

EARTHQUAKES IN NORTHERN CALIFORNIA

AND

THE REGISTRATION OF EARTHQUAKES . .

AT

BERKELEY—MOUNT HAMILTON—PALO ALTO

SAN FRANCISCO—FERNDALE—FRESNO

FROM

April 1, 1939 to June 30, 1939

BY

PERRY BYERLY

AND

PHILLIP M. KLEIN

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CONTENTS



	Page
EARTHQUAKES IN NORTHERN CALIFORNIA	55
THE REGISTRATION OF EARTHQUAKES	60
Symbols and Notations Employed	61
BERKELEY	63
Constants	63
Tabulation of Shocks	64
MOUNT HAMILTON	71
Constants	71
Tabulation of Shocks	72
PALO ALTO	79
Constants	79
Tabulation of Shocks	80
SAN FRANCISCO	86
Constants	86
Tabulation of Shocks	87
FERNDALE	90
Constants	90
Tabulation of Shocks	91
FRESNO	93
Constants	93
Tabulation of Shocks	94

EARTHQUAKE INTENSITY SCALE

Criteria of the Modified Mercalli Scale which were used to rate the intensities of the earthquakes registered were:

Intensity

- II Felt by a few people only. Duration or direction not appreciable.
 - III Duration or direction appreciable.
 - IV Rattling of doors and windows; swinging of suspended objects.
 - V Disturbance of movable objects; plaster cracked.
 - VI Overthrow of movable objects; cracking of chimneys and other brickwork.
 - VII Fall of some chimneys; some damage to buildings.
-

Epicenters located in the following list are plotted on the accompanying map. A number and a letter are given beside each epicenter. The number is that assigned to the earthquake in the list. Only those earthquakes are given numbers for which epicenters were located. The letter represents the excellence with which the epicenter has been located, a indicating excellent, b good, c fair, d poor.

EARTHQUAKES IN NORTHERN CALIFORNIA

(All intensities given on Modified Mercalli Scale)

1939 -- PACIFIC STANDARD TIME

- April 1, 9h 29m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 8 miles northwest of Gonzales. See map, epicenter 1d.
- April 4, 10h, 56m, p.m. Recorded at Berkeley and San Francisco; not reported felt; epicenter about 6 miles north of Danville. See map, epicenter 2d.
- April 5, 10h, 40m, a.m. Recorded at Palo Alto only; not reported felt; focus about 10 miles from Palo Alto station.
- April 6, 1h 43m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco. Intensities:
- IV East Oakland, San Leandro
- I-III Berkeley, Canyon, Oakland.
- Epicenter about 8 miles north of Hayward. See map, epicenter 3a.
- April 7, 5h 39m, a.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 4 miles southeast of Gonzales. See map, epicenter 4b.
- April 7, 2h 57 m, p.m. Recorded at Palo Alto only; not reported felt; focus about 11 miles from Palo Alto station (blast?).
- April 12, 8h 28m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; not reported felt; epicenter about 9 miles east of Niles. See map, epicenter 5d.
- April 22, 4h 36m, p.m. Recorded at Ferndale only; not reported felt; epicenter about 20 miles from Ferndale.
- April 24, 11h 16m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter in Monterey Bay. See map, epicenter 6c.
- April 28, 10h 11m, a.m. Recorded at Berkeley only; not reported felt; focus about 9 miles from University campus.
- April 28, 12h 56m, p.m. Recorded at Palo Alto only; not reported felt; focus about 10 miles from Palo Alto station.

1939 -- P.S.T.

April 28, 2h 34m, p.m. Recorded at Ferndale and poorly at Berkeley, Mount Hamilton, Palo Alto, San Francisco. Intensities:

IV Scotia, Whitlow
I-III Eureka, Ferndale, Upper Mattole.

Epicenter about 30 miles southerly from Ferndale.

May 1, 00h 48m, a.m. Recorded at Mount Hamilton and Palo Alto; not reported felt; epicenter about 8 miles east of Wrights. See map, epicenter 7b.

May 1, 1h 54m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Ferndale. Intensities:

V Capetown

IV Briceland, Cape Mendocino, Dyerville, Eureka, Ferndale, Honey Dew, Petrolia, Scotia, Upper Mattole, Westport

I-III Arcata, Blue Lake, Carlotta, Ethersburg, Garberville.

Epicenter at sea about 20 miles off Punta Gorda. See sub map.

May 2, 10h 48m, a.m. Recorded at Mount Hamilton, Palo Alto, Fresno; IV at Parkfield; epicenter about 6 miles north of Parkfield. See map, epicenter 8d.

May 2, 1h 21m, p.m. Recorded at Palo Alto only; not reported felt; focus about 12 miles from Palo Alto station.

May 9, 10h 17m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 7 miles southwest of Hollister. See map, epicenter 9b.

May 13, 7h 41m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; not reported felt; epicenter about 6 miles west of Priest Valley. See map, epicenter 10b.

May 16, 00h 24m, a.m. Recorded at Berkeley, San Francisco ($\bar{S} - \bar{P} = 6$ sec. at Mineral); IV at Greenville; epicenter about 30 miles east of Mineral.

May 28, 2h 52m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; not reported felt; epicenter about 9 miles east of Castroville. See map, epicenter 11c.

May 30, 6h 05m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; IV at Aptos, Los Gatos, Santa Cruz, Soquel; epicenter about 6 miles south of Wrights. See map, epicenter 12c.

1939 -- P.S.T.

June 7, 7h 14m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; felt at Healdsburg; epicenter about midway between Healdsburg and Jenner. See map, epicenter 13c.

June 12, 6h 42m, p.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 6 miles northeast of Panoche. See map, epicenter 14d.

June 12, 10h 58m, p.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 3 miles north of Idria. See map, epicenter 15c.

June 17, 5h 55m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; not reported felt; epicenter about 17 miles northeast of Mount Hamilton. See map, epicenter 16b.

June 21, 8h 34m, a.m. Recorded at Ferndale only; "felt by a very few near Ferndale;" epicenter about 20 miles from Ferndale. Probably a foreshock of next earthquake.

June 22, 10h 42m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Ferndale. Intensities:

V Upper Mattole

IV Capetown, Ettersburg, Ferndale, Fields Landing, Loleta, Petrolia, Scotia

I-III Cape Mendocino, Eureka, Punta Gorda Light Station.

Epicenter at sea about 6 miles northwest of Punta Gorda. See sub map.

June 23, 9h 28m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno ($\bar{S} - \bar{P} = 2.5$ sec. at Mineral); V at Broke Off Mountain Lookout Station near southeast corner of Lassen National Park, strong in Warner Valley, felt at Manzanita Lake and Mineral; epicenter about 12 miles from Mineral.

June 24, 5h 02m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno. Intensities:

VII Cienega (13 miles south of Hollister), Hollister, Paicines

VI Bitterwater, Spreckels, Tres Pinos

V King City

IV Almaden, Aptos, Aromas, Ben Lomond, Big Basin, Big Sur, Blanco, Boulder Creek, Bradley, Cambria, Carmel, Castroville, Cayucos, Chualar, Coalinga, Creston, Davenport, Gilroy,

1939 -- P.S.T.

Gonzales, Lockwood, Lonoak, Los Banos, Marina, Milpitas, Monterey, Morgan Hill, Moss Landing, Nipomo, Pacific Grove, Pinnacles, Salinas, San Ardo, San Juan, San Lucas, San Miguel, San Simeon, Santa Margarita, Seaside, Soquel, South Dos Palos, Templeton, Tranquillity, Watsonville.

I-III Capitola, Half Moon Bay, Los Gatos, Mendota, Parkfield, San Martin, Santa Cruz, San Francisco, Volta; felt in Paso Robles and Soledad.

Epicenter about 4 miles west of Tres Pinos. See map, epicenter 17b. This epicenter was based primarily on field data collected by D. S. Carder of the U. S. Coast and Geodetic Survey. He found a small area on the San Andreas Fault where damage was a maximum. This epicenter fits the instrumental data if the depth of focus is taken at 30 km. and the first arrivals at Mount Hamilton and Fresno are taken as P* while those at the other stations are taken as P₁.

June 25, 7h 15m, a.m. Recorded at Palo Alto only; not reported felt; focus about 13 miles from Palo Alto station.

June 25, 12h 53m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; I-III at Hollister; an aftershock of earthquake of June 24, 5h 02m, a.m.

June 26, 5h 36m, a.m. Recorded at Mount Hamilton and Palo Alto; IV at San Benito Winery (very near epicenter 17), I-III 9 miles east of Chualar; an aftershock of earthquake of June 24, 5h 02m, a.m.

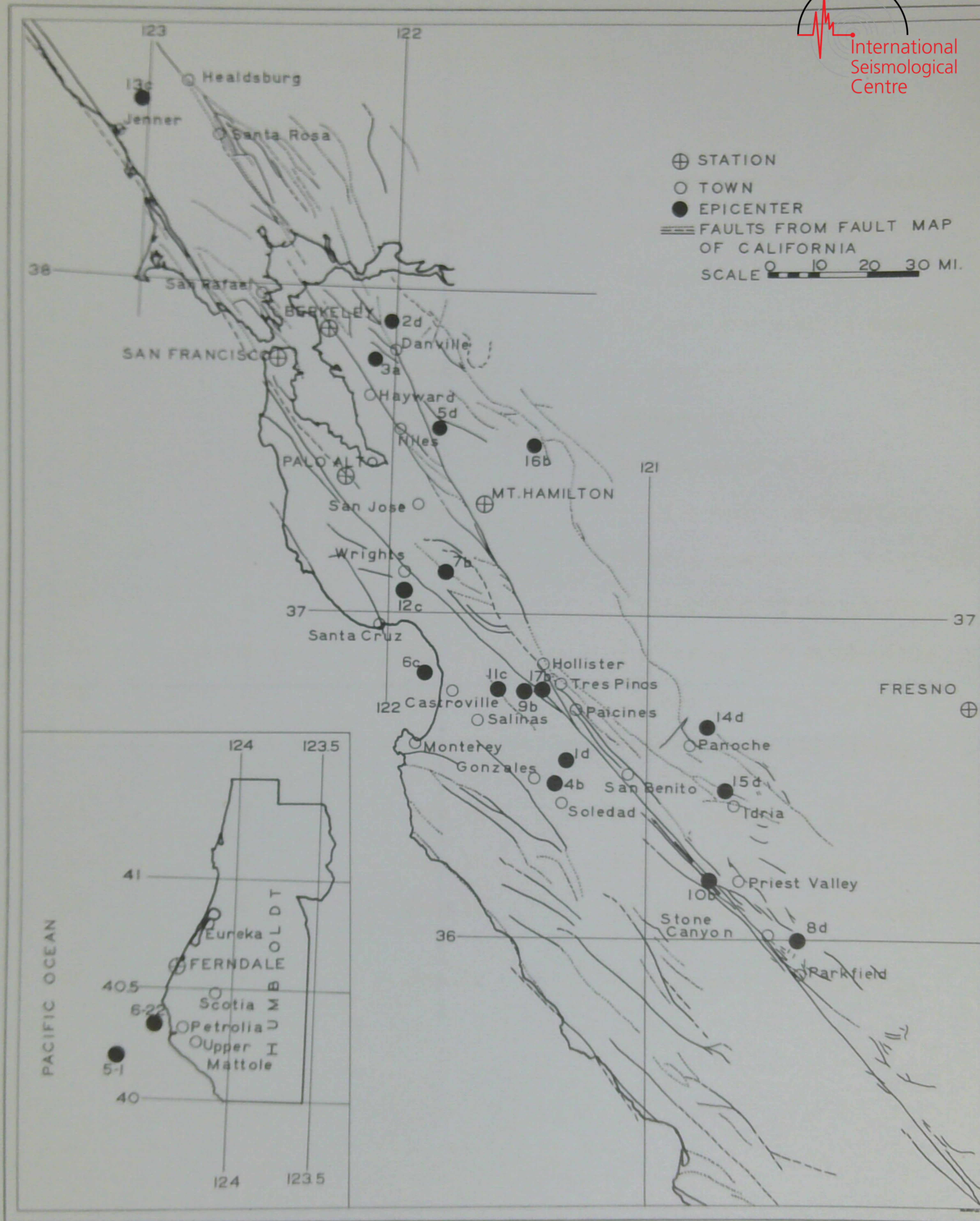
June 26, 10h 12m, p.m. Recorded at Mount Hamilton and Palo Alto; not reported felt; an aftershock of earthquake of June 24, 5h 02m, a.m.

June 28, 8h 52m, a.m. Recorded at Mount Hamilton and Palo Alto; IV at San Benito Winery (very near epicenter 17); an aftershock of earthquake of June 24, 5h 02m, a.m.



SUMMARY OF THE EPICENTERS

No.	Rating	Date	Location
1	d	April 1	8 miles northwest of Gonzales
2	d	April 4	6 miles north of Danville
3	a	April 6	8 miles north of Hayward
4	b	April 7	4 miles southeast of Gonzales
5	d	April 12	9 miles east of Niles
6	c	April 24	Monterey Bay
7	b	May 1	8 miles east of Wrights
8	d	May 2	6 miles north of Parkfield
9	b	May 9	7 miles southwest of Hollister
10	b	May 13	6 miles west of Priest Valley
11	c	May 28	9 miles east of Castroville
12	c	May 30	6 miles south of Wrights
13	c	June 7	Midway between Healdsburg and Jenner
14	d	June 12	6 miles northeast of Panoche
15	c	June 12	3 miles north of Idria
16	b	June 17	17 miles northeast of Mount Hamilton
17	b	June 24	4 miles west of Tres Pinos



MAP SHOWING EPICENTERS, APRIL 1, 1939 TO JUNE 30, 1939



THE REGISTRATION OF EARTHQUAKES

SYMBOLS AND NOTATIONS EMPLOYED

1. Character of the Earthquake--

	I. Perceptible.	II. Moderately Strong.	III. Strong
d (terrae motus domesticus)	Local shock (origin less than 100 kilometers distant).		
v (terrae motus vicinus)	Near shock (origin from 100 to 1,000 kilometers distant).		
r (terrae motus remotus)	Distant shock (origin from 1,000 to 5,000 kilometers distant).		
u (terrae motus ultimus)	Very distant shock or teleseism (origin more than 5,000 kilometers distant).		

2. Phases of the Seismogram--

P (undae primae)	Normal first phase, or first preliminary tremors (longitudinal).
P'	First preliminary tremors which have penetrated the core of the earth.
PR _n	Waves n times reflected at the earth's surface.
S (undae secundae)	Second phase, or second preliminary tremors (transverse).
SR _n	Waves n times reflected at the earth's surface.
PS	Waves changed from longitudinal to transverse oscillation or vice versa through reflection at the earth's surface.
PPS	Waves twice reflected at the earth's surface, having been longitudinal on two branches of the path and transverse on one branch.

In general a bar over two letters denoting types of waves indicates refraction. The subscript _c denotes the boundary at about 2900 km. depth between the core and the middle shell which surrounds it. Thus:

$\overline{S_c P_c S}$	Waves which have penetrated the core, having been transverse before entering and after leaving the core, and longitudinal within the core.
$\overline{P_c P_c} \overline{P_c P}$	Waves refracted at the core boundary into the core, reflected once at this boundary while within the core and again refracted out of the core, having remained longitudinal on all branches of the path.
L (undae longae)	Long waves of surface phase preceding M.
M (undae maximae)	Shorter and more regular waves of large amplitude in the surface phase.
M _n	Greatest motion in the surface phase.
C (coda)	Tail or end portion.
F (finis)	End of discernible movement.

For local earthquakes a special notation is used:

\overline{P}	The longitudinal wave which has traveled its whole path in the surface layer or crust of the earth.
\overline{S}	The transverse wave which has traveled its whole path in the surface layer of the earth.
P*	The longitudinal wave which has traveled the horizontal portion of its path in the intermediate layer.
S*	The corresponding transverse wave.



3. Nature of the Motion--

i (impetus)	Sudden beginning of the motion.
e (emersio)	Gradual beginning of the motion.
T (period)	Time of one complete oscillation.
A	Trace amplitude measured from the media line, + earth motion toward east, north, or zenith, - toward west, south, or nadir.
A _E	E-W component of A.
A _N	N-S component of A.
A _Z	Vertical component of A.

4. Time--

O (origin)	Time of shock at point of origin.
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BERKELEY

THE BERKELEY STATION, UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

 CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

$$\begin{aligned}\varphi &= 37^{\circ} 52!3 \text{ N.} \\ \lambda &= 122^{\circ} 15!6 \text{ W.}\end{aligned}$$

Time.--All determinations are reduced to Universal Time.

Altitude.--81 meters (266 feet) above mean sea level.

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	V		T_0	ϵ	$\frac{r}{T_0^2}$	
Bosch-Omori 100 kg. ...	E	45		12	10	0.001	
	N	45		12	10	0.001	
Wiechert 80 kg.	Z	44		4	5	0.005	
Wood-Anderson	E	3,000		0.9	15		
	N	3,000		0.9	15		
Galitzin		K	T	T_1	μ^2	A_1 (cm)	l (cm)
	E	112	12	11.8	0.00	100	11.3
	N	122	12	12.4	0.03	100	11.2
	Z	109	12	11.9	0.01	130	14.9
Benioff	Z	V		Coupled Period		ϵ	
				0.7		5	

The letter G before a reading designates that the seismogram was from the Galitzin instrument; W, Wiechert; B, Bosch-Omori; A, Wood-Anderson; H, Benioff.

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
	1939			h. m. s.	s.	mm.	mm.	mm.	
1	Apr. 2	Iv	ePN ePZ F	A 05 29 22.0 H 05 29 25.0 05 31.7					See discussion, p. 55
2	Apr. 4	I	eENZ F	G 10 50.7 11 01.0					Trace of distant shock
3	Apr. 5	Id	iPZ iZ iZ iSEN F	H 06 57 17.1 H 06 57 17.4 H 06 57 18.7 A 06 57 19.5	0.2		+3.5		See discussion, p. 55
4	Apr. 5	IIu	iPNZ ePE ePENZ eSNZ eZ eSEN eLE F	G 16 55 22 G 16 55 23 A&Z 16 55 26.0 G 17 05 35 G 17 06 09 A 17 06 51 A 17 23.2 18.0	9.0 9.0 30		-4 -4	J.S.A. epicenter: 20°0 S., 168°8 E.	
5	Apr. 6	Id	iPN iPZ iPE iSN F	A 21 43 19.7 H 21 43 19.8 A 21 43 20.0 A 21 43 22.3 21 45.2	0.3 0.2		+3 +10	See discussion, p. 55	
6	Apr. 12	Id	iNZ iN iN F	A&H 16 28 23.4 A 16 28 31.9 A 16 28 33.1 16 29.1				See discussion, p. 55	
7	Apr. 15	I	eENZ F	G 21 01 21.5				Trace of distant shock	
8	Apr. 17	I	iz F	H 02 37 47.9 02 39					
9	Apr. 18	IIu	iPZ iPZ iPE ePN iRN iPPZ eSN eLN F	G 06 34 53 H 06 34 53.8 G 06 34 54 A 06 34 54.3 G 06 34 55 G 06 38 15 A 06 45 10 A 07 01 08.0	6 2.5 8 10	-3	+5 +2 +3	U.S.C. & G.S. epicenter 27° S., 71° W. J.S.A. epicenter: 25°8 S., 75°2 W. Damage in Chile	

BERKELEY

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
	1939			h. m. s.	s.	mm.	mm.	mm.	
10	Apr. 20	I	eENZ F	G 22 58.5 23.7					Trace of distant shock
11	Apr. 21	Iu	iPz iPz ePN ipPz ipPz iSENZ F	G 04 39 13 H 04 39 13.7 A 04 39 14.2 G 04 41 05 H 04 41 06 G 04 47 33 05 11	6 5 & 10			+4 -3 -8	U.S.C. & G.S. epicenter 50° N., 140° E.
12	Apr. 23	Iu	iE eZ eEN eZ F	G 16 47 47 G 17 13.8 G 17 14.5 G 17 16.5 18.0					U.S.C. & G.S. epicenter 1° S., 17° W. J.S.A. epicenter: 0°1 N., 18°0 W.
13	Apr. 25	Iv	iPz ePN iz F	H 07 16 26.9 A 07 16 27.1 H 07 16 29.7 07 17					See discussion, p. 55
14	Apr. 28	Id	iPNZ iz iSN iMN F	A&H 18 10 52.2 H 18 10 53.3 A 18 10 54.0 A 18 10 57.1 18 11.5					See discussion, p. 56
15	Apr. 28	Iv	iPz eN iSN F	H 22 00 52 A 22 00 55 A 22 01 38 22 03					Nevada
16	Apr. 28	Iv	eN F	A 22 34 46.3 22 36.5					See discussion, p. 56
17	Apr. 30	IIIu	ePNZ ePz ePN eSN eGN eLN F	G 03 08 10 H 03 08 15.1 A 03 08 16 A 03 18 49 A 03 31.9 A 03 33.0 08.0					U.S.C. & G.S. epicenter: 11° S., 158° E.
18	May 1	Iv	ePNZ iENZ F	G 06 10 02 G 06 11 39 07.5					Felt at San Diego, Calif Probably S

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
				h. m. s.	s.	mm.	mm.	mm.		
19	May 1	Id	eP* _Z	H 08 48 38.2						See discussion, p. 56
			iS* _N	A 08 48 49.0						
			iS _Z	H 08 48 49.5						
			F	08 51.4						
20	May 1	Iv	eEN	G 23 56 30						Probably P
			iENZ	G 23 58 10						
			F	00 11						
21	May 2	IIu	ePENZ	G 13 17 30	14 & 10		-5	-6		U.S.C. & G.S. epicenter 29°5 N., 113°8 W. J.S.A. epicenter: 29°4 N., 113°5 W.
			ePNZ	A&H 13 17 33						
			eGN	A 13 19.7						
			eLEN	A 13 20.4						
			F	14 16						
22	May 4	Iv	eEN	G 00 02 22						Pasadena epicenter near 32° N., 117° W.
			eZ	G 00 03 12						
			F	00 18						
23	May 4	Iv	eN	A 20 47.9						Felt at Boulder Dam
			F	20 49						
24	May 6	IIu	ePN	G 06 08 35	6				+2	U.S.C. & G.S. epicenter 5°0 N., 84°0 W. J.S.A. epicenter: 7°5 N., 84°5 W.
			iz	G 06 08 46						
			iSEN	G 06 15 44						
			ie	G 06 15 50						
			eN	G 06 24.3						
			F	07.5						
25	May 6	I	eENZ	G 17 30.3						Distant ?
			F	18.2						
26	May 6	Iu	eEN	G 20 27 36	10					Japan
			eENZ	G 20 47.3						
			F	21.0						
27	May 8	IIu	ePZ	G 01 58 27						U.S.C. & G.S. epicenter 37° N., 24° W. J.S.A. epicenter: 36°4 N., 24°3 W Felt at Azores Islands
			ePEN	G 01 58 28						
			iPZ	H 01 58 29.3						
			ePN	A 01 58 30						
			F	03.0						
28	May 8	Iv	ePZ	H 02 49 03						Felt at Maricopa, Calif.
			ePN	A 02 49 05						
			F	02 54						

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
						mm.	mm.	mm.	
	1939			h. m. s.	s.				
29	May 9	Iu	ePENZ eEN eENZ F	G 07 34.3 G 07 39 G 07 42 09.0					J.S.A. epicenter: 51°0 N., 152°5 W.
30	May 9	Iv	ePN iPz F	A 18 17 06.3 H 18 17 06.8 18 17.8					See discussion, p. 56
31	May 10	IIr	ePz ePN iPz iPENZ eSEN eNZ eMz F	G 07 52 02 A 07 52 03 H 07 52 04.0 G 07 52 09 G 07 58 18 G 08 03.3 G 08 07.3 10.0	2		+1		U.S.C. & G.S. epicenter 51° N., 179°W. J.S.A. epicenter: 51°0 N., 177°2 W.
32	May 11	Iv	eN iNZ F	A 02 43 59 A&H 02 44 53 02 47					Nevada according to Pasadena
33	May 11	Iv	iPz ePN ePN iz iN iSENZ iSEN F	G&H 18 05 41.0 A 18 05 42 G 18 05 43 H 18 05 48.3 A 18 05 51 G 18 06 31 A 18 06 35 18 19					Epicenter about half way between Mina and Blair Junction, Nevada Felt slightly in follow- ing California towns: Benton, Bishop, Bodie, Bridgeport, Mono Lake, Topaz, Yosemite
34	May 11	Iv	ePN iPz iENZ iSNZ F	A 21 00 32 H 21 00 33 G 21 01.3 A&H 21 01 21.6 21 11					Aftershock of No. 33
35	May 13	Iv	ePNZ ePz eN iSN iSENZ F	A&H 02 50 11 G 02 50 12 G 02 50 45 A 02 50 56 G 02 50 58 02 56					Aftershock of No. 33
36	May 13	Iv	iPnNZ eN F	A&H 15 41 48.5 A 15 42 28 15 46					See discussion, p. 56

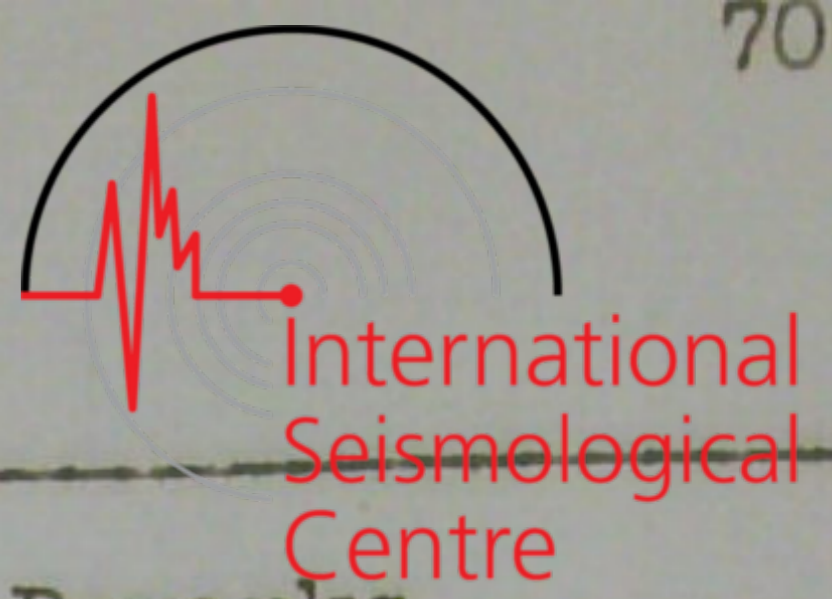
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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
						mm.	mm.	mm.		
37	May 14	I	ePz	G	18 25 33				Distant	
			eSN	G	18 35 53					
			eNZ	G	18 36.3					
			eLEN	G	18 53					
			F		19.5					
38	May 16	I	eEN	G	08 06				Trace of distant shock	
			F		09.0					
39	May 16	Iv	iPz	H	08 24 20				See discussion, p. 56	
			eSN	A	08 24 51					
			iz	H	08 24 52.6					
			F		08 26.2					
40	May 16	I	eEN	G	15 04				Trace of distant shock	
			F		15 11					
41	May 17	I	eEN	G	00 01				Trace of distant shock	
			F		01.5					
42	May 17	I	eEN	G	15 50				Trace of distant shock Lost in record change	
			F							
43	May 17	Iv	ePNZ	A&H	18 19 52				Epicenter near Mina, Nevada according to Pasadena	
			iSN	A	18 20 36					
			iN	A	18 20 37.8					
			iSEnz	G	18 20 38					
			F		18 25					
44	May 17	Iu	iPENz	G	18 42 40				J.S.A. epicenter: 29°0 N., 143°5 E.	
			iz	H	18 43 50					
			eN	A	18 43 54					
			iSN	A	18 52 40					
			eNZ	G	19 06.2					
			eLN	A	19 07.2					
			eENZ	G	19 09.1					
			F		20.0					
45	May 21	Iu	eNZ	A&H	20 33 11				Probably P Distant	
			F		20 34					
46	May 26	I	eE	G	18 14 32				Distant	
			eN	G	18 14 34					
			iz	G	18 16 18					
			eE	G	18 22 22					
			eENZ	G	18 35.2					
			eLEN	G	18 37.2					
			F		20.0					

BERKELEY

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				AE	AN	AZ	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1939										
47	May 28	Iv	iPz iPN iSNZ F	H A A&H 22	52 52 52 54.5	28 29.1 44.4 5					See discussion, p. 56
48	May 31	Id	ePNZ iN iSNZ F	A&H A A&H 02	05 05 05 07	46.8 49.9 58.3 7	0.2		-.1		See discussion, p. 56
49	June 2	I	eZ iE eN eN eLE eZ F	G G G G G G 06.0	03 03 04 04 04 04 06.0	27 46 56 10.4 20.4 56 0					Distant
50	June 4	I	ePZ eEN eEZ F	G G G 13.5	12 12 12 13.5	09 30.4 37.9 5					Probably L
51	June 7	Iv	iPZ ePN iSZ iSN F	H A H A 15	14 14 14 14 16	37.7 37.9 50.9 51.4 6					See discussion, p. 57
52	June 8	IIu	iPNZ iPZ iPN ipPZ iSENZ iSN eE F	G H A H G A G 23.5	20 20 20 20 21 21 21 23.5	58 58 58 58 07 07 17.8 5	6 3 10			-2 -4 -3	U.S.C. & G.S. epicenter 15° S., 173° W.
53	June 9	Iu	eE eENZ F	G G 01.5	00 00 01.5	30 33 21 5					J.S.A. epicenter: 15°1 N., 97°7 W.
54	June 12	IIu	iPZ iSN eSc SEN eLEN F	G G G G 0	04 04 04 04 06	14 21 25 29.9 16	7 10		+3	+1	U.S.C. & G.S. epicenter 21°8 N., 66°0 W. J.S.A. epicenter: 20°1 N., 67°6 W.



BERKELEY

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						AE	AN	AZ		
				h. m. s.	s.	mm.	mm.	mm.		
55	June 13	Iv	ePNZ	A&H 17 16 39.4						Near Beatty, Nevada
			ePE	G 17 16 44						
			eN	G 17 16 50						
			eSNZ	G 17 17 25						
			iN	G 17 17 40						
			iz	G 17 18 25						
			F	17 25						
56	June 17	Ia	iPZ	H 13 55 16.8						See discussion, p. 57
			iPN	A 13 55 17.0						
			F	13 55.8						
57	June 22	Iv	ePNZ	A&H 18 42 22						See discussion, p. 57
			F	18 46						
58	June 23	Iv	ePN	A 17 28 34						See discussion, p. 57
			eSN	17 29 03						
			F	17 30.6						
59	June 24	I	ePZ	G 00 00 13						Distant ?
			eEN	G 00 04.2						
			F	00.8						
60	June 24	Iv	iPZ	G 13 02 15	6	5 & 8	+5	+4	-3	See discussion, p. 57
			iPEN	G 13 02 15.5						
			iPZ	H 13 02 16.4						
			iPN	A 13 02 16.8						
			iz	H 13 02 18.0						
			iN	G 13 02 39						
			F	13.5						
61	June 24	Iv	eN	A 16 29 29						Aftershock of No. 60
			eEN	G 16 30 05						
			eZ	G 16 31 03						
			F	16 40						
62	June 25	Iv	iPZ	H 20 53 25.8						See discussion, p. 58
			eN	A 20 53 28.5						
			iN	A 20 53 43.8						
			F	20 54.3						
63	June 27	Iu	ePPZ	G 23 22 26						U.S.C. & G.S. epicenter 8° N., 128° E. J.S.A. epicenter: 7:8 N., 126:3 E.
			eN	G 23 28.6						
			eSKSE	G 23 30.0						
			eZ	G 23 45.6						
			eM _N	G 23 52.6						
			F	00.5						



MOUNT HAMILTON

THE LICK OBSERVATORY STATION, UNIVERSITY OF CALIFORNIA
MOUNT HAMILTON, CALIFORNIA

CONSTANTS

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Latitude and longitude:

$$\begin{aligned} \phi &= 37^\circ 20'4 \text{ N.} \\ \lambda &= 121^\circ 38'6 \text{ W.} \end{aligned}$$

Time--All determinations are reduced to Universal Time.

Altitude.--1281.7 meters (4205 feet) above mean sea level.

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	V	T ₀	ε
Wood-Anderson	E	3000	1	15
	N	3000	1	15

MT. HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
1	Apr. 2	Id	e \bar{P} N	05 29 12.1					See discussion, p. 55
			e \bar{P} E	05 29 12.8					
			e \bar{S} N	05 29 23.6					
			e \bar{S} E	05 29 23.8					
			F	05 30.0					
2	Apr. 5	Iu	ePE	16 55 26.9	25				Distant shock N-S component failed
			eSE	17 05 52					
			eLE	17 22.8					
			F	17 40					
3	Apr. 6	Id	e \bar{P} EN	21 43 27.4		-<.1	-<.1		See discussion, p. 55
			i \bar{S} N	21 43 34.7					
			iN	21 43 36.3					
			iE	21 43 40.5					
			iN	21 43 40.7					
			iN	21 43 42.7					
			F	21 45.2					
4	Apr. 7	Iv	i \bar{P} N	13 39 36.9	0.4		-<.1		See discussion, p. 55
			e \bar{P} E	13 39 37.3					
			iS*E	13 39 48.3					
			i \bar{E}	13 39 48.9					
			i \bar{S} N	13 39 49.7					
			F	13 40.9					
5	Apr. 12	Id	i \bar{P} NE	16 28 18.3	.4	-<.1	+<.1		See discussion, p. 55
			i \bar{E}	16 28 21.7					
			i \bar{S} N	16 28 22.3					
			iN	16 28 23.2					
			F	16 29.1					
6	Apr. 18	IIu	ePN	06 34 50.2	20				U.S.C. & G.S. epicenter 27° S., 71° W. J.S.A. epicenter: 25°8 S., 75°2 W. G ?
			ePE	06 34 51.4					
			eSE	06 44 50					
			eSN	06 44 53					
			eN	07 00					
			eLN	07 02.6					
			F	08.0					
7	Apr. 16	I	eN	22 51 13					
			eEN	22 51 18					
			F	22 51.6					

MT. HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						AE	AN	AZ		
				h. m. s.	s.	mm.	mm.	mm.		
8	Apr. 22	Ir	ePEN	04 39 17.5						
			eSN	04 47 39						
			eSE	04 47 42						
			F	04 50						
9	Apr. 25	Id	ePN	07 16 15.2						See discussion, p. 55
			ePE	07 16 15.3						
			iSN	07 16 22.7						
			iSE	07 16 22.8						
			F	07 17.6						
10	Apr. 28	Iv	ePN	22 00 43						Nevada
			eEN	22 00 49.3						
			iSE	22 01 34.4						
			iSN	22 01 36.6						
			F	22 03						
11	Apr. 28	Iv	ePE	14 34 39.8						See discussion, p. 56
			eN	14 34 55.8						
			F	14 36.7						
12	Apr. 30	IIIu	ePN	03 08 20.5	23					U.S.C. & G.S. epicenter 11°S., 158° E.
			iN	03 09 12						
			eSEN	03 18 44						
			eGN	03 32.2						
			eLN	03 33.7						
			F	06.0						
13	May 1	Iu	ePEN	06 10 01						U.S.C. & G.S. epicenter 40° N., 139° E. J.S.A. epicenter: 39°4N., 139° E.
			eSEN	06 19 33						
			F	06 30						
14	May 1	Id	ePE	08 48 28.5						See discussion, p. 56
			ePN	08 48 28.7						
			iSN	08 48 32						
			iSE	08 48 32.6						
			iE	08 48 35.1						
			F	08 49.2						
15	May 1	Iv	ePN	21 54 31.9						See discussion, p. 56
			ePE	21 54 32.5						
			F	21 58						
16	May 1	Iv	eN	23 54 52						Off the coast of Lower California according to Pasadena
			eE	23 54 55						
			F	00 12						



MT. HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
				h. m. s.	s.	mm.	mm.	mm.	
17	May 2	IIu	ePN	13 17 24.9	35 20 12	10			U.S.C. & G.S. epicenter: 29°5 N., 113°8 W. J.S.A. epicenter: 29°4 N., 113°5 W.
			ePE	13 17 26.6					
			eGE	13 19 38					
			eLE	13 20.2					
			ME	13 22 03					
18	May 2	Iv	ePN	18 49 56.8					See discussion, p. 56
			ePE	18 49 58.3					
			eN	18 49 59.8					
			iN	18 50 16.8					
			iSN	18 50 32.3					
			F	18 53.7					
19	May 4	Iv	eE	00 00 34.7					Felt in San Diego, Calif.
			eN	00 00 35					
			F	00 16					
20	May 4	Iv	ePE	20 46 33					Felt at Boulder Dam.
			ePN	20 46 33.1					
			eSE	20 47 47.1					
			eN	20 47 50					
			F	20 50					
21	May 8	Iu	ePN	01 58 28.0					U.S.C. & G.S. epicenter: 37° N., 24° W. J.S.A. epicenter: 36°4 N., 24°3 W. Felt on Azores Islands
			ePE	01 58 28.5					
			eLN	02 23.5					
			F	03 47					
22	May 8	Iv	ePN	02 48 55.0					Felt at Maricopa, Calif.
			ePE	02 48 55.5					
			iE	02 49 35.3					
			eSN	02 49 42.7					
			F	02 52.5					
23	May 9	Iv	e ⁻ PN	18 16 54.4					See discussion, p. 56
			i ⁻ SN	18 17 03.0					
			F	18 17.8					
24	May 10	Iu	ePE	07 52 10.4					U.S.C. & G.S. epicenter: 51° N., 179° W. J.S.A. epicenter: 51°0 N., 177°2 W.
			ePN	07 52 11					
			eSEN	07 58 28					
			eLE	07 06.8					
			F	08 46					



MT. HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
				h. m. s.	s.	mm.	mm.	mm.	
25	May 11	Iv	ePE	02 43 52.1					Nevada, according to Pasadena.
			eN	02 43 57.7					
			iSN	02 44 34.1					
			iN	02 44 43.9					
			F	02 47					
26	May 11	Iv	ePE	18 05 36.0					See Berkeley report.
			ePN	18 05 36.8					
			iN	18 05 43.5					
			iE	18 05 45.5					
			iEN	18 06 23					
			F	18 17					
27	May 11	Iv	ePE	21 00 26.2					Aftershock of No. 26.
			ePN	21 00 27.3					
			iSE	21 01 08.0					
			iSN	21 01 10.3					
			F	21 05					
28	May 12	Iv	ePN	06 42 54					Aftershock of No. 26.
			iN	06 43 28.8					
			iE	06 43 30.7					
29	May 12	Iv	ePE	07 50 21.0					Aftershock of No. 26.
			ePN	07 50 22.5					
			iSN	07 51 02.0					
			iSE	07 51 03.0					
			F	07 53					
30	May 13	Iv	ePE	02 50 01.5					Aftershock of No. 26. N-S component failed.
			iE	02 50 06.5					
			iSE	02 50 44.5					
			F	02 56					
31	May 13	Iv	ePnE	15 41 39.0					See discussion, p. 56
			ePnN	15 41 39.5					
			eSnE	15 42 57.0					
			F	15 45					
32	May 17	Iv	iPN	03 42 53.8					Epicenter near Laws according to Pasadena.
			ePE	03 42 54					
			iSnN	03 43 24.2					
			iS*E	03 43 29.2					
			F	03 44.2					



MT. HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
				h. m. s.	s.	mm.	mm.	mm.	
33	May 17	Iv	ePE	18 19 44.9					Epicenter near Mina, Nevada according to Pasadena.
			ePN	18 19 45.9					
			iSN	18 20 25.7					
			iSE	18 20 26.2					
			F	18 25					
34	May 17	Iu	ePEN	18 42 44					J.S.A. epicenter: 29°0 N., 143°5 E.
			eSN	18 52 46					
			F	19 21					
35	May 21	Iv	eP?EN	12 00 15.5					Epicenter near Laws according to Pasadena.
			F	12 01					
36	May 28	Id	iPEN	22 52 17.1	.3			-4.1	See discussion, p. 56
			iSE	22 52 24.1					
			iSN	22 52 26.1					
			F	22 55					
37	May 31	Id	iPEN	02 05 38.7					See discussion, p. 56
			iSEN	02 05 43.7					
			F	02 06.8					
38	June 7	Iv	ePE	15 14 50.6					See discussion, p. 57
			F	15 15.7					
39	June 8	Iu	ePEN	20 58 12.6				+4.1	U.S.C. & G.S. epicenter 15° S., 173° W.
			eSE	21 08 29					
			eSN	21 08 30					
			F	21 11					
40	June 12	Iv	ePN	18 06 19.7					North end of Death Valley according to Pasadena.
			iSEN	18 07 08.7					
			iE	18 07 09.2					
			F	18 08					
41	June 12	Iv	ePE	18 09 40.7					Same as preceding.
			iSEN	18 10 30.1					
			iE	18 10 32.2					
			F	18 12					
42	June 12	Iv	ePEN	18 25 54.2					Same as preceding.
			iSEN	18 26 42.7					
			F	18 28					



MT. HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
1939				h. m. s.	s.	mm.	mm.	mm.	
43	June 13	Iv	e \bar{P} N e \bar{P} E i \bar{S} N i \bar{S} E F	02 42 18 02 42 19 02 42 32 02 42 32.3 02 44					See discussion, p. 57
44	June 13	Iv	e \bar{P} EN i \bar{S} E F	06 58 50.9 06 59 06.1 07 00					See discussion, p. 57
45	June 13	Iv	ePN eE iN iN F	17 16 28 17 16 32.7 17 17 22 17 17 27 17 21					Near Beatty, Nevada
46	June 17	Id	i \bar{P} EN i \bar{S} E F	13 55 07.4 13 55 10.6 13 56.2		+3	+3		See discussion, p. 57
47	June 21	Iv	ePN ePE iSN iSN F	11 29 30.3 11 29 30.5 11 30 10.0 11 30 14.8 11 32.7					Nevada.
48	June 22	Iv	ePnEN F	18 42 32.1 18 45.1					See discussion, p. 57
49	June 23	Iv	ePEN F	17 28 39 17 31					See discussion, p. 57
50	June 24	IIv	iP* iP*E iP*N iS N F	13 02 07.4 13 02 07.6 13 02 15.6 13 18	0.3 0.4	+10	-0.3		
51	June 24	Iv	ePN ePE F	16 29 09.4 16 29 12.2 16 44					Lower California.
52	June 25	Iv	ePN iSEN F	20 53 14.1 20 53 22.5 20 54.3					See discussion, p. 58

MT. HAMILTON

No.	Date	Char- acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
	1939			h. m. s.	s.	mm.	mm.	mm.	
53	June 26	Iv	ePN iEN F	13 36 12.9 13 36 21.9 13 37.2					See discussion, p. 58
54	June 27	Iv	ePN iN F	02 11 55.4 02 12 03.8 02 12.6					See discussion, p. 58
55	June 28	Iv	ePEN iSEN	16 52 36 16 52 45.4					See discussion, p. 58 Very weak beginning.

PALO ALTO

THE BRANNER STATION, STANFORD UNIVERSITY
PALO ALTO, CALIFORNIA

CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

$$\begin{aligned} \varphi &= 37^{\circ} 25' 1'' \text{ N.} \\ \lambda &= 122^{\circ} 10' 8'' \text{ W.} \end{aligned}$$

Time.--All determinations are reduced to Universal Time.

Altitude.-- 83 meters (272 feet) above mean sea level.

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	V	T ₀	ε
Wood-Anderson	E	3000	1	15
	N	3000	1	15

PALO ALTO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
1	Apr. 2	Iv	ePnEN	05 29 17.1					See discussion, p. 55
			iSnE	05 29 32.7					
			eSN	05 29 35.3					
			F	05 30.3					
2	Apr. 5	II	ePE	16 55 25.3	0.3			Probably distant.	
			ePN	16 55 26.3					
			eSN	17 05.9					
			eE	17 16.9					
			eLN	17 19.4					
			F	18.0					
3	Apr. 5	Id	ePE	18 40 32.6				See discussion, p. 55	
			iPN	18 40 32.7					
			iEN	18 40 33.9					
			iSN	18 40 34.7					
			F	18 41 24					
4	Apr. 6	IIId	iPEN	21 43 23.5	0.2		+.5	See discussion, p. 55	
			iN	21 43 25.5					
			iE	21 43 25.8					
			iN	21 43 31					
			ME	21 43 33.7					
			F	21 45.5					
5	Apr. 7	Iv	ePEN	13 39 42.0				See discussion, p. 55	
			iEN	13 39 56.8					
			iSN	13 39 58.0					
			iE	13 39 59.5					
			F	13 41.1					
6	Apr. 7	Id	iPEN	22 57 28.5				See discussion, p. 55	
			iN	22 57 29.7					
			iE	22 57 30.2					
			iSEN	22 57 30.8					
			F	22 57 53					
7	Apr. 12	Id	ePN	16 28 19.3				See discussion, p. 55	
			iSE	16 28 23.1					
			iSN	16 28 23.5					
			F	16 28.7					
8	Apr. 16	I	eEN	22 51 19.4				Appears to be "domestic" but not well recorded at other stations.	
			iN	22 51 29.4					
			iEN	22 51 32.4					
			F	22 52.0					

PALO ALTO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1939				h. m. s.	s.	mm.	mm.	mm.	
9	Apr. 18	IIu	ePE	06 34 54	2.0				U.S.C. & G.S. epicenter: 27° S., 71° W. J.S.A. epicenter: 25°8' S., 75°2' W.
			ePN	06 34 55					
			eSEN	06 44 59					
			eLEN	07 01.7					
			F	08 21					
10	Apr. 21	IIu	ePE	04 39 15.6	1.5				U.S.C. & G.S. epicenter: 50° N., 140° E. J.S.A. epicenter: 48°6' N., 138°0' E.
			ePN	04 39 16.7					
			eSEN	04 47 38.9					
			F	04 50.5					
11	Apr. 25	Id	ePE	07 16 17.6					See discussion, p. 55
			ePN	07 16 17.7					
			iSE	07 16 26.0					
			iN	07 16 29.0					
			iE	07 16 29.1					
			F	07 17.2					
12	Apr. 28	Id	iPEN	20 55 44.0					See discussion, p. 55
			iSEN	20 55 46.0					
			F	20 56.1					
13	Apr. 28	Iv	ePN	22 00 52.5	1.2		+1		Nevada
			ePE	22 00 53					
			eE	22 01 11					
			eSN	22 01 42					
			F	22 04					
14	Apr. 28	Iv	eE	22 34 53.5					See discussion, p. 56
			eN	22 34 55.0					
			F	22 37					
15	Apr. 30	IIu	ePEN	03 08.1					U.S.C. & G.S. epicenter: 11° S., 158° E.
			eSE	03 18 47					
			eSN	03 19.1					
			eGN	03 31.6					
			eLN	03 35.1					
			eLE	03 36.6					
F	05.0								
16	May 1	Iu	eEN	06 10 47					Very poor record. U.S.C. & G.S. epicenter: 40° N., 139° E. J.S.A. epicenter: 39°4' N., 139° E.
			F	06 27					

PALO ALTO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
17	May 1	Id	e \bar{P} N	08 48 31.4					See discussion, p. 56
			e \bar{P} E	08 48 31.7					
			i \bar{E}	08 48 35.9					
			i \bar{N}	08 48 36.2					
			i \bar{S} E	08 48 37.1					
			i \bar{S} N	08 48 37.6					
			F	08 49.1					
18	May 1	Iv	e \bar{P} EN	21 54 26.8					See discussion, p. 56
			i \bar{E}	21 55 10.7					
			i \bar{E} N	21 55 11.9					
			F	21 57.7					
19	May 1	Iv	e \bar{E}	23 54 50					Off the coast of Lower California according to Pasadena.
			e \bar{N}	23 54 53					
			F	00 07					
20	May 2	IIu	e \bar{N}	13 17 31					G ? L ? U.S.C. & G.S. epicenter 29°5 N., 113°8 W. J.S.A. epicenter: 29°4 N., 113°5 W.
			e \bar{E}	13 17 32.3					
			e \bar{E} N	13 19.7					
			e \bar{E} N	13 20.5					
			F	15.1					
21	May 2	Iv	e \bar{P} EN	18 50 01.2					See discussion, p. 56
			e \bar{N}	18 50 04.5					
			i \bar{E}	18 50 32					
			i \bar{S} N	18 50 35					
			i \bar{N}	18 50 48					
			F	18 52.4					
22	May 4	I	e \bar{E} N	00 01.2					Trace of distant shock?
			F	00 12					
23	May 8	Iu	e \bar{E} N	01 58.5					U.S.C. & G.S. epicenter 37° N., 24° W. J.S.A. epicenter: 36°4 N., 24°3 W.
			F	02 03					
24	May 9	Id	e \bar{P} EN	18 16 59.2					See discussion, p. 56
			i \bar{S} E	18 17 11.3					
			i \bar{N}	18 17 12.8					
			F	18 17.3					



PALO ALTO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
						mm.	mm.	mm.		
						h. m. s.	s.			
35	May 10	Iu	ePE	07 52 07					U.S.C. & G.S. epicenter 51° N., 179° W. J.S.A. epicenter: 51° N., 177°2 W.	
			ePN	07 52 14						
			eSE	07 58 20						
			eGN	08 01.8						
			eLN	08 04						
			eLE	08 05.8						
			F	08.4						
26	May 11	IIv	ePN	18 05 44.6					See Berkeley report.	
			ePE	18 05 45.1						
			iN	18 05 56.1						
			iN	18 06 27.6						
			iSN	18 06 37.6						
			F	18 15						
27	May 11	Iv	ePEN	21 00 35					Aftershock of 18 ^h 05 ^m	
			iSN	21 01 21.1						
			F	21 04.3						
28	May 13	Iv	ePN	03 05.4					Aftershock of 18 ^h 05 ^m	
			iSE	30 05 56.0						
			iSN	30 06 00						
			F	04 10.4						
29	May 13	Iv	ePEN	15 41 43.5					See discussion, p. 56	
			iSnN	15 42 05.0						
			iME	15 42 07.0						
			iMN	15 42 07.5						
			F	15 45						
30	May 17	Iv	ePE	18 19 54					N-S component failed. Epicenter near Mina, Nevada according to Pasadena.	
			eSE	18 20 40						
			F	18 23						
31	May 28	Id	ePEN	22 52 22.0					See discussion, p. 56	
			eN	22 52 30						
			iE	22 52 31						
			eSnN	22 52 35.0						
			F	22 54						
32	May 31	Id	iPEN	02 05 39.8					See discussion, p. 56	
			iSEN	02 05 45.3						
			F	02 06.6						



PALO ALTO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
33	1939 June 7	Iv	e \bar{P} _E e _N i _{SE} i _N i _E F	15 14 46 15 14 50.2 15 15 07.3 15 15 09.5 15 15 10.0 15 16.0					See discussion, p. 57
34	June 8	Iu	e _{PE} e _{SEN} F	20 58 11.6 21 07 21	3		+2.5		U.S.C. & G.S. epicenter 15° S., 173° W. Lost in record change.
35	June 13	Iv	e \bar{P} _E e _N e _{SN} e _E i _E F	02 42 25.1 02 42 28.9 02 42 44.0 02 42 46.6 02 42 49.6 02 44.5					See discussion, p. 57 Beginning very uncertain
36	June 13	Iv	e \bar{P} _E F	06 59 00.5 06 59.7					See discussion, p. 57
37	June 13	IIv	e _{PE} e _{PN} i _N i _{SE} i _{SN} i _E F	17 16 39.1 17 16 42.1 17 16 47.6 17 17 35 17 17 35.1 17 17 37.6 17 24	1.5		-3		Near Beatty, Nevada.
38	June 17	Id	e \bar{P} _N i _{EN} F	13 55 15.0 13 55 21.8 13 56.3					See discussion, p. 57
39	June 21	Iv	e _{PE} e _{PN} e _{SEN} F	11 14 40 11 14 42 11 15 23.9 11 16					Nevada
40	June 22	Iv	e _{PN} e _{PE} F	18 42 28.4 18 42 29.0 18 43.7					See discussion, p. 57
41	June 23	Iv	e _{PEN} F	17 28 39.3 17 29.7					See discussion, p. 57

PALO ALTO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1939						mm.	mm.	mm.	
				h. m. s.	s.				
42	June 24	IIId	eP _n EN	13 02 11.3	1		-3		See discussion, p. 57
			i _E	13 02 15.0					
			F	13 11					
43	June 24	Id	eP _n EN	16 29 12					Aftershock.
			F	16 37					
44	June 25	Id	iP _N	15 15 26.1					See discussion, p. 58
			iP _E	15 15 26.3					
			i _N	15 15 27.3					
			i _N	15 15 27.4					
			iS _N	15 15 28.9					
			F	15 16					
45	June 25	Iv	eP _E	20 53 17.4					See discussion, p. 58
			eP _N	20 53 17.6					
			i _N	20 53 32.9					
			i _{EN}	20 53 39.0					
			F	20 54.3					
46	June 26	Iv	eP _N	13 36 16.0					See discussion, p. 58
			e _E	13 36 28.9					
			i _N	13 36 30.3					
			i _E	13 36 33.1					
			F	13 36.9					
47	June 27	Iv	eP _n EN	02 11 58.1					See discussion, p. 58
			i _E	02 12 07.3					
			i _N	02 12 07.9					
			i _{EN}	02 12 13.2					
			F	02 13.2					
48	June 28	Iv	iP _E	16 52 38.3					See discussion, p. 58
			i _N	16 52 51.3					
			F	16 53.7					

SAN FRANCISCO

THE SAN FRANCISCO STATION, UNIVERSITY OF SAN FRANCISCO
SAN FRANCISCO, CALIFORNIA

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Latitude and longitude:

$$\varphi = 37^{\circ} 46'.4 \text{ N.}$$

$$\lambda = 122^{\circ} 27'.2 \text{ W.}$$

Time.--All determinations are reduced to Universal Time.

Altitude.-- 100 meters (328 feet) above mean sea level.

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Apparatus	Component	V	T ₀	ϵ
Wood-Anderson	E 15°S	1500	1	15
	N	3000	1	15

SAN FRANCISCO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
1	1939 Apr. 5	Id	i \bar{S} _{EN} F	06 57 26.9 06 58.0	.3		-.1		See discussion, p. 55
2	Apr. 6	Id	i \bar{P} _E i \bar{P} _N i \bar{S} _E F	21 43 21.5 21 43 21.7 21 43 25.5 21 44.5					See discussion, p. 55
3	Apr. 12	Id	i \bar{N} i \bar{S} _N F	16 28 28.9 16 28 30.4 16 29.0					See discussion, p. 55
4	Apr. 18	Iu	e \bar{P} _N e \bar{P} _E e \bar{S} _{EN} e \bar{L} _N F	06 34 55 06 34 56 06 44 58 07 01.2 08.5	30				U.S.C. & G.S. epicenter 27° S., 71° N. J.S.A. epicenter: 25°8 S., 75°2 W.
5	Apr. 21	Iu	i \bar{N} F	04 39 15 04 42					U.S.C. & G.S. epicenter 50° N., 140° E. J.S.A. epicenter: 48°6 N., 138° E.
6	Apr. 28	Iv	i \bar{E} _N F	22 01 32.2 22 08.5					
7	Apr. 28	Iv	e \bar{N} F	22 34 56 22 36.0					See discussion, p. 56
8	Apr. 30	Iu	e \bar{P} _N e \bar{P} _E e \bar{S} _N e \bar{N} e \bar{N} e \bar{L} _N F	03 08 29 03 08 30 03 18 50 03 22 50 03 31.4 03 32 50 05.0	50 20				U.S.C. & G.S. epicenter 11° S., 158° E. G ?
9	May 1	Iv	e \bar{P} _N e \bar{S} _E F	21 54 20 21 54 57.1 21 58					See discussion, p. 56
10	May 2	Iv	e \bar{E} _N F	23 56.8 00 06					Off the coast of Lower California according to Pasadena.

SAN FRANCISCO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1939				h. m. s.	s.	mm.	mm.	mm.	
11	May 2	IIu	eP _E	13 17 35	23				N - S component failed. U.S.C. & G.S. epicenter: 29°5 N., 113°8 W. J.S.A. epicenter: 29°4 N., 113°5 W.
			eG _E	13 19.7					
			eL _E	13 20.6					
			eM _E	13 22.0					
			F	14.0					
12	May 10	Iu	eP _{EN}	07 52 07				U.S.C. & G.S. epicenter: 51° N., 179° W. J.S.A. epicenter: 51° N., 177°2 W.	
			F	08.5					
13	May 11	IIv	eP _E	18 05 49.0	3				See Berkeley report.
			eP _N	18 05 50.5					
			eS _E	18 06 06.0					
			eE	18 06 08	5				
			iS _N	18 06 08.8					
			F	18 14					
14	May 11	Iv	iP _{EN}	21 00 43				Aftershock of No. 13	
			iS _N	21 01 20					
			iS _E	21 01 21					
			F	21 06					
15	May 13	Iv	iP _{nN}	15 41 43.9				See discussion, p. 56	
			iE	15 41 48.3					
			iE	15 41 58					
			F	15 43					
16	May 16	Iv	eS _N	08 24 51				See discussion, p. 56	
			F	08 25.5					
17	May 17	Iv	eS _{EN}	18 20 38				Epicenter near Mina, Nevada according to Pasadena.	
			iN	18 20 40					
			F	18 23					
18	May 28	Iv	iE _N	22 52 41.6				See discussion, p. 56	
			F	22 55.0					
19	May 31	Id	eP _E	02 05 45	2			See discussion, p. 56	
			iP _N	02 05 45.5					
			eS _{EN}	02 05 56.0					
			iS _E	02 05 57.7					
			F	02 06.7					



SAN FRANCISCO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
20	June 7	Iv	iP _N	15 14 38.0					See discussion, p. 57
			iS _N	15 14 50.5					
			F	15 15.7					
21	June 8	Iu	eP _E	20 58 11					U.S.C. & G.S. epicente 15° S., 173° W.
			iP _N	20 58 11.5					
			F	21 00					
22	June 13	Iv	eP _E	17 16 42					Near Beatty, Nevada
			iE	17 16 34.8					
			iS _N	17 16 42.3					
			F	17 22					
23	June 17	Id	iP _N	13 55 19.3					See discussion, p. 57
			iS _N	13 55 31.3					
			F	13 56.0					
24	June 21	Iv	eP _N	11 29 41.8					Nevada
			eE	11 29 54					
			eS _E	11 30 25					
			eS _N	11 30 26.6					
			F	11 33					
25	June 24	IIv	iP _N	13 02 16.5					See discussion, p. 57
			eE	13 02 17.6					
			iN	13 02 17.9					
			iE	13 02 21					
			iN	13 02 21.1					
			F	13 10					

FERNDALE

 THE FERNDALE STATION
 FERNDALE, CALIFORNIA

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Latitude and longitude:

$$\phi = 40^{\circ} 34' \text{ N.}$$

$$\lambda = 124^{\circ} 16' \text{ W.}$$

Time.--All determinations are reduced to Universal Time.

Altitude.-- 17 meters (55 feet) above mean sea level.

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	V	T ₀	ϵ
Bosch-Omori 25 kg.	E	12	11	5
	N	12	8	5

The station is operated by Mr. Joseph Bognuda, of Ferndale, in cooperation with the University of California.



FERNDALE

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks			
						AE	AN	AZ				
						mm.	mm.	mm.				
						h. m. s.	s.					
1	Apr. 18	IIu	ePEN	06 35 12						U.S.C. & G.S. epicenter 27° S., 71° W.		
			eSEN	06 45 36								
			eGN	07 03.0								
			eLN	07 09.3								
			F	11.8								
2	Apr. 22	Id	iPEN	00 36 20						See discussion, p. 55		
			iSEN	00 36 24								
			F	00 37								
3	Apr. 28	IIId	iPEN	22 34 12						See discussion, p. 56		
			iSN	22 34 16								
			iSE	22 34 18								
			F	22 36.0								
4	Apr. 30	IIIu	ePE	03 08 16						U.S.C. & G.S. epicenter 11° S., 158° E.		
			ePN	03 08 20								
			eSEN	03 19 04								
			eE	03 24 00								
			F	06.0								
5	May 1	IIId	iPEN	21 53 42				+.1	+.1	See discussion, p. 56		
			iSEN	21 53 48								
			F	21 58.0								
6	May 2	IIIu	ePEN	13 18 20						U.S.C. & G.S. epicenter 29°5 N., 113°8 W. J.S.A. epicenter: 29°4 N., 113°5 W.		
			eSEN	13 21 12								
			eGEN	13 21 36							32	
			eLN	13 23.0							20	
			MN	13 24.8							12	15
			F	15.0								
7	May 2	Id	iPEN	21 20 45.9						See discussion, p. 56		
			iN	21 20 47.2								
			iE	21 20 47.3								
			iSEN	21 20 48.4								
			F	21 21.2								
8	May 8	Iu	ePEN	01 59.0						U.S.C. & G.S. epicenter 37° N., 24° W. J.S.A. epicenter: 36°4 N., 24°3 W.		
			eSE	02 08.0								
			eLE	02 24								
			F	03.0								
9	May 11	I	eEN	07 58.0						Trace of distant shock.		
			F	08.0								

FERNDALE

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
10	May 11	Iv	ePE	18 06 32					See Berkeley report.
			ePN	18 06 34					
			eSE	18 07 28					
			F	18 20					
11	May 17	I	eEN	19 07				Trace of distant shock.	
			F	19.5					
12	June 21	Id	ePN	16 34 27				See discussion, p. 57	
			iSEN	16 34 30					
			F	16 35.0					
13	June 22	IIId	iP ⁻ EN	18 41 41		+15	-30	See discussion, p. 57	
			iS ⁻ EN	18 41 45					
			F	18 45					
14	June 24	I	eEN	13 04				Trace of distant shock.	
			F	13 15					
15	June 24	I	eEN	16 34				Lower California	
			F	16 45					

FRESNO

THE FRESNO STATION, FRESNO STATE COLLEGE
FRESNO, CALIFORNIA

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Latitude and longitude:

$$\begin{aligned}\varphi &= 36^{\circ} 46'1 \text{ N.} \\ \lambda &= 119^{\circ} 47'8 \text{ W.}\end{aligned}$$

Time.--All determinations are reduced to Universal Time.

Altitude.-- 88.4 meters (290 feet) above mean sea level.

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	V	T_0	ϵ
Wood-Anderson	N	3000	0.9	15

FRESNO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
	1939			h. m. s.	s.	mm.	mm.	mm.	
1	Apr. 2	Iv	e \bar{S} N eN F	05 29 38.5 05 29 46.0 05 30					See discussion, p. 55
2	Apr. 3	Iv	iPN iSN F	07 10 21.1 07 10 36.8 07 13					Sierra, south of Mammoth, according to Pasadena
3	Apr. 5	Iu	ePN eSN F	16 55 32 17 06 08 17 34					J.S.A. epicenter: 20°0 S., 168°8 E.
4	Apr. 7	Iv	iSnN F	13 40 00.0 13 42.0					See discussion, p. 55
5	Apr. 18	Iu	ePN eSN F	06 34 42 06 44 33 07.0					U.S.C. & G.S. epicenter: 27°S., 71°W. J.S.A. epicenter: 25°8 S., 75°2 W.
6	Apr. 21	Iu	ePN eSN F	04 39 28.0 04 47 58 04 52					J.S.A. epicenter: 48°6 N., 138°0 E.
7	Apr. 28	Iv	ePN iSN F	22 00 39 22 01 17.3 22 05.4					
8	Apr. 30	IIu	ePN eSN eGN eLN F	03 08 38 03 19 24 03 31 59 03 34 13 05.0	50 20				U.S.C. & G.S. epicenter 11° S., 158° E.
9	May 1	Iu	ePN eSN F	06 10 12 06 19 53 06.5					U.S.C. & G.S. epicenter: 40° N., 139° E. J.S.A. epicenter: 39°4 N., 139° E.
10	May 1	Iv	ePN iN F	23 54 29.4 23 56 12.6 00 10					Off the coast of Lower California, according to Pasadena.
11	May 2	IIIu	ePN eLN F	13 17 05.9 13 19 52 14 15					U.S.C. & G.S. epicenter 29°5 N., 113°8 W. J.S.A. epicenter: 29°4 N., 113°5 W.



FRESNO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
				h. m. s.	s.	mm.	mm.	mm.	
12	1939 May 2	IIv	ePN iSN F	18 49 46.4 18 49 59.8 18 56					See discussion, p. 56
13	May 3	I	ePN F	23 59 54 00 16					Probably distant.
14	May 4	Iv	ePN iSN F	20 46 06 20 46 58.4 20 54					Felt at Boulder Dam and Las Vegas, Nevada.
15	May 8	IIu	ePN eLN F	01 58 21 02 21.4 02 47.9					U.S.C. & G.S. epicenter 37° N., 24° W. J.S.A. epicenter: 36°4 N., 24°3 W. Felt on Azores Islands.
16	May 8	IIv	ePN iSN F	02 48 36.9 02 48 59.9 02 55					Felt at Maricopa, Calif
17	May 9	Iv	eSnN iN F	18 17 23.9 18 17 37.4 18 18.9					See discussion, p. 56
18	May 10	Ir	ePN F	07 52 24.8 08.0					U.S.C. & G.S. epicenter 51° N., 179° W. J.S.A. epicenter: 51°0 N., 177°2 W.
19	May 11	Iv	ePN eSN F	02 43 32 02 44 10.0 02 48					Nevada according to Pasadena.
20	May 11	IIv	ePN iPN iN F	18 05 23.0 18 05 24.0 18 05 26.4 18 20					See Berkeley report.
21	May 11	IIv	ePN iN iSN F	21 00 09.5 21 00 12.0 21 00 45 21 08					Aftershock of No. 20.



FRESNO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
22	May 12	Iv	iPN	06 42 33.6					Aftershock of No. 20
			iSN	06 43 06.3					
			iN	06 43 12.1					
			F	06 44.9					
23	May 12	Iv	iPN	07 50 04.2					Aftershock of No. 20
			iSN	07 50 31.1					
			F	07 57					
24	May 13	IIv	iPN	02 49 41.5					Aftershock of No. 20
			iN	02 49 45.6					
			iN	02 49 48.3					
			iN	02 50 20.1					
			F	02 53.9					
25	May 13	Iv	iPN	15 41 35					See discussion, p. 56
			iSN	15 41 48.7					
			F	15 45.9					
26	May 17	Iv	ePN	03 42 33.0					Epicenter near Laws according to Pasadena
			iSN	03 42 49.7					
			iN	03 42 52.0					
			F	03 46.0					
27	May 17	Iv	ePN	18 19 26.8					Epicenter near Mina, Nevada according to Pasadena
			iPN	18 19 29.4					
			iN	18 19 41.8					
			iN	18 20 02					
			F	18 25.0					
28	May 17	Iu	ePN	18 42 55					J.S.A. epicenter: 29°0 N., 143°5 E.
			eSN	18 53 02					
			F	18 58					
29	May 21	Iv	ePN	19 59 54.3					Epicenter near Laws, Nevada according to Pasadena
			iSN	20 00 08.6					
			F	20 02					
30	May 21	I	ePN	20 33 17.2	1.0		-.1		
			F	20 37					
31	May 28	Iv	eN	22 52 38.5					See discussion, p. 56
			eN	22 52 53.0					
			F	22 55.0					



FRESNO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
				h. m. s.	s.	mm.	mm.	mm.	
32	1939 May 31	Iv	iS _{NN} F	02 06 21.7 02 08.0					See discussion, p. 56
33	June 4	I	e _N F	01 24 19 01 32					
34	June 8	Iu	e _N eS _N F	20 58 15.7 21 07 36 21 10	2 5		-.1 + 2		U.S.C. & G.S. epicenter 15° S., 173° W.
35	June 12	Iv	eP _N i _N F	18 05 55 18 06 21 18 08					North end of Death Valley according to Pasadena
36	June 12	Iv	eP _N iS _N F	18 09 18 18 09 42 18 12					Same as preceding
37	June 12	Iv	eP _N iS _N F	18 25 29.9 18 25 56.6 18 28.1					Same as preceding
38	June 13	Id	iS _N F	02 42 24.8 02 46.1					
39	June 13	Id	iS _N F	06 58 57.3 07 03					See discussion, p. 57
40	June 13	IIv	eP _N iP _N iS _N F	17 16 07.4 17 16 09.9 17 16 35.2 17 23					Near Beatty, Nevada
41	June 21	Iv	eP _N i _N i _N F	11 29 13.3 11 29 14.8 11 29 46.3 11 35					Nevada
42	June 23	Iv	eP _N [*] e _N i _N F	17 28 57 17 29 38 17 29 46 17 32					See discussion, p. 57
43	June 23	Iv	e _N F	20 49.8 20 56					Off the coast of Lower California according to Pasadena



FRESNO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
				h. m. s.	s.	mm.	mm.	mm.	
44	1939 June 23	I	ePN F	23 59 49 00 02					
45	June 24	IIIv	ePN* iN iN iN F	13 02 19.8 13 02 22.1 13 02 29.4 13 02 39.2 13 18.2					See discussion, p. 57
46	June 24	Iv	ePN iN F	16 28 45 16 29 10 16 44					Aftershock of No. 45
47	June 25	Iv	iN F	20 53 44.0 20 54.7					See discussion, p. 58