International Seismological Centre

COMMONWEALTH OF THE PHILIPPINES
DEPARTMENT OF AGRICULTURE AND COMMERCE

WEATHER BUREAU

MANILA CENTRAL OBSERVATORY

SEISMOLOGICAL BULLETIN FOR 1939
JANUARY–JUNE

By REV. WILLIAM C. REPETTI, S. J.
CHIEF OF THE SEISMIC AND MAGNETIC DIVISION

PREPARED UNDER THE DIRECTION OF

REV. MIGUEL SELGA, S. J.
DIRECTOR OF THE WEATHER BUREAU

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INTRODUCTION

SEISMIC STATIONS

The following is the list and data of stations equipped with seismographs.

Name	Islands	North latitude	East longitude	Elevation	Equipment	Substructure
		° ′	° ′	*m.*		
Manila	Luzon	14 35	120 59	3.0	Galitzin-Wilip, 3 components. Wiechert inverted pendulums, 955 kg. Two horizontal pendulums, 118 kg. each.	Alluvium and pyroclastics to unknown depth.
Baguio	do	16 25	120 35	1,512	Vicentini vertical. Wiechert inverted pendulum, 200 kg.	Limestone.
Ambulong	do	14 05	121 03	10.5	Wiechert inverted pendulum, 200 kg.	Soil underlaid by tuff.
Butuan	Mindanao	8 56	125 32	2.0	Wiechert inverted pendulum, 200 kg.	Alluvium.
Agana	Guam	13 28	144 45	5.0	do	Coral.

All meteorological stations, official and coöperative, have instructions to report all perceptible earthquakes.

NEW SEISMOGRAPH

After the eruption of Taal Volcano in 1911 an observatory was constructed at Ambulong, 11.5 kilometers from the crater and at the northeast corner of Lake Taal, and a Vicentini, 3-component, seismograph was installed. This remained in continuous operation until January of this year, 1939. It was then dismantled and removed and on February 9, 1939, a Wiechert Inverted Pendulum, 200 kilograms, was put into service. It has given satisfactory results and the only local disturbance is the pounding of rice at nearby houses which is done for a short time each day.

With the exception of a few jets of steam the volcano appears to be dormant.

SEISMIC RECORDS

The instrumental record is that obtained from the seismographs in the Manila Observatory. It is that of the Galitzin-Wilip instruments except when stated otherwise.

The time of occurrence given in the macroseismic records is that indicated by the seismographs of the Manila Observatory whenever the disturbance has been recorded by them. This fact is denoted by an asterisk in the macroseismic record. Otherwise the time is that given by the meteorological observer who reports the earthquake. Greenwich mean time is given and insular time is added in brackets.

Intensity is given according to the Rossi-Forel scale as adapted by Rev. W. C. Repetti, S. J., Chief of the Seismic Division, for use in the Philippine Islands.

ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITIES (Adapted)

I. *Microseismic shock.*—Felt only by an experienced observer under favorable conditions.
II. *Extremely feeble shock.*—Felt by a small number of persons at rest.
III. *Very feeble shock.*—Felt by several persons at rest. Duration and direction may be perceptible. Sometimes dizziness or nausea experienced.
IV. *Feeble shock.*—Felt generally indoors; outdoors by a few. Hanging objects swing slightly. Creaking of frames of houses.
V. *Shock of moderate intensity.*—Felt generally by everyone. Hanging objects swing freely. Overturn of tall vases and unstable objects. Light sleepers awakened.

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VI. *Fairly strong shock.*—General awakening of those asleep. Some frightened persons leave their houses. Stopping of pendulum clocks. Oscillation of hanging lamps. Slight damage in very old or poorly built structures.

VII. *Strong shock.*—Overturn of movable objects. General alarm, all run outdoors. Damage *slight* in well-built houses, *considerable* in old or poorly built structures, old walls, etc. Some landslides from hills and steep banks. Cracks in road surfaces.

VIII. *Very strong shock.*—People panicky. Trees shaken strongly. Changes in flow of springs and wells. Sand and mud ejected from fissures in soft ground. Small landslides. Slides in river banks.

IX. *Extremely strong shock.*—Panic general. Partial or total destruction of some buildings. Fissures in ground. Landslides and rock falls.

SYMBOLS AND ABBREVIATIONS

P	Normal first preliminary tremors; longitudinal waves which have passed below the continental layer.
$\bar{P}$	Upper first preliminary tremors whose path lies wholly in the continental layer.
P′	Longitudinal waves that have traversed the earth's core.
PPn	Longitudinal waves reflected "n" times at the earth's surface.
PcP	Longitudinal waves reflected from the outer surface of the earth's core.
S	Normal second preliminary tremors; transverse waves that have passed below the continental layer.
$\bar{S}$	Second preliminary tremors whose path lies entirely in the continental layer.
PS	Waves transformed from longitudinal to transverse oscillations or vice versa through one reflection at the earth's crust.
$\underline{SS}$	Normal transverse waves reflected "n" times at the earth's surface.
ScS	Normal transverse waves reflected from the outer surface of the earth's core.
SKP	Waves which start with transverse vibrations but on refraction into the core are changed to longitudinal, or starting as longitudinal are refracted out as transverse.
L	Long waves of irregular form at the beginning of the surface or main phase.
M	Shorter and more regular waves of large amplitude in the surface group which travel more slowly that the L waves.
Mn	Individual waves of relatively large amplitude in the surface phase and usually in the M group.
F	Finis. End discernible movement.
i	Impetus. Impulsive and sharply defined beginning of a phase.
e	Emersio. Poorly defined emergency of a phase.
m	Maximum wave in any phase.
T	Period of waves.
O	Time of earthquake at the epicenter.
H	Time of earthquake at focus.
h	Focal depth.
Δ	Arcual distance from station to epicenter.
To	Free or undamped period of the seismograph.
V	Static magnification.
ϵ	Ratio of successive damped amplitudes.
r	Friction constant.
J. S. A.	Jesuit Seismological Association. Central Office at St. Louis University, St. Louis, Missouri, U. S. A.
U. S. C. G. S.	United States Coast and Geodetic Survey, Washington, D. C., U. S. A.
C. M. O.	Central Meteorological Observatory, Tokyo, Japan.

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CONSTANTS OF THE WIECHERT INVERTED PENDULUM

1939	N–S component				E–W component			
	T_o	V	ϵ	$\frac{r}{T_o^2}$	T_o	V	ϵ	$\frac{r}{T_o^2}$
January	4.2	213	2.5	0.092	4.2	270	2.8	0.083
February	4.2	208	2.5	0.093	4.3	250	2.6	0.079
March	4.3	199	2.5	0.082	4.1	278	2.7	0.074
April	4.3	198	2.5	0.086	4.1	274	2.7	0.083
May	4.3	197	2.6	0.087	4.1	275	2.6	0.067
June	4.3	207	2.6	0.069	4.0	271	2.6	0.074

CONSTANTS OF THE GALITZIN-WILIP SEISMOMETERS

	T_1	T
N–S	12.6s	12.9s
E–W	11.9s	11.9s
Z	11.6s	9.0s

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SEISMOLOGICAL BULLETIN FOR 1939

JANUARY, 1939

MACROSEISMIC RECORD

5, 3h 24m 08s* [5, 11:24:08 A. M.] **Luzon.** Center of earthquake in the China Sea; felt throughout the western part of central Luzon. Intensity IV in Iba, Corregidor, and Manila.

5, 3h 54m 07s [5, 1:54:07 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

11, ---------- **Pilar, Abra.** Earthquake felt during the night.

15, 7h 00m [15, 3:00 P. M.] **Kaatoan, Bukidnon.** Earthquake felt.

16, 2h 18m 52s* [16, 12:18:52 P. M.] **Agaña, Guam.** Recorded and felt. Also felt by persons in the Yigo district, about 13 miles east of Agaña. Center in the Nero Deep.

16, 11h 00m [16, 7:00 P. M.] **Bukidnon, Mindanao.** Earthquake felt at Kaatoan and Impalutao.

17, 23h 14m [18, 7:14 A. M.] **Kaatoan, Bukidnon.** Earthquake felt.

18, 11h 03m [18, 7:03 P. M.] **Mindanao, Jolo, and Negros.** Center in the Sulu Sea. Felt sharply with intensity III in Zamboanga. Vertical motion felt in Jolo. Felt very lightly at Hacienda Asia in Negros. Felt in Basilan.

19, 21h 00m [20, 5:00 A. M.] **Barlig, Mountain.** Slight earthquake.

20, 13h 27m 02s* [20, 9:27:02 P. M.] **Samar and Leyte.** Center in the Pacific. Intensity IV at Guiuan. Slight at Oras and Borongan, Samar, and Tacloban, Leyte.

22, 9h 24m 18s* [22, 5:24:18 P. M.] **Palanan, Isabela.** Extremely feeble shock of five seconds duration.

23, 1h 10m [23, 9:10 A. M.] **Claveria, Cagayan.** Slight earthquake.

25, 7h 10m [25, 3:10 P. M.] **Ilagan, Isabela.** Earthquake of intensity II, N–S.

28, 16h 03m [29, 0:03 A. M.] **Port Lamon, Surigao.** Earthquake of intensity II, NE–SW.

29, 00h 37m 44s* [29, 8:37:44 A. M.] **Mindoro and Luzon.** Felt slightly at San Teodoro, Mindoro, and at Manila. Other light shocks were felt at San Teodoro at 8:43, 8:53, 10:09, and 10:32 A. M. A shock at 10:40 A. M. was also felt in Manila. Light shocks at San Teodoro at 10:57 A. M. and 1:12, 1:33, 1:54, 2:00, 2:18, 3:20, 10:50, and 11:01 P. M. Also at 4:58 A. M. on the 30th. Two shocks felt at Look, Mindoro on the 29th, time not given.

29, 10h 23m 10s [29, 8:23:10 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

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INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
3	3	PNEZ	23	15	11	1,420	
		SNE		17	39	----------	
		F		45		----------	
4	5	$\overline{\text{i}}$PNEZ	3	24	08	135	Dilatation. Felt in W. Luzon. 15° 05′N: 119° 45′E, by Manila and
		$\overline{\text{S}}$NE			25	----------	Baguio. $\overline{\text{S}}$ from the Wiechert and Horizontal.
		F	4	15		----------	
8	9	ePNE	3	10	32	2,755	
		SNEZ		14	48	----------	
		F		31		----------	
16	16	iPZ	2	18	52	2,780	Guam, 130 km. In the Nero Deep. Felt in Guam.
		iPN			56	----------	
		SNE		23	19	----------	
		LNE		26	15ca	----------	
		F	3	40		----------	
17	20	PNEZ	12	12	42	250	
		$\overline{\text{S}}$NEZ		13	18	----------	
		F		19		----------	
18	20	ePNEZ	13	27	02	830	Felt in Samar and Leyte.
		SNE		28	33	----------	
		F		37		----------	
19	20	ePNEZ	20	59	45	----------	13°N: 91.5°W, by U. S. C. G.S. 13°N: 89.5°W, by J. S. A.
		iNE	21	04	47	----------	
		F	22	20		----------	
20	22	ePNE	4	48	15	5,555	
		SNE		55	23	----------	
		LNE	5	04	ca	----------	
		ME		08	ca	----------	
		F		50		----------	
21	22	ePNEZ	9	24	18	280	Felt at Palanan, NE. Luzon.
		$\overline{\text{i}}$SNE			58	----------	
		F		35		----------	
22	22	PNEZ	11	14	54	2,310	
		SNE		18	39	----------	
		F		55		----------	
23	22	ePNEZ	13	38	37	4,680	5°S: 157°E, by Wellington.
		SNE		44	54	----------	
		F	15	37		----------	
24	22	iPZ	18	48	18	4,690	
		ePE			18	----------	
		SNE		54	36	----------	
		F	19	45		----------	
25	24	ePNEZ	4	08	20	2,645	
		SE		12	28	----------	
		F		32		----------	
26	25	iP$_1$′Z	3	52	05	17,200	Dilatation from SE. 37°S: 73°W; H= 3:32:16, by U. S. C. G. S. 36.4°S:
		eP$_1$′NE			05	----------	72.1°W, by J. S. A. h= 100 km.
		F	7	55		----------	
27	25	PNEZ	10	38	02	1,690	
		SNE		40	57	----------	
		F		57		----------	
28	25	PNEZ	17	26	17	3,600	
		SE		31	28	----------	
		LNE		35	20ca	----------	
		ME		38	10ca	----------	
		F	18	30		----------	
32	26	PNEZ	10	36	57	2,435	
		SNE		40	50	----------	
		LNE		43	10ca	----------	
		F	11	33		----------	
33	26	ePNEZ	17	31	14	2,745	
		SNE		35	29	----------	
		LNE		38	25ca	----------	
		F	18	30		----------	
35	27	iPZ	5	49	02	3,955	Dilatation.
		SE		54	35	----------	
		LE		59	15ca	----------	
		F	6	35		----------	
36	27	ePNEZ	10	44	08	3,765?	
		S?NE		49	30	----------	
		F	11	39		----------	

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INSTRUMENTAL RECORD—Continued.

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
41	29	$\overline{P}$NEZ	0 43 18	145	Felt at Mindoro.
		$\overline{S}$NE	36		
		F	48		
42	29	$\overline{P}$NEZ	0 53 06	145	Do.
		$\overline{S}$NE	24		
		F	56		
45	29	i$\overline{P}$Z	2 40 18	150	Dilatation. Slightly felt in Manila and strongly at San Teodoro, Mindoro.
		e$\overline{P}$NE	18		
		$\overline{S}$NE	37		
		F	3 04		
47	29	$\overline{P}$NEZ	5 12 26	160	Felt in Mindoro.
		$\overline{S}$NEZ	46		
		F	23		
48	29	$\overline{P}$NEZ	5 32 32	150	Do.
		$\overline{S}$NEZ	51		
		F	41		
55	29	ePNE	15 31 57	4,055?	
		S?NE	37 37		
		F	16 06		
58	30	iPNEZ	2 26 05	4,335	Compression. 6°S: 155°E, by Manila, Apia, and Honolulu. Data after P from the Wiechert. 7°S: 155°E, by U. S. C. G. S. 6°S: 155.8°E, by J. S. A. Felt strongly in New Guinea.
		SNE	32 13		
		LNE	37 45ca		
		MN	41 05ca		
		F	5 00		
59	30	PEZ	5 31 27	4,590	S from the Wiechert.
		SN	37 39		
		F	7 20		
61	30	PNEZ	12 35 20	2,465	
		SNE	39 15		
		F	13 18		
62	30	iPZ	23 56 44	3,520	Compression? 10°S: 145°E, by Wellington.
		ePNE	44		
	31	SNE	0 02		
		F	2 00		
63	31	$\overline{P}$NEZ	2 39 03	120	
		$\overline{S}$NE	18		
		F	45		
64	31	PNEZ	4 21 49	4,520	
		SE	27 57		
		F	5 05		

Thirty-two insignificant or undecipherable disturbances on the following days of January: 2nd, 3rd, 5th(2), 8th, 10th(3), 12th, 14th, 15th(2), 25th, 26th(3), 27th, 28th(2), 29th(12), and 30th.

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FEBRUARY, 1939

MACROSEISMIC RECORD

1, 7h 30m 23s* [1, 3:30:23 P. M.] **S Luzon and N Mindoro.** Center in Verde Island Passage. Felt strongly at Halcon Rubber Station, Mindoro. Intensity IV in Batangas with duration of fifteen seconds. Light at Boac, Atimonan, and Santa Cruz.

2, 6h 12m [2, 2:12 P. M.] **NW Luzon.** Light earthquake at Laoag, Batac, Piddig, Bangui, and Cape Bojeador.

4, 11h 36m 36s* [4, 7:36:36 P. M.] **Davao, Davao.** Earthquake of intensity II.

7, 1h 21m [7, 9:21 A. M.] **Dagupan, Pangasinan.** Extremely feeble oscillatory shock.

8, 19h 30m [9, 3:30 A. M.] **Batac, Ilocos Norte.** Slight earthquake.

9, 12h 30m [9, 8:30 P. M.] **Bulusan, Sorsogon.** Light earthquake.

10, 2h 15m [10, 10:15 A. M.] **Ambuklao, Benguet.** Strong earthquake.

10, 15h 45m [10, 11:45 P. M.] **Bangui, Ilocos Norte.** Light earthquake.

11, 0h 49m 36s [11, 10:49:36 A. M.] **Agaña,** Guam. Earthquake recorded and felt. Other shocks at 3:49 and 5:13 A. M. on the 12th.

15, 11h 42m [15, 7:42 P. M.] **Calbayog, Samar.** Earthquake of intensity VI with vertical motion. Duration, 15 seconds.

20, 13h 31m [20, 9:31 P. M.] **Borongan, Samar.** Oscillatory earthquake of intensity III and five seconds duration.

21, 13h 18m [21, 9:18 P. M.] **Claveria, Cagayan.** Light earthquake.

24, 2h 56m 18s* [24, 10:56:18 A. M.] **Daet, Camarines Norte.** Oscillatory earthquake of intensity III and five seconds duration.

24, 4h 40m [24, 12:40 P. M.] **Bangui, Ilocos Norte.** Light earthquake.

24, 13h 18m [24, 9:18 P. M.] **Davao, Davao.** Light earthquake.

27, 13h 00m [27, 9:00 P. M.] **Pamplona, Cagayan.** Light earthquake.

27, 15h 55m [27, 11:55 P. M.] **Bangui, Ilocos Norte.** Light earthquake.

27, 17h 15m [28, 1:15 A. M.] **Bobon, Samar.** Light earthquake.

28, 18h 10m [March 1, 2:10 A. M.] **Port Lamon, Surigao.** Earthquake of intensity III and three seconds duration.

28, 19h 01m 59s* [March 1, 3:01:59 A. M.] **Cataingan, Masbate.** Strong earthquake of three seconds duration. Slight damage in stores.

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INSTRUMENTAL RECORD

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
65	1	iPNEZ	1 44 24	2,665	Compression?
		iSNE	48 34		
		LNE	51 ca		
		MN	53 15ca		
		F	2 45		
66	1	iPNEZ	7 30 23	120	Compression? Felt in southern Luzon and northern Mindoro.
		SNEZ	38		
		F	8 03		
68	2	iPZ	7 11 48	1,545	Compression.
		SNE	14 29		
		LN	16 10ca		
		MNE	17 20ca		
		F	8 40		
71	2	PNEZ	23 24 32	4,620	
		SNE	30 46		
		MN	40 20ca		
	3	F	0 27		
72	3	iPNZ	5 34 39	4,655	Dilatation. 9°S: 159°E, by U. S. C. G. S. 10.5°: 159.4°E, by J. S. A. (Tentative).
		SNE	41 05		
		F	8 50		
74	3	iPNZ	20 24 47	9,055	Compression?
		SNE	35 00		
		F	21 30		
77	4	iPZ	5 27 42	5,310	9°S: 156°E, by Wellington.
		SNE	34 36		
		F	7 20		
79	4	iPZ	11 36 36	1,100	Felt at Davao.
		SNE	38 30		
		F	12 48		
83	7	ePNZ	4 14 43	3,290	
		SNE	19 34		
		LNE	22 45ca		
		F	5 08		
89	9	ePNZ	11 50 54	3,645	
		SNE	56 08		
		LNE	12 00 05ca		
		MN	02 50ca		
		F	30		
92	11	ePZ	18 40 50	850	
		SNEZ	42 22		
		F	19 38		
95	16	ePNEZ	18 57 22	4,520	
		SNE	19 03 30		
		MNE	11 ca		
		F	20 15		
97	17	ePNEZ	13 55 27?	510	No time marks on Galitzin records.
		SNEZ	56 27?		
		F	14 13		
98	17	ePEZ	19 46 36	3,665	
		SN	51 51		
		F	20 42		
99	17	ePNEZ	23 16 16	1,465	
		SNE	18 48		
		F	56		
103	20	PZ	2 45 55	1,800	
		SNE	48 59		
		F	3 17		
104	20	iPZ	3 53 10	4,680	Dilatation. 9°S: 156°E, by Wellington.
		ePNE	10		
		SE	59 27		
		ME	4 09 05ca		
		F	5 20		
106	23	ePNEZ	10 12 24	3,135	Dilatation (?).
		iSE	17 05		
		LN	20 ca		
		F	11 36		
107	23	PNE	15 54 49	3,235	
		SN	59 36		
		F	16 45		

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INSTRUMENTAL RECORD—Continued.

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
111	24	ePNEZ	14	26	48	8,165	Region of 53.2°N: 159.3°W; H=14:16:00; h= 100 km., J. S. A.
		iZ		27	04		
		SNE		36	25		
		F	15	30			
112	26	iPEZ	10	00	28	2,765	Compression?
		SN		04	44		
		LN		07	20ca		
113	26	iPZ	10	33	41	2,745	Compression.
		SNE		37	56		
		LNE		40	40ca		
		MNE		42	50ca		
		F	12	50			
114	28	iPEZ	2	42	51	4,120	Compression. Felt strongly in New Britain.
		SNE		48	35		
		LN		53	40ca		
		MN		56	45		
115	28	PNEZ	3	53	27	2,365	
		SNE		57	16		
		F	5	05			
116	28	PNE	19	01	59	360	
		SNE		02	45		
		F		16			

Twenty-seven insignificant or undecipherable disturbances on the following days of February: 1st, 2nd(2), 3rd, 4th(4), 5th, 6th, 7th(2), 8th(2), 9th(2), 10th, 13th(2), 17th, 18th(3), 20th, and 24th(3).

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MARCH, 1939

MACROSEISMIC RECORD

1, $0^h\ 12^m\ 54^s$* [1, 8:12:54 A. M.] **Manila.** Slight earthquake.

4, $19^h\ 05^m$ [5, 3:05 A. M.] **Masbate.** Light earthquake at Cataingan. Another light shock at 3:10 A. M. Each about three seconds duration. Also felt at Palanas.

4, $19^h\ 45^m\ 44^s$* [5, 3:45:44 A. M.] **Legaspi, Albay.** Earthquake of intensity II and eight seconds duration.

4, $20^h\ 06^m\ 39^s$* [5, 4:06:39 A. M.] **Davao, Davao.** Earthquake of intensity III. Another similar shock at 10:16 A. M.

8, $19^h\ 25^m$ [9, 3:25 A. M.] **Ormoc, Leyte.** Oscillatory earthquake of intensity III and thirty seconds duration.

13, $17^h\ 25^m$ [14, 1:25 A. M.] **Yakan, Basilan.** Light earthquake.

15, $14^h\ 00^m\ 15^s$* [15, 10:00:15 P. M.] **Manila.** Light earthquake.

16, $4^h\ 15^m$ [16, 12:15 P. M.] **Zamboanga, Zamboanga.** Earthquake with vertical motion of intensity II, and two seconds duration.

17, $9^h\ 42^m\ 10^s$* [17, 5:42:10 P. M.] **Romblon and Marinduque.** Light earthquake in both islands.

20, $4^h\ 45^m$ [20, 12:45 P. M.] **Davao, Davao.** Extremely feeble earthquake.

20, $6^h\ 30^m$ [20, 2:30 P. M.] **Kaatoan, Bukidnon.** Light earthquake.

22, $4^h\ 57^m$ [22, 12:57 P. M.] **Zamboanga, Zamboanga.** Extremely feeble earthquake of short duration.

23, $10^h\ 01^m\ 39^s$ [23, 8:01:39 P. M.] **Agaña, Guam.** Earthquake recorded and felt. Another light shock at 10:07:24 P. M., on the 24th.

24, $17^h\ 15^m\ 49^s$* [25, 1:15:49 A. M.] **Baguio, Benguet.** Slight earthquake of short duration.

25, $5^h\ 47^m$ [25, 1:47 P. M.] **Leyte.** Oscillatory earthquake of intensity III and thirty seconds duration at Ormoc. Another shock of intensity IV and forty seconds duration at 1:56 P. M. Felt slightly at Burawen.

26, $6^h\ 45^m$ [26, 2:45 P. M.] **Bangui, Ilocos Norte.** Light earthquake. Another light shock at 2:30 P. M. on the 27th.

29, $2^h\ 30^m\ 46^s$* [29, 10:30:46 A. M.] **NE Mindanao.** Center in the Philippine Deep. Felt strongly in Cantilan; moderately in Hinatuan and Dapa; and slightly in Port Lamon, Butuan, Mainit, and Cabadbaran.

30, $2^h\ 30^m$ [30, 10:30 A. M.] **Hernani, Samar.** Light earthquake of three seconds duration.

30, $3^h\ 25^m$ [30, 11:25 A. M.] **Bangui, Ilocos Norte.** Light earthquake.

International Seismological Centre

INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
117	1	$\overline{\text{iP}}$Z	0	12	54	115	Slightly felt in Manila.
		$\overline{\text{S}}$NEZ		13	09		
		F		21			
118	1	P?NEZ	11	28	43	5,420?	Disturbed by microseisms.
		SNE		35	43		
		F	12	35			
120	2	iPZ	7	06	20	1,365	Dilatation. Disturbed by microseisms.
		SN		08	42		
		LE		10	ca		
		F	8	25			
123	4	ePNEZ	20	06	39	1,220	Compression. Felt in Davao.
		SNE		08	53		
		LNE		09	50ca		
		MNE		13	20ca		
		F	21	35			
124	5	iPZ	2	16	31	1,200	Do.
		SNE		18	43		
		LNE		19	50ca		
		F	3	40			
125	5	$\overline{\text{eP}}$NEZ	15	12	31	135	
		$\overline{\text{S}}$NEZ			48		
		F		18			
127	7	ePNEZ	2	00	46	3,645	5°S: 149°E, by Wellington.
		SNE		06	11		
		LNE		10	05ca		
		F	3	45			
128	7	ePNEZ	15	14	34	7,020	
		SNE		23	08		
		LNE		34	24		
		MNE		39	40		
		F	16	40			
129	7	iPZ	17	24	38	4,955	Felt in New Britain. 10°S: 160°E, by Wellington.
		SNE		31	20		
		LNE		38	ca		
		F	18	45			
130	8	iPEZ	22	05	54	4,390	Compression. Felt in New Guinea, and New Britain. Approximately 8°S: 152°E, by Wellington.
		iSNE		11	54		
		LNE		17	30ca		
		MNE		20	50ca		
		F	23	58			
131	10	P?NE	2	48	52	3,945?	
		SNE		54	24		
		LNE		57	30ca		
		F	3	54			
132	10	$\overline{\text{P}}$NEZ	5	56	34	190	
		$\overline{\text{S}}$NEZ			58		
		F	6	01			
134	10	ePZ	22	02	48	3,080	
		SNE		07	25		
		MNE		12	45ca		
		F	23	10			
137	12	$\overline{\text{iP}}$Z	10	40	20	140	Compression. Ambulong, 100 km.
		$\overline{\text{eP}}$NE			20		
		$\overline{\text{S}}$NEZ			38		
		F	11	02			
143	15	$\overline{\text{iF}}$Z	14	00	15	125	Dilatation from NW. Felt slightly in Manila.
		$\overline{\text{eP}}$NE			15		
		$\overline{\text{S}}$NEZ			31		
		F		23			
145	16	$\overline{\text{P}}$NE	5	09	22	135	From the Wiechert. No time marks on Galitzin records.
		$\overline{\text{S}}$NE			39		
		F		18			
146	17	iPNEZ	9	42	10	200	Compression from SE. Felt in Marinduque, and Romblon.
		$\overline{\text{S}}$NEZ			36		
		F	10	00			
148	18	PNEZ	16	30	17	1,600	
		SN		33	04		
		F		49			

International Seismological Centre

INSTRUMENTAL RECORD—Continued.

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
149	20	iPNEZ	3 27 00	2,310	Compression. Japan. 33.4°N: 129.5°E; H= 3:22:33, by J. S. A.
		SNE	30 45		
		MN	34 50ca		
		F	5 30		
150	20	iPZ	22 09 50	2,310	
		SN	13 35		
		F	40		
151	21	iPEZ	1 18 06	4,000	Compression. 3°S: 90.6°E, by Strasbourg.
		iSNE	23 52		
		MNE	30 ca		
		F	4 50		
152	21	ePNEZ	8 03 25	?	
		SNE?	14 ca		
		F	9 25		
153	22	iPZ	3 52 03	3,735	Compression. Approximately 7°S: 150°E, by Wellington.
		ePNE	03		
		SN	57 34		
		LNE	59 43		
		F	5 40		
154	22	ePEZ	7 32 49	7,700	Compression. 18°S: 173°F, by Wellington.
		SNE	42 17		
		LNE	55 ca		
		F	10 25		
155	23	iPZ	16 32 02	8,340	Compression. Probably 32°S; 178°W, by Wellington.
		ePNE	02		
		SE	41 49		
		LN	55 ca		
		F	17 50		
158	25	ePNEZ	1 00 08	730	
		SNEZ	01 29		
		F	27		
159	25	ePNZ	1 45 36	1,600	
		SNE	48 23		
		MNE	51 20ca		
		F	2 20		
160	25	iPNZ	5 43 04	2,480	Dilatation from SE?
		SNE	47 00		
		LNE	48 20ca		
		F	6 45		
161	25	iPNZ	8 34 17	220	Compression.
		$\overline{S}$NE	47		
163	25	iPZ	8 43 27	220	
		$\overline{S}$NEZ	57		
		F	9 08		
164	25	ePNEZ	19 13 09	2,555	
		SE	17 11		
		F	43		
170	29	iPEZ	0 22 52	2,365	Compression.
		ePN	52		
		SNE	26 41		
		F	1 20		
171	29	iPNEZ	2 30 46	820	Compression. Felt in northeast Mindanao. S from the Wiechert. Epicenter in the Philippine Deep.
		SN	32 15		
		F	4 15		
173	31	ePEZ	22 22 32	4,680	
		SNE	28 50		
		F	48		

Twenty-three insignificant or undecipherable disturbances on the following days of March: 1st, 2nd, 4th 5th, 10th, 11th(2), 13th(3), 14th(2), 16th, 17th, 24th(2), 25th(2), 26th(2) 27th(2), and 31st.

International Seismological Centre

APRIL, 1939

MACROSEISMIC RECORD

3, 20^h 05^m [4, 4:05 A. M.] **Agunetan, Cagayan.** Light earthquake.

4, 5^h 28^m 51^s [4, 3:28:51 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

4, 16^h 47^m 33^s* [5, 0:47:33 A. M.] **Mindanao and Samar.** Felt with intensity V in Dapa with a duration of five seconds. Intensity IV in Guiuan and slight in Port Lamon, Mainit, and Butuan.

4, 21^h 30^m 06^s* [5, 5:30:06 A. M.] **Baguio, Benguet.** Light earthquake of short duration.

6, 3^h 55^m [6, 11:55 A. M.] **Cal-lao, Cagayan.** Light earthquake.

6, 13^h 00^m [6, 9:00 P. M.] **Pamplona, Cagayan.** Light earthquake.

6, 18^h 04^m 15^s [7, 4:04:15 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

6, 21^h 00^m 44^s* [7, 5:00:44 A. M.] **N Luzon.** Oscillatory and intensity III at Aparri with duration of eight seconds. Rotatory and intensity III at Laoag with duration of five seconds. Light at Piddig, Bangui, Amulong, and Claveria.

8, 7^h 30^m [8, 3:30 P. M.] **Itogon, Benguet.** Light earthquake.

8, 15^h 10^m 22^s* [8, 11:10:22 P. M.] **Baguio, Benguet.** Earthquake of intensity III and short duration.

9, 22^h 08^m 05^s* [10, 6:08:05 A. M.] **Zamboanga, Zamboanga.** Oscillatory earthquake of intensity II, and two seconds duration.

10, 13^h 23^m 01^s* [10, 9:23:01 P. M.] **N Luzon.** Intensity III at Baguio, Vigan, and Laoag. Slight in Piddig, Bangui, Tuao, Gattaran, and Claveria.

10, 17^h 05^m 48^s* [11, 1:05:48 A. M.] **Laoag, Ilocos Norte.** Intensity II, and three seconds duration.

10, 17^h 57^m 45^s [11, 3:57:45 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

12, 11^h 55^m [12, 7:55 P. M.] **Bangui, Ilocos Norte.** Light earthquake.

14, 15^h 55^m 46^s* [14, 11:55:46 P. M.] **SE Negros.** Earthquake of intensity V, and five seconds duration at Dumaguete. Also felt in Cauayan, Occidental Negros.

17, 8^h 00^m [17, 4:00 P. M.] **Piddig, Ilocos Norte.** Light earthquake of two seconds duration.

18, 6^h 53^m [18, 2:53 P. M.] **Calayan, Cagayan.** Very feeble, oscillatory earthquake of five seconds duration.

21, 18^h 29^m 49^s* [22, 2:29:49 A. M.] **SE Luzon.** Earthquake felt with intensity III in Sorsogon and with intensity II in Legaspi where it had a duration of fifteen seconds.

23, 18^h 19^m [24, 2:19 A. M.] **Vigan, Ilocos Sur.** Earthquake of intensity II, and six seconds duration.

25, 15^h 43^m 55^s* [25, 11:43:55 P. M.] **Daet, Camarines Norte.** Oscillatory earthquake of intensity III and three seconds duration.

26, 11^h 17^m 47^s* [26, 7:17:47 P. M.] **Batan Islands and N Luzon.** Center in Balingtan Channel. Felt with intensity III at Basco, Calayan, and Laoag. Two aftershocks at Calayan. Felt lightly throughout northern Luzon.

28, 17^h 05^m [29, 1:05 A. M.] **Dimasalang, Masbate.** Light earthquake.

International Seismological Centre

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ	Remarks
			h.	*m.*	*s.*	*Km*	
176	3	ePNEZ	8	46	26	1,835	
		SE		49	34		
		F	9	10			
178	3	iPz	21	32	33	4,055	
		SE		48	14		
		LN		42	ca		
		F	22	37			
179	4	ePz	10	20	42	6,265	
		SNE		28	31		
		LN		38	20ca		
		F	11	35			
180	4	ePNE	11	53	19	215	Deep focus.
		$\overline{S}$NEZ			47		
		F	12	00			
181	4	iPEZ	16	47	33	690	Compression from SE. Felt in Guiuan, Samar, and in NE. Mindanao. Probably deeper than normal.
		SNE		48	50		
		F	17	32			
182	4	$\overline{e}$PNE	21	30	06	165	Felt in Baguio. 50 km.
		$\overline{S}$NE			27		
		F		41			
188	4	P?NEZ	23	03	12	3,455?	
		SNE		08	14		
		F		29			
184	5	iPz	9	47	23	215	Dilatation.
		ePNE			23		
		i$\overline{S}$NE			52		
		F		57			
185	5	iPz	16	52	34	6,665	Dilatation from SE. 19°S: 168°E, by Riverview and Manila. Region of 27°S: 167°E, by J. S. A.
		SNEZ	17	00	46		
		LNEZ		11	ca		
		MNE		16	45ca		
		F	20	25			
188	6	ePNEZ	21	00	44	380	Felt in northern Luzon.
		SNEZ		01	31		
		F		38			
189	8	i$\overline{P}$z	15	10	22	175	Felt in Baguio. Baguio, 95 km.
		$\overline{S}$NEZ			44		
		F		20			
190	9	ePNEZ	22	08	05	1,190	Felt in Zamboanga.
		SNE		10	09		
		LN		11	20		
		F		32			
191	10	iPz	13	23	01	440	Dilatation. Deeper than normal. Felt in N Luzon.
		ePNE			01		
		iSNEZ			55		
		F	14	16			
192	10	ePNEZ	17	05	48	440	Aftershock of No. 191. Felt at Laoag.
		SNE		06	42		
		F		18			
196	13	$\overline{e}$PNE	19	22	28	135	
		i$\overline{S}$NE			45		
		F		29			
198	14	ePNEZ	15	55	46	640	Felt in SE Negros.
		SNE?		56	58		
		F	16	17			
199	14	ePNE	19	25	35	230	
		$\overline{S}$NE		26	06		
		F		35			
201	15	iPz	9	09	33	3,370	
		SNE		14	29		
		F	10	20			
202	15	ePNEZ	20	15	44	8,645	
		SNE		25	40		
		LNE		41	ca		
		F	21	34			
204	17	ePNE	10	13	15	1,250	
		SNE		15	25		
		LNE		16	29		
		F		33			

INSTRUMENTAL RECORD—Continued.

International Seismological Centre

No.	Date	Phase	Time			△	Remarks
			h.	m.	s.	Km.	
206	18	iP$_1$'z	6	42	45	17,510	Compression. 25.8°S: 75.2°W; H=6:22:56, by J. S. A. 27°S: 71°W, by U. S. C. G. S. L from the Wiechert
		iP$_1$'NE			47		
		SKKS		53	17		
		LNE	7	41	ca		
		F	10	50			
209	20	iPz	22	18	11	7,980	
		ePNE			11		
		iSN		27	39		
		LN		41	50ca		
		F	24	00			
210	21	iPNEZ	4	35	28	3,480	Compression from NE. Deep focus. 50°N: 140°E; H=4:29.2, G. M. T.; h= 500 km., U. S. C. G. S. 48.8°N: 138°E, by J. S. A.
		iSNE		40	31		
		LN		44	25ca		
		MN		47	25ca		
		F	6	04			
213	22	iPNEZ	11	27	31	1,655	Dilatation.
		SN		30	25		
		LNE		31	30ca		
		F	12	30			
215	23	ePNEZ	1	36	42	210	
		$\overline{\text{iS}}$NE		37	09		
		F		46			
216	23	eNE	16	43	42	15,145	0.1°N: 18°W; H=16:23:08, by J. S. A. 1°S: 17°W; H=16:23.1, U. S. C. G. S.
		PPNEZ		45	00		
		SKPE		46	06		
		ME	17	37	ca		
		F	18	36			
220	25	$\overline{\text{eP}}$z	14	47	41	140	
		$\overline{\text{iS}}$NEZ			59		
		F		56			
221	25	ePEZ	15	43	55	270	Felt at Daet.
		$\overline{\text{S}}$NE		44	33		
		F		52			
222	26	iPNZ	11	17	47	550	Compression. Felt in Batan Islands and N Luzon. Approximately 19°35'N: 121°15'E, by Manila, Hong Kong, and Baguio.
		iSNEZ		18	51		
		F	12	38			
224	26	$\overline{\text{eP}}$NEZ	19	54	02	150	
		$\overline{\text{iS}}$NEZ			21		
		F	20	02			
226	28	$\overline{\text{eP}}$NE	0	09	15	120	
		$\overline{\text{S}}$NEZ			30		
		F		14			
231	30	ePEZ	3	03	37	5,010	Solomon Islands. 7°S: 159.6°E by Strasbourg. 11°S: 158°E, by U. S. C. G. S. Phases after P from the Wiechert.
		iSNE		10	22		
232	30	PNE	5	57	48	310	No. 231 still recording. From the Wiechert. Baguio, 190 Km.
		$\overline{\text{S}}$NE		58	33		
		F	6	04			
234	30	PNEZ	14	11	05	4,900	
		SNE		17	44		
		LN		23	30ca		
		F	15	40			

Twenty-eight insignificant or undecipherable disturbances on the following days of April: 1st, 2nd, 3rd, 6th(2), 12th, 13th(2), 14th, 15th(2), 17th, 19th(2), 21st(2), 22nd, 24th(3), 26th, 27th, 28th(3), 29th, and 30th(2).

International Seismological Centre

MAY, 1939

MACROSEISMIC RECORD

3, 22h 59m 47s* [4, 6:59:47 A. M.] **NE Mindanao.** Moderately strong in Hinatuan. Vertical motion predominated in Butuan where the duration was thirty seconds. Pendulum clock stopped. Light at Port Lamon and Cabadbaran.

6, 4h 22m ? [6, 12:22 P. M.?] **Baganga, Davao.** Light earthquake of six seconds duration.

6, 17h 00m 23s* [7, 1:00:23 A. M.] **Mindoro and S Luzon.** Center in the Verde Island Passage. Very strong in towns along the north coast of Mindoro and the south coast of Luzon. Intensity V at Batangas, accompanied by loud noise. Intensity IV at Ambulong, Atimonan, Lucena, Boac, Daet, Santa Cruz, and Manila. Felt over an area of 200 km. radius. A light aftershock was felt near the epicenter at 1:09 A. M.

6, 17h 21m 09s* [7, 1:21:09 A. M.] **Mindoro and S Luzon.** Another shock from the same center as the preceding. Intensity II–III. Felt only in north Mindoro and the southern part of the province of Batangas. Other light shocks at Naujan, Mindoro, at 1:25, 2:05, and 3:14 A. M. Aftershocks reported from Batangas at 5:55 A. M. and 2:48 P. M.

8, 00h 48m 18s* [8, 8:48:18 A. M.] **SE Luzon.** Earthquake of intensity IV, and five seconds duration at Naga and Daet.

16, 14h 50m [16, 10:50 P. M.] **Oras, Samar.** Light earthquake.

17, 17h 38m [18, 1:38 A. M.] **Port Lamon, Surigao.** Oscillatory earthquake of intensity II, and fifteen seconds duration.

22, 6h 22m [22, 2:22 P. M.] **Boac, Marinduque.** Very feeble earthquake of two seconds duration.

25, 00h 01m 19s* [25, 8:01:19 A. M.] **Vigan, Ilocos Sur.** Earthquake of intensity II, and ten seconds duration.

25, 6h 16m 50s* [25, 2:16:50 P. M.] **SE Luzon.** Center in the Pacific Ocean. Intensity VII and about five seconds duration at Capalonga; vertical motion predominating. Wall of the church slightly cracked and some light damage in stores and houses. Intensity VI, and thirty seconds duration at Daet. Stores suffered about one thousand pesos damage to stocks. Intensity V in Naga; intensity IV in Libmanan, Legaspi, and Virac. Slight as far west as Ambulong in the Province of Batangas, and to the southeast in Catarman, Samar. The area of perceptibility had a radius of 250–300 kilometers. At 2:59:48 P. M. there was an aftershock of less intensity.

26, 0h 46m 34s* [26, 8:46:34 A. M.] **SE Luzon.** Very light shock at Naga and Libmanan.

26, 13h 15m [26, 9:15 P. M.] **Bangui, Ilocos Norte.** Light earthquake.

26, 20h 53m 34s* [27, 4:53:34 A. M.] **SE Luzon.** Light earthquake at Naga and Libmanan. Preceded by a noise at Naga. At 11:14 A. M. another light shock was felt at Libmanan and Daet.

27, 14h 52m 08s* [27, 10:52:08 P. M.] **SE Luzon.** Oscillatory earthquake of intensity III and four seconds duration at Daet and Naga. Very feeble at Libmanan.

28, 16h 35m [29, 0:35 A. M.] **Port Lamon, Surigao.** Oscillatory earthquake of intensity III and ten seconds duration.

30, 15h 45m [30, 11:45 P. M.] **Cantilan, Surigao.** Slight earthquake.

31, 7h 00m [31, 3:00 P. M.] **Libmanan, Camarines Sur.** Light earthquake.

31, 15h 46m 13s* [31, 11:46:13 P. M.] **SE Luzon.** Oscillatory earthquake of intensity III and short duration, preceded by a noise, at Naga. Very feeble at Libmanan.

31, 22h 05m [June 1, 6:05 A. M.] **Naga, Camarines Sur.** Very weak oscillatory earthquake of short duration. Preceded by a noise.

International Seismological Centre

INSTRUMENTAL RECORD

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km*	
236	1	PEZ	4 36 19	2,855	
		SNE	40 41		
		LNE	43 20ca		
		F	5 40		
237	1	iPz	6 04 37	3,610	Compression. Data after S from the Wiechert. 40°N: 139°E, by U. S. C. G. S. 39°N: 137.5°E, J. S. A.
		ePNE	40		
		SNE	09 49		
		LNE	13 20ca		
		F	9 35		
238	1	ePNEZ	11 56 42	3,410	
		SNE	12 01 41		
		LNE	05 40ca		
		F	13 10		
240	1	iPz	16 12 01	3,400	Dilatation.
		iSNE	16 57		
		LNE	20 25ca		
		MNE	23 20ca		
		F	18 30		
241	2	eEZ	13 33 06	12,355	Galitzin N–S component not recording. 29.4°N: 113.5°W, by J. S. A. 29.5°N: 113.8°W, by U. S. C. G. S.
		PSE	43 52		
		LNE	14 06 00		
		ME	11 ca		
		F	16 40		
242	3	ePNEZ	7 13 17	5,455	
		SNE	20 19		
		LE	28 50ca		
243	3	ePNEZ	8 21 12	4,120	
		SNE	26 56		
		F	9 27		
244	3	ePNEZ	16 21 03	2,320	
		SNE	24 49		
		MN	28 40ca		
		F	17 30		
245	3	iPz	22 59 49	700	Dilatation. Felt in NE Mindanao. Probably deeper than normal.
		SNE	23 01 06		
		F	18		
247	5	ePNEZ	12 17 26	2,890	
		SNE	21 51		
		F	46		
249	6	eP$_1$'NE	6 20 18	16,480	Near 5°N: 84°W, by U. S. C. G. S. 0=6:02:11.
		SS	42 30ca		
		GNE	48 00		
		LNE	7 12 ca		
		MN	36 30ca		
		F	8 15		
251	6	$\overline{\text{i}}$PNE	17 00 23	125	Dilatation from S. Deeper than normal. Probable epicenter 13°30'N: 121°15'E; h= 75 km.; H=17:00:07. $\overline{\text{S}}$ from the horizontals. Very strong in Calapan, Mindoro; moderate in S Luzon.
		$\overline{\text{S}}$NE	39		
253	6	$\overline{\text{P}}$NE	17 21 09	125	2nd earthquake, aftershock of No. 251.
		$\overline{\text{S}}$NE	25		
256	6	$\overline{\text{P}}$NE	18 54 56	125	3rd earthquake, aftershock of No. 251.
		$\overline{\text{i}}$SNE	55 12		
		F	19 21		
258	6	ePNE	20 12 49	5,035	Disturbed by microseisms.
		SN	19 27		
		LNE	26 30ca		
		F	21 26		
261	7	ePNE	0 34 29	2,890	Galitzin Z component not recording.
		SNE	38 54		
		LNE	41 40ca		
		F	2 10		
265	7	$\overline{\text{i}}$Pz	6 47 34	125	Dilatation.
		$\overline{\text{S}}$NEZ	50		
		F	59		
267	7	eP?NEZ	7 16 12	3,900?	
		SNE	21 42		
		F	8 10		
269	8	ePNE	0 48 18	240	Felt in SE Luzon.
		$\overline{\text{S}}$NE	51		
		F	1 06		

INSTRUMENTAL RECORD—Continued.

International Seismological Centre

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
270	8	$eP_1'N$	2 02 15	17,200	Near 37°N: 24°W, by U. S. C. G. S. 0=1:46:48.
		PPNE	06 45		
		PSNE	16 45		
		LN	43 25ca		
		MNE	51 30ca		
		F	5 23		
274	8	$\overline{e}$PNE	23 45 48	125	
		$\overline{S}$NE	46 04		
		F	49		
276	9	$\overline{i}$PZ	8 08 34	110	Dilatation. Deeper than normal.
		$\overline{e}$PNE	34		
		$\overline{S}$NEZ	48		
		F	30		
277	9	$\overline{e}$PNEZ	13 06 49	120	
		$\overline{S}$NEZ	07 04		
		F	16		
278	9	ePEZ	21 18 48	1,260	
		SE	20 59		
		F	22 16		
281	10	ePEZ	7 54 23	6,990	Compression. 51°N: 179°W, by U. S. C. G. S. 51°N: 177.2°W, by J. S. A.
		SNE	8 02 55		
		LNE	14 25ca		
		MNE	19 35ca		
		F	9 02		
284	11	$\overline{i}$PZ	2 34 26	135	Dilatation.
		$\overline{S}$NEZ	43		
285	11	$\overline{e}$PNEZ	2 43 43	135	
		$\overline{S}$NEZ	44 00		
		F	47		
286	11	iPEZ	17 36 29	2,755	
		iSNE	40 55		
		LN	43 30ca		
		F	18 30		
287	12	iPNZ	0 10 25	370	Dilatation.
		SNEZ	11 12		
		F	35		
288	13	ePNEZ	13 04 12	4,360?	
		S?NE	10 11		
		F	31		
289	13	ePNEZ	19 56 47	3,940	
		SNE	20 02 19		
		F	20		
290	14	iPEZ	18 24 04	8,160	Compression. Deep focus.
		iSNE	33 41		
		F	19 25		
292	16	iPNEZ	7 22 26	1,130	Dilatation. Felt strongly at Arisan, Formosa.
		iSNEZ	24 24		
		F	9 10		
294	17	PNEZ	0 24 58	1,500	
		SNE	27 33		
		F	56		
296	17	ePNEZ	15 16 53	4,150	
		SNE	22 39		
		ME	30 45ca		
		F	17 25		
298	17	iPNEZ	18 35 37	2,555	Dilatation. S from the Wiechert.
		SNE	39 47		
		F	21 30		
299	17	ePNEZ	22 47 37	540	
		SNE	48 40		
		F	56		
302	19	ePEZ	18 45 37	8,340	
		SNE	55 23		
		LNE	19 09 ca		
		MNE	16 20ca		
		F	20 21		

INSTRUMENTAL RECORD—Continued.

International Seismological Centre

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
304	21	iPz	20	32	05	6,765	Dilatation. Deep focus.
		ePE			05		
		SNE		40	24		
		LN		51	ca		
		F	21	52			
305	22	iPNEZ	1	40	40	3,400	
		SNE		45	38		
		LNE		49	10ca		
		F	3	10			
308	23	ePNZ	4	29	00	6,855	Near 10°N: 60°E, by Strasbourg.
		SE		37	30		
		F	5	47			
309	25	PNE	0	01	19		Trace. From the Wiechert. Felt at Vigan.
		F		07			
310	25	iPNEZ	6	16	50	240	Compression. Near 14° 30′N: 123° 10′E. Felt in southeastern part of Luzon and Marinduque Island.
		$\overline{\text{S}}$NE		17	23		
311	25	ePNEZ	6	59	48	240	Aftershock of No. 310.
		$\overline{\text{S}}$NE	7	00	21		
		F	8	15			
313	26	ePNEZ	9	47	53	4,910	Region of 55°N: 110°E, by Strasbourg.
		SNE		54	24		
		LNE	10	01	40ca		
		MNE		04	50ca		
		F	11	10			
315	26	ePNEZ	17	55	57	3,080	Compression.
		SNE	18	00	34		
		LNE		03	25ca		
		MN		06	ca		
		F	19	52			
316	26	PNEZ	20	11	45	3,520	
		SE		16	51		
		F		33			
318	27	iPNEZ	3	51	22	4,255	Compression. Near 25°N: 95° E, by Strasbourg.
		iSNE		57	14		
		iLNE	4	02	25ca		
		MNE		05	45ca		
		F	6	10			
321	27	ePNEZ	14	52	08	240	Felt in SE Luzon.
		$\overline{\text{S}}$NE			42		
		F	15	08			
324	28	ePNEZ	4	09	04	700	
		S?NEZ		10	18		
		F		32			
326	30	PNZ	10	16	04	5,700	
		SNE		23	20		
		F	11	10			
	30	From 17:09:12 to 17:12:12 conspicuous group of about 14 seconds period waves on N component.					
328	30	PNEZ	17	16	38	2,010	
		SN		20	04		
		F	18	22			
331	31	PNEZ	15	46	13	210	Felt in SE Luzon.
		$\overline{\text{S}}$NEZ			40		
		F	16	01			
332	31	PNEZ	18	09	49	1,600	
		SNE		12	36		
		F		26			

Forty-three insignificant or undecipherable disturbances on the following days of May: 1st, 4th, 6th(8), 7th(5), 8th(3), 9th, 10th(4), 15th, 16th, 17th(2), 18th(2), 20th, 22nd(2), 26th(3), 27th(4), 28th, 30th(2), and 31st.

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JUNE, 1939

MACROSEISMIC RECORD

2, 3h 36m 04s* [2, 11:36:04 A. M.] **Mindanao and Sulu.** Center in Netherlands East Indies. Intensity IV in Jolo and Davao. Intensity II–III in Zamboanga, Port Lamon, and Butuan. Pendulum clock stopped in Butuan.

2, 6h 11m 06s* [2, 2:11:06 P. M.] **SE Luzon.** Earthquake of intensity V in Naga, oscillatory, short and preceded by a noise. Intensity IV, oscillatory and about thirty seconds duration in Daet. Slight in Nabua.

3, 4h 05m [3, 12:05 P. M.] **SE Luzon.** Oscillatory earthquake of intensity II–III in Daet and Naga. Preceded by a noise at Naga.

3, 5h 47m 16s* [3, 1:47:16 P. M.] **SE Luzon.** Earthquake of intensity V and oscillatory motion lasting about fifty seconds at Daet. A noise was heard about five seconds before the shock. Intensity III at Capalonga and Naga. Preceded by a noise at Naga. Another oscillatory shock of intensity III and short duration was felt at Naga at 3:05 P. M.

3, 4h 31m 56s [3, 2:31:56 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

6, 8h 43m 05s* [6, 4:43:05 P. M.] **Mindanao and Negros.** Earthquake of intensity IV and five seconds duration at Dumaguete. Slight at Dapitan.

7, 4h 37m 52s* [7, 12:37:52 P. M.] **Naujan, Mindoro.** Slight earthquake.

9, 20h 50m [10, 4:50 A. M.] **Lagangilang, Abra.** Slight earthquake.

10, 6h 03m [10, 2:03 P. M.] **Libmanan, Camarines Sur.** Very feeble shock.

10, 17h 10m [11, 1:10 A. M.] **Kabakan, Cotabato.** Slight earthquake.

10, 20h 00m [11, 4:00 A. M.] **Milagros, Masbate.** Light earthquake.

11, 11h 55m [11, 7:55 P. M.] **Acandang, Cotabato.** Slight earthquake.

11, 17h 00m [12, 1:00 A. M.] **Siaton, Negros Oriental.** Slight earthquake.

12, 13h 23m 23s* [12, 9:23:23 P. M.] **Basco, Batanes.** Earthquake of intensity IV, and five seconds duration. A light aftershock at 9:52 P. M.

18, 12h 34m 32s* [18, 8:34:32 P. M.] **SE Luzon.** Light earthquake of short duration at Naga, Libmanan, and Tabaco.

19, 6h 05m [19, 2:05 P. M.] **Iloilo, Panay.** Oscillatory earthquake of intensity II and three seconds duration.

19, ——— (Night) **Maridagao, Cotabato.** Slight earthquake.

22, 0h 00m [22, 8:00 A. M.] **Acandang, Cotabato.** Slight earthquake, with another light at 8:45 A. M.

22, 19h 13m 25s* [23, 3:13:25 A. M.] **Dadiangas, Cotabato.** Earthquake of intensity III–IV and thirty seconds duration. This was the second earthquake this week and there was another during the preceding week.

24, 7h 26m 16s [24, 5:26:16 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

24, 8h 50m [24, 4:50 P. M.] **Mainit, Surigao.** Slight earthquake.

26, 8h 30m 38s [26, 6:30:38 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

27, 23h 06m 39s* [28, 7:06:39 A. M.] **Mindanao, and eastern Visayan Islands.** Center in the Philippine Deep. Intensity V, oscillatory and about two minutes duration in Butuan. Pendulum clock stopped. Church bell rang once. Sensation of sea-sickness felt. Intensity IV in Port Lamon, Dapa, Cagayan, Baganga, and Davao. Felt lightly in other parts of Mindanao, southern Leyte, southern Samar, and in Cebu at a distance of 460 kilometers from the epicenter.

30, 7h 00m [30, 3:00 P. M.] **Bulusan, Sorsogon.** Light earthquake.

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INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
335	1	ePNE	16	16	17	3,245	
		SN		21	05		
		F		51			
337	2	iPNEZ	3	36	04	1,310	Compression. Felt in Mindanao and Jolo. S from the Wiechert.
		SNE		38	20		
		F	6	06			
338	2	ePNEZ	6	11	06	250	Felt in southeastern part of Luzon.
		$\overline{S}$NEZ			41		
		F		30			
341	3	$\overline{i}$PNEZ	5	47	16	220	Felt at Daet, Capalonga, and Naga.
		$\overline{i}$SNEZ			46		
		F	6	35			
343	3	ePNEZ	17	50	25	1,070	
		SN		52	18		
		F	18	05			
344	4	ePNEZ	0	29	08	2,790	Compression.
		SNEZ		33	26		
		MN		38	30ca		
		F	1	35			
345	4	ePNEZ	3	26	20	2,535	Deeper than normal.
		SNEZ		30	20		
		F	4	00			
346	4	PZ	12	09	04		
		S?NE		19	00		
		F	13	10			
347	4	ePNEZ	15	21	12	4,330	
		SNE		27	09		
		LN		31	20ca		
		F	16	30			
352	5	PEZ	16	08	47	2,300?	
		S?NE		12	31		
			17	10			
353	6	ePNEZ	6	32	06	1,400	
		SNE		34	31		
		F	7	05			
354	6	ePNE	8	43	05	690	Felt at Dumaguete and Dapitan.
		SE		44	22		
		F	9	02			
356	7	$\overline{i}$PZ	4	37	52	125	Dilatation. Felt at Naujan, Mindoro
		$\overline{S}$NEZ		38	08		
		F		46			
357	8	ePNEZ	15	31	57	3,090	
		SNE		36	35		
		LN		39	30ca		
		F	16	36			
358	8	iPEZ	20	58	06	8,250	Compression. 15°S: 173°W; h= 100 km. by U. S. C. G. S.
		iSNE	21	07	48		
		LNEZ		21	30ca		
		F	23	05			
359	9	ePNEZ	5	42	21	210	
		$\overline{S}$NEZ			48		
		F		47			
360	9	iPNEZ	19	14	09	2,755	Compression (?). Deep focus.
		iSNE		18	25		
		MN		23	25ca		
		F	20	40			
363	10	$\overline{e}$PNEZ	7	32	21	160	Probably SW. Ambulong, 100 km.
		$\overline{S}$NEZ			41		
		F		38			
165	10	iPZ	9	47	49	2,880	Deep focus.
		ePNE			49		
		SNE		52	13		
		F	10	15			
367	11	ePNEZ	11	12	26	1,380	
		SNE		14	49		
		F		38			
368	12	ePNEZ	4	24	39	15,970	21.8°N: 66°W; H=4:05:11, by U. S. C. G. S.
		SKP		28	31		
		SKKS?		34	30ca		
		iE		41	38		
		SS?		46	ca		
		LNE	5	19	ca		
		MN		24	30ca		
		F	6	20			

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INSTRUMENTAL RECORD—Continued.

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
369	12	ePz	13	23	23	600?	Felt at Basco.
		S?NE		24	58		
		F		45			
370	13	iPz	20	43	18	2,545	Dilatation.
		ePNE			18		
		SNE		47	19		
		MN		51	50ca		
		F	22	20			
372	15	ePNEZ	3	42	09	210	
		SNEZ			36		
		F		49			
373	15	ePNEZ	14	03	45	2,645	
		SNE		07	53		
		F	15	00			
374	16	ePNEZ	5	21	51	2,220	
		SNE		25	30		
		MN		29	35		
		F	6	10			
375	16	ePNEZ	21	37	43	2,520	Compression.
		iSN		41	42		
		iLN		43	25ca		
		F	23	15			
377	17	ePEZ	9	31	28	3,080	
		SN		36	05		
		F	10	15			
378	17	ePNE	12	14	05	8,365?	
		S?E		23	48		
		LE		37	ca		
		MN		43	45ca		
		F	13	30			
380	18	ePNEZ	3	54	05	1,170	Felt rather strongly at Taito, Formosa
		iSNE		56	14		
		MN		58	30ca		
		F	5	00			
381	18	PNEZ	12	34	32	280	Felt at Naga.
		SNE		35	10		
		F	13	02			
382	18	iPz	17	05	38		Dilatation.
		ePNE			38		
		iNE		07	10		
		F		50			
384	19	ePNEZ	13	43	58	1,465	
		SNE		46	30		
		F	14	08			
385	19	ePNEZ	22	03	11	3,400	
		SNE		08	09		
		LNE		11	50ca		
		MNE		14	35ca		
		F	23	20			
386	20	ePNEZ	5	54	42	670	Felt slightly in Taihoku, Formosa.
		SNE		55	57		
		F	6	17			
390	22	iPz	19	13	25	1,100	Deeper than normal. Felt at Dadiangas, Cotabato. Butuan, about 300 km.
		SNE		15	27		
391	22	P_1'z	19	38	32	13,665	No. 390 still recording. 5°N: 1°W; H= 19:19:33 G. M. T., by U. S. C. G. S.
		iEZ		39	43		
		iE		40	34		
		LNE	20	25	ca		
396	25	ePz	2	48	05	2,755	Deep focus.
		ePNE			11		
		iSNE		52	21		
		F	3	40			
398	26	ePEZ	7	26	15	2,530	
		SNE		30	15		
		F	9	33			
401	26	ePNEZ	23	12	50	70	Ambulong, 65 km.
		iSNEZ			59		
		F		19			
403	27	iPNEZ	23	06	39	1,010	Compression from SE. S from the Wiechert. Dilatation from SE. in Butuan. Probable epicenter, 7° 30'N: 127°E. Felt generally in Mindanao; in southern Leyte and Samar; and in Cebu.
	28	F	1	30			

Thirty-three insignificant or undecipherable disturbances on the following days of June 1st(3), 3rd(3), 4th(3), 5th, 7th, 9th, 10th(2), 11th, 14th, 17th(2), 19th, 20th, 21st, 22nd, 24th(4), 25th, 26th(2), 27th, 28th, 29th, and 30th.

CATALOGUE OF EARTHQUAKES FELT IN GUAM 1825-1938

International Seismological Centre

W. C. Repetti, S.J.
Manila Observatory

The association of earthquakes with oceanic deeps is illustrated by the seismic history of the island of Guam, Marianas Islands. The Nero Deep, to the southeast of Guam, has a depth of 5,269 fathoms at a point about 90 miles from Guam and earthquake shocks can safely be characterized as frequent in Guam.

In the following catalogue we confine ourselves to the shocks which have been perceived by persons and reported. The records of the Wiechert Inverted Pendulum seismograph, installed in Agaña in 1914, indicate that there are quite a number of earthquakes which are felt and not reported, or which could be felt under favorable conditions. The reports from Sumay were made by the member of the Commercial Pacific Cable Company who made the routine meteorological observations at the point. The reports from Agaña after August, 1914, are due to Mr. W. W. Rowley who was in charge of the seismograph from the time of its installation to the time of his retirement in November, 1935. Since then the instrument has been under the care of Messrs. Inocencio Aflague and Atansio Haniu who continue to report the perceptible earthquakes.

The fact that most of the earthquakes are reported as felt in Agaña does not imply that they were not felt in other places on the island.

The sources of information used in the compilation of this catalogue were the following.

B.—Diccionario-Geográfico-Estadístico-Histórico de las Filipinas. Fr. Manuel Buzeta. Madrid. 1850.

CA.—Earthquake Records from Agaña, Island of Guam. Cleveland Abbe, Jr. Terrestial Magnetism and Atmospheric Electricity. June, 1904, Vol. IX, No. 2.

EC.—"El Comercio." A Manila newspaper.

GM.—"Gaceta de Manila." The official government gazette.

ML.—In the year 1892 Miguel de Lasa of Guam sent to Father Miguel Saderra Maso, S. J. a list of earthquakes which he had taken from a manuscript journal of important events in Guam. He ended with the note;

> "These are the scant data supplied by the above-mentioned book, and they have been verified by persons of that period (1825–70) who are still living. We remind you, however, that the moderate and light earthquakes, which frequently shake us, are not mentioned, but merely the violent ones." —MOB. September, 1902.

MOB.—Manila Observatory Bulletins.

MOR.—Manila Observatory Records.

SM.—Some Notes Concerning the Volcanoes and Seismic Phenomena of the Marianas Islands. Rev. Miguel Saderra Maso, S.J. —MOB. September, 1902.

VE.—"La Voz Española." A Manila newspaper.

Time.—We do not know what standard of time was followed in Spanish days; probably mean solar time, corrected at intervals. Our records carry a notation that up to 1916 the time in Guam was $9^h\ 40^m$ east of Greenwich; and that on August 16th of that year was changed to $9^h\ 39^m$.

On April 18, 1918 the official time was declared to be that of the meridian 149° 44′ 55″ east of Greenwich, the meridian of the governor's palace. This involved only a fraction of a second change from the existing standard, too slight to be of any practical importance.

On February 7, 1922, the official time was declared to be that of the 10th time zone east of Greenwich, the time of the 150th meridian east of Greenwich.

Intensity.—In some cases the Rossi-Forel scale of earthquake intensities is referred to, and for the sake of information it is given below.

I. *Feeble tremor.*—Felt only by a few persons on upper floors, or by experienced observers.

II. *Extremely feeble shock.*—Felt by small number of persons at rest.

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III. *Very feeble shock.*—Felt by several persons at rest; strong enough for direction or duration to be appreciable.
IV. *Feeble shock.*—Felt by persons in motion; disturbance of movable objects; creaking of building.
V. *Shock of moderate intensity.*—Felt generally by everyone; felt strongly on upper floors of tall buildings; light objects may be slightly disturbed.
VI. *Fairly strong shock.*—General awakening of those asleep; ringing of swinging bells; oscillation of hanging objects; stopping of pendulum clocks.
VII. *Strong shock.*—Overturn of movable objects; ringing of bells; general panic; some damage in poorly built or deteriorated buildings; landslides on steep banks; cracks in road surfaces.
VIII. *Very strong shock.*—Furniture and movable objects overturned; trees strongly agitated; flow of wells may be affected; spouting of sand and water in soft ground; stone and concrete walls craked; slides in river banks.
IX. *Extremely strong shock.*—Partial or total destruction of buildings.

Earthquakes.—

1825 and 1834. During the months of April and May of the years 1825 and 1834 terrible earthquakes were experienced in this island, causing great damage to buildings and spreading consternation among the inhabitants, who believed their last hour had come. —ML. S. M.

1849. On the 25th of January of this year, at four minutes before 3 o'clock in the afternoon, a terrible subterranean noise was heard; at the same instant there was a terrific earthquake, with strong vertical and horizontal movements, lasting a minute and a half, during which time the last fearful hour of complete desolation seemed to have arrived. The tower of the parish church of San Ignacio, that had just been completed, was thrown down upon the roof of the church. The parochial residence of Agaña, as well as those of Umatac, Pago and Agat, with their churches, and various houses in the towns, were more or less ruined, one of those that suffered most being that of the college of San Juan de Letran. The roof and many timbers fell to the ground, the heavier timbers alone saving it from complete destruction. As a result of the caving in of the earth from the great shocks, from the school of Santa Cruz in a line parallel to the river, twelve or fourteen holes opened in the ground, from which issued salt water and sand. In various other parts of the city great cracks appeared in the ground, from which gases issued, which, perhaps, hidden in the bosom of the earth, were the cause of the epidemic that then desolated the city; for this is shown from the fact that after these gases were thrown out the pest disappeared. There was only one fatal accident; it was the case of a woman of Inarajan, who happened to be near the river Falofofo, when a great sea wave rolling over the road carried her off and she was never seen again. A person of this town had the curiosity and patience to count the earth shocks that occurred from the 25th of January to the 11th of March, and he gives the number as 150. —ML. SM.
The following table of aftershocks has been left on record, although the total does not reach 150.

January		February		March	
Day	Number of shocks	Day	Number of shocks	Day	Number of shocks
26	18	1	7	1	1
27	14	2	6	2	1
28	13	3	2	5	1
29	10	4	1	8	1
30	10	5	2	10	2
31	9	6	4	11	1
		7	2		
		8	2		
		10	4		
		12	1		
		14	1		
		17	2		
		21	2		
		22	1		
		24	3		
		25	1		
		27	2		
		28	2		

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B.

A party of Caroline Islanders came to Guam from Satawal, 450 nautical miles SSE of Guam, saying that their island had been inundated by sea waves following the earthquake.
—GR. Oct., 1933; pp. 110 and 115.

1861. December 5th. An earthquake was felt in Agaña at 12:07 p. m. —GM. May 9, 1862.

1862. On the first of July, about 7:48 a. m. (the moment when the clock was stopped by the earthquake), a small but sufficiently perceptible vertical movement was felt, and soon terrible oscillations in a N–S direction followed, which caused the fall of many tile roofs. The earthquake lasted approximately from forty-five to fifty seconds.—ML. SM. GM. Oct. 27, 1862.

1863. On December 7th, a little after three oclock in the morning, a strong and long earthquake consisting of vertical movements, aroused the inhabitants of this town. —ML. SM.

1866. On June 24, at about 1:25 p. m., there was an earthquake similar to that of 1863.—ML. SM.

1870. On May 13th, at 3:27 p. m., two terrible vertical earthquake shocks were felt, which if they had been horizontal would have caused great damage to the stone buildings. There was an interval of about ten seconds between the shocks.

1873. August 18. At 10:45 (a. m. ?) an earthquake of vertical motion was felt. It lasted 3 seconds.
—GM. Sept. 16, 1874.

1873. September 22. A momentary earthquake was felt. Its motion was vertical and oscillatory.
—GM. Sept. 16, 1874.

1873. December 17. At 1:30 a. m. there was an earthquake with oscillations from E to W. It was moderately strong and lasted about ten seconds. No damage resulted. —GM. Sept. 16, 1874.

1875. April 29. At 10:58 (a. m.?) there was an earthquake shock which lasted about four seconds. No damage resulted. —GM. Nov. 17, 1875.

1875. April 30. An earthquake of about two seconds duration. —GM. Nov. 17, 1875.

1875. May 29. At 10:45 p. m.; moderately strong; duration about four seconds.—GM. Nov. 17, 1875.

1878. September 22. An earthquake at night: moderately strong; duration about three minutes; no damage. —GM. April 20, 1876.

1878. January 18. At 5:15 a. m.; duration 30 seconds; no damage. —GM. November 17, 1878.

1878. May 23. At 5:46 p. m.; moderately strong; duration about 15 seconds; no damage.
—GM. November 17, 1878.

1878. June 5. At 6:45 a. m.; duration, a few seconds. —GM. November 17, 1878.

1878. June 8. At 9:30 a. m.; moderately strong; duration 6 seconds. —GM. November 17, 1878.

1879. March 13. At 6:15 a. m.; strong; oscillatory, N–S. —MOR.

1887. October 14. At 6:17 p. m.; two shocks having duration of seven to eight seconds. —MOR.

1888. January 19. At 5:30 p. m.; earthquake reported by Mr. Le Marche. —MOR.

1892. May 16. At 9:10 p. m., the time shown by a stopped clock, there was a terrible vibratory movement which caused the people to leave their houses. It was followed by a very brusk oscillation from N to S and also E to W, in which direction it ended, as shown by pictures which were swung to the west in the houses. The earthquake lasted 60 seconds. Tiles of the masonry houses fell and some walls were cracked. A league from the town there were some small sinkings of the ground. The coast receded to the reefs, but, fortunately due to its slow return, it did not pass its ordinary line. If it had come back with a rush it would have dragged the whole village of San Antonio into the surf. That night there were three more small quakes, east to west, and others on the following days. —ML. SM.

1892. July 22. At 1:10 p. m.; oscillatory; light. —MOR.

1892. July 23. Noon. Light. —MOR.

1892. July 29. Noon. Light. —MOR.

1892. August 5. At Port Apra at 1:00 p. m.; light. —MOR.

1892. August 16. At 5:00 a. m.; oscillatory; light. —MOR.

1892. September 22. At 2:30 a.m.; oscillatory; moderate. —MOR.

1892. October 31. At 2:15 p. m.; oscillatory; moderate intensity and duration. —MOR.

1892. November 8. At 3:00 p. m. Light. —MOR.

1892. December 17. At 6:30 a. m.; oscillatory; north-south; light. —MOR.

1892. December 27. At 3:15 p. m.; oscillatory; light. —MOR.

1893. February 5. At 1:15 p. m.; two earthquakes with short intervals. Vibratory and oscillatory, NW–SE, with duration of two or three seconds. —VE. March 18, 1893.
—EC. March 18, 1893.

1893. February 14. At 11:30 p. m.; oscillatory; light. —ML. in MOR.

1893. February 16. At 6:45 p. m.; oscillatory; light; NW–SE. Aftershock at 7:00 p. m.
—ML. in MOR.

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1893. February 17. At 1:30 a. m., three strong vibratory shocks accompanied by subterranean noise. Duration two minutes. Barely perceptible shocks continued throughout the day. —ML. in MOR. VE. March 18, 1893. —EC. March 18, 1893.
1893. February 19. At 5:15 a. m.; oscillatory; light. —ML. in MOR.
1893. March 8. At 2.30 p. m.; light oscillatory; E–W. —MOR.
1893. March 15. At 10:45 a. m.; vibratory; light. —MOR.
1893. March 25. At 8:00 a. m.; moderate; oscillatory. —MOR.
1893. May 30. At 7:30 p. m.; moderate; vibratory. —MOR.
1893. July 10. At 3:30 p. m.; oscillatory; light. At Port Apra, light. —MOR.
1893. August 7. At 9:40 p. m.; oscillatory; moderate; 7 seconds duration. At 11:00 p. m.; light; accompanied by subterranean noise. —MOR.
1893. August 11. At 5:30 a. m.; light; oscillatory; E–W. —MOR.
1893. August 17. At 4:25 p. m.; vibratory; moderate. —MOR.
1893. August 20. At 9:40 p. m.; light; oscillatory. —MOR.
1893. September 13. At 10:05 a. m.; moderate; oscillatory. —MOR.
1893. September 16. At 8:15 p. m.; light. At Apra, moderate; oscillatory; E–W. —MOR.
1893. September 30. At 4:40 p. m.; oscillatory; moderate. At Apra, a light aftershock at 5:30 p. m. —MOR.
1893. October 1. At 4:38 p. m.; two earthquakes at an interval of three or four seconds. Moderate intensity and duration. At Port Apra, oscillatory; moderate. —MOR.
1893. October 11. At Port Apra at 2:00 p. m.; light. —MOR.
1893. October 21. At 11:55 a. m.; light, oscillatory; N–S. —MOR.
1893. November 1. At 2:30 p. m.; oscillatory; moderate intensity and duration. —MOR.
1893. November 4. At 5:15 p. m.; light. —MOR.
1893. December 10. At Piti at 2:45 a. m.; moderate. Aftershocks at 3:00 a. m. and 4:00 a. m., today and 5:45 a. m. on the 11th. —MOR.
1894. April 10. At 3:10 a. m.; vibratory; moderate intensity; short. —MOR.
1894. April 24. At 2:50 p. m.; oscillatory; light. —MOR.
1894. May 14. At 1:10 p. m.; oscillatory; moderate intensity; short. —MOR.
1894. May 20. At 3:00 a. m.; oscillatory; somewhat strong. —MOR.
1894. May 24. At 10:20 p. m.; very light; E–W. —MOR.
1894. June 18. At 6:45 a. m.; light; oscillatory. —MOR.
1894. October 11. At 3:05 a. m.; oscillatory; moderate intensity and duration. —MOR
1894. November 13. At 11:38 a. m.; light; oscillatory. —MOR.
1895. May 17. At 1:44 a. m.; moderate; oscillatory, S–N; 12 seconds duration. —MOR.
1895. May 20. At 2:20 p. m.; strong; oscillatory, E–W; 15 seconds duration. —MOR.
1895. July 7. At 4:45 a. m.; moderate; oscillatory; E–W; moderate duration. —MOR.
1895. August 2. At 7:40 a. m.; light; oscillatory; E–W. —MOR.
1895. August 14. At 4:45 a. m.; oscillatory; light. —MOR.
1895. August 26. At 8:55 p. m.; oscillatory, N–S; moderate intensity and duration. —MOR.
1895. October 4. At 2:05 a. m.; oscillatory, E–W; moderate intensity and duration. —MOR.
1895. November 1. At 10:16 pm.; rapid vibratory motion; duration 3 seconds. —MOR.
1895. November 16. At 2:16 a. m.; oscillatory, E–W, light; duration, 20 seconds. At Port Apra, strong, vibratory-oscillatory, N–S; 15 to 20 seconds duration. Everybody awakened. —MOR.
1895. November 18. At 2:34 p. m.; light; oscillatory. —MOR.
1896. April 10. At Port Apra at 6:20 p. m.; oscillatory, E–W; duration, 30 seconds. —MOR.
1896. April 11. At Port Apra at 5:30 a. m.; oscillatory, E–W. —MOR.
1896. April 14. At Port Apra at 1:00 a. m., oscillatory, N–S; duration, 20 seconds. —MOR.
1896. April 15. At 8:25 a. m.; oscillatory, light. —MOR.
1896. November 2. At 3:45 a. m.; oscillatory; moderate intensity and duration. —MOR.
1896. November 11. At 4:45 a. m.; oscillatory, N–S; moderate; 2 seconds duration. —MOR.
1897. January 3. At 6:30 p. m.; oscillatory; moderate duration. —MOR.
1897. January 28. At 6:05 a m.; light. —MOR.
1897. February 10. At 11:00 p. m.; oscillatory; light. —MOR.
1897. February 19. At Port Apra at 9:55 a. m.; light; oscillatory, E–W; 2 seconds duration. —MOR.
1897. March 27. At Port Apra at 3:15 p. m.; oscillatory; 2 seconds duration. —MOR.
1897. March 28. At Port Apra at 10:10 p. m.; oscillatory; one second duration. —MOR.

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1897. March 29. At 11:10 a. m.; oscillatory; light. —MOR.
1897. March 31. At Port Apra at midnight; strong; oscillatory, E–W; duration 4 seconds. —MOR.
1897. April 3. At 1:23 p. m.; oscillatory; moderate intensity and duration. —MOR.
1897. May 1. At 9:20 p. m. Earthquake. —MOR.
1897. May 26. At 8:00 a. m., moderate intensity and duration. —MOR.
1897. June 9. At 12:30 p. m.; oscillatory; light. At Port Apra, oscillatory, N–S; duration 10 seconds. —MOR.
1897. June 15. At Port Apra at 8:01 p. m.; oscillatory; N–S; duration, 30 seconds. —MOR.
1897. July 13. At 3:50 p. m.; oscillatory; moderate intensity and duration. —MOR.
1897. August 5. At 9:34 p. m.; vibratory; moderate intensity and duration. At Port Apra; oscillatory, N–S; duration 20 seconds. —MOR.
1897. August 11. Oscillatory; moderate intensity and duration. —MOR.
1897. August 22. At 8:20 p. m.; oscillatory. At Port Apra; strong; rapid vibratory-oscillatory, N–S; duration about 4 seconds. —MOR.
1897. August 25. At 4:40 p. m.; oscillatory; moderate. —MOR.
1897. September 11. At 11:00 a. m.; moderate; oscillatory; long duration. At Port Apra; vibratory-oscillatory, E–W; duration 30 seconds. —MOR.
1897. September 13. At 4:30 p. m.; perceptible. At Port Apra; oscillatory, E–W; duration, 10 seconds. —MOR.
1897. September 14. At 7:15 a. m.; moderate, oscillatory. At Port Apra; strong, rapid vibratory; duration 2 seconds. —MOR.
1897. October 3. At 5:30 a. m.; light; oscillatory. At 7:30 a. m. an aftershock. —MOR.
1897. October 8. At 7:50 p. m.; light. —MOR.
1897. October 21. At 1:30 p. m.; light, oscillatory. —MOR.
1897. October 26. At 1:50 p. m.; light; oscillatory. At Port Arpa, oscillatory, N–S; duration 3 seconds. —MOR.
1897. November 17. At Port Apra at 5:20 a. m.; strong; oscillatory, N–S; duration, 5 seconds. —MOR.
1897. December 24. At 12:55 p. m.; light; oscillatory, N–S; duration, 3 seconds. —MOR.
1898. January 5. At Port Apra at 4:35 a. m.; very strong; vibratory-oscillatory, N–S; duration, 20 seconds. —MOR.
1901. December 2. At 1:10 a. m.; earthquake. —CA.
1902. March 11. At 5:50 a. m.; slight duration about 8 seconds. —CA.
1902. March 30. At 7:10 p. m.; slight; duration about 5 seconds. —CA.
1902. April 6. At 4:48 a. m. Two shocks; the first light, the second heavier; duration of both about 8 seconds. —CA.
1902. April 29. At 1:50 a. m.; light; duration, about 2 seconds. —CA.
1902. May 7. At 2:50 a. m. Slight.
1902. May 18. At 3:08 p. m., three sharp shocks; total duration about 35 seconds. —CA.
At 3:20 p. m.; light shock; duration about 7 seconds.
1902. June 24. At 3:12 p. m.; two light shocks. —CA.
1902. July 25. At 8:56 a. m., very light shock, lasting two seconds. At 8:56 p. m., three shocks, one light and two heavy, in quick succession, lasting in all about six seconds. —CA.
1902. August 22. At 10:35 a. m.; very light shock. —CA.
1902. September 22. At 11:24 a. m., three heavy shocks and one light one, lasting in all 2½ and 3½ minutes, "during which time the island acted like a ship thrown on her beam ends in a heavy sea." Light aftershocks at 1:00; 2:47; 6:14; 7:14; 9:17; and 10:44 p. m. Seven other shocks, time not noted. News of the earthquake was brought to Manila by the station ship "Justin" and the following is a resume of the account which appeared in the Manila Times of October 7, 1902.

On September 22, at 11:15 a. m., a terrible subterraneous noise was heard, after which the earth began to tremble lightly until the real earthquake, which, as it lasted 45 seconds, was long enough to overthrow everything and terrify not only the natives but the Americans also. With one or two exceptions, all the stone buildings in Agaña suffered considerably and will need much repairing. Some of the houses were completely ruined. One house in particular sank 2 feet at one end, presenting a very curious picture, and many of the houses are distorted all out of proportion. Walls 18 and 20 inches thick swayed to and fro, cracked, and came to the ground; tile roofs came down on all sides; the ground opened in many places and spouted out salt water from the cracks; at Piti these crevices gave

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forth gases of a characteristic odor; huge rocks were dislodged from the hillsides and produced great landslides; many bridges were thrown down, preventing the passing of vehicles between the city of Agaña and the port of Piti, some 5 miles distant, where the warehouses are situated; telephone connection was also interrupted owing to the falling of many of the posts.

The casualties reported were only five natives injured On the Island of Saypan, also, masonry buildings were shattered. After the earthquake the whole island seemed to be in vibration; when the "Justin" left for Manila more than 100 small earthquakes had been felt. From the other islands and even from other points of Guam outside of Agaña no news has been received up to the present. The damage was estimated to amount to ₱250,000. —SM.

1902. September 23. At 4:05 and 8:20 a. m., light shocks. At 12:54 p. m., two light shocks and one heavy. "There was an almost continuous tremor of the earth during the afternoon, not noticeable apparently except to persons on floors of buildings elevated above the ground. Several quite marked shocks in the evening."—Seaton Schroeder, Commandant. —CA.

1902. September 24. At 11:32 a. m., light shock, lasting about 3 seconds. At 11:27 p. m., light shock, lasting about 2 seconds. —CA.

1902. September 25. At 9:45 a. m., light shock. At 4:10 p. m., one light shock, one heavy. At 4:30 p. m., light shock. —CA.

1902. September 26. At 5:05 a. m., light shock. At 1:16 p. m., two heavy shocks. —CA.

1902. September 27. At 2:30 a. m., light shock. At 12:39 p. m., two light shocks.

1902. "Ever since the earthquake of the 22nd, a tremor or trembling of the earth occurs at intervals varying from one to five minutes. No mention of this was made in our daily reports before, for the reason that at first we thought it was all imagination, but without a doubt it is a fact. As many other persons reported to us that they have felt these tremors quite plainly and in the same way." (Unsigned.) —CA.

1902. September 28. At 3:32 a. m., one light shock, one heavy. At 3:32 p. m., light shock. —CA.

1902. Semtember 29. Light shocks at 2:30 and 11:15 a. m., and at 6:50 p. m. —CA.

1902. September 30. At 10:30 a. m., light shock. "Trembling of the earth still continues and does not seem to decrease any."—(From Day's Record Sheet). At 10:40 p. m.; two light shocks. —CA.

1902. October 1. 4:10 a. m., two shocks; first heavy, second very light; lasting in all about four seconds. —CA.

1902. October 5. Freqent slight earthquake shocks have been felt each day since the strong shock of September 22nd. They are of very short duration but are very definite shocks, usually followed, and sometimes preceded, by a noticeable pulsation or trembling lasting for some 30 or 60 seconds. At night when lying in bed the shocks and trembling are felt with greater definition. The observers detailed for the meteorological station are quartered in a small stone house built low on the ground. Persons living in wooden houses or stone houses of two stories feel many shocks which the observers fail to notice. —CA.

1902. October 9. 2:00 p. m. Shock, lasting about one second. 10:15 p. m. Shock lasting about one half second.

1902. October 10. 1:10 a. m. One light shock lasting about 3 seconds. 10:00 p. m., two shocks, the first light, the second heavy, lasting in all about 4 seconds. "There was another quite noticeable earthquake, sudden and short, at 9:10 a. m. During a great part of the night of the 10th the earth was in a continuous light tremor."—Captain Schroeder. —CA.

1902. October 12. 12:32 a. m. Two light shocks, lasting about one second. 1:46 a. m., one light shock, lasting about 1 second. "The tremors mentioned in the accompanying report of October 5th were noticed on Monday or Tuesday of this week, but were plainly felt during the night of the 8th, 9th, 10th.—Lt. Cox. —CA.

1902. October 17. 5:04 p. m. One light shock, lasting about two seconds. —CA.

1902. October 19. 11:15 p. m. One short, sharp shock. —CA.

1902. October 20. 4:03 p. m. One light shock, lasting about 1 second. —CA.

1902. October 23. 9:56 p. m. Two moderate shocks, lasting about two and a half seconds. —CA.

1902. October 24. 1:25 a. m. Two short noticeable shocks in quick succession. —CA.

1902. October 27. 4:00 a. m. One short, sharp shock. 9:45 a. m. Another. —CA.

1902. October 31. 8:18 a. m. One light shock, lasting about two seconds. —CA.

1902. November 4. 1:50 a. m. One short shock. —CA.

1902. November 23. 11:03 p. m. Two light shocks, lasting about 15 seconds. —CA.

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1902. November 24. 10:15 p. m. Three moderately quick sharp shocks. —CA.
1902. November 27. 9:15 a. m. Light shock. 2:10 p. m. Shock. —CA.
1902. November 28. 10:40 p. m. Light shock. —CA.
1902. December 7. 8:55 p. m. One light shock. 9:30 p. m. One moderate shock lasting about one second. —CA.
1902. December 9. 4:17 p. m. Two light shocks, lasting in all about two seconds. —CA.
1902. December 14. 11:45 a. m. Light shock. 6:37 p. m. Two light shocks, lasting about two seconds.
1902. December 16. 6:55 a. m. Slight shock. 10:00 p. m. Slight shock. —CA.
1902. December 17. 11:10 p. m. One sharp shock, followed after 30 seconds by a second shock, vibratory, lasting about five seconds. —CA.
1902. December 24. 7:13 a. m. Two very heavy shocks, lasting in all about one minute and thirty seconds.

NOTE: My observations of the shock at 7:15 a. m. gives duration of shock 30 seconds, vibrations slow but of greater force than any of the minor shocks since September 22nd. —Lt. Cox. —CA.

1902. December 27. 2:36 p. m. One light shock, lasting about two seconds. —CA.
1902. December 28. 10:55 p. m. and 10:56 p. m. Two shocks of slight force and duration. —CA.
1903. January 5. 5:20 a. m. Slight shock of short duration. —CA.
1903. January 6. 11:45 p. m. Slight shock. —CA.
1903. January 9. 7:40 a. m. A slight shock, lasting about three seconds. —CA.
1903. January 10. 2:40 a. m. Two short vigorous shocks. —CA.
1903. January 13. 11:00 p. m. Slight shock. —CA.
1903. January 18. 9:22 a. m. Slight shock lasting about three seconds. —CA.
1903. January 19. 9:22 a. m. One heavy shock lasting about three seconds —CA.
1903. January 20. 8:40 p. m. One sharp shock. —CA.
1903. January 22. 10:20 p. m. One sharp shock with several minor vibrations during five seconds. —CA.
1903. January 27. 1:49 a. m. One slight shock, lasting about one and a half seconds. —CA.
1903. February 1. 7:02 p. m. A very sharp report or rumble to the eastward followed by two rather heavy shocks, lasting in all about seventeen seconds. —CA.
1903. February 10. 12:39 p. m. Two shocks, the first light and the second heavy lasting in all about one minute, fifteen seconds. Damaged the walls of the governor's mansion. The first part was a rapid vibration, N and S, and the latter part a comparatively slow oscillation E to W. —CA.
1903. February 11. 9:10 p. m. One heavy shock, lasting about eight seconds. Between 11:00 and 12:00 p. m., another shock. —CA.
1903. March 10. 9:02 a. m. Two light shocks, lasting about three seconds. —CA.
1903. March 27. 1:24 a. m. Three shocks, the first and second light ,the third very heavy, lasting in all about thirty seconds. 1:29 a. m. Another shock, rather heavy, lasting about ten seconds. —CA.
1903. April 26. 5:56 a. m. One light shock, lasting about six seconds. —CA.
1903. May 16. 7:37 p. m. One heavy shock, lasting about six seconds. —CA.
1903. May 23. 5:57 p. m. Two shocks, one light, one heavy, lasting about fourteen seconds. —CA.
1903. May 26. 9:00 a. m. One shock, lasting about three seconds. —CA.
1903. May 31. 9:06 p. m. One shock, lasting about five seconds. —CA.
1903. June 22. 4:25 a. m. Two light shocks, lasting about three seconds. —CA.
1903. June 24. 10:46 a. m. Two shocks, the first heavy, the second light, lasting about four seconds. —CA.
1903. July 12. 2:45 p. m. One light shock, lasting about three seconds. —CA.
1903. July 22. 4:40 a. m. A shock with duration two seconds. —CA.
1903. July 24. 9:45 p. m. A shock with duration one second. —CA.
1903. August 14. 6:20 a. m. One light shock, lasting about three seconds —CA.
1903. August 15. 2:51 p. m. Three shocks, lasting about four seconds. —CA.
1903. August 18. 9:38 p. m. One light shock, lasting about one second. 9:40 p. m. One light shock, lasting about one second. —CA.
1903. August 21. 3:52 p. m. One heavy shock, lasting about five seconds. —CA.
1903. September 1. 9:45 p. m. A shock with duration one second. —CA.

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1903. September 19. 10:56 a. m. A shock with duration two seconds. —CA.
1903. October 11. 4:50 p. m. Two shocks. One heavy and one light, lasting about five seconds.—CA.
1903. December 12. 12:30 a. m. A shock with duration six seconds. 5:17 a. m., a light shock with duration two seconds. —CA.
1908. April 30. 11:05 p. m. Sumay, intensity III. —MOB.
1908. May 8. 3:05 a. m. Sumay, intensity III. 11:30 p. m., intensity III. —MOB.
1908. May 11. 11:47 p. m. Sumay, intensity II. —MOB.
1908. June 10. 12:45 u. m. Sumay, intensity III. —MOB.
1908. June 25. 9:20 p. m. Sumay, intensity V. —MOB.
1909. September 13. 5:15 p. m. Sumay, intensity III. —MOB.
1909. October 8. 2:00 a. m. Sumay, intensity IV. 5:00 a. m., intensity II. —MOB.
1909. October 10. 6:15 a. m. Sumay, intensity III. —MOB.
1909. October 23. 9:20 p. m. Sumay, intensity III. —MOB.
1909. December 10. At 9:00 a. m. of December 10th there were two shocks lasting twenty seconds, of which the second was the more severe. Direction of the shocks SE–NW. In Agaña practically all the east and west walls of native mortar houses are badly cracked. In nearly every house articles on shelves of these walls were thrown down, while those of the north and south sides remained in place. The Women's Hospital, built of local mortar, was so badly injured as to necessitate tearing down; its tile roof slid off to the west, and the worst cracks were in the east wall. Many ceiling boards were shaken down in various houses. Several fissures opened in the ground, from one of which, near the river, came a large flow of water. The river bed sank in several places. The passing wave could be seen distinctly as it crossed the public square; and the station ship in the harbor reported having felt the shock. No damage of importance was done in the other towns on the island. The buildings of the Cable Station at Sumay, constructed of reenforced concrete were not injured; but a few objects were thrown down, and the steel water tower could be seen swaying No shocks were noticed before or after the earthquake nor was anything extraordinary observed in the sea. The disturbance was not felt at Yap, Western Carolines. (Report from Commercial Pacific Cable Co.).—MOB.
1910. March 6. 3:30 a. m. Sumay, intensity III. —MOB.
1910. April 4. 6:41 a. m. Sumay, intensity III. —MOB.
1910. April 5. 6:57 a. m. Sumay, intensity IV. —MOB.
1910. May 4. 5:55 a. m. Sumay, intensity IV. Two series of shocks separated by an interval of two seconds. Duration about 12 seconds. —MOB.
1910. June 15. 5:37 a. m. Sumay, intensity III. —MOB.
1910. August 15. 2:17 a. m. Sumay, intensity III and duration 5 seconds. —MOB.
1910. August 27. 4:40 a. m. Sumay, intensity III. —MOB.
1910. October 8. 8:34 a. m. Sumay, intensity IV. Duration 7 seconds. Two distinct series of shocks, followed by subterranean noise. —MOB.
1911. February 3. 8:30 p. m. Sumay, intensity III. —MOB.
1911. February 4. 4:00 a. m. Sumay, light shock. —MOB.
1911. April 13. 8:48 a. m. Sumay, intensity III. Aftershock at 8:54. —MOB.
1911. April 18. 0:06 a. m. Sumay, intensity III, very short duration. —MOB.
1911. May 18. 12:15 p. m. Sumay, intensity III. —MOB.
1911. June 6. 5:12 p. m. Sumay, intensity III. —MOB.
1911. June 10. 3:03 p. m. Sumay, intensity IV. —MOB.
1911. September 20. 6:07 a. m. Sumay, intensity II–III, short duration. —MOB.
1911. September 30. 1:44 a. m. Sumay, intensity IV, very short duration. —MOB.
1911. October 2. 1:20 a. m. Sumay, intensity III. —MOB.
1911. October 22. 8:45 p. m. Sumay, intensity III. —MOB.
1912. February 8. 1:48 p. m. Sumay, intensity III. —MOB.
1912. July 9. 7:37 p. m. Sumay, intensity II, short duration. —MOB.
1912. July 10. 11:44 a. m. Sumay, intensity IV–V; duration 10 to 15 seconds. —MOB.
1912. August 1. 8:00 p. m. Sumay, intensity III, short duration. —MOB.
1912. October 7. 11:30 p. m. Sumay, intensity III, short duration. —MOB.
1912. October 26. 6:32 p. m. Sumay, intensity VI, duration 15 seconds. It began with weak vibrations, W–E, for a few seconds; followed by strong undulations NW–SE, which stopped clocks and shook houses and furniture, without causing any damage. —MOB.
1912. December 23. 7:44 p. m. Sumay, intensity III. —MOB.

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1913. January 10. 8:58 p. m. Sumay, intensity III. —MOR.
1914. January 29. 4:11 a. m. Sumay, short, sharp earthquake. —MOR.
1914. February 15. 7:55 a. m. Sumay, short sharp earthquake. —MOR.
1914. February 25. 3:45 a. m. Sumay, short sharp earthquake. —MOR.
1914. April 9. 7:25 a. m. Sumay, sharp earthquake. —MOR.
1914. May 6. 1:00 a. m Sumay, short sharp earthquake. —MOR.
1914. June 6. 9:41 a. m. Sumay, short sharp earthquake. —MOR.
1914. June 29. 8:20 p. m. Sumay, short sharp earthquake. —MOR.
1914. July 12. 7:30 a. m. Sumay, slight earthquake. —MOR.
1914. July 16. 9:28 a. m. Sumay, short sharp earthquake. —MOR.
1914. August 18. 7:40 a. m. Agaña, light earthquake. —MOR.
1914. August 30. 2:21:40 a. m. Agaña, very light earthquake, the first registered by the Wiechert Inverted Pendulum. —MOR.
1914. September 29. 8:19 a. m. Agaña, light earthquake. —MOR.
1914. December 17. 3:07 a. m. Agaña, slight earthquake. —MOR.
1915. March 21. 3:12 p. m. Sharp shock in Sumay; strong in Agaña. —MOR.
1915. March 24. 8:32 p. m. Agaña. Very light shock; more noise than motion. —MOR.
1915. April 6. 9:00 a. m. Agaña, sharp shock lasting about 5 seconds. Much noise. —MOR.
1915. May 1. 2:06 p. m. Agaña, perceptible earthquake. —MOR.
1915. May 13. 4:18 p. m. Agaña, perceptible earthquake. —MOR.
1915. June 6. 1:33 p. m. Agaña, perceptible earthquake. —MOR.
1915. September 16. 5:26 a. m. Very slight at Sumay; perceptible in Agaña. —MOR.
1915. October 7. 7:17 p. m. Agaña, perceptible earthquake. —MOR.
1915. October 22. 12:37 p. m. Agaña, perceptible earthquake. —MOR.
1915. November 9. 6:32 a. m. Agaña, perceptible earthquake. —MOR.
1915. November 11. 4:41 p. m. Agaña, perceptible earthquake. —MOR.
1915. December 25. 8:14 p. m. Agaña, perceptible earthquake. —MOR.
1916. January 4. 4:58 a. m. Agaña, perceptible earthquake. —MOR.
1916. March 28. 7:27 p. m. Sumay, sharp earthquake of several seconds duration; no damage. Preceded by noise. Agaña, strong earthquake, one pen of seismograph dislocated. —MOR.
1916. June 11. 8:05 a. m. Sumay, sharp earthquake. Recorded in Agaña. —MOR.
1916. July 18. 0:54 a. m. Agaña, perceptible earthquake. —MOR.
1916. August 16. 7:12 a. m. Agaña, perceptible earthquake. —MOR.
1916. September 3. 5:23 p. m. Agaña, perceptible earthquake. —MOR.
1916. September 30. 6:51 p. m. Agaña, perceptible earthquake. —MOR.
1916. October 2. 3:31 p. m. Sumay, short but very sharp. Perceptible in Agaña. —MOR.
1916. November 13. 10:37 a. m. Sumay, very sharp quake which rocked houses from E to W; about five seconds duration. —MOR.
1917. January 19. 1:52 a. m. Agaña, perceptible earthquake. —MOR.
1917. March 11. 5:27 p. m. Agaña, perceptible earthquake. —MOR.
1917. April 28. 4:41 a. m. Sumay, short sharp earthquake. —MOR.
1917. April 28. 6:17 a. m. Agaña, perceptible earthquake. —MOR.
1917. May 7. 8:34 a. m. Sumay, short earthquake. Perceptible in Agaña. —MOR.
1917. May 10. 1:33 a. m. Sumay. Strong earthquake which stopped clocks but caused no damage. Perceptible in Agaña. —MOR.
1917. June 19. 2:00 a. m. Sumay. Two sharp earthquakes which seemed to be quite violent but did not stop wall clocks or spill solution from battery jars as other apparently lighter quakes have done on previous occasions. Agaña, perceptible; one pen of the seismograph was dislocated. —MOR.
1917. July 22. 2:14 p. m. Sumay, sharp earthquake. Agaña, perceptible; pens of seismograph dislocated. —MOR.
1917. July 30. 11:24 a. m. Sumay, short earthquake. —MOR.
1917. October 18. 4:57 a. m. Agaña, perceptible earthquake. —MOR.
1917. October 27. 2:01 a. m. Agaña, perceptible earthquake. —MOR.
1917. November 24. 8:52 p. m. Agaña, strong earthquake of long duration with motion of a rolling character; no sudden shocks. Sumay, strong earthquake, lasting about two seconds, which stopped clocks and spilled battery solutions. —MOR.
1917. December 24. 3:08 a. m. Sumay, moderate earthquake. —MOR.
1918. March 19. 3:30 p. m. Sumay, perceptible earthquake. —MOR.

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1918. May 19. 7:22 p. m. Sumay, perceptible earthquake. —MOR.
1918. August 22. 10:30 p. m. Sumay, perceptible earthquake. —MOR.
1919. February 4. 5:20 a. m. Sumay, sharp shock. Agaña, perceptible. —MOR.
1919. February 19. 6:44 a. m. Sumay, sharp shock. Agaña, perceptible. —MOR.
1919. August 29. 3:29 p. m. Agaña, perceptible earthquake. —MOR.
1919. September 18. 8:28 p. m. Agaña, perceptible earthquake. —MOR.
1920. January 4. 7:00 p. m. Sumay, sharp and prolonged earthquake. Agaña, perceptible. —MOR.
1920. January 15. 9:27 p. m. Agaña, Perceptible earthquake. —MOR.
1920. January 29. 9:00 p. m. Sumay, perceptible earthquake. —MOR.
1920. January 29. 9:00 p. m. Sumay, perceptible earthquake. —MOR.
1920. February 2. 9:16 p. m. Agaña, perceptible earthquake. MOR.
1920. February 14. 0:40 a. m. Sumay, very sharp shock. Agaña, perceptible earthquake. —MOR.
1920. February 29. 9:07 p. m. Sumay. Several earthquake shocks. Agaña, very perceptible shock. —MOR.
1920. March 2. 10:40 a. m. Agaña, perceptible earthquake. —MOR.
1920. March 11. 7:35 p. m. Agaña, perceptible earthquake. —MOR.
1920. March 14. 3:23 a. m. Agaña, perceptible earthquake. Sumay, perceptible. —MOR.
1920. March 20. 9:23 p. m. Agaña, perceptible earthquake. —MOR.
1920. May 31. 7:53 p. m. Agaña, perceptible earthquake. —MOR.
1920. June 24. 10:52 a. m. Agaña, perceptible earthquake. —MOR.
1920. June 30. 11:23 p. m. Sumay and Agaña, perceptible earthquake. —MOR.
1920. July 6. 9:21 p. m. Agaña, perceptible earthquake.
1920. July 12. 3:40 p. m. Agaña, perceptible earthquake. —MOR.
1920. September 19. 11:31 a. m. Agaña and Sumay, perceptible earthquake. —MOR.
1920. September 29. 5:50 a. m. Agaña, perceptible earthquake. —MOR.
1920. October 13. 1:30 p. m. Agaña, very perceptible earthquake. Sumay, considerable noise but not much motion. —MOR.
1920. October 17. 8:45 p. m. Sumay and Agaña. Perceptible earthquake. —MOR.
1920. October 18. 12:39 a. m. Sumay and Agaña. Perceptible earthquake. —MOR.
1920. October 23. 8:55 a. m. Sumay and Agaña. Very perceptible shock. —MOR.
1920. October 25. 9:27 p. m. Agaña. Perceptible earthquake. —MOR.
1920. October 27. 1:59 a. m. Agaña, perceptible earthquake. —MOR.
1920. November 11. 8:05 p. m. Agaña and Sumay, perceptible earthquake. —MOR.
1920. December 20. 9:36 p. m. Agaña, perceptible earthquake. —MOR.
1920. December 26. 3:43 a. m. Agaña, perceptible earthquake. —MOR.
1921. February 20. 5:13 p. m. Agaña, perceptible earthquake. —MOR.
1921. February 22. 4:24 p. m. Agaña, perceptible earthquake. —MOR.
1921. February 23. 4:25 a. m. Agaña, perceptible earthquake. —MOR.
1921. March 15. 8:37 a. m. Agaña, perceptible earthquake. —MOR.
1921. May 14. 10:58 p. m. Agaña, perceptible earthquake. —MOR.
1921. June 25. 11:59 a. m. Agaña, perceptible earthquake. —MOR.
1921. October 1. 7:07 a. m. Agaña, perceptible earthquake. —MOR.
1921. October 7. 12:10 a. m. Agaña, perceptible earthquake. —MOR.
1921. October 7. 10:42 a. m. Agaña, perceptible earthquake. —MOR.
1921. October 17. 6:33 p. m. Agaña, perceptible earthquake. —MOR.
1921. October 22. 3:00 p. m. Agaña, perceptible earthquake. —MOR.
1921. December 16. 12:12 p. m. Agaña, very perceptible earthquake. Sumay, quite strong. —MOR.
1921. December 25. 3:28 p. m. Agaña, perceptible earthquake. —MOR.
1921. December 26. 5:07 p. m. Agaña, perceptible earthquake. —MOR.
1922. January 6. 4:53 a. m. Agaña, very perceptible earthquake. Sumay, moderate earthquake. —MOR.
1922. February 28. 2:48 a. m. Agaña and Sumay, perceptible earthquake. —MOR.
1922. March 27. 10:22 p. m. Aagaña and Sumay, perceptible earthquake. —MOR.
1922. May 28. 11:04 a. m. Agaña, perceptible earthquake. —MOR.
1922. May 31. 2:16 a. m. Agaña, perceptible earthquake. —MOR.
1922. August 3. 1:26 p. m. Agaña, perceptible earthquake. —MOR.
1922. August 24. 8:24 a. m. Sumay and Agaña, perceptible earthquake. —MOR.
1922. September 15. 2:44 a. m. Agaña, perceptible earthquake. —MOR.
1922. October 30. 11:07 p. m. Agaña, perceptible earthquake. —MOR.

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1922. November 18. 10:47 a. m. Agaña, perceptible earthquake. —MOR.
1922. November 19. 3:32 a. m. Agaña and Sumay, perceptible earthquake. —MOR.
1922. November 20. 2:40 a. m. Agaña, perceptible earthquake. —MOR.
1922. December 22. 3:50 p. m. Agaña, perceptible earthquake. —MOR.
1922. December 31. 9:39 p. m. Sumay, earthquake perceptible for four seconds. Agaña, perceptible. —MOR.

1923. January 27. 10:32 a .m. Sumay, perceptible earthquake. —MOR.
1923. January 30. 7:03 a. m. Agaña, perceptible earthquake. —MOR.
1923. March 4. 2:42 a. m. Agaña, perceptible earthquake. —MOR.
1923. April 2. 3:00 p. m. Sumay, light earthquake. —MOR.
1923. April 15. Evening. Sumay, light earthquake. —MOR.
1923. April 30. 10:45 p. m. Agaña, perceptible earthquake. —MOR.
1923. May 6. 7:09 p. m. Sumay, perceptible earthquake. —MOR.
1923. June 15. 2:22 a. m. Agaña, perceptible. Sumay, perceptible for 34 seconds. —MOR.
1923. July 15. 4:28 p. m. Sumay and Agaña, perceptible earthquake. —MOR.
1923. July 18. 1:19 p. m. Agaña, perceptible earthquake. —MOR.
1923. July 29. 6:45 p. m. Sumay, light earthquake. —MOR.
1923. September 10. 11:29 a. m. Sumay, light earthquake. —MOR.
1923. September 14. 3:10 a. m. Sumay, light earthquake. —MOR.
1923. September 22. 9:01 p. m. Agaña, light earthquake. —MOR.
1923. September 23. 5:13 a. m. Agaña, light earthquake. —MOR.
1923. October 23. 11:05 p. m. Sumay and Agaña, light earthquake. —MOR.
1923. November 1. 1:37 p. m. Sumay, light earthquake. —MOR.
1923. November 15. 1:59 p. m. Agaña, light earthquake. —MOR.
1924. January 3. 2:21 a. m. Agaña, light earthquake. —MOR.
1924. January 9. 10:15 a. m. Agaña, light earthquake. —MOR.
1924. January 13. 10:51 a. m. Agaña, light earthquake. —MOR.
1924. January 13. 8:12 p. m. Agaña, light earthquake. —MOR.
1924. January 21. 5:43 a. m. Agaña, light earthquake. —MOR.
1924. January 26. 12:24 a. m. Agaña, light earthquake. —MOR.
1924. January 30. 2:48 p. m. Agaña, very perceptible earthquake. —MOR.
1924. February 11. 7:26 p. m. Agaña and Sumay, light earthquake. —MOR.
1924. March 22. 7:32 a. m. Agaña and Sumay, light earthquake. Duration, 5 seconds in Sumay. —MOR.
1924. March 30. 1:34 p. m. Agaña and Sumay, light earthquake. —MOR.
1924. April 7. 6:00 a. m. Sumay, light earthquake. —MOR.
1924. April 25. 1:50 a. m. Sumay, light earthquake. —MOR.
1924. June 17. 8:41 p. m. Sumay, severe shocks, lasting about 12 seconds. Agaña, very perceptible. —MOR.

1924. June 19. 2:22 p. m. Sumay, light earthquake. —MOR.
1924. August 14. 11:22 p. m. Agaña, very perceptible. —MOR.
1924. September 7. 4:34 p. m. Sumay, light earthquake. —MOR.
1924. September 12. 3:05 a. m. Agaña, light earthquake. —MOR.
1924. September 30. 8:33 p. m. Sumay, sharp shock. Agaña, perceptible. —MOR.
1924. October 18. 2:14 a. m. Agaña and Sumay, light earthquake. —MOR.
1924. October 23. 5:34 a. m. Sumay, light earthquake. —MOR.
1924. November 5. 9:56 p. m. Sumay, and Agaña, light earthquake. —MOR.
1924. December 10. 4:15 a. m. Agaña, light earthquake. —MOR.
1924. December 13. 9:51 p. m. Agaña, light earthquake. —MOR.
1925. January 22. 11:22 p. m. Sumay and Agaña, light earthquake. —MOR.
1925. March 8. 1:28 a. m. Sumay and Agaña, light earthquake. —MOR.
1925. March 16. 3:22 p. m. Agaña, light earthquake. —MOR.
1925. April 14. 2:26 p. m. Agaña, light earthquake. —MOR.
1925. April 14. 2:46 a. m. Agaña, light shock. Sumay, moderate intensity. —MOR.
1925. June 29. 6:44 a. m. Agaña, light earthquake. —MOR.
1925. August 13. 5:08 p. m. Agaña, light earthquake. —MOR.
1925. August 20. 11:34 a. m. Agaña and Sumay, light earthquake. —MOR.
1925. August 31. 6:50 a. m. Agaña, light earthquake. —MOR.
1925. October 8. 8:01 p. m. Agaña and Sumay, light earthquake. —MOR.

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1925. November 1. 5:31 a. m. Agaña, light earthquake. —MOR.
1925. December 11. 2:00 a. m. Sumay, light earthquake. —MOR.
1925. December 16. 1:39 p. m. Agaña and Sumay, light earthquake. —MOR.
1926. January 16. 10:35 a. m. Sumay, light earthquake. —MOR.
1926. January 24. 9:05 p. m. Sumay, light earthquake. —MOR.
1926. February 3. 3:07 a. m. Sumay, light earthquake. —MOR.
1926. February 19. 1:55 a. m. Sumay, light earthquake. —MOR.
1926. March 17. 5:24 p. m. Agaña and Sumay, light earthquake. —MOR.
1926. June 27. 4:12 p. m. Agaña, light earthquake. —MOR.
1926. August 7. 12:22 a. m. Agaña, light earthquake. —MOR.
1926. August 7. 5:18 a. m. Agaña, light earthquake. —MOR.
1926. August 19. 2:45 a. m. Agaña and Sumay, light earthquake. Five seconds duration in Sumay. —MOR.
1927. January 5. 11:30 p. m. Agaña, light earthquake. —MOR.
1927. January 6. 4:10 a. m. Agaña, light earthquake. —MOR.
1927. January 6. 4:33 a. m. Agaña, light earthquake. —MOR.
1927. January 6. 7:03 a. m. Agaña, light earthquake. —MOR.
1927. January 6. 9:32 a. m. Agaña, light earthquake. —MOR.
1927. January 10. 5:25 p. m. Agaña, light earthquake. —MOR.
1927. February 9. 3:51 a. m. Agaña, light earthquake. —MOR.
1927. February 9. 4:37 a. m. Agaña, light earthquake. —MOR.
1927. February 9. 6:45 p. m. Agaña, light earthquake. —MOR.
1927. April 24. 3:08 p. m. Agaña and Sumay, light earthquake. —MOR.
1927. May 2. 12:58 a. m. Sumay, light earthquake. —MOR.
1927. June 8. 8:44 p. m Agaña and Sumay, light earthquake. —MOR.
1927. July 24. 7:34 a. m. Agaña, light earthquake. —MOR.
1927. September 2. 8:57 a. m. Agaña, light earthquake. —MOR.
1927. November 10. 7:05 a. m. Agaña, light earthquake. —MOR.
1927. November 13. 10:30 p. m. Agaña, light earthquake. —MOR.
1927. December 19. 6:32 a. m. Agaña, light earthquake. Two more light shocks at 6:42 and 6:41. —MOR.
1927. December 23. 2:17 a. m. Agaña, light earthquake. —MOR.
1928. January 2. 3:46 p. m. Agaña, light earthquake. —MOR.
1928. February 13. 3:34 p. m. Agaña, moderate earthquake. Sumay, slight. —MOR.
1928. March 15. 3:39 a. m. Agaña, light earthquake. —MOR.
1928. March 30. 6:04 a. m. Agaña, light earthquake. —MOR.
1928. May 24. 1:37 a. m. Agaña, light earthquake. —MOR.
1928. June 3. 2:34 a. m. Sumay, light earthquake. —MOR.
1928. June 30. 11:38 p. m. Agaña, moderate earthquake, direction, E–W, intensity IV. Felt by many persons. —MOR.
1928. July 16. 4:34 a. m. Agaña, light earthquake. —MOR.
1928. August 29. 4:15 a. m. Agaña, light earthquake. —MOR.
1929. January 31. 1:28 a. m. Sumay, sharp shock. —MOR.
1929. May 6. 6:00 a. m. Sumay, light shock. —MOR.
1929. July 17. 8:47 p. m. Agaña, light earthquake. —MOR.
1929. August 9. 6:37 a. m. Agaña and Sumay, light earthquake. —MOR.
1929. October 16. 3:33 p. m. Agaña and Sumay, light earthquake. —MOR.
1929. October 17. 9:30 a. m. Sumay, light earthquake. —MOR.
1929. November 12. 2:08 a. m. Sumay, light earthquake. —MOR.
1929. November 18. 12:02 p. m. Agaña, light earthquake. —MOR.
1930. January 9. 3:10 p. m. Sumay, light earthquake. —MOR.
1930. March 24. 4:55 a. m. Agaña and Sumay, light earthquake. —MOR.
1930. April 26. 3:07 a. m. Agaña, light earthquake. —MOR.
1930. May 1. 7:17 p. m. and 7:54 p. m. Agaña, light earthquakes. —MOR.
1930. May 7. 6:10 p. m. Agaña, light earthquake. —MOR.
1930. May 11. 3:16 a. m. and 3:51 a. m. Agaña, light earthquakes. —MOR.
1930. May 21. 11:30 p. m. Sumay, light earthquake. —MOR.
1930. July 5. 1:00 a. m. Agaña, light earthquake. —MOR.
1930. July 20. 7:32 p. m. Agaña and Sumay, light earthquake. —MOR.

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1930. July 31. 7:51 a. m. Agaña, light earthquake. —MOR.
1930. August 26. 4:23 a. m. Agaña, light earthquake. —MOR.
1930. September 15. 10:55 a. m. Agaña, light earthquake. —MOR.
1930. October 2. 10:42 a. m. Agaña, light earthquake. —MOR.
1930. October 18. 12:53 p. m. Agaña, light earthquake. —MOR.
1930. October 25. 6:16 a. m. Agaña, light earthquake. —MOR.
1930. October 29. 7:11 a. m. Agaña, light earthquake. —MOR.
1930. November 19. 10:43 a. m. Agaña and Sumay, light earthquake. —MOR.
1930. November 23. 11:45 p. m. Sumay, light earthquake. —MOR.
1930. November 24. 9:35 a. m. Agaña, light earthquake. —MOR.
1930. December 27. Night. Sumay, light earthquake. —MOR.
1931. January 21. 4:30 a. m. Sumay, light earthquake. —MOR.
1931. January 25. 2:48 a. m. Sumay, light earthquake. —MOR.
1931. January 29. 7:25 a. m. Agaña and Sumay, light earthquake. —MOR.
1931. January 29. 10:37 a. m. Agaña, light earthquake. —MOR.
1931. February 16. 8:38 a. m. Agaña, light earthquake. —MOR.
1931. February 21. 9:46 p. m. Agaña and Sumay, light earthquake. —MOR.
1931. March 5. 9:56 p. m. Agaña and Sumay, light earthquake. —MOR.
1931. March 8. 11:00 p. m. Sumay, light earthquake. —MOR.
1931. April 22. 2:35 a. m. Agaña, light earthquake. —MOR.
1931. May 11. 9:54 p. m. Agaña and Sumay, light earthquake. —MOR.
1931. May 24. 7:34 a. m. Agaña, light earthquake. —MOR.
1931. June 3. 12:25 p. m. Agaña, light earthquake. —MOR.
1931. July 6. 5:45 p. m. Agaña, light earthquake. —MOR.
1931. July 15. 9:45 p. m. Agaña, light earthquake. —MOR.
1931. August 18. 12:48 a. m. Agaña, light earthquake. —MOR.
1931. August 31. 4:46 a. m. Agaña and Sumay, light earthquake. —MOR.
1931. September 25. 7:28 p. m. Agaña, light earthquake. —MOR.
1931. October 13. 9:18 a. m. Agaña, light earthquake. —MOR.
1931. October 30. 6:39 p. m. Agaña and Sumay, light earthquake. —MOR.
1931. November 4. 11:37 a. m. Agaña, light earthquake. —MOR.
1931. November 7. 10:45 p. m. Sumay, light earthquake. —MOR.
1931. December 13. 9:18 a. m. Agaña, light earthquake. —MOR.
1932. January 5. 9:22 p. m. Agaña and Sumay, light earthquake. —MOR.
1932. January 15. 1:12 a. m. Agaña, light earthquake. —MOR.
1932. February 21. 11:33 a. m. Agaña and Sumay, light earthquake. —MOR
1932. March 15. 2:32 p. m. Agaña, light earthquake. —MOR.
1932. March 19. 9:00 p. m. Agaña, light earthquake. —MOR.
1932. April 10. 9:14 p. m. Agaña, light earthquake. —MOR.
1932. May 11. 12:47 a. m. Agaña, light earthquake. —MOR.
1932. May 14. 11:15 p. m. Agaña, light earthquake. —MOR.
1932. June 12. 2:59 a. m. Strong earthquake of intensity VI. Center in the Nero Deep, SE of Guam. —MOR.
1932. June 22. 12:01 p. m. Agaña, light earthquake. —MOR.
1932. July 7. 5:19 a. m. Agaña, light earthquake. —MOR.
1932. August 18. 10:00 p. m. Agaña and Sumay, light earthquake. —MOR.
1932. August 25. 7:31 a. m. Agaña, light earthquake. —MOR.
1932. September 15. 3:28 p. m. Agaña, light earthquake. —MOR.
1932. September 21. 1:52 a. m. Agaña, light earthquake. —MOR.
1932. September 22. 2:05 a. m. Agaña, light earthquake. —MOR.
1932. September 26. 7:33 a. m. Agaña, light earthquake. —MOR.
1932. November 13. 8:28 a. m. Agaña, light earthquake. —MOR.
1932. November 14. 7:43 a. m. Agaña, light earthquake. —MOR.
1932. November 17. 7:55 p. m. Agaña, light earthquake. —MOR.
1932. November 22. 11:26 p. m. Agaña and Sumay, light earthquake. —MOR.
1932. November 22. 11:53 p. m Agaña, light earthquake. —MOR.
1932. November 23. 4:17 a. m. Agaña and Sumay, light earthquake. —MOR.
1932. December 23. 10:36 p. m. Agaña, light earthquake. —MOR.
1933. January 29. 9:30 a. m. Agaña, light earthquake. —MOR.

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1933. February 1. 4:24 a. m. Agaña, light earthquake. —MOR.
1933. February 15. 7:32 p. m. Agaña and Sumay, light earthquake. —MOR.
1933. February 26. 10:34 p. m. Agaña, light earthquake. —MOR.
1933. March 2. 6:10 p. m. Agaña, light earthquake. —MOR.
1933. March 11. 2:21 a. m. Agaña, light earthquake. —MOR.
1933. March 14. 11:28 p. m. Agaña, light earthquake. —MOR.
1933. March 15. 11:04 p. m. Agaña, light earthquake. —MOR.
1933. March 16. 10:08 p. m. Agaña, light earthquake. —MOR.
1933. March 20. 5:41 a. m. Agaña, light earthquake. —MOR.
1933. March 22. 7:45 p. m. Agaña and Sumay, light earthquake. —MOR.
1933. March 27. 8:49 a. m. Agaña. Light earthquake. —MOR.
1933. April 12. 1:06 a. m. Agaña, light earthquake. —MOR.
1933. April 22. 8:38 a. m. Agaña, light earthquake. —MOR.
1933. May 16. 8:15 p. m. Agaña, light earthquake. —MOR.
1933. May 30. 12:54 p. m. Agaña, strong earthquake. —MOR.
1933. May 31. 4:34 a. m. Agaña, light earthquake. —MOR.
1933. July 6. 8:42 p. m. Agaña, light earthquake. —MOR.
1933. July 30. 10:35 p. m. Agaña, light earthquake. —MOR.
1933. August 3. 6:36 p. m. Agaña, light earthquake. —MOR.
1933. August 16. 1:00 a. m. Agaña, light earthquake. —MOR.
1933. September 15. 9:42 p. m. Agaña, light earthquake. —MOR.
1933. September 23. 2:14 p. m. Agaña, light earthquake. —MOR.
1933. October 11. 9:50 p. m. Agaña, light earthquake. —MOR.
1933. October 24. 6:13 a. m. Agaña, light earthquake. —MOR.
1933. October 26. 7:23 p. m. Agaña, light earthquake. —MOR.
1933. November 9. 1:30 a. m. Agaña, light earthquake. —MOR.
1933. November 16. 4:49 p. m. Agaña, light earthquake. Other light shocks at 6:07 p. m. and 6:15 p. m. —MOR.
1933. November 18. 7:40 a. m. Agaña, light earthquake. —MOR.
1933. November 28. 11:05 a. m. Agaña, light earthquake. —MOR.
1933. December 4. 2:08 a. m. Agaña, light earthquake. —MOR.
1933. December 25. 5:42 a. m. Agaña, light earthquake. —MOR.
1934. January 26. 10:44 a. m. Agaña, light earthquake. —MOR.
1934. March 11. 8:40 p. m. Agaña, light earthquake. —MOR.
1934. March 15. 4:43 p. m. Agaña, light earthquake. —MOR.
1934. Marcch 30. 1:30 a. m. Agaña, light earthquake. —MOR.
1934. April 3. 1:53 a. m. Agaña, light earthquake. —MOR.
1934. April 16. 8:03 a. m. Agaña, light earthquake. —MOR.
1934. May 12. 4:55 a. m. Agaña, light earthquake. —MOR.
1934. May 14. 8:55 p. m. Agaña, light earthquake. —MOR.
1934. June 6. 5:55 p. m. Agaña, light earthquake. —MOR.
1934. July 29. 3:42 p. m. Agaña, light earthquake. —MOR.
1934. August 12. 4:33 a. m. Agaña, light earthquake. —MOR.
1934. August 13. 3:26 a. m. Agaña, light earthquake. —MOR.
1934. August 16. 10:59 a. m. Agaña, light earthquake. —MOR.
1934. August 20. 3:41 a. m. Agaña, light earthquake. Another light shock at 11:05 p. m. —MOR.
1934. September 25. 11:30 p. m. Agaña, light earthquake. —MOR.
1934. October 19. 8:54 p. m. Agaña, light earthquake. —MOR.
1934. October 28. 1:29 a. m. Agaña, light earthquake. —MOR.
1934. October 31. 3:14 p. m. Agaña, light earthquake. —MOR.
1934. December 2. 12:56 a. m. Agaña, light earthquake. —MOR.
1934. December 22. 5:57 a. m. Agaña, light earthquake. —MOR.
1935. January 10. 3:46 a. m. Agaña, light earthquake. —MOR.
1935. January 15. 1:09 a. m. Agaña, an abrupt earthquake felt by many persons. Its direction was E to W; its intensity, IV; and its duration, four seconds. Sounds accompanied the shock. —MOR.
1935. February 19. 6:07 a. m. Agaña, a severe earthquake which seemed to come from the SE. No damage. —MOR.
1935. March 5. 3:06 a. m. Agaña, light earthquake. —MOR.

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1935. March 20. 12:20 a. m. Agaña, light earthquake. —MOR.
1935. March 31. 12:06 a. m. Agaña, light earthquake. —MOR.
1935. April 10. 5:22 p. m. Agaña, light earthquake. —MOR.
1935. April 19. 4:01 p. m. Agaña, light earthquake. —MOR.
1935. April 20. 9:07 p. m. Agaña, light earthquake. —MOR.
1935. June 5. 1:14 a. m. Agaña, light earthquake. —MOR.
1935. June 25. 11:29 p. m. Agaña, light earthquake. —MOR.
1935. July 4. 2:25 p. m. Agaña, light earthquake. —MOR.
1935. July 6. 3:14 a. m. Agaña, light earthquake. —MOR.
1935. September 13. 11:48 a. m. Agaña, light earthquake. —MOR.
1935. September 19. 4:14 a. m. Agaña, light earthquake. Another very light shock at 4:20 a. m. —MOR.
1935. September 21. 12:11 a. m. Agaña, light earthquake. —MOR.
1935. October 18. 9:07 p. m. Agaña, light earthquake. —MOR.
1936. January 5. 9:12 p. m. Agaña, light earthquake. —MOR.
1936. January 27. 3:34 p. m. Agaña, strong earthquake, direction, E–W. —MOR.
1936. February 6. 11:47 a. m. Agaña, light earthquake. —MOR.
1936. February 19. 6:50 a. m. Agaña, light earthquake. Another light shock at 11:47 a. m. —MOR.
1936. February 28. 10:57 a. m. Agaña, light earthquake. —MOR.
1936. March 22. 10:43 p. m. Agaña, light earthquake. —MOR.
1936. April 12. 8:34 a. m. Agaña, light earthquake. —MOR.
1936. April 16. 3:37 p. m. Agaña, light earthquake. —MOR.
1936. April 28. 2:50 a. m. Agaña, light earthquake. —MOR.
1936. May 12. 8:01 a. m. Agaña, light earthquake. —MOR.
1936. June 1. 6:18 a. m. Agaña, light earthquake. —MOR.
1936. June 2. 5:28 a. m. Agaña, light earthquake. Another light shock at 5:38 a. m. —MOR.
1936. July 23. 2:35 a. m. Agaña, light earthquake. Another light shock at 5:59 a. m. —MOR.
1936. August 3. 3:47 p. m. Agaña, light earthquake. —MOR.
1936. August 30. 5:28 a. m. Agaña, light earthquake. —MOR.
1936. August 31. 7:38 p. m. Agaña, light earthquake. —MOR.
1936. September 1. 1:42 a. m. Agaña, moderately strong earthquake. Felt by everyone in Agaña. —MOR.
1936. September 21. 9:32 p. m. Agaña, light earthquake. —MOR.
1936. September 26. 1:04 p. m. Agaña, light earthquake. —MOR.
1936. September 28. 2:22 a. m. Agaña, light eathquake. —MOR.
1936. October 8. 10:14 a. m. Agaña, light earthquake. —MOR.
1936. October 30. 4:39 a. m. Agaña, light earthquake. —MOR.

The following telegram was received at the Manila Observatory from the Governor of Guam:

> "October 30. Guam. Earthquake of unusual intensity force VIII, duration approximately one minute, occurred at 4:39 a. m. this date followed by eight shocks in next ten minutes. Direction of the shocks NE–SW. Casualties none. Slight damage to buildings, remarkable in view intensity of original shock. Minor shocks continuing."

Mr. W. Rowley, the seismic observer, reported that during the first strong shock, which was of an abrupt and twisting character, the church bell was reported to have rung, the church tower clock stopped, plaster fell, walls were cracked, tile fell, glasses and dishes were broken, and electric fans were thrown from shelves. The seismograph was badly thrown out of adjustment. During the day of October 30, Mr. Rowley counted 25 shocks of various intensities from II to V; on October 31, 12 shocks, intensities II to IV; November 1, 7 shocks, intensities II to V; November 2, 21 shocks, intensities II to IV.

On November 13 another telegram was received from Guam which read:

> "Guam has experienced since 4:40 thirty October three hundred seven earthquake shocks. Fifty one shocks in last twenty four hours. Heaviest shock, since major initial shock, occurred 6:28 twelve November intensity VI Rossi-Forel scale duration about thirty seconds. Slight additional damage to buildings. No injuries to persons."

The seismograms of Guam from October 30 to November 27 show a total of 474 shocks, including all from the first and strongest shock down to the smallest, many of which were imperceptible to human senses. This is a minimum number for the seismograph was out of service about fifteen hours.

The center of the earthquake was in the Nero Deep. —MOR.

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1936. December 14. 7:30 a. m. Agaña, strong earthquake of intensity VII. Another shock of intensity III at 12:19 p. m. —MOR.
1936. December 15. 12:09 a. m. Agaña, light earthquake. Other light shocks at 3:50 p. m. and 6:42 p. m. —MOR.
1937. January 25. 10:37 p. m. Agaña, light earthquake. —MOR.
1937. January 26. 1:21 a. m. Agaña, light earthquake. Another light shock at 1:27 a. m. and stronger shocks at 5:04 p. m., 5:16 p. m. and 5:29 p. m. —MOR.
1937. January 27. 1:53 p. m. Agaña, light earthquake. Another light shock at 3:40 p. m. —MOR.
1937. January 30. 7:38 a. m. Agaña, light earthquake. Another light shock at 4:24 p. m. —MOR.
1937. January 31. 9:16 a. m. Agaña, light earthquake. —MOR.
1937. February 11. 6:47 p. m. Agaña, light earthquake. Another light shock at 8:30 p. m. —MOR.
1937. February 13. 12:40 p. m. Agaña, light earthquake. —MOR.
1937. February 16. 4:00 a. m. Agaña, light earthquake. —MOR.
1937. February 25. 9:50 p. m. Agaña, light earthquake. —MOR.
1937. March 7. 5:23 a. m. Agaña, light earthquake. —MOR.
1937. March 8. 7:39 a. m. Agaña, light earthquake. —MOR.
1937. March 18. 3:45 a. m. Agaña, light earthquake. —MOR.
1937. March 26. 9:06 p. m. Agaña, light earthquake. —MOR.
1937. April 7. 4:50 a. m. Agaña, light earthquake. Other light shocks at 5:00 a. m., 7:25 a. m., 2:59 p. m., 3:06 p. m., and 4:57 p. m. —MOR.
1937. April 20. 4:15 p. m. Agaña, light earthquake. —MOR.
1937. May 2. 3:57 p. m. Agaña, light earthquake. —MOR.
1937. May 6. 8:19 a. m. Agaña, light earthquake. Other light shocks at 5:32 p. m., 5:33 p. m., and 5:56 p. m. —MOR.
1937. May 24. 8:46 a. m. Agaña, light earthquake. Another light shock at 6:32 p. m. —MOR.
1937. May 28. 2:26 a. m. Agaña, light earthquake. Stronger shock at 5:10 a. m. —MOR.
1937. June 7. 6:25 p. m. Agaña, light earthquake. —MOR.
1937. June 22. 4:50 p. m. Agaña, light earthquake. —MOR.
1937. July 2. 1:43 p. m. Agaña, light earthquake. Another light shock at 3:51 p. m. —MOR.
1937. July 11. 8:12 p. m. Agaña, light earthquake. —MOR.
1937. July 14. 5:44 p. m. Agaña, light earthquake. —MOR.
1937. July 17. 10:18 a. m. Agaña, light earthquake. —MOR.
1937. July 19. 11:02 a. m. Agaña, light earthquake. Another light shock at 11:44 a. m. —MOR.
1937. July 20. 9:53 p. m. Agaña, light earthquake. Another light shock at 11:56 p. m. —MOR.
1937. July 21. 10:13 a. m. Agaña, light earthquake. —MOR.
1937. July 26. 7:18 p. m. Agaña, light earthquake. —MOR.
1937. August 3. 12:49 p. m. Agaña, light earthquake. —MOR.
1937. August 4. 9:42 p. m. Agaña, light earthquake. —MOR.
1937. August 8. 8:29 a. m. Agaña, light earthquake. —MOR.
1937. August 9. 8:24 p. m. Agaña, light earthquake. —MOR.
1937. August 21. 5:14 p. m. Agaña, light earthquake. —MOR.
1937. September 9. 12:17 a. m. Agaña, light earthquake. —MOR.
1937. September 18. 12:18 a. m. Agaña, light earthquake. —MOR.
1937. September 19. 1:21 p. m. Agaña, light earthquake. —MOR.
1937. October 3. 10:51 p. m. Agaña, light earthquake. —MOR.
1937. October 8. 4:38 p. m. Agaña, light earthquake. —MOR.
1937. October 10. 3:06 p. m. Agaña, light earthquake. —MOR.
1937. October 16. 12:24 p. m. Agaña, light earthquake. —MOR.
1937. October 19. 12:00:01 a. m. Agaña, light earthquake. Another light shock at 12:01:26 a. m. —MOR.
1937. October 27. 7:42 a. m. Agaña, light earthquake. —MOR.
1937. October 29. 12:39 p. m. Agaña, light earthquake. —MOR.
1937. November 7. 1:57 p. m. Agaña, light earthquake. —MOR.
1937. November 11. 7:34 a. m. Agaña, light earthquake. —MOR.
1937. November 14. 9:18 p. m. Agaña, light earthquake. —MOR.
1937. December 5. 2:10 p. m. Agaña, light earthquake. —MOR.
1937. December 7. 9:16 a. m. Agaña, light earthquake. —MOR.
1937. December 13. 6:00 a. m. Agaña, light earthquake. —MOR.
1938. January 2. 4:15 a. m. Agaña, light earthquake. —MOR.

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1938. January 12. 12:38 p. m. Agaña, light earthquake. —MOR.
1938. March 11. 5:00 a. m. Agaña, two light shocks separated by interval of few seconds. —MOR.
1938. March 29. 7:23 p. m. Agaña, light earthquake. —MOR.
1938. April 22. 8:42 a. m. Agaña, light earthquake. Another light shock at 3:45 p. m. —MOR.
1938. May 1. 3:38 p. m. Agaña, light earthquake. —MOR.
1938. May 21. 8:26 a. m. Agaña, light earthquake. —MOR.
1938. May 25. 6:23 a. m. Agaña, light earthquake. —MOR.
1938. June 5. 1:14 p. m. Agaña, light earthquake. —MOR.
1938. June 6. 4:56 a. m. Agaña, light earthquake. —MOR.
1938. June 14. 12:03 a. m. Agaña, light earthquake. —MOR.
1938. June 25. 8:50 a. m. Agaña, light earthquake. Another light shock at 12:26 p. m. —MOR.
1938. July 7. 2:57 a. m. Agaña, light earthquake. —MOR.
1938. July 18. 7:28 p. m. Agaña, light earthquake. Other light shocks at 7:33 pm., 7:37 p. m. and 7:42 p. m. —MOR.
1938. July 20. 5:49 p. m. Agaña, light earthquake. —MOR.
1938. July 21. 6:59 a. m. Agaña, light earthquake. —MOR.
1938. September 2. 11:13 a. m. Agaña, light earthquake. —MOR.
1938. September 22. 10:32 a. m. Agaña, light earthquake. —MOR.
1938. September 26. 1:02 p. m. Agaña, light earthquake. —MOR.
1938. October 4. 11:41 p. m. Agaña, light earthquake. —MOR.
1938. November 8. 1:26 a. m. Agaña, light earthquake. —MOR.
1938. November 22. 10:30 a. m. Agaña, light earthquake. —MOR.

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SEISMOLOGICAL BULLETIN FOR 1939

JULY–DECEMBER

International Seismological Centre

INTRODUCTION

SEISMIC STATIONS

The following is the list and data of stations equipped with seismographs.

Name	Islands	North latitude	East longitude	Elevation	Equipment	Substructure
		° ′	° ′	m.		
Manila	Luzon	14 35	120 59	3.0	Galitzin-Wilip, 3 components. Wiechert inverted pendulum, 955 kg. Two horizontal pendulums, 118 kg. each.	Alluvium and pyroclastics to unknown depth.
Baguio	do	16 25	120 35	1,512	Vicentini vertical. Wiechert inverted pendulum, 200 kg.	Limestone.
Ambulong	do	14 05	121 03	10.5	Wiechert inverted pendulum, 200 kg.	Soil underlaid by tuff.
Tagaytay	do	14 06	120 55	696.0	Wiechert inverted pendulum, 200 kg.	Compact ash and soil.
Butuan	Mindanao	8 56	125 32	2.0	Wiechert inverted pendulum, 200 kg.	Alluvium.
Agana	Guam	13 28	144 45	5.0	do	Coral.

All meteorological stations, official and coöperative, have instructions to report all perceptible earthquakes.

NEW SEISMOGRAPH

On November 24, 1939, a new 200-kg Wiechert Inverted Pendulum seismograph was installed in a small new observatory constructed by the Manila Railroad at Taal Vista Lodge, Tagaytay, Cavite Province. The primary purpose of this seismograph is to detect any earthquakes originating under or near Taal volcano. The surface of the ground at Tagaytay consists of a layer of more or less compact black volcanic cinders and the seismograph pier has been carried down two meters to a more compact stratum of volcanic ash and soil. The records obtained up to the present have been satisfactory.

The elevation of the observatory floor is 696 meters above sea level and it is 13 km. by direct line to the crater of Taal volcano. The direction from Tagaytay to the crater is almost at right angles to that from Ambulong to the crater. A similar seismograph was installed at Ambulong on February 9, 1939, as reported in the Seismological Bulletin for January–June, 1939.

SEISMIC RECORDS

The instrumental record is that obtained from the seismographs in the Manila Observatory. It is that of the Galitzin-Wilip instruments except when stated otherwise.

The time of occurrence given in the macroseismic records is that indicated by the seismographs of the Manila Observatory whenever the disturbance has been recorded by them. This fact is denoted by an asterisk in the macroseismic record. Otherwise the time is that given by the meteorological observer who reports the earthquake. Greenwich mean time is given and insular time is added in brackets.

Intensity is given according to the Rossi-Forel scale as adapted by Rev. W. C. Repetti, S. J., Chief of the Seismic Division, for use in the Philippine Islands.

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ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITIES (Adapted)

I. *Microseismic shock.*—Felt only by an experienced observer under favorable conditions.
II. *Extremely feeble shock.*—Felt by a small number of persons at rest.
III. *Very feeble shock.*—Felt by several persons at rest. Duration and direction may be perceptible. Sometimes dizziness or nausea experienced.
IV. *Feeble shock.*—Felt generally indoors; outdoors; by a few. Hanging objects swing slightly. Creaking of frames of houses.
V. *Shock of moderate intensity.*—Felt generally by everyone. Hanging objects swing freely. Overturn of tall vases and unstable objects. Light sleepers awakened.
VI. *Fairly strong shock.*—General awakening of those asleep. Some frightened persons leave their houses. Stopping of pendulum clocks. Oscillation of hanging lamps. Slight damage in very old or poorly built structures.
VII. *Strong shock.*—Overturn of movable objects. General alarm, all run outdoors. Damage *silght* in well-built houses, *considerable* in old or poorly built structures, old walls, etc. Some landslides from hills and steep banks. Cracks in road surfaces.
VIII. *Very strong shock.*—People panicky. Trees shaken strongly. Changes in flow of springs and wells. Sand and mud ejected from fissures in soft ground. Small landslides. Slides in river banks.
IX. *Extremely strong shock.*—Panic general. Partial or total destruction of some buildings. Fissures in ground. Landslides and rock falls.

SYMBOLS AND ABBREVIATIONS

P	Normal first preliminary tremors; longitudinal waves which have passed below the continental layer.
$\overline{P}$	Upper first preliminary tremors whose path lies wholly in the continental layer.
P′	Longitudinal waves that have traversed the earth's core.
PPn	Longitudinal waves reflected "n" times at the earth's surface.
PcP	Longitudinal waves reflected from the outer surface of the earth's core.
S	Normal second preliminary tremors; transverse waves that have passed below the continental layer.
$\overline{S}$	Second preliminary tremors whose path lies entirely in the continental layer.
PS	Waves transformed from longitudinal to transverse oscillations or vice versa through one reflection at the earth's crust.
SS	Normal transverse waves reflected "n" times at the earth's surface.
$\overline{ScS}$	Normal transverse waves reflected from the outer surface of the earth's core.
SKP	Waves which start with transverse vibrations but on refraction into the core are changed to longitudinal, or starting as longitudinal are refracted out as transverse.
L	Long waves of irregular form at the beginning of the surface or main phase.
M	Shorter and more regular waves of large amplitude in the surface group which travel more slowly than the L waves.
Mn	Individual waves of relatively large amplitude in the surface phase and usually in the M group.
F	Finis. End discernible movement.
i	Impetus. Impulsive and sharply defined beginning of a phase.
e	Emersio. Poorly defined emergency of a phase.
m	Maximum wave in any phase.
T	Period of waves.
O	Time of earthquake at the epicenter.
H	Time of earthquake at focus.
h	Focal depth.
△	Arcual distance from station to epicenter.
T_o	Free or undamped period of the seismograph.
V	Static magnification.
e	Ratio of successive damped amplitudes.
r	Friction constant.
J. S. A.	Jesuit Seismological Association. Central Office at St. Louis University, St. Louis, Missouri, U. S. A.
U. S. C. G. S.	United States Coast and Geodetic Survey, Washington, D. C., U. S. A.
C. M. O.	Central Meteorological Observatory, Tokyo, Japan.

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CONSTANTS OF THE WIECHERT INVERTED PENDULUM

1939	N–S component				E–W component			
	T_o	V	ϵ	$\frac{r}{T_o^2}$	T_o	V	ϵ	$\frac{r}{T_o^2}$
July	4.3	205	2.6	0.081	4.0	269	2.6	0.089
August	4.2	220	2.5	0.080	4.1	261	2.6	0.084
September	4.3	204	2.6	0.075	4.0	289	2.6	0.074
October	4.3	200	2.7	0.099	4.2	258	2.6	0.066
November	4.5	189	2.5	0.094	4.0	287	2.5	0.084
December	4.3	205	2.6	0.089	4.1	270	2.7	0.077

CONSTANTS OF THE GALITZIN-WILIP SEISMOMETERS

	T_1	T
N–S	12.6s	12.9s
E–W	11.9s	11.9s
Z	11.6s	9.0s

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JULY, 1939

MACROSEISMIC RECORD

5, ... P. M. ..... **Oras, Samar.** Earthquake.

10, 4h 53m [10, 12:53 P. M.?] **Ormoc, Leyte.** Oscillatory earthquake of intensity II and 15 seconds duration.

11, 22h 08m 49* [12, 6:08:49 A. M.] **Marinduque and Luzon.** Felt very feebly at Boac and slightly at Catanauan.

13, 23h 38m [14, 7:38 A. M.] **Iloilo, Iloilo.** Earthquake of intensity III and 3 seconds duration.

16, 6h 55m 41s* [16, 2:55:41 P. M.] **Libmanan, Camarines Sur.** Feeble earthquake.

17, 19h 00m [18, 3:00 A. M.] **Kabankalan, Negros Occidental.** Gentle earthquake.

20, 2h 06m [20, 10:06 A. M.] **NE Mindanao.** Short earthquake felt with intensity II in Butuan, Dapa, and Port Lamon.

20, 11h 20m [20, 7:20 P. M.] **Abuyog, Leyte.** Slight earthquake.

21, 18h 30m [22, 2:30 A. M.] **Santa Cruz, Laguna.** Oscillatory earthquake of intensity II and 3 seconds duration.

27, 14h 18m [27, 10:18 P. M.] **Maasin, Leyte.** Earthquake of intensity II and 2 seconds duration.

28, 21h 44m [29, 5:44 A. M.] **Baganga, Davao.** Earthquake of intensity II and 5 seconds duration.

29, ... **Mati, Davao.** Light earthquake.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ	Remarks
			h.	*m.*	*s.*	*Km.*	
407	1	ePNEZ	13	27	15	3,390	Probably deeper than normal.
		SNE		32	12	----------	
		F	14	17		----------	
409	2	ePNEZ	17	02	14	6,390	Probably deeper than normal.
		SNE		10	10	----------	
		F	18	10		----------	
410	2	iPZ	19	53	06	5,910	Dilatation.
		SN	20	00	34	----------	
		F	21	05		----------	
411	3	ePE	5	41	14	1,000	
		SE		43	00	----------	
		F		55		----------	
416	4	iP′1Z	18	45	53	18,745	Compression. 28°S: 67°W; h=300-400 Km. by U. S. C. G. S. 19.9°S: 67.3°W; h=300 Km. by J. S. A.
		eP′1NE			53	----------	
		P′2Z		47	07	----------	
		iE			13	----------	
		iZ		52	13	----------	
		iN		57	22	----------	
		iSSNE	19	11	39	----------	
		LNE		53	ca	----------	
		F	20	50		----------	
417	5	iPZ	8	47	40	1,090	
		ePNE			42	----------	
		iSNE		49	35	----------	
		F	10	00		----------	
419	5	iPEZ	22	51	05	7,155	Dilatation. Deep focus. 24°S: 179°W; h=500 Km. by U. S. C. G. S. 24°S: 180°W; h=550 Km. by J. S. A. 23°S: 178°E; h=600 Km. by Wellington.
		iPN			09	----------	
		iSNE		59	48	----------	
		LNE	23	12	30ca	----------	
		MN		16	30ca	----------	
	6	F	0	45		----------	
420	6	ePNEZ	1	15	58	2,480	
		SNE		19	54	----------	
		MNE		25	ca	----------	
		F		55		----------	

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INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
422	10	PNEZ	6 26 16	5,410	Disturbed by microseisms.
		SNE	33 15		
		F	7 10		
423	10	PNEZ	11 12 19	1,145	
		SNE	14 18		
		F	25		
426	11	ePNEZ	22 08 49	190	Felt at Boac and Catanauan.
		iSNEZ	09 13		
		F	14		
427	12	ePNEZ	12 51 59	2,655	Deep focus.
		SNE	56 08		
		F	13 25		
430	12	iPz	23 03 54	3,810	Dilatation? 4°S: 140°E by Wellington.
		ePNE	54		
		iSNE	09 18		
		LN	13 50cm		
		MNE	16 45cm		
	13	F	0 45		
431	13	iPz	17 10 31	3,290	Compression?
		ePNE	31		
		SE	15 22		
		ME	21 05cm		
		F	18 10		
439	18	eP(?)z	3 39 48	10,090	Disturbed by microseisms. 0—3 28 32. 49°N: 130.5°W by U. S. C. G. S. 49.2°N: 128.1°W by J. S. A.
		SNE	50 55		
		iE	52 42		
		F	5 30		
440	18	eP?NE	11 30 14	3,490?	
		SNE	35 18		
		LN	39 35cm		
		MNE	42 20cm		
		F	12 20		
441	20	ePNEE	2 33 01	6,840	Disturbed by microseisms. 22.4°S: 177°W; H—2 23 00; h—450–700 Km. by J. S. A. (A.F).
		SNE	41 30		
		F	3 40		
443	25	ePNEE	7 23 36	9,190	Disturbed by microseisms.
		SE	28 46		
		LE	32 15cm		
		F	50		
446	25	ePNEE	15 32 32	2,300	
		SN	36 16		
		F	55		
447	25	ePNEE	22 09 18	1,990	
		SN	12 38		
		F	40		
449	27	ePNEE	5 15 17	3,155	Disturbed by microseisms.
		SNE	20 00		
		F	55		

Twenty-three insignificant or undecipherable disturbances on the following days of July: 1st, 3rd(2), 4th(2), 5th, 9th, 11th(2), 12th(2), 14th(2), 15th, 16th(4), 23rd, 25th(2), 26th, and 29th.

International Seismological Centre

AUGUST, 1939

MACROSEISMIC RECORD

5, 0h 12m 11s* [5,8:12:11 A. M.] **NE Mindanao.** Center in the Philippine Deep. Felt with intensity V and 8 seconds duration in Surigao. Slight damages in Chinese stores. Intensity IV–V in Dapa with 4 seconds duration. Strongest motion at the beginning. Feeble in Butuan; pendulum clock stopped. Slight in Cantilan.

7, 7h 00m [7, 3:00 P. M.] **Buluan, Sorsogon.** Light earthquake.

13, 4h 25m 19s* [13, 12:25:19 P. M.] **Guiuan, Samar.** Center in the Philippine Deep. Oscillatory, with duration of 22 seconds.

16, 19h 42m 46s* [17, 3:42:46 A. M.] **Boac, Marinduque.** Extremely feeble shock with duration of 1 second.

17, 1h 05m [17, 9:05 A. M.] **Baganga, Davao.** Oscillatory earthquake of intensity III and 8 second duration.

20, 7h 07m 38s* [20, 3:07:38 P. M.] **Manila.** Slight earthquake.

21, 15h 25m [21, 11:25 P. M.] **Cape Bojeador, Ilocos Norte.** Light earthquake.

22, 22h 00m [23, 6:00 A. M.] **Kaatoan, Bukidnon.** Slight earthquake.

23, 4h 37m [23, 12:37 P. M.] **Carlota, Negros Occidental.** Slight earthquake.

23, 21h 23m 27s* [24, 5:23:27 A. M.] **E Mindanao.** Center in the Philippine Deep. Oscillatory with intensity V and 26 seconds duration at Baganga. Felt with intensity III at Butuan, Davao, and Port Lamon. Felt in Cantilan and Cabadbaran.

24, 12h 25m [24, 8:25 P. M.] **Tago, Surigao.** Light earthquake.

24, 18h 45m [25, 2:45 A. M.] **Jolo, Sulu.** Oscillatory earthquake of intensity III and 9 seconds duration.

26, 6h 48m [26, 2:48 P. M.] **Odiongan, Tablas.** Earthquake of intensity III.

International Seismological Centre

INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
457	4	ePNEZ	2	00	27	185	Dilatation.
		SNEZ			50		
		F		20			
458	4	PNEZ	2	31	52	200	Do.
		SNEZ		32	18		
		F		48			
460	5	ePNEZ	0	12	11	830	Dilatation from E at Butuan. Felt in NE Mindanao.
		iSEZ		13	42		
		F	1	14			
461	6	ePNEZ	4	41	08	2,610	
		SNE		45	13		
		LE		47	40ca		
		F	5	39			
463	8	iPZ	20	02	10	4,190	Deeper than normal.
		ePNE			10		
		iSNE		07	58		
		LN		13	05ca		
		F	21	10			
464	8	ePNEZ	21	36	08	185	
		SNE			31		
		F		48			
466	9	ePNEZ	16	35	23	95	
		SNEZ			35		
		F		43			
467	9	ePNEZ	22	26	12	2,400	
		SNE		30	03		
		F	23	07			
468	10	P?NEZ	6	16	17	5,210?	
		S?N		17	05		
		F	7	02			
473	12	iPNEZ	2	16	49	6,010	Dilatation from ESE. 13°S: 169°E; h=150 Km. by U. S. C. G. S. 17°S: 167°E by Wellington.
		iSNEZ		24	23		
		MNE		38	ca		
		F	4	00			
474	12	ePNEZ	9	57	33	4,530	Compression(?) 45°N: 153°E; 0=9:49.8 by U. S. C. G. S.
		SNE	10	03	42		
		LN		09	35ca		
		MNE		12	30ca		
		F	11	50			
476	13	ePNEZ	4	25	10	840	In the Philipine Deep. Felt at Guiuan, Samar.
		SNE		26	50		
		F	5	07			
479	14	ePNEZ	3	51	12	4,520	
		SNE		57	20		
		F	4	22			
481	14	ePNEZ	14	17	46	160	
		SNEZ		18	06		
		F		25			
483	16	PNE	19	42	46	160	Felt at Boac, Marinduque.
		SNE		43	06		
		F		51			
486	18	iPZ	22	25	48	6,280	Probably compression. 18°S: 168°E by U. S. C. G. S. 19°S: 168°E by Wellington.
		ePNE			48		
		SN		33	46		
		LNE		43	35ca		
		F	23	57			
487	19	iPNEZ	0	57	21	6,440	19°S: 168°E by Wellington.
		SNE	1	05	20		
		F	2	04			
489	20	ePNEZ	7	07	38	150	Felt in Manila. Ambulong, 100 Km. S from the Wiechert and Horizontals.
		SNE			57		
		F		26			
491	21	PNEZ	5	35	22	215	
		SNEZ			50		
		F		47			
495	23	iPZ	21	23	27	940	Dilatation. Near 8°N: 127°E. Felt in E Mindanao.
		iPN			28		
		ePE			28		
		iSNEZ		25	08		
		F	22	16			
499	26	ePNEZ	3	27	01	1,030	
		SNE		28	50		
		F	4	00			

Thirty-four insignificant or undecipherable disturbances on the following days of August: 1st(3), 3rd(3), 4th, 8th, 9th, 10th, 11th(3), 13th(2), 14th(2), 16th, 17th(2), 20th(2), 21st, 22nd, 23rd, 24th, 25th(2), 27th(2), 28th, 30th(2), and 31st.

SEPTEMBER, 1939

MACROSEISMIC RECORD

International Seismological Centre

1, 12h 45m [1, 8:45 P. M.] **San Jose, Mindoro.** Slight earthquake.

3, 7h 45m 29s* [3, 3:45:29 P. M.] **Batanes Islands.** Center in Luzon Strait. Felt with intensity IV at Basco with duration of 5 seconds. Feeble and oscillatory at Calayan.

7, 20h 40m 39s [8, 6:40:39 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

9, 15h 47m 51s* [9, 11:47:51 P. M.] **Iba, Zambales.** Feeble, oscillatory earthquake of 4 seconds duration.

11, 16h 30m [12, 0:30 A. M.] **Kabakan, Cotabato.** Slight earthquake with duration of 8 seconds.

12, 6h 02m 39s* [12, 2:02:39 P. M.] **Surigao, Surigao.** Earthquake of intensity IV and 5 seconds duration.

14, 12h 49m 08s [14, 10:49:08 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

18, 4h 54m 30s [18, 2:54:30 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

26, 9h 38m 44s [26, 7:38:44 P. M.] **Agaña, Guam.** Earthquake recorded and felt. Rumbling noise heard before and after the shock.

27, 3h 37m [27, 11:37 A. M.] **Port Lamon, Surigao.** Earthquake of intensity II and 13 seconds duration.

27, 15h 33m 32s [28, 1:33:32 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

29, 4h 20m [29, 12:20 P.M.] **Baganga, Davao.** Oscillatory earthquake of intensity III and 6 seconds duration.

29, 14h 27m 25s* [29, 10:27:25 P. M.] **N Luzon and Babuyan Islands.** Weak earthquake of 10 seconds duration at Calayan. Feeble in Cape Bojeador and Tuguegarao.

30, 22h 31m 00s* [October 1, 6:31:00 A. M.] **Libmanan, Camarines Sur.** Feeble earthquake.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remark
			h.	m.	s.	Km.	
507	2	iPz	9	08	02	5,880	Compression. Disturbed by microseisms. 13°S: 167°E by Wellington.
		iSNE		15	28		
		LNE		24	40ca		
		MNE		28	20ca		
		F	10	25			
508	3	iPz	7	45	29	670	Compression. Felt in Batanes Islands. S from the Wiechert.
		ePNE			29		
		iSNE		46	44		
		F	9	20			
510	6	ePNEZ	2	52	51	185	Very small.
		SNEZ		53	14		
		F		55			
514	7	iPz	13	46	01	3,480	
		ePN			01		
		SNE		51	04		
		F	14	23			
516	8	iPz	6	56	11	3,420	Compression.
		ePNE			11		
		SNE	7	01	11		
		MNE		09	ca		
		F		42			
517	8	iPz	12	14	25	6,390	Compression? 51°N: 175°E; 0—12:04:45 by U. S. C. G. S. 58.7°N: 175.8°E by J. S. A.
		ePNE			25		
		iSNE		22	25		
		LE		32	15ca		
		F	16	20	--		
520	9	iPz	15	47	51	165	Dilatation. Felt at Iba.
		ePNE			51		
		iSNEZ		48	12		
		F	16	17			
521	9	ePNEZ	21	31	34	2,645	
		iSNE		35	42		
		F	22	12			

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	Δ	Remarks
			h. *m.* *s.*	*Km.*	
522	11	eP?NEZ	8 03 16	8,710?	
		SE	13 20	----------	
		F	9 20	----------	
526	11	ePZ	22 50 32	1,040?	
		SNE?	52 22	----------	
		F	23 52	----------	
528	12	ePNEZ	8 28 35	1,700	
		iSNE	31 34	----------	
		F	51	----------	
529	12	iPZ	12 17 49	8,490	Compression. 30°S: 176°W; h=300 Km. Felt in Kermedec Island by Wellington.
		ePE	49	----------	
		iSN	27 42	----------	
		F	13 44	----------	
532	13	ePNEZ	20 07 01	260	
		$\overline{S}$NEZ	38	----------	
		F	25	----------	
533	14	ePEZ	9 06 36	2,810	
		SN	11 06	----------	
		LNE	13 29	----------	
		MNE	15 25	----------	
		F	10 30	----------	
534	14	ePNEZ	13 15 42	2,590?	
		SN?	19 55	----------	
		F	14 00	----------	
538	15	eP?Z	21 58 38	6,520?	
		iZ	59 28	----------	
		iN	36	----------	
		SNE	22 06 42	----------	
	16	F	0 20	----------	
539	16	iPZ	7 19 26	1,520+	Dilatation. Deeper than normal. Butuan, more than 660 Km. Netherlands East Indies.
		ePNE	26	----------	
		iSNE	22 04	----------	
		MN	25 ca	----------	
		F	9 00	----------	
542	17	ePNEZ	19 32 01	8,155	51.5°S: 164°E by Wellington.
		SNE	41 37	----------	
		LE	55 15ca	----------	
		F	20 27	----------	
543	18	iPZ	1 10 28	1,345	Compression.
		ePNE	28	----------	
		iSNEZ	12 48	----------	
		F	45	----------	
547	19	ePNEZ	3 42 ca	----------	Trace.
		F	4 32	----------	
550	19	iPZ	19 00 01	1,730?	
		iS?N	03 00	----------	
		F	20	----------	
554	24	ePNEZ	3 32 10	3,680	
		iSNE	37 26	----------	
		F	4 19	----------	
556	25	ePNEZ	15 36 48	3,090	
		SN	41 26	----------	
		LN	44 40ca	----------	
		MNE	46 25ca	----------	
		F	16 35	----------	
558	25	ePNEZ	21 13 04	3,455	
		SE	18 06	----------	
		ME	24 ca	----------	
		F	22 05	----------	
559	25	$\overline{e\text{P}}$NEZ	22 21 50	135	
		$\overline{S}$NE	22 07	----------	
		F	26	----------	
560	27	$\overline{e\text{P}}$NEZ	10 16 13	190	
		$\overline{S}$NE	37	----------	
		F	26	----------	
562	29	ePNZ	14 27 25	510	Felt in Northern Luzon and Babuyan Islands.
		iSNEZ	28 25	----------	
		F	52	----------	
563	30	ePNZ	16 25 46	1,520	
		iSNE	28 24	----------	
		F	54	----------	

Thirty-one insignificant or undecipherable disturbances on the following days of September: 1st, 5th, 6th(2), 7th(2), 9th(2), 11th(3), 12th, 13th(2), 14th(2), 15th, 17th(2), 18th(3), 19th(2), 20th, 22nd, 23rd, 24th, 25th, 28th, and 30th.

OCTOBER, 1939

MACROSEISMIC RECORD

International Seismological Centre

1, 12h 05m 03s [1, 10:05:03 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

2, 19h 00m [3, 3:00 A. M.] **Pontevedra, Negros Occidental.** Slight earthquake.

15, 19h 15m 14s* [16, 3:15:14 A. M.] **Iba, Zambales.** Very feeble oscillatory earthquake of 4 seconds duration.

19, 6h 26m 47s* [19, 2:26:47 P. M.] **S. Luzon and Mindoro.** Center probably in Verde Island Passage. Felt strongly at Halcon Rubber Station. Slightly in Naujan, Lobo, and Manila.

21, 9h 05m [21, 5:05 P. M.] **Batac, Ilocos Norte.** Slight earthquake.

23, 13h 30m [23, 9:30 P. M.] **Valderrama, Antique.** Slight earthquake.

25, 14h 20m [25, 10:20 P. M.] **Barbaza, Antique.** Strong earthquake.

27, 10h 19m 18s* [27, 6:19:18 P. M.] **Batanes and Babuyan Islands.** Earthquake felt at Basco with intensity III and 2 second duration. Extremely feeble at Calayan.

29, 0h 22m 14s* [29, 8:22:14 A. M.] **Davao, Davao.** Earthquake of intensity II.

29, 0h 50m 18s* [29, 10:50:18 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

30, 3h 30m [30, 11:30 A. M.] **Kabugao, Mountain Province.** Light earthquake. Another shock at 1:40 P. M.

30, 3h 51m 34s* [30, 11:51:34 A. M.] **Pasay, Rizal.** Very weak earthquake felt on Santa Escolastica Street, Pasay. Another shock at 12:50:43 P. M.*

30, 12h 40m [30, 8:40 P. M.] **Libmanan, Camarines Sur.** Feeble earthquake.

30, 13h 53m 21s* [30, 9:53:21 P. M.] **Central Luzon.** Earthquake of intensity IV in Baguio. Intensity II at San Fernando, La Union.

31, 0h 25m [31, 8:25 A. M.] **Hinatuan, Surigao.** Slight earthquake.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
565	1	ePNE	4	15	48	1,350	
		SNE		18	08	----------	
		F		40		----------	
566	1	$e\overline{P}$NE	7	44	26	195	
		$\overline{S}$NE			51	----------	
		F		50		----------	
572	3	iPZ	11	17	28	2,710	
		iSE		21	40	----------	
		F	12	30		----------	
573	3	iPZ	12	47	11	2,710	
		iSE		51	23	----------	
		F	14	20		----------	
577	5	iPZ	15	12	54	3,790	Dilatation.
		iSNE		18	17	----------	
		F		40		----------	
580	10	ePNEZ	9	03	45	200	Disturbed by microseisms. Baguio, 85 Km.
		$\overline{S}$NEZ		04	11	----------	
		F		10		----------	
581	10	ePNEZ	18	38	14	3,355	Disturbed by microseisms. Compression? 41°N: 143°E by U. S. C. G. S. 41.2°N: 143.4°E by J. S. A.
		iSNE		43	21	----------	
		LNE		49	20ca	----------	
		MNE		52	ca	----------	
		F	20	35		----------	
582	11	$e\overline{P}$NEZ	23	45	33	165	
		$\overline{S}$NEZ			54	----------	
		F		51		----------	
587	15	$e\overline{P}$NEZ	19	15	14	115	Felt at Iba, Zambales.
		$\overline{S}$NE			29	----------	
		F		19		----------	

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			Δ	Remarks
			h.	*m.*	*s.*	*Km.*	
588	17	ePNE	6	31	30	5,945+	Z component not recording. h probably 200 Km by Brunner chart. Δ probably 6,220 Km. New Hebrides by Riverview and Manila. Riverview reports h more than 200 Km. 16°S: 168°E; h=100 Km. by U. S. C. G. S. 16.8°S: 167.7°E by J. S. A.
		pP		32	14	----------	
		iSNE		39	02	----------	
		MNE		52	40ca	----------	
		F	9	35		----------	
589	19	iP̄NEZ		26	47	135	Dilatation from SSE. Deeper than normal. Slightly felt in Manila, Batangas, and Mindoro.
		iS̄NEZ		27	04	----------	
		F		40		----------	
593	21	P̄NEZ	22	46	10	95	
		S̄NEZ			22	----------	
		F		50		----------	
594	22	PNZ	14	46	23	4,330	48°N: 147°E by J. S. A.
		SN		52	20	----------	
		F	15	32		----------	
596	24	PNEZ	9	04	22	1,000?	Butuan, 230 Km. ±. Deeper than normal.
		S?NE		06	17	----------	
		F	10	10		----------	
597	26	eP̄NEZ	0	35	49	85	
		S̄NE		36	00	----------	
		F		40		----------	
598	26	eP̄NEZ	2	52	55	85	
		S̄NEZ		53	06	----------	
		F		56		----------	
599	26	P?NEZ	8	00	04	1,645?	
		SNEZ		02	55	----------	
		F		27		----------	
602	27	ePNEZ	10	19	18	700	Felt at Batanes Islands.
		SNE		20	36	----------	
		F		35		----------	
605	29	ePEZ	0	22	14	1,130	Felt at Davao.
		SNE		24	12	----------	
		F		40		----------	
606	29	ePEZ	0	50	18	2,430	Felt in Guam. Somewhat deeper than normal. Epicenter probably west of Guam. Guam, 0:45:45 GMT. 170 Km.
		SNE		54	18	----------	
		LNE		56	30ca	----------	
		F	2	00		----------	
609	30	eNE	3	51	34	5.5	Trace of the small shock felt in Santa Escolastica Street, Pasay.
		F		52		----------	
610	30	ePNE	4	01	10	250	
		S̄NE			45	----------	
		F		13		----------	
611	30	ENE	4	50	43	5.5	Do.
		F		52		----------	
612	30	eP̄NZ	5	25	01	165	
		S̄NEZ			22	----------	
		F		30		----------	
613	30	iPZ	13	23	44	7,800	Dilatation. Deeper than normal.
		ePNE			44	----------	
		SNE		33	00	----------	
614	30	iPZ	13	33	21	210	No. 613 still recording. Felt at Baguio and San Fernando, La Union. Baguio, 15 Km.
		S̄NEZ			48	----------	
		F	14	20		----------	
615	30	ePNEZ	17	46	06	2,300	
		SNE		49	50	----------	
		F	18	15		----------	

Twenty-six insignificant or undecipherable disturbances on the following days of October: 2nd(3), 3rd(3), 4th, 5th, 7th, 9th, 12th(4), 20th, 21st(2), 24th, 26th(2), 27th, 28th. 29th, 30th(2). and 31st.

NOVEMBER, 1939

MACROSEISMIC RECORD

1, 20h 04m 09s* [2, 6:04:09 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

3, 6h 29m 25s* [3, 2:29:25 P. M.] **SE Negros.** Earthquake felt at Dumaguete with intensity IV and 10 seconds duration. Also felt at Tayasan. Another shock of intensity II at 9:15:30 P. M.* This was also felt at Tayasan.

6, 21h 20m [7, 5:20 A. M.] **Butuan, Agusan.** Very feeble shock of short duration.

9, 16h 11m 10s* [10, 2:11:10 A. M.] **Agaña, Guam.** Earthquake recorded and felt. Another shock at 3:06 A. M. on the 11th.

11, ..., **Matuginao, Samar.** Feeble shock. Time not given.

11, 10h 30m [11, 6:30 P. M.] **Pamplona, Cagayan.** Light earthquake.

22, 10h 22m 07s* [22, 6:22:07 P. M.] **South Luzon.** Felt in Manila with intensity IV. Felt lightly over wide area from Libmanan, Camarines Sur, to Sabani Estate in Nueva Ecija. Center probably near Polillo Island and deeper than normal.

24, ..., **Torrijos, Marinduque.** Light earthquake. Time not given.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
619	1	eP?NEZ	6	17	25	6,870?	Disturbed by microseisms. Region of New Hebrides by Riverview and Manila.
		SNE		25	50	----------	
		LN		37	ca	----------	
620	1	eP?NEZ	7	27	19	1,830?	No. 619 still recording. Disturbed by microseisms.
		SNE		30	26	----------	
		F		50		----------	
621	1	ePNE	20	04	09?	2,535	Disturbed by microseisms. Felt at Guam at 19:59:07 GMT. △=180 Km. Deeper than normal.
		SNE		08	18?	----------	
		F		40		----------	
622	3	ePNEZ	6	29	25	600	Felt in South Negros.
		SNE		30	33	----------	
		F		48		----------	
625	4	ePNEZ	10	26	45	6,910?	
		S?NE		35	12	----------	
		F	11	30		----------	
626	5	ePNEZ	8	12	36	2,100	
		SNE		16	05	----------	
		F		30		----------	
627	6	iPZ	7	36	42	200	Dilatation.
		iPNE			43	----------	
		SNE		37	08	----------	
		F		40		----------	
628	7	ePNEZ	2	01	12	1,320	
		SNEZ		03	29	----------	
		LNE		04	55ca	----------	
		F		28		----------	
629	7	ePNEZ	3	55	50	1,380	
		SNEZ		58	13	----------	
		LNE		59	30ca	----------	
		MNE	4	00	50ca	----------	
		F	5	10		----------	
630	8	iPEZ	2	05	56	1,530	Compression.
		SE		08	35	----------	
		F		27		----------	
631	8	ePNEZ	17	19	07	175	
		SNEZ			29	----------	
		F		31		----------	
632	8	eP?NE	17	35	49	6,480?	
		SN		43	50	----------	
		LN		54	ca	----------	
		MN		59	10ca	----------	
		F	18	46		----------	
634	9	ePNEZ	9	28	54	2,640	
		SNE		33	02	----------	
		F	10	00		----------	

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
635	9	ePNEZ	16	11	10	2,440	Felt in Guam. 16:05:11 GMT. △=180 Km. Deeper than normal.
		SNE		15	04	----------	
		F	17	25		----------	
638	10	e	17	03	14	----------	P lost in microseisms.
		SNE		11	19	----------	
		LN		20	15ca	----------	
		F	18	10		----------	
639	10	ePNEZ	20	27	54	3,980	Western New Guinea by Manila and Riverview.
		SNE		33	40	----------	
		LN		38	ca	----------	
		F	21	30		----------	
641	12	ePNEZ	22	59	51	1,210	
		SNEZ	23	01	57	----------	
		F		32		----------	
648	15	ePNEZ	22	27	17	150	
		iSNE			36	----------	
		F		30		----------	
649	17	iPZ	9	09	00	1,695	Dilatation.
		SNE		11	52	----------	
		ME		15	30ca	----------	
		F		43		----------	
650	17	iPZ	18	49	48	6,680	Do.
		ePNE			48	----------	
		SNE		58	08	----------	
		F	19	19		----------	
651	18	ePZ	0	23	50	7,110	
		SE		32	29	----------	
		F	1	20		----------	
652	18	iPZ	1	41	17	5,230	Compression.
		ePNE			17	----------	
		SNE		48	07	----------	
		LNE		55	30ca	----------	
		F	4	20		----------	
654	19	ePNEZ	8	54	32	1,050	
		SNE		56	23	----------	
		F	9	15		----------	
655	20	PE	6	28	57	1,190	No. record on N component.
		SE		31	00	----------	
		ME		34	ca	----------	
		F	7	04		----------	
658	21	iPNEZ	11	10	16	5,165?	Compression from SW. 10°N: 60°E; h=200 Km. by U. S. C. G. S.
		SN?		17	10	----------	
		LN		24	10ca	----------	
		MNE		30	10ca	----------	
		F	12	50		----------	
659	21	ePZ	21	29	01	3,490	
		SNE		34	05	----------	
		MNE		40	30ca	----------	
		F	22	28		----------	
661	22	iPNEZ	10	22	07	160	Dilatation, E by N. Deeper than normal. Felt in Manila with intensity IV. S from the Wiechert and Horizontals.
		SNE			27	----------	
		F	11	10		----------	
665	23	ePNE	12	03	20	1,090	
		SNE		04	15	----------	
		F		15		----------	
666	24	ePNEZ	23	32	33	7,530	Disturbed by microseisms.
		SNE		41	37	----------	
		LNE		55	ca	----------	
	25	MNE	0	00	ca	----------	
		F	2	00		----------	
667	25	ePNEZ	6	55	47	3,120	
		SNE	7	00	27	----------	
		F		40		----------	
670	30	iPZ	9	38	20	280	Dilatation.
		ePNE			20	----------	
		iSNE			58	----------	
		F		48		----------	

Twenty-three insignificant or undecipherable disturbances on the following days of November 1st, 3rd(2), 8th, 10th(2), 12th, 13th, 14th(2), 15th(3), 18th, 20th, 21st, 22nd, 23rd(3), 26th, 29th, and 30th.

DECEMBER, 1939

MACROSEISMIC RECORD

7, 10h 50m 49s [7, 8:50:49 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

7, 17h 27m 49s* [8, 1:27:49 A. M.] **Tablas, Strait.** Felt strongly in Romblon. Clock stopped and bell rang at Bongabong, Mindoro. Intensity III at Odiongan, Tablas. Intensity II at Boac, Marinduque.

8, 6h 38m [8, 2:38 P. M.] **NE Mindanao.** Eathquake of intensity IV and only 2 seconds duration at Dapa. Very feeble at Butuan. Light at Cantilan and Mainit.

10, 1h 46m 13s [10, 11:46:13 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

11, 18h 30m [12, 2:30 A. M.] **Cantilan, Surigao.** Light earthquake.

13, 7h 09m [13, 3:09 P. M.] **SE Negros.** Earthquake of intensity III and 5 seconds duration at Dumaguete. Followed after a few seconds by another shock of intensity IV which lasted 25 seconds. Shocks felt at Jimalalud and La Carlota a little later; possibly same as at Dumaguete.

13, 10h 05m [13, 6:05 P. M.] **NE Mindanao.** Very light shock felt at Butuan, Mainit, Cantilan and Surigao.

17, 0h 30m [17, 8:30 A. M.] **Jimalalud, Negros Oriental.** Light earthquake.

19, 8h 50m [19, 4:50 P. M.] **Pontevedra, Negros Oriental.** Light earthquake.

20, ..., **Carabalan, Himamayland, Negros Occidental.** Light earthquake felt by forest ranger. Time not given.

20, 20h 25m [21, 4:25 A. M.] **Negros.** Earthquake of intensity V and 10 seconds duration at Dumaguete. Felt slightly at Tayasan, Carabalan, and Jimalalud.

20, 20h 55m [21, 4:55 A. M.] **Basilan.** Light earthquake at Yakan and Kabumbatan.

21, 21h 04m 03s* [22, 5:04:03 A. M.] **Mindanao and Sulu.** Earthquake in Celebes, Netherlands East Indies. Felt with intensity IV–V in Jolo. Felt lightly in Zamboanga and Davao.

22, 11h 00m [22, 7:00 P. M.] **Tayasan, Negros Oriental.** Light earthquake.

23, 1h 00m [23, 9:00 A. M.] **Negros.** Two strong shocks felt at Carabalan, one felt at Tayasan.

26, 2h 21m [26, 10:21 A. M.] **Negros.** Light shock felt at La Carlota, Pontevedra, and Carabalan.

26, 21h 22m [27, 5:22 A. M.] **Lagao, Cotabato.** Earthquake of 30 seconds duration.

27, 21h 25m [28, 5:25 A. M.] **Pulomoloc, Cotabato.** Light earthquake.

30, 19h 45m [31, 3:45 P. M.] **Pontevedra, Negros.** Light earthquake.

A report from the town of Gonzaga, Cagayan, dated January 3, 1940, stated that earthquakes were felt several times a day in that neighborhood. Dates and times were not given.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ	Remarks
			h.	*m.*	*s.*	*Km.*	
675	7	$i\overline{P}Z$	17	27	49	230	Dilatation from SE. Felt on islands surrounding Tablas Strait.
		$e\overline{P}NE$			49	----------	
		$\overline{S}NE$		28	29	----------	
		F		45		----------	
681	16	iPZ	10	53	41	4,100	Dilatation. 41.9°N: 147.3°E by U. S. C. G. S.
		ePNE			42	----------	
		SNE		59	24	----------	
		LNE	11	04	20ca	----------	
		F	12	10		----------	

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International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			Δ	Remarks
			h.	*m.*	*s.*	*Km.*	
682	17	ePNEZ	0	40	17	610	
		SE		41	26		
		F	1	05			
683	17	iPZ	7	53	55	3,180	
		SN		58	39		
		F	8	17			
684	18	P?EZ	10	28	22	3,890?	Disturbed by microseisms.
		S?N		33	51		
		F	11	00			
686	19	$i\overline{P}$EZ	21	44	53	150	Dilatation?
		$e\overline{P}$N			53		
		$\overline{S}$NEZ		45	12		
		F		53			
688	20	ePNEZ	20	25	13	1,820	
		SNE		28	19		
		F		37			
689	21	ePNEZ	10	21	43	1,465	
		SNE		24	15		
		F		42			
690	21	iPZ	21	04	03	1,635	Dilatation. Destructive in Menado, Celebes. Wiechert pens disjointed at 21:05:50. S from the Horizontals. Felt in Sulu and S. Mindanao. Near 0.5°N: 124°E.
		ePNE			03		
		SNE		06	53		
	22	F	0	47			
691	22	iPZ	5	03	39	16,000	Compression. No outstanding phases. 9.6°N: 85°W; H=4:44:00 by U. S. C. G. S.
		ePNE			39		
		LNE		51	53		
		F	7	15			
692	22	ePNEZ	21	04	14	2,165?	
		SNE?		07	48		
		F		22			
692	22	ePNEZ	21	04	14	2,165?	
		SNE?		07	48		
		F		22			
693	23	iPZ	2	58	46	1,625	Dilatation.
		ePNE			46		
		SNEZ	3	01	35		
		F		20			
695	23	iPEZ	21	02	58	1,620	Dilatation.
		SNEZ		05	46		
		F		20			
697	25	iPZ	16	32	22	3,290	
		ePNE			22		
		SNE		37	13		
		LN		40	40ca		
		MN		44	ca		
		F	17	20			
698	25	iPZ	20	59	37	1,645	Compression.
		ePNE		59	37		
		SNE	21	02	31		
		F		23			
699	25	ePNEZ	22	26	31	1,645	
		SNE	29	22			
		F		46			
700	26	ePNEZ	2	14	51	1,300	
		SNE		17	06		
		F		30			
701	26	ePNEZ	10	06	15	1,435	
		SNEZ		09	20		
		F		37			
703	27	iPZ	0	09	03	8,400	Dilatation. 39°N: 39°E by U. S. C. G. S.
		ePNE			03		
		SNE		18	48		
		MNE		44	ca		
704	27	iPZ	3	07	35	2,755	Dilatation. Deep focus. No. 703 still recording.
		ePNE			35		
		iSNEZ		11	51		
705	27	ePNEZ	21	24	29	1,390	
		SNE		26	53		
		F		47			

Sixteen insignificant or undecipherable disturbances on the following days of December: 1st, 5th(2), 10th(3), 11th, 15th, 19th, 20th, 23rd, 24th, 26th, 28th(2), and 31st.

International Seismological Centre

NUMBER OF EARTHQUAKES FELT IN THE PHILIPPINES, FROM 1903 TO 1939

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totai
1903	12	5	8	8	15	13	9	24	10	12	17	8	141
1904	22	10	10	9	6	8	11	5	11	15	4	6	117
1905	14	8	12	11	10	8	12	10	11	16	8	12	132
1906	13	6	5	12	6	11	9	9	9	11	5	7	103
1907	13	7	10	14	22	17	14	16	5	5	15	7	145
1908	17	6	11	6	13	9	5	11	8	10	15	11	122
1909	11	8	9	13	12	5	12	12	14	10	5	9	120
1910	13	13	14	12	23	18	22	8	12	21	23	17	196
1911	12	14	21	13	17	15	13	27	29	19	16	18	214
1912	14	21	28	16	15	18	22	15	15	14	12	12	202
1913	9	18	25	5	15	15	12	13	11	7	8	10	148
1914	15	17	12	10	5	11	14	12	13	10	13	14	146
1915	11	14	12	11	14	15	18	12	12	14	12	14	159
1916	13	15	12	7	8	8	15	18	20	15	7	5	143
1917	6	11	13	12	11	11	7	12	12	17	21	13	146
1918	12	17	8	12	19	11	16	14	11	13	20	14	167
1919	12	11	16	8	8	16	17	15	13	11	11	13	151
1920	19	11	12	7	15	10	8	18	8	18	12	9	147
1921	9	7	10	7	20	16	16	13	17	19	15	15	164
1922	15	12	16	13	21	15	13	14	11	14	17	11	172
1923	6	9	20	17	10	6	18	10	19	16	25	14	170
1924	11	12	15	14	15	8	13	14	15	13	7	12	149
1925	17	18	15	18	15	20	13	10	18	24	18	18	204
1926	23	16	11	13	13	4	13	12	7	18	10	18	158
1927	16	14	7	14	11	22	12	8	10	9	20	10	153
1928	11	14	11	15	7	15	6	9	5	5	7	9	114
1929	18	12	12	18	18	9	25	11	3	12	23	15	187
1930	10	13	11	9	10	8	10	15	17	14	9	7	133
1931	18	16	24	20	22	17	22	13	12	19	11	19	213
1932	17	17	18	19	19	16	8	37	16	15	12	20	214
1933	15	32	15	13	13	13	6	19	16	7	11	8	168
1934	12	8	5	16	14	8	14	13	12	18	14	15	149
1935	14	11	11	9	20	11	11	10	26	42	28	18	211
1936	13	11	18	13	4	6	18	16	11	22	16	23	171
1937	14	10	18	15	10	5	17	64	34	10	8	12	217
1938	13	12	13	14	13	15	24	13	20	9	11	19	176
1939	27	19	22	22	27	26	12	13	9	15	7	19	218

NUMBER OF SEISMIC DISTURBANCES RECORDED AT MANILA, FROM 1903 TO 1939

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1903	21	20	13	15	16	6	16	16	8	13	9	14	167
1904	15	19	11	19	17	35	25	18	16	26	18	18	237
1905	30	23	18	22	22	29	28	9	24	26	14	29	274
1906	30	17	22	27	13	35	11	3	14	86	21	26	316
1907	16	12	21	32	35	17	19	15	21	14	43	14	259
1908	16	14	23	15	20	12	14	15	9	108	25	24	295
1909	21	24	24	22	25	14	26	15	20	6	13	7	217
1910	20	17	20	17	17	21	19	11	12	18	15	29	216
1911	16	19	30	22	24	30	31	35	30	28	28	22	315
1912	27	16	30	24	23	35	27	35	20	20	31	34	322
1913	44	20	37	61	42	25	22	41	36	24	13	6	371
1914	22	35	30	48	25	23	24	20	22	26	32	22	329
1915	27	19	21	32	38	33	28	28	30	24	27	31	338
1916	37	46	43	38	37	28	31	28	31	39	22	17	397
1917	31	27	27	35	47	34	39	33	27	43	38	25	406
1918	62	35	32	30	22	37	64	68	45	34	48	53	530
1919	37	31	42	44	47	45	42	23	48	20	24	17	420
1920	30	35	17	25	48	40	30	34	32	47	15	19	372
1921	19	23	37	20	80	35	42	25	40	19	24	27	391
1922	41	25	20	41	50	33	33	46	39	32	24	37	421
1923	16	42	34	31	49	20	38	35	46	30	53	22	416
1924	24	31	27	48	74	26	33	30	59	24	20	23	419
1925	36	27	34	28	77	43	26	22	35	38	97	35	498
1926	30	20	32	23	29	41	27	52	34	38	29	22	377
1927	27	28	24	36	39	36	36	32	16	33	32	13	352
1928	24	25	31	27	29	97	18	34	33	22	33	35	408
1929	67	41	46	35	39	74	51	43	32	28	45	47	548
1930	32	39	61	54	93	58	29	48	67	85	39	39	644
1931	77	74	86	63	76	70	97	37	62	65	51	49	807
1932	49	56	44	71	55	66	60	61	109	93	52	60	776
1933	71	78	84	63	83	85	75	94	69	44	40	48	834
1934	52	93	56	68	78	81	77	78	52	34	93	94	856
1935	71	90	75	80	138	100	82	71	67	93	45	77	989
1936	61	70	63	106	104	73	51	56	65	48	49	60	806
1937	45	56	86	69	145	52	76	212	125	62	65	72	1,065
1938	53	94	56	84	129	91	94	75	63	45	53	61	898
1939	64	52	57	62	97	74	44	55	59	53	54	37	708

1903. Installation of Vicentini Seismograph.
1907. Installation of Horizontal Pendulums.
1911. Installation of Weichert 1,000 Kg. Inverted pendulum.
1930. Installation of Galitzin-Wilip Seismograph. Three components.

PHILIPPINE EARTHQUAKE EPICENTERS, 1930–1931–1932

International Seismological Centre

By W. C. Repetti, S. J.
Manila Observatory

In four previous publications [1, 2, 3, 4], we have given Philippine earthquake epicenters for the decade 1920–1929 and it was more or less expected that those of the next decade would be published together. After 1929 the number of determinable epicenters increased very considerably with the increase of instruments and improvement in timing, and the International Summary remains far in arrears with the prospect of falling still further behind owing to war conditions. In view of these factors we deem it advisable to publish another installment of Philippine epicenters covering the years 1930, 1931 and 1932.

It may seem on first thought that this is a needless duplication of the excellent data in the International Summary, but it is not so. The Summary is a very valuable collection of data and its determinations are useful for long distance investigations and plotting on small scale maps, but we have found that many of its Philippine epicenters are not sufficiently accurate for plotting on a large scale map of the Islands. Apparently the macroseismic evidence is ignored and the epicenters determined from instrumental reports of distant stations sometimes fail to agree with reliable macro reports. This frequently occurs in the case of earthquakes whose epicenters are in the southern part of the Philippine Deep. The longitude which is often given by the Summary is 125° or 126° East whereas the longitude of this portion of the Deep is 127°.

Without meaning to depreciate the work of the Summary we have to insist that an accurate view of the seismicity of the archipelago can not be obtained from the epicenters as given by the Summary.

The earthquakes of this period, 1930–32, do not reveal any new seismic area.

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[1] Philippine Earthquake Epicenters, 1920–1929, North of Latitude 14° 30′ N. Seismological Bulletin, 1930, July–December, pp. 65–87.

[2] Philippine Earthquake Epicenters, 1920–1929, South of Manila. Seismological Bulletin, 1931. January–June, pp. 37–52.

[3] Philippine Earthquakes, Marine Epicenters, 1920–1929. Publications of the Manila Observatory. Vol. II, No. 9, 1931.

[4] Tectonic Lines of the Philippine Islands. Seismological Bulletin, 1934. July–December, pp. 57–71.

EPICENTERS

	Δ ° ′	P h. m. s.	O–C s	Remarks
January 25, 1930				
7° 30′ N 127° 00′ E H=1h 38m 07s				
Manila	9 16	1 40 23	0	The International Summary gives 7° 30′ N: 126° E which is inland in Mindanao, whereas the great preponderance, if not all, of the earthquakes of this region are in the Philippine Deep. In this earthquake the P–wave was very weak, even at such a small distance as Manila, and hence positive residuals are to be preferred to negatives.
Hongkong	19 18	42 28	+ 4	
Phu-Lien	23 45	43 20	+ 1	
Batavia	24 20	26	+ 1	
Kobe	28 14	44 03	0	
Mizusawa	34 06	57	+ 2	
Riverview	47 15	46 48	+ 8	
Irkutsk	48 27	50	+ 1	
Agra	50 18	54	— 8	
Andijan	58 33	48 01	+ 1	
Tashkent	61 06	21	+ 4	
Samarkand	62 18	31	+ 7	
Sverdlovsk	70 57	49 24	+ 3	
Baku	75 20	53	+ 6	
Theodosia	85 51	50 49	+ 5	
Yalta	86 42	47	— 1	
Ksara	86 45	54	+ 5	
Pulkovo	86 51	52	+ 3	
Sebastopol	87 09	57	+ 6	

International Seismological Centre

EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O-C s	Remarks
March 16, 1930 **19° 06′ N 120° 10′ E H=4h 59m 35s**				
Manila	4 38	5 00 46	0	The International Summary gives 19° 30′ N: 120° E. The Manila determination agrees with the S–P distance from Manila. The Hongkong residual could be made smaller by moving the epicenter to 19° N: 118° 40′ E, but this would increase the negative residuals of the Japanese stations, and would not agree so well with the macroseismic data in which Aparri reported intensity IV and the northwest Luzon stations not quite so strong.
Taihoku	6 06	59	+ 7	
Hongkong	6 30	01 09	— 3	
Sumoto	20 06	04 01	— 9	
Kobe	20 30	05	— 9	
Nagoya	21 54	23	— 6	
Irkutsk	35 24	06 29	— 5	
Andijan	45 57	07 58	+ 1	
Tashkent	48 24	08 20	+ 4	
Samarkand	49 57	32	+ 5	
May 19, 1930 **20° 25′ N 120° 30′ E H=15h 04m 06s**				
Hokotu	3 16	15 05 00	+ 3	This earthquake presents some difficulty. The International Summary places the epicenter at 22° N: 120° 30′ E, and H=15:03:54, GMT. This agrees more or less with the statement in the monthly report from Taihoku that an earthquake was felt in southern Taiwan and that the epicenter was probably in the Simotansuikei valley. But this does not satisfy Manila data. The distance from the S-P interval at Manila is 655 km. and the shock was felt with intensity VI at Basco and somewhat lighter in north Luzon. We cannot admit an error of 8 seconds in Manila's time and the alternatives are a revision of the position given by the International Summary, a revision of travel time tables or the assumption of simultaneous earthquakes. Our solution is to place the epicenter at 20° 25′ N: 120° 30′ E with H=15:04:06, GMT, and a simultaneous shock in southern Taiwan. There are phases on the Manila seismograms which can be interpreted as coming from the shock in Taiwan. If the phase given as S at 15:05:17 by Taihoku is actually the P phase from the Philippine epicenter then the residual is only—1 second. Moreover, the interval L–P in the Taihoku report, if interpreted as S–P, gives a distance of 2.6° which agrees with the Taiwan epicenter. This assumption of simultaneous earthquakes gives a more satisfactory solution for arrival times. The stations to the northeast, north and northwest receive the first impulses from the Taiwan center while those to the southward receive the first from the Philippine center. Stations to the west are satisfied by either epicenter. Hoko and Riverview do not fit in with this double earthquake assumption and we have no solution to offer.
Taihoku	4 45	04 55	—23	
Manila	5 52	05 34	0	
Hong Kong	6 12	05 38	0	
Zikawei	10 48	06 14	—29	
Phu-Lien	13 00	07 15	+ 2	
Nagasaki	14 42	07 04	—31	
Hukuoka	15 50	07 16	—33	
Koti	17 30	07 32	—37	
Sumoto	18 51	07 51	—34	
Kobe	19 16	07 58	—33	
Osaka	19 28	08 01	—34	
Toyooka	19 38	08 01	—34	
Tyosi	23 31	08 37	—39	
Amboina	25 16	09 14	—19	
Mizusawa	25 46	09 02	—37	
Vladivostok	26 39	08 55	—52	
Batavia	29 49	10 18	+ 1	
Calcutta	29 57	10 02	— 7	
Malabar	30 24	10 12	—10	
Irkutsk	34 15	10 27	—30	
Colombo	41 36	11 49	— 5	
Tashkent	47 50	12 28	—14	
Sverdlovsk	56 42	13 27	—27	
Riverview	61 36	13 59	—20	
Baku	62 24	14 14	—10	
Simferopol	71 10	15 18	— 3	
Theodosia	72 21	15 14	—15	
Pulkovo	72 32	15 09	—20	
Yalta	73 18	15 16	—17	
Sebastopol	73 44	15 25	—11	
Ksara	74 30	15 27	—14	
Helsingfors	75 04	15 26	—19	
Copenhagen	82 51	16 07	—21	
Vienna	83 49	16 14	—19	
Stuttgart	87 49	16 31	—22	
De Bilt	88 20	16 37	—18	
Strasbourg	88 45	16 32	—25	
June 11, 1930 **10° 00′ N 129° 36′ E H=10h 23m 51s**				
Palau	5 32	10 27 10	+ 5	(Note) Not reported as felt in Mindanao. The International Summary gives the position 8° 00′ N: 128° 30′ E and 0=10:24:00. This gives negative residuals at the near stations. We prefer to satisfy the near stations and drop the distant stations with large positive residuals. The distant stations can easily miss the first weak impulses in an earthquake of this character. Note: It is assumed that the time of arrival at Palau was actually 10:25:10 and that the reported time is a misprint.
Manila	9 54	26 12	0	
Hong Kong	19 54	28 20	+ 1	
Phu-Lien	24 42	29 00?	— 9	
Batavia	27 52	29 56	+11	
June 18, 1930 **10° 00′ N 129° 36′ E H=20h 56m 43s**				
Manila	9 36	20 59 04	0	Not reported felt in Mindanao. The International Summary uses the same position as on June 11th, viz., 8° N: 128° 30′ E.
Andijan	58 46	21 06 27	—11	
Samarkand	62 44	06 54	— 9	
Sverdlovsk	70 12	07 50	— 2	
Pulkovo	85 58	09 18	— 3	
July 22, 1930 **8° 50′ N 126° 50′ E H=8h 59m 42s**				
Manila	8 24	9 01 49	0	h=200 km.±. Felt in Butuan and strongly in Cateel on the east coast of Mindanao. (Note) The International Summary puts the epicenter at 7.2° N: 123° E, as on December 28, 1928, with 0=8:59:42. This position is more than 300 km. from Butuan where the seismogram shows the characteristic of a deep quake less than 210 km. away. The macroseismic data do not at all agree with an epicenter in the position of that of December 28, 1928. Travel times based on table derived from earthquake of April 13, 1927. The epicenter as determined is considered as very probable. Note: We assume that the time of P at Irkutsk should be 9:09:01 instead of 9:08:01.
Phu-Lien	23 09	04 ?	—30	
Batavia	24 42	04 34	—11	
Irkutsk	55 12	08 01	— 5	
Sverdlovsk	70 16	10 38	— 3	

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
August 31, 1930 **15° 55′ N 122° 15′ E H=1h 14m 19s**				
Manila	1 48	1 14 50	0	The International Summary places the epicenter at 15° 30′ N: 122° E and adds "as on November 21, 1928." This earthquake was 200 km. from Manila whereas that of Nov. 21, 1928, was 160 km. The epicenter of the latter earthquake was 16° N: 120° 55′ E, which is 1° 20′ west of the present position.
Hong Kong	10 00	16 44	0	
September 24, 1930 **9° 30′ N 126° 30′ E H=7h 39m ca**				
				The amount of energy in this earthquake, as indicated by the Manila seismograms, was insufficient for an accurate determination of the epicenter. This is further indicated by the erratic residuals in the International Summary. The distance from Butuan cannot be determined owing to overlapping of traces from the earthquake swarm and time uncertainties. The distance from Manila, derived from the S–P interval, is about 830 km., and making the rather safe assumption that the earthquake was on the usual line of the Philippine Deep, the epicenter may be placed at 9° 30′ N: 126° 30′ E. The International Summary gives 9.2° N: 127.5° E, but this is too far from Manila. Felt at Cantilan and Butuan, Mindanao.
September 24, 1930. **9° 00′ N 126° 45′ E H=12h 06m 49s**				
Manila	7 56	12 08 46	0	Felt in northeastern Mindanao. The International Summary gives the position 9.2 N: 127.5° E and 0=12:06.51. This is further than the S-P distance derived from Manila seismograms.
Ishigakijima	15 33	10 21	— 8	
Hong Kong	17 57	56	— 3	
Zikawei	22 44	11 51	0	
Kagoshima	22 50	11 58	+ 1	
Nagasaki	23 54	12 04	+ 1	
Batavia	25 00	22	+ 8	
Koti	25 21	17	0	
Sumoto	26 26	18	—10	
Osaka	26 59	37	+ 3	
Colombo	46 27	15 05	—10	
Irkutsk	46 58	21	+ 2	
Tashkent	59 51	16 57	+ 6	
Samarkand	61 12	17 06	+ 7	
Sverdlovsk	69 33	18 01	+ 6	
Pulkovo	85 27	19 27	+ 3	
La Paz	163 39	26 43	— 4	
September 24, 1930. **9° 00′ N 126° 45′ E H=15h 47m 12s**				
Manila	7 56	15 49 19	+10	The International Summary gives 9.2° N: 127.5° E as in the preceding earthquake. This is another earthquake of small energy.
Hong Kong	17 57	51 20	0	
Sverdlovsk	69 33	58 23	+ 6	
Pulkovo	85 27	59 53	+ 5	
October 1, 1930. **18° 00′ N 122° 20′ E H=2h 53m 08s**				
Manila	3 41	2 54 07	+ 2	Felt very strongly in Aparri and only moderately or weakly in other places; an abnormal effect. The time of P at Batavia was probably 2:59:04 and our residual is based on that assumption. The International Summary puts the epicenter at 17° N: 122° E with 0=2:53:17, and adds the remark, „as on Jan. 12, 1927." Attention was called that this could not be the epicenter of Jan. 12, 1927, and a revised epicenter at 15° N: 119.7° E was adopted and printed on a separate sheet. The distance derived from the S–P interval at Manila is not less than 400 km. and this agrees with the report from Aparri. The residuals are large and it is suspected that this may be a case of shallow focus.
Hong Kong	8 48	55 18	0	
Phu-Lien	15 05	56 52	+10	
Koti	18 30	57 33	+10	
Sumoto	19 48	57 49	+10	
Osaka	20 24	57 56	+10	
Batavia	28 39	(3 00) 04	— 4	
Irkutsk	37 04	3 00 28	+ 8	
Samarkand	52 15	02 09	— 8	
Sverdlovsk	59 39	03 16	+ 8	

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
December 21, 1930 **20° 25′ N 122° 15′ E H=14h 51m 38s**				
Taito	2 35	14 52 27	0	Felt with intensity VI at Basco, Batan Islands, and perceptible as far south as Baguio in the island of Luzon. The epicenter was determined by means of data of nearby stations and the residuals of distant stations indicated a deep focus. A smooth curve was developed from the arrival times and the residuals are given in the table above. h=275 km. The International Summary gives a depth of 0.025 or 170 km.
Ishigakijima	4 03	38	+ 1	
Taihoku	4 42	41	— 1	
Manila	6 00	57	0	
Naha	7 39	53 21	0	
Hong Kong	7 46	20	— 2	
Zikawei	10 47	54 00	— 3	
Nagasaki	14 06	44	+ 1	
Kumamoto	14 30	49	0	
Phu-Lien	14 39	51	0	
Hokuoka	15 03	56	+ 1	
Koti	16 31	55 12	+ 1	
Palau	17 39	21	— 2	
Siomisaki	17 42	25	+ 1	
Sumoto	17 51	28	+ 2	
Kobe	18 16	33	+ 3	
Osaka	18 27	35	+ 3	
Toyooka	18 42	38	+ 3	
Titizima	19 24	48	+ 5	
Chiufeng	20 21	52	0	
Misima	20 46	56 00	+ 3	
Tokyo	21 40	06	0	
Tyosi	22 22	56 11	— 1	
Hukusima	23 27	23	0	
Akita	24 36	36	— 3	
Mizusawa	24 46	35	+ 1	
Amboina	27 18	50	— 6	
Irkutsk	34 45	58 04	+ 1	
Almata	44 00	59 23	+ 3	
Bombay	46 24	42	+ 2	
Tashkent	49 08	15 00 00	— 1	
Samarkand	50 46	14	+ 2	
Adelaide	57 30	58	— 2	
Sverdlovsk	57 34	01 02	+ 2	
Rlverview	60 54	21	— 4	
Baku	63 45	47	+ 3	
Pulkovo	73 24	02 43	0	
Theodosia	73 30	45	+ 1	
Simferopol	74 24	49	0	
Yalta	74 24	50	+ 1	
Sebastopol	74 48	52	+ 1	
Helsingfors	75 48	55	— 2	
Ksara	75 51	03 03	+ 6	
Wellington	78 34	07	— 6	
Upsala	79 24	16	— 2	
Helwan	80 42	25	+ 1	
Lund	83 21	15 03 27	0	
Copenhagen	83 42	36	— 3	
Beograd	83 42	33	— 6	
Vienna	84 52	44	— 1	
Potsdam	84 54	40	— 5	
Hamburg	85 54	50	0	
Zagreb	86 09	52	+ 1	
Jena	86 24	51	— 1	
Gottingen	87 00	54	— 2	
Innsbruck	88 12	04 02	+ 1	
Venice	88 24	03	+ 1	
Treviso	88 34	03	0	
Trent	88 45	05	+ 2	
Stuttgart	88 50	03	— 1	
De Bit	89 15	05	0	
Coire	89 35	07	0	
Strasbourg	89 44	06	— 1	
Victoria	89 48	06	— 2	
Zurich	89 54	08	0	
Florence	90 04	03	— 6	
Rocca d. Papa	90 04	08	— 1	
Rome	90 10	09	0	
Uccle	90 23	10	0	
Piacenza	90 24	19	+ 9	
Neuchatel	91 02	13	0	
Paris	92 30	21	+ 2	
Kew	92 46	20	0	
Berkeley	96 00	38	+ 5	
JANUARY 16, 1931. **19° 30′ N 122° 00′ E H=1h 25m 28s.**				
Mania	5 00	1 26 37	— 2	The above is taken from the International Summary. Not reported felt.
Kobe	19 06	29 47	— 1	
Osaka	19 18	51	+ 1	
Samarkand	50 54	34 26	0	
Sverdlovsk	58 12	35 18	— 2	

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
JANUARY 24, 1931. **9° 00′ N 126°45′ E H=13h 40m 55s.**				
Manila	7 54	13 42 52	0	The International Summary puts the epicenter at 9.8° N: 126.2° E as on February 15, 1929. This position is too far west of the fault line of the Philippine Deep. The epicenter of the earthquake of February 15, 1929, was at 6° 30′ N: 126° 42′ E. The P–residual at Palau is + 23 seconds. The calculated distance is 7° 50′ while the distance derived from the S–P interval is 7° 44′
Taito	14 45	44 36	+ 1PP	
Ishigakijima	15 30	47	+ 1PP	
Taihoku	16 48	44	— 6	
Hong Kong	17 54	45 00	— 3	
Zikawei	22 30	06	+ 1	
Phu–Lien	22 42	46 00	+ 3	
Kagosima	22 50	45 57	— 1	
Nagasaki	23 54	46 13	+ 4	
Hukuoka	24 48	19	+ 1	
Koti	25 12	27	+ 5	
Hamada	26 18	39	+ 6	
Sumoto	26 24	40	+ 6	
Kobe	26 48	46	+ 8	
Gihu	28 00	54	+ 5	
Medan	28 24	56	+ 3	
Chiufeng	32 30	47 26	— 4	
Irkutsk	47 50	49 31	+ 6	
Bombay	53 06	50 18	+ 8	
Samarkand	61 06	51 07	+ 7	
MARCH 18, 1931. **5° 36′ N 126° 18′ E H=20h 13m 53s.**				
Palau	8 18	13 15 41	— 8	The epicenter is that given by the International Summary. h=80 km ±. The use of normal travel times and the adjustment of focal time to suit the majority of stations gave a positive residual at Manila which could not be admitted. The iPz at Manila was unmistakeably definite and time was certain. Adjustment of focal time to suit Manila gave negative residuals at the majority of stations which suggested a focal depth greater than normal. The travel times developed from the earthquake of May 13, 1927, h=75–80 km., which have been used successfully in other instances, were tried on this earthquake and the residuals are given above.
Amboina	9 18	16 00	— 2	
Manila	10 24	17	0	
Ishigakijima	18 48	18 02	— 1	
Hong Kong	20 24	13	— 6	
Batavia	22 42	41	0	
Malabar	22 42	44	+ 3	
Phu–Lien	24 24	56	— 1	
Zikawei	25 54	19 06	— 5	
Titizima	26 12	09	— 5	
Miyazaki	26 48	19	0	
Nagasaki	27 18	22	— 2	
Kumamoto	27 30	24	— 2	
Medan	27 42	29	+ 3	
Hukuoka	28 12	36	— 6	
Muroto	28 36	33	— 3	
Koti	28 42	34	— 3	
Sumoto	29 48	43	— 3	
Kobe	30 12	53	+ 2	
Osaka	30 18	51	0	
Toyooka	30 54	51	— 6	
Nagoya	31 06	58	— 1	
Sendai	35 12	20 31	— 5	
Chiufeng	36 36	36	— 4	
Mizusawa	36 06	42	— 3	
Akita	36 18	45	— 1	
Vladivostok	37 48	49	—10	
Perth	38 54	21 00	— 8	
Sapporo	39 42	14	— 1	
Calcutta	40 18	26	+ 6	
Adelaide	42 12	30	— 6	
Riverview	45 54	59	— 6	
Colombo	46 12	22 02	— 6	
Melbourne	46 48	08	— 4	
Hyderabad	48 12	18	— 2	
Irkutsk	50 00	32	— 4	
Bombay	53 42	58	— 7	
Almata	57 28	23 30	— 1	
Andijan	59 30	42	— 3	
Samarkand	63 00	24 06	— 3	
Sverdlovsk	72 06	25 02	— 3	
Honolulu	74 48	21	— 1	
Tananarive	81 18	54	— 1	
Kucino	84 24	26 14	+ 3	
Theodosia	86 36	27	+ 5	
Ksara	87 12	28	+ 2	
Simferopol	87 36	27	0	
Yalta	84 36	27	0	
Pulkovo	88 12	26	— 5	
Helsingfors	90 42	41	— 4	
Helwan	91 30	43	— 5	
Königsberg	94 24	27 00	— 4	
Beograd	96 48	06	—10	
Budapest	97 18	11	— 7	
Lund	98 00	12	—10	
Zagreb	99 48	22	—10	
Hamburg	100 30	27	+ 2	
Jena	100 42	30	+ 4	
Göttingen	101 24	34	+ 5	
Treviso	102 24	39	+ 5	
Stuttgart	103 00	38	+ 1	
Rome	103 30	44	+ 5	
Chur	103 36	41	+ 1	
De Bilt	103 48	40	0	
Strasbourg	104 00	41	— 1	
Zurich	104 00	45	+ 3	
Uccle	104 54	45	— 2	
Neuchatel	105 12	46	— 2	
Kew	107 00	57	+ 1	
Pasadena	107 30	55	— 3	

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EPICENTERS—Continued

	Δ	P	O–C	Remarks
	° ′	h, m. s.	s	
MARCH 19, 1931. **18° 20′ N 120° 10′ E H=6h 25m 04s**				
Kosyun	3 45	6 26 03	+ 1	The Internationa Summary puts the epicenter at 18° N: 120° 24′ E. This is not satisfactory for the macroseismic evidence does not bear out this determination, and it is on the shore line of northern Luzon whereas the earthquakes of this region are centered out in the China Sea.
Manila	3 50	03	0	
Hokoto	5 25	(26) 21	— 4	
Taihoku	6 50	26 52	+ 6	
Hong Kong	6 54	48	+ 1	
Ishigakijima	7 40	48	+ 9	
Naha	10 30	27 34	— 3	
Zikawei	12 54	28 10	0	
Phu-Lien	13 00	13	+ 2	
Nagasaki	16 50	59	0	
Palau	17 45	29 04	— 6	
Hukuoka	17 48	13	+ 2	
Simidu	18 28	20	+ 1	
Koti	19 21	28	—1	
Zinsen	20 00	38	+ 1	
Sumoto	20 44	43	— 2	
Kobe	21 10	48	— 3	
Osaka	21 13	50	— 1	
Toyooka	21 32	53	— 1	
Kyoto	21 40	54	— 2	
Chiufeng	22 00	30 02	+ 3	
Nagoya	22 36	04	— 1	
Hatidyôzima	23 00	06	— 3	
Amboina	23 24	06	— 7	
Tokyo	24 30	22	— 2	
Tyosi	25 14	31	0	
Medan	25 42	(30) 33	— 3	
Vladivostok	26 45	37	— 9	
Mizusawa	27 38	50	— 5	
Batavia	27 49	51	— 6	
Calcutta	30 06	31 09	— 8	
Irkutsk	36 08	32 08	0	
Hyderabad	39 10	38	+ 5	
Dehra Dun	39 57	30	— 9	
Colombo	40 52	49	+ 3	
Almata	44 00	33 21	+10	
Bombay	44 45	23	+ 5	
Andijan	46 24	35	+ 5	
Perth	50 18	34 00	+ 1	
Samarkand	50 24	05	+ 5	
Adelaide	56 04	37	— 2	
Sverdlovsk	58 15	59	+ 4	
Riverview	59 57	35 06	0	
Melbourne	60 49	12	0	
Suva	67 54	(35) 54	— 5	
Pulkovo	73 40	36 40	+ 6	
Ksara	75 20	49	+ 4	
Honolulu	76 18	55	+ 5	
Helsingfors	76 42	54	+ 2	
Wellington	78 08	54	— 7	
Helwan	79 46	37 18	+ 8	
Upsala	80 18	18	+ 6	
Königsberg	80 30	18	+ 4	
Sitka	82 15	27	+ 4	
Beograd	83 48	36	+ 5	
Budapest	83 48	33	+ 2	
Lund	84 03	35	+ 3	
Copenhagen	84 30	36	+ 2	
Vienna	85 12	40	+ 2	
Potsdam	85 30	42	+ 3	
Bergen	85 38	(37) 42	+ 2	
Graz	86 12	47	+ 4	
Zagreb	86 22	44	0	
Hamburg	86 39	50	+ 5	
Cheb	86 50	51	+ 5	
Jena	86 57	48	+ 2	
Scoresby-Sund	87 20	49	+ 1	
Taranto	87 33	54	+ 5	
Göttingen	87 34	55	+ 5	
Trent	88 40	38 00	+ 5	
Treviso	88 52	00	+ 4	
Taunus	89 02	03	+ 6	
Padua	89 10	00	+ 2	
Stuttgart	89 15	00	+ 2	
Naples	89 30	08	+ 9	
Messina	89 38	00	0	
Coire	90 02	03	+ 1	
De Bilt	90 06	03	+ 1	
Strasbourg	90 12	00	— 3	
Rome	90 16	09	+ 6	
Zurich	90 18	03	0	
Piacenza	90 40			
Prato	90 57	00	— 6	
Uccle	91 00	09	+ 2	
Neuchatel	91 27	10	+ 1	
Victoria	92 39	16	+ 1	
Bidston	92 47	21	+ 5	
Paris	93 06	17	0	
Berkeley	98 56	37	— 8	
Algiers	99 06	52	+ 6	
Pasadena	103 04	39 05	— 2	
Mt. Wilson	103 45	01	— 6	
Little Rock	118 34	43 52	+ 2	P'_1
San Juan	142 45	44 42	+ 6	P'_1
La Paz	171 51	45 13	+ 3	P'_1

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
MARCH 22, 1931 **15° 55′ N 121° 35′ E H = 15h 7m 23s**				
Manila	1 24	15 07 46	0	We infer that Sverdlovsk and Pulkovo did not record the very first impulses. The International Summary places the epicenter at 15° 30′N: 122° E. and adds, "as on August 31, 1930." The position given above is 40′ west of the epicenter of August 31, 1930, and neither coincide with that of November 21, 1928.
Phu-Lien	15 00	10 56	0	
Sverdlovsk	61 00	17 37	+ 5	
Pulkovo	77 00	19 21	+ 8	
MARCH 30, 1931 **18° 20′ N 120° 10′ E H = 13h 38m 13s**				
Manila	3 50	13 39 08	0	The International Summary puts the epicenter at 18°N: 120.4°E as on March 19th, and assigns a normal depth of focus. h = 75 km. Felt strongly at Laoag and felt quite extensively over northern Luzon.
Hong Kong	6 54	43	— 6	
Zikawei	12 54	41 08	— 3	
Phu-Lien	13 00	17	+ 4	
Sumoto	20 44	42 38	— 4	
Nagoya	22 36	59	0	
Irkutsk	36 08	45 00	— 5	
Bombay	44 45	(45) 12	— 4	
Andijan	46 24	46 39	+10	
Samarkand	50 24	58	— 1	
Sverdlovsk	58 15	47 59	+ 2	
MAY 6, 1931 **16° 00′ N 121° 10′ E H = 9h 13m 12s**				
Manila	1 26	9 13 36	0	The distance derived from the S—P interval at Baguio agrees with this location. The International Summary puts the epicenter at 16° 18′N: 120° 36′E. This point is too far west.
Hong Kong	9 06	(15) 20	— 8	
Sverdlovsk	60 42	23 09	—10	
MAY 24, 1931 **10° 30′ N 126° 25′ E H = 0h 13m 05s**				
Manila	6 42	0 14 39	0	h = 100 km. ±. The International Summary puts the epicenter at 9.9°N: 125.7°E, at the South end of Dinagat Island, near Surigao. This position is not satisfactory. Earthquake epicenters fall in the Philippine Deep, not along the shore line of Mindanao. The seismogram at Butuan shows the form of a deep focus earthquake with normal S–P distance of 240 km. Hence we put the epicenter at 10° 30′N: 126° 25′E. The positive residuals can be accounted for by the lack of energy in the first portion of the P–phase. Gutenberg's travel times for h=100 km. were used. Travaux Scientifique. Fasc. XV.
Amboina	14 18	16 27	+ 1	
Hong Kong	16 39	53	— 3	
Zikawei	21 12	17 53	+ 6	
Phu-Lien	21 36	49	— 3	
Miyazaki	21 54	18 05	+10	
Nagasaki	22 30	10	+10	
Kobe	25 30	39	+10	
Osaka	25 33	36	+ 7	
Calcutta	38 18	20 28	+ 7	
Irkutsk	45 24	21 25	+ 6	
Hyderabad	46 27	21 33	+ 7	
Bombay	52 21	22 12	+ 3	
Andijan	56 06	41	+ 5	
Tashkent	58 36	23 01	+ 5	
Sverdlovsk	68 06	24 00	0	
Kucino	80 27	25 15	+ 5	
Pulkovo	84 00	34	+ 5	
Helsingfors	86 31	44	+ 3	
MAY 29, 1931 **13° 24′ N 121° 30′ E H = 8h 26m 21s**				
Manila	1 18	8 26 43	0	The International Summary identifies the epicenter of this earthquake with that of August 21, 1929. The epicenter of the latter was about 20 km. to the south by east.
Phu-Lien	16 00	30 00	— 6	
Osaka	24 42	31 43	0	
Irkutsk	41 12	34 01	— 5	
Sverdlovsk	63 00	36 41	— 2	
Baku	67 24	37 21	+ 9	
JUNE 3, 1931 **5° 25′ N 123° 30′ E H = 13h 59m 57s**				
Manila	9 30	14 02 16	0	Felt with intensity IV at Cotabato; felt at Jolo, Sulu. Not felt in eastern Mindanao. Hence the epicenter must be located in the Celebes Sea and not in the Philippine Deep. The time interval S–P at Batavia gives a distance of 20° 30′ and this puts the epicenter in the position given above. The distance by the Butuan seismogram is about 500 km. The International Summary puts the epicenter at 8°N: 128°E which is at least 5° too far to the NE.
Batavia	20 30	05 12	+38	
Sverdlovsk	70 48	11 07	— 3	

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
JULY 12, 1931				
12° 25′ N 123° 50 E H = 16h 45m 25s				
Manila	3 31	16 46 20	0	The macroseismic reports enable us to fix the epicenter very closely. The "Esteban Riu," 2½ miles off Ticao Island, felt strong shocks as if running on a reef. Towns along this shore were severely shaken, intensity VII–VIII. Some artesian wells ceased to flow, others renewed their flow. This position is in an active fault zone. The negative residuals at some stations seem to indicate that the focus was below normal depth but there is not sufficient consistency among the residuals to determine accurately. The International Summary puts the epicenter at 12°N: 123° 06′E, "as on May 25th, 1925." The position stated is too far to the southwest and is outside the zone of maximum intensity. The epicenter of May 25, 1925, is one degree still further west at 12° 12′N: 122° 06′E.
Taihoku	13 12	41	+ 6	
Hong Kong	13 30	36	— 3	
Amboina	16 42	(49) 10	— 9	
Phu-Lien	18 30	42	— 8	
Zikawei	18 54	36	— 9	
Miyazaki	20 39	50 08	+ 2	
Nagasaki	21 03	11	+ 2	
Hokuoka	22 00	21	+ 1	
Koti	22 52	30	0	
Matuyama	23 00	29	— 1	
Sumoto	24 12	38	— 4	
Kobe	24 34	45	— 1	
Osaka	24 36	51	+ 5	
Batavia	25 08	48	— 3	
Toyooka	25 18	56	+ 3	
Gihu	25 48	57	— 1	
Nagoya	25 48	57	0	
Medan	26 24	51 09	+ 5	
Chiufeng	28 33	51 15	— 9	
Mizusawa	30 48	48	+ 3	
Calcutta	35 15	(52) 32	+10	
Irkutsk	42 50	53 23	0	
Colombo	43 48	33	+ 2	
Hyderabad	45 48	(53) 36	—10	
Dehra Dun	45 56	40	— 7	
Almata	50 42	(54 28)	+ 5	
Riverview	53 04	49	+ 9	
Tashkent	55 24	55 03	+ 7	
Sverdlovsk	65 06	56 07	+ 6	
Tiflis	73 36	57 01	+ 6	
Kucino	78 34	23	— 1	
Theodosia	80 12	37	+ 3	
Simferopol	81 00	40	+ 2	
Yalta	81 00	43	+ 5	
Ksara	81 26	48	+ 8	
Pulkovo	81 36	42	+ 1	
Helwan	85 36	58 08	+ 7	
Budapest	90 36	30	+ 4	
Copenhagen	91 18	35	+ 6	
Vienna	92 06	39	+ 6	
Zagreb	93 12	44	+ 5	
Scoresby-Sund	93 51	52	+ 1	
Stuttgart	96 06	56	+ 4	
Florence	97 00	59 00	+ 3	
De Bilt	97 00	00	+ 3	
Zurich	97 12	01	+ 3	
Strasbourg	97 12	(00)	+ 2	
Neuchatel	98 24	04	0	
Paris	99 56	16	+ 6	
Granada	110 44	17 00 06	+ 5	
SEPTEMBER 22, 1931				
15° 10′ N 121° 40′ E H = 1h 25m 52s				
Manila	0 54	1 26 06	0	The seismograms of the Horizontal Pendulums show the form of earthquake of greater than normal depth. The macroseismic reports indicated a rather uniform intensity over a wide area around the epicenter. On the basis of these data we have taken a depth of 75–80 km. and moved the epicenter nearer to Manila than the normal distance. h=75–80 km.
Hong Kong	10 04	28 04	— 8	
Phu-Lien	15 21	29 17	— 6	
Hukuoka	20 02	30 13	— 1	
Koti	21 18	22	— 5	
Sumoto	22 33	45	+ 7	
Kobe	23 00	40	— 2	
Irkutsk	39 36	33 09	— 4	
DECEMBER 31, 1931				
8° 00′ N 127° 00′ E H = 11h 36m 34s				
Manila	8 51	11 38 45	0	Felt very strongly at Hinatuan, east coast of Mindanao, and strongly at Cateel, also on the east coast, and strongly at Butuan. The location given above is a probable one in view of the macroseismic data. The International Summary gives 8° 30′N: 126°E, "as on January 2, 1927." The seismogram from Butuan for Jan. 2, 1927, showed no disturbance. The earthquake of that day was far to the northwest of the Philippine Deep. Its center was in the China Sea, probably at 16° 15′N: 119° 25′E.
Hong Kong	18 54	40 53	— 1	
Sverdlovsk	70 32	47 49	+ 4	
JANUARY, 18, 1932				
19° 10′ N 120° 10′ E H = 20h 26m 52s				
Manila	4 42	20 28 03	0	Felt at Basco, Batan Islands, and at Aparri and Cape Bojeador in northern Luzon. An aftershock felt at Cape Bojeador. The International Summary gives 19°N: 120° 30′E, "as on November 2, 1929." The epicenter of this latter earthquake was at 18° 50′N: 120° 36′E.
Taihoku	6 00	22	0	
Hong Kong	6 26	28	0	
Phu-Lien	12 49	30 00	+ 3	
Chiufeng	20 58	31 29	— 7	
Nagoya	21 33	34	— 8	
MARCH 12, 1932				
19° 32′ N 120° 27′ E H = 13h 20m 44s				
Manila	4 58	13 21 59	0	Felt lightly in the northwest corner of Luzon.
HongKong	6 30	22 21	0	

International Seismological Centre

EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
APRIL 29, 1932				
8° 20′ N 126° 50′ E H = 17h 30m 57s				
Manila	8 32	17 32 56	0	As on June 13, 1929. h = 75 km. Felt throughout eastern Mindanao, especially strong at Hinatuan on the east coast, facing the Philippine Deep. The residuals, assuming normal depth, are not quite as satisfactory as the above. The International Summary puts the epicenter at 6° 18′N: 123° 12′E, "as on February 3, 1925." This position is at 5° too far to the west-southwest, in the Celebes Sea, and not at all in agreement with the macroseismic data. The epicenter of February 3, 1925, was slightly different, being at 5° 55′N: 122° 40′E.
Hong Kong	18 34	35 03	— 2	
Phu-Lien	23 12	46	— 3	
Zikawei	23 25	(35) 52	+ 1	
Sumoto	27 03	(36) 32	+ 7	
Nagoya	28 24	38	0	
Agra	49 42	39 32	— 6	
Bombay	53 24	57	— 9	
Andijan	57 50	40 33	— 5	
Tashkent	60 21	47	— 8	
Sverdlovsk	70 09	41 51	— 6	
Baku	74 42	42 20	— 3	
Tiflis	78 32	39	— 4	
La Paz	163 14	50 41	— 6?	
JUNE 8, 1932				
8° 00′ N 125° 20′ E H = 14h 54m 33s				
Manila	7 51	14 56 29	0	Felt somewhat strongly in Cagayan, Misamis Oriental, and with less intensity in eastern parts of Mindanao. The International Summary puts the epicenter at 8° 30′N: 126°E, "as on December 31, 1931." The macroseismic data favor a position a little further west such as we have adopted. We have placed the epicenter of December 31, 1931, at 8°N: 127°E.
Hong Kong	17 52	58 38	— 2	
Naze	20 45	59 11	— 3	
Phu-Lien	22 09	28	— 1	
Batavia	23 28	(59) 44	+ 1	
Zikawei	23 29	36	— 5	
Miyazaki	24 36	55	+ 1	
Nagasaki	24 51	55	— 1	
Medan	26 54	15 00 16	— 1	
Sumoto	27 47	18	— 8	
Kobe	28 12	32	+ 3	
Osaka	28 18	26	— 4	
Nagoya	29 12	31	— 7	
Chiufeng	33 12	01 16	+ 2	
Tashkent	59 30	04 24	— 8	
Baku	73 48	06 07	+ 3	
Tiflis	77 42	28	+ 1	
Pulkovo	85 36	07 06	— 3	
JUNE 10, 1932				
5° 30′ N 127° 00′ E H = 20h 21m 29s				
Palau	7 42	20 23 08	— 9	The distinctness of the S–phase in the seismograms of this earthquake, in contrast to the indistinctness of this phase in many records of earthquakes from this region, suggested a focus deeper than normal. Travel times for h = 75 km. were used with the results given above, which were more satisfactory than those obtained with normal values. The International Summary, following Batavia, gives an epicenter only a short distance away, 5° 06′N: 127° 18′E, but assumes normal depth. h = 75 km.
Manila	10 51	59	0	
Hoko	19 34	25 54	+ 7	
Taihoku	20 15	56	+ 2	
Hong Kong	20 54	26 00	0	
Batavia	23 18	(26) 12	— 1	
Phu-Lien	25 00	41	+ 2	
Zikawei	26 12	50	0	
Miyazaki	26 50	55	0	
Nagasaki	27 28	27 00	— 1	
Medan	28 24	06	— 4	
Kobe	30 15	(27) 26	— 1	
Nagoya	31 09	36	+ 1	
Tokyo	32 28	46	— 1	
Chiufeng	35 54	28 16	— 3	
Calcutta	41 03	(29) 08	+ 6	
Irkutsk	50 21	30 14	0	
Almata	57 55	31 00	—10	
Andijan	60 00	15	—10	
Sverdlovsk	72 36	32 46	+ 2	
Baku	76 36	33 09	+ 3	
Tiflis	80 30	29	+ 2	
Kucino	84 54	52	+ 2	
Yalta	88 10	34 08	+ 1	
Pulkovo	88 36	(34) 07	— 2	
Helsingfors	91 09	16	— 7	
Helwan	92 09	29	+ 1	
Budapest	97 54	(35) 00	+ 2	
Lund	98 30	34 55	— 6	
Copenhagen	98 51	55	—10	
Vienna	99 20	57	— 9	
Potsdam	99 48	35 00	— 8	
Zagreb	100 22	04	— 7	
Hamburg	101 03	05	— 9	
Scoresby-Sund	101 13	07	— 8	
Stuttgart	103 30	16	—10	
De Bilt	104 17	20	—10	
Zurich	104 30	22	— 9	
Strasbourg	104 28	21	—10	
Georgetown	130 20	40 26	— 6	P'_1
Balboa	149 51	(41) 06	+ 2	P'_1
San Juan	152 51	08	+ 1	P'_1
La Paz	161 36	20	+ 1	P'_1

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
JUNE 13, 1932 18° 15′ N 119° 25′ E H = 20h 57m 34s				The International Summary gives a position only a little different from the above, namely, 18° 30′N: 119° 30′E.
Manila	3 57	20 58 37	+ 2	
Hong Kong	6 24	59 04	— 5	
Taihoku	7 05	27	+ 8	
Phu-Lien	12 18	21 00 31	— 1	
Zikawei	13 04	38	— 5	
Nagasaki	17 15	01 34	0	
Hukuoka	18 14	45	— 1	
Zinsen	20 18	02 10	— 2	
Sumoto	21 10	18	— 3	
Kobe	21 36	25	0	
Chiufeng	22 00	29	0	
Nagoya	23 00	39	0	
Gihu	23 02	38	— 1	
Misima	24 09	45	— 5	
Medan	25 02	57	— 2	
Batavia	27 24	(03) 16	— 7	
Mizusawa	28 06	29	0	
Irkutsk	36 00	04 36	— 1	
Hyderabad	38 27	39	+ 2	
Bombay	44 03	05 41	— 1	
Andijan	46 03	06 01	0	
Tashkent	48 24	(08) 17	+ 2	
Sverdlovsk	57 54	28	+ 5	
Tiflis	66 36	08 26	+ 6	
Kucino	70 15	47	+ 4	
Pulkovo	73 51	09 11	+ 6	
Helwan	79 24	40	+ 2	
Lund	83 42	10 06	+ 6	
Copenhagen	84 09	09	+ 7	
Vienna	84 48	09	+ 3	
Potsdam	85 09	10 00	— 7	
Hamburg	86 20	19	+ 6	
Scoresby–Sund	87 15	23	+ 5	
Triest	87 27	23	+ 4	
Stuttgart	88 54	30	+ 4	
Chur	89 30	32	+ 3	
De Bilt	89 34	36	+ 6	
Strasbourg	89 50	40	+ 9	
Zurich	89 55	40	+ 9	
Uccle	90 40	39	+ 4	
Paris	92 43	49	+ 4	
La Paz	172 34	17 47	+ 7	
JUNE 14, 1932 18° 50′ N 120° 50′ E H = 5h 59m 36s				The International Summary gives a position only slightly different from the above, viz., 18° 42′N: 120° 18′E.
Manila	4 16	6 00 40	— 1	
Hong Kong	7 08	01 21	— 1	
Zikawei	12 21	02 36	+ 2	
Phu-Lien	13 30	54	+ 4	
Nagasaki	16 06	03 24	+ 1	
Hukuoka	17 03	37	+ 3	
Palau	17 45	35	— 7	
Koti	18 36	52	— 1	
Sumoto	19 54	04 09	+ 1	
Kobe	20 21	15	+ 2	
Toyooka	20 48	18	0	
Chiufeng	21 36	29	+ 2	
Nagoya	21 42	27	— 1	
Tyosi	24 27	57	0	
Medan	26 30	05 11	— 5	
Mizusawa	26 50	14	— 5	
Batavia	28 34	27	— 1	
Irkutsk	35 50	06 37	— 1	
Almata	44 09	07 46	+ 2	
Bombay	45 18	54	0	
Andijan	46 36	08 07	+ 4	
Tashkent	49 04	25	+ 3	
Sverdlovsk	58 12	09 31	+ 4	
Tiflis	67 21	10 32	+ 5	
Pulkovo	74 03	11 10	+ 1	
Simferopol	74 33	16	+ 9	
Yalta	74 36	15	+ 7	
Honolulu	75 03	18	0	
Ksara	75 06	21	+ 3	
Upsala	80 12	44	0	
Helwan	80 18	46	+ 2	
Konigsberg	80 27	46	+ 1	
Lund	84 03	12 05	+ 1	
Copenhagen	84 25	05	— 1	
Vienna	85 12	10	0	
Potsdam	85 27	13	+ 2	
Zagreb	86 25	09	— 7	
Scoresby–Sund	87 00	20	+ 1	
Hamburg	87 06	18	— 1	
Göttingen	87 31	21	0	
Triest	87 54	25	+ 2	
Stuttgart	89 18	31	+ 1	
De Bilt	89 50	34	+ 1	
Strasbourg	90 12	34	— 1	
Piacenza	90 43	44	+ 7	
Uccle	90 57	39	+ 1	
Prato	90 57	36	— 2	
Edinburgh	91 40	40	— 2	
Kew	93 00	48	— 1	
Paris	93 08	47	— 2	
Tinemaha	101 07	13 27	0	
Granada	103 21	38	+ 1	
San Juan	142 10	19 00	— 7	P′.
La Paz	171 08	44	+ 8	P′.

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
JUNE 14, 1932				
18° 00′ N 119° 00′ E H = 11h 20m 15s				
Manila	4 00	11 21 17	0	The data given for this earthquake in the report of the Manila Observatory for 1932 was erroneous owing to the fact that there were strong micros and a spurious oscillation commenced a short time before the beginning of P. The correct value of P is 11:21:17. The International Summary gives the epicenter as 17° 18′N: 120° 30′E, "as on May 24, 1924." An earthquake in this position, in a thickly peopled area could not have escaped perception, whereas there were no macro reports. The epicenter of May 24, 1924, was at 16° 15′N: 119° 32′E. Cf. Seis. Bull., Manila Ob., 1930.
Hong Kong	6 15	50	+ 2	
Phu-Lien	12 00	23 14	+ 1	
Zikawei	13 22	32	+ 4	
Sumoto	21 38	25 05	— 1	
Kobe	22 00	08	— 2	
Osaka	22 06	11	0	
Chiufeng	22 12	12	0	
Nagoya	23 25	23	+ 7	
Gihu	23 30	24	— 1	
Amboina	23 30	19	— 6	
Nagano	25 12	45	+ 3	
Irkutsk	36 24	27 19	— 3	
Almata	43 26	28 27	+ 9	
Tashkent	48 15	45	— 9	
Sverdlovsk	57 54	30 12	+ 8	
Baku	62 40	(30) 32	— 3	
Pulkovo	73 54	31 51	+ 4	
Stuttgart	89 00	33 13	+ 5	
JULY 9, 1932				
5° 00′ N 125° 30′ E H = 20h 23m 51s°				
Amboina	9 06	20 26 04	— 1	
Manila	10 33	24	0	
Hong Kong	20 30	28 40	+10	
Batavia	21 45	48	+ 5	
Irkutsk	50 30	32 39	— 9	
Tashkent	61 48	33 55	—10	
Tiflis	79 45	35 51	— 5	
Pulkovo	88 16	36 34	— 6	
JULY 11, 1932				
12° 15′ N 125° 30′ E H = 8^h 21^m 30^s				
Manila	4 58	8 22 45	0	
Hong Kong	14 45	24 59	— 1	
Phu-Lien	19 58	26 00	— 3	
Miyazaki	20 25	07	— 1	
Nanking	20 44	12	+ 1	
Sumoto	23 42	46	+ 4	
Kobe	24 06	43	— 3	
Osaka	24 18	46	— 2	
Kameyama	24 48	56	+ 3	
Batavia	26 09	27 05	— 1	
Irkutsk	43 30	29 31	— 2	
Sverdlovsk	66 09	(32) 15	+ 2	
Baku	71 12	52	+ 7	
Tifflis	75 00	(33) 12	+ 4	
Kucino	78 33	29	0	
Pulkovo	81 18	48	0	
Simferopol	82 18	50	+ 1	
JULY 18, 1932				
14° 40′ N 119° 45′ E H = 5h 02m 07s				
Manila	1 11	5 02 36	0	Felt in southern Luzon. The above epicenter was adopted by the International Summary..
Hong Kong	9 18	04 32	+ 8	
Phu-Lien	14 00	05 34	+ 7	
Nanking	17 24	06 18	+ 9	
Sumoto	23 54	07 13	— 8	
Kobe	24 18	17	— 8	
Osaka	24 32	18	— 9	
Irkutsk	39 36	09 34	— 5	
Almata	46 18	10 36	+ 4	
Andijan	48 27	46	— 2	
Tashkent	50 58	11 10	+ 3	
Sverdlovsk	61 05	12 17	0	
Baku	65 20	48	+ 4	
Tiflis	69 12	13 08	— 2	
Theodosia	75 45	47	— 2	
Simferopol	76 39	51	— 4	
Yalta	76 42	52	— 3	
Stuttgart	91 55	15 09	— 5	
AUGUST 5, 1932				
20° 45′ N 120° 00′ E H = 0h 46m 43s				
Taihoku	4 33	0 47 56	+ 4	Felt slightly at Basco, Batan Islands. The International Summary gives 21°N: 120°E, "as on April 27, 1928." The epicenter on April 27, 1928, was at 20° 10′N: 120° 25′E.
Hong Kong	5 43	48 09	0	
Manila	6 15	16	0	

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EPICENTERS—Continued

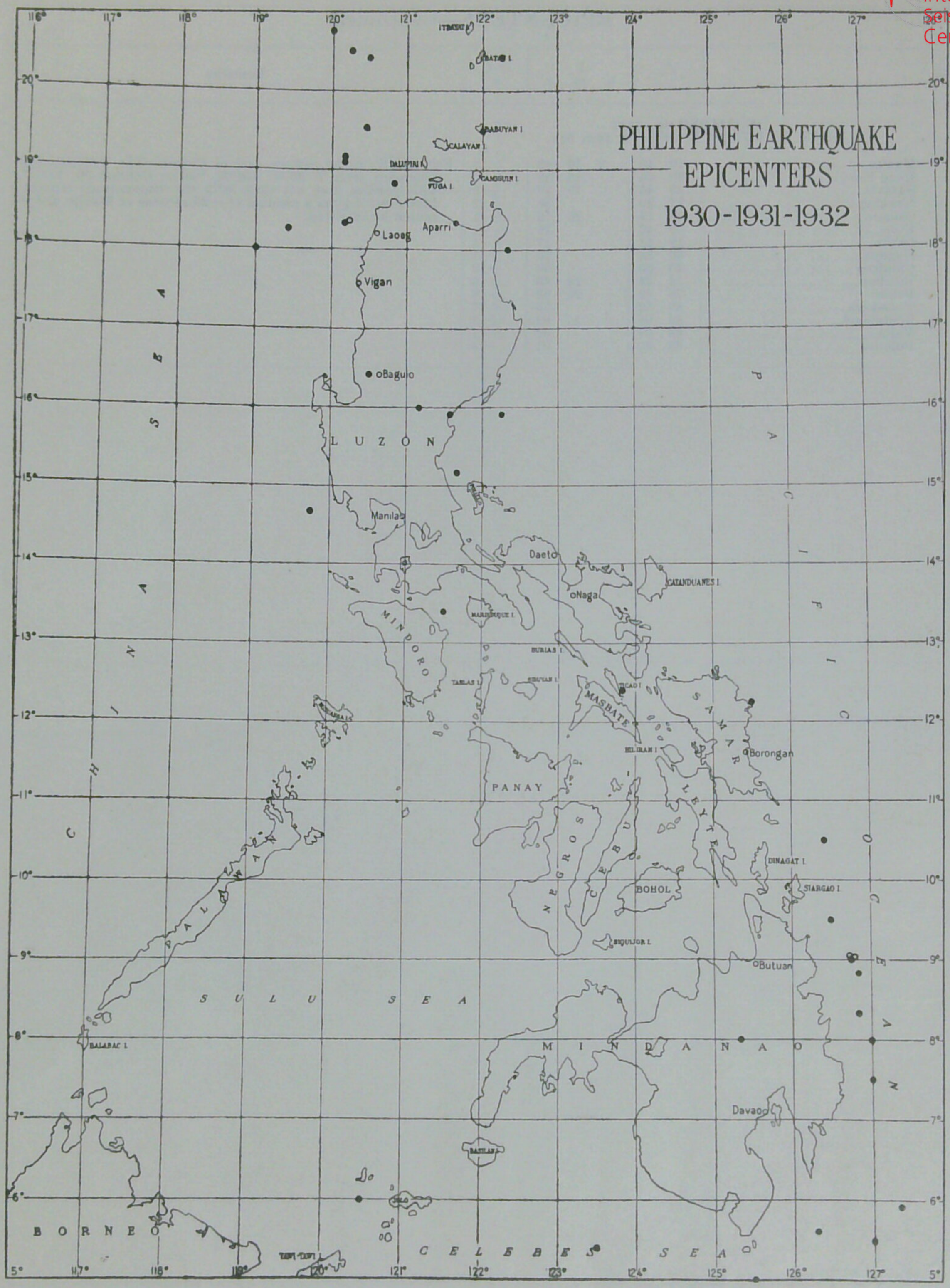
	Δ ° ′	P h. m. s.	O–C s	Remarks
AUGUST 24, 1932 **16° 25′ N 120° 30′ E H = 12h 10m 35s**				
Manila	1 54	12 11 07	0	Slightly destructive in Baguio and in old structures in nearby places. Perceived over almost the entire island of Luzon. The International Summary puts the epicenter at 16° 25′N: 120° 36′E, "as on May 6, 1931." The epicenter of May 6, 1931, was at 16_N: 121° 10′E, in the Caraballo Mts., east of Baguio.
Kosyun	5 36	12 15	+ 9	
Hong Kong	8 24	52	— 4	
Phu-Lien	13 51	32	— 1	
Palau	16 24	14 32	+ 7	
Nagasaki	18 24	50	+ 1	
Miyazaki	18 24	48	— 1	
Koti	20 46	15 16	— 1	
Sumoto	22 06	26	— 7	
Kobe	22 30	37	+ 2	
Nagoya	23 50	47	— 1	
Gihu	23 54	47	— 2	
Chiufeng	23 58	45	— 5	
Medan	25 00	16 08	+ 8	
Batavia	26 20	22	+ 9	
Mizusawa	29 00	36	— 2	
Irkutsk	38 06	17 54	— 1	
Kodaikanal	42 15	18 28	0	
Bombay	45 24	53	0	
Tashkent	50 22	(19) 33	+ 2	
Sverdlovsk	60 00	20 41	+ 4	
Theodosia	75 04	22 18	+ 4	
Simferopol	75 58	22	+ 3	
Pulkovo	75 58	23	+ 4	
Yalta	76 00	22	+ 3	
Copenhagen	86 12	23 18	+ 4	
Vienna	86 51	16	— 1	
Zagreb	88 00	18	— 5	
Stuttgart	91 00	42	+ 4	
Paris	94 49	24 00	+ 4	
SEPTEMBER 15, 1932 **6° 00′ N 120° 30′ E H = 11h 13m 18s**				
Manila	8 40	11 15 38	0	The International Summary gives 5° 54′N: 120° 42′E.
Amboina	12 21	16 09	— 7	
Palau	13 57	36	— 1	
Hong Kong	17 24	17 18	— 2	
Batavia	18 18	36	+ 5	
Ishigakijima	18 40	33	— 3	
Phu-Lien	20 00	55	+ 4	
Medan	21 52	18 15	+ 4	
Nagasaki	28 06	19 12	— 1	
Sumoto	31 18	40	— 2	
Chiufeng	34 18	20 03	+ 5	
Maebasi	35 08	06	— 8	
Akita	38 00	38	+ 1	
Mizusawa	38 00	43	+ 6	
Colombo	40 23	21 03	+ 6	
Sapporo	41 21	21 06	+ 2	
Kodaikanal	42 47	11	— 5	
Adelaide	44 20	25	— 3	
Irkutsk	48 09	22 00	+ 3	
Tcimkent	57 42	23 00	— 5	
Sverdlovsk	68 52	24 26	+ 8	
Baku	71 23	45	+10	
Tiflis	75 21	25 05	+ 7	
Theodosia	82 18	45	+ 8	
Yalta	83 06	46	+ 5	
Simferopol	83 15	47	+ 5	
Pulkovo	84 54	54	+ 4	
Helwan	86 18	26 00	+ 3	
DECEMBER 15, 1932 **20° 30′ N 120° 15′ E H = 19h 33m 45s**				
Hong Kong	5 57	19 35 14	0	The International Summary gives 21°N: 121° 12′ E.
Manila	5 57	15	+ 1	
Zikawei	10 44	36 21	+ 1	
Phu-Lien	12 45	50	+ 1	
Chiufeng	19 45	38 05	—10	
Amboina	25 25	39 16	— 1	
Medan	26 58	(39) 36	+ 6	
Agra	38 58	41 14	+ 2	
Hyderabad	39 30	18	+ 2	
Bombay	44 32	42 03	+ 7	
Andijan	45 09	04	+ 3	
Tcimkent	47 33	21	+ 2	
Tashkent	47 36	(42) 20	0	
Vienna	83 12	46 09	0	
La Paz	170 12	53 49	— 1	P'_1

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EPICENTERS—Continued

	Δ ° ′	P h. m. s.	O–C s	Remarks
DECEMBER 16, 1932 **5° 55′ N 127° 20′ E H = 7h 14m 05s**				
Manila	10 40	7 16 42	0	Felt lightly in the eastern part of Davao. The International Summary gives 7° 30′N: 126°E, "as on October 26, 1931." This position does not agree with the macroseismic reports. Moreover, it gives a residual of +23 seconds at Manila which cannot be admitted.
Hong Kong	20 45	18 49	0	
Batavia	23 46	19 30	+10	
Nanking	27 20	53	— 2	
Sumoto	29 18	20 12	— 1	
Kobe	29 42	16	— 1	
Osaka	29 48	17	— 1	
Nagoya	30 34	26	+ 1	
Chiufeng	35 30	56	—10	
Bombay	54 34	23 40	+ 8	
Baku	76 42	26 03	+ 8	
Theodosia	87 12	58	+ 7	
Simferopol	88 06	27 02	+ 7	
Yalta	88 06	02	+ 7	
Pulkovo	88 30	01	+ 4	

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M A N I L A ; P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVAT

Ref 2720

$\phi = 14^\circ\ 34'\ 42''$ N. $\lambda = 120^\circ\ 58'\ 41''$ E. h=3 m. ALTITUDE

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CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	230
Z	11.6	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M 955 Kg.
January 1, 1939.

	T_o	V	ε	$\frac{L}{T_o^2}$
N-S	4.2	213	2.5	0.092
E-W	4.2	270	2.8	0.083

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Jan. 1939				
#3 3rd	PNEZ	23 15 11	1420	
	SNE	17 39		
	F	45		
#4 5th	iPNEZ	3 24 08	155	Dilatation. Felt in W Luzon. 15° 05'N: 119° 45'E by Manila and Baguio. S from the Wiechert and Horizontal.
	SNE	25		
	F	4 15		
#8 9th	ePNE	3 10 32	2755	
	SNEZ	14 48		
	F	31		
#16 16th	iPZ	2 18 52	2780	Guam, 130 Km, In the Nero Deep.
	iPN	56		
	SNE	23 19		Felt in Guam.
	LNE	26 15ca		
	F	3 40		
#17 20th	PNEZ	12 12 42	250	
	SNEZ	13 18		
	F	19		
#18 20th	ePNEZ	13 27 02	850	Felt in Samar and Leyte.
	SNE	28 35		
	F	37		
#19 20th	ePNES	20 59 45	3455?	
	S?NE	21 04 47		
	F	22 20		
#20 22nd	ePNE	4 48 15	5555	
	SNE	55 25		
	LNE	5 04 ca		
	ME	08 ca		
	F	50		
#21 22nd	ePNEZ	9 24 18	280	Felt at Palanan.
	iSNE	58		
	F	35		
#22 22nd	PNEZ	11 14 54	2310	
	SNE	18 39		
	F	55		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Jan. 1939				
#23 22nd	ePNEZ	13 38 37	4680	
	SNE	44 54		
	F	15 37		
#24 22nd	iPZ	18 48 18	4690	
	ePE	18		
	SNE	54 36		
	F	19 45		
#25 24th	ePNEZ	4 08 20	2645	
	SE	12 28		
	F	32		
#26 25th	iP'Z	5 52 05		Dilatation from southeast.
	eP'NE	05		
	F	7 55		
#27 25th	PNEZ	10 58 02	1690	
	SNE	40 57		
	F	57		
#28 25th	PNEZ	17 26 17	3600	
	SE	31 28		
	LNE	35 20ca		
	ME	38 10ca		
	F	18 30		
#32 26th	PNEZ	10 36 57	2435	
	SNE	40 50		
	LNE	43 10ca		
	F	11 33		
#33 26th	ePNEZ	17 31 14	2745	
	SNE	35 29		
	LNE	38 25ca		
	F	18 30		
#35 27th	iPZ	5 49 02	3955	Dilatation.
	SE	54 35		
	LE	59 15ca		
	F	6 35		
#36 27th	ePNEZ	10 44 08	3765?	
	S?NE	49 30		
	F	11 39		
#41 29th	PNEZ	0 43 18	145	Felt at Mindoro.
	SNE	36		
	F	48		
#42 29th	PNEZ	0 53 06	145	Felt in Mindoro.
	SNE	24		
	F	56		
#45 29th	iPZ	2 40 18	150	Dilatation. Slightly felt in Manila and strongly at San Teodoro, Mindoro.
	ePNE	18		
	SNE	37		
	F	3 04		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Jan. 1939				
#47 29th	PNEZ	5 12 26	160	Felt in Mindoro.
	SNEZ	46		
	F	23		
#48 29th	PNEZ	5 32 32	150	Felt in Mindoro.
	SNEZ	51		
	F	41		
#55 29th	ePNE	15 31 57	4055?	
	S?NE	37 57		
	F	16 06		
#58 30th	iPNEZ	2 26 05	4335	Compression. 6°S: 155°E by Manila, apia, Honolulu.
	SNE	32 13		Data after P from the Wiechert.
	LNE	37 45ca		7°S: 155°E by U.S.C.G.S.
	MN	41 05ca		
	F	5 00		
#59 30th	PEZ	5 31 27	4590	S from the Wiechert.
	SN	37 39		
	F	7 20		
#61 30th	PNEZ	12 35 20	2465	
	SNE	39 15		
	F	13 18		
#62 30th 31st	iPZ	23 56 44	3520	Compression?
	ePNE	44		
	SNE	0 02 01		
	F	2 00		
#63 31st	PNEZ	2 39 03	120	
	SNE	18		
	F	45		
#64	PNEZ	4 21 49	4520	
	SE	27 57		
	F	5 05		

Thirty-two insignificant or undecipherable disturbances on the following days of January: 2nd, 3rd, 5th(2), 8th, 10th(3), 12th, 14th, 15th(2), 25th, 26th(3), 27th, 28th(2), 29th(12), and 30th.

No. 4. February, 1939.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

ϕ=14° 34' 42" N. λ=120° 58' 41" E. h=3 m. Alluvium.

International Seismological Centre

CONSTANTS OF THE GALITZIN-WILIP.

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
February 2, 1939.

	T_o	V	ε	$\frac{I}{T_o^2}$
N-S	4.2	208	2.5	0.093
E-W	4.3	250	2.6	0.079

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Kg.	Remarks.
Feb. 1939				
#65 1st	iPNE?	1 44 24	2665	Compression?
	iSNE	48 34		
	LNE	51 ca		
	MN	53 15ca		
	F	2 45		
#66 1st	iPNEZ	7 30 23	120	Compression?
	SNEZ	38		Felt in southern part of Luzon.
	F	8 03		
#68 2nd	iPZ	7 11 48	1545	Compression.
	SNE	14 29		
	LN	16 10ca		
	MNE	17 20ca		
	F	8 40		
#71 2nd	PNEZ	23 24 32	4620	
	SNE	30 46		
	MN	40 20ca		
3rd	F	0 27		
#72 3rd	iPNZ	5 34 39	4655	Dilatation.
	SNE	41 05		9° S: 159° E by U.S.C.G.S.
	F	8 50		
#74 3rd	iPNZ	20 24 47	9055	Compression?
	SNE	35 00		
	F	21 30		
#77 4th	iPZ	5 27 42	5310	
	SNE	34 36		
	F	7 20		
#79 4th	iPZ	11 36 36	1100	Felt at Davao.
	SNE	38 30		
	F	12 48		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Feb. 1939				
#83	ePNZ	4 14 43	3290	
7th	SNE	19 34		
	LNE	22 45ca		
	F	5 08		
#89	ePNZ	11 50 54	3645	
9th	SNE	56 08		
	LNE	12 00 05cq		
	MN	02 50ca		
	F	30		
#92	ePZ	18 40 50	850	
11th	SNEZ	42 22		
	F	19 38		
#95	ePNEZ	18 57 22	4520	
16th	SNE	19 03 30		
	MNE	11 ca		
	F	20 15		
#97	ePNEZ	13 55 27?	510	No time marks on Galitzin records.
17th	SNEZ	56 27?		
	F	14 13		
#98	ePEZ	19 46 36	3665	
17th	SN	51 51		
	F	20 42		
#99	ePNEZ	23 16 16	1465	
17th	SNE	18 48		
	F	56		
103	PZ	2 45 55	1800	
20th	SNE	48 59		
	F	3 17		
104	iPZ	3 53 10	4680	Dilatation.
20th	ePNE	10		
	SE	59 27		
	ME	4 09 05ca		
	F	5 20		
106	ePNEZ	10 12 24	3135	Dilatation(?)
23rd	iSE	17 05		
	LN	20 ca		
	F	11 36		
107	PNE	15 54 49	3235	
23rd	SN	59 36		
	F	16 45		
111	ePNEZ	14 26 48	8165	
24th	iZ	27 04		
	SNE	36 25		
	F	15 30		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Feb. 1939				
112 26th	iPEZ	10 00 28	2765	Compression?
	SN	04 44		
	LN	07 20ca		
113 26th	iPZ	10 33 41	2745	Compression?
	SNE	37 56		
	LNE	40 40ca		
	MNE	42 50ca		
	F	12 50		
114 28th	iPEZ	2 42 51	4120	Compression.
	SNE	48 35		
	LN	53 40ca		
	MN	56 45		
115 28th	PNEZ	3 53 27	2365	
	SNE	57 16		
	F	5 05		
116 28th	PNE	19 01 59	360	
	SNE	02 45		
	F	16		

Twenty-seven insignificant or undecipherable disturbances on the following days of February: 1st, 2nd(2), 3rd, 4th(4), 5th, 6th, 7th(2), 8th(2), 9th(2), 10th, 13th(2), 17th, 18th(3), 20th, and 24th(3).

No.7. March, 1939.

M A N I L A , P. I.

SIESMOLOGICAL BULLETIN OF THE OBSERVATORY.

ϕ=14° 34' 42" N. λ=120° 58' 41" E. h=3 m. Alluvium.

International Seismological Centre

CONSTANTS OF THE GALITZIN-WILIP.

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
March 1, 1939.

	T_o	V	ε	$\frac{\varepsilon}{T_o^2}$
N-S	4.3	199	2.5	0.082
E-W	4.1	278	2.7	0.074

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1939				
117	iPZ	0 12 54	115	Slightly felt in Manila.
1st	SNEZ	13 09		
	F	21		
118	P?NEZ	11 28 43	5420?	Disturbed by microseisms.
1st	SNE	35 43		
	F	12 35		
120	iPZ	7 06 20	1365	Dilatation.
2nd	SN	08 42		Disturbed by microseisms.
	LE	10 ca		
	F	8 25		
123	ePNEZ	20 06 39	1220	Compression.
4th	SNE	06 53		Felt in Davao.
	LNE	09 50ca		
	MNE	13 20ca		
	F	21 35		
124	iPZ	2 16 31	1200	Compression.
5th	SNE	18 43		Felt in Davao.
	LNE	19 50ca		
	F	3 40		
125	ePNEZ	15 12 31	135	
5th	SNEZ	48		
	F	18		
127	ePNEZ	2 00 46	3645	
7th	SNE	06 11		
	LNE	10 05ca		
	F	3 45		
128	ePNEZ	15 14 34	7020	
7th	SNE	23 08		
	LNE	34 24		
	MNE	39 40		
	F	16 40		
129	iPZ	17 24 38	4955	
7th	SNE	31 20		
	LNE	38 ca		
	F	18 45		
130	iPEZ	22 05 54	4390	Compression.
8th	iSNE	11 54		
	LNE	17 30ca		
	MNE	20 50ca		
	F	23 58		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1939				
131	P?NE	2 48 52	3945?	
10th	SNE	54 24		
	LNE	57 30ca		
	F	3 54		
132	PNEZ	5 56 34	190	
10th	SNEZ	58		
	F	6 01		
134	ePZ	22 02 48	3080	
10th	SNE	07 25		
	MNE	12 45ca		
	F	23 10		
137	iPZ	10 40 20	140	Compression.
12th	ePNE	20		Ambulong, 100 Km.
	SNEZ	38		
	F	11 02		
143	iPZ	14 00 15	425	Dilatation from NW.
15th	ePNE	15		Felt slightly in Manila.
	SNEZ	31		
	F	23		
145	PNE	5 09 22	135	From the Wiechert. No time marks on
16th	SNE	39		Galitzin records.
	F	18		
146	1PNEZ	9 42 10	200	Compression from SE.
17th	SNEZ	36		Felt at Boac, Marinduque, and Romblon.
	F	10 00		
148	PNEZ	16 30 17	1600	
18th	SN	33 04		
	F	49		
149	1PNEZ	5 27 00	2310	Compression. Japan.
20th	SNE	30 45		
	MN	34 50ca.		
	F	5 30		
150	1PZ	22 09 50	2310	
20th	SN	13 35		
	F	40		
151	1PEZ	1 18 06	4000	Compression.
21st	1SNE	23 52		
	MNE	30 ca		
	F	4 50		
152	ePNEZ	8 03 25	?	
21st	SNE?	14 ca		
	F	9 25		
153	iPZ	3 52 0[illegible]	[illegible]735	Compression.
22nd	ePNE	05		
	SN	57 34		
	LNE	59 43		
	F	5 40		
154	ePEZ	7 32 49	7700	Compression.
22nd	SNE	42 17		
	LNE	55 ca		
	F	10 25		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1939				
155	iPZ	16 32 02	8340	Compression.
23rd	ePNE	02		
	SE	-1 49		
	LN	55 ca		
	F	17 50		
158	ePNEZ	1 00 08	730	
25th	SNEZ	01 29		
	F	27		
159	ePNZ	1 45 36	1600	
25th	SNE	-6 20		
	MNE	51 20ca		
	F	2 20		
160	iPNZ	5 43 04	2480	Dilatation from SE?
25th	SNE	47 00		
	LNE	48 20ca		
	F	6 45		
161	iPNZ	8 34 17	220	Compression.
25th	SNE	47		
163	iPZ	8 43 27	220	
25th	SNEZ	57		
	F	9 08		
164	ePNEZ	19 13 09	2555	
25th	SE	17 11		
	F	43		
170	iPEZ	0 22 52	2365	Compression.
29th	ePN	52		
	SNE	26 41		
	F	1 20		
171	iPNEZ	2 30 46	820	Compression. Felt at Dapa and at Tandag, Surigao.
29th	SN	32 15		
	F	4 15		S from the Wiechert.
173	ePEZ	22 22 32	4680	
31st	SNE	28 50		
	F	48		

Twenty-three insignificant or undecipherable disturbances on the following days of March; 1st, 2nd, 4th, 5th, 10th, 11th(2), 13th(3), 14th(2), 16th, 17th, 24th(2), 25th(2), 26th(2), 27th(2), and 31st.

M A N I L A O B S E R V A T O R Y

M A R C H , 1 9 3 9

International Seismological Centre

We thankfully acknowledge the receipt of the following Bulletins and Reports.

S T A T I O N S	B U L L E T I N S
Apia	October, November and December, 1938.
Batavia	January, February and March, 1938.
Bucarest	December, 1938 and January, 1939.
Denver	May, 1938.
Fordham	October, November and December, 1938.
Graz	February 17 to March 18, 1938.
Hamburg	October 23 to December 31, 1938.
Hong Kong	Preliminary Report of Principal earthquakes of February, 1939.
Hong Kong	February, 1939.
J.S.A.	Preliminary Bulletin of earthquakes of October 20, November 6 and 17, 1938.
Kew	Janaury, 1939.
Ksara	Year 1936, and January, 1939.
La Plata	October and November, 1938.
Lemberg	January 1 to March 27, 1938.
Malaga	July 1 to December 31, 1937.
Melbourne	October, November and December, 1938.
Ottawa	September and October, 1938.
Palau	Year 1936, and July 27 to December 31, 1938.
Pasadena	Local shocks of October and November, 1938..
Pasadena	July, 1938, and Preliminary Report of January, 1939.
Pasadena	Local shocks of December, 1938, and January, 1939.
Perth	January, 1939.
Queensland	December, 1938 and January, 1939.
Riverview	January, 1939.
San Fernando	November and December, 1938.
Strasbourg:	
L'Institut	Decmmber, 1938.
Bureau Central	December, 1938.
Stuttgart	February, 1939.
Taihoku	February, 1939.
Uccle	March 21 to June 30, 1938.
Upsala	July 1, 1937 to June 30, 1938.
U.S.C.G.S.	Seismographic Report of April, 1937.
Wellington	December, 1938.
Zikawei	Preliminary Bulletin of March, 1939.
Zurich	Decemberl, 1938 to January 31, 1939.

MIGUEL SELGA, S.J.,
Director, Weather Bureau,
Manila, Philippine Islands.

WILLIAM C. REPETTI, S.J.,
Seismologist.

No. 10. April, 1939.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

International Seismological Centre

ϕ=14° 34' 42" N. λ=120° 58' 41" E. h=3 m. Alluvium.

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
April 1, 1939

	T_o	V	ε	$\frac{r}{T_o^2}$
N-S	4.3	198	2.5	0.086
E-W	4.1	274	2.7	0.083

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
April 176	ePNEZ	8 46 26	1835	
3rd	SE	49 34		
	F	9 10		
178	iPZ	21 32 33	4055	
3rd	SE	38 14		
	LN	42 on		
	F	22 37		
179	ePZ	10 20 42	6265	
4th	SNE	28 31		
	LN	38 20on		
	F	11 35		
180	ePNE	11 53 19	215	Deep focus.
4ht	SNEZ	47		
	F	12 00		
181	iPEZ	16 47 33	670	Compression from SE. Felt in Guiuan and Dapa.
4th	SNE	48 48		
	F	17 32		
182	ePNE	21 30 06	165	Felt in Baguio, 50 Km.
4th	SNE	27		
	F	41		
183	P?NEZ	23 03 12	3455?	
4th	SNE	08 14		
	F	29		
184	iPZ	9 47 23	215	Dilatation.
5th	eIPNE	23		
	iSNE	52		
	F	57		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
April				
185	iPZ	16 52 34	6665	Dilatation from SE.
5th	SNEZ	17 00 46		19°S: 168°E By Riverview and Manila.
	LNEZ	11 ca		
	MNE	16 45ca		
	F	20 25		
188	ePNEZ	21 00 44	380	Felt at Laoag and Aparri.
6th	SNEZ	01 31		
	F	38		
189	iPZ	15 10 22	175	Felt at Baguio.
8th	SNEZ	44		Baguio, 95 Km.
	F	20		
190	ePNEZ	22 08 05	1190	
9th	SNE	10 09		
	LN	11 20		
	F	32		
191	iPZ	13 23 01	440	Dilatation. Deeper than normal.
10th	ePNE	01		Felt at Laoag, Vigan and Baguio.
	iSNEZ	55		
	F	14 16		
192	ePNEZ	17 05 48	440	Aftershock of No. 191.
10th	SNE	06 42		Felt at Laoag.
	F	18		
196	ePNE	19 22 28	135	
13th	iSNE	45		
	F	29		
198	ePNEZ	15 55 46	640	Felt at Dumaguete.
14th	SNE?	56 58		
	F	16 17		
199	ePNE	19 25 35	230	
14th	SNE	26 06		
	F	35		
201	iPZ	9 09 33	3370	
15th	SNE	14 29		
	F	10 20		
202	ePNEZ	20 15 44	8645	
15th	SNE	25 40		
	LNE	41 ca		
	F	21 34		
204	ePNE	10 13 15	1250	
17th	SNE	15 25		
	LNE	16 29		
	F	33		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
April				
206	iP$_1$Z	6 42 45	17510	Compression.
18th	iP$_1$NE	47		27°S: 71°W by U.S.C.G.S.
	SKKS	53 17		0=6:22:42
	LNE	7 41 ca		L from the Wiechort.
	F	10 50		
209	iPZ	22 18 11	7980	
20th	ePNE	11		
	iSN	27 39		
	LN	41 50ca		
	F	24 00		
210	iPNEZ	4 35 28	3480	Compression from NE. Deep focus.
21st	iSNE	40 31		
	LN	44 25ca		
	MN	47 25ca		
	F	6 04		
213	iPNEZ	11 27 31	1655	Dilatation.
22nd	SN	30 25		
	LNE	31 30ca		
	F	12 30		
215	ePNEZ	1 36 42	210	
23rd	iSNE	37 09		
	F	46		
216	ePNEZ	16 45 00		
23rd	F	18 36		
220	ePZ	14 47 41	140	
25th	iSNEZ	59		
	F	56		
221	ePEZ	15 43 55	270	Felt at Daet.
25th	SNE	44 33		
	F	52		
222	iPNZ	11 17 47	550	Compression. Felt at Basco, Laoag and Vigan.
26th	iSNEZ	18 51		Approx. 19° 35'N: 121° 15'E by Manila,
	F	12 38		Hong Kong and Baguio.
224	ePNEZ	19 54 02	150	
26th	iSNEZ	21		
	F	20 02		
226	ePNE	0 09 15	120	
28th	SNEZ	30		
	F	14		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
April 1939				
231	ePEZ	3 03 37	5010	11°S: 158°E by U.S.C.G.S.
30th	iSNE	10 22		Phases after P from the Wiechert.
232	PNE	5 57 48	310	No. 231 still recording. From the
30th	SNE	58 33		Wiechert.
	F	6 04		Baguio, 190 Km.
234	PNEZ	14 11 05	4900	
30th	SNE	17 44		
	LN	23 30a.		
	F	15 40		

Twenty-eight insignificant or undeciphorable disturbances on the following days of April: 1st, 2nd, 3rd, 6th(2), 12th, 13th(2), 14th, 15th(2), 17th, 19th(2), 21st(2), 22nd, 24th(3), 26th, 27th, 28th(3), 29th, and 30th(2).

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

0=14 34 42 N. λ=120 58 +1 E. h=3 m. Alluvium

International Seismological Centre

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
May 1, 1939.

	T_o	V	ε	$\frac{r}{T_o^2}$
N-S	4.3	197	2.6	0.087
E-W	4.1	275	2.6	0.067

Cf. Theoretical Seismology.
Sohon, S.J.

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
May 1939				
236	PEZ	4 36 19	2855	
1st	SNE	40 41		
	LNE	43 20ca		
	F	5 40		
237	iPZ	6 04 37	3610	Compression. Data after S from the
1st	ePNE	40		Wiechert.
	SNE	09 49		40°N: 139°E by U.S.C.G.S.
	LNE	13 20ca		
	F	9 35		
238	ePNEZ	11 56 42	3410	
1st	SNE	12 01 41		
	LNE	05 40ca		
	F	13 10		
240	iPZ	16 12 01	3400	Dilatation.
1st	iSNE	16 57		
	LNE	20 25ca		
	MNE	23 20ca		
	F	18 30		
241	eEZ	13 33 06	12355	Galtzin N-S component not recording.
2nd	PSE	43 52		29.4°N: 113.5°W by J.S.A.
	LNE	14 06 00		29.5°N: 113.8°W by U.S.C.G.S.
	ME	11 ca		
	F	16 40		
242	ePNEZ	7 13 17	5455	
3rd	SNE	20 19		
	LE	28 50ca		
243	ePNEZ	8 21 12	4120	
3rd	SNE	26 56		
	F	9 27		
244	ePNEZ	16 21 03	2320	
3rd	SNE	24 49		
	MN	28 40ca		
	F	17 30		
245	iPZ	22 59 47	710	Dilatation. Felt at Hinatuan, Port Lamon
3rd	SNE	23 01 06		and Butuan.
	F	18		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.—Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
May 1939				
247 5th	ePNEZ	12 17 26	2890	
	SNE	21 51		
	F	46		
249 6th	eP_1NE	6 20 18	16480	Near 5°N: 84°W by U.S.C.G.S.
	SS	42 30ca		O=6:02:11
	GNE	48 00		
	LNE	7 12 ca		
	MN	26 30ca		
	F	8 15		
251 6th	iPNE	17 00 23	125	Dilatation from S. Deeper than normal.
	SNE	39		Probable epicenter 13° 30'N: 121° 15'E, h=75 Km. H=17:00:07
				S from the Horizontals. Very strong in Calapan, Mindoro: moderate in S Luzon.
253 6th	PNE	17 21 09	125	2nd earthquake, aftershock of No. 251.
	SNE	25		From the Wiechert.
256 6th	PNE	18 54 56	125	3rd earthquake, aftershock of No. 251.
	iSNE	55 12		
	F	19 21		
258 6th	ePNE	20 12 49	5035	Disturbed by microseisms.
	SN	19 27		
	LNE	26 30ca		
	F	21 26		
261 7th	ePNE	0 34 29	2890	Galitzin Z component not recording.
	SNE	38 54		
	LNE	41 40ca		
	F	2 10		
265 7th	iPZ	6 47 34	125	Dilatation.
	SNEZ	50		
	F	59		
267 7th	eP?NEZ	7 16 12	3900?	
	SNE	21 42		
	F	8 10		
269 8th	ePNE	0 48 18	240	
	SNE	51		
	F	1 06		
270 8th	eP_1N	2 02 15	17200	Near 37°N: 24°W by U.S.C.G.S.
	PPNE	06 45		O=1:46:48
	PSNE	16 45		
	LN	43 25ca		
	MNE	51 30ca		
	F	5 25		
274 8th	ePNE	23 45 48	125	
	SNE	46 04		
	F	49		
276	iPZ	8 08 34	110	Dilatation. Deeper than normal.
	ePNE	54		
	SNEZ	48		
	F	30		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
May 1939				
277	ePNEZ	13 06 49	120	
9th	SNEZ	07 04		
	F	16		
278	ePEZ	21 18 48	1260	
9th	SE	20 59		
	F	22 16		
281	ePEZ	7 54 23	6990	Compression. 51°N: 179°W by U.S.C.G.S.
10th	SNE	8 02 55		
	LNE	14 25cu		
	MNE	19 35cu		
	F	9 02		
284	iPZ	2 34 26	135	Dilatation.
11th	SNEZ	43		
285	ePNEZ	2 43 43	135	
11th	SNEZ	44 00		
	F	47		
286	iPEZ	17 36 29	2755	
11th	iSNE	40 55		
	LN	43 30cu		
	F	18 30		
287	iPNZ	0 10 25	370	Dilatation.
12th	SNEZ	11 12		
	F	35		
288	ePNEZ	13 04 12	4360?	
13th	S?NE	10 11		
	F	31		
289	ePNEZ	19 56 47	3940	
13th	SNE	20 02 19		
	F	20		
290	iPEZ	18 24 04	8160	Compression. Deep focus.
14th	iSNE	33 41		
	F	19 25		
292	iPNEZ	7 22 26	1130	Dilatation. Felt Strongly at Arisan,
16th	iSNEZ	24 24		Formosa.
	F	9 10		
294	PNEZ	0 24 58	1500	
17th	SNE	27 33		
	F	56		
296	ePNEZ	15 16 53	4150	
17th	SNE	22 39		
	ME	30 45cu		
	F	17 25		
298	iPNEZ	18 35 37	2555	Dilatation. S from the Wiechert.
17th	SNE	39 47		
	F	21 30		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
May 1939				
299 17th	ePNEZ	22 47 37	540	
	SNE	48 40		
	F	56		
302 19th	ePEZ	18 45 37	8340	
	SNE	55 23		
	LNE	19 09 ca		
	MNE	16 20ca		
	F	20 21		
304 21st	iPZ	20 32 05	6765	Dilatation. Deep focus.
	ePE	05		
	SNE	40 24		
	LN	51 ca		
	F	21 52		
305 22nd	iPNEZ	1 40 40	3400	
	SNE	45 58		
	LNE	49 10ca		
	F	3 10		
308 23rd	ePNZ	4 29 00	4045	
	SE	34 39		
	LNE	39 ca		
	F	5 47		
309 25th	PNE	0 01 19		Trace. From the Wiechert. Felt at Vigan.
	F	07		
310 25th	iPNEZ	6 16 50	240	Compression. Near 14° 30'N: 123° 10'E.
	SNE	17 23		Felt in southeastern part of Luzon and Marinduque Island.
311 25th	ePNEZ	6 59 48	240	Aftershock of No. 310.
	SNE	7 00 21		
	F	8 15		
313 26th	ePNEZ	9 47 50	4910	
	SNE	54 24		
	LNE	10 01 40ca		
	MNE	04 50ca		
	F	11 10		
315 26th	ePNEZ	17 55 57	3080	Compression.
	SNE	18 00 34		
	LNE	03 25ca		
	MN	06 ca		
	F	19 52		
316 26th	PNEZ	20 11 45	3520	
	SE	16 51		
	F	33		
318 27th	iPNEZ	3 51 22	4255	Compression.
	iSNE	57 14		
	iLNE	4 02 25ca		
	MNE	05 45ca		
	F	6 10		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
May 1939				
321 27th	ePNEZ	14 52 08	240	
	SNE	42		
	F	15 08		
324 28th	ePNEZ	4 09 04	700	
	SNEZ	10 18		
	F	32		
326 30th	PNZ	10 16 04	5700	
	SNE	23 20		
	F	11 10		

30th From 17:09:12 to 17:12:12 conspicuous group of about 14 seconds period waves on N component.

328 30th	PNEZ	17 16 38	2010	
	SN	20 04		
	F	18 22		
331 31st	PNEZ	15 46 13	210	Felt at Naga.
	SNEZ	+0		
	F	16 01		
332 31st	PNEZ	18 09 49	1600	
	SNE	12 36		
	F	26		

Forty-three insignificant or undecipherable disturbances on the following days of May: 1st, 4th, 6th(8), 7th(5), 8th(3), 9th, 10th(+), 15th, 16th, 17th(2), 18th(2), 20th, 22nd(2), 26th(3), 27th (4), 28th, 30th(2), and 31st.

No. 19. June, 1939.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

φ=14° 34' 42" N. λ=120° 58' 41" E. h=3 m. Alluvium.

International Seismological Centre

CONSTANTS OF THE GALITZI-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

Cf. Theoretical Seismology.
Bohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
June 1, 1939.

	T_o	V	ε	$\frac{r}{T_o^2}$
N-S	4.3	207	2.6	0.069
E-W	4.0	271	2.6	0.074

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
June 1939				
335 1st	ePNE	16 16 17	3245	
	SN	21 05		
	F	51		
337 2nd	iPNEZ	3 36 04	1310	Compression. Felt in Mindanao and Jolo.
	SNE	38 20		S from the Wiechert.
	F	6 06		
338 2nd	ePNEZ	6 11 06	250	Felt in southeastern part of Luzon.
	SNEZ	41		
	F	30		
341 3rd	iPNEZ	5 47 16	220	Felt at Daet, Capalonga and Naga.
	iSNEZ	46		
	F	6 35		
343 3rd	ePNEZ	17 50 25	1070	
	SN	52 18		
	F	18 05		
344 4th	ePNEZ	0 29 08	2790	Compression.
	SNEZ	33 26		
	MN	38 30ca		
	F	1 35		
345 4th	ePNEZ	3 26 20	2535	Deeper than normal.
	SNEZ	30 20		
	F	4 00		
346 4th	PZ	12 09 04		
	S?NE	19 00		
	F	13 10		
347 4th	ePNEZ	15 21 12	4350	
	SNE	27 09		
	LN	31 20ca		
	F	16 30		
352 5th	PEZ	16 08 47	2300?	
	S?NE	12 31		
	F	17 10		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
June 1939				
353 6th	ePNEZ	6 32 06	1400	
	SNE	34 31		
	F	7 05		
354 6th	ePNE	8 43 05	690	Felt at Dumaguete and Dapitan.
	SE	44 22		
	F	9 02		
356 7th	iPZ	4 37 52	125	Dilatation. Felt at Naujan, Mindoro.
	SNEZ	38 08		
	F	46		
357 8th	ePNEZ	15 31 57	3090	
	SNE	36 35		
	LN	39 30ca		
	F	16 36		
358 8TH	iPEZ	20 58 06	8250	Compression. 15°S: 173°W, h=100 by U.S.C.G.S.
	iSNE	21 07 48		
	LNEZ	21 30ca		
	F	23 05		
359 9th	ePNEZ	5 42 21	210	
	SNEZ	48		
	F	47		
360 9th	iPNEZ	19 14 09	2755	Compression(?). Deep focus.
	iSNE	18 25		
	MN	23 25ca		
	F	20 40		
363 10th	ePNEZ	7 32 21	160	Probably SW. Ambulong, 100 Km.
	SNEZ	41		
	F	38		
365 10th	iPZ	9 47 49	2880	Deep focus.
	ePNE	49		
	SNE	52 13		
	F	10 15		
367 11th	ePNEZ	11 12 26	1380	
	SNE	14 49		
	F	38		
368 12th	ePNEZ	4 24 39	15970	21°.8N: 66°W, H=4:05:11 by U.S.C.G.S.
	SKP	28 31		
	SKKS?	34 30ca		
	iE	41 38		
	SS?	46 ca		
	LNE	5 19 ca		
	MN	24 30ca		
	F	6 20		
369 12th	ePZ	13 23 23	600?	Felt at Basco.
	S?NE	24 58		
	F	45		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
June 1939				
370 13th	iPZ	20 43 18	2545	Dilatation.
	ePNE	18		
	SNE	47 19		
	MN	51 50ca		
	F	22 20		
372 15th	ePNEZ	3 42 09	210	
	SNEZ	36		
	F	49		
373 15th	ePNEZ	14 03 45	2645	
	SNE	07 53		
	F	15 00		
374 16th	ePNEZ	5 21 51	2220	
	SNE	25 30		
	MN	29 35		
	F	6 10		
375 16th	ePNEZ	21 37 43	2520	Compression.
	iSN	41 42		
	iLN	43 25ca		
	F	23 15		
377 17th	ePEZ	9 31 28	3080	
	SN	36 05		
	F	10. 15		
378 17th	ePNE	12 14 05	8365?	
	S?E	23 48		
	LE	37 ca		
	MN	43 45ca		
	F	13 30		
380 18th	ePNEZ	3 54 05	1170	
	iSNE	56 14		
	MN	59 30ca		
	F	5 00		
381 18th	PNEZ	12 34 32	280	Felt at Naga.
	SNE	35 10		
	F	13 02		
382 18th	iPZ	17 05 38		Dilatation.
	ePNE	38		
	iNE	07 10		
	F	50		
384 19th	ePNEZ	13 43 58	1465	
	SNE	46 30		
	F	14 08		
385 19th	ePNEZ	22 03 11	3400	
	SNE	08 09		
	LNE	11 50ca		
	MNE	14 35ca		
	F	23 20		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
June 1939				
386 20th	ePNEZ	5 54 42	670	
	SNE	55 57		
	F	6 17		
390 22nd	iPZ	19 13 25	1100	Deeper than normal. Felt at Dadiangas, Cotabato. Butuan, about 300 Km.
	SNE	15 27		
391 22nd	P?NEZ	19 39 41		No. 390 still recording.
	L?N	20 23 ca		
	F	21 45		
396 25th	ePZ	2 48 05	2755	Deep focus.
	ePNE	11		
	iSNE	52 21		
	F	3 40		
398 26th	ePEZ	7 26 15	2530	
	SNE	30 15		
	F	9 35		
401 28th	ePNEZ	23 12 50	70	Ambulong, 65 km.
	iSNEZ	59		
	F	19		
403 27th 28th	iPNEZ	23 06 39	1010	Compression from SE. S from the Wiechert. Dilatation from SE in Butuan. Probable epicenter, 7°30'N: 127°E. Felt generally in Mindanao, Leyte and Samar.
	iSNE	08 26		
	F	1 30		

Thirty-three insignificant or undecipherable disturbances on the following days of June: 1st(3), 3rd(3), 4th(3), 5th, 7th, 9th, 10th(2), 11th, 14th, 17th(2), 19th, 20th, 21st, 22nd, 24th(4), 25th, 26th(2), 27th, 28th, 29th, and 30th.

No. 23. July, 1939

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

ϕ=14° 34' 42" E. λ=120° 58' 41" N. h=3 m. Alluvium

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M 955 Kg.
July 1, 1939.

	T_o	V	ε	$\frac{T}{T_o^2}$
N-S	4.3	205	2.6	0.081
E-W	4.0	269	2.6	0.089

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
July 1939				
407 1st	ePNEZ	13 27 15	3390	Probably deeper than normal.
	SNE	32 12		
	F	14 17		
409 2nd	ePNEZ	17 02 14	6390	Probably deeper than normal.
	SNE	10 10		
	F	18 10		
410 2nd	iPZ	19 53 06	5910	Dilatation.
	SN	20 00 34		
	F	21 05		
411 3rd	ePE	5 41 14	1000	
	SE	43 00		
	F	55		
416 4th	$iP_1'Z$	18 45 53	18745	Compression. 23°S: 67°W, h=300-400 Km. by U.S.C.G.S.
	$eP_1'NE$	53		19.9S: 67.3W, h=300 Km. by J.S.A.
	$P_2'Z$	47 07		
	iE	13		
	iZ	52 13		
	iN	57 22		
	iSSNE	19 11 39		
	LNE	53 ca		
	F	20 50		
417 5th	iPZ	8 47 40	1090	
	ePNE	42		
	iSNE	49 35		
	F	10 00		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
July 1939				
419	iPEZ	22 51 06	7155	Dilatation. Deep focus.
5th	iPN	09		24°S: 179°W, h=500 Km. by U.S.C.G.S.
	iSNE	59 48		24°S: 180°W, h=550 Km. by J.S.A.
	LNE	23 12 30ca		
	MN	16 30ca		
6th	F	0 45		
420	ePNEZ	1 15 58	2480	
6th	SNE	19 54		
	MNE	25 ca		
	F	55		
422	PNEZ	6 26 16	5410	Disturbed by microseisms.
10th	SNE	33 15		
	F	7 10		
423	PNEZ	11 12 19	1145	
10th	SNE	14 18		
	F	25		
426	ePNEZ	22 08 49	190	
11th	iSNEZ	09 13		
	F	14		
427	ePNEZ	12 51 59	2655	Deep focus.
12th	SNE	56 08		
	F	13 25		
430	iPZ	23 03 54	3810	Dilatation?
12th	ePNE	54		
	iSNE	09 18		
	LN	13 50ca		
	MNE	16 45ca		
13th	F	0 45		
431	iPZ	17 10 31	3290	Compression?
13th	ePNE	31		
	SE	15 22		
	ME	21 05ca		
	F	18 10		
439	eP(?)Z	3 39 48	10320	Disturbed by microseisms. 0-3:26:32.
18th	SNE	50 55		
	iE	52 42		40°N: 130?5W. by U.S.C.G.S.
	F	5 30		
440	eP?NE	11 30 14	3490?	
18th	SNE	35 18		
	LN	39 35ca		
	MNE	42 20ca		
	F	12 20		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVatory.--Continued.

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
July 1939				
441 20th	ePNEZ	2 33 01	6840	Disturbed by microseisms.
	SNE	41 30		
	F	3 40		
443 25th	ePNEZ	7 23 36	3590	Disturbed by microseisms.
	SE	28 46		
	LE	32 15ca		
	F	50		
446 25th	ePNEZ	15 32 32	2300	
	SN	36 16		
	F	55		
447 25th	ePNEZ	22 09 18	1990	
	SN	12 38		
	F	40		
449 27th	ePNEZ	5 15 17	3155	Disturbed by microseisms.
	SNE	20 00		
	F	55		

Twenty-three insignificant or undecipherable disturbances on the following days of July: 1st, 3rd(2), 4th(2), 5th, 9th, 11th(2), 12th(2), 14th(2), 15th, 16th(4), 23rd, 25th(2), 26th, and 28th.

M A N I L A , P . I .

SIESMOLOGICAL BULLETIN OF THE OBSERVATORY.

International Seismological Centre

ϕ=14° 34' 42" N. λ=120° 58' 41" E. h=3 . Alluvium.

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0	.	

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M 955 Kg.
August 1, 1939.

	T_o	V	ε	$\frac{\varepsilon}{T_o^2}$
N-S	4.2	220	2.5	0.080
E-W	4.1	261	2.6	0.084

Cf. Theoretical Seismology.
Sohon, S.J.

No. and Date	Phase	Greenwich Time h.	m.	s.	Dist. Km.	Remarks
457	ePNEZ	2	00	27	185	Dilatation.
4th	SNEZ			50		
	F		20			
458	PNEZ	2	31	52	200	Dilatation.
4th	SNEZ		32	18		
	F		48			
460	ePNEZ	0	12	11	830	Dilatation from E at Butuan.
5th	iSEZ		13	42		Felt in NE Mindanao.
	F	1	14			
461	ePNEZ	4	41	08	2610	
6th	SNE		45	13		
	LE		47	40ca		
	F	5	39			
463	iPZ	20	02	10	4190	Deeper than normal.
8th	ePNE			10		
	iSNE		07	58		
	LN		13	05ca		
	F	21	10			
464	ePNEZ	21	36	08	185	
8th	SNE			31		
	F		48			
466	ePNEZ	16	35	23	95	
9th	SNEZ			35		
	F		43			
467	ePNEZ	22	26	12	2400	
9th	SNE		30	03		
	F	23	07			
468	P?NEZ	6	10	17	5210?	
10th	S?N		17	05		
	F	7	02			
473	iPNEZ	2	16	49	6010	Dilatation from ESE. 13° S: 169° E.
12th	iSNEZ		24	23		h=150 Km. by U.S.C.G.S.
	MNE		38	oa		
	F	4	00			

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
474	ePNEZ	9 57 33	4530	Compression(?) 45°N: 153°E, 0=9:49.8 by
12th	SNE	10 03 42		U.S.C.G.S.
	LN	09 35ca		
	MNE	12 30ca		
	F	11 50		
476	ePNEZ	4 25 19	840	In the Philippine Deep. Felt at Guiuan,
13th	SNE	26 50		Samar.
	F	5 07		
479	ePNEZ	3 51 12	4520	
14th	SNE	57 20		
	F	4 22		
481	ePNEZ	14 17 46	160	
14th	SNEZ	18 06		
	F	25		
483	PNE	19 42 46	160	Felt at Boac, Marinduque.
16th	SNE	43 06		
	F	51		
486	1PZ	22 25 48	6280	Probably compression. 18°S: 168°E by
18th	ePNE	48		U.S.C.G.S.
	SN	33 46		
	LNE	43 35ca		
	F	23 57		
487	1PNEZ	0 57 21	6440	
19th	SNE	1 05 20		
	F	2 04		
489	ePNEZ	7 07 38	150	Felt in Manila. Ambulong, 100 Km. S
20th	SNE	57		from the Wiechert and Horizontals.
	F	26		
491	PNEZ	5 35 22	215	
21st	SNEZ	50		
	F	47		
495	1PZ	21 23 27	940	Dilatation. Near 8°N: 127°E. Felt in
23rd	1PN	28		E Mindanao.
	ePE	28		
	1SNEZ	25 08		
	F	22 16		
499	ePNEZ	3 27 01	1030	
26th	SNE	28 50		
	F	4 00		

Thirty-four insignificant or undecipherable disturbances on the following days of August: 1st(3), 3rd(3), 4th, 8th, 9th, 10th, 11th(3), 13th(2), 14th(2), 16th, 17th(2), 20th(2), 21st, 22nd, 23rd, 24th, 25th(2), 27th(2), 28th, 30th(2), and 31st.

International Seismological Centre

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

ϕ=14° 34' 42" N. λ=120° 58' 41" E. h=3 m. Alluvium.

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	$)u^2$	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	116.	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M 955 Kg.
September 1, 1939.

	To	V	ε	T_o^2
N-S	4.3	204	2.6	0.075
E-W	4.0	289	2.6	0.074

No. and Date	Phase.	Greenwich Time h.	m.	s.	Dist. Km.	Remarks
Sept. 1939						
507	iPZ	9	08	02	5,880	Compression.
2nd	iSNE		15	28		Disturbed by microseisms.
	LNE		24	40ca		
	MNE		28	20ca		
	F	10	25			
508	iPZ	7	45	29	670	Compression. Falt in Batanes Islands.
3rd	ePNE			29		S from the Wiechert.
	iSNE		46	44		
	F	9	20			
510	ePNEZ	2	52	51	185	Very small.
6th	SNEZ		53	14		
	F		55			
514	iPZ	13	46	01	3,480	
7th	ePN			01		
	SNE		51	04		
	F	14	23			
516	iPZ	6	56	11	3,420	Compression.
8th	ePNE			11		
	SNE	7	01	11		
	MNE		09	ca		
	F		42			
517	iPZ	12	14	25	6,390	Compression? 51°N: 175°E, 0 12:04:45
8th	ePNE			25		by U.S.C.G.S.
	iSNE		22	25		
	LE		32	15ca		
	F	16	20			
520	iPZ	15	47	51	165	Dilatation. Felt at Iba.
9th	ePNE			51		
	iSNEZ		48	12		
	F	16	17			
521	ePNEZ	21	31	34	2,645	
9th	iSNE		35	42		
	F	22	12			

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Septm 1939				
522	ePNEZ	8 03 16	8,710?	
11th	SE	13 20		
	F	9 20		
526	ePZ	22 50 32	1,040?	
11th	SNE?	52 22		
	F	23 52		
528	ePNEZ	8 28 35	1,700	
12th	iSNE	31 34		
	F	51		
529	iPZ	12 17 49	8,490	Compression.
12th	ePE	49		
	iSN	27 42		
	F	13 44		
532	ePNEZ	20 07 01	260	
13th	SNEZ	38		
	F	25		
533	ePEZ	9 06 36	2,810	
14th	SN	11 06		
	LNE	13 29		
	MNE	15 25		
	F	10 30		
534	ePNEZ	13 15 42	2,590?	
14th	SN?	19 55		
	F	14 00		
538	eP?Z	21 58 38	6,520?	
15th	iZ	59 28		
	iN	36		
	SNE	22 06 42		
16th	F	0 20		
539	iPZ	7 19 26	1,520+	Dilatation. Deeper than normal. Butuan, more than 660 Km.
16th	ePNE	26		
	iSNE	22 04		Netherlands East Indies.
	MN	25 ca		
	F	9 00		
542	ePNEZ	19 32 01	8,155	
17th	SNE	41 37		
	LE	55 15ca		
	F	20 27		
543	iPZ	1 10 28	1,345	Compression.
18th	ePNE	28		
	iSNEZ	12 48		
	F	45		
547	eNEZ	3 42 ca		Trace.
19th	F	4 32		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Sept. 1939				
550 19th	iPZ	19 00 01	1,730?	
	iS?N	03 00		
	F	20		
554 24th	ePNEZ	3 32 10	3,680	
	iSNE	37 26		
	F	4 19		
556 25th	ePNEZ	15 36 48	3,090	
	SN	41 26		
	LN	44 40ca		
	MNE	46 25ca		
	F	16 35		
558 25th	ePNEZ	21 13 04	3,455	
	SE	18 06		
	ME	24 ca		
	F	22 05		
559 25th	ePNEZ	22 21 50	135	
	SNE	22 07		
	F	26		
560 27th	ePNEZ	10 16 13	190	
	SNE	37		
	F	26		
562 29th	ePNZ	14 27 25	510	Felt in northern Luzon.
	iSNEZ	28 25		
	F	52		
563 30th	ePNZ	16 25 46	1,520	
	iSNE	28 24		
	F	54		

Thirty-one insignificant or undecipherable disturbances on the following days of September: 1st, 5th, 6th(2), 7th(2), 9th(2), 11th(3), 12th, 13th(2), 14th(2), 15th, 17th(2), 18th(3), 19th(2), 20th, 22nd, 23rd, 24th, 25th, 28th, and 30th.

No. 31. October, 1939.

M A N I L A , P . I .

SIEMOLOGICAL BULLETIN OF THE OBSERVATORY.

ϕ=14° 34' 42" N. λ=120° 58' 41" E. h=3 m. Alluvium.

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
October 1, 1939.

	T_o	V	ε	$\frac{-r}{T_o^2}$
N-S	4.3	200	2.7	0.099
E-W	4.2	258	2.6	0.066

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Oct. 1939				
565	ePNE	4 15 48	1,350	
1st	SNE	18 08		
	F	40		
566	ePNE	7 44 26	195	
1st	SNE	51		
	F	50		
572	iPZ	11 17 28	2,710	
3rd	iSE	21 40		
	F	12 30		
573	iPZ	12 47 11	2,710	
3rd	iSE	51 23		
	F	14 20		
577	iPZ	15 12 54	3,790	Dilatation.
5th	iSNE	18 17		
	F	40		
580	ePNEZ	9 03 45	200	Disturbed by microseisms.
10th	SNEZ	04 11		Baguio, 85 Km.
	F	10		
581	ePNEZ	18 38 14	3,355	Disturbed by microseisms.
10th	iSNE	43 21		Compression?
	LNE	49 20ca		
	MNE	52 ca		
	F	20 35		
582	ePNEZ	23 45 33	165	
11th	SNEZ	54		
	F	51		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Oct. 1939				
587 15th	ePNEZ	19 15 14	115	Felt at Iba, Zambales.
	SNE	29		
	F	19		
588 17th	ePNE	6 31 30	5,945÷	Z component not recording.
	pP	32 14		h probably 200 Km by Brunner chart
	1SNE	39 02		△ probably 6,220 Km.
	MNE	52 40ca		New Hebrides by Riverview and Manila.
	F	9 35		Riverview reports h more than 200 Km.
589 19th	iPNEZ	6 26 47	135	Dilatation from SE. Deeper than normal.
	iSNEZ	27 04		Slightly felt in Manila, Batangas, and
	F	40		Mindoro.
593 21st	PNEZ	22 46 10	95	
	SNEZ	22		
	F	50		
594 22nd	PNZ	14 46 23	4,330	
	SN	52 20		
	F	15 32		
596 24th	PNEZ	9 04 22	1,000?	Butuan, 230 Km. ∴ . Deeper than normal.
	S?NE	06 17		
	F	10 10		
597 26th	ePNEZ	0 35 49	85	
	SNE	36 00		
	F	40		
598 26th	ePNEZ	2 52 55	85	
	SNEZ	53 06		
	F	56		
599 26th	P?NEZ	8 00 04	1,645?	
	SNEZ	02 55		
	F	27		
602 27th	ePNEZ	10 19 18	700	Felt at Batanes Islands.
	SNE	20 06		
	F	35		
605 29th	ePEZ	0 22 14	1,130	Felt at Davao.
	SNE	24 12		
	F	40		
606 29th	ePEZ	0 50 18	2,430	
	SNE	54 11		
	LNE	56 30ca		
	F	2 00		
609 30th	eNE	3 51 34	5.5	Trace of the small shock felt in Santa
	F	52		Escolastica street, Pasay.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Oct. 1939				
610 30th	ePNE	4 01 10	250	
	SNE	45		
	F	13		
611 30th	eNE	4 50 43	5.5	Trace of the small shock felt in Santa Escolastica street, Pasay.
	F	52		
612 30th	ePNZ	5 25 01	165	
	SNEZ	22		
	F	30		
613 30th	iPZ	13 23 44	7,800	Dilatation. Deeper than normal.
	ePNE	44		
	SNE	33 00		
614 30th	iPZ	13 53 21	210	#613 still recording.
	SNEZ	48		Felt at Baguio and San Fernando Union.
	F	14 20		Baguio, 15 Km.
615 30th	ePNEZ	17 46 06	2,300	
	SNE	49 50		
	F	18 15		

Twenty-six insignificant or undecipherable disturbances on the following days of October: 2nd(3), 3rd(3), 4th, 5th, 7th, 9th, 12th(4), 20th, 21st(2), 24th, 26th(2), 27th, 28th, 29th, 30th(2), and 31st.

No. 34. November, 1939.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

$\phi = 14^\circ\ 34'\ 42''$ N. $\lambda = 120^\circ\ 58'\ 41''$ E. h=3 m. Alluvium.

International Seismological Centre

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0.		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
November 1, 1939.

	T	V	ε	r/T_o^2
N-S	4.5	189	2.5	0.094
E-W	4.0	287	2.5	0.084

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Nov. 1939				
619 1st	ePNEZ	6 17 25	6,870?	Disturbed by microseisms. Region of New Hebrides by Riverview and Manila.
	SNE	25 50		
	LNE	37 ca		
620 1st	ePNEZ	7 27 19	1,830?	No. 619 still recording. Disturbed by microseisms.
	SNE	30 26		
	F	50		
621 1st	ePNE	20 04 09?	2,535	Disturbed by microseisms. Felt at Guam at 19:59:07 GMT. Δ=180 Km. Deeper than normal.
	SNE	08 18?		
	F	40		
622 3rd	ePNEZ	6 29 25	600	Felt in south Negros.
	SNE	30 33		
	F	48		
625 4th	ePNEZ	10 26 45	6,910?	
	S?NE	35 12		
	F	11 30		
626 5th	ePNEZ	8 12 36	2,100	
	SNE	16 05		
	F	30		
627 6th	iPZ	7 36 42	200	Dilatation.
	iPNE	43		
	SNE	37 08		
	F	40		
628 7th	ePNEZ	2 01 12	1,320	
	SNEZ	03 29		
	LNE	04 55ca		
	F	28		
629 7th	ePNEZ	3 55 50	1,380	
	SNEZ	58 13		
	LNE	59 30ca		
	MNE	4 00 50ca		
	F	5 10		
630 8th	iPEZ	2 05 56	1,530	Compression.
	SE	08 35		
	F	27		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h.	m.	s.	Dist. Km.	Remarks.
Nov. 1939.						
631	ePNEZ	17	19	07	175	
8th	SNEZ			29		
	F		31			
632	eP?NE	17	35	49	6,480?	
8th	SN		43	50		
	LN		54	ca		
	MN		59	10ca		
	F	18	46			
634	ePNEZ	9	28	54	2,640	
9th	SNE		33	02		
	F	10	00			
635	ePNEZ	16	11	10	2,440	Felt in Guam. 16:06:11 GMT. Δ=180 Km.
9th	SNE		15	04		Deeper than normal.
	F	17	25			
638	e	17	03	14		P lost in microseisms.
10th	SNE		11	19		
	LN		20	15ca		
	F	18	10			
639	ePNEZ	20	27	54	3,980	Western New Guinea by Manila and Riverview.
10th	SNE		33	40		
	LN		38	ca		
	F	21	30			
641	ePNEZ	22	59	51	1,210	
12th	SNEZ	23	01	57		
	F		32			
648	ePNEZ	22	27	17	150	
15th	iSNE			36		
	F		30			
649	iPZ	9	09	00	1,695	Dilatation.
17th	SNE		11	52		
	ME		15	30ca		
	F		43			
650	iPZ	18	49	48	6,680	Dilatation.
17th	ePNE			48		
	SNE		58	08		
	F	19	19			
651	ePZ	0	23	50	7,110	
18th	SE		32	29		
	F	1	20			
652	iPZ	1	41	17	5,230	Compression.
18th	ePNE			17		
	SNE		48	07		
	LNE		55	30ca		
	F	4	20			
654	ePNEZ	8	54	32	1,050	
19th	SNE		56	23		
	F	9	15			

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY,--Continued.

International Seismological Centre

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Nov. 1939				
655 20th	PE	6 28 57	1,190	No record on N Component.
	SE	31 00		
	ME	34 ca		
	F	7 04		
658 21st	iPNEZ	11 10 16	5,165?	Compression from SW. 10°N: 60 E. h=200 by USCGS.
	SN?	17 10		
	LN	24 10ca		
	MNE	30 10ca		
	F	12 50		
659 21st	ePZ	21 29 01	3,490	
	SNE	34 05		
	MNE	40 30ca		
	F	22 28		
661 22nd	iP̄NEZ	10 22 07	160	Dilatation. E by N. Deeper than normal. Felt in Manila with intensity IV. S̄ from the Wiechert and Horizontals.
	S̄NE	27		
	F	11 10		
665 23rd	ePNE	12 03 20	1,090	
	SNE	04 15		
	F	15		
666 24th	ePNEZ	23 32 33	7,530	Disturbed by microseisms.
	SNE	41 37		
	LNE	55 ca		
25th	MNE	0 00 ca		
	F	2 00		
667 25th	ePNEZ	6 55 47	3,120	
	SNE	7 00 27		
	F	40		
670 30th	iPZ	9 58 20	280	Dilatation.
	ePNE	20		
	iSNE	58		
	F	48		

Twenty-three insignificant or undecipherable disturbances on the following days of November: 1st, 3rd(2), 8th, 10th(2), 12th, 13th, 14th(2), 15th(3), 18th, 20th, 21st, 22nd, 23rd(3), 26th, 29th, and 30th/

No. 37. December, ~~1939~~.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

$\phi = 14^\circ\ 34'\ 42''$ N. $\lambda = 120^\circ\ 58'\ 41''$ E. h=3 m. Alluvium.

CONSTANTS OF THE GALITZIN-WILIP

	T_1	T	μ^2	V_s
N-S	12.6	12.9	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

Cf. Theoretical Seismology.
Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
December 1, 1939.

	T_o	V	ε	$\frac{r}{T_o^2}$
N-S	4.3	205	2.6	0.089
E-W	4.1	270	2.7	0.077

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Dec. 1939				
675	iPZ	17 27 49	160	Dilatation from SE. Felt at Boac, Ma-
7th	ePNE	49		rinduque and at Odoingan.
	SNE	28 09		
	F	45		
681	iPZ	10 53 41	4,100	Dilatation. 41.9°N: 147.3°E USCGS.
16th	ePNE	42		
	SNE	59 24		
	LNE	11 04 20ca		
	F	12 10		
682	ePNEZ	0 40 17	610	
17th	SE	41 26		
	F	1 05		
683	iPZ	7 53 55	3,180	
17th	SN	58 39		
	F	8 17		
684	P?EZ	10 28 22	3,890?	Disturbed by microseisms.
18th	S?N	33 51		
	F	11 00		
686	iPEZ	21 44 53	150	Dilatation?
19th	ePN	53		
	SNEZ	45 12		
	F	53		
688	ePNEZ	20 25 13	1,820	
20th	SNE	28 19		
	F	37		
689	ePNEZ	10 21 43	1,465	
21st	SNE	24 15		
	F	42		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
Dec. 1939				
690 21st	iPZ	21 04 03	1,635	Dilatation. Destructive in Menado, Celebes. Wiechert pens disjointed at 21:05:50. S from the Horizontals.
	ePNE	03		
	SNE	06 53		
22nd	F	0 47		Felt in Sulu and S Mindanao. Near 0.5° N: 124°E.
691 22nd	iPZ	5 03 39		Compression. Long distance?
	ePNE	39		
	F	7 15		
692 22nd	ePNEZ	21 04 14	2,165?	
	SNE?	07 48		
	F	22		
693 23rd	iPZ	2 58 46	1,625	Dilatation.
	ePNE	46		
	SNEZ	3 01 35		
	F	20		
695 23rd	iPEZ	21 02 58	1,620	Dilatation.
	SNEZ	05 46		
	F	20		
697 25th	iPZ	16 32 22	3,290	
	ePNE	22		
	SNE	37 13		
	LN	40 40ca		
	MN	44 ca		
	F	17 20		
698 25th	iPZ	20 59 37	1,645	Compression.
	ePNE	59 37		
	SNE	21 02 31		
	F	23		
699 25th	ePNEZ	22 26 31	1,645	
	SNE	29 22		
	F	46		
700 26th	ePNEZ	2 14 51	1,300	
	SNE	17 06		
	F	30		
701 26th	ePNEZ	10 06 15	1,435	
	SNEZ	09 20		
	F	37		
703 27th	iPZ	0 09 03	8,400	Dilatation?
	ePNE	03		
	SNE	18 48		
	MNE	44 ca		

International Seismological Centre

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No.and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Dec. 1939				
704	iPZ	3 07 35	2,755	Dilatation. Deep Focus. No. 703 still
27th	ePNE	35		recording.
	iSNEZ	11 51		
705	ePNEZ	21 24 29	1,390	
27th	SNE	26 53		
	F	47		

Sixteen ibsignificant or undecipherable disturbances on the following days of December: 1st, 5th(2), 10th(3), 11th, 15th, 19th, 20th, 23rd, 24th, 26th, 28th(2), and 31st.

CORRECTED READING.

May 8, 1939, #270.

ePN	2	02	15
P_1'E		06	45
PPNE		07	03
SKPE		08	29
SKSNE		12	36
PSNE		16	45
PPSNE		18	14
SSNE		23	31
SSSNE		28	07
LNE		43	ca
MNE		53	ca

May 19, 1939, #302.

ePEZ	18	45	37	18,790	New energy comes in
PPP?		55	12		at 19:09:00.
PSKS	19	01	08		No L or M waves.
SS?		17	46		