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No. 45.

1938.

## Geodætisk Institut

Proviantgaarden, Copenhagen, Denmark.

### Bulletin

of the seismological station

# KOBENHAVN

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

Lithologic foundation: chalk.

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Instruments:

Galitzin-Wilip seismographs.

Constants:

Component	1	$A_1$	T <sub>1</sub>	$\mu^2$	T	k	
N	em 12.5	em 100	sec 12.61	-0.05	sec 12.6	103	
E	12.5	100	12.65	0.1	12.5	104	
Z	14.5	100	11.55	0.1	9	95	

On february 24th recording on E was suspended.

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

Component		T	ν	e	V
N	1/1-3/2	sec 9.5	4.3	mm 0.3	215
E	1/1-3/2	9.3	4.0	0.4	190
Z		5.4	4.0	0.2	160

After february 3rd readjustments of the horizontal seismograph took place and the constants varied.

Milne-Shaw seismograph, E component, with the approximate constants  $T=12^s$   $\nu=20$  V=300. Benioff vertical seismograph,  $T_1 = \frac{1}{4^8}$   $T = 1^8$ .

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#### København.

	Købennavn.														
			Forerunners									Un-			
No.	No. Date Hour		PS			Didiani He			L	L defin		Δ	Remarks		
	1020		1			,									
	1938 Jan.		m	s	m	S	h m	S	m	s	h	m	h m	0	
1	1	11					41	33	48	57	1.1				Readings not certain. Masked by
		ig about							3 30						[irregular microseismic movement.
2*	1*	23	i 40	49	51	30	44	18	57.3	3	1.2				Pacific Ocean.
4*	2*	22			50	59	3 43	58 34	50	40		6			Crete. Mexico.
5	3	21					37.0				.7			1 36s	WICKICO.
6	4	5									.4				
8	7	15 18	Albert 1						and in	N. UN	1.3		55		Small preceding movement.
9	8	7											21		Read on Benioff Z. Seismic?
10	9	19	my 1	STATE.	7. 2. 2. 2.	2000							55		
11	10	18	F tony		96. 3		h 815 =6	ALT A	1.05.97	ST 34	A V	33	33	y and i	» » » »
12	10	21	i6	35	16	38			acide	Luno	.6	lod r		80	Pacific Ocean.
13 14*	11 11*	14 15	i 23	58	22	54	27	2					2	78	T
15	12	13	123	30	33	34	21	2	PER I	then t	OF THE	30	TOTAL CO.	10	Japan.
16	13	9	Billion C								.0				
17	16	15					11.				.1				
18 19*	18 18*	9	36	46	43	1*	39.3		44.3	3	1.2			41	Masked by strong microseisms.  Afghanistan.
20	19	10											12		
21	22	3									.0		42		Read on Benioff $Z$ . Seismic?
22	23	8	-									74			Preceding movement disturbed.
23*	24* 25	10					50.8		12 1						sacqueou
25	26	4					11	45	13.5		1.1	15			
26	29	4				0.51	20)		18.		.8		2.51		Masked by strong microseisms.
27	30	17	or grad						28.				44		
	Febr.	er sin	The Section						*****		1591				
28*	1*	19	19	5			23	42	29	51	Day 3		gnibirge	2441	Banda Sea.
29	2	14	NEW YORK										34		Read on Benioff Z. Seismic?
30	4	0	rades									49			
31	4	11	20	0			20	10	25	0		15	. HEGALLE	Jameson	
32*	5* 7	14	36 i 54	0 48	64	30	36	40	37	0	1.4		-Alga	76	Colombia.  Japan.
34	8	7	8 70/	lectly.			40	6	40.6	6	1.1		g_longite		Ecuador.
35	8	14	TOVE:		P T				Name of the last o		.0			inanoq	did bein bestimation configuration.
36	10	14					45				1.2				
38	10	10			HE IN		5.0		America		.5	in a	the state of	0 020	bore film languages at elbanten and
39	10	20	42	58	783						.8				P not quite certain, masked by mi-
															[croseisms.
40	11	15	MIS SK	aulg :	ioo) i	iqua	omeise is	rizonte	he ho	of to	.4	usu j	3rd read	naunds	TOST A.
41 42*	13 14*	8	iO	33	5	36	23 i0	50 46	5	46	1.2			30	Disturbed. Golf of Karabugas.
43	15	3	<i>i</i> 36	15	43	5	10	10	2000	edami	eoriga	48	diffw ,s	47	eP ca. 36 <sup>m</sup> 13 <sup>s</sup> . Atlantic Ocean.
														-	dependent tonionary Water of

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#### København.

٢	Køpennavn.										
	No.	Date	Hour		Fore	runners	2370	BETOM			Remarks
1				P	S				defined		
ľ	s File	1938	可是四百万	m s	m s	h m s	m s	h m	h m	0	No. 2. Jun. 1. 234, Pacific Occur;
	44	Febr.	7	i5 42	12 36	me estima vel	bolococous sa	20		48	Possibly a small earlier beginning
	to an	innigod	off A	050 a 8.5	03. 22 .1.0	EE as . 100 m 10	29 ; 48	22,7401	8KS 500	3=34=.	[of P. Atlantic Ocean.
1	45 46	15 21	10 14					15	53		Read on Benioff Z. Seismic?
	47	22	5	alaminod a	di arret th	in G ilbaigrans	e deltenië e	.9	nemoliteli	oso las	was yd bawollol skeres 8
-	48	22	6	9=,5,543	6,5,=08 +	25.3	32 26	1.1	is, Maske	spil ge	e 42 <sup>m</sup> .3.
	49	26	12		CarCA	2 - 2 - 1	20330000 80	aibser s	naiososois	90000	e ted boskepid POI 35 call 35 cal
	50 51	27 27	1 12	i 40 52	50 20		w. n.h.#60n	1.1	21年8月末3	73	P+. East of Japan. Faint.
	31	A Chois	12	P 19955, c	seldables.	rong to become his	Med John	.3	BLI PERIL	2 m 3 0 cg	raint. short at the series of
		March	CALLEGE VA	37m.4. 51	and E. e	no égiallyis	O 10 - 10 - 10 - 10 - 10 - 10 - 10 - 1	The S.	1. 112 33 4	E. #56 a	bolton and to antitalliase
	52 53	4	0 14	.sinais	n i madi s	porn to boing	30 annisal	.4	50	943	Read on Benioff Z. Seismic?
	54*	8*	5	ciants. Pg	33010 300	55.6	61 16	1.5		8 .00 m (8) 46 m	Pacific Ocean.
	55 56	9	16	n. ipP 0*	candensatio	2.9	aumon nad	1.3	spian Sea	O .emi	Small preceding movement.
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	58	11	14	55.0	58 26			60		19	Greece.
1	59		16	i 10 14	delieson b	Short vinests	100 P81 #E	12	el ettoiu	dO mod	40. 73 Merch 22, 134, West of Or
	60 61	11 12	17 13		1.400 888			.3		24 NO	Small preceding movement.
	62	12	20					.5			» « »
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	64 65	13	15 17	49.8	53 0*	53 12	53 17	51 54		18	Greece.
	66	13	21	14 14				.5	aoitate P	reg.mi	Baluchistan.
	67 68	14	5	i 58 16 i 24 57		i 58 20		1.3	w. innibu	rison .	P+. Bengal. P+. China.
	69	14	14	124 51					16	eyi igori enin el	Read on Benioff Z. Seismic?
	70	15	15	pengo lapis	rey bea 3	1 ,814 no pa	DE HORIZO	.mm ni	27	trace s	» » » »
	71	21	1	being	Fishtin -	to the or	M of best	1.4	m bano	ates g	Small preceding movement.
	72 73*	22*	15 15	33 16	42 31	<i>i</i> 24 5 35.8	46.8		***	71	Read on Benioff $Z$ .  West of Queen Charlotte Islands.
	74	22	22	38 49				1.1	e'dhao	dr ta 1	P+. South of Queen Charlotte
	75 76	25 27	17	TOTTICE	Arisan est			.0	se s'dree	919 32 26 fine	[Islands.
	77	27	3	venan ea	dring Jan	wrisnel sa vi	PROTESTED	32	ding s'il	tas set	ta_bgtoeffer esuaw;299 ;29
	78	27	11	i 18 50	192 201	reserved three lands	th one had	21	OVEREN S		Small beginning on Benioff Z 18 <sup>m</sup> 48 <sup>s</sup> .
	79	31	22	43 43	54 2*		distinge la	1.2	HE W OU	83	[Yugoslavia.] P—. Southeast of Formosa.
	one no	handiy	enibuti	anol dub	enop išmi	dedoubt tibbee	der Sée .e	STRUMBERTO STRUMBERTO	ense es	obnar.	den seroven doinw sevew — Zhiki
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#### København.

#### NOTES

- No. 2. Jan. 1. 23h. Pacific Ocean;  $\triangle = \text{ca. } 90^{\circ}$ .  $iP_Z 40^{\text{m}}49^{\text{s}}$ , dilatation.  $PP 44^{\text{m}}18^{\text{s}}$ , 31s.  $SKS 51^{\text{m}}18^{\text{s}}$ .  $S 51^{\text{m}}30^{\text{s}}$ .  $PS 52^{\text{m}}31^{\text{s}}$ .  $e_N 56^{\text{m}}.5$ .  $SS 57^{\text{m}}.3$ .
- No. 4. Jan. 2. 22h. Mexico;  $\triangle = \text{ca. }88^{\circ}$ .  $e_Z$  40m12s, possibly preceded by quite small movement, masked by microseisms, beginning about 40m.0. PP 43m34s. SKS 50m40s; S 50m59s; PS 51m56s.  $e_E$  53m.1. SS 56m.3. e 63m.5. The beginning of L not certain.
- No. 14. Jan. 11. 15h. Japan. Possibly deeper than normal.  $iP_Z$  23m58s, dilatation. i(pP) 24m13s. PP 27m2s; e 27m.4.  $e_E$  33m44s. S 33m54s, followed by several oscillations; phases not clearly separated. L not large, the beginning uncertain.
- No. 19. Jan. 18. 9h. Afghanistan. Deep Focus. Masked by strong microseisms. iP  $36^{\rm m}46^{\rm s}$ . e  $39^{\rm m}.2$ ,  $39^{\rm m}.5$ . S  $43^{\rm m}1^{\rm s}$ .  $e_E$   $44^{\rm m}.3$ . e  $46^{\rm m}.2$ ,  $46^{\rm m}.5$ .
- No. 23. Jan. 24. 10<sup>h</sup>. Masked by strong microseisms, readings uncertain.  $e_Z$  50<sup>m</sup>.8.  $e_N$ , z 52<sup>m</sup>26<sup>s</sup>.  $e_E$  53<sup>m</sup>.3;  $e_N$  53<sup>m</sup>.8. e 55<sup>m</sup>.9.  $e_E$  57<sup>m</sup>50<sup>s</sup>.  $e_E$  58<sup>m</sup>20<sup>s</sup>,  $e_N$  58<sup>m</sup>.6.  $e_E$  z 59<sup>m</sup>19<sup>s</sup>. e 62<sup>m</sup>.4, 63<sup>m</sup>.4.
- No. 28. Febr. 1. 19h. Banda Sea;  $\triangle = \text{ca. }110^\circ$ . Large earthquake. Galitzin records not readable. eP 19m5s, condensation. P' 22m55s. PP 23m42s very large. PPP 25m54s.  $e_N$  27m.4; 28m.0.  $e_E$  29m.1. e 29m23s. SKS 29m51s very large.  $e_N$  30m.9.  $e_N$ , E 31m.3, oscillations of long period. e 32m.7. PS 33m.2 and PPS 34m.0 very large on N and E.  $e_E$  37m.4. SS 38m55s very large on N. e 40m1s very large on E.  $L_Q$  49m, very large oscillations of period of more than 1 minute.
- No. 32. Febr. 5. 2<sup>h</sup>. Colombia;  $\triangle = \text{ca. }85^{\circ}$ . h = ca. 160 km. Records masked by strong microseisms.  $P_Z$  36<sup>m</sup>0<sup>s</sup>. pP 36<sup>m</sup>40<sup>s</sup>, sP 37<sup>m</sup>0<sup>s</sup>. PP 39<sup>m</sup>.8. e 42<sup>m</sup>.4. (S) 46<sup>m</sup>.2. e 47<sup>m</sup>.0, 47<sup>m</sup>.5.
- No. 42. Febr. 14. 3h. Golf of Karabugas, Caspian Sea. Deeper than normal. iP 0m32s.5, condensation. ipP 0m46s. S 5m36s. ez 5m46s. Movement of short period prevailing; strong Benioff Z record.
- No. 54. March 8. 5h. Pacific Ocean;  $\triangle = \text{ca. } 125^{\circ}$ . PP about  $55^{\text{m}}.6$ , not clearly marked. SKS  $61^{\text{m}}16^{\text{s}}$ . SKKS  $62^{\text{m}}52^{\text{s}}$ . PS  $65^{\text{m}}.5$ . SS  $72^{\text{m}}.3$ .
- No. 73. March 22. 15<sup>h</sup>. West of Queen Charlotte Islands.  $P 33^{m}16^{s}$ , not clearly marked, possibly two seconds later.  $e_{E} 34^{m}4$ .  $PP 35^{m}.8$ .  $e_{E} 41^{m}.4$ ,  $e_{N} 41^{m}40^{s}$ .  $S_{E} 42^{m}31^{s}$ .  $e_{N} 42^{m}.9$ ,  $43^{m}.4$ .  $e_{N} 46^{m}.5$ ,  $SS 46^{m}.8$ .  $SSS 50^{m}.0$ .

#### Seismometric readings: Notation

- P— normal first preliminary tremors, longitudinal waves.
- P+ first wave condensational (away from the epicentre).
- P—— first wave dilatational (towards the epicentre).
- $P(\pm a, \pm b, \pm c)$  a, b and c are trace amplitudes in mm. of first swing on NS, EW and vertical component Galitzin records respectively. + indicates ground motion directed to N, to E or up, indicates ground motion to S, to W or down. When a second set of amplitudes is given it refers to the second swing. If an amplitude is not measurable the number is replaced by x.
- PP... longitudinal waves reflected at the earth's surface.
- S normal second preliminary tremors, transverse waves.
- SS... transverse waves reflected at the earth's surface.
- PS; PPS;... waves reflected at the earth's surface which travel partly as longitudinal, partly as transverse waves.
- SKS waves which traverse the mantle as transverse waves but are refracted through the core with longitudinal oscillation.
- PKS waves which pass the mantle on one side of the core as longitudinal waves, on the other side as transverse waves and are refracted through the core with longitudinal oscillation.
- SKKS waves which traverse the mantle as transverse waves, are refracted through the core with longitudinal vibration and are reflected on its inner boundary.
- L long, or surface, waves; main phase.
- M waves of greatest amplitude in the surface waves.
- i sharply defined beginning of a phase.
- e gradual beginning of a phase.
- $\Delta$  arcual distance from the station to the epicentre.
- \*) affixed to time of phase indicates that the beginning is in a time-mark.
- \*) affixed to number and date refers to Notes.