No. 1. January, 1937.

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 WIECHERT INVERTED PENDULUM. M$\frac{1}{2}$=955 Kg.
January 1, 1937.

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

	T_o	V	ε	$\frac{r}{T_o^2}$
N-S	4.2	196	2.5	0.076
E-W	4.4	271	3.0	0.062

Cf. Theoretical Seismology,
Sohon, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1937 Jan.				
No. 1 1st	PNEZ	9 19 16	580	Felt at Tacloban and Guiuan with intensity IV.
	SNE	20 22		
	F	46		
No. 3 1st	PNEZ	15 54 10	430	
	SNE	55 02		
	iE	11		
	F	16 16		
#4 4th	ePZ	22 52 50	2720	
	ePE	53		
	SNE	57 03		
	F	23 55		
#5 5th	PNEZ	0 00 00		Deep focus. Distance less than 2500 KM .
	SNE	04 08		
	LNE	06 40cs		
	F	1 15		
#6 5th	PNEZ	4 51 30	2780	Deep focus.
	SNEZ	55 42		
	F	6 05		
#8 7th	PNEZ	11 13 23	1150?	North Riu-Kiu Islands according to Chiufeng.
	S?NZ	15 30		
	F	12 15		
#10 5th	PNEZ	21 42 29	2400	Compression from NE.
	SNEZ	46 27		32°N; 133°.5E by Chiufeng.
	F	23 20		
#13 7th	PNEZ	6 18 13	3445	Disturbed by microseisms.
	SNEZ	23 14		
	F	7 45		
#14 7th	iPNEZ	13 26 45	3245	Compression from NW. Disturbed by microseisms.
	SNE	31 33		35°.5N; 97°.5E by U.S.C.G.S.
	F	17 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.
1937 Jan.				
#15 7th	PNEZ	17 56 21	3890	Disturbed by microseisms.
	SNE	18 01 50		
	F	30		
#18 15th	PNEZ	5 14 11	2535	
	SNE	18 11		
	F	6 15		
#26 22nd	iPZ	2 08 54	175	Compression. Felt slightly in Manila.
	ePNE	54		
	SNEZ	09 16		Baguio, 260 Km.
	F	18		
#27 22nd	PNZ	4 33 09	4790	
	SNEZ	39 33		
	LN	45 50ca		
	F	5 50		
#28 23rd	iPEZ	11 05 11	4090	Compression.
	ePN	11		
	iZ	05 31		
	SNE	08 53		
	F	14 20		
#30 25th	iPNEZ	6 42 46	5080	Compression. Data after P from the Wiechert.
	S?NE	49 35		
	LNE	7 00 ca		5°S; 165°E according to Chiufeng.
	F	10 20		
#33 26th	PZ	7 11 20		Disturbed by microseisms.
	i?NE	16 18		Felt in Guam.
	F	8 30		
#36 27th	PNEZ	3 38 53	2880	Disturbed by microseisms.
	SNE	4 03 17		Felt in Guam.
	F	45		
#37 27th	PNZ	5 45 11	3100	Disturbed by microseisms.
	SNE	49 50		Felt in Guam.
	F	6 53		
#38 27th	PNEZ	20 32 01	595	P in minute gap. Felt in Cuyo Island and at Kabankalan, Negros.
	SNEZ	36 09		
	F	37		
#41 29th	PNEZ	14 11 03	1545	Felt in northeastern Formosa.
	SNE	13 43		
	LNE	15 00ca		
	F	55		
#42 29th	PZ	17 30 46	4370	
	SNE	36 45		
	1N	49		
	F	18 50		

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
1937 Jan.						
#43 29th	PNEZ	21	20	41	1800	
	SNE		23	45		
	F	22	05			
#44 30th	PNEZ	1	17	37	1835	
	SNE		20	44		
	F		43			
#45 30th	iPZ	6	29	35	2655	Felt in Guam.
	ePNE			55		
	SN		33	44		
	LNE		35	55ca		
	F	7	55			

Twenty-one insignificant or undecipherable disturbances on the following days of January: 1st, 5th(2), 6th(2), 12th(2), 16th(3), 17th, 19th, 20th. 21st, 24th, 25th(2), 26th, 27th, and 28th(2),

No.4. February, 1937.

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		

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
February 2, 1937.

	T_o	V	ε	$=\frac{\varepsilon}{T_o^2}$
N-S	4.8	147	2.3	0.065
E-W	4.5	250	2.9	0.063

Cf. Theoretical Seismology.
Sohon, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1937 Feb.				
#46	PNEZ	8 18 29	2710	
1st	SNE	22 41		
	F	55		
#47	PNEZ	9 20 37	4390	
1st	SNE	26 37		
	LNE	32 10ca		
	F	10 45		
#51	iZ	20 38 06		
1st	eNEZ	43 05		
	iNE	47 57		
	F	21 50		
#52	PNEZ	16 18 05	4455	
2nd	SNE	24 09		
	F	55		
#55	PNEZ	13 38 11	830	
6th	SE	39 41		
	F	51		
#56	P?NEZ	11 39 18	1445?	
7th	SNEZ	41 48		
	F	12 00		
#57	PNEZ	8 42 36	4445	
8th	SNE	48 39		
	LNE	55 40ca		
	F	9 28		
#58	PNEZ	21 55 11	1300	Felt at Zamboanga. intensity II.
8th	SNE	57 26		
	F	22 14		
#61	PNEZ	14 14 00	510	
11th	SN	15 00		
	F	50		

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSEVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
#62 12th	PNE	4 56 12	248	Z component lacking.
	SE	5 03 08		
	F	6 30		
#64 12th	PNE	19 32 12	1480	
	SNE	34 45		
	LNE	36 15ca		
	F	20 13		
#65 12th	PNE	20 16 20	175	Recorded in Baguio.
	SNE	42		
	F	22		
#72 17th	PNEZ	9 22 00	5100	Disturbed by microseisms.
	SNE	28 42		Long period waves in N Component from 9:4[illegible] to 9:44.
	LNE	35 ca		
	MN	40 50ca		
	F	10 30		
#74 20th	1PNEZ	5 56 27	210	Dilatation from NW. S from the Wiechert and Horizontal Pendulums. Felt in Manila, Baguio, [illegible]5 Km. 16° 05 N; 119° 45 E by Manila and Baguio
	SNE	54		
	F	6 55		
#75 21st	PNEZ	7 10 02	4755	Compression. Kurile Islands.
	SNE	16 24		
	LNE	22 40ca		45°N; 148°E; 0=7:02:40 by U.S.C.G.S.
	F			
#76 21st	PNEZ	10 59 56	5610	#75 still recording. Disturbed by microseisms.
	SNE	11 06 47		
	F	12 40		
#80 21st	PNEZ	22 36 06	4590	
	SNE	42 18		
	F	23 40		
#81 21st 22nd	PNEZ	23 48 48		Compression?
	SN	51 00	1200	
	F	1 08		
#82 22nd	PZ	3 01 28	4090	
	SNE	07 10		
	F	4 25		
#83 22nd	P?NEZ	4 43 04	7610?	
	SE	52 12		
	F	5 45		
#84 22nd	1PZ	9 36 02	145	Dilatation from NW. Felt slightly in Manila. About 17° 45' N; 118° 45' E by Manila and Baguio.
	2PNE	02		
	SNE	20		
	F	10 22		
#85 22nd	PNEZ	13 31 20	4390	
	SNE	37 20		
	F	15 15		

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.
1937 Feb. #87 23rd	INE	0 14 34	2980	
	SNE	19 04		
	F	53		
#88 23rd	PNEZ	0 55 39	5645	Compression.
	SNE	1 01 43		
	L?N	09 51		
	F	3 25		
#92 24th	PNEZ	15 54 12	2355	
	SNE	58 08		
	F	16 20		
#94 25th	PN	20 01 30	2520	
	SNE	05 38		
	LNE	09 50ca		
	F	45		
#96 26th	PNEZ	16 55 48	185	Compression. Felt at Echague with intensity III. In the northern part of Nueva Vizcaya province.
	SNE	56 13		
	F	17 11		
#98 27th	PNEZ	1 21 37	4335	
	SNE	27 34		
	F	2 07		
#99 27th	iPZ	14 46 46	2535	Deep focus.
	ePNE	46		
	iSNEZ	50 46		
	iN	53		
	F	15 50		

Twenty-seven insignificant or undecipherable disturbances on the following days of February: 1st(3), 3rd, 4th, 9th, 10th, 12th, 13th(4), 14th(2), 18th, 21st(3), 22nd, 23rd(3), 24th, 26th(2), 27th, and 28th.

No. 7. March, 1937.

M A N I L A , P . I .

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

International Seismological Centre

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
March 2, 1937.

	T_1	T	μ^2	V_s
N-S	12.6	12.8	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

	T_o	V	h	$\frac{I}{T_o^2}$
N-S	4.2	189	2.5	0.081
E-W	4.3	255	2.9	0.079

Cf. Theoretical Seismology.
Sohon, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 March				
#102 2nd	PNEZ	11 54 36	850	
	SE	56 08		
	F	12 30		
#103 2nd	PNEZ	20 20 51	975	Felt at Casc with intensity III.
	SNEZ	22 35		
	F	21 35		
#104 2nd	PNEZ	22 52 04	1235	
	SNEZ	54 12		
	F	23 20		
#111 5th	PNEZ	13 22 26	245	
	SNE	25 00		
	F	14 10		
#113 6th	PNEZ	1 29 18	880	
	SNE	30 52		
	F	2 08		
#116 8th	ePNEZ	21 21 57	80	Felt at Infanta with intensity V and in Manila with II.
	SNEZ	22 07		
	F	32		
#118 9th	iPz	16 00 06		Compression.
	iPNE	07		
	F	18 05		9° N; 84° W; 0=15:40:20 by U.S.C.G.S.
#119 9th	iPZ	16 22 20	125	Dilatation. Felt slightly in Manila.
	SNEZ	36		#118 still recording.
#124 12th	iPZ	9 31 55	3600	Dilatation.
	ePNE	55		
	SNE	37 06		
	LNE	40 55ca		
	F	10 40		
#125 14th	iPZ	1 56 33	2425?	
	ePNE	33		
	S?E	2 00 25		
	LNE	02 40ca		
	F	33		

M A N I L A , P . I .

SEISMOLGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 March				
#126 14th	iPE	12 15 51		Dilatation.
	ePE	55		
	iZ	16 47		Provisional epicenter: 25°S; 70°W; O=11: 55:48 by U.S.C.G.S.
	INE	20 39		
	F	14 20		
#127 15th	PE	6 01 12	3490	
	SNE	06 16		
	F	45		
#130 16th	iPNEZ	15 46 40	330	Compression from NNE. Felt in northern Luzon and slightly in Manila.
	SNE	47 23		S from the Wiechert. Baguio, 145 Km.
	F	17 40		
#131 16th	iPZ	22 34 35	1515	Compression from SE.
	ePNE	35		
	SNE	37 12		
	F	23 30		
#132 17th	iPZ	11 13 50	140	Dilatation.
	ePNE	50		
	SNE	14 08		
	F	23		
#142 19th	PNEZ	13 07 58	685	Compression from SE. Felt in NE Mindanao.
	SNE	09 14		
	F	52		
#144 19th	PNEZ	18 31 50		
	iNE	36 23		
	F	18 20		
#146 20th	PNEZ	1 04 36	2720	
	SNE	08 49		
	F	55		
#164 21st	PNEZ	16 18 00	4240	
	SNE	25 51		
	LNE	28 ca		
	F	17 17		
#165 21st	iPNEZ	18 11 46	1565	Compression from SE.
	SNE	14 29		
	iN	16 00		
	F	54		
#166 21st	PNZ	19 35 44	3680?	
	S?NE	41 00		
	F	20 25		
#169 22nd	PNEZ	6 13 03	1290	From the SE.
	SNE	15 17		
	F	7 30		
#173 26th	S?NEZ	1 45 04		From the SE.
	L?NE	46 48		
	F	2 13		

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.
1937 March				
#174 26th	PNEZ	4 08 56	135	Compression. Felt at San Antonio, Zambales.
	SN	09 13		
	F	16		
#176 26th	PNEZ	15 45 09	860	Felt at Cagayan, Oriental Misamis with intensity VI.
	SE	46 42		
	eN	46 42		
	F	17 00		
#182 29th	PNEZ	5 41 36	1570	From the SE.
	SNE	44 19		
	F	6 45		
#183 29th	PNEZ	8 10 18	2480?	
	S?NE	14 14		
	F	9 05		
#184 30th	PNEZ	11 40 28	1155	24°.6 N; 121°.1 E by Taihoku.
	SE	42 28		
	LNE	43 40		
	F	12 20		
#185 30th	PNEZ	14 59 33	8690?	
	SNE?	15 03 41		
	F	55		

Fifty-seven insignificant or undecipherable disturbances on the following days of March: 3rd(2), 4th(4), 5th, 7th, 8th, 9th(2),10th, 11th(2),13th, 16th, 17th(5), 18th(4), 19th(2), 20th(13), 21st(5), 22nd (3), 23rd, 26th(2), 27th(2), 28th, 29th, and 31st(2).

No. 10. April, 1937

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.

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.
April 1, 1937.

	T_o	V	ε	$\frac{-r}{T_o^2}$
N-S	4.3	184	2.6	0.068
E-W	4.4	250	3.2	0.062

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1937 April				
#188 1st	•PNEZ	17 31 58		
	iN	37 16		
	iE	24		
	iE	41 51		
	F	18 50		
#190 2nd	iPZ	5 40 33	6980	Dilatation.
	SNE	49 04		
	F	6 40		
#192 3rd	PZ	3 58 28	4020	
	SNE	4 04 00		
	LN	08 05ca		
	MNE	11 40		
	F	5 00		
#193 3rd	PNEZ	11 22 53	1310	Felt in Taihoku, Formosa.
	SNE	25 09		
	LNE	27 ca		
	F	12 30		
#195 3rd	iPNEZ	21 11 06	145	Dilatation from NW. Felt in western Luzon.
	iSNE	24		S from the Wiechert and Horizontal Pendulums.
	F	22 52		
#198 5th	iPNEZ	7 01 08	2290	Compression from SE. Deep focus.
	SNE	04 51		Netherlands East Indies by Manila and Riverview.
	F	10 50		S from the Wiechert and Horizontal Pendulums.
#199 5th	PNEZ	11 11 43	360	Felt at Vigan and Laoag with intensity III.
	SNE	12 29		
	F	27		

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.
1937 April				
#200	PNEZ	23 43 59	5110?	S in N-S component lost in changing
5th	S?E	50 42		record.
	LNE	57 30ca		
6th	F	0 55		
#203	PNEZ	17 40 20	135	
7th	SNE	37		
	F	50		
#204	eNEZ	18 52 40		Trace.
7th	F	19 43		
#210	PZ	14 07 40	1100	Felt slightly in Taihoku, Formosa.
9th	S?NE	09 55		
	F	15 06		
#211	PNEZ	4 18 30	290	Felt at Vigan, intensity III.
10th	SNE	19 09		
	F	25		
#213	PNEZ	22 39 12	2465	
10th	SNE	43 07		
	F	23 30		
#214	P?NEZ	15 56 44		Felt in Taihoku, Formosa.
11th	F	16 55		
#215	ePNE	20 45 40	970	
11th	SNE	47 23		
	F	21 35		
#219	PNEZ	14 02 27	1480	Deeper than normal.
14th	SNE	05 00		
	F	25		
#221	PEZ	19 53 53	430	
14th	SNE	54 45		
	F	20 20		
#223	PE	20 18 11	4000	
15th	SN	23 47		
	LNE	30 ca		
	F	50		
#225	iPNEZ	3 12 13	7380	Dilatation. In region of the Tonga
16th	SNE	21 07		Islands by Manila and Riverview.
	F	6 40		Region of 22° S; 174° W by U.S.C.G.S.
				S from the Wiechart.
#227	PNE	21 42 36	1660	
16th	SNE	45 28		
	F	22 10		

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.
1937 April #231 19th	PNE	12 27 36	990	Felt at Davao, intensity II.
	SNZ	29 21		
	F	42		
#233 20th	PNEZ	6 25 07	470	Felt at Virac, intensity IV.
	SEZ	26 05		
	F	40		
#234 20th	PNEZ	18 55 54	390	Very strong earthquake felt at Irosin.
	SNEZ	56 42		
	iE	57 22		
	F	19 42		
#238 22nd	iPZ	18 05 13	340	Dilatation. Felt at Legaspi, intensity III.
	SEZ	06 08		
#239 22nd	ePEZ	18 33 19	2633	#238 still recording.
	SN	37 26		
	LNE	39 43		
	F	19 15		
#240 23rd	PNEZ	12 12 26	1410	
	SNE	14 52		
	F	13 12		
#241 23rd	PNEZ	15 15 43	700	
	SNEZ	17 01		
	F	48		
#244 25th	PNEZ	11 24	2400	
	SE	15 15		
	LN	17 18		
	F	45		
#246 26th	PN	7 14 05	1155?	
	PEZ	05		
	S?NE	16 03		
	F	34		
#247 26th	P?NE	10 57 00	4900?	
	SNE	11 03 31		
	F	33		
#249 28th	PNEZ	14 01 37	3765	
	SNE	06 59		
	LNE	11 ca		
	F	15 12		
#250 28th	PNEZ	16 12 30	165	
	SNEZ	51		
	F	18		

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.
1937 April				
#251 29th	iPNEZ	19 03 53	7880	Compression.
	iE	13 09		
	SNE	15		53°N; 161°W by U.S.C.G.S.
	iN	23 18		
	LNE	26 55ca		
	F	21 46		
#252 29th	iPZ	20 25 13	800	Dilatation.
	SNE	26 40		#251 still recording.
#254 30th	PNEZ	12 02 05	250	
	SEZ	39		
	F	22		

Thirty-four insignificant or undecipherable disturbances on the following days of April: 1st, 2nd, 3rd, 4th(2), 7th(4), 8th(3), 10th, 12th(2), 13th, 14th(2), 15th, 16th, 18th(3), 20th, 21st(3), 23rd, 24th, 26th, 27th, and 30th(3).

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	u^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, 1937.

	T_0	V	ε	$\frac{-E}{T_0^2}$
N-S	4.4	173	2.5	0.053
E-W	4.4	259	3.0	0.078

Cf. Theoretical Seismology, Sohon, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 May.				
#257 1st	PEZ	0 21 24	215	
	SNE	52		
	F	31		
#260 3rd	PEZ	18 16 23	540	Felt at Cebu and Ormos with intensity III and at Borongan II.
	SN	17 26		
	F	19 05		
#262 4th	PZ	12 11 59	350	Felt at Legaspi with intensity III.
	SNE	12 44		
	F	50		
#263 5th	PEZ	21 20 38	2210	
	SNE	24 16		
	LNE	23 15ca		
	F	22 10		
#266 6th	PNEZ	16 50 45	435	Felt at Lucag with intensity III.
	SNE	51 58		
	F	17 02		
#267 7th	PNEZ	12 24 57	145	
	SN	25 15		
	F	47		
#268 7th	iPZ	14 22 14	7845	Compressions.
	SNE	31 35		55°N; 162°W (Chiufeng).
	F	15 30		
#270 7th	PNZ	17 27 50	1900?	
	S?NE	31 02		
	LN	33 ca		
	F	18 04		

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.
1937 May.				
#272 7th	iPZ	23 49 42		Dilatation. Felt in Manila.
	ePNE	42		Baguio, 175 Km.
	iN	57		
8th	F	0 11		
#273 8th	iPZ	12 11 16	520	Dilatation. Felt at Cuyo and Iloilo with intensity III.
	SNE?	12 17		
	F	43		
#277 9th	iPNZ	14 54 08	4390	48°N: 150°.5E (Chiufeng).
	SNE	15 00 08		
	LNE	07 ca		
	MNE	11 ca		
	F	17 10		
#278 9th	PNEZ	22 46 03	280	Recorded in Baguio.
	SNE	41		
	F	55		
#281 10th	iPZ	10 18 40	1550	Compression.
	SNE	19 25		
	F	34		
#282 10th	PNEZ	10 49 09	3710	
	SNE	54 27		
	F	11 43		
#283 10th	iPZ	15 35 45	6935	Dilatation.
	ePNE	45		
	iN	53		
	SE	44 45		
	F	16 40		
#285 11th	iPZ	5 20 49	1380?	
	ePNE	45		
	S?NE	23 18		
	F	6 10		
#291 12th	iPZ	2 50 59	4410?	Dilatation.
	ePNE	59		
	iN	51 54		3°S: 142°.5E, h=130 Km. ca (Chiufeng).
	S?N	57 01		
	F	4 16		
#293 12th	PZ	13 14 06	4845	
	SE	20 33		
	LN	27 ca		
	F	14 56		
#296 13th	PZ	7 36 20	2280	
	SNE	40 03		
	LNE	42 ca		
	F	8 23		

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.
1937. May.				
#297 13th	PZ	8 31 31	2990?	
	S?N	36 02		
	F	9 30		
#298 13th	iPNEZ	18 51 20	1620	Dilatation. Deep focus.
	iSEZ	54 08		
	F	19 49		
#299 13th	PNEZ	19 21 44	120	#298 still recording.
	SNE	59		
	F	26		
#300 14th	PNEZ	3 31 41	185	
	SNE	32 04		
	F	27		
#302 15th	PNE	16 45 01	1690	
	SNE	47 55		
	F	17 30		
#303 15th	PNE	23 27 25	2678	
	SNE	31 35		
	F	31		
#305 16th	PZ	11 50 59	8865	Deep focus.
	SN	12 01 10		
	sSz?	04 28		
	F	13 10		
#309 17th	PNE	8 31 46	200	
	SNE	32 12		
	F	38		
#311 17th	PNEZ	19 56 37	470	
	SNE	57 33		
	F	20 11		
#315 19th	PNZ	20 22 33	2190	
	SE	26 09		
	F	49		
#317 20th	ePNEZ	12 20 05	3710	
	SNE	25 23		
	LNE	28 30ca		
	F	13 25		
#318 21st	ePNE	2 03 2[illegible]	3390	
	SNE	08 26		
	LNE	12 30ca		
	F	3 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.
1937 May.				
#320	PZ	13 32 12	17120	2°.5N: 78°.7W; 0=13:12.2 by U.S.C.G.S.
21st	iZ	36 07		
	iN	37 00		
	F	14 12		
#321	PNEZ	17 07 15	170	
21st	SE	36		
	F	14		
#323	PNE	10 05 33	135	Recorded lightly in Baguio.
22nd	SNE	50		
	F	11		
#362	PZ	7 31 17	1720	
25th	SNE	34 15		
	F	8 10		
#380	ePNZ	4 41 03	3245	
27th	SNE	45 51		
	LNE	49 20ca		
	F	6 10		
#387	iPZ	17 08 09	2110	
27th	SNE	11 31		
	F	43		
#388	ePNEZ	19 16 20	2720	Felt in Guam.
27th	SNE	20 33		
	F	56		
#389	P?NEZ	23 37 01	2090?	
27th	SNE	40 59		
	F	58		
#390	ePZ	3 24 04	5990	
28th	SNE	31 57		
	F	4 19		
#391	iPZ	7 18 52	3780	Dilatation.
28th	ePNE	52		
	SNE	22 15		
	F	8 22		
#395	iPNEZ	20 00 27	1365	Compression. Deep focus.
28th	SNE	02 49		
	F	21 40		
#396	iPZ	2 04 23	1865	Compression.
29th	ePE	25		
	S?NE	07 53		
	F	48		

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.
1937 May.				
#399 31st	iPNEZ	10 41 53	1590	Dilatation from SE. Netherlands East Indies.
	iE	43 38		
	iSNE	44 39		
	F	11 40		
#400 31st	ePNEZ	15 39 19	4355	2°.5S: 159°.5E (Chiufeng).
	iSNE	45 17		
	LNE	51 ca		
	F	17 02		
#401 31st	PNEZ	21 38 ca	185	
	SNE	39 05		
	F	50		

Ninety-nine insignificant or undecipherable disturbances on the following days of May: 2nd, 3rd, 4th, 6th(2), 7th(2), 9th(3), 10th(3), 11th(5), 12th(3), 15th, 16th(4), 17th, 18th(3), 20th, 21st, 22nd(12), 23rd(19), 24th(7), 25th(14), 26th(4), 27th(6), 28th(3), and 29th(2).

CORRECTION TO EARTHQUAKE #252, APRIL 1, 1929.

iSNE 20:30:15

Distance 3280 Km.

No. 19. June, 1937.

International Seismological Centre

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

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.
June 3, 1937

	T_o	V	ε	$\frac{f}{T_o^2}$
N-S	4.3	191	2.6	0.061
E-W	4.2	249	3.2	0.064

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1937 June 6th #414	PMZ	17 59 35	3365	
	SNE	18 04 31		
	LNE	08 ca		
	F	56		
#418 7th	P?EZ	11 53 59	3610?	
	S?NE	59 11		
	F	12 40		
#420 7th	iPZ	15 25 52	8935?	
	S?NE	36 06		
	F	16 34		
#421 8th	ePNZ	3 46 03	5735?	
	S?N	53 21		
	F	5 56		
#422 8th	PNEZ	18 07 59	5500	
	iE	13 51		
	iN	59		
	SNE	15 04		
	F	19 02		
#423 8th	PZ	22 48 43	15200	18°N: 94°W: O=22:29:40 by U.S.C.G.S.
	iNE	53 07		14°.7N: 92°.6W: H=22:29:35 by J.S.A.
	iE	55 01		
	F	23 57		
#424 9th	PNEZ	7 35 25	430	Felt at Laoag, intensity III.
	SNE	36 15		Recorded slightly in Baguio.
	F	46		
#425 9th	iPZ	17 08 12	125	Compression.
	SNE	23		
	F	14		

International Seismological Centre

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Mean Time H. M. S.	Dist. Km.	Remarks
1937 June #428 10th	ePNEZ	21 23 44	400	
	SNE	24 34		
	F	22 40		
#430 11th	iPZ	13 01 11	580	Compression. Felt at Laoag, int. III.
	eINE	11		
	SNE	02 17		
	F	49		
#432 12th	ePNEZ	18 13 32	2920	
	iNZ	14 25		
	SN	17 59		
	F	19 20		
#435 14th	ePNZ	12 41 02	7290	Disturbed by microseisms.
	SE	49 51		
#436 14th	ePZ	13 20 18	6955	#435 still recording. Disturbed by microseisms.
	iE	4		
	iN	27 03		22°S: 171°E by Riverview and Manila.
	SN	30 03		
	iE	30 08		
	F	15 03		
#438 19th	ePNEZ	17 17 51	7705	
	S(?)NE	26 45		
	F	57		
#439 20th	iPZ	18 30 08	690	Felt at Borongan, int.V, at Calbayog, IV, and at Tacloban, III.
	SNE	31 25		11° 05' N: 126° 10' E by Butuan and Manila.
	F	19 40		
#440 21st	PZ	14 03 20	2690	
	SN	07 45		
	F	53		
#441 21st	iP'Z	15 33 00	17000	Dilatation.
	iP''Z	37		7?8S: 80°W: 0=15:13:02 by U.S.C.G.S.
	iNE	35 25		6?8S: 79?9W: h=50 Km: H=15:13:17 by J.S.A.
	iZ	37 16		
	iE	38 33		
	PSKS	48 00		
	SS(?)	56 00		
	LE	59 00		
	SSS	16 03 45		
	LNE	24 [illegible]		
	F	19 00		
#443 23rd	iPZ	5 19 09	9540	
	SN	20 50		
	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.
1937 June				
#446	iP_1Z	13 31 25	16265	Dilatation.
24th	iNZ	33 18		
	iE	33 22		8°N: 84°W: 0-13:11:47 by U.S.C.G.S.
	PP	34 43		
	F	14 40		
#450	PNZ	5 05 29	2500	Disturbed by microseisms.
28th	SNE	09 27		
	F	46		
#453	iPNEZ	14 01 03	1210	Dilatation from SE.
30th	iZ	03 13		Felt at Kaatoan, Mukidnon.
	SN	16		
	iNE	04 16		
	F	15 40		

Thirty-one insignificant or undecipherable disturbances on the following days of June: 1st(2), 2nd(3), 3rd(2), 4th, 5th, 6th(3), 7th(4), 10th(2), 11(?), 13th(2), 15th, 22nd, 23rd(2), 24th, 25th(2), 28th, and 29th.

No. 22. July, 1937.

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.

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=[illegible] Kg.
July 1, 1937

	T_o	V	E	$\frac{r}{T_o^2}$
N-S	4.2	189	2.5	0.061
E-W	4.0	275	3.0	0.084

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
July 1937				
#454 1st	iPZ	11 55 30	3140	Compression. Disturbed by microseisms.
	PNE	31		
	SNE	12 00 15		
	LNE	03 20ca		
	MNE	06 ca		
	F	13 50		
#456 2nd	PNE	2 46 03	3120?	Disturbed by microseisms.
	SE?	50 44		
	LE	53 40ca		
	F	4 00		
#458 3rd	PNEZ	3 59 30	1235?	Felt in southeastern Mindanao. Disturbed by microseisms. Butuan, 6°3.
	S?NEZ	4 01 38		
	F	25		
#459 4th	PNEZ	6 04 09	[illegible]	Compression.
	iZ	06 03		
	SNE	14 25		
#460 4th	P?NEZ	6 39 38	8565?	#459 still recording.
	S?NE	49 35		
#461 4th	P?NE	7 22 14		#459 still recording.
	F	9 30		
#464 5th	PNEZ	17 05 03	3365	
	SE	09 59		
	F	36		
#466 7th	PZ	22 12 44	320	S from the Wiechert.
	SNE	13 13		
	F	25		

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 1937				
#468 8th	iP̄Z	4 45 27	150	Compression from SE. Felt in Manila, intensity II and at Indang, Cavite, slightly. S from the Wiechert and Horizontal Pendulums.
	S̄NE	46		
	F	5 00		
#470 9th	iP̄NEZ	6 16 46	160	Recorded in Baguio, slightly.
	S̄NE	17 06		
	F	27		
#472 9th	iPZ	21 26 43	2190	
	ePNE	44		
	SNE	30 19		
	F	22 21		
#473 10th	iPZ	20 46 32	1585	Dilatation.
	ePNE	34		
	SNE	49 16		
	LNE	50 50ca		
	F	22 30		
#476 11th	ePNEZ	13 44 51	3770	
	SNE	50 13		
#477 11th	iP̄NEZ	15 27 36	155	Dilatation from SE. Felt at Batangas and at Indang with intensity II. #476 still recording.
	S̄NE	53		
#478 11th	P̄NEZ	15 45 28	135	Aftershock of #477.
	S̄NE	45		
	F	55		
#481 12th	ePZ	0 08 13	3080	
	SN	12 50		
	F	1 10		
#482 12th	P̄EZ	7 11 53	730	
	SNE	13 14		
	F	37		
#485 13th	iPZ	2 59 25	1320	
	SNE	3 01 42		
	F	45		
#486 13th	P?NEZ	10 48 28	2735?	
	SNE	52 42		
	F	11 15		
#487 14th	PZ	5 37 33	600	
	SEZ	38 41		
	F	6 28		

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 1937				
#490	PNEZ	22 33 46	3310	Dilatation.
14th	1E	35 43		
	iN	36 08		
	SNE	38 38		
	LNE	42 10ca		
	MNE	44 40ca		
15th	F	0 15		
15th	PZ	2 40 26	2655	
#491	iSN	44 35		
	F	3 03		
#493	P?NE	19 14 17	3265?	Disturbed by microseisms.
15th	SNE	19 07		
	F	40		
#494	PNEZ	10 24 21	3120	
16th	SNE	29 01		
	F	11 30		
#495	PNE	18 57 52	180	
16th	SNE	58 15		
	F	19 03		
#496	PNEZ	18 26 36	125	Dilatation from NE. Felt at Baler and Santa Cruz, Laguna, with intensity V, Lagupan and Infanta, III, and in Manila, II. 3 from the Wiechert.
17th	SNE	52		
	F	19 10		
#497	PEZ	3 00 29	4345	Dilatation.
19th	iZ	02 16		
	iN	05 53		
	SNE	06 27		
	LNE	11 00		
	F	4 11		
#500	iP,Z	19 55 08	17300	Dilatation.
19th	SNPN	58 48		
	iZ	20 00 09		1°N; 78°W; 0=19:35:23 by U.S.C.G.S.
	LNE	50 ca		
	F	22 10		
#501	PNZ	23 29 20	160	Compression. Felt at Baguio, intensity III.
20th	SNEZ	40		
	F	42		
#503	PNEZ	13 00 00	200	
21st	SNE	25		
	F	09		
#504	PZ	15 19 37	370	Felt in northern Luzon.
21st	SNE	20 24		
	F	35		

No. 25. July, 1938

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	T	$)^u$	V
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, 1938

	T	V	ϵ	$\frac{F}{T_o^2}$
N-S	4.2	207	2.4	0.088
E-W	4.3	257	2.8	0.105

No. and Date	Phase	Greenwich Time h. m. s.	Dist. Km.	Remarks
July 1938				
#511 3rd	ePNEZ	9 29 13	395	Felt at Legaspi.
	SNE	30 02		
	F	52		
512 3rd	PEZ	11 23 04	690	
	SNE	24 21		
	F	12 02		
513 3rd	PEZ	21 31 12	715	E component stopped at 21:04.
	SE	32 31		Felt at Butuan, Dapa and Surigao.
	F	22 10		Butuan 80 Km.
514 4th	PNEZ	1 24 01	160	Dilatation. Felt at Capalonga and Legas--
	SNEZ	21		pi.
	F	34		
518 4th	PNEZ	17 06 48	280	
	SNE	07 25		
	F	40		
519 4th	ePNEZ	21 22 39	6645	
	SNE	30 50		
	iE	31 39		
	F	22 41		
521 5th	ePNEZ	2 15 43	5410	
	SN	20 42		
	LNE	28 40ca		
	MNE	32 30ca		
	F	4 40		
524 5th	iPZ	22 17 31	6990	Region 24° S: 173° E by USCGS.
	iPNE	32		
	SNEZ	26 03		
	LNE	37 30ca		
	ME	42 45ca		
	F	23 59		

No. 26. August, 1937.

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	333
Z	11.6	0.0		

Cf. Theoretical Seismology, Sohon, S.J.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM. M=955 Kg.
August 4, 1937.

	T_o	V	m	$\frac{I}{I_o^2}$
N-S	4.3	192	2.5	0.059
E-W	4.3	251	2.5	0.078

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Aug. 1937.				
#530 1st	iPZ	10 45 53	2580	Compression. Shantung, China.
	ePNE	55		
	iSNE	56		
	MNE	54 35a		
	F	11 52		
#535 4th	iPZ	23 41 03	3020	
	ePNE	04		
	iZ	51		
	SNE	45 36		
	iN	47 35		
5th	F	0 35		
#536 5th	iPZ	14 50 40	4260	
	iE	48		
	iZ	52 34		
	SNE	56 32		
	F	16 [illegible]		
#541 7th	PNEZ	23 57 01	2145	
	SNE	58 34		
	F	23 12		
#543 8th	iPZ	10 17 12	3535	Compression.
	ePE	18		
	iZ	47		
	SNE	22 19		
	iE	23 48		
	F	11 15		
#544 8th	iPZ	15 23 56	1345	Butuan, 460 Km.
	ePNE	56		
	iE	24 56		
	SNE	26 16		
	F	16 55		

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

M A N I L A , P. I.

International Seismological Centre

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Aug. 1937				
#545 9th	iPZ	12 42 31	2810	
	ePNE	36		
	SNE	46 50		
	LNE	49 ca		
	F	13 57		
#546 9th	iPZ	14 44 35	2455	
	ePNE	35		
	SNE	48 29		
	LNE	50 40ca		
	F	16 30		
#548 9th	ePNEZ	19 24 01	2610	
	SNE	26 06		
	F	20 25		
#550 10th	PNEZ	2 51 25	2655	
	SNEZ	55 34		
	F	3 25		
#551 10th	ePNEZ	12 18 12	740	Felt at Dapa, int. V and at Surigao, int. II.
	SNE	19 34		
	F	38		
#552 10th	ePNEZ	18 04 51	2580	Deeper than normal.
	SNEZ	08 54		
	F	40		
#553 11th	PNEZ	1 00 05	1610	S from the Wiechert and Horizontal. Compression.
	SNE	02 52		
	F	4 00		
#554 11th	PNEZ	9 42 15	2600	
	SNE	45 19		
	F	10 04		
#557 12th	iP̄Z	4 25 14	160	Compression.
	S̄NEZ	34		
	F	41		
#558 12th	P̄EZ	11 54 05	2165	
	SNE	57 39		
	F	12 13		
#559 12th	P̄NEZ	14 42 17	145	
	S̄NE	55		
	F	52		
#560 12th	iP̄NEZ	16 31 19	100	Felt at Santa Cruz, Laguna with int. IV and at Lucban and Manila slightly. S̄ from the Wiechert.
	S̄NE	35 02		
	F	51		
#561 12th	P̄NEZ	20 07 52	190	
	S̄NE	13 16		
	F	15		

M A N I L A . P. I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
	PNEZ	17 43 39	200	
	SNE	44 15		
	F	18 02		
	ePZ	10 52 32	2635	
	SNE	53 39		
	LE	59 oa		
	F	11 45		
	PNEZ	4 28 26	430	Dilatation. Felt at Calayan, Aparri, Cagayan; San Pablo, Isabela with int. IV, and at Laoag, III. S from the Wiechert and Horizontal.
	SNE	29 32		
	F	5 55		
	PNZ	13 15 15	3220	
	SN	20 01		
	LE	23 20cu		
	F	14 20		
	PNEZ	21 14 03	420	Felt at Laoag, int. III.
	SNE	54		
	F	26		
	PNEZ	5 01 20	2780	Deeper than normal.
	SNE	05 37		
	F	43		
	PEZ	6 48 45	5665?	
	S?NE	54 00		
	F	7 55		

iPNEZ 11:59:38 Δ=130 Km. Very strong Earthquake. Dilatation from SE.

Galitzin-Wilip traces vanished after beginning of first throw. N-S light spot off until 0h G.M.T. 21st. Bottom suspension hinge of E-W component broken: new hinge inserted on 27th.

Wiechert pens dislocated after beginning of first throw.

NNW-SSE component, Horizontal pendulum, V=20, pen dislocated 10 seconds after beginning of earthquake.

ENE-WSW component, Horizontal pendulum, V=8, pen remained on throughout the earthquake, but pendulum bumped the arresting screws during the first ten minutes of the earthquake.

Butuan pens oscillated to the limit. Distance interpreted with difficulty as 670 Km.

Baguio, NW-SE component, strong first throw. NE-SW pen dislocated by transverse wave. Distance interpreted approximately as 280 Km.

Intensity IX in epicentral area. Intensity VII in Manila. Considerable damage in Manila; people panicky. Damage in the provinces.

Felt throughout southern and southeastern Luzon and northeastern Visayan Islands.

Epicenter, 14° 10' N: 122° 05' E. H=11:59:13 G.M.T.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

#578 $\overline{P}$ 12:20:ca Aftershock of #577. Felt in southern Luzon and in Manila.

#579 $\overline{P}$ 12:40:ca Aftershock of #577. Felt in Manila with intensity III.

Small aftershocks. Although the E-W component of the Galitzin-Wilip was disabled the galvanometer responded to these aftershocks at approximately the following times. 12:53, 12:56, 13:00, 13:15, 13:20, 13:28, 13:30, 13:36, 13:41, 13:47, 13:51, 13:55, 13:58, 14:00, 14:03, 14:23, 14:31, 14:39, 14:40, 14:47, 14:49, 15:16, 15:18, 15:25, 15:35, 15:39, 16:02, 16:16, 16:50, 17;18, 17:48, 18:12, 18:23, 19:07, 20:10, 20:19, 20:32, 20:50, 20:58, 21:10, 21:22, 21:35, 21:49, 22:48, 23:23, 23:36.

#626 21st	$\overline{P}$NZ	0	27	ca	128 Aftershock of #577.
#627 to #630	Four small aftershocks of #577.				
#631 21st	$\overline{P}$N	2	24	45	128 Aftershock of #577.
	$\overline{S}$N		25	01	
#632 21st	$\overline{P}$NE	4	19	41	95 Probably deeper than normal.
	$\overline{S}$NZ			53	
#633 21st	$\overline{P}$E	4	28	ca	Aftershock.
#634 21st	$\overline{P}$N	4	57	13	128 Aftershock.
	$\overline{S}$N			29	#635, #636 small aftershocks.
#637 21st	$\overline{P}$NZ	5	28	43	135 #638 small aftershock.
	$\overline{S}$N		29	00	
#639 21st	$\overline{P}$NZ	5	55	38	128 #640 small aftershock.
	$\overline{S}$NZ			54	
#641 21st	$\overline{P}$Z	6	25	36	135 Probably aftershock.
	$\overline{S}$N			53	
#642 21st	$\overline{P}$Z	6	59	07	135 Probably aftershock.
	$\overline{S}$N			24	
#643 21st	$\overline{P}$Z	7	14	12	190
	$\overline{S}$N			36	
#644 21st	$\overline{P}$Z	7	42	17	135 Aftershock of #577.
	$\overline{S}$N			34	#647, #648 small aftershocks.
#649 21st	$\overline{P}$Z	15	07	55	95 $\overline{S}$-$\overline{P}$ interval approx. from Wiechert on which minute gaps were lacking.
	$\overline{S}$		08	07	#651, #652 small aftershocks.
#653 21st	PNZ	23	07	21	3190
	SNZ		12	07	
	LN		15	13	
	MN		17	30ca	
22nd	F	0	20		

M A N I L A ? P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

International Seismological Centre

No.ard Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Aug. 1937				
#657 22nd	iP̄Z iS̄N	3 30 31 43	95	Deeper than normal. #654, 655, 656 aftershocks of #577. #658 and 659 small aftershocks of #577.
#660 22nd	P̄Z S̄N	6 54 42 57	120	Aftershock of #577. #661 to 675 small aftershocks of #577.
#676 22nd	P̄Z S̄N	18 56 03 19	128	Aftershock of #577.
#677 23rd	PNZ SN	0 29 06 47	305	
#680 23rd	iP̄Z S̄N	3 44 39 54	120	Compression. Aftershock of #577. #678 and 679 aftershocks of #577.
#681 23rd	P̄N iS̄N	4 14 24 36	95	Deeper than normal. #682 aftershock of 577.
#683 23rd	P̄NZ S̄N	6 15 19 35	128	Aftershock of #577. Felt in Alabat Island. with intensity V. #584, 685, 686, 687 and 689 aftershocks.
#688 24th	P̄Z S̄NZ	6 01 48 02 08	160	
#690 24th	P̄NZ S̄N	10 36 12 31	150	Deeper than normal.
#691 24th	P̄NZ S̄NZ	16 51 46 52 01	120	Aftershock of #577. #693 aftershock of #577.
#692 24th	iPNZ iZ F	18 39 29 33 20 17		Dilatation.
#694 25th	iP̄Z S̄NZ	0 11 44 56	95	Deeper than normal. Felt slightly at Lucban.
#697 25th	P̄Z S̄N	17 05 58 06 10	120	Aftershock of #577. #698, 699 and 703 probably aftershocks.
#700 25th	P̄Z S̄N	20 06 35 47	95	Deeper than normal. Felt slightly at Lucban.
#701 25th	iPNZ SN	21 55 34 57 40	1135	Compression. Felt in Davao and southern Cotabato. Butuan, 360 Km.
#702 25th	P̄NE S̄N	22 00 02 20	142	P from Wiechert.

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.
Aug. 1937 #704 26th	$\overline{S}N$	0 48 32		Probably aftershock of #577.
#705 26th	i$\overline{P}Z$	8 02 08	118	Compression. Aftershock of #577.
	$\overline{S}N$	23		#706 very small: probably aftershock of #577.
#707 26th	$\overline{P}Z$	9 50 25	245	
	$\overline{S}N$	51 00		
#709 26th	$\overline{P}Z$	16 34 54	128	Felt slightly in Manila. Aftershock of #577.
	$\overline{S}N$	35 10		
#710 26th	PNZ	18 58 38	2335	
	SN	19 02 25		
	LN	04 30		
	F	20 12		
#711 26th	$\overline{P}N$	19 31 08	190	
	$\overline{S}N$	32		
#712 26th	$\overline{P}Z$	23 28 25	175	Compression. Felt slightly in Manila.
	$\overline{S}N$	47		
#713 27th	$\overline{P}NEZ$	1 49 31	130	Aftershock of #577. Galitzin-Wilip E-W component again operating.
	$\overline{S}NE$	47		
#714 27th	$\overline{P}Z$	5 18 08	95	Deeper than normal.
	$\overline{S}NE$	20		
#715 27th	$\overline{P}Z$	7 01 32	135	Probably aftershock of #577.
	$\overline{S}NE$	49		#716 small, probably aftershock of #577.
#717 27th	PNEZ	7 24 53	215	
	$\overline{S}NE$	25 21		
#718 27th	P?NE	22 10 55	2035?	
	SNE	14 19		
	F	30		
#719 27th	$\overline{P}NE$	22 33 18	165	Deeper than normal.
	$\overline{S}NE$	39		$\overline{P}$ from the Wiechert.
#720 28th	$\overline{P}NEZ$	0 05 43	175	Compression. Deeper than normal.
	$\overline{S}NE$	06 04		Felt in Camarines Norte.
#721 28th	$\overline{P}Z$	3 47 33	230	
	$\overline{S}NE$	48 03		
#725 28th	$\overline{P}E$	23 30 27	175	
	$\overline{S}NE$	49		
#731 30th	$\overline{S}NE$	0 10 36		P lost in microseisms.
	,			Probably aftershock of #577.

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.
Aug. 1937				
#733	PZ	14 33 05	135	Aftershock of #577.
30th	SNE	22		
#734	PZ	15 16 56	220	
30th	SNE	17 25		
#736	PNEZ	18 41 03	128	Aftershock of #577.
30th	SNE	19		
#737	PNE	18 45 48	120	Aftershock of #577.
30th	SNE	46 03		
#738	PNEZ	2 38 11	5880	
31st	SNE	45 37		
	F	3 10		
#740	PNEZ	14 20 43	2680	
31st	SE	25 03		
	LNE	28 ca		
	MNE	30 20ca		
	F	15 30		

Thirty-six insignificant or undecipherable disturbances on the following days of August: 2nd, 4th(3), 6th(2), 7th(2), 8th, 9th(2), 11th, 12th, 13th(2), 15th(2), 19th(4), 25th(2), 26th, 28th, 29th(5), 30th(2), and 31st(2).

No. 33.

M A N I L A ; P . I .

September, 1937.

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		V_s
N-S	12.6	12.0	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.
September 3, 1937.

	T_o	V	ε	$\frac{I}{T_o^2}$
N-S	4.2	200	2.5	0.068
E-W	4.3	262	2.2	0.086

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Sept. 1937				
#742 1st	iPNEZ	8 50 20	8500	Compression from SE.
	SNE	9 00 12		
	LNE	15 25ca		31°S: 179°W: 0=8:38:54 by U.S.C.G.S.
	MN	21 25		
	F	11 40		
#743 1st	PNE	12 59 24	940	
	SN	13 01 04		
	F	15		
#747 1st	iPZ	17 54 06	1920	
	SNE	57 20		
	F	18 45		
#750 1st	PNEZ	21 53 01	7845	
	SNE	22 02 22		
	F	23 10		
#752 2nd	$\bar{P}$NEZ	8 30 14	145	Compression.
	$\bar{S}$E	32		Felt at Santa Cruz, Marinduque.
	F	44		
#753 2nd	PNEZ	18 53 28	1645	Felt in Santa Cruz, Davao.
	SN	56 21		
	LNE	19 00 30ca		
	F	56		
#754 3rd	$\bar{P}$NEZ	6 50 03	188	Probably an aftershock of #577.
	$\bar{S}$NE	19		
	F	7 06		
#759 3rd	PNEZ	18 58 22	6565	Dilatation from NE.
	SNE	19 06 35		52°.5N: 177°.5W by U.S.C.G.S.
#760 3rd	i$\bar{P}$NEZ	21 10 55	165	Compression. Felt in Central Luzon.
	$\bar{S}$NE	11 16		#759 still recording. $\bar{S}$ from the Wiechert
	F	50		16° 05'N: 121° 05'E by Baguio and Manila as on March 22, 1931.

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. 1937				
#762 3rd	P?NEZ	22 43 02	4555?	Disturbed by microseisms.
	S?NE	49 12		
	F	23 25		
#763 4th	$\bar{P}$NEZ	2 03 57	160	
	$\bar{S}$NE	04 17		
	F	06		
#764 4th	ePNEZ	6 24 39	6045	
	SNE	33 08		
	LN	44 ca		
	MN	48 30ca		
	F	8 30		
#766 4th 5th	$\bar{P}$NEZ	23 56 16	220	
	$\bar{S}$NE	45		
	F	0 11		
#768 5th	$\bar{P}$NEZ	16 52 38	135	Probably aftershock of #577.
	$\bar{S}$NE	55		
	F	57		
#770 5th	iPZ	20 58 20	2400	Dilatation.
	ePNE	58 20		
	SNE	21 02 18		
#771 5th	$\bar{P}$NZ	21 07 28	250	Felt in northern Luzon. Deeper than normal. #770 still recording.
	$\bar{S}$N	08 04		
	F	55		
#775 7th	$\bar{P}$NEZ	15 06 47	135	Aftershock of #577. Felt in Alabat Islands.
	$\bar{S}$NEZ	07 04		
	F	15		
#776	$\bar{P}$NE	15 46 04	128	Aftershock of #577. Felt in Manila with intensity II and slightly in Atimonan.
	$\bar{S}$NE	20		
	F	58		
#778 8th	iP'NZ	0 59 04	15000ca	South Atlantic according to U.S.C.G.S.
	i^1EZ	1 01 28		
	iNEZ	02 19		
	F	2 45		
#780 8th	SNE	20 16 00		P lost in microseisms.
	LNE	19 15ca		Butuan, 265 Km. Deeper than normal.
	F	50		
#783 10th	P?N	14 19 29	2180?	
	SNE	23 04		
	F	15 05		
#787 12th	P?NEZ	12 00 08	3245?	
	SNE	04 56		
	F	28		

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.
Sept. 1937				
#788	$\bar{P}$NEZ	4 21 34	105	
14th	$\bar{S}$NE	47		
	F	32		
#789	i$\bar{P}$Z	11 51 50	100	Compression.
14th	e$\bar{P}$NE	50		Deeper than normal
	$\bar{S}$NE	52 13		
	F	12 05		
#791	PEZ	23 49 54	1925	
14th	SNE	50 09		
15th	F	0 30		
#792	iPEZ	12 36 02	5320	Compression.
15th	iZ	37 55		
	SNE	43 05		9°S: 161°E: 0=12:27:51 by U.S.C.G.S.
	F	13 15		
#794	P_1NEZ	0 08 22	15180	P lost in changing records.
16ht	S_1K_1P	11 54		14°N: 92°W: 0=23:48:52(Sept.15) by U.
	PPN	14 00		S.C.G.S.
	F	2 20		
#797	i$\bar{P}$NEZ	18 11 52	140	Compression from SE. Felt in Marinduque
16th	$\bar{S}$NE	12 10		Island and S Luzon.
	F	19 35		$\bar{S}$ from the Wiechert and Horizontal.
#798	i$\bar{P}$Z	4 05 55	110	Dilatation.
17th	e$\bar{P}$NE	55		
	$\bar{S}$NE	06 07		
	F	14		
#799	ePNZ	9 50 17		
17th	iZ	53 41		
	iE	55 06		
	iN	20		
	F	12 20		
#800	$\bar{P}$NEZ	15 13 17	135	
17th	$\bar{S}$NE	34		
	F	21		
#801	i$\bar{P}$NEZ	2 12 35	200	
18th	$\bar{S}$NE	15 01		
	F	17		
#807	iPZ	7 51 13	2350	
21st	SNE	55 00		
	F	9 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. K..	Remarks
Sept. 1937				
#809 21st	iPNEZ	9 43 04	1545	
	iE	44 37		
	iSN	45 48		
	F	12 10		
#812 22nd	iPNEZ	3 12 02	435	Dilatation. 12° 03'N: 124° 03'E.
	SNEZ	55		Felt in Eastern Visayas.
	F	5 12		
#820 22nd 23rd	PNEZ	22 58 30		
	iZ	59 07		
	F	0 06		
#822 23rd	ePNEZ	13 13 24	4300	Probably Dilatation.
	SNE	19 35		
	iE	22 08		6°S: 154°E: 0h13m06s.09 by U.S.C.G.S.
	iN	23 36		6°S: 154°E by Riverview and Manila.
	LNE	25 50ca		
#824 23rd	iZ	17 28 17		#822 still recording.
	eN	30 16		
	iE	30 18		
	F	18 50		
#826 24th	PNEZ	5 53 00	2400	
	SNE	56 51		
	F	6 22		
#828 24th	eNEZ	9 00 27		
	iN	55		
	iE	01 03		
	F	25		
#829 24th	$\bar{i}$PZ	14 06 03	130	
	e$\bar{P}$NE	03		
	$\bar{S}$NE	28		
	F	17		
#830 24th	i$\bar{P}$NEZ	16 38 03	125	Dilatation from the west.
	$\bar{S}$NE	19		
	F	53		
#834 25th	PNE	15 45 03	1770	
	SEZ	48 05		
	F	14 05		
#837 25th	iPNEZ	17 47 10	2680	Dilatation.
	iE	49 42		
	iSNE	51 20		
	iNE	52 14		
	F	19 10		
#841 26th	$\bar{P}$NEZ	19 56 36	95	
	$\bar{S}$NEZ	48		
	F	20 01		

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.
Sept. 1937				
#842 26th	iPNEZ	21 30 02	125	Dilatation from SE.
	SNEZ	14		Probably from epicenter of #577.
	F	47		
#843 26th	iPZ	23 17 31		Compression.
	iE	20 15		
	iE	21 52		
27th	F	0 15		
#844 27th	iPZ	3 38 09	150	Dilatation.
	ePNE	11		
	SNE	28		
	F	46		
#845 27th	iPNEZ	9 00 44	2810	Data after P from the Wiechert.
	iN	01 58		Compression from SW.
	iE	03 12		Felt in Central Java.
	iE	44		
	SNE	05 14		
	LNE	45ca		
#846 27th	PNEZ	11 18 02	2300	#845 still recording.
	SNEZ	21 46		
	F	13 17		
#847 27th	PNEZ	16 40 38	175	Felt in Camarines Norte with int. IV.
	SNEZ	41 00		
	F	17 00		
#849 28th	PNEZ	0 58 45	150	
	SNE	59 04		
	F	1 03		
#853 28th	iPNEZ	13 21 03	1620	Compression from SE.
	iE	22 17		
	SN	23 51		
	F	14 20		
#854 28th	PEZ	18 03 20	95	
	SN	32		
#855 28th	PNEZ	18 11 23	40	Center northeast of Manila. Felt slightly in Manila. (Intensity IV in Novaliches).
	SEZ	28		
	F	17		
#860 29th	iPNEZ	19 36 48	110	Felt at Indang, Cavite.
	SNZ	37 02		
	F	20 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
Sept. 1937				
#861 30th	$\overline{P}Z$	6 48 58	135	
	$\overline{S}NE$	49 15		
	F	7 03		
#865 30th	ePNEZ	21 45 26	9020	
	SNE	55 38		
	LN	22 14 50ca		
	F	23 20		
#866 30th	$\overline{P}NEZ$	23 34 02	60	
	$\overline{S}NEZ$	10		
	F	35		

Sixty-six insignificant or undecipherable disturbances on the following days of September: 1st(5), 2nd, 3rd(5), 4th, 5th(3), 6th, 7th(2), 8th, 9th(2), 11th(2), 12th, 14th, 15th, 16th(2), 18th(2) 19th, 20th(2), 21st(3), 22nd(7), 23rd(3), 24th, 25th(5), 26th(3), 27th, 28th(4), 29th(3), and 30th(3).

No. 39. October, 1937

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	T	μ^2	V
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. October 3, 1937.

	T	V	ε	$\frac{R}{T_o^2}$
N-S	4.2	206	2.6	0.073
E-W	4.3	252	2.7	0.086

Cf. Theoretical Seismology, Sohon, S.J.

No. and Date	Phase.	Greenwich Time h.	m.	s.	Dist. Km.	Remarks
Oct. 1937						
#868	ePEZ	19	27	59	8955	
1st	SNE		38	14		
	F	21	20			
#871	PEz	23	49	00	70	
2nd	SNE			09		
	F		52			
#872	PNEZ	19	14	1[illegible]	160	Baguio, 175 Km.
3rd	SNE			58		
	F		27			
#878	PNEZ	19	23	00	150	
4th	SNE			19		
	F		28			
#881	PNEZ	3	45	14	195	
5th	SNEZ			39		
	F		48			
#882	PNEZ	4	49	54	145	Felt at Iba, intensity II.
5th	SNEZ		50	12		
	F		54			
#885	$P_1'Z$	10	06	24	14235	18°N: 99°W; O=9:47:15 by U.S.C.G.S.
6th	PPNEZ		08	18		
	F	11	30			
#886	iPNEZ	17	12	14	1635	Dilatation from SE.
6th	SNE		15	04		
	F	20	20			
#887	PNEZ	8	11	08	2820	Dilatation.
7th	iN		15	01		
	SE			28		
	F	9	35			
#888	PNEZ	5	17	50	150	
8th	SNZ		18	09		
	F		24			

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. 1937				
#890	PNZ	18 09 22	7365	
9th	SNE	18 16		
	F	19 20		
#893	PNEZ	20 26 14	6245	
10th	SNE	34 02		
	LNE	48 12ca.		
	F	21 45		
#896	PNZ	21 10 49	3190	Disturbed by microseisms.
12th	SE	15 54		
	F	22 09		
#901	PNEZ	6 26 57	75	
20th	SNEZ	27 07		
	F	31		
#906	P?NEZ	16 20 28	3755?	Disturbed by microseisms.
22nd	LNE	33 ca		
	F	17 00		
#907	PNEZ	14 46 08	215	Disturbed by microseisms.
23rd	S?NEZ	36		
	F	15 25		
#909	PNEZ	17 05 00	3880	Disturbed by microseisms.
23rd	SE	10 28		
	LNE	14 44		
	F	18 07		
#910	PNEZ	18 25 32	3270	Disturbed by microseisms.
23rd	SN	30 22		
	F	19 20		
#911	PNEZ	11 47 53	8230	62°N: 150°W: 0:11:36:06 by U.S.C.G.S.
24th	SNE	57 30		Disturbed by microseisms.
	F	13 02		
#912	P?NE	7 33 09	9855?	Disturbed by microseisms.
25th	SNE	44 01		
	F	8 37		
#913	iPEZ	10 45 04	8245	In region of north New Zealand by
25th	SNE	54 45		Riverview and Manila.
	LN	11 09 41		
	F	12 10		
#914	PNEZ	11 14 18	125	
25th	SNEZ	34		
	F	18		
915	iPZ	23 28 53	5000	
25th	ePNE	53		
	SNE	35 29		
26th	F	0 20		

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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. 1937				
#916	PNEZ	13 05 47	2645	
26th	SNE	09 55		
	LNE	12 20ca		
	F	14 08		
#917	ePNEZ	19 02 05	2655	
26th	SNE	06 14		
	LN	08 30ca		
	F	20 05		
#920	PNEZ	18 55 09	1910?	
27th	iS?N	58 22		
	iZ	24		
	F	19 51		
#922	$\bar{P}$NEZ	1 07 40	160	
28th	$\bar{S}$NE	08 00		
	F	19		
#924	PNEZ	15 33 04	1620	
28th	SNE	35 52		
	LN	38 46		
	F	16 40		
#927	PNEZ	7 35 38	4880	Disturbed by microseisms.
29th	SNE	42 07		
	LNE	49 15ca		
	F	8 15		
#928	PNEZ	16 28 07	2055	
30th	SE	31 32		
	LE	33 30ca		
	F	47		

Thirty-two insignificant or undecipherable disturbances on the following days of October: 1st, 2nd(2), 4th(7), 5th(2), 8th, 10th(2), 11th(2), 17th, 18th(3), 20th, 21st(2), 22nd, 23rd, 27th(2), and 28th(4).

No. 42. November, 1937

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.

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, 1937.

	T_o	V	ε	$\frac{r}{T_o^2}$
N-S	4.3	197	2.5	0.078
E-W	4.4	247	2.8	0.085

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 Nov. #930 2nd	PNEZ	11 02 19	4420	Conspicuous group of about 16 seconds period waves on N-S Component from 11:15 to 11:24.
	SNE	08 22		
	SSN	10 55		
	F	12 30		
#933 3rd	iPNEZ	5 27 00	2600	Dilatation.
	SNE	31 04		
	F	50		
#934 3rd	PNEZ	8 28 36	2265	
	SNE	32 18		
	F	45		
#941 5th	PNEZ	2 35 23	420	Felt at Calayan and Aparri with intensity III and at Laoag, II.
	SNEZ	36 14		
	F	3 10		
#942 5th	iPZ	9 33 19	2560	
	ePNE	19		
	iNE	35 11		
	SNE	37 21		
	iN	38 04		
	iE	39 13		
	F	10 30		
#943 5th	$\bar{P}$Z	23 13 13	170	
	$\bar{P}$NE	16		
	$\bar{S}$NE	54		
	F	30		
#947 9th	P?NEZ	6 29 09	1700?	Disturbed by microseisms.
	SNE	32 04		
	LNE	33 35ca		
	F	7 07		

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. 1937				
#949	iPZ	10 02 06	8600	Dilatation.
13th	ePNE	06		
	iPR, NZ	06 04		
	SNE	12 10		
	F	13 15		
#950	PNZ	18 05 24	8520	
13th	SNE	15 18		
	F	19 35		
#954	iPNEZ	11 06 47	7135	Compression.
14th	SNE	15 27		Arabia and West India.
	LN	27 16		Data after P from Wiechert and Horizon-
	F	14 10		tal.
#955	$\bar{P}$EZ	15 40 33	145	
14th	$\bar{S}$NEZ	51		
	F	46		
#956	$\bar{P}$EZ	18 47 47	85	
14th	$\bar{S}$NE	58		
	F	52		
#957	$\bar{P}$NEZ	19 16 31	150	Felt at Dagupan, intensity III.
14th	$\bar{S}$NEZ	50		
	F	26		
#960	PEZ	23 52 58	520	Felt at Basco and Calayan, intensity II
14th	SEZ	53 59		
15th	F	0 40		
#962	$\bar{P}$NE	13 52 06	165	From the Wiechert.
15th	$\bar{S}$NE	27		
	F	58		
#963	PNEZ	21 45 33	5135	
15th	SNEZ	52 17		
	LNE	59 ca		
	MNE	22 03 ca		
	F	23 27		
#964	$\bar{P}$NEZ	11 07 33	95	
17th	$\bar{S}$NE	45		
	F	13		
#970	iPZ	14 01 12	3100?	
23rd	ePNE	12		
	S?N	05 51		
	L?N	08 25		
	F	15 06		
#972	PNZ	0 57 03	3030?	Disturbed by microseisms.
24th	S?E	1 01 37		
	F	54		

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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. 1937 #973 25th	P?NEZ	4 54 04	3790?	Disturbed by microseisms.
	SE	59 30		
	LN	5 03 10		
	F	35		
#974 25th	PNEZ	5 37 23	1280	Disturbed by microseisms.
	SNE	39 36		
	MN	42 00		
	F	6 35		
#975 26th	iPZ	10 47 33	1445	Dilatation. Disturbed by microseisms.
	ePNE	33		
	SNEZ	50 03		
	F	12 50		
#977 27th	PNE	1 14 38	1155	Felt at Baganga with intensity IV.
	SNE	16 38		
	F	24		
#979 28th	i$\bar{P}$Z	0 57 39	150	Compression from SW.
	e$\bar{P}$NE	39		
	$\bar{S}$NE	58		
	F	1 40		
#980 28th	i$\bar{P}$Z	4 54 03	150	Compression from SW.
	e$\bar{P}$NE	03		
	$\bar{S}$NEZ	22		
#981 28th	$\bar{P}$NEZ	4 57 28	150	#980 still recording.
	$\bar{S}$NE	47		
	F	5 15		
#982 28th	PNEZ	5 29 47	4680	
	SNE	36 04		
	LNE	42 30ca		
	F	8 30		
#983 28th	$\bar{P}$NEZ	6 35 45	150	#982 still recording.
	$\bar{S}$NEZ	36 04		
#984 28th	$\bar{P}$NEZ	7 04 16	150	#982 still recording.
	$\bar{S}$NEZ	35		Felt very slightly in Manila.
#986 28th	$\bar{P}$NEZ	15 49 44	150	
	$\bar{S}$NEZ	50 03		
	F	16 00		
#987 28th	$\bar{P}$NEZ	17 56 59	150	
	$\bar{S}$NEZ	57 18		
	F	18 03		

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.
Nov. 1937				
#989	PNEZ	5 07 31	560	Felt at Calayan with intensity III and
29th	SNE	08 36		at Aparri, II.
	F	24		
#990	$\overline{P}$NEZ	18 35 56	100	P in minute gap. Felt at Tayabas.
29th	$\overline{S}$NZ	36 09		
	F	44		
#991	iPEZ	0 46 45	7180?	Compression.
30th	iE	48 56		
	iZ	50 04		
	iE	52 40		
	S?NE	55 28		
	F	2 35		
#992	iPZ	13 10 20	9270	Compression.
30th	ePNE	20		
	SNE	20 48		
	F	15 10		
#993	$\overline{P}$NEZ	23 03 02	95	Dilatation.
30th	$\overline{S}$NEZ	14		
	F	06		

Twenty-nine insignificant or undecipherable disturbances on the following days of November: 2nd(3), 3rd, 4th(3), 5th(2), 6th, 7th(2), 12th, 13th, 14th(4), 15th, 17th, 18th(2), 20th, 22nd, 24th, 26th, 27th, and 28th(2).

No. 46. December, 1937.

M A N I L A , p . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY

International Seismological Centre

Ø 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.
December 2, 1937

	T_o	V	ε	$\frac{-I-}{T_o^2}$
N-S	4.3	204	2.6	0.070
E-W	4.4	256	2.8	0.072

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Dec. 1937				
#995	PNEZ	19 57 34	470	Felt in northern Luzon.
1st	iNE	56		
	SNE	58 30		
	F	20 09		
#996	PNZ	6 34 42	165	
2nd	SNE	35 03		
	F	50		
#1002	P?NEZ	4 41 46	4190?	Disturbed by microseisms.
6th	S?NE	47 34		
	F	5 35		
#1004	iPNZ	8 34 14	1300	Dilatation. Felt in all Formosa, 23°.2 N.
8th	ePE	14		121° E by Taihoku.
	SNE	36 35		S from the Wiechert.
	F	11 20		
#1005	PNEZ	16 54 56	3265	
8th	SN	59 46		
	F	17 25		
#1006	iPZ	20 40 54	1180	Compression.
8th	ePNE	54		
	SN	42 56		
	F	22 10		
#1007	PNZ	23 33 40	2610	E-W Cylinder stopped at 23:24.
9th	SN	37 45		
	LN	40 ca		
	F	0 25		

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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. 1937				
#1012	PNEZ	13 35 39	5080	
10th	iZ	40 15		
	SNE	42 20		
	MNE	53 15ca		
	F	15 25		
#1018	$\bar{P}$NEZ	9 47 41	150	
12th	$\bar{S}$E	48 00		
	F	10 00		
#1019	iPZ	18 55 56	890	Compression.
13th	iPN	58		Felt in all Formosa.
	ePE	58		
	SNE?	57 30		
	F	21 00		
#1020	PNEZ	8 06 26	245	
14th	$\bar{S}$NEZ	07 00		
	F	14		
#1022	iPNEZ	8 31 34	1245?	Dilatation. Felt at Jolo.
16th	S?NE	33 43		
#1023	P?NEZ	9 41 24	4410?	#1022 still recording.
16th	S?NE	47 26		
	F	10 09		
#1024	$\bar{P}$NEZ	11 52 58	110	
16th	$\bar{S}$NE	53 12		
	F	58		
#1025	iPEZ	18 26 16	420	Dilatation. Felt at Virac.
16th	ePN	16		S and $\bar{S}$ from the Wichert.
	$\bar{S}$NE	27 07		
	$\bar{S}$N	20		
	F	30 08		
#1027	PNEZ	4 32 32	4255	
17th	SNE	38 22		
	LNE	40 40ca		
	F	5 42		
#1028	PNEZ	9 34 19	910	Compression.
17th	SNE	35 50		Fekt in whole of Formosa.
	F	12 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.
Dec. 1937				
#1032	ePNEZ	13 27 0[illegible]	5555	
18th	SNE	34 18		
	iE	34 23		
	F	15 10		
#1035	PEZ	[illegible] 43 29	4700?	Disturbed by microseisms.
20th	S?NE	49 48		
	iN	51 42		
	iE	52 58		
	F	4 35		
#1036	PNEZ	22 43 05	4880	Disturbed by microseisms.
20th	SNE	49 34		
	F	23 25		
#1037	PNZ	3 58 26		17°N: 106°W: 0-3:37:17 by U.S.C.G.S.
22nd	F	5 40		
#1038	PNEZ	20 52 47	430	
22nd	SEZ	53 39		
	F	21 07		
#1039	PNEZ	23 55 34	3610	
22nd	SNE	24 00 46		
23rd	F	0 17		
#1041	iP'EZ	13 37 15	14500	Dilatation.
23rd	PPNEZ	39 25		16°N: 98°W, 0=13:17:56 by U.S.C.G.S.
	SKP	40 02		
	LNE	14 22 ca		
	F	18 10		
#1043	eP'EZ	6 40 58		
24th	iE	44 16		
	iZ	45 22		
	iN	48 06		
	F	8 48		
#1044	$\overline{P}$EZ	16 42 17	140	
24th	$\overline{S}$NE	35		
	F	49		
#1045	iPNEZ	1 15 03	2780	P in minute gap.
25th	SNE	19 20		
	F	2 25		
#1046	PNE	10 08 08	5235	
25th	SNE	09 58		
	MNE	19 ca		
	F	11 02		

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.
Dec. 1937				
#1049	PNEZ	21 25 29	4155	
25th	SN	31 15		
	F	22 15		
#1050	$\overline{P}$NEZ	23 31 55	180	
25th	$\overline{S}$NE	32 16		
	F	36		
#1051	$\overline{P}$NEZ	4 35 22	180	
26th	$\overline{S}$NE	45		
	F	45		
#1052	PNEZ	22 58 16	300	Felt in northwestern Luzon.
26th	SNEZ	57		
	F	23 10		
#1053	iPNZ	3 14 31	2745	Dilatation.
28th	SN	18 46		E-W Component defective.
	iN	24 46		
	F	4 20		
#1054	iPZ	6 39 02	3420?	Dilatation.
28th	ePN	02		
	SN?	44 02		
	F	8 20		
#1056	iPZ	0 29 55	2640	Dilatation.
29th	ePN	55		E-W component out of order.
	SN	34 12		
	F	45		
#1064	$\overline{P}$NEZ	7 16 44	145	
31st	$\overline{S}$NE	17 02		
	F	32		
#1065	ePNEZ	18 02 54		
31st	PP?	04 04		
	iE	10 57		
	F	19 50		

Thirty-five insignificant or undecipherable disturbabces on the following days of December: 1st, 2nd, 3rd(2), 4th, 5th, 8th, 9th (2), 10th(4), 12th(3), 15th, 17th(3), 18th(2), 19th, 23rd(2), 25th(2) 28th, 29th(4), and 30th(3).

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SEISMOLOGICAL BULLETIN FOR 1937
JULY–DECEMBER

18686

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, mass 955 kg. Two horizontal pendulums, mass 118 kg. each.	Alluvian and pyroclastics to unknown depth.
Baguio	do	16 25	120 35	1,512	Vicentini, 3 components. Wiechert Inverted Pendulum, mass 200 kg.	Limestone.
Ambulong	do	14 05	121 03	10.5	Vicentini, 3 components	Soil underlaid by tuff.
Butuan	Mindanao	8 56	125 32	2.0	Wiechert Inverted Pendulum, mass 200 kg.	Alluvium.
Agaña	Guam	13 28	144 45	5.0	do	Coral.

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

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.

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 builty 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.

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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.

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.

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.

CONSTANTS OF THE WIECHERT INVERTED PENDULUM

1937	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	4.2	190	2.5	0.061	4.0	275	3.0	0.084
August	4.3	190	2.5	0.059	4.3	250	2.5	0.078
September	4.2	200	2.5	0.068	4.3	260	2.2	0.086
October	4.2	205	2.6	0.073	4.3	250	2.7	0.086
November	4.3	200	2.5	0.078	4.4	245	2.8	0.085
December	4.3	205	2.6	0.070	4.4	255	2.8	0.072

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CONSTANTS OF THE GALITZIN-WILIP SEISMOMETERS

	N–S	E–W	Z
PERMANENT CONSTANTS			
Galvanometers to drums	100.5 cm	100.5 cm	100.5 cm.
Telescope to seismographs	500 cm	492 cm	450 cm.
Reduced pendulum lengths	11.52 cm	11.40 cm	14.82 cm.
TEMPORARY CONSTANTS			
Seismometer periods	12.9s	11.9s	9.0s
Galvanometer periods	12.6s	11.8s	11.6s
μ^2	0.0	0.08	
V_s	400	230	

International Seismological Centre

SEISMOLOGICAL BULLETIN FOR 1937

JULY, 1937

MACROSEISMIC RECORD

2, $3^h\ 42^m\ 45^s$ [2, 1:42:45 P. M.] **Agaña, Guam.** Earthquake recorded and perceived. A second shock occurred at 3:51:30 P. M.

2, $16^h\ 32^m$ [3, 0:32 A. M.] **Cotabato, Mindanao.** Strong earthquake of five seconds duration followed by a shock of light intensity, lasting two seconds, at Kiamba. Also felt strongly at Glan.

3, $3^h\ 59^m\ 30^s$* [3, 11:59:30 A. M.] **Davao, Davao.** Earthquake of intensity II.

8, $4^h\ 47^m\ 27^s$* [8, 12:47:27 P. M.] **SW. Luzon.** Earthquake felt slightly in Manila and in Indang, Cavite.

11, $12^h\ 20^m\ 20^s$ [11, 8:20:20 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

11, $15^h\ 27^m\ 36^s$* [11, 11:27:36 P. M.] **SW. Luzon.** Earthquake of intensity II felt in Indang, Cavite, and in Batangas and Tanauan, Batangas.

14, $7^h\ 43^m\ 51^s$ [14, 5:43:51 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

17, $0^h\ 18^m\ 12^s$ [17, 10:18:12 A. M.] **Agaña, Guam.** Earthquake recorded and perceived.

17, $18^h\ 26^m\ 36^s$* [18, 2:26:36 A. M.] **Central and Eastern Luzon.** Earthquake centered in the Cordilleras, northeast of Manila. Felt with intensity V at Baler, with a duration of 18 seconds. Intensity IV in Santa Cruz, Laguna; intensity III in Alabat, Infanta and Dagupan; intensity II in Manila, Mt. Arayat and Lucban. The motion was oscillatory in every place.

19, $1^h\ 02^m\ 34^s$ [19, 11:02:34 A. M.] **Agaña, Guam.** Earthquake recorded and perceived. There was a second shock at 11:43 A. M.

20, $6^h\ 30^m$ [20, 2:30 P. M.] **Santo Domingo, Ilocos Sur.** Light earthquake.

20, $11^h\ 53^m\ 41^s$ [20, 9:53:41 P. M.] **Agaña, Guam.** Earthquake recorded and perceived. There was a second shock at 9:56 P. M.

20, $23^h\ 29^m\ 20^s$* [21, 7:29:20 A. M.] **Baguio, Mountain Province.** Very light earthquake.

21, $0^h\ 13^m\ 19^s$ [21, 10:13:19 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

21, $15^h\ 19^m\ 37^s$* [21, 11:19:37 P. M.] **N. Luzon.** Center probably in the Mountain Province. Felt with intensity III at Laoag; intensity II at Aparri; and slightly at Mt. Data. Oscillatory.

22, $4^h\ 50^m\ 42^s$* [22, 12:50:24 P. M.] **E. Mindanao.** Center probably in southern part of the Philippine Deep. Felt in Davao and very slightly in Butuan.

23, $15^h\ 07^m$ [23, 11:07 P. M.] **Borongan, Samar.** Earthquake of intensity III.

24, $6^h\ 43^m$ [24, 2:43 P. M.] **Dapa, Surigao.** Oscillatory earthquake of intensity IV and of five seconds duration.

26, $9^h\ 17^m\ 40^s$ [26, 7:17:40 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

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27, 2h 10m [27, 10:10 A. M.] **Vigan, Ilocos Sur.** Very light earthquake.

28, 11h 25m [28, 7:25 P. M.] **Butuan, Agusan.** Earthquake felt by a considerable number of persons, especially in the church, the roof of which rattled. The movement seemed to be vertical.

29, 11h 12m 22s* [29, 7:12:22 P. M.] **Indang, Cavite.** Very light earthquake.

30, 13h 26m 56s* [30, 9:26:56 P. M.] **Laoag, Ilocos Norte.** Earthquake of intensity II and eight seconds duration. Another shock was felt at 10:09 P. M.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			Δ	Remarks
			h.	*m.*	*s.*	*Km.*	
454	1	iPz	11	55	30	3,140	Compression. Disturbed by microseisms. 5° N: 95° E by Strasbourg.
		PNE			31		
		SNE	12	00	13		
		LNE		03	20ca		
		MNE		06	ca		
		F	13	50			
456	2	PNE	2	46	03	5,420?	Disturbed by microseisms. Solomon Islands by Riverview and Manila. 13° S: 166° E by Apia.
		SE		53	20ca		
		F	4	00			
458	3	PNEZ	3	59	30	1,235?	Felt in southeastern Mindanao. Disturbed by microseisms. Butuan, 6.3°
		S?NEZ	4	01	38		
		F		35			
459	4	PNEZ	6	04	09	9,120	Compression. 13° S: 163° E by U. S. C. G. S.; 7° S: 160° E by Wellington.
		iZ		06	03		
		SNE		14	25		
460	4	P?NEZ	6	39	38	8,565?	No. 459 still recording.
		S?NE		49	35		
461	4	P?NE	7	22	14		Do.
		F	9	30			
464	5	PNEZ	17	05	03	3,365	
		SE		09	59		
		F		36			
466	7	Pz	22	12	44	220	S from the Wiechert.
		SNE		13	13		
		F		25			
468	8	$i\overline{P}z$	4	45	27	150	Compression from SE. Felt in Manila and SW. Luzon. $\overline{S}$ from the Wiechert and Horizontal Pendulums.
		$\overline{S}$NE			46		
		F	5	00			
470	9	$i\overline{P}$NEZ	6	16	46	160	Recorded in Baguio, slightly.
		$\overline{S}$NE		17	06		
		F		27			
472	9	iPz	21	26	43	2,190	
		ePNE			44		
		SNE		30	19		
		F	22	21			
473	10	iPz	20	46	32	1,585	Dilatation.
		ePNE			34		
		SNE		49	16		
		LNE		50	50ca		
		F	22	30			
476	11	ePNEZ	13	44	51	3,770	
		SNE		50	13		
477	11	$i\overline{P}$NEZ	15	27	36	135	Dilatation from SE. Felt in SW. Luzon. No. 476 still recording.
		$\overline{S}$NE			53		
478	11	$\overline{P}$NEZ	15	45	28	135	Aftershock of No. 477.
		$\overline{S}$NE			45		
		F		55			
481	12	ePz	0	08	13	3,080	
		SN		12	50		
		F	1	10			
482	12	PEZ	7	11	53	730	
		SNE		13	14		
		F		37			
485	13	iPz	2	59	25	1,320	
		SNE	3	01	42		
		F		45			
486	13	P?NEZ	10	48	28	2,735?	
		SNE		52	42		
		F	11	15			

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	Δ	Remarks
			h. *m.* *s.*	*Km.*	
487	14	Pz	5 37 33	600	
		Sez	38 41		
		F	6 28		
490	14	Pnez	22 33 46	3,310	Dilatation.
		iE	35 43		
		iN	36 08		
		Sne	38 38		
		Lne	42 10ca		
		Mne	44 40ca		
	15	F	0 15		
491	15	Pz	2 40 26	2,655	
		iSn	44 35		
		F	3 03		
493	15	P?ne	19 14 17	3,265?	Disturbed by microseisms.
		Sne	19 07		
		F	40		
494	16	Pnez	10 24 21	3,120	
		Sne	29 01		
		F	11 30		
495	16	$\overline{P}$ne	18 57 52	180	
		$\overline{S}$ne	58 15		
		F	19 03		
496	17	$\overline{P}$nez	18 26 36	125	Dilatation from NE. Felt in S. and E. Luzon. $\overline{S}$ from the Wiechert.
		$\overline{S}$ne	52		
		F	19 10		
497	19	Pez	3 00 29	4,345	Dilatation.
		iz	02 16		
		iN	03 53		
		Sne	06 27		
		Lne	11 00		
		F	4 11		
500	19	iP_1z	19 55 08	17,290	Dilatation. 0°: 77° W; h=160; 0=19:35.4, U. S. C. G. S. 1.5° N: 77.5° W; H=19:35:50, J. S. A.
		SKPn	58 48		
		iz	20 00 09		
		Lne	50 ca		
		F	22 10		
501	20	$\overline{P}$nz	23 29 20	160	Compression. Felt at Baguio.
		$\overline{S}$nez	40		
		F	42		
503	21	$\overline{P}$nez	13 00 00	200	
		$\overline{S}$ne	25		
		F	09		
504	21	Pz	15 19 37	370	Felt in northern Luzon.
		Sne	20 24		
		F	35		
505	22	Pnez	4 50 42	1,095	Slightly deeper than normal. Butuan, 435 Km.
		Sez	52 37		
		F	5 12		
507	22	Pnez	7 36 44	1,135	Slightly deeper than normal. Butuan, 360 Km.
		Sne	38 42		
		F	8 20		
508	22	Pez	17 21 31	8,380	Felt at Fairbanks, Alaska. 64.6° N: 145.6° W; 0=17:09.5, U. S. C. G. S. 64.5° N: 145.1° W, by J. S. A.
		Sne	31 19		
		Mne	49 ca		
		iz	57 07		
		F	20 35		
514	24	Pne	10 23 10	1,710	
		Sne	26 07		
		F	42		
522	26	Pnez	4 06 16	2,090	Dilatation. Disturbed by microseisms.
		iz	08 30		
		Sne	09 44		
		F	5 55		
523	26	iPnez	20 02 41	3,220	Dilatation. Disturbed by microseisms. 37.8° N: 142.5° E by Tokio. 40° N: 141° E; 0=19:56.6 by U. S. C. G. S.
		Sne	07 40		
		iN	10 40		
		F	21 40		
529	31	iPnez	20 40 35	2,610	Compression. Felt in Kiangsi province, China.
		Sne	44 40		
		F	22 35		

Thirty-eight insignificant or undecipherable disturbances on the following days of July: 1st, 2nd, 5th(2), 6th, 8th(2), 9th, 11th(4), 12th(2), 14th(2), 15th, 19th(2), 21st, 22nd, 23rd(4), 24th(4), 25th(3), 26th, 29th(2), 30th(2), and 31st.

International Seismological Centre

AUGUST, 1937

MACROSEISMIC RECORD

3, $2^h\ 49^m\ 12^s$ [3, 12:49:12 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

4, $1^h\ 24^m\ 45^s$* [4, 9:24:45 A. M.] **Legaspi, Albay.** Earthquake of intensity IV and five seconds duration. At 4:30 P. M. there was another sharp shock of intensity IV and at 4:55 P. M. there was a light shock That same evening there were light shocks at 8:21, 8:28, 9:37, 9:55 and 10:29. At 10:40 P. M. there was another shock of intensity IV followed by a lighter shock at 10:42.

4, $11^h\ 58^m$ [4, 7:58 P. M.] **Jolo, Sulu.** Earthquake of intensity III and three seconds duration.

4, $23^h\ 13^m\ 00^s$* [5, 7:13:00 A. M.] **Legaspi, Albay.** Oscillatory earthquake of intensity IV and five seconds duration. It was preceded at 7:12 by a light shock, and at 9:23 A. M. there was another light earthquake.

5, $4^h\ 11^m$ [5, 12:11 P. M.] **Butuan, Agusan.** Earthquake of intensity II and vertical movement. Duration 10 seconds.

5, $6^h\ 12^m$ [5, 2:12 P. M.] **Casiguran, Tayabas.** Earthquake of intensity III.

6, $15^h\ 41^m$ [6, 11:41 P. M.] **Legaspi, Albay.** Earthquake of intensity III and five seconds duration. A second shock, intensity IV, was felt at 2:47 A. M. on the 7th.

7, $22^h\ 35^m\ 01^s$*[8, 8:35:01 A. M.] **Agaña, Guam.** Earthquake recorded and perceived.

8, $17^h\ 42^m$ [9, 1:42 A. M.] **Legaspi, Albay.** Sharp shock of intensity IV. Another sharp shock at 3:53 A. M.

8, $18^h\ 13^m$ [9, 2:13 A. M.] **Basco, Batanes.** Earthquake of intensity III and two seconds duration.

9, $10^h\ 23^m\ 47^s$ [9, 8:23:47 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

10, $12^h\ 18^m\ 12^s$* [10, 8:18:12 P. M.] **NE. Mindanao.** Center probably in the Philippine Deep. Intensity V and one minute duration at Dapa. Intensity IV at Butuan and II at Surigao. An aftershock of intensity III was felt at 8:54 at Butuan and Dapa.

12, $16^h\ 34^m\ 49^s$* [13, 0:34:49 A. M.] **E. Luzon.** Oscillatory movement of five seconds duration and intensity IV at Santa Cruz, Laguna. Felt slightly in Manila and Mauban. A second shock of intensity V was felt at Santa Cruz at 0:39 A. M.

15, $4^h\ 28^m\ 26^s$* [15, 12:28:26 P. M.] **N. Luzon.** Earthquake of intensity IV in Aparri and Calayan. Intensity III at Laoag and light at Mt. Data, Bontoc, and San Pablo, Isabela.

17, $21^h\ 14^m\ 03^s$* [18, 5:14:03 A. M.] **NW. Luzon.** Earthquake of intensity III at Laoag and Santo Domingo, Ilocos Sur.

19, $23^h\ 30^m\ 10^s$* [20, 7:30:10 A. M.] **Dapa, Surigao.** Earthquake of intensity III.

20, $11^h\ 59^m\ 32^s$* [20, 7:59:32 P. M.] **S. and SE. Luzon.** Destructive earthquake centered at Alabat Island, Province of Tayabas. See special account at end of this Bulletin.

21, $3^h\ 10^m$ [21, 11:10 A. M.] **Tabaco, Albay.** Light earthquake.

21, $5^h\ 32^m$ [21, 1:32 P. M.] **Laoag, Ilocos Norte.** Earthquake of intensity II and five seconds duration.

International Seismological Centre

21, 7h 14m 19s [21, 5: 14: 19 P. M.] **Agaña, Guam.** Earthquake recorded and felt.

21, 15h 05m [21, 11: 05 P. M.] **Infanta, Tayabas.** Very feeble earthquake.

21, 15h 45m [21, 11: 45 P. M.] **Santo Domingo, Ilocos Sur.** Light earthquake.

21, 20h 29m 34s* [22, 4: 29: 34 A. M.] **Santa Cruz, Laguna.** Earthquake of intensity III and three seconds duration. Aftershocks at 8: 32 A. M. and 9: 30 P. M. On the 23rd there were shocks of intensity III at 2: 45 A. M.; at 5: 55 A. M. and at 9: 35 A. M.

22, 22h 00m [23, 6: 00 A. M.] **Culion, Palawan.** Light oscillatory earthquake of a few seconds duration.

23, 6h 15m 19s* [23, 2: 15: 19 P. M.] **E. Luzon.** A strong aftershock of the earthquake of August 20th felt in Alabat Island and at Atimonan.

23, 11h 35m [23, 7: 35 P. M.] **Santa Cruz, Laguna.** Earthquake of intensity III.

25, ——— **Compostela, Davao.** Time uncertain. Light earthquake.

25, 0h 11m 44s* [25, 8: 11: 44 A. M.] **Lucban, Tayabas.** Light earthquake.

25, 2h 15m [25, 10: 15 A. M.] **Santa Cruz, Laguna.** Earthquake of intensity III.

25, 20h 06m 35s* [26, 4: 06: 35 A. M.] **Laguna and Batangas.** Felt with intensity III at Santa Cruz and lightly at Lucban and Ambulong.

25, 21h 55m 34s* [26, 5: 55: 34 A. M.] **S. Mindanao.** Felt with intensity II at Davao and Kiamba, Cotabato.

26, 2h 08m [26, 10: 08 A. M.] **Santa Cruz, Laguna.** Earthquake of intensity III.

26, 13h 56m [26, 9: 56 P. M.] **Laoag, Ilocos Norte.** Earthquake of intensity II and five seconds duration.

26, 23h 28m 25s* [27, 7: 28: 25 A. M.] **Manila.** Slight earthquake, distance 175 kilometers.

26, 16h 00m [27, 0: 00] **Lucban, Tayabas.** Light earthquake.

27, 18h 09m [28, 2: 09 A. M.] **Santa Cruz, Laguna.** Earthquake of intensity III. Another shock of intensity II at 3: 35 A. M.

28, 0h 05m 43s* [28, 8: 05: 43 A. M.] **Camarines Norte.** Oscillatory earthquake of intensity IV and twenty seconds duration at Daet. Intensity II at Capalonga and Naga.

28, 8h 52m [28, 4: 52 P. M.] **Port Lamon, Surigao.** Oscillatory earthquake of intensity III felt by a few persons.

30, 9h 19m [30, 5: 19 P. M.] **Aroroy, Masbate.** Light earthquake followed by another at 6: 37 P. M.

International Seismological Centre

INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
530	1	iPz	10	45	53	2,580	Compression. Shantung, China.
		ePNE			56		
		iSNE		49	56		
		MNE		54	35ca		
		F	11	52			
535	4	iPz	23	41	03	3,020	10° N: 95° E by Strasbourg.
		ePNE			04		
		iz			51		
		SNE		45	36		
		iN		47	35		
	5	F	0	35			
536	5	iPz	14	50	40	4,260	6° S: 146° E by Wellington.
		iE			48		
		iz		52	34		
		SNE		56	32		
		F	16	25			
541	7	PNEZ	22	35	01	2,145	
		SNE		38	34		
		F	23	12			
543	8	iPz	10	17	12	3,535	Compression.
		ePE			12		
		iz			47		
		SNE		22	19		
		iE		23	48		
		F	11	15			
544	8	iPz	15	23	56	1,345	Butuan, 460 Km.
		ePNE			56		
		iE		24	56		
		SNE		26	16		
		F	16	35			
545	9	iPz	12	42	31	2,810	
		ePNE			36		
		SNE		46	30		
		LNE		49	ca		
		F	13	57			
546	9	iPz	14	44	35	2,455	
		ePNE			35		
		SNE		48	29		
		LNE		50	40ca		
		F	16	20			
548	9	ePNEZ	19	24	01	2,610	
		SNE		28	06		
		F	20	25			
550	10	PNEZ	2	51	25	2,655	
		SNEZ		55	34		
		F	3	25			
551	10	ePNEZ	12	18	12	740	Felt in NE. Mindanao.
		SNE		19	34		
		F		38			
552	10	ePNEZ	18	04	51	2,580	Deeper than normal.
		SNEZ		08	54		
		F		40			
553	11	PNEZ	1	00	05	1,610	S from the Wiechert and Horizontal. Compression. 7° S: 115.7° E; h=600 Km. by Batavia.
		SNE		02	52		
		F	4	00			
554	11	PNEZ	9	42	15	2,600	
		SNE		46	19		
		F	10	04			
557	12	$i\overline{P}z$	4	25	14	160	Compression.
		$\overline{S}$NEZ			34		
		F		41			
558	12	PEZ	11	54	05	2,165	
		SNE		57	39		
		F	12	13			
559	12	$\overline{P}$NEZ	14	42	17	145	
		$\overline{S}$NE			35		
		F		52			
560	12	$i\overline{P}$NEZ	16	34	49	100	Felt in S. Luzon. $\overline{S}$ from the Wiechert.
		$\overline{S}$NE		35	02		
		F		57			
561	12	$\overline{P}$NEZ	20	07	52	190	
		$\overline{S}$NE		08	16		
		F		15			

INSTRUMENTAL RECORD—Continued

International Seismological Centre

No.	Date	Phase	Time	Δ	Remarks
			h. *m.* *s.*	*Km.*	
564	13	PNEZ	17 43 39	200	
		$\overline{S}$NE	44 15		
		F	18 02		
565	14	ePZ	10 52 32	2,635	
		SNE	56 39		
		LE	59 ca		
		F	11 45		
566	15	PNEZ	4 28 26	430	Dilatation. Felt in north Luzon. $\overline{S}$ from the Wiechert and Horizontal.
		$\overline{S}$NE	29 32		
		F	5 55		
569	17	PNZ	13 15 15	3,220	
		SN	20 01		
		LE	23 20ca		
		F	14 20		
570	17	PNEZ	21 14 03	420	Felt in NW. Luzon.
		SNE	34		
		F	26		
571	18	PNEZ	5 01 20	2,780	Deeper than normal.
		SNE	05 37		
		F	43		
576	20	PEZ	6 48 45	5,665?	
		S?NE	54 00		
		F	7 55		
577	20	i$\overline{P}$NEZ	11 59 32	130	Very strong earthquake. Dilatation from SE.

Galitzin-Wilip traces vanished after beginning of first throw. N–S light spot off until 0h G. M. T. 21st. Bottom suspension hinge of E–W component broken; new hinge inserted on 27th.

Wiechert pens dislocated after beginning of first throw.

NNW–SSE component, *Horizontal Pendulum*, V=20, pen dislocated 10 seconds after beginning of earthquake.

ENE–WSW component, *Horizontal Pendulum*, V=2, pen remained on throughout the earthquake, but pendulum bumped the arresting screws during the first ten minutes of the earthquake.

Butuan pens oscillated to the limit. Distance interpreted with difficulty as 670 km.

Baguio, NW–SE component, strong first throw. NE–SW pen dislocated by transverse wave. Distance interpreted approximately as 280 km.

Intensity IX in epicentral area. Intensity VII in Manila. Considerable damage in Manila; people panicky. Damage in the provinces.

Felt throughout southern and southeastern Luzon and northwestern Visayan Islands.

Epicenter, 14° 10′ N: 122° 05′ E. H=11 59:13 G. M. T.

578		$\overline{P}$ 12:20:ca			Aftershock of No. 577. Felt in southern Luzon and in Manila.
579		$\overline{P}$ 12:40:ca			Aftershock of No. 577. Felt in Manila with intensity III.

Small aftershocks. Although the E–W component of the Galitzin-Wilip was disabled the galvanometer responded to these aftershocks at approximately the following times: 12:53, 12:56, 13:00, 13:15, 13:20, 13:28, 13:30, 13:36, 13:41, 13:47, 13:51, 13:55, 13:58, 14:00, 14:03, 14:23, 14:31, 14:32, 14:39, 14:40, 14:47, 14:49, 15:16, 15:18, 15:25, 15:35, 15:39, 16:02, 16:16, 16:50, 17:18, 17:48, 18:12, 18:23, 19:07, 20:10, 20:19, 20:32, 20:50, 20:58, 21:10, 21:22, 21:35, 21:49, 22:48, 23:23, 23:36.

626	21	$\overline{P}$NZ	0 27 ca		128	Aftershock of No. 577.
627 to 630	21	----------				Four small aftershocks of No. 577.
631	21	$\overline{P}$N	2 24 45		128	Aftershock of No. 577.
		$\overline{S}$N	25 01			
632	21	$\overline{P}$NE	4 19 41		95	Probably deeper than normal.
		$\overline{S}$NE	53			
633	21	$\overline{P}$E	4 28 ca			Aftershock.
634	21	$\overline{P}$N	4 57 13		128	Aftershock. No. 635 and No. 636 small aftershocks.
		$\overline{S}$N	29			
637	21	$\overline{P}$NZ	5 28 43		135	No. 638 small aftershock.
		$\overline{S}$N	29 00			
639	21	$\overline{P}$NZ	5 55 38		128	No. 640 small aftershock.
		$\overline{S}$NZ	54			
641	21	$\overline{P}$Z	6 25 36		135	Probably aftershock.
		$\overline{S}$N	53			
642	21	$\overline{P}$Z	6 59 07		135	Do.
		$\overline{S}$N	24			
643	21	$\overline{P}$Z	7 14 12		190	
		$\overline{S}$N	36			
644	21	$\overline{P}$Z	7 42 17		135	Aftershock of No. 577. No. 647, No. 648 small aftershocks.
		$\overline{S}$N	34			

INSTRUMENTAL RECORD—Continued

International Seismological Centre

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s*	*Km*	
649	21	$\overline{P}$z	15	07	55	95	$\overline{S}$–$\overline{P}$ interval approximately from Wiechert on which minute gaps were lacking. No. 651, No. 652 small aftershocks.
		$\overline{S}$		08	07	----------	
653	21	PNZ	23	07	21	3,190	
		SNZ		12	07	----------	
		LN		15	13	----------	
		MN		17	30ca	----------	
	22	F	0	20		----------	
657	22	i$\overline{P}$z	3	30	31	95	Deeper than normal. Nos. 654, 655, 656 aftershocks of No. 577. No. 658 and 659 small aftershocks of No. 577.
		i$\overline{S}$N			43	----------	
660	22	$\overline{P}$z	6	54	42	120	Aftershock of No. 577. Nos. 661 to 675 small aftershocks of No. 577.
		$\overline{S}$N			57	----------	
676	22	$\overline{P}$z	18	56	03	128	Aftershock of No. 577.
		$\overline{S}$N			19	----------	
677	23	PNZ	0	29	06	305	
		SN			47	----------	
680	23	i$\overline{P}$z	3	44	39	120	Compression. Aftershock of No. 577. Nos. 678 and 679 aftershocks of No. 577.
		$\overline{S}$N			54	----------	
681	23	$\overline{P}$N	4	14	24	95	Deeper than normal. No. 682 aftershock of No. 577.
		i$\overline{S}$N			36	----------	
683	23	$\overline{P}$NZ	6	15	19	128	Aftershock of No. 577. Felt in Alabat Island with intensity V. Nos. 684, 685, 686, 687 and 689 aftershocks.
		$\overline{S}$N			35	----------	
688	24	$\overline{P}$z	6	01	48	160	
		$\overline{S}$NZ		02	08	----------	
690	24	$\overline{P}$NZ	10	36	12	150	Deeper than normal.
		$\overline{S}$N			31	----------	
691	24	$\overline{P}$NZ	16	51	46	120	Aftershock of No. 577. No. 693 aftershock of No. 577.
		$\overline{S}$NZ		52	01	----------	
692	24	iPNZ	18	39	29	----------	Dilatation.
		iz			33	----------	
		F	20	17		----------	
694	25	i$\overline{P}$z	0	11	44	95	Deeper than normal. Felt slightly in Lucban.
		$\overline{S}$NZ			56	----------	
697	25	$\overline{P}$z	17	05	58	120	Aftershock of No. 577. Nos. 698, 699, 703 probably aftershocks.
		$\overline{S}$N		06	13	----------	
700	25	$\overline{P}$z	20	06	35	95	Deeper than normal. Felt slightly in provinces of Laguna and Batangas.
		$\overline{S}$N			47	----------	
701	25	iPNZ	21	55	34	1,135	Compression. Felt in S. Mindanao. Butuan, 360 km.
		SN		57	40	----------	
702	25	$\overline{P}$NE	22	00	02	142	$\overline{P}$ from Wiechert.
		$\overline{S}$N			20	----------	
704	26	$\overline{S}$N	0	48	32	----------	Probably aftershock of No. 577.
705	26	i$\overline{P}$z	8	02	08	118	Compression. Aftershock of No. 577. No. 706 very small; probably aftershock of No. 577.
		$\overline{S}$N			23	----------	
707	26	Pz	9	50	25	245	
		$\overline{S}$N		51	00	----------	
709	26	$\overline{P}$z	16	34	54	128	Felt slightly in Manila. Aftershock of No. 577.
		$\overline{S}$N		35	10	----------	
710	26	PNZ	18	58	38	2,335	
		SN	19	02	25	----------	
		LN		04	30	----------	
		F	20	12		----------	
711	26	$\overline{P}$N	19	31	08	190	
		$\overline{S}$N			32	----------	
712	26	$\overline{P}$z	23	28	25	175	Compression. Felt slightly in Manila.
		$\overline{S}$N			47	----------	
718	27	$\overline{P}$NEZ	1	49	31	130	Aftershock of No. 577. Galitzin-Wilip E–W component again operating.
		$\overline{S}$NE			47	----------	

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			△	Remarks
			h	*m.*	*s.*	*Km*	
714	27	$\overline{P}$Z	5	18	08	95	
		$\overline{S}$NE			20		Deeper than normal.
715	27	$\overline{P}$Z	7	01	32	135	Probably aftershock of No. 577. No. 716 small, probably aftershock of No. 577.
		$\overline{S}$NE			49		
717	27	$\overline{P}$NEZ	7	24	53	215	
		$\overline{S}$NE		25	21		
718	27	P?NE	22	10	55	2,035?	
		SNE		14	19		
		F		30			
719	27	$\overline{P}$NE	22	33	18	165	Deeper than normal.
		$\overline{S}$NE			39		
720	28	$\overline{P}$NEZ	0	05	43	175	Compression. Deeper than normal. Felt in Camarines Norte.
		$\overline{S}$NE		06	04		
721	28	$\overline{P}$Z	3	47	33	230	
		$\overline{S}$NE		48	03		
725	28	$\overline{P}$E	23	30	27	175	
		$\overline{S}$NE			49		
731	30	$\overline{S}$NE	0	10	36		P lost in microseisms. Probably aftershock of No. 577.
733	3	$\overline{P}$Z	14	33	05	135	Aftershock of No. 577.
		$\overline{S}$NE			22		
734	30	PZ	15	16	56	220	
		$\overline{S}$NE		17	25		
736	30	$\overline{P}$NEZ	18	41	03	128	Aftershock of No. 577.
		$\overline{S}$NE			19		
737	30	$\overline{P}$NE	18	45	48	120	Do.
		$\overline{S}$NE		46	03		
738	31	PNEZ	2	38	11	5,880	14° S: 166° by Wellington.
		SNE		45	37		
740	31	PNEZ	14	20	43	2,680	
		SE		25	03		
		LNE		28	ca		
		MNE		30	20ca		
		F	15	30			

Thirty-six insignificant or undecipherable disturbances on the following days of August: 2nd, 4th(3), 6th(2), 7th(2), 8th, 9th(2), 11th, 12th, 13th(2), 15th(2), 19th(4), 25th(2), 26th, 28th(3), 29th(5), 30th(2), and 31st(2).

International Seismological Centre

SEPTEMBER, 1937

MACROSEISMIC RECORD

2, $8^h\ 30^m\ 14^s$* [2, 4: 30: 14 P. M.] **Santa Cruz, Marinduque.** Light earthquake.

2, $20^h\ 54^m$ [3, 4: 54 A. M.] **Butuan, Agusan.** Very feeble earthquake of vertical motion.

2, $18^h\ 53^m\ 28^s$* [3, 2: 53: 28 A. M.] **Santa Cruz, Davao.** Strong earthquake.

2, $21^h\ 11^m$ [3, 5: 11 A. M.] **Iba, Zambales.** Light earthquake of four seconds duration.

3, $19^h\ 41^m$ [4, 3: 41 A. M.] **Davao, Davao.** Earthquake.

3, $21^h\ 10^m\ 55^s$* [4, 5: 10: 55 A. M.] **Central and N. Luzon.** Center in the Caraballo Mountains. Intensity V and three seconds duration in Baguio. Intensity III in Dagupan, Casiguran and Laoag. Feeble in San Fernando, La Union; San Pablo, Isabela; Echague and Manila.

5, $21^h\ 07^m\ 28^s$* [6, 5: 07: 28 A. M.] **N. Luzon.** Center probably in mountains of northern Luzon. Moderately strong in Santo Domingo, Ilocos Sur and with intensity II at Aparri and Laoag.

5, $21^h\ 05^m$ [6, 5: 05 A. M.] **Alabat, Tayabas.** Light earthquake. Another shock at 11: 00 P. M.

7, $22^h\ 43^m$ [8, 6: 43 A. M.] **Surigao, Surigao.** Earthquake of intensity III.

8, $13^h\ 07^m$ [8, 9: 07 P. M.] **Santa Cruz, Laguna.** Earthquake of intensity III and two seconds duration.

8, $14^h\ 16^m\ 32^s$ [9, 0: 16: 32 A. M.] **Agaña, Guam.** Earthquake recorded and felt.

8, $20^h\ 00^m$ [9, 4: 00 A. M.] **Maridagao, Cotabato.** Light earthquake.

12, $5^h\ 00^m$ [12, 1: 00 P. M.] **Halcon, Mindoro.** Slight earthquake.

16, $9^h\ 10^m$ [16, 5: 10 P. M.] **Boac, Marinduque.** Earthquake of intensity V.

16, $16^h\ 00^m$ [17, 0: 00] **Lucban, Tayabas.** Light earthquake.

16, $18^h\ 11^m\ 52^s$* [17, 2: 11: 52 A. M.] **S. Luzon.** Center in Tayabas Bay. Felt in Marinduque Island and in the provinces of Batangas, Laguna, and Tayabas. Moderately strong in Santa Cruz, Boac and Atimonan. At 11: 18 A. M. another shock of intensity II was felt at Santa Cruz.

17, $14^h\ 17^m\ 21^s$ [18, 0: 17: 21 A. M.] **Agaña, Guam.** Earthquake recorded and perceived.

18, $21^h\ 56^m\ 05^s$* [19, 5: 56: 05 A. M.] **Dapa, Surigao.** Earthquake of intensity IV and about 25 seconds duration. Accompanied by low sound.

19, $3^h\ 21^m\ 02^s$ [19, 1: 21: 02 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

19, $23^h\ 56^m$ [20, 7: 56 A. M.] **Aparri, Cagayan.** Oscillatory earthquake of intensity II and five seconds duration.

20, $14^h\ 09^m\ 23^s$* [20, 10: 09: 23 P. M.] **N. Mindanao.** Earthquake felt with intensity IV in Cagayan, Misamis Oriental, and Jimenez, Misamis Occidental.

20, $18^h\ 30^m$ [21, 2: 30 A. M.] **Kaatoan, Bukidnon.** Light earthquake.

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22, $3^h\ 12^m\ 02^s$* [22, 11:12:02 A. M.] **E. Visayas and SE. Luzon.** Center in Samar Sea near Masbate. Very strong in southern Masbate; intensity V in the northern part of the island. Intensity IV in Legaspi and Calbayog. Felt as far north as Atimonan; in northeast Panay, and at Catbalogan to the southeast. Aftershocks felt in Masbate at 8:44 and 9:12 P. M., and at 9:49 A. M. on the 23rd.

25, $13^h\ 46^m\ 42^s$* [25, 9:46:42 P. M.] **San Pablo, Isabela.** Moderate earthquake.

27, $16^h\ 00^m$ [28, 0:00] **Lucban, Tayabas.** Light earthquake.

27, $16^h\ 40^m\ 38^s$* [28, 0:40:38 A. M.] **Camarines Norte.** Oscillatory earthquake of intensity IV in Daet and intensity III in Capalonga.

28, $18^h\ 11^m\ 23^s$* [29, 2:11:23 A. M.] **S. Luzon.** Earthquake centered in eastern Cordillera. Felt sharply at Novaliches. Intensity II at Atimonan, Santa Cruz, Antipolo and Manila. A second light shock felt at Santa Cruz, Laguna, at 2:13 A. M.

29, $19^h\ 36^m\ 48^s$* [30, 3:36:48 A. M.] **Cavite and Batangas.** Earthquake of intensity III felt at Indang, Cavite, and at Ambulong, Talisay and Tanauan in Batangas. Center probably in Verde Island Passage.

30, $6^h\ 51^m$ [30, 2:51 P. M.] **Masbate.** Earthquake of intensity II felt in the island of Masbate. A shock felt at the Mayon Rest House was probably from the same earthquake. Light aftershock felt at 3:00 A. M. and at 2:51 P. M. on October 1st.

INSTRUMENTAL RECORD

No.	Date	Phase	Time	△	Remarks
			h *m* *s*	*Km*	
742	1	iPNEZ	8 50 20	8,500	Compression from SE. 31° S: 179° W; 0=8:38:54 by U. S. C. G. S.
		SNE	9 00 12		
		LNE	15 25ca		
		MN	21 25		
		F	11 40		
743	1	PNE	12 59 24	940	
		SN	13 01 04		
		F	15		
747	1	iPZ	17 54 06	1,920	
		SNE	57 20		
		F	18 45		
750	1	PNEZ	21 53 01	7,845	
		SNE	22 02 22		
		F	23 10		
752	2	$\overline{P}$NEZ	8 30 14	145	Compression. Felt at Santa Cruz, Marinduque.
		$\overline{S}$E	32		
		F	44		
753	2	PNEZ	18 53 28	1,645	Felt in Santa Cruz, Davao.
		SN	56 21		
		LNE	19 00 30ca		
		F	56		
754	3	$\overline{P}$NEZ	6 50 03	128	Probably an aftershock of No. 577.
		$\overline{S}$NE	19		
		F	7 06		
759	3	PNEZ	18 58 22	6,565	Dilatation from NE. 52.5° N: 177.5° W by U. S. C. G. S.
		SNE	19 06 35		
760	3	i$\overline{P}$NEZ	21 10 55	165	Compression. Felt in Central and northern Luzon. No. 759 still recording. $\overline{S}$ from the Wiechert. 16° 05′ N: 121° 05′ E by Baguio and Manila as on March 22, 1931.
		$\overline{S}$NE	11 16		
		F	50		
762	3	P?NEZ	22 43 02	4,555?	Disturbed by microseisms.
		S?NE	49 12		
		F	23 25		
763	4	$\overline{P}$NEZ	2 03 57	160	
		$\overline{S}$NE	04 17		
		F	06		
764	4	ePNEZ	6 24 39	6,245	
		SNE	33 08		
		LN	44 ca		
		MN	49 30ca		
		F	8 30		

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INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
766	4	$\overline{P}$NEZ	23 56 16	220	
		$\overline{S}$NE	45		
		F	0 11		
768	5	$\overline{P}$NEZ	16 52 38	135	Probably aftershock of No. 577.
		$\overline{S}$NE	55		
		F	57		
770	5	iPZ	20 58 20	2,400	Dilatation.
		ePNE	58 20		
		SNE	21 02 18		
771	5	PNZ	21 07 28	250	Felt in northern Luzon. Deeper than normal. No. 770 still recording.
		$\overline{S}$N	08 04		
		F	55		
775	7	$\overline{P}$NEZ	15 06 47	135	Aftershock of No. 577. Felt in Alabat Island.
		$\overline{S}$NEZ	07 04		
		F	15		
776	7	$\overline{P}$NE	15 46 04	128	Aftershock of No. 577. Felt in Manila and E. Luzon.
		$\overline{S}$NE	20		
		F	58		
778	8	iP'$_1$NZ	0 59 04	15.000ca	South Atlantic according to U. S. C. G. S.
		iEZ	1 01 28		
		iNEZ	02 19		
		F	2 45		
780	8	SNE	20 16 00		P lost in microseisms. Butuan, 265 km. Deeper than normal.
		LNE	19 15ca		
		F	50		
783	10	P?N	14 19 29	2,180?	
		SNE	23 04		
		F	15 05		
787	12	P?NEZ	12 00 08	3,245?	
		SNE	04 56		
		F	28		
788	14	$\overline{P}$NEZ	4 21 34	105	
		$\overline{S}$NE	47		
		F	32		
789	14	i$\overline{P}$Z	11 51 50	100	Compression. Deeper than normal.
		e$\overline{P}$NE	50		
		$\overline{S}$NE	52 13		
		F	12 05		
791	14	PEZ	23 49 54	1,925	
		SNE	53 09		
	15	F	0 30		
792	15	iPEZ	12 36 02	5,320	Compression. Felt in Solomon Islands. 10° S: 160° E by Wellington. 9° S: 161° E; 0=12:27:51 by U. S. C. G. S. 8.3° S: 162° E; H=12:27:37, J. S. A.
		iZ	37 55		
		SNE	43 05		
		F	16 15		
794	16	P'$_1$NEZ	0 08 22	15,180	P lost in changing records. 14° N: 92° W; 0=23:48:52 (Sept. 15) by U. S. C. G. S. 14.2° N: 91.6° W; H=24:48:55 by J. S. A.
		SKP	11 54		
		PPN	14 00		
		F	2 20		
797	16	i$\overline{P}$NEZ	18 11 52	140	Compression from SE. Felt in Marinduque Island and S. Luzon. $\overline{S}$ from the Wiechert and Horizontal.
		$\overline{S}$NE	12 10		
		F	19 35		
798	17	i$\overline{P}$Z	4 05 55	110	Dilatation.
		e$\overline{P}$NE	55		
		$\overline{S}$NE	06 07		
		F	14		
799	17	ePNZ	9 50 17		
		iZ	53 41		
		iE	55 06		
		iN	20		
		F	12 20		
800	17	$\overline{P}$NEZ	15 13 17	135	
		$\overline{S}$NE	34		
		F	21		
801	18	iPNEZ	2 12 35	200	
		$\overline{S}$NE	13 01		
		F	17		
807	21	iPZ	7 51 13	2,350	
		SNE	55 00		
		F	9 18		

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
809	21	iPNEZ	9 43 04	1,545	
		iE	44 37		
		iSN	45 48		
		F	12 10		
812	22	iPNEZ	3 12 02	435	Dilatation. 120° 03′ N: 124° 03′ E. Felt in Western Visayas and SE. Luzon.
		SNEZ	55		
		F	5 12		
820	22	PNEZ	22 58 30		
		iz	59 07		
	23	F	0 06		
822	23	ePNEZ	13 13 24	4,300	Probably dilatation. 7° S: 154° E by Wellington. 6° S: 154° E by Riverview and Manila.
		SNE	19 35		
		iE	22 08		
		iN	23 36		
		LNE	25 50ca		
824	23	iz	17 28 17		No. 822 still recording.
		eN	30 16		
		iE	30 18		
		F	18 50		
826	24	PNEZ	5 53 00	2,400	
		SNE	56 51		
		F	6 22		
828	24	eNEZ	9 00 27		
		iN	55		
		iE	01 03		
		F	25		
829	24	$i\overline{P}z$	14 06 08	160	
		$e\overline{P}NE$	08		
		$\overline{S}NE$	28		
		F	17		
830	24	$i\overline{P}NEZ$	16 59 03	125	Dilatation from the west.
		$\overline{S}NE$	19		
		F	53		
834	25	PNE	13 45 03	1,770	
		SEZ	48 05		
		F	14 05		
837	25	iPNEZ	17 47 10	2,680	Dilatation.
		iE	49 42		
		iSNE	51 20		
		iNE	52 14		
		F	19 10		
841	26	$\overline{P}NEZ$	19 56 36	95	
		$\overline{S}NEZ$	48		
		F	20 01		
842	26	$i\overline{P}NEZ$	21 30 02	125	Dilatation from SE. Probably from epicenter of No. 577.
		$\overline{S}NEZ$	14		
		F	47		
843	26	iPz	23 17 31		Compression
		iE	20 15		
		iE	21 52		
	27	F	0 15		
844	27	$i\overline{P}z$	3 38 09	150	Dilatation.
		$e\overline{P}NE$	11		
		$\overline{S}NE$	28		
		F	46		
845	27	iPNEZ	9 00 44	2,810	Data after P from the Wiechert. Compression from SW. Felt in Central Java.
		iN	01 58		
		iE	03 12		
		ix	44		
		SNE	05 14		
		LNE	45ca		
846	27	PNEZ	11 18 02	2,300	No. 845 still recording.
		SNEZ	21 46		
		F	13 17		
847	27	$\overline{P}NEZ$	16 40 38	175	Felt in Camarines Norte.
		$\overline{S}NEZ$	41 00		
		F	17 00		
849	28	$\overline{P}NEZ$	0 58 45	150	
		$\overline{S}NE$	59 04		
		F	1 03		

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
853	28	iPNEZ	13	21	03	1,620	Compression from SE.
		iE		22	17		
		SN		23	51		
		F	14	20			
854	28	$\overline{P}$EZ	18	03	20		
		$\overline{S}$N			32		
855	28	$\overline{P}$NEZ	18	11	23	40	Center east of Manila. Felt slightly in Manila.
		$\overline{S}$EZ			28		
		F		17			
860	29	i$\overline{P}$NEZ	19	36	48	110	Felt in provinces of Cavite and Batangas.
		$\overline{S}$NZ		37	02		
		F	20	00			
861	30	$\overline{P}$Z	6	48	58	300	Felt in Aroroy, Masbate.
		$\overline{S}$NE		49	15		
		F	7	03			
865	30	ePNEZ	21	45	26	9,020	
		SNE		55	38		
		LN	22	14	50cr		
		F	23	20			
866	30	$\overline{P}$NEZ	23	34	02	60	
		$\overline{S}$NEZ			10		
		F		38			

Sixty-six insignificant or undecipherable disturbances on the following days of September: 1st(5), 2nd, 3rd(5), 4th, 5th(3), 6th, 7th(2), 8th, 9th(2), 11th(2), 12th, 14th, 15th, 16th(2), 18th(2), 19th, 20th(2), 21st(3), 22nd(7), 23rd(3), 24th, 25th(5), 26th(3), 27th, 28th(4), 29th(3), and 30th(3).

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OCTOBER, 1937

MACROSEISMIC RECORD

2, 8h 56m 09s* [2, 4:56:09 P. M.] **Aroroy, Masbate.** Light earthquake.

3, 12h 51m 09s [3, 10:51:09 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

4, 7h 04m [4, 3:04 P. M.] **Santa Cruz, Laguna.** Earthquake of intensity II and two seconds duration.

5, 4h 49m 54s* [5, 12:49:54 P. M.] **Iba, Zambales.** Earthquake of intensity II. Center in China Sea.

6, 23h 38m [7, 7:38 A. M.] **Tabaco, Albay.** Slight earthquake.

7, 0h 40m [7, 8:40 A. M.] **Santa Cruz, Laguna.** Earthquake of intensity II. A shock of intensity III was felt at 11:32 P. M. and one of intensity II at 11:34 P. M.

13, 18h 30m [14, 2:30 A. M.] **Kaatoan, Bukidnon.** Light earthquake.

16, 17h 17m [17, 1:17 A. M.] **Aroroy, Masbate.** Light earthquake.

19, 12h 19m [19, 8:19 P. M.] **Laoag, Ilocos Norte.** Earthquake of intensity II.

INSTRUMENTAL RECORD

No.	Date	Phase	Time			△	Remarks
			h.	*m.*	*s.*	*Km.*	
868	1	ePEZ	19	27	59	8,955	29° S: 166° W by Wellington.
		SNE		38	14		
		F	21	20			
871	2	$\overline{P}$EZ	23	49	00	70	
		$\overline{S}$NE			09		
		F		52			
872	3	$\overline{P}$NEZ	19	14	18	160	Baguio, 175 km.
		$\overline{S}$NE			38		
		F		27			
878	4	$\overline{P}$NEZ	19	23	00	150	
		$\overline{S}$NE			19		
		F		28			
881	5	$\overline{P}$NEZ	3	45	14	195	
		$\overline{S}$NEZ			39		
		F		48			
882	5	PNEZ	4	49	54	145	Felt at Iba.
		SNEZ		50	12		
		F		54			
885	6	P'_1Z	10	06	24	14,235	18° N: 99° W; 0=9:47:15 by U. S. C. G. S.
		PPNEZ		08	18		
		F	11	30			
886	6	iPNEZ	17	12	14	1,635	Dilatation from SE. 10° S: 150° E by Strasbourg.
		SNE		15	04		
		F	20	20			
887	7	PNEZ	8	11	08	2,820	Dilatation.
		iN		15	01		
		SE			28		
		F	9	35			
888	8	$\overline{P}$NEZ	5	17	50	150	
		$\overline{S}$NZ		18	09		
		F		24			
890	9	PNZ	18	09	22	7,365	
		SNE		18	16		
		F	19	20			
893	10	PNEZ	20	26	14	6,245	
		SNE		34	02		
		MNE		48	12ca		
		F	21	45			

International Seismological Centre

INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	Δ	Remarks
			h. *m.* *s.*	*Km.*	
896	12	PNZ	21 10 49	3,190	
		SE	15 34		
		F	22 09		
901	20	$\overline{P}$NEZ	6 26 57	75	
		$\overline{S}$NEZ	27 07		
		F	31		
906	22	P?NEZ	16 20 28	3,755?	Disturbed by microseisms.
		MNE	33 ca		
		F	17 00		
907	23	$\overline{P}$NEZ	14 46 08	215	Do.
		$\overline{S}$?NEZ	36		
		F	15 25		
909	23	PNEZ	17 05 00		Felt in N. New Zealand. 37.9° S: 177.8° E by Wellington.
		F	18 07		
910	23	PNEZ	18 25 32	3,270	
		SN	30 22		
		F	19 20		
911	24	PNEZ	11 47 53	8,230	62° N: 150° W; 0=11:36:06 by U. S. C. G. S. 59.7° N: 148.8° W by J. S. A.
		SNE	57 30		
		F	13 02		
912	25	P?NE	7 33 09	9,855?	Disturbed by microseisms.
		SNF	44 01		
		F	8 37		
913	25	iPEZ	10 45 04	8,245	In region of north New Zealand by Riverview and Manila. Same epicenter as No. 909.
		SNE	54 45		
		LN	11 09 41		
		F	12 10		
914	25	$\overline{P}$NEZ	11 14 18	125	
		$\overline{S}$NEZ	34		
		F	18		
915	25	iPZ	23 28 53	5,000	
		ePNE	53		
		SNE	35 29		
	26	F	0 20		
916	26	PNEZ	13 05 47	2,645	
		SNE	09 55		
		LNE	12 20ca		
		F	14 08		
917	26	ePNEZ	19 02 05	2,655	
		SNE	06 14		
		LN	08 30ca		
		F	20 05		
920	27	PNEZ	18 55 09	1,910?	
		iS?N	58 22		
		iz	24		
		F	19 51		
922	28	$\overline{P}$NEZ	1 07 40	160	
		$\overline{S}$NE	08 00		
		F	10		
924	28	PNEZ	15 33 04	1,620	
		SNE	35 52		
		MN	38 46		
		F	16 40		
927	29	PNEZ	7 35 38	4,880	Disturbed by microseisms.
		SNE	42 07		
		LNE	49 15ca		
		F	8 15		
928	30	PNEZ	16 28 07	2,055	
		SE	31 32		
		LE	33 30ca		
		F	47		

Thirty-two insignificant or undecipherable disturbances on the following days of October: 1st, 2nd(2), 4th(7), 5th(2), 8th, 10th(2), 11th(2), 17th, 18th(3), 20th, 21st(2), 22nd, 23rd, 27th(2), and 28th(4).

International Seismological Centre

NOVEMBER, 1937

MACROSEISMIC RECORD

5, 2h 35m 23s* [5, 10:35:23 A. M.] **N. Luzon.** Oscillatory earthquake of intensity III at Aparri, and intensity II at Laoag and Calayan.

7, 3h 57m 13s [7, 1:57:13 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

12, 3h 11m [12, 11:11 A. M.] **Basco, Batanes.** Earthquake of intensity II and three seconds duration.

14, 11h 17m 57s [14, 9:17:57 P. M.] **Agaña, Guam.** Earthquake recorded and perceived.

14, 19h 16m 31s* [15, 3:16:31 A. M.] **Dagupan, Pangasinan.** Oscillatory earthquake of intensity III and nine seconds duration.

14, 23h 52m 58s* [15, 7:52:58 A. M.] **Batanes.** Earthquake of intensity II in Basco and Calayan.

27, 1h 14m 38s* [27, 9:14:38 A. M.] **Baganga, Davao.** Oscillatory earthquake of intensity II and four seconds duration.

28, 7h 04m 16s* [28, 3:04:16 P. M.] **SW. Luzon.** Felt lightly in Manila and Ambulong.

29, 5h 07m 31s* [29, 1:07:31 P. M.] **N. Luzon.** Felt with intensity III at Calayan and intensity II at Aparri.

29, 18h 35m 56s* [30, 2:35:56 A. M.] **E. Luzon.** Felt with intensity III at Santa Cruz and Atimonan, and intensity II at Infanta, Lucban and Tayabas.

INSTRUMENTAL RECORD

International Seismological Centre

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
930	2	PNEZ	11 02 19	4 420	Conspicuous group of about 16 seconds period waves on N–S component from 11:15 to 11:24.
		SNE	08 22		
		SSN	10 55		
		F	12 30		
933	3	iPNEZ	5 27 00	2 600	Dilatation.
		SNE	31 04		
		F	50		
934	3	PNEZ	8 28 36	2,265	
		SNE	32 18		
		F	45		
941	5	PNEZ	2 35 23	420	Felt at Calayan and in N. Luzon.
		SNEZ	36 14		
		F	3 10		
942	5	iPZ	9 33 19	2,560	
		ePNE	19		
		iNE	35 11		
		SNE	37 21		
		iN	38 04		
		iE	39 13		
		F	10 30		
943	5	$\overline{P}$Z	23 13 13	170	
		$\overline{P}$NE	15		
		$\overline{S}$NE	34		
		F	30		
947	9	P?NEZ	6 29 08	1,700?	Disturbed by microseisms.
		SNE	32 04		
		LNE	33 35ca		
		F	7 07		
949	13	iPZ	10 02 06	8 600	Dilatation.
		ePNE	06		
		iPR$_1$NZ	06 04		
		SNE	12 10		
		F	13 15		
950	13	PNZ	18 05 24	8 520	
		SNE	15 18		
		F	19 35		
954	14	iPNEZ	11 06 47	5 670	Compression. Data after P from Wiechert and Horizontal. 36.5° N: 70.5° E; H=10:58:12; h=220 km. by Strasbourg. 35.2° N: 72.8° E; H=10:58:05; h=250 km. by J. S. A.
		SNE	14 09		
		LN	27 16		
		F	14 10		
955	14	$\overline{P}$EZ	15 40 33	145	
		$\overline{S}$NEZ	51		
		F	46		
956	14	$\overline{P}$EZ	18 47 47	85	
		$\overline{S}$NE	58		
		F	52		
957	14	$\overline{P}$NEZ	19 16 31	150	Felt at Dagupan.
		$\overline{S}$NEZ	50		
		F	26		
960	14	PEZ	23 52 58	520	Felt at Basco and Calayan.
		SEZ	53 59		
	15	F	0 40		
962	15	$\overline{P}$NE	13 52 06	165	From the Wiechert.
		$\overline{S}$NE	27		
		F	58		
963	15	PNEZ	21 45 33	5,135	35° N: 82° E; 0=21:37:00; h=200 km. by U. S. C. G. S.
		SNEZ	52 17		
		LNE	59 ca		
		MNE	22 03 ca		
		F	23 27		
964	17	$\overline{P}$NEZ	11 07 33	95	
		$\overline{S}$NE	45		
		F	13		
970	23	iPZ	14 01 12	3,100?	
		ePNE	12		
		S?N	05 51		
		L?N	08 25		
		F	15 06		

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INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s.*	*Km.*	
972	25	PNZ	0 57 03	3,030?	Disturbed by microseisms.
		S?E	1 01 37		
		F	54		
973	25	P?NEZ	4 54 04	3,790?	Do.
		SE	59 30		
		LN	5 03 10		
		F	35		
974	25	PNEZ	5 37 23	1,280	
		SNE	39 36		
		MN	42 00		
		F	6 35		
975	26	iPZ	10 47 33	1,445	Dilatation.
		ePNE	33		
		SNEZ	50 03		
		F	12 50		
977	27	PNE	1 14 38	1,155	Felt at Baganga. Center in Philippine Deep.
		SNE	16 38		
		F	24		
979	28	$\overline{\text{iP}}$Z	0 57 39	150	Compression from SW.
		e$\overline{\text{P}}$NE	39		
		$\overline{\text{S}}$NE	58		
		F	1 40		
980	28	$\overline{\text{iP}}$Z	4 54 03	150	Do.
		e$\overline{\text{P}}$NE	03		
		$\overline{\text{S}}$NEZ	22		
981	28	$\overline{\text{P}}$NEZ	4 57 28	150	No. 980 still recording.
		$\overline{\text{S}}$NE	47		
		F	5 15		
982	28	PNEZ	5 29 47	4,680	
		SNE	36 04		
		LNE	42 30ca		
		F	8 30		
983	28	$\overline{\text{P}}$NEZ	6 35 45	150	No. 982 still recording.
		$\overline{\text{S}}$NEZ	36 04		
984	28	$\overline{\text{P}}$NEZ	7 04 16	150	No. 982 still recording. Felt very slightly in Manila and SW. Luzon.
		$\overline{\text{S}}$NEZ	35		
986	28	$\overline{\text{P}}$NEZ	15 49 44	150	
		$\overline{\text{S}}$NEZ	50 03		
		F	16 00		
987	28	$\overline{\text{P}}$NEZ	17 56 59	150	
		$\overline{\text{S}}$NEZ	57 18		
		F	18 03		
989	29	PNEZ	5 07 31	560	Felt at Calayan and Aparri.
		SNE	08 36		
		F	24		
990	29	$\overline{\text{P}}$NEZ	18 35 56	100	P in minute gap. Felt in provinces of Laguna and Tayabas.
		$\overline{\text{S}}$NZ	36 09		
		F	44		
991	30	iPEZ	0 46 45	7,180?	Compression. 5° N: 90° E by Strasbourg.
		iE	48 56		
		iZ	50 04		
		iE	52 40		
		S?NE	55 28		
		F	2 35		
992	30	iPZ	13 10 20	9,270	Compression.
		ePNE	20		
		SNE	20 48		
		F	15 10		
993	30	$\overline{\text{P}}$NEZ	23 03 02	95	Dilatation.
		$\overline{\text{S}}$NEZ	14		
		F	06		

Twenty-nine insignificant or undecipherable disturbances on the following days of November; 2nd(3), 3rd, 4th(3), 5th(2), 6th, 7th(2), 12th, 13th, 14th(4), 15th, 17th, 18th(2), 20th, 22nd, 24th, 26th, 27th, and 28th(2).

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DECEMBER, 1937

MACROSEISMIC RECORD

1, 19h 57m 34s* [2, 3:57:34 A. M.] **N. Luzon.** Oscillatory earthquake of intensity III at Aparri and intensity II at Laoag.

4, 2h 48m [4, 10:48 A. M.] **Ormoc, Leyte.** Oscillatory earthquake of intensity II.

7, 3h 25m [7, 11:25 A. M.] **Masbate, Masbate.** Earthquake of intensity III.

7, 23h 16m 40s* [8, 9:16:40 A. M.] **Agaña, Guam.** Earthquake recorded and perceived.

12, 1h 25m 29s* [12, 9:25:29 A. M.] **Santa Cruz, Laguna.** Earthquake of intensity III. Also felt at San Pablo.

16, 8h 30m [16, 4:30 P. M.] **Jolo, Sulu.** Earthquake of intensity II and five seconds duration. Another shock at 4.31 of intensity III.

16, 11h 52m 58s* [16, 7:52:58 P. M.] **Bongabon, Nueva Ecija.** Light earthquake of three seconds duration.

16, 18h 26m 16s* [17, 2:26:16 A. M.] **Virac, Catanduanes.** Oscillatory earthquake of intensity V and twelve seconds duration. Aftershock of intensity III.

19, 7h 36m [19, 3:36 P. M.] **Butuan, Agusan.** Very light earthquake of short duration.

26, 22h 58m 16s* [27, 6:58:16 A. M.] **NW. Luzon.** Epicenter in China Sea. Oscillatory earthquake of intensity III at Laoag and intensity II at Vigan.

29, 12h 55m [29, 8:55 P. M.] **Ormoc, Leyte.** Oscillatory earthquake of intensity II and fifteen seconds duration.

INSTRUMENTAL RECORD

International Seismological Centre

No.	Date	Phase	Time	Δ	Remarks
			h. *m.* *s.*	*Km.*	
995	1	PNEZ	19 57 34	470	Felt in northern Luzon.
		iNE	36		
		SNE	58 30		
		F	20 09		
996	2	$\overline{P}$NZ	6 34 42	165	
		$\overline{S}$NE	35 03		
		F	50		
1002	6	P?NEZ	4 41 46	4,190?	Disturbed by microseisms.
		S?NE	47 34		
		F	5 35		
1004	8	iPNZ	8 34 14	1,300	Dilatation. Felt in all Formosa. 23.2° N: 121° E by Taihoku. S from the Wiechert.
		ePE	14		
		SNE	36 35		
		F	11 20		
1005	8	PNEZ	16 54 56	3,265	
		SN	59 46		
		F	17 25		
1008	8	iPZ	20 40 54	1,180	Compression.
		ePNE	54		
		SN	42 56		
		F	22 10		
1007	8	PNZ	23 33 40	2,610	E–W cylinder stopped at 23:24.
		SN	37 45		
		LN	40 ca		
	9	F	0 25		
1012	10	PNEZ	13 35 39	5,080	
		iz	40 15		
		SNE	42 20		
		MNE	53 15ca		
		F	15 25		
1018	12	$\overline{P}$NEZ	9 47 41	150	
		$\overline{S}$E	48 00		
		F	10 00		
1019	13	iPZ	18 55 56	890	Compression. Felt in all Formosa.
		iPN	58		
		ePE	58		
		SNE?	57 30		
		F	21 00		
1020	14	PNEZ	8 06 26	245	
		$\overline{S}$NEZ	07 00		
		F	14		
1022	16	iPNEZ	8 31 34	1,245?	Dilatation. Felt at Jolo.
		S?NE	33 43		
1023	16	P?NEZ	9 41 24	4,410?	No. 1022 still recording.
		S?NE	47 26		
		F	10 09		
1024	16	$\overline{P}$NEZ	11 52 58	110	Felt at Bongabon, Nueva Ecija.
		$\overline{S}$NE	53 12		
		F	58		
1025	16	iPEZ	18 26 16	420	Dilatation. Felt at Virac. S and $\overline{S}$ from the Wiechert.
		ePN	16		
		SNE	27 07		
		$\overline{S}$N	20		
		F	20 08		
1027	17	PNEZ	4 32 32	4,235	
		SNE	38 22		
		LNE	43 40ca		
		F	5 42		
1028	17	PNEZ	9 34 19	910	Compression. Felt in whole of Formosa.
		SNE	35 56		
		F	12 10		
1032	18	ePNEZ	13 27 02	5,555	
		SNE	34 18		
		iE	34 23		
		F	15 10		
1035	20	PEZ	3 43 29	4,700?	Disturbed by microseisms.
		S?NE	49 48		
		iN	51 42		
		iE	52 58		
		F	4 35		
1036	20	PNEZ	22 43 05	4,880	Do.
		SNE	49 34		
		F	23 25		

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INSTRUMENTAL RECORD—Continued

No.	Date	Phase	Time	△	Remarks
			h. *m.* *s*	*Km.*	
1037	22	PNZ	3 58 26		17° N: 106° W; 0=3:37:17 by U. S. C. G. S. 17.2° N: 105.7° W; H=3:37:15 by J. S. A.
		F	5 40		
1038	22	PNEZ	20 52 47	430	
		SEZ	53 39		
		F	21 07		
1039	22	PNEZ	23 55 34	3,610	
	23	SNE	0 00 46		
		F	17		
1041	23	iP'EZ	13 37 15	14,500	Dilatation. 15.5° N: 98.5° W; 0=13:17:56 by U. S. C. G. S.
		PPNEZ	39 25		
		SKP	40 02		
		LNE	14 22 ca		
		F	18 10		
1043	24	eP'EZ	6 40 58	18,155	10.5° S: 75.5° W; 0=6:20.7 by U. S. C. G. S.
		SKP	44 16		
		PP	45 22		
		F	8 48		
1044	21	$\overline{P}$EZ	16 42 17	140	
		$\overline{S}$NE	35		
		F	49		
1045	25	iPNEZ	1 15 03	2,780	P in minute gap.
		SNE	19 20		
		F	2 25		
1046	25	PNE	10 03 08	5 235	
		SNE	09 58		
		MNE	19 ca		
		F	11 02		
1049	25	PNEZ	21 25 29	4,155	
		SN	31 15		
		F	22 15		
1050	25	$\overline{P}$NEZ	23 31 55	180	
		$\overline{S}$NE	32 16		
		F	36		
1051	26	$\overline{P}$NEZ	4 35 22	180	
		$\overline{S}$NE	45		
		F	45		
1052	26	PNEZ	22 58 16	300	Felt in northwestern Luzon.
		SNEZ	57		
		F	23 10		
1053	28	iPNZ	3 14 31	2,745	Dilatation. E–W component defective.
		SN	18 46		
		iN	24 46		
		F	4 20		
1054	28	iPZ	6 39 02		Dilatation. Region of 1° N: 28° W; 0=6:19.5 by U. S. C. G. S.
		ePN	02		
		F	8 20		
1056	29	iPZ	0 29 55	2,640	Dilatation. E–W component out of order.
		ePN	55		
		SN	34 12		
		F	45		
1064	31	$\overline{P}$NEZ	7 16 44	145	
		$\overline{S}$NE	17 02		
		F	32		
1065	31	PPEZ	18 02 54	14,600	15° N: 98° W; 0=17:41.2 by U. S. C. G. S.
		iE	10 57		
		F	19 50		

Thirty-five insignificant or undecipherable disturbances on the following days of December: 1st, 2nd, 3rd(2), 4th, 5th. 8th, 9th(2), 10th(4), 12th(3), 15th, 17th(3), 18th(2), 19th, 23rd(2), 25th(2), 28th, 29th(4), and 30th(3).

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THE ALABAT EARTHQUAKE OF AUGUST 20th, 1937

THE EPICENTER, TIME AND DEPTH OF FOCUS

In order to determine the epicenter of the earthquake our first step was to examine the seismogram of the station at Butuan, Mindanao. Under normal conditions this should have been a good record, but Butuan can not be said to afford normal conditions. The town is located on the alluvial land of the Agusan river and hence gives a very unsatisfactory foundation for a seismograph. Instead of showing the seismic phases clearly the pens were thrown into wide oscillations from the very beginning which made the interpretation of the record very difficult. In view of this we measured the distance from Butuan to the region of Alabat Island and thus ascertained what approximate phase interval should be looked for on the Butuan seismogram. In this way we located what might be taken as the beginning of the S—Phase and its time after "P" was measured. The resulting time interval indicated a distance of 670 kilometers and with this radius we drew an arc on the map near Alabat Island. We next took up the seismogram of Baguio. The seismograph at Baguio is situated in a satisfactory place. It stands on limestone and is not subject to spurious vibrations. It so happens that the two components of this seismograph were oriented most favorably for the quake of August 20th. One component is pointed in NW–SE direction, i. e., towards the epicenter; and the other is pointed in a NE–SW direction, i. e., at right angles to the direction of the epicenter. As a result of this orientation, the longitudinal wave gave a very strong impulse to the NW–SE component. The transverse waves, on the other hand, gave their strongest motion to the other component, i. e., the NE–SW and this motion was so strong that the pen of this component was dislocated. We assumed that the time of this dislocation was the time of beginning of the secondary phase and its time interval after the beginning of the longitudinal phase denoted a distance of 280 kilometers. With this distance as a radius we drew another arc in the region of Alabat Island. These two arcs do not determine the position of the epicenter exactly, but they might be taken as indicating the limits within which it is located. We consider this a very satisfactory result in view of the conditions involved in reading the seismograms of Butuan and Baguio. The arcs which we have drawn are each only about twelve kilometers from the epicenter as finally determined.

We next turned our attention to the seismograms of Manila. First the Galitzin–Wilip. There are three components to this set, N–S and E–W for horizontal motion, and the third for vertical motion. These are intended primarily to record long distance earthquakes and are much too sensitive for local shocks. These record photographically and within one second after the beginning of the record the light spots were moving so rapidly that they did not affect the photographic paper. Nevertheless, when the very beginning of the first motion is simultaneous on the three components and can be perceived, as happened in this earthquake, we can determine the direction from which the shock came. The records showed that the shock came from southeasterly direction but in the present instance this is merely a confirmation of what we know from actual reports. The vertical component remained in operation but the

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oscillation of the galvanometer was so rapid that the light spot did not produce a perceptible record until one hour after the beginning of the earthquake. The N–S component lamp was jolted out of adjustment and remained so until the following morning.

The suspension hinges of these pendulums are strips of extremely thin steel and the bottom suspension hinge of the E–W component was broken by the force of the shock. However, the light spot remained on the paper and the galvanometer, which has a very delicately suspended coil, reacted to the aftershocks of the earthquake and from this record we were able to ascertain the number of aftershocks between 8:00 P. M. on the 20th and 8:00 A. M. on the 21st. They were 49 in number. The times could be determined only approximately because the clocks of the observatory had been broken or stopped by the earthquake.

The next seismograms were those of the Wiechert Inverted Pendulum. We learned nothing from these about the first shock because the pens were dislocated a few seconds after the beginning of the first motion.

The next seismograms were those of the Horizontal Pendulums. These each have a mass of 113 kilograms but of quite different magnification. The one which is oriented for NNW–SSE motion has a magnification of approximately 20 and the pen of this component was dislocated about ten seconds after the beginning of the motion. This was due to strong impulses in the longitudinal phase. The other Horizontal Pendulum component is oriented for motion in a ENE–WSW direction and has a magnification of only two. The pen of this component remained in operation throughout the earthquake, although for about ten minutes the pendulum bumped against the arresting screws.

On this record we were able to measure approximately the time interval between the first and second preliminaries and obtained a distance of 130 kilometers, more or less. The first strong aftershock which occurred about 8:20 P. M. gave a more legible record and this gave us a quite definite distance of 125–130 kilometers. On the strength of this observation we drew an arc at a distance of 130 kilometers from Manila and placed the epicenter of the earthquake on this arc about half-way between the arcs of Baguio and Butuan. This position is 14° 10′ N and 122° 05′ E.

Many of the aftershocks as recorded on the Galitzin–Wilip seismometers during the next few days could be measured with satisfactory accuracy and gave three different distances, around 120, 128 and 135 kilometers. On the basis of these distances and the general trend of the structural features of this region, we have drawn a fault line of limited extent through the epicenter with a NW–SE trend.

Dr. Feliciano of the University of the Philippines suggests the existence of a fault along the east side of Alabat Island. An examination of the Coast and Geodetic Survey chart seems to confirm this suggestion. The east side of the island is mountainous, the peaks rising to a maximum of 1,100 feet, with the eastern face apparently steep. The western side of the island is much lower. The water between the island and the mainland shows depths of 40–50 fathoms while that on the other side is 60–70 fathoms deep. The west side of the island has a sloping shelf while deep water comes close up to the eastern side. The east side of the island is probably a fault plane dipping to the northeast and we may assume that movement on this plane was the cause of the earthquake.

We judge this earthquake to have been of normal depth from the reports which we have received up to the present from Hongkong; Phulien; Zikawei Observatory in Shanghai; Riverview College in Sydney, Australia; Ksara in Syria and some stations in the United States. If the earthquake had been deeper than normal the longitudinal waves would have arrived at those stations considerably earlier than the normal time.

International Seismological Centre

Reports show that they arrived on time at Phulien; three seconds early at Zikawei; four seconds early at Hong Kong and fourteen seconds late at Riverview. These results do not indicate a deep focus.

The records of the Galitzin–Wilip seismometers indicated that the shock arrived at Manila from a southeasterly direction. They also indicated something else. Since the earthquake waves are elastic waves, the first impulse will commence with either a compression or dilatation, i. e., a motion away from, or a motion towards, the epicenter. In this earthquake the first motion, very small, was a dilatation, i. e., towards the epicenter. The first at Baguio was a compression, i. e., a motion away from the epicenter.

If we had a network of seismic stations covering the Islands, as there is in Japan, we would probably be able to learn something definite about the mechanism of the earthquake from the first motions. In the present case, with only two observations we can only suggest what possibly took place. Since we have some evidence of a fault in a NW–SE direction it would seem possible that Manila's first motion was caused by motion on the SW side of the fault and Baguio's first motion by movement on the NE side of the fault.

This suggests an elastic rebound phenomenon as postulated by Reid for the San Francisco earthquake. That means a differential movement of earth blocks causing a strain at the fault with a release and spring back when the stress became great enough to overcome the friction on the fault plane. In our present case there would seem to have been a slight vertical component in the motion because of the disturbance of the sea. A purely horizontal shift at the sea bottom would not set up a wave. We wish to emphasize that this explanation of the motion at the center is a sugestion of the nature of the earthquake. Our material is too scanty to justify a positive statement.

INTENSITY

The intensity in the island of Alabat, practically at the epicenter, may safely be given as VIII, and possibly IX, R–F scale. The macroseismic reports which were sent in by the meteorological observers were too inconsistent to allow the drawing of isoseismal lines. The intensity in Manila was VII, R–F scale and as Manila was 130 kilometers from the epicenter we may assume that distance as the approximate radius of one isoseismal line. The motion was perceptible at Laoag, 475 kilometers to the NNW and at Iloilo 400 kilometers to the SSE. Several weeks after the earthquake reports were received that it had been felt at two points in Mindanao but it appears very doubtful that it could have been felt so far away without being noticed at intermediate distances.

DURATION

The writer, who was away from Manila at the time of the earthquake, made a number of inquiries to ascertain the duration of the perceptible motion in Manila. Mr. C. Dulueña who has been in the Weather Bureau since 1890 and has considerable experience in the observation of earthquakes stated that the strongest part of the quake lasted about forty seconds and that there was perceptible motion for about four minutes. Everyone else whom the writer questioned seemed to have been too thoroughly frightened or dazed to have given any thought to timing the earthquake.

EFFECTION THE SEA

The water is said to have risen at the town of Quezon at the south end of Alabat Island. This town is practically on Calauag Bay at the head of which there was a rise

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in the sea-level. The people of the town of Calauag, at the head of the bay, reported that the water rose from low to high tide level in the space of about ten minutes. Some persons who were ascending the Calauag river in bancas were surprised at the rapid progress they made, not knowing that they were being pushed upstream by a wave.

DAMAGE AND EFFECTS

(Press Reports)

Manila water main.—A 36″ water main broke in the Santa Ana section of the city. A 16″ main on Ayala Bridge broke. An 8″ main at Pier No. 3 and No. 5 broke and flooded a warehouse damaging several hundred sacks of flour.

Buildings.—The outstanding loss was the Heacock building, erected in 1928 at a cost of ₱950,000. It was so badly cracked and damaged that the City Engineer ordered its demolition. The upper floors overhung the first floor givin a cantilever effect and there was lack of bracing in the first floor. This floor had been designed to give a large open space with no obstruction except the column. The column capitals crushed when the building rocked. The building was covered by insurance.

Cracks were produced in the Insular Life building, the Philippine National Bank, in the Grand Theater, in the church of San Francisco, in the Great Eastern Hotel, in two concrete arches in the Army and Navy Club and in the cupola of the stairway in the monastery of San Augustine. No doubt there were many others which were not reported.

The Great Eastern Hotel seems to have settled a few inches and the elevators jammed during the earthquake. There were some minor cracks and dislodged plaster in the Bayview and Luneta Hotels. Some of the tile floor was loosened in the kitchen of the Army and Navy Club and a water pipe was broken. The kitchen floor of the American Y M C A dropped several inches. A crack twelve feet long appeared in the lobby of the University Club. Some cracks appeared on the second floor of the Law Building of Santo Tomas University. The vault of the City Treasurer was cracked. Some stones fell from the tower of the Recoleto church. The tower of the Pandacan church collapsed. The Ermita elementary school was condemned. Two factories were closed by order of the city authorities and damage of various degrees was reported from 33 private houses. Ten city schools were slightly damaged but the total cost did not exceed ₱1,500 according to the Assistant Superintendent of City Schools.

Miscellaneous damage.—A crack appeared in Dewey Boulevard but did not stop the traffic. Cracks in the concrete railings of the Arlegui Bridge. Show windows were broken in the Heacock Building, Estrella del Norte, the Philippine National Bank, the People Shoe, and some on Rizal Avenue. Bookstacks in the National Library overturned. A crane was derailed on Pier 7.

DAMAGE IN THE PROVINCES

Bulacan.—The ceiling of the convento of San Miguel church and the front wall of the Municipal building cracked.

Cavite.—Several old buildings in the town of Cavite were cracked; a building on Calle Colon collapsed; some piers in the Navy Yard cracked; one wall of a house in the Navy Yard collapsed. Some cracks appeared in the walls of the churches at Mendez Nuñez and Silang. The latter church is about 300 years old.

Rizal.—At Caloocan the municipal building and church suffered some cracks. The municipal building at Morong sustained some cracks. One exterior edge from roof to ground of one transept of the church at Antipolo collapsed. Some damage was sus-

International Seismological Centre

tained by the churches in the following towns: Teresa, Pililla, Taytay, Tanay, Baras, Morong, Mariquina and Pasig. The churches at Antipolo, Taytay and Morong are some 300 years old.

Camarines Sur.—Some walls of the Abella building in Naga collapsed. The Manila Railroad water tank having a capacity of 65,000 gallons crushed its tower. Some smaller tanks at other places which were filled at the time were overturned. Tanks which were empty or nearly so were not damaged.

Laguna.—The constabulary building in Santa Cruz was damaged and the vault of the church was cracked. The provincial telephone lines were broken. The Manila Railroad water tank at Panaon collapsed. The bridge at Siniloan was damaged. The walls were cracked in the market and in the municipal building of Pagsanjan. Considerable loss in coconuts will result from unripe nuts being shaken from the trees. It is said that there is an injurious effect on the trees from which they do not recover for several years.

Tayabas.—The town of Polillo reported that damage had been sustained there to the amount of ₱5,000. The sea wall at Mauban was damaged. The water system of Tayabas and Atimonan suffered some damage. A total of ₱50,000 damage was estimated in Atimonan. Some houses were damaged in the towns of Sariaya, Lucban and Lucena. In the island of Alabat nearly all of the houses were tilted or slightly damaged.

DIOCESE OF LIPA

Bishop Alfredo Verzosa compiled the following report of damage to the churches of the diocese of Lipa, which includes the provinces of Batangas, Laguna and Tayabas.

Church of Santa Maria (destroyed completely)	₱15,000.00
Church and convent of Paete (destroyed completely)	45,000.00
Church and convent of Pangil (damaged to the extent of)	8,000.00
Church of Famy (destroyed completely)	10,000.00
Convent of Pakil (destroyed completely)	20,000.00
Tower of Gumaca (destroyed completely)	20,000.00
Tower of Atimonan (damaged to the extent of)	2,000.00
Tower of Santa Cruz, Laguna (damaged to the extent of)	2,000.00
Church of Cavinti (damaged to the extent of)	4,000.00
Church of Lumbang (damaged to the extent of)	1,000.00
College of Atimonan (damaged to the extent of)	4,000.00
Other edifices damaged to the extent of	2,000.00
Total	₱133,000.00

AFTERSHOCKS

Earthquakes were felt on the island of Alabat almost unceasingly during the night of the 20th. The town of Mauban reported fifteen shocks between 8:00 P. M. on the 20th and 5:00 A. M. on the 21st. Eleven aftershocks during the night of the 20th were felt on Polillo Island. The seismographs in Manila recorded one hundred and twenty-three aftershocks which could be attributed to the Alabat earthquake with a high degree of certainty.

PERSONAL INJURIES

At least two persons died of heart failure caused by fright. The hospitals of Manila reported a total of forty-one persons treated for minor injuries. The Province of Laguna reported the minor injury of thirty-two persons and in the island of Alabat thirty-seven were slightly injured.

International Seismological Centre

NUMBER OF EARTHQUAKES FELT IN THE PHILIPPINES, FROM 1903 TO 1937

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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

NUMBER OF SEISMIC DISTURBANCES RECORDED AT MANILA, FROM 1903 TO 1937

Year	Jan.	Feb.	Mar.	Apr.	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	14	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

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