

EARTHQUAKES IN NORTHERN CALIFORNIA

AND

THE REGISTRATION OF EARTHQUAKES

AT

BERKELEY—MOUNT HAMILTON—PALO ALTO
SAN FRANCISCO—FERNDALE—FRESNO

FROM

January 1 to March 31, 1938

BY

PERRY BYERLY

AND

HORACE MILLER

BULLETIN OF THE SEISMOGRAPHIC STATIONS

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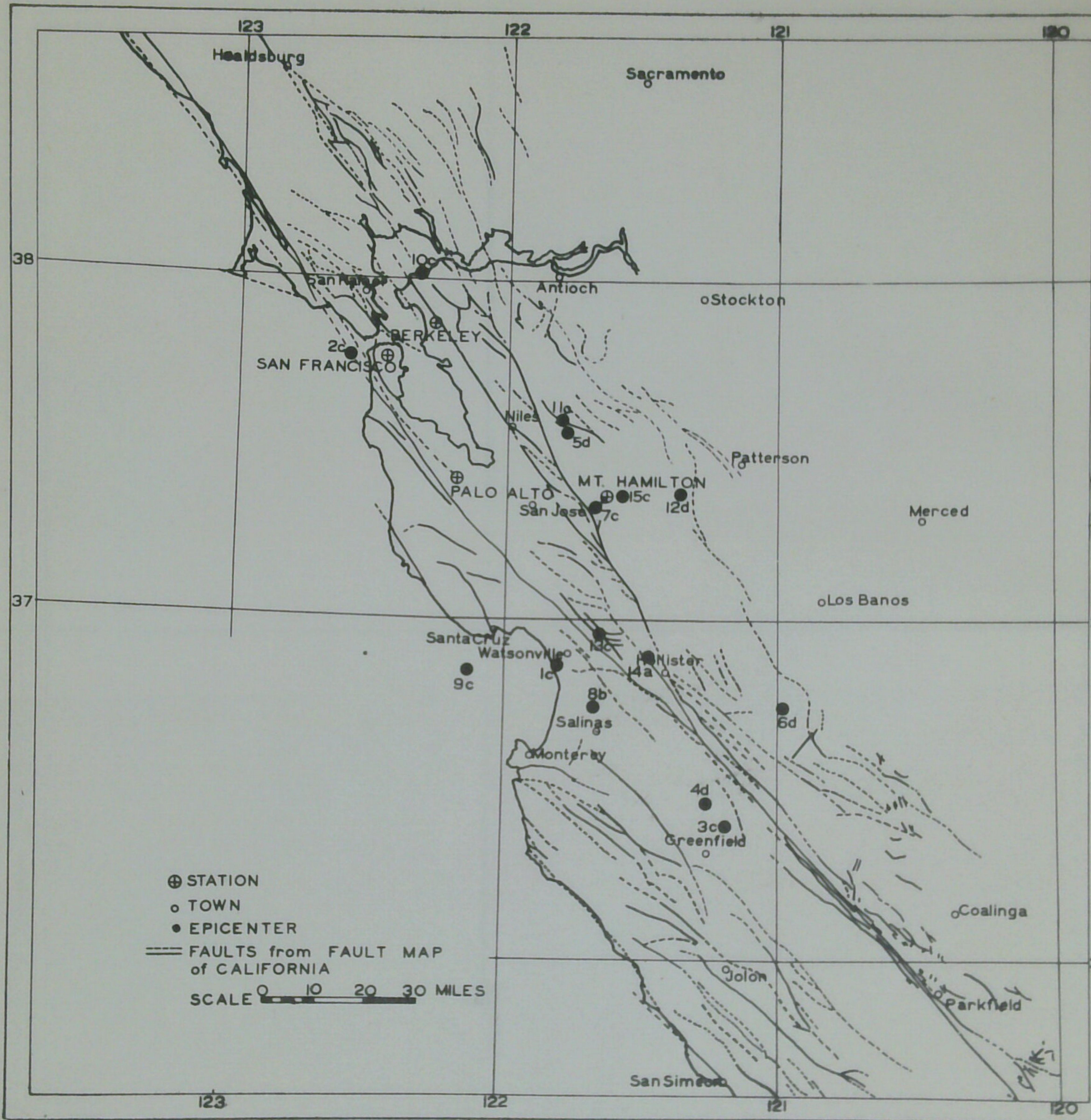
EARTHQUAKE INTENSITY SCALE

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.



MAP SHOWING EPICENTERS, JANUARY 1, 1938 TO MARCH 31, 1938

EARTHQUAKES IN NORTHERN CALIFORNIA

(All intensities are given on the Modified Mercalli Scale)

1938 -- Pacific Standard Time

January 2, 1h 47m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 3 miles southwest of Watsonville. See map, epicenter No. 1c.

January 3, 10h 20m, p.m. Recorded at Berkeley, Palo Alto, San Francisco; not reported felt; epicenter on San Andreas Fault about 4 miles off Ocean Beach in San Francisco. See map, epicenter No. 2c.

January 3, 10h 31m, a.m. Recorded at Palo Alto only; focus about 6 miles from Palo Alto station.

January 4, 10h 51m, a.m. Recorded at Berkeley only; not reported felt; focus about 9 miles from University campus.

January 5, 7h 16m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 7 miles east of Soledad. See map, epicenter No. 3c.

January 10, 10h 57m, a.m. Recorded at Berkeley only; not reported felt; focus about 5 miles from University campus.

January 10, 11h 33m, a.m. Recorded at Berkeley only; not reported felt; focus about 5 miles from University campus.

January 10, 4h 25m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Ferndale. Intensities:

VI Bachelor, Talmadge

V Potter Valley, Ukiah

IV Blue Lakes Resort, Hopland, Lakeport, Philo,
Preston, Upper Lake

I-III Calpella, Cloverdale, Navarro, Redwood Valley, Willits

The recordings were weak and interpretation difficult. The epicenter appears to have been near Lakeport.

January 11, 1h 19m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 10 miles west of Gonzales. See map, epicenter No. 4d.

January 11, 2h 01m 18s, p.m. Recorded at Berkeley only; not reported felt; focus about 8 miles from University campus.

1938 -- P.S.T.

January 11, 10h 05m, a.m. Recorded at Berkeley, Mount Hamilton, San Francisco, Palo Alto. Intensities:

IV Bachelor, Preston

I-III Cloverdale, Hopland, Lakeport, Talmadge, Ukiah

Probably an aftershock of the earthquake of January 10, 4h 24m, p.m.

January 11, 3h 51m, p.m. Recorded at Berkeley only; not reported felt; focus about 5 miles from University campus.

January 13, 11h 38m, a.m. Recorded at Palo Alto only; not reported felt; focus about 7 miles from Palo Alto station.

January 13, 12h 27m, p.m. Recorded at Berkeley only; not reported felt; focus about 6 miles from University campus.

January 14, 10h 25m, a.m. Recorded at Berkeley, Palo Alto, Mount Hamilton, San Francisco; not reported felt; epicenter about 11 miles east of Niles. See map, epicenter No. 5d.

January 15, 9h 30m, (a.m.?) The "Mariposa Gazette" reports a shock of intensity IV at Usona; not recorded on seismographs.

January 22, 6h 30m, a.m. Recorded at Fresno and weakly at Mount Hamilton; epicenter about 40 miles from Fresno station.

January 24, 12h 52m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 13 miles northwest of Panoche. See map, epicenter No. 6d.

January 30, 10h 09m, p.m. Recorded at Berkeley only; IV at San Leandro; epicenter about 15 miles from University campus, probably on Haywards Fault near San Leandro.

February 2, 12h 06m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 3 miles southwest of Lick Observatory; depth of focus about 6 miles. See map, epicenter No. 7b.

February 2, 12h 08m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; another shock from same focus as previous shock.

February 8, 5h 49m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; not reported felt; epicenter about 5 miles southeast of Castroville. See map, epicenter No. 8b.

February 12, 11h 54m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; a foreshock from same focus as following earthquake.

1938 -- P.S.T.

February 12, 12h noon. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco. Intensities:

- VI-VII Santa Cruz
- VI Watsonville
- V Ben Lomond, Coyote, Morgan Hill, Mountain View
- IV Aptos, Belmont, Berkeley, Big Sur, Boulder Creek, Carmel, Castroville, Colma, Davenport, Felton, Lafayette, La Honda, Los Gatos, Milpitas, Monterey, Moss Landing, Niles, Pacific Grove, Palo Alto, Paradise Valley, Pigeon Point Light, Salinas, San Bruno, San Francisco, San Mateo, Saratoga, Seaside, Soquel, South San Francisco.
- I-III Aromas, Brisbane, Cupertino, Hayward, Hollister, Marina, Martinez, Menlo Park, Montara, Newark, Oakland, Pinnacles, Rockaway Beach, Rodeo, San Gregorio, San Juan Bautista, San Jose, San Rafael.

Epicenter in Monterey Bay about 10 miles southwest of Santa Cruz. See map, epicenter No. 9c.

February 17, 2h 07m, a.m. Recorded at Berkeley only; not reported felt; focus about 8 miles from University campus.

February 19, 10h 23m, p.m. Recorded at Berkeley, Palo Alto, San Francisco; felt in Richmond; epicenter in San Pablo Bay. See map, epicenter No. 10c.

February 20, 2h 46m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 6 miles southeast of Pleasanton. See map, epicenter No. 11c.

February 20, 11h 41m, a.m. Recorded at Berkeley only; not reported felt; focus about 16 miles from University campus.

February 20, 11h 36m, p.m. Recorded at Berkeley and Mount Hamilton; not reported felt; epicenter about 16 miles east of Lick Observatory. See map, epicenter No. 12d.

February 21, 1h 24m, a.m. Recorded at Berkeley only; not reported felt; focus about 6 miles from University campus.

February 22, 6h 46m, p.m. Recorded at Berkeley only; not reported felt; focus about 5 miles from University campus.

February 26, 1h 14m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; III at Gilroy; epicenter about 5 miles southwest of Gilroy. See map, epicenter No. 13c.

1938 -- P.S.T.

- March 1, 12h 25m, p.m. Recorded weakly at Berkeley and Ferndale; IV at Bridgeville; epicenter probably about 40 miles from Ferndale.
- March 1, 10h 35m, p.m. Recorded at Ferndale only; slight at Petrolia and Ferndale; epicenter about 20 miles from Ferndale.
- March 1, 3h 29m, p.m. Recorded at Berkeley only; not reported felt; focus about 5 miles from University campus.
- March 7, 4h 31m, a.m. Recorded at Ferndale only; not reported felt; epicenter about 30 miles from Ferndale.
- March 8, 12h 39m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 9 miles from Lick Observatory.
- March 20, 1h 35m, a.m. Recorded at Berkeley, San Francisco, Mount Hamilton, Palo Alto, Fresno; not reported felt; focus about $5\frac{1}{2}$ miles north-west of Hollister. See map, epicenter No. 14a.
- March 21, 7h 53m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 2 miles east of Lick Observatory; depth of focus about 6 miles. See map, epicenter No. 15c.
- March 29, 1h 44m, a.m. Recorded at Mount Hamilton only; not reported felt; epicenter about 55 miles from Mount Hamilton.

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.
AE	E-W component of A.
AN	N-S component of A.
AZ	Vertical component of A.

4. Time--

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

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.--85 meters (279 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	Λ_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.

Operation of the Benioff instrument was resumed November 9, 1937.

BERKELEY

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks	
				U.T.				A _E	A _N	A _Z		
				h.	m.	s.	s.	mm.	mm.	mm.		
1	Jan. 1	Ir	e _E	A	11	40	50.8				U.S.C. & G.S. epi-center: 15°N, 98°W. Long period (surface?) waves.	
			e _Z	B	11	42	30.8					
			e _N	A	11	42	40.8					
			F		11	51						
2	Jan. 1	Iu	i _{PZ}	H	23	39	58.3	Cal			-1	
			e _N	A	23	39	58.8					
			e _{NEZ}	G	23	39	59.3	5	+1.5		-3.5	
			i _N	G	23	49	48.3	8		+2		
			e _E	G	23	49	52.3	6	+2			
			i _E	G	23	50	5.3	6	-3.5			
			e _Z	G	24	4	52.3	12			+1.1	
			e _N	G	0	5	46.8	15		+2		
F	G	0	58									
3	Jan. 2	Iv	i _{PZ}	H	9	47	20.6				See discussion, p. 5	
			i _{SZ}	H	9	47	35.8					
			e _N	A	9	47	36.5					
			F		9	48						
4	Jan. 2	IIr	i _Z	G	22	33	29.3	2.2			-4.5	Damage in Guerrero (Mexico) U.S.C. & G.S. epi-center: 15°7 N, 98°0 W. J.S.A.: 16°7 N; 98°3W
			e _Z	B	22	33	31.1					
			i _E	G	22	33	37.9	4	+5.0			
			i _Z	G	22	34	38.9	3			-5.5	
			i _Z	G	22	39	8.9	4			+4	
			i _Z	G	22	40	51.3	4			-3.2	
F	G	15	40									
5	Jan. 4	Id	e _{PZ}		6	20	12.9				See discussion, p. 5	
			i _Z		6	20	15.8					
			i _{SZ}		6	20	16.7					
			F		6	20	39					
6	Jan. 4	Id	e _{PZ}	H	18	50	38.9				See discussion, p. 5	
			e _{SN}	A	18	50	40.5					
			i _{SZ}	H	18	50	40.6					
			e _E	A	18	50	41					
			F		18	51						
7	Jan. 5	I	e _{NE}	A	6	54	35.4					
			i _Z	H	6	54	35.6					
			F		6	56						
8	Jan. 5	Iv	e _{PZ}	H	15	16	45				See discussion, p. 5	
			F		15	33						
9	Jan. 7	I	e _E	G	16	8	9.1					
			e _Z	G	16	8	21.9					
			F	G	16	26	5.1					

BERKELEY

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1938										
10	Jan. 10	Id	iPz eSN iSz eE F	H A H A	18 18 18 18	56 56 56 56	46.4 47.2 47.6 47.9				See discussion, p. 5
11	Jan. 10	Id	iPz eE eN iSz eE F	H A A H A	19 19 19 19 19	32 32 32 32 32	46.3 46.8 47.1 47.7 48.6				See discussion, p. 5
12	Jan. 11	IIv	iPnz eE iz eN eSn _E iSn _N iS _E iN F	H A H A A A A A	00 00 00 00 00 00 00 00	25 25 25 25 25 25 25 25	15.2 17.5 18.2 31.5 32.0 33.0 39.3 42.0	3	+0.7	See discussion, p. 5	
13	Jan. 11	Id	iPz eN iz eE eSN eE F	H A H A A A	18 18 18 18 18 18	4 4 4 4 4 6	36.5 37.5 48.1 39.0 55.5 55.8				See discussion, p. 5
14	Jan. 11	Id	iPz* eE iS _{NEZ} F	H A AA	21 21 21	19 19 19	31.4 32.8 52.7				See discussion, p. 5
15	Jan. 11	Id	iPz iSz F	H H	22 22	1 1	17.9 19.5				See discussion, p. 5
16	Jan. 11	Id	iPz iSz eS _{NE} F	H H A	23 23 23	50 50 50	33.2 34.3 34.5				See discussion, p. 6
			F		23	51					

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No.	Date	Char-acter	Phase	Time			Period	Amplitude				
				U.T.				A _E	A _N	A _Z		
				h.	m.	s.	s.	mm.	mm.	mm.		
1938												
17	Jan. 13	Id	iPz	H	20	26	58.8				See discussion, p. 6	
			eS _{NE}	A	20	26	59.8					
			F		20	27						
18	Jan. 14	Id	iPn _Z	H	18	25	40.9				See discussion, p. 6	
			e _N	A	18	25	41.3					
			iz	H	18	25	42.8					
			eS* _E	A	18	25	45.3					
			iz	A	18	25	46.4					
			iSn _{NZ}	AH	18	25	49.1					
			F		18	27						
19	Jan. 22	Id	eN	A	19	22	55.1				Seismic ?	
			iz	H	19	22	55.0					
			eE	A	19	22	55.4					
			eN	A	19	22	55.8					
			eE	A	19	22	56.7					
			F		19	23						
20	Jan. 22	Id	iz	H	23	54	44.6				Seismic ?	
			eE	A	23	54	45.5					
			eN	A	23	54	46.3					
			F		23	55						
21	Jan. 23	Iv	eP _E	A	8	39	31.2				U.S.C. & G.S. epi- center: 21°2' N, 156°1' W	
			eP _{NZ}	AH	8	39	31.5					
			iPz	H	8	39	32.8	1.2		+12.5		
			iPR _{1Z}	H	8	40	35.0					
			eE	A	8	44	48.8					
			eS _Z	H	8	44	55.3					
			eS _N	A	8	44	55.8					
			iP ₁ 'P ₁ 'Z	H	9	12	24.8					
			iz	H	9	14	13.2					
			eP ₂ 'P ₂ 'E	A	9	14	22.3					
			iP ₂ 'P ₂ 'Z	H	9	14	22.4					
			eP ₂ 'P ₂ 'N	A	9	14	24.7					
			F		11	9						
22	Jan. 24	I	iz	H	6	11	39.3					
			e _{NE}	A	6	11	49.2					
			iz	H	6	11	50					
			F		6	12						
23	Jan. 24	Iv	eZ	G	10	50	41.2				U.S.C.&G.S. epicenter: near 71°S; 47°W J.S.A. 60°4' S; 34°6' W	
			eE	G	10	51	59.7					
			eN	G	10	52	7.7					
			eZ	G	10	52	8.7					
			F		13	24						

BERKELEY

No.	Date	Char-acter	Phase	Time U.T.	Period	AMPLITUDE			Remarks
						A _E	A _N	A _Z	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
24	Jan. 24	Iv	iPz F	H 20 52 35.9 20 54					See discussion, p. 6
25	Jan. 25	Id	eZ eN iZ eN eZ eZ eZ eE eE eZ eE eZ F	H 17 6 16.6 G 17 6 16.6 G 17 6 17.4 G 17 6 24.6 H 17 6 45.6 G 17 6 48.6 G 17 16 24.6 G 17 16 47.6 G 17 28 51.1 G 17 32 6.0 G 17 32 48.6 G 17 40 24.6 18 48					
26	Jan. 31	Iu	iZ eE iZ eN eN iZ eE F	H 3 58 17.2 A 3 58 17.5 H 3 58 18.0 A 3 58 18.2 A 3 59 9.4 H 3 59 9.9 A 3 59 10.4 4 1					
27	Jan. 31	Id	iPz ePN iSE iSN F	H 6 8 35.0 A 6 8 35.2 A 6 8 37.5 A 6 8 37.6 6 10					See discussion, p. 6
28	Feb. 1	Iu	eZ eE eN eZ eN eNE eZ eZ eZ F	H 19 18 33.8 A 19 18 38.3 A 19 18 42.3 H 19 22 40.3 A 19 23 7.3 A 19 29 10.3 H 19 32 5.3 H 19 32 54.3 H 19 51 10.3 21 54					U.S.C.&G.S. give epi- center @ 5°S; 131°E
29	Feb. 2	Id	iPz eSN eSE eSN F	H 20 6 29.2 A 20 6 40.0 A 20 6 40.1 A 20 6 40.5 20 7					See discussion, p. 6

BERKELEY

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks				
						A _E	A _N	A _Z					
1938						mm.	mm.	mm.					
				h. m. s.	s.								
30	Feb. 2	Id	iP _Z	H	20 8 45.7				See discussion, p. 6				
			eS _N	A	20 8 56.7								
			eS _E	A	20 8 57.1								
			iS _Z	H	20 8 57.3								
			F		20 10								
31	Feb. 5	IIu	eP _Z	H	2 32 46.6				Deep. Damage in Columbia. U.S.C. & G.S. epicenter 495 N, 7599 W. J.S.A. 591 N, 7597 W				
			eP _E	A	2 32 47								
			iP _Z	G	2 32 48								
			eP _E	G	2 32 48								
			eP _N	A	2 32 48.3								
			eP _N	G	2 32 49								
			iZ	G	2 36 44.9								
			eE	G	2 36 50								
			eN	A	2 37 2.0								
			eE	A	2 39 19								
			eN	G	2 39 47								
			iS _Z	G	2 41 19								
			eS _E	G	2 41 19								
			eS _N	A	2 41 20								
			iG _Z	G	2 46 38								
			F	G	19 30								
			F	A&H	19 00								
			32	Feb. 9	IV	eP _Z	H	1 49 02.0					See discussion, p. 6
						iZ	H	1 49 04.2					
eN	A	1 49 07.8											
eE	A	1 49 11.8											
iZ	H	1 49 17.2											
iS _Z	H	1 49 19.6											
eS _{NE}	A	1 49 20.3											
F		1 50 30											
33	Feb. 10	Id	iZ	H	10 47 35.9								
			eN	A	10 47 41.3								
			eN	A	10 47 54.6								
			eE	A	10 47 54.5								
			F		10 48 30								
34	Feb. 12	Iv	iP* _Z	H	19 54 18.5				See discussion, p. 6				
			iS* _Z	H	19 54 32.3								
			iS* _N	A	19 54 32.4								
			eS* _E	A	19 54 32.5								
			F		19 56								

BERKELEY

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1938										
35	Feb. 12	Iv	ePNE iPZ iPN iPE iSNE F	H H A A A	20 20 20 20 20	00 00 00 00 00 05	31.4 31.5 33.1 33.2 47.6				See discussion, p. 7
36	Feb. 13	Iu	eE eN eN eE F	G G G G	8 8 8 8	27 27 40 41 57	31.3 32.3 25.3 17.3				
37	Feb. 17	Id	iz eN iz eE F	H A H A	9 9 9 9	14 14 14 14 16	29.4 45.3 45.4 45.6				P ? S ?
38	Feb. 17	Id	iPZ eSE eSN F	H A A	11 11 11	6 6 6 7	39.1 42.3 42.5				See discussion, p. 7
39	Feb. 20	Id	iz iz eN eE eE F	H H A A A	1 1 1 1 1	7 7 7 7 7 9	30.1 30.3 36.1 37.1 39.1				
40	Feb. 20	Id	ePN iPNE iPZ iSNE F	A A H A	6 6 6 6	23 23 23 23 25	16.5 16.7 16.9 18.9				See discussion, p. 7
41	Feb. 20	Id	iPZ iz eS*N eS*E F	H H A A	10 10 10 10	45 45 45 45 47	52.0 53.3 59.1 59.8				See discussion, p. 7
42	Feb. 20	Id	iPZ iSE iSN F	H A A	19 19 19	41 41 41 42	18.1 21.4 21.8				See discussion, p. 7

BERKELEY

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks	
				U.T.				A _E	A _N	A _Z		
				h.	m.	s.	s.	mm.	mm.	mm.		
43	Feb. 21	Iv	iP _Z	H	7	36	17.0				See discussion, p. 7	
			eS _Z	H	7	36	30.4					
			eS _{NE}	A	7	36	30.4					
			F		7	37						
44	Feb. 21	Id	iP _Z	H	9	23	58.1				See discussion, p. 7	
			eP _E	A	9	23	58.2					
			eP _N	A	9	23	58.3					
			eS _E	A	9	24	59.4					
			eS _N	A	9	24	59.5					
			F		9	24	40					
45	Feb. 21	Id	eZ	H	10	59	53.4					
			eN	A	11	00	24.1					
			eN	A	11	00	25.1					
			F		11	2						
46	Feb. 23	Id	iP _Z	H	2	46	26.8				See discussion, p. 7	
			eP _E	A	2	46	26.8					
			eP _N	A	2	46	26.9					
			eS _E	A	2	46	27.8					
			iS _N	A	2	46	28.1					
			F		2	47						
47	Feb. 26	Id	iP*Z	H	21	14	22.6				See discussion, p. 7	
			eN	A	21	14	36.6					
			iS _Z	H	21	14	37.3					
			eS _{NE}	A	21	14	37.4					
			F		21	15	30					
48	Mar. 1	Id	iZ	H	20	24	53.4				See discussion, p. 8	
			F		20	26	45					
49	Mar. 1	Id	iP _Z	H	23	29	0.8				See discussion, p. 8	
			eS _N	A	23	29	1.4					
			iS _Z	H	23	29	1.7					
			eE	A	23	29	2.8					
			F		23	29	45					
50	Mar. 4	I	iZ	H	2	32	36.2					
			iZ	H	2	32	37.5					
			iZ	H	2	32	38.3					
			eE	A	2	32	38.5					
			eN	A	2	32	38.8					
			F		2	33	45					

BERKELEY

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1938										
51	Mar. 4	I	eZ	H	13	37	17.7				
			eN	A	13	37	19.4				
			eZ	H	13	37	20.4				
			eE	A	13	37	21.4				
			F		13	39	45				
52	Mar. 6	Iu	ePE	A	17	5	11.6				
			ePZ	H	17	5	11.8				
			ePN	A	17	5	12.6				
			F		17	7					
53	Mar. 7	II	eE	G	6	21	54.1				
			eZE	G	6	39	1.1				
			F		7	30					
54	Mar. 14	Iv	iPnZ	H	21	21	57.8				Nevada
			iPZ	H	21	22	9.0				
			eE	A	21	22	42.5				
			F		21	24					
55	Mar. 20	Iv	iPZ	H	9	35	21.2				See discussion, p. 8
			iSZ	H	9	35	37				
			eSE	A	9	35	37.1				
			eSN	A	9	35	37.3				
			F		9	37					
56	Mar. 22	Id	iP*Z	H	3	53	21.6				See discussion, p. 8
			eSE	A	3	53	32.6				
			eSZ	H	3	53	32.9				
			eSN	A	3	53	33				
			F		3	54					
57	Mar. 22	I Ir	eZN	G	15	26	4.0				Queen Charlotte Is. U.S.C.&G.S. epicenter: 53°0 N., 131°8 W. J.S.A. epicenter: 52°2 N., 133°1 W.
			ePZ	H	15	26	4.5				
			ePN	A	15	26	5.3				
			ePE	A	15	26	5.5				
			eE	G	15	26	6				
			eZ	G	15	29	20				
			eSE	A	15	29	23.5				
			eSN	A	15	29	24.5				
			eE	G	15	29	27				
			eLZ	H	15	31	14				
			F		16	15					
58	Mar. 22	Ir	ePN	A	22	31	28.7				Queen Charlotte Is. Aftershock.
			ePZ	H	22	31	29.4				
			eZ	H	22	31	38				
			eZ	H	22	31	44.4				
			eZ	H	22	31	57.5				
			eZ	H	22	32	8.1				

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

MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.	h.	m.		s.	A _E	A _N	
				h.	m.	s.	s.	mm.	mm.	mm.	
1	Jan. 1	Ir	e _N F	11 31 27.6							U.S.C. & G.S. epicenter: 15°N, 98°W
				11 57 22.6							
2	Jan. 1	Id	e _E e _N F	23 40 03.8							
				23 40 04.0							
				23 44							
3	Jan. 2	Id	e _P e _S e _{NN} e _E F	9 47 10			0.5	-0.1			See discussion, p. 5
				9 47 14.5			0.5	+0.1			
				9 47 18.4			0.8	+0.2			
				9 47 16.3							
				9 48							
4	Jan. 2	IIr	e _N e _E F	22 33 27							Damage in Guerrero (Mex.) U.S.C. & G.S. epicenter: 15°7' N; 98°0' W J.S.A. epicenter: 16°7' N; 98°3' W
				22 33 29							
				23 08							
5	Jan. 4	Iv	e _E e _N e _S F	00 30 57							Pasadena epicenter: 33°28' N; 116°31' W
				00 31 07							
				00 32 26							
				00 34							
6	Jan. 4	Id	e _N e _E e _N F	17 05 36.2							
				17 05 43.8							
				17 05 44							
				17 07							
7	Jan. 5	Id	i _P e _P e _S F	15 16 31.0							See discussion, p. 5
				15 16 31							
				15 16 43.3							
				15 18							
8	Jan. 11	Id	e _P e _N e _E F	00 25 26.5							See discussion, p. 5
				00 26 05.0							
				00 26 04.0							
				00 28							
9	Jan. 11	Id	e _N e _N e _N	18 4 40.7							See discussion, p. 5
				18 5 18							
				18 5 28.9							

MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time U.T.			Period	Amplitude			Remarks
				h.	m.	s.		A _E	A _N	A _Z	
	1938										
10	Jan. 11	Id	e \overline{P} _N e \overline{S} _N i \overline{S} _E F	21	19	18.3 31.1 31.3 21				See discussion, p. 5	
11	Jan. 14	Id	i \overline{P} _N e \overline{S} _N i \overline{S} _E F	18	25	33.4 36.3 36.6 27	0.5		-0.3	See discussion, p. 6	
12	Jan. 20	Id	e \overline{N} e \overline{N} F	15	49	15.4 11.4 51					
13	Jan. 22	Id	e \overline{N} F	14	30	51.4 31				See discussion, p. 6	
14	Jan. 23	Ir	e \overline{P} _N e \overline{S} _N e \overline{LNE} e \overline{NE} F	8	39	35.0 06 00.7 37 15				Strong in Hawaiian Is. U.S.C. & G.S. epicenter: 21°2' N; 156°1' W. J.S.A. epicenter: 21°0' N; 156°2' W.	
15	Jan. 24	Id	e \overline{PE} e \overline{PN} i \overline{S}^*N i \overline{SN} F	20	52	23.7 23.9 35.2 35.9 5				See discussion, p. 6	
16	Jan. 25	Id	e \overline{N} e \overline{E} F	17	06	22 25 08					
17	Feb. 1	Iu	e \overline{PN} e \overline{N} e \overline{SN} F	19	18	42 06 11 00				U.S.C. & G.S. epicenter: 5°S; 131°E. J.S.A. epicenter: 5°5' S; 131°E	
18	Feb. 2	Id	i \overline{PN} i \overline{SN} F	20	06	16.8 18.2 30				See discussion, p. 6	
19	Feb. 2	Id	i \overline{PN} i \overline{SN} F	20	08	33.8 35.2 10				See discussion, p. 6	

MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time			Amplitude			Remarks	
				U.T.			A _E	A _N	A _Z		
				h.	m.	s.	mm.	mm.	mm.		
	1938										
20	Feb. 5	Iir	eE eN iN F	02	32	43 44.8 50.5 39					Deep. damage in Columbia. U.S.C. & G.S. epicenter: 4°5 N., 75°9 W. J.S.A. epicenter: 5°1 N., 75°7 W.
21	Feb. 9	Id	iPN iSN F	1	48	50.1 58.7 3					See discussion, p. 6
22	Feb. 12	Id	ePE iSE F	19	54	11.7 20.8 55.5					See discussion, p. 6
23	Feb. 12	Id	iP F	20	00	26.3 06					See discussion, p. 7
24	Feb. 20	Id	ePN iSN F	10	45	48.5 53.7 48					See discussion, p. 7
25	Feb. 21	Id	iPE iSE F	7	36	4.1 07.5 37					See discussion, p. 7
26	Feb. 26	Id	ePN iSN F	21	14	11.6 17.2 15					See discussion, p. 7
27	Mar. 4	Id	eNE F	13	37	12 39					
28	Mar. 8	Id	iPN iSEN F	20	39	14.4 16.3 40					See discussion, p. 8
29	Mar. 14	Id	eN eSN eE F	10	28	10.2 20.2 21 29					See Fresno report
30	Mar. 14	Iv	ePE eSE F	21	21	57.0 32.9 35					Nevada

MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
				h.	m.	s.	s.	mm.	mm.	mm.	
31	Mar. 20	Id	eP _N	9	35	9.4					See discussion, p. 8
			iS _E	9	35	14.8					
			F	10	36						
32	Mar. 22	Id	iP _E	03	53	09.2					See discussion, p. 8
			iS _E	03	53	10.7					
			F	03	54						
33	Mar. 22	IIr	eP _{NE}	15	26	15.5					Queen Charlotte Islands. U.S.C. & G.S. epicenter: 53°N; 131°8' W.
			eS _{NE}	15	29	49					
			F	17	10						
34	Mar. 29	Id	eP _N	09	44	00.9					See discussion, p. 8
			eE	09	44	04					
			eS _N	09	44	12					
			iS _E	09	44	14					
			iS _N	09	44	14.2					
			F	09	45						

PALO ALTO

 THE BRANNER STATION, STANFORD UNIVERSITY
 PALO ALTO, CALIFORNIA

CONSTANTS

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Latitude and longitude:

$$\varphi = 37^{\circ} 25'1 \text{ N.}$$

$$\lambda = 122^{\circ} 10'8 \text{ W.}$$

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			Remarks
				U.T.			
				h.	m.	s.	
	1938						
1	Jan. 1	I	e _{NE} F	23 40	1.3		See discussion, p. 5
2	Jan. 2	Id	e _{S*} e _{SN} F	9 47	22.2		See discussion, p. 5
				9 47	24.5		
				1 48			
3	Jan. 2	IIr	e _{P_{NE}} e _N e _N e _E F	22 33	31.4		Damage in Guerrero (Mex.) U.S.C. & G.S. epicenter: 15°7 N; 98°0 W. J.S.A. epicenter: 16°7 N; 98°3 W.
				22 35	27.4		
				22 44	25.4		
				22 44	26.4		
				22 53			
4	Jan. 3	Id	e _{P_N} i _{SN} i _E F	18 31	9.4		See discussion, p. 5
				18 31	10.6		
				18 31	11.0		
				18 32			
5	Jan. 4	Id	e _{SN} F	6 20	23.1		See discussion, p. 5
				6 30			
6	Jan. 5	Iv	e _{P_N} e _{S_{NE}} e _{S_N} e _{S_N} F	15 16	37.1		See discussion, p. 5
				15 16	52.6		
				15 16	52.7		
				15 16	55.3		
				15 17			
7	Jan. 11	Iv	e _N e _E i _E i _N i _E i _E i _M F	00 25	27.9		See discussion, p. 5
				00 25	28.9		
				00 25	41.9		
				00 25	51.9		
				00 25	53.9		
				00 25	56.9		
				00 26	0.9		
				00 28.4			
8	Jan. 11	Iv	e _{P_E} e _{P_N} e _E e _M e _{S_E} i _{SN} F	18 04	50.2		See discussion, p. 5
				18 04	51.4		
				18 04	52.7		
				18 05	13.7		
				18 05	16.9		
				18 05	20.7		
				18 05.9			
9	Jan. 11	Iv	e _{P_N} e _E e _{S_E} i _N F	21 19	24.7		See discussion, p. 5
				21 19	24.8		
				21 19	39.8		
				21 19	42.8		
				21 20.6			

PALO ALTO

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
10	Jan. 13	Id	eP _N iS _E iS _N iN _F F	19	37	56.4 57.6 57.8 58.9 38.2	See discussion, p. 6
11	Jan. 14	Id	oP _N eN _E iS _E iN _E iE _F F	18	25	36.2 40.5 41.6 45.8 51.3 26.6	See discussion, p. 6
12	Jan. 20	I	eN _F F	15	50	57.5 55	
13	Jan. 23	IIr	eP _N eP _E eS _E eS _N eL _N F	08	39	32.9 33.9 58.9 59.9 39.9 8 43.9	Strong in Hawaiian Islands. U.S.C. & G.S. epicenter: 21°2 N; 156°1 W. J.S.A. epicenter: 21°0 N; 156°2 W.
14	Jan. 24	Iv	eP _N _{NE} eS* _E iS _N	20	52	28.2 43.6 45.6	See discussion, p. 6
15	Jan. 31		eN _E eE _E eN _F F	3	58	21.8 18.8 19.8 4 00	
16	Feb. 1	IIv	eP _N eE eS _C P _C S _E F	19	18	42 07 15 59	U.S.C. & G.S. epicenter: 5°S; 131°E. J.S.A. epicenter: 5°5 S; 131°E.
17	Feb. 2	Id	eP _N eS _N F	20	06	23.7 29.7 07	See discussion, p. 6
18	Feb. 2	Id	eP _N eS _N F	20	08	40.7 46.7 09	See discussion, p. 6

PALO ALTO

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
19	Feb. 5	Ir	eP _N	02 32 46.9	Deep - Damage in Columbia. U.S.C. & G.S. epicenter: 4°5 N; 75°9 W. J.S.A. epicenter: 5°1 N; 75°7 W.
			eP _E	02 32 48.2	
			iP _{NE}	02 32 52.8	
			eS _N	02 40 02.4	
			F	02 42	
20	Feb. 9	Id	eP _N	01 48 55	See discussion, p. 6
			iN	01 49 06.2	
			iS _E	01 49 08.1	
			F	01 49.8	
21	Feb. 12	Id	eP _N	19 54 11.6	See discussion, p. 6
			iS _E	19 54 19.3	
			iS _N	19 54 19.9	
			F	19 55	
22	Feb. 12	Id	iP _{NE}	20 00 25.3	See discussion, p. 7
			iS _{NE}	20 00 33.6	
			F	20 04	
23	Feb. 20	Id	eP _N	06 23 26.7	See discussion, p. 7
			iS _E	06 23 35.3	
			iS _N	06 23 37.2	
			F	06 24	
24	Feb. 20	Id	eP _N	10 45 49.9	See discussion, p. 7
			iS _N	10 45 54.2	
			F	10 53.1	
25	Feb. 26	Id	eE	21 14 17.4	See discussion, p. 7
			eS _E	21 14 25.5	
			iE	21 30.1	
26	Mar. 20	Id	eP _N	9 35 14.3	See discussion, p. 8
			eN	9 35 18.5	
			iS _E	9 35 24.7	
			iS [*] _N	9 35 26.7	
			F	9 36	
27	Mar. 22	Id	eP _N	03 53 16.9	See discussion, p. 8
			eN	03 53 19.0	
			eS _E	03 53 23.3	
			eN	03 53 33.1	
			F	03 54.5	

PALO ALTO

No.	Date	Char- acter	Phase	Time U.T.	Remarks
	1938			h. m. s.	
28	Mar. 22	Iir	eP _N eS _E eS _N F	15 26 14.8 15 29 27.8 15 29 30.8 16 20.5	Queen Charlotte Islands. U.S.C. & G.S. epicenter: 53°0 N; 131°8 W.

SAN FRANCISCO

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



CONSTANTS

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Latitude and longitude:

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

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

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

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

CONSTANTS OF THE SEISMOGRAPHS

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

SAN FRANCISCO

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1938										
1	Jan. 1	Id	eP _{NE} e _N F	23	39	55	2	+ .1	+ .1		
				23	40	44.5					
				23	50						
2	Jan. 2	IIr	eP _N e _E eL _N F	22	33	30.1	25				Damage in Guerrero (Mex.) U.S.C.&G.S. epicenter: 15°7' N; 98°0' W. J.S.A. epicenter: 16°7' N; 98°3' W.
				22	33	35.1					
				22	43	17.1					
				22	58						
3	Jan. 4	Id	iS _{NE} F	06	20	12					See discussion, p. 5
				06	28						
4	Jan. 11	Iv	eP _N e _E iP _N e _E iS _N F	00	25	18.4					See discussion, p. 5
				00	25	20.9					
				00	25	21.5					
				00	25	22.7					
				00	25	39.4					
				00	29						
5	Jan. 11	Id	eP _N iS _N F	18	04	40					See discussion, p. 5
				18	05	00.8					
				18	07						
6	Jan. 14	Id	e _N F	18	25	56					See discussion, p. 6
				18	27.3						
7	Jan. 23	Ir	e _N e _E e _{NE} e _N e _E e _E F	08	39	16.1	1.5		+ .1		Strong in Hawaiian Is. U.S.C. & G.S. epicenter: 21°2' N; 156°1' W. J.S.A. epicenter: 21°0' N; 156°2' W.
				08	39	16.2	1.5	+ .1			
				08	39	31.6	2	+ .1	- .2		
				08	44	54.8	7		.5		
				08	44	55.6					
				08	48	3.1					
				09	45						
8	Jan. 31	Ir	e _E e _E i _E i _N i _N F	03	58	20.8					
				03	58	33.9					
				03	59	08.	1	- .5			
				03	59	08.6	1		- 1		
				03	59	15.8					
				04	01						

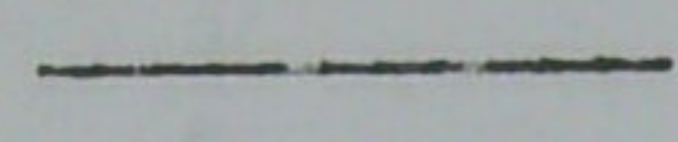
SAN FRANCISCO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
				h. m. s.	s.	mm.	mm.	mm.		
9	Feb. 1	Iu	ePP _N	19 22 45.4					U.S.C. & G.S. epicenter: 5° S; 131° E. J.S.A. epicenter: 5.5 S., 131° E.	
			ePP _E	19 22 51.9						
			eSKS _N	19 28 53.4						
			eSKS _E	19 29 1.4						
			ePS _E	19 31 54.4						
			ePS _N	19 32 0.4						
			eN	19 36 42.4						
			eE F	19 37 19.4 20 40						
10	Feb. 2	Iv	eNE	01 49 17.2				See discussion, p. 6		
			F	01 50						
11	Feb. 12	Id	iP*N	20 00 31.3				See discussion, p. 6		
			eP*E	20 00 31.4						
			iS*E	20 00 44.6						
			iS*N	20 00 44.8						
			F	20 04						
12	Feb. 20	Id	iP _N	06 23 19.1	.25		+ .75	See discussion, p. 7		
			iP _E	06 23 20.1						
			iS _{NE}	06 23 22.9	.25		+2.5			
			F	06 24 15						
13	Feb. 26	Id	eP _N	21 14 25.3				See discussion, p. 7		
			eS _{nNE}	21 14 39.1						
			iS _{NE}	21 14 40.7						
			F	21 15.5						
14	Mar. 20	Id	eS*N	09 35 37.3				See discussion, p. 8		
			eS*E	09 35 37.4						
			iS _{nN}	09 35 38.4						
			F	09 36						
15	Mar. 22	Id	eP _E	15 26 2.6						
			eP _N	15 26 5.6						
			eN	15 29 28.6						
			eN	15 30 2.1						
			F	16 25						



FERNDALE

THE FERNDALE STATION
FERNDALE, CALIFORNIA



CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

$$\begin{aligned} \phi &= 40^{\circ} 34' \text{ N.} \\ \lambda &= 124^{\circ} 16' \text{ W.} \end{aligned}$$

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

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

The seismographs are Bosch-Omori 25 kg. horizontal pendulums. They are oriented to record N-S and E-W motion. The station is operated by Mr. Joseph Bognuda, of Ferndale, in cooperation with the University of California.

FERNDALE

No.	Date	Char- acter	Phase	Time			Remarks	
				U.T.				
	1938			h.	m.	s.		
1	Jan. 2	Iv	eP _N e _N	22	33	48	Damage in Guerrero (Mexico) U.S.C. & G.S. epicenter: 15°7' N; 98°0' W. J.S.A. epicenter: 16°7' N; 98°3' W.	
				22	45	00		
2	Jan. 10	Id	eP _N e _N iS _N	00	25	33	See discussion, p. 5	
				00	25	35.2		
				00	26	00		
3	Jan. 11	Id	e _N e _N F	00	25	39.7		
				00	26	01		
				00	28			
4	Jan. 23	IIr	eP _{NE} e _N e _N e _E e _E e _N e _E e _E e _E e _E e _E e _E	8	39	39	Strong in Hawaiian Islands. U.S.C. & G.S. epicenter: 21°2' N; 156°1' W. J.S.A. epicenter: 21°0' N; 156°2' W.	
				8	45	01		
				8	46	10		
				8	47	4.1		
				8	47	27		
				8	47	36		
				8	51	4.0		
				8	51	40		
				8	57	04		
				8	58	24		
				9	30			
5	Feb. 1	IIv	e _E e _N e _N e _E e _E e _E e _E e _E e _E e _E e _E e _E	19	18	50		U.S.C. & G.S. epicenter: 5° S; 131° E. J.S.A. epicenter: 5°5' S; 131° E.
				19	23	20		
				19	23	34		
				19	29	08		
				19	31	54		
				19	53	00		
				19	54	47		
				19	58	12		
				20	5	12		
				21	00			
6	Feb. 5	Id	eP _E e _E e _E e _N F	2	33	14	Deep - Damage in Columbia, S.A. Epicenters: U.S.C. & G.S.: 4°5' N; 75°9' W J.S.A.: 5°1' N; 75°7' W	
				2	34	8.8		
				2	36	5.2		
				2	36	10		
				3	00			
7	Mar. 1	Id	eP _{NE} iS _E F	20	24	24	See discussion, p. 8	
				20	24	30		
				20	26			

FERNDALE

No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
	1938			h.	m.	s.	
8	Mar. 2	Id	eP _E	6	34	47	See discussion, p. 8
			iS _{NE}	6	34	51	
			F	6	36		
9	Mar. 7	Id	eP _E	12	31	3	See discussion, p. 8
			iS _E	12	31	9	
			F	12	31.5		
10	Mar. 22	Ir	eP _E	15	25	34.9	
			eS _E	15	28	8.1	
			eL _E	15	29	16	

FRESNO

THE FRESNO STATION, FRESNO STATE COLLEGE
FRESNO, CALIFORNIA



CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

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

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

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

CONSTANTS OF THE SEISMOGRAPHS

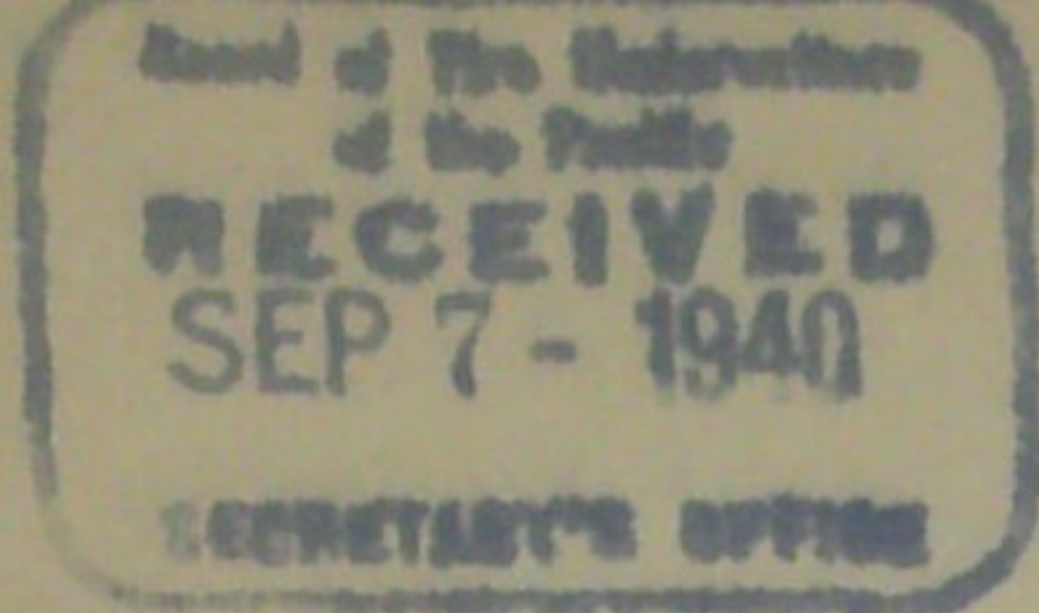
Apparatus	Component	V	T ₀	e
Wood-Anderson	N	3000	0.9	15

FRESNO

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
1	Jan. 1	Ir	e _N F	11 40 35 11 52			U.S.C. & G.S. epicenter: 15°N; 98°W
2	Jan. 1	Id	e _N e _N F	23 40 13.3 23 42 58.3 23 45			
3	Jan. 2	Id	e _S F	9 47 47.6 9 48.5			See discussion, p. 5
4	Jan. 2	I Ir	e _P e _N e _N e _N i _N F	22 33 12 22 33 41 22 33 59 22 39 06 22 39 24 22 56 15			Damage in Guerrero (Mexico). U.S.C. & G.S. epicenter: 15°7' N; 98°0' W J.S.A. epicenter: 16°7' N; 98°3' W
5	Jan. 4	Iv	e _P e _S F	00 30 38.6 00 31 34.5 00 33			Pasadena epicenter: 33°28' N; 116°35' W
6	Jan. 11	Id	e _P F	21 19 30(Ca) 21 22			e _S - e _P = 1m, 20s See discussion, p. 5
7	Jan. 22	Id	i _P F	14 32 (Ca) 14 33			Δt unknown S - P = 8 seconds
8	Jan. 23	I Ir	e _P	08 39 (Ca)			Δt unknown S - P = 5m 38s i - P = 9m 10s (PcP?) Strong in Hawaiian Islands. U.S.C. & G.S. epicenter: 21°2' N; 156°1' W J.S.A. epicenter: 21°0' N; 156°2' W
9	Jan. 24	Id	e _P	12 52 (Ca)			Δt unknown S - P = 13.5 sec. See discussion, p. 6
10	Jan. 25	Iv	e _P F	12 49 (Ca) 12 51			Δt unknown. S - P = 13.5 sec. ? Some 110 sec. after what is ap- parently P, there is an har- monic train of waves which is part of the same shock sug- gesting that it is local in origin.

FRESNO

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
11	Jan. 30	I		20	(Ca)		Δt unknown. S - P = 74 sec. ?
12	Feb. 8	I	iP _N iS _N F	7 40 35.5 7 41 31.4 7 43			Pasadena epicenter: 34°03' N; 116°26' W
13	Feb. 14	Id	eP _N i _N iS _N F	10 27 29.3 10 27 37.8 10 27 43.3 10 28			Epicenter near N-E corner of Fresno County
14	Mar. 14	Iv	iP _N iS _N F	21 21 41.4 21 22 7.7 21 24			Nevada
15	Mar. 16	Id	e _N F	1 9 48 1 10			
16	Mar. 17	Id	e _N F	16 27 43.8 16 29			
17	Mar. 20	Id	e _N eS _N e _N e _N F	9 35 37.8 9 35 41.8 9 35 47.9 9 35 48.3 9 36.5			Doubtful - may be earlier. See discussion, p. 8
18	Mar. 22	IIr	e _N e _N F	15 26 28 15 32 47 16 00			Queen Charlotte Islands. U.S.C. & G.S. epicenter: 53° N; 131°8 W
19	Mar. 22	Ir	i _N F	17 22 0.8 17 25 4.4			Aftershock
20	Mar. 22	Ir	e _N F	22 31 59.3 22 45			Aftershock
21	Mar. 23	I	i _N i _N F	23 53 16 23 53 46.8 23 55			



EARTHQUAKES IN NORTHERN CALIFORNIA

AND

THE REGISTRATION OF EARTHQUAKES

AT

BERKELEY—MOUNT HAMILTON—PALO ALTO

SAN FRANCISCO—FERNDALE—FRESNO

FROM

April 1, 1938 to June 30, 1938

BY

PERRY BYERLY

AND

HORACE MILLER

BULLETIN OF THE SEISMOGRAPHIC STATIONS

VOLUME 8, No. 2, pp. 40-86

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EARTHQUAKE INTENSITY SCALE

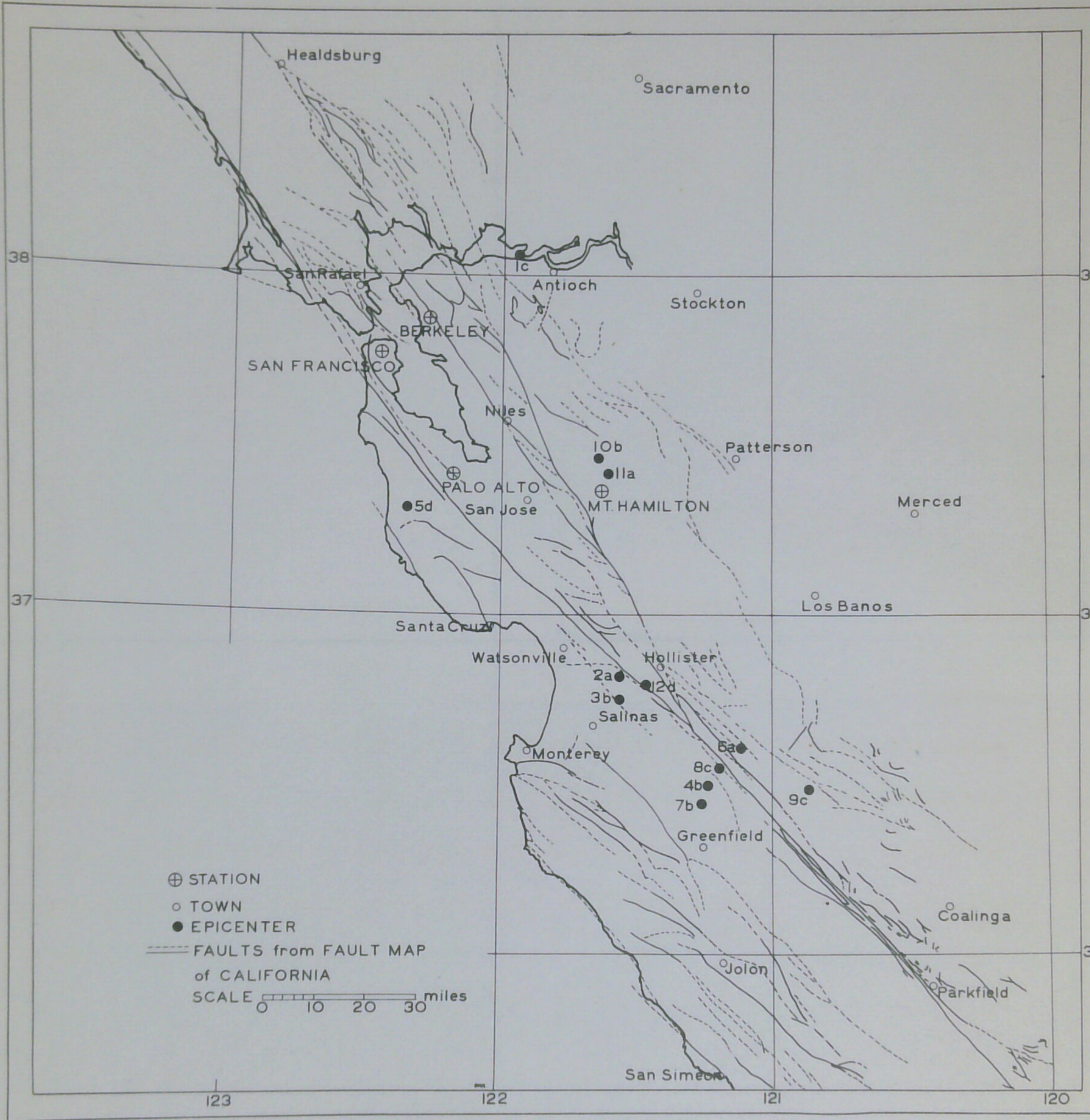


Criteria of the Modified Mercalli Scale which were used to rate the intensities of the earthquakes registered were:

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.



MAP SHOWING EPICENTERS, APRIL 1, 1938 TO JUNE 30, 1938

EARTHQUAKES IN NORTHERN CALIFORNIA

(All intensities given on Modified Mercalli Scale)



International
Seismological
Centre

1938 -- PACIFIC STANDARD TIME

- April 3, 9h 59m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; not reported felt; epicenter about 5 miles northwest of Antioch. See map, epicenter 1c.
- April 7, 2h 19m, p.m. Recorded at Berkeley only; not reported felt; focus about 10 miles from University campus.
- April 12, 1h 46m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; not reported felt; epicenter about 12 miles southeast of Watsonville.
- April 15, 1h 55m, p.m. IV at Ferndale, Upper Mattole; III at Cape Mendocino Light Station and Punta Gorda Light Station. (Ferndale seismograph not in operation.)
- April 18, 6h 34m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; IV at Hollister; epicenter about 11 miles southwest of Hollister. See map, epicenter 3b.
- April 18, 6h 36m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; felt at Hollister, shock from same epicenter as previous quake and of about the same magnitude.
- April 18, 6h 37m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; felt at Hollister, another shock from same epicenter as previous two shocks. This was the largest of the three.
- April 19, 5h 44m, p.m. Recorded at Berkeley only; not reported felt; focus about 7 miles from University campus. Blast?
- April 24, 12h 04m, p.m. Recorded at Berkeley only; not reported felt; focus about 7 miles from University campus. Record very small, probably a blast.
- April 26, 9h 43m, a.m. Recorded at Berkeley only; not reported felt; focus about 10 miles from University campus.
- May 2, 5h 43m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 9 miles from Lick Observatory.
- May 2, 10h 41m, a.m. Recorded at Palo Alto only; not reported felt; focus about 9 miles from Palo Alto station.
- May 4, 7h 31m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; IV at Pinnacles; epicenter about 9 miles west of San Benito. See map, epicenter 4b.



1938 -- P.S.T.

- May 4, 7h 32m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; IV at Pinnacles; probably from same epicenter as previous quake in the coda of which it was recorded.
- May 4, 11h 51m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 3 miles west of La Honda. See map, epicenter 5d.
- May 9, 6h 47m, a.m. Recorded at Mount Hamilton and poorly at Berkeley, Palo Alto, Fresno; not reported felt; probably a foreshock of May 10, 2h 32m, a.m.
- May 10, 2h 06m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; not reported felt; epicenter about 7 miles north of San Benito. This was a foreshock of the two following earthquakes. See map, epicenter 6a.
- May 10, 2h 32m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno. Intensities:
- IV Big Sur, King City, Monterey, Pinnacles, Salinas, Soledad, Soquel, Tres Pinos
 - III Hollister, San Benito; same epicenter as previous quake.
- May 10, 2h 34m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno, San Francisco; felt in same area as first shock, the two being reported together. Same epicenter as that of previous shock. These two earthquakes were of same magnitude.
- May 10, 2h 41m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; if felt, reports confused with those of earlier shocks. Epicenter about 11 miles southwest of San Benito. The seismograms indicate that this was not an aftershock of earlier quakes. See map, epicenter 7b.
- May 10, 3h 59m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 7 miles northwest of San Benito. See map, epicenter 8c.
- May 12, 7h 45m, a.m. Recorded at Mount Hamilton, Palo Alto; not reported felt; probably an aftershock from epicenter 6a.
- May 12, 8h 37m, a.m. Recorded at Mount Hamilton, Palo Alto; not reported felt; probably an aftershock from epicenter 6a.
- May 13, 7h 53m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 12 miles from Lick Observatory.
- May 14, 2h 41m 58s, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 8 miles from Lick Observatory.



1938 -- P.S.T.

- May 14, 2h 42m 08s., p.m. Recorded at Mount Hamilton only; not reported felt; focus about 8 miles from Lick Observatory.
- May 14, 2h 44m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 8 miles from Lick Observatory.
- May 14, 2h 46m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 8 miles from Lick Observatory.
- May 15, 10h 02m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto and poorly at Fresno; not reported felt; probably another shock from epicenter 6a.
- May 21, 4h 56m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; probably another shock from epicenter 6a.
- May 22, 9h 58m, a.m. Recorded at Palo Alto only; not reported felt; focus about 6 miles from Palo Alto station.
- May 27, 9h 28m, a.m. Recorded at Mount Hamilton, Palo Alto, San Francisco, Fresno. Intensities:
- V Sattley
 - IV Calpine, Chilcoot, Downieville, Loyalton, Sierraville
 - II-III Graniteville, Johnsville, Sierra City; felt at Portola; epicenter near Downieville.
- May 27, 2h 05m, p.m. Recorded at Mount Hamilton, Palo Alto, Fresno; felt in King City; epicenter about 12 miles east of San Benito.
- May 30, 4h 41m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 15 miles from Lick Observatory.
- June 1, 6h 02m, p.m. Recorded at Palo Alto only; not reported felt; focus about 7 miles from Palo Alto station.
- June 9, 5h 14m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 9 miles from Lick Observatory.
- June 9, 5h 27m, a.m. Recorded at Berkeley, San Francisco, Mount Hamilton, Palo Alto; not reported felt; focus about 8 miles north of Lick Observatory. See map, epicenter 10b.
- June 9, 7h 02m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about $6\frac{1}{2}$ miles from Lick Observatory.
- June 11, 12h 31m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 6 miles north of Lick Observatory.

1938 -- P.S.T.



- June 12, 10h 47m, a.m. Recorded at Palo Alto only; not reported felt; focus about 11 miles from Palo Alto station.
- June 14, 10h 57m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 5 miles west of Tres Pinos. See map, epicenter 12d.
- June 14, 1h 25m, p.m. Recorded at Berkeley, Palo Alto, Mount Hamilton; not reported felt; recordings do not agree well; probably another shock from epicenter 2a.
- June 19, 8h 56m, a.m. Recorded at Berkeley only; not reported felt; focus about 13 miles from University campus.
- June 23, 5h 49m, a.m. Recorded at Mount Hamilton only; not reported felt; epicenter about 50 miles from Lick Observatory, no doubt southerly.
- June 25, 1h 39m, p.m. Recorded at Palo Alto only; not reported felt; focus about 5 miles from Palo Alto station.
- June 25, 2h 00m, p.m. Recorded at Mount Hamilton and poorly at Berkeley and Palo Alto; not reported felt; two small shocks 5.5 seconds apart; foci about 7 miles from Lick Observatory.
- June 25, 3h 05m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 7 miles from Lick Observatory.
- June 25, 5h 14m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 7 miles from Lick Observatory.
- June 28, 10h 57m, a.m. Recorded at Palo Alto only; not reported felt; focus about 10 miles from Palo Alto station.



THE REGISTRATION OF EARTHQUAKES

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.
- AE E-W component of A.
- AN N-S component of A.
- AZ Vertical component of A.

4. Time--

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



BERKELEY
 THE BERKELEY STATION, UNIVERSITY OF CALIFORNIA
 BERKELEY, CALIFORNIA

CONSTANTS
 CONSTANTS OF THE STATION

Latitude and longitude:

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

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

Altitude.--85 meters (279 feet) above mean sea level.

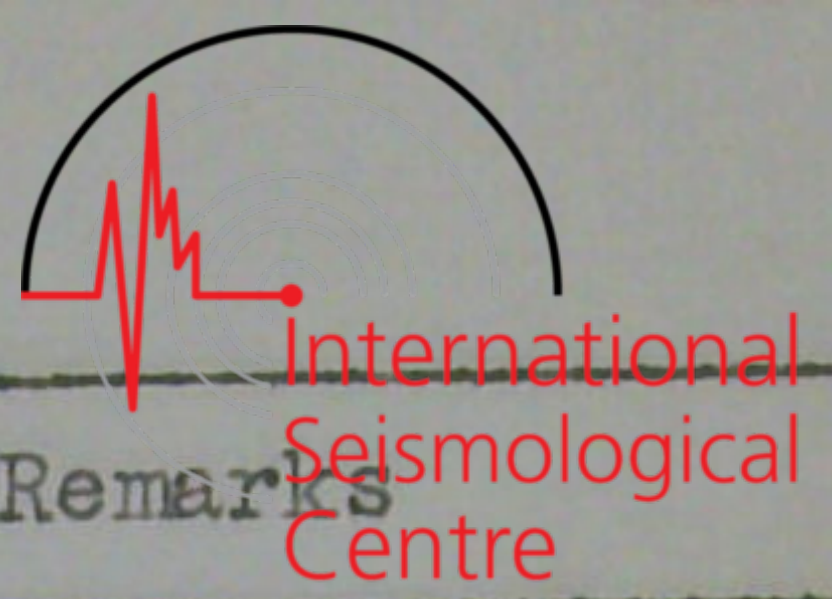
CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	V		T ₀	ε	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.

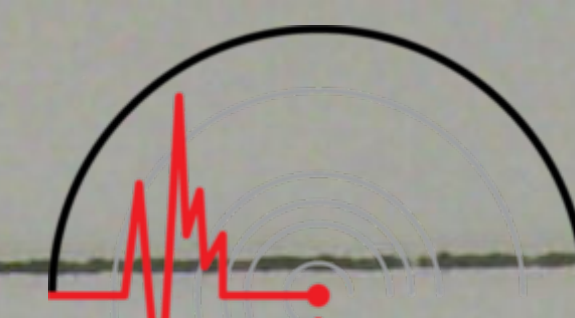
Operation of the Benioff instrument was resumed November 9, 1937.

BERKELEY



No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E mm.	A _N mm.	A _Z mm.	
				h. m. s.	s.				
1	Apr. 2	II	eE	G 06 31 11.6					South Atlantic
			eZ	G 06 56 47.6					
			eE	G 06 57 11.6					
			eZ	G 06 59 30.6					
			F	08 00					
2	Apr. 4	Id	iP _{EZ}	AH 05 59 02.7					See discussion, p. 44
			iS _E	A 05 59 07.7					
			iS _N	A 05 59 08.0					
			F	05 59 45.0					
3	Apr. 7	Id	eP _N	A 22 18 46.2					See discussion, p. 44
			iP _Z	H 22 18 46.2					
			eS _E	A 22 18 48.0					
			iS _N	A 22 18 48.2					
			F	22 19 06.0					
4	Apr. 9	IIu	iP _Z	H 09 23 05.1					Epicenter by Apia: 16°S., 170°E.
			eN	G 09 53 29.0					
			F	10 30.3					
5	Apr. 12	Iv	iP _Z	H 09 46 24.0					See discussion, p. 44
			eS _N _{EN}	A 09 46 40.1					
			iS _Z	H 09 46 42.4					
			F	09 50.3					
6	Apr. 12	I	eN	G 11 20 09.3					
			eN	G 11 21 19.3					
			eZ	G 11 23 06.3					
			eZ	G 11 27 19.3					
			F	11 38.3					
7	Apr. 13	IIu	iP _Z	G 02 58 36.8					Pasadena epicenter: 39°12' N., 15°12' E. Felt in Italy.
			iP _Z	H 02 58 37.3					
			eN	A 02 58 37.3					
			eE	A 02 58 37.8					
			eE	G 03 02 19.8					
			iZ	H 03 02 22.8					
			eN	G 03 02 26.8					
			ePP _Z	G 03 02 27.8					
8	Apr. 16	II	eN	G 20 29 37.0					
			eE	G 20 34 09.0					
			eN	G 20 34 23.0					
			eZ	G 20 37 35.0					
			eE	G 20 39 39.0					
			F	21 04.4					

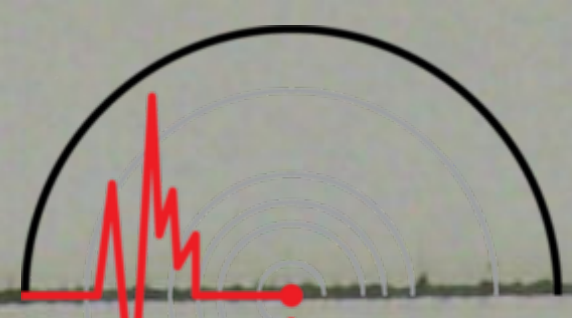
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No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				Δ_E	Δ_N	Δ_Z	
	1938			h.	m.	s.	s.	mm.	mm.	mm.	
9	Apr. 17	IIr	eN	A	14	51	15.2	4	+2	+8.5	Pasadena reports shock in Bolivia
			iz	H	14	51	16.9				
			iE	G	14	51	17.1				
			iN	G	15	00	59.1				
			iE	G	15	01	01.1				
			eZ	G	15	01	08.1				
10	Apr. 19	Iv	ePnN	A	02	34	48.7				See discussion, p. 44
			iz	H	02	34	51.1				
			iz	H	02	34	53.2				
			iz	H	02	34	55.4				
			iS \bar{Z}	H	02	35	08.2				
11	Apr. 19	Iv	ePnZ	H	02	37	46.9				See discussion, p. 44
			eP $\bar{E}N$	A	02	37	48.4				
			iPZ	H	02	37	48.9				
			iS $\bar{E}Z$	AH	02	38	06.4				
			F								
12	Apr. 19	Iv	iS \bar{E}	A	02	38	38.9				See discussion, p. 44
			iS \bar{N}	A	02	38	39.4				
			F				02				
13	Apr. 19	IIu	ePZ	G	11	12	44.0				U.S.C.&G.S. epicenter: 39°30' N., 33°30' E.
			ePPZ	G	11	17	11.8				
			e \bar{E}	G	11	26	18.8				
			F				12				
14	Apr. 20	Id	iPZ	H	01	43	52.8				See discussion, p. 44
			eP $\bar{E}N$	A	01	43	53.0				
			iS \bar{Z}	H	01	43	54.2				
			F				01				
15	Apr. 20	II	ePZ	G	06	39	39.3				Pasadena epicenter: 22°S., 175°E.
			eN	G	06	50	02.3				
			eE	G	06	50	06.3				
			eN	G	07	02	11.3				
			eZ	G	07	06	26.3				
			F				07				
16	Apr. 22	IIr	iP $\bar{E}N$	A	04	18	58.0				Off Vancouver Island. Pasadena epicenter: 51°N., 129°W. approx.
			iPEZ	G	04	18	58.5				
			eZ	G	04	20	02.5				
			eZ	G	04	21	46.5				
			eE	G	04	21	53.5				
			eZ	G	04	22	48.5				
			F				05				

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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.	
17	Apr. 24	Id	iP _Z	H 20 04 31.8					See discussion, p. 44
			iS _Z	H 20 04 33.3					
			F	20 04 45					
18	Apr. 25	II	eN	G 17 21 24.9				Surface waves	
			eE	G 17 22 02.9					
			eZ	G 17 30 38.9					
			F	17 52.4					
19	Apr. 26	Id	iP _Z	H 17 42 44.2				See discussion, p. 44	
			iN	A 17 42 45.5					
			eE	A 17 42 45.5					
			iS _Z	H 17 42 46.0					
20	Apr. 28	IIv	eE	G 06 10 19.0				Pasadena epicenter: 32°37' N; 118°12' W Felt at San Diego, California	
			eZ	G 06 11 49.0					
			F	06 18.4					
21	May 3	IIr	iP _Z	G 02 21 12.7				U.S.C. & G.S. epicenter: 18°N., 99°W. near Iguala, Mexico.	
			eP _E	G 02 21 12.7					
			iP _Z	H 02 21 13.2					
			eP _{EN}	A 02 21 13.7					
			iN	A 02 21 33.7					
			iz	H 02 21 33.7					
			eZ	G 02 22 08.7					
			eE	G 02 22 24.7					
			iz	H 02 24 27.7					
			eN	A 02 24 30.7					
			iE	A 02 24 54.7					
			eS _Z	G 02 25 43.0					
			eG _E	G 02 26 29.0					
			eN	A 02 30 51.7					
eN	G 02 37 46.7								
F	02 40.4								
22	May 4	I	iz	H 02 38 32.8	1 ^s			+1.5	
			eEN	A 02 38 33.3	1 ^s	+0.5	+0.5		
			eN	A 02 40 41.3					
23	May 4	Iv	iP _{nZ}	H 15 30 58.5				See discussion, p. 44 Lost in beginning of next shock	
			eP _{nN}	A 15 30 59.0					
			F						

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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.	
24	May 4	Iv	iz	H 15 31 54.0					In coda of previous shock See discussion, p. 45
			e _N	A 15 31 54.0					
			e _E	A 15 32 17					
			F	15 33.5					
25	May 4	Id	iP _Z	H 19 50 55.3				See discussion, p. 45 large as P, too early for S	
			iz	H 19 51 01.3					
			F	19 51.5					
26	May 6	IIr	e _N	G 18 31 20.0				U.S.C. & G.S. epicenter: 13°N., 87°W.	
			e _Z	G 18 40 26.0					
			F	19 00					
27	May 8	IIu	e _Z	H 14 07 48.0				Pasadena epicenter: 50°S., 98°E.	
			e _Z	G 14 07 49.4					
			iz	H 14 07 51.2					
			iz	H 14 07 54.5					
			e _E	A 14 07 54.5					
			e _E	G 14 08 37.0					
			e _Z	G 14 08 50.4					
			e _{EN}	G 14 58 26.0					
			e _Z	G 14 58 34.1					
			F	16 05.5					
28	May 9	II	e _N	G 02 46 52.0					
			e _E	G 02 47 18.0					
			e _Z	G 02 47 26.0					
			F	03 00					
29	May 9	II	e _N	G 03 28 55.0					
			e _E	G 03 29 56.0					
			e _Z	G 03 30 06.0					
			e _N	G 03 31 18.0					
			F	03 38.5					
30	May 9	II	e _{EN}	G 03 47 38.0					
			e _Z	G 03 48 08.0					
			F	04 04.5					
31	May 9	Iv	iz	H 14 47 41.0				See discussion, p. 45	
			F	14 48.3					
32	May 10	Iv	iP _{nZ}	H 10 06 45.8	.5				
			iP _Z	H 10 06 48.5	.5				
			iz	H 10 06 55.0	.5			+3.0	
			e _E	A 10 06 58.0					
			iS _{nZ}	H 10 07 04.2	.4			+3.0	
			iz	H 10 07 10.8	.75			+3.0	
			e _E	A 10 07 11.0					
			iz	H 10 07 22.3	.4			-1.0	
			F	10 08.5					

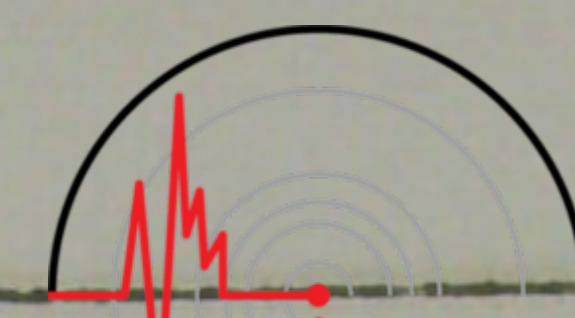
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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E mm.	A _N mm.	A _Z mm.	
1938				h. m. s.	s.				
33	May 10	IIv	iPnZ	H	10 32 46.2				See discussion, p. 45
			ePnE	A	10 32 47.0				
			iP _Z	H	10 32 49.0				
			iP _E	A	10 32 50.0				
			iz	H	10 32 53.5				
			iSnz	H	10 33 12.8				
			iSnE	A	10 33 13.0				
			iS _Z	H	10 33 19.0				
			F						
34	May 10	IIv	eE	A	10 34 01.5				See discussion, p. 45 Z record confused by previous shock
			iSnE	A	10 34 22.0				
			F		10 37.5				
35	May 10		iPnZ	H	10 41 52.3				See discussion, p. 45
			iP*Z	H	10 41 54.5				
			iE	A	10 42 18.5				
			F		10 45.5				
36	May 10		eP*Z	H	23 59 35.1				See discussion, p. 45
			eP _Z	H	23 59 39.0				
			F		00 03				
37	May 11	IIr	iPZE	G	14 50 38.2				U.S.C. & G.S. epicenter: 16°54' N., 101°W.
			iE	A	14 51 04.0				
			iz	G	14 56 14.0				
			ez	G	14 57 15.0				
			eE	A	15 04 06.0				
			eN	A	15 04 39.0				
			eN	A	15 07 41.0				
			F		16 00				
38	May 12	IIu	iPZ	H	15 52 20.0				U.S.C. & G.S. epicenter: 8°S., 147°E.
			ePEZ	G	15 52 26.0				
			ePN	G	15 52 43.0				
			iz	G	15 56 11.0				
			eE	A	15 56 13.2				
			eN	A	15 56 16.0				
			eSEZ	G	16 02 30.0				
			eSN	G	16 02 36.0				
			eN	A	16 02 56.0				
			eE	A	16 03 11.5				
			F		18 40.5				
			39	May 15	IV	iPnZ	H	18 01 50.5	
eE	A	18 01 52.0							
eN	A	18 01 53.0							
iN	A	18 02 06.5							
iz	H	18 02 07.2							
F		18 04.5							

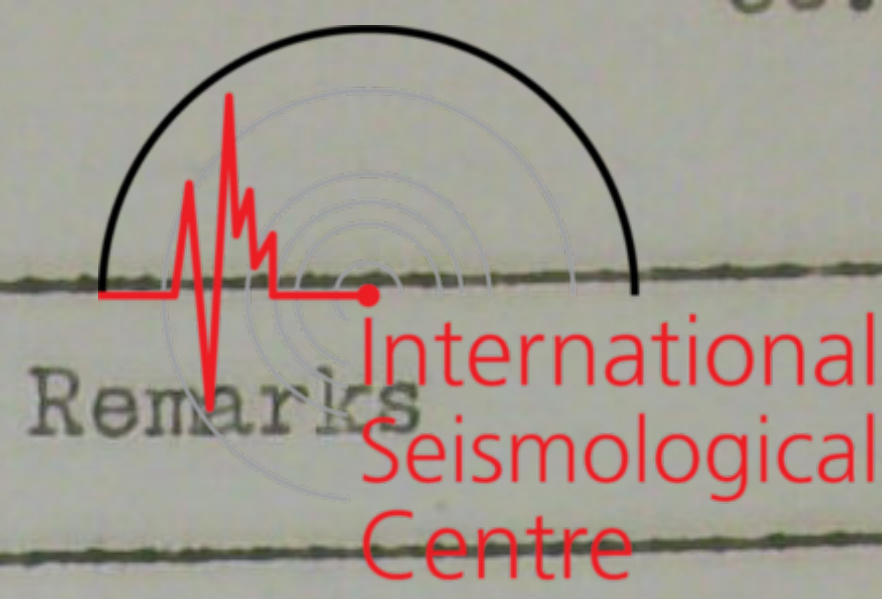
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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks		
						A _E	A _N	A _Z			
						mm.	mm.	mm.			
						h. m. s.	s.				
40	May 19	IIu	eEZ	G	17 23 25.0				U.S.C. & G.S. epicenter: 00°30' N., 119°E.		
			eN	G	17 23 45.0						
			eN	A	17 27 03.0						
			eE	A	17 27 59.0						
			eE	G	17 28 00.0						
			eN	A	17 28 02.0						
			eN	G	17 28 03.0						
			eN	A	17 37 15.0						
			eN	A	17 37 43.0						
			eE	A	17 37 55.0						
			eE	A	17 43 05.0						
			eN	A	17 43 34.8						
			eN	A	17 55 35.0						
F	G	20 30.5									
41	May 22	Iv	ePnz	H	00 56 24.4			See discussion, p. 46			
			eZ	H	00 56 29.8						
			F		00 57						
42	May 22	II	ePEZ	G	07 58 36.4						
			eE	G	08 10 24.4						
			eE	G	08 27 20.4						
			eZ	G	08 27 24.4						
			F		09 45.5						
43	May 23	IIu	ePE	G	07 29 58.7			U.S.C. & G.S. epicenter: 36°N., 141°E.			
			ePZ	G	07 29 59.7						
			iPENZ	AH	07 30 01.8						
			eN	G	07 30 02.7						
			iz	G	07 30 02.7						
			iNZ	G	07 39 24.7						
			iN	G	07 39 27.7						
			eZ	G	07 52 08.7						
			F		11 40.5						
44	May 28	IIu	iPZ	G	16 53 01.5			Strasbourg epicenter: 43°N., 144°E.			
			eEN	G	17 01 53.5						
			eZ	G	17 01 57.5						
			F		18 20.5						
45	May 30	IIu	iPZ	H	14 42 28.8			U.S.C. & G.S. epicenter: 20°S., 169°E.			
			iPENZ	G	14 42 30.8						
			iz	H	14 42 38.8						
			eEZ	G	14 52 48.8						
			eE	A	14 53 08.8						
			eE	A	14 54 18.8						
			eZ	G	14 54 21.8						
			eE	G	14 54 22.8						
			eZ	G	14 59 32.8						
F		17 35.5									

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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.	
46	May 31	IIv	iPz	H	08 36 17.3				Pasadena epicenter: 33°41' N., 117°32' W.
			iz	H	08 36 18.3				
			iN	A	08 36 22.3				
			eE	A	08 36 22.3				
			iN	A	08 36 48.3				
			iE	A	08 36 49.3				
			eE	G	08 36 51.3				
			iz	H	08 37 04.3				
			iN	A	08 37 21.4				
			eN	G	08 37 34.3				
			ez	G	08 37 36.3				
F		08 43.5							
47	June 5	I	eN	G	01 33 20.4				
			ez	G	01 36 24.4				
			eN	G	01 36 33.4				
			F		01 45.5				
48	June 5	I	eN	G	02 24 02.4				
			ez	G	02 27 09.4				
			F		02 37.5				
49	June 6	I	eE	G	02 45 08.2				Pasadena epicenter: 32°54' N., 115°13'
			eE	G	02 46 39.2				
			eN	G	02 46 55.2				
			eN	A	02 47 00.2				
			ez	G	02 47 10.2				
			eE	A	02 47 15.2				
			eN	G	02 47 54.2				
			eEN	G	02 47 55.2				
F		02 54.5							
50	June 9	Id	ePz	H	13 27 07.2				See discussion, p. 46
			iPnZ	H	13 27 08.5				
			ePn ^{EN}	A	13 27 08.7				
			iz	H	13 27 09.7				
			iSZ	H	13 27 17.2				
			iSE	A	13 27 18.2				
			iSN	A	13 27 18.7				
			iSnZ	H	13 27 19.2				
			iz	H	13 27 22.7				
			F		13 28				
51	June 10	IIu	eEZ	G	19 29 40.4				U.S.C. & G.S. epicenter: 02°S., 128°E.
			eE	G	19 34 00.0				
			ez	G	19 34 04.4				
			ez	G	19 43 24.4				
			ez	G	20 06 48.3				
			F		22 00				

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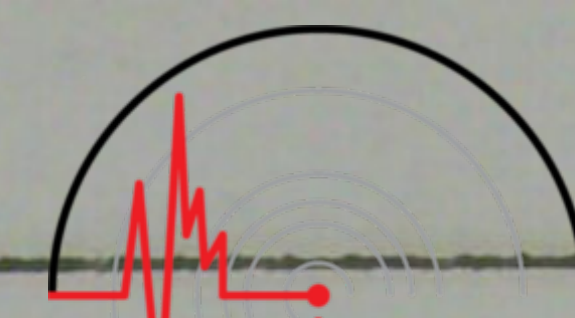
No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
52	June 10	IIu	eZ	G	10 06 40.9				U.S.C. & G.S. epicenter: 25°N., 125°E.
			eN	G	10 06 43.9				
			eE	G	10 06 47.9				
			iZ	G	10 06 56.9				
			eEN	G	10 17 24.9				
			F		12 50.8				
53	June 10	IIr	eZ	G	18 12 14.2				U.S.C. & G.S. epicenter: 16°30' N., 98°W.
			eEN	G	18 12 15.2				
			eN	G	18 17 18.2				
			eN	G	18 17 19.2				
			eZ	G	18 17 23.2				
			eZ	G	18 23 35.2				
			F		18 50.8				
54	June 11	Id	e ⁻ PEN	A	20 31 26.5				See discussion, p. 46
			iPZ	H	20 31 27.0				
			iSN	A	20 31 36.5				
			iSE	A	20 31 37.0				
			F		20 32.7				
55	June 12	II	eN	G	03 39 05				
			eN	G	03 41 58				
			eE	G	03 43 40				
			F		04 30.8				
56	June 14	Iv	iPZ*	H	18 56 12.3				See discussion, p. 47
			eN	A	18 56 13.8				
			iZ	H	18 56 17.8				
			iN	A	18 56 39.8				
			F		18 57 10.0				
57	June 14	IIv	iZ	G	21 25 07.1				See discussion, p. 47
			iZ	G	21 25 09.4				
			iZ	G	21 25 12.6				
			iN	G	21 25 35.1				
			iE	G	21 25 36.1				
			F		21 25.7				
58	June 15	II	iZ	G	12 53 36.0				
			eN	G	13 04 02.0				
			eE	G	13 04 03.0				
59	June 16	IIu	iPEZ	G	02 27 59.8				U.S.C. & G.S. epicenter: 29°N., 128°E.
			iPN	G	02 28 00.3				
			ePEN	A	02 28 00.8				
			iN	A	02 28 27.8				
			eN	A	02 28 35.8				

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
						mm.	mm.	mm.		
						h. m. s.	s.			
59	June 16 cont'd.	IIu	eZ	G	02 31 23.8					
			eE	G	02 38 16.8					
			eE	A	02 38 39.8					
			eZ	H	02 55 25.8					
			F		04 30					
60	June 19	Id	eP _Z	H	16 56 02.4				See discussion, p. 47	
			iS _{ENZ}	AH	16 56 05.1					
			F		16 56.3					
61	June 20	II	eE	G	14 14 18.5					
			eE	G	14 16 30.5					
			eN	G	14 16 34.5					
			eZ	G	14 17 32.5					
			F		14 26					
62	June 21	IIu	eE	G	00 07 20.8				Strasbourg epicenter: 41°18'N., 77°18'E. Felt in Turkestan.	
			eZ	G	00 07 43.8					
			eN	G	00 08 20.8					
			eZ	G	00 17 18.8					
			F		01 26					
63	June 23	IIu	eP _N	G	13 08 05				U.S.C. & G.S. epicenter: 20°S., 169°E.	
			iP _E	A	13 08 06					
			iP _{EZ}	G	13 08 08					
			eZ	H	13 11 43					
			eE	G	13 18 05					
			eE	G	13 18 29					
			iE	A	13 19 05					
			eN _Z	G	13 20 01					
			eZ	G	13 35 01					
			eN	A	13 37 15					
			F		14 41					
64	June 25		iZ	H	22 00 54.7				See discussion, p. 47	
			iZ	H	22 01 01.2					
			iZ	H	22 01 06.2					
			F		22 01.4					
65	June 25	II	iP _Z	G	23 55 31.7				Strasbourg epicenter: 77°N., 2°E.	
			eN	G	23 55 32.7					
			eN	G	00 04 00.7					
			eE	G	00 04 04.7					
			F		00 31					

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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.		
66	June 28	IIr	iP _Z	G	07 23 30				U.S.C. & G.S. epicenter: 19°N., 100°W.	
			e _E	G	07 23 31					
			iP _E	A	07 23 31.5					
			iP _N	A	07 23 32					
			eP _N	G	07 23 34					
			e _N	A	07 27 37					
			e _N	G	07 28 12					
			e _E	G	07 28 16					
			e _Z	G	07 28 35					
			e _E	A	07 33 00					
67	June 29	IIu	e _Z	G	18 56 00				Near Apia	
			e _N	G	19 05 56					
			e _{NE}	G	19 17 00					
			F	G	20 00					
68	June 30	IIu	eP _{EZ}	G	16 57 26				Apia: U.S.C. & G.S. epicenter: 24°S., 167°E.	
			iP _E	A	16 57 26.5					
			eP _N	G	16 57 27					
			i _E	A	16 57 35					
			e _N	G	17 08 --					
			e _E	G	17 08 06					
			e _E	G	17 24 41					
			F		18 16 --					

MOUNT HAMILTON



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

CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

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

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

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

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

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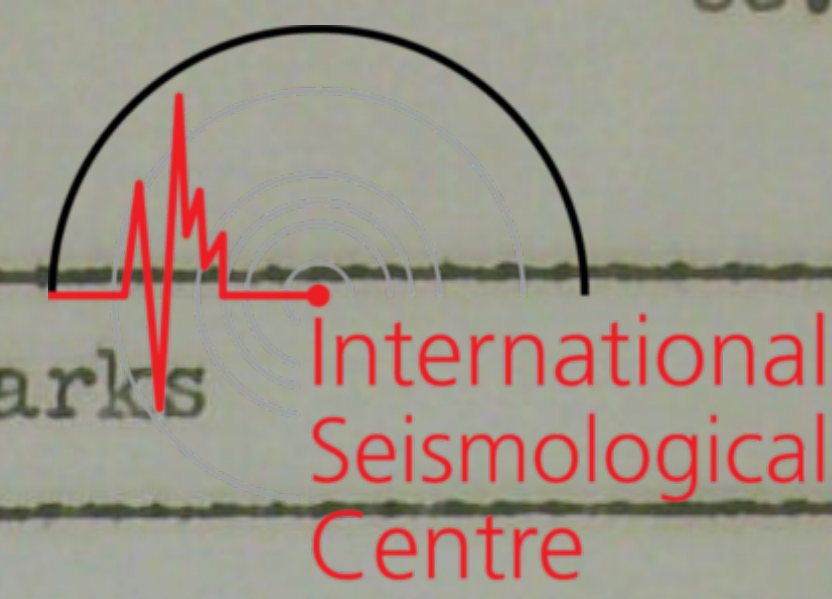
No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
	1938			h.	m.	s.	
1	Apr. 4	Id	e \bar{N}	05	59	11.5	See discussion, p. 44
			e \bar{E}	05	59	13.5	
			e \bar{S}_N	05	59	20.5	
			e \bar{S}_E	05	59	21.0	
			F	06	00		
2	Apr. 12	Id	e \bar{P}_N	09	46	12.9	See discussion, p. 44
			i \bar{S}_E	09	46	20.4	
			i \bar{S}_N	09	46	20.6	
			F	09	47.3		
3	Apr. 13	Iv	e \bar{N}	19	31	53.1	Felt in Imperial Valley Pasadena epicenter: 32°53' N., 115°35' W.
			e \bar{N}	19	31	59.6	
			e \bar{N}	19	33	26.1	
			e \bar{S}	19	33	29.1	
				19	35.7		
4	Apr. 19	Id	i \bar{P}_{EN}	02	34	37.6	See discussion, p. 44
			i \bar{S}_{EN}	02	34	45.9	
			F	02	36	21	
5	Apr. 19	Id	i \bar{P}_{EN}	02	36	35.5	See discussion, p. 44 Lost in beginning of next shock
			i \bar{S}_{EN}	02	36	43.4	
			F				
6	Apr. 19	Id	i \bar{S}_N	02	37	14.9	P lost in coda of pre- ceding shock See discussion, p. 44
			i \bar{S}_E	02	37	15.9	
			F	02	39.8		
7	Apr. 20	I	e \bar{E}	00	59	51.4	
			e \bar{N}	00	59	52.4	
			e \bar{E}	01	00	07.2	
			e \bar{N}	01	00	07.9	
			F	01	01.8		
8	Apr. 22	IIr	e \bar{P}_{EN}	04	19	07.7	Off Vancouver Island Pasadena epicenter: 51°N., 129°W. approx.
			e \bar{N}	04	23	44.0	
			F	04	36.8		
9	Apr. 28	II	e \bar{E}	06	08	46.9	
			e \bar{N}	06	08	47.2	
			F	06	16.8		
10	May 2	Id	i \bar{P}_{EN}	13	42	37.5	See discussion, p. 44
			i \bar{S}_{EN}	13	42	39.3	
			F	13	43		

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No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
11	May 3	IIr	iP _N	02 21 07.7	U.S.C. & G.S. epicenter: 18°N., 99°W. near Iguala, Mexico
			eP _E	02 21 07.8	
			eE	02 21 28.3	
			eN	02 22 12.8	
			eN F	02 30 52.7 02 36.8	
12	May 4	Iv	iP _{EN}	15 30 49.4	See discussion, p. 44 Lost in beginning of next shock
			iS _E	15 31 02.3	
			iS _N	15 31 02.4	
			F		
13	May 4	Iv	eP _E	15 31 42.9	See discussion, p. 45
			iS _E	15 31 55.1	
			iS _N	15 31 55.3	
			F	15 33.9	
14	May 4	Iv	eS _E	19 51 04.0	See discussion, p. 45
			F	19 51 35	
15	May 9	I	eE	14 42 12.3	
			eN	14 42 12.5	
			eE	14 43 18.8	
			F	14 44	
16	May 9	Id	iP _N	14 47 28.8	See discussion, p. 45
			eP _N	14 47 29.3	
			eS _N	14 47 40.0	
			eS _E	14 47 40.3	
			F	14 48.5	
17	May 10	Id	iP _N	10 06 36.4	See discussion, p. 45
			eS _N	10 06 48.4	
			iS _N	10 06 49.4	
			F	10 08	
18	May 10	IIId	iP _N	10 32 37.2	See discussion, p. 45 Lost in beginning of next shock
			iS _N	10 32 49.2	
			F		
19	May 10	Id	eP _N	10 33 47.2	See discussion, p. 45
			eS _N	10 33 59.2	
			F	10 38	
20	May 10	Id	iP _N	10 41 42.7	See discussion, p. 45
			iS _N	10 41 56.2	
			F	10 44	

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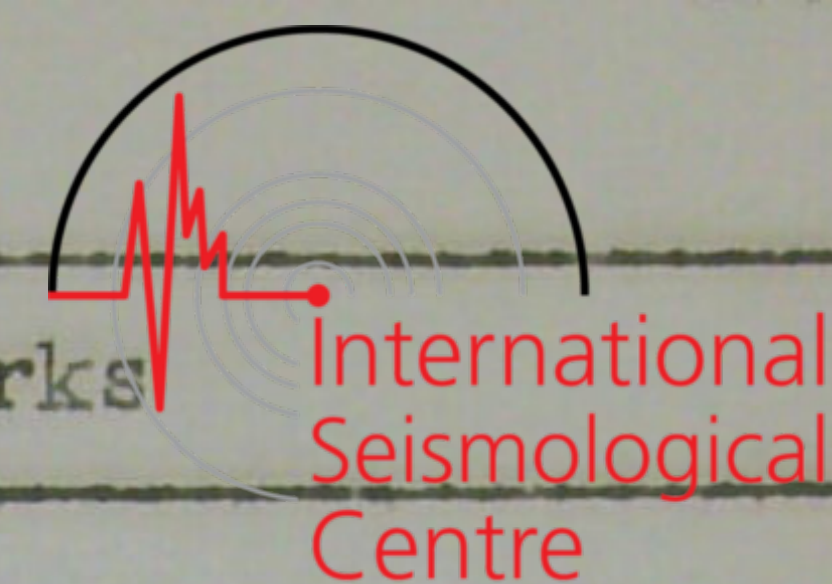
No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
21	May 10	Id	e \overline{P}_N	23 59 23.7	See discussion, p. 45
			iS*N	23 59 34.9	
			i \overline{S}_N	23 59 36.1	
			iSn \overline{N}	23 59 37.1	
			F	24 00.5	
22	May 11	II	e \overline{N}	14 50 38.6	Surface waves U.S.C. & G.S. epicenter: 16°54' N., 101°W.
			e \overline{N}	14 58 56.1	
			e \overline{N}	15 03 29.1	
			F	15 29	
23	May 12	Id	e \overline{P}_N	15 44 46.4	See discussion, p. 45
			e \overline{S}_{EN}	15 44 57.4	
			F	15 45.5	
24	May 12	IIu	e \overline{P}_E	15 52 28.4	U.S.C. & G.S. epicenter: 8°S., 147°E.
			e \overline{N}	15 52 33.4	
			F	16 56	
25	May 12	Id	e \overline{P}_{EN}	16 37 34.2	See discussion, p. 45
			e \overline{S}_{EN}	16 37 45.8	
			F	16 39	
26	May 13	Id	i \overline{P}_{EN}	15 53 16.1	See discussion, p. 45
			i \overline{S}_{EN}	15 53 18.6	
			F	15 54	
27	May 14	Id	e \overline{P}_E	22 41 58.7	See discussion, p. 46
			i \overline{P}_N	22 41 58.8	
			e \overline{EN}	22 42 00.3	
			F		
					Lost in beginning of next shock
28	May 14	Id	e \overline{P}_E	22 42 08.7	See discussion, p. 46
			i \overline{S}_E	22 42 10.2	
			F	22 42 20	
29	May 14	Id	e \overline{P}_N	22 44 05.7	See discussion, p. 46
			e \overline{P}_E	22 44 05.8	
			i \overline{S}_N	22 44 07.3	
			i \overline{S}_E	22 44 07.5	
			F	22 44.5	
30	May 14	Id	e \overline{P}_E	22 46 09.4	See discussion, p. 46
			i \overline{S}_{EN}	22 46 10.9	
			i \overline{N}	22 46 11.3	
			F	22 46.5	

MOUNT HAMILTON



No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
31	May 15	Id	e \overline{P} _{EN}	18 01 41.5	See discussion, p. 46
			i \overline{S} _E	18 01 52.7	
			i \overline{S} _N	18 01 53.1	
			F	18 03	
32	May 19	IIu	e _E	17 28 12.7	U.S.C.& G.S. epicenter: 00°30' N., 119°E.
			e _N	17 28 14.7	
			e _E	17 38 02.7	
			e _E _F	18 00 34.7	
			F	18 42	
33	May 22	Id	e \overline{P} _E	00 56 12.7	See discussion, p. 46
			i \overline{S} _E	00 56 24.4	
			F	00 57.6	
34	May 23	IIu	e \overline{P} _E	07 30 06.6	U.S.C.& G.S. epicenter: 36°N., 141°E.
			e \overline{P} _N	07 30 07.1	
			e \overline{S} _N	07 39 34.1	
			e \overline{S} _E	07 39 34.1	
			e _N _F	07 49 21.6	
F	08 27				
35	May 27	Iv	e \overline{P} _E	17 28 33.0	See discussion, p. 46
			e \overline{P} _N	17 28 33.4	
			e _E	17 28 34.4	
			e _E	17 29 05.3	
			e \overline{S} _E	17 29 05.9	
			e \overline{S} _N	17 29 06.4	
			F	17 31	
36	May 27	Iv	e \overline{P} _{EN}	22 03 21.1	See discussion, p. 46
			e \overline{S} _{nE}	22 03 34.8	
			i _N	22 03 36.8	
			i _E	22 03 41.2	
			F	22 05	
37	May 28	IIv	e _E	10 02 11.1	U.S.C.& G.S. epicenter: 43°N., 125°W.
			e _N	10 15 39.4	
			e _N	10 15 41.3	
			e _E _F	10 15 41.9	
			F	10 37	
38	May 30	IIu	e _S	14 42 34.8	U.S.C.& G.S. epicenter: 20°S., 169°E.
			e _N	14 42 36.7	
			F	15 47	

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No.	Date	Char- acter	Phase	Time	Remarks
				U.T.	
				h. m. s.	
	1938				
39	May 31	Id	i \overline{P} EN	00 40 36.9	See discussion, p. 46
			i \overline{S} E	00 40 38.9	
			i \overline{S} N	00 40 39.2	
			F	00 41 30	
40	May 31	Iv	e \overline{N}	08 36 09.4	Pasadena epicenter: 33°41' N., 117°32' W. Felt throughout Southern California
			e \overline{E}	08 36 11.0	
			e \overline{N} F	08 37 39.4	
			F	08 47	
41	June 6	Iv	e \overline{N}	02 44 58.5	Felt in Imperial Valley
			e \overline{E}	02 45 00.3	
			e \overline{E} F	02 46 32.1	
			F	02 50	
42	June 9	Id	i \overline{P} EN	13 14 03.5	See discussion, p. 46
			i \overline{S} N	13 14 05.4	
			i \overline{S} E	13 14 05.5	
			F	13 15	
43	June 9	Id	i \overline{P} N	13 26 56.6	See discussion, p. 46
			i \overline{P} E	13 26 56.7	
			i \overline{S} E	13 26 58.2	
			F	13 27.8	
44	June 9	Id	i \overline{P} EN	15 02 42.2	See discussion, p. 46
			i \overline{S} EN	15 02 43.6	
			F	15 03 22.6	
45	June 10	Iu	e \overline{E} F	10 06 51.6	U.S.C. & G.S. epicenter: 25°N., 125°E.
			F	10 26.8	
46	June 10	IIr	e \overline{N} F	18 22 00.2	U.S.C. & G.S. epicenter: 16°30'N., 98°W.
			F	18 34.8	
47	June 11	IIId	i \overline{P} N	20 31 15.1	See discussion, p. 46
			i \overline{P} E	20 31 15.2	
			F	20 33.8	
48	June 14	Id	e \overline{P} N	18 56 02.1	See discussion, p. 47
			i \overline{S} EN	18 56 10.1	
			i \overline{N}	18 56 11.4	
			i \overline{NE}	18 56 12.1	
			F	18 56.8	

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No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
49	June 14	Id	e \overline{P} N	21 24 57.5	See discussion, p. 47
			e \overline{P} E	21 24 58.0	
			i \overline{E}	21 25 02.3	
			i \overline{S} EN	21 25 04.9	
			i \overline{N}	21 25 06.2	
			F	21 25.6	
50	June 16	IIu	eE	02 28 03.9	U.S.C. & G.S. epicenter: 29°N., 128°E.
			e \overline{N}	02 28 03.2	
			F	02 42.7	
51	June 23	IIu	e \overline{P} E	13 08 09.2	U.S.C. & G.S. epicenter: 20°S., 169°E.
			i \overline{P} E	13 08 12.0	
			e \overline{N}	13 08 09.5	
			F	13 10.7	
52	June 23	Id	e \overline{P} EN	13 48 37.0	See discussion, p. 47
			e \overline{S} N	13 48 47.6	
			e \overline{S} E	13 48 48.9	
			F	13 49.7	
53	June 25	Id	i \overline{P} EN	22 00 43.8	See discussion, p. 47
			i \overline{S} N	22 00 45.3	
			F	22 01	
54	June 25	Id	e \overline{P} EN	22 00 38.3	See discussion, p. 47 Lost in beginning of next shock
			i \overline{S} N	22 00 39.8	
			F		
55	June 25	Id	i \overline{P} N	23 05 14.5	See discussion, p. 47
			i \overline{P} E	23 05 14.6	
			i \overline{S} N	23 05 15.9	
			i \overline{S} E	23 05 16.0	
			F	23 05.7	
56	June 26	Id	e \overline{P} E	01 13 43.3	See discussion, p. 47
			i \overline{P} N	01 13 43.4	
			i \overline{S} EN	01 13 44.8	
			F	01 14.7	
57	June 28	IIr	e \overline{P} E	19 23 24.3	U.S.C. & G.S. epicenter: 19°N., 100°W.
			i \overline{P} N	19 23 24.4	
			e \overline{E}	19 32 37.2	
			F	19 41.6	

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PALO ALTO, CALIFORNIA



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Latitude and longitude:

$$\varphi = 37^{\circ} 25'1 \text{ N.}$$

$$\lambda = 122^{\circ} 10'8 \text{ W.}$$

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

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

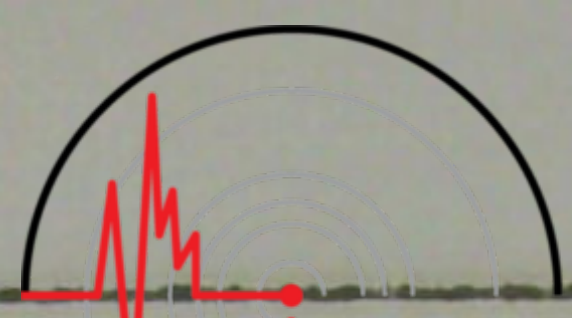
CONSTANTS OF THE SEISMOGRAPHS

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

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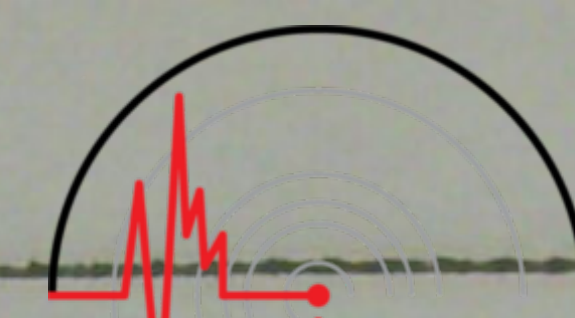
No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
1	Apr. 4	Id		05 59					See discussion, p. 44 $\bar{S} - \bar{P} = 9.3$ secs. Clock correction unknown
2	Apr. 12	Id	e \bar{P} N	09 46 18.1					See discussion, p. 44
			e \bar{E}	09 46 26					
			e \bar{S} N	09 46 29.1					
			i \bar{S} E	09 46 30.0					
			F	09 47.5					
3	Apr. 19	Id	e \bar{P} nN	02 34 43.4					See discussion, p. 44
			i \bar{S} N	02 34 54.4					
			F	02 36.5					
4	Apr. 19	Id	i \bar{P} n \bar{E} N	02 36 41.9					See discussion, p. 44
			i \bar{S} E	02 36 52.1					
			i \bar{S} N	02 36 52.3					
			F						
5	Apr. 19	Id	P						Lost in beginning of next shock
			i \bar{S} E	02 37 24.3					
			F	02 39					
6	Apr. 20	I	eN	01 00 02.6					
			eN	01 00 22.4					
			F	01 01.5					
7	Apr. 22	IIr	eE	04 19 13.9					Off Vancouver Island Pasadena epicenter: 51°N., 129°W. approx. Surface waves
			eN	04 19 28.7					
			eE	04 24 05.7					
			eN	04 24 07.7					
			eE	04 25 00.7					
			F	04 34.2					
8	Apr. 28	IIv	eN	06 08 52.3					Pasadena epicenter: 32°37' N., 118°12' W.
			eE	06 08 55.1					
			eE	06 09 10.9					
			eN	06 09 55.1					
			eE	06 09 56.3					
			F	06 14.2					
9	May 2	Id	i \bar{P} E	18 41 02.0					See discussion, p. 44
			i \bar{P} N	18 41 02.1					
			i \bar{S} E	18 41 03.7					
			F	18 41.7					

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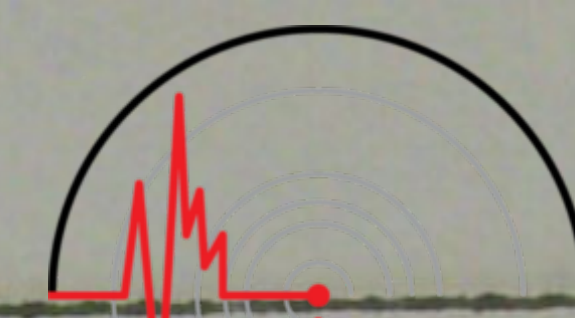
No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
10	May 3	I Ir	iEN iN F	02 21 12.1 02 21 15.1 02 23.2					U.S.C. & G.S. epicenter: 18°N., 99°W.
11	May 4	Iv	iP _{EN} iS _{NE} eS _N F	15 30 55.2 15 31 09.4 15 31 12.6					See discussion, p. 44 Lost in beginning of next shock
12	May 4	Iv	iE iN F	15 32 04.3 15 32 04.4 15 33 20					In coda of previous shock See discussion, p. 45
13	May 4	Id	iP _{EN} iS _N iS _E F	19 50 47.4 19 50 49.8 19 50 50.4 19 51.7					See discussion, p. 45
14	May 9	Iv	eN eN F	14 47 24.1 14 47 39.8 14 49					See discussion, p. 45
15	May 10	Iv	iP _E iP _N iS _{EN} F	10 06 41.3 10 06 41.8 10 06 57.6 10 08.6					See discussion, p. 45
16	May 10	IIv	iP _{EN} iS _{EN} F	10 32 42.3 10 32 58.6					See discussion, p. 45 Lost in beginning of next shock
17	May 10	IIv	iP _N iS _{EN} F	10 33 52.8 10 34 09.0 10 38.5					In coda of previous shock See discussion, p. 45
18	May 10	Iv	eP _E eP _N iS*E iS*N F	10 41 48.3 10 41 48.6 10 42 02.3 10 42 03.3 10 43.6					See discussion, p. 45
19	May 10	Iv	eE iS _{NE} F	23 59 32.5 23 59 44.2 00 01					See discussion, p. 45

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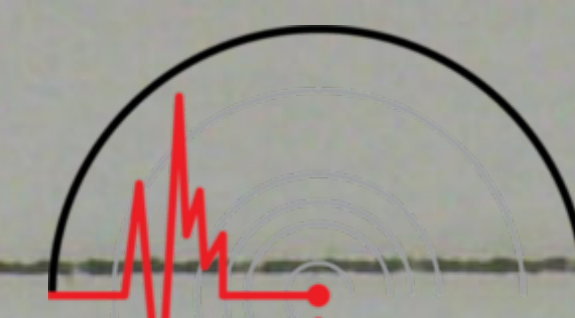
No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
1938						mm.	mm.	mm.		
				h. m. s.	s.					
20	May 11	IIr	eN	14 56 01.9					U.S.C. & G.S. epicenter: 16°9' N., 101°W.	
			eE	14 56 59.4						
			eE	14 58 08.9						
			eN	14 58 36.4						
			eE	15 01 49.4						
			eN	15 03 28.9						
			eE F	15 04 09.9 15 17.5						
21	May 12	Iv	eP _N	15 44 51					See discussion, p. 45	
			eN	15 44 53						
			eS _N	15 45 06.9						
			F	15 46						
22	May 12	Iv	eP _{EN}	16 37 39.1					See discussion, p. 45	
			eS _N	16 37 05.5						
			F	16 39.5						
23	May 12	IIu	eE	16 22 25.9					Surface waves U.S.C. & G.S. epicenter: 8°S., 147°E.	
			F	16 43.5						
24	May 15	Iv	iP _{EN}	18 01 45.9					See discussion, p. 46	
			iS _E	18 01 01.5						
			iS _N	18 01 01.9						
			F	18 03.5						
25	May 19	IIu	eE	17 37 40.9					U.S.C. & G.S. epicenter: 00°30' N., 119°E.	
			eE	17 37 55.9						
			eE	18 00 17.9						
			F	18 14.5						
26	May 22	Iv	eP _{nEN}	00 56 17.9					See discussion, p. 46	
			iS _{nEN}	00 56 33.7						
			iS _E	00 56 37.4						
			F	00 57.4						
27	May 22	Id	eP _{EN}	17 58 26.8					See discussion, p. 46	
			iS _{EN}	17 58 28.0						
			F	17 59.0						
28	May 23	IIu	eEN	07 30 05.6					U.S.C. & G.S. epicenter 36°N., 141°E.	
			eE	07 39 28.6						
			eN	07 39 29.6						
			F	08 06						

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
1938						mm.	mm.	mm.		
				h. m. s.	s.					
29	May 27	IIv	ePnE	17 28 35.8					See discussion, p. 46	
			ePnN	17 28 36.6						
			eSnN	17 29 04.6						
			iE	17 29 07.8						
			iN	17 29 10.2						
			F	17 30.4						
30	May 27	Iv	ePnE	22 03 25.1					See discussion, p. 46	
			eE	22 03 31.2						
			eSN	22 03 48.6						
			eE	22 03 49.2						
			eN	22 03 50.9						
31	May 28	IIv	ePE	10 15 37.8					U.S.C. & G.S. epicenter: 43°N., 125°W.	
			ePN	10 15 39.3						
			iPN	10 15 41.8	2		+0.5			
			eE	10 16 35.3						
			eE	10 17 23.3		+1.2				
			eN	10 17 30.8						
			eN	10 18 15.8			+2			
			eE	10 18 38.8	9	-2.5				
			eN	10 18 40.4	8		-2.1			
			eN	10 21 13.8	6		+1.8			
			eN F	10 23 22.0 10 34	7		-2			
32	May 30	IIu	iPN	14 42 33.0					U.S.C. & G.S. epicenter: 20°S., 169°E. Surface waves beginning	
			eN	15 10 51.5						
			F	15 26.3						
33	May 31	IIv	eN	08 36 29.1					Pasadena epicenter: 33°41' N., 117°32' W.	
			eE	08 36 33.1						
			eN	08 36 41.1						
			iE	08 37 29.1						
			eN	08 37 39.4						
			F	08 41.3						
34	June 2	Id	iP ⁻ EN	02 01 41.0					See discussion, p. 46	
			iSE	02 01 42.5						
			iSN	02 01 43.4						
			F	02 02.2						
35	June 9	Id	eP ⁻ N	13 27 03.0					See discussion, p. 46	
			eS ⁻ N	13 27 09.0						
			F	13 28						

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
1938						mm.	mm.	mm.		
				h. m. s.	s.					
36	June 11	Id	i \overline{P} _E	20 31 21.4					See discussion, p. 46	
			i \overline{P} _N	20 31 21.7						
			i \overline{E}	20 31 25.9						
			i \overline{S} _N	20 31 28.1						
			i \overline{E} _F	20 31 29.2						
			F	20 39.3						
37	June 12	Id	e \overline{P} _{EN}	18 46 53.6					See discussion, p. 47	
			i \overline{P} _N	18 46 55.0						
			i \overline{S} _E	18 46 54.9						
			i \overline{S} _N	18 46 55.7						
			F	18 47.4						
38	June 14	Id	e \overline{P} _{EN}	18 56 07.3					See discussion, p. 47	
			e \overline{S} * _N	18 56 18.1						
			i \overline{E}	18 56 25.9						
			F	18 57.8						
39	June 14	Id	e \overline{P} _N	21 25 02.1					See discussion, p. 47	
			i \overline{S} _N	21 25 12.9						
			i \overline{N}	21 25 16.6						
			F	21 25.9						
40	June 16	IIu	e \overline{E}	02 28 04.0					U.S.C. & G.S. epicenter: 29°N., 128°E.	
			e \overline{N}	02 28 05.0						
			e \overline{N}	02 28 17.8						
			F	02 32.8						
41	June 23	IIu	e \overline{E}	13 08 06.2					U.S.C. & G.S. epicenter: 20°S., 169°E.	
			e \overline{N}	13 08 08.5						
			e \overline{E}	13 08 10.0						
			F	13 09.8						
42	June 25	Id	i \overline{P} _{EN}	21 39 24.9					See discussion, p. 47	
			i \overline{S} _N	21 39 25.9						
			F	21 39.8						
43	June 25	Id	e \overline{N}	22 00 49.4					See discussion, p. 47	
			e \overline{N}	22 01 02.4						
			i \overline{N}	22 01 07.9						
			F	22 01.3						
44	June 28	Id	i \overline{P} _{EN}	18 56 59.3					See discussion, p. 47	
			i \overline{S} _{EN}	18 57 01.5						
			F	18 57.8						

PALO ALTO

International
Seismological
Centre

No.	Date	Char- acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
	1938			h. m. s.	s.	mm.	mm.	mm.	
45	June 28	IIr	e _E	19 23 22.4					U.S.C. & G.S. epicenter: 19°N., 100°W.
			e _{EN}	19 23 28.9					
			F	19 24.8					
46	June 30	IIu	e _{PE}	16 57 25.3					U.S.C. & G.S. epicenter: 24°S., 167°E.
			e _{PN}	16 57 26.0					
			F	16 58.8					

SAN FRANCISCO



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

CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

$$\begin{aligned} \phi &= 37^{\circ} 46'4 \text{ N.} \\ \lambda &= 122^{\circ} 27'2 \text{ W.} \end{aligned}$$

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

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

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	V	T_0	ϵ
Wood-Anderson	E 15° S	1500	1	15
	N	3000	1	15

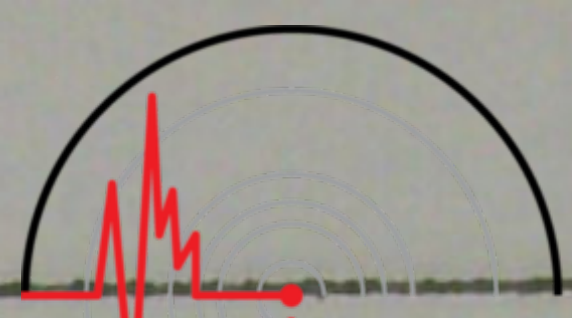
SAN FRANCISCO



International
Seismological
Centre

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
1	Apr. 4	Id	e _N	05 59 08.3	See discussion, p. 44
			i _{SEN}	05 59 13.3	
			F	05 59 20	
2	Apr. 12	Iv	e _N	09 46 26.2	See discussion, p. 44
			e _{SN}	09 46 42.2	
			F	09 47	
3	Apr. 22	IIr	e _N	04 19 02.6	Off Vancouver Island Pasadena epicenter: 51°N., 129°W. approx.
			e _N	04 23 58.8	
			F	04 47.4	
4	May 4	Iv	e _{P_N}	15 31 04.8	See discussion, p. 44
			e _E	15 31 07.0	
			e _E	15 31 13.0	
			i _N	15 31 13.4	
			F		
					Lost in beginning of next shock
5	May 4	Iv	e _N	15 32 26.3	In coda of previous shock See discussion, p. 44
			e _E	15 32 26.8	
			F	15 33.5	
6	May 10	Iv	e _{P_N}	10 06 46.1	See discussion, p. 45
			e _E	10 06 55.6	
			F	10 08	
7	May 10	IIv	e _{P_n_N}	10 32 47.4	See discussion, p. 45
			e _{S_n_N}	10 33 07.2	
			i _{S_N}	10 33 19.5	
			F		
					Lost in beginning of next shock
8	May 10	Iv	e _{P_n_N}	10 34 01.2	See discussion, p. 45
			i _{S_n_N}	10 34 21.0	
			i _{S_N}	10 34 28.0	
			F	10 37	
9	May 11	Iv	e _N	14 56 52.8	U.S.C. & G.S. epicenter: 16°9' N., 101°0' W.
			e _E	14 57 55.8	
			F	15 18	
10	May 15	Iv	e _{P_n_N}	18 01 49.4	See discussion, p. 46
			e _N	18 02 09.3	
			e _N	18 02 12.3	
			F	18 03	

SAN FRANCISCO

International
Seismological
Centre

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
				h. m. s.	
	1938				
11	May 19	Iu	e _N e _E F	17 55 34.9 18 00 04.9 18 09	U.S.C.& G.S. epicenter: 00°30' N., 119°E.
12	May 23	Iu	e _{EN} F	07 39 21.2 07 26.5	U.S.C.& G.S. epicenter: 36°N., 141°E.
13	May 27	Iv	e _{SN} F	17 29 06.9 17 30	See discussion, p. 46
14	May 28	Iv	e _{PEN} e _E e _N e _E e _N e _E e _N F	10 15 34.3 10 16 36.8 10 16 57.1 10 19 07.3 10 19 23.3 10 19 24.8 10 20 00.3 10 33	U.S.C.& G.S. epicenter: 43°N., 125°W.
15	May 31	Iv	e _N e _E e _E e _N F	08 35 30.2 08 35 57.0 08 38 09.0 08 38 18.0 08 40	Pasadena epicenter: 33°41' N., 117°32' W.
16	June 9	Id	e _N i _{SN} F	13 27 08.1 13 27 18.6 13 28 20	See discussion, p. 46
17	June 16	IIv	e _N e _E F	02 28 00.7 02 28 08.7 02 30	U.S.C.& G.S. epicenter: 29°N., 128°E.



FERNDALE

THE FERNDALE STATION
FERNDALE, CALIFORNIA

CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

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

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

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

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

The seismographs are Bosch-Omori 25 kg. horizontal pendulums. They are oriented to record N-S and E-W motion. The station is operated by Mr. Joseph Bognuda, of Ferndale, in cooperation with the University of California.



FERNDALE

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
1	Apr. 22	IIr	eN eE eN iE eN iN F	4	18	20 22 44 20 12 16 00	Pasadena epicenter: 51°N., 129°W. approx.
2	May 3	IIr	iE iN F	02	32	32 34 40	U.S.C. & G.S. epicenter: 18°N., 99°W. near Iguala, Mexico
3	May 9	II	eE eE F	02	45	00 04.2 05	
4	May 9	II	eE F	03	29	14	Lost in beginning of next shock
5	May 9	II	iE F	03	47	44 07	
6	May 9	Id	iP iS F	19	42	20 24 32	
7	May 11		eE iE iE F	14	51	39 12 18 49	U.S.C. & G.S. epicenter: 16°54' N., 101°W.
8	May 12	IIu	eE eE eN eE eN eE eE eN F	15	55	20 00 28 32 00 28 44 52 56	U.S.C. & G.S. epicenter: 8°S., 147°E.

FERNDALE



No.	Date	Char-acter	Phase	Time U.T.	Remarks
	1938			h. m. s.	
9	May 19	IIu	eE eE eE eE eE F	17 27 32 17 40 20 17 51 00 17 59 00 18 03 00 18 36 00	Pasadena epicenter: 00°30'N., 119°E.
10	May 23	IIu	eE eN eEN eN eE F	07 30 02 07 30 10 07 39 00 07 53 00 07 54 20 08 10	U.S.C. & G.S. epicenter: 36°N., 141°E.
11	May 28	IIv	ePE eN iE eN eEN iE eN F	10 14 42.9 10 14 48 10 15 14 10 15 16 10 16 28 10 16 58 10 17 06 10 43	Felt at Marshfield, Oregon U.S.C. & G.S. epicenter: 43°N., 125°W.
12	May 30	IIu	eE eE eN eE eEN eE F	14 42 40 14 54 24 15 09 00 15 10 00 15 15 -- 15 27 10 16 00	U.S.C. & G.S. epicenter: 20°S., 169°E.
13	June 16	IIu	iE iN eE F	02 27 48 02 27 52 02 38 30 02 42	



FRESNO

THE FRESNO STATION, FRESNO STATE COLLEGE
FRESNO, CALIFORNIA



CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

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

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			Remarks
				U.T.			
				h.	m.	s.	
	1938						
1	Apr. 12	Iv	e _N e _N F	01	51	01.9 32.4 54	Pasadena epicenter: 34°33' N., 120°47' W. Off Pt. Arguello
2	Apr. 12	Iv	e _{P_N} i _{S_N} F	16	26	20.0 29.9 34	Imperial Valley ?
3	Apr. 13	Iu	e _N F	02	58	37.3 07.5	Pasadena epicenter: 39°2' N., 15°2' E. Felt in Italy
4	Apr. 13	Iv	e _{P_N} i _{P_N} i _{S_N} F	19	31	22.1 28.5 36.5 38.5	Felt in Imperial Valley Pasadena epicenter: 32°53' N., 115°35' W.
5	Apr. 19	Iv	e _{P_N} i _{S_N} i _N F	02	34	54.8 09.8 10.8	See discussion, p. 44 Lost in beginning of next shock
6	Apr. 19	Iv	i _{S_N} F	02	37	09.0	See discussion, p. 44 Lost in beginning of next quake
7	Apr. 19	Iv	i _{S_N} e _N F	02	37	40 17.3 43	See discussion, p. 44
8	Apr. 20	I	e _N i _N i _N F	00	59	44 51.3 58.9 63	
9	Apr. 20	Iu	e _N F	06	39	7 41	Pasadena epicenter: 22°S., 175°E.
10	Apr. 22	Iv	e _{P_N} i _N i _{PR_{1N}} F	04	19	22.1 24.5 31.0 34.5	Pasadena epicenter: 51°N., 129°W.
11	Apr. 28	Iv	e _{P_N} i _N F	06	08	33.7 22.0 19	Pasadena epicenter: 32°37' N., 118°12' W.



FRESNO

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
				1938			
12	May 2	Ir	iP _N	02	20	53.6	U.S.C.& G.S. epicenter: 18°N., 99°W.
			e _N	02	25	43.9	
			F	02	40.5		
13	May 4	Iv	eP _N	15	30	55.4	See discussion, p. 44 Lost in beginning of next shock
			iS _N	15	31	09.9	
			F				
14	May 4	Iv	i _N	15	32	03.2	See discussion, p. 45
			F	15	35.5		
15	May 9	Iv	e _N	14	47	52	See discussion, p. 45
			e _N	14	47	58	
			F	14	48.5		
16	May 10	Iv	eP _N	10	06	41.5	See discussion, p. 45
			eS _N	10	06	56.7	
			F	10	10		
17	May 10	IIv	eP _N	10	32	41.8	See discussion, p. 45 Lost in beginning of next shock
			iS _N	10	32	54.3	
			F	10	32	57.4	
18	May 10	IIv	P				Lost in previous shock See discussion, p. 45
			eS _N	10	34	04.4	
			F	10	34	07.4	
19	May 10	Iv	eP _N	10	41	47.4	See discussion, p. 45
			iS [*] _N	10	42	02.6	
			e _N	10	43	32.4	
			e _N	10	44	07.4	
			F	10	46		
20	May 10	Iv	iS _N	23	59	45.2	See discussion, p. 45
			i _N	23	59	50.5	
			F	24	00		
21	May 11	Ir	e _N	14	50	27.9	U.S.C.& G.S. epicenter: 16°9 N., 101°W.
			e _N	14	55	47.0	
			F	15	11		
22	May 15	Iv	e _N	10	01	45	Uncertain beginning See discussion, p. 46
			iS _N	10	02	02.2	
			i _N	10	02	07.4	
			F	10	06		

FRESNO

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
23	May 19	Iu	e _N e _N F	17 22 50.5 17 28 33.5 18 09			U.S.C.& G.S. epicenter: 0°5' N., 119°E
24	May 24	Iu	e _P _N e _S _N F	07 30 23.8 07 39 56.4 07 59.6			U.S.C.& G.S. epicenter: 36°N., 141°E.
25	May 27	Iv	e _N e _N e _N e _N F	17 28 38.4 17 28 59.3 17 29 15.8 17 29 16.5 17 32			See discussion, p. 46
26	May 27	Iv	i _S _N F	22 03 31.3 22 06.5			See discussion, p. 46
27	May 28	Iv	e _P _N e _N F	10 16 01.7 10 17 47.7 10 40			U.S.C.& G.S. epicenter: 43°N., 125°W.
28	May 30	Iu	e _P _N F	14 42 37.7 14 51.5			U.S.C.& G.S. epicenter: 20°S., 169°E.
29	May 31	Iv	i _P _N i _S _N F	08 35 50.8 08 35 59.4 08 46.5			Pasadena epicenter: 33°41' N., 117°32' W.
30	June 6	Iv	e _P _N e _S _N F	02 55 29.7 02 56 40.9 03 02			Felt in Imperial Valley
31	June 10	IIr	e _N e _N e _N F	18 11 12.9 18 12 11.9 18 21 20.9 18 35.5			U.S.C.& G.S. epicenter: 16°30' N., 98°W.
32	June 11	Iv	e _P * _N e _S _N F	20 31 41.6 20 32 00.8 20 34.8			See discussion, p. 46
33	June 16	Iu	e _N e _N F	02 28 12.3 02 38 54.4 02 43.5			Strong in Rin-kin Islands U.S.C.& G.S. epicenter: 29°N., 128°E.
34	June 23	Iu	e _P _N F	13 08 14.4 13 16			U.S.C.& G.S. epicenter: 20°S., 169°E.

FRESNO



No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
35	June 28	Ir	e _P N	19	23	10.6	U.S.C. & G.S. epicenter: 19°N., 100°W.
			e _N	19	31	32.1	
			e _N	19	32	04.1	
			F	19	42		
36	June 29	I	e _N	10	26	(Ca.)	
			e _N	10	27	39.7	
			F	10	31		
37	June 29	I	e _N ?	10	41	37.9	
			e _N	10	42	26.9	
			F	10	47		

EARTHQUAKES IN NORTHERN CALIFORNIA

AND

THE REGISTRATION OF EARTHQUAKES

AT

BERKELEY—MOUNT HAMILTON—PALO ALTO
SAN FRANCISCO—FERNDALE—FRESNO

FROM

July 1, 1938 to September 30, 1938

BY

PERRY BYERLY

AND

HORACE MILLER

BULLETIN OF THE SEISMOGRAPHIC STATIONS

VOLUME 8, No. 3, pp. 87-129

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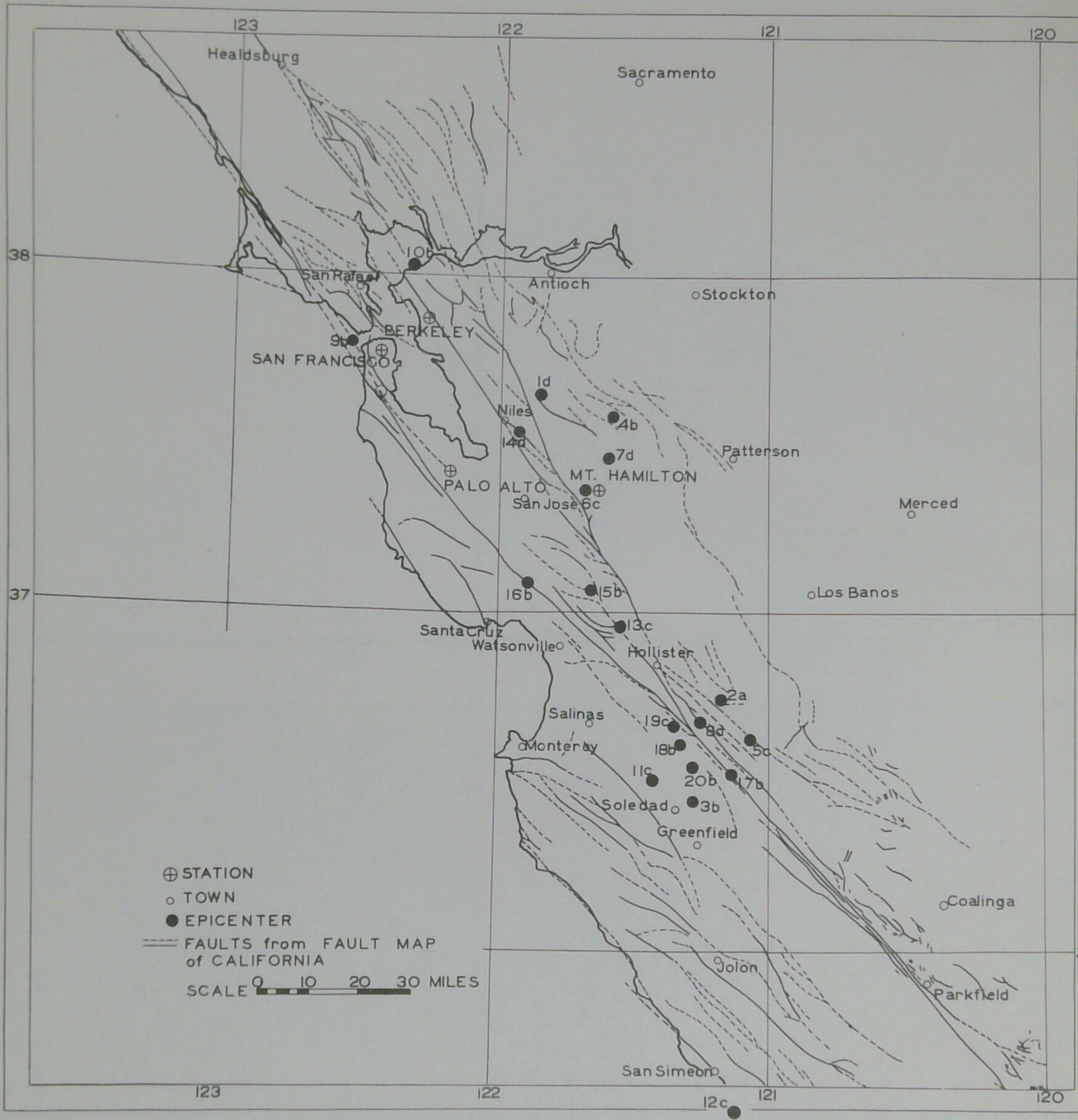
EARTHQUAKE INTENSITY SCALE

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.



MAP SHOWING EPICENTERS, JULY 1, 1938 TO SEPTEMBER 30, 1938

EARTHQUAKES IN NORTHERN CALIFORNIA

(All intensities given on Modified Mercalli Scale)

1938 -- PACIFIC STANDARD TIME

- July 3, 12h 17m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter very near Pleasanton. See map, epicenter 1d.
- July 7, 1h 25m, a.m. Not recorded on seismographs; IV at Mineral.
- July 7, 3h 44m, p.m. Recorded at Palo Alto only; not reported felt; focus about 5 miles from Palo Alto station.
- July 16, 7h 10m, a.m. Recorded at Ferndale only; felt in Ferndale; focus very close to the Ferndale station.
- July 17, 6h 47m, p.m. Recorded at Palo Alto only; not reported felt; focus about 10 miles from Palo Alto station.
- July 21, 4h 50m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 6 miles east of Paicines. See map, epicenter 2b.
- July 21, 4h 51m, p.m. Recorded at Palo Alto, Mount Hamilton, Fresno; not reported felt; another shock from epicenter 2b.
- July 24, 11h 08m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 4 miles northeast of Soledad. See map, epicenter 3b.
- July 25, 4h 06m, p.m. Recorded at Palo Alto only; not reported felt; focus about 11 miles from Palo Alto station.
- July 29, 6h 07m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 12 miles southeast of Livermore.
- July 31, 0h 43m, a.m. Recorded at Mount Hamilton and Fresno; III at Pinnacles; epicenter 7 miles northwest of Pinnacles. See map, epicenter 5c.
- July 31, 5h 24m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 2 miles west of Lick Observatory; depth of focus about 7 miles. See map, epicenter 6c.
- August 1, 0h 29m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 7 miles north of Lick Observatory. See map, epicenter 7d.
- August 1, 9h 34m, a.m. Recorded at Palo Alto only; not reported felt; focus about 6 miles from Palo Alto station.



1938 -- P.S.T.

- August 2, 8h 39m, a.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 4 miles southwest of Paicines. See map, epicenter 8d.
- August 2, 1h 10m, p.m. Recorded at Palo Alto only; not reported felt; focus about 4 miles from Palo Alto station.
- August 2, 6h 22m, p.m. Recorded at Berkeley only; not reported felt; focus about 10 miles from University campus.
- August 3, 2h 28m, p.m. Recorded at Berkeley, Palo Alto, San Francisco; not reported felt; epicenter about 6 miles west northwest of San Francisco station; depth of focus about 8 miles. See map, epicenter 9b.
- August 6, 12h 02m, p.m. Recorded at Berkeley, Mount Hamilton, San Francisco; (S-P = 8.5 sec. at Palo Alto but the minute marks failed); not reported felt; epicenter about 11 miles north northwest of Berkeley. See map, epicenter 10b.
- August 12, 4h 01m, p.m. Recorded at Berkeley only; not reported felt; focus about 7 miles from the University campus.
- August 14, 9h 31m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 4 miles from Lick Observatory.
- August 20, 12h 12m, p.m. Recorded at Palo Alto only; not reported felt; focus about 7 miles from Palo Alto station.
- August 27, 1h 23m, p.m. Recorded at Ferndale only; IV at Upper Mattole; epicenter about 22 miles from Ferndale.
- August 27, 2h 55m, p.m. Recorded at Berkeley only; not reported felt; focus about 7 miles from University campus.
- August 30, 7h 09m, p.m. Recorded at Ferndale only; IV at Upper Mattole; epicenter about 20 miles from Ferndale.
- August 31, 12h 38m, p.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter very near Gonzales. See map, epicenter 11c.
- August 31, 1h 11m, p.m. Recorded at Mount Hamilton only; not reported felt; epicenter about 60 miles from Mount Hamilton, no doubt southerly.
- September 1, 6h 44m, a.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter just off coast about 8 miles south of San Simeon. See map, epicenter 12c.
- September 2, 12h 40m, p.m. Not recorded at Bay stations; IV at Redwood Valley.
- September 3, 0h 49m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; IV at Watsonville; epicenter about 3 miles south southeast of Gilroy. See map, epicenter 13c.



1938 -- P.S.T.

September 4, 3h 43m, a.m. Recorded at Ferndale only; IV at Upper Mattole; epicenter about 28 miles from Ferndale.

September 5, 11h 59m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 3 miles south of Niles. See map, epicenter 14d.

September 5, 2h 25m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; another shock from epicenter 14d. (The records of both shocks are peculiar and may be composites.)

September 8, 0h 29m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 4 miles from Lick Observatory.

September 8, 6h 55m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 16 miles from Lick Observatory.

September 8, 7h 26m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 16 miles from Lick Observatory.

September 9, 0h 04m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 4 miles south of Morgan Hill. See map, epicenter 15c.

September 11, 10h 11m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno, Ferndale. Intensities:

VII Pepperwood.

VI Alder Point, Bridgeville, Eppersburg, Ferndale, Fortuna, Garberville, Holmes, Ocean House (Cape Mendocino), Scotia, Shively, Weott.

V Brush Creek Ranger Station, Cape Mendocino, Eel Rock, Island Mountain, Punta Gorda Light Station, Rio Dell, Upper Mattole.

IV Albion, Alton, Arcata, Bayside, Beatrice, Bell Springs, Benbow, Broad Camp Lookout Station, Branscomb, Briceland, Capetown, Carlotta, Caspar, Chico, Clipper Mills, Cobbs, Corning, Covelo, Cummings, Cutten, Del Loma, Dos Rios, Elk, Eureka, Farley, Fernbridge, Fields Landing, Forest Glen, Forest Ranch, Fort Bragg, Fort Seward, Gerber, Grass Valley, Harris, Harrison Gulch Ranger Station, Hayfork, Honeydew, Hyampom, Johnsville, Klamath, Lake Mountain, La Moine, Little River, Loleta, Mad River Ranger Station, Mina, Mineral, Orick, Orland, Peanut, Petrolia, Piercy, Plummer Peak Lookout, Red Bluff, Redding, Rockport, Rohnerville, Salyer, Samoa, South Fork, Strawberry Valley, Spyrock, Trinity Center, Trinidad, Vina, Weaverville, Weitchpec, Westport, Whitlow, Willits, Willows.

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Intensities (continued)

III Bronsville, Burnt Ranch, Comptche, Eel River, Forbestown, Freshwater, Inskip Butte Lookout Tower, Las Plumas, Laytonville, Mad River, McCam, Nashmead.

I-II Brookings (Ore.), Feather Falls, Flourney, Longvale, Orleans, Oroville, Paradise, Redwood Valley, Smith River, Ukiah.

Jesuit Seismological Association places epicenter at 40°2 N, 125°0 W, about 30 miles west of Punta Gorda.

September 12, 8h 15m, a.m. Recorded at Ferndale only; not reported felt; focus about 20 miles from Ferndale.

September 12, 2h 04m, p.m. Recorded at Ferndale only; IV at Upper Mattole; epicenter about 30 miles from Ferndale.

September 12, 8h 52m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 4 miles southeast of Wrights. See map, epicenter 16b.

September 13, 12h 33m, p.m. Recorded at Ferndale only; probably felt in Ferndale.

September 13, 1h 40m, p.m. Recorded at Palo Alto only; not reported felt; focus about 7 miles from Palo Alto station.

September 13, 4h 44m, p.m. Recorded at Ferndale only; felt in Ferndale; epicenter about 30 miles from Ferndale.

September 15, 10h 11m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; III at Pinnacles; epicenter very near Pinnacles. See map, epicenter 17b. (Small shocks were reported felt at Pinnacles by an observer on September 13 at 2h 08m, p.m. and on September 14 at 6h 30m, p.m., but neither were recorded.)

September 18, 5h 49m, a.m. Recorded at Ferndale only; not reported felt; epicenter about 35 miles from Ferndale.

September 18, 8h 02m, a.m. Recorded at Ferndale only; IV in southern Humboldt County; epicenter about 35 miles from Ferndale.

September 19, 12h 34m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 11 miles northwest of Pinnacles. See map, epicenter 18c.

September 20, 3h 27m, p.m. Recorded at Ferndale only; III at Freshwater; felt widely in southern Humboldt County; epicenter about 20 miles from Ferndale.

September 24, 3h 14m, p.m. Recorded at Palo Alto only; not reported felt; focus about 8 miles from Palo Alto station.



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September 26, 3h 53m, p.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 9 miles south southwest of Paicines. See map, epicenter 19c.

September 27, 04h 24m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno, Ferndale. Intensities:

VI Paicines, San Lucas.

V Gonzales, Soledad.

IV Alma, Big Sur, Bryson, Castroville, Carmel, Chualar, Cholane Peak, Creston, Dos Palos, Gilroy, Greenfield, Harmony, Hollister, Jolon, King City, Lockwood, Los Banos, Marina, Mendota, Metz, Monterey, Moss Landing, Paraiso Springs, Pinnacles, Salinas, San Benito, San Juan, San Luis Obispo, Santa Cruz, Santa Margarita, Seaside, Shandon, Soledad, Soquel, South Dos Palos, Spreckels, Stevinson, Tres Pinos, Volta, Watsonville.

III Aptos, Boulder Creek, Bradley, Cambria, Loneoak, Paso Robles, Pescadero, Pozo.

I-II Atascadero, Ben Lomond, Capitola, Coalinga, Glenwood, Parkfield, San Ardo, Templeton; epicenter about 8 miles west of Pinnacles. See map, epicenter 20b.

September 29, 8h 21m, a.m. Recorded at Mount Hamilton, Palo Alto; II at Pinnacles; epicenter same as that of shock of September 27 listed above.



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.
<p>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:</p>	
$\overline{S_c P_c S}$	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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CONSTANTS

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Latitude and longitude:

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

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
						A _E	A _N	A _Z	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
1	July 2	IIu	e _N	G	21 19 59				Surface waves Pasadena reports shock near Panama
			e _E	G	21 20 07				
			e _E	G	21 39 20				
			e _N F	G	21 39 22 23				
2	July 3	Id	i _{PZ}	H	20 16 45.1				See discussion, p. 91
			e _{SEN}	A	20 16 50.0				
			F		20 18				
3	July 4	IIu	i _{PZ}	G	21 25 15.3				
			e _{PEN}	G	21 25 17				
			e _{SE}	G	21 35 40				
			e _{SN}	G	21 35 47				
4	July 5	IIu	i _{PZ}	G	02 16 19				Wellington epicenter: 21°S., 169°E.
			e _{PEN}	G	02 16 19				
			e _{SE}	G	02 26 42				
			e _{SN}	G	02 26 48.5				
			F		04 41				
5	July 5	IIu	i _{PZ}	G	22 19 49				U.S.C. & G.S. epicenter: 24°S., 173°E.
			i _{PZ}	H	22 19 52.0				
			e _{PEN}	G	22 19 56				
			e _{SN}	G	22 30 10				
			e _{SE}	G	22 30 12				
			e _{LE} F	G	22 43 33 23				
6	July 6	IIu	e _{PN}	G	01 37 02				Wellington epicenter: 21°S., 169°E.
			i _{PZ}	G	01 37 06				
			e _{PE}	G	01 37 06				
			i _Z	H	01 37 14.5				
			e _{EN}	A	01 37 16.0				
			e _{SE}	G	01 47 08				
			e _{LN}	G	02 00 44				
			F		03 21				
7	July 6	I	e _N	A	22 26 56.0				Peculiar records--may not be earthquake
			i _Z	H	22 26 57.3				
			e _E	A	22 26 58.0				
			i _N	A	22 26 58.2				
			F		22 27				
8	July 7	I	i _Z	H	05 09 31.7	.5		+1	
			F		05 10.1				

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No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1938										
9	July 7	I	iZ F	H	05	27	05.0				
					05	27	32.0				
10	July 12	IIu	ePZ ePE eSN eLN F	G	12	49	29				Wellington epicenter: 22°S., 170°E.
				G	12	49	31				
				G	13	00	15				
				G	13	13	03				
					14	00					
11	July 22	IIu	iP _{ENZ} e _N eZ F	G	07	53	15.8				U.S.C. & G.S. epicenter: 18°54' N., 107°W.
				G	07	57	48				
				G	08	00	19				
					09	40					
12	July 22	Iv	e _P _N ePE iE eS _n E iN F	A	00	50	25.9				See discussion, p. 91
				A	00	50	26.2				
				A	00	50	35.7				
				A	00	50	40.2				
				A	00	50	50.2				
					00	53.5					
13	July 22	I	eN eN eE eE F	A	06	07	08.0				
				A	06	07	15.0				
				A	06	07	16.0				
				A	06	07	35.0				
					06	08					
14	July 22	I	eN eEN eE eN F	A	07	53	14.5				Surface waves
				A	07	53	15.0				Surface waves
				A	07	56	23.0				
				A	08	06	12.0				
					08	30					
15	July 24	Ir	eZ iZ eN eZN eZ iN eE eN eZ F	H	13	19	00.8				U.S.C. & G.S. epicenter: 53°N., 107°W.
				H	13	19	03.3				
				A	13	19	03.8				
				HA	13	19	13.8				
				G	13	19	16				
				A	13	19	18.0				
				G	13	24	28				
				G	13	25	06				
				G	13	28	06				
					13	00					

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No.	Date	Char- acter	Phase	Time U.T.	Period	Amplitude			Remarks		
						A _E	A _N	A _Z			
						mm.	mm.	mm.			
						h.	m.	s.			
						s.					
16	July 25	Iv	eP _{NE}	A	07 08 53.3				See discussion, p. 91		
			eP _N	A	07 08 57.0						
			iP _Z	H	07 08 57.2						
			iZ	H	07 09 06.5						
			iS _{NN}	A	07 09 17.5						
			iN F	A	07 09 41.0 07 11						
17	July 29	IIu	iP' _Z	G	13 25 41			U.S.C.&G.S. epicenter: 1°N., 96°E.			
			iPR _{1E}	G	13 27 38						
			iPR _{1Z}	G	13 27 40						
			eZ F	G	13 28 54 15 50						
18	July 29	Id	eP _N	A	14 06 45.3			See discussion, p. 91			
			iP _Z	H	14 06 45.4						
			iS _{EN}	A	14 06 54.1						
			F		14 07						
19	July 31	I	iZ	H	10 38 41.5						
			iZ	H	10 38 54.0						
			eN	A	10 39 23.5						
			iZ	H	10 39 40.5						
			eE	A	10 39 44.5						
			eN F	A	10 39 47.5 10 42.1						
20	Aug. 1	Id	iP _Z	H	01 23 59.2			See discussion, p. 91			
			iZ F	H	01 24 10 01 24 20						
21	Aug. 1	Id	iP _Z	H	08 29 53.7			See discussion, p. 91			
			F		08 30.6						
22	Aug. 3	Id	eP _N	A	02 21 47.8			See discussion, p. 92			
			iP _Z	H	02 21 48.0						
			iN	A	02 21 49.8	.5	+6.5				
			iS _Z	H	02 21 50.0						
			iS _E F	A	02 21 50.3 02 22.3	.4	+2.0				
23	Aug. 3	II	oPZEN	G	13 34 15			Near Vancouver Id. ?			
			eEN	A	13 34 19.0						
			eN	G	13 35 43						
			eZ	G	13 35 51						
			eE	G	13 36 11						
			eLE	A	13 36 23.0						
			eE	A	13 39 34.0						
			eN F	A	13 39 36.0 14						

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
						mm.	mm.	mm.		
						h.	m.	s.		
24	Aug. 3	Id	iP _{ZN} eS _{EN} F	HA	22 28 26.0				See discussion, p. 92	
				A	22 28 29.7					
					22 29.0					
25	Aug. 4	IIu	eN eE iZ iZ eN iE iZ iZ eEN F	A	09 06 41.7				Malaga epicenter: 24°S., 64°4' W. Pasadena epicenter: 24°S., 67°W.	
				A	09 06 43.2					
				H	09 06 43.7					
				G	09 06 44					
				G	09 06 44					
				G	09 06 45					
				H	09 06 47.2					
				G	09 09 55					
				G	09 16 36					
					10 31					
26	Aug. 6	Id	iP _Z eP _{EN} iS _N iS _E F	H	20 01 42.2				See discussion, p. 92	
				A	20 01 42.5					
				A	20 01 44.3					
				A	20 01 44.7					
					20 02.5					
27	Aug. 13	Id	iP _Z iS _Z iZ F	H	00 01 54.2				See discussion, p. 92	
				H	00 01 55.7					
				H	00 01 57.2					
					00 02					
28	Aug. 15	II	eE F	G	00 54 49					
					01 07.3					
29	Aug. 16	IIu	ePR ₁ ZEN eZ eE eE eZ F	G	04 47 17				U.S.C. & G.S. epicenter: 24°± N., 95°± E. Strasbourg epicenter: 22°6' N., 94°6' E.	
				G	04 49 33					
				G	04 52 57					
				G	04 54 41					
				G	04 56 21					
					06					
30	Aug. 20	II	iE eN eE eE F	G	08 54 37				Wellington epicenter: 4°S., 146°E. Strasbourg epicenter: 1°5' S., 148°7' E.	
				G	08 54 56					
				G	09 00 54					
				G	09 12 20					
					10 40					
31	Aug. 21	II	iP _Z eP _N eE eN eZ F	G	16 27 16					
				G	16 27 16.6					
				G	16 31 24					
				G	16 31 32					
				G	16 34 52					
					17 30					



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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks		
						A _E	A _N	A _Z			
						mm.	mm.	mm.			
						h.	m.	s.			
						s.					
32	Aug. 23	II	e _E	G	10	33	11				
			e _E	G	10	33	41				
			e _Z	G	10	34	40				
			F	G	10	47					
33	Aug. 25	IIu	iP' 1N	G	01	49	17				Malaga epicenter: 5°S., 100°E.
			eP' 1E	G	01	49	20				
			eS _c P _c P _E	G	01	50	36				
			ePR 1E	G	01	54	26				
			eS _c P _c S _E	G	01	56	04				
			eS _{EN}	G	01	59	12				
			e _E	G	02	01	22				
F		04	00								
34	Aug. 27	Id	iP _Z	H	22	55	27.3				See discussion, p. 92
			eP _N	A	22	55	27.3				
			iS _Z	H	22	55	28.7				
			F		22	55.8					
35	Aug. 28	IIu	e _Z	G	15	39	53				Epicenter: 12°06'N., 124°06'E. Destruction in the Philippines
			e _E	G	15	39	59				
			e _E	G	15	46	48				
			F		18	00					
36	Aug. 30	IIu	eP _Z	G	12	03	05				Strasbourg epicenter: 03°S., 146°E.
			ePR _{2Z}	G	12	07	07				
			eS _E	G	12	15	23				
			e _Z	G	12	20	57				
			eL _E	G	12	32	38				
			eL _Z	G	12	32	39				
			F		13	51					
37	Aug. 31	II	iP _Z	G	17	57	36				
			e _Z	G	17	58	56				
			e _E	G	18	07	34				
			e _E	G	18	09	04				
			e _Z	G	18	09	05				
			e _E	G	18	10	12				
			F		19						
38	Sept. 1	IIr	e _E	A	22	55	45.4				U.S.C.& G.S. epicenter: 13°06'N., 89°24'W.
			e _N	A	22	55	45.9				
			i _Z	H	22	55	48.9				
			i _{ZE}	G	22	55	49.2				
			e _Z	G	22	59	02				
			e _E	A	23	01	45.4				
			e _E	G	23	01	49				
			e _Z	G	23	01	54				
			e _N	A	23	06	12.4				
			F		01						

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
						mm.	mm.	mm.		
						h. m. s.	s.			
39	1938 Sept. 3	Iv	iP*ZN eS*E eSnE eSN F	HA 08 49 45.8 A 08 49 58.3 A 08 50 00.8 A 08 50 01.8 08 51					See discussion, p. 92	
40	Sept. 5	IIu	eE eZ eZ eE F	G 14 52 48 G 14 55 01 G 15 06 45 G 15 07 18 17					Pasadena epicenter: 55°S., 145°W.	
41	Sept. 5	Id	eP*Z eP*N eSE iS*N iEN iZ F	H 19 59 04.0 A 19 59 04.2 A 19 59 09.7 A 19 59 11.7 A 19 59 13.5 H 19 59 14.0 20 00					See discussion, p. 93	
42	Sept. 5	Id	eSN eSE eN F	A 22 25 35.8 A 22 25 36.0 A 22 25 52.8 22 26.5					See discussion, p. 93	
43	Sept. 7	IIu	iPEZ F	AH 04 27 11 06					U.S.C. & G.S. epicenter: 24°N., 121°5 E.	
44	Sept. 7	IIu	iPZ ePE iZ eSEZN F	G 13 10 55 G 13 10 56 G 13 11 37 G 13 21 30 14 16					Wellington epicenter: 7°S., 156°E.	
45	Sept. 9	Iv	iPnZ eSnE iSnN F	H 08 04 09.2 A 08 04 22.5 A 08 04 23.0 08 05					See discussion, p. 93	
46	Sept. 12	IIv	iPnZN ePnE iP*N iFN F	HA 06 11 27.5 A 06 11 27.7 A 06 11 33.4 A 06 11 57.7 06 25.5					See discussion, p. 93 F = False S	

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No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1938										
47	Sept. 13	Id	e \bar{P} _N i \bar{P} _Z e _N e \bar{E} i \bar{S} _Z F	A	04	52	31.5				See discussion, p. 94
				H	04	52	32.1				
				A	04	52	41.9				
				A	04	52	42.5				
				H	04	52	43.5				
					04	53	3				
48	Sept. 16	Iv	i \bar{P} _{nZ} e \bar{P} _{nN} i \bar{S} _{nZ} i _N F	H	06	11	25.6				Felt in Pinnacles P.O.
				A	06	11	25.6				
				H	06	11	45.5				
				A	06	11	48.9				
					07	12					
49	Sept. 17	Iv	e _Z e _N i _N e _E i \bar{E} F	H	14	24	11.0				Epicenter: 35°36'N., 117°39'W. O = 14:23:05
				A	14	24	11.2				
				A	14	24	16.2				
				A	14	25	15.2				
				A	14	25	19.7				
					14	29					
50	Sept. 17	IIr	e _Z e _E e _N e _Z F	G	17	26	10				J.S.A. epicenter: 33°36'N., 109°06'W.
				G	17	26	26				
				G	17	26	49				
				G	17	27	52				
					17	37	5				
51	Sept. 19	Iv	e \bar{P} _Z F	H	20	34	22.1				See discussion, p. 94
					20	35	0				
52	Sept. 23	Iv	e _N i _Z i _Z e _E e _N F	A	08	21	02.7				Nevada, near: 38°N., 118°W.
				H	08	21	03.2				
				H	08	21	44.7				
				A	08	21	45.7				
				A	08	21	47.7				
					08	24	5				
53	Sept. 25	IIu	e _Z e _E e _Z F	G	20	26	38				Wellington epicenter: 8°S., 153°E.
				G	20	52	46				
				G	20	52	56				
					21	26	5				
54	Sept. 27	IIu	e \bar{P} _Z i \bar{S} _E e \bar{L} _E e \bar{L} _Z F	G	10	28	50				Wellington epicenter: 6°S., 151°E.
				G	10	39	42				
				G	10	57	39				
				G	10	58	03				
					11	47					



BERKELEY

No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
	1938			h.	m.	s.	s.	mm.	mm.	mm.	
55	Sept.27	IIv	ePnZEN	HA	12	24	08.7				See discussion, p. 95
			iN	A	12	24	11.9				
			iSN	A	12	24	32.1				
			F		12	30					
56	Sept.28	IIu	iPz	G	18	26	07				Strasbourg epicenter: 11°S., 164°E.
			eE	G	18	26	14				
			eZ	G	18	29	20				
			eS _E	G	18	36	34				
			eL _E	G	18	51	54				
			eL _Z	G	18	52	10				
			F		19	36					

MOUNT HAMILTON

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

 CONSTANTS

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Latitude and longitude:

$$\varphi = 37^{\circ} 20' 4'' \text{ N.}$$

$$\lambda = 121^{\circ} 38' 6'' \text{ W.}$$

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



MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Remarks
	1938			h. m. s.	
1	July 3	Id	e _N i _{SE} F	20 16 45.5 20 16 49.5 20 16.4	See discussion, p.91
2	July 22	Id	e _{PN} i _{SE} i _{SN} F	00 50 13.6 00 50 24.9 00 50 25.6	See discussion, p.91 Lost in beginning of next shock
3	July 22	Id	e _{SEN} F	00 51 26.9 00 51.3	See discussion, p.91
4	July 22	I	e _N e _E F	06 07 09.2 06 07 10.5 06 07.1	
5	July 22	IIr	i _{PN} e _N e _E e _N e _E	07 53 11.3 07 57 35.3 07 57 37.3 07 59 20.3 08 26	U.S.C.& G.S. epicenter: 18°54'N., 107°W.
6	July 25	Iv	i _{PN} e _{PE} i _{SEN} F	07 08 43.7 07 08 43.9 07 08 56.2 07 11	See discussion, p.91
7	July 29	Id	i _{PN} i _{PE} i _{SEN} F	14 06 38.1 14 06 38.3 14 06 41.6 14 08	See discussion, p.91
8	July 31	Id	e _{PN} e _{PE} e _{SN} e _{SE} F	08 43 05.1 08 43 05.3 08 43 17.3 08 43 17.7 08 44	See discussion, p.91
9	Aug. 3	II	e _E e _N e _N F	13 34 28.7 13 34 28.9 13 34 34.2 13 54	

MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
10	Aug. 5	I	e _N	09 06 39.3	
			e _E	09 06 41.4	
			e _E	09 16 37.9	
			F	09 21	
11	July 31	Ir	e _E	10 38 40.5	Pasadena epicenter: Nevada - 38°18'N., 115°48'W.
			e _N	10 38 40.9	
			e _{EN}	10 39 34.1	
			F	10 42	
12	Aug. 1	Id	i _{EN}	01 23 47.6	See discussion, p. 91
			i _{EN}	01 23 49.1	
			F	01 25	
13	Aug. 1	Id	e _{EN}	08 29 42.7	See discussion, p. 91
			i _E	08 29 44.2	
			i _N	08 29 44.5	
			F	08 31	
14	Aug. 2	Id	e _{EN}	16 39 01.9	See discussion, p. 92
			i _{EN}	16 39 12.4	
			F	16 40.3	
15	Aug. 6	Id	e _{EN}	20 01 57.2	See discussion, p. 92
			e _{S*N}	20 02 08.8	
			e _E	20 02 10.2	
			F	20 02.7	
16	Aug. 15	Id	e _E	05 30 45.4	See discussion, p. 92
			i _{EN}	05 30 46.2	
			F	05 31.5	
17	Aug. 18	Iv	e _N	07 41 10	Pasadena epicenter: 34°00'N., 116°13'W.
			e _N	07 43 23.3	
			e _E	07 43 24.3	
			F	07 44.4	
18	Aug. 30	IIu	e _E	12 33 20.0	Surface waves between 12 and 13 hrs. Strasbourg epicenter: 03°S., 146°E.
19	Aug. 31	Id	e _N	20 38 11.0	See discussion, p. 92
			e _N	20 38 23.0	
			e _E	20 38 23.3	
			F	20 39	

MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
				h. m. s.	
20	Aug. 31	Id	\overline{ePN}	21 11 39.5	Doubtful beginning See discussion, p. 92
			\overline{eN}	21 11 42.4	
			\overline{eSE}	21 11 54.0	
			\overline{eSN}	21 11 54.4	
			F	21 12	
21	Sept. 1	Iv	\overline{ePnN}	14 44 48.3	See discussion, p. 92
			\overline{eSnN}	14 45 10.8	
			\overline{eE}	14 45 11.3	
			F	14 46	
22	Sept. 1	IIr	\overline{ePN}	22 55 42.8	U.S.C. & G.S. epicenter: 13°06'N., 89°24'W.
			\overline{ePE}	22 55 43.3	
			\overline{eSE}	23 01 42.8	
			\overline{eSN}	23 01 45.3	
			F	23 30	
23	Sept. 3	Id	\overline{iPN}	08 49 34.6	See discussion, p. 92
			\overline{iPE}	08 49 35.0	
			\overline{iSEN}	08 49 40.3	
			F	08 52	
24	Sept. 5	Id	\overline{ePEN}	19 59 01.3	See discussion, p. 93
			\overline{iSEN}	19 59 05.8	
			\overline{iE}	19 59 08.2	
			F	20 02	
25	Sept. 5	Id	\overline{ePEN}	22 25 27.1	See discussion, p. 93
			\overline{eSEN}	22 25 31.6	
			F	22 27	
26	Sept. 8	Id	\overline{ePN}	08 29 15.4	See discussion, p. 93
			\overline{iSEN}	08 29 16.2	
			F	08 30	
27	Sept. 8	Id	\overline{ePN}	14 55 25.2	See discussion, p. 93
			\overline{iSEN}	14 55 28.4	
			F	14 56	
28	Sept. 8	Id	\overline{ePN}	15 25 46.6	See discussion, p. 93
			\overline{ePE}	15 25 46.7	
			\overline{eSE}	15 25 50.2	
			\overline{eSN}	15 25 50.3	
			F	15 27	

MOUNT HAMILTON

No.	Date	Char-acter	Phase	Time U.T.	Remarks
	1938			h. m. s.	
29	Sept. 9	Id	$\overline{iP_{EN}}$ iS_E iS_N F	08 03 56.4 08 04 00.4 08 04 00.6 08 05	See discussion, p. 93
30	Sept. 9	Id	$\overline{eP_N}$ eP_E iS_{EN} F	10 02 21.0 10 02 21.2 10 02 25.2 10 03	See discussion, p. 93
31	Sept. 12	IIv	eP_E eP_N iN iN F	06 11 39.3 06 11 39.9 06 12 20.9 06 12 23.3 06 29.8	See discussion, p. 93
32	Sept. 13	Id	$\overline{iP_{EN}}$ iS_E F	04 52 21.4 04 52 25.9 04 53.2	See discussion, p. 94
33	Sept. 16	Id	$\overline{iP_{EN}}$ iS_{EN} F	06 11 16.3 06 11 29.5 06 14.7	See discussion, p. 94
34	Sept. 17	Iv	eP_E eP_N eS_E eS_N F	14 24 03.5 14 24 04.1 14 24 55.7 14 24 57.8 14 27.6	Pasadena epicenter: 35°36'N., 117°39'W.
35	Sept. 17	Iv	eN eE eE eE F	17 23 11.3 17 23 17.1 17 26 19.1 17 26 20.1 17 29.6	J.S.A. epicenter: 33°36'N., 109°06'W. Felt in Arizona and New Mexico
36	Sept. 19	Id	$\overline{eP_N}$ eP_E iS_E iS_N F	20 34 08.6 20 34 08.8 20 34 19.8 20 34 20.3 20 35.5	See discussion, p. 94
37	Sept. 21	IIu	eN eN F	19 03 42.0 19 03 44.0 19 08.5	36°35'N., 141°05'E.

MOUNT HAMILTON

No.	Date	Char- acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
38	Sept. 23	Iv	eE	08 21 00.0	Nevada--Near 38°N., 118°W.
			eE	08 21 42.7	
			F	08 24	
39	Sept. 26	Id	$\overline{iP_N}$	23 52 49.9	See discussion, p. 95
			$\overline{eP_E}$	23 52 50.9	
			$\overline{eS_E}$	23 53 00.4	
			$\overline{eS_N}$	23 53 01.2	
			F	23 54.4	
40	Sept. 27	IIv	$\overline{iP_N}$	12 23 59.2	See discussion, p. 95
			$\overline{iP_E}$	12 23 59.6	
			$\overline{iS_E}$	12 24 11.4	
			F	12 35.4	
41	Sept. 28	Iv	eN	01 09 15.3	Perhaps an aftershock of the previous quake
			eN	01 09 26.3	
			\overline{eE}	01 09 27.1	
			F	01 10.3	
42	Sept. 29	Id	$\overline{iP_N}$	16 21 25.2	See discussion, p. 95
			$\overline{eP_E}$	16 21 25.7	
			$\overline{iS_N}$	16 21 37.2	
			$\overline{eS_E}$	16 21 37.7	
			F	16 23.3	
43	Sept. 29	Ir	eE	23 37 49.9	St. Louis Epicenter: 33°36'N., 109°06'W. Felt in Arizona and New Mexico
			eN	23 40 58.9	
			\overline{eE}	23 41 00.9	
			F	23 45.3	



PALO ALTO

THE BRANNER STATION, STANFORD UNIVERSITY
PALO ALTO, CALIFORNIA

CONSTANTS

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Latitude and longitude:

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

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	e
Wood-Anderson	E	3000	1	15
	N	3000	1	15

PALO ALTO

No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
1	July 3	Id	iS _{EN} F	20 16 48.7 20 17			See discussion, p. 91
2	July 7	Id	eP _{EN} eS _N eS _E F	23 44 27.3 23 44 28.3 23 44 28.8 23 45			See discussion, p. 91
3	July 18	Id	iP _{EN} iS _{EN} F	02 47 23.5 02 47 25.5 02 48			See discussion, p. 91
4	July 21	Iv	eP* _N eS _{EN} F	00 50 17.5 00 50 34.4			See discussion, p. 91 Lost in beginning of next shock
5	July 21	Iv	iS _E iS _N F	00 51 36.1 00 51 36.4 00 53			See discussion, p. 91
6	July 22	IIr	eP _N eP _E e _N e _N F	07 53 13.9 07 53 16.8 07 55 35.9 07 57 32.4 08 23			U.S.C.& G.S. epicenter: 18°54'N., 107°W.
7	July 25	Iv	ePn _N iPn _E iS _E F	07 08 48.5 07 08 49.1 07 09 06.7 07 11			See discussion, p. 91
8	July 26	Id	iP _{EN} iS _N F	00 05 58.3 00 06 00.5 00 06.5			See discussion, p. 91
9	July 29	Id	e _N e _E eS _{EN} F	14 06 43.5 14 06 44.4 14 06 49.7 14 08			See discussion, p. 91
10	July 31	Iv	ePn _N eS _N e _N F	08 43 09.3 08 43 28.3 08 43 37.0 08 44.5			See discussion, p. 91



PALO ALTO

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
	1938			h.	m.	s.	
11	July 31	Iv	e _N e _N e _E F	10	39	41.2 46.9 49.8 42	Pasadena epicenter: 38°18' N., 115°48' W.
12	Aug. 1	Id	i _N i _E F	01	23	53.4 58.9 24.6	See discussion, p. 91
13	Aug. 1	Id	i _{EN} F	08	29	55.9 22	See discussion, p. 91
14	Aug. 1	Id	i _N i _N i _N F	17	34	11.0 12.2 13.0 34.6	See discussion, p. 91
15	Aug. 2	Id	e _E e _E F	16	39	07.3 19.9 41	See discussion, p. 92
16	Aug. 2	Id	i _E i _E F	21	09	58.3 59.3 10.4	See discussion, p. 92
17	Aug. 3	Id	e _E e _{NE} F	22	28	30.4 41.1 30	See discussion, p. 92
18	Aug. 4	IIu	e _E e _N F	09	06	42.7 43.0 14	U.S.C. & G.S. epicenter 24°S., 65°24' W.
19	Aug. 20	Id	e _{EN} e _E e _N F	20	12	17.1 18.5 18.7 12.8	See discussion, p. 92
20	Aug. 21	I	e _{EN} F	16	27	14.1 31	Pasadena epicenter: Roughly 20°N., 107°W.
21	Aug. 31	Iv	e _E F	20	38	20 39	$\bar{S} - \bar{P} = 15.5$ sec.; clock correction not known. See discussion, p. 92
22	Sept. 1	Iv	e _N F	14	45	14 46.5	$S_n - P_n = 24.5$ sec.; clock correction not known. See discussion, p. 92

PALO ALTO

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
23	Sept. 3	Id	\overline{eP}_N F	08	49		$\overline{S} - \overline{P} = 9.6$ secs.; clock correction not known. See discussion, p. 92
24	Sept. 5	Id	\overline{eP}_{EN}	19	59		$\overline{S} - \overline{P} = 03.2$ secs.; clock correction not known. See discussion, p. 93
25	Sept. 5	Id	eP	22	25		$\overline{S} - \overline{P} = 03.2$ secs.; clock correction not known. See discussion, p. 93
26	Sept. 9	Id	eP	08	04		$\overline{S} - \overline{P} = 9.7$ NS or 7.5 EW Clock correction not known. See discussion, p. 93
27	Sept. 12	Iv	eP_E	06	12		See discussion, p. 93 Clock correction not known.
28	Sept. 12	Id	\overline{eP}_N	20	52		See discussion, p. 94 Clock correction not known. $\overline{S} - \overline{P} = 5.7$ sec.
29	Sept. 13	Id	\overline{eP}_{EN} \overline{eS}_N F	21	40	26.0	See discussion, p. 94
				21	40	27.5	
				21	42		
30	Sept. 16	Id	$i\overline{P}_{EN}$ $i\overline{S}_{EN}$ F	06	11	21.1	Pasadena epicenter: Approx. $36^\circ 24' N.$, $121^\circ 12' W.$
				06	11	37.9	
				06	13.5		
31	Sept. 17	Iv	eP_N e_E e_N i_E F	14	24	09.9	Pasadena epicenter: $35^\circ 36' W.$, $117^\circ 39' W.$
				14	24	12.6	
				14	25	10.7	
				14	25	16.8	
				14	29.5		
32	Sept. 17	IIr	e_N e_{EN} F	17	23	31.6	J.S.A. epicenter: $33^\circ 24' N.$, $109^\circ 06' W.$ O = 17:20:16
				17	26	44.6	
				17	30.5		
33	Sept. 19	Id	\overline{eP}_{EN} \overline{eS}_E \overline{eS}_N F	20	34	15.1	See discussion, p. 94
				20	34	30.1	
				20	34	30.4	
				20	36.5		
34	Sept. 21	IIu	e_N	19	03	47.9	$36^\circ 35' N.$, $141^\circ 05' E.$
				19	05.5		

PALO ALTO

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
35	Sept. 23	Iv	e \bar{P} _E	08 21 52.1	Nevada, near 38°N., 118°W.
			e \bar{N} _F	08 21 53.6	
			F	08 24	
36	Sept. 24	Id	e \bar{P} _N	23 13 57.1	See discussion, p. 94
			e \bar{P} _E	23 13 57.2	
			i \bar{S} _E	23 13 58.7	
			i \bar{S} _N	23 13 58.9	
			F	23 15	
37	Sept. 26	Iv	e \bar{P} _N	23 52 55.2	See discussion, p. 95
			e \bar{S} _{nN}	23 53 08.9	
			e \bar{E} _F	23 53 12.2	
			F	23 54.7	
38	Sept. 27	IIv	e \bar{P} _{EN}	12 24 03.8	See discussion, p. 95
			i \bar{S} _{nN}	12 24 17.8	
			i \bar{S} _E	12 24 20.1	
			i \bar{S} _N	12 24 20.4	
			F	12 34	
39	Sept. 29	Iv	e \bar{P} _N	16 21 31.3	See discussion, p. 95
			i \bar{S} _{nE}	16 21 44.8	
			i \bar{S} _N	16 21 46.4	
			F	16 24	

SAN FRANCISCO

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

 CONSTANTS

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Latitude and longitude:

$$\begin{aligned}\phi &= 37^{\circ} 46' 4'' \text{ N.} \\ \lambda &= 122^{\circ} 27' 2'' \text{ W.}\end{aligned}$$

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

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

CONSTANTS OF THE SEISMOGRAPHS

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			Remarks
				U.T.			
				h.	m.	s.	
	1938						
1	July 22	Ir	eE eN eN F	07 53 16.1 07 53 17.6 07 59 55.6 08 16			U.S.C.& G.S. epicenter: 18°54' N., 107°W.
2	July 29	IIu	eN eN eE F	14 06 46.4 14 06 58.4 14 06 58.8 14 08			U.S.C.& G.S. epicenter: 1°N., 96°E.
3	July 31	Iv	eEN F	10 39 53.8 10 41			Pasadena epicenter: Nevada 38°18'N., 115°48'W.
4	Aug. 3	II	eN eN eE eE F	13 36 18.7 13 36 48.1 13 36 57.7 13 37 30.7 14			Near Vancouver Island?
5	Aug. 3	Id	ePE iPN eSE iSN F	22 28 22.8 22 28 22.9 22 28 24.4 22 28 24.8 22 29			See discussion, p. 92
6	Aug. 4	IIu	eEN F	08 06 45.0 08 17			U.S.C.& G.S. epicenter: 24°S., 64°24'W. Pasadena epicenter: 24°S., 67°W.
7	Aug. 6	Id	ePN iSN eSE F	20 01 44.9 20 01 48.5 20 01 49.0 20 02.5			See discussion, p. 92
8	Aug. 21	II	eN F	16 27 17.2 16 29			Roughly 20°N., 107°W.
9	Sept. 3	Iv	iP*N eP*E eSne iSnN F	08 49 46.0 08 49 46.0 08 50 00.6 08 50 00.7 08 51.5			See discussion, p. 92
10	Sept. 9	Iv	ePne eSne F	08 04 10.4 08 04 24.4 08 05			See discussion, p. 93

SAN FRANCISCO



No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
	1938			h.	m.	s.	
11	Sept. 12	IIv	eP _N	06	11	28.5	See discussion, p. 93
			eP _E	06	11	28.7	
			i _E	06	12	04.5	
			i _N	06	12	06.7	
			i _E	06	12	42.9	
			F	06	27		
12	Sept. 16	Iv	eP* _N	06	11	28.6	See discussion, p. 94
			e _N	06	11	46.1	
			eS _{NE}	06	11	48.1	
			F	06	13.8		
13	Sept. 17	Iv	eP _N	14	24	20.5	Pasadena epicenter: 35°36'N., 117°39'W.
			eS _N	14	25	18.5	
			F	14	28.7		
14	Sept. 23	Iv	e _N	08	21	15.5	Nevada, near 38°N., 118°W.
			e _E	08	21	50.9	
			e _N	08	21	51.9	
			F	08	23.7		
15	Sept. 27	Iv	e _N	12	24	09.9	See discussion, p. 95
			e _E	12	24	11.7	
			e _N	12	24	13.2	
			eS _E	12	24	31.7	
			F	12	32		



FERNDALE

THE FERNDAL STATION
FERNDAL, CALIFORNIA

CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

$$\begin{aligned} \phi &= 40^{\circ} 34' \text{ N.} \\ \lambda &= 124^{\circ} 16' \text{ W.} \end{aligned}$$

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

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

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	T ₀	ε
Bosch-Omori 25 kg.	E	12	5
	N	11	6

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

FERNDALE

No.	Date	Char- acter	Phase	Time	Remarks	
				U.T.		
1938						
				h. m. s.		
1	July 16	Id	i _{EN} F	15 09 41	Felt in Ferndale. See discussion, p. 91	
				15 10		
2	July 22	IIr	e _E e _N e _E e _N e _L _N e _E e _M _N F	07 53 49.5	U.S.C.& G.S. epicenter: 18°54' N., 107°W.	
				07 53 51.2		
				07 54 35.8		
				07 55 04.1		
				08 01 26.6		
				08 02 20.0		
				08 02 38.0		
3	July 24	IIr	e _E e _E F	13 26 58	U.S.C.& G.S. epicenter: 53°N., 167°W.	
				13 29 50		
4	Aug. 3	Ir	e _E e _N e _N e _E F	13 33 32.2	Off coast of Lower California	
				13 34 07.0		
				13 34 29.0		
				13 34 35.0		
				13 08		
5	Aug. 23	I	e _N e _E e _E e _N F	10 31 26.0		
				10 31 30.0		
				10 32 18.0		
				10 32 36.2		
				10 45		
6	Aug. 27	Id	e _{PN} e _{PE} i _{SEN} i _E i _N i _E F	21 22 32	See discussion, p. 92	
				21 22 33		
				21 22 36.5		
				21 22 37.3		
				21 22 38.0		
				21 22 38.5		
				21 24		
7	Aug. 30	IIu	e _E F	12 34 20.0	Strasbourg epicenter: 3°S., 146°E.	
				13 10		
8	Aug. 31	Id	e _{PN} i _{SN} i _{SE} F	03 09 24	See discussion, p. 92	
				03 09 28		
				03 09 30		
				03 11		
9	Sept. 4	Id	e _{PE} i _{SE} F	11 43 30.2	See discussion, p. 93	
				11 43 35.9		
				11 45		



FERNDALE

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
10	Sept. 12	IIIId	iP _E iP _N i _N i _N iS _E F	06	10	49.6 52.0 55.0 56.8 57.6	See discussion, p. 93 S - P = 8 secs. Discrepancy in time of P - due to bad drum rate. Record off
11	Sept. 12	Id	eP _{EN} iS _N i _E F	16	15	07 11 13 16	See discussion, p. 94
12	Sept. 12	Id	eP _{EN} iS _E iS _N F	22	04	02 08 09 05	See discussion, p. 94
13	Sept. 13	Id	iS _{EN} F	20	33	04 34	See discussion, p. 94
14	Sept. 14	Id	eP _E i _N iS _E F	00	43	41 46 47 44	See discussion, p. 94
15	Sept. 17	IIR	e _N e _E F	17	28	08.2 24.0 32	J.S.A. epicenter: 33°36'N., 109°06'W.
16	Sept. 18	Id	eP _{EN} iS _{EN} F	13	48	49 56 50	See discussion, p. 94
17	Sept. 18	Id	iP _{EN} iS _{EN} F	16	01	49 56 03	See discussion, p. 94
18	Sept. 20	Id	iP _N e _E iS _E F	23	26	52 53 56.4 28	See discussion, p. 94
19	Sept. 27	Iv	e _N e _E e _N F	12	26	04.3 32.2 34.6 40	See discussion, p. 95



FRESNO

THE FRESNO STATION, FRESNO STATE COLLEGE
FRESNO, CALIFORNIA

CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

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

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			Remarks
				U.T.			
	1938			h.	m.	s.	
1	July 1	Iv	ePN	18	15	07.3	Felt in Salt Lake City, Utah
			eSN	18	16	42.0	
			F	18	20.2		
2	July 4	IIu	eN	21	24	27.4	Malaga epicenter: 22°03' S., 169°12' E.
			F	21	29.1		
3	July 4	Iv	eN	22	01	16.0	Pasadena epicenter: 35°52' N., 116°12' W.
			F	22	02		
4	July 5	IIu	eN	02	15	33.7	Wellington epicenter: 21°S., 169°E.
			F	02	21.2		
5	July 5	Iv	eN	18	07	54	Pasadena epicenter--in Santa Ana mountains. Felt in Los Angeles and San Bernardino.
			eN	18	07	41.7	
			F	18	10		
6	July 6	Iv	eN	01	36	03.6	
			F	01	41.3		
7	July 6	Iv	eN	06	26	53.5	Pasadena epicenter: "South end of Death Valley"
			eN	06	27	33.3	
			F	06	40		
8	July 10	Iv	eN	18	08	31.7	Pasadena epicenter: 33°10' N., 116°25' W.
			F	18	10.7		
9	July 21	Id	ePN	22	46	29.6	Pasadena epicenter--near Piru, Ventura County
			eSN	22	46	58.1	
			F	22	48.8		
10	July 22	Iv	eN	00	50	18.4	See discussion, p. 91 Lost in beginning of next shock.
			iSnN	00	50	33.9	
			F				
11	July 21	Iv	iSnN	22	51	36.9	See discussion, p. 91
			F	22	53.8		
12	July 22	IIr	ePN	07	52	53.7	U.S.C. & G.S. epicenter: 18°54' N., 107° W.
			ePR ₁ N	07	53	20.7	
			ePR ₂ N	07	53	40.7	
			eN	08	02	08.7	
			F	08	48.8		
13	July 24	IIr	eN	13	19	22.0	U.S.C. & G.S. epicenter: 33°N., 167°W.
			F	13	24.2		

FRESNO

No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
14	July 25	Iv	eP _N iS _N F	07	08	47.5	See discussion, p. 91
				07	09	03.0	
				07	13	3	
15	July 26	Iv	e _N e _N F	06	36	41.8	Pasadena epicenter: 35°35' N., 117°05' W.
				06	36	15.0	
				06	39	4	
16	July 28	Iv	e _N F	00	01	33.9	Foreshock--Pasadena epi- center: 37°36' N., 115°48' W.
				00	03	6	
17	July 28	Iv	e _N e _N e _N F	00	06	26.0	Foreshock--Pasadena epi- center: 37°36' N., 115°48' W.
				00	07	02.5	
				00	07	52.5	
				00	10	6	
18	July 28	Iv	e _N F	00	14	51.0	
				00	16	6	
19	July 28	IIv	e _N iS _N F	00	39	24.1	Pasadena epicenter: Nevada, 37°36' N., 115°48' W.
				00	40	06.2	
				00	44	7	
20	July 31	Iv	e _N iS _N F	08	43	13.3	See discussion, p. 91
				08	43	23.3	
				08	44	5	
21	July 31	Iv	eP _N eS _N F	10	38	11.8	
				10	38	53.7	
				10	45	2	
22	July 31	Iv	e _N F	12	44	03.6	Pasadena epicenter: Nevada, 38°18' N., 115°48' W.
				12	45	2	
23	Aug. 2	Iv	e _S F	16	39	27.2	See discussion, p. 92
				16	40	5	
24	Aug. 3	Ir	eP _N F	13	34	48.1	Off coast of Lower California
				13	49	5	
25	Aug. 4	IIu	eP _N F	09	06	32.8	U.S.C. & G.S. epicenter: 24°S., 65°24' W.
				09	17	5	
26	Aug. 6	Iv	e _N e _N F	02	29	25.3	Felt in Riverside County, California.
				02	30	13.8	
				02	32		

FRESNO

No.	Date	Char-acter	Phase	Time	Remarks	
				U.T.		
1938						
				h. m. s.		
27	Aug. 8	I	e _N F	18 30 41.1 18 40.2	Pasadena epicenter: Roughly 27°N., 112°W.	
28	Aug. 18	I	e _N e _N e _N F	07 40 47.9 07 40 50.5 07 41 32.2 07 48	Pasadena epicenter: 35°00'N., 116°13'W. Felt at Ludlow, California.	
29	Aug. 18	IIu	e _N F	09 49 06.5 09 57.4	Strasbourg epicenter: 4°S., 104°E.	
30	Aug. 21	I	e _N F	16 26 56.0 16 34.8	Pasadena epicenter: Roughly 20°N., 107°W.	
31	Aug. 25		e _N e _N F	01 47 17.8 01 50 58.3 02 20	Sumatra epicenter: 5°S., 100°E. U.S.C. & G.S. epicenter: 5°S., 103°E.	
32	Aug. 31	Iv	iS _N F	20 38 36.1 20 39.4	See discussion, p. 92	
33	Sept. 1	IIr	eP _N eS _N F	22 55 27.7 23 01 39.2 23 08	U.S.C. & G.S. epicenter: 13°06'N., 89°24'W.	
34	Sept. 1	Iv	eS _N F	14 45 06 14 46	See discussion, p. 92	
35	Sept. 3	Iv	e _N ? eS _N F	08 49 54 08 50 10.0 08 53.2	See discussion, p. 92	
36	Sept. 9	Iv	eS _N iS _N F	08 04 35.5 08 04 39.5 08 05.1	See discussion, p. 93	
37	Sept. 12	IIv	eP _N iP _N eS _N F	06 11 59.1 06 12 00.1 06 12 34.6 06 34.4	See discussion, p. 93	
38	Sept. 16	Iv	iS _N F	06 11 33.9 06 15.8	See discussion, p. 94	

FRESNO

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No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
1938				h.	m.	s.	
39	Sept. 17	IIv	iP _N	14	23	39.9	Pasadena epicenter: 35°36'N., 117°39'W.
			iS _N	14	23	41.9	
			iL _N	14	24	08.9	
			F	14	32		
40	Sept. 17	IIr	eN	17	22	49.2	J.S.A. epicenter: 33°36'N., 109°06'W.
			eN	17	25	26.2	
			F	17	34		
41	Sept. 19	Iv	e \bar{S} _N	20	34	36.0	See discussion, p. 94
			F	20	37		
42	Sept. 20	IIr	eN	05	44	15.5	Felt in Arizona and New Mexico
			F	05	47.3		
43	Sept. 23	Iv	eN	08	20	45.7	Pasadena epicenter: Nevada. 38°N., 118°W.
			iN	08	20	46.5	
			F	08	24.7		
44	Sept. 26	Iv	eN	23	53	01.8	See discussion, p. 95
			iS _N	23	53	14.5	
			F	23	56		
45	Sept. 27	Iv	eP _N	06	11	03.2	Pasadena epicenter: 34°42'N., 119°11'W.
			eS _N	06	11	29.0	
			F	06	13.3		
46	Sept. 27	Iv	eN	10	02	06.9	
			eN	10	02	25.8	
			F	10	03.3		
47	Sept. 27	Iv	i \bar{P} _N	12	24	06.4	See discussion, p. 95
			iN	12	24	08.0	
			iS _N	12	24	23.0	
			F	12	38.3		
48	Sept. 29	Iv	eN	12	13	07.0	Pasadena epicenter: 34°33'N., 120°47'W. Off Point Arguello.
			eN	12	13	36.5	
			eN	12	15	44.0	
			iN	12	18.5		
			F	12	25		
49	Sept. 29	Iv	eN	23	36	56.9	J.S.A. epicenter: 33°36'N., 109°06'W.
			eN	23	40	13.9	
			F	23	49.6		

EARTHQUAKES IN NORTHERN CALIFORNIA

AND

THE REGISTRATION OF EARTHQUAKES

AT

BERKELEY—MOUNT HAMILTON—PALO ALTO

SAN FRANCISCO—FERNDALE—FRESNO

FROM

October 1, 1938 to December 31, 1938

BY

PERRY BYERLY

AND

PHILLIP M. KLEIN

BULLETIN OF THE SEISMOGRAPHIC STATIONS

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UNIVERSITY OF CALIFORNIA PRESS

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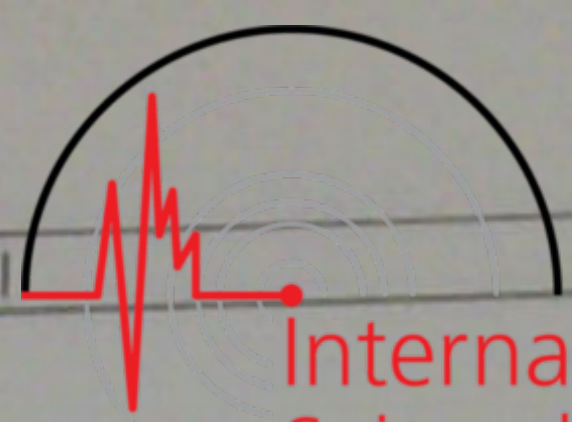
EARTHQUAKE INTENSITY SCALE

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

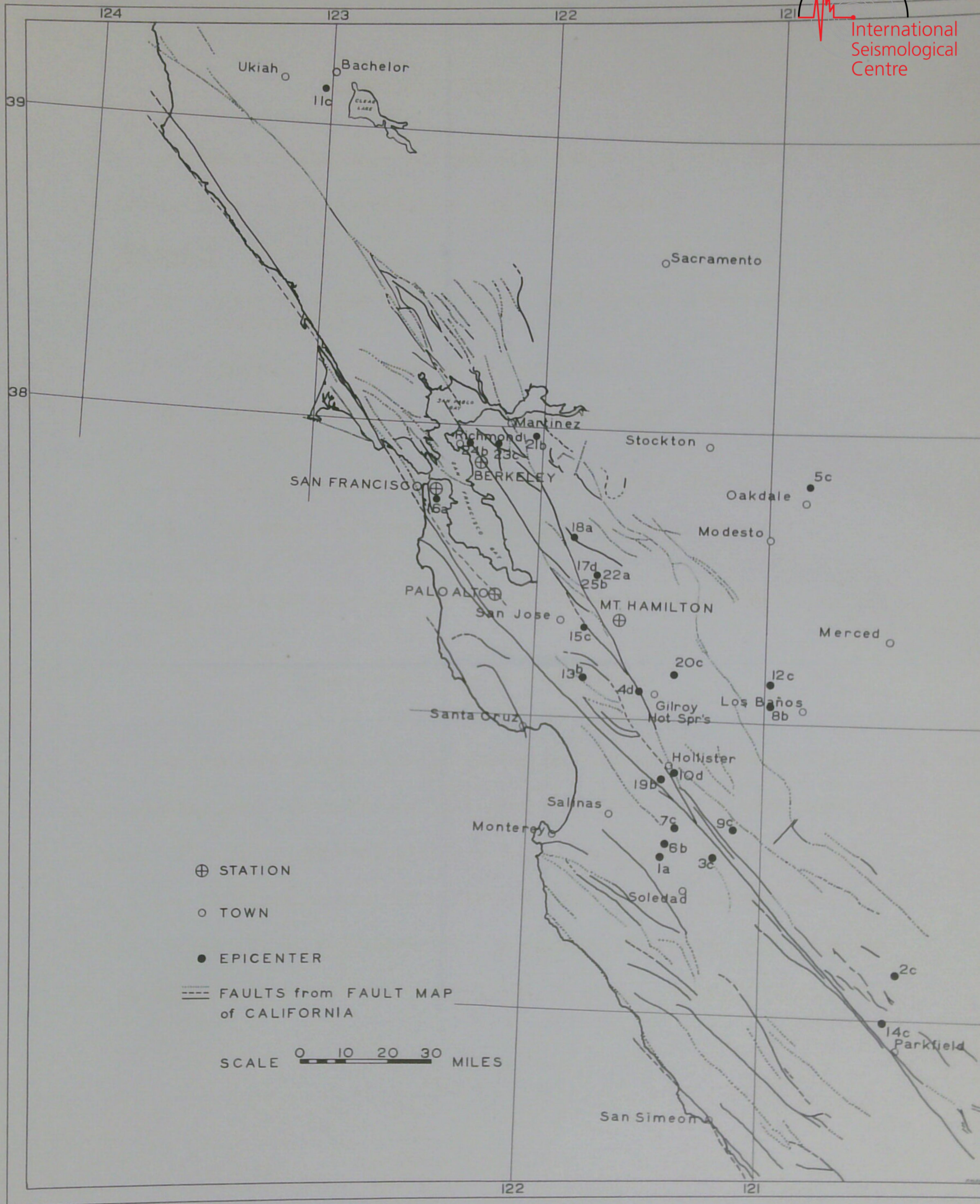
Intensity

- 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.



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MAP SHOWING EPICENTERS, OCTOBER 1, 1938 TO DECEMBER 31, 1938

EARTHQUAKES IN NORTHERN CALIFORNIA

(All intensities given on Modified Mercalli Scale)

1938 -- PACIFIC STANDARD TIME

- October 13, 1h 58m, p.m. Recorded at Palo Alto only; not reported felt; focus about 6 miles from Palo Alto Station.
- October 14, 7h 31m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; not reported felt; epicenter about 3 miles northeast of Gonzales. See map, epicenter 1a.
- October 15, 2h 10m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 16 miles from Lick Observatory.
- October 16, 10h 00m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; I at Pinnacles; probably an aftershock from epicenter 1.
- October 17, 3h 30m, a.m. Recorded at Fresno only; not reported felt; epicenter about 40 miles from Fresno.
- October 17, 4h 00m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 6 miles from Lick Observatory.
- October 17, 10h 13m, a.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 4 miles west northwest of Coalinga. See map, epicenter 2c.
- October 17, 9h 05m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Ferndale, Fresno; II-III at Eureka, Upper Mattole, "quite strong" at Ferndale; epicenter about 30 miles west of Cape Mendocino.
- October 18, 4h 36m, a.m. Recorded at Berkeley only; not reported felt; focus about 5 miles from University campus.
- October 18, 5h 50m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; III at Pinnacles; epicenter about 3 miles west of Pinnacles. See map, epicenter 3c. A second shock is superposed on the coda of this shock, probably from the same source or one near it.
- October 18, 10h 27m, p.m. Recorded at Berkeley only; not reported felt; focus about 7 miles from University campus.
- October 20, 7h 12m, a.m. Recorded at Mount Hamilton and poorly at Palo Alto; felt in Mulberry; probably another shock from epicenter 1.
- October 20, 5h 45m, p.m. Recorded at Berkeley, Mount Hamilton, San Francisco, (Palo Alto records being changed); not reported felt; epicenter about 5 miles east of Morgan Hill. See map, epicenter 4d.



1938 -- P.S.T.

- October 21, 5h 28m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 3 miles north of Oakdale. See map, epicenter 5c.
- October 21, 9h 56m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 4 miles from Lick Observatory.
- October 23, 3h 00m, p.m. Recorded at Berkeley only; not reported felt; focus about 15 miles from University campus.
- October 24, 4h 04m, a.m. Recorded at Mount Hamilton only; not reported felt; epicenter about 56 miles from Lick Observatory; no doubt a fore-shock from epicenter 6.
- October 24, 5h 36m, a.m. Recorded at Mount Hamilton only; not reported felt; epicenter about 56 miles from Lick Observatory; no doubt a fore-shock from epicenter 6.
- October 24, 5h 40m, a.m. Recorded at Berkeley, Mount Hamilton, Fresno; felt at Hollister; epicenter about 6 miles northeast of Gonzales. See map, epicenter 6b.
- October 24, 5h 46m, a.m. Recorded at Mount Hamilton only; not reported felt; epicenter about 56 miles from Lick Observatory; no doubt an after-shock from epicenter 6.
- October 24, 5h 51m, a.m. Recorded at Mount Hamilton only; not reported felt; epicenter about 56 miles from Lick Observatory; no doubt an after-shock from epicenter 6.
- October 25, 3h 19m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 7 miles northeast of Gonzales. See map, epicenter 7c.
- October 25, 6h 49m, a.m. Recorded at Ferndale only; felt in Ferndale and "to the south." Epicenter 15 to 20 miles from Ferndale station.
- October 31, 1h 07m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 7 miles west of Los Banos. See map, epicenter 8b.
- October 31, 7h 06m, p.m. Recorded at Berkeley only; not reported felt; focus about 6 miles from University campus (blast?).
- November 4, 7h 34m, a.m. Recorded at Palo Alto only; not reported felt; focus about 10 miles from Palo Alto Station.
- November 4, 10h 58m, a.m. Recorded at Ferndale only; not reported felt; focus about 20 miles from Ferndale.



1938 -- P.S.T.

- November 9, 9h 21m, p.m. Recorded at Ferndale only; IV at Beatrice and Eureka, III at Arcata and Fields Landing; epicenter about 25 miles from Ferndale. (The record at Ferndale was very small and might have been passed as due to traffic had not there been reports of its being felt.)
- November 11, 12h 55m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 12 miles from Lick Observatory.
- November 14, 2h 16m, p.m. Recorded at Mount Hamilton, Palo Alto, Fresno; not reported felt; epicenter about 9 miles north of San Benito. See map, epicenter 9c.
- November 14, 5h 57m, p.m. Recorded at Mount Hamilton and Palo Alto; not reported felt; epicenter very near Hollister. See map, epicenter 10d.
- November 15, 5h 49m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Ferndale, Fresno; ($\bar{S} - \bar{P} = 2$ seconds at Ukiah).
Intensities:
- VII Talmadge
 - VI Redwood Valley
 - V Calpella, Clearlake Oaks, Manchester, Potter Valley
 - IV Albion, Annapolis, Bachelor, Clear Lake, Comptche, Finlay, Mendocino, Point Arena, Ukiah, Upper Lake, Willits, Witter Springs
 - III Elk, Kelseyville, Littleriver, Longvale, Philo
 - II Hopland
- Epicenter about 5 miles southwest of Bachelor. See map, epicenter 11c.
- November 15, 6h 41m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; epicenter 9 miles northwest of Los Banos. See map, epicenter 12c.
- November 15, 11h 38m, p.m. Recorded at Mount Hamilton and poorly at Palo Alto; not reported felt; focus about 7 miles from Lick Observatory probably south or southeast.
- November 16, 2h 32m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno; not reported felt; epicenter about 5 miles southwest of Coyote. See map, epicenter 13b.
- November 16, 4h 38m, p.m. Recorded at Palo Alto only; not reported felt; focus about 10 miles from Palo Alto Station.

1938 -- P.S.T.

November 20, 2h 12m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 16 miles from Lick Observatory.

November 20, 7 h 15 m, p.m. Recorded at Ferndale only; not reported felt; focus about 13 miles from Ferndale. (May not be an earthquake.)

November 22, 7h 31m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno. Intensities:

- IV Atascadero, Cambria, Parkfield, Paso Robles, Shandon
- III Creston, Morro Bay, San Miguel, Templeton; felt in San Luis Obispo

Epicenter about 6 miles northwest of Parkfield. See map epicenter 14c.

November 23, 6h 13m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 12 miles from Lick Observatory.

November 28, 2h 37m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; IV 6 miles east of San Jose; epicenter about 2 miles southeast of San Jose. See map, epicenter 15c.

November 29, 9h 49m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco. Intensities:

- IV Brisbane, Colma, Fort Baker and Barry, Larkspur, Hayward, Mile Rock Light Station, Oakland, Rockaway Beach, San Bruno, San Francisco, San Pablo, Sharp Park
- I-III Berkeley, Benicia, Burlingame, Fairfax, Montara, Moraga, Palo Alto, Ross, San Rafael, Sausalito, Stinson Beach. (A report from Belvedere states that plaster and chimney were cracked.)

Epicenter about 2 miles south of St. Ignatius Church, San Francisco. See map, epicenter 16a.

December 1, 8h 18m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno. Intensities:

- V-VI San Jose
- V Saratoga
- IV Alviso
- I-III Ben Lomond, Chualar, Coyote, Cupertino, Irvington, (Paso Robles?).

The seismograms indicate an epicenter about 12 miles northwest of Lick Observatory. See map, epicenter 17d. The field data do not support the instrumental location.



1938 -- P.S.T.

December 3, 4h 46m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 2 miles southeast of Pleasanton. See map, epicenter 18a.

December 3, 9h 43m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco, Fresno. Intensities:

- VI Laws, Owens River Gorge, Terra Bella
- V Delpiedra, Dunlap, Fresno, Hanford, Mather, Orange Cove, Reedley, Stanislaus
- IV Auberry, Bass Lake, Benton, Big Creek, Bigpine, Bishop, Burrel, Cathay, Cholame, Clovis, Coarsegold, Corcoran, Deep Springs, Delano, Dinuba, Ducor, Dyer (Nev.), El Portal, Exeter, Fairmead, Famoso, Friant, General Grant National Park, Hetch Hetchy, Independence, Isabella, Ivanhoe, Jamestown, June Lake, Kernville, Lemoncove, Little Lake, Lone Pine, Lost Hills, Mammoth Lakes, Mariposa, Mather, Mendota, Mount Montgomery (Nev.), Mountain Ranch, Miramonte, Navelencia, North Fork, Onyx, Owenyo, Porterville, Pineridge, Raymond, Riverdale, Sand Canyon, Selma, Sonora, Squaw Valley, Stratford, Three Rivers, Trimmer Springs (Sanger), Tulare, Visalia, Wawona, Westhaven, Woodlake, Yosemite
- I-III Armona, Avenal, Coulterville, Cutler, Goshen, Grass Valley, Groveland, Knight's Ferry, Laton, Le Grand, Lindsay, Modesto, Oakdale, Oasis, Oilfields, Pinedale, South Dos Palos, Snelling, Stockton; felt in Bakersfield, Kingsburg, Madera, Wasco.

Epicenter near Pine Creek Pass and Fresno-Inyo County Line, west of Bishop. A large number of aftershocks were recorded at most stations, the greatest occurred at 10h 41m a.m.

December 7, 1h 43m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, Fresno; IV at Hollister; epicenter about 4 miles south southwest of Hollister. See map, epicenter 19b

December 7, 10h 18m, a.m. Recorded at Mount Hamilton only; not reported felt; focus about 6 miles from Lick Observatory.

December 7, 3h 03m, p.m. Recorded at Palo Alto only; not reported felt; focus about 5 miles from Palo Alto station.

December 11, 10h 08m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; epicenter about 9 miles northeast of Gilroy Hot Springs. See map, epicenter 20c.

December 12, 9h 04m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; not reported felt; epicenter about 5 miles southeast of Martinez. See map, epicenter 21b.

1938 -- P.S.T.

- December 13, 1h 10m, p.m. Recorded at Palo Alto only; not reported felt; focus about 12 miles from Lick Observatory.
- December 20, 9h 20m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 12 miles northwest of Lick Observatory. See map, epicenter 22a.
- December 22, 4h 11m, pm. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco; not reported felt; epicenter about half way between Martinez and Richmond. See map, epicenter 23c.
- December 22, 4h 12m p.m. Recorded at Berkeley only; not reported felt; focus about 6 miles from University campus. Probably an aftershock of quake a minute earlier.
- December 22, 7h 19m, p.m. Recorded at Berkeley, Mount Hamilton, Palo Alto, San Francisco. Intensities:
- IV Berkeley, Emeryville, Fort Baker and Barry, Lafayette, North Oakland, Pinole
- I-III Moraga, San Pablo
- Epicenter about 6 miles northwest of Berkeley station. See map, epicenter 24b.
- December 22, 7h 20m, p.m. Recorded at Berkeley, San Francisco; not reported felt; an aftershock of previous quake.
- December 24, 1h 24m, p.m. Recorded at Palo Alto only; not reported felt; focus about 10 miles from Palo Alto station.
- December 25, 6h 14m, p.m. Recorded at Mount Hamilton only; not reported felt; focus about 6 miles from Lick Observatory.
- December 28, 02h 00m, a.m. Recorded at Berkeley, Mount Hamilton, Palo Alto; not reported felt; epicenter about 12 miles northwest of Lick Observatory, (same epicenter as 20). See map, epicenter 25a.

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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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.

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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		
						A _E	A _N	A _Z			
						mm.	mm.	mm.			
						h. m. s.	s.				
1	Oct. 4	I	e _E	G	09 06 43				Surface waves		
			e _Z	G	09 07 43						
			e _N	G	09 10 43						
			F		09 41.7						
2	Oct. 4	I	e _N	G	20 38 42				Surface waves		
			F		21 01.7						
3	Oct. 5	Iu	e _E	G	00 33 43				Surface waves		
			e _Z	G	00 33 43						
			F		01 00.0						
4	Oct. 7	Iu	e _E	G	01 41.7						
			F		03 01.6						
5	Oct. 10	I	e _N	G	03 11 16				Surface waves		
			e _N	G	03 15 46						
			e _{EZ}	G	03 16 46						
			F		04 01.7						
6	Oct. 10	Ir	e _{PZ}	G	21 01 17.5				U.S.C. & G.S. epicenter: 1°N., 125°E, J.S.A. epicenter: 1°0 N., 125°E.		
			e _N	A	21 05 57.5						
			e _{EZ}	G	21 06 14.5						
			e _E	A	21 06 27.5						
			e _N	G	21 06 47.5						
			e _E	G	21 12 48						
			e _N	G	21 13 47.5						
			e _{EZ}	G	21 15 01.5						
			e _Z	G	21 18 19.5						
			e _N	G	21 24 58						
			e _{LN}	G	21 31.8						
			e _E	A	21 36 12						
			F		23 36.0						
7	Oct. 12	Iu	e _{EN}	G	00 54 41				Japan Pasadena epicenter: 39°8 N., 144°3 E.		
			e _N	G	01 03 49						
			e _{LEN}	G	01 06.8						
			e _Z	G	01 13 19						
			F		02 32.0						
8	Oct. 14	Iv	e _{PZ}	H	15 30 41.2				See discussion, p. 134		
			e _F	A	15 30 43.3						
			e _N	A	15 30 46.5						
			e _E	A	15 30 47.3						
			e _N	A	15 31 04						
			e _F	A	15 31 06						
F		15 34.0									

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No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				AE	AN	AZ	
				h.	m.	s.	s.	mm.	mm.	mm.	
	1938										
9	Oct. 16	Iv	ez iz iz F	H H H	17 17 17	59 59 59	08.9 10.5 27.9				See discussion, p. 134
10	Oct. 17	I	eN eE ez F	G G G	23 23 23	06 07 08	53 54 53				
			F		23	25.0					
11	Oct. 18	Iv	eN ePnE iz iz eENZ eSnN iSnZ eSnE iN eEZ iE F	A A H H G A H A G G G	05 05 05 05 05 05 05 05 05 05 05 05	04 05 05 05 06 06 06 06 07 07 07 07	53 51.5 53.0 54.0 13 33.0 33.2 33.5 01 05 25 13.0				See discussion, p. 134
12	Oct. 18	Id	iPZ eSE iSZ iSN iz F	H A H A H	12 12 12 12 12	36 36 36 36 36	14.4 15.3 15.3 15.6 16.3				See discussion, p. 134
			F		12	36	28				
13	Oct. 18	Iv	iz eN iz iz eE eN F	H A H H A A	13 13 13 13 13 13	50 50 50 50 50 50	10.5 16 17.5 21.7 33 37.3				Two quakes superposed. See discussion, p. 134
			F		13	53.0					
14	Oct. 19	Iu	eN eE ez F	G G G	05 05 05	00 02 03	54 50 06				Strasbourg epicenter: 49°7 N., 90°5 E.
			F		05	41.9					
15	Oct. 19	Id	iPZ iSN iSZ F	H A H	06 06 06	27 27 27	09.7 11.2 11.2				See discussion, p. 134
			F		06	27.4					

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
						mm.	mm.	mm.		
						h.	m.	s.		
16	Oct. 19	Iu	ez	G	02 38 04				U.S.C. & G.S. epicenter 10°S., 123°E. J.S.A. epicenter: 9°5 S., 122°8 E.	
			eE	A	02 38 06					
			eN	A	02 38 16					
			ez	G	02 44 36					
			eEN	A	02 44 44					
			iz	G	02 48 10					
			eM _Z	G	03 11 56					
		F			04 02					
17	Oct. 21	Iv	iP _Z	H	01 45 47.3				See discussion, p. 134	
			iP _N	A	01 45 47.6					
			iS _Z	H	01 46 00.5					
			eN	A	01 46 01.0					
			iS _N	A	01 46 01.1					
			F		01 47.5					
18	Oct. 21	Iu	iz	H	06 57 12.3				Pasadena epicenter: 43°5 N., 131°E.	
			eN	A	06 57 13.3					
			eE	A	06 57 14.8					
			iz	H	06 57 16.5					
			iz	H	06 59 10.3					
			eEN	A	06 59 10.8					
			F		07 02.0					
19	Oct. 21	I	iP _Z	H	19 52 17.0					
			iN	A	19 52 21.8					
			iE	A	19 52 25.3					
			eN	A	19 52 27.0					
			iE	A	19 52 42.3					
			F		19 56.0					
20	Oct. 22	Iv	iz	H	01 28 46.1				See discussion, p. 135	
			eN	A	01 28 50.3					
			iS* _Z	H	01 28 56.6					
			F		01 29.8					
21	Oct. 23	Id	iP _Z	H	23 00 28.2				See discussion, p. 135	
			iS _Z	H	23 00 32.2					
			eN	A	23 00 32.7					
			F		23 01.0					
22	Oct. 24	Iv	iP _{NZ}	H	13 40 18.5				See discussion, p. 135	
			iz	H	13 40 19.4					
			eN	A	13 40 19.5					
			iP _Z	H	13 40 21.2					
			eE	A	13 40 22					
			eN	A	13 40 26					
			eS _{NE}	A	13 40 39					
					13 43.0					

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
	1938			h. m. s.	s.	mm.	mm.	mm.	
29	Nov. 6	IIu	iP _{ENZ}	G	09 05 15				Japan. U.S.C. & G.S. epicente 36°N., 144°E. J.S.A. epicenter: 37°4 N., 143°7 E.
			eP _Z	H	09 05 15.1				
			eP _N	A	09 05 15.6				
			eP _E	A	09 05 16.6				
			iE	A	09 05 31.6				
			eS _{EN}	A	09 14 30				
			eS _Z	G	09 14 49				
			eL _N	G	09 22 09				
			eL _E	A	09 22 10				
			eN	A	09 23 40				
			F		14 02				
30	Nov. 6	IIu	eP _Z	H	21 50 07.2				Japan. U.S.C. & G.S. probably an aftershock of 08 h.
			eP _N	A	21 50 09.7				
			iP _Z	G	21 50 10				
			eS _E	A	21 59 22.7				
			eS _{EZ}	G	21 59 50				
			eG _E	A	22 08 10				
			eN	A	22 09.1				
			eL _N	G	22 11.1				
F		24 00							
31	Nov. 7	Iu	eP _Z	G	19 44 56				Japan. After shock of Nov. 6., 08 h. Earthquake Research Institute: 37°40 N., 141°50 E.
			eE	G	19 45 10				
			iN	G	19 45 10				
			eS _Z	G	19 54 30				
			eE	G	20 07 10				
			iN	G	20 08 10				
			eL _N	A	20 09.1				
			F		22 32.1				
32	Nov. 9	IIu	eZ	G	09 35 11				Japan. Aftershock of Nov. 6., 08 h. F lost in next shock.
			eE	G	09 36 41				
			eZ	G	09 37 25				
			eN	G	09 37 41				
			eE	G	09 41 11				
			eN	G	09 47 10				
			eEN	A	09 48.1				
			eZ	G	09 50.1				
33	Nov. 9	IIu	eE	G	11 07.9				Probably coda of #31.
			eN	G	11 08.1				
			eEN	G	11 18 10				
			eZ	G	11 21.1				
			F		13.2				

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No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks	
				U.T.				Δ_E	Δ_N	Δ_Z		
				h.	m.	s.	s.	mm.	mm.	mm.		
34	1938 Nov. 10	IIr	eE	A	20	24	51.6				Alaska. U.S.C. & G.S. epicenter: 56°N., 159°W. J.S.A. epicenter: 55°6 N., 157°7 W.	
			ez	H	20	24	51.6					
			eN	A	20	24	56.6					
			eE	A	20	25	05					
			iz	H	20	25	8.7					
			iN	A	20	26	10					
			iz	H	20	26	10					
			iSN	A	20	31	4.5					
			eGN	A	20	32	10					
			ez	H	20	33	9.6					
			eLN	A	20	33	1					
			eMN	A	20	37	1					
			F		02	00						
35	Nov. 12	I	eN	G	08	38	40					
			eE	G	08	39	10					
			ez	G	08	47	10					
			eE	G	08	48	11					
			ez	G	09	01	0					
			F		10	32	1					
36	Nov. 12	Iu	iz	G	15	00	9.7				Strasbourg epicenter: 47°2 N., 153°8 E.	
			eEN	G	15	08	10					
			eN	G	15	14	30					
			eE	G	15	15	10					
			F		21	03						
37	Nov. 13	IIu	iPZ	G	13	24	8.9				J.S.A. epicenter: 46°N., 149°4 E.	
			iPE	G	13	24	10	3.5	-4			
			iPN	G	13	24	10	3		-2.5		
			iPZ	G	13	24	10	2.5				+4
			ePEN	A	13	24	15					
			iEN	G	13	32	40	4				+8
			iN	G	13	40	9.5					
			ez	G	13	43	10					
			F		15	32						
38	Nov. 13	IIu	iPEZ	G	22	42	43.5				Japan.	
			eSEnz	G	22	52	09.5					
			eEN	A	23	02	10					
			ez	G	23	04	10					
			eZ	H	00	43	54					
			F		01	47	1					

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						Λ_E	Λ_N	Λ_Z	
		1938		h. m. s.	s.	mm.	mm.	mm.	
39	Nov. 14	I	iPz	G	12 19 11.5				Wellington gives: 7°S., 148°E.
			eN	G	12 29 30				
			eE	G	12 30 10				
			eE	G	12 48 10				
			F		13 32.1				
40	Nov. 15	IIr	eN	G	09 51 11				Alaska.
			eEZ	G	09 51.2				
			eN	G	09 57.2				
			eZ	H	09 58 26.9				
			eN	A	09 58 27				
			eE	G	10 00.2				
			F		10 16.0				
41	Nov. 15	Iv	iPz	H	13 49 05.6				See discussion, p. 136
			ePN	A	13 49 05.7				
			iz	H	13 49 10.6				
			eE	A	13 49 14.6				
			eN	G	13 49 19.2	1	+0.2		
			eS _{NE}	G	13 49 20.6				
			iz	H	13 49 35.6				
			iLN	G	13 49 37.0	2	-1		
			eLN	A	13 49 38.6				
			iLE	G	13 49 44.6	6	-2		
			F		13 53.2				
			42	Nov. 15	Iv	iPz	H	14 41 38.0	
iN	A	14 41 51.6							
iz	H	14 41 54.6							
F		14 42.1							
43	Nov. 15	Iu	eP'z	H	21 19 20.9				Strasbourg gives: 5°S., 97°E. Pasadena gives: 3°S., 99°E.
			eN	G	21 21 23				
			iz	H	21 21 26.9				
			ePN	A	21 21 28.9				
			eZ	G	21 21 41.9				
			eE	A	21 22 00				
			eN	G	21 22 56				
			F		23 02.0				
44	Nov. 16	Id	iPz	H	10 32 01.3				See discussion, p. 136
			ePN	A	10 32 01.5				
			eS*E	A	10 32 11.3				
			F		10 33.5				

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No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
	1938			h.	m.	s.	s.	mm.	mm.	mm.	
45	Nov. 16	Iu	iP _Z e _N F	H A	11 11	19 19	31.4 37.4				Earthquake Research Institute gives: 37°23 N., 141°25 E. according to Pasadena.
46	Nov. 17	Iir	eP _E iP _Z iP _{EN} e _Z e _N eS _E iS _Z eG _N e _E F	A G G H A A G A A	04 04 04 04 04 04 04 04 04	00 00 00 00 00 05 05 07 08 08	39 39 40 46.7 47.5 10 38 40 32 12 00	+0.2		Alaska. U.S.C. & G.S. epicenter 55°N., 158°W. J.S.A. epicenter: 55°3 N., 157°5 W.	
47	Nov. 18	Iv	e _E i _Z e _N e _N i _Z F	A H A A H	13 13 13 13 13	29 29 29 29 29	17.8 22.8 28.5 57.5 58.7 32.5			Nevada?	
48	Nov. 22	Iu	eP _Z iP _{NZ} e _N eS _{EN} eS _Z eL _N e _N e _E F	H G A A H G A A	01 01 01 01 01 01 01 01 04	25 25 25 34 34 42 47 49 32	27 27 31.5 47 47 17 3 3 32.3			Japan. U.S.C. & G.S. epicenter 37°N., 142°E. J.S.A. epicenter: 36°3N., 141°6E.	
49	Nov. 22	Iv	iP* _Z i _Z e _N e _N i _N F	H H A A A	15 15 15 15 15	31 31 31 32 32	27.5 30.7 36.6 08.2 11.8 35.3			See discussion, p. 137	
50	Nov. 25	Iu	e _Z e _N F	H A	08 08	36 36	46 46.5 37.1			Japan.	

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
51	Nov. 25	Iu	iz	G	08 38 52.5				
			e ^{EN}	G	08 50.5				
			e ^{EZ}	G	08 54.4				
			F		09 52.3				
52	Nov. 27	Iv	i _N	G	00 19 23.5				Arizona - New Mexico.
			e _Z	G	00 19 31.5				
			iz	G	00 20 04.5				
			i _E	G	00 20 20.5				
			i _N	G	00 20 33.5				
			F		00 22.3				
53	Nov. 28	Id	i ^P _Z	H	10 36 54.3				See discussion, p. 137
			iz	H	10 37 04.4				
			F		10 37.9				
54	Nov. 30	Iu	e _Z	G	02 41 22				U.S.C. & G.S. epicenter: 37°N., 142°E. J.S.A. epicenter: 37°5 N., 141°3 E.
			e _N	A	03 02 22				
			e _Z	G	03 02.5				
			F						
55	Nov. 30	Id	i ^P _N	A	05 49 14.9				See discussion, p. 137
			i ^P _Z	H	05 49 14.9				
			i ^S _N	A	05 49 17.8				
			F		05 50.4				
56	Dec. 1	Iu	i ^P _Z	H	02 24 28				Marianne Islands?
			e _N	A	02 24 29.5				
			e _N	A	02 24 53				
			F		02 26.4				
57	Dec. 1	Id	i ^P _N	A	16 17 45.5				See discussion, p. 137
			iz	H	16 17 46.1				
			i _N	A	16 17 50.2				
			i ^S _N	A	16 17 53.3	0.7	+0.1		
			F		16 20.4				
58	Dec. 3	IIId	e ^P _N	A	12 48 58.2	0.1	+0.1		See discussion, p. 138
			i ^P _Z	E	12 48 58.2	0.1	+1		
			e ^S _N	A	12 49 04.5				
			F		12 49.4				

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No.	Date	Char-acter	Phase	Time			Period	Amplitude			Remarks
				U.T.				A _E	A _N	A _Z	
	1938			h.	m.	s.	s.	mm.	mm.	mm.	
59	Dec. 3	Iv	iPnZ	H	17	43	37.6	0.5		-0.1	See discussion, p. 138
			iPn _N	A	17	43	37.9				
			iP _E	A	17	43	39.4				
			iP [*] _N	A	17	43	44.9				
			iP _N	A	17	43	50.4				
			iP _E	A	17	43	51.4				
			iSn _N	A	17	44	14.9				
			iS _N	A	17	44	29.4				
60	Dec. 3	Iv	iPnZ	H	18	42	05.3				Aftershock.
			iPn _{EN}	A	18	42	06.0				
			iSn _N	A	18	42	45.9				
			iSn _E	A	18	42	49.9				
			iS _N	A	18	42	57.1				
			F		18	46.4					
61	Dec. 3	Iv	e _N	A	22	18	32.8				Aftershock
			e _N	A	22	21	23.1				
			F		22	25.0					
62	Dec. 7	Iv	ePnZ	H	09	42	56.5				See discussion, p. 138
			ePn _N	A	09	42	56.8				
			iSnZ	H	09	43	13.1				
			iSn _N	A	09	43	13.5				
			F		09	44.4					
63	Dec. 7	Iu	eP _{NZ}	G	13	36	44				Solomon Islands.
			eP _Z	H	13	36	45.9				
			eE _Z	G	14	04	26				
			eE	A	14	04	26				
			eZ	G	14	08	26				
			F		15	33					
64	Dec. 9	Ir	iP _{ENZ}	G	04	01	16				Alaska.
			e _N	A	04	01	35				
			iZ	G	04	06	27				
			eL _{EN}	G	04	08.5					
			F		05	02.5					
65	Dec. 12	Iv	e _{EN}	G	03	19	29				Lower California.
			eZ	G	03	20	29				
			F		03	30.5					

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No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						A _E	A _N	A _Z	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
66	Dec. 12	Iv	iP*N	A	06 08 02.5				See discussion, p. 138
			iP*Z	H	06 08 02.5				
			ePnN	A	06 08 03.3				
			iS*Z	H	06 08 15.4				
			iS*N	A	06 08 15.7				
			F		06 09.5				
67	Dec. 12	I	eN	A	07 44 24				
			eN	A	07 47 29				
			eEN	G	07 47.5				
			F		08 02.5				
68	Dec. 12	Id	iP _N	A	17 04 05.9	0.5		-0.1	See discussion, p. 138
			iP _Z	H	17 04 05.9				
			iP _E	A	17 04 06.1				
			iS _E	A	17 04 09.1				
			F		17 05.0				
69	Dec. 16	Iv	iP _Z	H	10 48 58.0				Felt at Benton
			iZ	H	10 49 04.3				
			iN	A	10 49 09				
			iN	A	10 49 38.5				
			F						
70	Dec. 16	Iu	eZ	G	18 10 07				New Zealand.
			F		18 23				
71	Dec. 16	Iu	eN	A	23 54.5				Surface waves. New Zealand.
			eZ	G	00 05.5				
			F		00 20				
72	Dec. 18	I	eN	A	08 30 10.9				
			eZ	H	08 30 10.9				
			F		08 31.5				
73	Dec. 20	Id	iP _Z	H	17 19 45.8				See discussion, p. 139
			iZ	H	17 19 46.9				
			iN	A	17 19 54.6				
			F		17 20.5				
74	Dec. 23	Id	iP _Z	H	00 11 22.3				See discussion, p. 139 $\bar{S} - \bar{P} = 1.3^s$ from Bosch-Omori records.
			iP _E	A	00 11 22.8				
			F		00 12.2				



BERKELEY

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks		
						A _E	A _N	A _Z			
						mm.	mm.	mm.			
						h.	m.	s.	s.		
75	Dec. 23	Id	iP _Z	H	00	12	42.8			Aftershock. See discussion, p. 139	
			iS _Z	H	00	12	44.1				
			F		00	13.2					
76	Dec. 23	Id	iP _Z	H	03	18	57.2			S - P = 1.2 ^s from Bosch-Omori records. See discussion, p. 139 F lost in aftershock.	
			eP _E	A	03	18	57.5				
77	Dec. 23	Id	iP _Z	H	03	19	46.8			Aftershock. See discussion, p. 139	
			F		03	20.0					
78	Dec. 23	I	eENZ	G	18	28	34				
			F		18	42.5					
79	Dec. 28	Id	iP _Z	H	11	00	13.5			See discussion, p. 139	
			iz	H	11	00	18.8				
			iz	H	11	00	23.5				
			F		11	01.0					
80	Dec. 31	I	eN	G	00	33	46				
			eNZ	G	00	39	44				
			eE	G	00	41	44				
			F		01	02.5					



MOUNT HAMILTON

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

CONSTANTS

CONSTANTS OF THE STATION

Latitude and longitude:

$\phi = 37^{\circ} 20' 4''$ N.
 $\lambda = 121^{\circ} 38' 6''$ W.

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			Remarks
				U.T.			
	1938			h.	m.	s.	
1	Oct. 9	I	eE	06	15	00.7	
			eN	06	15	01.6	
			eE	06	15	02.9	
			F	06	15	10	
2	Oct. 14	Id	$\bar{e}P_E$	15	31	27.9	See discussion, p. 134
			iS _E	15	31	39.4	
			F	15	35.5		
3	Oct. 15	Id	iP _E	22	10	19.5	See discussion, p. 134
			eP _N	22	10	19.5	
			iS _N	22	10	22.7	
			iS _E	22	10	22.8	
			F	22	11	07	
4	Oct. 16	Id	$\bar{e}P_E$	17	59	52.5	See discussion, p. 134
			iP _N	17	59	52.5	
			iS _N	18	00	04.4	
			eS _E	18	00	04.5	
			F	18	02.0		
5	Oct. 17	Id	iP _N	11	59	43.3	See discussion, p. 134
			iP _E	11	59	43.6	
			iS _N	11	59	44.6	
			iS _E	11	59	44.7	
			F	12	00	03	
6	Oct. 17	Iv	eP [*] _N	18	13	51.8	See discussion, p. 134
			eS _{nN}	18	14	9.5	
			eS _{nE}	18	14	10.0	
			F	18	16.0		
7	Oct. 18	Iv	eN	05	06	06.2	See discussion, p. 134
			eS _{nE}	05	06	53.8	
			eS _{nN}	05	06	54.7	
			F	05	12.0		
8	Oct. 18	Id	$\bar{e}P_N$	13	50	01.8	See discussion, p. 134
			eE	13	50	02.6	
			eN	13	50	12.6	
			eE	13	50	13.0	
			eS _N	13	50	14.1	
			eS _E	13	50	14.2	
						F lost in next quake.	

MT. HAMILTON

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
9	Oct. 18	Id	eN	15 50 40.5	See discussion, p. 134
			eE	13 50 40.6	
			eSEN	13 50 42.1	
			F	13 52 03	
10	Oct. 20	Iu	e _C ^P _C ^S EN	02 44 45.8	U.S.C. & G.S. epicenter: 10°S., 123°E. J.S.A. epicenter: 9°5 S., 122°8 E.
			F	03 14.0	
11	Oct. 20	Id	ePN	15 12 24.4	See discussion, p. 134
			eSE	15 12 36.0	
			eSN	15 12 36.2	
			F	15 13.5	
12	Oct. 21	Id	iPN	01 45 33.1	See discussion, p. 134
			iSE	01 45 36.9	
			iSN	01 45 37.2	
			F	01 47.0	
13	Oct. 21	I	ePEN	19 52 26.8	
			F	19 57.0	
14	Oct. 22	Id	ePN	01 28 36.9	See discussion, p. 135
			eE	01 28 39.6	
			iSE	01 28 49.0	
			eSN	01 28 49.0	
			F	01 30.0	
15	Oct. 22	Id	ePN	07 55 52.7	See discussion, p. 135
			iSEN	07 55 53.5	
			F	07 56 30	
16	Oct. 24	Id	ePN	12 03 54.3	See discussion, p. 135
			eE	12 03 56.3	
			eSN	12 04 05.9	
			eSE	12 04 11.9	
			F	12 05.0	
17	Oct. 24	Id	ePN	13 35 59.2	See discussion, p. 135
			eSE	13 36 10.2	
			eSN	13 36 10.4	
			iN	13 36 11.5	
			F	13 36.8	

MT. HAMILTON

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
18	Oct. 24	IId	e \bar{P} E	13	40	09.6	See discussion, p. 135
			i \bar{E}	13	40	10.2	
			iSEN	13	40	21.2	
			F	13	44	10	
19	Oct. 24	Id	ePE	13	46	16.7	See discussion, p. 135
			iPN	13	46	16.7	
			iSN	13	46	27.2	
			iN	13	46	28.2	
			iSE	13	46	28.8	
			F	13	48.0		
20	Oct. 24	Id	ePN	13	51	22.0	See discussion, p. 135
			ePE	13	51	32.2	
			eSN	13	51	32.7	
			eSE	13	51	34.4	
			F	13	57.0		
21	Oct. 25	Id	e \bar{P} N	11	18	49.1	See discussion, p. 135
			e \bar{P} E	11	18	49.4	
			eSN	11	19	00.2	
			iN	11	19	01.7	
			F	11	20.0		
22	Oct. 31	Id	e \bar{P} N	09	07	28.7	See discussion, p. 135
			e \bar{P} E	09	07	29.0	
			iSE	09	07	37.1	
			eSN	09	07	37.7	
			F	09	09.0		
23	Nov. 5	Iu	ePN	08	54	58.0	Japan. U.S.C. & G.S. epicenter: 38°N., 141°E. J.S.A. epicenter: 36°8 N., 139°6 E.
			ePE	08	55	02.0	
			eE	09	04	19.0	
			eSN	09	04	22.0	
			F	09	56		
24	Nov. 5	Iu	eN	11	01	42.9	Japan. U.S.C. & G.S. epicenter: 38°N., 141°E. J.S.A. epicenter: 36°7 N., 141°0 E.
			eE	11	01	51.4	
			eSN	11	11	11.9	
			eE	11	11	17.9	
			F	12	04.0		
25	Nov. 6	Iu	ePE	09	05	25.2	Japan. U.S.C & G.S. epicenter: 36°N., 144°E. J.S.A. epicenter: 37°4 N., 143°7 E.
			ePN	09	05	25.3	
			eSEN	09	14	44.7	
			eE	09	24	19.7	
			F	12	44		

MT. HAMILTON

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
26	Nov. 6	Iu	eP _{EN} e _N e _N F	21 50 16.6 21 59 38.6 22 02 59 23 00			Japan. U.S.C. & G.S.: Probably an aftershock of Nov. 6, 08 h.
27	Nov. 9	Iu	e _N e _E F	09 46 57.4 09 48 42.4 10 44			Japan. Aftershock of Nov. 6, 08 h.
28	Nov. 10	IIr	eP _E eS _E eI _E F	20 25 06.0 20 30 24.6 20 33 34.6 23 00			Alaska. U.S.C. & G.S. epicenter: 56°N., 159°W. J.S.A. epicenter: 55.6°N., 157.7°W.
29	Nov. 11	Ir	e _E F	01 04 01.4 01 44			Aftershock, Alaska. J.S.A. epicenter: 54.9°N., 156.0°W.
30	Nov. 11	Id	iP _N iS _N F	20 55 15.9 20 55 16.4 20 56.0			See discussion, p. 136
31	Nov. 13	Iu	eP _{EN} eS _N F	13 24 15.3 13 32 49.3 13 39			J.S.A. epicenter: 46.0°N., 149.4°E.
32	Nov. 13	Iu	e _N F	23 14 00 30			Japan?
33	Nov. 14	Id	eP _N eP _E eS _E eS _N F	22 16 28.6 22 16 29.1 22 16 40.8 22 16 41.1 22 18.0			See discussion, p. 136
34	Nov. 15	Id	eP _N eS _{EN} F	01 57 09.1 01 57 16.7 01 58.0			See discussion, p. 136
35	Nov. 15	Iv	eP _{nEN} e _E e _N F	13 49 16.1 13 50 00.0 13 50 03.5 13 52 30			See discussion, p. 136

MT. HAMILTON

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
36	Nov. 15	Id	e \bar{P} _{EN}	14	41	23.7	See discussion, p. 136
			e \bar{S} _E	14	41	30.9	
			e \bar{N}	14	41	31.7	
			F	14	43		
37	Nov. 15	Iu	e \bar{N}	21	21	42.4	Strasbourg epicenter: 5°S., 97°E.
			F	21	26.0		
							Pasadena epicenter: 3°S., 99°E.
38	Nov. 16	I \bar{d}	i \bar{P} _{EN}	07	38	16.7	See discussion, p. 136
			i \bar{S} _{EN}	07	38	18.0	
			F	07	39.0		
39	Nov. 16	II \bar{d}	i \bar{P} _{EN}	10	31	48.5	See discussion, p. 136
			F	10	34		
40	Nov. 17	Ir	e \bar{P} _E	04	00	47.7	Alaska: U.S.C. & G.S. epicenter: 55°N., 158°W. J.S.A. epicenter: 55°3 N., 157°5 W.
			e \bar{S} _N	04	05	48.7	
			e \bar{S} _E	04	05	50.7	
			e \bar{L} _E	04	08	59	
			F	05	00		
41	Nov. 18	I	e \bar{N}	08	34	22.5	
			e \bar{E}	08	34	26.0	
			F	08	36.0		
42	Nov. 18	Iv	e \bar{N}	13	29	30.3	Nevada?
			e \bar{E}	13	29	38.8	
			e \bar{E}	13	30	02.0	
			F	13	32		
43	Nov. 20	I	i \bar{P} _{EN}	01	57	37.2	
			i \bar{E}	01	57	38.5	
			F	02	00		
44	Nov. 20	I \bar{d}	e \bar{P} _N	22	11	44.4	See discussion, p. 137
			e \bar{P} _E	22	11	44.6	
			e \bar{S} _N	22	11	47.6	
			e \bar{S} _E	22	11	47.9	
			F	22	12.1		

MT. HAMILTON

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
45	Nov. 22	Iu	eEN eE F	01 25 36.5 01 35 03.0 02 30			Japan. U.S.C. & G.S. epicenter: 37°N., 142°E. J.S.A. epicenter: 36°3 N., 141°6 E.
46	Nov. 22	Iv	ePN iSE iN F	15 31 17.5 15 31 41 15 31 54 15 36.0			See discussion, p. 137
47	Nov. 24	Id	iPEN eSE iSN F	02 12 57.6 02 13 00.0 02 13 00.0 02 14.0			See discussion, p. 137
48	Nov. 27	Iv	eEN F	00 18 39 00 21.8			Arizona - New Mexico
49	Nov. 28	Id	iPE iPN iSE iSN F	10 36 46.1 10 36 46.5 10 36 49.1 10 36 49.4 10 37.7			See discussion, p. 137
50	Nov. 30	Id	iPEN iSEN F	05 49 25.7 05 49 37.0 05 51.0			See discussion, p. 137
51	Dec. 1	IIId	iPEN F	16 17 39.0 16 21.0			See discussion, p. 137
52	Dec. 3	Iv	ePN eSEN F	12 45 57.1 12 46 02.0 12 47.0			Very weak.
53	Dec. 3	IIv	ePN iPNE iPmN iSNE F	17 43 31.3 17 43 31.5 17 43 31.9 17 44 06.3 17 51.0			See discussion p. 138 Several smaller earthquakes, probably aftershocks, superposed on the coda of this shock
54	Dec. 3	Iv	eRN eSN F	17 51 45.9 17 52 16.2 17 54.0			Probably aftershock of previous earthquake.

MT. HAMILTON

No.	Date	Char- acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
55	Dec. 3	Iv	iP _N ^{EN} iS _N ^N	18 41 59.2	Aftershock of 17 h.
				18 42 34.2	
				18 47.0	
56	Dec. 3	Iv	eP _E iP _N eS _{EN} F	22 18 22.3	Aftershock of 17 h.
				22 18 22.3	
				22 18 57.3	
				22 21.0	
57	Dec. 3	Iv	e _N e _N eS _{EN} F	22 21 15.3	Aftershock of 17 h.
				22 21 20.7	
				22 21 48.3	
				22 24.0	
58	Dec. 4	Iv	eP _N e _{EN} F	18 50 15.9	Probably aftershock of Dec. 3, 17 h.
				18 50 47.1	
				18 52.0	
59	Dec. 7	I	e _P ^N iS _{EN} F	09 42 44.9	See discussion, p. 138
				09 42 53.0	
				09 45.0	
60	Dec. 7	Iu	e _E F	13 36 50.6	Solomon Islands Pasadena gives: near 6° S., 155° E.
				13 44.0	
61	Dec. 7	Id	i _P ^{EN} i _S ^{EN} F	18 17 32.7	See discussion, p. 138
				18 17 34.0	
				18 18.0	
62	Dec. 9	Ir	e _E F	04 01 34.0	Alaska.
				04 19.0	
63	Dec. 12	Id	i _P ^{EN} i _S ^{EN} F	06 07 48.9	See discussion, p. 138
				06 07 52.5	
				06 09.0	
64	Dec. 12	Id	e _P ^N e _E e _S ^N e _E e _E e _N F	17 04 15.3	See discussion, p. 138
				17 04 18.7	
				17 04 25.9	
				17 04 27.0	
				17 04 29.0	
				17 04 29.2	
				17 05.2	

MT. HAMILTON

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
65	Dec. 16	Iv	iP ⁻ EN	10 48 52.5	Felt at Benton
			iS ⁻ EN	10 49 25.5	
			F	10 52.0	
66	Dec. 18	I	eN	08 30 19.9	Very faint
			F	08 35.0	
67	Dec. 20	Id	iP ⁻ EN	17 19 38.0	See discussion, p. 139
			iS ⁻ N	17 19 40.5	
			F	17 21.0	
68	Dec. 23	Id	eN	00 11 40.2	See discussion, p. 139
			eS ⁻ nN	00 11 48.7	
			eE	00 11 50.2	
			eEN	00 11 51.5	
			F	00 12.5	
69	Dec. 23	Id	iS ⁻ EN	03 19 24.3	See discussion, p. 139
			F	03 19.7	
70	Dec. 26	I	iP ⁻ EN	02 14 23.4	See discussion, p. 139
			iS ⁻ EN	02 14 24.7	
			F	02 15.0	
71	Dec. 28	Id	eP ⁻ E	11 00 06.6	See discussion, p. 139
			iP ⁻ E	11 00 06.6	
			iS ⁻ N	11 00 09.1	
			F	11 01.0	

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	Oct. 9	I	eE	06 15 07.7					
			eN	06 15 10.4					
			eE	06 15 13.7					
			F	06 15.6					
2	Oct. 10	Iu	eE	21 02 51.5					U.S.C. & G.S. epicenter 1°N., 125°E. J.S.A. epicenter: 1.0 N., 125° E.
			eE	21 05 59.5					
			eN	21 07 00.5					
			eLE	21 21 08					
			F	21 30.1					
3	Oct. 13	Id	iPE	21 57 41.5					See discussion, p. 134
			iPN	21 57 41.6					
			iSN	21 57 42.8					
			iSN	21 57 43.8					
			F	21 58 04					
4	Oct. 14	Iv	iPN	15 31 32.8	0.2		-0.1		See discussion, p. 134
			iPE	15 31 33.0					
			iS _{NE}	15 31 46.3					
			iSEN	15 31 48.3					
			iN	15 31 51.3					
			F	15 33.3					
5	Oct. 16	Iv	iPN	17 59 56.7	0.4		-0.1		See discussion, p. 134
			iPE	17 59 56.8					
			iSE	18 00 11.3					
			iSN	18 00 12.6					
			F	18 01.3					
6	Oct. 17	Iv	iPN	18 13 57.2					See discussion, p. 134
			iE	18 13 58.2					
			iN	18 14 23.7					
			iE	18 14 24.2					
			F	18 15.3					
7	Oct. 18	Iv	eP _{NN}	05 05 59.4					See discussion, p. 134
			iP _{NE}	05 05 59.5					
			iS _{NE}	05 06 44.5					
			iS _{NN}	05 06 45.0					
			F	05 14.9					
8	Oct. 18	Iv	eP _{NEN}	15 50 06.4					See discussion, p. 134 F lost in next quake.
			iS*E	13 50 21.1					
			iS _{NN}	13 50 22.4					

PALO AITO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks	
						A _E	A _N	A _Z		
						mm.	mm.	mm.		
						h. m. s.	s.			
9	Oct. 18	Iv	iSE	13 51 18.7						See discussion, p. 134
			iN	13 51 21.4						
			iE	13 51 21.9						
			F	13 53.0						
10	Oct. 20	Iu	eE	02 38 41.2						U.S.C. & G.S. epicenter 10°S., 123°E. J.S.A. epicenter: 9°5 S., 122°8 E.
			eEN	02 44 44.2						
			F	03.0						
11	Oct. 20	Iv	eP _N	15 12 28.8						See discussion, p. 134
			eS _E	15 12 44.3						
			eS _N	15 12 44.8						
			F	15 14.0						
12	Oct. 21	I	eP _N	19 52 20.1						
			iP _E	19 52 21.4						
			iN	19 52 28.4						
			iN	19 52 35.4						
			iE	19 52 36.4						
			F	19 55.5						
13	Oct. 22	Iv	eP*E	01 28 42.9						See discussion, p. 135
			eN	01 28 57.0						
			eS*N	01 28 58.1						
			F	01 30.0						
14	Oct. 25	Iv	iP _N	11 18 54.5	0.2					See discussion, p. 135
			iP _E	11 18 54.8						
			iS _E	11 19 08.6	1.0					
			iS _N	11 19 10.3						
			F	11 20.0						
15	Oct. 31	Id	eP _N	09 07 57.2						See discussion, p. 135
			eS*N	09 07 49.7						
			F	09 08.6						
16	Nov. 4	Id	eP _N	15 35 32.5						See discussion, p. 135
			eP _E	15 35 32.9						
			iS _N	15 35 54.6						
			iE	15 35 35.7						
			F	15 36.0						



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	Nov. 5	IIu	ePE	08 54 55.9						Japan. U.S.C. & G.S. epicenter 38°N., 141°E. J.S.A. epicenter: 36°8 N., 139°6 E.
			ePN	08 54 59.4						
			eSE	09 04 12.4						
			eSN	09 04 15.4						
			eLE	09 12 45						
			eN	09 14 05						
			eMN	09 20 15.4						
F	11 00								?	
18	Nov. 5	IIu	ePE	11 01 45.7						Japan. U.S.C. & G.S. epicenter 38°N., 141°E. J.S.A. epicenter: 36°7 N., 141°0 E.
			eN	11 02 09.7						
			eSN	11 10 57.7						
			eSE	11 11 05.7						
			eEN	11 20 45.7						
			eLN	11 25 16						
			F	12 15.7						
19	Nov. 6	IIu	ePE	09 05 21.5						Japan. U.S.C. & G.S. epicenter 36°N., 144°E. J.S.A. epicenter: 37°4 N., 143°7 E.
			ePN	09 05 21.8						
			eSN	09 14 37.8						
			eSE	09 15 10.8						
			eGE	09 21 48						
			eLE	09 23 48						
			eLN	09 24 15						
			F	11 15.7						
20	Nov. 6	IIu	ePE	21 50 09						Japan. U.S.C. & G.S.: Probably an aftershock of 08 h.
			ePN	21 50 10						
			eLEN	22 11 09						
			F	00 30.7						
21	Nov. 9	Iu	eN	09 48 25						Japan. Aftershock of Nov. 6, at 08 h.
			eE	09 49 55						
			F	10 30.9						
22	Nov. 10	IIIr	ePE	20 24 56						Alaska. U.S.C. & G.S. epicenter 56°N., 159°W. J.S.A. epicenter: 55°6 N., 157°7 W.
			ePN	20 24 59						
			F	03 00						
23	Nov. 13	Iu	ePN	13 24 13.6						J.S.A. epicenter: 46°0 N., 149°4 E.
			ePE	13 24 14.6						
			eSEN	13 32 45.6						
			F	13 41.1						

PALO ALTO

No.	Date	Char-acter	Phase	Time U.T.	Period	Amplitude			Remarks
						AE	AN	AZ	
1938						mm.	mm.	mm.	
				h. m. s.	s.				
24	Nov. 13	Iu	eEN F	23 02 36.5 23 59					Japan.
25	Nov. 14	Iv	ePnN F	22 16.5 22 17.5					See discussion, p. 136 $\bar{S} - Pn = 17^s.6$; $i - Pn = 21^s.6$.
26	Nov. 15	Id	ePN F	01 57.2 01 58.1					See discussion, p. 136 $\bar{S} - \bar{P} = 12$ s.
27	Nov. 15	Ir	eEN	09 58.5 10 00					Probably Alaska.
28	Nov. 15	Iv	i \bar{P} E eN iEN F	13 49.2 13 49.3 13 49.9 13 52.1					See discussion, p. 136
29	Nov. 15	Iv	ePnN F	14 41.5 14.7					See discussion, p. 136 $\bar{S} - Pn = 15^s.5$; $i - Pn = 12^s.5$.
30	Nov. 16	Id	eEN F	07 38.5 07 39.1					See discussion, p. 136
31	Nov. 16	Id	i \bar{P} EN F	10 16.9 10 33.5					See discussion, p. 136 $\bar{S} - \bar{P} = 5^s.5$ $i - \bar{P} = 7^s.5$
32	Nov. 17	Id	i \bar{P} EN	00 38.2 00 38.6					See discussion, p. 136 $\bar{S} - \bar{P} = 2^s.0$
33	Nov. 17	IIr	iPN iE eN eE F	04 00 47 04 00 53 04 08 08 04 08 08 04 46					Alaska. U.S.C. & G.S. epicenter: 55°N., 158°W. J.S.A. epicenter: 55°3 N., 157°5 W.
34	Nov. 18	Iv	eN iE F	13 30 2.3 13 30 5.8 13 30 41					Nevada?



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.	
35	Nov. 22	Iu	eP _E	01 25 36					Japan. U.S.C. & G.S. epicenter: 37°N., 142°E. J.S.A. epicenter: 36.3 N., 141.6 E.
			eP _N	01 25 39					
			eN	01 34 58					
			eLN	01 48 48					
			eLE	01 49 18					
			F	03 16					
36	Nov. 22	Iv	iP _{EN}	15 31 20.5					See discussion, p. 137
			iE	15 31 49					
			iM _N	15 31 54.7					
			iM _E	15 31 56.5					
			F	15 34.3					
37	Nov. 27	Iv	eN	00 18 44.3					Arizona - New Mexico.
			eE	00 19 16.8					
			F	00 21.5					
38	Nov. 28	Id	eS _N	10 36 50.6					See discussion, p. 137
			eS _E	10 36 51.2					
			eEN	10 37 02.2					
			F	10 39					
39	Nov. 30	Id	iP _E	05 49 19.1					See discussion, p. 137
			iP _N	05 49 20.1					
			iS*N	05 49 26.6					
			iS*E	05 49 27.1					
			iN	05 49 28.5					
			F	05 51.5					
40	Dec. 1	Id	iP _{EN}	16 17.7					See discussion, p. 137
			F	16 20.0					
41	Dec. 3	Id	eP _E	12 45 57.2					See discussion, p. 138
			eP _N	12 45 57.5					
			eS _N	12 46 02.0					
			iS _E	12 46 02.1					
			F	12 47.0					
42	Dec. 3	Iv	eP _{mN}	17 43 36.8					See discussion, p. 138
			eP _{nE}	17 43 37.5					
			iP _E	17 43 44.8					
			iP _N	17 43 46.0					
			F	17 50.5					

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.	
43	Dec. 3	Iv	iP _N EN	18 42.1					Aftershock of 17 h.
			i _N	18 42.2					
			i _E	18 42.3					
			i _E	18 42.5					
			F	18 45.5					
44	Dec. 7	Id	eP*N	09 42 50.5					See discussion, p. 138
			eP*E	09 42 51.0					
			iS*N	09 43 01.9					
			iS*E	09 43 02.3					
			i _S N	09 43 05.3					
			i _S E	09 43 05.5					
			F	09 44.2					
45	Dec. 7	Iu	eL _E	14 04.6				Solomon Islands. Pasadena gives: near 6°S., 155°E.	
			F	14 22.7					
46	Dec. 7	Id	i _P E	23 02.55				See discussion, p. 138	
			i _E N	23 02.57					
			i _S N	23 02.58					
			F	23 02.7					
47	Dec. 9	Ir	e _{EN}	04 01 32.3				Alaska	
			e _N	04 08 57					
			e _N	04 09 12.3					
			F	04 22.0					
48	Dec. 12	Id	eP* _{EN}	06 07 56.2				See discussion, p. 138	
			e _E	06 08 03.9					
			e _N	06 08 04.2					
			e _{SE}	06 08 07.5					
			e _S n _N	06 08 09.2					
			F	06 08.3					
48	Dec. 12	Id	i _P E	17 04 12.5				See discussion, p. 138	
			eP _N	17 04 13.0					
			iS*N	17 04 18.5					
			i _S E	17 04 20.0					
			F	17 04.9					
50	Dec. 13	Id	i _P E	21 09 48.6				See discussion, p. 139	
			i _P N	21 09 48.7					
			i _S N	21 09 51.2					
			F	21 10.4					

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.					
51	Dec. 16	Iv	eP _{EN}	10 48.9						Felt at Benton.
			e _{EN}	10 49.1						
			e _{EN}	10 49.6						
			F	10 51.0						
52	Dec. 18	I	e _{EN}	08 30.3						
			e _E	08 30.8						
			e _N	08 31.1						
			F	08 32.6						
53	Dec. 20	Id	e _{P_N}	17 19 41.9						See discussion, p. 139
			e _{P_E}	17 19 42.1						
			e _{S_{EN}}	17 19 46.9						
			F	17 20.3						
54	Dec. 23	Id	e _{EN}	00 11.6						See discussion, p. 139
			i _{S_{EN}}	00 11.7						
			F	00 12.3						
55	Dec. 23	Id	e _E	03 19.12						See discussion, p. 139
			e _E	03 19.24						
			e _E	03 19.28						
			F	03 19.8						
56	Dec. 24	Id	i _{P_E}	21 24.25						See discussion, p. 139 $\bar{S} - \bar{P} = 2$ s ca.
			F	21 24.6						
57	Dec. 28	I	e _{P_{EN}}	11 00.16						See discussion, p. 139
			i _{S_E}	11 00.25						
			i _N	11 00.3						
			F	11 01.0						

SAN FRANCISCO

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

 CONSTANTS

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Latitude and longitude:

$$\begin{aligned}\phi &= 37^{\circ} 46' 4'' \text{ N.} \\ \lambda &= 122^{\circ} 27' 2'' \text{ W.}\end{aligned}$$

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

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

CONSTANTS OF THE SEISMOGRAPHS

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	Remarks
				U.T.	
				h. m. s.	
1	Oct. 14	Iv	eP* _E	15 31 38.9	See discussion, p. 134
			eP* _N	15 31 39.1	
			e _P _E	15 31 41.2	
			e _S _E	15 31 56.8	
			i _S _E	15 31 58.3	
			i _S _N	15 31 58.6	
			F	15 33.5	
2	Oct. 18	Iv	ePn _{EN}	05 05 54.6	See discussion, p. 134
			eSn _E	05 06 33.7	
			e _N	05 06 35.1	
			F	05 10.5	
3	Oct. 18	Id	e _N	13 50 17.2	See discussion, p. 134
			e _E	13 50 27.6	
			F	13 51.5	
4	Oct. 20	Iu	e _S _o _P _e _{SEN}	02 44 42	U.S.C. & G.S. epicenter: 10° S., 123° E.
F	02 48.5				
5	Oct. 21	Iv	i _P _N	05 45 47.8	See discussion, p. 134
			i _P _E	05 45 48.3	
			i _S _{EN}	05 46 01.2	
			F	05 47.0	
6	Nov. 5	Iu	e _P _E	08 55 57.3	Japan. U.S.C. & G.S. epicenter: 38° N., 141° E. J.S.A. epicenter: 36°8 N., 139°6 E.
			e _P _N	08 55 57.6	
			e _S _N	09 05 08.3	
			F	10 56	
7	Nov. 5	Iu	e _P _N	11 02 49.4	Japan. U.S.C. & G.S. epicenter: 38° N., 141° E. J.S.A. epicenter: 36°7 N., 141°0 E.
			e _S _N	11 12 02.4	
			e _S _E	11 12 05.4	
			F	3 42.5	
8	Nov. 6	Iu	e _P _{EN}	09 05 19.4	Japan. U.S.C. & G.S. epicenter: 36° N., 144° E. J.S.A. epicenter: 37°4 N., 143°7 E.
			e _P _{R2E}	09 09 46.4	
			e _S _E	09 14 37.4	
			e _S _N	09 14 38.4	
			F	10 27.5	

SAN FRANCISCO

No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
9	Nov. 6	Iu	ePN eSN F	21 50 14.8 21 59 30.0 22 43.0			Japan. U.S.C. & G.S. Probably an aftershock of 08 h.
10	Nov. 10	IIr	ePN iN ePR ₂ N eSN eLN F	20 24 58.5 20 25 05.0 20 25 59.0 20 30 00.0 20 33 17 23 59			Alaska. U.S.C. & G.S. epicenter: 56° N., 159° W. J.S.A. epicenter: 55°6 N., 157°7 W.
11	Nov. 11	Ir	ePN F	01 04 00.7 01 36.3			Alaska. Aftershock J.S.A. epicenter: 54°9 N., 156°0 W.
12	Nov. 13	Iu	ePN eSN F	13 24 08.8 13 33 39.6 13 41.0			J.S.A. epicenter: 46°0 N., 149°4 E.
13	Nov. 13	Iu	eN F	23 02 12.2 23 26.0			Japan.
14	Nov. 15	Iv	eE eSE F	13 49 16.0 13 49 37.4 13 52.0			See discussion, p. 136
15	Nov. 16	Id	ePN eSEN F	10 32 01.0 10 32 13.0 10 34.1			See discussion, p. 136
16	Nov. 17	Ir	ePN eE eN eSEN eLE F	04 00 42.2 04 00 47.9 04 00 49.1 04 05 33.2 04 08 17.2 04 36.0			Alaska. U.S.C. & G.S. epicenter: 55° N., 158°W. J.S.A. epicenter: 55°3 N., 157°5 W.
17	Nov. 22	Iu	eSN F	01 34 55.2 01 49.7			Japan. U.S.C. & G.S. epicenter: 37° N., 142° E. J.S.A. epicenter: 36°3 N., 141°6 E.

SAN FRANCISCO

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
18	Nov. 22	Iv	e _E	15 31 36.1	See discussion, p. 137
			eSn _E	15 31 57.0	
			e _N	15 32 00.3	
			e _E	15 32 16.8	
			F	15 34.2	
19	Nov. 30	IIId	i _E	05 49 11.1	See discussion, p. 137
			i _N	05 49 11.2	
			F	05 50.2	
20	Dec. 1	Iv	i _{EN}	16 17 45.6	See discussion, p. 137
			e _N	16 17 56.6	
			e _E	16 17 57.6	
			F	16 20.2	
21	Dec. 3	Iv	ePn _E	17 43 41.0	See discussion, p. 138
			e _N	17 43 41.9	
			eP* _E	17 43 47.4	
			eSn _E	17 44 19.7	
			F	17 50.0	
22	Dec. 3	Iv	e _E	18 42 17.8	Aftershock of 17 h.
			e _E	18 42 30.3	
			F	18 45.0	
23	Dec. 7	Iv	e _E	09 42 58.6	See discussion, p. 138
			eSn _{EN}	09 43 13.8	
			e _E	09 43 16.7	
			F	09 43.7	
24	Dec. 12	I	eS* _E	22 08 15.6	See discussion, p. 138
			e _E	22 08 19.1	
			F	22 09.0	
25	Dec. 12	I	e _E	17 04 09.2	See discussion, p. 138
			e _E	17 04 14.7	
			F	17 04.8	
26	Dec. 18	I	e _N	08 30 14.7	
			i _N	08 30 16.2	
			i _N	08 30 34.7	
			F	08 32.5	



SAN FRANCISCO

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
27	Dec. 23	Id	e \bar{N}	00 11 27.4	See discussion, p. 139
			e \bar{E}	00 11 27.7	
			i \bar{S}_N	00 11 30.6	
			F	00 12.3	
28	Dec. 23	Id	e \bar{S}_E	03 19 02.5	See discussion, p. 139
			e \bar{S}_N	03 19 02.7	
			F	03 19 50	
29	Dec. 23	Id	i \bar{N}	03 19 52.7	See discussion, p. 139 Aftershock of quake 50 ^s earlier.
			i \bar{N}	03 19 54.0	
			F	03 20.1	

FERNDALE

THE FERNDAL STATION
FERNDAL, CALIFORNIA

 CONSTANTS

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Latitude and longitude:

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

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

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

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

CONSTANTS OF THE SEISMOGRAPHS

Apparatus	Component	T_0	ϵ
Bosch-Omori 25 kg.	E	12	5
	N	11	6

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

FERNDALE

No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
1	Oct. 18	Iv	iPnN iPnE iSnE iSnN F	05 05 05 05 05	05 05 05 05 11	14 15 25 26	See discussion, p. 134
2	Oct. 21	I	eE eN F	19 19 20	52 52 00	00 02	
3	Oct. 25	I	ePE iSEN F	14 14 14	48 49 50.5	57 00	See discussion, p. 135
4	Nov. 5	IIu	ePE ePN eSEN eLEN F	08 08 09 09 10	54 55 03 12.0 00	45 00 40 0	Japan. U.S.C. & G.S. epicenter: 38° N., 141° E. J.S.A. epicenter: 36°8 N., 139°6 E.
5	Nov. 5	IIu	ePEN eSEN eME F	11 11 11 12	01 10 26.0 00	50 40 0	Japan U.S.C. & G.S. epicenter 38° N., 141° E. J.S.A. epicenter: 37°7 N., 141° E.
6	Nov. 6	IIu	ePEN iSE eSN eLE eLN MN F	09 09 09 09 09 09 12	05 14 14 22.0 23.0 29.0 00	03 04 06 0 0 0	Japan U.S.C. & G.S. epicenter 36° N., 144° E. J.S.A. epicenter: 37°4 N., 143°7 E.
7	Nov. 6	Iu	iPE eSEN eLEN F	21 21 22 23	50 59 09 58	00 00	Japan U.S.C. & G.S.: Probably aftershock of 08 h.
8	Nov. 10	Id	ePE eSE F	05 05 05	21 21 22	36 41 12	Very slight. North record being changed See discussion, p. 136

FERNDALE

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
				h. m. s.	
9	Nov. 10	IIIr	eP _E	20 24 40	Alaska. U.S.C. & G.S. epicenter: 56° N., 159° W. J.S.A. epicenter: 55° N., 157° 7 W.
			eP _N	20 24 48	
			eS _E	20 30.0	
10	Nov. 11	Ir	eE	09 05.0	Alaska aftershock
			eE	09 15.5	
			F	09 20.0	
11	Nov. 14	Id	iP _{EN}	18 57 49.5	See discussion, p. 136 S very small, perhaps not an earthquake.
			iS _E	18 57 54.5	
			F	18 58.5	
12	Nov. 15	Iv	eP _{nEN}	13 49 08	See discussion, p. 136
			eP _E	13 49 14.6	
			iEN	13 49 20	
			iN	13 49 29	
			F	13 51	
13	Nov. 16	Ir	eP _E	04 00 05	Alaska.
			eP _N	04 00 07	
			eS _N	04 03 04	
			eE	04 06 04	
			M _E	04 07.0	
			F	04 30.0	
14	Nov. 21	Id	eP _N	03 15 04.6	See discussion, p. 137
			eE	03 15 05.2	
			eS _N	03 15 06.2	
			iE	03 15 07.8	
			iE	03 15 10	
			F	03 15.5	
15	Nov. 22	Iu	eL _{EN}	01 48.0	Japan.
			F	02 44	
16	Dec. 7	Iu	eEN	13 04.0	Japan. Surface waves.
			eE	13 10.0	
			eEN	13 14.0	
			F	13 36.0	

FERNDALE

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
	1938			h. m. s.	
17	Dec. 9	Ir	eN	04 05 12	Alaska.
			eE	04 07.0	
			F	04 30	
18	Dec. 17	I	eN	00 10.0	Surface waves.
			eE	00 13.0	
			F	01 00	

FRESNO

THE FRESNO STATION, FRESNO STATE COLLEGE
FRESNO, CALIFORNIA

 CONSTANTS

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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	Remarks
				U.T.	
	1938			h. m. s.	
1	Oct. 2	Iv	e _N F	18 45 56.0 18 52.0	Felt near Santa Barbara
2	Oct. 14	I	i _N e _N F	13 10 50.5 13 17 22.6 13 20.3	
3	Oct. 14	Iv	e _P i _P i _S F	15 31 37.5 15 31 39.5 15 31 52.8 15 36.3	See discussion, p. 134
4	Oct. 16	Iv	i _S F	18 00 15.4 18 01.5	See discussion, p. 134
5	Oct. 17	Id	i _P i _S F	11 30 37.8 11 30 46.3 11 32.5	See discussion, p. 134
6	Oct. 17	Id	i _P i _N i _S F	18 13 38.5 18 13 39.3 18 13 51.0 18 16.5	See discussion, p. 134
7	Oct. 18	I	e _N e _N F	02 59 35.5 02 59 46.0 03 01 35	
8	Oct. 18	Iv	e _P e _N F	05 06 28.5 05 07 42.5 05 13.5	See discussion, p. 134
9	Oct. 18	Iv	e _S	13 50 25.3	See discussion, p. 134 F lost in next quake.
10	Oct. 18	Iv	e _S F	13 50 53.0 13 54.5	See discussion, p. 134
11	Oct. 20	Iu	e _N e _S e _S e _N F	02 38 10.4 02 39 59.5 02 44 54.5 02 48 34.7 02 55.6	U.S.C. & G.S. epicenter: 10° S., 123° E. J.S.A. epicenter: 9°5 S., 122°8 E.

FRESNO

No.	Date	Char-acter	Phase	Time	Remarks
				U.T.	
				h. m. s.	
	1938				
12	Oct. 22	Iv	iSn _N F	01 29 02.7 01 30.0	See discussion, p. 135
13	Oct. 24	Iv	iP _N iSn _N F	13 40 18.5 13 40 33.5 13 46 13.5	See discussion, p. 135
14	Oct. 25	Iv	eSn _N F	11 19 13.0 11 20.3	See discussion, p. 135
15	Oct. 31	Iv	eP _N iS _N F	09 07 36.4 09 07 51.0 09 09.5	See discussion, p. 135
16	Nov. 1	Iv	e _N e _N F	13 53 20 13 54.0 13 56.0	Pasadena suggests Eureka County, Nevada.
17	Nov. 5	Iu	eP _N e _N eS _N F	08 55 05 08 55 10 09 04 38 09 27.6	Japan. U.S.C. & G.S. epicenter: 38° N., 141° E. J.S.A. epicenter: 36°8 N., 139°6 E.
18	Nov. 5	Iu	e _N e _N e _N F	11 01 59.5 11 11 31 11 12 08 8 37.7	Japan. U.S.C. & G.S. epicenter: 38° N., 141° E. J.S.A. epicenter: 36°7 N., 141°0 E.
19	Nov. 6	Iu	eP _N eS _N e _N F	09 05 32.5 09 15 06 09 25 20 09 57.7	Japan. U.S.C. & G.S. epicenter: 36° N., 144° E. J.S.A. epicenter: 37°4 N., 143°7 E.
20	Nov. 10	Iir	eP _N e _N ePRZN eM _N F	20 25 08.8 20 25 14.7 20 26 26.5 20 35 26.5 23 38.0	Alaska. U.S.C. & G.S. epicenter: 56° N., 159° W. J.S.A. epicenter: 55°6 N., 157°7 W.
21	Nov. 11	Ir	eP _N F	01 04 18.0 01 23.3	Alaska. Aftershock. J.S.A. epicenter: 54°9 N., 156°0 W.

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No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
	1938						
22	Nov. 15	Iu	eP _N eN F	13	24	25.0 09.5 39.5	J.S.A. epicenter: 46°0 N., 149°4 E.
23	Nov. 14	Iv	eN iS _N F	22	16	42.0 47.0 20.6	See discussion, p. 136 P lost in traffic disturbance.
24	Nov. 15	Ir	eN F	09	58	49.1 04.6	Probably Alaska.
25	Nov. 15	Iv	ePnN eN eSnN eN F	13	49	34 39 05 06 51.8	See discussion, p. 136
26	Nov. 15	Iv	eN eSnN F	14	41	43.5 47.5 42.2	See discussion, p. 136
27	Nov. 15	Iu	eN F	21	37	13 38.8	Strasbourg epicenter: 5° S., 97° E. Pasadena epicenter: 3° S., 99° E.
28	Nov. 16	Iv	ePnN eSnN F	10	32	12.5 33.2 33.7	See discussion, p. 136
29	Nov. 17	Iu	eP _N ePR _{ZN} eN eL _N F	04	01	00.3 06 42 25 38.7	Alaska. U.S.C. & G.S. epicenter: 55° N., 158° W. J.S.A. epicenter: 55°3 N., 157°5 W.
30	Nov. 18	Iv	eN eN F	08	33	49.5 24 35.9	Probably Nevada.
31	Nov. 18	Iv	eN eN eN F	13	29	28 01.0 12.5 33.9	Nevada ?

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No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
				h.	m.	s.	
32	Nov. 22	Iu	eP _N	01	25	50.7	Japan. U.S.C. & G.S. epicenter: 37° N., 142° E. J.S.A. epicenter: 36.3° N., 141.6° E.
			eS _N	01	35	28.5	
			F	01	54.4		
33	Nov. 22	Iv	eP _N	15	31	04.6	See discussion, p. 137
			iS [*] _N	15	31	15.9	
			iS _N	15	31	18	
			F	15	37.5		
34	Dec. 1	Iv	eP _{nN}	16	18	05.5	See discussion, p. 137
			eS _{nN}	16	18	31	
			e _N	16	20	09.8	
			F	16	25.2		
35	Dec. 3	IIv	iP _N	17	43	12.1	or Pn. See discussion, p. 138 F lost in aftershock.
36	Dec. 3	Iv	iP _N	17	58	16.6	Aftershock F last in next shock.
			iS _N	17	58	31.8	
37	Dec. 3	Iv	e _N	18	04	50.4	Probably aftershock of 17 h. F lost in next shock.
38	Dec. 3	Iv	iP _N	18	06	27.2	Aftershock F lost in next shock.
			iS _N	18	06	42.0	
39	Dec. 3	Iv	eS _N	18	09	13.2	Aftershock F lost in next shock.
40	Dec. 3	Iv	eP _N	18	10	26.8	Aftershock F lost in next shock.
			eS _N	18	10	41.6	
41	Dec. 3	Iv	iP _N	18	13	34.3	Aftershock
			iS _N	18	13	49.7	
42	Dec. 3	Iv	iP _N	18	20	01.2	} Double aftershock.
43	Dec. 3	Iv	e _N	18	20	30.5	
			e _N F	18	20	34.5	
			F	18	25		S ?



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No.	Date	Char-acter	Phase	Time			Remarks
				U.T.			
	1938			h.	m.	s.	
44	Dec. 3	IIIv	iP _N F	18	41	40.5 18 48.3	S̄ - P̄ = 15.5 ca. Aftershock
45	Dec. 3	Iv	iS _N	19	09	17.7	Aftershock
46	Dec. 3	Iv	iP _N eS _N F	19	26	41.1 19 26 56.3 19 36.4	Aftershock
47	Dec. 3	Iv	iP _N iS _N	20	26	40.5 20 27 00.5	Aftershock
48	Dec. 3	Iv	e _N F	21	02	09.2 21 02.4	
49	Dec. 3	Iv	iP _N iS _N	22	18	03.8 22 18 19.4	Aftershock
50	Dec. 3	Iv	iP _N iS _N F	22	20	56.7 22 21 11.3 22 25.5	Aftershock
51	Dec. 4	I	iS _N F	12	40	24.2 12 41.5	
52	Dec. 4	Iv	iS _N iS _N	13	00	23.2 13 01 04.2	} Double aftershock
53	Dec. 4	Iv	iP _N iS _N F	18	49	53.5 18 50 08.5 18 51.5	Aftershock
54	Dec. 7	Iv	e _N eS _N F	09	43	01.7 09 43 18.2 09 44.2	See discussion, p. 138
55	Dec. 10	I	e _N F	04	01	44 04 09.1	
56	Dec. 12	Iv	e _N e _N F	03	18	52.2 03 21 13.2 03 29.3	Lower California ?

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No.	Date	Char- acter	Phase	Time			Remarks
				U.T.			
	1938			h.	m.	s.	
57	Dec. 16	Iv	iP _N	10	48	34.9	Felt at Benton
			iS _N	10	48	48.4	
			F	10	52.7		
58	Dec. 18	I	e _N	08	31	16.5	
			e _N	08	31	33.8	
			F	08	33.9		
59	Dec. 24	I	e _N	18	21	24.2	
			e _N	18	21	43.0	
			F	18	25.5		
60	Dec. 27	Iv	eP _N	10	11	25.6	Felt in San Bernardino
			iS _N	10	12	02.7	
			F	10	14.7		