

Bulletin of the Seismographic Stations

Volume 33, No. 1, pp. 1 - 53

ARCATA--BERKELEY--CALISTOGA--CONCORD
FERNDALE--FRESNO--LLANADA--MANZANITA LAKE
MINERAL--MOUNT HAMILTON--PALO ALTO--PARAISO
POINT REYES--PRIEST--RENO--SAN FRANCISCO
SANTA CRUZ--SHASTA--VINEYARD

Earthquakes and the Registration of Earthquakes

From January 1, 1963 to March 31, 1963

By

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and

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University of California

Berkeley

1965

BULLETIN OF THE SEISMOGRAPHIC STATIONS

of the University of California

Volume 33, Number 1

January 1, 1963 to March 31, 1963

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INTRODUCTION

Each quarterly issue of the Bulletin includes determinations of epicenters, origin times, magnitudes, and other information available at the time of writing, for earthquakes in northern California and adjoining areas. Recorded arrival times of seismic waves are tabulated only for the major earthquakes in the local area and for teleseisms.

Information items regarding the seismographic stations which comprise the Berkeley network are repeated in every issue. Information of a general nature, such as the Modified Mercalli Intensity Scale, will be found only in the first number of each volume.

The present issue contains several special features, as follows:

A. ERRATA, 1942-1962.

A review of the local earthquake section of the Bulletin for the above period has yielded a number of corrections, most of which were due to misprints. The majority of errors were spotted by means of a digital computer program designed to select earthquakes from the file by epicentral location.

Any remaining errors should be brought promptly to our attention. The cooperation of Bulletin users is very much appreciated in this connection.

B. MAP OF CALIFORNIA EARTHQUAKES, 1932-1962.

The map of California earthquakes shown in this issue includes all earthquakes of magnitude 4.0 and over for California and parts of western Nevada and northern Baja California, during the period 1932-1962. The map is a reproduction of direct computer output.

The data include all epicenters furnished by the Bulletin of the Seismographic Stations plus data from the Seismological Laboratory of the California Institute of Technology at Pasadena, as compiled by the State of California Department of Water Resources*. Revision of these data is continuously under way; we should be grateful if errors would be brought to our attention.

The plotting routine including the geographical outlines, names of localities, and general layout was programmed for the Berkeley IBM 7094-Calcomp Plotter installation by John S. Derr.

C. MAGNITUDES OF LOCAL EARTHQUAKES FOR THE YEAR 1947.

During the year 1947 (Vol. 17 of this Bulletin) no magnitudes of local shocks were provided. This gap in magnitude determinations was filled in by W. G. Milne in 1956 for station use.

The same magnitudes are now provided as a loose-leaf supplement for insertion in Vol. 17 (1947) of this Bulletin. Each magnitude corresponds to an earthquake listed in the Local Section of the 1947 Bulletins.

*Crustal Strain and Fault Movement Investigation, California Department of Water Resources, Bulletin 116-2, 96 pp. (1964).

PERSONNEL (AUGUST 1965)

Station Director	Bruce A. Bolt
Director Emeritus	Perry Byerly
Associate Research Seismologist	Cinna Lomnitz
Assistant Research Seismologist	Helen Freedman
Postgraduate Research Seismologist	Michio Otsuka
Associate	Don Tocher (U.S. Coast and Geodetic Survey, San Francisco)
Associate Engineer	Walter Marion
Full-time Technical Staff	G. Mitchell, R. Sell, M. Hilger, J. Firby
Research Assistants	A. Nowroozi, H. Acharya, P. Rodgers, J. Derr, J. Dewey, J. Filson
Secretary	Loretta Martin

MAILING ADDRESS

The Director	Telephone:
Seismographic Station	
University of California	845-6000 (Ext. 3977)
475 Earth Sciences Building	(Area Code 415)
Berkeley, California 94720	

THE BYERLY SEISMOGRAPHIC STATION (BKS)

Standardized equipment began operating in a newly constructed tunnel east of the main campus on June 8, 1962. The closest buildings, part of the Lawrence Radiation Laboratory, are about 0.8 km away. The tunnel was cut into the upper part of the Claremont Formation. Of Miocene age, this formation consists of thin layers of cherty material alternating with shale.

A plan of the tunnel is shown in the diagram. Piers are constructed of reinforced concrete with no isolation from floor and walls. The temperature is stable. A ventilating and dehumidifying system is connected to all rooms.

The short-period world-wide standard instruments are operated with an approximate magnification of 25,000 at 1 sec and the long-period standard instruments with 3,000 at 30 sec.

On March 20, 1964, the Regents of the University of California named this station the "Byerly Seismographic Station" in recognition of the work of Professor Perry Byerly.

HISTORY OF THE UNIVERSITY OF CALIFORNIA STATIONS

"The Seismographic Stations at Mount Hamilton and Berkeley present several items of interest in the history of earthquake science, one of which is that according to the available records they were the first seismographic stations set up in America. Furthermore, they have functioned continuously from their founding to the present day, with improvements in instrumental equipment from time to time as the development of the science and opportunity have permitted.

"Several outstanding figures in the seismology of the 1880's were impressed with the importance of these stations, and Ewing, Milne, and Gray each took a personal interest in aiding one or both stations to obtain their own best and most modern types of instruments."

The quotation is from "History of the University of California Seismographic Stations and Related Activities" by Professor George D. Louderback, published in the Bulletin of the Seismological Society of America, Vol. 32, No. 3, pp. 205-229, 1942. In this paper may be found a detailed account of the development of the Berkeley stations from the installation of the instruments (the first earthquake known recorded at Mount Hamilton was on April 24, 1887) to 1942.

Since 1942, the number of seismographic stations associated with the University of California has increased from six to twenty in 1962. In 1950, Professor Perry Byerly was appointed Director by the Regents; he had been in charge of instruction and research since 1925. In 1960, the University entered into a contract with the Air Force Office of Scientific Research of the Research Projects Agency of the Department of Defense. Funds were made available under the Vela Uniform program to design and operate a telemetered network of eight new stations in central California and to construct a new seismic vault near the Berkeley campus.

STATIONS IN OPERATION: JANUARY - MARCH 1963

Station	North Latitude	West Longitude	Elev. Meters	Symbol	Present Auspices and Date Established
Berkeley (Haviland)	37° 52.4'	122° 15.6'	81	BRK, BRX	Univ. of California, 1887
Berkeley (Strawberry)	37° 52.6'	122° 14.1'	276	BKS	Univ. of California, 1962
Mt. Hamilton	37° 20.5'	121° 38.5'	1282	MHC	Lick Observatory, 1887
Palo Alto	37° 25.0'	122° 10.9'	83	PAC	Stanford University, 1927
San Francisco	37° 46.6'	122° 27.1'	100	SFB	Univ. of San Francisco, 1931
Ferndale	40° 34.6'	124° 15.7'	15	FER	City of Ferndale, 1933
Fresno	36° 46.0'	119° 47.8'	88	FRE	Fresno City College, 1935
Mineral	40° 20.7'	121° 36.3'	1495	MIN	National Park Service, 1938
Arcata	40° 52.6'	124° 04.5'	59	ARC	Humboldt State College, 1948
Reno*	39° 32.3'	119° 48.8'	1386	REN	Univ. of Nevada, 1948
Shasta	40° 41.7'	122° 23.3'	312	SHS	Bureau of Reclamation, 1942
Manzanita Lake	40° 32.2'	121° 33.7'	1800	MLC	National Park Service, 1956
Vineyard (local)	36° 45.0'	121° 23.1'	330	VIN	W. A. Taylor and Co., 1959
(telemeter)	36° 45.0'	121° 23.3'	380	VIT	
Concord	37° 58.1'	122° 04.3'	36	CNC	Diablo Valley College, 1960
Santa Cruz	37° 00.4'	121° 59.8'	128	SCC	City of Santa Cruz, 1961
Paraiso	36° 19.9'	121° 22.2'	363	PRS	Paraiso Hot Springs, 1961
Llanada	36° 37.0'	120° 56.6'	475	LLA	Charles McCullough Ranch, 1961
Calistoga	38° 38.2'	122° 35.1'	457	CLS	Terrance Kirk Ranch, 1961
Point Reyes	38° 04.8'	122° 52.0'	404	PRC	Federal Aviation Agency, 1961
Priest	36° 08.5'	120° 39.9'	1187	PRI	Federal Aviation Agency, 1961

*Reno readings are not included after March 7, 1963. Future readings at Reno and other Nevada stations may be obtained from the University of Nevada at Reno.

STATION INSTRUMENTATION

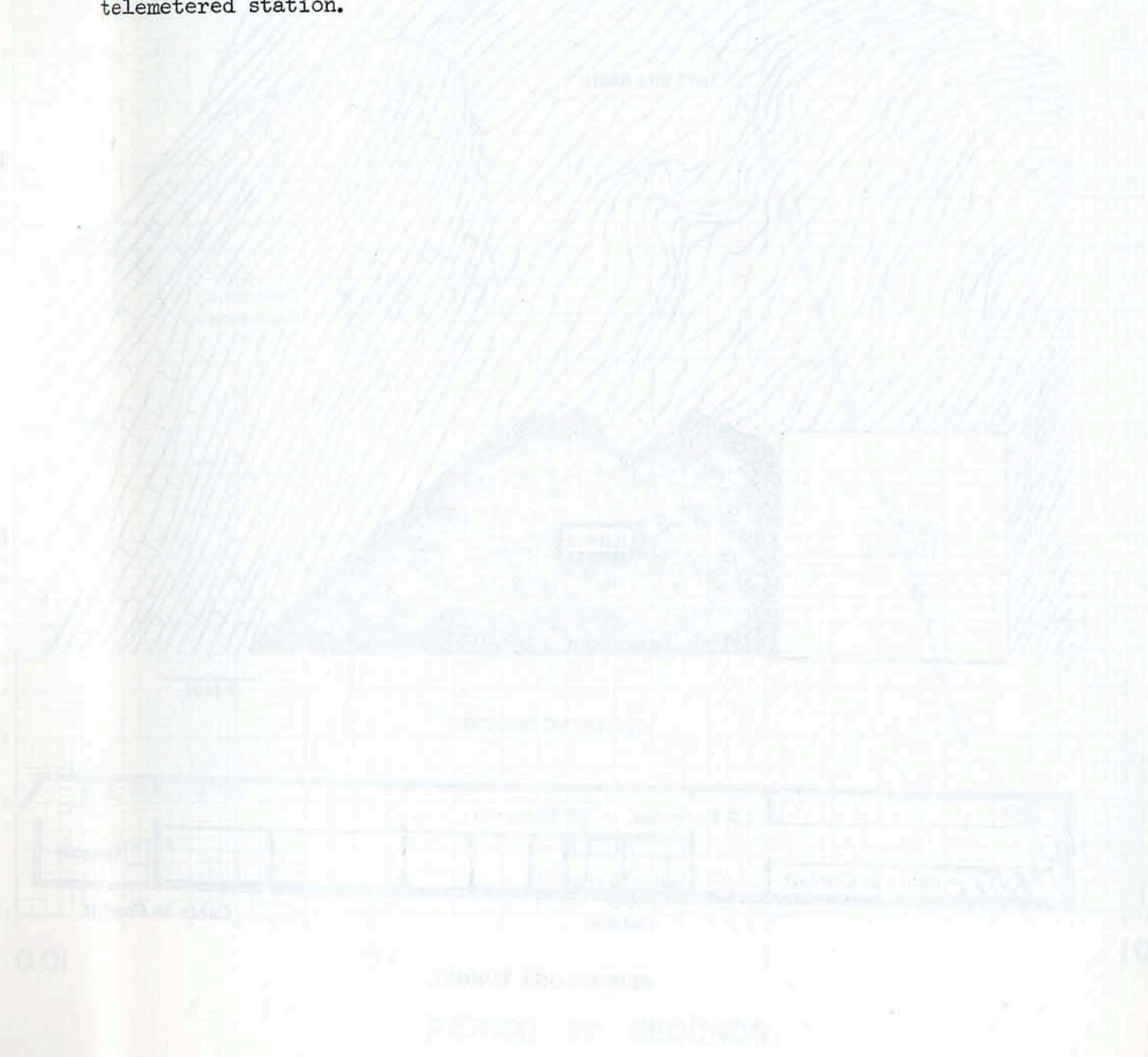
January-March 1963

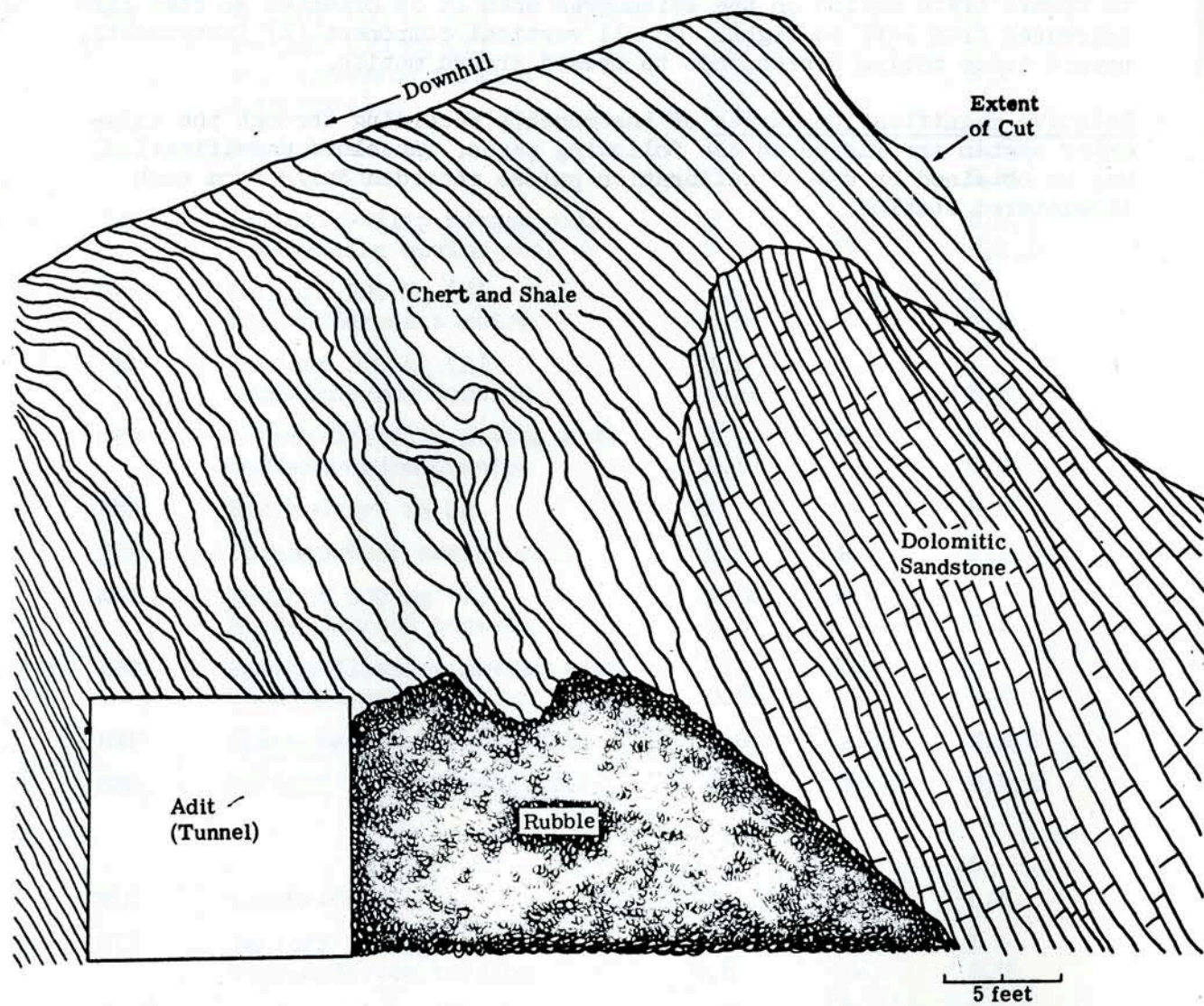
Station	Type of Instrument	T _o sec	T _g sec	Component
BRK	Benioff 100 kg (Z)	1.0	0.4	Z
	Benioff 100 kg (Z)	1.0	8.0	Z
	Wood-Anderson torsion	0.8	-	S,W
	100X torsion	0.8	-	N,W
BKS	Benioff 100 kg	1.0	0.75	N,E,Z
	Sprengnether	30	100	N,E,Z
BRX	Galitzin-Wilip moving coil	12	12	N,E,Z
	Press-Ewing moving coil	30	90	N,E,Z
MHC	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	S,E
PAC	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	N,E
SFB	Lehner-Griffith moving coil	1.2	0.3	Z
	Wood-Anderson torsion	0.8	-	S,W
FER	Bosch-Omori 25 kg	12	-	S,W
FRE	Sprengnether moving coil	2.0	2.0	N,E,Z
MIN	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	S,E
ARC	Marion-Slichter moving coil	1.1	0.2	Z
	Wood-Anderson torsion	0.8	-	N,E
REN	Sprengnether moving coil	2.0	2.0	N,E,Z
SHS	Benioff 50 kg moving coil	1.5	0.45	N,E,Z
MLC	Loucks-Omori	3½	-	S,E
VIN	Benioff 100 kg (Z)	1.0	0.2	Z
	Wood-Anderson torsion	0.8	-	S,W
VIT ^Δ	Benioff 14 kg (Z)	1.0	2.0	Z
CNC ^Δ	Benioff 100 kg (Z)	1.0	0.2	Z
SCC ^Δ	Benioff 14 kg (Z)	1.0	0.2	Z
PRS ^Δ	Benioff 14 kg (Z)	1.0	0.2	Z
LLA ^Δ	Benioff 14 kg (Z)	1.0	0.2	Z
CLS ^Δ	Benioff 14 kg (Z)	1.0	0.2	Z
PRC ^Δ	Benioff 14 kg (Z)	1.0	0.2	Z
PRI ^Δ	Benioff 14 kg (Z)	1.0	0.2	Z

^Δ Signals from these eight stations are transmitted via leased telephone lines to recorders at Berkeley.

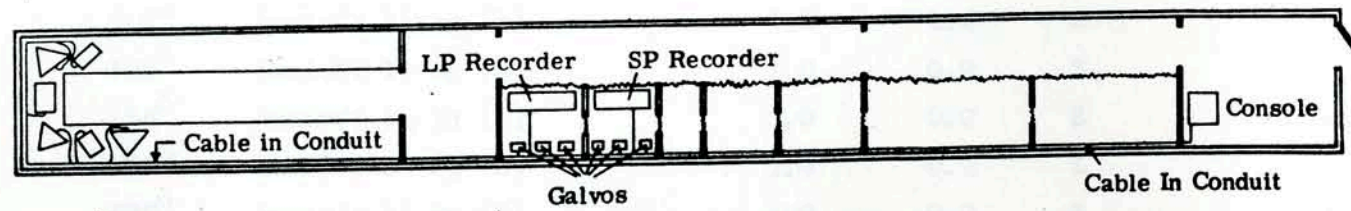
Direction of Motion: In the "Component" column, each horizontal component seismograph is designated by the direction of ground motion corresponding to upward trace motion on the seismogram when it is oriented so that time increases from left to right. On all vertical component (Z) instruments, upward trace motion corresponds to upward ground motion.

Relative magnification curves of instruments recording through the telemeter system are listed on the following pages. Absolute magnification may be obtained by use of calibration pulses recorded daily from each telemetered station.



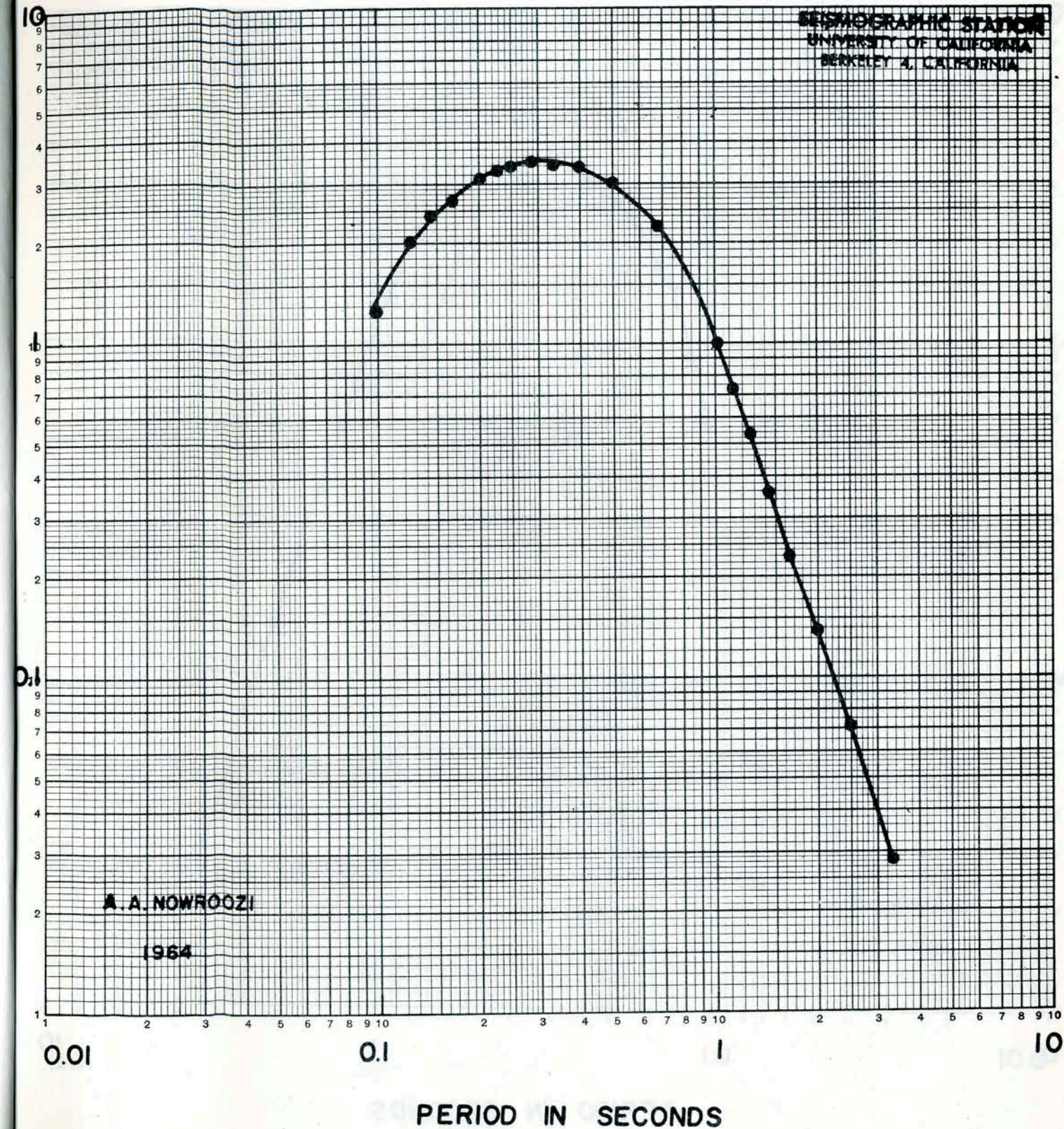


GEOLOGIC SECTION

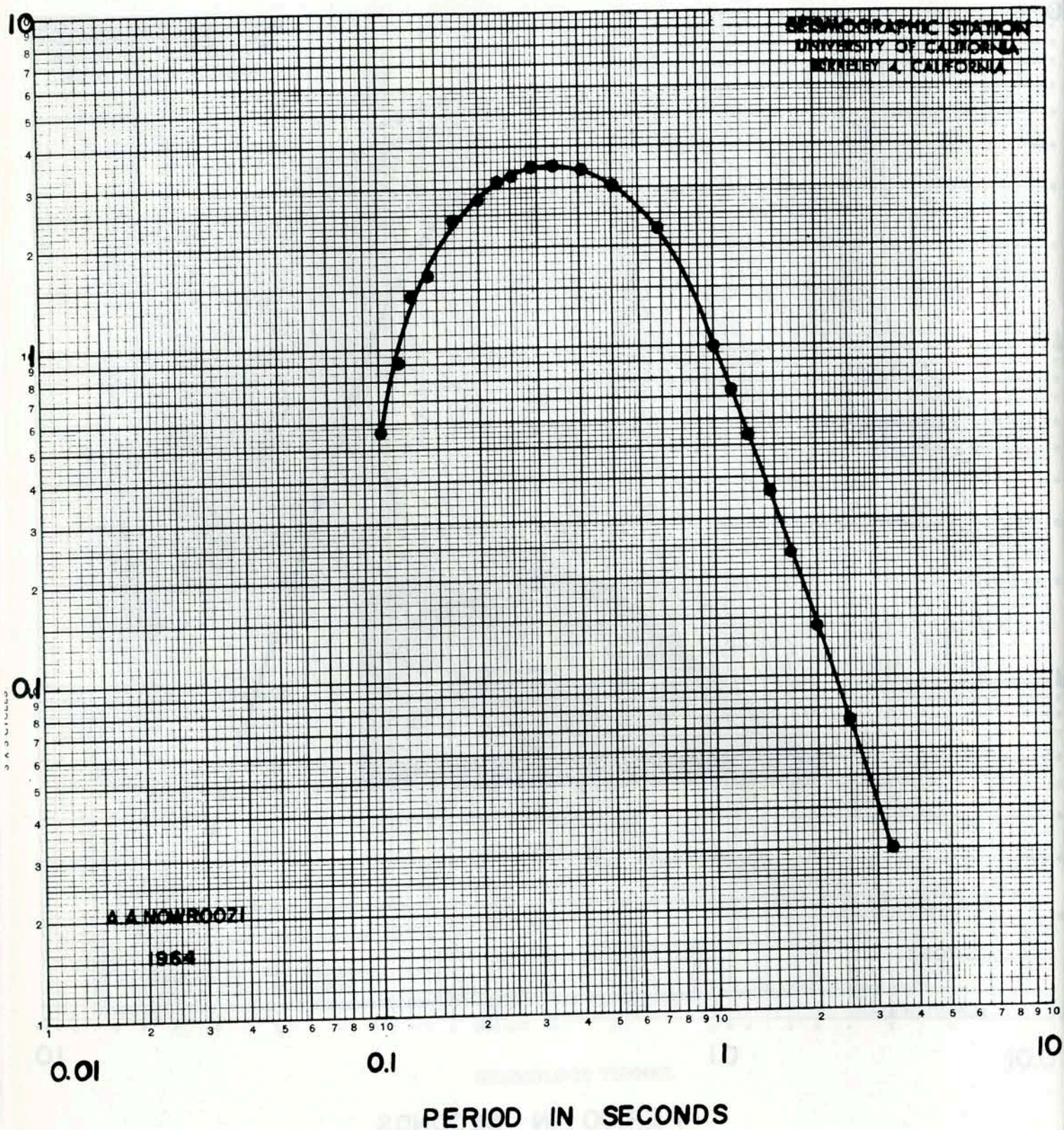


SEISMOLOGY TUNNEL

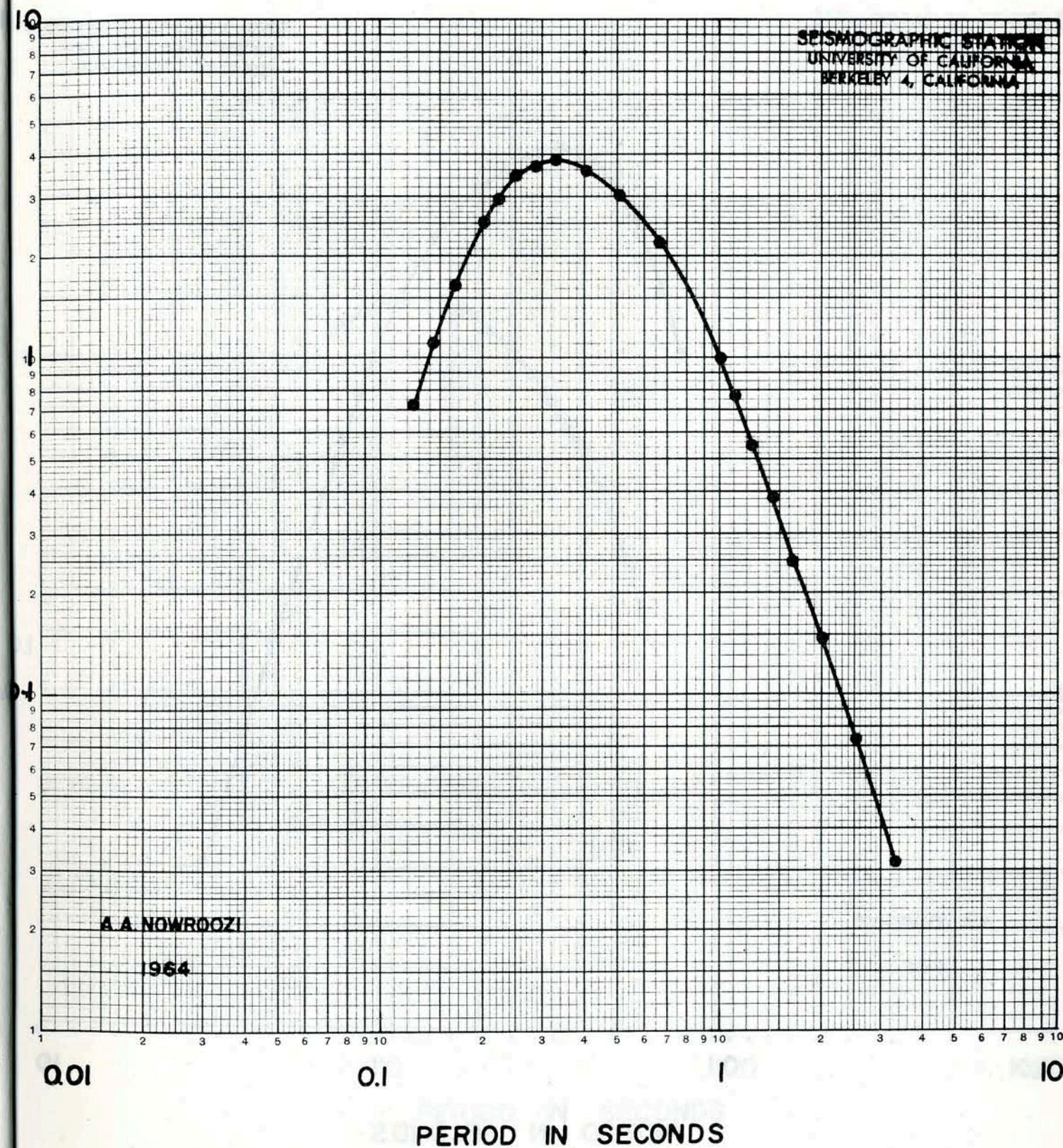
RESPONSE OF SEISMOMETER-DEVELORECORDER
 SYSTEM. 100KG. Z. S. P



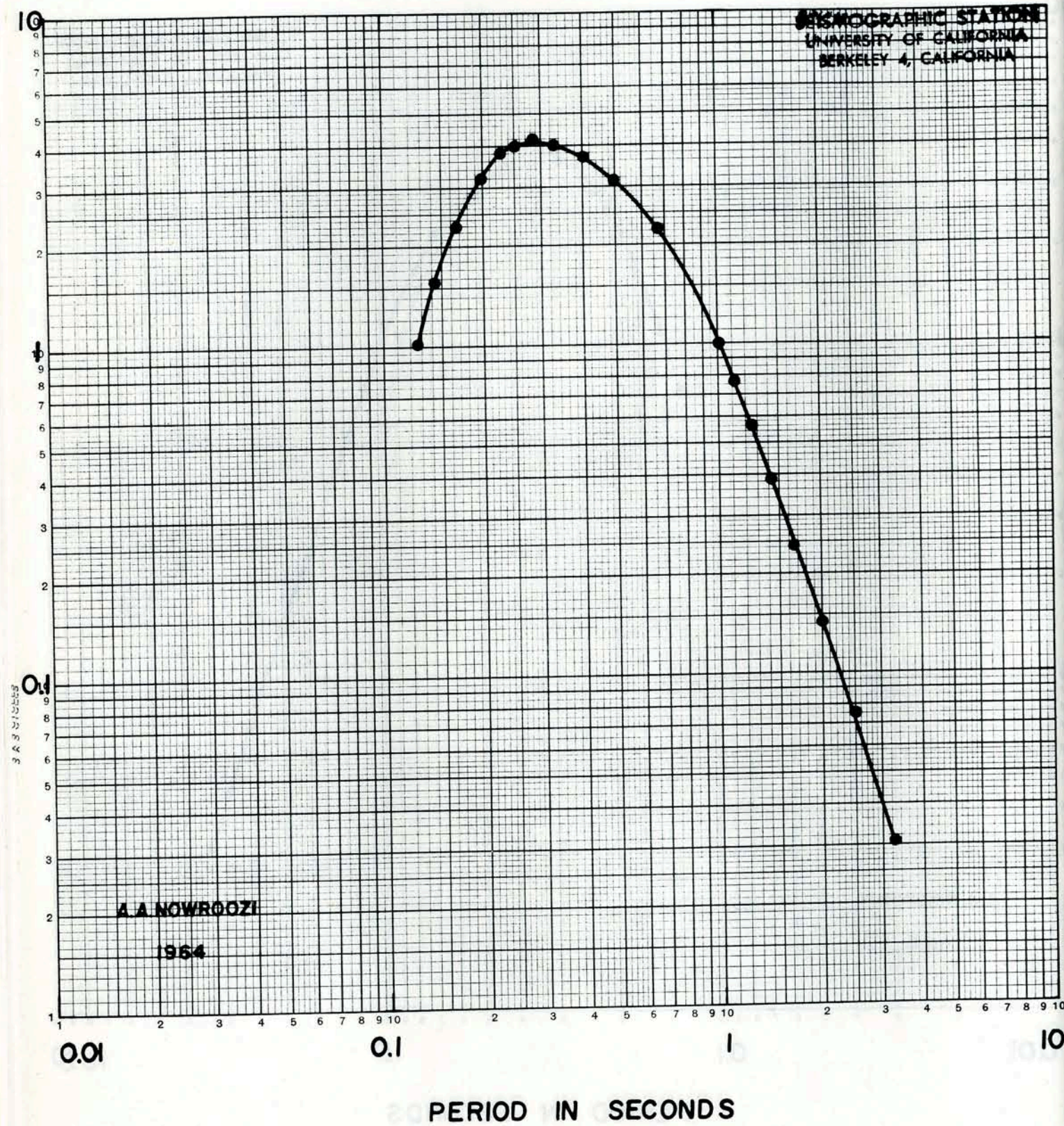
RESPONSE OF SEISMOMETER - HELICORDER SYSTEM. 100KG. Z. S.P.



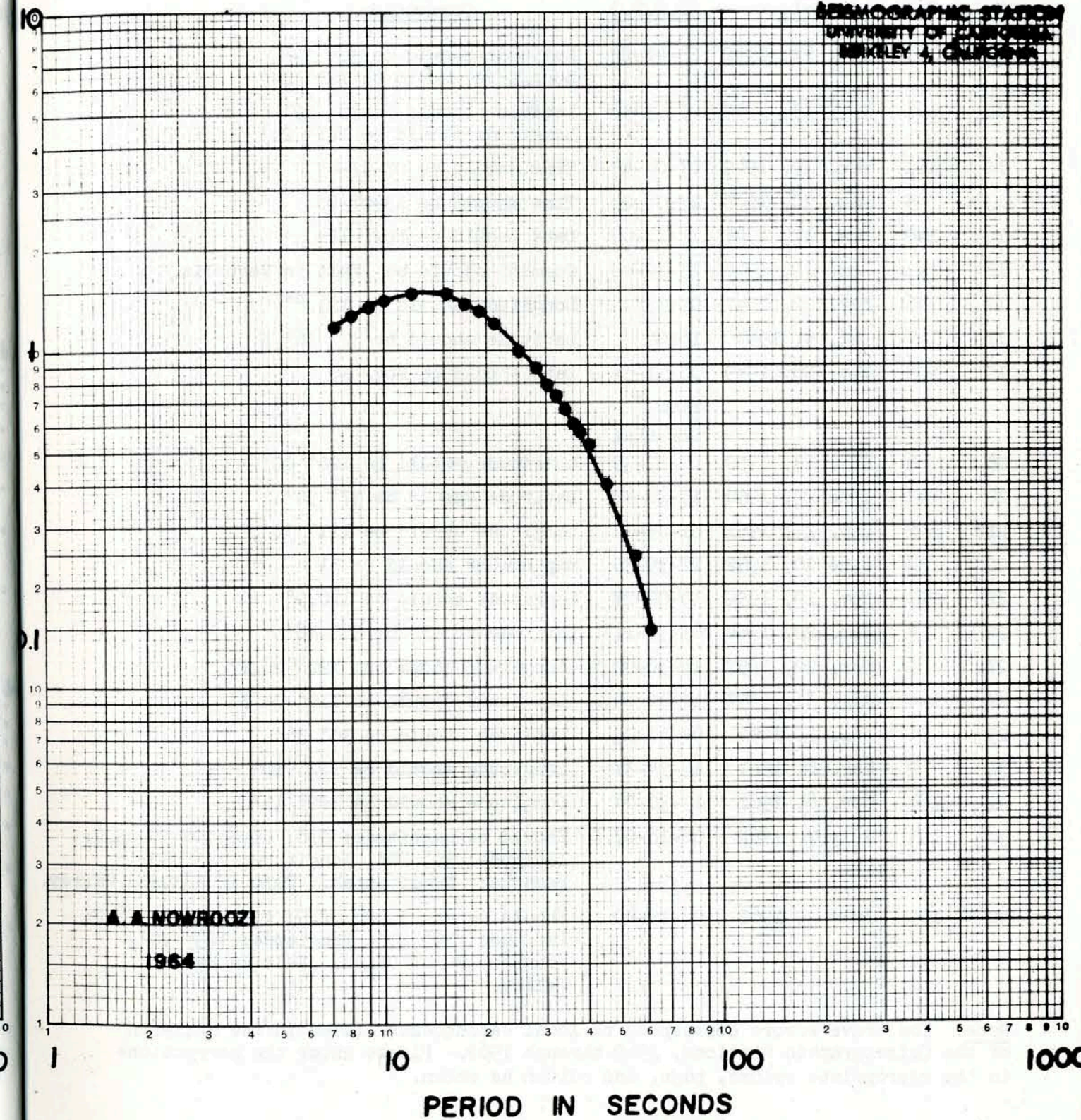
RESPONSE OF SEISMOMETER - HELICORDER SYSTEM. 14.7 KG. Z. S.P.



RESPONSE OF SEISMOMETER-DEVELOCORDER SYSTEM. 14.7 KG. Z. S.P



RESPONSE OF SEISMOMETER - HELICORDER SYSTEM. PRESS-EWING. Z. T.G=30 S., T.S=15 S.



LOCAL EARTHQUAKES

ERRATA 1942-1962

<u>Vol.</u>	<u>Page</u>	<u>Date</u>	<u>Time</u> <u>(P.S.T.)</u>	<u>Correction</u>
12	161	Oct. 11, 1942	15-48-23	Latitude should be 36° 29' Longitude should be 121° 24'
12	161	Oct. 15, 1942	05-53-56	Latitude should be 36° 29' Longitude should be 121° 24'
12	161	Dec. 17, 1942	07-08-43	Time should be 07-07-43
13	5	Mar. 30, 1943	13-08-28	Time should be 13-07-28
15	140	Nov. 17, 1945	17-12-08	Date should be Nov. 12
16	43	Apr. 12, 1946	23-42-08	Comment should be "Felt in Vernalis."
17	46	Apr. 22, 1947	07-33	Longitude should be 121.8°
17	147	Dec. 5, 1947	18-06	Latitude should be 37° 36' N
19	289	Nov. 28, 1949	00-31-54	Date should be Nov. 30
			<u>Time</u> <u>(G.C.T.)</u>	
20	6	Mar. 13, 1950	17-17-39	Longitude should be 120° 05'
20	43	June 23, 1950	15-38-49	Latitude should be 37° 50'
21	122	Oct. 14, 1951	01-09-24	Longitude should be 121° 54'
22	38	June 20, 1952	22-39-35	Map number should be 31
22	123	Nov. 19, 1952	10-06-27	Longitude should be 120.9°
24	4	Jan. 22, 1954	09-32-17	Latitude should be 36° 48'
27	9	Mar. 22, 1957	16-38-00.7	Longitude should be 122° 28.7'
27	144	Aug. 31, 1957	12-30-00.1	Longitude should be 116° 04.1'
29	94	Aug. 1, 1959	04-41-03	Latitude should be 36° 36'
31	9	Mar. 6, 1961	13-54-37	Longitude should be 122° 10'
31	184	Nov. 8, 1961	19-30-04	Longitude should be 122° 13'
32	103	July 7, 1962	08-18-07.0	Should be magnitude: 2.8; time: 08-18-05.2; latitude: 39° 20'; longitude: 123° 20'; remarks: NW of Ukiah. Felt in Redwood Valley.
32	103	July 7, 1962	08-19-00	Should be magnitude: 2.9; time: 08-18-58.2; latitude: 39° 20'; longitude: 123° 20'; remarks: NW of Ukiah. Felt in Redwood Valley.

Note: The above errors correspond to local earthquakes listed in the Bulletin of the Seismographic Stations, 1942 through 1962. Please enter the corrections in the appropriate volume, page, and column as shown.

1932-1962 MAGNITUDE GREATER THAN 4.0 EARTHQUAKE MAGNITUDE KEY

- ◇ 4.0 TO 4.9
- 5.0 TO 5.9
- ◻ 6.0 TO 6.9
- * 7.0 OR GREATER



MAGNITUDES OF LOCAL EARTHQUAKES FOR THE YEAR 1947

No local magnitudes were published in Volume 17 (1947) of the Bulletin of the Seismographic Stations. The following magnitudes were determined by W.G. Milne in 1956 and should be inserted in Volume 17.

<u>Date</u>	<u>Time (P.S.T.)</u>	<u>Richter Magnitude</u>	<u>Date</u>	<u>Time (P.S.T.)</u>	<u>Richter Magnitude</u>
Jan. 4	06-50	2.9	Aug. 8	14-02	2.5
20	22-59	3.8	10	13-58	4.4
25	03-49	3.7	12	23-33	3.1
25	20-13	2.6	14	16-15	2.9
27	21-54	3.0	16	08-45	2.5
30	20-02	2.4	19	05-32	3.4
Feb. 4	22-14	5.0	20	23-58	3.4
9	08-21	3.0	23	01-29	3.0
11	16-47	3.2	24	13-13	3.2
20	11-45	3.6	Sept 7	21-52	4.5
Mar. 14	03-36	4.0	7	23-13	4.7
17	00-46	4.4	10	14-30	2.6
23	04-00	2.9	20	10-02	3.8
29	23-44	4.6	23	05-53	5.3
Apr. 1	21-48	2.5	25	04-28	3.7
12	15-07	3.5	26	23-40	-
13	01-12	2.0	Oct. 4	21-23	3.2
14	08-36	3.6	5	20-19	2.9
21	18-24	2.5	6	10-49	3.2
22	07-33	2.8	8	06-25	2.7
26	03-20	3.1	15	02-29	2.1
29	05-17	2.3	15	09-52	2.8
May 2	22-04	2.6	20	18-46	2.9
4	00-45	3.4	24	16-29	2.7
7	07-41	3.6	31	05-20	2.5
10	00-11	4.2	Nov. 1	23-01	4.8
12	18-01	2.7	9	22-49	3.9
14	17-55	2.4	12	05-22	1.9
25	19-05	2.3	12	13-27	3.1
27	12-59	5.2	15	14-30	4.1
June 5	19-36	2.5	17	03-23	2.5
22	15-30	4.7	25	10-09	4.0
22	16-26	3.3	26	00-46	3.3
July 6	20-40	4.3	28	21-16	3.1
12	21-35	3.4	Dec. 1	05-03	3.7
22	09-36	2.4	4	13-22	-
31	00-16	4.4	4	16-35	2.2
			5	18-06	-
			8	00-29	3.0
			11	17-48	3.0
			13	00-35	2.2
			13	21-42	3.4
			16	01-21	3.6
			18	03-20	3.4
			18	05-29	3.1
			22	18-02	3.5

MODIFIED MERCALLI INTENSITY SCALE OF 1931

(Abridged)

- I. Not felt except by a very few under especially favorable circumstances.
- II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
- III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing truck. Duration estimated.
- IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls made creaking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
- V. Felt by nearly everyone; many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned; Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
- VI. Felt by all; many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
- VII. Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
- VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Disturbs persons driving motor cars.
- IX. Damage considerable in specially designed structures; well designed frame structures thrown out of plumb; great in substantial buildings with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
- X. Some well-built/^{wooden} structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
- XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipe lines completely out of service. Earth slips and land slips in soft ground. Rails bent greatly.
- XII. Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into the air.

PART I. LOCAL EARTHQUAKES IN NORTHERN CALIFORNIA, NEVADA, AND OREGON

This section includes information on earthquakes in northern California (including adjacent offshore areas) and in adjoining sections of Nevada and Oregon which were well enough recorded to permit a determination of the epicenter. Latitude and longitude of each epicenter and the corresponding date and origin time are tabulated in the following list; epicenters are also plotted on one or both of the two maps immediately following the list.

For the entire northern California region, every effort is made to list all earthquakes of Richter magnitude 3.0 and above, but it is likely that some such shocks have been omitted because the available seismographic data were inadequate for epicenter determination. Within the limited region covered by the map of the central Coast Ranges of California, locatable shocks of magnitude 2.5 and over are included in the tabulation and plotted on the map. Shocks of magnitude 3.0 and over occurring in the limited region are plotted on both maps. Shocks of magnitude less than 3.0 in northern California (and less than 2.5 in the central Coast Ranges) are tabulated only if reported felt or if of special interest for some other reason. Identified artificial earthquakes (explosions) ordinarily are not tabulated.

Epicenters are located by an IBM 7090 computer program. Information on Version I of this program may be found in "Computer Location of Local Earthquakes within the Berkeley Seismographic Network" by Bolt and Turcotte, published in Computers in the Mineral Industries, Part 2, (George Parks, Editor); Stanford University Publications, Geological Sciences, Vol. 9, No. 2, pp. 561-576, 1964.

Explanation of the table:

Map No. for each epicenter corresponds to the number plotted beside that epicenter on the maps. Epicenters without numbers lie outside the area of the map. The underlining of a map number in the table (and on the maps) indicates that one point on a map has been used to represent more than one earthquake in the table.

Date and Origin Time are given in Greenwich Civil Time (GCT). Subtract eight (8) hours to convert to Pacific Standard Time (PST).

M is the Richter magnitude of the earthquake as determined from the maximum trace amplitudes recorded for the shock by standard Wood-Anderson torsion seismographs.

h is the focal depth given to the nearest kilometer or by the following ranges: a, 0-5 km; b, 6-10 km; c, 11-15 km; d, 16-30 km.

No. of Stas. is the number of stations used by the computer program in locating the epicenter.

The quality of the solution is partially reflected by the listed number of stations. The highest quality locations are given to the nearest

minute of arc in latitude and longitude and to the tenth of a second origin time. Poorer quality locations are given to the nearest minute in latitude and longitude, to the nearest second in origin time, and are denoted by an asterisk.

Under Remarks will be found a short descriptive location of the epicenter, usually relative to a point named on the map. Information on small foreshocks and aftershocks is sometimes included under Remarks, but when numerous foreshocks or aftershocks accompany a large earthquake, a separate tabulation may be included following the main list of local shocks.

Information on maximum intensities of shocks reported felt is also included under Remarks. Reports on felt earthquakes may be obtained from the Seismological Field Survey of the U.S. Coast and Geodetic Survey, which publishes a more complete summary in "Abstracts of Earthquake Reports for the Pacific Coast and Western Mountain Region." This regular quarterly publication may be obtained from the District Officer, San Francisco District, Coast and Geodetic Survey, 121 Customhouse, San Francisco 26, California, or from the Director, U.S. Coast and Geodetic Survey, Washington Science Center, Rockville, Maryland 20852. Intensities given in Roman numerals are assigned by the Coast and Geodetic Survey and based on the Modified Mercalli Intensity Scale of 1931.

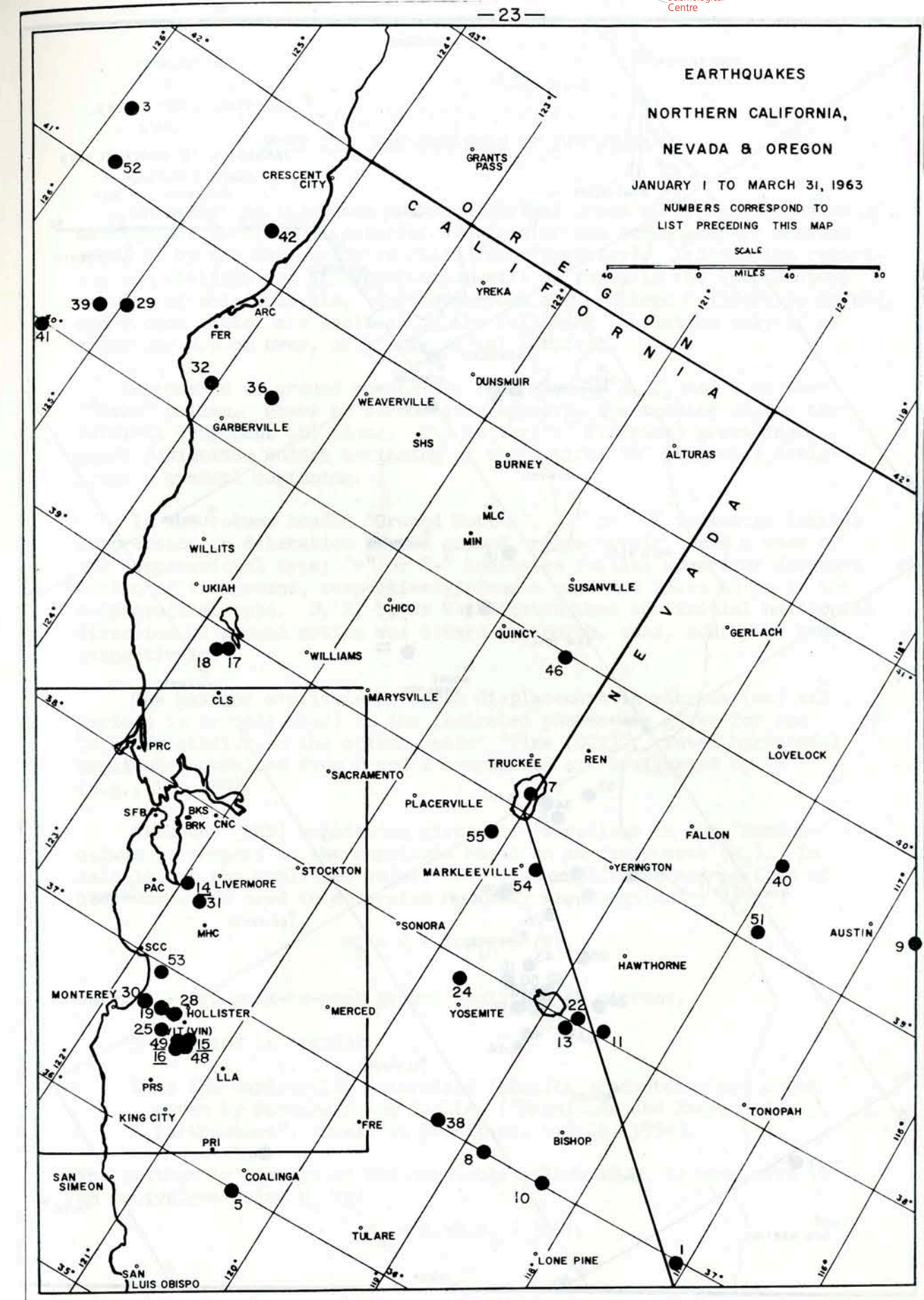
EARTHQUAKES IN NORTHERN CALIFORNIA, NEVADA, AND OREGON

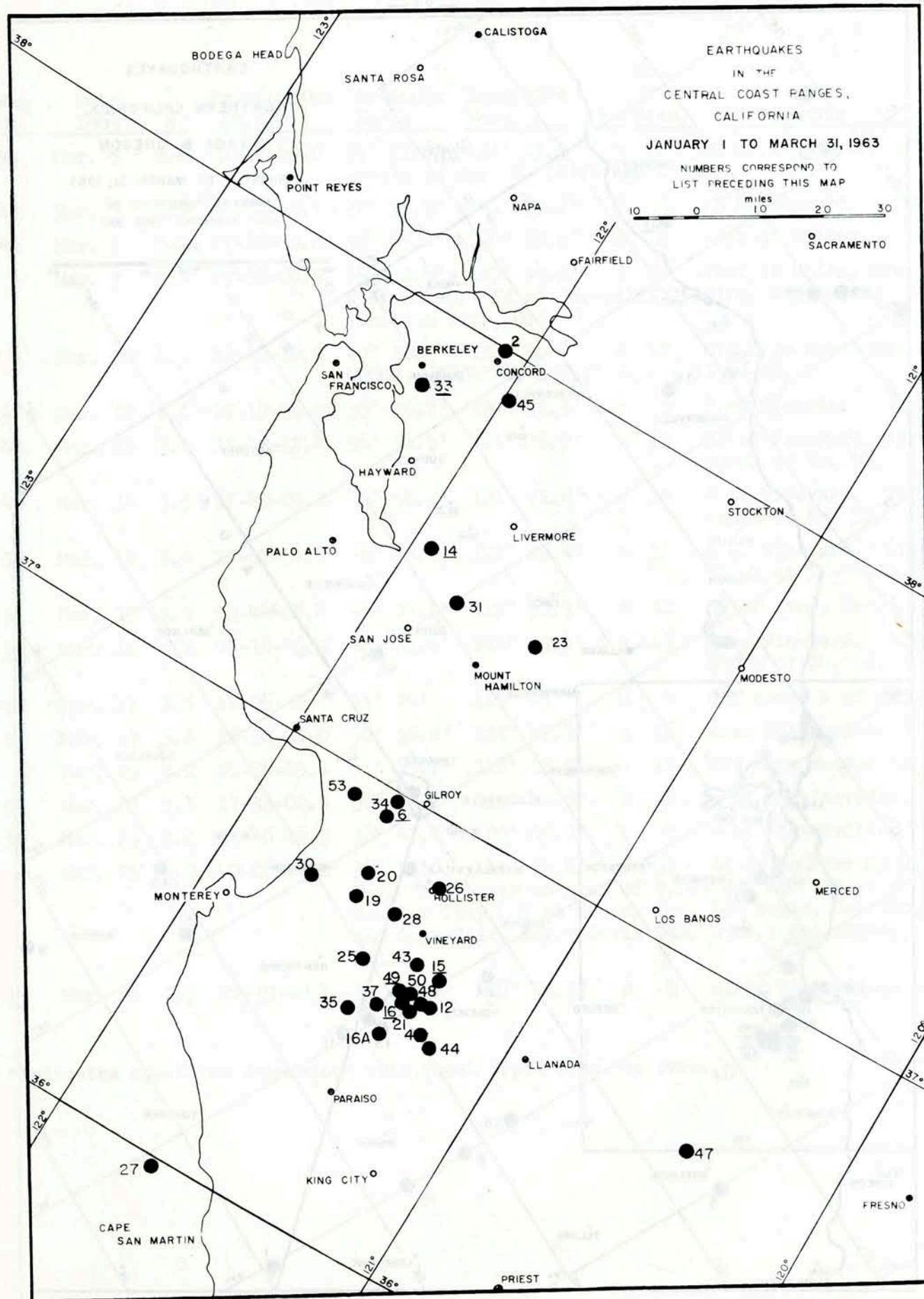
Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	No. of h Stas.	Remarks
1	Jan. 1	3.6	10-28-07.7	36° 58.1'	117° 04.3'	b 8	West of Beatty, Nev.
2	Jan. 3	2.5	14-15-17.1	37° 59.7'	122° 04.4'	a 10	North of Concord.
3	Jan. 5	3.5	21-26-56.5	41° 25.1'	125° 54.4'	a 10	NW of Eureka.
4	Jan. 9	2.7	04-03-29.2	36° 32.8'	121° 14.2'	a 15	Near Vineyard. Felt at Harris Ranch.
5	Jan. 9	3.2	06-04-25.7	35° 58.9'	120° 21.6'	c 14	SE of Priest. III at Wheeler Ridge.
6	Jan. 13	2.5	04-29-51.8	36° 56.0'	121° 38.7'	c 12	E of Watsonville.
7	Jan. 15	2.8	20-16-44.2	39° 06.7'	120° 04.1'	c 6	Lake Tahoe.
8	Jan. 18	3.6	21-11-46.5	36° 59.4'	118° 50.8'	a 11	SW of Bishop.
9	Jan. 19	4.3	06-41-51.2	39° 31.1'	116° 41.3'	a 12	W of Eureka, Nev.
10	Jan. 19	3.6	19-44-36.7	36° 59.9'	118° 19.0'	a 14	S of Bishop.
11	Jan. 23	3.6	13-21-16.8	38° 02.1'	118° 31.7'	a 17	S of Hawthorne, Nev.
12	Jan. 26	2.8	13-40-28.8	36° 36.5'	121° 15.1'	a 16	SE of Vineyard.
13	Jan. 27	2.9	23-15-32.7	37° 56.4'	118° 47.2'	a 11	E of Mono Lake.
-	Jan. 29	3.7	02-47-59.0	33° 56.2'	121° 29.9'	c 7	Off coast SW of Point Arguello.
<u>6</u>	Jan. 29	2.7	17-19-06.9	36° 56.5'	121° 38.9'	b 11	E of Watsonville.
14	Jan. 31	3.3	08-23-13.3	37° 30.9'	121° 56.9'	b 15	SE of Hayward. Felt.
<u>14</u>	Jan. 31	2.7	08-58-42.9	37° 31.5'	121° 56.8'	a 13	SE of Hayward. Aftershock of No. 14.
15	Jan. 31	3.0	21-53-25.8	36° 40.2'	121° 16.2'	a 7	SE of Vineyard.
16	Feb. 2	3.4	04-09-23.2	36° 34.8'	121° 20.2'	a 18	SE of Vineyard.
17	Feb. 2	2.9	11-51-41.4	38° 54.5'	122° 43.4'	a 16	NW of Calistoga. IV at Clear Lake Highlands. Foreshock of No. 18.
18	Feb. 2	3.1	12-09-37.0	38° 51.7'	122° 48.2'	a 17	NW of Calistoga. V at Clear Lake Highlands. IV at Clear Lake Oaks, Glenhaven, and Lower Lake. Aftershock at 12-14-16.
19	Feb. 2	3.7	13-58-20.1	36° 44.7'	121° 36.0'	a 27	W of Vineyard. Felt over an area of 500 sq. mi. of San Benito and Santa Clara Counties. IV at Hollister and Libby Ranch.
20	Feb. 3	2.5	12-36-41.5	36° 48.1'	121° 36.4'	a 11	Aftershock of No. 19.
21	Feb. 4	2.8	08-23-52.0	36° 34.9'	121° 17.8'	a 11	SE of Vineyard.
22	Feb. 6	3.4	09-52-35.7	38° 02.0'	118° 45.5'	a 8	E of Mono Lake. Foreshock at 03-56.
23	Feb. 6	2.6	19-08-22.8	37° 26.8'	121° 32.5'	a 12	NE of Mt. Hamilton.

Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	No. of h Stas.	Remarks
24	Feb. 7	2.8	04-43-55.8	37° 52.8'	119° 43.9'	a 9	NW of Yosemite.
25	Feb. 8	3.6	09-44-24.1	36° 37.9'	121° 29.3'	a 19	SW of Vineyard.
26	Feb. 8	2.6	15-16-56.9	36° 51.3'	121° 24.6'	b 11	Near Hollister. Felt.
27	Feb. 9	2.8	02-52-14.5	35° 58.9'	121° 41.5'	a 8	Off coast S of Big Sur.
28	Feb. 9	3.2	04-08-01.4	36° 45.3'	121° 29.0'	b 16	W of Vineyard. Felt in Hollister.
29	Feb. 11	3.5	09-43-07.1	40° 22.1'	124° 58.7'	d 6	Off Cape Mendocino.
30	Feb. 11	3.1	15-53-57.6	36° 44.1'	121° 44.5'	d 14	NW of Salinas.
31	Feb. 11	3.3	19-48-54.9	37° 26.2'	121° 48.2'	a 18	NW of Mt. Hamilton.
32	Feb. 12	2.9	01-44-04.0	40° 15.5'	124° 02.6'	c 3	S of Scotia.
16A	Feb. 12	2.6	03-44-30.9	36° 30.0'	121° 19.7'	a 10	S of Vineyard.
33	Feb. 12	2.0	07-51-39.1	37° 49.1'	122° 13.6'	a 10	E of Oakland. Felt in East Oakland. Foreshock of following earthquake.
<u>33</u>	Feb. 12	2.7	08-50-42.7	37° 50.2'	122° 13.3'	a 10	E of Oakland. V at Canyon and Oakland. IV at Moraga. Aftershocks at 16-18 and 18-03-21. M about 1.7 each.
34	Feb. 14	2.5	08-25-35.4	36° 58.9'	121° 38.8'	b 12	E of Watsonville.
35	Feb. 14	2.7	15-05-49.5	36° 30.9'	121° 27.5'	a 14	S of Vineyard.
36	Feb. 15	3.1	00-38-48.6	40° 23.3'	123° 34.4'	a 4	E of Scotia.
37	Feb. 15	2.8	01-21-40.9	36° 33.1'	121° 23.4'	a 15	S of Vineyard.
38	Feb. 18	2.7	11-46-33.1	37° 02.0'	119° 16.3'	b 6	NE of Fresno.
39	Feb. 21	3.9	12-01-12.6	40° 16.5'	125° 09.8'	a 21	Off Cape Mendocino.
<u>16</u>	Feb. 22	2.8	00-23-42.5	36° 35.7'	121° 19.3'	a 11	S of Vineyard.
-	Feb. 22	3.3	15-56-21.9	35° 06.4'	121° 26.7'	a 15	Off coast, SW of Morro Bay.
40	Feb. 23	3.7	08-22-39.7	39° 31.4'	117° 57.4'	d 9	W of Austin, Nev.
*-	Feb. 27	3.5	12-57-50	35° 55'	117° 46'	0 5	E of Little Lake.
-	Mar. 1	5.1	00-25-57.6	34° 54.5'	119° 04.5'	a 25	S of Bakersfield. Felt over an area of 8,000 sq. mi., centered in SW Kern County. VI at Fort Tejon, Frazier Park, Lebec, and Taft. V at Bakersfield, Chatsworth, Gorman, Maricopa, Tehachapi, and Wheeler Ridge.
41	Mar. 2	3.7	10-55-08.7	39° 58.8'	125° 27.3'	d 3	Off Cape Mendocino.
*42	Mar. 3	3.5	01-09-22	41° 17'	124° 21'	0 3	Off coast, NW of Eureka.
43	Mar. 4	2.5	18-01-25.5	36° 40.8'	121° 21.0'	a 6	South of Vineyard.
-	Mar. 4	4.4	20-10-30.3	33 42.3'	119 04.1'	d 18	Off coast, S of Oxnard. Felt in the Ventura-Oxnard area.

Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	No. of Stas. h	Remarks
44	Mar. 5	2.6	21-17-49.0	36° 31.6'	121° 11.5'	a 10	SE of Vineyard. After-shocks on Mar. 6, 04-28 and 07-48.
45	Mar. 7	2.5	07-33-47.7	37° 53.9'	121° 59.2'	c 8	SE of Concord.
46	Mar. 7	3.2	17-18-32.8	39° 58.1'	120° 22.9'	a 12	East of Quincy.
-	Mar. 7	5.4	23-53-26.5	44° 52.6'	123° 44.3'	a 21	East of Salem, Ore. V at Salem. IV at Corvallis, Elmira, Eugene and Junction City, Ore.
* -	Mar. 10	4.3	11-40-10.0	40° 30'	128° 00'	0 12	Off Cape Mendocino. USCGS: 38.4° N, 127.2° W; 0 = 11-40-29.
47	Mar. 12	2.6	09-19-36.3	36° 36.7'	120° 25.3'	d 9	E of Llanada.
48	Mar. 14	3.2	17-42-17.4	36° 36.4'	121° 16.9'	a 13	SE of Vineyard. Fore-shock of No. 50.
49	Mar. 14	3.3	17-49-03.0	36° 36.2'	121° 21.0'	a 14	S of Vineyard. Fore-shock of No. 50.
50	Mar. 14	3.4	17-57-34.8	36° 36.6'	121° 19.4'	a 13	S of Vineyard. After-shock at 17-58-20.
51	Mar. 15	3.5	03-44-26.8	39° 04.9'	117° 50.3'	d 11	NW of Ione, Nev.
49	Mar. 15	2.7	05-18-46.9	36° 36.6'	121° 20.4'	a 13	S of Vineyard. After-shock of No. 50.
*52	Mar. 17	3.5	18-06-40	41° 05'	125° 45'	0 4	Off coast W of Eureka.
53	Mar. 19	3.0	18-30-05.0	36° 56.6'	121° 45.5'	d 16	Near Watsonville.
-	Mar. 23	4.2	05-34-05.4	40° 49.7'	128° 08.0'	c 14	Off Cape Mendocino.
54	Mar. 23	3.4	17-33-00.5	38° 42.2'	119° 40.8'	b 14	E of Markleeville.
55	Mar. 23	3.0	17-46-06.3	38° 47.0'	120° 09.0'	b 7	E of Placerville.
-	Mar. 25	4.9	09-28-41.1	35° 53.8'	114° 44.4'	a 31	SE of Boulder City, Nev. Felt over an area of 9,000 sq. mi. VI at Boulder City. V at Hoover Dam, Las Vegas, Overton, and Logandale, Nev.; Davis Dam, Ariz.; and Nipton, Calif.
15	Mar. 26	2.5	02-39-02.1	36° 40.1'	121° 16.3'	d 6	SE of Vineyard.

*Indicates epicenter determined with focal depth fixed as zero.





PART II. REGISTRATION OF EARTHQUAKES

This section tabulates measured arrival times of prominent phases of earthquakes recorded at selected stations of the seismographic network operated by the University of California (Berkeley). Information regarding the stations and instrumentation will be found in the introductory section of this Bulletin. Earthquakes in the northern California, Nevada, and Oregon region are included in the following tabulation only if of magnitude 4.0 or over, or if of special interest.

Components of ground motion are indicated by N, E, and Z in the "Phase" column. Where no such letter appears, the reading is for the vertical component (Z) alone. The letter "i" (impetus) preceding a phase designates sudden beginning of the motion; "e" (emersio) designates a gradual beginning.

In the column headed "Ground Motion", "c" or "d" indicates initial compression or dilatation of the ground, respectively, from a wave of the compressional type; "+" or "-" indicates initial upward or downward motion of the ground, respectively, from a wave not known to be of the compressional type. N, E, S, or W indicates that the initial horizontal direction of ground motion was toward the north, east, south, or west, respectively.

The maximum amplitude of earth displacement in microns (μ) and periods in seconds (sec) in the indicated phases are given for the Berkeley station in the column headed "Time (GCT)". Total horizontal amplitudes combined from N and E components are designated by "H" (e.g., PH, PPH).

Berkeley (BKS) magnitudes given for teleseisms in the "Remarks" column correspond to the magnitude based on surface waves (M_S). In calculating the published value, body wave amplitudes and periods of body waves are used to determine M_B (body wave magnitude) by:

$$M_B = Q + \log_{10} (A/T),$$

where $A = 1/2$ peak-to-peak ground amplitude in microns,

$T =$ period in seconds

Q is the empirically determined function of distance and depth given by Gutenberg and Richter ("Magnitude and Energy of Earthquakes", *Annali di Geofisica*, 9:1-15, 1956).

The arithmetic average of the available values of M_B is converted to an equivalent value M_S by:

$$M_S = 1.59 M_B - 3.97.$$

This value is then compared with the value of M_s determined from surface waves of period near 20 seconds.

Frequently quoted sources of information regarding epicenters, origin times, or shock magnitudes are as follows:

- USCGS - U.S. Coast and Geodetic Survey, Washington Science Center, Rockville, Maryland
- BCIS - Bureau Central International de Seismologie, Strasbourg, France
- PAL - Lamont Geological Observatory, Palisades, New York
- PAS - Seismological Laboratory, Pasadena, California
- WMSO - Wichita Mountains Observatory, Oklahoma
- BKS - Byerly Seismographic Station, Berkeley
- BRK - indicates the average magnitude determined by the Berkeley network.

All measurement and interpretation of seismograms (i.e., identification of phases, arrival times, directions of initial ground motion, and ground amplitudes and periods) are done at Berkeley. Readings from the remaining stations in the network other than the six listed (BRK, CLS, MHC, MIN, PRI, REN) are available on request. Requests for additional data or for copies of seismograms should be addressed to the Director.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 1	BKS	iP	04 14 39.7	d	USCGS: 6.9°N, 73.1°W, 0 = 04 05 27.5. Colombia h about 151 km.
	CLS	eP	42.5	c	
	MHC	iP	35.0	c	
	PRI	eP	26.0	d	
Jan. 1	MIN	eP	42.1	c	USCGS: 6.8°S, 155.9°E, 0 = 12 17 38.6. Solomon Islands. h about 165 km.
	BKS	e(P)	12 30 12.8	d	
	PRI	eP	15.7	c	
	CLS	eP	09.4	c	
Jan. 1	MHC	iP	12.2	c	USCGS: 20.8°N, 144.6°E, 0 = 13 48 06.5 Mariana Islands. h about 43 km.
	MIN	eP	15.3	c	
	BKS	eP	14 00 13.2	d	
	PRI	eP	23.4	c	
Jan 1	CLS	eP	10.7	c	USCGS: 20.0°S, 175.4°W, 0 = 16 27 38.1. Tonga Islands. h about 130 km.
	MHC	iP	16.8	d	
	MIN	iP	11.6	c	
	BKS	ep	16 39 14.5	c	
		e	46.7	d	
	PRI	eP	14.4	c	
		e	45.8		
	CLS	eP	15.6	c	
		e	47.7	d	
	MHC	iP	14.9	c	
Jan. 1	MIN	iP	25.5	d	USCGS: 56.6°N, 157.7°W, 0 = 23 39 05.6. Alaska Peninsula. h about 50 km. Magnitude 6 1/2 (PAS).
		e	56.7	d	
	BKS	eP	23 45 12.0	d	
		ipP	28.5	d	
		i	57.0	c	
		iPP	46 21.0	d	
		eSNEZ	50 07	NW-	
		i	30		
		iGNE	51.2		
		i	52 50		
Jan. 2	PRI	eP	R From NW 45 31.4	d	USCGS: Swan Islands. USCGS: 4.6°S, 105.9°W, 0 = 01 15 50.6. South of Galapagos Islands. h about 33 km.
		e	51.5	c	
	CLS	eP	04.4	c	
		e	23.0	c	
Jan. 2	MHC	e	48 10.4	d	
		iP	45 18.0	d	
		ipP	35.9	c	
	MIN	iP	44 58.5	d	
Jan. 2		i	45 15.5	d	
	MIN	eP	01 01 26.2	d	
	BKS	eNZ	01 36.5		
	PRI	e(P)	23 48.0	c	
Jan. 2	CLS	e	24 18.6	c	
	MHC	eP	23 59.8	c	
	MIN	eP	24 22.1	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 2	MIN	eP	10 01 34.2	d	USCGS: West Coast of Costa Rica.
Jan. 2	MIN	e(P)	12 05 07.6	c	USCGS: Andreanof Islands.
Jan. 2	BKS	e(L)	16 37.9		USCGS: 52.9°S, 118.2°W, 0 = 15 55 47.9.
	PRI	e	08 44.6	d	Southern Pacific Ocean. h about 33 km.
	CLS	e	55		
	MHC	eP	45		
	MIN	eP	09 05.9		
Jan. 3	BKS	eP	03 17 36.0		USCGS: 29.7°N, 130.1°E, 0 = 03 05 03.5.
		e	43.0		Ryukyu Islands. h about 30 km.
	PRI	eP	17 46.6	c	Magnitude 5 1/2 (Moscow).
	CLS	eP	32.3	d	
	MHC	iP	39.8	c	
		i	49.4	d	
	MIN	eP	30.4	d	
Jan. 3	BKS	eP	09 52 41.7	d	USCGS: 5.3°S, 151.5°E, 0 = 09 39 46.8.
		e	10 04.5		New Britain. h about 74 km.
		eR	20.0		
	PRI	e(P)	09 52 46.8	c	
	CLS	e(P)	37.2	c	
	MHC	eP	43.8	d	
Jan. 4	BKS	eP	12 29 32	d	USCGS: 4.7°S, 154.0°E, 0 = 12 16 38.0.
		eSEZ	39.7	W+	Solomon Islands Region.
		eEZ	41 09	W-	h = about 69 km. Felt in Rabaul.
		e	45.9		
		eNE	53.0		
		eEZ	56.5		
	MHC	i	31 43.3	d	
Jan. 5	BKS	eP	00 39 17.3	d	USCGS: 3.2°N, 127.0°E, 0 = 00 20 11.6.
	PRI	eP	17.5	d	Halmahera Region. h about 33 km.
	CLS	eP	18.0	c	
	MHC	iP	17.5	d	
Jan. 5	PRI	ePKP	13 35 28.1	d	USCGS: 9.4°S, 124.2°E, 0 = 13 16 43.0.
	MHC	ePKP	25.5	c	Timor. h about 33 km.
	MIN	ePKP	24.2	c	
Jan. 6	BKS	e	04 44 30	c	USCGS: 23.6°N, 108.6°W, 0 = 04 40 14.
		e	49.8		Gulf of California. h about 33 km.
	PRI	e	44 09	(d)	
	CLS	e	31	(d)	
	MHC	eP	23.8	d	
	MIN	eP	50.2	c	
Jan. 6	BKS	e(P)	06 27 01	c	USCGS: 1.8°S, 80.7°W, 0 = 06 17 28.0
		eSNZ	34 40	N-	Near the coast of Ecuador.
		eGNE	41.0		h about 51 km.
		eZ	44.0		
		eZ	44.9		
	PRI	eP	06 26 42.6	c	
	CLS	e	27 03.0	c	
	MHC	iP	06 26 50.4	d	
	MIN	eP	27 00.0		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 6	REN	eP	27 35.5	c	
(Cont.)	MHC	eP	18 10 22.4	d	USCGS: 44.7°N, 112.0°W, 0 = 18 07 47.8.
Jan. 6		e	13 10		Montana-Idaho Border. h about 33 km.
	MIN	i(P)	10 02.9	d	Felt in the upper Madison Valley, Montana.
	REN	eP	04.9	d	
Jan. 6	BKS	eP	21 30 51.0	c	Moscow: 48.3°N, 155.4°E, 0 = 21 20 56.5.
		e	31 42.5	d	Kurile Islands. USCGS h about 33 km.
	PRI	eP	05.4	c	Magnitude about 5 1/2 (Moscow).
	CLS	eP	30 46.2	c	
	MHC	iP	55.4	d	
	MIN	iP	43.0		
Jan. 7	BKS	eP	06 37 34.7	d	BCIS: 6.4°S, 154.7°E, 0 = 06 24 49.2.
		e	58.1		Solomon Islands Region. h about 80 km.
		e	07 04.5		Felt in Baku.
	PRI	eP	06 37 39.5	c	
	CLS	eP	33.0		
	MHC	eP	35.8	c	
	MIN	eP	40.8	c	
	REN	iP	44.7		
Jan. 7	BKS	e	12 07 16	d	USCGS: 0.6°N, 126.7°E, 0 = 11 48 22.7.
		eNE	15.2		Halmahera region. h about 42 km.
		eN	21.3		Magnitude 5 1/2 - 5 3/4 (PAL).
		eNE	32.2		
		eZ	33.6		
	MHC	e	12 06 43.7	c	
Jan. 8	PRI	eP	15 59 03.2	d	USCGS: South of Kyushu, Japan.
Jan. 8	MIN	eP	20 01 37.6	d	USCGS: Samoa Islands Region,
Jan. 9	BKS	eP	02 15 03.0	c	USCGS: 28.9°S, 177.4°W, 0 = 02 02 38.5.
		i	20.5	d	Kermadec Islands. h about 71 km.
		e	40.5		
	PRI	eP	15 02.4	c	
	CLS	eP	04.0	c	
	MHC	eP	02.9	c	
		i	20.3	d	
	MIN	eP	12.8	d	
Jan. 9	BKS	eP	03 25 19.2	c	USCGS: 18.6°N, 145.4°E, 0 = 03 13 26.4.
		e	26 04.0	d	Mariana Islands. h about 193 km.
		e	48.0		
	PRI	eP	25 28.2	c	
	CLS	eP	16.3	c	
	MHC	eP	22.3	c	
		i	26 07.4	d	
	MIN	iP	25 18.1	d	
	REN	iP	26.8	d	
		e	26 13.8		
Jan 9	MIN	eP	08 38 26.6	d	
Jan. 10	BKS	eNZ	05 30.0		USCGS: 18.8°N, 106.3°W, 0 = 05 18 36.9.
	PRI	e	23 23.7	d	Off coast of Jalisco, Mexico. h about
	MHC	iP	40.7	d	33 km.
	MIN	eP	24 00.5	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 11	BKS	e(P) e(S)NE e(SSS)NZ eL eRNZ	12 25 28 36.6 46.5 50.0 55.8	(c)	USCGS: 45.0°S, 75.7°W, 0 = 12 12 16.2. Near coast of Southern Chile. h : about 33 km. Magnitude 6 (Kew).
Jan. 11	PRI MIN BKS	e e(P) eEZ eNE	25 17.5 31 14 56.5 59.4	(c)	USCGS: Off the coast of El Salvador.
Jan. 12	BKS PRI CLS MHC REN	eZ eP eP iP iP	15 00.5 03 49 43.4 28.2 47.0 38.9 37.3	c c c c c	USCGS: 4.8°N, 76.7°W, 0 = 03 40 34.8. Colombia. h about 102 km.
Jan. 13	MIN	eP	13 55 01.5	c	USCGS: Central Alaska.
Jan. 14	MIN	ip e	02 23 44.0 24 06.8	d	
Jan 14	BKS	eP e(S)EZ eNE e(R)NZ	11 32 32.3 52.4 12 00.5 05.3	d	USCGS: 21.2°S, 169.3°E, 0 = 11 19 47.5. Loyalty Islands. h about 33 km.
Jan. 15	PRI CLS MHC REN BKS	eP eP iP eP e	11 32 33.8 32.5 33.2 44 02 00.0	c c c d	USCGS: 68.9°N, 17.1°W, 0 = 01 32 20.0. Denmark Strait, h about 33 km. Magnitude 5 (Pal).
Jan. 15	PRI CLS MHC MIN BKS	e e e(P) eP i	01 42 33 22 31 11.5 02 45 08.2	c c d c d	USCGS: 13.4°N, 145.3°E, 0 = 02 32 39.9. Mariana. Islands, h about 38 km. Magnitude 5 (Moscow)
Jan. 15	PRI CLS MHC MIN REN BKS	e(S)NEZ eN eZ eP eP iP i eP	55 32 03 06.8 10.5 02 45 16.2 05.7 10.7 24.5 06.8 25.8 16.4	NE- d c d c d d c c	BCIS: 69.5°N, 17.5°W, 0 = 05 23 00. Jan Mayen Islands Region, Magnitude 5.3 (Uppsala).
Jan. 15	BKS	eP e(S)NE e(L)NE	05 33 21.0 41 40 49.0	c NW	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 15		e(R)NZ	51.5		
(Cont.)	PRI CLS MHC MIN	e(P) eP eP eP	33 27.7 14.2 20.5 32 59.5	c c c	
Jan. 15	BKS MHC MIN	e iP eP	10 25.4 00 16.8 21.9	c d	USCGS. 10.6°S, 164.9°E, 0 = 09 47 42.9. Solomon Islands. h about 89 km.
Jan. 15	BKS PRI	e e(P)	17 50 48.5 43	d c	USCGS: 17.1°S, 179.6°W. 0 = 17 39 19.2. Fiji Islands. h about 276 km. Magnitude 4.8 (WMO).
Jan. 15	CLS MHC MIN	e(P) e iP i eP	44 52 43.6 50.5 53.0	c c d c	
Jan. 15	BKS	iP i i	51 01.3 19 37 43.0 38 02.0	d c c	USCGS: 205°S, 177.9°W, 0 = 19 26 34.3. Fiji Islands. h about 496 km. Magnitude 5.8 (WMO).
Jan. 16	PRI CLS MHC MIN REN BKS	eP eP iP i iP e(P)	37 43.3 44.0 43.3 49.8 52.5 59.0 56.6 03 27 15.0	d d d d d d d	USCGS: 54.0°S, 133.5°W, 0 = 03 14 05.9. South Pacific Ocean, h about 33 km.
Jan. 16	PRI CLS MHC BKS	e e eP eP	27 06 17 12.5 05 52 43.0	d d c d	USCGS: 51.3°N, 179.9°W, 0 = 05 44 52.3. Andreanof Islands. h about 38 km. Magnitude 4.9 (WMO).
Jan. 16	BKS	i e eEZ eP e(P) e P eP eP	53 04.7 06 02.5 04.5 05 53 00.5 52 36.6 48.0 37.4 47.6	c c c c c c d	
Jan. 16	CLS MHC	e iP	06 54 51 54.9	d c	USCGS: 54.3°N, 35.2°W, 0 = 06 44 56.8. Mid Atlantic Ridge. h about 33 km.
Jan. 16	BKS	eNZ e	13 01.0 05.0	d	USCGS: 54.4°N, 35.0°W, 0 = 12 32 37.6. Mid Atlantic Ridge. h about 33 km. Magnitude 4.9 (WMO).
Jan. 16	PRI CLS MHC MIN	e e eP e	12 42 38 33.5 35.5 20.6	c d c c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 16	PRI	e	15 20 55.7	d	USCGS: 24.0°S, 68.2°W, 0 = 15 09 16.6. Chile-Argentina Border, h about 150 km. Magnitude 4.6 (WMO).
	CLS	e	21 05	d	
		e	13.4	d	
Jan. 18	MHC	iP	06.8	d	JMA: 33°10'N, 136°01'E. 0 = 03 12 04.2 Off S. Honshu, Japan. h about 450 km. Magnitude 4.8 (WMO).
	MIN	eP	16.0	c	
	BKS	eP	03 23 24.3	c	
	PRI	eP	35.2	c	
	CLS	eP	20.6	c	
	MHC	iP	27.9	c	
Jan. 20	MIN	iP	18.8	c	USCGS: 51.9°N 173.2°W 0 = 08 56 06.2. Andreanof Islands, h about 30 km. Magnitude 4.4 (WMO).
	REN	eP	24.0	c	
	BKS	e	09 03 22	(d)	
		eNE	12.4		
Jan. 20		eZ	13.7		USCGS: 50.3°N, 129.4°W, 0 = 10 56 51.4. Vancouver Island, h about 33 km. Magnitude 4.3 (WMO).
	CLS	e	03 17	c	
	MHC	eP	29.1	d	
	MIN	eP	13.6	d	
	BKS	e(P)	10 59 54	(c)	
		eE	11 02.3		
		eNZ	02.6		
	PRI	e	00 27	d	
	CLS	e(P)	10 59 48.7	d	
	MHC	e(P)	11 00 03		
Jan. 20	MIN	eP	10 59 34.4	d	USCGS: 26.4°N, 110.7°W, 0 = 13 16 27.0. Gulf of California, h about 27 km. Magnitude 5.1 (WMO).
	REN	eP	52.9	c	
	BKS	e	13 20 09.5		
		eNE	22.6		
		eZ	23.0		
	PRI	e	13 19 30.8	d	
	CLS	e	20 11	c	
	MHC	eP	19 51		
	MIN	eP	20 19.7	c	
	REN	eP	02.1	c	
Jan. 21	BKS	iP	04 28 15.5	c	USCGS: 34.3°S, 69.7°W, 0 = 04 15 50.2 Mendoza Prov., Argentina. h about 183 km. Magnitude 4.7 (WMO).
	FRI	eP	05.2	c	
	CLS	eP	18.4	d	
	MHC	iP	12.0	d	
		ipP	53.8	c	
	MIN	eP	21.7	c	
	REN	eP	13.4	d	
Jan. 21	MHC	iPKP	07 19 41.3	d	USCGS: 60.5°S, 27.8°W, 0 = 07 00 45. Sandwich Islands, h about 33 km.
		e	55.4		
	MIN	ePKP	44.4	c	
Jan. 21	MIN	e(P)	12 09 13.0	c	USCGS: 2.7°S, 150.1°E, 0 = 11 56 15.3. New Ireland. h about 50 km.
Jan. 21	MIN	iP	14 52 39.4	d	USCGS: 59.5°N, 151.2°W, 0 = 14 47 05.4. Kenai Peninsula, Alaska. h about 67 km. Magnitude 4.8 (WMO).
		i	54.1	c	
	REN	eP	52.6	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h.m.s.		
Jan. 21	MHC	iP	18 47 17.9	d	USCGS: 18.0°S, 175.4°W, 0 = 18 35 41.5. Tonga Islands, h about 64 km.
Jan. 22	MIN	eP	28.0		USCGS: 11.3°S, 74.7°W, 0 = 08 32 33.2. Peru. h about 33 km.
	MIN	e	08 43 36.9	d	
Jan. 24	BKS	eP	03 02 28.7	d	USCGS: 8.4°N, 60.8°W, 0 = 02 52 09.0. Off coast of Venezuela. h about 66 km. Magnitude 4.5 (WMO).
	PRI	e(P)	19	c	
	CLS	eP	31.4	c	
	MHC	iP	25.3	d	
	MIN	iP	28.4	c	
	MHC	i(PKP)	09 47 08.7	d	
Jan. 24	MIN	e(PKP)	06.5	c	BCIS: 6.1°S, 113.0°E, 0 = 09 29 24.1. Java Sea. h about 650 km. Magnitude 5.6 (Quetta).
	REN	e(PKP)	13.7	d	
	MHC	eP	10 27 32.7	c	
Jan. 24	MIN	eP	36.4	d	USCGS: 10.1°S, 160.8°E, 0 = 10 14 52.0. Solomon Islands. h about 33 km.
	BKS	eP	12 20 21.1	d	
Jan. 24		i	32.2	c	USCGS: 15.2°S, 173.6°W, 0 = 12 09 01.2 Tonga Islands. h about 33 km. Magnitude 5.4 (Tulsa). Felt (IV) at Apia.
		e(S)E	29.6		
		eEZ	40.7		
	PRI	eP	20 20.8	d	
		e	32.1	d	
	CLS	eP	21.6	d	
	MHC	eP	21.1	d	
		i	33.3		
	MIN	eP	31.4	d	
		i	43.8		
Jan. 24	REN	eP	35.6	d	USCGS: 47.5°N, 121.9°W, 0 = 21 43 13. King County, Wash., h about 33 km. Magnitude 4.7 (WMO). Felt.
	BKS	eP	20 26 32.4	d	
	PRI	e(P)	33	d	
	CLS	e(P)	32	d	
	MHC	eP	32.6	d	
	MIN	eP	35.4		
	PRI	e(P)	21 46 01.3	d	
Jan. 24	CLS	e(P)	45 23.0		USCGS: 8.0°N, 126.6°E. 0 = 22 44 16.5. Mindanao (Philippines), h = 44 km.
	MHC	iP	41.2	d	
		i	56.7	c	
	MIN	eP	44 59.4	c	
	REN	eP	45 14.7	c	
	BKS	i	23 04 08.7	c	
		eNZ	09.4		
Jan. 25	BKS	iP	00 11 30.5	c	USCGS: 61.9°N, 148.9°W, 0 = 00 05 34.8 S. Alaska, h about 78 km.
	CLS	eP	22.8	c	
	MHC	iP	35.7	d	
Jan. 25	MIN	eP	12.3	d	USCGS: 20.3°S, 169.6°E, 0 = 00 16 05.7. Loyalty Islands. h about 135 km. Magnitude 6 1/2 (Noumea).
	BKS	iP	00 28 34.0	d	
		e	29 06.0	d	
	PRI	eP	28 35.8	d	
		e	29 07.0	d	
	CLS	eP	28 34.2	d	
		e	29 06.5	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h.m.s.		
Jan. 25 (Cont.)	MHC	ip	28 34.1	d	
		i	29 07.4	c	
	MIN	iP	28 41.6	d	
Jan. 25	MIN	e	11 18 29.1	d	
Jan. 25	BKS	eP	13 01 31.7	c	USCGS: 21.8°N, 143.8°E, 0 = 12 49 42.0. Mariana Islands, h about 190 km. Magnitude 4.4 (WMO).
		e	55.0	c	
		e	02 17.3	c	
	PRI	eP	01 41.6	c	
		e	02 28.2	c	
	CLS	eP	01 29.0	c	
		e	02 16.0	c	
	MHC	iP	01 35.3	c	
		i	02 21.5	c	
	MIN	iP	13 01 29.6	c	
		i	02 15.8	c	
	REN	iP	01 38	c	
Jan. 26	BKS	eP	10 00 50.6	c	
	PRI	eP	01 20.5	c	
	CLS	eP	00 40.0	d	
	MHC	iP	01 00.4	d	
	MIN	iP	00 33.3	d	
Jan. 27	MHC	e	01 19 35.9	d	
Jan. 27	BKS	e(P)	01 19 43.3	c	USCGS: 25.6°N, 128.3°E. 0 = 01 06 55.4. Ryukyu Islands, h about 61 km. Magnitude 5 (Moscow).
	PRI	e(P)	53.5	c	
	CLS	e(P)	40.0	c	
	MIN	eP	38.0	d	
Jan. 27	BKS	e	11 53 50.5	c	USCGS: 59.4°N, 153.4°W, 0 = 11 47 36.3. Gulf of Alaska, h about 94 km. Magnitude 4.5 (WMO).
	PRI	eP	53 51.0	d	
		epP	54 10.0	c	
	CLS	eP	53 23.5	d	
		epP	42.9	d	
	MHC	iP	37.5	c	
		ipP	56.5	c	
	MIN	iP	16.1	c	
		ipP	34.8	c	
Jan. 27	BKS	eP	15 27 05.5	c	USCGS: 44.3°N, 114.5°W, 0 = 15 24 46.5. Idaho. Magnitude 4.5 (WMO).
		e	30.7	d	
		e	28.9	d	
	PRI	eP	27 08.0	d	
		e	29 32.4	c	
	CLS	eP	26 48.1	c	
		e	29 16	c	
	MHC	eP	26 55.6	c	
		i	29 15.7	d	
	MIN	iP	26 20.6	d	
		i	31.5	d	
		i	28 11.3	c	
	REN	eP	26 23.9	c	
		i(S)N	27 49.4	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 27	MHC	eP	18 59 28.6	c	USCGS: 5.2°S, 152.3°E, 0 = 18 46 14.6. New Britain. h about 72 km. Felt.
Jan. 27	MIN	e(P)	30	c	MOSCOW: 40.8°N, 49.8°E, 0 = 19 35 10. Caspian Sea. h about 50 km. Magnitude 5 3/4 (PAL).
	PRI	e(P)	19 49 12	c	
	CLS	e(P)	48 59.7	c	
	MHC	e(PP)	52 16.6	c	
Jan. 28	MIN	eP	48 50.8	d	USCGS: 10.8°S, 76.7°W, 0 = 02 12 14.3. Central Peru. h about 105 km. Magnitude 5.4 (WMO).
	BKS	eP	02 22 42.3	c	
		e	23 06.7	d	
		e	15.0	d	
	PRI	eP	22 28.5	c	
	CLS	eP	46.5	c	
	MHC	iP	37.6	c	
	MIN	eP	48.8	c	
Jan. 28	REN	eP	39.8	c	JMA: 43°35'N, 145°00'E, 0 = 04 05 26.8. Hokkaido, Japan. h about 40 km. Magnitude 5.3 (JMA).
	BKS	eP	04 16 24.5	d	
	PRI	eP	37.6	d	
	CLS	eP	20.8	c	
	MHC	eP	28.7	c	
	MIN	eP	16.6	c	
		i	34.5	c	
	REN	eP	29.8	d	
Jan. 28	BKS	eP	10 51 45.3	c	USCGS: 19.0°S, 169.6°E, 0 = 10 39 30.6. New Hebrides, h about 220 km. Magnitude 5.0 (WMO).
	PRI	eP	47.2	c	
	CLS	eP	45.3	c	
	MHC	iP	45.8	c	
	MIN	eP	52.7	c	
Jan. 28	REN	eP	57.3	c	
	BKS	eP	12 25 18.5	d	USCGS: 2.6°S, 149.3°E, 0 = 12 12 19.8. New Britain. h about 33 km. Magnitude 6 1/2 (PAS)
		e	37.0	c	
		e	50.0	d	
		e	30 51		
		e(S)NE	35.9		
		e(G)N	48.7		
		e(R)EZ	52.7		
	PRI	e(P)	25 25.8	d	
	CLS	eP	17.0	d	
	MHC	iP	24.7	d	
		e(PP)	29 04.2		
	MIN	eP	25 20.7	c	
		i(PcP)	25.9	c	
Jan. 28	BKS	eP	13 07 12.5	d	USCGS: 54.7°N, 161.6°W, 0 = 13 00 50.8. Alaska Peninsula, h about 33 km. Magnitude 6.5 (PAS).
	PRI	eP	31.5	(d)	
	CLS	eP	03.0	(d)	
		e(R)	15.3		
	MHC	iP	07 18.5	c	
		i	41.0	d	
		i	08 24.8	c	
	MIN	eP	06 59.6	d	
		i	07 13.1	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 28 (Cont.)	REN	i	49.4	d	
Jan. 28	BKS	eP	07 15.5	d	
		ePZ	13 13 44.2	c	
		iNE	18 43	NW	
	PRI	e(P)	52.1	c	
	CLS	e(P)	39.0	d	
	MHC	e	46.0	d	
	MIN	i	39.4	c	
	REN	e	46	c	
Jan. 28	BKS	iP	14 01 29.0	d	USCGS: 19.7°S, 178.1°W, 0 = 13 50 28.3. Fiji Islands. h about 587 km. Magnitude 4.6 (WMO).
	PRI	eP	28.2	c	
	CLS	eP	28.3	d	
	MHC	iP	29.3	d	
	MIN	iP	37.6	c	
Jan. 28	BKS	eP	16 19 58.3	c	USCGS: 31.2°S, 177.7°W, 0 = 16 07 19 Kermadec Islands, h about 33 km.
		e	20 11.0	c	
	PRI	eP	57.5	d	
	CLS	eP	20 00.0	c	
	MHC	iP	19 58.7	d	
	MIN	eP	20 08.7	c	
Jan. 29	MIN	e(PKP)	07 47 09.5	d	USCGS: 12.7°S, 66.1°E, 0 = 07 27 17.9. Indian Ocean. h about 33 km.
		e	18.3	c	
Jan. 29	BKS	eP	09 30 55.8	d	USCGS: 49.7°N, 154.9°E, 0 = 09 21 14.3. Kurile Islands. h about 126 km. Magnitude 6 1/4 (PAS).
		i	31 06.0	c	
		i	30	d	
		eSNE	38 50		
		e(G)NE	45.4		
	PRI	eP	31 09.3	d	
	CLS	e(P)	30 51.2		
	MHC	iP	31 00.6	d	
		i	09.6	d	
	MIN	iP	30 47.7	d	
		i	56.3	d	
	REN	i	58.7	d	
Jan. 29	BKS	iP	20 45 17.7	d	USCGS: 21.5°S, 68.6°W, 0 = 20 33 27.0. Chile-Bolivia border, h about 78 km.
	PRI	eP	05.8	d	
	CLS	eP	21.0	d	
	MHC	iP	13.6	d	
		i	34.5	d	
	MIN	eP	23.2	d	
	REN	iP	16.0	d	
Jan. 30	BKS	iPKP	10 28 57.5	d	USCGS: 55.6°S, 28.3°W, 0 = 10 10 04.1. Sandwich Islands, h about 33 km. Magnitude 6.7 (KEW).
		i	29 07.6	c	
	PRI	e(PKP)	28 57.5	d	
	CLS	e(PKP)	58.3	d	
	MHC	i(PKP)	56.1	d	
	MIN	i(PKP)	29 00.4	d	
		i	10.8	c	
	REN	ePKP	28 59.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Jan. 31	BKS	i(P)	05 19 38.0	(d)	JMA: 26°00'N, 126°45'E, 0 = 05 06 29.9. Ryukyu Islands, h about 20 km. Magnitude 6.5 (Moscow).
	PRI	e(P)	47	(c)	
	CLS	eP	32.7	c	
	MHC	iP	39.5	c	
	MIN	eP	29.5	d	
		i	36.3	d	
	REN	eP	38.8	d	
Feb. 2	PRI	eP	21 32 19.5	c	USCGS: 13.9°N, 92.1°W, 0 = 21 25 38. Off coast of Guatemala, h about 33 km.
	MIN	eP	46.4	d	
Feb. 3	BKS	eP	13 01 39.5	c	USCGS: 7.6°N, 72°1'W, 0 = 12 52 13.8. Venezuela-Colombia border, h about 33 km.
	PRI	e(P)	25.5	c	
	CLS	eP	42.5	c	
	MHC	eP	34.8	c	Felt: Bucaramanga, Cucuta.
	MIN	iP	42.3	d	
Feb. 4	BKS	eP	23 30 58.0	d	USCGS: 48.5°N, 154.9°E, 0 = 23 21 09.0. Kurile Islands, h about 85 km. Magnitude 5.2 (Tulsa).
		eE	39.0		
		eEZ	47.7		
	PRI	eP	31 12.7	d	
	CLS	eP	30 53.2	d	
	MHC	iP	31 02.4	c	
	MIN	iP	30 49.6	c	
		i	31 41.3	c	
	REN	iP	01.9	d	
Feb. 5	MHC	iP	05 16 09.7	d	USCGS: 19.2°N, 147.1°E, 0 = 05 04 03.4. Mariana Islands, h about 38 km. Magnitude 4 3/4 (Matsushiro).
		i	17 14.2	d	
	MIN	eP	16 04.5	d	
Feb. 5	MHC	iP	07 31 08.4	c	USCGS: 44.3°N, 114.5°W, 0 = 07 29 00.3. Idaho. h about 33 km.
	MIN	eP	30 41.2	c	
		i	53.3	c	
		i	32 27.7		
	REN	eP	30 45.6	c	
Feb. 5	BKS	eP	12 14 58.3	d	USCGS: 53.7°N, 165.4°W, 0 = 12 08 20.6. Fox Islands (Aleutians). h about 33 km.
		e	23.5		
	PRI	eP	15 16.9	d	
	CLS	eP	14 51.7	d	
	MHC	iP	15 04.8	c	
	MIN	iP	14 48.0	c	
	REN	eP	15 02.3	c	
Feb. 5	BKS	eP	20 52 11.5	d	USCGS: 38.4°S, 73.2°W, 0 = 20 39 21.6. Coast of Central Chile. h about 41 km. Magnitude 6 - 6 1/4 (BKS).
		i	34	d	
		i	53 20	d	
		i	54 48		
		iSNEZ	21 02 40	SEc	
		eNE	04.0		
		eSSNE	08.2		
		eSSSNE	12.4		
		eGNE	15.7		
		eRNZ	21.5		
	PRI	eP	20 52 01	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Feb. 5 (Cont.)	CLS MHC MIN	eP e(P) e(P)	13 20 52 08 18	c	
Feb. 6	REN BKS	e(P) eP	11 01 34 22	c	
		eSNE e(G)NE e(R)NZ	44 56 59.5 02 03.5	NE	USCGS: 38.4°S, 73.6°W, 0 = 01 21 19.0. Aftershock of preceding. h about 33 km. Magnitude 5 1/4 - 5 1/2 (PAL).
Feb. 6	PRI BKS	eP iP	01 34 04 03 37 12.2	d c	USCGS: 6.8°N, 73.2°W, 0 = 03 27 55.8. Venezuela-Colombia border. h about 108 km.
	PRI CLS MHC MIN REN	eP eP iP eP eP	36 58.7 37 15.5 07.8 14.2 04.6	c d d d d	
Feb. 6	BKS PRI CLS MHC MIN REN	eP eP eP iP iP eP	06 04 52.0 52.5 52.8 52.5 05 02.0 05.9	c c c c d c	USCGS: 18.1°S, 177.6°W, 0 = 05 53 53.9. Fiji Islands. h about 500 km.
Feb. 6	MHC MIN	iP iP	07 10 09.9 20.8	d c	USCGS: 7.4°N, 82.6°W, 0 = 07 01 47.0. Panama. h about 61 km.
Feb. 6	BKS	e(P) eN eEZ	10 51 22.8 58.8 11 02.8		
Feb. 6	BKS PRI CLS MHC MIN	e(P) eP eP iP iP i	18 26 11 19.2 25 57.3 26 16.7 25 52.0 59.1	c c d c d c	USCGS: 53.6°N, 166.1°E, 0 = 18 17 20.9. Komandorsky Islands. h about 33 km. Magnitude 5 1/2 (Moscow).
Feb. 6	REN BKS PRI CLS MHC MIN	e(P) eP eP eP iP eP	26 04.7 21 55 44.0 32.8 47.2 39.5 50.5	c c c d c c	USCGS: 28.2°S, 67.4°W, 0 = 21 43 16.3. La Rioja Province, Argentina. h about 19 km.
Feb. 7	PRI CLS MHC MIN	e(P) e(P) iP eP	01 34 36.9 37 37.7 46.4	d c d d	USCGS: 17.7°S, 178.7°W, 0 = 01 23 41.7 Fiji Islands, h about 559 km.
Feb. 8	PRI	e e	02 41 03 12.5	(d) d	USCGS: 26.9°S, 176.7°W, 0 = 02 29 00.4. Kermadec Islands, h about 19 km.
	CLS MHC MIN	e iP iP	40 57 41 05.8 15.8	(d) c d	
Feb. 9	MIN	iP	08 07 35.9	c	USCGS: 51.2°N, 179.8°W, 0 = 07 59 52.9. Andreanof Islands. h = 33 km.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Feb. 9	MIN	iP	16 15 23.3	d	USCGS: 43.7°N, 150.6°E, 0 = 16 05 03.0. Kurile Islands. h = 33 km.
Feb. 10	MIN	eP	15 15 14.8	c	USCGS: 53.5°N, 33.4°W, 0 = 15 05 25.3. N. Atlantic Ocean. h about 41 km.
Feb. 10	MIN REN	iP eP	21 46 13.8 24.6	c d	USCGS: 44.6°N, 147.8°E, 0 = 21 35 48.7. Kurile Islands. h = about 67 km.
Feb. 11	MIN	iP	15 12 03.6	d	USCGS: 67.7°N, 146.7°W, 0 = 15 05 38.8. Alaska. h about 33 km.
Feb. 12	PRI CLS MHC MIN REN	eP eP iP eP eP	08 48 16.8 48.2 33.7 56.0 44.1	d d c c c	USCGS: 19.0°N, 107.4°W, 0 = 08 43 37.9. Revilla Gigedo Islands, h about 33 km.
Feb. 12	BKS PRI	iP eP	23 18 22.8 23.2	d c	USCGS: 17.8°S, 178.6°W, 0 = 23 07 28.9. Fiji Islands. h about 583 km. Magnitude 5.2 (College).
	CLS MHC MIN	eP e iP i i	20 24 18 23.0 20 21.5 18 23.5 19 05.4 18 34.2	c c c c c c	
Feb. 13	REN BKS	eP eNE	18 36.6 00 40.2	d	
	MIN PRI CLS	eP eP eP	30 00.6 29 35.5 58.1	d d d	
Feb. 13	BKS	eP i i i eNE eSNEZ e eGNE eREZ	09 03 17.0 32.3 06 20 07 20 13 40 14 16 20 17 27.9 33.0	c d d d c c c c c	USCGS: 24.5°N, 121.8°E, 0 = 08 50 02.2. Northern Taiwan. h about 33 km. Magnitude 7 1/4 (BKS). 3 killed, 15 wounded.
	PRI CLS MHC	eP eP eP	03 26.8 13.7 20.4	c c c	
	MIN REN	iP iP	11.8 20.3	c c	
Feb. 13	MIN	e(P)	09 43 42.8	c	Aftershock of preceding.
Feb. 13	BKS	eP iPP iSNEZ	18 26 35.2 29 54 37 12	c SE+	USCGS: 9.9°S, 160.8°E, 0 = 18 13 55.1. Solomon Islands. h about 29 km. Magnitude 6 1/4 - 6 1/2 (BKS).

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Feb. 13 (Cont.)		i(PPS)NE	38 20		
		i(SS)NEZ	42.3	NE-	
		eGNE	49.3		
		eREZ	52.5		
Feb. 14	PRI	eP	18 26 39.5	c	
	CLS	eP	34.7	c	
	MHC	iP	37.0	c	
	MIN	iP	40.3	c	
Feb. 14	REN	eP	46.6	c	
	MHC	e(P)	07 13 41.0	c	
Feb. 14	MIN	eP	14.3	c	
	BKS	e(P)	07 18 54.5	c	USCGS: 7.2°S, 128.2°E. 0 = 07 04 40.8. Banda Sea. h about 197 km. Magnitude 6 1/2 (PAS). Felt: Darwin.
		e	19 05	c	
		ePKP	22 52.8	c	
		i	23 01.8		
		i	28.5		
PRI	e(P)	18 50.8	d		
	ePKP	22 55.5	c		
CLS	e(P)	18 51.2	d		
	ePKP	22 51.2	c		
MHC	i(P)	18 56.9	c		
	iPKP	22 54.0	d		
	i	23 02.2			
	e(P)	18 55			
MIN	iPKP	22 56.7	c		
	e(P)	19 01.2	d		
REN	e(P)	22 57.2	d		
	ePKP	22 57.2	d		
Feb. 14	MHC	iP	07 33 56.9	d	
	MIN	eP	55.0	d	
Feb. 14	REN	e(P)	34 00.7	c	
	MHC	e(P)	08 40 28		USCGS: 6.2°N, 82.5°W, 0 = 08 31 59.5. Off Panama. h about 33 km. Magnitude 4.2 (USCGS).
Feb. 14	MIN	e(P)	45		USCGS: 0.9°N, 30.0°W, 0 = 12 09 11.4. Mid Atlantic Ridge. h about 33 km. Magnitude 5 3/4 (Kew).
	BKS	eP	12 22 21.8	d	
		eSNE	33.0	SW	
		iNE	34 32	SE	
		e(G)NE	39.3		
		eRNZ	46.0		
PRI	eP	22 14.9	c		
	CLS	eP	23.7	d	
	MHC	iP	21.2	c	
	MIN	eP	20.2	d	
Feb. 14	REN	e(P)	22 13.1	c	
	MIN	eP	14 19 45.9	d	USCGS: 45.2°N, 148.6°E, 0 = 14 09 29.8. Kurib Islands. h about 97 km.
Feb. 14	MHC	eP	15 42 41.7	d	USCGS: 9.8°S, 160.5°E, 0 = 15 29 58.2 Solomon Islands. h about 25 km. Magnitude 5.0 (USCGS).
	MIN	eP	45		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks	
1963			h. m. s.			
Feb. 14	BKS	eP	22 21 12.7	d	USCGS: 5.0°S, 144.6°E, 0 = 22 07 54.3. New Guinea. h about 80 km. Magnitude 6 1/2 (PAS).	
		i	28.4	d		
		e	24 00	SE		
		e(S)NE	31 40	E		
		eN	37 4			
		eNZ	38.6			
		e(G)N	46.0			
		e(R)EZ	51.4			
		PRI	eP	21 18.3		d
			e	38		c
Feb. 14	CLS	eP	11.0	d		
		e	29.2	c		
Feb. 14	MHC	iP	15.5	c		
		i	32.9	c		
		i	25 26.1	d		
		eP	21 15.1	c		
Feb. 15	REN	eP	21	d		
		iP	01 01 41.7	d	USCGS: 33.2°S, 179.2°W, 0 = 00 48 51.9. Kermadec Islands Region. h about 42 km. Magnitude 6.0 (Wellington).	
Feb. 15	BKS	PRI	eP	40.0	c	
		CLS	eP	42.1	c	
		MHC	iP	41.2	c	
		i	54.3	c		
Feb. 15	MIN	eP	49	c		
		eP	53	d		
Feb. 15	BKS	eP	07 06 30.5	c	USCGS: 14.9°S, 178.7°W, 0 = 06 54 51.8. Fiji Islands. h about 33 km.	
		eNEZ	29.0			
Feb. 15	PRI	eP	06 29.3	c		
		CLS	eP	29.5	c	
Feb. 15	MHC	iP	31.2	c		
		i	08 19.0	c		
		eP	06 39.9	c		
		eP	45	c		
Feb. 16	MIN	eP	08 15 19.1	c	USCGS: 15.1°N, 46.5°W, 0 = 08 04 13.4. North Atlantic Ocean. h about 33 km.	
		eP	08 15 19.1	c	USCGS: 17.7°S, 178.6°W, 0 = 08 31 17.5. Fiji Islands. h about 534 km.	
Feb. 16	BKS	eP	08 42 14.5	c		
		eEZ	09 19.5			
		PRI	eP	42 15.3	c	
		CLS	eP	15.2	c	
Feb. 16	MHC	iP	15.5	c		
		MIN	iP	24.2	d	
		BKS	iPKP	11 04 06.8	c	USCGS: 7.0°S, 117.3°E, 0 = 10 46 22.0. Flores Sea, h about 561 km.
		PRI	ePKP	10.6	d	
Feb. 16	CLS	ePKP	05.8	d		
		iPKP	08.6	c		
Feb. 16	MIN	ePKP	06.0	c		
		e	12 36 58.2	d		
Feb. 17	MIN	eP	19 38 07.8	d	USCGS: 23.9°S, 179.8°W, 0 = 19 26 31.5. Fiji Islands. h about 250 km.	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Feb. 18	BKS	ePEZ iN	14 24 39.7 40.2	dE N	USCGS: 36.2°S, 90.4°W, 0 = 14 12 36.0. Off Chile. h about 33 km.
	PRI	eP	29.3	d	
	CLS	eP	42.9	d	
	MHC	iP	36.4	d	
	MIN	eP	18.4	c	
	REN	i(P)	43.2	d	
Feb. 20	BKS	e	09 01 44	d	
		e	02 16		
		eNEZ	24.0		
Feb. 20	BKS	eP	14 40 10.2	d	USCGS: 51.9°N, 177.9°E, 0 = 14 32 07.7. Rat Islands, Aleutians. h about 33 km.
	PRI	eP	27.2	d	
	CLS	eP	04.2	c	
	MHC	iP	15.7	c	
Feb. 20	BKS	e(S)NE eNEZ e(G)NE e(R)NZ	17 31 47 37.8 44.5 50.5	NE SWd	USCGS: 45.7°S, 78.7°W, 0 = 17 07 33.5. Off S. Chile. h about 33 km. Magnitude 5.4 (Tulsa).
	MIN	e(P)	20 52		
Feb. 20	MIN	eP	19 53 41.2	d	USCGS: 24.6°N, 122.1°E, 0 = 19 40 30.9. Off Taiwan. h about 33 km.
Feb. 21	BKS	iP	13 27 55.0	d	USCGS: 20.6°S, 175.1°W, 0 = 13 16 05.6. Tonga Islands. h about 33 km. Magnitude 5.4 (ALQ).
		i	28 24.6	d	
	PRI	eP	27 54.2	c	
	CLS	eP	55.7	c	
	MHC	iP	54.8	c	
	MIN	iP	28 05.2	d	
Feb. 21	BKS	e	14 40 09.5	c	USCGS: 20.5°S, 173.9°W, 0 = 14 28 29. Tonga Islands. h about 29 km. Magnitude 5.0 (ALQ).
		e	33.0	d	
		e(S)NE	50.0	NW	
		e	15 02.8		
		eRZ	04.7		
	CLS	e(P)	14 40 14.5	c	
	MHC	iP	15.3	d	
	MIN	eP	25.6	d	
Feb. 22	BKS	eP	07 20 03.2	d	USCGS: 85.0°N, 98.9°E, 0 = 07 10 28.0. North Arctic. h about 33 km. Magnitude 5 1/2 (Moscow).
		eSNZ	28 00		
		e(R)NZ	37.0		
	CLS	eP	20 00.8	c	
	MHC	iP	11.3	c	
	MIN	eP	19 48.6	d	
	REN	iP	57	c	
		i	20 10		
Feb. 22	MIN	eP	07 32 38.1	d	USCGS: 84.7°N, 104.3°E, 0 = 07 23 14. North Arctic. h about 33 km.
Feb. 22	BKS	iP	08 09 54.4	d	USCGS: 17.8°S, 178.8°W, 0 = 07 58 57.0. Fiji Islands, h about 550 km. Magnitude 4.9 (Port Moresby).
	PRI	eP	54.8	c	
	CLS	eP	53.4	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Feb. 22	MHC	iP	54.9	c	
(Cont.)		i	11 51.3	d	
	MIN	eP	10 02.9	c	
	REN	iP	08.4	c	
Feb. 22	BKS	eP	21 22 47	d	USCGS: 18.1°N, 71.3°W, 0 = 21 14 06. Dominican Republic. h about 50 km.
		eN	39.0		
		eEZ	43.2		
	PRI	eP	22 36	c	
	CLS	eP	53	c	
Feb. 22	MHC	iP	23 25 08.0	d	USCGS: 58.8°N, 137.2°W, 0 = 23 19 57.7. Alaska. h about 33 km.
Feb. 23	MIN	iP	24 38.9	d	USCGS: 36.0°S, 102.5°W, 0 = 06 32 30. Southern Pacific Ocean. h about 33 km.
	BKS	iP	06 44 16.6	c	
	PRI	eP	04.8	d	
	MHC	iP	11.5	c	
	MIN	eP	30.8	d	
Feb. 23	MHC	e	17 22 29		USCGS: 49.4°N, 158.6°E, 0 = 17 12 47.4. Kurile Islands. h about 50 km.
	MIN	iP	14.7	d	
	REN	eP	27.8	d	
Feb. 24	BKS	iP	13 41 06.8	d	USCGS: 14.6°N, 91.4°W, 0 = 13 34 15.7. Central Guatemala. h about 135 km. Magnitude 5.3 (Tulsa). Felt: W.El Salvador.
		i(PcP)	43 31.0	d	
		iSNE	46 42	NE	
		IScP	47 09.0	d	
		e(G)NE	49.3		
	PRI	eP	40 49.8	d	
		e(PcP)	43 25.5		
	CLS	eP	41 12.0	d	
		e(PcP)	43 32.5	d	
	MHC	iP	41 00.8	c	
		i	37.3	c	
		i(PcP)	43 29.9	d	
		i	47 07.1		
	MIN	eP	41 13.3	c	
		i	31.8	c	
		i(PcP)	43 33.2	d	
		e	47 14.4		
	REN	iP	41 01	d	
Feb. 24	MIN	iP	22 45 33.2	d	USCGS: 26.4°N, 44.5°W, 0 = 22 35 00.0. North Atlantic Ocean. h about 33 km.
Feb. 25	MHC	iP	08 20 48.5	d	USCGS: 28.1°S, 65.4°W, 0 = 08 08 20.1. San Luis Province, Argentina. h about 33 km.
	MIN	eP	56.6	c	
	REN	eP	51	c	
Feb. 25	MHC	e	09 06 06		USCGS: 12.2°N, 88.2°W, 0 = 08 58 40.8. Off El Salvador. h about 33 km.
		e	20.8	d	
Feb. 25	MIN	eP	17 24 18.7	c	USCGS: 24.4°N, 123.4°E, 0 = 17 11 01.7. E. Taiwan. h about 33 km. Magnitude 5.3 (USCGS).
	BKS	e	54.0	W+	
	PRI	e	24 21.1	c	
	CLS	e	24.0	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Feb. 25 (Cont.)	MHC	e(P)	16.9	c	USCGS: 7.5°S, 146.2°E, 0 = 20 14 08.7. New Guinea. h about 171 km. Magnitude 7 - 7 1/4 (BKS).
Feb. 26	MIN	iP	08.6	d	
	BKS	iPNEZ	20 27 17.5	SWd	
		ipP	58.0	c	
		i	28 15.3	c	
		i	31 10.0	d	
	PRI	eP	27 23.3	d	
	CLS	eP	16.2	d	
		epP	28 00.1	c	
		e	31 08.3	d	
	MHC	iP	27 19.5	d	
		ipP	28 03.6	c	
		i	31 13.6	d	
	MIN	iP	27 19.9	d	
		ipP	28 02.1	d	
		i	31 14.5	c	
	REN	iP	27 27.5	d	
		ipP	28 09.5	d	
		i	31 25.6	d	
Feb. 27	BKS	eP	04 43 10	c	USCGS: 6.0°S, 149.4°E, 0 = 04 30 00.8. New Britain. h about 52 km. Magnitude 6 1/4 (PAS).
		i(P)EZ	46 32	c	
		eE	53.0	c	
	PRI	e	43 04.5	c	
	CLS	e	07	c	
		e	13	c	
	MHC	i	42.9	d	
	MIN	eP	22.4	d	
	REN	e	37.0	d	
		e	53.0	d	
Feb. 27	MIN	eP	07 45 58.7	c	USCGS: 16.2°S, 173.3°W, 0 = 07 34 23.8. Tonga Islands. h about 33 km.
Feb. 27	BKS	eN	21 05.0		USCGS: 16.3°S, 66.0°E, 0 = 01 31 13.2. Indian Ocean. h about 33 km.
		eEZ	08.0		
Feb. 28	MIN	ePKP	01 51 04.6	d	
Feb. 28	BKS	e	02 15.5		
		eNEZ	20.5		
		eNE	31.5		
		eNE	36.2		
		e(G)NE	38.5		
		e(R)NZ	46.5		
Mar. 1	MIN	eP	04 50 37.6	c	
Mar. 1	BKS	i	11 05 14		USCGS: 18.2°S, 177.9°W, 0 = 04 39 34.3. Fiji Islands. h about 568 km. USCGS: 41.2°N, 142.9°E, 0 = 10 45 55.7. S. Hokkaido, Japan. h about 41 km.
		e	15 16		
		e	17.6		
	MHC	i	10 57 24.9	d	
	MIN	eP	56 49.0	c	
			57 05.0	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 2	MHC	i	09 36 31.7	c	USCGS: 46.1°N, 153.1°E, 0 = 09 25 55.0. Kurile Islands. h about 33 km.
	MIN	eP	35 58.5	c	
Mar. 2	MIN	e	16 31 27.4	d	USCGS: 82.9°N, 7.7°W, 0 = 07 41 51.0 Northern Arctic. h about 33 km.
Mar. 4	BKS	eSNE	07 59.0		
		e(R)NEZ	08 07.0		
	PRI	e(P)	07 51 38.2	d	
	CLS	eP	20.6	c	
	MHC	i(P)	31.6	d	
	MIN	e(P)	06.9	c	
Mar. 4	BKS	eSNE	14 02.7		
		eQNE	17.7		
		e(R)EZ	22.3		
	PRI	e(P)	13 52 08.2	c	
	MHC	i(P)	02.0	c	
	MIN	eP	51 51.5	c	
Mar. 4	BKS	eP	15 52 45.0	c	USCGS: 4.5°S, 81.6°W, 0 = 15 43 04.0. Off Peru. h about 33 km. Magnitude 5 3/4 (Kew).
		iPcP	53 43.5		
	PRI	eP	52 30.6	c	
	CLS	eP	50.0	c	
	MHC	iP	40.6	c	
	MIN	eP	53.3	c	
	REN	iP	43.3	c	
Mar. 5	BKS	eP	07 14 44.4	c	
		i	15 04.0	d	
		iPcP	40.7	d	
	PRI	eP	14 29.1	c	
	CLS	eP	48.7	c	
	MHC	iP	39.6	c	
		i	48.0	c	
	MIN	eP	51.6	c	
		i	15 18.9		
	REN	iP	14 42.1		
Mar. 5	BKS	eP	09 23 14.6	c	USCGS: 17.5°S, 178.6°W, 0 = 09 12 16.8. Fiji Islands, h about 512 km.
	PRI	eP	15.5	c	
	CLS	eP	15.3	c	
	MHC	iP	15.0	c	
	MIN	iP	24.2	d	
	REN	eP	28.3	c	
Mar. 7	BKS	eP	05 32 40.5	c	
		i	50.0		
		e	33 04	c	
		e(PcP)	33 24		
		i	34 13		
		eSN	41 18		
		eNZ	30		
		eNZ	44.0		
		e(SS)NZ	45 28		
		eGNE	49.0		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 7 (Cont.)	PRI	eRNEZ eP e	52.3 32 28.0 41.3	d c	
	CLS	eP	44.1	d	
	MHC	iP i	35.9 46.5	c d	
	MIN	iP i	56.8 33 21.3	c c	
Mar. 7	REN	iP	32 49.9	d	
Mar. 7	MHC	iP	11 52 07.0	d	Easter Island aftershock.
Mar. 7	BKS	eP	12 29 34.7	c	USCGS: 44.3°S, 75.3°W, 0 = 12 16 28.5. Southern Chile. h about 45 km. Magnitude 5.6 (USCGS).
		ePP eNZ eZ eNZ e(SS)NEZ e(SSS)NZ eNE eRNZ	33 12 39 40 40 48 41 40 46.3 50.5 53.4 59.7		
	PRI	eP	29 24.6	c	
	CLS	eP	37.7	d	
	MHC	iP e(PP)	31.8 33 11	c	
	MIN	eP	29 46		
Mar. 7	BKS	iP e	13 51 05.6 14 03.0	c	USCGS: 50.8°N, 178.6°E, 0 = 13 43 01.2. Rat Islands, Aleutians. h about 33 km.
	PRI	eP	13 51 22.8	c	
	CLS	eP	00.1	c	
	MHC	iP i	11.0 22.1	d c	
	MIN	eP i	50 56.5 51 08.2	d c	
Mar. 8	BKS	eP eS e e(SS) eR	02 57 08.5 03 07 42 08 46 12 48 23.0	d	USCGS: 19.2°S, 169.7°E, 0 = 02 44 31.5. New Hebrides. h about 33 km.
	PRI	eP	02 57 08.8	d	
	CLS	eP	08.4	d	
	MHC	iP i	09.9 23.5	c	
	MIN	eP	15.1	d	
Mar. 8	BKS	eP eR	03 37 32.5 04 03.5	c	USCGS: 19.2°S, 169.6°E, 0 = 03 24 57.2. New Hebrides. h about 49 km. Felt: Tanna Island.
	PRI	eP	03 37 34.0	d	
	CLS	eP	36.7	c	
	MHC	eP i	33.4 41.9	c c	
	MIN	eP	41.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 8	BKS	eP e e(R)	03 45 39.3 46 02 04 12.2	c	USCGS: 19.3°S, 169.6°E, 0 = 03 33 03.4. New Hebrides. h about 33 km. Felt: Tanna Island.
	PRI	eP	03 45 42.8	c	
	MHC	e(P)	39		
	MIN	eP	47.9	c	
Mar. 8	MHC	iP	14 11 27.8	c	USCGS: 21.8°S, 176.5°W, 0 = 13 59 40.1. Tonga Islands. h about 137 km.
Mar. 8	MIN	eP	37.6	c	
Mar. 8	BKS	e(R)	15 45.4		USCGS: 1.1°N, 29.9°W, 0 = 15 06 05.3. Mid Atlantic Ridge. h about 33 km.
	PRI	eP	19 04.3	c	
	MHC	eP i(PcP)	07.9 10.8	c c	
	MIN	eP	06.2	d	
Mar. 8	BKS	e(P)	22 34 44	d	USCGS: 9.0°N, 84.1°W, 0 = 22 26 26. Coast of Costa Rica. h about 33 km.
	MHC	i	46.9	d	
Mar. 9	BKS	eP	06 55 26.6	d	USCGS: 46.1°N, 141.0°E, 0 = 06 44 28.1. Kurile Islands. h about 31 km.
	PRI	eP	40.5	c	
	CLS	eP	21.5	c	
	MHC	iP	29.9	c	
	MIN	iP	17.6	c	
Mar. 9	BKS	eN eEZ	17 01.8 05.0		
Mar. 9	MHC	iP	22 55 00.0	d	USCGS: 21.5°S, 179.0°W, 0 = 22 43 50.5. Fiji Islands. h about 529 km.
	MIN	eP	14.4	c	
Mar. 10	BKS	i	01 31 57.8	c	USCGS: 56.2°N, 153.8°W, 0 = 01 26 04.1. Kodiak Island, Alaska. h about 33 km.
	PRI	e	32 12.5	c	
	CLS	e(P)	31 45.0	c	
	MHC	iP i	56.9 32 27.3	c	
	MIN	iP i	31 39.3 49.4	c c	
		e	35 03.0	c	
Mar. 10	BKS	iP	01 38 21.3	d	
	PRI	eP	20.8	c	
	CLS	eP	22.0	c	
	MHC	iP	21.3	c	
	MIN	iP	30.5	d	
Mar. 10	BKS	e eGNEZ e	03 06 54.7 31.4 36.4		USCGS: 24.7°N, 122.1°E, 0 = 02 53 33.0. Eastern Taiwan. h about 33 km. Magnitude 6 (Moscow).
	PRI	e(P)	06 57.1	c	
	CLS	e(P)	44	c	
	MHC	iP	50.6	c	
	MIN	iP i	42.4 47.8	c c	
Mar. 10	BKS	iP ipP iSNEZ eSSE	11 04 06.1 23.3 14 18 19 36	c c SW+	USCGS: 29.9°S, 71.2°W, 0 = 10 51 48.1. Coast of Central Chile. h about 70 km. Magnitude 6 - 6 1/4 (PAS).

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 10 (Cont.)		eQEZ	25.0		
		e(R)Z	31.2		
	PRI	eP	11 03 54.8	d	
		epP	04 12.2	c	
	CLS	e(P)	08.5	d	
		epP	26.6	c	
	MHC	iP	02.2	d	
		i	29.1	c	
	MIN	iP	12.2	c	
		i	30.2	d	
Mar. 11	PRI	e(P)	15 35 36.6	d	USCGS: 17.6°N, 100.8°W, 0 = 15 30 07.6. Guerrero, Mexico. h about 33 km.
	MHC	iP	49.3	d	
Mar. 14	BKS	eNZ	01 57.2	Sd	
Mar. 14	BKS	e	08 26.6		USCGS: 19.0°N, 120.4°E, 0 = 08 00 15.6. Off N. Luzon, Philippines. h about 51 km. Magnitude 5.8 (Uppsala).
		eNEZ	31.8		
		eN	40.0		
		eEZ	45.5		
Mar. 15	MIN	eP	13 46.3	d	
	BKS	eP	00 29 40	c	USCGS: 8.4°N, 126.4°E, 0 = 00 16 01.3. Mindanao, Philippines. h about 117 km.
		eEZ	34.6		
		eEZ	42.5		
		eE	46.9		
		eNEZ	51.9		
		eEZ	01 01.8		
Mar. 16	BKS	iP	08 54 51.3	c	USCGS: 46.5°N, 154.7°E, 0 = 08 44 48.3. Kuri Islands. h about 26 km. Magnitude 7 3/4 (BKS).
		i	55 02.7	c	
		i	17.7	d	
		i	25.5	c	
		e	09 24 10.7	c	
	PRI	eP	08 55 04.6	c	
		e	09 24 10.8	c	
	CLS	iP	08 54 46.7	c	
		e	09 24 10.7	c	
	MHC	iP	08 54 55.6	d	
		i	55 02.9	d	
		i(PKPPKP)	09 24 19.9	c	
	MIN	iP	08 54 43.6	c	
		i	54.9	c	
		e(PKPPKP)	09 24 25.8	c	
Mar. 17	MIN	eP	08 52 06.8		USCGS: 15.7°S, 178.4°W, 0 = 13 16 23.5. Fiji Islands. h about 561 km.
Mar. 18	MHC	iP	13 27 11.3	d	
	MIN	iP	19.7	d	
Mar. 19	MIN	eP	14 16 41.6	c	USCGS: 27.0°N, 115.0°W, 0 = 14 13 18.1. Baja California. h about 33 km.
Mar. 20	BKS	iP	04 54 09.1	c	USCGS: 19.9°S, 179.1°W, 0 = 04 43 13.5. Fiji Islands. h about 680 km.
	PRI	eP	09.4	c	
	CLS	eP	10.2	d	Foreshock of next event.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 20 (Cont.)	MHC	iP	09.3	c	
		i	13.6	d	
	MIN	eP	18.1	c	
Mar. 20	BKS	eP	04 56 44.7	c	USCGS: 19.6°S, 179.3°W, 0 = 04 45 49.5. Fiji Islands. h about 680 km. Magnitude 5.2 (USCGS).
	PRI	e(P)	44.7	c	
	CLS	eP	45.3	c	
	MHC	iP	44.8	c	
		i	57 03.5	c	
	MIN	eP	56 38.9	d	
		i	49.0	c	
Mar. 21	BKS	iP	04 11 39.6	c	USCGS: 36.5°N, 140.9°E, 0 = 04 00 11.1. E. Honshu, Japan. h about 50 km. Magnitude 5.4 (JMA)
		i	51.3	c	
	PRI	e(P)	51.4	c	
	CLS	eP	35.5	c	
		e	47.3	c	
	MHC	iP	43.6	c	
		i	54.5	c	
	MIN	eP	33.3	c	
	MIN	i	47.0	c	
Mar. 21	PRI	eP	18 23 03.6	d	USCGS: 50.6°N, 129.4°W, 0 = 18 19 22.7. Vancouver Island. h about 33 km.
	MHC	iP	22 51.5	c	
	MIN	eP	08.5	c	
Mar. 22	BKS	eNEZ	04 40.0	NW+	USCGS: 44.7°N, 110.7°W, 0 = 04 34 43.3. Yellowstone National Park, Wyoming. Magnitude 4.1 (Eureka). Felt.
	MHC	iP	37 38.5	d	
	MIN	e(P)	36 56.8		
Mar. 22	BKS	eNZ	13 13.0		USCGS: 9.7°S, 120.4°E, 0 = 02 07 12.8. Sumba Island, Indonesia. h about 33 km. Magnitude 6 1/4 (PAS).
Mar. 24	BKS	ePKP	02 25 59.0	d	
		e(PP)	27 04	c	
		eSKKSNE	34 08	W(N)	
		e(PKKP)	36.0		
		e(SP)EZ	52.8	E(+)	
		eNEZ	43.4	NE-	
		eNE	46.5		
		eGN	54.0		
		eEZ	56.5		
		eEZ	03 00.8		
	PRI	ePKP	02 26 02.6	d	
		e	11.0	d	
	CLS	ePKP	25 58.2	d	
		e	26 07.0	d	
		e	31 57.5	-	
	MHC	iPKP	26 00.9	c	
		i	08.0	d	
		i	32 08.5	-	
	MIN	ePKP	25 58.2	d	
		i	26 07.4	c	
		i	31 55.5	+	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 24	BKS	iP	21 43 03.8	c	USCGS: 51.8°N, 178.1°W, 0 = 21 35 24.4. Andreanof Islands, Aleutians. h about 57 km. Magnitude 5 3/4 (Matsushiro).
		i	16.2		
		e(PcS)	48 47.8		
		iSNEZ	49 12	SE-	
		eNE	36	NE	
		e	52.4		
		eNE	52.5		
		eRNEZ	54.5		
		PRI	eP	43 21.1	
	CLS	i	28.6	d	
		e	49 02.8	d	
		eP	42 58.5	c	
	MHC	e	43 10.7		
		e	48 48	(+)	
		iP	43 09.4	c	
		i	21.5	c	
		i(PcS)	48 50.9	c	
		iP	42 54.8	c	
Mar. 25	BKS	i	43 06.9	c	USCGS: 0.7°N, 96.5°E, 0 = 22 46 16.2. Off SW Sumatra. h about 30 km. Magnitude 5.6 (USCGS).
		i	44 58.4	c	
		e(PcS)	48 45.2	c	
	ePKP	23 05 20.8	c		
	e(SSP)	24 50	S-		
	eSSSNZ	29.3			
	eEZ	45.7			
	eEZ	50.0			
	PRI	ePKP	05 25.6	c	
MHC	ePKP	19.2	c		
	iPKP	21.7	d		
	i	37.1	c		
MIN	iPKP	17.8	c		
	i	28.6	d		
	ePNEZ	10 00 52.2	NEc		
Mar. 26	BKS	i	01 00.0	d	USCGS: 29.7°S, 177.8°W, 0 = 09 48 19.7. Kermadec Islands, h about 45 km. Magnitude 7 (BKS). Felt: Raoul Island.
		i	10.0	c	
		i	13.1	c	
	eSN	10 30			
	iPKPPKP	27 11.5	d		
	PRI	eP	00 51.0	c	
	i	58.7			
	ePKPPKP	27 08			
	CLS	eP	00 53.3	c	
		ePKPPKP	27 10.8	d	
		eT	11 33		
	MHC	eP	10 00 52.3	c	
ePKPPKP		27 10.9	c		
eT		11 33.7			
MIN	eP	10 01 00.7	c		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks	
1963			h. m. s.			
Mar. 26		i	07.5	d	(Cont.)	
		iPKPPKP	27 02.7	d		
Mar. 26	BKS	iP	11 58 34.5	d	USCGS: 30.1°S, 177.4°W, 0 = 11 46 02.5. Kermadec aftershock. h about 50 km.	
		PRI	e(P)	32		c
		CLS	e	35		c
	MHC	iP	34.3	d		
	MIN	eP	43.5	c		
	BKS	iP	13 04 11.2	c		
Mar. 26	BKS	PRI	eP	10.2	c	USCGS: 29.9°S, 177.6°W, 0 = 12 51 39.7. Kermadec aftershock. h about 60 km.
		CLS	eP	12.0	d	
		MHC	eP	10.4	c	
	MIN	eP	20.4	d		
	BKS	iPNZ	13 37 36.3	Nc		
		i	47.7			
Mar. 26	BKS	i	38 45.7		USCGS: 29.8°S, 177.9°W, 0 = 13 25 02.6. Kermadec aftershock. h about 42 km. Magnitude 6 1/2 (PAL).	
		i	41 09.9			
		i(PP)	37 35.1	c		
	PRI	eP	37 35.1	c		
	e	50.6	d			
	ePKPPKP	14 03 47.5	d			
	CLS	eP	13 37 37.4	c		
		e	51.0	c		
		iP	36.4	c		
	MHC	i	52.6	c		
		iPKKP	55 41.3	c		
		eT	15 10			
MIN	iP	13 37 46.1	d			
	i	38 01.2	d			
	iP	19 58 17.0	c			
Mar. 26	BKS	iP	19 58 17.0	c	USCGS: 44.4°N, 146.7°E, 0 = 19 47 46.0. Kurile Islands. h about 110 km. Magnitude 5.6 (USCGS).	
	PRI	eP	29.5	c		
	CLS	eP	12.4	c		
Mar. 26	BKS	MIN	iP	09.4	c	JMA: 35°47'N, 135°46'W, 0 = 21 34 35.9. Eastern Honshu, Japan. h about 33 km. Magnitude 6 1/2 (BKS). Some damage in Central Honshu.
		BKS	ePEZ	21 46 33.0	Wc	
		i(PcP)	47.5	d		
	i	47 06.3	d			
	iNZ	40	Sd			
	iSNE	56 24	NE			
	eNE	22 01.0				
	iSSNE	01 28				
	eNE	04				
	e(Q)NE	06.5				
	eZ	07.0				
	eREZ	10.3				
PRI	eP	46 44.7	c			
CLS	eP	30.0	d			
	MHC	eP	37.0	c		
	i	48.1	c			
MIN	eP	26.2	c			
	i	35.7	d			

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 26	MIN	eP	22 48 18.0	c	JMA: 34°02'N, 140°00'E, 0 = 22 36 47.6. Off S. Honshu, Japan. h about 100 km.
Mar. 27	MIN	iP	03 51 29.3	c	USCGS: 37.0°N, 71.9°E, 0 = 03 39 04.9. Hindu Kush. h about 189 km.
Mar. 27	MHC	iP	07 24 56.8	d	USCGS: 44.3°N, 110.6°W, 0 = 07 22 08.9. Yellowstone National Park, Wyoming. h about 33 km.
Mar. 27	MIN	e(P)	25.0	c	
Mar. 27	PRI	e(P)	09 15 36.0	d	USCGS: 51.1°N, 130.1°W, 0 = 09 11 43.7. Queen Charlotte Island, British Columbia. h about 33 km.
Mar. 27	MHC	e(P)	21.0	d	
Mar. 27	MIN	iP	14 37.8	d	
Mar. 27		e	15 01.6	d	
Mar. 28	BKS	i(P)	00 26 04.5	c	USCGS: 66.3°N, 19.6°W, 0 = 00 15 47.6. N. Iceland, h about 15 km. Magnitude 6 1/2 (BKS). Light damage; 3 injured.
Mar. 28		i(S)	34 06		
Mar. 28		i	22		
Mar. 28	PRI	eP	26 09.3	c	
Mar. 28	CLS	iP	25 59.0	c	
Mar. 28	MHC	iP	26 04.2	c	
Mar. 28	MIN	iP	25 35.0	c	
Mar. 28	BKS	iP	11 25 06.0	c	USCGS: 30.2°S, 177.8°W, 0 = 11 12 31.3. Kermadec Islands. h about 38 km. Magnitude 6.0 (Riverview).
Mar. 28		i	16.0	c	
Mar. 28		i	51.4	d	
Mar. 28	PRI	eP	05.0	c	
Mar. 28	CLS	eP	07.5	c	
Mar. 28	MHC	eP	05.8	c	
Mar. 28		i	23.9	d	
Mar. 28	MIN	eP	15.3	d	
Mar. 28	PRI	eP	23 41 43.1	c	USCGS: 29.6°S, 177.5°W, 0 = 23 29 14.6. Kermadec Islands. h about 54 km. Magnitude 5 1/2 (Moscow).
Mar. 28	CLS	eP	45.6	c	
Mar. 28	MHC	iP	43.0	c	
Mar. 28	MIN	eP	53.1	c	
Mar. 29	BKS	iP	21 29 15.8	d	USCGS: 30.2°S, 177.7°W, 0 = 21 16 43.7. Kermadec Islands. h about 60 km.
Mar. 29	PRI	e(P)	17	c	
Mar. 29	CLS	e(P)	17	d	
Mar. 30	PRI	eP	00 38 27.0	c	USCGS: 51.1°N, 129.4°W, 0 = 00 34 40.1. Queen Charlotte Island. h about 33 km.
Mar. 30	MHC	i	18.7	c	
Mar. 30	MIN	iP	37 29.2	d	
Mar. 30	BKS	eP	02 05 52	c	USCGS: 19.1°S, 169.1°E, 0 = 01 53 28.8. New Hebrides. h about 160 km. Magnitude 6 1/2 (Riverview).
Mar. 30		iNEZ	53.5	SEd	
Mar. 30		i	06 14.0	d	
Mar. 30	PRI	eP	05 54.0	c	
Mar. 30	CLS	eP	52.0	c	
Mar. 30	MHC	iP	53.0	c	
Mar. 30		i	54.4	d	
Mar. 30	MIN	iP	06 00.3	d	
Mar. 30	BKS	iPEZ	17 02 33.2	Ec	USCGS: 44.2°N, 148.0°E, 0 = 16 51 56.6. Kurile Islands. h about 33 km. Magnitude 6 1/4 - 6 1/2 (Matsushiro).
Mar. 30		i	43.5	d	
Mar. 30		i(PcP)	03 09.7		
Mar. 30	PRI	iP	02 46.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Mar. 30	CLS	eP	28.5	c	
Mar. 30	(Cont.)	MHC	iP	37.5	c
Mar. 30		i	47.2	d	
Mar. 31	MIN	iP	25.0	c	
Mar. 31	PRI	e(P)	04 55 40.7	c	USCGS: 6.5°S, 81.1°W, 0 = 04 46 00.8. Off N. Peru, h about 33 km. Magnitude 5.2 (USCGS).
Mar. 31	MHC	eP	50.7	c	
Mar. 31	MIN	eP	56 06.5	c	USCGS: 29.9°S, 177.7°W, 0 = 05 30 49.3. Kermadec Islands. h about 48 km. Magnitude 6 1/4 - 6 1/2 (PAS).
Mar. 31	BKS	eP	05 43 21.9	c	
Mar. 31		i	37.2	c	
Mar. 31		i	44 23.6	c	
Mar. 31		iSNE	53 44	SW	
Mar. 31		ePPSNE	55.3		
Mar. 31		eSSNE	59.5		
Mar. 31		eGNE	06 05.6		
Mar. 31		eRNE	09.0		
Mar. 31	PRI	eP	05 43 20.8	c	
Mar. 31		e	38.8	d	
Mar. 31	CLS	eP	23.1	c	
Mar. 31		e	40.8	d	
Mar. 31	MHC	iP	21.9	c	
Mar. 31		i	25.6		
Mar. 31		i	39.4	d	
Mar. 31	MIN	iP	32.6	d	
Mar. 31		i	48.9	d	
Mar. 31	MHC	iP	06 01 25.4	c	USCGS: 10.7°S, 78.5°W, 0 = 05 51 00.9. Off Central Peru. h about 33 km.
Mar. 31	MIN	i(P)	37.5	d	
Mar. 31	MHC	i	07 20 58.5	c	USCGS: 6.1°S, 149.0°E, 0 = 07 07 36.3. New Britain. h about 60 km. Felt.
Mar. 31	MIN	iP	49.0	d	
Mar. 31	MHC	iP	09 19 54.1	d	USCGS: 30.1°S, 177.7°W, 0 = 09 07 20.1. Kermadec aftershock. h about 48 km. Magnitude 5.2 (USCGS).
Mar. 31		i	20 01.5	d	
Mar. 31	MIN	iP	03.3	d	
Mar. 31	BKS	eP	19 35 27.6	c	USCGS: 30.0°S, 178.0°W, 0 = 19 22 53.3. Kermadec aftershock. h about 50 km. Magnitude 6 (Kew).
Mar. 31		i	43.7	c	
Mar. 31		i	36 03.0	d	
Mar. 31		e(S)	45 48		
Mar. 31		iPSNEZ	46 56	SWd	
Mar. 31		eSSEN	51.2		
Mar. 31		eSSSZ	55.0		
Mar. 31		eQEZ	57.5		
Mar. 31		e(R)NEZ	20 01.2		
Mar. 31	PRI	eP	19 35 26.0	c	
Mar. 31		e	43.5		
Mar. 31	CLS	eP	28.1	c	
Mar. 31		e	45.0		
Mar. 31	MHC	iP	26.7	c	
Mar. 31		i	28.1	d	
Mar. 31		i	44.4	c	
Mar. 31	MIN	iP	37.0	d	
Mar. 31		i	54.5	d	

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ARCATA--BERKELEY--CALISTOGA--CONCORD
FERNDALE--FRESNO--LLANADA--MANZANITA LAKE
MINERAL--MOUNT HAMILTON--PALO ALTO--PARAISO
POINT REYES--PRIEST--SAN FRANCISCO
SANTA CRUZ--SHASTA--VINEYARD

Earthquakes and the Registration of Earthquakes

From April 1, 1963 to June 30, 1963

By

Cinna Lomnitz

and

James W. Dewey

University of California

Berkeley

1966

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INTRODUCTION

Each quarterly issue of the Bulletin includes determinations of epicenters, origin times, magnitudes, and other information available at the time of writing, for earthquakes in northern California and adjoining areas. Recorded arrival times of seismic waves are tabulated only for the major earthquakes in the local area and for teleseisms.

Information items regarding the seismographic stations which comprise the Berkeley network are repeated in every issue. Information of a general nature, such as the Modified Mercalli Intensity Scale, will be found only in the first number of each volume.

PERSONNEL (December 1965)

Station Director	Bruce A. Bolt
Director Emeritus	Perry Byerly
Associate Research Seismologist	Cinna Lomnitz
Assistant Research Seismologist	Helen Freedman
Postgraduate Research Seismologist	Peter Rodgers
Associate	Don Tocher (U.S. Coast and Geodetic Survey, San Francisco)
Associate Engineer	Walter Marion
Full-time Technical Staff	G. Mitchell, R. Sell, M. Hilger, J. Firby
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Secretary	Loretta Martin

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THE BYERLY SEISMOGRAPHIC STATION (BKS)

Standardized equipment began operating in a newly constructed tunnel east of the main campus on June 8, 1962. The closest buildings, part of the Lawrence Radiation Laboratory, are about 0.8 km away. The tunnel was cut into the upper part of the Claremont Formation. Of Miocene age, this formation consists of thin layers of cherty material alternating with shale.

A plan of the tunnel is shown in the diagram. Piers are constructed of reinforced concrete with no isolation from floor and walls. The temperature is stable. A ventilating and dehumidifying system is connected to all rooms.

The short-period world-wide standard instruments are operated with an approximate magnification of 25,000 at 1 sec and the long-period standard instruments with 3,000 at 30 sec.

On March 20, 1964, the Regents of the University of California named this station the "Byerly Seismographic Station" in recognition of the work of Professor Perry Byerly.

HISTORY OF THE UNIVERSITY OF CALIFORNIA STATIONS

"The Seismographic Stations at Mount Hamilton and Berkeley present several items of interest in the history of earthquake science, one of which is that according to the available records they were the first seismographic stations set up in America. Furthermore, they have functioned continuously from their founding to the present day, with improvements in instrumental equipment from time to time as the development of the science and opportunity have permitted.

"Several outstanding figures in the seismology of the 1880's were impressed with the importance of these stations, and Ewing, Milne, and Gray each took a personal interest in aiding one or both stations to obtain their own best and most modern types of instruments."

The quotation is from "History of the University of California Seismographic Stations and Related Activities" by Professor George D. Louderback, published in the Bulletin of the Seismological Society of America, Vol. 32, No. 3, pp. 205-229, 1942. In this paper may be found a detailed account of the development of the Berkeley stations from the installation of the instruments (the first earthquake known recorded at Mount Hamilton was on April 24, 1887) to 1942.

Since 1942, the number of seismographic stations associated with the University of California has increased from six to twenty in 1962. In 1950, Professor Perry Byerly was appointed Director by the Regents; he had been in charge of instruction and research since 1925. In 1960, the University entered into a contract with the Air Force Office of Scientific Research of the Research Projects Agency of the Department of Defense. Funds were made available under the Vela Uniform program to design and operate a telemetered network of eight new stations in central California and to construct a new seismic vault near the Berkeley campus.

STATIONS IN OPERATION: APRIL - JUNE 1963

Station	North Latitude	West Longitude	Elev. Meters	Symbol	Present Auspices and Date Established
Berkeley (Haviland)	37° 52!4	122° 15!6	81	BRK, BRX	Univ. of California, 1887
Berkeley (Strawberry)	37° 52!6	122° 14!1	276	BKS	Univ. of California, 1962
Mt. Hamilton	37° 20!5	121° 38!5	1282	MHC	Lick Observatory, 1887
Palo Alto	37° 25!0	122° 10!9	83	PAC	Stanford University, 1927
San Francisco	37° 46!6	122° 27!1	100	SFB	Univ. of San Francisco, 1931
Fresno	36° 46!0	119° 47!8	88	FRE	Fresno City College, 1935
Mineral	40° 20!7	121° 36!3	1495	MIN	National Park Service, 1938
Arcata	40° 52!6	124° 04!5	59	ARC	Humboldt State College, 1948
Shasta	40° 41!7	122° 23!3	312	SHS	Bureau of Reclamation, 1942
Manzanita Lake	40° 32!2	121° 33!7	1800	MLC	National Park Service, 1956
Vineyard (local)	36° 45!0	121° 23!1	330	VIN	W. A. Taylor and Co., 1959
(telemeter)	36° 45!0	121° 23!3	380	VIT	
Concord	37° 58!1	122° 04!3	36	CNC	Diablo Valley College, 1960
Santa Cruz	37° 00!4	121° 59!8	128	SCC	City of Santa Cruz, 1961
Paraiso	36° 19!9	121° 22!2	363	PRS	Paraiso Hot Springs, 1961
Llanada	36° 37!0	120° 56!6	475	LLA	Charles McCullough Ranch, 1961
Calistoga	38° 38!2	122° 35!1	457	CLS	Terrance Kirk Ranch, 1961
Point Reyes	38° 04!8	122° 52!0	404	PRC	Federal Aviation Agency, 1961
Priest	36° 08!5	120° 39!9	1187	PRI	Federal Aviation Agency, 1961

STATION INSTRUMENTATION

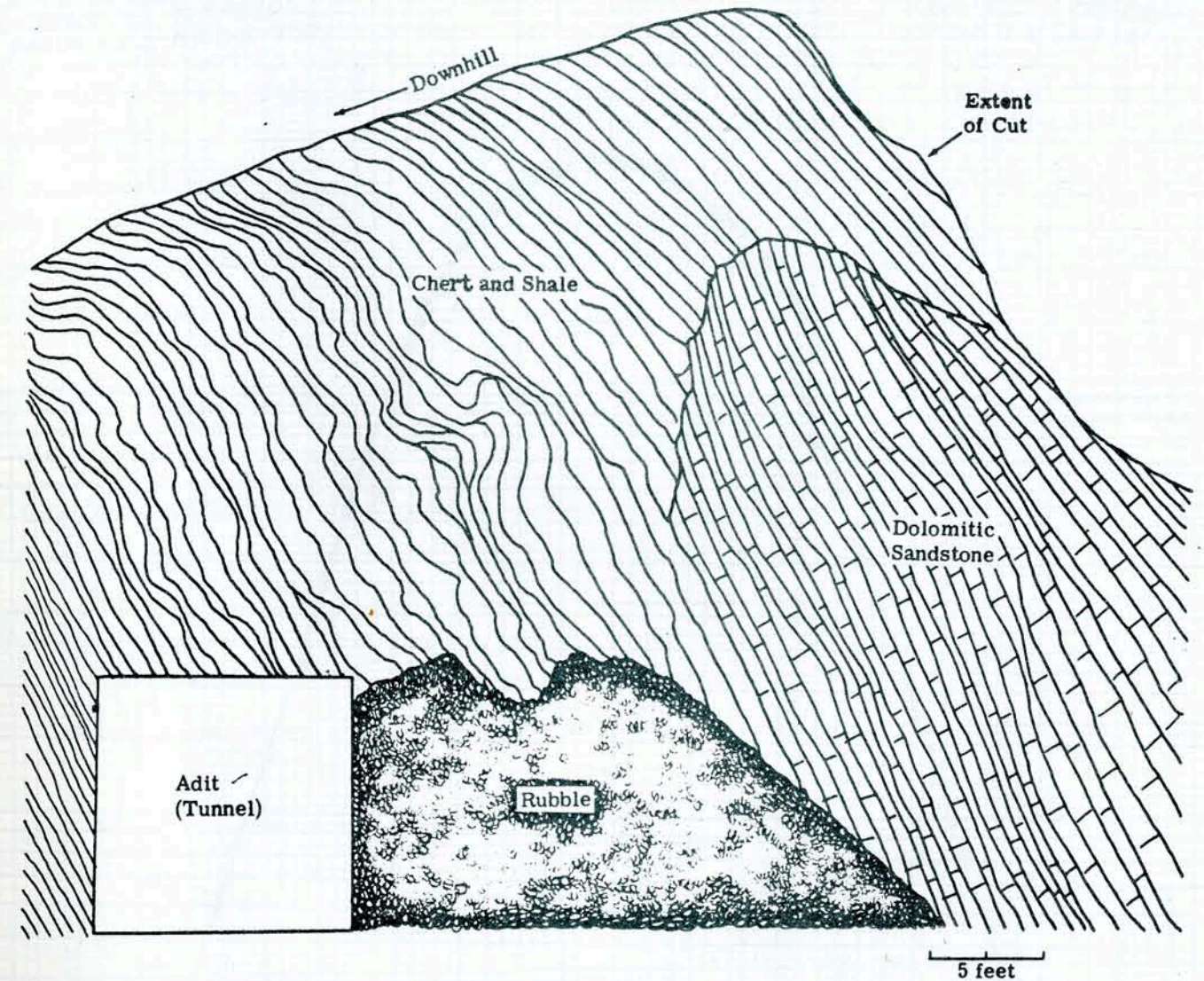
April-June 1963

Station	Type of Instrument	T _o sec	T _g sec	Component
BRK [△]	Benioff 100 kg (Z)	1.0	0.2	Z
BRK	Benioff 100 kg (Z)	1.0	8.0	Z
	100X torsion	0.8	-	N,W
BKS	Benioff 100 kg Sprengnether	1.0	0.75	N,E,Z
	Wood-Anderson torsion	30	100	N,E,Z
		0.8	-	S,W
BRX	Galitzin-Wilip moving coil	12	12	N,E,Z
	Press-Ewing moving coil	30	90	N,E,Z
MHC	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	S,E
PAC	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	N,E
SFB	Lehner-Griffith moving coil	1.2	0.3	Z
	Wood-Anderson torsion	0.8	-	S,W
FRE	Sprengnether moving coil	2.0	2.0	N,E,Z
MIN	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	S,E
ARC	Marion-Slichter moving coil	1.1	0.2	Z
	Wood-Anderson torsion	0.8	-	N,E
SHS	Benioff 50 kg moving coil	1.5	0.45	N,E,Z
MLC	Loucks-Omori	3½	-	S,E
VIN	Benioff 100 kg (Z)	1.0	0.2	Z
	Wood-Anderson torsion	0.8	-	S,W
VIT [△]	Benioff 14 kg (Z)	1.0	0.2	Z
CNC [△]	Benioff 100 kg (Z)	1.0	0.2	Z
SCC [△]	Benioff 14 kg (Z)	1.0	0.2	Z
PRS [△]	Benioff 14 kg (Z)	1.0	0.2	Z
LLA [△]	Benioff 14 kg (Z)	1.0	0.2	Z
CLS [△]	Benioff 14 kg (Z)	1.0	0.2	Z
PRC [△]	Benioff 14 kg (Z)	1.0	0.2	Z
PRI [△]	Benioff 14 kg (Z)	1.0	0.2	Z

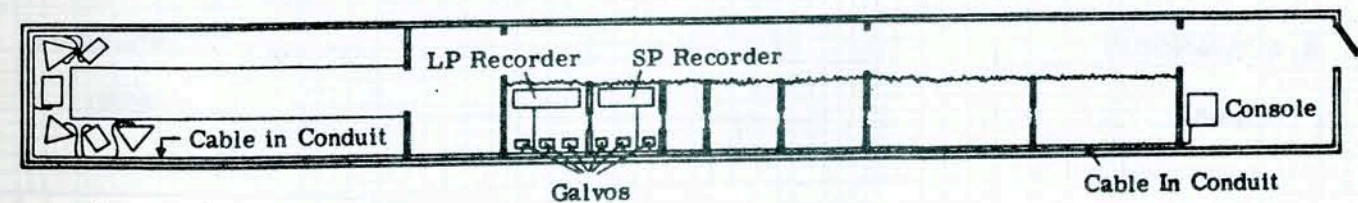
△ Signals from these eight stations are transmitted via leased telephone lines to recorders at Berkeley.

Direction of Motion: In the "Component" column, each horizontal component seismograph is designated by the direction of ground motion corresponding to upward trace motion on the seismogram when it is oriented so that time increases from left to right. On all vertical component (Z) instruments, upward trace motion corresponds to upward ground motion.

Relative magnification curves of instruments recording through the tele-meter system are listed on the following pages. Absolute magnification may be obtained by use of calibration pulses recorded daily from each telemetered station.

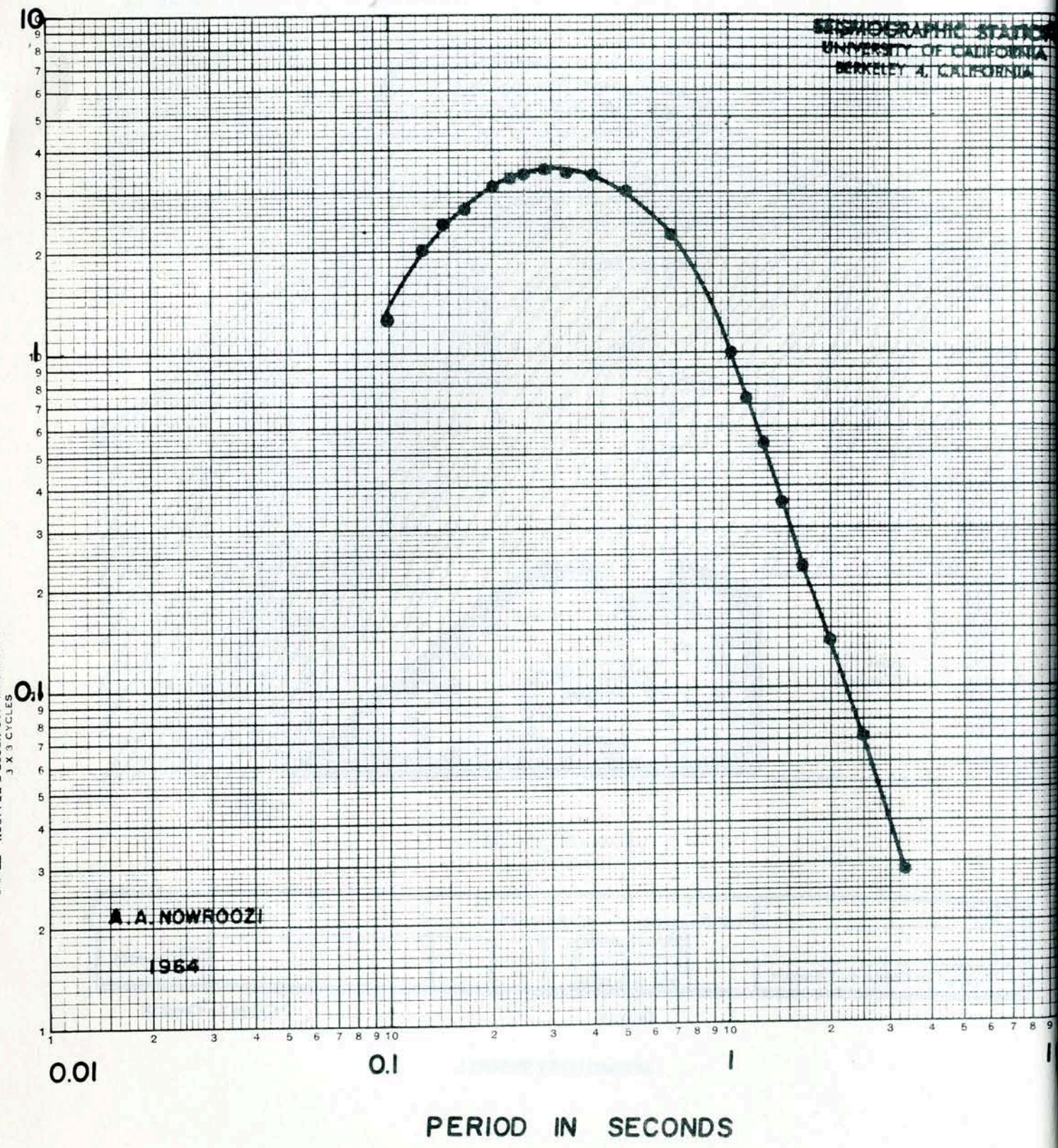


GEOLOGIC SECTION

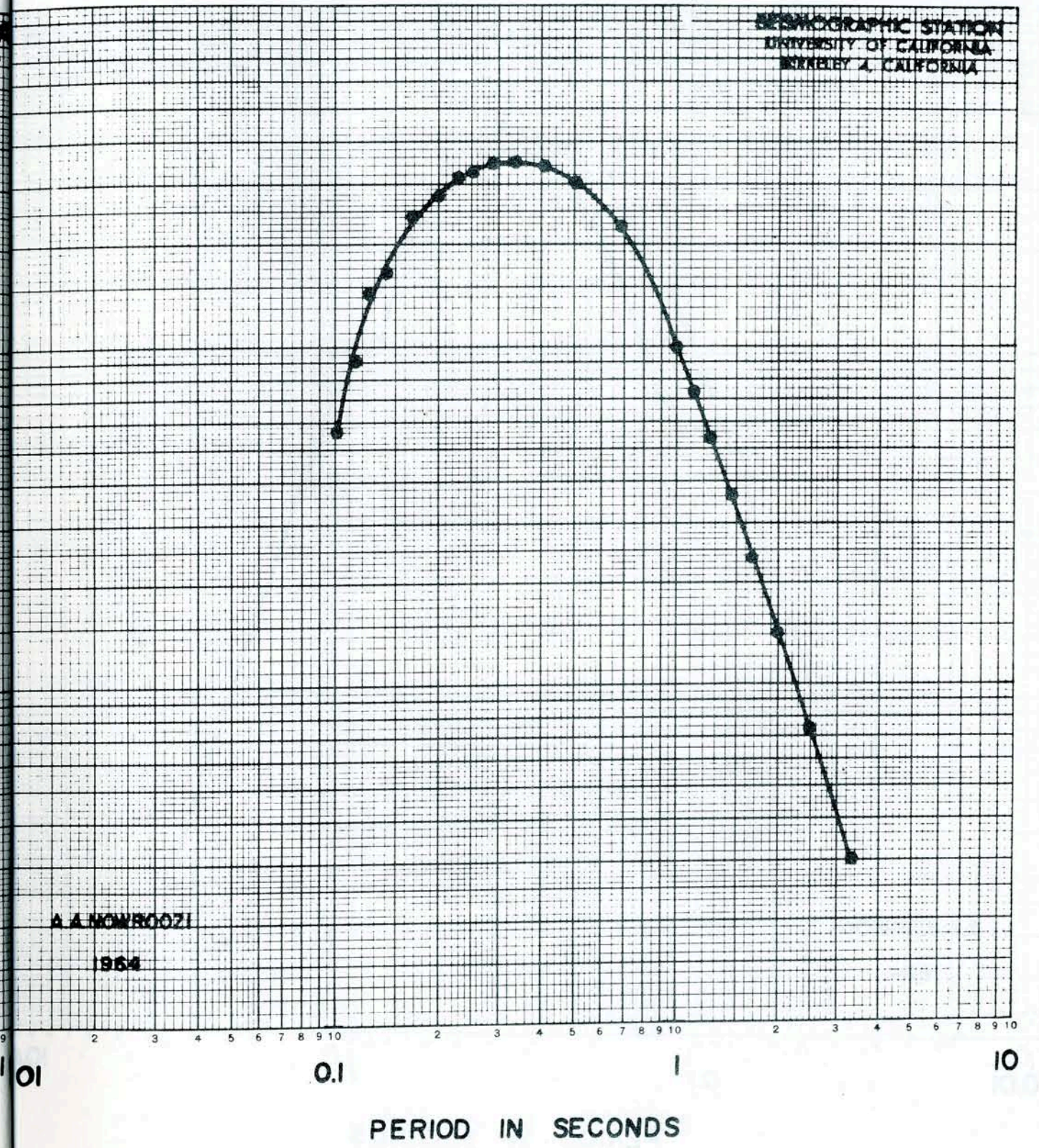


SEISMOLOGY TUNNEL

RESPONSE OF SEISMOMETER-DEVELORECORDER SYSTEM. 100KG. Z. S.P

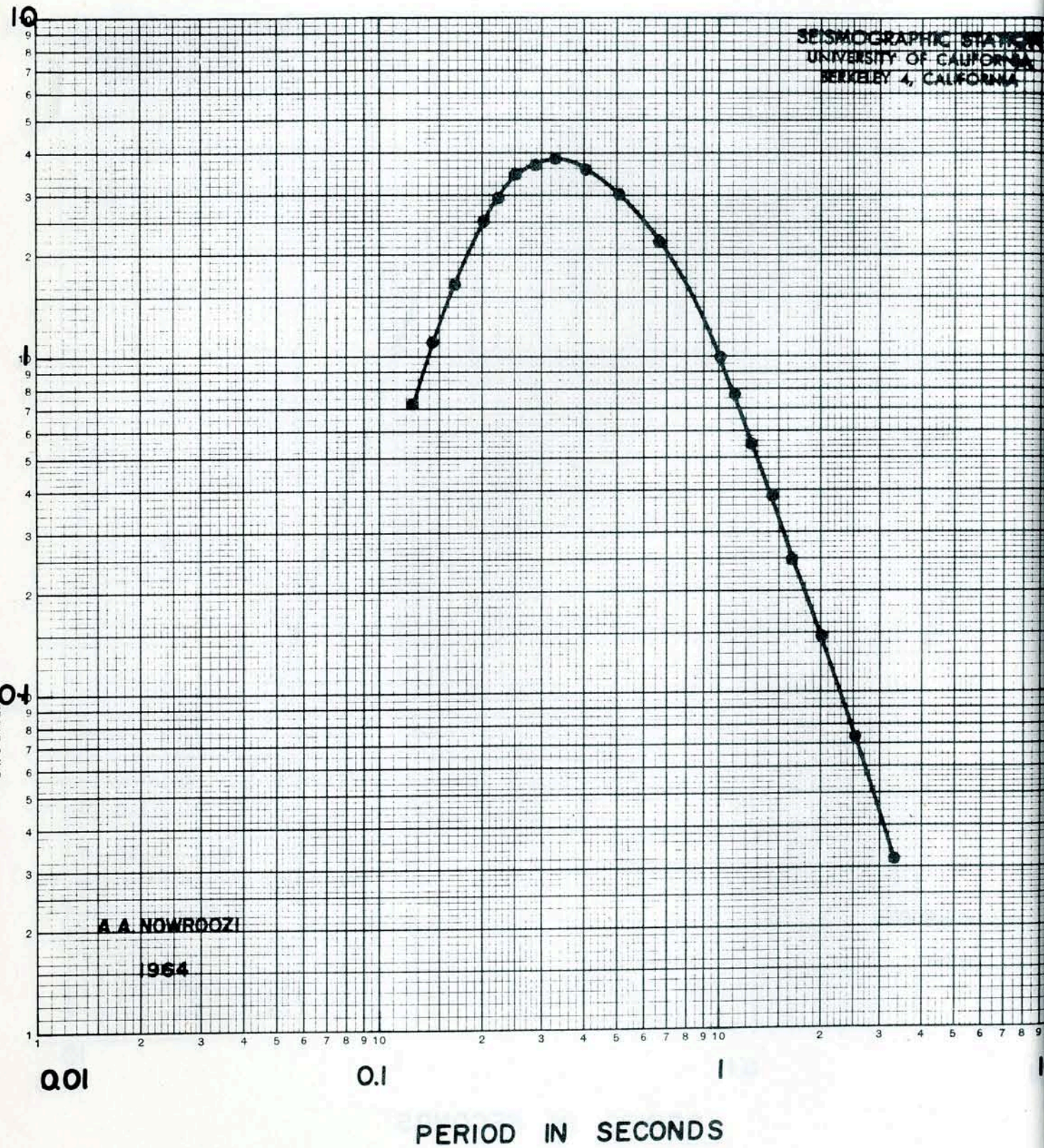


RESPONSE OF SEISMOMETER-HELICORDER SYSTEM. 100KG. Z. S.P

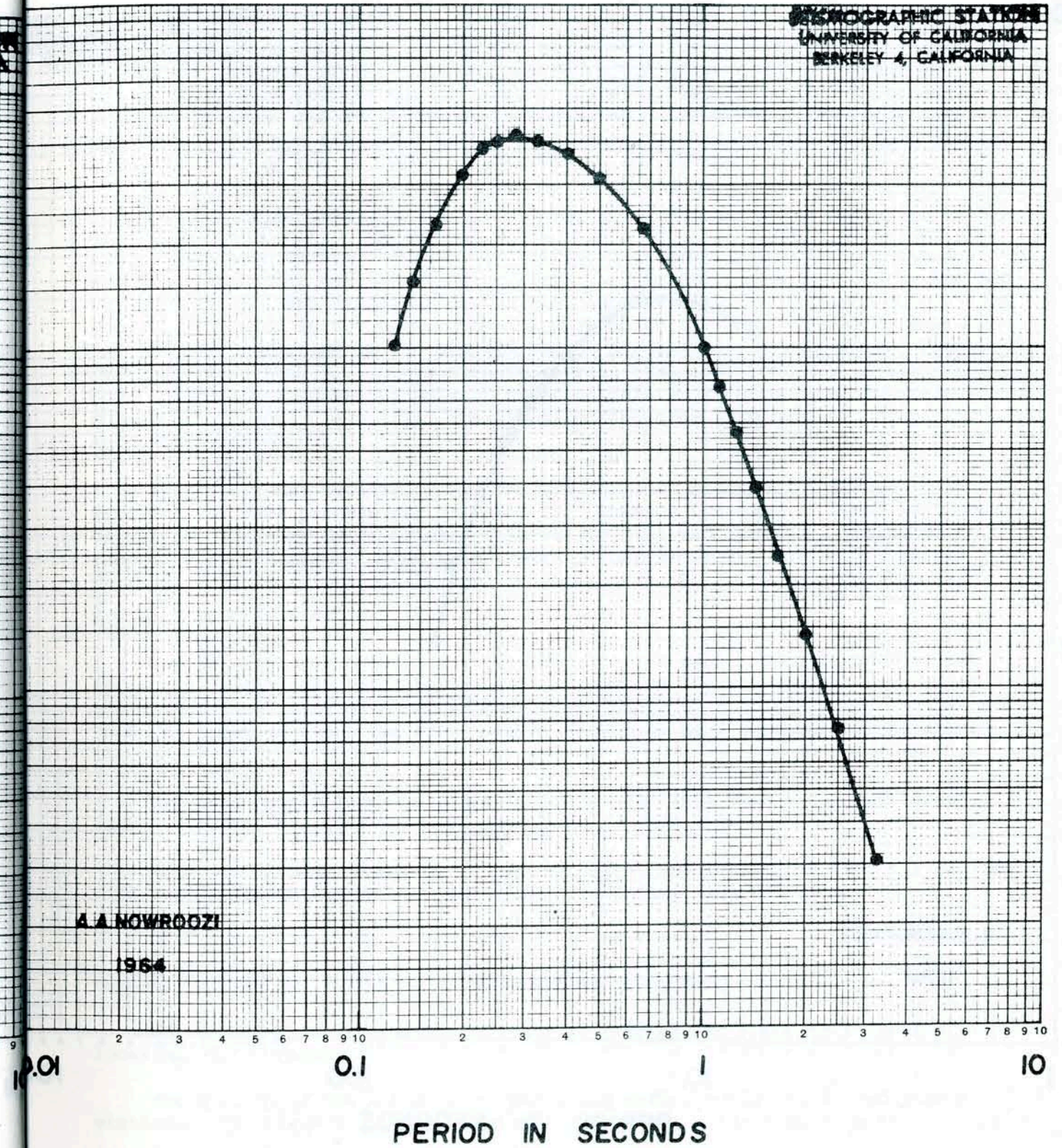


K&E KEUFFEL & ESSER CO. MADE IN U.S.A. 3 X 3 CYCLES

RESPONSE OF SEISMOMETER—HELICORDER SYSTEM. 14.7 KG. Z. S.P



RESPONSE OF SEISMOMETER—DEVELOCORDER SYSTEM. 14.7 KG. Z. S.P



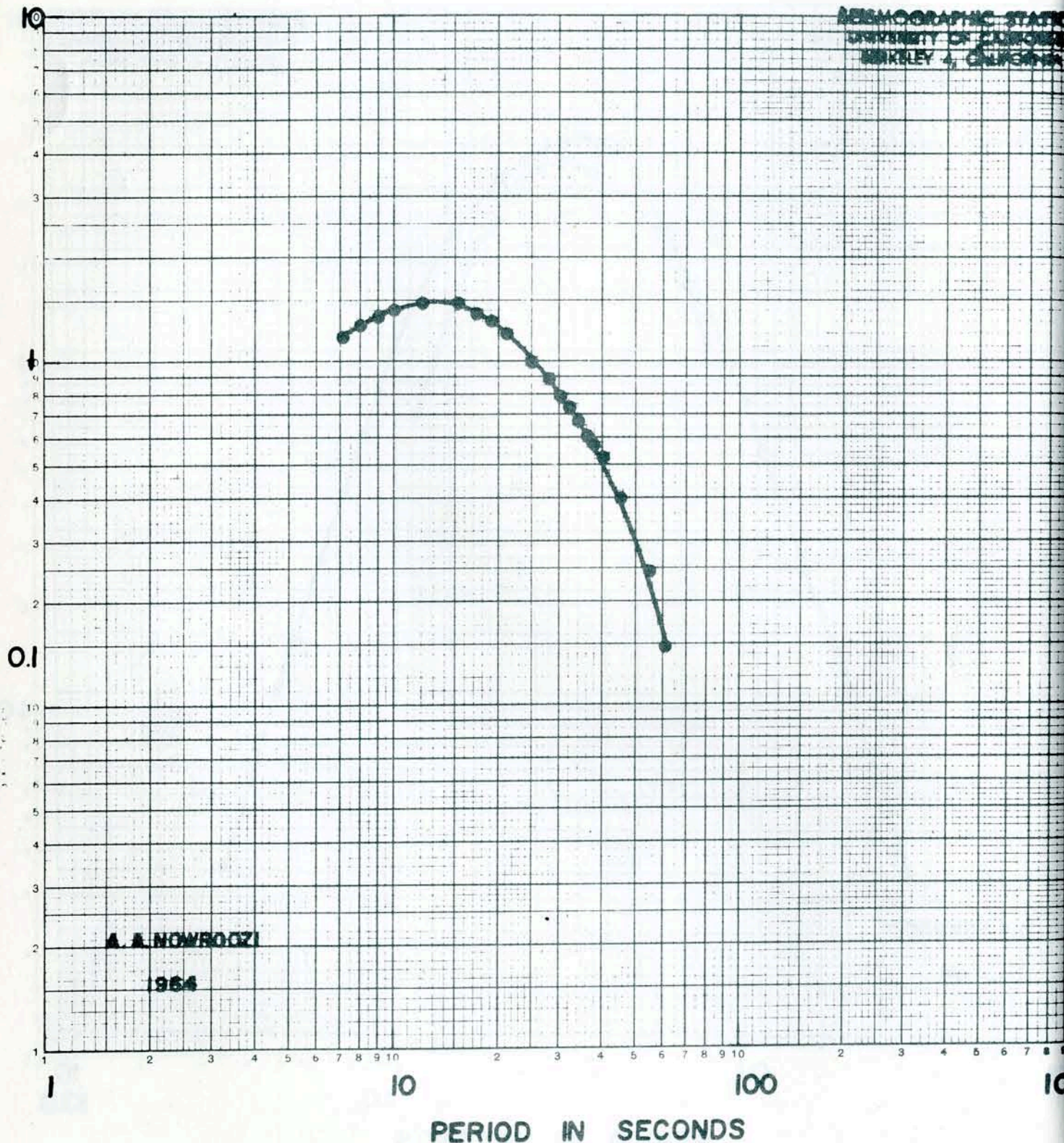
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 X 3 CYCLES

RESPONSE OF SEISMOMETER — HELICORDER

SYSTEM. PRESS-EWING.

Z. T.G=30 S., T.S=15 S.

SEISMOGRAPHIC STATION
UNIVERSITY OF CALIFORNIA
BERKELEY 4, CALIFORNIA



PART I. LOCAL EARTHQUAKES IN NORTHERN CALIFORNIA, NEVADA, AND OREGON

This section includes information on earthquakes in northern California (including adjacent offshore areas) and in adjoining sections of Nevada and Oregon which were well enough recorded to permit a determination of the epicenter. Latitude and longitude of each epicenter and the corresponding date and origin time are tabulated in the following list; epicenters are also plotted on one or both of the two maps immediately following the list.

For the entire northern California region, every effort is made to list all earthquakes of Richter magnitude 3.0 and above, but it is likely that some such shocks have been omitted because the available seismographic data were inadequate for epicenter determination. Within the limited region covered by the map of the central Coast Ranges of California, locatable shocks of magnitude 2.5 and over are included in the tabulation and plotted on the map. Shocks of magnitude 3.0 and over occurring in the limited region are plotted on both maps. Shocks of magnitude less than 3.0 in northern California (and less than 2.5 in the central Coast Ranges) are tabulated only if reported felt or if of special interest for some other reason. Identified artificial earthquakes (explosions) ordinarily are not tabulated.

Epicenters are located by an IBM 7090 computer program. Information on Version I of this program may be found in "Computer Location of Local Earthquakes within the Berkeley Seismographic Network" by Bolt and Turcotte, published in *Computers in the Mineral Industries, Part 2* (George Parks, Editor); Stanford University Publications, Geological Sciences, Vol. 9, No. 2, pp. 561-576, 1964.

Explanation of the table:

Map No. for each epicenter corresponds to the number plotted beside that epicenter on the maps. Epicenters without numbers lie outside the area of the map. The underlining of a map number in the table (and on the maps) indicates that one point on a map has been used to represent more than one earthquake in the table.

Date and Origin Time are given in Greenwich Civil Time (GCT). Subtract eight (8) hours to convert to Pacific Standard Time (PST).

M is the Richter magnitude of the earthquake as determined from the maximum trace amplitudes recorded for the shock by standard Wood-Anderson torsion seismographs.

h is the focal depth given to the nearest kilometer or by the following ranges: a, 0-5 km; b, 6-10; c, 11-15 km; d, 16-30 km.

No. of Stas. is the number of stations used by the computer program in locating the epicenter.

The quality of the solution is partially reflected by the listed number of stations. The highest quality locations are given to the nearest minute of arc

in latitude and longitude and to the tenth of a second origin time. Poorer quality locations are given to the nearest minute in latitude and longitude, to the nearest second in origin time, and are denoted by an asterisk.

Under Remarks will be found a short descriptive location of the epicenter, usually relative to a point named on the map. Information on small foreshocks and aftershocks is sometimes included under Remarks, but when numerous foreshocks or aftershocks accompany a large earthquake, a separate tabulation may be included following the main list of local shocks.

Information on maximum intensities of shocks reported felt is also included under Remarks. Reports on felt earthquakes may be obtained from the Seismological Field Survey of the U.S. Coast and Geodetic Survey, which publishes a more complete summary in "Abstracts of Earthquake Reports for the Pacific Coast and Western Mountain Region." This regular quarterly publication may be obtained from the District Officer, San Francisco District, Coast and Geodetic Survey, 121 Customhouse, San Francisco 26, California, or from the Director, U.S. Coast and Geodetic Survey, Washington Science Center, Rockville, Maryland 20852. Intensities given in Roman numerals are assigned by the Coast and Geodetic Survey and based on the Modified Mercalli Intensity Scale of 1931.

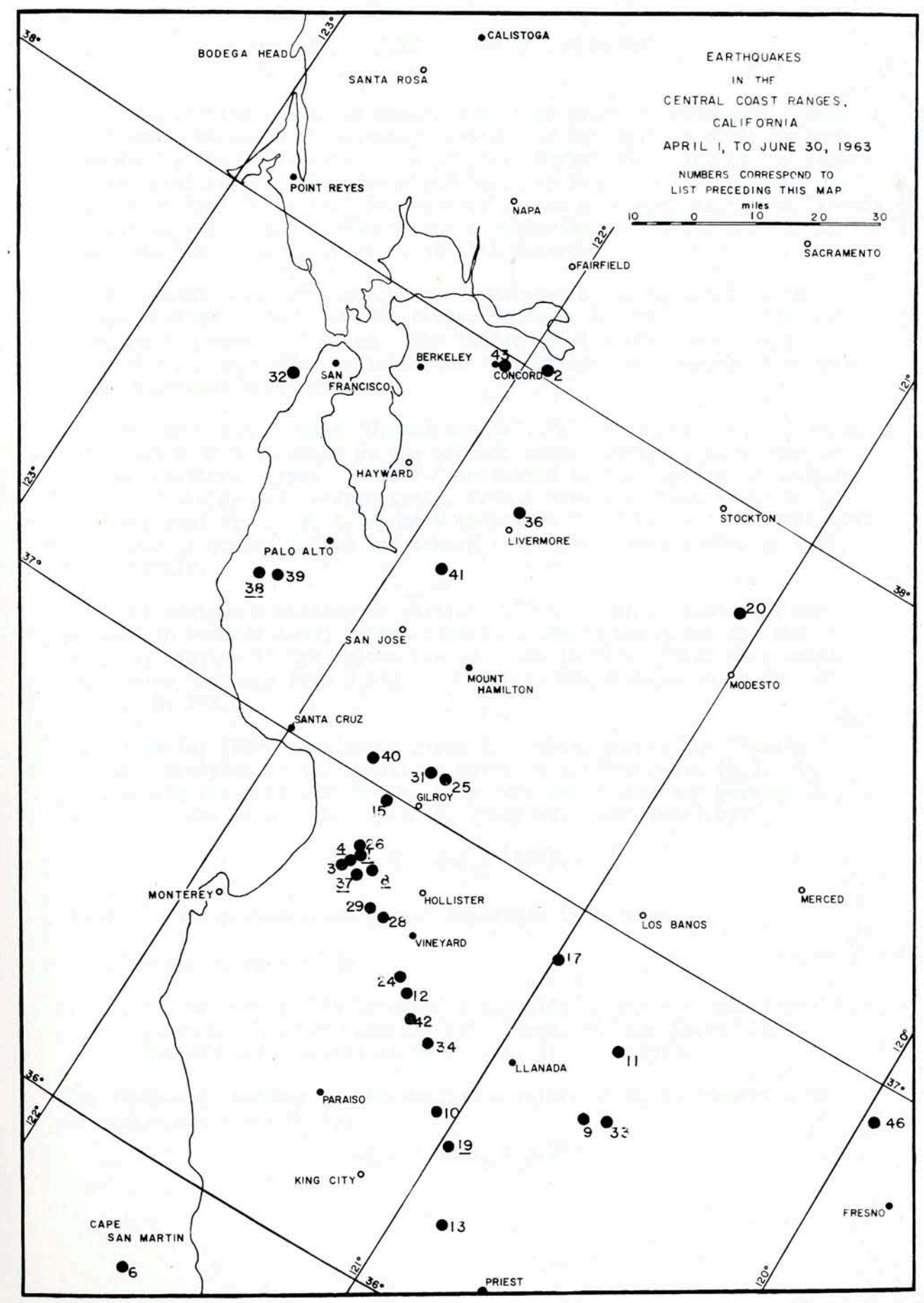
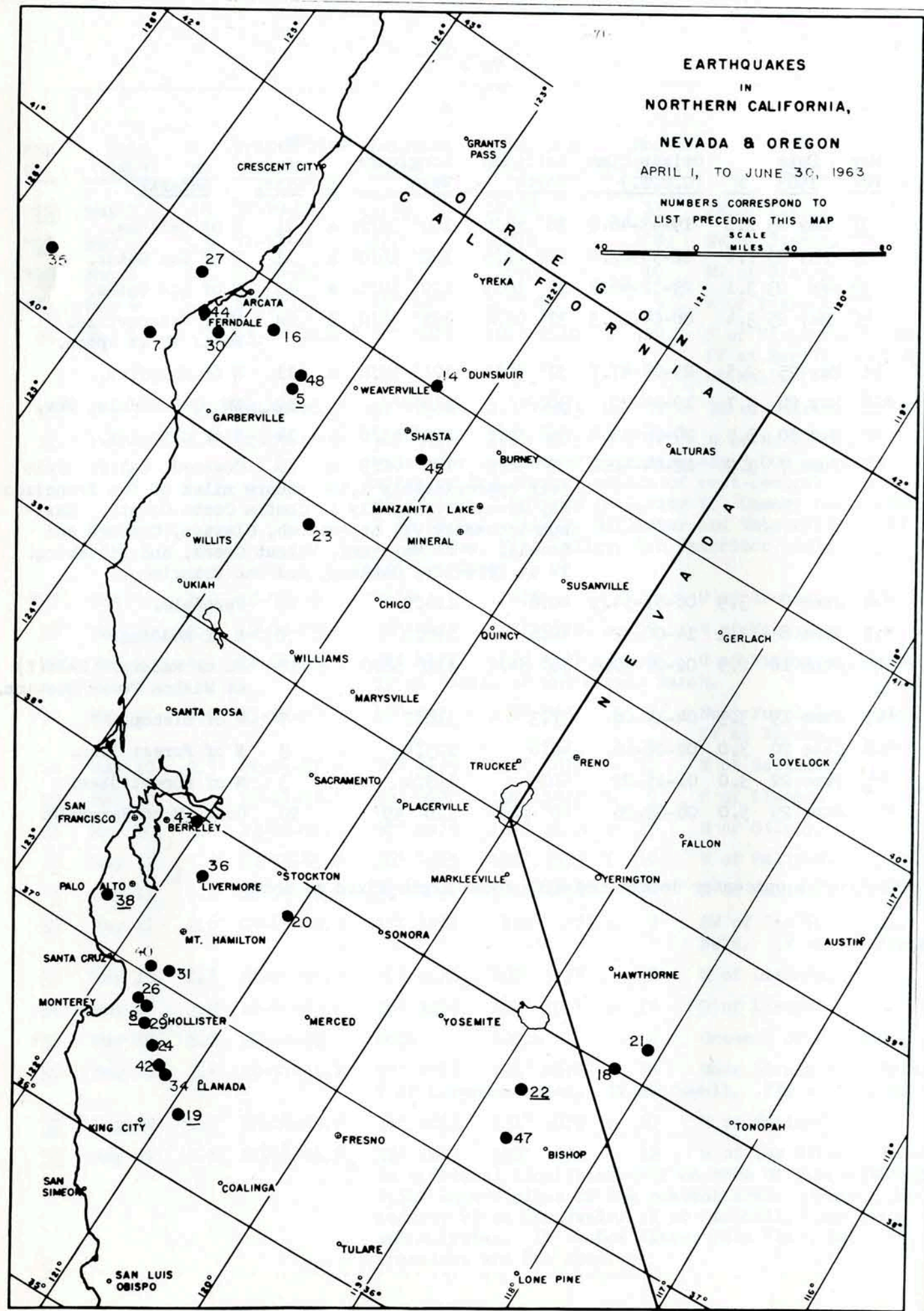
EARTHQUAKES IN NORTHERN CALIFORNIA, NEVADA, AND OREGON

Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	No. of Stas.	Remarks
<u>1</u>	Apr. 1	2.5	10-14-34.6	36° 50!4	121° 37!2	a 7	N. of Salinas.
<u>1</u>	Apr. 1	2.8	15-07-04.1	36° 50!1	121° 38!6	b 14	N. of Salinas.
2	Apr. 2	2.7	00-57-29.0	38° 01!0	121° 55!6	b 12	W. of Pittsburg.
3	Apr. 2	2.7	02-18-11.2	36° 48!0	121° 39!7	a 16	N. of Salinas.
<u>1</u>	Apr. 2	2.7	21-40-28.9	36° 50!3	121° 37!5	b 14	N. of Salinas.
<u>4</u>	Apr. 3	2.6	11-41-55.1	36° 49!3	121° 38!9	b 15	N. of Salinas.
* <u>5</u>	Apr. 4	3.6	00-10-24	40:5	123:4	7	S. of Hyampom.
6	Apr. 4	2.5	01-00-58	35:8	121:5	6	NW of San Simeon.
*7	Apr. 6	3.5	16-12-42.0	40° 18'	124° 33'	10	SW of Ferndale.
*	Apr. 6	4.0	20-18-19	40:7	128:3	10	Ocean W of Arcata.
<u>8</u>	Apr. 7	2.6	00-23-34.5	36° 48!5	121° 34!4	a 11	N of Salinas.
9	Apr. 7	2.9	01-56-19.1	36° 35!1	120° 40!7	a 8	E of Llanada.
10	Apr. 10	2.9	01-38-56.8	36° 25!5	121° 03!1	a 11	SW of Llanada
11	Apr. 11	2.9	00-46-33.3	36° 45!3	120° 42!2	a 12	NE of Llanada.
12	Apr. 11	2.8	04-57-18.3	36° 37!6	121° 18!4	a 11	SE of Vineyard.
13	Apr. 11	2.9	14-02-31.8	36° 12!3	120° 52!6	13	NW of Priest.
*14	Apr. 13	3.6	21-10-24	41:0	122:4	6	Near Gibson.
15	Apr. 17	2.6	19-16-31.9	36° 58!7	121° 39!0	b 13	W of Gilroy.
*16	Apr. 17		19-40-35	40 3/4°	123 3/4°	2	E of Arcata.
17	Apr. 18	2.5	01-50-35.5	36° 52!4	120° 59!6	a 6	N of Llanada.
*18	Apr. 19	3.3	03-59-45	38°	118 1/4°	7	W of Coaldale, Nev.
<u>19</u>	Apr. 20	3.0	16-37-33.0	36° 22!6	120° 57!7	a 14	S of Llanada.
20	Apr. 22	3.1	14-06-47.0	37° 46!3	121° 04!9	8	NW of Riverbank.
*	Apr. 25		01-49-15	41°	128°	6	Ocean, W of Arcata.
*21	Apr. 29	3.7	09-30-50	38:2	118:1	7	W of Coaldale, Nev.
* <u>22</u>	May 3	3.3	01-28-07	37:6	118:8	10	NW of Bishop.
* <u>22</u>	May 3	3.3	01-54-16	37:6	118:8	12	NW of Bishop.
* <u>22</u>	May 3	4.1	02-14-44	37:6	118:8	12	NW of Bishop.
* <u>22</u>	May 3	3.5	08-42-46	37:6	118:8	8	NW of Bishop.
* <u>22</u>	May 3	3.3	11-15-19	37:6	118:8	6	NW of Bishop.
* <u>22</u>	May 3	3.0	13-59-29	37:6	118:8	5	NW of Bishop.

Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	h	No. of Stas.	Remarks
*22	May 3	3.6	17-29-01	37°6	118°8		13	NW of Bishop.
*22	May 3	3.3	17-37-10	37°6	118°8		8	NW of Bishop.
*22	May 4	3.3	03-58-35	37°6	118°8		10	NW of Bishop.
*23	May 4	3.2	16-37-15	39° 53'	122° 38'		5	W of Paskenta.
24	May 6	3.7	03-04-28.8	36° 38'7	121° 21'0	a	19	S of Vineyard. Felt. IV at Harris Ranch S of Hollister.
25	May 7	2.9	00-35-46.5	37° 05'6	121° 32'3	b	17	NE of Gilroy.
26	May 7	4.4	07-07-48.0	36° 51'6	121° 39'3	d	17	W of Hollister. Felt over an area of approximately 3,000 square miles of the coastal region of west-central California. Maximum intensity V. Damage negligible. V at Carmel, Gilroy, Hollister and Watsonville. IV at Big Sur, Mill Valley, San Francisco, Salinas, and San Jose.
*27	May 8	3.2	12-52-44	40°8	124°5		6	W of Arcata.
28	May 9	2.7	12-00-09.4	36° 44'4	121° 28'6	c	12	W of Vineyard.
29	May 9	3.4	12-04-19.9	36° 44'7	121° 31'4	d	15	W of Vineyard. Felt. IV at Hollister and Harris Ranch.
*30	May 9	4.0	13-24-08	40° 33'	124° 07'		7	Near Ferndale. Felt. IV at Eureka.
4	May 10	2.5	02-23-57.3	36° 49'5	121° 38'2	b	11	N of Salinas.
19	May 10	2.5	10-17-57.1	36° 22'0	120° 59'1	b	9	S of Llanada.
31	May 10	3.0	12-06-35.8	37° 04'9	121° 35'2	b	17	N of Gilroy.
8	May 11	3.2	22-53-45.0	36° 49'5	121° 35'9	b	16	N of Salinas.
8	May 12	3.1	00-56-19.9	36° 49'4	121° 34'8	b	14	N of Salinas.
32	May 12	2.6	03-45-09.4	37° 42'1	122° 32'9	a	9	SW of San Francisco. Felt. IV at San Francisco.
33	May 13	2.6	21-28-21.8	36° 36'1	120° 37'3		7	E of Llanada.
34	May 15	3.2	10-38-43.0	36° 32'8	121° 10'7	a	17	W of Llanada.
*35	May 19	3.5	20-48-55	40°4	125°6		4	Ocean W of Ferndale.
36	May 20	3.4	19-57-51.7	37° 42'2	121° 46'4	c	14	Near Livermore. Felt. V at Livermore area. IV at Cowell. III at Canyon.
37	May 22	2.7	10-18-29.2	36° 48'2	121° 36'9	a	10	N of Salinas.
38	May 22	4.6	22-41-04.8	37° 16'3	122° 19'1		12	W of Los Gatos. Felt in scattered localities over an area of approximately 1,500 square miles of the coastal area. Maximum intensity VI at Sunnyvale. V at Campbell, Cupertino, and Milpitas. IV at Los Altos, Palo Alto, San Francisco and San Jose.

Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	h	No. of Stas.	Remarks
37	May 23	2.8	19-43-46.0	36° 47'6	121° 36'2	a	11	N of Salinas.
39	May 23	2.6	22-50-02.6	37° 17'5	122° 16'0	a	11	W of Los Gatos.
38	May 23	3.1	23-32-46.4	37° 16'3	122° 19'1	a	13	W of Los Gatos.
40	May 25	3.4	08-04-20.3	37° 02'6	121° 45'0	d	14	N of Watsonville. Felt. IV at Aptos.
41	May 25	2.5	23-07-47.7	37° 30'0	121° 52'6	a	11	N of Milpitas.
*18	May 26	3.7	19-44-50	38°2	118°0		12	NW of Coaldale, Nev.
42	May 30	3.5	20-26-39.4	36° 34'6	121° 15'6	b	14	E of Gonzales.
43	June 7	3.9	12-04-42.2	37° 58'5	122° 02'9	c	16	Concord, Calif. Felt over approximately 1,500 square miles of San Francisco Bay area, principally in Contra Costa County. Maximum intensity VI, at Antioch, Clayton, Concord and Cowell. V at Martinez, Walnut Creek, and Pittsburg. IV at Berkeley, Oakland, and San Francisco.
*44	June 8	3.9	08-51-54.5	40°6	124°3		12	Ferndale.
*45	June 8	3.1	14-00-32	40°6	122°2		2	E of Redding.
46	June 18	2.9	02-27-40.6	36° 54'7	119° 58'0		10	SE of Madera. Felt(?) at Wishon Power Station.
*47	June 19	3.3	04-15-08	37°3	118°7		7	W of Bishop.
*48	June 20	3.0	02-28-46	40°6	123°4		3	N of Forest Glen.
*5	June 22	3.0	01-15-22	40°5	123°4		3	N of Forest Glen.
*	June 29	5.0	08-09-26	40° 20'	126° 49'		20	Ocean W of Ferndale.

*Indicates epicenter determined with focal depth fixed as zero.



PART II. REGISTRATION OF EARTHQUAKES

This section tabulates measured arrival times of prominent phases of earthquakes recorded at selected stations of the seismographic network operated by the University of California (Berkeley). Information regarding the stations and instrumentation will be found in the introductory section of this Bulletin. Earthquakes in the northern California, Nevada, and Oregon region are included in the following tabulation only if of magnitude 4.0 or over, or if of special interest.

Components of ground motion are indicated by N, E, and Z in the "Phase" column. Where no such letter appears, the reading is for the vertical component (Z) alone. The letter "i" (impetus) preceding a phase designates sudden beginning of the motion; "e" (emersio) designates a gradual beginning.

In the column headed "Ground Motion", "c" or "d" indicates initial compression or dilatation of the ground, respectively, from a wave of the compressional type; "+" or "-" indicates initial upward or downward motion of the ground, respectively, from a wave not known to be of the compressional type. N, E, S, or W indicates that the initial horizontal direction of ground motion was toward the north, east, south, or west, respectively.

The maximum amplitude of earth displacement in microns (μ) and periods in seconds (sec) in the indicated phases are given for the Berkeley station in the column headed "Time (GCT)". Total horizontal amplitudes combined from N and E components are designated by "H" (e.g., PH, PPH).

Berkeley (BKS) magnitudes given for teleseisms in the "Remarks" column correspond to the magnitude based on surface waves (M_S). In calculating the published value, body wave amplitudes and periods of body waves are used to determine M_B (body wave magnitude) by:

$$M_B = Q + \log_{10} (A/T),$$

where $A = 1/2$ peak-to-peak ground amplitude in microns,

$T =$ period in seconds

Q is the empirically determined function of distance and depth given by Gutenberg and Richter ("Magnitude and Energy of Earthquakes", *Annali di Geofisica*, 9:1-15, 1956).

The arithmetic average of the available values of M_B is converted to an equivalent value M_S by:

$$M_S = 1.59 M_B - 3.97.$$

This value is then compared with the value of M_s determined from surface waves of period near 20 seconds.

Frequently quoted sources of information regarding epicenters, origin times, or shock magnitudes are as follows:

- USCGS - U.S. Coast and Geodetic Survey, Washington Science Center, Rockville, Maryland
- BCIS - Bureau Central International de Seismologie, Strasbourg, France
- PAL - Lamont Geological Observatory, Palisades, New York
- PAS - Seismological Laboratory, Pasadena, California
- WMSO - Wichita Mountains Observatory, Oklahoma
- BKS - Byerly Seismographic Station, Berkeley
- BRK - indicates the average magnitude determined by the Berkeley network.

All measurement and interpretation of seismograms (i.e., identification of phases, arrival times, directions of initial ground motion, and ground amplitudes and periods) are done at Berkeley. Readings from the remaining stations in the network other than the six listed (BRK, CLS, MHC, MIN, PRI, REN) are available on request. Requests for additional data or for copies of seismograms should be addressed to the Director.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
April 1	BKS	eP	04 39 21.3	d	JMA: 44°42'N, 141°38'E, 0 = 04 28 42. Off Hokkaido, Japan. h about 280 km. Magnitude 6.1 (Matsushiro).
	MHC	iP	26.4	c	
	MIN	eP	01.4	c	
	CLS	eP	17.0	c	
	PRI	eP	34.8	c	
April 2	BKS	eZ	04 18 15		USCGS: 55.2°N, 160.3°E, 0 = 04 06 57.8. Kamchatka. h about 40 km.
		eZ	20 24		
		eRz	31.8		
	MHC	iP	16 24.1	d	
	MIN	eP	03.5	d	
April 2	BKS	eSNEZ	05 06.5		USCGS: 29.5°S, 177.1°W, 0 = 04 43 31.1. Kermadec Islands. h about 49 km.
		e(R)Z	22.0		
April 2	MIN	eP	04 57 11.5	c	USCGS: 53.1°N, 171.7°W, 0 = 16 18 55.3. Andreanov Islands. h about 140 km. Magnitude 5 1/2 (BKS).
	BKS	eP	16 25 54.0	d	
		epP	26 27.2		
		ePPZ	28 10.8		
		iSNEZ	31 30		
		iScPZ	43.0		
		eLNEZ	34 24		
			mu sec		
		PZ	.28 .9		
		SH	2.0 12		
April 3	MHC	iP	16 26 00.3	d	USCGS: 17.0°N, 46.5°W, 0 = 01 13 15.5. Atlantic Ocean. h about 33 km.
	MIN	iP	25 44.0	d	
	CLS	eP	48.3	d	
	PRI	eP	26 12.0	d	
	MHC	iP	01 24 26.3	d	
April 3	MIN	eP	07.6	c	USCGS: 14.7°S, 176.4°W, 0 = 01 21 54.3. Fiji Islands. h about 33 km.
	MHC	eP	01 33 30		
April 3	MIN	eP	32.6	c	USCGS: 8.3°S, 112.6°E, 0 = 11 44 57.3. Java. h about 161 km.
	BKS	eP'	12 00.2		
April 3	BRK	eP	15 01 25		USCGS: 55.5°S, 128.1°W, 0 = 14 47 55.6. South Pacific Ocean. h about 33 km. Magnitude 6 - 6 1/4 (Matsushiro).
	BKS	e(S)NEZ	12 18		
		e(G)E	25.4		
		eRNZ	30.6		
			mu sec		
April 3		MaxH	5.9 20		USCGS: 6.1°S, 149.2°E, 0 = 15 18 36.4. New Britain. h about 63 km.
	MHC	eP	15 01 05.9	d	
	CLS	eP	03	d	
	PRI	eP	00	c	
	BKS	eP	16 00 40.0	c	
April 3	MHC	iP	45.9	d	
	CLS	eP	32.2	c	
	PRI	eP	59.5	c	
	BKS	e	06 14 42		
April 6	BKS	iP	07 14 04.0	c	USCGS: 17.5°S, 178.9°W, 0 = 07 03 06.5. Fiji Islands. h about 526 km.
MHC	iP	04.5	c		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
April 6 (Cont.)	MIN	iP	12.7	d	
	CLS	eP	04.8	c	
	PRI	eP	04.9	c	
April 6	BKS	iP	11 25 34.4	d	USCGS: 63.4°N, 149.5°W, 0 = 11 19 23.3. Central Alaska. h about 39 km. Magnitude 5.5 (USCGS)
		eEZ	30.8		
	MHC	iP	25 39.5	c	
	MIN	iP	15.4	c	
	CLS	eP	26.9	d	
	PRI	eP	52.8	c	
April 6	BKS	iP	20 19 39.7	d	USCGS: 40.7°N, 128.3°W, 0 = 20 18 19.3. Off N. California. h about 33 km. Magnitude 4.2 (USCGS).
April 6	BKS	eEZ	22 16.0		
April 6	BKS	eP	23 45 03.5	c	USCGS: 19.9°N, 109.3°W, 0 = 23 40 20. Off W. Mexico. h about 33 km.
	MHC	iP	44 51.2	c	
	CLS	eP	45 11.4	c	
	PRI	eP	44 41.1	d	
April 7	BKS	eZ	04 13 23.0		USCGS: 24.5°S, 177.0°W, 0 = 03 57 31.6. Tonga Islands. h about 114 km.
	MHC	iP	09 33.7	c	
	MIN	eP	43.1	c	
	CLS	eP	34.6	c	
	PRI	eP	32.5	d	
April 7	BKS	iP	15 20 32.5	d	USCGS: 27.0°N, 129.2°E, 0 = 15 07 34.9. Ryukyu Islands. h about 33 km.
	MHC	iP	36.4	c	
	MIN	i(P)	19 38.3	c	
	CLS	eP	20 20	c	
	PRI	eP	42.5	d	
April 7	BKS	eP	15 34 46.5	c	USCGS: 53.7°N, 170.1°W, 0 = 15 28 01.8. Fox Islands. h about 202 km.
		eZ	40 36.6	d	
		eEZ	43 14		
	MHC	iP	34 52.9	d	
		iZ	40 39.3		
	MIN	eP	34 37.1	c	
	CLS	eP	40.5	c	
	PRI	eP	35 04.5	c	
April 7	BKS	iP'	22 55 04.0	d	USCGS: 4.9°S, 103.2°E, 0 = 22 36 03.4. Off SW Sumatra. h about 72 km. Magnitude 7 (BKS)
		i(P ₂)Z	58 36		
		ePPZ	59 40		
		eSNE	23 06 58		
		ePSNZ	08.7		
		eSSEZ	14.0		
		eEZ	19.5		
		eRNEZ	35.2		
			mu sec		
		PZ	.27 1.3		
		SH	1.16 12		
		MaxH	7.2 36		
	MHC	iP'	22 55 05.1	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
April 7 (Cont.)	MIN	iP'	01.5	d	
	CLS	eP'	02.2	c	
	PRI	eP'	07.4	c	
April 8	BKS	eP	14 49 07	c	USCGS: 27.7°N, 44.3°W, 0 = 14 38 27.0. North Atlantic Ocean. h about 33 km.
		eSEZ	57.8		
		eQN	15 05.5		
		eREZ	08.5		
			mu sec		
		MaxH	2.5 20		
	MHC	iP	14 49 01.7	c	
	MIN	iP	48 54.4	d	
	CLS	eP	49 04.5	c	
	PRI	eP	03.7	d	
April 9	MHC	eP	01 52 21.6	d	BCIS: 71.5°N, 12.9°W, 0 = 01 42 07. Off E. Greenland.
	MIN	iP	51 57.4		
April 9	BKS	iP	02 13 22.2	c	USCGS: 17.7°S, 178.7°W, 0 = 02 02 25.1. Fiji Islands. h about 538 km.
	MHC	iP	23.0	c	
	CLS	eP	23.0	c	
	PRI	eP	22.6	c	
April 9	BKS	eZ	23 35.0		USCGS: 11.5°S, 166.1°E, 0 = 22 57 50.0. Santa Cruz Islands. h about 66 km.
	MHC	iP	10 09.8	c	
	MIN	iP	15.6	c	
April 10	BKS	eZ	04 17.0		
April 10	BKS	eP'	08 09 10.0	c	USCGS: 9.2°S, 125.0°E, 0 = 07 50 30.2. Timor. h about 33 km.
		e(S)E	19.6		
		eREZ	46.5		
			mu sec		
		MaxH	1.5 20		
	MHC	iP'	08 09 11.5	c	
	MIN	iP'	15.5	d	
	CLS	eP'	07.6	c	
	PRI	eP'	10.0	c	
April 11	BKS	iP	12 15 10.3	d	USCGS: 19.9°N, 109.0°W, 0 = 12 10 25.5. Off Mexico. h about 33 km.
		eSNEZ	19 16		
		eRNZ	20.8		
	MHC	iP	15 02.1	d	
	CLS	eP	15.2	c	
	PRI	eP	14 47.0	d	
April 11	MIN	iP	20 16 21.9	d	
April 12	BKS	eP	08 55 06.1	c	USCGS: 39.0°S, 176.7°E, 0 = 08 41 56.7. North Island, New Zealand. h about 106 km. Light damage in North-Central New Zealand.
		e(S)NEZ	09 08.8		
		eREZ	25.0		
	MHC	iP	08 55 06.8	c	
	MIN	eP	33.5	d	
	CLS	eP	13.2	c	
	PRI	eP	03.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
April 12	BKS	iP	20 59 44.4	d	USCGS: 16.7°S, 173.7°W, 0 = 20 48 16.7. Tonga Islands. h about 33 km.
		e(R)EZ	21 21.4		
	MHC	iP	20 59 44.8	d	
	MIN	iP	54.9	d	
	CLS	eP	44.0	d	
	PRI	eP	44.4	d	
April 13	BKS	iP	02 31 00.8	d	USCGS: 6.2°S, 76.5°W, 0 = 02 20 57.5. Peru. h about 125 km. Magnitude 6.3 (BKS)
		ipP	21.7		
		isP	28.8		
		iPcP	42.0		
		isNEZ	39 12		
		isSNEZ	40.0		
		eSSE	43.1		
		eGNEZ	46.4		
		ePKKPZ	50.7		
			mu sec		
		PZ	2.4 8		
		SH	13 18		
		MaxH	18 60		
	MHC	iP	02 30 55.8	d	
	MIN	iP	31 06.8	d	
	CLS	eP	04.9	d	
	PRI	eP	30 46.7	d	
April 13	MHC	iP	14 45 20.5	d	USCGS: 3.4°S, 135.4°E, 0 = 14 31 31.0. Northern New Guinea. h about 31 km.
	MIN	iP	18.5	c	
April 15	MHC	iP	23 51 02.9	d	USCGS: 18.3°S, 173.7°W, 0 = 23 39 27.3. Tonga Islands. h about 33 km.
	MIN	i	13.1	c	
April 16	BKS	eP	01 43 07	c	USCGS: 0.9°S, 128.2°E, 0 = 01 29 15.9. Halmahera Island. h about 6 km. Magnitude 7.1 (BKS)
		ePPZ	47 20		
		eSKSNE	54 08		
		eN	02 13.5		
		eREZ	17.4		
			mu sec		
		PZ	3 8		
		PPZ	2.7 18		
		SH	10 20		
		MaxH	2.7 18		
	MHC	iZ	01 44 16.1	c	
	MIN	eZ	47 30		
	CLS	eP	43 44	c	
	PRI	eZ	48 08		
April 16	MIN	eP	13 37 58.5	d	
April 16	MIN	eP	14 20 46.2	c	
April 16	MHC	i	17 56 53.3		
	MIN	eP	27.1	c	
April 17	BKS	eZ	02 03 26		USCGS: 31.7°S, 67.7°W, 0 = 01 42 54.1. Western Argentina. h about 88 km.
		eRZ	16.0		
April 17	BKS	iP	02 23 34.1	d	USCGS: 19.6°S, 178.6°E, 0 = 02 11 26.1. Fiji Islands. h about 33 km.
		i	42.0		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks	
1963			h. m. s.			
April 17		iPPZ	27 04		Magnitude 6 (BKS)	
(Cont.)		eSKSNEZ	33 42			
		eSNZ	34 26			
		iSSNEZ	38 20			
		eGN	43.5			
		eRNEZ	47.5			
			mu sec			
		PZ	4.9 10			
		PPZ	2.3 16			
		SH	8.5 40			
	MHC	iP	02 23 34.2	c		
	MIN	eP	42.0	c		
	CLS	eP	34.2	c		
	PRI	eP	34.3	c		
April 17	MHC	iP	08 34 47.0	c	USCGS: 15.7°S, 174.1°W, 0 = 08 23 33.4. Samoa. h about 120 km.	
	MIN	eP	58.0	d		
April 18	MHC	iP	02 03 00.1	c	USCGS: 20.3°S, 177.7°W, 0 = 01 51 55.2. Fiji Islands. h about 531 km.	
	MIN	iP	02 03 09.7	c		
April 18	BKS	eP	04 32 26	d	USCGS: 19.3°N, 109.2°W, 0 = 04 27 40. Off Jalisco, Mexico. h about 33 km.	
		eSNE	36 40			
		eRNZ	39.0			
	MHC	iP	32 24.5	c		
	MIN	eP	49.5	d		
	PRI	eP	06	c		
April 19	BKS	iP	03 22 12.3	d		USCGS: 35.7°N, 118.1°W, 0 = 03 21 11.6. Kern County, Calif. h about 33 km. Magnitude 4 (BKS)
	MHC	eP	03.3	d		
	MIN	iP	46.2	c		
	CLS	eP	21.7	d		
	PRI	eP	21 46.2	c		
		eSZ	22 18.7			
April 19	BKS	iP	07 48 50	d	USCGS: 35.8°N, 96.9°E, 0 = 07 35 23.7. Tsinghai, China. h about 33 km. Magnitude 6.8 (BKS)	
		iP'Z	51 34	d		
		iPPZ	53 06			
		iZ	58 50			
		iSKSNEZ	59 26			
		ISE	08 00 36			
		iFSEZ	01 56			
		iSSNEZ	11.0			
		eGNE	14.7			
		eRNZ	18.2			
			mu sec			
		PZ	1.3 8			
		PPZ	1.5 28			
		SH	11.9 28			
		MaxH	32 20			
	MHC	iP'	07 52 29.9	c		
	MIN	eP'	42			
	CLS	e(PP)	53 21.7	(c)		
	PRI	e(PP)	21.2	d		

Date	Sta.	Phase	Time	Ground Motion	Remarks
1963			h. m. s.		
April 21	MHC	iP	04 51 39.7	c	USCGS: 24.2°N, 122.3°E, 0 = 04 38 21.7.
	MIN	iP	31.4	d	Off Taiwan. h about 35 km.
April 22	BKS	eP	07 38 05.3	c	USCGS: 30.0°S, 177.8°W, 0 = 07 25 31.6.
	MHC	iP	04.9	c	Kermadec Islands. h about 40 km.
	CLS	eP	06.0	c	
	PRI	eP	04.0	c	
April 23	BKS	eP	03 04 01	c	USCGS: 46.7°N, 103.5°E, 0 = 02 51 15.8.
	MHC	iP	03 59.9	d	Outer Mongolia. h about 33 km.
	MIN	eP	46.7	c	Magnitude 5 (Peking)
	CLS	eP	54.9	c	
	PRI	eP	06.0	d	
April 23	MHC	iP	07 38 43.4	c	USCGS: 60.7°S, 24.6°W, 0 = 07 19 45.
	MIN	eP	36	c	Sandwich Islands. h about 33 km.
April 23	BKS	eZ	10 37.6	c	
April 23	MIN	eP	13 00 41.2	d	USCGS: 50.9°N, 128.1°W, 0 = 12 58 06
					Vancouver Island. h = 93 km.
					Magnitude 3.3 (USCGS)
April 23	MHC	iP	15 43 48.3	c	USCGS: 17.8°S, 178.6°W, 0 = 15 32 50.1.
	MIN	iP	56.8	d	Fiji Islands. h about 532 km.
April 24	BKS	e(P)	02 37 06	c	USCGS: 1.0°S, 91.6°W, 0 = 02 33 08.3.
		ePPNZ	41 51	c	Galapagos Islands. h about 33 km.
		iSNE	48 58	c	
		e(SS)NZ	56.6	c	
April 24	MHC	i(P)	04 06 24.2	d	USCGS: 17.5°S, 174.6°W, 0 = 03 55 00.0.
	MIN	iP	32.6	c	Tonga Islands. h about 130 km.
April 24	BKS	iP	21 53 54.0	d	USCGS: 20.8°S, 179.0°W, 0 = 21 42 58.8.
	MHC	iP	53.9	d	Fiji Islands. h about 600 km.
	MIN	iP	54 03.6	c	
	CLS	eP	54.9	d	
	PRI	eP	53.9	d	
April 25	MHC	iP	08 30 39.2	c	USCGS: 4.6°N, 122.5°E, 0 = 08 12 52.5.
					Celebes Sea. h about 550 km.
April 25	BKS	eZ	11 53.7	c	
April 25	MHC	iP	13 12 41.2	d	USCGS: 23.4°S, 113.0°W, 0 = 13 02 29.
	MIN	e	13 02.4	c	Easter Island region. h about 33 km.
April 25	BKS	e(P')	17 03 44	c	USCGS: 1.4°S, 128.8°E, 0 = 16 35 54.2.
		eNEZ	13.5	c	Halmahera Island. h about 15 km.
		eREZ	23.5	c	
April 25	BKS	iP	18 01 51.1	c	USCGS: 21.7°S, 177.9°W, 0 = 17 50 21.4.
	MHC	iP	51.1	d	Fiji Islands. h about 346 km.
	MIN	iP	02 01.3	d	
	CLS	eP	01 52.0	c	
	PRI	eP	51.0	c	
April 26	MHC	iP	08 29 45.4	c	USCGS: 18.1°S, 173.9°W, 0 = 08 18 11.2.
	MIN	eP	55.6	c	Tonga Islands. h about 33 km.
April 26	MHC	iP	16 55 40.3	d	USCGS: 18.2°S, 69.3°W, 0 = 16 44 14.6.
	MIN	iP	48.7	c	Peru-Chile border. h about 131 km.
	CLS	eP	46.8	c	
	PRI	eP	31.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
April 27	MIN	eP	04 56 16.5	c	USCGS: 44.8°N, 110.3°W, 0 = 04 53 50.9.
					Yellowstone National Park, Wyo.
					h about 33 km.
					Magnitude 4.4 (USCGS).
April 27	MIN	iP	08 45 36.3	d	USCGS: 16.1°S, 173.9°W, 0 = 08 33 38.2.
					Tonga Islands. h about 62 km.
April 27	BKS	eP	11 15 22.0	c	USCGS: 22.4°S, 68.5°W, 0 = 11 03 36.5.
	MHC	iP	18.3	c	Northern Chile. h about 161 km.
	MIN	iP	27.3	c	
	CLS	eP	25.0	d	
	PRI	eP	10.4	d	
April 27	MHC	i	15 15 33.7	d	USCGS: 61.4°N, 147.2°W, 0 = 15 10 10.2.
	MIN	eP	45.2	c	S. Alaska. h about 33 km.
April 28	MHC	iP	18 26 13.4	c	USCGS: 9.8°S, 160.4°E, 0 = 18 13 30.9.
	MIN	iP	16.9	d	Solomon Islands. h about 7 km.
April 29	MIN	iP	07 55 19.7	c	BCIS: Vancouver Island region.
April 29	BKS	eNZ	15 21.8	c	
April 29	MIN	iP	19 16 52.0	d	
April 29	BKS	eP	20 42 17.7	c	USCGS: 17.6°N, 92.4°W, 0 = 20 35 59.3.
		eNE	50.0	c	Chiapas, Mexico. h about 9 km.
	MHC	iP	42 11.1	c	Magnitude 5.2 (USCGS).
	MIN	eP	24.2	d	
	CLS	eP	22.5	c	
	PRI	eP	01.1	d	
April 29	BKS	eP	21 52 12.0	d	USCGS: 51.3°N, 178.7°E, 0 = 21 44 17.2.
		iSNEZ	58 36	c	Andreanov Island. h about 56 km.
		eGNEZ	22 01.9	c	Magnitude 5.2 (BKS).
		eREZ	04.0	c	
			mu sec		
		PZ	2.5 10		
		SH	10.9 18		
		MaxH	17.7 20		
	MHC	iP	21 52 17.8	c	
	MIN	iP	03.4	c	
	CLS	eP	07.0	c	
	PRI	eP	31.5	c	
April 30	BKS	eP	01 16 36	d	USCGS: 0.9°S, 128.8°E, 0 = 00 58 19.2.
		eSE	24 00	c	Halmahera Island. h about 33 km.
		eGNE	42.2	c	Magnitude 6 3/4 (PAS).
		eREZ	46.2	c	
	MHC	iP	16 51.8	c	
	MIN	eP	45	c	
	CLS	eP	51	c	
	PRI	eP	53	c	
April 30	MIN	eP	03 26 38.9	d	USCGS: 51.3°N, 178.5°E, 0 = 03 18 47.9.
					Rat Islands. h about 34 km.
April 30	BKS	iP	03 34 04.5	c	USCGS: 51.2°N, 178.6°E, 0 = 03 26 05.2.
		i	19.5	c	Rat Islands. h about 60 km.
	MHC	iP	06.7	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
April 30 (Cont.)	MIN	eP	33 51.6	c	
	CLS	eP	55.8	d	
	PRI	eP	34 21.2	c	
April 30	BKS	iP	07 15 51.0	d	USCGS: 51.3°N, 178.6°E, 0 = 07 07 53.4. Rat Islands. h about 45 km.
		eSNEZ	22 16		
		eREZ	27.3		
	MHC	iP	15 57.0	d	
	MIN	eP	42.1	c	
	CLS	eP	45.5	c	
	PRI	eP	16 12.2	d	
April 30	MHC	e(P)	08 37 35.6	c	USCGS: 17.2°S, 175.0°W, 0 = 08 26 22.8. Tonga Islands. h about 320 km.
	MIN	eP	45.8	d	
April 30	BKS	eEZ	11 03.5		
April 30	BKS	eP	18 53 30.2	d	USCGS: 8.3°S, 80.0°W, 0 = 18 43 07.0. Coastal Peru. h about 9 km.
		eSNEZ	19 01 32		
		eGE	09.3		
		eREZ	12.5		
		mu	sec		
	MaxH		1.0 22		
	MHC	eP	18 53 22		
	MIN	eP	34		
	CLS	eP	23.2	d	
	PRI	eP	05	c	
May 1	BKS	eP	01 12 36.0	c	USCGS: 52.2°N, 174.6°W, 0 = 01 05 12.7. Andreanov Islands. h about 34 km.
		e	23.0		
	MHC	iP	12 42.0	c	
	MIN	iP	54.6	c	
	CLS	eP	30.6	c	
	PRI	eP	53.8	c	
May 1	BKS	iP	10 15 45.7	c	USCGS: 19.0°S, 168.9°E, 0 = 10 03 20.2. New Hebrides. h about 142 km. Magnitude 6.8 (BKS).
		i	53.5		
		iPPNEZ	19 04		
		iSNEZ	25 56		
		iSSNEZ	31 46		
		iLNEZ	38.6		
		iRNEZ	42.5		
		mu	sec		
	PZ		8.8 12		
	PPZ		2.6 12		
	SH		18 12		
	MaxH		59 24		
	MHC	iP	10 15 46.9	c	
	MIN	iP	52.4	c	
	CLS	iP	45.9	c	
	PRI	iP	47.9	c	
May 1	MIN	eP	10 33 43.3	d	
May 1	MHC	iP	10 41 57.3	c	
	MIN	eP	42.1	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 3	BKS	eP	02 15 28.2	c	USCGS: 37.7°N, 118.8°W, 0 = 02 14 44.4. N. Owens Valley, Calif. h about 15 km. Magnitude 4.0 (BKS).
	MHC	iP	27.2	c	
	MIN	iP	43.8	c	
	CLS	eP	34.3	c	
	PRI	eP	19.8	c	
May 3	MHC	iP	11 05 57.0	d	USCGS: 15.2°S, 173.2°W, 0 = 10 54 44.7. Tonga Islands. h about 47 km.
	MIN	iP	06 24.3	c	
May 4	BKS	iP	06 03 29.2	c	USCGS: 51.8°N, 175.4°W, 0 = 05 56 01.1. Andreanov Islands. h about 41 km.
	MHC	iP	35.7	c	
	MIN	iP	18.9	c	
	CLS	eP	21.0	c	
	PRI	eP	46.3	c	
May 5	BKS	eN	15 38.9		USCGS: 24.8°S, 69.6°W, 0 = 15 17 02.1. N. Chile. h about 53 km.
		eNEZ	55.9		
	MIN	eP	29 11.5	d	
	CLS	eP	09.1		
	PRI	eP	28 53.6	c	
May 5	MHC	eP	17 23 31.5	c	USCGS: 17.6°S, 173.7°W, 0 = 17 11 48.8. Tonga Islands. h about 52 km.
	MIN	eP	28.6	c	
May 6	MHC	i(P')	08 57 25.7	c	USCGS: 9.2°S, 112.4°E, 0 = 08 38 32.1. S. Java. h = 80 km.
	MIN	i	23.8	c	
May 6	MHC	iP	09 28 00.1	d	USCGS: 10.0°S, 160.9°E, 0 = 09 15 21.7. Solomon Islands. h about 53 km.
	MIN	iP	03.6	d	
May 7	MHC	iP	05 12 58.1	d	USCGS: 18.8°N, 145.5°E, 0 = 05 00 50.0. Marianas Islands. h about 90 km.
	MIN	iP	52.2	d	
May 7	MHC	iP	05 22 36.5	c	USCGS: 64.5°N, 146.7°W, 0 = 05 16 17.9. Central Alaska. h about 8 km.
	MIN	iP	12.0	c	
May 7	MHC	iP	07 07 57.8	d	USCGS: 36.7°N, 121.8°W, 0 = 07 07 45.1. Off Monterey Co., Calif. h about 33 km. Magnitude 4 1/2 (BKS).
	MIN	eP	08 42.2	c	
May 7	BKS	iP	16 35 00.5	d	USCGS: 22.1°S, 68.7°W, 0 = 16 23 11.8. N. Chile. h about 112 km.
	MHC	iP	34 57.1	d	
	MIN	iP	35 06.8	d	
	CLS	eP	04.1	d	
	PRI	eP	34 49.0	d	
May 8	BKS	eN	09 02.5		USCGS: 54.9°N, 163.8°W, 0 = 08 50 56.3. Unimak Island. h about 90 km.
	MHC	iP	08 57 30.1	d	
	MIN	iP	42.3	d	
	CLS	eP	16.8	d	
	PRI	eP	41.7	d	
May 8	BKS	iP	10 33 39.8	d	JMA: 36°24'N, 141°11'E, 0 = 10 22 08.6. Honshu, Japan. h about 40 km. Magnitude 6.1 (JMA).
		eSNEZ	43 06		
		eGNE	52.5		
		eREZ	55.2		
	MHC	iP	33 43.7	c	
	MIN	iP	34.0	c	
	CLS	eP	34.8	c	
	PRI	eP	51.3	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 9	MHC	iP	15 11 10.7	c	USCGS: 12.7°N, 86.6°W, 0 = 15 06 24. Nicaragua. h about 33 km.
May 9	MIN	iP	20 51 30.0	c	USCGS: 53.8°N, 165.5°W, 0 = 20 45 12.6. Fox Islands. h about 27 km.
May 10	BKS	eP	04 41 27.0	c	USCGS: 20.2°S, 168.1°E, 0 = 04 28 42.6. Loyalty Islands. h about 40 km.
	MHC	iP	27.4	d	
	MIN		33.7	c	
	CLS		27.0	c	
	PRI		28.4	c	
May 10	BKS	eP'	11 29 30.5	c	USCGS: 8.2°S, 68.1°E, 0 = 11 09 43.3. Indian Ocean. h about 33 km.
	MHC	iP'	32.5	c	
	MIN	iP'	23.1	c	
	CLS	eP'	27.8	d	
	PRI	eP'	36.2	c	
May 10	BKS	eP	22 32 30	d	USCGS: 2.1°S, 77.6°W, 0 = 22 22 42.7. Ecuador. h about 30 km. Magnitude 6 (BKS)
		eSNe	40 24		
		eScSN	41 35		
		eSSZ	44 10		
		eGNE	47.8		
		ePKPZ	51.1		
			mu sec		
		PZ	2 9		
		SH	5.6 10		
		MaxH	14.5 21		
	MHC	iP	22 32 25.6	c	
	MIN	iP	35.8	c	
	CLS	eP	34.2	c	
	PRI	eP	15.2	c	
May 11	MIN	eP	03 03 50.1	c	USCGS: 45.1°N, 110.8°W, 0 = 03 00 58.7. Montana. h about 15 km.
May 11	BKS	eP	04 55 12.8		USCGS: 15.7°S, 176.7°W, 0 = 04 44 26.9. Fiji Islands. h about 487 km.
	MHC	iP	12.9	d	
	MIN	iP	23.5	c	
	CLS	eP	13.1	d	
	PRI	eP	12.2	d	
May 12	BKS	eP	20 14 32.1		USCGS: 57.3°N, 154.0°W, 0 = 20 08 40.8. Kodiak Island. h about 60 km. Magnitude 5 3/4 (BKS)
		ipP	48		
		eSNEZ	19 16		
		eGE	20.5		
		eREZ	21.7		
			mu sec		
		PZ	7.6 16		
		SH	8.3 28		
		MaxH	28 20		
	MHC	iP	20 14 39.2	d	
	MIN	iP	18.8	d	
	CLS	eP	26.3	d	
	PRI	eP	52.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 12	MHC	iP	20 46 22.9	c	USCGS: 56.1°N, 163.1°E, 0 = 20 37 17.8 E. Kamchatka. h about 69 km.
	MIN	eP	06.2	d	
May 13	BKS	eP	12 50 50	c	USCGS: 14.6°N, 92.9°W, 0 = 12 44 00.7. Mexico-Guatemala border. h about 60 km. Magnitude 4 3/4 - 5 (BKS).
		ePPEZ	52 06		
		ePPNE	24		
		eSNZ	56 22		
		eScSEZ	56.9		
		eGNE	59.0		
		eRZ	13 01.5		
			mu sec		
		PZ	1.2 6		
		PPZ	0.6 16		
		SH	1.1 24		
		MaxH	11.7 20		
	MHC	iP	12 50 42.7	c	
	MIN	iP	57.4	c	
	CLS	eP	54.3	c	
	PRI	eP	31.2	c	
May 13	BKS	eNE	14 30.2		USCGS: 19.5°S, 169.2°E, 0 = 14 07 46.5. New Hebrides. h about 158 km.
	MHC	iP	20 11.0	c	
	MIN	eP	17.4	c	
	CLS	eP	10.5	c	
	PRI	eP	12.3	c	
May 13	MHC	iP	18 15 00.3	d	USCGS: 61.1°N, 150.0°W, 0 = 17 50 19.3. Kenai Peninsula, Alaska. h about 96 km.
	CLS	eP	08.2	c	
	PRI	eP	14 52.3		
May 14	MIN	eP	13 55 21.2	d	USCGS: 57.4°N, 154.0°W, 0 = 13 50 42.3. Kodiak Island. h about 42 km.
May 15	BKS	eZ	03 16 08	c	USCGS: 3.4°S, 146.9°E, 0 = 02 52 39.7. Bismarck Sea. h about 33 km.
		eSEZ	23 12		
		eGN	30.6		
		eREZ	34.5		
	MHC	iP	05 58.7	c	
	MIN	eZ	06 02.8	d	
May 15	BKS	eZ	12 19 29	d	USCGS: 38.6°N, 26.7°W, 0 = 12 08 12 Azores Islands. h about 33 km.
	MHC	iP	37.2	d	
	MIN	eP	20.8	c	
	CLS	eP	36.5	d	
	PRI	eP	35.7	c	
May 16	BKS	eN	16 36.5		
		eREZ	40.0		
May 16	MIN	iP	19 31 13.7	d	USCGS: 18.0°S, 178.4°W, 0 = 19 20 09.0. Fiji Islands. h about 565 km.
	CLS	eP	04.3	c	
	PRI	eP	04.5	c	
May 17	MHC	iZ	04 16 25.2	c	USCGS: 45.5°N, 150.9°E, 0 = 04 06 39.5. Kurile Islands. h about 51 km.
	MIN	iP	50.6	c	
	CLS	eP	52.5	c	
	PRI	eP	17 12.6	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 17	BKS	eSKSEZ eEZ eGEZ eRNEZ	06 33 36 41 36 50.6 55.5		USCGS: 15.7°N, 120.1°E, 0 = 06 09 20.4. West Luzon, Philippines. h about 99 km.
	MHC	iP	23 06.9	d	
	MIN	eP	22 59.0	d	
May 17	BKS	eP	07 45 24.5	d	USCGS: 31.2°S, 179.9°W, 0 = 07 33 15.2. Kermadec Islands. h about 343 km.
	MHC	iP	24.9	d	
	MIN	iP	34.2	c	
	CLS	eP	25.8	d	
	PRI	eP	24.0	d	
May 17	BKS	eP	12 20 22.0	c	USCGS: 41.6°N, 142.0°E, 0 = 12 09 08.1. South Hokkaido, Japan. h about 72 km.
		eSEZ	29 16		
		eRNEZ	41.0		
	MHC	eP	20 34.7	c	
	CLS	eP	26.0	c	
	PRI	eP	43.7	c	
May 17	BKS	eP	22 52 14.2	d	USCGS: 24.7°S, 177.3°W, 0 = 22 40 12.4. Tonga Islands. h about 128 km.
	MHC	iP	14.7	c	
	MIN	eP	23.5	d	
	CLS	eP	15.3	d	
	PRI	eP	13.7	d	
May 18	BKS	eP	05 45 52	c	USCGS: 29.7°S, 68.6°W, 0 = 05 33 26.7. West Argentina. h about 42 km.
		eNEZ	56 20		
	MHC	iP	45 51.6	c	
	MIN	eP	46 00.4	d	
	CLS	eP	45 57.4	c	
	PRI	eP	43.3	c	
May 18	BKS	eEZ	12 50.4		USCGS: 8.2°S, 115.6°E, 0 = 12 20 34.4. Bali, Indonesia. h about 65 km. Eruption of Gynung Agung Volcano.
		eNEZ	57.3		
		eREZ	13 24.4		
	MHC	iP'	12 39 21.6	c	
	MIN	eP'	40 21.2	c	
	CLS	eP'	39 24.6	c	
	PRI	eP'	24.5	c	
May 18	MHC	iP	21 00 27.4	d	USCGS: 35.7°N, 115.1°W, 0 = 20 59 00. S. Nevada. h about 33 km.
		e(S)Z	01 52.5		
	PRI	eP	00 15.9	c	
May 19	BKS	eP	01 16 21.8	d	USCGS: 46.3°S, 74.8°W, 0 = 01 03 06.2. S. Chile. h about 48 km. Magnitude 6 1/2 (BKS)
		i	30.0		
		ePP	20 06		
		eSNE	27 00		
		ePSNEZ	28.8		
		iSSNEZ	33.9		
		iSSSNEZ	37 18		
		eGNE	40.0		
		eP'P'NE	42.2		
		eRNZ	47.0		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 19 (Cont.)			mu sec		
		PZ	4.5 10		
		PPZ	4.1 16		
		SH	5.2 16		
		MaxH	14 28		
	MHC	iP	01 16 18.1	c	
	CLS	eP	22.8	c	
	PRI	eP	11.0	d	
May 19	BKS	iP	21 46 33.0	c	BCIS: 23.9°N, 46.0°W, 0 = 21 35 47. Mid-Atlantic Ridge. h about 10 km. Magnitude 6 1/4 - 6 1/2 (BKS)
		ePP	49 03.0		
		eSNEZ	55 22		
		eQNE	22 02.4		
		eREZ	06.0		
			mu sec		
		PZ	2 20		
		SH	15 34		
		MaxH	58 30		
	MHC	iP	21 46 30.2	c	
	CLS	eP	33.5	c	
	PRI	eP	26.4	c	
May 19	BKS	eP	23 42 50.0	c	USCGS: 17.7°S, 69.4°W, 0 = 23 31 25.3. Peru-Bolivia-Chile border. h about 137 km.
	MHC	iP	46.5	d	
	MIN	eP	56.1	c	
	CLS	eP	52.9	c	
	PRI	eP	38.2	d	
May 20	MHC	iP	01 43 52.0	d	USCGS: 8.2°N, 83.0°W, 0 = 01 35 31.3 Panama-Costa Rica border. h about 27 km.
	MIN	eP	44 03.2	c	
May 20	BKS	eP	11 50 39.3	c	USCGS: 30.7°S, 178.3°W, 0 = 11 38 05.3. Kermadec Islands. h about 68 km. Magnitude 6 1/2 (BKS)
		iZ	50.5		
		iPPNEZ	54 00		
		iSKSNE	12 00 40		
		iSNEZ	01 00		
		iPSNEZ	02 16		
		iSSNE	06 12		
		eGNE	13.0		
		eRNEZ	16.9		
			mu sec		
		PZ	11.7 12		
		PPZ	2.7 22		
		SH	22.8 24		
		MaxH	41 32		
	MHC	iP	11 50 39.8	c	
	MIN	iP	50.1	c	
	CLS	iP	40.9	c	
	PRI	iP	38.6	c	
May 20	MHC	iP	13 12 13.1	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 21	MHC CLS PRI	iP eP eP	17 43 11.4 42 48.5 52.2	c d c	USCGS: 11.1°S, 163.3°E, 0 = 17 30 15.3. Solomon Islands. h about 33 km. Magnitude 5 3/4 - 6 (PAL)
May 22	BKS	eP eSNE eGNE eREZ	02 40 25.5 51 12 03 02.7 05.9	c	
May 22	MHC CLS PRI BKS	iP eP eP eP	02 40 28.0 24 29.6 04 29 40	d c c d	USCGS: 18.1°N, 106.0°W, 0 - 04 24 33.5 Off Jalisco, Mexico. h about 33 km.
		eSN eLNEZ eRNZ	34 12 35.0 38.5		
May 22	MHC CLS PRI BKS	eP eP eP eP	29 43.9 27.2 28.6 10 30 59.2	c d d c	USCGS: 11.1°S, 163.5°E, 0 - 10 18 26.3. Solomon Islands. h about 33 km.
May 22	MHC CLS PRI BKS	iP eP eP eP	59.6 57.8 31 02.1 14 06 40.9	c c c d	USCGS: 48.7°N, 154.8°E, 0 - 13 56 47.5. Kurile Islands. h about 54 km. Magnitude 6 (BKS)
		iSNE eNEZ eGNE eRZ	14 46 18.7 21.3 23.6		
		mu sec			
		PZ SH MaxH	5.5 8 4.0 18 7 22		
May 22	MHC CLS PRI MHC CLS PRI	iP eP eP eP eP eP	14 06 45.4 35.8 55.3 16 31 57.2 32 09.7 31.0	d d d d d c	USCGS: 52.0°N, 165.4°W, 0 - 16 25 37.2. Fox Islands. h about 33 km.
May 22	BKS	e(P')	22 11 32		USCGS: 8.2°S, 115.7°E, 0 = 21 53 03.7. Bali, Indonesia. h about 47 km. Near Gunung Agung Volcano.
		eEZ eSSNE eGEZ	23.0 29.7 49.0		
May 22	CLS PRI BKS CLS	e(P')	11 48	c	
		e(P')	51.3	c	
May 22	BKS CLS	iP eP	22 41 18.1 29.9	d c	Berkeley: 37°16'N, 122°19'W, 0 = 22 41 04.8. Off Central California. h about 33 km. Magnitude 4.6 (BKS).
May 23	MHC BKS	eP iP iPcP ipP eSNE	15.7 03 44 21.8 40.4 45 33.2 53 24	d d	USCGS: 14.7°S, 176.2°W, 0 = 03 33 24.8. Fiji Islands. h about 302 km. Magnitude 5 1/4 (PAL).

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 23 (Cont.)		eScSNE eSSE eREZ	54.0 58.4 04 13.9		
		mu sec			
		MaxH	3.4 36		
	MHC CLS PRI	iP eP eP	03 44 22.6 23.5 23.0	c d c	
May 23	MHC	iP	06 38 13.9	c	USCGS: 32.9°N, 115.0°W, 0 = 06 36 32.6. Imperial Valley, Calif. h about 14 km. Magnitude 4.4 (PAS)
May 23	BKS	eP eSNEZ	07 53 09 08 00 54	c	USCGS: 19.2°N, 64.5°W, 0 = 07 43 56.9. Virgin Islands. h about 47 km.
	MHC CLS PRI	iP eP eP	07 53 09.8 15.2 01.7	c c c	
May 23	MHC	iP	09 07 43.0		USCGS: 31.9°N, 115.9°W, 0 = 09 05 59.3. Baja California. h about 39 km. Magnitude 4.6 (PAS)
May 23	MHC	iP	15 54 39.6		USCGS: 32.5°N, 115.3°W, 0 = 15 53 00.2. Baja California. h about 14 km. Minor damage at Westmorland, Brawley, and El Centro.
		iSZ eP	56 23.0 54 25.5		
May 23	BKS	eZ eSNEZ eGNE eRNEZ	18 27 44 31 48 33.6 34.2		USCGS: 14.5°N, 105.2°W, 0 = 18 21 18.3. Off W. Mexico. h about 33 km.
	MHC CLS PRI	iP eP eP	27 00.9 23.2 26 49.3	c d d	
May 23	BKS	eP	21 15 20.9	c	
May 25	CLS	eP	34.7	d	
May 25	MHC	eP	08 08 49.9	c	USCGS: 24.2°S, 66.8°W, 0 = 07 56 58.8 NW Argentina. h about 185 km.
May 25	MHC	eP	08 52 04.8	c	USCGS: 42.9°N, 144.4°E, 0 = 08 41 11.6. E. Hokkaido, Japan. h about 88 km. Magnitude 5.3 (JMA)
May 25	MHC	iP	14 59 33.6	c	
May 25	BKS	eP ePPNEZ eSSN eNEZ	16 26 58.3 34 06 46 00 17 07.5	d	USCGS: 56.7°S, 24.8°W, 0 = 16 08 00.6. Sandwich Isles. h about 33 km. Magnitude 6 (KEW)
		mu sec			
		MaxH	3.8 16		
	MHC CLS PRI	iP eP eP	18 26 57.1 27 05 26 54.2	d d c	
May 26	MHC	iP	05 01 54.6	c	USCGS: 51.6°N, 160.0°E, 0 = 04 52 24.0. E. Kamchatka. h about 33 km.
May 26	MHC	iP	12 45 02.8	c	
May 26	BKS	eP eNEZ eSNE	23 16 11.2 22 26 23 48	d	USCGS: 55.2°N, 160.1°E, 0 = 23 06 54.0 E. Kamchatka. h about 34 km. Magnitude 5 1/4 - 5 1/2 (BKS)

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 26 (Cont.)		eGNE	29.7		
		eRNE	32.3		
			mu sec		
		SH	1.8 24		
		MaxH	3.1 28		
May 27	MHC	iP	23 16 16.7	c	USCGS: 55.2°N, 160.1°E, 0 = 03 58 46.6. E. Kamchatka. h about 49 km. Magnitude 5 1/4 (BKS)
	CLS	eP	06.4	d	
	PRI	eP	27.6	d	
	BKS	eP	04 08 02.5	d	
		eSNE	15 36		
		eScSNE	17 52		
		eSSNEZ	19.4		
		eGNE	21.5		
		eREZ	24.2		
			mu sec		
	PZ	1.3 6			
	SH	1.6 12			
	MaxH	2.4 28			
May 28	CLS	eP	04 07 57.6	d	Berkeley: Near Oxnard, Southern California. 0 = 11 37 54. Magnitude 4.3 (BKS).
	PRI	eP	08 18.7	d	
	BKS	iP	11 38 54.3	d	
		eSE	40 08.4		
	MHC	iP	38 44.6	c	
	MIN	iP	39 19.2	c	
		iSZ	40 26.0		
	PRI	iP	38 24.7	c	
		iS	51.3		
	May 29	MIN	eP	04 55 54.2	
May 29	MHC	iP	08 38 44.2	c	USCGS: 17.6°S, 178.8°W, 0 = 08 27 44.5. Fiji Islands. h about 516 km.
May 30	MIN	iP	53.0	d	
May 31	BKS	e(S)E	07 33 12		USCGS: 15.2°S, 173.4°W, 0 = 06 03 34.2. Tonga Islands. h about 29 km.
		eGEN	44.5		
		eRZ	49.5		
	MHC	iP	21 52.1	d	
	BKS	eP	06 14 55	c	
		iSNEZ	24 12		
		eGNE	33.0		
		eRNEZ	35.8		
			mu sec		
		MaxH	3.5 30		
	MHC	iP	06 14 54.2	d	
	MIN	eP	15 05.3	d	
	CLS	eP	14 59.7	d	
	PRI	eP	52.0	d	
May 31	BKS	eP	24 10 14.5	c	USCGS: 15.3°S, 173.4°W, 0 = 23 58 52.2. Samoa. h about 61 km.
		eSNEZ	19 30		
		eGNE	28.1		
		eRNEZ	31.0		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
May 31 (Cont.)		MaxH	3.5 28		
		iP	24 10 08.6	c	
	MHC	iP	24 10 08.6	c	
	MIN	eP	19.2	c	
	CLS	eP	16.7	c	
	PRI	eP	06.5	c	
June 1	BKS	eP	12 42 11.5	c	USCGS: 15.0°S, 172.5°W, 0 = 12 30 55.5. Tonga Islands. h about 33 km.
		eSNE	52 00		
		eGNE	13 00.0		
		eRNEZ	02.9		
	MHC	iP	12 42 11.5	c	
	MIN	eP	22.1	c	
	CLS	eP	11.0	d	
	PRI	eP	11.3	c	
	BKS	iP	21 25 13.7	d	
		eSNE	34 24		
	eGNE	43.3			
	eREZ	45.8			
		mu sec			
	MaxH	6.7 32			
June 2	MHC	iP	21 25 12.3	c	USCGS: 6.2°S, 154.4°E, 0 = 10 00 00.1. Solomon Islands. h about 60 km. Magnitude 5 1/2 - 5 3/4 (PAL).
	MIN	eP	22.8	c	
	CLS	eP	13.1	c	
	PRI	eP	11.7	d	
	BKS	iP	10 12 50.8	c	
		eSNEZ	23 44		
		eREZ	39.8		
			mu sec		
		MaxH	3.9 20		
	MHC	iP	10 12 52.5	c	
MIN	eP	52.8	c		
CLS	eP	49.5	d		
PRI	eP	56.0	d		
June 2	BKS	e(P)P	21 23 22.0	d	USCGS: 33.6°S, 178.6°W, 0 = 21 07 07.5. Kermadec Islands. h about 33 km.
		i(P')Z	25 44		
		eNZ	26 55		
		eSSNEZ	43 10		
		eGNE	58.0		
		eRZ	22 05.5		
	MHC	iP	21 19 58.8	c	
	MIN	iZ	21 37.8	c	
	CLS	eP	19 58.5	c	
		e(P)P	23 33.9	d	
PRI	eP	19 56	c		
	e(P)P	23 26.4	c		
June 2	MHC	iP	22 28 58.0	c	USCGS: 13.7°N, 90.7°W, 0 = 22 22 02.0. Guatemala. h about 100 km.
	MIN	eP	29 12.1	c	
	CLS	eP	09.3	c	
	PRI	eP	46.8	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 3	BKS	i(P) eNE	07 47 49.0 08 07.5	d	JMA: 34°03'N, 138°46'E, 0 = 07 35 50.3. Honshu, Japan. h about 40 km. Magnitude 5.9 (JMA).
	MHC	iP	07 47 48.9	d	
	CLS	eP	34.5	d	
	PRI	eP	51	c	
June 3	BKS	eP	11 41 22.5	c	USCGS: 5.4°N, 73.0°W, 0 = 11 31 50.5. Colombia. h about 32 km.
	MHC	iP	18.5	d	
	MIN	iP	26.0	d	
	CLS	eP	26.5	c	
	PRI	eP	08.1	d	
June 4	BKS	iP	12 06 46.3	d	USCGS: 30.5°S, 177.8°W, 0 = 11 54 09.1. Kermadec Islands. h about 33 km.
		eSNZ	17 18		
		eGNE	29.0		
		eREZ	32.7		
			mu sec		
		MaxH	3.2 28		
	MHC	iP	12 06 45.9	c	
	MIN	eP	55.1	c	
	CLS	eP	45.7	c	
	PRI	eP	43.5	c	
June 4	BKS	eP	19 33 54.6	d	USCGS: 18.9°N, 146.0°E, 0 = 19 21 54.8. Marianas Islands. h about 96 km.
		eEZ	57.5		
	MHC	iP	33 58.7	d	
	MIN	iP	53.5	d	
	CLS	eP	52.6	d	
	PRI	eP	34 05.0	d	
June 4	BKS	iPP	21 23 22	d	USCGS: 1.2°S, 127.3°E, 0 = 21 04 42.3. Halmahera Island. h about 33 km. Magnitude 6 - 6 1/4 (PAS).
		e(S)EZ	32 24		
		eGE	48.3		
		eREZ	52.8		
			mu sec		
		MaxH	5.5 20		
	MHC	iPP	21 23 19.2	d	
	MIN	ePP	21.0	c	
	CLS	ePP	20.8	c	
	PRI	ePP	36.4	c	
June 5	MIN	iP	09 23 26.4	d	USCGS: 31.3°N, 142.6°E, 0 = 09 11 50.2. SE Honshu, Japan. h about 33 km.
June 5	MHC	iP	10 24 41.1	c	USCGS: 14.9°S, 166.9°E, 0 = 10 12 08.1. New Hebrides. h about 35 km.
	MIN	eP	46.2	d	
June 6	MIN	iP	05 32 25.4	d	USCGS: 19.9°N, 120.5°E, 0 = 05 18 54.9.
June 7	BRK	iP	12 04 46.7	c	BKS: 37°58.5 N, 122°02.9 W 0 = 12 04 42.2 Near Concord, Calif. Magnitude 3.9 (BKS)
	MHC	iP	55.3	d	
	MIN	iP	05 20.9	d	
		iSZ	51.3		
	CLS	iP	04 56.5	d	
June 7	BKS	eSSNE	16 05.5		USCGS: 15.4°S, 178.8°W, 0 = 15 34 49.0. Fiji Islands. h about 33 km.
		eGN	30.0		
		eREZ	34.6		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 7	MHC	iP	15 46 39.9	d	
(Cont.)	MIN	eP	41.5	d	
	CLS	eP	38.0	d	
	PRI	eP	32.8	c	
June 7	BKS	eP	19 37 16	d	USCGS: 8.5°N, 103.1°W, 0 = 19 30 35.6. Clipperton Island. h about 33 km. Magnitude 5 3/4 (BKS)
		eSNEZ	42 50		
		eGNE	45 12		
		eR	46.7		
			mu sec		
		SH	3.7 20		
		MaxH	21 20		
	MHC	iP	19 37 14.2	d	
	MIN	eP	34		
	CLS	eP	25.5	d	
	PRI	eP	00.6	d	
June 7	BKS	iP	21 35 14.0	d	USCGS: 8.7°N, 102.8°W, 0 = 21 28 48.2. Clipperton Island. h about 33 km.
		eGZ	43.3		
		eRNZ	45.0		
	CLS	eP	35 22	d	
	PRI	eP	13	c	
June 7	BKS	eP	22 48 50	d	USCGS: 15.5°S, 173.1°W, 0 = 22 37 30.3. Samoa. h about 33 km. Magnitude 6 1/2 (BKS)
		eSNEZ	58 10		
		eQNEZ	23 06.8		
		eRNEZ	10.0		
			mu sec		
		PZ	1.0 10		
		SH	6.5 24		
		MaxH	6.8 32		
	CLS	eP	22 48 46.5	c	
	PRI	eP	50	c	
June 8	BKS	eZ	05 18.0		
June 8	MHC	iP	05 47 09.5	c	USCGS: 5.5°S, 147.1°E, 0 = 05 34 06.9. N. New Guinea. h about 171 km.
	MIN	iP	09.5	c	
	CLS	eP	06.5	d	
	PRI	eP	12.6	c	
June 8	MHC	iP	12 55 12.5	c	USCGS: 6.9°N, 73.2°W, 0 = 12 46 04.2. N. Colombia. h about 140 km.
	MIN	iP	19.7	c	
June 9	BKS	eEZ	21 14.0		USCGS: 10.6°N, 41.8°W, 0 = 20 37 47.1. Mid-Atlantic Ridge. h about 11 km.
	MHC	iP	20 49 39.0	d	
	MIN	iP	33.6	d	
	PRI	eP	31.0	c	
June 10	BKS	eP'	04 36 52.6	d	USCGS: 55.9°S, 146.2°E, 0 = 04 16 48.4. Indian-Antarctic Rise. h about 33 km. Magnitude 6 1/4 (PAS)
		eSPZ	47 12		
		eSSN	53 42		
		eGNE	05 04.8		
		eREZ	10.8		
			mu sec		
		MaxH	5.3 20		
	MHC	iP'	04 35 29.1	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 10 (Cont.)	MIN	eP'	32.2		
	CLS	eP'	36 50.9	d	
	PRI	eP'	54.2	d	
June 10	BKS	eP'	06 59 28	c	USCGS: 55.2°S, 146.1°E, 0 = 06 39 04.1 Indian-Antarctic Rise. h about 19 km. Magnitude 6 1/4 6 1/2 (PAS).
		ePKSZ	07 01 08		
		iPSNEZ	09 28		
		ePPSNEZ	10 46		
		eSSNEZ	15 36		
		eLNE	28.0		
		eRNEZ	34.3		
		mu sec			
		MaxH	12.5 20		
	MIN	eP'	06 58 00.1	c	
	PRI	eP'	59 24.8	c	
June 10	PRI	eZ	07 38 37	c	
June 10	BKS	iP	10 56 25.4	c	USCGS: 51.0°N, 160.1°E, 0 = 10 46 59.4. Off Kamchatka. h about 44 km.
		eGNE	11 10.0		
		eRZ	12.0		
	MHC	iP	10 56 30.3	d	
	MIN	iP	57 05.9	d	
	CLS	eP	56 25.3	c	
	PRI	eP	40.5	d	
June 11	MIN	eP	04 21 24.3	d	USCGS: 59.9°N, 152.9°W, 0 = 04 15 52.3. S. Alaska. h about 78 km.
June 11	BKS	eP	13 14 47.0	c	USCGS: 63.2°N, 151.4°W, 0 = 13 08 31.5. Central Alaska. h about 36 km.
	MHC	iP	52.7	d	
	MIN	iP	39.2	d	
	CLS	eP	39	c	
	PRI	eP	15 06.0	d	
June 11	BKS	iP	15 25 34.9	c	USCGS: 31.8°N, 116.2°W, 0 = 15 23 42.7. Baja California. h about 33 km. Magnitude 5 1/2 (BKS). Felt: Southern California
		iSNE	27 22		
		mu sec			
		PZ	0.07 0.6		
		MaxH	21 20		
	MHC	iP	15 25 25.0	c	
	MIN	iP	26 02.4	d	
	CLS	eP	25 45.0	c	
	PRI	eP	05.4	c	
June 12	MHC	iP	22 17 03.4	d	USCGS: 31.5°N, 116.3°W, 0 = 22 15 15.3. Baja California. h about 33 km. Magnitude 4 3/4 - 5 (PAS). Felt: San Diego, El Centro.
	MIN	eP	39	d	
	CLS	eZ	28	d	
	PRI	eP	16 41.9	c	
June 15	MIN	eP	02 26 46.4	c	USCGS: 53.2°N, 167.0°W, 0 = 02 20 11.5. Fox Islands. h about 33 km.
June 15	BKS	iP	05 12 52.6	c	USCGS: 15.2°S, 177.7°W, 0 = 05 01 55.8. Fiji Islands. h about 392 km.
	MHC	iP	53.3	c	
	MIN	iP	13 02.3	c	
	CLS	eP	12 52.8	d	
	PRI	eP	53.0	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 15	BKS	eP	15 42 29.0	c	USCGS: 36.3°S, 98.9°W, 0 = 15 30 37.7. Off Central Chile. h about 33 km.
	MHC	iP	28.0	c	
	MIN	eP	42.5	c	
	CLS	eP	33.4	c	
	PRI	eP	18.0	c	
June 15	MHC	iP	16 01 20.1	c	
	MIN	eP	29.0	c	
June 16	BKS	eN	06 38 32		USCGS: 16.6°N, 100.3°W, 0 = 06 27 15. Guerrero, Mexico. h about 33 km.
June 16	BKS	eP	09 23 12.7	d	USCGS: 50.8°N, 129.5°W, 0 = 09 19 53.2. Vancouver Island. h about 20 km.
	MHC	iP	15.6	d	
	MIN	eP	22 43.0	c	
	CLS	eP	59.3	d	
	PRI	eP	23 37.2	d	
June 17	BKS	eP	18 37 40	d	USCGS: 60.5°N, 140.8°W, 0 = 18 32 13.7. S. Alaska. h about 28 km.
		eZ	38 12		
		eSEZ	42 12		
		e(R)Z	44 49		
	MHC	iP	37 47.4	c	
	MIN	eP	21.7	d	
	CLS	eP	32.6	d	
	PRI	eP'	38 00.7	c	
June 17	BKS	eNE	19 16 12		
		e(R)NZ	22.2		
June 17	MHC	iP	20 20 23.3	d	USCGS: 20.4°S, 174.2°W, 0 = 20 08 37.4. Tonga Islands. h about 33 km.
	MIN	eP	33.2	d	
	CLS	eP	26.0	d	
	PRI	eP	22.7	d	
June 17	BKS	iP'	23 21 05.0	c	USCGS: 4.1°S, 102.0°E, 0 = 23 02 06.0. S. Sumatra. h about 69 km.
	MHC	iP'	07.1	c	
	MIN	eP'	02.9	c	
	CLS	eP'	04.3	c	
	PRI	eP'	10.6	d	
June 18	BKS	iP	04 15 06.3	d	USCGS: 28.8°N, 130.0°E, 0 = 04 02 32.4. Ryukyu Islands. h about 53 km.
	MHC	iP	09.3	c	
	MIN	eP	50.8	c	
	CLS	eP	02.4	c	
	PRI	eP	16.8	d	
June 19	BKS	eNEZ	02 37 44		USCGS: 23.6°S, 174.9°W, 0 = 02 15 54.1. Tonga Islands. h about 55 km.
	MHC	iP	27 50.7	c	
	MIN	eP	28 03.9	c	
June 19	BKS	e(P')	09 27 36	c	USCGS: 4.7°N, 126.5°E, 0 = 09 09 04.0. Talaud Islands. h about 83 km. Magnitude 6.2 (USCGS).
		eSKSNEZ	33 36		
		ePSEZ	36 16		
		eSSE	41.5		
		eGN	50.5		
		eREZ	55.5		
		mu sec			
		MaxH	6.3 36		
	MHC	iP	09 23 11.0	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 19 (Cont.)	MIN	eP	02.2	c	
June 19	BKS	eN	11 10.5		MOSCOW: 24.7°N, 92.1°E, 0 = 10 47 21. NE Bengal. h about 51 km.
	MIN	eZ	05 54		
	CLS	ePP	06 16.2	d	
	PRI	ePP	41.7	d	
June 19	BKS	eZ	11 41.3		USCGS: 44.7°N, 129°6'W, 0 = 11 30 48.2. Off Oregon. h about 33 km.
June 19	MIN	eP	32 37.3	d	
June 19	BKS	eP	12 11 39.1	c	USCGS: 9.3°S, 158.8°E, 0 = 11 58 55.1. Solomon Islands. h about 33 km.
		iZ	52.2		
	MHC	iP	40.8	c	
	MIN	eP	43.8	c	
	CLS	eP	38.4	c	
	PRI	eP	43.8	c	
June 19	BKS	eZ	18 44 32		USCGS: 3.6°S, 153.4°E, 0 = 18 22 09.7. New Ireland. h about 278 km.
	MHC	iP	34 33.4	c	
	MIN	eZ	31.4	c	
	CLS	eP	18.8	c	
	PRI	eP	34.5	c	
June 19	BKS	iP	23 13 40.4	c	USCGS: 31.7°N, 140.0°E, 0 = 23 01 55.9. S. Honshu, Japan. h about 62 km. Magnitude 5 1/4 = 5 1/2 (BKS).
		iZ	48.3		
		ePPZ	16 28		
		eSNE	23 30		
		eScSEZ	24 08		
		eSSNEZ	28.7		
		eGN	34.4		
		eREZ	36.9		
			mu sec		
		PZ	1.4 8		
		PPZ	0.8 8		
		SH	2 26		
		MaxH	2.3 32		
June 20	MIN	eP	23 13 39.2	c	
	CLS	eP	48.2	d	
	PRI	eP	55.2	d	
June 20	BKS	iP	01 07 21.3	d	USCGS: 36.4°N, 144.6°E, 0 = 00 56 02.2. Off E. Honshu, Japan. h about 15 km.
		eEZ	28.4		
	MIN	eP	07 15.4	d	
	CLS	eP	17.4	d	
	PRI	eP	34.1	c	
June 20	BKS	eP	22 58 40.3	c	USCGS: 28.0°S, 176.5°W, 0 = 22 46 18.8. Kermadec Islands. h about 48 km. Magnitude 5 1/2 (BKS)
		epPZ	53.9		
		ePcPZ	59 12		
		eSNEZ	23 09 00		
		eSSE	14 14		
		eGNE	20.0		
		eRNEZ	25.8		
			mu sec		
		PZ	0.7 7		
		SH	1.4 16		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 20 (Cont.)	CLS	MaxH	4.8 16		
	PRI	eP	22 58 41.8	d	
June 21	BKS	iP	12 30 16.6	c	USCGS: 23.8°S, 66.6°W, 0 = 12 18 24.4. N. Argentina. h about 203 km.
	MIN	iP	21.6	c	
	CLS	eP	19.5	d	
	PRI	eP	04.5	c	
June 21	BKS	eNE	14 15.7		USCGS: 47.8°N, 130.5°E, 0 = 13 44 20.8. NE Manchuria. h about 203 km.
	MIN	eP	13 55 42.9	c	
	CLS	eP	47.6	c	
	PRI	eP	56 06.5	c	
June 21	MIN	eZ	17 55 10		USCGS: 27.9°S, 173.6°W, 0 = 17 42 33.4. Kermadec Islands. h about 9 km.
June 21	MIN	iP	21 54 51.6	d	USCGS: 29.9°S, 177.1°W, 0 = 21 42 00.5. Kermadec Islands. h about 47 km.
June 23	BKS	iP	04 02 05.0	c	USCGS: 29.7°S, 177.9°W, 0 = 03 49 34.1. Kermadec Islands. h about 52 km.
	MIN	e(P)	16		
	CLS	eP	06.5	c	
	PRI	eP	05.8	c	
June 23	MIN	eP	09 06 38.2	c	USCGS: 6.0°S, 146.6°E, 0 = 08 53 09.5. E. New Guinea. h about 60 km.
June 24	BKS	iP	04 32 33.8	d	USCGS: 59.5°N, 151.7°W, 0 = 04 26 37.9. Cook Inlet, Alaska. h about 52 km. Magnitude 6 1/4 = 6 1/2 (BKS)
		e(S)Z	37 35.0		
		eREZ	40.7		
			mu sec		
		PZ	5.8 8		
		SH	13 14		
	MIN	iP	04 32 16.1	d	
	CLS	eP	25.4	d	
	PRI	eP	52.4	d	
June 24	MIN	iP	05 49 24.5	d	USCGS: 59.4°N, 151.5°W, 0 = 05 43 48.0. Kenai Peninsula, Alaska. h about 56 km.
June 24	MIN	iP	10 20 30.3	d	USCGS: 52.9°N, 131.7°W, 0 = 10 17 04.2. Queen Charlotte Islands. h about 56 km.
June 24	MIN	eP	13 30 06.1	c	USCGS: 25.6°S, 175.2°W, 0 = 13 17 48.3. Tonga Islands. h about 58 km.
June 24	MIN	iP	15 12 50.0	d	USCGS: 15.4°S, 177.6°W, 0 = 15 01 42.7. Tonga Islands. h about 397 km.
	CLS	eP	40.4	c	
	PRI	eP	40.6	c	
June 24	BKS	eP	16 24 23.0	c	USCGS: 52.2°N, 171.1°W, 0 = 16 17 15.7. Fox Islands. h about 36 km.
		iSNEZ	30 06		
		eRZ	34.1		
	MIN	eP	24 12.1	c	
	CLS	eP	13.8		
	PRI	eP	40.8		
June 25	MIN	eP	08 27 00.6	c	USCGS: 44.3°N, 129.1°W, 0 = 08 26 21.7. Off Oregon. h about 32 km.
	CLS	eZ	28 05.8	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 25	BKS	eNEZ	09 43 14		USCGS: 44.3°N, 129.0°W, 0 = 09 39 30.4.
	MIN	eP	41 07.4	c	Off Oregon. h about 43 km.
	CLS	eZ	14.0	c	
June 25	MIN	eP	11 52 07.4	c	USCGS: 8.5°N, 83.0°W, 0 = 11 43 38.2.
					Costa Rica. h about 19 km.
June 25	MIN	eP'	14 51 25		USCGS: 8.8°S, 106.3°E, 0 = 14 32 09.2.
					S. Java. h about 42 km.
June 25	MIN	eP	15 54 13.6	c	USCGS: 44.0°N, 110.0°W, 0 = 15 51 49.6.
					Yellowstone National Park, Wyoming.
					h about 33 km.
June 25	MIN	eP	23 10 07.2	d	USCGS: 11.6°N, 142.9°E, 0 = 07 55 40.4.
					Marianas Islands. h about 44 km.
June 26	MIN	eP	08 08 21.3	c	
June 26	MIN	eP	10 39 39.4	c	BCIS: 35.6°N, 3.7°W, 0 = 10 27 03
					Off N. Morocco. h about 33 km.
					Magnitude 4.6 (USCGS).
June 26	BKS	iP	17 51 17.5		USCGS: 7.0°N, 82.3°W, 0 = 17 42 42.2
		iSNEZ	58 14		Off S. Panama. h about 34 km.
		eNE	18 04 18		Magnitude 5 3/4 - 6 (BKS).
			mu sec		Felt.
		PZ	2.7 10		
		SH	6 24		
	MIN	eP	17 51 21.6	c	
	CLS	eP	21.2	c	
	PRI	eP	01.6	d	
June 27	MIN	eP	07 13 09.1	d	USCGS: 60.5°N, 140.8°W, 0 = 07 08 01.8.
	CLS	eP	21.2	d	S. Alaska. h about 31 km.
	PRI	eP	48.5	d	
June 27	MIN	iP'	15 51 34.0	d	USCGS: 14.4°N, 93.7°E, 0 = 15 32 53.1.
					Andaman Islands. h about 33 km.
June 28	BKS	iP'	02 50 02.3	c	USCGS: 27.5°S, 66.0°E, 0 = 02 28 50.7.
	MIN	eP'	48 28.9	c	S. Indian Ocean. h about 28 km.
	CLS	eP'	49 58.8	c	Magnitude 6 (USCGS).
	PRI	eP'	50 13.1	c	
June 28	MIN	iP'	14 06 47.0	c	USCGS: 1.2°N, 97.3°E, 0 = 13 47 44.9.
					N. Sumatra. h about 27 km.
June 28	BKS	iP	22 05 48.0	d	USCGS: 46.7°N, 153.3°E, 0 = 21 55 36.8.
		iSNEZ	13 58.4		Kurile Islands. h about 12 km.
		iZ	21.8		Magnitude 7 (BKS)
			mu sec		
		PZ	5 16		
		SH	7 21		
	MIN	iP	22 05 38.6	c	
	CLS	eP	44	d	
	PRI	eP	06 03	d	
June 28	MIN	eP	22 35 02.9	c	USCGS: 46.9°N, 153.6°E, 0 = 22 25 07.1.
					Kurile Islands. h about 47 km.
June 28	MIN	iP	23 05 49.0	c	
June 28	BKS	eP	24 04 16.7	d	USCGS: 46.6°N, 153.5°E, 0 = 23 53 56.6.
	MIN	eP	03 57		Kurile Islands. h about 33 km.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
June 28	CLS	eP	04 07.0	c	
(Cont.)	PRI	eP	32.3	d	
June 29	MIN	eZ	02 31 48.4	d	Kurile Islands aftershock.
June 29	MIN	eZ	05 49 02		Kurile Islands aftershock.
June 29	BKS	iP	08 10 32.0	d	USCGS: 40.3°N, 126.9°W, 0 = 08 09 27.6.
					Off N. California. h about 33 km.
					Magnitude 5.0 (BKS).
	MIN	iP	10 27.7	d	
		i(S)Z	11 11.6		
June 29	MIN	eP	10 14 55.6	c	BCIS: South Pacific.
June 29	BKS	eP	12 56 33.3	c	USCGS: 11.7°N, 142.6°E, 0 = 12 43 46.3.
	MIN	eP	30.8	c	Marianas Islands. h about 24 km.
	CLS	eP	28.5	c	
	PRI	eP	40.4	c	
June 29	MIN	eZ	13 17 10.7	d	USCGS: 11.7°N, 142.6°E, 0 = 13 04 23.0.
					Marianas Islands. h about 33 km.
					Marianas aftershock.
					Kurile Islands aftershock.
June 29	MIN	eZ	13 31 51.8	c	
June 29	MIN	eP	18 52 15.3	c	
June 29	BKS	e(P)	20 34 41.5	c	
	MIN	iZ	33 53.9	c	
	CLS	e(P)	34 15.3		
	PRI	e(P)	46.7	c	
June 29	MIN	eP	22 14 47.2	c	USCGS: 27.8°N, 141.8°E, 0 = 22 02 13.
					Bonin Islands. h about 21 km.
June 30	MIN	eP	02 17 21.4	c	USCGS: 22.0°S, 170.9°E, 0 = 02 04 35.9.
					Loyalty Islands. h about 66 km.
June 30	MIN	eP	04 32 00.3	c	Marianas aftershock.
June 30	MIN	eP'	07 04 18.8	c	USCGS: 2.6°S, 102.5°E, 0 = 06 45 38.7.
	CLS	eP'	19.8	d	S. Sumatra. h about 181 km.
	PRI	eP'	26.1	c	
June 30	BKS	e(P)	22 15 02.3	(d)	USCGS: 46.7°N, 153.6°E, 0 = 22 04 52.7.
	MIN	eP	14 54.5	c	Kurile Islands. h about 22 km.
	CLS	eP	15 15.0	c	
	PRI	e(P)	11.6	(c)	

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ARCATA--BERKELEY--CALISTOGA--CONCORD

FRESNO--LIANADA--MANZANITA LAKE

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POINT REYES--PRIEST--SAN FRANCISCO

SANTA CRUZ--SHASTA--VINEYARD

Earthquakes and the Registration of Earthquakes

From July 1, 1963 to September 30, 1963

By

Cinna Lomnitz

John R. Filson

and

Don J. Pershing

University of California

Berkeley

1966

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INTRODUCTION

Each quarterly issue of the Bulletin includes determinations of epicenters, origin times, magnitudes, and other information available at the time of writing, for earthquakes in northern California and adjoining areas. Recorded arrival times of seismic waves are tabulated only for the major earthquakes in the local area and for teleseisms.

Information items regarding the seismographic stations which comprise the Berkeley network are repeated in every issue. Information of a general nature, such as the Modified Mercalli Intensity Scale, will be found only in the first number of each volume.

PERSONNEL (March 1966)

Station Director	Bruce A. Bolt
Director Emeritus	Perry Byerly
Associate Research Seismologist	Cinna Lomnitz
Assistant Research Seismologist	Helen Freedman
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THE BYERLY SEISMOGRAPHIC STATION (BKS)

Standardized equipment began operating in a newly constructed tunnel east of the main campus on June 8, 1962. The closest buildings, part of the Lawrence Radiation Laboratory, are about 0.8 km away. The tunnel was cut into the upper part of the Claremont Formation. Of Miocene age, this formation consists of thin layers of cherty material alternating with shale.

A plan of the tunnel is shown in the diagram. Piers are constructed of reinforced concrete with no isolation from floor and walls. The temperature is stable. A ventilating and dehumidifying system is connected to all rooms.

The short-period world-wide standard instruments are operated with an approximate magnification of 25,000 at 1 sec and the long-period standard instruments with 3,000 at 30 sec.

On March 20, 1964, the Regents of the University of California named this station the "Byerly Seismographic Station" in recognition of the work of Professor Perry Byerly.

HISTORY OF THE UNIVERSITY OF CALIFORNIA STATIONS

"The Seismographic Stations at Mount Hamilton and Berkeley present several items of interest in the history of earthquake science, one of which is that according to the available records they were the first seismographic stations set up in America. Furthermore, they have functioned continuously from their founding to the present day, with improvements in instrumental equipment from time to time as the development of the science and opportunity have permitted.

"Several outstanding figures in the seismology of the 1880's were impressed with the importance of these stations, and Ewing, Milne, and Gray each took a personal interest in aiding one or both stations to obtain their own best and most modern types of instruments."

The quotation is from "History of the University of California Seismographic Stations and Related Activities" by Professor George D. Louderback, published in the Bulletin of the Seismological Society of America, Vol. 32, No. 3, pp. 205-229, 1942. In this paper may be found a detailed account of the development of the Berkeley stations from the installation of the instruments (the first earthquake known recorded at Mount Hamilton was on April 24, 1887) to 1942.

Since 1942, the number of seismographic stations associated with the University of California has increased from six to twenty in 1962. In 1950, Professor Perry Byerly was appointed Director by the Regents; he had been in charge of instruction and research since 1925. In 1960, the University entered into a contract with the Air Force Office of Scientific Research of the Research Projects Agency of the Department of Defense. Funds were made available under the Vela Uniform program to design and operate a telemetered network of eight new stations in central California and to construct a new seismic vault near the Berkeley campus.

STATIONS IN OPERATION: JULY - SEPTEMBER 1963

Station	North Latitude	West Longitude	Elev. Meters	Symbol	Present Auspices and Date Established
Berkeley (Haviland)	37° 52!4	122° 15!6	81	BRK, BRX	Univ. of California, 1887
Berkeley (Strawberry)	37° 52!6	122° 14!1	276	BKS	Univ. of California, 1962
Mt. Hamilton	37° 20!5	121° 38!5	1282	MHC	Lick Observatory, 1887
Palo Alto	37° 25!0	122° 10!9	83	PAC	Stanford University, 1927
San Francisco	37° 46!6	122° 27!1	100	SFB	Univ. of San Francisco, 1931
Fresno	36° 46!0	119° 47!8	88	FRE	Fresno City College, 1935
Mineral	40° 20!7	121° 36!3	1495	MIN	National Park Service, 1938
Arcata	40° 52!6	124° 04!5	59	ARC	Humboldt State College, 1948
Shasta	40° 41!7	122° 23!3	312	SHS	Bureau of Reclamation, 1942
Manzanita Lake	40° 32!2	121° 33!7	1800	MLC	National Park Service, 1956
Vineyard (local)	36° 45!0	121° 23!1	330	VIN	W. A. Taylor and Co., 1959
(telemeter)	36° 45!0	121° 23!3	380	VIT	
Concord	37° 58!1	122° 04!3	36	CNC	Diablo Valley College, 1960
Santa Cruz	37° 00!4	121° 59!8	128	SCC	City of Santa Cruz, 1961
Paraiso	36° 19!9	121° 22!2	363	PRS	Paraiso Hot Springs, 1961
Llanada	36° 37!0	120° 56!6	475	LLA	Charles McCullough Ranch, 1961
Calistoga	38° 38!2	122° 35!1	457	CLS	Terrance Kirk Ranch, 1961
Point Reyes	38° 04!8	122° 52!0	404	PRC	Federal Aviation Agency, 1961
Priest	36° 08!5	120° 39!9	1187	PRI	Federal Aviation Agency, 1961

STATION INSTRUMENTATION

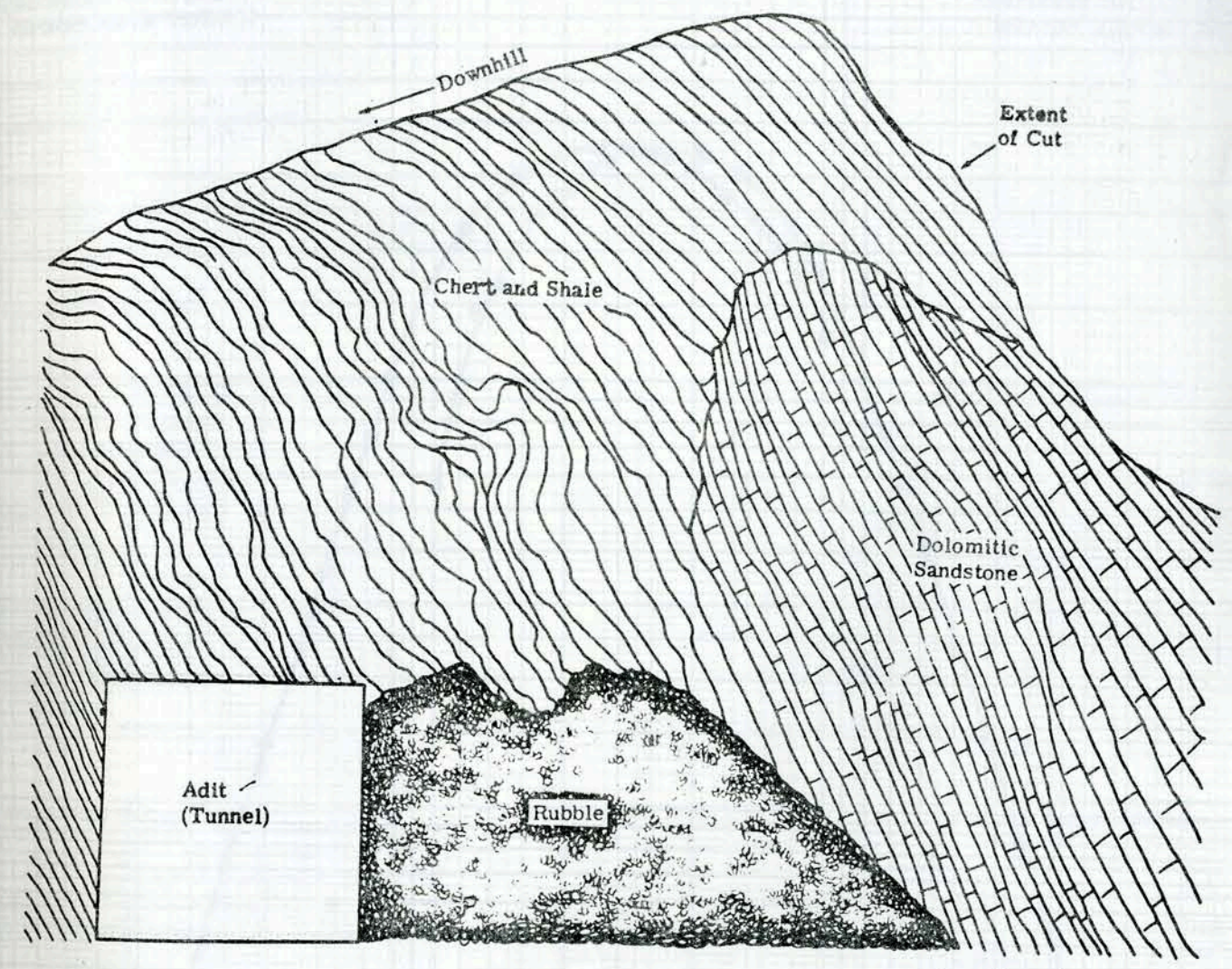
July - September 1963

Station	Type of Instrument	T _o sec	T _g sec	Component
BRK [△]	Benioff 100 kg (Z)	1.0	0.2	Z
BRK	Benioff 100 kg (Z)	1.0	8.0	Z
	100X torsion	0.8	-	N,W
BKS	Benioff 100 kg Sprengnether	1.0	0.75	N,E,Z
	Wood-Anderson torsion	30	100	N,E,Z
		0.8	-	S,W
BRX	Galitzin-Wilip moving coil	12	12	N,E,Z
	Press-Ewing moving coil	30	90	N,E,Z
MHC	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	S,E
PAC	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	N,E
SFB	Lehner-Griffith moving coil	1.2	0.3	Z
	Wood-Anderson torsion	0.8	-	S,W
FRE	Sprengnether moving coil	2.0	2.0	N,E,Z
MIN	Benioff 100 kg (Z)	1.0	0.4	Z
	Wood-Anderson torsion	0.8	-	S,E
ARC	Marion-Slichter moving coil	1.1	0.2	Z
	Wood-Anderson torsion	0.8	-	N,E
SHS	Benioff 50 kg moving coil	1.5	0.45	N,E,Z
MLC	Loucks-Omori	3½	-	S,E
VIN	Benioff 100 kg (Z)	1.0	0.2	Z
	Wood-Anderson torsion	0.8	-	S,W
VIT [△]	Benioff 14 kg (Z)	1.0	0.2	Z
CNC [△]	Benioff 100 kg (Z)	1.0	0.2	Z
SCC [△]	Benioff 14 kg (Z)	1.0	0.2	Z
PRS [△]	Benioff 14 kg (Z)	1.0	0.2	Z
LLA [△]	Benioff 14 kg (Z)	1.0	0.2	Z
CLS [△]	Benioff 14 kg (Z)	1.0	0.2	Z
PRC [△]	Benioff 14 kg (Z)	1.0	0.2	Z
PRI [△]	Benioff 14 kg (Z)	1.0	0.2	Z

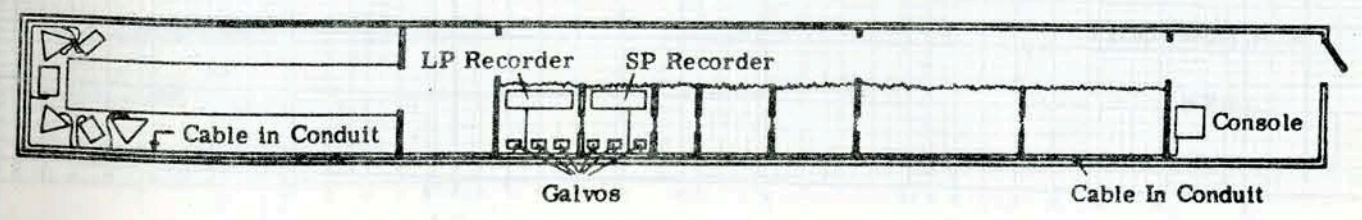
△ Signals from these eight stations are transmitted via leased telephone lines to recorders at Berkeley.

Direction of Motion: In the "Component" column, each horizontal component seismograph is designated by the direction of ground motion corresponding to upward trace motion on the seismogram when it is oriented so that time increases from left to right. On all vertical component (Z) instruments, upward trace motion corresponds to upward ground motion.

Relative magnification curves of instruments recording through the telemeter system are listed on the following pages. Absolute magnification may be obtained by use of calibration pulses recorded daily from each telemetered station.

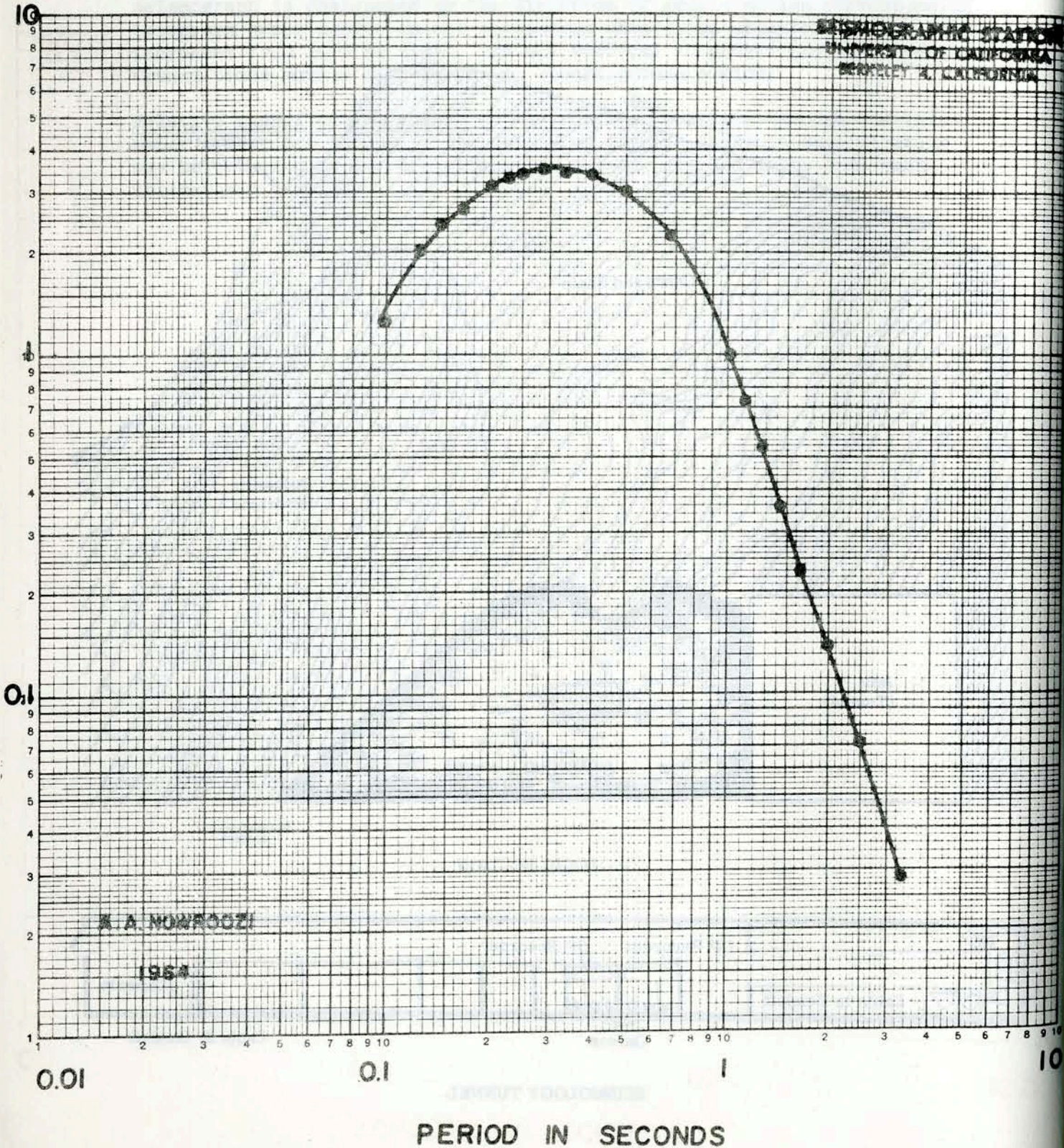


GEOLOGIC SECTION

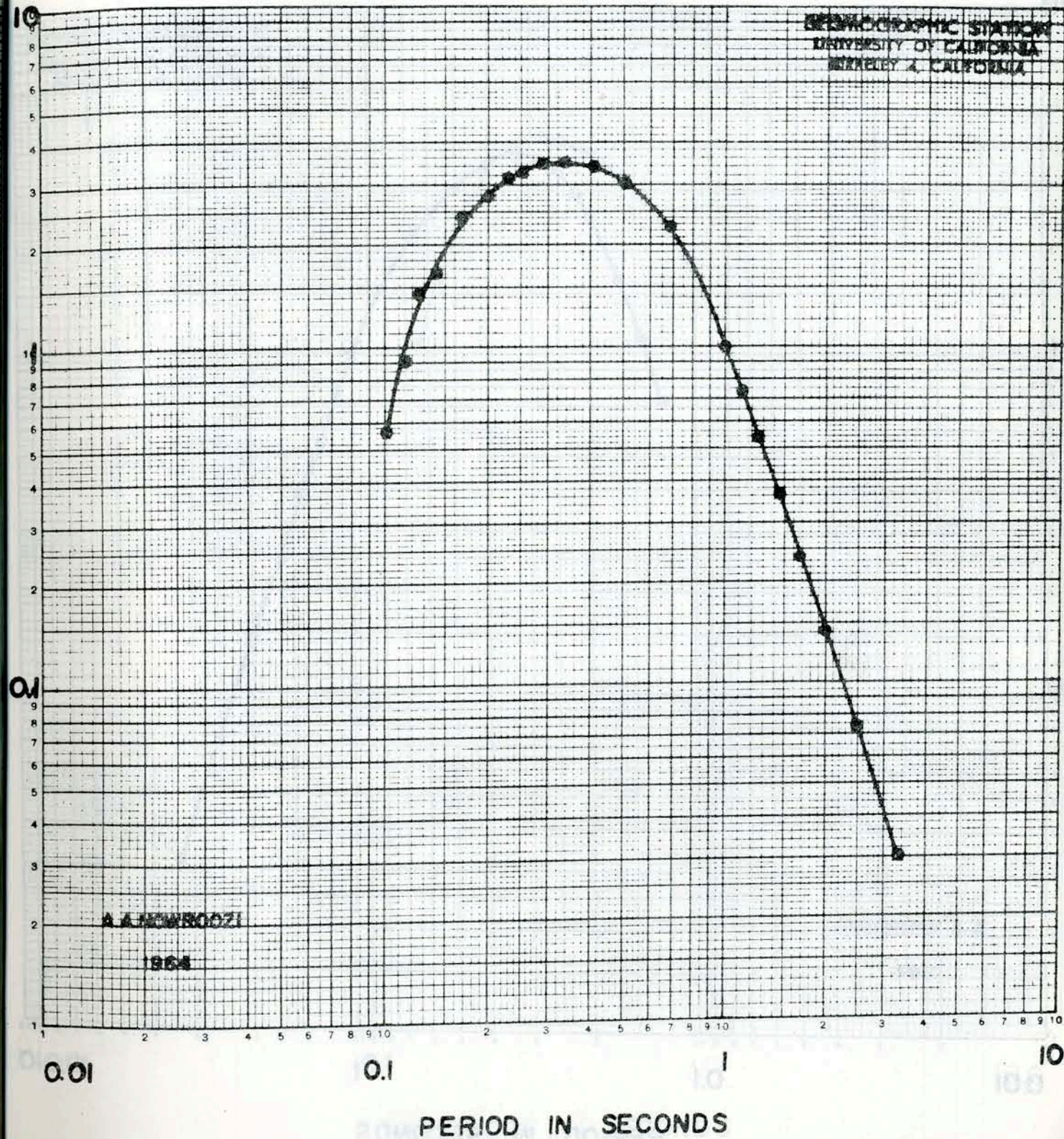


SEISMOLOGY TUNNEL

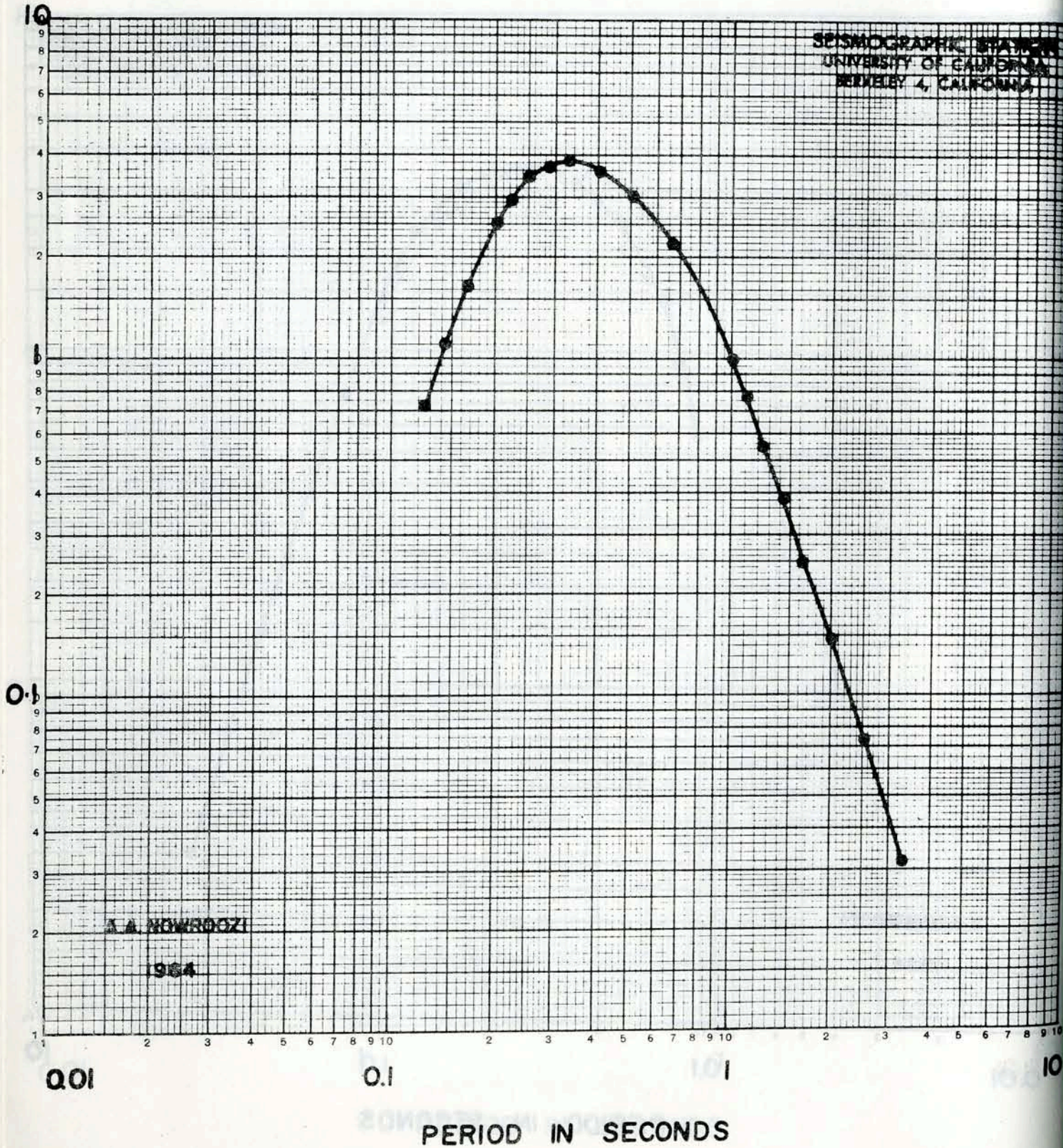
RESPONSE OF SEISMOMETER-DEVELORECORDER SYSTEM. 100KG. Z. S.P



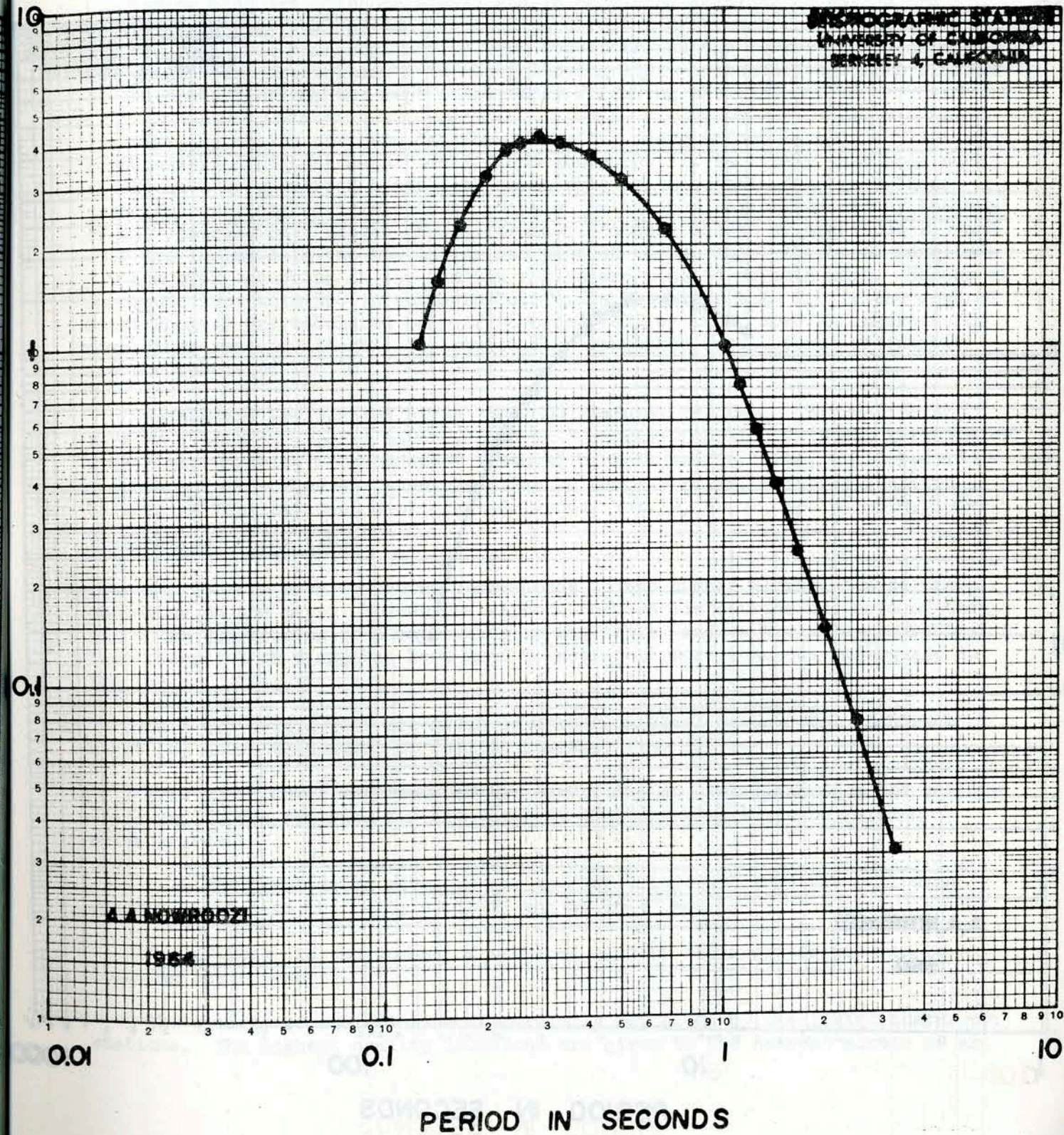
RESPONSE OF SEISMOMETER-HELICORDER SYSTEM. 100KG. Z. S.P



RESPONSE OF SEISMOMETER—HELICORDER SYSTEM. 14.7 KG. Z. S.P



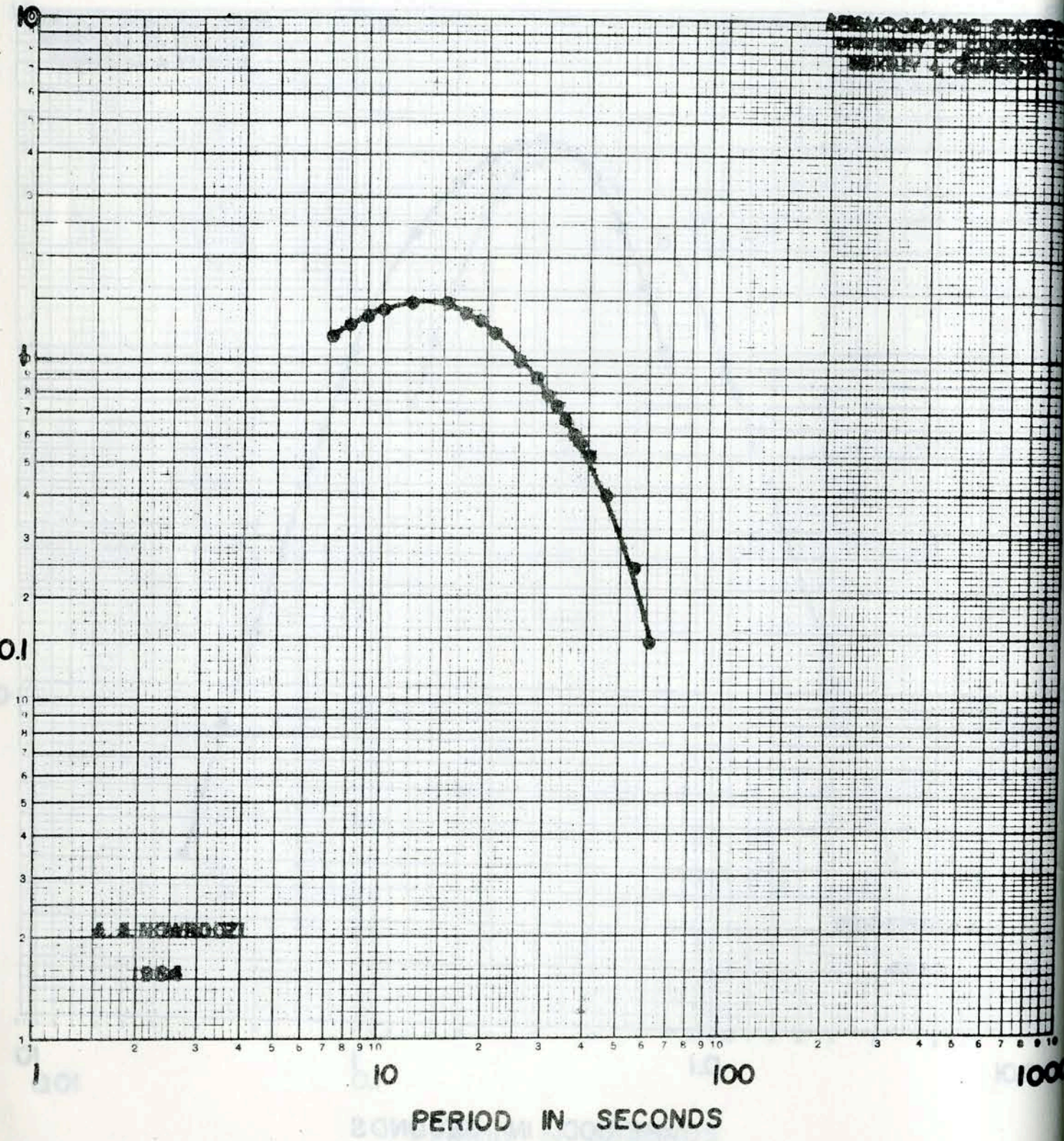
RESPONSE OF SEISMOMETER—DEVELOCORDER SYSTEM. 14.7 KG. Z. S.P



— 111 —
RESPONSE OF SEISMOMETER — HELICORDER

SYSTEM. PRESS-EWING.

Z. T.G=30 S., T.S=15 S.



PART I. LOCAL EARTHQUAKES IN NORTHERN CALIFORNIA, NEVADA, AND OREGON

This section includes information on earthquakes in northern California (including adjacent offshore areas) and in adjoining sections of Nevada and Oregon which were well enough recorded to permit a determination of the epicenter. Latitude and longitude of each epicenter and the corresponding date and origin time are tabulated in the following list; epicenters are also plotted on one or both of the two maps immediately following the list.

For the entire northern California region, every effort is made to list all earthquakes of Richter magnitude 3.0 and above, but it is likely that some such shocks have been omitted because the available seismographic data were inadequate for epicenter determination. Within the limited region covered by the map of the central Coast Ranges of California, locatable shocks of magnitude 2.5 and over are included in the tabulation and plotted on the map. Shocks of magnitude 3.0 and over occurring in the limited region are plotted on both maps. Shocks of magnitude less than 3.0 in northern California (and less than 2.5 in the central Coast Ranges) are tabulated only if reported felt or if of special interest for some other reason. Identified artificial earthquakes (explosions) ordinarily are not tabulated.

Epicenters are located by an IBM 7090 computer program. Information on Version I of this program may be found in "Computer Location of Local Earthquakes within the Berkeley Seismographic Network" by Bolt and Turcotte, published in *Computers in the Mineral Industries*, Part 2 (George Parks, Editor); Stanford University Publications, Geological Sciences, Vol. 9, No. 2, pp. 561-576, 1964.

Explanation of the table:

Map No. for each epicenter corresponds to the number plotted beside that epicenter on the maps. Epicenters without numbers lie outside the area of the map. The underlining of a map number in the table (and on the maps) indicates that one point on a map has been used to represent more than one earthquake in the table.

Date and Origin Time are given in Greenwich Civil Time (GCT). Subtract eight (8) hours to convert to Pacific Standard Time (PST).

M is the Richter magnitude of the earthquake as determined from the maximum trace amplitudes recorded for the shock by standard Wood-Anderson torsion seismographs.

h is the focal depth given to the nearest kilometer or by the following ranges: a, 0-5 km; b, 6-10; c, 11-15 km; d, 16-30 km.

No. of Stas. is the number of stations used by the computer program in locating the epicenter.

The quality of the solution is partially reflected by the listed number of stations. The highest quality locations are given to the nearest minute of arc

in latitude and longitude and to the tenth of a second origin time. Poorer quality locations are given to the nearest minute in latitude and longitude, to the nearest second in origin time, and are denoted by an asterisk.

Under Remarks will be found a short descriptive location of the epicenter, usually relative to a point named on the map. Information on small foreshocks and aftershocks is sometimes included under Remarks, but when numerous foreshocks or aftershocks accompany a large earthquake, a separate tabulation may be included following the main list of local shocks.

Information on maximum intensities of shocks reported felt is also included under Remarks. Reports on felt earthquakes may be obtained from the Seismological Field Survey of the U.S. Coast and Geodetic Survey, which publishes a more complete summary in "Abstracts of Earthquake Reports for the Pacific Coast and Western Mountain Region." This regular quarterly publication may be obtained from the District Officer, San Francisco District, Coast and Geodetic Survey, 121 Customhouse, San Francisco 26, California, or from the Director, U.S. Coast and Geodetic Survey, Washington Science Center, Rockville, Maryland 20852. Intensities given in Roman numerals are assigned by the Coast and Geodetic Survey and based on the Modified Mercalli Intensity Scale of 1931.

EARTHQUAKES IN NORTHERN CALIFORNIA, NEVADA, AND OREGON

Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	h	No. of Stas.	Remarks
-	July 2	4.1	12-34-34.0	42°9	126°2	d	2	Off coast of Oregon (determined by USCGS).
1	July 8	4.3	01-13-43.1	41° 17'	126° 17'	d	9	Off Cape Mendocino.
-	July 8	4.8	04-18-41.8	41° 44'	128° 04'	c	17	Off Cape Mendocino. USCGS: 40°8 N, 125°8 W, 0 = 04-19-08.4.
* 2	July 8	3.2	05-35-35.5	40° 07'9	121° 28'4	a	12	Near Belden. Felt at Caribou Power Station. USCGS: 40°2 N, 121°0 W, 0 = 21-35-31.
3	July 8	2.8	12-08-39.2	36° 35'6	121° 15'5	a	11	NW of Gonzales.
4	July 10	3.4	21-30-40.8	39° 58'5	120° 11'7	a	4	N of Vinton.
5	July 11	2.5	17-59-13	36° 43'	121° 03'	a	8	N of Llanada.
6	July 13	2.7	13-25-54.1	36° 56'8	121° 42'1	d	10	W of Watsonville.
7	July 15	2.7	20-29-47.0	39° 23'3	120° 01'9	c	4	Near Truckee.
8	July 16	2.8	18-00-25.9	36° 51'4	121° 35'7	b	10	Near San Juan Bautista. Foreshock of following event.
<u>8</u>	July 16	3.6	18-17-54.6	36° 51'9	121° 36'8	b	16	Felt at San Juan Bautista and Hollister. USCGS: 36° 53' N, 121° 32' W, 0 = 10-17-54.
9	July 17	2.8	07-43-54.3	36° 38'5	121° 36'6	a	6	SE of Salinas.
-	July 20	4.0	03-24-05.4	40° 39'6	126° 15'1	c	20	Off Cape Mendocino.
10	July 24	2.7	18-42-54.8	37° 16'9	121° 39'1	c	12	SW of Mt. Hamilton.
11	July 25	2.6	02-48-46.1	36° 42'6	121° 01'1	a	8	NW of Llanada.
12	July 26	3.2	11-29-15.4	36° 38'8	121° 19'1	a	14	NE of Gonzales.
13	July 31	2.7	05-08-46.0	36° 51'1	121° 23'0	b	12	Near Hollister. Foreshock of following event.
<u>13</u>	July 31	3.9	06-45-53.4	36° 50'6	121° 24'0	c	17	Felt at Hollister and Tres Pinos. USCGS: 36° 52' N, 121° 21' W, 0 = 06-45.
14	Aug. 2	4.2	22-17-17.0	40° 25'5	125° 44'1	b	13	Off Cape Mendocino.
15	Aug. 4	4.0	17-35-03.6	37° 36'5	122° 34'2	a	15	Off Point Montara. Felt over 1,500 square miles of San Francisco Bay area. V at Lagunitas. IV at Berkeley, Half Moon Bay, San Francisco, San Rafael. USCGS: 37° 36' N, 122° 35' W, 0 = 17-35.
-	Aug. 4	4.5	21-34-26	41° 43'	126° 53'	a	7	Off Cape Mendocino.
16	Aug. 10	2.3	13-23-34.4	37° 50'8	122° 17'6	a	9	Felt in Berkeley. Foreshock of following event.

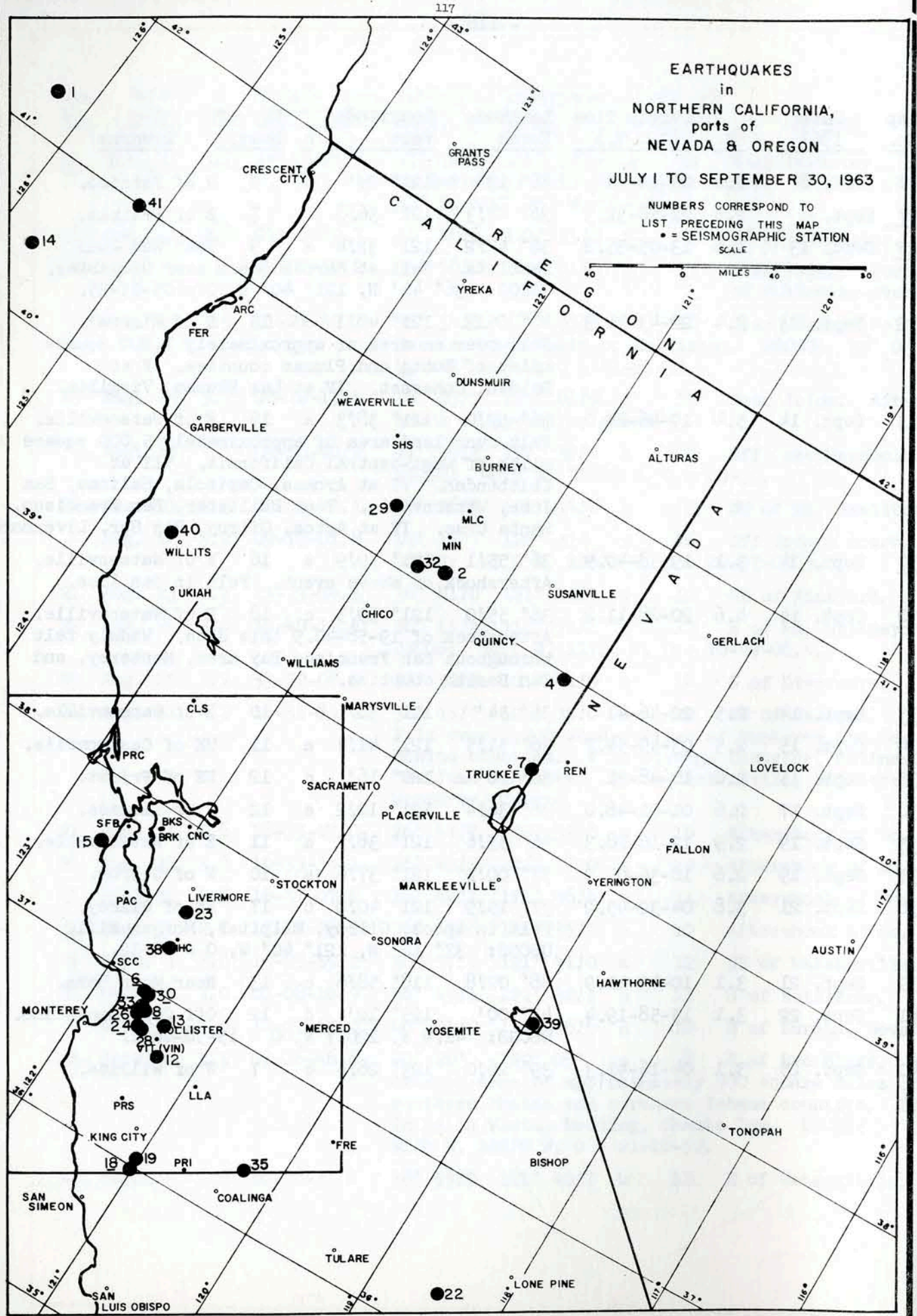
Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	h	No. of Stas.	Remarks
16	Aug. 10	2.7	14-32-24.9	37° 51'5	122° 16'8	a	10	Near Berkeley. Felt in Berkeley, Oakland, and Richmond. USCGS: 37° 52' N, 122° 15' W, 0 = 06-32.
17	Aug. 12	2.8	01-50-42.7	36° 48'6	121° 15'2	b	9	SE of Hollister.
18	Aug. 15	3.6	21-02-32.2	35° 58'0	121° 01'8	b	15	Near Jolon. Foreshock of following event.
18	Aug. 15	3.9	21-21-32.1	35° 54'6	121° 03'8	b	18	Near Jolon. Felt at Harris Ranch south of Hollister. USCGS: 36° 03' N, 121° 00' W, 0 = 21-21-33.
19	Aug. 16	3.2	08-12-13.6	36° 03'7	121° 01'0	a	10	Near Jolon. Aftershock of preceding event.
-	Aug. 19	4.1	09-38-40'2	41° 38'3	127° 30'4	b	8	Off Cape Mendocino. USCGS: 40°9 N, 126°0 W, 0 = 09-39.
20	Aug. 21	2.5	20-01-42.1	37° 26'7	121° 44'0	b	9	NW of Mt. Hamilton.
-	Aug. 22	5.0	09-27-01.8	42° 15'	126° 33'	a	16	Off Oregon coast. USCGS: 42°0 N, 126°2 W, 0 = 09-27-09.3.
21	Aug. 23	2.7	13-23-54.5	36° 41'8	121° 12'4	b	10	SE of Vineyard.
22	Aug. 24	3.8	10-49-16.5	36° 15'4	118° 31'1	a	12	S of Mt. Whitney. USCGS: 36°0 N, 117°6 W, 0 = 10-49-08.4.
23	Aug. 25	3.1	33-22-08.5	37° 30'7	121° 41'9	c	14	S of Livermore.
24	Aug. 31	4.2	16-31-14.2	36° 45'7	121° 35'0	a	19	NE of Salinas. Felt over 1,300 square miles of Monterey and San Benito counties. V in Cienega District, Salinas, San Juan Bautista. IV in Castroville, Hollister, Monterey, Coyote.
25	Aug. 31	2.6	16-35-17.0	36° 47'7	121° 33'0	a	10	Aftershock of No. 24.
26	Aug. 31	3.0	16-35-34.1	36° 46'9	121° 37'0	a	12	Aftershock of No. 24.
27	Aug. 31	2.7	16-37-07.6	36° 44'1	121° 36'4	a	11	Aftershock of No. 24.
24	Aug. 31	2.7	17-12-26.7	36° 45'8	121° 35'2	a	10	Aftershock of No. 24.
6	Sept. 1	3.0	15-05-59.2	36° 57'7	121° 41'0	a	12	NE of Watsonville.
28	Sept. 3	3.0	01-08-16.9	36° 45'1	121° 32'1	a	11	S of Hollister.
-	Sept. 3	3.8	10-27-19.0	40° 01'2	116° 06'6	d	10	N of Eureka, Nevada.
29	Sept. 4	3.3	05-16-46.8	40° 20'	122° 05'	a	8	E of Red Bluff. Felt over an area of approximately 900 square miles of southern Shasta and northern Tehama counties. IV in Bella Vista, Redding, Shasta Dam. USCGS: 40°4 N, 122°0 W, 0 = 21-16-52.
30	Sept. 4	3.0	10-26-31.4	36° 55'9	121° 40'7	b	11	E of Watsonville.

Map No.	Date 1963	M	Origin Time (G.C.T.)	Latitude North	Longitude West	h	No. of Stas.	Remarks
31	Sept. 6	2.6	03-54-34	36° 13'	121° 29'	a	8	W of Paraiso.
27	Sept. 6	2.5	22-58-32.3	36° 44'3	121° 36'8	a	7	E of Salinas.
25	Sept. 13	2.6	13-05-35.2	36° 47'2	121° 32'4	a	9	Near San Juan Bautista. Felt at Harris Ranch near Hollister. USCGS: 36° 41' N, 121° 40' W, 0 = 05-05-35.
32	Sept. 13	3.4	22-43-16.3	40° 05'3	121° 40'1	c	15	S of Mineral. Felt over an area of approximately 1,200 square miles of Butte and Plumas counties. V at Belden, Cohasset. IV at Las Plumas, Virgilia.
33	Sept. 14	5.4	19-46-17.0	36° 52'0	121° 38'3	a	19	E of Watsonville. Felt over land area of approximately 5,000 square miles of west-central California. VII at Chittenden. VI at Aromas, Capitola, Salinas, San Jose, Watsonville. V at Hollister, San Francisco, Santa Cruz. IV at Aptos, Gilroy, Big Sur, Livermore.
30	Sept. 14	3.1	19-58-40.9	36° 55'1	121° 39'9	a	16	E of Watsonville. Aftershock of above event. Felt in San Jose.
30	Sept. 14	4.6	20-28-11.2	36° 55'0	121° 39'3	c	18	E of Watsonville. Aftershock of 19-58-40.9 this date. Widely felt throughout San Francisco Bay area, Monterey, and San Benito counties.
33	Sept. 14	2.5	22-46-41	36° 54'	121° 38'	b	10	E of Watsonville.
34	Sept. 15	2.5	03-49-54.7	36° 51'5	121° 41'4	a	11	NE of Castroville.
35	Sept. 15	3.0	10-48-31	36° 20'	120° 16'	c	12	NE of Priest.
36	Sept. 17	2.6	01-01-48.0	36° 36'4	121° 10'2	a	12	W of Llanada.
33	Sept. 19	2.9	12-16-28.3	36° 53'6	121° 38'7	a	11	E of Watsonville.
37	Sept. 19	2.6	18-36-05.0	37° 00'2	121° 37'6	a	10	W of Gilroy.
38	Sept. 21	3.8	04-32-45.2	37° 15'9	121° 40'8	b	17	NE of Gilroy. Felt in Aptos, Gilroy, Milpitas, Morgan Hill. USCGS: 37° 16' N, 121° 40' W, 0 = 04-32.
39	Sept. 21	3.1	10-49-11.9	38° 02'8	118° 58'6	c	13	Near Mono Lake.
41	Sept. 22	3.1	15-58-19.4	41° 00'	125° 12'	d	12	Off Cape Mendocino. USCGS: 41°9 N, 126°7 W, 0 = 15-58-06.1.
*40	Sept. 25	3.1	04-16-41.3	39° 26'0	123° 28'4	b	7	W of Willits.

EARTHQUAKES in NORTHERN CALIFORNIA, parts of NEVADA & OREGON

JULY 1 TO SEPTEMBER 30, 1963

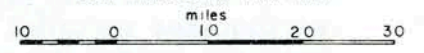
NUMBERS CORRESPOND TO
LIST PRECEDING THIS MAP
• = SEISMOGRAPHIC STATION
SCALE



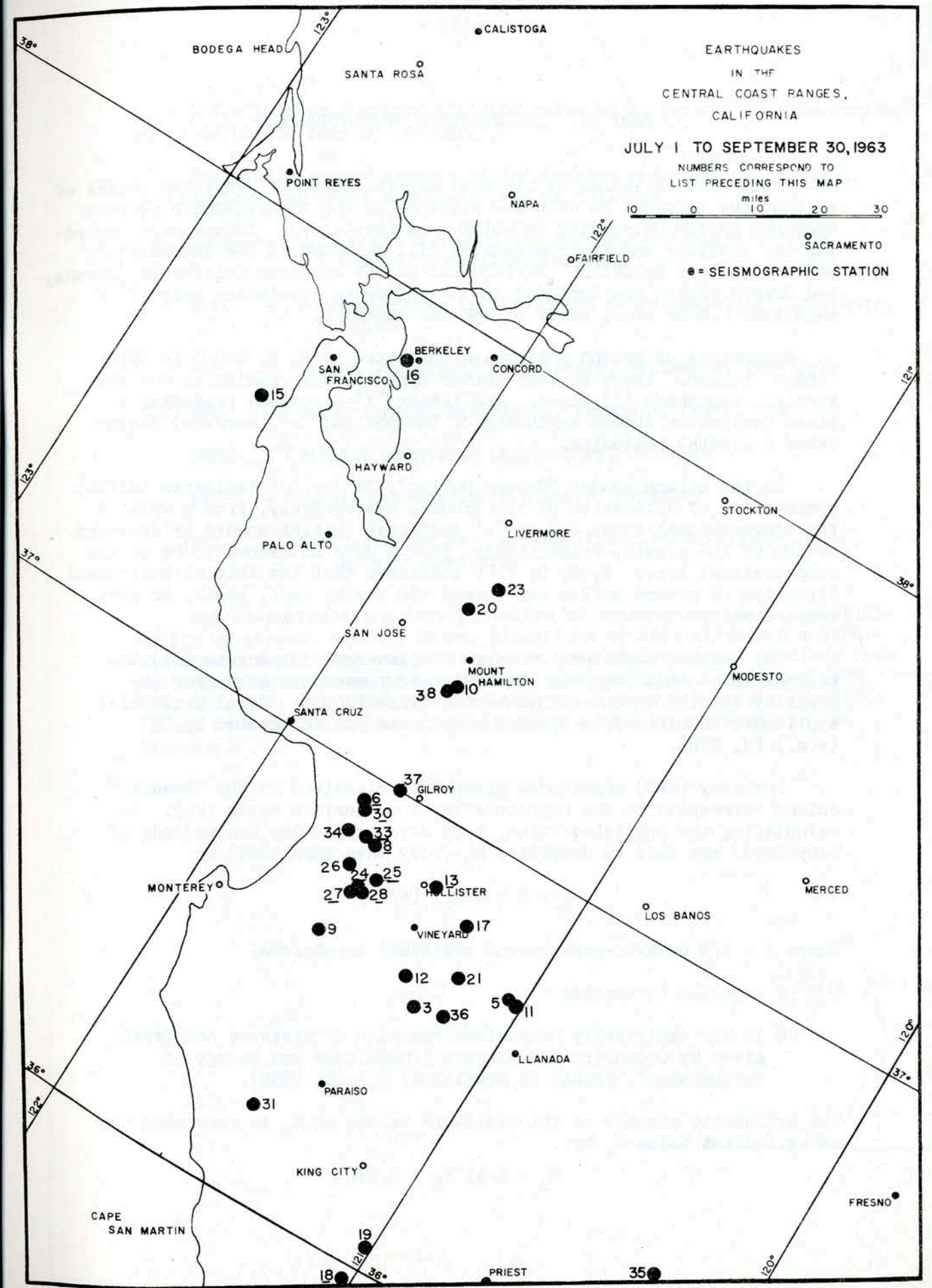
EARTHQUAKES IN THE CENTRAL COAST RANGES, CALIFORNIA

JULY 1 TO SEPTEMBER 30, 1963

NUMBERS CORRESPOND TO
LIST PRECEDING THIS MAP



• = SEISMOGRAPHIC STATION



PART II. REGISTRATION OF EARTHQUAKES

This section tabulates measured arrival times of prominent phases of earthquakes recorded at selected stations of the seismographic network operated by the University of California (Berkeley). Information regarding the stations and instrumentation will be found in the introductory section of this Bulletin. Earthquakes in the northern California, Nevada, and Oregon region are included in the following tabulation only if of magnitude 4.0 or over, or if of special interest.

Components of ground motion are indicated by N, E, and Z in the "Phase" column. Where no such letter appears, the reading is for the vertical component (Z) alone. The letter "i" (impetus) preceding a phase designates sudden beginning of the motion; "e" (emersio) designates a gradual beginning.

In the column headed "Ground Motion", "c" or "d" indicates initial compression or dilatation of the ground, respectively, from a wave of the compressional type; "+" or "-" indicates initial upward or downward motion of the ground, respectively, from a wave not known to be of the compressional type. N, E, S, or W indicates that the initial horizontal direction of ground motion was toward the north, east, south, or west, respectively.

The maximum amplitude of earth displacement in microns (μ) and periods in seconds (sec) in the indicated phases are given for the Berkeley station in the column headed "Time (GCT)". Total horizontal amplitudes combined from N and E components are designated by "H" (e.g., PH, PPH).

Berkeley (BKS) magnitudes given for teleseisms in the "Remarks" column correspond to the magnitude based on surface waves (M_s). In calculating the published value, body wave amplitudes and periods of body waves are used to determine M_B (body wave magnitude) by:

$$M_B = Q + \log_{10} (A/T),$$

where $A = 1/2$ peak-to-peak ground amplitude in microns,

$T =$ period in seconds

Q is the empirically determined function of distance and depth given by Gutenberg and Richter ("Magnitude and Energy of Earthquakes", *Annali di Geofisica*, 9:1-15, 1956).

The arithmetic average of the available values of M_B is converted to an equivalent value M_s by:

$$M_s = 1.59 M_B - 3.97.$$

This value is then compared with the value of M_s determined from surface waves of period near 20 seconds.

Frequently quoted sources of information regarding epicenters, origin times, or shock magnitudes are as follows:

- USCGS - U.S. Coast and Geodetic Survey, Washington Science Center, Rockville, Maryland
- BCIS - Bureau Central International de Seismologie, Strasbourg, France
- PAL - Lamont Geological Observatory, Palisades, New York
- PAS - Seismological Laboratory, Pasadena, California
- WMSO - Wichita Mountains Observatory, Oklahoma
- BKS - Byerly Seismographic Station, Berkeley
- BRK - indicates the average magnitude determined by the Berkeley network.

All measurement and interpretation of seismograms (i.e., identification of phases, arrival times, directions of initial ground motion, and ground amplitudes and periods) are done at Berkeley. Readings from the remaining stations in the network other than the six listed (BRK, CLS, MHC, MIN, PRI, REN) are available on request. Requests for additional data or for copies of seismograms should be addressed to the Director.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 1	MIN	eP	09 31 53.9	c	USCGS: 29.9°N, 141.3°E, 0 = 09 20 12.5. South of Honshu, Japan. h about 75 km.
July 1	MIN	eP	21 23 53.5	c	USCGS: 37.0°N, 96.1°E, 0 = 21 10 28.5. Tsinghai Prov., China. h about 33 km.
July 1	MIN	eP	22 50 02.9	d	USCGS: 46.5°N, 153.6°E, 0 = 22 39 57.8. Kurile Islands. h about 69 km.
July 2	MIN	eP	03 02 46.5	c	USCGS: 2.4°S, 77.8°W, 0 = 02 52 53.0. Ecuador. h about 33 km.
July 2	MIN	eP	06 11 33.1	c	USCGS: 51.5°N, 159.1°E, 0 = 06 02 13.7. Off Kamchatka. h about 33 km.
July 2	MIN	eP	08 06 13.6	d	USCGS: 39.8°N, 104.7°W, 0 = 08 02 54.1. Colorado. h about 15 km. Felt: Denver and Boulder.
July 2	MIN	eP	12 01 31.7	c	
July 2	MIN	eP	12 35 34.4	c	USCGS: 42.9°N, 126.2°W, 0 = 12 34 34.0. Off coast of Oregon. h about 33 km.
July 2	MIN	iP	22 08 00.7	c	USCGS: 10.9°N, 85.5°W, 0 = 22 00 19. Off Nicaragua. h about 130 km.
July 3	MIN	eP	12 10 27.0	c	
July 4	BKS	iP	11 10 20.0	d	USCGS: 26.3°S, 177.7°W, 0 = 10 58 13.2. Tonga Islands. h about 250 km. Magnitude 6.8 (BKS).
		ipP	11 18.0		
		ePPNEZ	13 32		
		iSNE	20 26		
		eNEZ	21 16		
		eNE	25 42		
		eNE	31 52		
			mu sec.		
		PZ	10.5 10		
		PPZ	10.3 8		
		SH	11.8 20		
	MIN	iP	11 10 23.4	d	
		eZ	11 08.4		
	CLS	iP	10 20.9	d	
	PRI	iP	19.2	d	
July 4	MIN	eZ	11 36 41.1		
	MIN	eP	14 29 03.7	c	USCGS: 22.9°S, 175.6°W, 0 = 14 16 51.1. Tonga Islands. h about 33 km.
July 5	BKS	iP	05 58 48.1		USCGS: 11.6°S, 77.5°W, 0 = 05 48 13.4. Peru. h about 55 km.
	MIN	iP	56.5	c	
	CLS	eP	52.5	c	Minor damage at Lima.
	PRI	eP	34.6	c	
July 5	MIN	eP	08 46 47.0	c	USCGS: 31.7°N, 142.4°E, 0 = 08 35 10.9. South of Honshu, Japan. h about 30 km.
July 6	MIN	iZ	08 43 59.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
			h. m. s.		
July 7	BKS	iP	10 29 25.5	c	USCGS: 17.9°N, 145.6°E, 0 = 10 17 24.4. Mariana Islands. h about 137 km.
	MHC	eP	28.4	d	
	MIN	iP	23.3	d	
	CLS	eP	22.5	d	
	PRI	eP	34.4	d	
July 7	BKS	eP	19 22 42.3	d	USCGS: 39.6°N, 111.9°W, 0 = 19 20 42.3. Central Utah. h about 33 km. Felt: Nephi area. Magnitude 5.6 (BKS)
		e(S)NZ	24 58		
		e(R)Z	25 28.5		
	MHC	eP	22 39.6	c	
	MIN	eP	31.5	c	
	CLS	eP	43.3	(d)	
	PRI	eP	37.5	c	
July 8	BKS	iP	01 14 51.7	c	Foreshock of following earthquake, 0 = 01 13 43.1. Magnitude 4.3 (BKS)
		eSNE	15 34.0		
	MHC	eP	15 01.3	c	
		eSZ	57.7		
	MIN	iP	14 38.1	c	
	CLS	eP	40.9	c	
July 8	BKS	eP	04 20 08.2	c	BKS: 41°44'N, 128°04'W, 0 = 04 18 41.8. Off Cape Mendocino, Calif. h about 12 km. Magnitude 4.8 (BKS).
		e(S)NEZ	54.5		
	MHC	eP	18.9	c	
	MIN	iP	19 56.8	c	
	CLS	eP	57.5	d	
	PRI	eP	20 37.9	d	
July 8	MIN	eP	11 51 29.5	c	USCGS: 19.9°S, 178.7°W, 0 = 11 40 17.1. Fiji Islands. h about 582 km.
July 8	MIN	eP	14 18 25		USCGS: 57.4°N, 154.0°W, 0 = 14 12 30.5. Kodiak Island, Alaska. h about 30 km.
July 8	BKS	eP	17 56 08.5	d	USCGS: 65.8°N, 153.9°W, 0 = 17 49 30.9. Central Alaska. h about 33 km.
		e(S)NE	18 01 32		
		e(G)E	03.9		
		e(R)Z	05.2		
	MIN	iP	17 55 51.6	c	
	CLS	eP	01.2	c	
	PRI	eP	22.9	d	
July 9	BKS	eZ	03 30.1		USCGS: 46.3°N, 153.7°E, 0 = 03 04 37.4. Kurile Islands. h about 33 km.
July 9	MIN	eP	04 21 24.8	c	USCGS: 22.0°N, 145.7°E, 0 = 04 09 28.6. Volcano Islands. h about 33 km.
July 9	MIN	eP	04 27 48		USCGS: 15.2°N, 94.0°W, 0 = 04 20 50.6. Mexico-Guatemala border. h about 33 km.
July 9	MIN	eP	04 32 22.1		
July 9	BKS	e(P)	09 32 56.0	d	USCGS: 8.5°N, 83.0°W, 0 = 09 24 33.3. Costa Rica-Panama border. h about 31 km. Magnitude 6.2 (BKS)
		iZ	33 04.4	d	
		e(PP)	34 32	d	
		eSNE	39 48	NE	
		eScSN	42 44	s	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 9 (Cont.)	MHC	e(G)NE eP	45.5 32 51.0	d	
	MIN	eP	00.6	d	
	CLS	eP	53.3	e	
	PRI	eP	40.7	c	
July 9	MIN	iP	20 27 54.9	d	USCGS: 40.1°N, 111.3°W, 0 = 20 25 28.8. Central Utah, h about 33 km.
		eZ	29 22.2		
July 10	BKS	eZEN	03 31.1		USCGS: 46.3°N, 153.4°E, 0 = 03 14 41.8. Kurile Islands. h about 33 km.
July 10	MIN	eP	04 42 24.6	c	USCGS: 29.7°S, 177.2°W, 0 = 04 29 25.1. Kermadec Islands. h about 33 km.
July 10	BKS	iP	05 33 08	c	USCGS: 46.3°N, 152.9°E, 0 = 05 22 57.1. Kurile Islands. h about 33 km.
		iPP	35 36		
		iSNEZ	41 15	SE(U)	Magnitude 6.4 (BKS)
		eScSN	42 44	S	
		e(SS)N	44.8		
		e(G)NE	47.9		
		e(R)Z	50.4		
	MIN	iP	33 00.3	c	
	CLS	eP	04.3	d	
	PRI	eP	33 21.4	c	
July 10	BKS	eZ	10 23.6		USCGS: 13.4°N, 44.9°W, 0 = 09 49 29.6. North Atlantic Ocean. h about 37 km.
	MIN	eP	10 00 47.3	d	
		iZ	00.5	d	
	CLS	eP	55.4	c	
	PRI	eP	45.2	c	
July 10	MIN	eP	14 04 23.7	d	USCGS: 46.1°N, 153.9°E, 0 = 13 54 22.6. Kurile Islands. h about 33 km.
July 10	MIN	iP	17 01 30.3	c	USCGS: 30.2°S, 177.8°W, 0 = 16 48 42.2. Kermadec Islands. h about 25 km.
July 10	BKS	iP	20 04 13.8	d	USCGS: 19.2°N, 145.4°E, 0 = 19 52 19.4. Mariana Islands. h about 171 km.
		iZ	26.8	d	
		eZ	28.3		
	MIN	iP	03 11.9	d	
		eP	17.1	d	
	CLS	eP	04 11.1	d	
		ePP	30.7		
	PRI	eP	04 23.3	d	
		ePP	36.4	c	
		eZ	07 19	d	
July 10	MIN	eP	20 28 28.2	c	USCGS: 53.0°N, 171.4°W, 0 = 20 21 44. Fox Islands. h about 33 km.
					Aleutian Islands.
July 12	MIN	eZ	06 53 07.2	d	USCGS: 7.0°N, 73.2°W, 0 = 06 43 51.5. Colombia. h about 127 km.
July 12	MIN	iP	06 54 45.8	c	USCGS: 50.1°N, 129.8°W, 0 = 06 54 43.6. Vancouver Island. h about 33 km.
		iZ	56 26.0		
		eZ	57 34.5		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 12	MIN	eP	08 06 07.3	c	USCGS: 17.9°S, 178.5°W, 0 = 07 55 02.3. Fiji Islands. h about 550 km.
July 12	MIN	eP	12 26 10.3	d	USCGS: 50.2°N, 129.7°W, 0 = 12 23 27.5. Vancouver Island. h about 33 km.
		iZ	13.6	d	
	CLS	eP	26 27	c	
	PRI	eP	27 06.0	c	
July 12	MIN	eP	12 55 22.1	d	USCGS: 50.4°N, 129.0°W, 0 = 12 52 41.4. Near Vancouver Island. h about 33 km.
July 12	BKS	eZE	14 09 24		USCGS: 50.3°N, 129.6°W, 0 = 14 03 38.3. Near coast of Vancouver Island. h about 33 km.
	MIN	eP	06 21.1	d	
		iZ	51.9		
		iZ	07 23.6		
	CLS	eP	07 37.4	c	
	PRI	eP	16.2	c	
July 12	BKS	eP	15 38 26	c	USCGS: 46.8°N, 153.6°E, 0 = 15 28 08.5. Kurile Islands. h about 33 km.
		eSNEZ	46 28	NE	
		eSSNEZ	50 30	Ec	
		e(G)NE	50.3	SW	
		e(R)EZ	55.7		
	MIN	eP	38 17.8	c	
	CLS	eP	11.2	c	
	PRI	eP	27	d	
July 13	BKS	eN	00 13.3		USCGS: 5.5°S, 153.3°E, 0 = 23 51 16.0. New Britain. h about 56 km.
July 13	MIN	eP	14 08 51.3	d	USCGS: 44.3°N, 148.8°E, 0 = 13 58 25.7. Kurile Islands. h about 33 km.
July 14	BKS	eP	00 14 57.5	c	USCGS: 30.5°S, 177.2°W, 0 = 00 02 22.9. Kermadec Islands. h about 33 km.
		iZ	15 09.5	d	
		iZ	17 24	c	
		iSNE	25 24		
		eE	27 16		
		e(G)NE	37.2		
		e(R)Z	41.3		
	MIN	eP	15 07.1	c	
	CLS	eP	14 58.4	c	
	PRI	eP	56.0	d	
July 14	BKS	eZ	04 37.5		USCGS: 30.5°S, 177.3°W, 0 = 03 59 12.4. Kermadec Islands. h about 56 km.
	CLS	eP	11 08.6	d	
	PRI	eP	07.6	c	
July 14	BKS	iP	05 51 49.2	d	USCGS: 10.4°N, 62.6°W, 0 = 05 41 43.0. Off coast of Northern Venezuela. Felt: Trinidad, W. Indies. Magnitude 5.9 (BKS)
		epP	52 05.7	c	
		eZ	53 05.9	c	
		ePcP	52 56	d	
		iPPEZ	54 07	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 14 (Cont.)		eSNE eEZ e(G)N e(R)EZ	59 36 06 00 04 06.5 11.1	c SG	
	MIN CLS PRI BKS	eP eP eP iP	05 51 46.8 51.1 36.7 14 40 57.1	d d d d	
July 14		e(S)NEZ e(G)NE eZ eRZ	51 28 15 03.2 06.8 09.0	NEd NW	USCGS: 30.2°S, 177.4°W, 0 = 14 28 22.1. Kermadec Islands. h about 42 km.
	MIN CLS PRI MIN	eP eP eP eP	14 41 06.9 40 54.0 40 53.2 06 35 47.8	d c c c	
July 14					USCGS: 51.8°N, 178.8°W, 0 = 06 28 21.7. Aleutian and Andreanof Islands. h about 33 km.
July 15	MIN CLS PRI	iP eP eP	08 50 02.8 07.8 30.2	d c d	USCGS: 55.6°N, 162.0°E, 0 = 08 41 07.5. Kamchatka. h about 60 km.
July 15	MIN	eZ	16 47 36.8	d	USCGS: 62.0°N, 134.4°W, 0 = 16 42 34.8. Yukon. h about 33 km.
July 16	MIN	eZ	01 45 05.5	d	
July 16	BKS MIN	eZ eP	08 08.0 11 23.9	d c	USCGS: 15.4°S, 173.3°W, 0 = 07 59 52.3. Samoa Islands. - h about 33 km.
July 16	MIN	eP	11 25 16.8	d	USCGS: 48.9°N, 130.7°W, 0 = 11 22 43. Vancouver Island. h about 33 km.
July 16	BRK MHC MIN PRI	eP iS eP iS iS eP	18 18 14.4 31.7 03.6 10.8 54.1 19 39.5 18 14.0	c d d d	BKS: 36°52'N, 121°37'W, 0 = 18 17 54.6. Near San Juan Bautista, Calif. h about 10 km. Magnitude 3.6 (BKS). Felt: San Juan Bautista, Hollister.
July 16	BKS	iS eP ePcP ePPN ePPPN e(S)NE ePSNE	32.2 18 40 52 41 20 44 48 47 02 51 36 53 48	d c d Nd Nd NG SW	USCGS: 43.1°N, 41.5°E, 0 = 18 27 18.4. Georgia, S.S.R., h about 33 km.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 16 (Cont.)		eSSN e(G)E e(R)N	58 56 19 08.0 13.8	Sd	
	MIN CLS PRI	eP eP eP	18 40 41.1 40 50.6 41 01.3	c d d	
July 16	BKS CLS PRI	eP eP eP	19 03 41.2 58 20.5	d c d	
July 16	BKS MIN CLS PRI	eZ eP eP eP	19 21 05 21 12.6 05.5 04.7	d c c c	USCGS: 30.6°S, 177.2°N, 0 = 19 08 24.2. Kermadec Islands. h about 41 km.
July 17	MIN	iP	01 11 31.4	c	
July 17	BKS	eZ	04 45.9	c	USCGS: 7.5°S, 107.2°E, 0 = 07 01 57.1. Java. h about 41 km.
July 17	MIN	iP	07 20 55.9	c	
July 17	MIN	eP	10 45 24.8	d	USCGS: 25.4°S, 111.6°W, 0 = 10 34 36.9. Easter Islands. h about 33 km.
July 17	BKS MIN	eZ eP	12 43.5 10 29.2	d c	USCGS: 43.1°N, 41.5°E, 0 = 11 57 06.7. Georgia. h about 33 km.
July 18	BKS	eP iZ	00 06 57.8 07 24.2	d d	USCGS: 49°N, 128.9°W, 0 = 00 04 05.3. Vancouver Island. h about 33 km.
		eS e(R)	09 20 10	d	
	MHC MIN	eP iP	00 07 07.0 06 31.0	d d	
	CLS PRI	eP eP	46.8 26.2	d d	
July 18	BKS	iP' iZ	05 17 10.5 23.8	c c	USCGS: 61.0°S, 22.3°W, 0 = 04 58 09.2. Sandwich Islands. h about 33 km.
		e(P)NEZ i(PKS)Z i(PPS)NEZ e(SS)NE e(SSS)NE e(G)NE e(R)	19 06 20 22 30 54 36 06 41 12 52.5 59.0	SWc c c	
	MHC MIN CLS PRI	eP' eP' eP' eP'	17 09.3 11.9 12.3 06.0	d d c d	
July 18	MIN	eP	05 36 45.4	c	USCGS: 18.5°S, 69.3°W, 0 = 05 25 04.3. Northern Chile. h about 72 km.
July 18	MHC MIN PRI	e(P) eP iS e(P) e(S)	06 34 52 34 52.3 36 14.6 34 40.6 35 32.8	d c c d	USCGS: 37.1°N, 115.5°W, 0 = 06 33 23.8. Southern Nevada. h about 25 km. Magnitude 3.9 (CGS).

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 18	MIN	eP	10 42 54.4	c	USCGS: 34.1°N, 116.1°W, 0 = 10 40 30.4. San Bernardino, Calif. h about 14 km.
July 18	MIN	eP	11 27 54.1	c	USCGS: 22.5°S, 67.0°W, 0 = 11 15 11.3. Jujuy Prov., Argentina. h about 258 km.
July 19	BKS	eP N i NE eZ ePP eN eSNE eSSNE e(G)NE e(R)	05 58 15 53 06 01 20 02 27 08 12 09 22 15.5 23.8 28.0	Sc SWc d d Sc NEc NEd	USCGS: 43.4°N, 8.2°E, 0 = 05 45 28.0. Ligurian Sea. h about 33 km.
	MHC	eP	05 58 15.3	c	
	MIN	iP	02.1	c	
	CLS	eP	11.8	c	
	PRI	eP	18.2	c	
July 19	MIN	eP	08 58 43.5	c	
July 19	BKS	eZ	09 33.7	c	USCGS: 36.3°N, 141.0°E, 0 = 09 00 44.8. Honshu, Japan. h about 70 km.
July 19	MIN	eP	12 04.4	c	
July 19	MIN	eP	11 53 39.9	c	USCGS: 52.0°N, 172.5°W, 0 = 11 46 39.1. Andreanof Islands. h about 50 km.
July 19	MIN	eP	12 25 01.4	c	
July 19	MIN	iP	18 59 35.5	c	USCGS: 18.8°N, 145.7°E, 0 = 18 48 35.7. Mariana Islands. h about 102 km.
July 20	BKS	eP e(S)NE e(R)N e(ScS)NE	00 17 18 22 30 25.3 28.0	c	
	MHC	eP	17 35.5	c	
	CLS	eP	22.0	d	
	PRI	eP	32.5	c	
July 20	MIN	iP i(S)	03 24 58.9 25 19.2	c	BKS: 40°40'N, 126°15'W, 0 = 03 24 05.4. West of Cape Mendocino, Calif. h about 20 km. Magnitude 4.0 (BKS)
	CLS	eP	24 58.2	c	
July 20	MIN	iP	05 38 51.5	c	USCGS: 14.4°N, 142.9°E, 0 = 05 26 19.1. Mariana Islands. h about 33 km.
July 20	BKS	eP' iPP i(PKS) i(SKS) eNE e(PS)NE e(PPS) eSSE e(G)NE e(R)NE	06 56 10 57 47 07 00 12 02 48 04 32 06 28 07 48 13 00 25 31.5	d c c c NE NEd c W	USCGS: 57.6°S, 148.5°E, 0 = 06 36 10.8. Macquarie Islands. h about 33 km.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 20	CLS	eP'	05 56 36.2	d	
(Cont.)	PRI	eP'	44.0	c	
July 20	MIN	eP	07 50 21.0	c	USCGS: 32.4°N, 145.5°E, 0 = 07 38 50.9. South of Honshu, Japan. h about 124 km.
July 20	MIN	iP	08 56 57.0	c	
July 20	MIN	eP	15 18 12.9	c	USCGS: 68.8°N, 4.6°W, 0 = 15 07 58.2. Jan Mayen Island. h about 49 km.
July 20	MIN	eP	19 14 32.9	c	USCGS: 37.1°N, 115.6°W, 0 = 19 13 05.9. Southern Nevada.
July 21	MIN	eP	06 58 27.6	c	USCGS: 17.8°N, 46.5°W, 0 = 06 47 32.2. North Atlantic Ocean. h about 33 km.
July 22	BKS	eP ePP eSKS eSN ePSE eSSN e(G)N e(R)E	00 42 20 46 16 52 54 53 24 54.9 59.3 01 06.5 11.0	c d Wc S	USCGS: 6.1°S, 148.9°E, 0 = 00 24 14.4. New Britain. h about 59 km.
	MIN	eZ	00 42 37.5	d	
	CLS	eP	42 24.9	c	
	PRI	eP	25.9	d	
July 23	BKS	eZ	06 29 14.6	c	USCGS: 41.5°N, 141.9°E, 0 = 06 17 51.5. Tsugaru Strait. h about 91 km.
	MHC	eP	28 56.8	d	
	MIN	eP	48.4	c	
	CLS	eP	51.3	c	
July 23	MIN	eZ	18 22 31.5	c	USCGS: 17.5°S, 167.2°W, 0 = 18 09 52.3. New Hebrides Islands. h about 33 km.
July 24	MIN	eP	05 33 12.8	c	USCGS: 20.6°S, 178.7°W, 0 = 05 22 54.3. Fiji Islands. h about 531 km.
July 24	MIN	eZ	09 01 39.5	c	USCGS: 32.4°N, 138.4°E, 0 = 08 50 20.7. South of Honshu, Japan. h about 297 km.
July 24	MIN	eZ	09 39 19.2	d	USCGS: 27.2°S, 177.2°W, 0 = 09 26 46.5. Kermadec Islands. h about 33 km.
July 24	MIN	eP	09 54 37.9	d	USCGS: 57.6°N, 150.5°W, 0 = 09 49 12.6. Kodiak Islands, Alaska. h about 33 km.
July 24	BKS	eP eZ e(SKS)NE e(S)E e(PS)NE e(SS)E e(SSS) e(G)NE e(R)E	11 45 32.0 42.2 56 06 42 57 48 12 02.5 06 44 11.6 15.6	c d SWc E SWd Wd c	USCGS: 24.6°N, 122.0°E, 0 = 11 32 17.7. Near East Coast of Formosa. h about 33 km.
	MHC	eP	11 45 35.3	c	
	MIN	iP	27.0	c	
	CLS	eP	29.0	c	
	PRI	eP	41.9	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 24	BKS	iP eZ e(S)NE e(PS)NE e(R)E	19 17 18.3 43.0 28 05 29 08 46.7	d c SW NWc	USCGS: 9.0°S, 158.2°E, 0 = 19 04 32.5. Solomon Islands, h about 33 km.
	MHC	eP	17 19.6	c	
	MIN	iP	23.2	c	
	CLS	eP	17.2	c	
	PRI	eP	21.3	c	
July 24	MIN	microseisms			USCGS: 9.7°S, 154.4°E, 0 = 21 47 54.1. Solomon Islands. h about 16 km.
July 25	BKS	eP iZ	07 13 34 38.2	c d	USCGS: 6.8°N, 73.0°W, 0 = 07 04 21.9. Northern Colombia. h about 152 km. Felt: Cúcuta, Bogotá, and Medellín.
	MHC	eP	29.5	c	
	MIN	iP	36.5	c	
	CLS	eP	37.5	c	
	PRI	eP	20.9	c	
July 26	BKS	iP iPP eSKSNE ePSNEZ eSSNE eSSSN e(G)NE e(R)	04 30 33.6 34 22 41 18 43 05 48 00 52.6 56.5 05 02.0	c c NE SWc Sd Sd	USCGS: 42.1°N, 21.5°E, 0 = 04 17 16.7. Southern Yugoslavia. 1200 killed, plus 3,000 injured in Skopje. h about 33 km.
	MHC	eP	04 30 33.2	c	
	MIN	eP	29 21.1	d	
	CLS	eP	31.0	c	
	PRI	eP	36.4	d	
July 26	BKS	eP e(S)NE e(G)NE e(R)	23 59 08 00 07 12 14.8 19.0	c NW NW	USCGS: 9.7°S, 78.5°W, 0 = 23 48 26.5. Near coast of Peru. h about 62 km.
	MHC	eP	23 58 50.6	d	
	CLS	eP	51.2	d	
	PRI	eP	31.3	d	
July 27	MIN	eP	06 10 57.8	c	USCGS: 43.5°N, 8.4°E, 0 = 06 58 23.4. Ligurian Sea. h about 33 km.
July 27	BKS	eP e(S)NE	06 28 50 30 20	SEc	USCGS: 43.9°N, 128.3°W, 0 = 06 27 03.0. Off coast of Oregon. h about 33 km.
	MHC	eP	29 08.6	c	
	MIN	eP	28 33.7	d	
	CLS	eP	28 40.5	d	
	PRI	eP	29 28.8	c	
July 27	BKS	eE	17 13.0		USCGS: 35.9°S, 102.7°W, 0 = 16 47 03.7. Easter Island. h about 33 km.
	MHC	eP	16 58 46.0	d	
	MIN	eP	59 18.3	c	
	CLS	eP	58 52.4	c	
	PRI	eP	36.3	c	
July 28	BKS	e(S)N eRN	07 35 24 53.0	S	USCGS: 29.8°S, 177.6°W, 0 = 07 12 17.1. Kermadec Islands. h about 33 km.
	MHC	eP	24 52.0	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 28	MIN	eP	25 00.9	c	
(Cont.)	CLS	eP	24 53.2	c	
	PRI	eP	50.7	c	
July 28	BKS	eP eZ eNE e(S)N e(S)E e(G)N e(R)	08 14 24.5 40.2 16 12 33 15 33 20 47.0 53.7	d d SW Sd W	USCGS: 11.3°S, 112.1°E, 0 = 07 55 21.9. Off coast of Java. h about 21 km.
	MHC	eP	14 25.9	d	
	MIN	eP	15 23.0	c	
	CLS	eP	22.8	d	
	PRI	eP	28.5	d	
July 28	MIN	iP	12 20 47.2	c	USCGS: 52.6°N, 158.9°E, 0 = 12 11 27.9. Kamchatka. h about 33 km.
July 28	BKS	e(NE)	13 55.0		
July 28	MIN	eZ	14 55 38.8	d	USCGS: 51.9°N, 174.2°W, 0 = 14 48 07.3. Andreanof Islands. h about 33 km.
July 28	BKS	eE	17 13.0		USCGS: 4.9°S, 152.7°E, 0 = 16 32 25.0. New Ireland. h about 69 km.
July 29	BKS	iP eZ e(S)NE e(G)NE e(R)	19 01 47.0 02 11.0 10 06 16.9 19.0	c d SW	USCGS: 46.6°N, 153.1°E, 0 = 18 51 36.7. Kurile Islands. h about 33 km.
	MHC	eP	01 51.2	d	
	MIN	eP	38.8	d	
	CLS	eP	42.4	c	
	PRI	eP	02 01.3	c	
July 29	MIN	eP	10 49 13.8	c	USCGS: 34.1°S, 70.4°W, 0 = 10 36 26. Central Chile. h about 33 km.
July 29	BKS	eP iZ ePP eSNE ePSNE e(G)NE e(R)	20 26 40.3 55.0 29 44 37 07 39 42 48.5 53.7	d d d SWd SWd	USCGS: 30.2°S, 177.3°W, 0 = 20 14 07.3. Kermadec Islands. h about 39 km.
	MHC	eZ	29 07	d	
	MIN	eP	26 50.0	c	
	CLS	eP	41.1	c	
	PRI	eP	38.8	c	
July 30	MIN	eP	03 10 16.2	c	USCGS: 30.0°S, 177.2°W, 0 = 02 57 31.6. Kermadec Islands. h about 40 km.
July 30	MIN	eP	04 40 12.1	c	USCGS: 30.2°S, 177.3°W, 0 = 04 27 25.0. Kermadec Islands. h about 17 km.
July 30	BKS	eP eZ ePP ePPP eSNE	05 58 25.5 40.9 06 01 42 03 20 08 52	d c c c SWc	USCGS: 29.6°S, 177.3°W, 0 = 05 45 53.3. Kermadec Islands. h about 33 km.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 30 (Cont.)		e(G)NE e(R)NE	20.5 24.5		
	MHC	eP	05 58 25.1	c	
	MIN	eP	35.4	c	
	CLS	eP	26.8	d	
	PRI	eP	24.7	c	
July 30	BKS	eP	06 36 27.2	c	USCGS: 34.0°N, 116.3°W, 0 = 06 34 55.9. San Bernardino County, Calif. h about 16 km. Magnitude 4.7 (CGS).
		eSN	38 08.0		
	MHC	eP	36 18.0	c	
	MIN	eP	50.7	c	
	CLS	eP	37.4	c	
	PRI	eP	00.3	c	
July 30	BKS	eP	07 01 56.7	c	USCGS: 51.7°N, 158.1°E, 0 = 06 52 22.7. Kamchatka. h about 33 km.
	MHC	eP	02 01.5	c	
	MIN	iP	01 47.0	c	
	CLS	eP	51.3	c	
	PRI	eP	02 10.9	c	
July 30	BKS	e(S)N	13 16 52	N	USCGS: 29.2°S, 112.1°W, 0 = 12 57 25.3. Easter Islands. h about 33 km.
		eNE	17 24	NEd	
		e(G)NE	25.0		
		e(R)N	29.4		
	MHC	eP	08 15.3	c	
	MIN	eZ	32.0	c	
	CLS	eP	25.7	c	
	PRI	eP	08.1	c	
July 30	BKS	iP	14 10 50.7	d	
		iZ	11 07.0	c	
		eZ	14 17.5	d	
	MHC	eP	10 49.4	c	
	MIN	eP	53.3	c	
	CLS	eP	52.1	c	
	PRI	eP	47.9	c	
July 30	BKS	eP	14 35 45.5	d	USCGS: 29.5°S, 127.1°W, 0 = 14 23 13.7. Kermadec Islands. h about 33 km.
		e(R)N	15 02.4		
	MHC	eP	14 35 45.5	d	
	MIN	iP	55.4	c	
	CLS	eP	46.7	d	
	PRI	eP	44.2	d	
July 30	BKS	eP	15 17 08.5	c	USCGS: 29.9°S, 177.4°W, 0 = 15 04 38.7. Kermadec Islands. h about 76 km.
		iZ	36.0	d	
		i(S)NE	27 28	SW	
		e(G)NE	39.0		
		e(R)N	43.7		
	MHC	eP	17 05.9	c	
	MIN	eP	16.2	c	
	CLS	eP	09.0	d	
	PRI	eP	05.7	c	
July 30	MIN	iP	17 43 49.0	d	USCGS: 59.3°N, 151.7°W, 0 = 17 38 10.2. Kenai Peninsula. h about 33 km.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
July 31	BKS	eP e(S)NE e(G)NE e(R)	01 56 46 02 07 18 19.0 22.4	d NW	USCGS: 29.8°S, 177.2°W, 0 = 01 44 18.8. Kermadec Islands. h about 65 km.
	MHC	eP	01 56 47.5	c	
	MIN	eZ	58.5	d	
	CLS	eP	45.3	c	
	PRI	eP	47.4	d	
July 31	BRK	iP	06 46 14.6	c	BKS: 36°50'N, 121°24'W, 0 = 06 45 53.4. Near Hollister, Calif. h about 12 km. Magnitude 3.9 (BKS). Felt at Hollister and Tres Pinos.
		eS	29.5		
	MHC	iP	03.6	c	
	MIN	eP	47.4	c	
	CLS	eP	25.7	d	
	PRI	iP	10.6	c	
July 31	MIN	eP	11 40 20.0	c	USCGS: 41.9°N, 142.4°E, 0 = 11 29 20.4. Near south coast of Hokkaido, Japan. h about 33 km.
July 31	MIN	iP	16 32 06.2	d	USCGS: 22.5°S, 176.8°W, 0 = 16 20 20.0. Tonga Islands. h about 267 km.
August 1	MIN	eP	10 54 00.3	c	USCGS: 55.3°N, 161.8°E, 0 = 10 45 02.7. Near east coast of Kamchatka. h about 50 km.
August 1	MIN	iP	12 53 56.7	c	
August 1	BKS	eNE	09 31.7	NEc	USCGS: 56.2°N, 34.1°W, 0 = 09 07 18.0. North Atlantic Ocean. h about 41 km.
	MHC	eP	07 17 14.5	d	
	MIN	eZ	09 16 57.1	d	
	CLS	eP	17 14.3	c	
	PRI	eP	18.4	d	
August 2	MIN	eZ	10 32 27.8	c	USCGS: 26.8°N, 141.3°E, 0 = 10 20 39.7. Mariana Islands. h about 109 km.
August 2	BKS	eP	22 18 44.3	c	BKS: 40°25'N, 125°44'W, 0 = 22 17 17.0. Off Cape Mendocino, California h about 10 km. Magnitude 4.2 (BKS)
		iS	55.5		
	MHC	eP	23.6	c	
	MIN	iP	06.0	c	
		iS	35.1		
	CLS	eP	03.7	c	
		iZ	26.3		
	PRI	eP	44.3	c	
August 3	BKS	eZ	01 32.5		USCGS: 8.8°S, 108.3°W, 0 = 01 09 56. Southwest of Galapagos Islands. h about 33 km.
	CLS	eP	18 27.0	c	
	PRI	eP	28.7	d	
August 3	BKS	iP	04 00 12.7	c	USCGS: 7.6°S, 156.8°E, 0 = 03 48 06.4. Solomon Islands. h about 402 km.
		iZ	01 46.5	d	
	MHC	eP	00 14.7	c	
	MIN	eP	51.6	c	
Aug. 3	BKS	eP	10 33 58.2	d	USCGS: 7.7°N, 35.8°W, 0 = 10 21 36.6. Mid-Atlantic Ocean. h about 33 km.
		iZ	34 41.5	d	
		iPP	37 07.5	d	
		iSE	44 18	Wd	
		iPSZ	45 18	SE	
		iSSNE	49 44		
		i(G)N	55.9		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 3 (Cont.)	MHC	i(R)E	11 00.2		
	MHC	eP	10 33 56.3	d	
	MIN	eP	53.9	d	
	CLS	eP	34 00.3	c	
	PRI	eP	33 56.3	d	
August 3	BKS	eP	16 37 09.0	d	USCGS: 52.0°N, 174.3°W, 0 = 16 24 35.8. Andreanof Islands. h about 33 km.
		eE	42.56	Ed	
		eNE	45.9	SW	
		eZ	47.3		
	MHC	eP	37 04.8	c	
	MIN	eZ	36 45.5	d	
	CLS	eP	51.4	d	
	PRI	eP	11.5	c	
August 3	BKS	iP	20 38 42.8	d	USCGS: 30.7°S, 178.3°W, 0 = 20 26 04.1. Kermadec Islands. h about 37 km.
		iZ	57.8	c	
		e(S)NE	49 10	NE	
		eE	51.6		
	MHC	eP	38 42.3	c	
	MIN	eZ	44		
	CLS	eP	43.6	c	
	PRI	eP	40.3	c	
August 4	MIN	eZ	07 27 30.4	d	
August 4	MIN	eP	09 26 17.1	c	USCGS: 22.6°S, 173.4°E, 0 = 09 13 17.8. Loyalty Islands. h about 72 km.
August 4	BKS	eP	12 17 14.5	d	USCGS: 4.1°S, 80.9°W, 0 = 12 07 24.4. Near north coast of Japan. h about 34 km.
		eZ	28.5	d	
		eSNE	25 06	NEc	
		eSS	29 24	c	
		e(G)N	31.5		
		eE	34.4		
	MHC	eP	16 54.2	d	
	MIN	eZ	17 13.1	d	
	CLS	eP	17 03	c	
	PRI	eP	16 44.7	c	
August 4	MIN	eP	13 13 17.0	c	USCGS: 12.6°N, 143.8°E, 0 = 13 00 44.7. Mariana Islands. h about 61 km.
August 4	BKS	iP	17 35 11.2	c	BKS: 37°36.5'N, 122°34.2'W, 0 = 17 35 03.6. Off Pt. Montara, Calif. h about 3 km. Magnitude 4.0 (BKS). Felt: Lagunitas, San Francisco, Berkeley.
		iSNE	15.2		
	MHC	eP	19.1	c	
	MIN	eP	49.3	c	
	CLS	eP	21.4	d	
	PRI	eP	40.7	c	
August 4	MIN	iP	21 35 43.3	d	BKS: 41°43'N, 126°53'W, 0 = 21 34 26. Off Cape Mendocino, Calif. h about 10 km. Magnitude 4.5 (BKS).
		iS	36 12.9		
August 4	BKS	iP	00 05 13.5	c	USCGS: 17.5°S, 179.1°W, 0 = 23 54 14.0. Fiji Islands. h about 515 km. (NOTE: Origin time on August 4; arrival times on August 5.)
		iZ	07 09.0	d	
		eZ	04.0	d	
		eNE	18 36	NE	
	MIN	eP	05 23.2	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 5	MIN	eZ	07 54 05.3	d	USCGS: 27.2°S, 178.0°W, 0 = 07 41 37.9. Kermadec Islands. h about 33 km.
August 5	MIN	eP	08 57 29.9	d	USCGS: 9.9°S, 79.0°W, 0 = 08 46 59.7. Near coast of Peru. h about 31 km.
August 5	BKS	e(SKKs)	16 07 16	N	
		e(SP)	09 24	c	
		e(SS)N	15 40	NW	
		e(PSPS)E	16 28	d	
		e(P'P')N	19 08	SW	
		e(G)NE	26.8		
		e(R)NE	32.5		
August 6	BKS	eP	13 46 30.8	c	USCGS: 57.0°N, 33.6°W, 0 = 13 36 35.6. North Atlantic Ocean. h about 33 km.
		iZ	40.0	d	
		ePP	48 38	d	
		ePPPN	49 55	c	
		eSNE	54 40	NEc	
		e(G)N	14 01.6		
		e(R)E	03.8		
		eNE	09.4		
	MHC	eP	13 46 31.7	c	
	MIN	eP	13.5	c	
	CLS	eP	31.6	d	
	PRI	eP	39.4	c	
August 7	BKS	eSE	04 49 12		USCGS: 21.8°S, 173.5°E, 0 = 04 26 23.4. Loyalty Islands. h about 106 km.
		e(G)NE	05 01.0		
		e(R)NE	04.5		
	MHC	eP	04 38 54.3	d	
	CLS	eP	04 38 54.8	d	
	PRI	eP	57.7	c	
August 7	MHC	eP	04 44 12.2	c	USCGS: 54.0°N, 142.1°E, 0 = 04 33 42.7. Sakhalin Islands. h about 33 km.
	MIN	eZ	43 59.3	c	
	CLS	eP	06.2	c	
	PRI	eP	25.7	d	
August 7	BKS	e(G)N	07 51.5		USCGS: 7.5°N, 37.2°W, 0 = 07 17 25.8. Atlantic Ocean. h about 33 km.
		e(R)E	56.3		
	MHC	eP	29 43.0	d	
	CLS	eP	55.0	d	
	PRI	eP	38.9	d	
August 7	BKS	eP	11 26 07.0	d	USCGS: 20.0°S, 178.3°W, 0 = 11 15 07.6. Fiji Islands. h about 33 km.
	MHC	eP	26 08.2	c	
	MIN	eP	15.3	c	
	CLS	eP	08.5	c	
	PRI	eP	07.0	c	
August 7	BKS	eP	18 43 49	c	USCGS: 13.6°N, 90.9°W, 0 = 18 36 46.6. Near south coast of Guatemala. h about 67 km.
		eSN	49 36		
		eNE	49 30		
		e(G)NE	53.3		
		e(R)	55.0		
	MHC	eP	43 46.5	c	
	CLS	eP	46.6	d	
	PRI	eP	35.0	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks	
1963			h. m. s.			
August 8	BKS	iP	02 23 39.0	d	USCGS: 54.2°N, 168.1°E, 0 = 02 14 54.4. Commander Islands. h about 33 km. Magnitude 5 (BKS)	
		iZ	24 07.0	d		
		ePPE	25 28	c		
		eSNE	30 44	NEc		
		eScSE	33 18	Wc		
		eSSNE	34.5			
		e(G)N	35.5			
		e(R)NE	37.7			
		MHC	eP	23 44.5		d
		MIN	iP	55.5		d
August 8	BKS	CLS	eP	33.5	d	
		PRI	eP	55.0	c	
		eP	11 10 05.0	d	USCGS: 35.9°S, 103.6°W, 0 = 10 58 23.1. Easter Islands. h about 33 km.	
		eZ	24.5	d		
		MHC	eP	10 02.3		c
MIN	eP	19.1				
CLS	eP	04.2	c			
August 8	BKS	PRI	eP	54.1	d	
		eP	11 29 12.0	c	USCGS: 5.8°S, 151.0°E, 0 = 11 16 11.2. New Britain. h about 48 km. Felt: Palmalmol, Pomino.	
		eZ	19.0	c		
		ePPE	32 48	Ec		
		ePKIKP	34 14	c		
		eSNE	40 00	NW		
		eE	41 18	Wd		
		eSSE	45 26	E		
		eSSSNE	50.0	NEc		
		e(G)N	53.1			
		e(R)E	57.2			
		MHC	eP	29 14.2		c
		MIN	eP	20.7		c
August 8	BKS	CLS	eP	10.8		c
		PRI	eP	18.1	c	
		iP	14 05 12.5	d	USCGS: 18.3°N, 145.3°E, 0 = 13 53 42.2. Mariana Islands. h about 423 km.	
		MHC	eP	05 15.2		c
		MIN	eP	11.1		d
CLS	eP	09.7	d			
PRI	eP	20.7	d			
August 9	MIN	eP	06 18 09.4	c	USCGS: 44.5°N, 11.9°E, 0 = 05 05 32.2. Northern Italy. h about 33 km.	
August 9	BKS	eP	14 48 14.1	d	USCGS: 15.3°S, 175.7°W, 0 = 14 36 45.9. Fiji Islands. h about 33 km.	
		eZ	27.1	c		
		iZ	39.5	c		
		eSNE	57 42	NEd		
		e(G)N	15 06.4			
		e(R)	09.9			
		MHC	eP	14 48 14.6		d
		MIN	eP	23.9		d
		CLS	eP	15.1		d
		PRI	eP	14.7		d

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks	
1963			h. m. s.			
August 10	BKS	iP	13 29 49.4	d	USCGS: 24.7°N, 142.7°E, 0 = 13 17 47.1. Volcano Islands. h about 33 km.	
		MHC	eP	29 52.3		d
		MIN	eP	45.8		d
		CLS	eP	46.0		d
		PRI	eP	59.5		d
August 10	BKS	eP	16 17 00.5	d	USCGS: 15.0°S, 179.0°W, 0 = 16 05 59.7. Fiji Islands.	
		MHC	eP	01.5		d
		CLS	eP	01.6		c
		PRI	eP	01.9		d
August 10	BKS	eN	18 31 08	N	USCGS: 54.4°S, 132.8°E, 0 = 18 07 26.2. South Pacific Ocean. h about 33 km.	
		e(G)E	46.4			
		e(R)N	49.8			
August 10	BKS	MHC	eP	20 33.5	c	
		CLS	eP	37	d	
		PRI	eP	26.7	c	
		eP	18 46 02.3	c	USCGS: 8.8°N, 82.9°W, 0 = 18 37 45.3. Panama-Costa Rica border. h about 33 km.	
		MHC	eP	46 01.5		d
CLS	eP	09.8	d			
PRI	eP	48.4	c			
August 11	BKS	eP	02 03 20.2	c		
		eZ	40.0	d		
		e(S)NE	10 52	NW		
		eNE	14 16	NW		
		e(G)NE	22.0			
		e(R)NE	28.5			
		eP	07 48 41.7	c	USCGS: 38.8°N, 140.9°E, 0 = 07 37 20.4. Near coast of Northern Honshu, Japan. h about 45 km.	
		MHC	eP	48 46.0		c
		MIN	eP	35.1		c
		CLS	eP	37.8		c
PRI	eP	54.3	c			
eZ	10 00 12.2	d				
eP	10 15 49.0	c				
eP	50.8	c				
eP	41.4	d				
August 12	BKS	eSNE	13 22 00	NWd		
		e(G)NE	27.3			
		e(R)NE	29.3			
		MHC	eP	14 56.9	c	
		CLS	eP	51.3	c	
August 12	BKS	PRI	eP	56.5	c	
		eZ	19 30.0			
		eZ	21 34.7			
August 12	BKS	eP	03 32 42	c	USCGS: 55.0°N, 156.4°W, 0 = 03 26 45.4. Kodiak Islands. h about 33 km.	
		eP	37 36	SWd		
August 13	BKS	e(S)NE	37 36			
		e(G)NE	38.8			
		e(R)NE	39.6			
		MHC	eP	32 50.5	d	
		MIN	eP	27.8	d	
August 13	BKS	CLS	eP	33 34.0	d	
		PRI	eP	06.8	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 13	BKS	eP	06 40 24.4	c	USCGS: 20.6°S, 178.5°W, 0 = 06 29 19.1. Fiji Islands. h about 562 km.
	MHC	eP	40 25.1	d	
	MIN	eP	34.2	d	
	CLS	eP	25.9	d	
	PRI	eP	25.2	c	
August 13	BKS	eP	07 03 44	c	USCGS: 19.3°S, 173.7°W, 0 = 21 52 37.4. Tonga Islands. h about 33 km.
		eSNE	13.4		
		e(G)NE	22.7		
		e(R)E	26.5		
	MIN	eZ	03 55.7	d	
August 13	BKS	iP	22 04 13.0	c	USCGS: 16.7°S, 28.7°E, 0 = 00 15 07.1. Northern Rhodesia. h about 33 km.
		eZ	23.0	d	
		ePP	07 30	d	
		eSNE	13 56	NWd	
		eSSSNE	14 24	NE	
		eSSNE	18 28	SW	
		e(G)NE	23.3		
		e(R)E	26.5		
	MHC	eP	04 16.6	c	
	CLS	eP	17.0	d	
	PRI	eP	14.0	d	
	August 14	BKS	eP	00 34 23	
MIN		eZ	40		
CLS		eP	10.9	c	
August 14	BKS	eP	02 58 40	d	USCGS: 4.9°S, 152.3°E, 0 = 03 32 33.5. New Britain. h about 62 km. Felt: Pomio.
		eZ	03 02 36	c	
		eSNE	08 30	NE	
		eE	13.4		
		e(G)NE	18.2		
		e(R)E	22.2		
	MHC	eP	02 58 37	c	
	MIN	eP	47.0	c	
	CLS	eP	48.1	c	
	PRI	eP	36.5	c	
August 14	BKS	eE	04 13.2		USCGS: 22.3°S, 68.7°W, 0 = 14 32 36.7. Northern Chile. h about 120 km.
	MIN	eP	03 45 28	c	
August 14	BKS	iP	14 44 25.5	c	USCGS: 27.9°N, 139.6°E, 0 = 02 17 16.9. Bonin Islands. h about 476 km.
	MHC	eP	21.9	d	
	CLS	eP	28.7	c	
	PRI	eP	13.5	c	
		eP	13.5	c	
August 15	BKS	iP	02 28 35.1	d	
	MHC	eP	34.0	d	
	MIN	iP	30.3	c	
	CLS	eP	28.5	d	
	PRI	eP	41.3	c	
		eP	41.3	c	
August 15	BKS	iP	02 30 22.9	d	
	MHC	eP	24.7	d	
	MIN	eP	20.2	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 15	CLS	eP	12.3	c	
	PRI	eP	35.4	d	
August 15	BKS	iP	06 22 54.5	c	USCGS: 37.9°N, 141.6°E, 0 = 06 11 34.6. Near east coast of Honshu, Japan. h about 59 km.
		iZ	23 05.0	d	
		iSNE	32 14.0	SEd	
		iScSNE	33 32	NWc	
		e(G)NE	40.0		
		e(R)NE	44.2		
	MIN	eP	23 06.6	d	
	CLS	eP	22 51.4	c	
	PRI	eP	23 06.9	c	
	BKS	iP	17 35 33.6	d	
August 15		ine	48.2	NW	USCGS: 13.8°S, 69.3°W, 0 = 17 25 05.9. Peru-Bolivia border. h about 543 km.
		iPPZ	37 41.2		
		e NE	38 07.8	SE	
		eS NE	44 07.5	SE	
		iSNE	44 11	SW	
		ine	21		
		e(PKKP)	54 44		
	MHC	iP	35 30	c	
		eS	44 05		
		eP'P'	18 03 25		
	MIN	iP	17 35 39.1	d	
	CLS	iP	37.6	d	
PRI	eP	21.8	c		
August 16	BKS	e(S)	43 56		
		eP'P'	18 03 26.6		
August 17	BKS	eZ	23 61.3		USCGS: 30.6°N, 130.9°E, 0 = 11 12 41.2. Ryukyu Islands. h about 33 km.
	BKS	eP	11 25 06.2	c	
		iZ	14.8	c	
		ePP	28 18	c	
		ePPP	30 30	c	
		eSNE	35 26	NEc	
		eSSNE	41.0	SWd	
		eSSSNE	44 34	NW	
		e(G)NE	47.2		
		e(R)NE	50.9		
August 17	MHC	eP	25 11.6	c	
	MIN	eP	01.7	c	
	CLS	eP	24 54.0	c	
	PRI	eP	25 18.7	c	
	BKS	iP	11 40 19.5	c	
August 17	MHC	eP	40 28.1	d	USCGS: 17.7°N, 94.3°W, 0 = 11 34 23.4. Vera Cruz, Mexico. h about 163 km.
	MIN	iP	58.3	c	
	CLS	eP	39.7	c	
	PRI	eP	16.2	d	
	BKS	eZ	22 50.2		
	MIN	eP	07 21 00.4	d	
August 17	BKS	eZ	22 50.2		
	MIN	eP	07 21 00.4	d	
August 18	BKS	eZ	22 50.2		USCGS: 35.9°N, 139.2°E, 0 = 07 09 51.6. Central Honshu, Japan.
	MIN	eP	07 21 00.4	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 18	BKS	iP iZ iZ ePP eSNE e(G)NE e(R)E	18 50 53.2 51 16.2 34.5 52 29 57 04 19 00.2 01.7	d c d d SW d	USCGS: 50.3°N, 176.9°W, 0 = 18 13 16.1. Andreanof Islands. h about 33 km.
	MHC MIN CLS PRI	eP eP eP eP	18 50 58.6 51 44.3 50 47.7 51 10.3	d d d d	
August 18	BKS	iP eZ eSE e(G)E e(R)NE	20 40 25.1 49.7 50 56 03.0 08.7	(d) d Ed d	USCGS: 32.1°S, 178.1°W, 0 = 20 27 41.9. Kermadec Islands. h about 33 km.
	MHC MIN CLS PRI	eP eP eP eP	20 40 24.8 33.7 26.1 23.6	c d c c	
August 19	BKS	eP e(S)NE e(G)NE	04 36 44 47 16 59.8	d NE d	USCGS: 32.0°S, 177.9°W, 0 = 04 24 00. Kermadec Islands. h about 33 km.
	MHC MIN PRI	eP eP eP	36 07.3 53.9 12	d d c	
August 19	MIN	eP	07 49 33.2	c	
August 19	BKS	eZ eSNE iP i(S)	09 40 05.3 46.0 39 49.4 40 27.0	c c c c	BKS: 41°38'N, 127°30'W, 0 = 09 38 40.2. Off Cape Mendocino, Calif. h about 10 km. Magnitude 4.1 (BKS)
August 20	MIN	eZ	07 12 42.2	c	
August 20	MIN	eP	09 32 15.5	c	USCGS: 27.8°S, 176.5°W, 0 = 09 20 26.7. Kermadec Islands. h about 37 km.
August 20	BKS	eP eZ eSE eN eSS e(G)NE e(R)E	15 59 14 31.5 16 08 20 52 12.8 16.2 19.7	d c Ed N d d d	USCGS: 41.2°N, 142.7°E, 0 = 15 48 12.2. Off coast of Honshu, Japan. h about 50 km.
	MHC MIN PRI	eP iP eP	15 59 25.7 58 11.4 59 35.8	d d d	
August 20	BKS	eZ	20 22.8	d	
	MIN	iP	19 50 23.9	d	
August 21	BKS	eP eZ iPP	03 48 14.5 24.3 50 16	c c c	USCGS: 14.3°N, 72.5°W, 0 = 03 39 22.6. Caribbean Sea. h about 33 km. Felt: Caracas, Venezuela.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 21 (Cont.)		e(S)E e(SS)E e(G)NE e(R)	55 24 59 18 00.8 03.4	Ec Wc c	
	MHC MIN CLS PRI	eP iP eP eP	48 10.3 47 57.3 17.7 02.5	c c c c	
August 21	MIN	eP	17 38 48.9	c	USCGS: 20.2°N, 108.6°W, 0 = 17 33 45.8. Revilla Gigedo Islands. h about 33 km.
August 21	MIN	eZ	18 12 16.5	c	USCGS: 49.0°N, 158.2°E, 0 = 18 02 44.4. Kurile Islands. h about 33 km.
August 22	MIN	iP	04 04 25.2	c	USCGS: 63.2°N, 148.5°W, 0 = 03 58 43.2. Central Alaska. h about 101 km.
August 22	BKS	iP eSEZ	04 35 19.5 36 43.5	d d	USCGS: 24.1°N, 116.2°W, 0 = 04 33 54.2. San Bernardino, Calif. h about 14 km. Magnitude 4.4 (CGS).
	MHC MIN CLS PRI	eP eP eP eP	35 17.2 51.4 36.2 34 59.0	d c c c	
August 22	BKS	e(P) eSE e(P)	09 28 24.2 29 21.4 28 34.5	c c (c)	BKS: 42°15'N, 126°33'W, 0 = 09 27 01.8. Off coast of Oregon. h about 10 km. Magnitude 5.0 (BKS).
	MHC MIN CLS	iP i(S) iP	07.1 47.1 13.6	c c (c)	
	PRI	e(S) eP	29 04.0 28 56.8	c c	
August 22	MIN	eP	12 14 59.7	c	USCGS: 33.7°N, 118.0°W, 0 = 12 13 11.4. Orange County, California. h about 14 km.
August 22	BKS	e(S)N eNE e(R)N	18 18 52 22 44 25.0	Nc SW d	
	MHC CLS PRI	eP eP eP	12 08 20 11 58	d d d	
August 22	BKS	eP eZ ePP e(S)NE e(PPS)NE eSSE eSSS e(G)NE e(R)E	20 05 13.0 28.9 08 20 15 40 16 56 21.0 25 12 26.4 31.8	c d d NWc SWd Ed d	USCGS: 9.4°S, 158.0°E, 0 = 19 52 25.0 Solomon Islands. h about 33 km.
	MHC MIN	eP iP	05 14.5 17.3	d c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 22 (Cont.)	CLS	eP	12.3	c	
	PRI	eP	17.4	d	
August 23	BKS	eZ	13 26 36	c	USCGS: 52.4°N, 159.6°E, 0 = 13 09 25.3. Off east coast of Kamchatka. h about 33 km.
		e(R)NE	35.0		
	MIN	eZ	18 54		
August 24	BKS	eNE	10 19.3		USCGS: 19.3°N, 108.8°W, 0 = 10 10 15.1. Off Jalisco, Mexico. h about 33 km.
	MHC	eP	14 49	c	
	MIN	eZ	16 26.3	c	
	CLS	eP	15 03.9	c	
	PRI	eP	14 38.0	c	
August 25	MIN	eP	02 30 13.1	d	USCGS: 48.7°N, 148.8°E, 0 = 02 20 12.7. Sea of Okhotsk. h about 134 km.
August 25	BKS	iP	12 29 06.7	NEc	USCGS: 17.5°S, 178.8°W, 0 = 12 18 12.5. Fiji Islands. h about 565 km.
		ipP	31 07.8	SWd	
		eZ	31 32.5	c	
		eNE	38 08	SE	
		iSPNE	32 06	SWd	
		iE	38 32	E	
		iNE	40 10	NE	
		iN	49 50		
		iSKPP'NE	58.4	NEc	
	MIN	iP	29 15.6	c	
		ipPZ	31 17.5	d	
		iP'P'Z	56 17.0	c	
	CLS	iP	29 07.3	c	
		ipP	31 08.3	d	
		eP'P'	56 18		
	PRI	iP	29 07.4	c	
		ipP	31 08.4	d	
		eS	38 11.5		
		eP'P'	56 20		
		iSKPP'	58 58	c	
August 25	MIN	eZ	18 51 34		USCGS: 52.5°N, 172.5°W, 0 = 18 44 15.5. Andreanof Islands. h about 80 km.
August 26	BKS	eP	05 00 38.5	d	USCGS: 17.7°S, 178.8°W, 0 = 04 49 43.8. Fiji Islands. h about 575 km.
	MHC	eP	39.3	d	
	MIN	eP	46.8	c	
	CLS	eP	39.3	d	
	PRI	eP	39.3	d	
August 26	MIN	eP	08 54 54.0	c	USCGS: 51.6°N, 157.0°E, 0 = 08 45 32.4. Near east coast of Kamchatka. h about 105 km.
August 27	BKS	eP	03 36 44	c	USCGS: 45.9°S, 75.3°W, 0 = 03 23 32.6. Near coast of Chile. h about 33 km.
		ePP	40 18		
		eSNE	48 04	NEd	
		eSPN	49 12	Sc	
		eSSN	54 10	NEc	
		eSSSNE	57.9	NWd	
		eP'P'NE	04 01.2		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 27 (Cont.)		e(G)NE	02.8		
		e(R)N	07.7		
	CLS	eP	03 36 43.3	c	
	PRI	eP	43.5	c	
August 27	BKS	eNE	05 55.4		USCGS: 44.1°N, 129.5°W, 0 = 05 51 37.4. Off coast of Oregon. h about 33 km.
	CLS	eP	53 25.5	c	
	PRI	eP	24.0	c	
August 27	BKS	eNE	23 52.2		USCGS: 16.1°N, 96.9°W, 0 = 23 40 42.9. Oaxaca, Mexico. h about 38 km.
		e(G)NE	55.4		
		eZ	58.9		
August 28	BKS	e(S)NE	13 24.5	NW	
		eNE	36.0		
		eZ	40.5		
August 28	BKS	iP	16 02 56.5	c	USCGS: 28.3°N, 141.0°E, 0 = 15 51 06.3. Bonin Islands. h about 96 km.
	MHC	eP	36.4	d	
	MIN	iP	57.0	d	
	CLS	eP	52.8	d	
	PRI	eP	03 03.5	d	
August 28	BKS	e(S)NE	17 20 20	SWd	USCGS: 39.1°S, 91.8°W, 0 = 16 57 46.2. West of Chile. h about 33 km.
		e(G)NE	31.5		
		e(R)N	35.8		
	MHC	eP	10 02.7	d	
	PRI	eP	09 55	c	
August 29	MIN	eP	04 46 31.5	c	
August 29	MIN	eP	06 20 30.2	d	USCGS: 21.9°N, 145.5°E, 0 = 06 08 48.0. Mariana Islands. h about 130 km.
August 29	BKS	eP	09 07 39	c	USCGS: 39.6°N, 74.2°E, 0 = 08 53 48.4. Sinkiang Province, China. h about 31 km.
		eZ	08 14	c	
		e(P)N	11 50	Sc	
		e(S)N	13 42	c	
		eSPNE	21.0	NEd	
		eSSNE	27.1	SE	
		e(SS)NE	30.2	SE	
		e(G)E	37.9		
		e(R)N	41.8		
	MHC	eP	07 43.4	c	
	MIN	eP	27.2	c	
	CLS	eP	34.8	c	
	PRI	eP	55.3	c	
August 29	BKS	iPNE	15 40 30.2	SEd	USCGS: 7.1°S, 81.6°W, 0 = 15 30 31.4. Off coast of Peru. h about 23 km.
		iZ	41 00.5	c	
		iE	42 11.1	Ec	
		iPP	43 06	d	
		iSNE	48 34	SEd	
		iNE	49 06	NW	
		eSNE	48 34	NEc	
		e(G)NE	16 00.3		
		e(R)NE	03.0		
		eP'P'	10 17.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
August 29 (Cont.)	MHC	eP	15 40 25.5	d	USCGS: 15.5°S, 172.9°W, 0 = 20 57 31.5. Tonga Islands. h about 33 km.
		eP'P'	16 10 03.0	d	
	MIN	iP	15 40 37.0	d	
		iP'P'	16 10 12.6	d	
	CLS	eP	15 40 34.5	d	
		PRI	eP	15 40 15.3	
August 29	BKS	eP'P'	16 10 12.5	c	
		eP	21 08 50	SEc	
		ePP	10 36	d	
		eZ	15 36	d	
		eSNE	18 06	NEd	
		e(ScS)NE	18 44	SWd	
		eSSNE	22 24	NEd	
		e(G)NE	26.9		
		e(R)NE	29.7		
		MIN	eP	09 02.5	c
	CLS	eP	54.0	c	
	August 30	PRI	eP	51.0	d
MIN		iP	00 35 38.0	d	
August 30	MIN	eP	03 00 47.5	c	
August 30	BKS	eZ	14 29.0		
		eP	03 54.5	c	
		eP	03 55.3	c	
		eP	53.8	c	
August 30	MIN	eZ	12 59 47		
August 31	MIN	eP	21 37 32.0	c	
August 31	BKS	eZ	13 30.5		
		eP	16 20.3	d	
	CLS	eP	31.1	c	
		eP	08.3	d	
	August 31	BKS	iP	16 31 36.9	d
			MHC	iP	26.0
August 31	MIN	eP	32 11.8	c	
		i(S)	33 01.6		
		CLS	eP	31 46.5	c
		PRI	iP	32.9	d
Sept. 1	MIN	eZ	07 04 15.5	c	
Sept. 1	MIN	eP	07 16 36.4	c	
Sept. 1	MIN	eP	11 19 59.5	d	
Sept. 1	MIN	eP	15 26 36.5	c	
Sept. 1	MIN	eZ	19 25 32.9	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 1	BKS	eP	23 05 08.5	c	USCGS: 11.3°N, 85.5°W, 0 = 22 57 34.4. Nicaragua. h about 120 km.
	MHC	eZ	12.8	d	
	CLS	eP	07.8	c	
Sept. 2	PRI	eP	08.9	d	
	MIN	eP	02 31 37.1	c	
	Sept. 2	MIN	eP	03 48 43.1	
Sept. 2	BKS	eP	13 17 36	c	
		eNE	26.4		
Sept. 2	BKS	eNE	13 18.2	SW	
Sept. 2	BKS	eP	13 30 48	c	
		e(P)NE	33 32	SWc	
		e(PPP)E	35 52		
		e(SS)NE	48 36		
		MHC	eP	31 01.5	c
		MIN	eP	30 21.2	c
Sept. 2	CLS	eP	39.0	c	
		PRI	eP	31 21.3	c
		BKS	eP	14 14 34	c
		e(S)NE	17 42	SWd	
		e(G)NE	17.9		
		MHC	eP	14 22.0	d
Sept. 2	MIN	eP	53.4		
		eP	40.0	c	
		eP	11.3	d	
		eP	05 08 23.7	d	
Sept. 2	MIN	eP	05 08 23.7	d	
Sept. 3	MIN	eP	05 39 53.3	c	
		eP	06 19 25.0	d	
Sept. 3	BKS	eZ	29.5		
		eP	19 31.0	d	
		MIN	eP	05.5	d
		CLS	eP	19.7	c
		PRI	eP	42.7	d
		Sept. 3	MIN	iP	09 23 22.6
Sept. 3	MIN	eP	09 23 22.6	d	
		eP	03 13 00.3	c	
Sept. 4	BKS	e(S)EN	05 15 56		
		e(PS)N	17 20	N	
		e(SS)N	21 44	S	
		e(G)E	29.5		
		e(R)N	34.4		
		Sept. 4	BKS	eP	05 18 24
Sept. 4	MHC	eNE	50.3		
		eN	54.6		
		eZ	05 19 54.9	c	
Sept. 4	MHC	eZ	05 19 54.9	c	
		eP	05 18 24	c	
		eNE	50.3		
		eN	54.6		
		eZ	05 19 54.9	c	
		eP	05 18 24	c	
		eNE	50.3		
		eN	54.6		
		eZ	05 19 54.9	c	
		eP	05 18 24	c	
		eNE	50.3		
		eN	54.6		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 4 (Cont.)	MIN	iP	42.3	c	
	CLS	eZ	51.2	c	
	PRI	eZ	57.4	c	
Sept. 4	BKS	iP	13 40 02.5	d	USCGS: 71.4°N, 73.3°W, 0 = 13 32 12.3.
		iZ	08.5	c	Near east coast of Baffin Island.
		iPPNE	41 43	SWc	h about 33 km.
		iSNE	46 16	SEd	Felt: Clyde River.
		iNE	49 20	NEc	
		e(G)NE	53.5		
		e(R)NE	51.7		
	MIN	iP	39 41.8	c	
	CLS	eP	56.6	d	
	PRI	eP	40 11.9	d	
Sept. 5	MHC	eP	01 06 54.3	c	
	MIN	iP	07 03.4	d	
	CLS	eP	54.4	c	
	PRI	eP	54.4	c	
Sept. 5	BKS	eE	11 42 12	Ed	USCGS: 50.3°N, 129.1°W, 0 = 11 36 31.6.
	MHC	eP	39 48.3	d	Vancouver Island. h about 33 km.
	MIN	eP	12.1	c	
	CLS	eP	28.3	c	
	PRI	eP	40 07.5	d	
Sept. 5	BKS	e(S)NE	23 52.5		USCGS: 18.6°N, 106.8°W, 0 = 23 43 05.0.
		e(R)	54.3		Off coast of Jalisco, Mexico.
	MHC	eP	48 05.2	c	h about 33 km.
	MIN	eP	30.2	c	
	CLS	eP	23.3	c	
	PRI	eP	47 50.6	c	
Sept. 6	MIN	eZ	01 53 46.6	d	USCGS: 71.5°N, 73.0°W, 0 = 01 46 13.3.
					Near east coast of Baffin Island.
					h about 33 km.
Sept. 6	BKS	e(G)E	03 04.0		
		e(R)N	08.8		
Sept. 6	BKS	iP	06 16 02.5	d	USCGS: 36.4°N, 130.6°E, 0 = 06 03 52.1.
		iZ	10.0	c	Sea of Japan. h about 33 km.
		e(S)NE	26.1		
		e(G)N	37.4		
		e(R)NE	40.5		
	MHC	eP	16 05.4	c	
	MIN	eP	54.6	c	
	CLS	eP	56.0	c	
	PRI	eP	12.8	c	
Sept. 6	BKS	eP	10 28 08.3	c	USCGS: 24.0°S, 179.9°E, 0 = 10 16 38.9.
	MHC	eP	08.7	c	Kermadec Islands. h about 500 km.
	MIN	eP	17.0	c	
	CLS	eP	09.1	c	
	PRI	eP	08.1	c	
Sept. 6	BKS	eZ	12 41.7		
Sept. 6	MIN	iP	19 25 38.8	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 6	BKS	eP	20 34 57.8	c	USCGS: 50.1°N, 129.5°W, 0 = 20 31 46.1.
		e(S)E	37 32	SE	Vancouver Island region.
		e(G)NE	37.7		h about 31 km.
	MHC	eP	35 02.5	c	
	MIN	iP	34 28.4	c	
	CLS	eP	44.4	c	
	PRI	eP	22.3	c	
Sept. 6	BKS	eP	21 03 38.0	c	USCGS: 53.9°N, 165.6°W, 0 = 20 56 59.9.
		ei	44.7	c	Fox Islands. h about 33 km.
		eZ	12.0		
	MHC	eP	03 43.2	c	
	MIN	iP	27.3	c	
	CLS	eP	31.4	d	
	PRI	eP	58.8	c	
Sept. 6	MIN	eP	22 28 05.8	d	
Sept. 6	MIN	eP	24 04 50.3	d	
Sept. 7	BKS	e(S)NE	01 39 08	SEd	USCGS: 36.4°N, 130.6°E, 0 = 01 16 55.1.
		eNE	43 36		Off east coast of South Korea.
		e(G)NE	50.0		h about 33 km.
		e(R)	53.5		
	MHC	eP	29 04	c	
	MIN	eZ	28 58.0	c	
	CLS	eP	54.5	c	
	PRI	eP	29 16.8	d	
Sept. 7	MHC	eP	02 41 30.8	d	USCGS: 21.5°S, 174.6°W, 0 = 02 29 38.3.
	MIN	eP	41.3	c	Tonga Islands. h about 33 km.
	CLS	eP	18.0	c	
	PRI	eP	29.7	d	
Sept. 7	BKS	e(S)NE	07 32 28	NEd	USCGS: 45.4°N, 150.8°E, 0 = 07 13 39.9.
		e(G)NE	39.8		Kurile Islands. h about 33 km.
		e(R)	42.4		
	MHC	eP	24 06.5	d	
	MIN	eP	23 53.8	c	
	CLS	eP	08.4	c	
	PRI	eP	16.9	c	
Sept. 7	BKS	eP	12 53 13.4	c	USCGS: 54.0°N, 160.3°E, 0 = 12 44 01.1
		eZ	34.5	c	Kamchatka. h about 110 km.
		e(S)E	13 00 40	Wd	
		e(SS)E	04 32	Wc	
		e(G)N	06.5		
		e(R)E	09.0		
	MHC	eP	53 17.4	c	
	MIN	iP	01.8	c	
	CLS	eP	06.4	c	
	PRI	eP	27.9	c	
Sept. 7	BKS	eP	15 20 10.2	c	USCGS: 22.0°S, 179.6°W, 0 = 15 16 55.4.
	MHC	eP	28 10.7	c	Fiji Islands. h about 558 km.
	MIN	eZ	19.6	d	
	CLS	eP	11.2	c	
	PRI	eP	10.8	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 8	BKS	eP	00 59 49.5	c	USCGS: 28.1°S, 176.8°W, 0 = 00 47 27.7. Kermadec Island. h about 57 km.
		eZ	55.5	c	
		e(S)NE	01 10 16	NWd	
		e(PS)NE	11 34	NE	
		e(SS)NE	15.0	NE	
		e(Q)NE	21.0		
		e(R)N	25.0		
	MHC	eP	00 59 50.6	d	
	MIN	eP	01 00 00.1	d	
	CLS	eP	00 59 50.0	d	
	PRI	eP	48.3	d	
Sept. 8	MIN	eP	01 16 57.7	c	
Sept. 8	MIN	eP	07 49 29.7	d	USCGS: 20.7°S, 178.3°W, 0 = 07 38 14.8. Fiji Islands. h about 573 km.
Sept. 8	BKS	eP	09 18 06.3	d	
		eZ	17.0	d	USCGS: 36.2°S, 100.5°W, 0 = 09 06 16.0. About 1,500 km southeast of Easter Island. h about 33 km.
		e(S)NE	27 56	NE	
		e(G)NE	38.7		
		e(R)NE	42.2		
	MHC	eP	18 01.3	d	
	MIN	eP	20.1	d	
	CLS	eP	05.2	c	
	PRI	eP	17 53.2	c	
Sept. 8	BKS	iPNE	20 01 53.5	NEc	USCGS: 23.6°S, 179.8°E, 0 = 19 50 29.8. Fiji Islands. h about 550 km.
		epPZ	03 53.5	c	
		eZ	05 05.4	d	
		eNE	04 54	SWd	
		eSNE	11 24	NE	
		eSPE	12 20	Ed	
		esSNE	14 46	NEd	
		isPSNE	15 40	NE	
		eSSSNE	19.6		
		e(G)NE	23.0		
		eSKPP'	31 06	c	
	MHC	eP	01 53.9	c	
		epP	03 53.3	c	
	MIN	iP	02 01.8	c	
	CLS	eP	01 54.5	c	
		epP	03 55.2	d	
	PRI	eP	01 53.5	c	
		epP	03 53.0	c	
Sept. 9	MHC	eP	00 30 21.0	c	USCGS: 22.6°S, 179.5°W, 0 = 00 19 02.7. Fiji Islands. h about 550 km.
	MIN	iP	30.2	d	
	CLS	eP	20.3	c	
	PRI	eP	21.0	d	
Sept. 9	BKS	eP	02 58 44.0	c	USCGS: 4.4°S, 152.7°E, 0 = 02 45 45.5. New Britain. h about 34 km. Felt: Rabaul
		ePP	03 02 04	c	
		ePPP	04 26	c	
		eSNE	09 06	SWc	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 9		ePSE	10 22	Ec	
(Cont.)		eSSE	15 00	W	
		eSSN	15 24	Nc	
		e(G)N	22.2		
		e(R)E	26.5		
	MHC	eP	02 58 35.0	d	
	MIN	eZ	43.1	c	
	CLS	eP	38.2	d	
	PRI	eP	41.8	d	
Sept. 9	MHC	eP	03 24 28	c	
	MIN	eP	34.7	c	
	CLS	eP	19.2	c	
	PRI	eP	16.9	c	
Sept. 9	MIN	eP	05 21 17.9	d	USCGS: 49.8°N, 130.0°W, 0 = 05 18 36.9. Vancouver Island. h about 33 km.
Sept. 9	MIN	eP	07 30 35.7	c	
Sept. 9	MIN	eP	19 09 16.2	c	USCGS: 44.3°N, 114.6°W, 0 = 19 07 19.0. Central Idaho. h about 33 km.
Sept. 10	BKS	e(R)E	01 47.0		
	MIN	eZ	24 51.5	c	
Sept. 10	BKS	eP	06 36 38.8	c	USCGS: 23.0°S, 179.8°E, 0 = 06 25 14.5. Fiji Islands. h about 520 km.
	MIN	iP	36 47.9	d	
	CLS	eP	39.4	d	
	PRI	eP	39.1	d	
Sept. 10	MIN	iP	11 35 14.9	c	
Sept. 10	BKS	iP	17 07 17.5	c	USCGS: 53.8°N, 159.9°W, 0 = 17 01 07.3. Alaska Peninsula. h about 33 km.
		e(G)N	13 48		
		eE	14.3		
		e(R)	14.9		
	MIN	iP	07 05.5	c	
	CLS	eP	10.7	c	
	PRI	eP	36.0	c	
Sept. 10	BKS	eP	19 26 40.3	d	
		eZ	27 01.7	d	
		e(S)N	36 48	Sd	
		e(PPS)NE	37 48	NE	
		eSS	41.5		
		e(R)	51.5		
	MHC	eP	26 41.7		
	MIN	iP	49.6	c	
	CLS	eP	41.4	d	
	PRI	eP	42.0	d	
Sept. 11	MIN	eP	00 14 16.8	c	USCGS: 44.3°N, 114.7°W, 0 = 00 12 29.6. Central Idaho. h about 33 km.
Sept. 11	BKS	eP	02 10 58.5	d	
		eE	11 27	d	
		e(S)N	13 12.5	NE	
	MHC	eP	10 54.7	c	
	MIN	eP	25.9	c	
	CLS	eP	47.8		
	PRI	eP	11 11.5	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 11	MIN	eZ	02 34 58.8	d	
Sept. 11	MIN	eZ	03 47 21.0	c	USCGS: 44.4°N, 114.8°W, 0 = 03 45 35.6. Central Idaho. h about 33 km.
Sept. 11	MHC	eP	06 44 08.4	d	USCGS: 19.0°S, 169.3°E, 0 = 06 31 54.7. Near Hebrides Islands. h about 245 km.
	MIN	eP	04.5	d	
	CLS	eP	07.3	d	
	PRI	eP	09.3	d	
Sept. 11	MIN	eP	09 44 05.1	c	USCGS: 44.3°N, 114.8°W, 0 = 09 42 06.9. Central Idaho. h about 33 km.
Sept. 11	MIN	eP	12 02 28.0	c	USCGS: 33.2°N, 110.7°W, 0 = 11 59 41.2. Arizona; felt: Miami, Globe, and San Carlos.
Sept. 11	MHC	eP	22 33 17.0	c	USCGS: 33.1°S, 178.2°W, 0 = 22 20 26.6. South of Kermadec Islands.
	CLS	eP	33 18.5	c	
	PRI	eP	16.0	c	
Sept. 12	BKS	eP	06 26 33.7	d	h about 21 km.
		eZ	50.5	d	
		eSNE	28 16		
	MHC	eP	26 01.2	d	
		e(S)	28 28	c	
	MIN	eP	25 31.9	c	
	CLS	eP	25 53.5	d	
		e(S)	28 10.4	d	
	PRI	eP	26 37.8	d	
		e(S)	28 47.6	c	
Sept. 12	MIN	iZ	08 03 17.9	c	USCGS: 44.4°N, 114.7°W, 0 = 08 01 23.2. Central Idaho. h about 33 km.
Sept. 12	MIN	iZ	11 18 38.0	c	USCGS: 44.4°N, 114.7°W, 0 = 11 16 48.9. Central Idaho. h about 33 km.
Sept. 12	MIN	eZ	12 30 17.3		
Sept. 13	BKS	iP	10 55 49.7	c	USCGS: 29.1°N, 105.6°W, 0 = 10 51 56.6. Chihuahua, Mexico. h about 33 km.
		e(pP)	56 09.5	d	
		eZ	55.3	d	
		e(S)NE	59 51	SW	
	MHC	eP	55 41.8	c	
	MIN	eP	56 48.2	c	
	CLS	eP	55 54.3	c	
	PRI	eP	28.8	c	
Sept. 13	BKS	eP	13 54 18.5	d	
		eZ	27.7		
		eNE	55 34.7		
	MHC	eP	54 20.0	d	
		e(S)	55 24.0	c	
	MIN	iP	54 27.7	d	
		i(S)	42.2		
	CLS	eP	22.4	c	
	PRI	eP	01.7	d	
		e(S)	55 01.5	c	
Sept. 13	BKS	eZ	21 51 20	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 13	BKS	eP	23 09 14.5	c	
	MHC	eP	20.3	c	
	MIN	eP	05.0	c	
	CLS	eP	08.9	c	
	PRI	eP	32.1	c	
Sept. 13	BKS	eP	23 46 24.5	d	USCGS: 31.3°S, 179.3°W, 0 = 23 33 32.9. Kermadec Islands. h about 16 km.
		e(G)NE	00 09.0		
		e(R)NE	12.7		
	MHC	eP	23 46 18.9	c	
	MIN	iP	37.8	c	
	CLS	eP	19.5	d	
	PRI	eP	17.8	c	
Sept. 14	BKS	eE	01 03.4		USCGS: 31.3°S, 179.1°W, 0 = 00 38 07.5. Kermadec Islands. h about 33 km.
	MHC	eP	00 50 50.8	c	
	MIN	eZ	51 01.1	c	
	CLS	eP	46.0	c	
	PRI	eP	43.2	c	
Sept. 14	BKS	eZ	03 52 34.7	c	USCGS: 33.4°N, 118.5°W, 0 = 03 51 15.5. Off Southern California.
		eE	53 24.7		
	MIN	eP	05.7	c	h about 15 km.
		iS	54 39.1		Magnitude 4.8 (CGS).
Sept. 14	BKS	iP	04 05 06.1	d	Felt: Los Angeles.
		i	15.0	c	
		eSNE	15 36		
		ePPSNE	16 48		
		eSSNE	21 44		
		e(G)NE	27.4		
		e(R)NE	31.0		
			mu sec		
		PZ	0.1 1.5		
		SH	1.3 24		
		MaxH	6.7 32		
	MHC	eP	04 05 00.8	d	
	MIN	iP	15.2	d	
	CLS	eP	57.0	c	
	PRI	eP	52.7	c	
Sept. 14	BKS	eP	07 28 31.0	d	USCGS: 19.0°N, 145.0°E, 0 = 07 17 18.5. Mariana Islands. h about 610 km.
	MHC	eP	30.4	d	
	MIN	iP	29.2	d	
	CLS	eP	28.4	d	
	PRI	eP	40.5	c	
Sept. 14	MIN	eP	10 38 42.5	c	
Sept. 14	BKS	eP	12 29 15.7	c	USCGS: 35.5°N, 118.1°W, 0 = 12 28 13.3. Kern County, Calif. h about 14 km.
		eEZ	30 06.0		
	MHC	eP	29 07.3	d	Magnitude 4.2 (CGS).
		e(S)	53.2		
	MIN	eP	40.9	c	
		i(S)	30 42.7		
	CLS	eP	29 26.3	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 14 (Cont.)	PRI	e(S) eP eS	30 21.6 28 50.3 29 21.4	d	
Sept. 14	MIN	iP i(S)	15 59 43.8 16 01 10.8	c	USCGS: 44.2°N, 114.8°W, 0 = 15 58 03.8. Central Idaho. h about 33 km. Felt: Boise.
Sept. 14	MIN	eP	16 08 42.8	d	USCGS: 44.3°N, 114.7°W, 0 = 16 06 49.3. Central Idaho. h about 33 km.
Sept. 14	MIN	eP	16 28 03.4		USCGS: 44.3°N, 114.7°W, 0 = 16 25 13.2. Central Idaho. h about 33 km.
Sept. 14	MIN	eZ	16 41 36.9	c	
Sept. 14	BKS	iP iS	19 46 36.7 54.2	c	BKS: 36°52.0'N, 121°38.3'W, 0 = 19 46 17.0. Near Watsonville, Calif. h about 5 km.
	MHC	iP iS	27.0 42.2	d	Felt: Chittenden, Salinas, San Jose, Watsonville, San Francisco, etc. Magnitude 5.4 (BKS). (Numerous aftershocks.)
	MIN	eP iS	47 11.5 52.2	d	
	CLS	eP	48.0	c	
Sept. 14	PRI	iP	37.2		
	BKS	iP eS	20 28 30.5 43.8	c	BKS: 36°55.0'N, 121°39.3'W, 0 = 20 28 11.2. Aftershock of preceding. h about 12 km.
	MHC	iP	20.6	d	
	MIN	iP	29 06.0	c	Felt: Monterey, San Benito counties and San Francisco Bay area. Magnitude 4.6.
	CLS	iP	28 41.6	c	
	PRI	iP	31.8	c	
Sept. 15	BKS	iP iZ eZ iPP iSNE eE eSSNE e(G)N e(R)EN	00 59 14.7 19.2 01 01 23 02 26 09 38 14 22 15 14 21.2 24.2	d d d d NE Wd SW	USCGS: 10.3°S, 165.6°E, 0 = 00 46 54.1. Santa Cruz Islands. h about 43 km. Felt: Vanikaro.
	MHC	iP	00 59 16.5	d	
	MIN	iP	20.8	d	
	CLS	eP	14.3	d	
	PRI	eP	18.7	d	
Sept. 15	BKS	eP eZ	02 09 59.0 10 09.0	c d	USCGS: 9.4°S, 167.0°E, 0 = 01 57 24. Santa Cruz Islands. h about 33 km.
	MHC	eP	00.8	c	
	MIN	eP	04.0	c	
	CLS	eP	09 58.7	c	
	PRI	eP	10 01.3	d	
Sept. 15	MIN	eP	02 36 56.2	c	
Sept. 15	MIN	eP	05 36 44.8	d	USCGS: 44.3°N, 114.8°W, 0 = 05 35 00.2. Central Idaho. h about 33 km.
Sept. 15	MIN	eP	06 27 50.2	c	USCGS: 10.2°S, 165.4°E, 0 = 06 15 21.7. Santa Cruz Islands. h about 28 km.

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 15	MIN		11 25 31.2	d	
Sept. 16	BKS	eZ	02 31.3		
	MHC	eP	01 27.7	d	
	MIN	eP	32.6	d	
	CLS	eP	26.2	c	
	PRI	eP	41.2	d	
Sept. 16	MIN	iP	09 52 38.2	d	
Sept. 16	MIN	eP	12 07 57.0	c	
Sept. 16	CLS	eP	17 16 52.0	c	
	PRI	eP	17 37.7	d	
Sept. 17	MIN	eP	00 25 39.9	c	
	CLS	eP	56.7	d	
	PRI	eP	26 40.0	d	
Sept. 17	MIN	eP	05 38 11.2	c	USCGS: 44.3°N, 114.8°W, 0 = 05 36 17.1. Central Idaho. h about 33 km.
Sept. 17	BKS	iP iSE eSSNE e(Q)NE e(R)NE	06 05 00 13 30 17.7 21.0 26.0	d Ec NEc	USCGS: 10.6°S, 78.2°W, 0 = 05 04 33.7. Central Peru. h about 61 km. Slight damage at Huaraz.
	MHC	eP	04 55.5	d	
	MIN	iP	05 06.8	d	
	CLS	eP	04.2	d	
	PRI	eP	04 46.0	d	
Sept. 17	MIN	eZ	06 33 56.5	d	
Sept. 17	MHC	eP	07 44 40.0	d	USCGS: 1.5°S, 77.9°W, 0 = 07 34 38.7. Ecuador. h about 178 km.
	MIN	eP	11.4	c	
	CLS	eP	47.2	d	
	PRI	eP	30.0	d	
Sept. 17	BKS	iPNE iNE iZ eZ eNE eSNE eSSNE e(SSS)N e(G)N e(R)E	19 32 32 32 45 33 21 35 20 38 20 43 00 48 25 51 40 54.2 57.5	SWd SWd c NWc NEc SEd Nc	USCGS: 10.1°S, 165.3°E, 0 = 19 20 08.2. Santa Cruz Islands.
	MHC	eP	32 34.2	d	
	MIN	eP	38.0	d	
	CLS	eP	32.0	d	
	PRI	eP	35.6	c	
Sept. 17	MHC	eP	20 10 02.6	c	USCGS: 10.1°S, 165.0°E, 0 = 20 57 40.3.
	MIN	eP	14.3	c	
	CLS	eP	02.5	d	
	PRI	eP	03.8	c	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 17	MIN	eP	20 13 21.8	c	USCGS: 9.9°S, 164.7°E, 0 = 20 00 56.6. Santa Cruz Islands. h about 33 km.
	MIN	eZ	03.2	c	
	CLS	eP	19.5	c	
Sept. 17	PRI	eP	23.8	c	USCGS: 10.7°S, 165.1°E, 0 = 01 55 46.2. Santa Cruz Islands. h about 28 km.
	BKS	eP	22 40 53.5	c	
		eZ	41 14.3	c	
	MHC	eP	40 53.8	d	
	MIN	eP	58.8	c	
Sept. 18	CLS	eP	52.3	c	USCGS: 40.9°W, 29.2°E, 0 = 16 58 12.5. Turkey. 1 killed and several injured at Istanbul. h about 33 km.
	PRI	eP	55.6	d	
	MIN	eP	02 08 17.7	c	
Sept. 18	BKS	eP	17 11 41	c	USCGS: 15.2°S, 167.6°E, 0 = 19 27 17.0. New Hebrides Islands. h about 161 km.
		ePP	15 51	c	
		eSNE	23 18	NW	
		eSSE	29 48		
		e(G)E	37 28		
		e(R)	43.0		
	MHC	eP	11 45	c	
	MIN	eP	35.9	c	
	CLS	eP	45.2	c	
	PRI	eP	38.8	d	
Sept. 19	BKS	eNE	17 21.0		USCGS: 76.5°N, 7.9°E, 0 = 0303 32.9. Snalbard region. h about 33 km.
	MHC	eP	00 18.4	c	
	MIN	eP	05.2	c	
	CLS	eP	16.1	c	
	PRI	eP	19.0	c	
Sept. 19	MHC	eP	19 42 17.3	d	USCGS: 21.5°S, 68.0°W, 0 = 14 41 22.6. h about 155 km.
	CLS	eP	15.4	d	
	PRI	eP	18.6	d	
Sept. 20	MHC	eP	03 13 47.3	c	USCGS: 17.8°S, 68.8°W, 0 = 22 11 32.2. Peru-Bolivia border. h about 171 km.
	MIN	eP	32.4	c	
	CLS	eP	46.8	d	
	PRI	eP	14 00.8	c	
	BKS	eP	07 36 57.0	d	
Sept. 20	MHC	eP	36 53.8	d	USCGS: 44.3°N, 114.8°W, 0 = 06 30 03.5. Central Idaho. h about 33 km.
	MIN	eP	37 02.6	d	
	CLS	eP	01.1	c	
	PRI	eP	36 45.8	d	
	BKS	eP	14 53 05.5	d	
Sept. 20	MHC	eP	53 02.3	d	USCGS: 44.3°N, 114.8°W, 0 = 00 50 37.8. Central Idaho. h about 33 km.
	MIN	eP	11.8	c	
	CLS	eP	09.1	d	
	PRI	eP	54.5	d	
	BKS	iP	22 22 56.5	c	
	i(pP)	23 34.5	c		
	eSNE	32 22	NE		
	e(ScS)NE	33 30	SEc		
	e(SS)E	38.0	w		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 20 (Cont.)		e(G)NE	45.6		USCGS: 40.4°N, 140.0°E, 0 = 09 17 25.3. Near east coast of Honshu, Japan. h about 179 km.
		e(R)NE	48.9		
	MHC	eP	22 52.3	c	
	MIN	iP	52.1	c	
	CLS	eP	58.9	d	
Sept. 21	PRI	eP	43.6	d	USCGS: 23.0°S, 179.8°E, 0 = 16 28 04.7. Fiji Islands. h about 413 km.
	MIN	eP	09 28 19.6	d	
	BKS	eP	16 39 31.6	c	
Sept. 21	MHC	eP	39 32.2	c	USCGS: 44.3°N, 114.8°W, 0 = 00 50 37.8. Central Idaho. h about 33 km.
	MIN	eP	38.7	d	
	CLS	eP	32.5	c	
	PRI	eP	32.0	d	
	BKS	eE	00 54 54.8	E	
Sept. 22		eZ	55 21.5	c	USCGS: 19.3°S, 175.9°E, 0 = 02 56 24.3. Fiji Islands. h about 28 km.
	MHC	eP	52 46.6	c	
	MIN	eZ	15.2	c	
	CLS	eP	40.0	c	
	PRI	eP	53 14.5	c	
Sept. 22	BKS	eNE	02 51.2		USCGS: 19.3°S, 175.9°E, 0 = 02 56 24.3. Fiji Islands. h about 28 km.
	BKS	eP	02 56 20.5	c	
Sept. 22		e(pP)	45.5	d	USCGS: 44.3°N, 114.8°W, 0 = 06 30 03.5. Central Idaho. h about 33 km.
		e(PcP)	58 40.0	c	
		eSNE	03 02 12	SW	
		e(G)NE	05.6		
		e(R)N	07.0		
	MHC	eP	02 56 26.3	d	
	MIN	eP	10.0	c	
	CLS	eP	15.1	c	
	PRI	eP	38.2	d	
	BKS	ePNE	03 08 40.0	SWd	
	e(pP)	09 02.9	c		
	eZ	11 28	c		
	ePPNE	12 20	SW		
	eSNE	18 56	SWc		
	e(PS)NE	19 40	SW		
	e(G)NE	29.5			
	e(R)NE	33.5			
Sept. 22	MHC	eP	08 40.7	d	USCGS: 44.3°N, 114.8°W, 0 = 06 30 03.5. Central Idaho. h about 33 km.
	MIN	iP	46.3	d	
	CLS	eP	40.5	d	
	PRI	eP	41.2	d	
	MIN	eZ	06 31 34.7	c	
Sept. 22	BKS	eP	19 34 13.5	d	USCGS: 44.3°N, 114.8°W, 0 = 06 30 03.5. Central Idaho. h about 33 km.
		eZ	35 44	c	
		e(S)NE	45 16	SW	
		e(R)NE	59.1	NWd	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 22 (Cont.)	MHC	eP	34 14.2	d	
	MIN	eP	20.3	d	
	CLS	eP	14.0	d	
	PRI	eP	14.6	d	
Sept. 22	MHC	eP	19 41 06.8	c	USCGS: 10.3°S, 165.1°E, 0 = 19 28 42.2. Santa Cruz Islands. h about 33 km.
	MIN	eP	09.6	c	
	CLS	eP	02.7	c	
	PRI	eP	08.0	c	
Sept. 22	MIN	eP	21 15 26.3	d	USCGS: 44.3°N, 114.6°W, 0 = 21 13 35.6. Central Idaho. h about 33 km.
Sept. 22	MIN	iP	22 37 22.2	c	USCGS: 42.0°N, 126.5°W, 0 = 22 36 24. Off coast of Northern California. h about 33 km.
Sept. 23	MIN	iP	01 32 42.8	d	USCGS: 43.2°N, 111.2°W, 0 = 01 30 32.8. Southeastern Idaho. h about 33 km.
Sept. 23	BKS	iP	07 00 20.5	d	USCGS: 16.6°S, 28.6°E, 0 = 06 40 36.5. Northern Rhodesia. h about 33 km.
		e(G)E	49.7		
		e(R)E	57.5		
	MHC	eP	07 00 18.2	d	
	MIN	iP	10.7	d	
	CLS	eP	19.2	d	
	PRI	eP	18.5	d	
Sept. 23	MIN	iP	08 30 10.5	c	USCGS: 16.7°S, 28.7°E, 0 = 08 10 35.4. Northern Rhodesia. h about 33 km.
	PRI	eZ	17	d	
Sept. 23	BKS	eP	09 21 38.5	c	USCGS: 16.6°S, 28.8°E, 0 = 09 01 56.8. Northern Rhodesia. h about 33 km.
		iZ	54.5	c	
		e(S)NE	39 16	NEd	
		eNE	44.9	SWd	
		e(G)E	10 05.5		
		e(R)E	10.7		
	MHC	eP	09 21 38.4	d	
	MIN	iP	31.0	d	
	CLS	eP	37.7	c	
	PRI	eP	38.4	d	
Sept. 23	MIN	eP	10 06 03.5	c	USCGS: 5.6°S, 153.8°E, 0 = 09 58 46.0. New Britain. h about 80 km.
	PRI	eZ	11.0	c	
Sept. 23	BKS	iP	14 43 21.8	d	USCGS: 33.6°N, 117.0°W, 0 = 14 41 51.0. Riverside County, Calif. h about 15 km.
		e(S)	44 23.5		
	MHC	eP	43 11.9	c	Felt as far as San Diego.
		eS	44 01.5		Magnitude 4.3 (CGS).
	CLS	eP	43 30.6	c	
		e(S)	44 26.5		
	PRI	eP	42 52.2		
		iS	43 34.4		
Sept. 23	MIN	iP	16 27 13.4	c	
	PRI	eZ	23.8	d	
Sept. 23	BKS	eP	17 10 32.0	d	
		eE	16 50.0	s	
		e(G)NE	19.9		
		e(R)E	21.9		

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 23 (Cont.)	MHC	eP	10 38.4	c	
	MIN	iP	19.6	c	
	CLS	eP	19.5	d	
	PRI	eP	44.5	c	
Sept. 23	BKS	eP	22 43 19.5	c	
	MHC	eP	18.5	c	
	MIN	iP	16.2	c	
	CLS	eP	21.7	d	
	PRI	eP	19.8	d	
Sept. 24	MIN	eP	08 42 24.3	d	USCGS: 28.6°S, 68.4°W, 0 = 08 20 01.6. La Rioja Province, Argentina. h about 94 km.
Sept. 24	BKS	eP	09 33 19.5	c	USCGS: 16.6°S, 28.7°E, 0 = 09 13 38. Northern Rhodesia. h about 33 km.
		eE	10 22.5		
	MHC	eP	09 33 19.1	c	
	MIN	iP	12.6	c	
	CLS	eP	18.1	c	
	PRI	eP	18.6	d	
Sept. 24	BKS	iPN	16 40 40.8	Sd	USCGS: 10.6°S, 78.0°W, 0 = 16 30 16.0. Near coast of Peru.
		iZ	47.7	d	
		iN	41 03.0	SWc	
		iNE	41 16	NEd	
		ePPNE	43 00	SEc	
		iSNE	49 11	NEd	
		eSSNE	53 30	SEd	
		e(G)NE	56.9		
		e(R)E	17 00.1		
		iP'P'	09 46	d	
	MHC	eP	16 40 36.3	d	
		eP'P'	17 09 36.3	c	
	MIN	iZ	16 40 50		
		eNE	51		
	CLS	eP	44.7	c	
		eP'P'	17 09 32	c	
	PRI	eP	16 40 26.7	d	
		eP'P'	17 09 37	c	
Sept. 24	MIN	eP	01 17 08.7	c	USCGS: 16.6°N, 87.1°W, 0 = 01 09 39.7. Honduras. h about 33 km.
Sept. 25	MIN	eZ	04 08 20.5	d	
Sept. 25	MHC	eP	05 39 29	c	
	MIN	eP	28.3	c	
	CLS	eP	32.0	c	
	PRI	eP	25.0	c	
Sept. 25	BKS	eP'	07 23 36.0	d	USCGS: 16.7°S, 28.7°E, 0 = 07 03 54.6. Northern Rhodesia. h about 33 km.
		eZ	24 08.5	d	
		e(S)NE	47 16	NE	
		eNE	51 48	NE	
		e(R)NE	12.0		
	MHC	eP'	23 36.0	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 25 (Cont.)	MIN CLS PRI	iP' eP' eP'	28.3 35.2 35.8	d c c	
Sept. 25	MIN	eP	08 39 34.1	c	
Sept. 25	MIN	eP	11 28 29.8	c	
Sept. 25	MIN	eZ	13 56 50.0	c	USCGS: 10.3°S, 164.4°E, 0 = 13 44 21.9. Santa Cruz Islands. h about 43 km.
Sept. 25	BKS MHC MIN CLS PRI	eP eP eZ eP eP	14 13 21 22 5 6 23 23.5	d c c d d	USCGS: 10.2°S, 164.6°E, 0 = 14 00 54.6. Solomon Islands. h about 33 km.
Sept. 25	MIN	eP	14 36 17.9	c	USCGS: 9.8°S, 164.5°E, 0 = 14 23 47.7. Santa Cruz Islands. h about 33 km.
Sept. 25	BKS MHC MIN CLS PRI	eP eP eZ eP eP	15 02 43.5 45.3 50.5 42.7 47.3	c c c c c	USCGS: 10.1°S, 164.5°E, 0 = 14 50 18.2. Solomon Islands. h about 33 km.
Sept. 26	BKS	eP	04 25 54	c	USCGS: 56.5°N, 153.4°W, 0 = 04 20 21.5. Kodiak Islands. h about 33 km.
		e(s)NE	30 52	SEd	
		e(ScP)NE	32 24		
		eNE	33.0		
Sept. 26	MIN PRI BKS	iP eP iP	25 55.5 26 31 05 35 44.0	c c d	
		iZ	54.3	c	
		iPP	37 24	d	
		eSNE	41 54	SWc	
		e(G)EN	45.0		
		e(R)E	46.0		
	MHC	eP	35 49.7	d	
		e(PP)	37 50.8	c	
	MIN	eP	35 35.5	d	
	CLS	eP	35 38.4	d	
	PRI	eP	36 01.0	d	
		ePP	37 56.0	c	
Sept. 26	MIN	eP	06 08 10.7	c	USCGS: 5.6°S, 148.0°E, 0 = 05 55 09.7. New Britain. h about 156 km.
Sept. 26	MIN	iP	06 46 16.1	c	USCGS: 56.6°N, 153.2°W, 0 = 06 40 43.5. Kodiak Island. h about 33 km.
Sept. 27	MIN	eP	05 37 30.4	c	
Sept. 27	MIN	iP	10 14 00.6	c	USCGS: 10.8°N, 62.2°W, 0 = 10 04 04.7. Trinidad. h about 104 km.
Sept. 27	MIN	eP	11 38 16.3	c	
Sept. 28	MIN	iP	06 45 33.0	c	
Sept. 28	BKS	iP	07 10 14.0	d	USCGS: 31.5°S, 179.6°E, 0 = 06 58 12.7. Kermadec Islands. h about 457 km.
		eNE	20.4		
	MHC	eP	10 14.0	d	

Date	Sta.	Phase	Time (GCT)	Ground Motion	Remarks
1963			h. m. s.		
Sept. 28 (Cont.)	MIN CLS PRI	eP eP eP	17.0 14.3 13.3	d c c	
Sept. 28	MIN	iP	10 05 42.0	d	
Sept. 28	MIN	eP	11 17 00.3	c	USCGS: 39.3°N, 136.0°E, 0 = 11 04 13.6. Sea of Japan. h about 351 km.
Sept. 29	MIN	eP	02 50 31.6	c	
Sept. 29	BKS	ePNE	19 53 44	Nc	
		e(S)E	20 02 20	E	
		eZ	02 32	d	
		eNE	17.6		
		e(R)E	22.0		
Sept. 29	BKS	eP	22 30 10	d	USCGS: 36.1°N, 18.0°E, 0 = 22 16 38.6. Ionian Sea. h about 47 km.
	MHC	eP	30 09.5	d	
	MIN	eP	29 59.1	c	
	CLS	eP	30 08.2	c	
	PRI	eP	15.0	d	
Sept. 29	BKS	eP	22 50 57	c	USCGS: 14.4°N, 91.9°W, 0 = 22 44 02.9. Guatemala. h about 61 km.
		e(S)NE	56 40	NWd	
		e(G)NE	59.5		
		e(R)	23 02.0		
	MHC	eP	22 50 50.8	d	
	MIN	iP	51 06.0	d	
	CLS	eP	50 52.4	d	
	PRI	eP	40.3	d	
Sept. 30	MIN	eP	03 12 39.4	d	USCGS: 14.1°N, 91.9°W, 0 = 03 05 38.1. Near west coast of Guatemala.
Sept. 30	BKS	eP	03 55 52.5	d	USCGS: 7.3°N, 76.9°W, 0 = 03 46 51.3. Colombia. h about 33 km.
		eE	04 14.5		
	MHC	eP	03 55 17.7	d	
	MIN	iP	56.5	d	
	CLS	eP	32.4	c	
	PRI	eP	21.7	c	
Sept. 30	BKS	(e)NE	09 22 16	SEc	USCGS: 38.0°N, 111.0°W, 0 = 09 17 42.2. Southern Utah. h about 33 km.
	MHC	eP	19 49.3	d	
		e(S)	22 06.2	c	
	MIN	eP	19 46.0	c	
	PRI	eP	40.7	d	
		e(S)	21 45.7	d	