

M A N I L A , P . I .

## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.

 $\phi=14^{\circ} 34' 42''$  N. $\lambda=120^{\circ} 58' 41''$  E.

h=3 m.

Alluvium.



CONSTANTS OF THE WIECHERT  
INVERTED PENDULUM.  $M\pm=955$  Kg.  
January 1, 1937.

	$T_1$	$T$	$\mu^2$	$V_s$
N-S	12.6	12.0	0	400
E-W	11.8	11.9	.08	229
Z	11.6	9.0		

	$T_0$	$V$	$\epsilon$	$\frac{F}{T_0^2}$
N-S	4.2	196	2.5	0.076
E-W	4.4	271	3.0	0.062

Cf. Theoretical Seismology,  
Sohn, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1937 Jan. No. 1 1st	PNEZ SNE F	9 19 16 20 22 46	580	Felt at Tacloban and Guiuan with intensity IV.
No. 3 1st	PNEZ SNE iE F	15 54 10 55 02 11 16 16	430	
#4 4th	ePZ ePE SNE F	22 52 50 53 57 03 23 55	2720	
#5 5th	PNEZ SNE LNE F	0 00 00 04 08 06 40ca 1 15		Deep focus. Distance less than 2500 KM.
#6 5th	PNEZ SNEZ F	4 51 30 55 42 6 05	2780	Deep focus.
#8 5th	PNEZ S?NZ F	11 13 23 15 30 12 15	1150?	North Riu-Kiu Islands according to Chiufeng.
#10 5th	PNEZ SNEZ F	21 42 29 46 27 23 20	2400	Compression from NE. 32°N; 133.5E by Chiufeng.
#13 7th	PNEZ SNEZ F	6 18 13 23 14 7 45	3445	Disturbed by microseisms.
#14 7th	1PNEZ SNE F	13 26 45 31 33 17 25	3245	Compression from NW. Disturbed by microseisms. 35.5N; 97.5E by U.S.C.G.S.

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## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 Jan.				
#15 7th	PNEZ SNE F	17 56 21 18 01 50 30	3890	Disturbed by microseisms.
#18 15th	PNEZ SNE F	5 14 11 18 11 6 15	2535	
#26 22nd	1PZ ePNE SNEZ F	2 08 54 54 09 16 18	175	Compression. Felt slightly in Manila. Baguio, 260 Km.
#27 22nd	PNZ SNEZ LN F	4 33 09 39 33 45 50ca 5 30	4790	
#28 23rd	1PEZ ePN 1Z SNE F	11 05 11 11 05 31 08 53 14 20	4090	Compression.
#30 25th	1SNEZ S?NE LNE F	6 42 46 49 35 7 00 ca 10 20	5080	Compression. Data after P from the Wiechert. 5°S; 165°E according to Chiufeng.
#33 26th	PZ 1?NE F	7 11 20 15 18 8 30		Disturbed by microseisms. Felt in Guam.
#36 27th	PNEZ SNE F	3 58 53 4 03 17 45	2880	Disturbed by microseisms. Felt in Guam.
#37 27th	PNZ SNE F	5 45 11 49 50 6 53	3100	Disturbed by microseisms. Felt in Guam.
#38 27th	PNEZ SNEZ F	20 22 01 23 09 37	595	P in minute gap. Felt in Cuyo Island and at Kabankalan, Negros.
#41 29th	PNEZ SNE LNE F	14 11 03 13 43 15 00ca 55	1545	Felt in northeastern Formosa.
#42 29th	PZ SNE 1N F	17 30 46 36 45 42 18 50	4370	

# 3.

January, 1937.

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## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks
1937 Jan. #43 29th	PNEZ SNE F	21 20 41 25 45 22 05	1800	
#44 30th	PNEZ SNE F	1 17 37 20 44 43	1835	
#45 30th	iPZ ePNE SN LNE F	6 29 35 55 33 44 35 55ca 7 55	2655	Felt in Guam.

Twenty-one insignificant or undecipherable disturbances on the following days of January: 1st, 5th(2), 6th(2), 12th(2), 16th(3), 17th, 18th, 20th, 21st, 24th, 25th(2), 26th, 27th, and 28th(2),

MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY



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

CONSTANTS OF THE GALITZIN-WILIP.

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

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

	$T_0$	$V$	$\epsilon$	$\frac{\epsilon^2}{T_0^2}$
N-S	4.8	147	2.3	0.065
E-W	4.5	250	2.9	0.063

Cf. Theoretical Seismology, Schou, S.J.

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

## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
#62 12th	PNE	4	59	12	2480	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. Long period waves in N Component from 9:49 to 9:44.
	SNE		23	42		
	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 Ma- nila, Baguio, 95 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. 45° N; 148° E; 0=7:02:40 by U.S.C.G.S.
	SNE		16	24		
	LNE		22	40ca		
	F					
#76 21st	PNEZ	10	59	36	5610	#75 still recording. Disturbed by mi- croseisms.
	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	46	1200	Compression?
	SN		51	00		
	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	0	36	02	145	Dilatation from NW. Felt slightly in Manila. About 17° 45' N; 110° 45' E by Manila and Baguio.
	PNE			02		
	SNE			20		
	F	10	22			
#85 22nd	PNEZ	13	31	20	4300	
	SNE		37	20		
	F	15	15			

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## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 Feb. #87 23rd	PNE SNE F	0 14 34 19 04 53	2980	
#88 23rd	PNEZ SNE L?N F	0 55 39 1 01 43 09 51 3 25	5645	Compression.
#92 24th	PNEZ SNE F	15 54 12 58 08 16 20	2355	
#94 25th	PN SNE LNE F	20 01 30 05 38 09 50ca 45	2520	
#96 26th	PNEZ SNE F	16 55 48 56 13 17 11	185	Compression. Felt at Echague with intensity III. In the northern part of Nueva Vizcaya province.
#98 27th	PNEZ SNE F	1 21 37 27 34 2 07	4335	
#99 27th	1PZ ePNE iSNEZ iN F	14 46 46 46 50 46 53 15 50	2535	Deep focus.

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(5), 22nd, 23rd(3), 24th, 26th(2), 27th, and 28th.

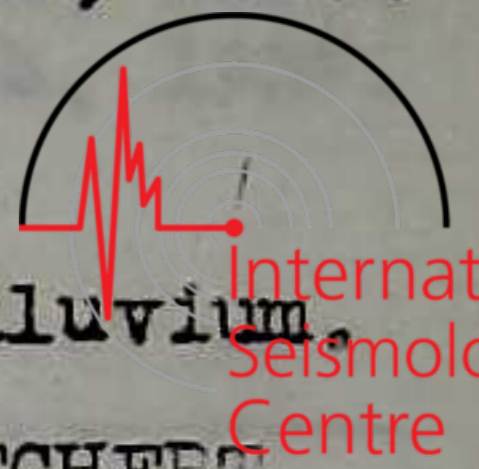
MANILA, P. I.

$\phi = 14^{\circ} 34' 42''$  N.

$\lambda = 120^{\circ} 58' 41''$  E.

h=3 m.

Alluvium.



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

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

	$T_0$	V	$\epsilon$	$\frac{F}{T_0^2}$
N-S	4.2	189	2.5	0.081
E-W	4.3	255	2.9	0.079

Cf. Theoretical Seismology,  
Schoen, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 March #102 2nd	PNEZ SE F	11 54 36 56 03 12 30	850	
#103 2nd	PNEZ SNEZ F	20 20 51 22 35 21 55	975	Felt at Pasco with intensity III.
#104 2nd	PNEZ SNEZ F	22 52 04 54 12 23 20	1235	
#111 5th	PNEZ SNE F	13 22 26 25 00 14 10	245	
#113 6th	PNEZ SNE F	1 29 18 30 52 2 08	880	
#116 8th	ePNEZ SNEZ F	21 21 57 22 07 32	80	Felt at Infanta with intensity V and in Manila with II.
#118 9th	iPz iPNE F	16 00 06 07 18 05		Compression. $9^{\circ}$ N; $84^{\circ}$ W; $0=15:40:20$ by U.S.C.G.S.
#119 9th	iPZ SNEZ	16 22 20 36	125	Dilatation. Felt slightly in Manila. #118 still recording.
#124 12th	iPZ ePNE SNE LNE F	9 31 55 55 37 06 40 55ca 10 40	3600	Dilatation.
#125 14th	iPZ ePNE S?E LNE F	1 56 33 33 2 00 25 02 40ca 33	2425?	

## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 March #126 14th	iPE iPE iZ INE F	12 15 51 55 16 47 20 39 14 20		Dilatation. Provisional epicenter: 25°S; 70°W; 0=11: 55:48 by U.S.C.G.S.
#127 15th	PE SNE F	6 01 12 06 16 45	3490	
#130 16th	iPNEZ SNE F	15 46 40 47 23 17 40	330	Compression from NNE. Felt in northern Luzon and slightly in Manila. S from the Wiechert. Baguio, 145 Km.
#131 16th	iPZ ePNE SNE F	22 34 35 35 37 12 23 30	1515	Compression from SE.
#132 17th	iPZ ePNE SNE F	11 13 50 50 14 08 23	140	Dilatation.
#142 19th	PNEZ SNE F	13 07 50 09 14 52	685	Compression from SE. Felt in NE Min- danao.
#144 19th	PNEZ INE F	18 31 50 36 23 19 20		
#146 20th	PNEZ SNE F	1 04 56 08 49 55	2720	
#164 21st	PNEZ SNE INE F	16 18 00 25 51 28 ca 17 17	4240	
#165 21st	iPNEZ SNE IN F	18 11 46 14 29 16 00 54	1565	Compression from SE.
#166 21st	PNZ S?NE F	19 35 44 41 00 20 25	3680?	
#169 22nd	PNEZ SNE F	6 13 03 15 17 7 30	1290	From the SE.
#173 26th	S?NEZ L?NE F	1 45 04 46 48 2 13		From the SE.



No. 9.

March, 1937.

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SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
1937 March #174 26th	PNEZ SN F	4 08 56 09 13 16	135	Compression. Felt at San Antonio, Zam- bales.
#176 26th	PNEZ SE eN F	15 45 09 46 42 46 42 17 00	860	Felt at Cagayan, Oriental Misamis with intensity VI.
#182 29th	PNEZ SNE F	5 41 36 44 19 6 45	1570	From the SE.
#183 29th	PNEZ S?NE F	8 10 18 14 14 9 05	2480?	
#184 30th	PNEZ SE LNE F	11 40 28 42 28 43 40 12 20	1155	24°6' N; 121°1' E by Taihoku.
#185 30th	PNEZ SNE? F	14 59 33 15 09 41 55	8690?	

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).

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SEISMOLOGICAL BULLETIN OF THE OBSERVATORY



$\phi=14^{\circ} 34' 42''$  N.

$\lambda=120^{\circ} 58' 41''$  E.

h=3 m.

Alluvium

CONSTANTS OF THE GALITZIN-WILIP

	T	T	$\mu$	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. July 1, 1938

	T	V	E	$\frac{r}{T_0^2}$
N-S	4.2	207	2.4	0.088
E-W	4.3	257	2.8	0.105

Cf. Theoretical Seismology. Schon, S.J.

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

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SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.



$\phi=14^{\circ} 34' 42''$  N.

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h=3 m.

Alluvium.

CONSTANTS OF THE GALITZEN-WILIP

	$T_1$	$T$	$\mu^2$	$V_s$
N-S	12.6	12.9	0.400	
E-W	11.8	11.9	.08	229
Z	11.6	3.0		

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

	$T_0$	$V$	$m$	$\frac{T}{T_0^2}$
N-S	4.3	192	2.5	0.059
E-W	4.3	251	2.5	0.078

Cf. Theoretical Seismology, Sokol, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Aug. 1937. #530 1st	iPZ ePNE iSNE MNE F	10 45 53 53 49 56 54 35ca 11 52	2580	Compression. Shantung, China.
#535 4th 5th	iPZ ePNE iZ SNE iN F	23 41 03 04 51 45 36 47 35 0 30	3020	
#536 5th	iPZ iE iZ SNE F	14 50 40 48 52 34 56 32 16 25	4260	
#541 7th	PNEZ SNE F	23 55 01 58 34 23 12	2145	
#543 8th	iPZ ePE iZ SNE iE F	10 17 12 12 47 22 19 23 48 11 15	3535	Compression.
#544 8th	iPZ ePNE iE SNE F	15 23 56 56 24 56 26 16 16 55	1345	Butuan, 460 Km.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.

MANILA, P. I.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Aug. 1937 #545 8th	iPZ ePNE SNE LNE F	12 42 31 36 46 50 49 ca 13 57	2810	
#546 8th	iPZ ePNE SNE LNE F	14 44 35 35 48 29 50 40ca 16 30	2455	
#548 9th	ePNEZ SNE F	19 24 01 26 06 20 25	2610	
#550 10th	PNEZ SNEZ F	2 51 25 55 34 3 25	2655	
#551 10th	ePNEZ SNE F	12 18 12 19 54 38	740	Felt at Dava, int. V and at Surigao, int. II.
#552 10th	ePNEZ SNEZ F	18 04 51 08 54 40	2580	Deeper than normal.
#553 11th	PNEZ SNE F	1 00 05 02 52 4 00	1610	S from the Wiechert and Horizontal. Compression.
#554 11th	PNEZ SNE F	9 42 15 45 19 10 04	2600	
#557 12th	iPZ SNEZ F	4 23 14 34 41	160	Compression.
#558 12th	PEZ SNE F	11 54 05 57 39 12 13	2165	
#559 12th	PNEZ SNE F	14 42 17 58 52	145	
#560 12th	iPNEZ SNE F	16 31 19 35 02 57	100	Felt at Santa Cruz, Laguna with int. IV and at Lucban and Manila slightly. S from the Wiechert.
#561 12th	PNEZ SNE F	20 07 52 08 16 15	190	

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## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No.	Phase.	Greenwich Time			Dist. Km.	Remarks.
		h.	m.	s.		
4533	PNEZ	17	43	39	200	
	SNE		44	15		
	F	18	02			
4535	ePZ	10	52	32	2635	
	SNE		54	39		
	LE		59	00		
	F	11	45			
4538	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			
4539	PNZ	13	15	15	3220	
	SN		20	01		
	LE		23	20ca		
	F	14	20			
4540	PNEZ	21	14	03	420	Felt at Laoag, int. III.
	SNE			54		
	F		26			
4571	PNEZ	5	01	20	2780	Deeper than normal.
	SNE		05	37		
	F		43			
4573	PEZ	6	48	45	5665?	
	S?NE		54	00		
	F	7	55			

4577  
4578  
iPNEZ 11:59:32  $\Delta=130$  Km.  $\downarrow$  Very strong Earthquake. Dilatation from SE.

Galitzin-Wilip traces vanished after beginning of first throw. N-S light spot off until on 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,  $V=3$ , pen remained on throughout the earthquake, but pendulum bumped the arresting screws during the first ten minutes of the earthquake.

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

Paguio, 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,  $14^{\circ}10'N$ :  $122^{\circ}05'E$ . H=11:59:13 G.M.T.

M A N I L A , P . I .

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



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

#579  $\bar{P}$  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	$\bar{P}N\bar{Z}$	0 27 ca	128	Aftershock of #577.	14:32,
#627 t #630				Four small aftershocks of #577.	
#631 21st	$\bar{P}N$ $\bar{S}N$	2 24 45 25 01	128	Aftershock of #577.	
#632 21st	$\bar{P}N\bar{E}$ $\bar{S}N\bar{Z}$	4 19 41 53	95	Probably deeper than normal.	
#633 21st	$\bar{P}E$	4 28 ca		Aftershock.	
#634 21st	$\bar{P}N$ $\bar{S}N$	4 57 13 29	128	Aftershock. #635, #636 small aftershocks.	
#637 21st	$\bar{P}N\bar{Z}$ $\bar{S}N$	5 28 43 29 00	135	#638 small aftershock.	
#639 21st	$\bar{P}N\bar{Z}$ $\bar{S}N\bar{Z}$	5 55 38 54	128	#640 small aftershock.	
#641 21st	$\bar{P}Z$ $\bar{S}N$	6 25 36 53	135	Probably aftershock.	
#642 21st	$\bar{P}Z$ $\bar{S}N$	6 59 07 24	135	Probably aftershock.	
#643 21st	$\bar{P}Z$ $\bar{S}N$	7 14 12 36	190		
#644 21st	$\bar{P}Z$ $\bar{S}N$	7 42 17 34	155	Aftershock of #577. #647, #648 small aftershocks.	
#649 21st	$\bar{P}Z$ $\bar{S}$	15 07 55 08 07	95	$\bar{S}$ - $\bar{P}$ interval approx. from Wiechert on which minute gaps were lacking. #651, #652 small aftershocks.	
#653 21st	$P\bar{N}\bar{Z}$ $S\bar{N}\bar{Z}$ $L\bar{N}$ $M\bar{N}$	23 07 21 12 07 15 13 17 30ca	3190		
22nd	$F$	0 20			

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Aug. 1937 #657 22nd	iPZ iSN	3 30 31 43	95	Deeper than normal. #654, 655, 656 aftershocks of #577. #658 and 659 small aftershocks of #577.
#660 22nd	PZ SN	6 54 42 57	120	Aftershock of #577. #661 to 675 small aftershocks of #577.
#676 22nd	PZ SN	18 56 03 19	128	Aftershock of #577.
#677 23rd	PNZ SN	0 29 06 47	305	
#680 23rd	iPZ SN	3 44 39 54	120	Compression. Aftershock of #577. #678 and 679 aftershocks of #577.
#681 23rd	PN iSN	4 14 24 36	95	Deeper than normal. #682 aftershock of 577.
#683 23rd	PNZ SN	6 15 19 35	128	Aftershock of #577. Felt in Alabat Is- land. with intensity V. #684, 685, 686, 687 and 689 aftershocks.
#688 24th	PZ SNZ	6 01 48 02 08	160	
#690 24th	PNZ SN	10 36 12 31	150	Deeper than normal.
#691 24th	PNZ SNZ	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	iPZ SNZ	0 11 44 56	95	Deeper than normal. Felt slightly at Lucban.
#697 25th	PZ SN	17 05 58 00 15	120	Aftershock of #577. #698, 699 and 703 probably aftershocks.
#700 25th	PZ SN	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	PNE SN	22 00 02 20	142	P from Wiochart.

## SEISMOLOGICAL BULLETIN OF THE OBSERVATORY.--Continued.



No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Aug. 1937 #704 26th	$\overline{SN}$	0 48 32		Probably aftershock of #577.
#705 26th	$i\overline{PZ}$ $\overline{SN}$	8 02 08 23	118	Compression. Aftershock of #577. #706 very small: probably aftershock of #577.
#707 26th	$\overline{PZ}$ $\overline{SN}$	9 50 25 51 00	245	
#709 26th	$\overline{PZ}$ $\overline{SN}$	16 34 54 35 10	128	Felt slightly in Manila. Aftershock of #577.
#710 26th	$\overline{PNZ}$ $\overline{SN}$ $\overline{LN}$ F	18 58 38 19 02 25 04 30 20 12	2335	
#711 26th	$\overline{PN}$ $\overline{SN}$	19 31 08 32	190	
#712 26th	$\overline{PZ}$ $\overline{SN}$	23 28 25 47	175	Compression. Felt slightly in Manila.
#713 27th	$\overline{PNEZ}$ $\overline{SNE}$	1 49 31 47	130	Aftershock of #577. Galitzin-Wilip E-W component again operating.
#714 27th	$\overline{PZ}$ $\overline{SNE}$	5 18 08 20	95	Deeper than normal.
#715 27th	$\overline{PZ}$ $\overline{SNE}$	7 01 32 49	135	Probably aftershock of #577. #716 small, probably aftershock of #577.
#717 27th	$\overline{PNEZ}$ $\overline{SNE}$	7 24 53 25 21	215	
#718 27th	$\overline{P?NE}$ $\overline{SNE}$ F	22 10 55 14 19 30	2035?	
#719 27th	$\overline{PNE}$ $\overline{SNE}$	22 33 18 39	165	Deeper than normal. P from the Wischart.
#720 28th	$\overline{PNEZ}$ $\overline{SNE}$	0 05 43 06 04	175	Compression. Deeper than normal. Felt in Camarines Norte.
#721 28th	$\overline{PZ}$ $\overline{SNE}$	3 47 33 48 03	230	
#725 28th	$\overline{PE}$ $\overline{SNE}$	23 30 27 49	175	
#731 30th	$\overline{SNE}$	0 10 36		P lost in microseisms. Probably aftershock of #577.



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

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).

MANILA, P. I.

SEISMOLOGICAL BULLETIN OF THE OBSERVATORY



$\phi$  14°34' 42" N.

$\lambda$  = 120° 58' 41" E.

h = 3 m.

Alluvium.

CONSTANTS OF THE GALITZIN-WILIP

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

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

	$T_0$	V	$\epsilon$	$\frac{-I}{T_0^2}$
N-S	4.3	204	2.6	0.070
E-W	4.4	256	2.8	0.072

Cf. Theoretical Seismology.  
Sohn, S.J.

No. and Date	Phase.	Greenwich Time h. m. s.	Dist. Km.	Remarks.
Dec. 1937				
#995 1st	PNEZ iNE SNE F	19 57 34 56 58 30 20 09	470	Felt in northern Luzon.
#996 2nd	<del>P</del> NZ SNE F	6 54 42 35 03 50	165	
#1002 5th	P?NEZ S?NE F	4 41 46 47 34 5 35	4190?	Disturbed by microseisms.
#1004 8th	iPNZ ePE SNE F	8 34 14 14 36 35 11 20	1300	Dilatation. Felt in all Formosa, 23° 2' N. 121° E by Taihoku. S from the Wiechert.
#1005 3th	PNEZ SN F	16 54 56 59 46 17 25	3265	
#1006 8th	iPZ ePNE SN F	20 40 54 54 42 56 22 10	1180	Compression.
#1007 8th 9th	PNZ SN LN F	23 53 40 37 45 40 ca 0 25	2610	E-W Cylinder stopped at 23:24.

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
Dec. 1937				
#1012 10th	PNEZ IZ SNE MNE F	13 35 39 40 15 42 20 53 15ca 15 25	5080	
#1018 12th	PNEZ SE F	9 47 41 48 00 10 00	150	
#1019 13th	iPZ iPN ePE SNE? F	18 55 56 58 58 57 30 21 00	890	Compression. Felt in all Formosa.
#1020 14th	PNEZ SNEZ F	8 06 26 07 00 14	245	
#1022 16th	iPNEZ S?NE	8 31 34 33 43	1245?	Dilatation. Felt at Jelo.
#1023 16th	P?NEZ S?NE F	9 41 24 47 26 10 09	4410?	#1022 still recording.
#1024 16th	PNEZ SNE F	11 52 58 53 12 58	110	
#1025 16th	iPEZ ePN SNE SN F	18 26 16 16 27 07 20 20 08	420	Dilatation. Felt at Virao. S and S from the Wichert.
#1027 17th	PNEZ SNE LNE F	4 32 32 38 22 40 40ca 5 42	4235	
#1028 17th	PNEZ SNE F	9 34 19 35 56 12 10	910	Compression. Felt in whole of Formosa.

## 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				
#1032 13th	ePNEZ SNE iE F	13 27 02 34 18 34 23 15 10	5555	
#1035 20th	PEZ S?NE iN iE F	3 43 29 49 48 51 42 52 58 4 35	4700?	Disturbed by microseisms.
#1036 20th	PNEZ SNE F	22 43 05 49 34 23 25	4880	Disturbed by microseisms.
#1037 22nd	PNZ F	3 58 26 5 40		17°N: 106°W: 03:37:17 by U.S.C.G.S.
#1038 22nd	PNEZ SEZ F	20 52 47 53 39 21 07	430	
#1039 22nd 23rd	PNEZ SNE F	23 55 34 24 00 46 0 17	3610	
#1041 23rd	iP' EZ PPNEZ SKP LNE F	13 37 15 39 25 40 02 14 22 ca 18 10	14500	Dilatation. 16°N: 98°W, 0=13:17:56 by U.S.C.G.S.
#1043 24th	eP' EZ iE iZ iN F	6 40 58 44 16 45 22 48 06 8 48		
#1044 24th	PEZ SNE F	16 42 17 35 49	140	
#1045 25th	iPNEZ SNE F	1 15 03 19 20 2 25	2780	P in minute gap.
#1046 25th	PNE SNE MNE F	10 03 03 09 58 19 ca 11 02	5235	

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