SEISMOLOGICAL LABORATORY

CARNEGIE INSTITUTION OF WASHINGTON
CALIFORNIA INSTITUTE OF TECHNOLOGY

220 NORTH SAN RAFAEL AVENUE.
PASADENA, CALIFORNIA

BULLETIN

The SEISMOLOGICAL LABORATORY, Pasadena, California, is maintained and operated by the Carnegie Institution of Washington and the California Institute of Technology as a coöperative undertaking. This laboratory is the **central station** of a coördinated group. Auxiliary stations in southern California are maintained and operated as follows: At the Mount Wilson Observatory on Mount Wilson (a Department of the Carnegie Institution of Washington); at Riverside (in coöperation with the City of Riverside); at Santa Barbara (in coöperation with the Santa Barbara Museum of Natural History); at La Jolla (in coöperation with the Scripps Institution of Oceanography of the University of California); at Tinemaha, and at Haiwee, in the Owens Valley (in coöperation with the Department of Water and Power of the City of Los Angeles).

TIME: At all these stations the minute-marks on the seismograms are coördinated directly by means of auxiliary records written at each station on which the minute-marks are registered closely parallel with recorded dot-and-dash radiotelegraphic signals sent in ordinary course from a powerful transmitting station. This permits direct correlation of the minute-marks at all the stations of the group at practically all times with an accuracy of one second, and usually of one-fifth second.

The constants of these stations follow.

PASADENA SEISMOLOGICAL LABORATORY **Central Station**

$\Phi = 34° 08.9'$ N., $\lambda = 118° 10.3'$ W., h = 295 m., Deeply weathered granitic rock, with inclusions of gneiss and schist.

Apparatus: horizontal-component torsion seismometers with magnetic damping and optical recording. (Cf.Bull.Seis.Soc.Am.,XV,1,1925).

a vertical-component short-period seismometer with oil damping and galvanometric-optical recording.

The constants of the short-period instruments do not undergo any significant changes. The constants of the instruments of longer period will be given from time to time when deviations from the values given below are significant.

Experimental seismographs of various kinds are in process of development from time to time, and are used for intervals of variable duration. Information concerning these will be given when necessary.

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z	0.3 sec.	5,000	Critical
N — S	6 sec.	800	0.8-0.9
E — W	"	"	"

AUXILIARY STATIONS

Each of the auxiliary stations has equipment as follows:

Apparatus: two horizontal-component torsion seismometers with magnetic damping and optical recording;

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z			

The Station Constants follow.

Coördinates are geodetic positions referred to the North American Datum.

Mount Wilson Seismologic Station
$\Phi = 34° 13.5'$ N., $\lambda = 118° 03.4'$ W., h = 1742 m., Weathered granite.

Riverside Seismologic Station
$\Phi = 33° 59.6'$ N., $\lambda = 117° 22.4'$ W., h = 250 m. approx., Weathered granite.

Santa Barbara Seismologic Station
$\Phi = 34° 26.6'$ N., $\lambda = 119° 42.8'$ W., h = 100 m. approx., Heavy, boulder-laden alluvium.

La Jolla (Scripps Institution Seismologic Station)
$\Phi = 32° 51.8'$ N., $\lambda = 117° 15.2'$ W., h = 7.7 m. approx., Consolidated detrital material.

Tinemaha Seismologic Station
$\Phi = 37° 05.7'$ N., $\lambda = 118° 15.5'$ W., h = 1180 m. approx., Basalt.

Haiwee Seismologic Station
$\Phi = 36° 08.2'$ N., $\lambda = 117° 58.6'$ W., h = 1100 m. approx., Loosely cemented tuff.

SYMBOLS AND NOTATION: in general the symbols and notation conform with the usual international practice.

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PASADENA SEISMOLOGICAL LABORATORY

For routine instruments of period 0.8 seconds . . . . . P
For routine instruments of period 6 seconds . . . . . P_6
For instruments of different period analogous notation will be employed.

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CARNEGIE INSTITUTION OF WASHINGTON
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In April, 1927, instrumental assemblies of more permanent design were installed in the present Seismological Laboratory at Pasadena and within a few months thereafter the experimental recording at the temporary stations was discontinued. The Seismological Laboratory is maintained and operated by the Carnegie Institution of Washington and the California Institute of Technology as a coöperative undertaking.

In October, 1926, the first of the routine auxiliary stations was established at Riverside, California. Others were put in operation at Santa Barbara in May, 1927; at La Jolla in May, 1927; on Mount Wilson in April, 1928; at Tinemaha, and at Haiwee, in September, 1929. All these stations are in southern and southeastern California. At all of them the Seismological Laboratory acts in coöperation with the local agencies named in the following Bulletin.

The immediate purpose of this program of research is the study of local earthquakes—shocks originating in or near the southern California province, within a distance of about three hundred kilometers from Pasadena. More distant earthquakes are recorded, of course, but study of these is only incidental, and long-period seismometers are installed only at the Seismological Laboratory in Pasadena.

Because of uncompleted developments, and the extended task of installing and completing the adjustment of the instrumental equipment at the several stations, it has not seemed advisable hitherto to undertake the circulation of regular reports on the measurement of the seismograms, especially since the majority of the shocks registered, local in origin and small in energy, are not recorded elsewhere. However, a considerable number of teleseismic disturbances have been recorded as well, not only at Pasadena, but also at the auxiliary stations. Consequently it appears desirable, and it is now practicable, to issue partial reports, following the end of each month. These reports will begin with that for January, 1931.

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Date	Station	Phase	G. C. T. h m s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jan 2	P6	iPNE	09 53 16	5	7	4		Rarefaction. First motion of ground to southeast at all stations
		iNE	19	4	28	20		Compression.
		eE	56 43	8		2		
		eLE	57 40	24		9		U.S.C.G.S. 18°N.108°W,
		ME	59 28	11		38		0 = 9:48:38
		iE	10 04 21	10		17		J.S.A. 15°N. 108°5 W.
		FNE	11 30					
	P	iPNE	09 53 16	5	2			
		iPZ	15	4			0.6	
		iNE	20	4	5	4		
		iZ	19	4			2.5	
		eE	56 43	5		1		
		eLN	57 44	26	2			
		eLE	48	20		1		
		eZ	58 47	19			1	
		MN	59 36	15	5			
		ME	27	14		4		
		MZ	38	16			2	
	MW	iPN	53 15					
		iPE	16					
	R	iPNE	09					
	SB	iPN	29					
	H	ePE	32	4		0.5		
		iE	36	4		1		
		iE	39	2		1.5		
		iE	52	2		1.5		
		eE	57 34	2		1		
Jan 2	P6	eN	11 16 00					
		eE	11					
		MNE	53	2	1	1		
	P	eN	03					
		eE	12					
		MNE	53	2	1	1		
	MW	eNE	08					
	R	eNE	12					
	H	ePE	33					
Jan 2	P	eNEZ	11 41 37					
	MW	eNE	37					
	R	eNE	37					
	H	eE	16					
Jan 2	P6	iPNE	18 48 55					Compression from south-east
	P	ePNEZ	55					
	MW	ePNE	55					
	R	ePNE	51?					
	H	ePE	49 14					
Jan 6	P6	eN	20 15 00					Local ?
		eE	07					
	P	eE	14 51					
		eZ	15 02					
	MW	eNE	14 41					
		eN	15 04					
		eE	17					
	R	eNE	14 33					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jan 3	T	ePE	05	50	07					Probably in Northern
		eSE		51	39					California
	H	eE		52	01					
Jan 6	P6	ePNE	23	29	37					Felt at Hollister and
		iSE		30	24					Santa Cruz,California
	P	ePEZ		29	34					
		iSEZ		30	23			1		
	R	ePNE		29	45					
	SB	iPN			26					
		iSN		30	08		2			
	T	ePNE		29	21					
		iSE			55					
		M					6	5		
	H	ePNE		29	23					
		eSE			58					
Jan 8	P6	iPE	13	53	23.5					35° 0' N. 117° 0' W.
		iSE			40.5					Near Barstow,California.
	P	iPE			22.5					Felt at Big Bear City,
		ePZ			22.8					California.
		eSE			39.2					
		eSZ			40.0					
		ME						4		
	R	iPN			19.4					
		iPE			18.9					
		eSN			32.6					
		iSNE			33.2					
	SB	eP			38					
		iS		54	12					
	T	ePE		53	40					
		ePN			41					
		eSE		54	14					
		eSN			16					
	H	ePNE		53	25.3					
		iSE			43.7					
Jan 10	P6	ePNE	07	54	12					
	P	ePEZ			11					
	SB	ePN			09					
	LJ	ePN			12					
	H	ePN			22					
		ePE			21					
Jan 12	P6	eNE	20	43	53					
	P	eEZ			46					
		eEZ			53					
	R	ePNE			55					
		eE		44	12					
	SB	eN		43	46					
	LJ	eN		44	01					
		eE			02					
	T	eE		43	33					
		eN			38					
		eE			40					
		PE		47						
	H	eE		43	37					
		eE			41					
		eN			42					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jan 15	P6	iPNE	01	56	21					Rarefaction. First motion to southeast at all stations. Destructive in Oaxaca, Mexico. U.S.C.G.S. 16°N, 96°W., O = 1:50:32 J.S.A. 15°N. 97°W., O = 1:50:20
		iN	02	00	48					
		iN		01	04					
		eLN		03	40	40	4			
		iN		04	13	24	21			
		ME		07	55	15		77		
		FE	04	30						
	P	iPEZ	01	56	21					
		eE	02	01	04					
		eLE		03	50	40		7		
	R	iPNE	01	56	16					
		eN	02	00	58					
		iE			56					
	SB	ePN	01	56	36					
	LJ	iPNE			09					
	T	iPN			39					
		iPE			40					
	H	iPNE			32					
		eN	02	01	09					
		eE			20					
Jan 15	P6	eN	13	57	03					
	P	eE			03					
	LJ	eN		56	41					
	T	eN		57	17					
		eE			18					
		eNE	14	06	16					
	H	eN	13	57	15					
		eE			13					
		eE	14	06	00					
Jan 15	P6	eN	23	25	32					
		eE			33					
	P	eEZ			34					
	R	eNE			36					
	SB	eN			36					
	LJ	eN			34					
		eE			32					
	H	eN			44					
		eE			43					
Jan 16	P6	ePE	19	25	33					Strong in Oaxaca; felt at Mexico City U.S.C.G.S., 16°N. 96°W O = 19:19:28 J.S.A., 14?5 N. 96° W., O = 19:19:26
	P	ePE			33					
		eZ			29					
	R	ePNE			28					
		eN		30	09					
		eE			08					
	LJ	ePNE		25	20					
		eN		29	54					
		eE			52					
	H	ePN		25	42					
		ePE			41					
		eE		30	28					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jan 17	P6	ePN	02	52	44					U.S.C.G.S.,26°N.111°W.,
		ePE			38					0 - 02:50:10
		iPE			43					J.S.A., 25°N. 110°W,
		iLNE		54	45	43	1	6		0 - 02:49:58
	P	ePN		52	42					
		ePE			40					
		ePZ			44					
		eLNE		54	44	50	1	1	-	
	R	ePNE		52	33					
		eLNE		54	19	30	1	1		
	SB	ePN		52	58					
		eLN		55	27	24	1			
	LJ	iPNE		52	21					
		eLE		54	11	28		1		
	T	ePNE		53	15					
	H	ePNE			02					
		eNE		55	24					
Jan 17	P6	ePE	05	41	30					About 15°N. 97°W. Felt
	P	ePNE			31					in Oaxaca and at Mexico
		ePZ			30					City
	R	ePNE			24					
		eE		46	00					
	LJ	ePE		41	16					
		ePN			19					
		eE		45	55					
	T	ePNE		41	49					
	H	ePN			42					
		ePE			41					
		eE		46	29					
		eE		50	28					
Jan 17	P6	ePE	08	08	26					Vicinity of 37°30' N.
		eE		09	14					119°00' W.
	P	ePEZ		08	24					
	R	iPN			28.7					
		eE			28					
	SB	eP			25					
		i		09	11					
	LJ	ePE		08	47					
		ePN			48					
		eN		09	53					
	T	iPNE		07	31.6					
		iSNE			40.1					
		M					29	36		
	H	ePNE			47.9					
		eSNE		08	10					
Jan 18	T	eN	05	24	08					
	H	eN			19					
		eE			12					
Jan 23	P6	ePN	05	57	43					Strong in Oaxaca,Mexico.
		iPE			46					About 15°N. 97°W.
		eE	06	02	14					
		ME		07	34			1		
		FE		17						(Continued on page 5)

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jan 23	P	ePN	05	57	46					(Continuation)
		ePE			45					
		eZ			53					
	R	ePN			39					
		ePE			38					
		eE	06	02	12					
		eN			24					
	SB	eN	05	58	01					
	T	ePN		58	03					
		eN	06	06	54					
		MN		07	37	4	1			
	H	ePN	05	57	55					
		ePE			54					
Jan 24	P6	eE	15	35	48					Mexico ?
		ME		36	27	12		1		
		EE		45						
	T	ePN		29	02					
		ePE			05					
	H	ePN		28	52					
		ePE		29	02					
Jan 24	P6	ePN	17	00	07					Δ = 5790 km.(83.°9)
		ePE			06					0 = 16:47:37
		eSE		10	37					Probably about 11°N.
		iSE			40					153°E. (Caroline Islands)
	P	ePN		00	07					
		ePZ			06					
		iSNE		10	39					
	R	ePNE		00	10					
	T	ePN			02					
		ePE			03					
		eSN		10	34					
	H	ePN		00	05					
		ePE			06					
		eSN		10	35					
		eSE			34					
Jan 25	P6	ePN	12	39	28					Mexico ?
		ePE			31					
		eN		43	47					
		eE			56					
		ME		48		14		2		
	P	ePNZ		39	29					
		ePE			30					
		eN		43	46					
		eE			54					
	R	ePN		39	24					
		ePE			25					
		eN		43	39					
	H	ePNE		39	46					
Jan 27	P6	ePE	14	35	43					Δ = 3830 km.(34.°5).
	P	ePE			42					Strong at Seward and
		ePZ			41					Anchorage, Alaska.
	R	ePN			48					About 61°N., 150°W.
	SB	eN			39					
	LJ	eN			51					
		eE			53					
	T	ePNE			19					
		eSN		40	23					Δ = 3500 km.(31.°5)
	H	ePNE		35	28					0 = 14:28:38

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jan 27	P6	eN	20	28	46					△ = 12200 km.? (110°)?
		eE			56					
		eE		37	48					
		eN		38	09					
		iLE	21	05	06	35		3		
		FE	22	30						
	P	eN	20	28	44					
		eE			40					
	R	eN			51					
		eE		29	10					
	SB	eN			09					
	LJ	eN			00					
		eE		28	46					
	T	eE		27	27					
		eN			42					
		eE		28	30					
		eLE	21	01	39	45		1		
	H	eE	20	28	20					
		eN			30					
		eN		35	26					
		eLE	21	01	41	47				
Jan 28	P6	ePN	21	37	10					△ = 10090 km.(90.°8)
		ePE			09					0 = 21:24:03
		eE		47	41					U.S.C.G.S. 15°N.,144°E.
		iE		48	10					0 = 21:24:25
		iSNE			12	10		3		
		FE	23	04						
	P	ePN	21	37	10					
		ePEZ			09					
		eSNE		48	11					
	R	ePNE		37	13					
		eSN		48	19					
		eSE			16					
	SB	ePN		37	03					
		eSN		47	46					
	LJ	eN		37	13					
		eE			10					
		eSE		48	18					
	H	ePN		37	20					
		ePE			18					
		eN		47	59					
		eE			43					
Jan 29	P6	eN	16	55	12					
		eE			08					
	P	eE			09					
	H	ePN		45	45					
		ePE			40					
		eNE		54	37					
Jan 29	P6	ePNE	17	16	05					Strong in Oaxaca,Mexico.
	P	ePNZ			05					About 15°N.97°W.
		ePE			04					
		eN		20	56					
	R	ePN		16	00					
		ePE		15	59					
	SB	ePN		16	18					
	LJ	ePN		15	49					
		eE			54					
	H	ePN		16	18					
		ePE			16					

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Assistant.

PASADENA

PRELIMINARY REPORT

Date	Phase	G C T h m s	Remarks
1931			
Feb 2	cP	23 00 12	$\Delta = 95°$
	PR1	04 01	Destructive on North Island,
	ScPcS	10 40	New Zealand.
	iS	11 34	
	L	25 38	
	M	45 45	
Feb 3	W2	01 01 25	
	F	42	

VERTICAL-COMPONENT INSTRUMENTS.

At Pasadena the vertical component is now registered optically by two galvanometers, both actuated by the same inertia-mass which has a period of 0.5 second and is critically damped.

I. For local earthquakes; designated by P in the station column with Z attached to the phase symbol.
Galvanometer heavily overdamped by low resistance, producing response similar to that of the short-period torsion seismometers.

Effective constants:

	T_o	V	h
Jan. 1 to Feb. 5	0.3 sec.	5000	Critical
Feb.21 - - -	0.5 sec.	5000	Critical

II. For teleseisms; designated by PX in the station column with Z attached to the phase symbol.
Galvanometer critically damped,with resulting magnification high for short earth periods but moderate and nearly uniform for longer earth periods.
Period of galvanometer: Feb.6 to 21, 9.9 sec.;
Feb.21 --,13.5 sec.

V = 5000.

ADDITIONS AND CORRECTIONS TO PREVIOUS REPORT.

Page	
No.1	For Jan. 6, 20:15 read Jan. 2, 20:15.
No.2	Local shock of Jan.8,13:53. R.F.III at Barstow. Both reports from U.S.C.G.S.
No.4	Local shock of Jan.17, 08:08. Epicenter by Prof.Gutenberg, using Berkeley,Lick,P,R,SB,LJ,T,H: 37°35'N.,118°04'W. Inyo Mts. near California-Nevada boundary.
No.6	Jan.27, 20:28. J.S.A. 31°N.,108°E.
No.6	Jan.28, 21:37. J.S.A. 16°N.,143°E. 8°.7 N., 144°.7 E. by Riverview and Pasadena.

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Feb 2	P6	eNE	23	00	12	3		0.3		Δ = 10510 km. (94°.6),
		eE			41	5		1.5		O = 22:46:45;
		ePP1E		04	05					Destructive on North
		ScPcS		10	40					Island, New Zealand.
		iSE		11	34	8		3		U.S.C.G.S. 39°S 177°E
		eE		13	41					O = 22:46:57
		eLE		25	38	45		1		J.S.A. 39°S 177°E
		ME		45	45	17		7		O = 22:46:28
Feb 3		WZE	01	01	25	17		2		
		FE		42						
Feb 2	P	ePNE	23	00	12					
		ePR1N		04	00					
		ePR1E			01					
		ScPcS		10	40					
		eSN		11	29					
		eSE			38					
	R	ePNE	23	00	14					
		iSN		11	40					
		iSE			35					
	SB	eN		00	22					
		ePE			10					
		iSN		11	28					
		iSE			34					
	T	ePE		00	19					
		eE		11	17					
		eE			51					
	H	ePN		00	22					
		ePE			19					
		ePR1N		04	19					
		ePR1E			12					
		eN		10	59					
		eSN		11	50					
Feb 3	P6	eE	00	58	11					
	P	eN			13					
		eE			10					
	R	ePNE			15					
	T	ePE			34					
	H	ePNE			35					
Feb 4	R	eSNE	12	59	41					Local? La Jolla out of
	T	eSE	13	01	31					order; Pasadena emerg-
	H	eSNE		00	55					ences ill-defined.
Feb 7	R	eE	01	03	29					
	T	eE		01	34					
		eE		05	46					
	H	eNE		01	21					
Feb 7	PX	iPZ	03	37	31					See page No.7 for con-
	P6	ePE			31					stants of PX
	P	eN			34					
		ePE			31					
	R	eE			24					
	H	eN			57					
		eE			48					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Feb 8	PX	ePZ	01	57	15					Δ = 10530 km (94°.8)
		eZ	02	01	07					0 = 01:43:47
		eSZ		08	35					Reported strong at
	P6	iSE	02	08	33					Napier, New Zealand.
	P	ePE	01	57	15					
		iSN	02	08	36					
		eSE			33					
	R	ePE	01	57	14					
		eN	02	07	47					
		eE			46					
		iSN		08	39					
		iSE			37					
		iN			58					
		iE			57					
	SB	eE	01	57	28					
		eSNE	02	08	28					
	T	ePE	01	57	29					
		eSE	02	08	50					
	H	eN	01	57	39					
		eE			35					
		eN	02	01	19					
		eE			21					
Feb 9	PX	ePZ	02	21	25					
	P6	eE			33					
	P	eN			32					
		ePE			29					
	R	eN			37					
	H	eNE			42					
Feb 10	PX	ePZ	06	53	30	1			0.2	Δ = 14770 km (133°)
		iP'Z			48	2			1	0 = 06:34:21
		iZ			53					
		eZ		55	11					
		eZ			46					
		iPR1Z		56	11	9			2	
		eZ			58					
		iZ		57	11					
		iPcPcSZ			17	8			4	
		iPR2Z		59	04					
		iZ	07	05	49	7			2	
		eZ		14	25	11			2	
		MZ		49	40	20			3	
		eZ		52	45	25			1	
		FZ	08	50						
	P6	eP'N	06	53	52					
		iPcPcSNE		57	18	3	1	1		
		PR2NE		59	03					
		eE	07	05	45					
		eLE		36	34	40				
		FE	08	58						
	P	eP'E	06	53	48					
		PcPcSE		57	18					
	H	eP'N		53	47					
		eP'E			45					
		eE		57	10					
Feb 12	PX	eZ?	06	03	05					Probably aftershock of
		iZ			17					preceding; if so,
		iZ		06	40					0 = 05:43:50
	P6	eN		03	13					
		eN		06	44					
	P	eN		03	22					
		eE			26					
		eN		06	43					
		eE			41					
	H	eN		03	27					
		eN		06	42					

Note: J.S.A. places the two preceding shocks at about 5°S., 102°E. The distance of this point from Pasadena is 132°45', which closely fits the above readings.

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Feb 12	PX	iPZ	08	12	36					J.S.A.: Acapulco Deep, off Mexican coast. 14°.0 N., 92°.4 W., by St Louis and Pasadena
		iZ		14	29					
	P6	ePN		12	35					
	P	ePN			38					
		ePE			36					
	H	eN			47					
Feb 13	PX	ePZ	00	54	17					
		eZ			18					
	P6	ePN			18					
	P	ePE			17					
	SB	eE			13					
	H	eN			15					
Feb 13	PX	ePZ	01	40	40					Δ = 10790 km.(97°.1)
		ePR1Z		44	39					0 = 01:27:00
		iSZ		52	10					New Zealand
		MZ	02	26		15			4	U.S.C.G.S., 42°S., 178°E.
	P6	ePN	01	40	40					0 = 01:27.1
		ePR1N		44	39					
		eE		51	19					
		eN		51	28					
		eN		52	00					
		eSN			07					
		iSE			08					
		iNE			16					
		eLE	02	07	57	30				
	P	eN	01	40	48					
		eE			47					
		eE		51	27					
		eE		52	02					
		iN			16					
	SB	eSN		52	10					
	H	ePN		40	55					
		eSN		51	20					
Feb 13	PX	eZ	19	29	51					
		eZ			58					
	P6	eN		30	11					
	P	eN		30	14					
		eE		29	53					
	H	eN		29	50					
Feb 14	PX	eZ	14	18	06					Δ = 14770 km.(133°) ?
		eZ		21	30					0 = 13:58:52 ?
	P6	eN		18	09					
		eN		21	37					
	P	eN		18	09					
		eE			16					
		eN		21	36					
		eE			40					
	H	eN		18	18					
Feb 16	PX	eZ	19	00	03	0.5				
		iZ			10	1.3				
	P6	eN			09					
		eE			11					
	P	eNE			11					
	SB	eNE			06					
	H	eN			06					

No. 11 PASADENA and auxiliary stations 1931

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Feb 20	PX	iPZ	05	44	44	2			2	Compression.
		eZ		45	28					Seismograms of "deep
		eZ		46	05	8			1	focus" type. iP nearly
		iZ		47	05	3			2	vertical, iS nearly
		eZ		48	58	8			1	horizontal. Surface
		eSZ		59	03	5			1	waves practically absent.
		eZ	06	00	22	18			1	From tables
	P6	eE?	05	44	35					△ = 7810 km.(70°.3)
		eE			43					0 = 05:33:33
		eN			48					Epicenter presumably
		iSN?		54	02	5	2	2		more distant, in region
	P	eE		44	43					of Yezo.
		eN			47					
		iSN		54	02					
		eSE			01					
	SB	ePN		44	40					
		eSN		54	01					
	H	ePN		44	37					
		eSN		53	50					
Feb 23	P6	eN	02	25	04					
		eN			07					
	P	iPNEZ			04					Compression.
		eN			08					Possibly also "deep
	R	iPNE			06					focus" type. No trace
	SB	iPNE		24	59					of S or surface waves.
	H	iPN			57					Computed epicenter
										57°N.,157°E.(Kamchatka).
										May be more distant.
Feb 27	PX	eZ	09	56	10					
		eZ		57	06					
		MZ	10	36	16	21			1	
	P	eZ	09	56	10					
	H	eN			42					

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Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Mar 1	PX	iPZ	14	33	52					Compression
	P6	ePEZ			52					
	P	ePEZ			52					
	T	ePE			38					
	H	ePN			45					
Mar 2	PX	iPZ	02	31	09	1			1	Compression
		iZ			12	2				Rarefaction
		iZ			41	2				Compression
		ePR1Z		35	06	10				△ = 97°.0
		eZ		41	52	12			2	0 = 02:17:29
		eZ		42	50	8			2	
		eZ		43	31	10			2	
		eZ		44	37	10				
		eZ		47	34	16				
	P6	ePNE		31	09					
		eNE		41	44					
		iN		42	44	8	2			
		eE			51					
		eN		43	30					
		eLE	03	01	15	19		1		
	P	iPNEZ	02	31	09					
		ePR1Z		35	06					
		eE		41	44					
		eNZ			50					
		eN		42	36					
		eE			44					
		eZ			49					
		eE			51					
		eZ		43	31					
	SB	ePE		31	11					
		eN		42	25					
	H	ePN		31	18					
		eN		42	54					
Mar 7	P6	iPNE	00	49	07					
		eN		59	15					
	P	ePEZ		49	04					Compression
		ePN			06					
		iEZ			07					Rarefaction
		eZ		51	23					U.S.C.G.S. 10°N 87°W(app-
	SB	eNE		49	21					rox.) 0 = 00:41:35
	H	ePN			14					J.S.A. 7°.5N 84°W
Mar 7	P6	eN	10	13	28					
		eE			23					
		eLE		48	23	22				
	P	eE		13	27					
		ePZ			24					
		eLZ		48	23	22				
	T	eE		13	29					
	H	ePN			36					
Mar 7	P	eEZ	11	34	15					
Mar 7	PX	ePZ	18	31	00					
	P	ePZ		30	57					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Mar 7	PX	iPZ	02	03	52					Rarefaction
		ePR1Z		07	52					△ = 95° 0 = 01:50:23
	P6	ePN		03	57					U.S.C.G.S. 42°N 23°E
		eLE		41	01	30				0 = 01:50:13
		FE	03	15						
	P	ePZ	02	03	52					Rarefaction
		iPZ			53					Compression
		ePN			56					
		eE			59					
		ePR1Z		07	46					
		eLZ		41	23	40				
	SB	ePNE		03	54					
	T	ePNE		03	42					
	H	ePN			45					
Mar 8	PX	eZ	06	09	37					
	P	eZ			37					
	T	eE			33					
	H	eN			55					
Mar 8	PX	eZ	12	03	59					
	P	eZ			59					
Mar 9	PX	ePZ	04	00	28					Compression
		iZ			47					Rarefaction
		ePR1Z		03	23					△ = 73°.1 0 = 03:49:00
		FZ	05	51						U.S.C.G.S. 41°N 142°E
	P6	eNE	04	00	36					0 = 03:48:40
		eE			47					
		eSN		10	09					
		eSE			03					
	P	ePZ		00	28					
		ePE			33					
		eNZ			36					
		iZ			47					
		eSN		10	06					
		eSE			04					
		eZ			10					
		eLZ		23	09	25				
	SB	ePNE		00	25					
		eSNE		09	55					
	H	ePN	03	59	44					
		eSN	04	08	59					
Mar 10	PX	ePZ	03	30	54.5					Probably northern
		eZ			55.7					California
		eZ		32	25					
	P6	eNE		30	57					
	P	ePZ			54.1					
		eE			55					
		iZ			55.8					
		eN			57					
		eZ		32	25					
	MW	ePNE		30	54.5					
		eN		32	24.4					
		eE			26.7					
	SB	iPN		30	37.2					
		ePE			37.7					
		iN		31	59.9					
		iE		32	01.9					
	H	ePN		30	41					
		iN			42					
		eN		32	04					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm) N	E	Z	Remarks
Mar.11	PX	iPZ	12	39	15					Compression
		eLZ	13	05	15	30				△ = 8960 km. (80.6°)
	P6	ePNE	12	39	15					0 = 12:27:04
		eSN		49	34					U.S.C.G.S. 19°N 145°E
		eSE			29					0 = 12:26:15
	P	iPEZ		39	14					
		eZ		46	31					
		eSN		49	32					
		eSE			29					
	MW	ePE		39	15					
		eSN		49	38					
		eSE			36					
	SB	eSE			16					
	T	ePE		39	08					
		eSE		49	21					
	H	ePN		39	15					
		eSN		49	28					
Mar.12	PX	ePZ	10	53	09					△ = 9020 km. (81.2°)
	P6	ePN			11					0 = 10:40:55
		eSN	11	03	29					
		eSE			27					
	P	ePE	10	53	11					
		ePZ			10					
	T	ePE			04					
		eSE	11	03	14					
	H	ePN	10	53	09					
Mar.12	PX	eZ	19	17	04					
	P	eZ			03					
	T	eE		16	58					
Mar.12	PX	eZ	19	21	33					
	P	eE			37					
		eZ			33					
	T	eE			33					
Mar.12	PX	eZ	21	11	14					
	P	eZ			14					
	T	eE			19					
Mar.14	PX	iPZ	14	12	15					Rarefaction
		i		13	04					
	P6	ePN		12	15					
		ePE			16					
	P	eN			17					
		ePE			16					
		iPZ			15					
		iZ		13	07					
	MW	eNE		12	15					
	T	ePE			14					
		eSE		22	30					
		eE			45					
	H	ePN		12	23					
		eN		22	31					
		eN			43					
Mar.14	PX	iPZ	21	55	47					Compression
	P	iZ			47					
	T	eE			27					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Mar.15	PX	eZ	16	45	13					
		iZ			22					
Mar.18	PX	ePZ	08	14	32					Δ = 8670 km. (78°)
		eSZ		24	42					0 = 08:02:35
		iZ		25	48	13			2	U.S.C.G.S. 34°S 72°W
		eZ		34	06					0 = 08:02.3
		eZ		43	17					J.S.A. 32°S 73°W
		MZ		49	09	14			15	
		FZ	11	02						
	P6	ePN	08	14	31					
		eSN		24	38					
		iSE			33			1		
		eE		30	02					
		eLE		36	00	25		1		
		ME		49	10	14		5		
		FE	10	15						
	P	ePNEZ	08	14	31					
		ePE			32					
		eSNE		24	36					
		eSZ			41					
		eZ		25	44	13			1	
		eZ		28	50					
	MW	ePNE	08	14	31					
		eSNE		24	36					
	R	ePE		14	29					
		eSNE		24	32					
	H	ePN		14	42					
		eSN		24	55					
Mar.18	PX	iPZ	20	27	58					Δ = 12450 km. (112°)
		ePZ		31	38					0 = 20:13:04
		eZ		33	00					Philippines
		eZ		34	57					U.S.C.G.S. 06°N 127°E
		eZ		39	18					0 = 20:13.5
	P6	ScPcSN		38	31					
		iScPcSE			32					
		eScPcPcSN		39	18					
		iScPcPcSE			17					
		eLE	21	03		40		1		
	P	ePZ	20	27	58					
		eP'Z		31	40					
		eZ		33	08					
		eScPcSE		38	29	5				
		eScPcPcSE		39	17	6				
		iZ		43	31	2				
		eLZ	21	01	59	45			1	
		FZ		48						
	MW	eN	20	39	19					
		eE			17					
	R	eN		31	07					
		eE			36					
		eN		38	36					
		eE			34					
		eN		39	23					
		eE			20					
	SB	eE		38	14					
	H	eN		32	03					
		eN		38	23					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Mar.19	PX	ePZ	06	39	06					Philippines
		eZ		42	11					U.S.C.G.S. 20°N 120°E
		eZ		43	15					0 = 06:24.8
	P6	eN		49	42					
		iE			41					
		eE		50	06					
		eN		51	15					
	P	iPEZ		39	07					
		eZ		42	09					
		eZ		43	15					
		eLZ	07	13		25			1	
		FZ		44						
	MW	eNE	06	39	01					
	R	eN		42	10					
		eNE		49	46					
	H	eN		39	14					
		eN		50	36					
		eN			44					
Mar.28	PX	ePZ	12	53	16	1.5				
		iP'		57	10	2			1	Rarefaction
		ePR1Z		58	01					Δ = 12550 km. (113°)
		iPSZ	13	07	16	8			1	0 = 12:38:17
		iZ			26	10			4	Banda Sea
		MZ		43		17			2	J.S.A. 07°S 128°E
		FZ	14	32						
	P6	ePE	12	53	18					
		eP'E		57	09					
		ePR1E			55					
		iScPcSN	13	03	42					
		iScPcSE			41					
		eE			55					
		iN			58					
		iE		04	57					
	P	ePN	12	53	17					
		ePE			18					
		ePZ			16					
		eP'N		57	09					
		iP'EZ			10					
		ePR1N			57					
		eZ		58	01					
		iScPcSN	13	03	42					
		eScPcSE			41					
		eScPcPcSN		04	42					
		iPZ		08	07					
	MW	eN	12	53	33					
		eN		57	11					
		eNE	13	03	43					
		eNE			59					
	R	eP'NE	12	57	08					
		iNE	13	03	42					
		iE			56					
		eE		04	59					
	SB	eN	12	57	04					
		eE	13	04	49					
	T	ePE	12	53	10					
		eP'E		57	08					
		iE	13	03	41					
	H	iP'N	12	57	09					
		iN	13	03	41					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Mar.29	PX	ePZ	17	32	47					All records extremely small. J.S.A. 16.5°S 94°W
	P	ePZ			47					
	MW	eE			58					
	T	eN			51					
		eE			31					
Mar.29	PX	ePZ	18	03	10					Rarefaction.
	P6	ePNE			10					From tables Δ = 7810 km (70.3°)
		iSN		12	28					0 = 17:51:58
		iN		13	06					
	P	ePNEZ		03	09					Rarefaction.
		iZ			10					Compression.
		iSN		12	28					
	MW	ePNE		03	11					No surface waves. Probably "deep focus" type.
		iSNE		12	30					
	SB	ePN		03	03					
	T	iPNE		02	59					
		eSNE		12	08					Region of Yezo.
Mar.31	PX	eZ	16	09	24					Destructive at Managua, Nicaragua, distant 4040 km.(36°24')
		eZ		10	48					
		eLZ		22	15	15				
	P6	eNE		09	33					
	P	eN			23					
		eE			32					
		ePZ			16					
	T	ePNE			36					

Correction: Page No.12, 2nd line of report, for "P6 ePEZ" read "P6 ePNE".

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Research Associate in charge.
C.F.Richter,
Assistant.

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Apr. 1	P	ePNEZ	13	20	08					
Apr. 3	P6	ePNE	02	06	00					
	P	ePNEZ		05	58					Rarefaction
	MW	eNE		06	01					
	T	eN			19					
		ePE			17					
	H	eN			10					
Apr. 3	P6	ePNE	05	30	56					
	P	ePNEZ			56					Compression
	MW	eNE			58					
	R	ePNE			52					
	T	ePNE		31	06					
	H	ePN			04					
Apr. 3	PX	ePZ	23	30	28					"Deep focus" type. P nearly vertical. No surface waves.
		iZ			30					
		iZ			35					From tables: Δ = 7800 km.
		iZ		32	53					= 70.2°
		eZ		33	43					O = 23:19:17
	P6	ePNE		30	28					Damage in Argentina
		iNE			30					
		iNE			35					
		eSN		39	44					
		iSN			45					
	P	ePN		30	26					
		ePE			28					
		iPZ			27					Compression
		iZ			32					Rarefaction
		iZ		33	43					
		eSN		39	45					
		eSE			44					
	MW	ePNE		30	28					
	R	ePNE			32					
		eSE		39	50					
		iNE			51					
	SB	ePE		30	28					
		eE		39	36					
	T	ePNE		30	34					
		iNE			41					
		eSN		39	57					
		eSE			52					
	H	ePN		30	35					
		iN			42					
		eN		39	59					
Apr. 4	P	ePNZ	19	20	53					
	H	ePN		21	06					
Apr. 5	P6	ePNE	03	13	50					
	P	ePNEZ			50					
	MW	eE			51					
	H	eN		14	08					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Apr.6	PX	iPZ	07	02	45					Compression
		eZ		06	27					Δ = 10630 km (95.7°)
		eSZ		14	11					0 = 06:49:12
		eZ		15	03					U.S.C.G.S. 0 - 06:49.5
		eZ		19	51					J.S.A. 10°N 146°E
		eL		33	39	23				
		FZ	08	02						
	P6	ePNE	07	02	45					
		eSN		14	07					
		eSE			12					
		eE		15	08					
		eLE		31	13					
	P	ePNEZ		02	45					
	MW	ePNE			46					
	R	ePNE			47					
		eE		13	38					
	SB	ePNE		02	49					
		eE		13	40					
	LJ	ePNE		02	48					
Apr.9	P6	eSNE	23	21	47					Δ = 7700 km (69.3°)
	P	ePEZ		12	33					0 = 23:01:28
		eSE		21	47					
	MW	ePE		12	33					
	R	eN			38					
	T	eE			18					
		eSE		21	20					
	H	ePN		12	26					
		eSN		21	33					
Apr.12	P6	eN	02	13	45					
		eE			51					
		eN		24	49					
	P	eN		13	44					
		eZ			45					
		eE			51					
		eN		24	49					
Apr.16	P6	ePNE	07	50	00					
		eSN		58	39					
	P	ePNEZ		49	59					Compression
		eSN		58	39					No surface waves. From
	MW	eE		50	00					tables, Δ = 7130 km (64.2°)
	T	eE		49	56					0 = 07:39:14
Apr.16	P6	eNE	22	37	53					
	P	eNEZ			53					Compression
Apr.18	P6	eE	13	16	59					
		eE		17	42					Records very confused
		eN		19	13					
	P	eEZ		10	42					
		eZ		17	23					
		eE			44					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Apr.19	PX	ePZ	02	04	08					U.S.C.G.S. 19°N 109°W
		eMZ		10	04	11			8	0 = 02:00.0
	P6	ePN		04	08					J.S.A. 21.5°N 110°W
		ePE			10					
		eE		07	24					
	P	ePE		04	09					
		eE		07	24					
	MW	ePNE		04	10					
		eNE		07	25					
	R	ePNE		04	03					
		eLN		07	24	23				
	SB	ePN		04	34					
	T	ePE			38					
		eE		10	26					
Apr.19	PX	eZ	13	52	38					
	P6	eNE			42					
	P	iZ			38					
	MW	eE			42					
	T	eE			35					
Apr.22	P6	ePNE	00	14	47					
		eNE		24	24					
		eLN		34		18				
	P	ePNE		14	47					
		iPZ			45					
	R	eE			53					
	T	eE		14	58					
Apr.23	P	iPEZ	23	34	37.7					Epicenter, by Professor Gutenberg:
		iZ			39.1					35°25' N 117°36'W.
		iSEZ		35	00.1					Near Searles Lake.
	MW	ePNE		34	37					Reported felt, by U.S.C.G.S.
	R	ePNE			38.0					
		iNE			40.1					
		iSNE		35	01.3					
	SB	iPNE		34	51.3					
		iSNE		35	23.2					
	LJ	ePNE		34	55					
		eSN		35	31					
	T	iPNE		34	30.0					
		iSE			54.0					
Apr.24	PX	iPZ	17	35	20					△ = 11220 km (101°)
		iPR1Z		39	02					0 = 17:21:18
	P6	ePNE		35	20					U.S.C.G.S. 01°N 151°E
		eN		39	21					0 = 17:22.1
		iE			16					J.S.A. 10°N 146°E
		iE		46	13					
		eLE	18	03	17	40		1		
		iLE		04	04	32		2		
	P	iPNZ	17	35	19					
		ePE			20					
		eN		39	21					
		eE			16					
	MW	ePE		35	21					
		eE		39	03					

-----Continued on page 21--------

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
			Continued from page 20							
Apr.24	R	ePNE	17	35	23					
		eE		39	01					
	SB	eE		35	26					
	LJ	eN			27					
		ePE			25					
		eE		39	12					
	T	ePNE		35	21					
Apr.24	P	iPNEZ	18	28	03.9					Epicenter by Professor Gutenberg: 33°46' N 118°29' W R F VI on the coast. Recorded at all stations
Apr.25	P	eZ	05	19	43					
Apr.26	P6	eNE	04	32	02					
	P	eNEZ			01					
Apr.27	P6	eNE	17	09	14					
	P	eNEZ			14					

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C.F.Richter,
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Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
May 1	PX	ePZ	22	45	59					U.S.C.G.S. 8°N 70°W
	P6	ePN			57					0 = 22:36.6
		ePE			59					J.S.A. 8°N 70°W
	P	ePN			58					
		ePE			59					
		ePZ			57					
	MW	ePE			58					
	R	ePN			57					
		ePE			55					
	H	eN			56					
		eE			54					
May 2	P6	eN	22	37	52					
	P	eE			57					
		eZ			52					
	MW	eN			45					
	R	eNE			31					
	LJ	eNE			59					
May 2	P6	eNE	23	30	48					
	P	iEZ			48					
	MW	eNE			49					
	R	eNE			49					
	H	eNE			55					
May 6	PX	eZ	04	36	22					
	MW	eNE			26					
	T	eNE			31?					
May 9	PX	ePZ	10	37	45					U.S.C.G.S., 23°N 108°W
		eZ		40	35					0 - 10:34.0
	P6	ePE		37	47					J.S.A. 23.7°N 108.5°W
		eE		39	54					
		eE		40	42					
	P	ePNZ		37	48					
		ePE			46					
	MW	ePE			50					
	R	ePN			40					
		eE			48					
		eN		42	26					
	SB	eNE		38	15					
	LJ	ePNE		37	28					
	H	ePNE		38	16					
May 10	P6	ePNE	19	34	54					
	P	ePNEZ			54					
	T	ePE		35	10					
	H	eN		34	55					
May 12	P6	ePNE	01	47	11					No surface waves.
		eSNE		55	20					△ = 6610 km. (59.5°)
	P	ePN		47	12					0 = 01:37:05
		ePEZ			09					U.S.C.G.S.: Region of
		eSNE		55	21					Kamchatka,
	MW	ePNE		47	10					0 - 01:37.4 approx.
		eSNE		55	20					J.S.A. 54°N 161°E
	R	ePNE		47	13					o = 01:37:22
	LJ	eNE			44					
	H	ePE		46	59					
		eSE	01	55	00					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
May 15	P6	ePNE	07	53	48					No surface waves.
		eNE	08	03	24					△ = 8420 km (75.8°)
		eSNE			38					0 = 07:42:04
	P	ePNEZ	07	53	48					Compression
		eZ	08	03	25					
		eNE			37					
	MW	ePNE	07	53	49					
		eNE	08	03	39					
	H	ePN	07	53	56					
		eN	08	03	32					
May 16	P6	ePNE	20	53	07					△ = 3070 km (27.6°)
		eSNE		57	43					0 = 20:47:04
		eLE	21	00	28	23		1		U.S.C.G.S. 16°N 96°W
	P	ePNEZ	20	53	07					0 = 20:47.2
	MW	ePNE			08					J.S.A. 14.7°N 91.5°W
		eSNE		57	38					0 = 20:47:10
	R	ePNE		53	02					
		eSN		57	30					
	LJ	ePNE		53	10					
	H	eN		52	37					
May 20	PX	eZ	00	06	01					
	H	eN			18					
May 20	PX	ePZ	02	34	52					Compression
		eZ		37	57					
		eZ		39	57					△ = 8900 km (80.1°)
	P6	eNE		34	59					0 = 02:22:44
		eSE		45	04					U.S.C.G.S. 37.5°N 17.2°W
		eLN		58	15	40				0 = 02:22.9
	P	ePZ		34	52					J.S.A. 37.5°N 16.5°W
		eE			58					
		eSE		45	04					Damage in Portugal and
	MW	eNE		34	59					Madeira.
	R	ePNE			53					
	LJ	ePE		35	13					
	SB	ePNE			13					
	H	ePN		34	45					
May 20	P	eZ	10	05	00					
	H	eN		04	57					
May 20	P6	ePNE	22	05	42					△ = 8330 km. (75.0°)
		eSE		15	27					0 = 21:54:03
	P	ePNEZ		05	42					Rarefaction
	MW	ePNE			44					U.S.C.G.S. 28°S 74°W
	R	ePNE			38					0 = 21:54.0
	LJ	eN			32					J.S.A. 26.7°S 72.5°W
	H	ePN			53					
May 27	P	ePZ	06	09	15					
	H	eN			39					
May 27	P6	ePN	06	44	25					
	P	ePNZ			25					
		eN	07	01	23					
	H	eN	06	44	40					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
May 27	P6	ePN	06	44	25					
	P	ePNZ			35					
		eE	07	01	23					
	H	eN	06	44	40					
May 27	P6	ePN	10	25	52					
	P	ePNEZ			52					
	MW	ePNE			52					
	R	ePNE			45					Δ = 4840 km. (43.6°)
		eSNE		32	12					O = 10:17:27
	LJ	ePE		25	38					
	H	ePN		26	12					
		eSN		32	53					
May 29	P6	eNE	05	25	46					U.S.C.G.S. 55°N 156°W
	P	eE			45					0 - 05:16.0
		ePZ			25					
	MW	ePNE			25					
	R	eN			28					
		eNE			47					
	LJ	eE			58					
	H	ePN			12					
		eN			32					

Additions and corrections:

Page No.13 1st line, for "Mar.7" read "Mar.8".
Page No.23 20th line, for "20:52:37" read "20:53:23" .

Epicenters by Zürich:
May 12, 1h : 54°N 174°E
20, 2h : 39°N 17°W

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SEISMOLOGICAL LABORATORY

CARNEGIE INSTITUTION OF WASHINGTON
CALIFORNIA INSTITUTE OF TECHNOLOGY

220 NORTH SAN RAFAEL AVENUE,
PASADENA, CALIFORNIA

BULLETIN

The SEISMOLOGICAL LABORATORY, Pasadena, California, is maintained and operated by the Carnegie Institution of Washington and the California Institute of Technology as a coöperative undertaking. This laboratory is the **central station** of a coördinated group. Auxiliary stations in southern California are maintained and operated as follows: At the Mount Wilson Observatory on Mount Wilson (a Department of the Carnegie Institution of Washington); at Riverside (in coöperation with the City of Riverside); at Santa Barbara (in coöperation with the Santa Barbara Museum of Natural History); at La Jolla (in coöperation with the Scripps Institution of Oceanography of the University of California); at Tinemaha, and at Haiwee, in the Owens Valley (in coöperation with the Department of Water and Power of the City of Los Angeles).

TIME: At all these stations the minute-marks on the seismograms are coördinated directly by means of auxiliary records written at each station on which the minute-marks are registered closely parallel with recorded dot-and-dash radiotelegraphic signals sent in ordinary course from a powerful transmitting station. This permits direct correlation of the minute-marks at all the stations of the group at practically all times with an accuracy of one second, and usually of one-fifth second.

The constants of these stations follow.

PASADENA SEISMOLOGICAL LABORATORY Central Station

$\Phi = 34° 08.9'$ N., $\lambda = 118° 10.3'$ W., h = 295 m., Deeply weathered granitic rock, with inclusions of gneiss and schist.

Apparatus: horizontal-component torsion seismometers with magnetic damping and optical recording. (Cf.Bull.Seis.Soc.Am.,XV,1,1925).

a vertical-component short-period seismometer with oil damping and galvanometric-optical recording.

The constants of the short-period instruments do not undergo any significant changes. The constants of the instruments of longer period will be given from time to time when deviations from the values given below are significant.

Experimental seismographs of various kinds are in process of development from time to time, and are used for intervals of variable duration. Information concerning these will be given when necessary.

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z	0.3 sec.	5,000	Critical
N — S	6 sec.	800	0.8-0.9
E — W	"	"	"

AUXILIARY STATIONS

Each of the auxiliary stations has equipment as follows:

Apparatus: two horizontal-component torsion seismometers with magnetic damping and optical recording;

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z			

The Station Constants follow.

Coördinates are geodetic positions referred to the North American Datum.

Mount Wilson Seismologic Station
$\Phi = 34° 13.5'$ N., $\lambda = 118° 03.4'$ W., h = 1742 m., Weathered granite.

Riverside Seismologic Station
$\Phi = 33° 59.6'$ N., $\lambda = 117° 22.4'$ W., h = 250 m. approx., Weathered granite.

Santa Barbara Seismologic Station
$\Phi = 34° 26.6'$ N., $\lambda = 119° 42.8'$ W., h = 100 m. approx., Heavy, boulder-laden alluvium.

La Jolla (Scripps Institution Seismologic Station)
$\Phi = 32° 51.8'$ N., $\lambda = 117° 15.2'$ W., h = 7.7 m. approx., Consolidated detrital material.

Tinemaha Seismologic Station
$\Phi = 37° 05.7'$ N., $\lambda = 118° 15.5'$ W., h = 1180 m. approx., Basalt.

Haiwee Seismologic Station
$\Phi = 36° 08.2'$ N., $\lambda = 117° 58.6'$ W., h = 1100 m. approx., Loosely cemented tuff.

SYMBOLS AND NOTATION: in general the symbols and notation conform with the usual international practice.

However, when measurements referring to **local** earthquakes are included P and S will be used without index or subscript, as no attempt will be made in these bulletins to distinguish between $\overline{P}$, P*, and P_n, although such complications are often clearly indicated and are the subject of study.

AMPLITUDES, (half-ranges), are measured in millimeters of the seismographic trace.

SPECIAL SYMBOLS indicating the stations of this coördinated group are as follows:

PASADENA SEISMOLOGICAL LABORATORY

For routine instruments of period 0.8 seconds . . . . . P
For routine instruments of period 6 seconds . . . . . P_6
For instruments of different period analogous notation will be employed.

Mount Wilson Seismologic Station . . . . . MW
Riverside Seismologic Station . . . . . R
Santa Barbara Seismologic Station . . . . . SB
La Jolla (Scripps Institution Seismologic Station) . . . . . LJ
Tinemaha Seismologic Station . . . . . T
Haiwee Seismologic Station . . . . . H

In general detailed measurements will be given only for the records of the Seismological Laboratory: those for records of the other stations will be given only to supplement the information.

NOTICE

Circumstances made it impracticable to issue this Bulletin at the end of June,1931. Accordingly, the data for both June and July,1931,are included in the enclosed issue, sheets Nos. 25 - 28.

Reply cards were enclosed with the Bulletin for May,1931,in mailing to stations and individuals from whom no previous acknowledgement had been received. Cards returned to date have been used in revising the address list. It is desired to make the Bulletin available to all who have real use for it.

The courtesy of a number of recipients who have acknowledged receipt of the separate issues of the Bulletin is greatly appreciated. Such regular acknowledgement is now unnecessary. If any issues fail to arrive in future, however, notification of the fact to this Laboratory will be appreciated.

Copies of previous issues, Nos. 1 - 24, 1931, are available. If files of the Bulletin are incomplete please notify this Laboratory.

Grateful acknowledgement is made of the receipt of numerous bulletins, and other publications, received in exchange. These have proved very useful, and the receipt of future issues will be appreciated.

Preliminary report - PASADENA

Earthquake of August 10, 1931.

oP	21:32:09
e	27
e	43:07
i	45:09
oL	22:01:20
M	22
W2	23:30

No.25 PASADENA and auxiliary stations 1931

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jun 1	P6	ePNE	12	07	45					Compression
	P	ePNEZ			45					
	MW	ePNE			45					
	R	eNE			49					
	LJ	ePE			49					
	H	ePNE			47					
Jun 2	P	eNEZ	02	49	40					Rarefaction followed by compression
	MW	eNE			40					
	T	ePNE			30					
		eE		59	10					
	H	iPNE		49	37					
Jun 6	P6	eNE	12	05	44					Rarefaction
	P	eNEZ			44					
	MW	eNE			47					
	R	ePNE			47					
	SB	ePN			39					
	LJ	ePE			44					
	H	ePNE			52					
Jun 9	P6	eNE	14	03	45					
	P	ePNZ			44					
	P6	eN		13	20					
		eN		19	05					
		eLN		24	40	11				
Jun 13	PX	ePZ	15	46	08					
		eZ	16	00	13					
		eZ		13	15				2	
		eZ		15	43	8			1	
		eLZ		19	43	17				
Jun 15	P6	ePNE	11	30	31					
	P	ePNEZ			31					
	MW	eNE			35					
	R	eNE			32					
	LJ	eNE			24					
Jun 17	P6	eNE	12	21	48					
	P	eN			48					
		eEZ			45					
	P6	eN		31	43					
	P	eN			42					
	MW	eNE		21	43					
	R	eNE			46					
	SB	eNE			40					
	LJ	eNE			53					
Jun 20	P6	ePN	15	15	24					
	P	iPNEZ			24					
	MW	eNE			24					
	R	eNE			25					
Jun 21	P6	ePE	12	27	27					U.S.C.G.S.: 18°N 108°W 0 - 12:22:48
		eE		35	58					
	P	ePNEZ		27	27					J.S.A.: 19°N 110°W
	MW	ePNE			26					
	R	ePNE			21					
	SB	ePN			42					
	LJ	ePNE			06					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jun 22	P	eZ	09	57	15					
Jun 22	P6	eNE	14	41	00					
		iPNEZ		40	59					
Jun 23	P6	eN	06	26	52					Δ = 76.8°, 0 = 06:15:03 Japan
	P	ePZ			55					
	P6	eE		36	27					
		iSE			47					
Jun 28	P	iPNZ	08	29	24					Rarefaction
	MW	ePNE			23					
Jun 28	P	iPNZ	13	35	28					
	MW	ePNE			28					
Jun 28	P	iPNZ	16	36	40					
	MW	ePNE			39					
Jun 29	P	iPNEZ	13	11	11					Compression
Jun 29	P6	ePE	16	55	00					
	P	ePNEZ			00					Compression
	P6	eSN	17	04	46					Δ = 75.1°, 0 = 16:43:21
	MW	ePNE	16	55	01					Japan
	R	ePNE			04					
Jun 29	P6	ePNE	20	36	05					U.S.C.G.S. 29°S 72°W
	P	iPNZ			04					0 = 20:24:18
	MW	eNE			05					
	R	ePNE			06					
	SB	eNE			25					
	LJ	eN		35	58					
Jul 7	P6	ePNE	04	00	10					
	P	ePNEZ			09					
	MW	ePE			10					
	R	ePNE			04					
Jul 11	P6	ePN	06	06	12					
	P	ePNEZ			11					
	MW	eE			13					
Jul 12	P6	eE	10	15	14					
	P	iPNEZ			14					
Jul 17	P6	ePNE	09	19	23					
	P	iPNEZ			23					Rarefaction
	P6	eSNE		23	55					U.S.C.G.S. 14°N 96°W
	MW	ePNE		19	23					0 = 09:13:22
	R	ePNE			18					J.S.A. 14.5°N 97.5°W
	LJ	iPNE			12					0 = 09:13:20
Jul 18	P6	ePNE	05	38	27					
	P	iPNEZ			27					Compression
	P6	eSE		47	50					U.S.C.G.S. 21°S 69°W
	MW	ePNE		38	28					0 = 05:27:09
	R	ePNE			23					J.S.A. 21°S 71°W
	LJ	eN			19					0 = 05:27:04

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jul 18	P6	ePNE	11	33	41					
	P	iPNEZ			41					Compression
	P6	iSNE		41	41					
	P	iSNZ			40					U.S.C.G.S. 53°N 162°E
	MW	iPNE		33	40					0 = 11:23:52
		eSNE		41	39					J.S.A. 58.3° 159°E
	R	ePNE		33	43					0 = 11:24:00
		eSNE		41	44					
	LJ	iPNE		33	52					
Jul 18	P6	eNE	12	03	30					
	P	eNEZ			31					
	MW	eNE			32					
Jul 20	P	iPZ	05	11	40					Rarefaction
Jul 20	P6	ePNE	08	41	42					
	P	iPNEZ			41					
	P6	eLE	09	03	01	33				
	MW	ePE	08	41	46					
	R	ePNE			45					
Jul 21	P6	ePNE	03	48	57					
	P	iPNEZ			57					Rarefaction
		iPRlZ		52	23					
	P6	eN		59	12					U.S.C.G.S. 22°S 174°E
		eN			33					0 = 03:36.1
	MW	ePNE		48	58					J.S.A. 22°S 174°E
		eE		59	12					0 = 03:36:09
	R	ePNE		49	00					
		iNE		59	16					
		eE			38					
	LJ	iPNE		48	58					
		eE		59	14					
Jul 23	P6	ePNE	14	33	20					U.S.C.G.S. 01°S 155°E
	P	iPNEZ			19					0 = 14:20:37
		iNEZ			27					J.S.A. 01°N 155°E
		eZ		34	58					
		eZ		43	57					
	MW	ePNE		33	23					
	R	ePNE			30					
		eNE		43	22					
	SB	eN		33	17					
Jul 27	P6	iPNE	07	22	57					
	P	iPNEZ			57					Compression
	P6	eN		25	32					U.S.C.G.S. 15°N 85°W
		eSN		28	24					0 = 07:15:50
	MW	ePNE		22	57					J.S.A. 15.9°N 86.2°W
	R	ePNE			51					0 = 07:15:56
	LJ	iPNE			48					
Jul 27	P6	iN	16	36	45					
	P	iNZ			44					Compression
	MW	eNE			44					U.S.C.G.S. 01°S 90°W approx
	R	eNE			41					0 = 16:28:30
	LJ	eN			38					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Jul 28	P6	eNE	08	41	57					Felt in Arizona
	P	eE		40	55					
		ePZ			50					
		eNEZ		41	55					
	MW	eE		40	34					
		eE		41	28					
	R	ePNE		40	21					
		eNE		41	14					
	LJ	eNE			43					
Jul 29	P6	ePN	11	48	25					
	P	iPNEZ			25					Compression
		eSE		56	28					
	MW	ePNE		48	30					
	R	ePN			30					
	LJ	ePNE			22					

CORRECTION:

Shock of April 3, 23:30.
Origin not in Argentina; apparently
South Pacific Ocean.

H.O.Wood,
Research Associate in Charge.
C.F.Richter,
Assistant.

SEISMOLOGICAL LABORATORY

CARNEGIE INSTITUTION OF WASHINGTON
CALIFORNIA INSTITUTE OF TECHNOLOGY

220 NORTH SAN RAFAEL AVENUE,
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TIME: At all these stations the minute-marks on the seismograms are coördinated directly by means of auxiliary records written at each station on which the minute-marks are registered closely parallel with recorded dot-and-dash radiotelegraphic signals sent in ordinary course from a powerful transmitting station. This permits direct correlation of the minute-marks at all the stations of the group at practically all times with an accuracy of one second, and usually of one-fifth second.

The constants of these stations follow.

PASADENA SEISMOLOGICAL LABORATORY Central Station

$\Phi = 34° 08.9'$ N., $\lambda = 118° 10.3'$ W., h = 295 m., Deeply weathered granitic rock, with inclusions of gneiss and schist.

Apparatus: horizontal-component torsion seismometers with magnetic damping and optical recording. (Cf.Bull.Seis.Soc.Am.,XV,1,1925).
a vertical-component short-period seismometer with oil damping and galvanometric-optical recording.

The constants of the short-period instruments do not undergo any significant changes. The constants of the instruments of longer period will be given from time to time when deviations from the values given below are significant.

Experimental seismographs of various kinds are in process of development from time to time, and are used for intervals of variable duration. Information concerning these will be given when necessary.

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z	0.3 sec.	5,000	Critical
N — S	6 sec.	800	0.8-0.9
E — W	"	"	"

AUXILIARY STATIONS

Each of the auxiliary stations has equipment as follows:

Apparatus: two horizontal-component torsion seismometers with magnetic damping and optical recording;

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z			

The Station Constants follow.

Coördinates are geodetic positions referred to the North American Datum.

Mount Wilson Seismologic Station
$\Phi = 34° 13.5'$ N., $\lambda = 118° 03.4'$ W., h = 1742 m., Weathered granite.

Riverside Seismologic Station
$\Phi = 33° 59.6'$ N., $\lambda = 117° 22.4'$ W., h = 250 m. approx., Weathered granite.

Santa Barbara Seismologic Station
$\Phi = 34° 26.6'$ N., $\lambda = 119° 42.8'$ W., h = 100 m. approx., Heavy, boulder-laden alluvium.

La Jolla (Scripps Institution Seismologic Station)
$\Phi = 32° 51.8'$ N., $\lambda = 117° 15.2'$ W., h = 7.7 m. approx., Consolidated detrital material.

Tinemaha Seismologic Station
$\Phi = 37° 05.7'$ N., $\lambda = 118° 15.5'$ W., h = 1180 m. approx., Basalt.

Haiwee Seismologic Station
$\Phi = 36° 08.2'$ N., $\lambda = 117° 58.6'$ W., h = 1100 m. approx., Loosely cemented tuff.

SYMBOLS AND NOTATION: in general the symbols and notation conform with the usual international practice.

However, when measurements referring to **local** earthquakes are included P and S will be used without index or subscript, as no attempt will be made in these bulletins to distinguish between $\overline{P}$, P*, and P_n, although such complications are often clearly indicated and are the subject of study.

AMPLITUDES, (half-ranges), are measured in millimeters of the seismographic trace.

SPECIAL SYMBOLS indicating the stations of this coördinated group are as follows:

PASADENA SEISMOLOGICAL LABORATORY

For routine instruments of period 0.8 seconds . . . . . P
For routine instruments of period 6 seconds . . . . . P_6
For instruments of different period analogous notation will be employed.

Mount Wilson Seismologic Station . . . . . MW
Riverside Seismologic Station . . . . . R
Santa Barbara Seismologic Station . . . . . SB
La Jolla (Scripps Institution Seismologic Station) . . . . . LJ
Tinemaha Seismologic Station . . . . . T
Haiwee Seismologic Station . . . . . H

In general detailed measurements will be given only for the records of the Seismological Laboratory: those for records of the other stations will be given only to supplement the information.

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Aug 2	P	iPZ	20	23	54					Rarefaction
		iZ		24	37					
Aug 2	P6	eSNE	23	47	48					
	P	iPEZ		39	41					
		eSE		47	49					
	MW	eNE		39	42					
	R	eNE			44					
	T	iPNE			29					
	H	eN			34					
Aug 6	P	iPEZ	18	28	28					
	MW	eNE			29					
	R	eNE			33					
	T	eE			14					
	H	eN			20					
Aug 7	P6	ePE	02	25	26					U.S.C.G.S.: Region of New Guinea, 0 = 02:11.8
		eNE		29	30					
		iE		36	11					
		iLE		42	09	38				J.S.A.: Doubtfully, 0°N 137°E 0 = 02:11:10
	P	ePZ		25	22					
		eE			25					
		iEZ		29	32					
		eNE		36	11					
	PX	eZ		29	06					
	MW	eNE		25	26					
	R	ePNE			27					
		eNE		36	15					
	SB	eN		29	21					
	LJ	eN		25	39					
		eNE		29	39					
	T	eE		25	23					
		eE		29	29					
	H	eN		25	40					
		eN		29	35					
Aug 9	PX	iPZ	01	36	32					
		iZ			46					
Aug 10	PX	ePZ	14	46	14					Rarefaction
Aug 10	P6	ePN	21	32	12					U.S.C.G.S.: 46°N 89.5°E approx. 0 = 21:18:25
		ePE			14					
		eN		43	07					
		iE			50					
		iNE		45	09					J.S.A.: 49°N 92°E 0 = 21:18:46
	P	eN		32	14					
		eNZ			09					
		eN			27					
		eN		45	08					
		eLE	22	01	23	50				
		MN		15						
		W2N	23	30						
	PX	iPZ	21	32	09					Compression
	MW	ePNE			12					
	R	ePN			10					

(continued on Page No.30)

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Aug 10		(continued from Page No. 29)								
	R	eN	21	43	08					
	SB	ePNE		32	09					
		eNE		45	05					
	LJ	eNE		32	25					
	H	ePNE			03					
Aug 13	P6	ePNE	22	21	49					
		eE		31	34					
		eNE		32	12					
	P	iPNEZ		21	49					
	PX	iPZ			48					Compression
		iZ		25	20					
		eZ		32	23					
		eZ		33	15					
	MW	ePE		21	50					
	R	ePNE			51					
	H	ePN			57					
Aug 14	P6	eE	16	19	36					
	P	eNE			40					
		eZ			36					
	PX	ePZ			34					
	MW	ePNE			40					
	R	eNE			36					
	H	eN			31					
Aug 15	P	iPNEZ	22	32	27					Rarefaction
	PX	iZ		33	37					No surface waves
	MW	eNE		32	28					
	H	eN			35					
Aug 15	P6	eE	12	55	31					
	P	iPNEZ			31					Rarefaction
		eZ		57	10					No surface waves
	MW	ePNE		55	32					
	R	ePN			34					
	H	ePN			28					
Aug 15	PX	ePZ	15	16	53					Compression
	H	eN		17	02					
Aug 16	PX	iPZ	02	14	19					Compression
	H	eN			18					
Aug 16	PX	iPZ	08	14	32					Rarefaction
	H	eN			34					
Aug 16	P6	eN	11	21	14					Foreshock of following
		eE			26					
	P	eNEZ			21					
	MW	eNE			20					
	H	eN			34					
Aug 16	P6	iPNE	11	43	19					Felt in Texas
		eLN		45	53	36				U.S.C.G.S.: 30°N 104.5°W
	P	ePNE		43	22					0 = 11:40.2
		ePZ			18					J.S.A.: 30.6°N 103.8°W
		iPZ			25					0 = 11:40:20
		eLN		46	12	35				
		iE			26					
	MW	ePNE		43	19					
	H	ePN			29					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Aug 16	P6	eN	13	39	12					Aftershock of the preceding
		eE		36	29					
	P	eNE		39	15					
		ePZ		36	11					
	MW	eNE		39	31					
	H	eN		36	30					
Aug 17	PX	iPZ	05	17	28					Rarefaction
		iZ			58					
		iZ		18	11					
	H	ePNE		17	37					
Aug 17	H	ePN	13	22	16					
Aug 17	PX	iPZ	15	01	25					Compression
Aug 17	PX	iPZ	18	01	58					Compression
	H	eE			53					
Aug 18	PX	iZ	05	52	22					
	H	eN			20					
Aug 18	P6	eN	14	45	47					U.S.C.G.S.: 49°N 90°E
		eE			41					0 = 14:21.3
		iN		47	03					J.S.A.: 46°N 89°E
		eE			08					0 = 14:20:54
	P	iPNEZ		34	28					
		eN		44	48					
		eN		46	05					
	MW	eN		34	26					
	H	ePN			24					
		eN		45	33					
Aug 18	P6	eNE	19	42	41					Felt in Texas
	P	eNEZ			41					
	H	eN		39	30					
		eN		42	49					
Aug 18	P	ePNEZ	21	50	57					
	H	eN		51	13					
Aug 22	P	iPNEZ	22	45	50					
	H	eN		26	02					
Aug 23	P6	eNE	18	03	50					J.S.A.: 42°N 127°W
		eN		06	14					0 = 18:01:19
	P	iPNEZ		03	46					
		eNEZ		05	20					
		eN		06	20					
	MW	ePNE		03	48					
	H	eP			32.1					
		iE			34.5					
		iSNE		05	12					
Aug 24	P6	eN	21	55	16					U.S.C.G.S.: 33°N 69°E
		eE			22					o= 21:35.5
	P	eN			17					
		eE			21					
	H	eN		54	32					
		eE			37					
Aug 25	P6	eNE	22	27	30					
	P	eNEZ			30					
	MW	eNE			30					
	H	eNE			39					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Aug 27	P6	eN	15	47	16					Destructive in Baluchistan
		MNE	16	42	12	16				U.S.C.G.S.: 29.5°N 67.5°E
		W2NE	17	43		16				G ≈ 15:27.6
	P	eNE	15	47	11					
	MW	eE		46	53					
	H	eE			06					
Aug 28	P	ePNEZ	13	03	17					
	MW	eNE			19					
	LJ	eNE			16					
	H	ePNE			23					
Aug 28	P6	ePNE	23	33	55					
	P	ePNEZ			55					
	MW	ePNE			55					
	LJ	eNE			55					
	H	iPNE		34	04					
Aug 29	P6	ePN	16	46	38					
	P	iPNZ			38					Compression
	MW	ePN			37					
		eE			44					
	LJ	eNE			28					
	H	eNE			52					
Aug 30	P	iPZ	07	41	08					
	H	ePN			30					
		ePE			27					
Aug 31	P6	eN	06	47	54					
		eSN		58	47					
		iSE			44					
	P	iPNEZ		47	50					
	LJ	eN		48	04					
		eE		47	58					

Harry O. Wood,
Research Associate in Charge.
C.F.Richter,
Assistant.

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TIME: At all these stations the minute-marks on the seismograms are coördinated directly by means of auxiliary records written at each station on which the minute-marks are registered closely parallel with recorded dot-and-dash radiotelegraphic signals sent in ordinary course from a powerful transmitting station. This permits direct correlation of the minute-marks at all the stations of the group at practically all times with an accuracy of one second, and usually of one-fifth second.

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Apparatus: horizontal-component torsion seismometers with magnetic damping and optical recording. (Cf.Bull.Seis.Soc.Am.,XV,1,1925).

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Experimental seismographs of various kinds are in process of development from time to time, and are used for intervals of variable duration. Information concerning these will be given when necessary.

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z	0.3 sec.	5,000	Critical
N — S	6 sec.	800	0.8-0.9
E — W	"	"	"

AUXILIARY STATIONS

Each of the auxiliary stations has equipment as follows:

Apparatus: two horizontal-component torsion seismometers with magnetic damping and optical recording;

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z			

The Station Constants follow.

Coördinates are geodetic positions referred to the North American Datum.

Mount Wilson Seismologic Station
$\Phi = 34° 13.5'$ N., $\lambda = 118° 03.4'$ W., h = 1742 m., Weathered granite.

Riverside Seismologic Station
$\Phi = 33° 59.6'$ N., $\lambda = 117° 22.4'$ W., h = 250 m. approx., Weathered granite.

Santa Barbara Seismologic Station
$\Phi = 34° 26.6'$ N., $\lambda = 119° 42.8'$ W., h = 100 m. approx., Heavy, boulder-laden alluvium.

La Jolla (Scripps Institution Seismologic Station)
$\Phi = 32° 51.8'$ N., $\lambda = 117° 15.2'$ W., h = 7.7 m. approx., Consolidated detrital material.

Tinemaha Seismologic Station
$\Phi = 37° 05.7'$ N., $\lambda = 118° 15.5'$ W., h = 1180 m. approx., Basalt.

Haiwee Seismologic Station
$\Phi = 36° 08.2'$ N., $\lambda = 117° 58.6'$ W., h = 1100 m. approx., Loosely cemented tuff.

SYMBOLS AND NOTATION: in general the symbols and notation conform with the usual international practice.

However, when measurements referring to **local** earthquakes are included P and S will be used without index or subscript, as no attempt will be made in these bulletins to distinguish between $\overline{P}$, P*, and P_n, although such complications are often clearly indicated and are the subject of study.

AMPLITUDES, (half-ranges), are measured in millimeters of the seismographic trace.

SPECIAL SYMBOLS indicating the stations of this coördinated group are as follows:

PASADENA SEISMOLOGICAL LABORATORY

For routine instruments of period 0.8 seconds . . . . . P
For routine instruments of period 6 seconds . . . . . P_6
For instruments of different period analogous notation will be employed.

Mount Wilson Seismologic Station . . . . . MW
Riverside Seismologic Station . . . . . R
Santa Barbara Seismologic Station . . . . . SB
La Jolla (Scripps Institution Seismologic Station) . . . . . LJ
Tinemaha Seismologic Station . . . . . T
Haiwee Seismologic Station . . . . . H

In general detailed measurements will be given only for the records of the Seismological Laboratory: those for records of the other stations will be given only to supplement the information.

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Sept 2	P6	ePNE	03	06	41					
	P	ePNEZ			41					Rarefaction
	MW	eNE			43					
Sept 2	P	ePNEZ	15	36	31					
		eSNEZ		38	08					
	SB	ePN		36	19					
		eSNE		37	46					
Sept 5	P	ePZ	10	01	44					
		eSNEZ		02	44					
	MW	ePNE		01	45					
		eSNE		03	41					
Sept 5	P	eSNEZ	10	15	39					Aftershock of above
	MW	eNE			35					
Sept 6	P	eN	08	12	18					
	MW	eNE			24					
Sept 9	P6	ePNE	13	42	35					U S C G S : 41°N 126°W
	P	ePNE			35					0 = 13:40.3
		ePZ			32					J S A : 40.5°N 126.5°W
		iPZ			35					0 = 13:40:16
		eSN		44	37					
		eE			59					Felt on coast of northern
	P6	eSN			39					California and southern
	PX	eP		42	32					Oregon.
		iP			35					
		i		44	59					
	MW	ePNE		42	37					
		eSNE		45	05					
	R	ePNE		42	42					
		eSN		44	50					
	SB	eN		42	32					
		eE			29					
	T	ePNE			11					
		eSNE		43	34					
	H	ePNE		42	20					
		eN		43	04					
Sept 9	P6	iPNE	20	50	44					
	P	iPNEZ			43					Rarefaction
	P6	iE		54	00					
	P	eEZ			00					U S C G S : 20°N 144°E
	P6	iSN	21	00	51					0 = 20:38.0
		iSE			47					J S A : 18.5°N 146°E
	P	iSN			51					0 = 20:37:56
		iSE			49					
		eSZ			55					
	P6	iE		02	01					
	MW	iPNE	20	50	45					
		iSNE	21	00	50					
	R	iPNE	20	50	46					
		iSNE	21	00	53					
	SB	ePNE	20	50	36					
		iSNE	21	00	42					
	T	iPNE	20	50	39					
		iSNE	21	00	45					
	H	iPNE	20	50	42					
		iSNE	21	00	48					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Sept 10	P	ePNEZ	04	36	20					Reported felt at Palm Springs and vicinity. Epicenter 34°3' No., 116°43' W. 0 - 04:35:56.6
Sept 11	P6	eN	23	19	31					
	P	eN			32					
	MW	eN			33					
	R	eNE			21					
	T	eE			08					
	H	eNE			28					
Sept 12	P	iPNEZ	01	54	50					Rarefaction
	MW	ePNE			51					
	R	ePN			55					
	T	iPNE			36					
	H	ePNE			42					
Sept 12	P6	eN	15	50	11					
	P	ePNEZ			11					
	MW	ePNE			11					
	R	eN			14					
	T	eNE			26					
	H	eE			18					
Sept 16	P6	eN	12	28	07					
	P	eNZ			07					
	PX	eZ			07					
		iZ		29	23					
	MW	eNE		28	05					
	R	eNE		27	48					
	T	eE		24	49					
		eE		28	38					
	H	eNE			12					
Sept 16	P6	ePNE	12	55	19					No surface waves.
		iSN	13	05	18					
	P	ePN	12	55	18					
		iPEZ			15					Compression
		eSN	13	05	18					
	MW	ePNE	12	55	16					
	R	eNE			36					
	SB	eN			05					
	T	ePE			07					
	H	ePNE			10					
Sept 21	P6	ePNE	02	32	09					Damage in Japan. U S C G S 36°N 140°E - 0 = 02:19.8 Compression
		eSN		42	07					
	P	ePNEZ		32	09					
		eSNE		42	07					
	MW	ePNE		32	09					
		eSNE		42	07					
	R	ePNE		32	11					
		eSN		42	13					
	SB	iPN		32	00					
	T	ePNE		31	58					
		eSNE		41	57					
	H	ePNE		32	02					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Sept 21	P6	eNE	13	47	40					New Zealand
		eSE		58	35					
		iSN			38					
	P	ePNEZ		47	37					Compression
		ePR1Z		51	21					
		eSN		58	37					
	MW	ePNE		47	37					
	R	ePNE			39					
		eNE		57	59					
		eSN		58	43					
		eN		59	58					
	SB	ePNE		47	34					
	T	ePE			46					
		eN			50					
		iE		58	09					
	H	ePE		47	45					
		eN			51					
		eN		58	53					
Sept 22	P	ePNEZ	09	41	52					Compression
	MW	ePNE			53					
	T	iPE			55					
Sept 24	P6	ePE	18	43	52					
	P	ePNEZ			52					Compression
	MW	ePE			53					
	R	ePNE			55					
	T	ePNE		44	02					
	H	ePNE			00					
Sept 25	P6	eNE	06	19	12					
		eN			21					Δ = 133° (14770 km.)
	PX	eZ			01					
		iZ			08					U S C G S :
	P	eP'NEZ			11					04°S 100°E approx.
	PX	iPR1Z		21	24					O = 05:59.6
	P6	ePcPcSE		22	35					
		ePcPcSN			39					
	P	ePcPcSNE			39					
		ePcPcSZ			32					
	PX	iPcPcSZ			29					
		eZ		23	59					
		eZ		26	11					
		eZ		28	10					
	P6	eE		31	40					
		eE		33	25					
	PX	eZ		34	37					
	P6	eLE	07	02	01	35				
	MW	eP'NE	06	19	13					
		ePcPcSE		22	29					
	R	eP'N		19	16					
		ePcPcSN		22	46					
	SB	eP'NE		19	10					
		ePcPcSN		22	36					
	T	eP'E		19	07					
		ePcPcSE		22	33					
	H	eP'E		19	06					
		ePcPcSE		22	30					

DATE	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Sept 26	P6	iPNE	19	56	45					Compression
	P	iPNEZ			45					USCGS: 12°N 91°W
	MW	ePNE			44					0 = 19:49.9
	R	ePNE			39					JSA :12.5°N 91°W
	T	ePE			59					0 = 19:49:59
	H	ePE			53					
		eN			56					
Sept 26	P6	iPNE	20	09	30					Compression
	P	ePNEZ			29					USCGS : 12°N 91°W
	MW	ePE			30					0 = 20:02.7
	R	ePNE			23					JSA : 12.5°N 91°W
	SB	eNE			45					0 = 20:02:37
	T	ePE			44					
	H	ePNE			39					
Sept 26	P	iPNEZ	21	01	42					Compression
	T	ePE			50					
	H	ePNE			49					
Sept 28	PX	eZ	17	37	54					
		eZ		41	17					
	T	eE		38	28					
	H	eN		41	28					
Sept 29	P	ePZ	02	33	07					
Sept 30	P6	ePN	05	46	08					
	P	iPNEZ			08					Compression
	MW	ePNE			08					
	R	ePNE			07					
	T	iPNE			19					
	H	ePN			12					
Sept 30	P	iPNEZ	15	47	23					Source near 32°N 115°W.
	LJ	iPNE			01					Felt at El Centro, San Diego, etc.
Oct 1	P6	ePN	11	46	44					
		iNE		47	12					
		iNE			15					
	P	ePNEZ		46	53					USCGS: 29.4°N 114.6°W,
		iNZ		47	12					0 = 11:45.4
		iE			17					
		iN		48	13					
		iE			10					
		iZ			17					
	MW	ePE		46	53					
		iE			14					
		iE		48	15					
	R	ePNE		46	49					
		iNE		47	00					
		iNE		48	00					
	LJ	ePE		46	35					
		iE			45					
		iE		47	34					
	T	eE			41					
		iE		48	04					
		eE		49	30					
		iE			41					
	H	ePN		47	05					
		eN			25					
		iN		48	55					

Harry O. Wood,
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SEISMOLOGICAL LABORATORY

CARNEGIE INSTITUTION OF WASHINGTON
CALIFORNIA INSTITUTE OF TECHNOLOGY

220 NORTH SAN RAFAEL AVENUE.
PASADENA, CALIFORNIA

BULLETIN

The SEISMOLOGICAL LABORATORY, Pasadena, California, is maintained and operated by the Carnegie Institution of Washington and the California Institute of Technology as a coöperative undertaking. This laboratory is the **central station** of a coördinated group. Auxiliary stations in southern California are maintained and operated as follows: At the Mount Wilson Observatory on Mount Wilson (a Department of the Carnegie Institution of Washington); at Riverside (in coöperation with the City of Riverside); at Santa Barbara (in coöperation with the Santa Barbara Museum of Natural History); at La Jolla (in coöperation with the Scripps Institution of Oceanography of the University of California); at Tinemaha, and at Haiwee, in the Owens Valley (in coöperation with the Department of Water and Power of the City of Los Angeles).

TIME: At all these stations the minute-marks on the seismograms are coördinated directly by means of auxiliary records written at each station on which the minute-marks are registered closely parallel with recorded dot-and-dash radiotelegraphic signals sent in ordinary course from a powerful transmitting station. This permits direct correlation of the minute-marks at all the stations of the group at practically all times with an accuracy of one second, and usually of one-fifth second.

The constants of these stations follow.

PASADENA SEISMOLOGICAL LABORATORY Central Station

$\Phi = 34° 08.9'$ N., $\lambda = 118° 10.3'$ W., h = 295 m., Deeply weathered granitic rock, with inclusions of gneiss and schist.

Apparatus: horizontal-component torsion seismometers with magnetic damping and optical recording. (Cf.Bull.Seis.Soc.Am.,XV,1,1925).

a vertical-component short-period seismometer with oil damping and galvanometric-optical recording.

The constants of the short-period instruments do not undergo any significant changes. The constants of the instruments of longer period will be given from time to time when deviations from the values given below are significant.

Experimental seismographs of various kinds are in process of development from time to time, and are used for intervals of variable duration. Information concerning these will be given when necessary.

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z	0.3 sec.	5,000	Critical
N — S	6 sec.	800	0.8-0.9
E — W	"	"	"

AUXILIARY STATIONS

Each of the auxiliary stations has equipment as follows:

Apparatus: two horizontal-component torsion seismometers with magnetic damping and optical recording;

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z			

The Station Constants follow.

Coördinates are geodetic positions referred to the North American Datum.

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$\Phi = 34° 13.5' N., \lambda = 118° 03.4' W., h = 1742$ m., Weathered granite.

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$\Phi = 33° 59.6' N., \lambda = 117° 22.4' W., h = 250$ m. approx., Weathered granite.

Santa Barbara Seismologic Station
$\Phi = 34° 26.6' N., \lambda = 119° 42.8' W., h = 100$ m. approx., Heavy, boulder-laden alluvium.

La Jolla (Scripps Institution Seismologic Station)
$\Phi = 32° 51.8' N., \lambda = 117° 15.2' W., h = 7.7$ m. approx., Consolidated detrital material.

Tinemaha Seismologic Station
$\Phi = 37° 05.7' N., \lambda = 118° 15.5' W., h = 1180$ m. approx., Basalt.

Haiwee Seismologic Station
$\Phi = 36° 08.2' N., \lambda = 117° 58.6' W., h = 1100$ m. approx., Loosely cemented tuff.

SYMBOLS AND NOTATION: in general the symbols and notation conform with the usual international practice.

However, when measurements referring to **local** earthquakes are included P and S will be used without index or subscript, as no attempt will be made in these bulletins to distinguish between $\overline{P}$, P*, and P_n, although such complications are often clearly indicated and are the subject of study.

AMPLITUDES, (half-ranges), are measured in millimeters of the seismographic trace.

SPECIAL SYMBOLS indicating the stations of this coördinated group are as follows:

PASADENA SEISMOLOGICAL LABORATORY

For routine instruments of period 0.8 seconds . . . . . P
For routine instruments of period 6 seconds . . . . . P_6
For instruments of different period analogous notation will be employed.

Mount Wilson Seismologic Station . . . . . MW
Riverside Seismologic Station . . . . . R
Santa Barbara Seismologic Station . . . . . SB
La Jolla (Scripps Institution Seismologic Station) . . . . . LJ
Tinemaha Seismologic Station . . . . . T
Haiwee Seismologic Station . . . . . H

In general detailed measurements will be given only for the records of the Seismological Laboratory: those for records of the other stations will be given only to supplement the information.

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm) N	E	Z	Remarks
Oct. 1 ff.		- Numerous small aftershocks of preceding,(Oct.1, 11:46).								
Oct. 3	P6	ePE	00	58	27					
	P	iPNEZ			27					Rarefaction
	MW	ePN			27					
	LJ	ePE			42					
	T	iE			11					
		eN			15					
	H	eN			17					
Oct. 3	P6	iPNE	19	26	09					USCGS : 14°S 160°E
		iE		29	08					0 = 19:12.8
		eN			51					JSA : 10°S 161.4°E
		eNE		31	57					0 = 19:13:10
		eSNE		36	59					Destructive in Solomon
		iN		49	30	46				Islands.(Note striking long
	P	ePZ		26	05					wave recorded
		iPNEZ			09					Compression at 19:49).
		ePRlEZ		29	39					
		iE		38	39					
		eE		43	23					
		eE		53	28	40				
	MW	ePN		26	09					
		eSN		36	56					
		eN		49	31	50				
	R	ePE		26	08					
		eNE			11					
		eSN		36	53					
		eN		49	49	52				
	SB	ePN		25	59					
		eE		26	03					
		eN		49	03	52				
	LJ	ePNE		26	09					
		iE			13					
		eSNE		38	13					
		iN			37					
		eN		49	25	50				
	T	ePE		26	12					
		iNE			16					
		eSN		37	01					
		eN		49	50	52				
	H	ePN		26	10					
		eSN		36	56					
		eN		49	50	52				
Oct. 3	P	eEZ	19	44	27					Rarefaction
	MW	eN			21					
	R	eN			37					
Oct. 3	P	eZ	19	50	36					Rarefaction
		eEZ			46					
	MW	eN			40					
	R	eNE			43					
	LJ	eNE			49					
	T	eE			42					
Oct. 3	P	eZ	19	59	27					Compression
	MW	eN			34					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Oct. 3	P	eZ	19	59	27					Compression
	MW	eN			34					
Oct. 3	P	eZ	20	06	43					Compression
	MW	eN			45					
	T	eE			48					
Oct. 3	P	eZ	20	33	37					Compression
	MW	eN			42					
	T	eE			41					
Oct. 3	P	eZ	20	59	19					Rarefaction
	MW	eN			20					
Oct. 3	P	eZ	21	03	12					Compression
	MW	eN			16					
	T	eE			18					
Oct. 3	P	eEZ	21	31	11					Rarefaction
	MW	eN			12					
	R	eNE			10					
	LJ	eNE			11					
	T	eE			15					
	H	eN			16					
Oct. 3	P	eZ	21	43	25					Compression
	MW	eN			28					
	T	eE			31					
Oct. 3	P	ePEZ	22	07	55					Rarefaction
	MW	eN			59					
	R	eN		08	08					
	T	eE			03					
Oct. 3	P6	ePNE	23	00	33					
		eE		10	46					
		eN		12	20					
		eLE		27	28	35				
	P	iPEZ		00	33					Rarefaction
	MW	eN			35					
	R	ePNE			29					
	T	ePNE			38					
		eE		11	28					
	H	ePN		00	38					
		eLN		28	--					
Oct. 3	P	eZ	23	17	56					Rarefaction
	MW	eN		18	00					
	H	eN			12					
Oct. 4	P	eZ	01	01	48					
	MW	eN			48					
Oct. 5	P6	eNE	07	20	22					
	P	eE			22					
	MW	eN			24					
	R	eNE			29					
	T	eNE			23					
	H	eN			24					
Oct. 5	P	ePNEZ	22	46	54					
	MW	eN			56					
	R	eE			57					
	T	eE		45	23					
		eE		46	51					
Oct. 6	P	ePNEZ	14	30	49					
	MW	eN			48					
	R	eNE			55					
	T	eNE			18					
	H	eN			30					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Oct.6	P	ePNEZ	17	15	22					
		eZ			31					
	MW	eN			44					
	R	ePNE			36					
	T	eE			31					
	H	eN			41					
Oct.6	PX	eZ	18	26	34					
	P	eZ			42					
	T	eN			41					
	H	eN			55					
Oct.8	PX	eZ	02	08	36					
	MW	eN			39					
	T	eE			40					
	H	eN			47					
Oct.8	P	iZ	23	35	29					Rarefaction
		eNEZ			39					
	MW	eN			33					
	T	eE			43					
	H	eN			29					
Oct. 9	P	iPNEZ	02	58	18					Compression
	MW	ePN			20					
	R	eE			20					
	T	ePE			22					
	H	eN			16					
Oct.9	P	iPNEZ	23	28	35					Origin near 32°N 115°W
	MW	iPN			36					
	R	ePNE			28					
	LJ	iPN			16					
	T	ePE		29	11					
	H	ePN			01					
Oct.10	P	iPNEZ	00	32	45					USCGS: 08°S 160°E
	PX	iZ		37	30					0 = 00:19.8
	P	eNE		43	23					J S A: 09.1°S 160.2°E
		eNE			45					0 = 00:19:53
		eNE		44	11					
		eLNE	01	01	48	30				
	MW	ePN	00	32	49					
	R	ePNE			49					
		eN		43	34					
		eE			16					
	SB	ePNE		32	43					
		eE		43	26					
	T	ePE		32	51					
		eE		44	37					
		eLE	01	01	44	24				
	H	ePN	00	32	50					
Oct.10	P	eNEZ	00	57	04					
		eN			11					
	MW	eN			11					
	R	eNE			14					
	SB	eNE			12					
	LJ	eE			13					
	T	ePE			13					
		eE			20					
		eE	01	08	51					
	H	eN	00	57	18					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Oct.10	P	eNEZ	01	21	12					
	MW	eN			14					
	R	eNE			12					
		eNE		31	54					
	SB	eN		21	11					
		eE		31	47					
	LJ	eE		21	15					
	T	eNE			20					
		eE		32	00					
	H	eN		21	14					
Oct.10	P	eZ	01	37	25					
		eNE			28					
	MW	eN			28					
	R	eNE			33					
	LJ	eE			44					
	T	ePNE			33					
	H	eN			33					
Oct.10	P	eNEZ	01	39	40					
	R	eNE			47					
	T	eE			43					
	H	eN			53					
Oct.10	P	ePNEZ	01	43	37					
	R	eNE			44					
	LJ	eE			43					
	T	eE			42					
	H	eN			45					
Oct.10	P	ePZ	01	51	51					
	R	eNE		52	14					
	LJ	eE			06					
	T	ePE			06					
		eE	02	02	52					
Oct.10	P	ePZ	01	56	50					
Oct.10	P	ePNEZ	02	04	29					
	T	eE			35					
	H	eN			36					
Oct.10	P	ePNZ	02	06	23					
	R	eNE			29					
	T	eE			24					
Oct.10	P	ePNEZ	02	24	55					
	LJ	eE		25	04					
	T	eE		24	59					
Oct.10	P	ePNEZ	02	29	39					
	R	eNE			51					
	LJ	eE			56					
	T	ePNE			44					
		eE		40	26					
Oct.10	P	ePNEZ	03	08	39					
	T	ePE			44					
		eE		19	29					
Oct.10	P	eNE	03	10	34					
	R	eNE			38					
	T	eE			25					
Oct.10	P	ePNEZ	04	07	33					
	T	eE			39					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Oct.10	P	ePNEZ	05	38	25					
	T	eE			29					
Oct.10	P	ePNEZ	07	13	10					
	T	ePE			14					
Oct.10	P	ePNEZ	07	22	26					
	T	eE			31					
Oct.10	P	ePNEZ	07	26	13					
	T	eE			18					
Oct.10	P	ePZ	16	47	31					
		eN			38					
	MW	eNE			37					
	R	eN			52					
	T	ePE			17					
	H	ePN			25					
Oct.11	P	ePZ	10	57	41					
Oct.12	P	ePNEZ	00	51	01					
	T	eE			06					
Oct.12	P6	ePNE	03	12	35					
	PX	ePZ			35					Compression
		eZ		16	52					
		eZ		24	50					
		eLZ		40	17	23				
	P	ePNEZ		12	35					
	MW	ePN			37					
	R	ePNE			38					
	LJ	eE			39					
	T	eNE			40					
Oct.12	P	ePNEZ	04	05	24					
	MW	ePN			24					
	R	ePNE			18					
	T	ePNE			39					
	H	ePN			30					
		eN		12	07					
Oct.12	P	eNZ	09	50	47					
	T	ePNE		51	01					
		eE		59	10					
Oct.12	P	ePNEZ	10	31	25					
	MW	ePN			28					
	R	eNE			28					
	T	eE			29					
Oct.12	P	ePNEZ	13	36	29					
	R	eNE			31					
	LJ	eE			30					
	T	ePE			27					
Oct.13	P	ePNEZ	04	47	18					
	P6	eLE	05	16	--	25				
	MW	ePN	04	47	21					
	T	ePE			21					
	H	eN			26					
Oct.13	P	eZ	11	29	13					
	T	ePE			18					
	H	eN			26					
Oct.13	P	eZ	19	26	19					
	T	ePE		27	04					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Oct.13	P	ePNZ	20	23	38					Compression
	MW	eN			42					
	R	eE			43					
	T	ePE			40					
	H	eN			46					
Oct.17	P	eNZ	12	41	34					Peculiar shock
		eNEZ			59					
	MW	eNE			58					
	R	eN			36					
		eNE		42	02					
	LJ	eE		41	57					
		eE		42	16					
	T	eE		41	13					
		eN			39					
	H	eNE			19					
		eN			47					
Oct.17	P	ePNEZ	15	46	03					No surface waves
	MW	ePNE			04					
	R	eN			04					
	SB	ePNE		45	58					
	LJ	ePE		46	12					
	T	ePNE		45	56					
		eSE		56	03					
	H	ePNE		45	58					
		eSNE		56	04					
Oct.18	P	iPNEZ	04	42	15					Compression
	PX	iZ			19					
		iZ		44	04					No surface waves
	P6	eNE			05					
		iSE		51	51					
		iN		52	12					
	MW	ePNE		42	17					
		eNE		44	09					
		iSNE		51	58					
		iN		52	14					
	R	ePNE		42	17					
		eSE		51	55					
		eSN			59					
		iN		52	10					
	LJ	ePN		42	17					
		eN			19					
		eN		44	05					
		eSN		52	00					
	T	ePNE		42	25					
		eSE		52	04					
		eNE			24					
	H	ePNE		42	23					
		eSN		52	01					
		iNE			19					
Oct.23	P	iPNEZ	11	58	13					
	MW	ePNE			14					
	T	ePNE			20					
	H	ePE			18					

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Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Oct.23	P	iPNEZ	18	59	13					Rarefaction
	MW	ePNE			13					
	R	eN			12					
	T	ePNE			20					
	H	ePE			20					
Oct.23	P	iPNEZ	20	19	30					Compression
	MW	ePNE			32					
	R	ePNE			33					
	LJ	iPNE			33					
	T	iPNE			35					
	H	ePE			36					
Oct.24	P	ePNEZ	17	41	08					
	MW	eE			07					
	R	eN			11					
	T	ePNE			20					
	H	ePE			17					
Oct.26	PX	ePZ	04	28	29					USCGS : 20°N 107°W
	P	ePR1E			37					0 - 04:24.6
		eE		31	11					J S A : 21.5°N 108°W
	MW	ePNE		28	40					0 - 04:24:47
	R	ePNE			30					
	T	ePNE			58					
	H	ePE			48					
Oct.27	P	eZ	00	03	56					
	T	eNE		04	14					
	H	eE			16					
Oct.29	P	iPNEZ	08	51	03					Rarefaction
		iSN	09	01	37					No surface waves
	MW	iPNE	08	51	04					
	R	iPNE			05					
	SB	iPNE		50	54					
	T	iPNE		51	00					
	H	iPE			01					
Oct.30	P	ePNEZ	08	51	58					
		iSN	09	02	36					
	T	ePE	08	51	57					
	H	eNE			57					

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SEISMOLOGICAL LABORATORY

CARNEGIE INSTITUTION OF WASHINGTON
CALIFORNIA INSTITUTE OF TECHNOLOGY

220 NORTH SAN RAFAEL AVENUE,
PASADENA, CALIFORNIA

BULLETIN

The SEISMOLOGICAL LABORATORY, Pasadena, California, is maintained and operated by the Carnegie Institution of Washington and the California Institute of Technology as a coöperative undertaking. This laboratory is the **central station** of a coördinated group. Auxiliary stations in southern California are maintained and operated as follows: At the Mount Wilson Observatory on Mount Wilson (a Department of the Carnegie Institution of Washington); at Riverside (in coöperation with the City of Riverside); at Santa Barbara (in coöperation with the Santa Barbara Museum of Natural History); at La Jolla (in coöperation with the Scripps Institution of Oceanography of the University of California); at Tinemaha, and at Haiwee, in the Owens Valley (in coöperation with the Department of Water and Power of the City of Los Angeles).

TIME: At all these stations the minute-marks on the seismograms are coördinated directly by means of auxiliary records written at each station on which the minute-marks are registered closely parallel with recorded dot-and-dash radiotelegraphic signals sent in ordinary course from a powerful transmitting station. This permits direct correlation of the minute-marks at all the stations of the group at practically all times with an accuracy of one second, and usually of one-fifth second.

The constants of these stations follow.

PASADENA SEISMOLOGICAL LABORATORY Central Station

$\Phi = 34° 08.9'$ N., $\lambda = 118° 10.3'$ W., h = 295 m., Deeply weathered granitic rock, with inclusions of gneiss and schist.

Apparatus: horizontal-component torsion seismometers with magnetic damping and optical recording. (Cf.Bull.Seis.Soc.Am.,XV,1,1925).

a vertical-component short-period seismometer with oil damping and galvanometric-optical recording.

The constants of the short-period instruments do not undergo any significant changes. The constants of the instruments of longer period will be given from time to time when deviations from the values given below are significant.

Experimental seismographs of various kinds are in process of development from time to time, and are used for intervals of variable duration. Information concerning these will be given when necessary.

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z	0.3 sec.	5,000	Critical
N — S	6 sec.	800	0.8-0.9
E — W	"	"	"

AUXILIARY STATIONS

Each of the auxiliary stations has equipment as follows:

Apparatus: two horizontal-component torsion seismometers with magnetic damping and optical recording;

Instruments, and Constants (approximate).

	T_o	V	h
N — S	0.8 sec.	2,800	0.8-0.9
E — W	"	"	"
Z			

The Station Constants follow.

Coördinates are geodetic positions referred to the North American Datum.

Mount Wilson Seismologic Station
$\Phi = 34° 13.5' N., \lambda = 118° 03.4' W., h = 1742$ m., Weathered granite.

Riverside Seismologic Station
$\Phi = 33° 59.6' N., \lambda = 117° 22.4' W., h = 250$ m. approx., Weathered granite.

Santa Barbara Seismologic Station
$\Phi = 34° 26.6' N., \lambda = 119° 42.8' W., h = 100$ m. approx., Heavy, boulder-laden alluvium.

La Jolla (Scripps Institution Seismologic Station)
$\Phi = 32° 51.8' N., \lambda = 117° 15.2' W., h = 7.7$ m. approx., Consolidated detrital material.

Tinemaha Seismologic Station
$\Phi = 37° 05.7' N., \lambda = 118° 15.5' W., h = 1180$ m. approx., Basalt.

Haiwee Seismologic Station
$\Phi = 36° 08.2' N., \lambda = 117° 58.6' W., h = 1100$ m. approx., Loosely cemented tuff.

SYMBOLS AND NOTATION: in general the symbols and notation conform with the usual international practice.

However, when measurements referring to **local** earthquakes are included P and S will be used without index or subscript, as no attempt will be made in these bulletins to distinguish between $\overline{P}$, P*, and P_n, although such complications are often clearly indicated and are the subject of study.

AMPLITUDES, (half-ranges), are measured in millimeters of the seismographic trace.

SPECIAL SYMBOLS indicating the stations of this coördinated group are as follows:

PASADENA SEISMOLOGICAL LABORATORY

For routine instruments of period 0.8 seconds . . . . . P
For routine instruments of period 6 seconds . . . . . P_6
For instruments of different period analogous notation will be employed.

Mount Wilson Seismologic Station . . . . . MW
Riverside Seismologic Station . . . . . R
Santa Barbara Seismologic Station . . . . . SB
La Jolla (Scripps Institution Seismologic Station) . . . . . LJ
Tinemaha Seismologic Station . . . . . T
Haiwee Seismologic Station . . . . . H

In general detailed measurements will be given only for the records of the Seismological Laboratory: those for records of the other stations will be given only to supplement the information.

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Nov. 1	P	ePNZ	19	05	52					
		iSN		16	36					
	T	ePNE		05	51					
	H	ePE			57					
Nov. 2	P	iPNEZ	00	37	40					USCGS : 15°N 96°W
	P6	eSNE		42	13					0 = 00:31.8
	MW	ePNE		37	41					J S A : 15.7°N 96.2°W
		eSE		42	17					0 = 00:31:51
	R	ePNE		37	37					
		eSN		42	07					
	SB	eN		37	52					
	T	ePNE		38	01					
	H	ePE		37	56					
Nov. 2	P	iPNZ	08	46	37					Rarefaction
	MW	ePNE			37					
	T	ePNE			50					
	H	ePE			48					
Nov. 2	PX	iPZ	10	15	44					Compression
	P6	ePE			44					
		eN			47					Damage in Southern Japan
		eSE		26	14					
		eSN			21					J S A : 32°N 132°E approx.
		eN			24					0 = 10:03:01 approx.
	P	eSNE			20					
	MW	ePE		15	47					
		eN			53					
		eSNE		26	23					
	R	ePNE		15	48					
		eSN		26	22					
		eE			30					
	SB	ePNE		15	39					
		eSNE		26	08					
	T	ePNE		15	36					
		eSE		26	05					
		eSN			09					
	H	ePE		15	43					
		eSE		26	13					
Nov. 2	P	eZ	11	13	19					
		eN			28					
	T	eNE			13					
	H	eE			19					
Nov. 2	P	iPZ	17	16	43					Compression
		eNE			46					
	P6	eE		27	21					
		eLE		50	11					
	MW	eE		16	45					
	SB	eN			49					
	T	eNE		16	47					
	H	eE			45					
Nov. 2	P	ePZ	22	41	13					
		eN			16					
	MW	eE			15					
	T	eNE			22					
	H	eE			34					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Nov. 3	P	iPNEZ	02	48	21					
		eSN		58	37					Rarefaction
		eSE			45					
	MW	ePNE		48	23					
	R	ePNE			24					
		eSN		58	49					
	SB	ePNE		48	16					
	T	iPNE			33					
	H	iPE			19					
		eSE		58	32					
Nov. 3	P	ePZ	16	31	46					
	T	ePE			37					
	H	eE			39					
Nov. 4	P	iPEZ	18	04	00					
	MW	ePE			00					
	T	ePNE		03	48					
	H	ePE			54					
Nov. 5	P	iPNEZ	07	09	31					
	MW	ePNE			31					Compression
	R	eNE			26					
	SB	ePN			41					
	T	ePNE			37					
	H	ePE			34					
Nov. 5	P	ePNEZ	07	33	55					
	MW	ePNE			58					
	T	ePNE		34	00					
	H	eE			11					
Nov. 5	P	iPNEZ	12	33	00					
	T	ePE		32	49					Rarefaction
		eN			54					
		eSNE		43	24					
	H	eE		32	54					
Nov. 6	P	eZ	21	14	54					
	T	eE		15	04					
	H	eE			06					
Nov. 8	P	ePNEZ	18	56	08					
	MW	eN			10					
Nov.11	T	eE	08	47	14					
	H	eE			14					
Nov.14	P	ePNEZ	13	55	28					
	MW	ePNE			30					
	T	ePE		56	02					
	H	ePE		55	44					
Nov.18	P	ePNEZ	03	44	02					
	R	eN			11					
	T	ePE			04					
	H	eE			11					

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Nov.20	P	iPNEZ	14	29	19					USCGS: Solomon Islands,
		eNE		40	01					0 - 14:16.8
	P6	eLE		56	32	30				
	MW	ePN		29	21					JSA: 08°S 161°E
		eN		40	06					0 - 14:16:40 approx.
	R	iPNE		29	24					
		eE		39	54					
	SB	eN		29	05					
	T	ePNE			24					
		eE		39	53					
		iN		40	08					
	H	iPNE		29	22					
		eNE		40	06					
		eE			54					
Nov.23	P	iPEZ	13	57	53					
		eN			56					
	T	eN			48					
Nov.28	P	ePNEZ	03	09	11					
	T	ePNE			30					
Nov.28	P	ePNEZ	14	14	47					
	MW	eN			48					
	T	ePNE			21					
		eN		15	42					
Dec. 4	P	eNZ	05	11	24					

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No. 47 PASADENA and auxiliary stations 1931

Date	Station	Phase	G. C. T. h	m	s	Period (sec.)	A (mm.) N	E	Z	Remarks
Dec. 6	P	ePZ	04	18	28					
	MW	eE			34					
	T	eNE			36					
Dec.20	P	eNE	15	06	39					
	PX	iZ			38					
	MW	eNE			38					
	T	eNE			54					
	H	eE			49					
Dec.27	PX	eZ	00	56	36					
	T	eE			22					
	H	eE			29					
Dec.31	P	eZ	02	29	26					
	T	ePNE			11					
	H	eNE			21					

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