

No. 17.

1931.

Geodætisk Institut
 Proviantgaarden, Copenhagen, Denmark.

Bulletin
 of the seismological station

KØBENHAVN

$\varphi = 55^{\circ}41' N.$ $\lambda = 12^{\circ}27' E.$ $h = 13$ m.

Lithologic foundation: chalk.

No. 17. Jan.—March 1931.

Instruments:

Galitzin pendulums with galvanometric registration.

Constants:

Component	l	T_1	A_1		μ^2	T	k
N	cm 12.5	sec 12.62	cm 100	$\frac{1}{1} - \frac{6}{3}$	0.14	sec 12.5	103
E	12.5	12.62	100	$\frac{6}{3} - \frac{31}{3}$	-0.02	12.4	103
Z	14.4	11.56	100		-0.1	10	95

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

Component		T	ν	ρ	V
N	$\frac{1}{1} - \frac{12}{1}$	sec 9.6	4.4	mm 0.8	223
E	$\frac{12}{1} - \frac{31}{3}$	9.6	4.5	0.5	220
Z		9.4	4.2	0.7	194
		5.3	4.3	0.2	165

Milne-Shaw seismograph, E component, with the approximate constants $T = 12^s$ $\nu = 20$ $V = 300$.

Wood-Anderson torsion seismometer, E component, $T = c. 4^s$.

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No.	Date	Hour	Forerunners				L	Un- defined	△	Remarks
			P	S						
			m s	m s	h m s	m s	h m	h m	°	
1	1931 Jan.	2 0			14		.5			
2*	2*	10	2							
3	4	0	5	8.7			11		Pacific Ocean near Mexico. Greece.	
4	7	2					.5			
5	8	11			10.4				Artificial explosion, Limhamn, Sweden.	
6	9	2					.4			
7	9	7					.3			
8	9	12					.1			
9	11	19					29			
10*	12*	15	11 0	14 59			18		23	
11	12	16	0.3	4.3			8			
12	12	20	44 59	53 53					66	
13*	15*	2	i 3 29		14 4		27			
14	15	21	13.8	23.8			.7			
15	15	23			.2		.7			
16	16	19	32 40		43 23*		1.0			
17	17	3	3 1	13 23			.4		82	
18	17	6					21			
19	19	12						52		
20	19	17					.3			
21*	20*	9	35 10*							
22	20	15			49 15					
23	21	0						39		
24	23	6					.6			
25	24	14			5.2		.4			
26	24	17						50		
27	25	13					.3			
28	25	18						.7		
29	26	22					.8		Faint.	
30*	27*	20	20 4	i 28 52	i 30 8	33 12*			65	
31	28	5	59.0	62.0			63			
32*	28*	21	38.3		42 26	i 48 56				
33	29	1					.5			
34	29	17			34.2		53			
35	30	4						.1		
	Febr.									
36	1	1					50			
37*	2*	23			6 46	7 35				
38	6	23						39		
39	8	3					.1			
40	8	12					41			
41	10	1					59			
42*	10*	6	47 56		58 49					
43	11	18					.5			
44	12	6			9		.6			
45	13	1						.4		
46*	13*	1			47.3	48.1				
47	13	23					.0			
48	14	14			23.0		.7			

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No.	Date	Hour	Forerunners				L	Un- defined	△	Remarks
			P	S						
			m s	m s	h m s	m s	h m	h m	°	
	1931 Febr.									
49	16	19					.4			Faint forerunners masked by micro-seisms.
50	19	18			5.0		.5			
51	19	22					.5			
52*	20*	5	i 43 57	i 52 34	45 16	i 53 21			64	Siberia.
53	20	10			32		.7			
54	24	14					.7			
55	24	18					.5			
56	27	9			56.0	62 10	1.4			
57	27	12					.0			
	March									
58*	2*	2			37 51	41 1	1.3		15	
59	3	10								
60	3	20					.1			
61	5	4						.0		
62	5	18			18.0		39			
63*	7*	0	20 30	23 30					16	Yugoslavia.
64	7	1					.4			Superposed on preceding shock.
65	7	11					.0			Faint preceding movement.
66*	8*	1	54 0	57 0			58		16	Yugoslavia.
67	8	5						13		
68	8	13					.2			
69*	9*	4	0 35	10 18	3 28	15.6	21		75	Japan.
70	11	5					.7			
71	11	6						.5		
72*	11*	12	39.9		43 23	50.6	1.2			
73	12	11			4		.4			
74	12	19							3	
75	12	19			39		.9			
76	12	21					46			
77	14	11					.2			Faint.
78	14	12					.9			"
79	15	15						.9		"
80	15	17					.2			
81*	18*	8			22.0	31 40				Chile.
82*	18*	20	27 13	38 32	31.2		57			SE of Mindanao.
83*	19*	6	37 36	i 47 55	41.0	48.5	1.1			Near Luzon.
84	19	19						9		
85	21	23						11		
86	22	4						0		
87	22	15					51			
88	24	13					.4			
89*	28*	12			58 0	63 5	.5			
90	29	17			36 33	46 52				36 ^m 33 ^s on Z only.
91*	29*	18	3 33	12 33					67	
92	30	8					9			
93	30	11					.6			Faint.
94	30	14			1.0		.4			
95	30	16					.9			
96	31	16			25.2		.6			

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NOTES

- No. 2. Jan. 2. 10^h. Pacific Ocean near Mexico. Phases not clearly marked; irregular microseismic movement. P about 2^m; PP c. 6^m.3; $\overline{S_c P_c S}$, small, 12^m.6; S_n , larger, 13^m.1. The beginning of L uncertain.
- No. 10. Jan. 12. 15^h. Asia Minor. No GZ record. P small; S clearly marked by a large oscillation.
- No. 13. Jan. 15. 2^h. Mexico. Very strong record. iP , dilatation, followed by large oscillations. PP smaller, not very clearly marked, about 7^m.0. ($\overline{S_c P_c S}$), 14^m.4^s, clearly marked on N , on E less certain, perhaps earlier; followed by very large oscillations. PS 15^m.3. SS 19^m.3 and SSS 24^m.2 very large, of long period. L 27^m; on N 28^m—29^m a few very large oscillations of long period. M large, regular.
- No. 21. Jan. 20. 9^h. Alai Mountains; $\Delta = c. 40^\circ$. Much disturbed by work at the station. Clearly marked phases in forerunners; small main phase; presumably deep focus shock. $e_{E,Z}$ 36^m19^s. i_Z 37^m59^s, i_E 38^m3^s, large movement. e_E 41^m29^s; e_E 42^m5; e_E 44^m55^s.
- No. 30. Jan. 27. 20^h. Burma. Strong record. The beginning of P small, the reading not quite certain (no WZ record); iP 20^m8^s. S large, followed by large oscillations; i ($\overline{S_c P_c S}$), 30^m8^s, very large. SS , 30^m12^s, followed by large oscillations; the beginning of L not certain. M large; very large M groups about 47^m.0 on N and about 50^m.6 on E and Z .
- No. 32. Jan. 28. 21^h. Caroline Islands; $\Delta = c. 105^\circ$. P quite small; P' , 41^m.4, distinct on Z ; PP , 42^m26^s, large; PPP 44^m.5. $i \overline{S_c P_c S}$ 48^m56^s, iPS 51^m38^s, well marked phases; $\overline{S_c P_c S}$ followed by some oscillations, but no other distinct phases before PS . SS , 57^m.2, large. The beginning of L uncertain.
- No. 37. Febr. 2. 23^h. New Zealand; $\Delta = c. 160^\circ$. Small beginning on Z c. 6^m.6; P'_1 6^m46^s and P'_2 7^m35^s, large on Z . PP 11^m15^s; PPP 14^m23^s. In later forerunners strong irregular movement, phases not very clearly marked; clearest marked: PPS 25^m5^s; e 26^m21^s; SS 32^m.0. 39^m a very large oscillation. The beginning of L uncertain; in first part large, irregular oscillations of long period; later regular M waves.
- No. 42. Febr. 10. 6^h. Sumatra; $\Delta = c. 95^\circ$. P clearly marked on Z ; reflections small, PP c. 51^m.8. $\overline{S_c P_c S}_E$ 58^m49^s; e_N 59^m33^s; i_N 59^m23^s, large. SS 65^m.6. L' c. 8^h.7.
- No. 46. Febr. 13. 1^h. New Zealand. Much disturbed by microseisms. P'_1 47^m.3, P'_2 48^m.1, PP 51^m.8, best marked on Z . e_N 58^m.5; $e_{N,E}$ 62^m.9; SS 72^m.7.
- No. 52. Febr. 20. 5^h. Siberia. Deep focus. P_Z very large; 45^m16^s large and clearly marked; e 46^m.4. S and the following phase very large and sharp; e 54^m.9. Small main phase.
- No. 58. March 2. 2^h. $\Delta = c. 130^\circ$. P'_Z 37^m51^s; PP 41^m.0; $\overline{P_c P_c S}$ 41^m39^s; PPP 44^m.2. e 51^m2; e 53^m32^s. SS 60^m.3.
- No. 63. March 7. 0^h. Yugoslavia. The beginning of S not very sharp; e_E 23^m39^s, followed by larger movement.
- No. 66. March 8. 1^h. Yugoslavia. Strong record. The beginning of P small, read at end of minute-break, not quite certain; followed by large oscillations. The beginning of S small; e_N 57^m10^s, i_E 57^m14^s followed by very large oscillations. M very large.
- No. 69. March 9. 4^h. Japan. Strong record. Phases clearly marked. M very large.
- No. 72. March 11. 12^h. Marianne Islands region. P small; PP , 43^m23^s, larger. 50^m.6 a clearly marked phase, but the beginning not sharp; in following movement no clearly marked phases. Several M groups.
- No. 81. March 18. 8^h. Chile; $\Delta = c. 115^\circ$. Disturbed by change of sheets. PP 22^m.0; on Z faint preceding movement. Later phases most clearly marked on E . 29^m6^s; PS_E 31^m40^s; PS_Z 31^m55^s; PPS 32^m.7. e_E 34^m46^s. SS 38^m.0; SSS 42^m.5. The beginning of L uncertain; large, regular M .
- No. 82. March 18. 20^h. 5° N 127° 30' E according to Manila; $\Delta = c. 100^\circ$. Strong microseisms. P and PP , 31^m.2, small. $\overline{S_c P_c S}$, 37^m.7, not clearly marked; S_n and PS , 39^m20^s, best marked on E . SS 46^m, SSS 50^m.
- No. 83. March 19. 6^h. 18° 20' N 120° 10' E according to Manila; $\Delta = c. 85^\circ$. P clearly marked on Z ; $e_{E,Z}$ 37^m50^s, larger. S large and well defined; PS , 48^m.5, smaller. No marked SR . Long period waves in first part of L ; M of short duration.
- No. 89. March 28. 12^h. South Moluccas according to Batavia; $\Delta = c. 110^\circ$. P , 52^m40^s, small, the reading not quite certain; no GZ record. Some increase of movement (P') previous to PP , 58^m0^s. $\overline{S_c P_c S}$ 63^m.5; $\overline{S_c P_c P_c S}$ 64^m41^s; S_n 65^m.4; PS , 67^m.3, followed by increasing oscillations (PPS). e 69^m.3; e_E 70^m.5; SS 73^m.3, followed by strong, irregular movement. L irregular, the beginning not certain.
- No. 91. March 29. 18^h. P and S well defined phases. L irregular; no marked M phase.

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$\varphi = 55^{\circ}41' N.$ $\lambda = 12^{\circ}27' E.$ $h = 13$ m.

Lithologic foundation: chalk.

No. 18. April—June 1931.

Instruments:

Galitzin pendulums with galvanometric registration.

Constants:

Component	l	T_1	A_1	μ^2	T	k
	cm	sec	cm		sec	
<i>N</i>	12.5	12.62	100	0.00	12.4	104
<i>E</i>	12.5	12.62	100	0.1	12.2	101
<i>Z</i>	14.4	11.56	100	-0.1	10	95

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

Component	T	ν	ρ	V
	sec		mm	
<i>N</i>	9.6	4.5	0.6	220
<i>E</i>	9.4	4.2	0.7	194
<i>Z</i>	5.3	4.3	0.2	165

Milne-Shaw seismographs, *N* and *E* components, with the approximate constants $T = 12^s$ $\nu = 20$ $V = 300$.

Wood-Anderson torsion seismometer, *E* component, $T = c. 4^s$, recording intermittingly.

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No.	Date	Hour	Forerunners				L	Un- defined	△	Remarks
			P	S						
			m s	m s	h m s	m s	h m	h m	°	
1	1931 April	14					.1			
2	1	1					.1			
3	3	2			20 33	21 25	.8			
4	3	6					.3			
5	3	21			56 40	62 48	1.2			
6*	3*	23			i 37 42	40.3				
7	5	22					.5			
8*	6*	7			10 10	20.1	.7			
9	6	12					.9			
10	7	0						.9		
11	7	8					.8		Disturbed.	
12	8	19			31.7		.9			
13	9	23	i 12 48	22 14	23.1		.7		72	
14	11	1						.5		
15	11	15			33		1.1		No time-marks.	
16	12	2			20		1.1			
17	13	12					.8		Faint.	
18	14	22					.3		Faint.	
19*	15*	17	4 29	9.0				11	27	
20	16	12					.9		Atlantic Ocean.	
21	19	2			30		.7		Superposed on next shock.	
22	19	3					.3			
23*	20*	20	38.8	42 50				46		
24	21	0			22.0				Asia Minor. Distant.	
25	21	6					.0			
26	21	14						25	Not very distant. Faint; distant.	
27	22	0			.0					
28*	22*	0			22.8	25.8	1.2			
29	24	0					.7			
30	24	3					.2			
31	24	15			30.3				Following movement small.	
32*	24*	17			41 12	42.7		74		
33	25	16					57			
34	25	20					.1			
35	26	4	33 9	42.5			.9		71	
36	26	6					.6		Irregular. Armenia.	
37*	27*	16	i 56 31	61 14					28	
38	27	21						30		
39	May	22	49.0	59.0				75	78	
40	3	6						50	Venezuela.	
41*	3*	20						.8		
42	4	3					.5			
43	4	18					.3		Faint.	
44	5	6						56		
45	5	14			25.0				L small.	
46	6	15			.5		1.3			
47	6	17			39.8	44				
48	6	20			32 16					

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No.	Date	Hour	Forerunners				L	Un- defined	△	Remarks
			P	S						
			m s	m s	h m s	m s	h m	h m	°	
49	1931 May	7 0			59.9					
50		7 6					.5			Seismic?
51		9 10			58.0		1.3			
52		10 10						57		
53		10 19			47.6		1.5			Faint.
54		11 19					.2			
55*		12* 1	i 48 9	i 57 8					67	
56		12 10						36		L irregular.
57		13 9					.3			
58		13 23					.8			
59		15 0					.0			
60*		16* 21	0.2	11 3*	10 47	12.0	.5			Mexico.
61		17 10						10		Preceding movement disturbed.
62		17 13					.5			
63		17 15			34		.7			
64		18 11					.6			Small.
65		19 14					.1			
66*		20* 2	i 28 28	i 33 1					27	Azores.
67		20 22			13.0	19.1	.8			
68		22 8						9		
69		24 0			.6		1.0			
70		24 21			40.8					
71		26 10					.0			Faint.
72		26 15					.1			
73		27 1					.3			
74		27 6			19 43		.6			
75		27 7					.6			
76		27 11						.2		
77		28 3						39		
78		28 5						.5		
79		28 18	45 16	54 22			1.2		68	
80		29 6					.3			
81		29 9					.3			
82		30 11			45.7	55.1	1.2			Beginning lost by change of sheets.
83		30 19					.7			
84	June	1 0						46		
85		1 12			14.8		.9			
86		1 14						.7		
87*		2* 2	49 22	58 49	50 21	60 34			72	Superposed on preceding shock. Japan.
88		2 5					.1			
89		2 18						1		
90		4 10			.3		.8			
91		5 20						50		
92*		6* 12			13 8			3		
93		6 17								
94*		7* 0	i 26 51	i 27 59	i 27 1					North Sea.
95		9 0						.9		
96		9 5	19 43	29 37	29 58		.8		77	Japan.

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No.	Date	Hour	Forerunners				L	Un- defined	△	Remarks
			P	S						
	1931 June		m s	m s	h m s	m s	h m	h m	°	
97	9	12	25 23	34.5			.9		68	
98	9	14			11.8	15.4	1.0			Superposed on next shock.
99*	9*	16			18 25					
100	10	12						48		
101	10	17						8		
102	11	7					.0			
103	12	2						.4		Faint.
104	13	15						.0		
105	13	15			53 48		2.0			
106	15	11			44		1.1			
107	17	12	21 37	31 25	24 32	36 35	.8		75	
108	17	17			22.0	31.9	1.0			
109	18	13	8 7*	15 52	19.5		28		56	
110	19	22						.1		
111	20	1			36.2		.9			
112	20	15			17.2		.4			
113	21	13					.2			Faint preceding movement.
114	22	10					.4			
115	22	16					.9			
116	23	6	26 58*	36 51	41.9		.9		76	
117	23	12					.7			
118	24	23	56.5	64.1			1.3			
119	25	1					.3			
120	27	18			.5		1.0			
121	28	6					.3			
122	28	12						56		
123	28	16			47		1.1			
124	29	16	54 42	64 7					71	L small. Japan.
125*	29*	20					56			
126*	29*	21					.4			
127	30	10	29.1	32 11					16	Italy.

No. 6.
 No. 8.
 No. 19.
 No. 23.
 No. 28.
 No. 32.
 No. 37.
 No. 41.
 No. 55.
 No. 60.
 No. 66.
 No. 87.
 No. 92.
 No. 94.
 No. 99.
 Nos. 125—

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NOTES

- No. 6. April 3. 23^h. The first phase, P' , large on Z ; the rest of the record small. The beginning of L uncertain, 23^h.9—24^h.0.
- No. 8. April 6. 7^h. PP , 10^m10^s, clearly marked on Z and E . e_Z 25^m53^s.
- No. 19. April 15. 17^h. P clearly marked on Z and E , absent on N . S quite large, but the beginning not sharp.
- No. 23. April 20. 20^h. P quite small; S clearly marked. L begins very clearly with waves of long period.
- No. 28. April 22. 0^h. Preceded by faint movement due to other shock. Distinct forerunners, but later phases not clearly marked. L regular.
- No. 32. April 24. 17^h. $\Delta = c. 120^\circ$. P' , 41^m12^s, small; PP , 42^m.7, large. In later forerunners phases not very clearly marked. S_cP_cS 48^m.1; PS 52^m.4; SS 58^m.5. In first part of L periods of more than 1 min.
- No. 37. April 27. 16^h. Armenia. P , dilatation, large on Z and E , followed by much oscillatory movement; e_N 56^m.9. S well-defined on E , followed by large oscillations; on N small, but large increase of movement 62^m.1. L irregular.
- No. 41. May 3. 20^h. The reading of this and the following shock uncertain, since L waves are not easily distinguished from a movement of long period which disturbs the record May 3.—4.
- No. 55. May 12. 1^h. P , condensation, and S both very clearly marked. S followed by a group of oscillations, but no other distinct phases. The beginning of L uncertain.
- No. 60. May 16. 21^h. Mexico. P small; PP , 3^m46^s, larger; PPP 5^m42^s. S_cP_cS , S_n and PS well-defined on E . SS c. 17^m. L regular; in first part waves of long period.
- No. 66. May 20. 2^h. Near Azores. Very strong record. iP , condensation; i 28^m57^s followed by larger oscillations. S very large; large oscillations continue into L , beginning about 35^m. Very large M , largest on N .
- No. 87. June 2. 2^h. Japan. Kōti states: Deep focus. P and the following phase quite small, on Z only. S and the following phase clearly marked on N and E , the latter the larger. e 63^m.8. L irregular, not large, the beginning uncertain.
- No. 92. June 6. 12^h. Clearly marked impulse on Z , quite small movement on N and E , lasts about 10 sec. only and not followed by other phases. Read at Stuttgart at about the same time. P' of a distant earthquake?
- No. 94. June 7. 0^h. North Sea, near the English coast; $\Delta = c. 650$ km. Felt in England; felt slightly in Denmark. iP , condensation, large on Z ; $i_{E,Z}$ 27^m1^s, larger. e_E 27^m13^s, followed by larger movement of long period ($PL?$) with movement of short period superposed. S very well defined on N ; followed by large movement of long period with short period waves superposed. Pronounced M group on N , begins 29^m.0.
- No. 99. June 9. 16^h. Probable epicentre 38° S 174° W according to Wellington. First phase clearly marked on Z , followed by some oscillations. Later forerunners distinct, but phases not clearly marked. The beginning of L not certain; M very regular, of long duration.
- Nos. 125—126. June 29. 20^h; 21^h. Forerunners begin about 20^h51^m. After 20^h56^m movement of the appearance of L waves of a not very distant shock. 21^h.4 regular L waves of a distant shock.

NOTIZIA

NOTIZIA

Faint, illegible text, likely bleed-through from the reverse side of the page. The text appears to be organized into paragraphs and possibly includes a list or table of data, but the characters are too light to transcribe accurately.