



HELWAN OBSERVATORY



# SEISMOLOGICAL REPORT FOR THE YEAR 1952

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Professor A. H. SAMAHA, B.Sc., D.C.E., F.R.A.S.

*Director of Helwan Observatory*



**SEISMOLOGICAL REPORT**

**1952**



# HELWAN OBSERVATORY



## Seismological Bulletin

Constants of the Station:

$$\phi = 29^{\circ} 51'N. \quad \lambda = 31^{\circ} 20'E. \quad h = 115 \text{ m.}$$

NATURE OF STRATA: Limestone rock.

INSTRUMENTS: Galitzin Wilip Aperiodic Seismograph, Photo Galvanometric Registration, Vertical Component.  
Milne-Shaw Seismographs, Photographic Registration, two Horizontal Components.

Component	Date from which Constants apply	Pendulum Free Period T	Galvanometer Free Period T <sub>1</sub>	Damping Constant	Transmission Coefficient K	Static Magnification V
N	Monthly	sec. 12.0	sec.			250
E	"	12.0				250
Z	9-6-1938	11.16	11.13	+0.05	175	1000

The Seismological station at Helwan is superintended by Assis. Professor Azouz Ismail who carried out the measurements contained in this volume.

N.B. Compression should be taken dilatation  
& dilatation compression.

\*\* Confused with the succeeded earthquake

\*\*\* Lost in changing the paper.





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks											
								A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>													
				H.	M.	S.		Sec.	μ	μ	μ		Kms.										
1	Janv. 2	Z Z	e i	9	33	58						Local (not felt)											
					34	18																	
2	2	Z Z Z Z	e e i e	9	54	22						"	"										
					38																		
					54																		
					55	54																	
3	3	Z Z Z Z NE	iP PPP i (S) e F	6	06	57				1445		Compression											
					07	15																	
					08	25																	
					09	22																	
					11	02																	
4	4	Z Z Z	ePKP e e F	6	07	02						Very weak											
					08	48																	
					10	06																	
5	12	Z Z N N N N	eP e e SKS S e F	20	25	12				10335		"	"										
					29	06																	
6	13	Z Z Z Z Z Z NE N N N N N N	eP PcP e e e PP (PPP) S SS SP e e M F	4	16	08				9390		h = 100 Km.											
					12																		
					17	12																	
					19	30																	
					21	14																	
					26	18																	
					27	00																	
					30	48																	
					31	42																	
					51																		
					6.0																		
					7	15							Z NE E	P (S) e F	2	41	10				3780		Very Weak
																48	52						
																49	45						
8	20	Z Z Z N	P S e M F	14	49	06	12	16															
					54	30																	
					55	10																	
					02	06																	
9	21	Z Z N N	e e i i F	3	56	30						Very Weak											
					4	00							24										
						07							03										
													18										
					7.0																		
10	23	N N	e e F	3	46	18						"	"										
					48	36																	
11	31	Z Z Z E E	iP e PP S e F	21	01	57				3945		Compression											
					02	24																	
					03	15																	
					07	32																	
					09	37																	
12	Feb. 1	Z Z Z	e e e F	9	29	39						Very Weak											
					30	21																	
					32	13																	
13	2	N N N	e e F	10	43	50						"	"										
					45	54																	
14	2	Z Z	e i	23	19	00						"	"										
					21	33																	





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
				μ	μ	μ	Kms.					
15	6	Z	e F	5 6.2	36	27						Very weak
16	6	Z Z Z Z Z	e e e e e F	7	16	06 15 27 41 02 00						
17	22	E E ZE EN N	P i PP S eeS F	7	12	27 48 15 52 21 45 25 48				9110		Confused with microseisms h = 700 Km.
18	11	Z Z E	i i i F	16	39	45 51 30						Confused with microseisms
19	11	Z E E N N	eP PP e e e F	3	51	52 00 54 15 36				11110		
20	14	N	e F	21 23.4	28	06						Very weak
21	14	Z Z Z E E	iPKP ePKKP PP e PSKS F	1	36	55 15 48 06 09				17145		Dilatation
22	25	Z NE	Pg Sg F	22 22.9	49	10 24				122		Slightly felt in Cairo
23	25	Z Z Z Z	e e e e F**	11	28	12 42 45 30						
24	26	Z Z E N EN EZ	PP PPP e S SS PPS F	11	49	24 15 18 36 24 51				12000		h = 250 km.
25	26	Z Z	e e F	21 23.0	26 28	15 45						Very weak
26	27	Z Z	e e F	17	09 10	50 27						" "
27	28	Z Z Z	P e e F	00	43 44 50	31 15 06						" "
28	28	EZ Z	e e F	4 4.6	29 30	04 27						" "
29	March 1	Z Z Z Z	iP e e e F	15	43	38 51 07 32						Dilatation Very weak
30	3	Z Z Z	i i i F	7	33 34 36	00 18 39						





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
				μ	μ	μ	Kms.					
31	4 (contd)	Z	iP F	1 6.5	35	20						Dilatation badly tangled
32	4	Z E E	iP e e F	8.1	15 25 26	24 21 12						Compression Very weak
33	4	Z Z E	iP PP S F	16 18.0	43 47 54	42 00 13				5900		Compression
34	4	Z Z Z Z	PKP PP i i F**	19	49 51 52 53	42 56 15 10				14610		Very weak
35	4	Z Z Z Z Z E Z	iP i i PP i eS PS PPS F	20 23.0	08 09 11 12 13 9 20	57 37 11 18 29 30 28 51				9555		Dilatation
36	5	Z Z E E	eP i PP SKKS S F	4 5.5	01 05 12	48 55 10 18 30				9555		Very weak
37	5	Z E	P (S) F	9 10.7	29 40	51 25						" "
38	9	N Z Z	e e e F	1 1.6	23 24 25	00 42 23						" "
39	9	Z Z Z	e e e F	4 5.2	50 51 52	30 18 30						" "
40	9	Z Z	e e F	5 6.4	53 54	12 57						" "
41	9	Z Z EN E EN EN N	iP PP iSKS eS PS SS M F	17 23.0	16 19 26 27 32 55	22 41 44 52 48 30 09	24		91	9500		Dilatation
42	9	Z	i	20	13	24						Confused with the preceding choc
43	13	Z	e	6	35	27						Very weak
44	13	Z Z	e e F	7 7.4	05 07	48 47						" "
45	13	Z Z Z N E Z N	iP pP pPP S e sS SS F*	14	09 10 13 19 20 21 24	24 30 34 30 26 02 30				9110		Compression h = 330 Km.
46	13	Z	(P) F	14 15.2	29	05						Very weak





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H	M.	S.		Sec.	A <sub>n</sub>	A <sub>c</sub>		
				μ	μ	μ	Kms.					
47	14	Z Z	i i F	21 22.1	08 11	00 15					Very weak	
48	15	Z Z Z E E	eP PP e eS M F	11 13.0	27 30 32 37 58	36 24 18 08 00	21	38		8220		
49	18	Z Z N	e e e	4	19 20	12 42 20					" "	
50	18	Z Z Z	i e i	11	15 16 18	46 50 54						
51	19	Z Z NZ	iPn i (Sn) F	1 2.1	29 31	43 57 26				1000		
52	20	Z NE NE N	iP SKS iS M F	11 16.0	10 20 21 52	14 42 06 36	24	218		10000	Compression	
53	22	Z Z N NE	iPn Pg Sn S* F**	4	53 54	29 39 06 15				333	Dilatation	
54	22	Z Z	e e	5	44 45	21 54					Very weak	
55	23	Z Z Z	e e e F	15 17.0	34 38	30 48 21					" "	
56	25	Z Z Z	e e e F	3 4.0	37 39 40	36 33 10					" "	
57	25	Z Z Z Z Z	PKP PKKP sPKP e e	4	27 29 31 36	38 59 09 33 27				16665	" = 250 Km.	
58	27	Z Z NE	eP (PP) (S) F	16 17.4	19 20 27	33 00 23				6445	Very weak h = 200 Km.	
59	31	Z	eP F	6 7.1	27	38					Very weak	
60	April 1	Z Z Z	ePKP e e F	14 16.2	28 29 31	42 03 26					" "	
61	3	Z Z Z Z Z	e e i e i F	16 16.4	08 09 10 12 13	06 24 02 16 15					Confused with microseisms	
62	3	Z Z	e e F	17 17.5	17 19	54 08					" " "	
63	4	Z Z Z Z	iP e e ePP	3	05 07 09	39 24 00 21				9890	Dilatation above normal	

\*\* Confused with the succeeded earthquake.





No	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
								μ	μ	μ	Kms.	
63	4 (contd).	Z	e		21	39						
		EN	SKS		16	00						
		EN	S			18						
		N	PS		17	30						
				4.4								
64	4	Z	P	20	16	02						Near earthquake
		Z	i			16						
		Z	e	21.0	24	45						
65	5	Z	iPKP	8	52	56						Dilatation Very weak
		Z	(PKKP)		53	10						
		Z	e		55	00						
		Z	e		56	30						
66	8	Z	P	10	13	04					9780	h = 100 Km.
		Z	e			22						
		Z	e		14	06						
		Z	PP		16	38						
		Z	pPP		17	00						
		EZ	S		23	39						
		Z	e		24	39						
				11.5								
67	8	Z	e	21	07	30						Very weak
		Z	e			47						
68	10	Z	iP	6	09	34						Dilatation Very weak
		Z	e		19	45						
		Z	e	7.1	20	45						
69	12	Z	e	1	35	48						" "
		Z	e		37	08						
70	15	Z	iP	00	03	03					10280	Dilatation
		Z	e			21						
		Z	PP		06	45						
		Z	e		07	15						
		Z	e			39						
		N	SKS		13	36						
		N	S		14	06						
		N	e		16	00						
				2.3								
71	15	Z	iP	6	12	24					9110	Dilatation h = 100 Km.
		Z	i			44						
		Z	e		14	45						
		Z	PP		15	39						
		Z	pPP		16	00						
		Z	eS		22	24						
		NZ	sS		23	06						
				7.1								
72	15	Z	(PKP)	9	34	46						Very weak
		Z	i			51						
		Z	i		35	06						
		Z	F		38	42						
73	15	Z	eP	19	16	03					11220	
		Z	e			14						
		Z	e		19	57						
		Z	PPP		22	30						
		N	e		26	48						
		N	S		27	39						
		Z	PS		29	07						
				21.5								
74	16	Z	e	3	53	11						" "
		Z	e		54	05						
		E	e	4	03	51						
				4.6								
75	19	Z	eP	10	12	30					11000	
		Z	i			36						
		Z	e		15	32						
		Z	PP		16	33						
		E	SKKS		23	06						
		E	eS			59						
		Z	PS		25	30						
		Z	i		27	06						
				14.0								





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
				μ	μ	μ	Kms.					
76	19	N N NE	e e M F	19 20 21.0	50 51 22	18 24						Very weak
77	20	ZN	e F	9 11.5	59	32						" "
78	24	Z	e	12	32	12						" "
79	27	Z Z	e e F	13 15.0	02 03	58 24						" "
80	28	Z Z Z Z Z N N E E	iP PP e e PP eS e i PS F	11 12.4	06 07 10 17 18	50 16 24 51 (06) 18 32 39 18				9665		Dilatation h = 100 Km
81	29	Z Z Z Z Z Z EN EN EN	iP PP sP (PP) (PPP) e S e SP F	2 4.6	47 48 50 52 53 56 58	05 06 33 09 03 30 42 00 33				8890		Dilatation h = 250 km.
82	May 4	Z Z Z Z Z	eFKP (PKKP) e e e e F	14 17.0	35 36 37 40 43	14 37 22 49 43						Very weak
83	8	Z Z Z Z N ZN N	eP e e PP SKS S e F	2.2	11 14 21 22	24 45 02 47 42 58 18				9555		" "
84	8	Z Z	eP e F	4 4.4	13 14	45 06						
85	8	Z Z E E Z	eP e SKS S PPS F	23.0	24 34 35 37	00 21 33 06 09				10415		
86	9	Z Z Z Z	ePKP PKKP e PP F	5.8	48 49 52	12 34 12 06				17165		
87	9	Z Z Z E Z	ePKP (PP) e PS e F	21.0	06 08 11 18 20	36 00 09 12 12				13555		
88	10	Z N	e e F	9.9	19 44 45	34 24						
89	13	Z Z	ePKP e	19	50 51	24 08						









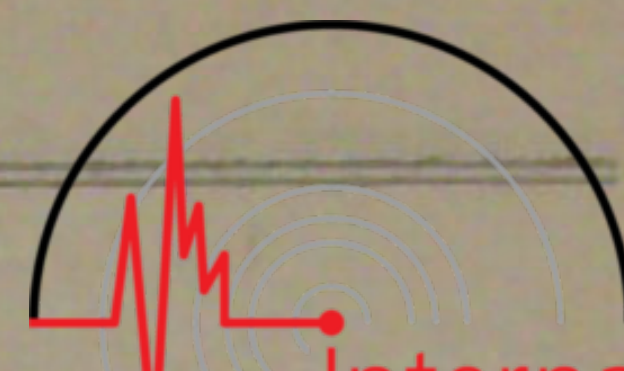
No.	Date	Comp.	Phase	G.M.T			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
								μ	μ	μ	Kms.	
104	3	Z Z Z	P e e F	21  21.6	32 33	30 52 14						Very weak
105	4	Z Z Z	i i i F	6  7.0	55 56	24 52 06						" "
106	5	Z Z	e e	3	03 04	42 17						" "
107	9	Z Z Z	P e e F	14  15.2	50 51 54	30 50 06						" "
108	10	Z Z E	ePKP e SKP F	10  13.0	18 21	18 23 50				16935		" "
109	11	Z Z Z Z E E Z EZ	eP e PP PPP SKS eSKKS PS PPS F	00     1 4.0	46 50 51 53 57 58 00 01	31 50 06 27 05 03 39 44				12335		
110	12	Z Z Z	eP e i F	11  11.3	01 02	50 05 45						
111	13	Z Z Z	e e e	1	09 11 12	56 49 00						" "
112	15	Z Z Z	eP e e F	15  16.2	25 27 32	00 02 36						" "
113	16	Z Z Z Z	ePKP (PKKP) e e	3  4	57 59 10	22 36 12 42						" "
114	17	Z	e F	12 13.5	23	54						" "
115	19	Z Z Z	eP PP S F	12  14.4	23 25 31	10 24 22				6665		
116	19	Z Z Z	e e e F	21  23.5	17 20 21	22 57 54						" "
117	20	Z Z Z Z Z	iP e PP e PS F	5  6  7.5	58 59 01 08 09	20 14 32 30 21				8665		Dilatation
118	20	Z Z ZE Z Z	ePn e iSn e i F	18  18.6	32 33	44 17 27 43 51				400		Preceded by microseisms
119	21	Z Z Z	P e e F	6  7.9	41 42 52	48 09 30						Very weak





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
								μ	μ	μ	Kms.	
120	22	Z Z Z	P e e F	10  11.9	21 22	05 18 25						Very weak
121	22	Z Z Z E ZE Z	iP e i SKS S PS F	21 22  1.5	54 55 01 05 06	44 14 38 15 29 38					9835	Dilatation
122	23	Z Z Z	iP e e F	12  13.3	15 17 20	15 22 15						Dilatation Very weak
123	24	Z Z Z	eP e e F	16  17.8	41 42 43	56 20 41						" "
124	25	Z Z	eP e F	23  0.7	30	04 14						" "
125	27	Z Z	e e F	13  13.5	12 14	19 40						" "
126	30	Z Z Z E	P e i i F	21  22.3	10 11 19 20	40 19 14 02						" "
127	July 4	Z Z	e e	5	04 07	47 12						" "
128	5	Z Z E	eP e e F	17  18.0	26 27 36	13 18 13						" "
129	6	Z	eP F	6 7.4	20	17						" "
130	9	Z Z Z	e F	18 20.0	34	06						" "
131	10	Z Z Z Z Z E Z	ePKP PPKP i e e e SKSP F	16  16.7	04 06 07 10 11 13 17	00 32 16 03 18 33 03				17220	h = 300 Km,	
132	13	Z	e F	3 3.6	09	30						Very weak
133	13	Z Z Z	eP e e F	6  6.6	29 30 31	45 58 30						" "
134	13	Z Z Z Z E Z	PKP PPKP sPKP SKP e SKSP F	12  20.5	17 18 19 20 27 30	28 45 12 46 00 21				16110	h = 300 Km,	
135	13	Z Z Z Z Z	eP (PP) PPP SSKS PS F	17  20.5	48 51 54 59 05	00 48 06 05 51				10835		
136	16	ZE	e	14	27	38						





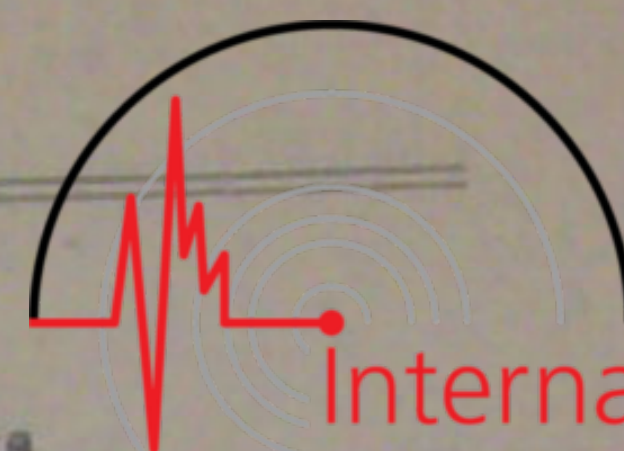
No.	Date	Comp.	Phase	G.M.T.			Period Sec.	Amplitude			Δ Kms	Remarks
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
137	17	Z Z Z E E E	iP ipP PP S sS e F	16     18.0	22  25 32 33 34	15 36 (30) 30 18 21				9335	Compression h about 100 Km.	
138	18	Z Z	e i	5	37 41	59 33					Very weak	
139	18	Z	PKP	18	59	26				16665	" "	
	18	Z Z Z	PKS PP e F	19   21.0	03  04	00 14 26					" "	
140	20	Z Z Z	e e e	11	07 08	18 08 40					" "	
141	21	Z Z E E E E	iP PP SKS e PS e F	12	06 11 17 19 20 22	45 17 17 09 36 00				12165	Dilatation	
142	22	Z Z Z Z	eP e e e F	23    24.0	10   11	00 21 55 15					Very weak	
143	23	Z Z	(e) i F	00  2.0	52 57	30 34					" "	
144	24	E	e F	23 23.5	32	44					" "	
145	27	Z Z Z	e e e	2	31 32 34	14 15 54					" "	
146	27	Z Z Z E E E E E E	iPKP pPKP e e e SKSP PSKS e F	8       10.5	42 44  49 52 55 56 58	20 07 27 51 12 45 33 36				17220	Compression h = 680 Km.	
147	August 1	Z Z Z Z Z	P e PpP e S F	10    11.1	34 35 38  39	48 06 04 36 39				3110		
148	4	Z Z Z E E	P e i e e e (S) M F	1    2 2.5	53 54 55 56 58 02	29 05 18 38 12 51	8	11				
149	6	Z Z	i e e	1  1.5	12 17	58 21					Very weak	
150	13	Z Z Z Z ZE E	iP i e i i (S) M F	14     15.2	34 35 36 37 38 42	06 25 06 06 33 56	9	9		2890	Dilatation	





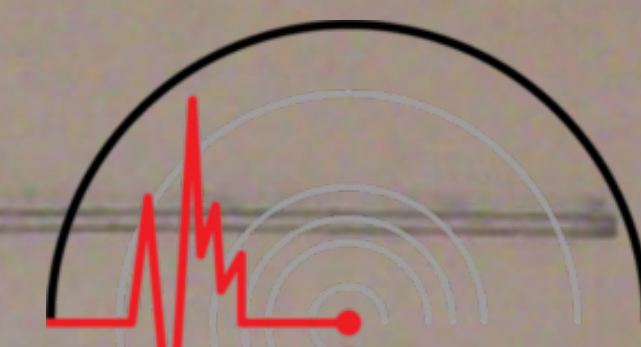
No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
								μ	μ	μ		
151	13	Z	e F	21 22.2	24	39						Very weak
152	14	Z E E	eP e M F	16 17.1	12 21 40	06 00						" "
153	14	Z Z	e i F	23 1.6	37	06 17						" "
154	16	Z Z Z	e e e F	14 16.6	12 13 15	34 05 30						" "
155	17	Z Z	e e F	4 5.6	34 35	21 34						" "
156	17	Z E E E E	iP PP S e SS F	16 20.5	11 13 18 21 22	15 18 39 12 12				5780		Compression
157	18	Z Z Z Z E	eP e (S) (PS) M F	13 14 15.3	24 26 35 36 16	39 48 33 42						Very weak
158	18	Z Z	eP e F	19 20.1	33 42	10 36						" "
159	19	Z Z Z	P e i F	10 11.4	15 18	07 19 41						" "
160	20	Z E Z Z Z	e e e e e F	15 16 17.5	43 51 52 54 03	42 12 00 00 21						" "
161	21	Z E E	P <sub>n</sub> (S <sub>n</sub> ) e F	4 4.6	20 21	10 24 45				710		" "
162	24	Z ZE	eP <sub>n</sub> (S <sub>n</sub> ) F	20 21.1	45 46	48 55				667		" "
163	25	Z Z	e e F	4 4.5	14 15	50 16						" "
164	27	Z Z Z	P i i	11	41 45	07 26 13						" "
165	27	Z Z	e e	19	31 35	17 06						" "
166	28	Z Z Z Z Z Z	iPKP e PPKP e SKKS e SKSP F	11 12.6	00 02 03 09 10 13	06 52 18 09 54 09 50				17780		Dilatation h = 550 Km.
167	28	Z Z Z Z	PKP e PP SKP F	13 14.4	16 18 20	33 54 54 09				16110		h = 100 Km.





No.	Date	Comp.	Phase	G.M.T.			Por.	Amplitude			Δ	Remarks
				H.	M.	S.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
							S.	μ	μ	μ	Km.	
168	28	Z Z Z	eP e e F	14  15.8	34 37	11 04 39						Very weak
169	29	Z Z Z Z Z Z	eP e e e e e F	5  6 6.5	38 41 48 55 57 01	52 24 09 06 30 35						Probably two earthquakes
170	30	Z ZE Z Z Z	eP PPP e PcP S F	6  6.8	23 26 27	05 45 39 56 09				2555		Very weak
171	31	E Z E Z Z	eP PP S PS e	16	22 25 32 33 34	10 24 57 52 21				9780		" "
172	31	Z	i	16	51	46						" "
173	Sept. 3	Z Z ZE	c e e F	13  14.1	54 55 56	24 18 15						" "
174	7	Z Z Z Z Z Z	PKP PKKP e e e SKP	2 3	58 59 00 01 02	52 09 12 37 14 25				17045		" "
175	9	Z Z E E E E	e e e i e i F	13  15.6	12 19 22 23 24	33 42 55 48 19 21						
176	10	Z Z Z ZE E	P e e (eS) e F**	9	10 12 13 15	15 24 35 39 42				2055		
177	10	Z Z	eP /e F	9  10.2	52 56	10 30						" "
178	10	Z Z	iP e	18 19	59 00	50 03						Compression
179	11	Z Z	i e	5	46 48	12 14						Very weak
180	11	Z Z Z	P i e	8	32 39	30 41 58						" "
181	11	Z Z Z	(eP) e (iS) F	8  9.6	46 48 49	46 30 50						
182	11	Z E	ePKP M F	22 23 1.1	46 47	39						" "
183	14	Z Z ZE	iP e eS F	9  10.6	43 45 50	27 39 52				5835		Compression





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
							Sec.	μ	μ	μ	Kms.	
184	15	Z Z Z E	eP e e e F	4   5.0	36 37 38 41	44 09 27 17						Very weak
185	15	Z Z F Z Z Z E	eP e e e e e M F	11   12.3	35 38 41 43 44 48 51	03 12 36 08 25 12						" "
186	15	E Z Z	e e e F	19  19.7	32	21 32 42						" "
187	21	ZE Z E E E E E	eP PP PP PPP iSKS e i F	2   5.0	44 45 48 49 54 55 56	26 31 48 51 42 29 39				11555		h = 280 km.
188	21	Z Z Z	eP e e F	11  11.7	25 29	05 32 05						Very weak
189	23	E E E	e e e F	20  20.9	34	06 13 22						" "
190	24	ZE	i F	20 21.2	53	41						" "
191	27	Z Z Z ZE	eP e PP S F	19  20.0	18 21 28	21 58 38 45				9335		" "
192	28	E E	e e F	14  14.9	40 41	32 42						" "
193	30	Z Z Z ZZ	eP PPP S e F	2  3.3	55 56 57	00 16 33 15				3335 1500		" "
194	30	Z Z Z Z E E E E	iP i c PPP iS i e e F	13  14.7	02 04 05 06 10 12 13 14	16 24 18 06 32 06 30 36				6835		Compression
195	Oct. 1	Z Z Z	iP e i F	7  8.7	57 58	03 00 42						" "
196	1	Z Z	(e) (e) F	9  10.6	15 26	02 22						Very weak
197	1	Z Z Z	P i e F	12  14.1	34 38	22 37 06						" "
198	2	Z Z	i e	13	24	09 47						" "



No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			$\Delta$	Remarks
				H.	M.	S.		Sec.	$A_n$	$A_e$		
								$\mu$	$\mu$	$\mu$	Kms.	
198	(contd) 2	Z Z	e e		25 27	15 48						Very weak
199	4	Z Z Z Z Z	eP e e e e F	4	14 15 23	32 39 48 50 18						
200	5	E E	e i F	10 11.7	58 59	09 44						
201	5	E E E	e e i F	22 23.1	13 15 21	36 39 09						" "
202	6	E E	e e F	5 5.9	45 46	42 00						" "
203	7	Z Z Z Z Z	P e e e e F	16 16.6	13 14 20	29 45 09 48 33						" "
204	7	Z Z	e e F	18 18.8	17 21	57 36						" "
205	10	Z Z E E	eP e e e F	11 12.5	54 56 57	54 15 45 45						" "
206	10	E E	e e F	16 17.1	15 19	51 21						" "
207	10	E E E E E	(eP) e e e M F	18 19 20.4	54 55 58 00 09	12 12 18 45 51	18	79				" "
208	11	Z E Z	eP e e F	00 0.6	20 34	12 30 10						" "
209	11	Z Z Z Z	eP e e e F	1 2.5	39 40 49	08 21 24 23						" "
210	11	Z Z	e e F	9 9.6	30 32	53 09						" "
211	13	Z Z Z Z	P e e e F	16 17.2	45 47 50 53	12 27 36 15						" "
212	13	Z Z	e e	23	42 44	18 03						" "
213	15	E E E	ePn e i F	17 18.2	52 53 54	27 06 06						" "
214	18	E E	e e F	5 6.2	42 45	12 00						" "



No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ Kms.	Remarks	
				H.	M.	S.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>			
215	18	Z	P	11	09	03					Very weak		
		Z	e			39							
		Z	i			12						18	
		Z	i			13						48	
		Z	i			14						27	
			F	12.5									
216	18	Z	ePKP	19	53	09				17220	" "		
		Z	i			18							
		Z	PKKP			29							
		Z	iPP		57	05							
217	22	E	(eP)	4	16	58							
		E	e			18						06	
		E	i									24	
		E	i									57	
			F	4.7									
218	22	Z	iP	17	02	32				1390	h = 300 km.		
		Z	PP			42							
		Z	i			03						08	
		Z	i									26	
		Z	i			04						14	
		E	eS									52	
		E	e			08						39	
			F	18.0									
219	26	Z	P	8	53	10				9445	Very weak		
		Z	PP			21							
		Z	sP			53							
		Z	PP			56						35	
		Z	PPP			58						28	
		ZE	S			9						03	03
		Z	P <sub>s</sub>									47	
		E	SS									05	16
			F	9.8									
220	26	Z	P	13	33	00				9780	" "		
		Z	e			13							
		Z	PP			36						28	
		E	eSKS			43						27	
		E	eS									44	
			F	14.5									
221	26	Z	P	14	42	46				9780			
		Z	PP			46						12	
		E	eS			53						30	
			F	15.6									
222	26	Z	P	15	59	00				9780	Confused with the succeeding earthquake		
		Z	i			12							
		Z	(PP)			16						02	26
223	26	Z	iP	16	05	45				9780	Dilatation		
		Z	e			07						19	
		Z	PP			09						09	
		E	SKS			16						12	
		E	S									27	
			F	17.6									
224	26	Z	P	18	14	45				9780			
		Z	e			15						08	
		Z	e			16						25	
		Z	e			18						03	
		Z	PP									12	
		E	eSKS			25						13	
		ZE	eS									28	
			F**										
225	26	Z	iP	19	31	59				9665	Dilatation		
		Z	PP			35						22	
		ZE	SKS			42						24	
		ZE	eS									36	
			F**										
226	26	Z	P	20	40	11				9665	Very weak		
		Z	i			21							
		Z	e			43						33	
		E	e			50						54	
			F	22.0									
227	26	Z	iP	22	13	20				9665	Dilatation		
		Z	i			33							
			F	23.2									





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
								μ	μ	μ	Kms.	
228	27	E E E E E	eP PP SKS S e F	3	30 33 40 41	00 20 22 33 21					9555	
229	28	E E	e e F	4	53 55	48 27						
230	28	E E E	e e i F	6	47 54	10 12 30						
231	28	Z Z E	P e (SKS) (S) F	16 17	58 08	06 26 30 51						Very weak
232	29	Z Z Z Z	e e e e	19	39 40 43	47 04 49 39						" "
233	29	Z Z Z Z Z Z Z ZE Z E E	P pP e e iPP pPP e SKS i e e F	19 20	53 54 55 56 57 58 02 04 05 08	55 46 15 06 50 33 03 08 30 12 06					10445	h = 200 Km.
234	31	E E E	e e i F	16 17	50 53 00	06 24 28						
235	Nov. 1	E E	e M F	00	09 29	40						
236	2	E E	e e F	00	05	18 38						
237	4	Z E	iP i F**	17	11	05 15						Dilatation (Very strong)
238	4	Z E E	eP i e F**	21	01 12	33 09 39						
239	4	Z	eP F**	22	05	41						
240	4	Z E	P i F**	22	25 36	45 23						
241	4	Z E E	P e e F**	23	41 52	46 18 26						
242	5	Z Z Z Z Z E E	P i e P i i SKS S F**	2	32 33 36 39 43	42 10 44 08 39 27 05 17					9555	

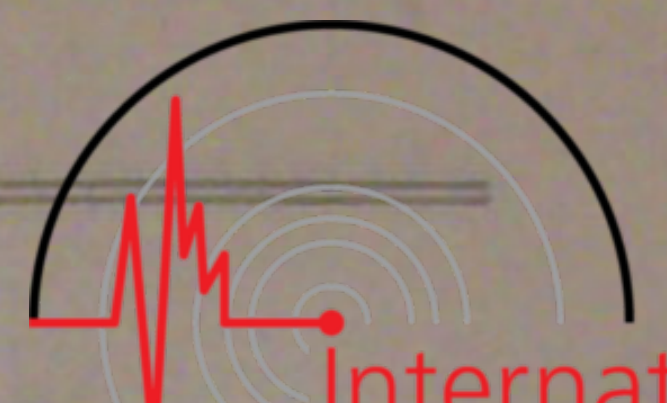


No	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks			
				H.	M.	S.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>					
							Sec.	μ	μ	μ	Kms.				
243	5	Z	iP	3	42	32					9555	Dilatation			
		Z	i											42	
		Z	e											45	09
		Z	e											46	29
		E	SKS											52	58
		E	S											53	12
244	5	Z	eP	6	10	35					9555				
		Z	i											12	07
		Z	i											17	33
		ZE	SKS											21	00
		ZE	S												12
245	5	Z	P	6	48	27						Very weak			
		Z	e											37	
		Z	e											49	04
246	5	Z	e	7	48	00						" "			
		Z	e											29	
247	5	Z	e	8	51	12						" "			
248	5	Z	e	9	11	20						" "			
		Z	e											12	15
		Z	e											14	48
		Z	e											15	18
249	5	Z	P	9	43	00									
		Z	i											12	
250	5	Z	i	10	28	12									
			F <sub>1</sub>	10.7											
251	5	Z	eP	11	30	51									
252	5	Z	i	11	47	26									
		Z	e											49	04
253	5	Z	iP	11	59	20						Compression			
		Z	i											29	
		Z	i											48	
		E	(eS)											12	09
			F	13.2											
254	5	Z	iP	13	19	11					9555	Dilatation			
		Z	i											21	30
		Z	PP											22	34
		Z	e											26	09
		Z	e											28	25
		E	iS											29	45
														F <sub>1</sub>	
255	5	Z	e	14	23	30									
		Z	e											44	
256	5	Z	iP	15	01	27						Compression			
		Z	e											03	15
		Z	e											08	14
		Z	e												35
		Z	i											12	10
		Z	i												19
		Z	e											13	14
257	5	Z	P	16	16	57									
		Z	e											18	08
258	5	Z	iP	19	21	09					9555	Dilatation			
		Z	i											19	
		Z	i											23	33
		Z	i												39
		Z	ePP											24	30
		Z	e											25	12
		Z	e											27	54
		E	eS											31	42
			F <sub>1</sub>												



No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
							Sec.	μ	μ	μ	Kms	
259	5	Z	i	20	23	47						
260	5	Z Z Z	P i e F**	20	43 46	17 24 30						
261	5	Z	iP	21	21	20						
262	5	Z Z	P i	21	58 59	51 07						Very weak
263	5	Z Z Z E	eP PP e eS F	22 23 24.5	58 02 06 09	46 15 13 28				9780		
264	6	Z	P	1	11	36						" "
265	6	Z	P	2	36	30						" "
266	6	Z Z Z Z E	iP e e PP eS F	4	07 08 10 17	14 43 12 41 52				9665		Dilatation
267	6	Z Z E	eP e e F	5 6 7.0	55 56 05	07 09 54						Very weak
268	6	Z Z Z	P e e	8	18 20	03 27 42						" "
269	6	Z Z Z	P i i F	14 15.5	19 20	43 02 33						" "
270	6	Z Z	P e	18	02	30 47						" "
271	6	Z Z Z Z Z ZE E E E	iP i e PP i i SKS S i F	19 20 23.0	58 59 01 02 06 09 10	47 10 48 08 14 49 15 27 09				9720		Dilatation
272	6	Z Z	P e	23	48 49	39 27						Very weak
273	7	Z	P F	2 3.7	34	38						" "
274	7	E	e F	14 15.6	31	36						" "
275	7	E E	e e F	22	28 29	41 50						" "
276	8	Z Z Z Z	P i i e F**	17	17 18 21	14 33 19 00						" "
277	8	Z Z	eP e	18	08 11	18 18						" "
278	8	Z Z Z Z	iP PP e e	19	46 49 52 56	10 36 59 22				9555		Dilatation





No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
							Sec.	μ	μ	μ	Kms.	
278	(contd) 8	Z Z	e e F**			42 06						
279	8	Z	i	20	27	46						Very weak
280	8	Z	P	22	38	58						" "
281	9	Z Z Z	P i e	00	05 06 07	48 02 27						" "
282	9	Z Z Z Z Z Z	iP e e e e e F**	00	35 38 39 42 47 48	09 35 00 14 17 10 24						Dilatation
283	9	Z	iP e F**	1	30	24 35						" "
284	9	Z	iP	1	51	52						" "
285	9	Z Z Z	P e e F**	4	47 49 51	56 51 22						Very weak
286	9	Z Z Z	P e e F**	5	19 25 26	06 45 18						" "
287	9	Z Z Z	P e e	6	09 20	44 17 28						" "
288	9	Z Z Z Z	iP i e e	(15)	35 36 44 45	36 09 57 10						Dilatation
289	9	Z Z Z	P i e	(16)	00 02	35 48 22						
290	10	E	e F	1 2.4	18	27						Very weak
291	10	Z Z	eP e F	14	23	17 33						" "
292	12	Z	e F	16 16.7	09	42						" "
293	12	Z Z	e e F	16	54 55	52 05						" "
294	12	Z Z	e e	20	20 21	54 15						" "
295	13	Z Z Z Z E E E	iP le e PP SKS S e F	8	11 13 14 21 22	31 05 31 57 56 07 24				9610		Dilatation
296	13	Z Z Z	leP i e F	15	35 36	31 09 18						Very weak
297	13	Z Z	(PKP) (iPKKP) F	22 23.7	38	25 36						" "



No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
								A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
								μ	μ	μ		
				H.	M.	S.	Sec.				Kms.	
298	14	Z Z Z Z	e e e i F	17	05	22 36 45 12						Very weak Near
299	15	Z Z	iP e F	5	35	51 04						Dilatation Very weak
300	16	Z Z	iP e	2	00	43 00						Dilatation Very weak
301	16	Z Z Z	e e e F	4	23	20 33 30						" "
302	16	Z Z Z Z Z Z	(P) e (PP) e (SKS) e e F*	7	55	05 29 31 00				9555		" "
				8	05	27						
					07	42						
					09	38						
303	16	Z Z Z	e e e F	8	11	39 53 27						" "
					15							
				10.0								
304	16	Z Z Z	e e e F	14	28	00 36 00						" "
					31							
				16.3								
305	17	Z Z	e e	7	55	36 49						" "
306	17	Z Z Z Z Z	(iPKP) (PKKP) e e (SKS) F	8	26	17 27 29 48 15				16780		" "
					30							
					33							
				9.7								
307	19	Z Z Z Z S	P PP i S i F	10	32	07 08 16 08 07			100	5555		" "
					34							
					35							
					39							
					41							
				11.1								
308	20	Z Z Z Z Z Z	(P) (PP) e E E (s) F	5	52	09 23 56 18 33 23 12				1890		
					53			10E				
					54							
					55							
				6.1								
309	20	Z	P	11	38	42						" "
310	20	Z Z Z E E Z E	P e e e e e e F	15	56	03 27 50 30 22 51 06						
					57							
					02							
					05							
					07							
				18.2								
311	21	Z Z Z	i i e	3	32	09 21 47						" "
312	21	Z	i	17	93	22						" "
313	22	Z Z Z Z	P e e e	7	05	46 06 30 51				8110		" "
					07							



No.	Date	Comp.	Phase	G.M.T			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
								μ	μ	μ	Kms.	
313	(contd) 22	Z Z Z	S  SKS		15	12 30 48						Dilatation
314	26	Z Z Z Z Z Z E Z	iP     SKS S F	13   13	38   39 43 44 48 49	02 36 41 49 42 12 36 23					10780	
315	26	Z E Z	e e e F	23	40 42	15 57 10						Very weak
316	28	Z Z Z Z Z Z Z Z	P i i i e e SKS S M F	8	18  19 21 25 29 03	24 36 14 42 35 51 05 40					10665	" "
317	28	Z Z Z Z Z	e e e e	21	20  21 22 25	18 39 09 06 45						" "
318	29	E	M F	9 11.6	22	08	18	14				Record lost in changing the the paper
319	29/30	Z Z Z Z E E Z	iP i PP i SKS S PPS F	23 00	59 00 03 04 10 12	48 02 31 07 18 52 38					10280	Dilatation
320	30	Z Z E	iP i e F	19	41 48 52	30 30 06						Compression Very weak
321	Dec. 2	Z Z	e e F	4	56	17 32						" "
322	2	Z Z	e e F	19	13	00 13						" "
323	3	Z Z	e e F	20	07 09	06 32						" "
324	3	Z Z Z Z	iP i e e F	22	38 39	34 44 14 40						Dilatation Very weak
325	4	Z Z Z Z E E Z	P PP e e S sS PS F	4	04 05 09 10 15 16 17	42 20 04 59 40 39 19					10555	h = 150 Km.
326	4	Z Z Z	iP PP e	15	05 09 11	29 16 29					10335	Compression



No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
							Sec.	μ	μ	μ	Kms.	
326	(cont.) 4	E Z	e S F		12 16	39 35						
				15.6								
327	5	Z Z E	P e M F	20 21 21.7	55 56 24	20 19						Very weak
328	6	Z Z E	P i e F	3 4.7	47 57	00 22 45						" "
329	6	Z Z Z E E EZ Z	iPKP e e SKS e SKKS e F	11 15.0	00 02 03 07 08 09 11	21 09 06 25 17 06 17				14110		Dilatation
330	6	Z Z EZ	eP e e F	21 23.0	09 11	39 15 24						Very weak
331	7	Z Z Z Z EZ E Z	iP e PP PPP SKS S PS F	1 4.0	03 06 07 09 14 15	27 36 09 12 00 30 45				10220		Dilatation
332	7	Z Z	e e F	16 18.0	46	00 45						Very weak
333	8	Z Z	P e F	15 16.5	19 23	45 29						" "
334	9	Z Z ZE	e i e F	7 7.7	39 40 42	57 21 45						" "
335	9	Z Z Z Z Z	PKP PP i SKP PKS F	9 10.0	34 37 38	39.8 30 56 06 15				15280		" "
336	10	Z Z E	iP PP S F	6 7.5	06 08 13	34.2 23 20				5110		Dilatation
337	10	Z Z Z	iP e i F	8 10.5	25 26 29	54 38 56						"
338	11	Z Z Z ZE E Z	P e PP e SKS PS PPS F	9 11.0	11 14 16 21 22	00 28 21 45 24 34 55				9555		
339	12	Z Z Z	e i i	20	44	42 46 51						Very weak
340	17	Z E E	iP <sub>n</sub> P* S <sub>n</sub> F	23 1.3	05 06 07	49 05 09				778		Compression



No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks	
				H.	M.	S.		Sec.	A <sub>n</sub>	A <sub>e</sub>			A <sub>z</sub>
								μ	μ	μ			
341	18	Z	i	9	33	15						Very weak	
		Z	e		34	08							
		E	e		43	54							
				10.6									
342	18	Z	e	10	43	37						" "	
		ZZ	e		44	36							
		Z	e		45	15							
				11.6									
343	91	Z	Pn	12	45	58.6				677			
		Z	Pg		46	26							
		EN	Sn		47	10							
				12.9									
344	19	Z	PKP	19	25	42				16665	Very weak	h = 250 Km.	
		Z	i		49								
		Z	PKKP		26	02							
		Z	PPKP		27	46.5							
		Z	sPKP		27	17							
		Z	PP		29	32							
345	19	Z	ePn	21	16	02				699			
		Z	e		15								
		Z	e		35								
		NE	Sn		17	15							
						21.4							
346	20	Z	i	4	18	30						Very weak	
		Z	e		24	42							
347	21	N	e	14	13	36						" "	
		N	e		49								
		Z	e		14	00							
		Z	e		14.4	15							47
348	22	Z	eP	22	37	28						" "	
		Z	e		38	24							
		Z	e		39	32							
						23.5							
349	22	ENZ	Pn	23	53	31				744	Confused with microseisms		
		EN	Pg		54	04							
		EN	Sn		48								
						24.0							
350	24	Z	P	18	58	30						" " "	
		Z	i		41								
		Z	e		59	50							
		Z	e		19	01							30
				21.4									
351	24	Z	P	21	57	38				3555	" " "		
		Z	e		58	09							
		N	i		22	00							46
		Z	S		22.5	02							50
				22.5									
352	25	Z	P	22	29	25.8				5000	" " "		
		Z	e		30	37							
		Z	PP		31	09							
		Z	S		36	06							
		E	e		37	08							
						23.4							
353	26	Z	e	4	16	4.7						Very weak	
		Z	i		6.7								
		Z	e		15								
354	26	Z	P	11	33	57.2				1390			
		Z	PP		34	07.5							
		Z	S		36	18.6							
355	26	Z	eP	14	35	41						" "	
		Z	e		36	06.4							
		Z	e		37	06							
356	26	Z	iP	23	59	32.4				1710	Dilatation		
		Z	S		24	02							25.2
357	27	Z	P	1	38	35.2						Very weak	
		Z	e		39	42							
		Z	e		42	20							
		Z	e		49	15							
						2.7							



No.	Date	Comp.	Phase	G.M.T.			Period	Amplitude			Δ	Remarks
				h.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
								μ	η	η	Kms.	
358	27	Z Z	i e	18	52 53	54 06						
359	27	Z N	e e	23	12 14	2·8 11						Very weak
360	28	Z N N	e e e	2	44 45	00 49·8 36·6						" "
361	28	Z Z	i i	5	07	39 42·6						" "
362	28	Z Z Z Z	iP i (PP) e F**	15	02 05 06	24 40 54 42						Dilatation
363	28	Z Z Z N	P e PP PPS	15	14 17 18 26	28·8 28 02 52				9890		Confused with the preced- ing earthquake
364	28	Z Z Z Z	P e e e F	18 19·3	46 47 49 56	21 36 09 00						Very weak
365	29	Z Z Z N Z	P e PP eS e	2 3·3	22 23 25 32	08 00 39 55				9890		
366	29	Z Z	P i	9	31	28·8 44·2						
367	29	Z Z Z	eP e e	18	49 50 51	16 59 16						
368	29	Z ZN	eP e	19	02 03	32 55						
369	29	Z Z Z Z Z	Pn i iP* Sn e	23	40 41 42	12·0 19·7 30 35·4 16				799		
370	30	Z Z	e i	18	47	34 42·4						
371	31	Z Z	P i	12	29	15·2 26·5						Very weak
372	31	Z Z N N	Pn P* Sn S* F	14 15·2	50 51 52	29·6 45 45 09				722		
373	31	Z Z N N	Pn P* i Sn F	17 17·8	20 21	32·0 47 09 45·5				710		
374	31	Z NZ	Pn Sn	20	00 01	31 49				744		
375	31	Z Z Z	P e e	21 22	56 03	38 51·4 42						" "
376	31	Z Z N	P e e	22	28 29 30	56 05 56						" "





Tremors were also recorded at:

	D	H	D	H	D	H
January . . . . .	1 5	9 18	2 10	16 1	3	16
February . . . . .	5 26	18 16	6	9,12	8	20
March . . . . .	2 11 21	20 21 1	7 13 22	8 2 19	8 19 30	14,19 9,10 2
April . . . . .	1 4 16	21 5 12,15,18, 22	2 5 18	11 1,16,18 17,21	3 7 24	4 3 17
May . . . . .	21	3				
June . . . . .	2	11	6	11	26	15
July . . . . .	3 11 29	2 7 3, 8,21,	6 15 31	0 7 13	8 18	21 1
August . . . . .						
September . . . . .	20	14				
October . . . . .	6 13 22	3,23 13 1	8 14	6 1	9 18	10 7
November . . . . .	7 11	7, 8,12 13 0, 2,20	9 14	19,22 9	10 15	6,21, 23 15
December . . . . .	4	12	7	16		



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