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Old seismologic reports

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SEISMIC OBSERVATIONS
AT FABRA OBSERVATORY IN 1989

by M^a TERESA SUSAGNA VIDAL

The Observatory has the following seismographs:

Station FONT (Coordinates 41°45,7'N, 2°26,1'E)

— Three short period «Teledyne Geotech» seismograph, vertical and horizontal components, with ink recording.

Station FBR (Coordinates 41°25,0'N, 2°07,5'E).

— One short period «Hiller-Stuttgart» seismograph, vertical component, with mechanic recording.

— Two long period «Mainka» seismograph, horizontal components, with mechanic recording.

— One short period «Vicentini» seismograph, vertical component, with mechanic recording.

We symbolize by ZT Teledyne Geotech vertical components, by NT and ET the Teledyne Geotech horizontal components, by ZH the Hiller-Stuttgart vertical component, by NM and EM the Mainka horizontal components and by ZV the Vicentini vertical component.

For the most outstanding earthquakes, we describe their epicentral characteristics, calculated by the Seismic Section of this Observatory, together with «Servei Geològic de Catalunya» (SGC) or provided by the United States Geological Survey (GS), by the «Centre Seismologique Europeo-Mediterranean» (CSEM), by the «Instituto Geográfico Nacional» (I.G.N.) or by the Laboratoire de Détection et de Géophysique (LDG).

The average instrumental constants have been:

1) Electromagnetic seismograph (electronic and ink recording):

Type	Component	Mass (kg)	Period(s) To	Amplification (m/ms ⁻¹)	Damping
Teledyne Geotech	Z (ZT)	5	1	7.200	0,7
	N-S (NT)	5	1	7.200	0,7
	E-W (ET)	5	1	7.200	0,7

2) Electromagnetic seismograph (photographic recording):

Type	Component	Period(s)		Maximum Amplification (m/ms ⁻¹)	Damping
		T _p	T _g		
Hiller-Stuttgart	Z (ZH)	1,61	1,3	7.326	Critical

3) Mechanical seismographs (recording on smoke paper):

Type	Component	Mass (kg)	Period(s) To	Damping E	Friction r/T o ²	Amplification V
Mainka	N-S (NM)	141	7,0	3,00	0,015	37,9
	E-W (EM)	144	6,2	3,91	0,013	58,9
Vicentini	Z (ZV)	56	0,9	—	—	125



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
2 Jan	ZT	P	02	11		17.400	Ep.: 18,59 S; 174,56 W; H = 01:52:08.0 h = 108 km; M = 6,1 (GS) Tonga island
2	ZT	Pg	19	46		40,8	Ep.: Local
	ET	Pg	19	46		44,7	
3	ZT	Pn	02	24		38,0	Ep.: 43,32 N; 5,86 E; H = 02:23:56,9 h = 22 km; M = — (GS) Near south coast of France
3	ZT	Pn	16	54		33,1	Ep.: 36,92 N; 8,09 E; H = 16:53:04,3 h = 5 km; M = 3,6 (IGN) Argelia-Tunez
4	ZT	Pg	01	16		12,4	Ep.: Local
	ET	Sg	01	16		19,2	
5	ZT	Pg	11	54		01,0	Ep.: See pag. 107
	ZT	Sg	11	54		12,7	
5	ZT	Pn	19	22		46,0	Ep.: 43,0 N; 0,2 W; H = 19:22:07,2 h = —; M = 2,9 (LDG) Pau
	ET	Sn	19	23		19,0	
6	ZT	Pg	19	33		45,0	Ep.: See pag. 107
	ZL	Pg	19	33		45,1	
7	ZT	Pn	11	59		26,7	Ep.: 42,5 N; 1,4 W; H = 11:58:37,9 h = —; M = 2,7 (LDG) Luz
8	ZT	Pn	02	05		14,7	Ep.: 36,6 N; 1,7 E; H = 02:03:59,6 h = —; M = 3,7 (LDG) Algeria
9	ZT	P	13	55		9.730	Ep.: 46,99 N; 153,78 E; H = 13:42:36,4 h = 146 km; M = 6,0 (GS) Kuril islands
10	ZT	P	06	13		13.310	Ep.: 3,16 S; 130,56 E; H = 05:55:01,4 h = 47 km; M = 5,9 (GS) Ceram
12	ZT	P	03	08		9.790	Ep.: 46,47 N; 153,63 E; H = 02:55:35,9 h = 33 km; M = 5,6 (GS) Kuril island
13	ZT	P	16	19		16.730	Ep.: 15,37 S; 167,455 E; H = 15:59:53,4 h = 138 km; M = 5,3 (GS) Vanuatu islands
14	ZT	Pn	22	47		32,5	Ep.: 43,2 N; 0,7 W; H = 22:46:49,2 h = 4 km; M = 2,8 (LDG) Pau
	ET	Sn	22	48		10,4	



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
17 Jan	ZT	P	00	54		14.850	Ep.: 6,15 S; 148,95 E; H = 00:35:23,1 h = 32 km; M = 5,9 (GS) New Britain region
17	ZT	Pn	20	18	59,7		Ep.: 6,15 S; 148,95 E; H = 20:18:14,8 h = 10 km; M = 5,9 (GS) Near south coast of France
18	ZT	Pg	07	04	20,7		Ep.: See pag. 107
	ZT	Sg	07	04	34,0		
18	ZT	Sg	19	07	18,0		Ep.: 43,0 N; 0,3 W; H = 18:06:00,9 h = —; M = 2,6 (LDG) Luz
22	ZT	P	04	06		5.724	Ep.: 49,92 N; 78,83 E; H = 03:57:06,6 h = 0 km; M = 6,1 (GS) Eastern Kazakh SSR
24	ZT	P	20	16		9.850	Ep.: 42,23 N; 142,69 E; H = 20:03:39,0 h = 50 km; M = 5,6 (GS) Hokkaido, Japan
25	ZT	P	10	26		8.140	Ep.: 27,99 S; 26,73 E; H = 10:14:33,4 h = 5 km; M = 5,5 (GS) Republic of South Africa
25	ZT	Pn	21	29	34,7		Ep.: 43,39 N; 5,42 E; H = 21:28:49,5 h = —; M = — (GS) Near south coast of France
29	ZT	Pn	15	21	03,3		Ep.: 43,1 N; 0,3 W; H = 15:20:23,2 h = 9 km; M = 3,5 (LDG) Pau
	ZT	Sg	15	21	38,4		
1 Feb	ZT	Pn	15	07	40,0		Ep.: 43,37 N; 5,42 E; H = 15:05:53,8 h = 10 km; M = — (GS) Near south coast of France
3	ZT	Pg	05	48	53,6		Ep.: Local
	ET	Sg	05	48	57,7		
3	ZT	P	15	23		2.830	Ep.: 54,58 N; 17,38 W; H = 15:18:25,4 h = 10 km; M = 5,3 (GS) Iceland
3	ZT	Pg	21	37	00,5		Ep.: Local
	ET	Sg	21	37	24,3		
4	ZT	P	16	00		5.015	Ep.: 0,08 N; 16,66 W; H = 15:51:52,3 h = 10 km; M = 5,6 (GS) North of Ascension islands
4	ZT	P	19	36		9.150	Ep.: 5,86 N; 82,70 W; H = 19:24:07,4 h = 10 km; ; = 5,8 (GS) South of Panama



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
4 Feb	ZT	Pn	21	39	06,7		Ep.: 44,3 N; 7,3 E; H = 21:38:00,0 h = 20 km; M = 3,2 (LDG) Gap
4	ZT	P	22	29		14.950	Ep.: 4,63 S; 153,07 E; H = 22:10:38,9 h = 52 km; M = 6,1 (GS) New Ireland region
7	ZT	Pn	00	37	06,9		Ep.: 36,55 N; 1,66 E; H = 00:37:51,4 h = 25 km; M = 3,0 (GS) Argelia
8	ZT	Pn	21	36	34,3		Ep.: 43,38 N; 5,43 E; H = 21:36:39,4 h = 10 km; M = — (GS) Near south coast of France
9	ZT	Pn	01	15	03,9		Ep.: 39,32 N; 0,34 E; H = 01:14:19,0 h = 13 km; M = 3,2 (IGN) Golfo de Valencia
9	ZT ET	Pg Sg	19 19	13 13	34,3 38,2		Ep.: Local
9	ZT ET	Pg Sg	22 22	21 21	52,7 56,7		Ep.: See pag. 107
9	ZT ET	Pg Sg	23 23	19 19	00,0 04,0		Ep.: See pag. 107
10	ZT ET	Pg Sg	06 06	07 07	32,7 36,7		Ep.: See pag. 107
10	ZT ET	Pg Sg	09 09	54 54	02,0 06,0		Ep.: See pag. 107
11	ZT ET	Pg Sg	03 03	25 25	48,1 52,0		Ep.: See pag. 107
11	ZT ET	Pg Sg	03 03	44 45	58,0 02,0		Ep.: Local
11	ZT ZT	Pn Sn	20 20	51 52	55,5 21,7		Ep.: See pag. 107
12	ZT	Pn	03	53	01,7		Ep.: 44,2 N; 6,5 E; H = 03:52:04,1 h = 7 km; M = 3,8 (LDG) Gap, F.
12	ZT	P	04	24		5.720	Ep.: 49,93 N; 78,74 E; H = 04:15:06,8 h = 0 km; M = 4,6 (GS) Eastern Kazakh SSR



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
12 Feb	ZT	P	12	03	40,7		Ep.: 36,39 N; 2,65 E; H = 12:02:19,0 h = 10 km; M = 4,4 (GS) Algeria
13	ZT	Pn	17	34	04,9	555	Ep.: 45,9 N; 1,4 W; H = 17:32:50,4 h = 2 km; M = 4,0 (LDG) Rochefort, F.
14	ZT	Pn	00	48	16,8		Ep.: 45,9 N; 1,4 W; H = 00:47:45,9 h = 2 km; M = 4,0 (LDG) Rochefort, F.
14	ZT	P	06	39		15.960	Ep.: 10,45 S; 161,37 E; H = 06:20:21,3 h = 32 km; M = 6,0 (GS) Solomon islands
16	ZT	P	22	02			Ep.: 45,31 N; 151,81 E; H = 21:50:37,8 h = 96 km; M = 5,6 (GS) Kuril islands
17	ZT ET	Pg Sg	22 22	06 07	45,5 00,0		Ep.: See pag. 107
19	ZT	P	10	58			Ep.: 2,01 S; 138,92 E; H = 10:39:03,4 h = 33 km; M = 5,5 (GS) West Iran
19	ZT	P	13	08		16.670	Ep.: 14,89 S; 167,17 E; H = 12:49:09,9 h = 101 km; M = 5,6 (GS) Vanuatu islands
20	ET	Pn	03	26	54,1	565	Ep.: 38,88 N; 3,09 W; H = 03:25:37,1 h = 10 km; M = 3,8 (IGN) Alhambra, CR
20	ZT	Pn	20	53	53,3	640	Ep.: 43,15 N; 5,06 W; H = 20:52:28,1 h = 9 km; M = 3,9 (IGN) Picos de Europa, O.
23	ZT	P	06	10		16.670	Ep.: 14,77 S; 167,30 E; H = 05:51:11,4 h = 155 km; M = 5,4 (GS) Vanuatu island
24	ZT	Pg	12	23	06,7		Ep.: See pag. 107
24	ZT ZT	Pg Sg	16 16	48 48	33,7 41,6		Ep.: See pag. 107
25	ZT	Pn	02	56	04,3		Ep.: 43,5 N; 0,6 W; H = 02:55:18,6 h = 13 km; M = 3,6 (LDG) Pau, F.
25	ZT ET	Pg Sg	23 23	11 11	43,6 51,2		Ep.: See pag. 107



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
4 Mar	ZT	P	07	24		7.105	Ep.: 18,38 N; 68,66 W; H = 07:13:46,1 h = 134 km; M = 5,6 (GS) Mona passage
5	ZT	Pn	17	47	13,7		Ep.: 43,2 N; 1,9 W; H = 17:46:22,2 h = 9 km; M = 3,2 (LDG) Pau, F.
5	ZT	Pn	20	52	25,2		Ep.: 43,4 N; 0,6 W; H = 20:51:40,2 h = 15 km; M = 3,2 (LDG) Pau, F.
6	ZT	P	14	53		10.410	Ep.: 35,54 N; 140,44 E; H = 14:39:42,6 h = 42 km; M = 5,9 (GS) Near east coast of Honshu
10	ZT	Pn	13	53	10,4		Ep.: 43,4 N; 0,7 W; H = 13:52:23,7 h = 8 km; M = 3,8 (LDG) Pau, F.
10	ZT	P	14	33		14.900	Ep.: 4,35 S; 152,80; H = 14:14:10,2 h = 53 km; M = 5,6 (GS) New Britain region
10	ZT ET	Pn Sn	21 21	17 18	36,3 21,3		Ep.: 43,4 N; 0,7 W; H = 21:16:49,9 h = 9 km; M = 3,5 (LDG) Pau, F.
10	ZT	P	22	00		6.980	Ep.: 13,70 S; 34,42 E; H = 21:49:45,8 h = 30 km; M = 6,2 (GS) Malawi
10	ZT ET	Pn Sn	23 23	36 37	38,8 10,0		Ep.: See pag. 108
10	ZT ET	Pn Sn	23 23	37 38	55,7 26,1		Ep.: See pag. 108
11	ZT ET	Pn Sn	01 01	16 16	01,3 32,7		Ep.: See pag. 108
11	ZT	P	05	24		17.315	Ep.: 17,77 S; 174,76 W; H = 01:05:00,6 h = 230 km; M = 6,4 (GS) Tonga islands
11	ZT	Pn	10	58	21,6		Ep.: 43,4 N; 0,6 W; H = 10:57:36,2 h = 11 km; M = 3,6 (LDG) Pau, F.
12	ZT ET	Pg Sg	03 03	08 08	15,9 20,0		Ep.: See pag. 108
13	ZT	P	13	03		1.150	Ep.: 50,8 N; 10,1 E; H = 13:02:18,3 h = 11 km; M = 5,5 (LDG) Coburg, D.



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
17 Mar	ZT	P	05	47		2.160	Ep.: 34,66 N; 25,45 E; H = 05:42:54,4 h = 31 km; M = 4,8 (GS) Crete
21	ZT	Pn	05	17	35,3		Ep.: See pag. 108
	ZT	Sg	05	18	07,1		
21	ZT	Pn	22	38	34,0		Ep.: See pag. 108
	ZT	Sg	22	38	39,3		
23	ZT	Pn	05	59	28,7		Ep.: See pag. 108
	ZT	Sn	05	59	46,1		
26	ZT	Pg	08	15	47,3		Ep.: See pag. 108
	ET	Sg	08	15	55,5		
29	ZT	Pg	13	19	42,7		Ep.: See pag. 108
	ZT	Sg	13	19	56,7		
2 Apr	ZT	P	06	50		5.125	Ep.: Local h = 10 km; M = 5,0 (GS) Southern Iran
2	ZT	P	11	05		14.645	Ep.: 5,43 S; 164,79 E; H = 10:43:32,7 h = 251 km; M = 5,6 (GS) East Papua New Guinea
2	ZT	P	21	30		4.090	Ep.: 32,62 N; 47,78 E; H = 21:24:36,9 h = 33 km; M = 5,4 (GS) Iran-Iraq border region
3	ZT	Pg	08	10	55,0		Ep.: See pag. 108
	ET	Sg	08	10	58,0		
6	ZT	P	08	24		17.265	Ep.: 19,31 S; 169,00 E; H = 08:05:57,1 h = 166 km; M = 6,1 (GS) Vanuatu islands
7	ZH	P	13	37			Ep.: 51,34 N; 29,98 W; H = 13:32:11,6 h = 10 km; M = 5,3 (GS) North Atlantic ridge
8	ZH	P	03	38	55,0		Ep.: 39,41 N; 8,91 W; H = 03:36:48,0 h = 18 km; M = 4,5 (GS) Portugal
8	ZH	P	08	10			Ep.: 37,26 N; 24,35 W; H = 08:05:44,4 h = 10 km; M = 4,9 (GS) Azores islands region
11	ZT	Pg	12	17	13,0		Ep.: See pag. 108
	ET	Sg	12	17	15,9		



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
11 Apr	ZT	Pn	13	45	39,0		Ep.: See pag. 108
	ET	Sn	13	46	02,3		
11	ZT	Pn	13	51	20,0		Ep.: 34,89 N; 9,4 E; H = 13:49:15,2 h = 38 km; M = 4,8 (GS) Tunisia
15	ZT	P	20	45		8.350	Ep.: 429,99 N; 99,20 E; H = 20:34:08,9 h = 13 km; M = 6,2 (GS) Sichuan province, China
16	ZT	Pg	04	45	55,2		Ep.: See pag. 108
17	ZT	P	05	48	45,3		Ep.: 45,2 N ; 7,4 E; H = 05:47:29,0 h = 2 km; M = 3,5 (LDG) Annecy, F.
20	ZT	P	23	11	7.655		Ep.: 57,17 N; 121,98 E; H = 22:59:54,0 h = 26 km; M = 6,1 (GS) Eastern USSR
23	ZT	P	08	10		16.660	Ep.: 14,83 S; 166,69 E; H = 07:50:30,4 h = 61 km; M = 5,0 (GS) Vanuatu islands
23	ZT	P	19	32		7.785	Ep.: 66,96 N ; 156,29 W; H = 19:21:06,4 h = 6 km; M = 5,7 (GS) Alaska
24	ZT	Pg	06	47	56,1		Ep.: See pag. 108
	ET	Sg	06	48	12,0		
25	ZT	Pg	14	16	17,7		Ep.: See pag. 108
	ET	Sg	14	16	30,0		
25	ZT	P	14	42		9.700	Ep.: 16,77 N, 99,33 W; H = 14:29:00,5 h = 19 km; M = 6,2 (GS) Near coast of Guerrero
27	ZT	Pg	06	40	34,3		Ep.: See pag. 108
	ET	Sg	06	40	46,7		
28	ZT	Pg	15	19	10,8		Ep.: See pag. 108
	ET	Sg	15	19	25,3		
28	ZT	Pn	15	50	02,3		Ep.: 43,1 N; 0,4 W; H = 15:49:21,0 h = 12 km; M = 3,7 (LDG) Pau, F.
2 May	ZT	P	06	32		2.470	Ep.: 45,07 N; 28,14 W; H = 06:27:28,2 h = 10 km; M = 5,2 (GS) North Atlantic ridge



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
2 May	ZT	P	09	35		2.090	Ep.: 44,97 N; 28,03 W; H = 09:30:58,9 h = 10 km; M = 5,0 (GS) North Atlantic ridge
2	ZT ET	Pg Sg	19	59	21,3		Ep.: See pag. 109
3	ZT	P	06	04		8.360	Ep.: 30,09 N; 99,48 E; H = 05:53:01,1 h = 14 km; M = 6,1 (GS) Sichuan province, China
3	ZT	P	15	53		9.300	Ep.: 30,05 N; 99,50 E; H = 15:41:30,8 h = 8 km; M = 5,8 (GS) Sichuan province, China
5	ZT	P	18	40			Ep.: 8,28 S; 71,38 W; H = 18:28:39,4 h = 593 km; M = 6,4 (GS) Western Brazil
9	ZT	P	14	47		17.940	Ep.: 23,43 S; 179,95 W; H = 14:28:30,9 h = 548 km; M = 5,6 (GS) South Fiji islands
9	ZT	P	02	35		2.270	Ep.: 28,07 N; 16,16 W; H = 02:30:37,8 h = 23 km; M = 5,2 (GS) Canary islands region
13	ZT	P	03	45		7.350	Ep.: 50,10 N; 105,36 E; H = 03:35:02,8 h = 10 km; M = 5,0 (GS) USSR-Mongolia border region
14	ZT	P	01	19		18.790	Ep.: 30,52 S; 178,41 W; H = 00:59:50,4 h = 44 km; M = 5,9 (GS) Kermadec islands
15	ZT ET	Pn Sn	04	19	29,7		Ep.: See pag. 109
15	ZT	P	23	54		15.800	Ep.: 9,80 S; 159,53 E; H = 23:34:33,6 h = 24 km; M = 5,9 (GS) Solomon islands
16	ZT	P	12	33		9.290	Ep.: 43,55 N; 127,63 W; H = 12:21:10,7 h = 10 km; M = 5,0 (GS) Off coast of Oregon
17	ZT	P	05	15		7.660	Ep.: 57,09 N; 122,02 E; H = 05:04:35,9 h = 31 km; M = 5,6 (GS) eastern USSR
19	ZT	P	02	34		9.265	Ep.: 54,31 N; 165,57 W; H = 02:21:56,3 h = 10 km; M = 5,0 (GS) Fox islands, Aleutian islands



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
21 May	ZT	Pn	17	54	54,7		Ep.: 43,1 N; 4,2 E; H = 17:54:24,6 h = 2 km; M = 2,8 (LDG) Marseille, F.
21	ZT	P	22	15		17.340	Ep.: 17,95 S; 178,59 W; H = 21:56:48,6 h = 584 km; M = 5,7 (GS) Fiji islands region
23	ET	Sg	13	02	24,3		Ep.: See pag. 109
23	ZT	P	11	15		17.950	Ep.: 52,34 S; 160,57 E; H = 10:54:46,3 h = 10 km; M = 6,4 (GS) Macquaire islands region
27	ZT	P	03	21		16.490	Ep.: 55,28 S; 133,19 W; H = 03:01:24,9 h = 10 km; M = 5,5 (GS) South Pacific cordillera
27	ZT	P	20	16		4.485	Ep.: 30,17 N; 50,92 E; H = 20:08:37,3 h = 31 km; M = 5,6 (GS) Iran
28	ZT	Pn	11	57	38,7		Ep.: 44,6 N; 7,3 E; H = 11:56:30,2 h = 10 km; M = 5,0 (GS) Gap, F.
29	ZT	P	22	26		15.940	Ep.: 10,20 S; 161,39 E; H = 22:07:11,8 h = 86 km; M = 5,6 (GS) Salomon islands
30	ZT	Pn	06	28	50,0		Ep.: 43,1 N; 0,3 W; H = 06:28:09,6 h = 7 km; M = 4,5 (LDG) Pau, F.
30	ZT	P	14	03			Ep.: 17,40 N; 94,64 W; H = 13:50:56,2 h = 138 km; M = 5,2 (GS) Chiapas
2 Jun	ZT	P	11	22		17.170	Ep.: 19,07 S; 168,83 E; H = 11:02:19,8 h = 100 km; M = 5,3 (GS) Vanuatu islands
3	ZT	Pn	02	34	15,5		Ep.: See pag. 109
	ET	Sn	02	34	32,0		
4	ZT	Pg	12	43	32,7		Ep.: See pag. 109
	ET	Sg	12	43	43,5		
6	ZT	Pn	01	10	04,1		Ep.: See pag. 109
7	ZT	P	19	49		1.680	Ep.: 38,06 N; 21,62 E; H = 19:45:53,7 h = 25 km; M = 5,0 (GS) Greece



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
9 Jun	ZT	P	18	13		5.890	Ep.: 39,67 N; 74,49 E; H = 18:04:05,7 h = 33 km; M = 5,2 (GS) Southern Xinjiang, China
9	ZT	Pn	22	15	09	458	Ep.: 38,08 N; 0,09 E; H = 22:14:05,0 h = 20 km; M = 3,0 (IGN) SE Alicante
11	ZT	P	13	30		3.320	Ep.: 35,12 N; 35,01 W; H = 13:24:32,0 h = 10 km; M = 5,8 (GS) North Atlantic ridge
12	ZT	P	00	15		8.190	Ep.: 21,86 N; 89,76 E; H = 00:04:09,7 h = 6 km; M = 6,1 (GS) Bangladesh
12	ZT	P	06	06		16.720	Ep.: 15,28 S; 167,57 E; H = 05:47:35,7 h = 247 km; M = 5,4 (GS) Vanuatu islands
14	ZT	P	18	11		2.200	Ep.: 34,29 N; 26,06 E; H = 18:06:38,2 h = 14 km; M = 5,2 (GS) Creete
14	ZT	P	18	30			Ep.: 34,19 N; 26,18 E; H = 18:26:20,8 h = 40 km; M = 4,3 (GS) Creete
16	ZT	P	11	03		8.720	Ep.: 57,76 N; 153,99 W; H = 10:51:21,4 h = 58 km; M = 5,8 (GS) Kodiak islands region
16	ZT	P	23	55		10.650	Ep.: 31,81 N; 137,98 E; H = 23:42:35,1 h = 360 km; M = 5,9 (GS) South of Honshu, Japan
18	ZT ET	Pn Sn	10 10	23 24	47,1 15,7		Ep.: See pag. 109
18	ZT	P	14	17		7.160	Ep.: 17,76 N; 68,81 W; H = 14:06:28,8 h = 62 km; M = 5,9 (GS) Mona passage
19	ZT ET	Pn Sn	11 11	09 09	02,7 37,3		Ep.: 43,1 N; 0,4 W; H = 11:08:20,2 h = 7 km; M = 3,3 (LDG) Pau, F.
25	ZT	P	11	22		3.800	Ep.: 32,91 N; 30,61 W; H = 11:15:59,3 h = 10 km; M = 5,2 (GS) North Atlantic ridge
25	ZT	P	20	50		9.260	Ep.: 1,13 N; 79,62 W; H = 20:37:32,4 h = 15 km; M = 5,9 (GS) Near coast of Ecuador
26	ZH	P	10	43		2.570	Ep.: 39,11 N; 28,24 W; H = 10:38:39,4 h = 10 km; M = 5,0 (GS) Azores islands



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
26 Jun	ZT	Pn	16	53	24,3		Ep.: See pag. 109
	ZT	Sn	16	53	55,0		
26	ZT	Pg	01	12	38,7		Ep.: See pag. 109
	ET	Sg	01	12	52,5		
6 Jul	ZT	Pn	04	42	36,0		Ep.: 43,0 N; 0,5 W; H = 04:41:53,7 h = 7 km; M = 3,2 (LDG) Pau, F.
	ET	Sn	04	43	12,7		
6	ZT	Pn	09	32	0,8		Ep.: 43,1 N; 4,9 E; H = 09:31:28,2 h = 3 km; M = 2,9 (LDG) Marseille, F.
8	ZT	P	03	56		5.725	Ep.: 49,89 N; 78,89 E; H = 03:46:57,6 h = 0 km; M = 5,6 (GS) Eastern Kazakh SSR
9	ZT	P	09	55		5.145	Ep.: 1,58 S; 15,55 W; H = 09:46:39,6 h = 10 km; M = 5,4 (GS) North of Ascension islands
10	ZT	Pn	03	05	04,3		Ep.: See pag. 109
	ET	Sn	03	05	23,0		
11	ZT	Pg	05	48	07,7		Ep.: 43,3 N; 3,8 E; H = 05:47:32,7 h = 3 km; M = 2,8 (LDG) Montpellier, F.
	ET	Sg	05	48	31,0		
11	ZT	Pg	06	16	36,0		Ep.: 43,3 N; 3,8 E; H = 06:16:00,9 h = 6 km; M = 2,8 (LDG) Montpellier, F.
	ET	Sg	06	16	59,3		
11	ZT	Pg	19	32	35,7		Ep.: 43,3 N; 3,8 E; H = 19:32:00,8 h = 5 km; M = 2,9 (LDG) Montpellier, F.
	ET	Sg	19	32	59,0		
13	ZT	P	02	21		16.495	Ep.: 13,26 W; 167,11 E; H = 02:02:22,9 h = 202 km; M = 5,3 (GS) Vanuatu islands
14	ZT	Pn	06	39	31,0		Ep.: See pag. 109
	ET	Sn	06	39	57,0		
14	ZT	P	21	02		13.280	Ep.: 8,08 S; 125,13 E; H = 20:42:40,0 h = 10 km; M = 6,4 (GS) Timor
15	ZT	Pn	02	13	26,7		Ep.: 43,0 N; 0,5 W; H = 02:12:42,7 h = 4 km; M = 3,2 (LDG) Pau, F.
	ET	Sn	02	13	59,3		
15	ZT	Pn	11	49	30,0		Ep.: 43,0 N; 0,5 W; H = 11:48:46,1 h = 16 km; M = 3,0 (LDG) Pau, F.



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
20 Jul	ZT	P	06	40		9.895	Ep.: 5,05 N; 95,64 E; H = 06:27:25,1 h = 82 km; M = 5,9 (GS) Northern Sumatera
21	ZT	P	02	42		16.915	Ep.: 16,90 S; 167,67 E; H = 02:22:59,0 h = 33 km; M = 4,9 (GS) Vanuatu islands
21	ZT	P	03	21		8.365	Ep.: 30,03 N; 99,46 E; H = 03:09:16,3 h = 36 km; M = 5,5 (GS) Sichuan province, China
22	ZT ZH	P P	05 05	20 20		12.680	Ep.: 2,30 N; 128,14 E; H = 05:02:11,05 h = 142 km; M = 6,4 (GS) Halmahera
24	ZT	P	03	35		5.845	Ep.: 36,09 N; 71,07 E; H = 03:27:48,7 h = 95 km; M = 5,8 (GS) Afhanistan-USSR border region
24	ZT NT	Pg Sg	21 21	55 55	04,0 27,9		Ep.: 43,2 N; 3,8 E; H = 21:54:28,7 h = 2 km; M = 2,9 (LDG) Motpellier, F.
31	ZT	P	17	26		12.965	Ep.: 8,05 S; 121,38 E; H = 17:07:27,8 h = 14 km; M = 6,3 (GS) Flores islands region
31	ZT	P	21	47		16.780	Ep.: 15,80 S; 167,62 E; H = 21:29:12,4 h = 138 km; M = 5,1 (GS) Vanuatu islands
3 Aug	ZT ET	Pn Sn	14 14	20 21	35,0 05,0		Ep.: 43,5 N; 4,8 E; H = 14:19:43,5 h = 2 km; M = 2,9 (LDG) Marseille, F.
4	ZT NT	Pg Sg	16 16	19 19	15,7 17,3		Ep.: See pag. 110
16	ZT ET	Pg Sg	23 23	28 28	26,0 42,0		Ep.: See pag. 110
20	ZT	P	11	25		5.070	Ep.: 11,77 N; 41,94 E; H = 11:16:56,5 h = 12 km; M = 5,8 (GS) Ethiopia
20	ZT	P	11	54		5.050	Ep.: 11,88 N; 41,81 E; H = 11:46:28,1 h = 10 km; M = 6,1 (GS) Ethiopia
20	ZT	P	12	05		5.070	Ep.: 11,76 N; 41,96 E; H = 11:56:17,8 h = 10 km; M = 5,3 (GS) Ethiopia



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
20 Aug	ZT	P	13	33		5.040	Ep.: 11,88 N; 41,88 E; H = 13:26:19,4 h = 10 km; M = 6,1 (GS) Ethiopia
20	ZT	P	18	36		1.680	Ep.: 37,28 N; 21,20 E; H = 18:32:29,1 h = 10 km; 5,6 (GS) Southern Greece
20	NT	P	18	48		5.060	Ep.: 11,98 N; 41,87 E; H = 18:39:48,9 h = 10 km; M = 5,4 (GS) Ethiopia
20	ZT	P	19	34		5.050	Ep.: 11,90 N; 41,82 E; H = 19:25:56,5 h = 11 km; M = 6,2 (GS) Ethiopia
21	ZT	P	01	17		5.055	Ep.: 11,87 N; 41,87 E; H = 01:09:06,6 h = 15 km; M = 6,3 (GS) Ethiopia
21	ZT	P	05	11		5.040	Ep.: 11,94 N; 41,77 E; H = 05:03:05,6 h = 9 km; M = 5,8 (GS) Ethiopia
21	ZT ET	Pn Sn	06 06	55 56	01,3 26,7		Ep.: 48,3 N; 5,5 W; H = 06:52:59,1 h = 10 km; M = 5,0 (LDG) Brest
21	ZT	P	18	43		14.975	Ep.: 4,10 S; 154,46 E; H = 18:25:41,0 h = 493 km; M = 5,8 (GS) Solomon islands
22	ZT ET	Pg Sg	00 00	44 44	42,1 53,1		Ep.: See pag. 110
22	ZT	Pn	02	19	05,7		Ep.: 38,1 N; 0,03 E; H = 02:18:05,3 h = 15 km; M = 3,2 (IGN) Mediterráneo
22	ZT	Pn	14	51	38,1		Ep.: 37,2 N; 10,1 E; H = 14:49:54,9 h = — km; M = 3,9 (LDG)
24	ZT	P	02	16		1.570	Ep.: 37,99 N; 20,18 E; H = 02:13:15,2 h = 26 km; M = 5,2 (GS) Ionian sea
27	ZT	P	01	25		2.200	Ep.: 34,92 N; 26,24 E; H = 01:21:17,9 h = 61 km; M = 5,0 (GS) Crete
30	ZT	P	11	50		9.900	Ep.: 55,61 N; 161,36 E; H = 11:38:12,8 h = 73 km; M = 5,8 (GS) Near east coast of Kamchatka



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
4 Sep	ZT	P	13	27		9.010	Ep.: 55,54 N; 156,84 W; H = 13:14:58,2 h = 11 km; M = 6,5 (GS) South of Alaska
9	ZT	Pn	04	45	53,5		Ep.: See pag. 110
13	ZT	P	07	09		4.400	Ep.: 37,28 N; 54,22 E; H = 07:01:31,5 h = 33 km; M = 5,1 (GS) Banda sea
14	ZT	P	19	28		12.665	Ep.: 1,64 N; 127,32 E; H = 19:10:25,7 h = 103 km; ; = 6,0 (GS) Halmahera
15	ZT	P	18	46		9.220	Ep.: 53,23 N; 159,72 E; H = 18:34:13,0 h = 51 km; M = 5,6 (GS) Near east coast of Kamchatka
16	ZT ET	Pg Sg	01 01	41 41	19,7 41,2		Ep.: See pag. 110
16	ZT	P	02	12		4.100	Ep.: 40,34 N; 51,53 E; H = 02:05:08,9 h = 55 km; M = 6,4 (GS) Caspian sea
16	ZT	P	01	14		8.380	Ep.: 32,56 S; 14,25 W; H = 04:03:03,2 h = 10 km; M = 5,8 (GS) South Atlantic rige
16	ZT	P	23	33		9.260	Ep.: 16,50 N; 93,67 W; H = 23:20:53,2 h = 108 km; M = 6,0 (GS) Chiapas, México
17	ZT	P	01	00		4.085	Ep.: 40,20 N; 51,75 E; H = 00:53:39,8 h = 51 km; M = 6,1 (GS) Caspian sea
18	ZT ET	Pg Sg	08 08	15 16	54,7 02,7		Ep.: See pag. 110
22	ZT	P	02	37		8.470	Ep.: 31,58 N; 102, 43 E; H = 02:25:50,8 h = 15 km; M = 6,1 (GS) Sichuan province, China
23	ZT	P	20	05	38,9		Ep.: 38,29 N; 8,67 W; H = 20:03:29,7 h = 18 km; M = 4,1 (IGN) Granola, Portugal
24	ZT	P	11	07		8.690	Ep.: 20,70 N; 94,97 E; H = 10:55:20,9 h = 134 km; M = 5,3 (GS) Burma
24	ZT ET	Pn Sn	20 20	16 17	47,3 20,0		Ep.: 41,21 N; 1,14 W; H = 20:16:03,5 h = 5 km; M = 3,1 (IGN) Sierra de Algairen, Z.



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
25 Sep	ZT	P	14	37		17.315	Ep.: 20,35 W; 169,28 E; H = 14:17:47,1 h = 33 km; M = 6,4 (GS) Vanuatu islands
25	ZT	Pn	21	47	14,7		Ep.: See pag. 110
	ET	Sn	21	47	38,3		
27	ZT	P	00	29			Ep.: 43,2 N; 4,8 E; H = 00:29:21,3 h = 5 km; M = 3,0 (LDG) Marseille, F.
28	ZT	P	02	12			Ep.: 43,4 N; 3,4 E; H = 02:12:01,8 h = 2 km; M = 2,6 (LDG) Montpellier, F.
30	ZT	Pn	04	42	29,2		Ep.: 46,3 N; 7,3 E; H = 04:41:03,8 h = 2 km; M = 4,3 (LDG) Thonon, F.
1 Oct	ZT	P	03	06		4.480	Ep.: 30,96 N; 51,43 E; H = 02:59:05,5 h = 33 km; M = 5,2 (GS) Iran
7	ZT	P	16	01		9.660	Ep.: 51,31 N; 179,03 W; H = 15:48:29,0 h = 20 km; M = 6,1 (GS) Andranof islands, Aleutian islands
13	ZT	Pn	14	49	14,8		Ep.: See pag. 110
	ZT	Sn	14	49	40,0		
15	ZT	P	16	02	59,0	1.155	Ep.: 37,14 N; 9,61 W; H = 16:00:31,1 h = 15 km; M = 4,3 (IGN) W Cabo San Vicente
16	ZT	Pn	05	43	25,6		Ep.: 43,5 N; 0,7 W; H = 05:42:38,6 h = 8 km; M = 3,2 (LDG) Pau, F.
18	ZT	P	00	17		9.585	Ep.: 37,04 N; 121,88 W; H = 00:04:15,2 h = 19 km; M = 6,5 (GS) Central California
18	ZT	P	12	00		15.915	Ep.: 10,16 S; 161,06 E; H = 11:40:50,2 h = 45 km; M = 6,1 (GS) Solomon islands
18	ZT	P	21	29	27,5		Ep.: 39,80 N; 8,67 W; H = 21:27:25,1 h = 21 km; M = 3,8 (IGN) Leira, Portugal
19	ZT	P	09	59		5.735	Ep.: 49,94 N; 78,97 E; H = 09:49:57,2 h = 0 km; M = 6,0 (GS) Eastern Kazakh



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
19 Oct	ZT	Pn	17	27	44,8		Ep.: See pag. 110
22	ZT	P	10	09	28,7		Ep.: 43,1 N; 1,1 W; H = 10:08:41,0 h = 9 km; M = 3,1 (LDG) Pau, F.
22	ZT	Pn	23	55	00,0		Ep.: 36,42 N; 4,59 E; H = 23:53:39,3
	ZT	Sn	23	56	01,3		h = 33 km; M = 3,8 (IGN) Akbon, Argelia
25	ZT	P	20	39		7.490	Ep.: 57,52 N; 118,81 E; H = 20:29:00,0 h = 22 km; M = 5,4 (GS) East of lake Baikal
27	ZT	P	21	24		16.065	Ep.: 11,02 S; 162,35 E; H = 21:04:51,8 h = 25 km; M = 6,1 (GS) Solomon islands
29	ZT	Pn	19	10	29,0	555	Ep.: 36,69 N; 2,43 E; H = 19:09:13,3 h = 31 km; M = 5,8 (IGN) W Argel
29	ZT	Pn	19	23			Ep.: 36,69 N; 2,43 E; H = 19:21:55,6 h = 27 km; M = 5,5 (IGN) W Argel
29	ZT	Pn	20	21			Ep.: 36,82 N; 2,44 E; H = 20:20:16,4 h = 17 km; M = 4,1 (IGN) W Argel
29	ZT	Pn	22	03			Ep.: 36,79 N; 2,44 E; H = 22:01:56,9 h = 16 km; M = 4,0 (IGN) W Argel
30	ZT	Pn	02	32			Ep.: 36,8 N; 2,6 E; H = 02:31:47,3 h = — km; M = 3,7 (LDG)
31	ZT	Pn	21	27	42,5		Ep.: 36,72 N; 2,52 E; H = 21:26:29,3 h = 16 km; M = 4,3 (IGN) W Argel
1 Nov	ZT	P	06	53		10.060	Ep.: 21,00 W; 67,95 W; H = 06:40:30,3 h = 140 km; M = 5,9 (GS) Southern Bolivia
1	ZT	Pn	11	33	47,6		Ep.: 36,88 N; 2,33 E; H = 11:32:34,5 h = — km; M = 4,4 (IGN) W Argel
1	ZT	P	11	49			Ep.: 11,01 S; 162,21 E; H = 11:29:59,0 h = 33 km; M = 5,8 (GS) Solomon islands
1	ZT	P	18	38		10.100	Ep.: 39,84 N; 142,76 E; H = 18:25:34,9 h = 29 km; M = 6,4 (GS) Near east coast of Honshu, Japan



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
2 Nov	ZT	P	06	02	51,7	1.155	Ep.: 36,67 N; 8,86 W; H = 06:00:26,8 h = — km; M = 4,3 (IGN) S. Cabo San Vicente
4	ZT	Pn	00	19	07,7		Ep.: 43,2 N; 4,9 E; H = 00:18:29,7 h = 6 km; M = 3,1 (LDG) Marseille, F.
4	ZT	Pn	20	09	22,8		Ep.: 36,54 N; 2,51 E; H = 20:08:06,9 h = — km; M = 4,7 (IGN) W Argel
5	ZT	Pn	11	39	35,1		Ep.: 36,68 N; 2,55 E; H = 11:38:21,03 h = — km; M = 4,6 (IGN) W Argel
8	ZT ET	Pn Sn	06 06	09 09	00,3 18,8		Ep.: See pag. 110
10	ZT	P	23	34		9.775	Ep.: 46,08 N; 151,70 E; H = 23:21:40,6 h = 56 km; M = 5,6 (GS) Kuril islands
12	ZT	Pn	03	57	36,7		Ep.: 43,1 N; 0,4 W; H = 03:56:54,9 h = 11 km; M = 3,1 (LDG) Pau, F.
14	ZT NT	Pg Sg	11 11	40 40	02,9 11,7		Ep.: See pag. 110
15	ZT	P	04		09	5.215	Ep.: 0,58 S; 19,99 W; H = 04:00:40,6 h = 10 km; M = 5,5 (GS) Central mid-Atlantic ridge
18	ZT	Pn	04	53	12,0		Ep.: 43,1 N; 0,9 W; H = 04:52:26,1 h = 22 km; M = 2,8 (LDG) Pau, F.
20	ZT	P	04	27		5.965	Ep.: 29,89 N; 57,72 E; H = 04:19:04,6 h = 18 km; M = 5,6 (GS) Southern Iran
22	ZT ET	Pn Sn	11 11	42 42	05,1 40,0		Ep.: 43,0 N; 0,5 W; H ? 11:41:21,8 h = 2 km; M = 3,5 (LDG) Pau, F.
22	ZT ET	Pn Sg	20 20	39 39	05,7 58,4		Ep.: 36,84 N; 2,36 E; H = 20:37:54,7 h = — km; M = 4,2 (IGN) W Argel
23	ZT	Pg	23	17	43,7		Ep.: See pag. 111
26	ZT ET	Pg Sg	14 14	32 32	44,1 58,3		Ep.: See pag. 111



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
29 Nov	ZT ET	P Sg	01 14	13 32		10.025 58,3	Ep.: 15,81 S; 167,27 E; H = 01:00:14,8 h = 71 km; M = 6,1 (GS) Southern Peru
1 Dec	ZT	P	19	18		16.634	Ep.: 14,46 S; 167,27 E; H = 18:59:12,3 h = 216 km; M = 5,1 (GS) Vanuatu islands
2	ZT	Pn	19	43	11,3		Ep.: 42,7 N; 0,7 W; H = 19:42:28,9 h = 2 km; M = 2,8 (LDG) Luz, F.
3	ZT	P	14	29		9.500	Ep.: 7,63 S; 74,46 W; H = 14:16:48,7 h = 53 km; M = 5,9 (GS) Peru-Brazil border region
4	ZT	P	07	02		17.040	Ep.: 15,47 S; 173,16 W; H = 06:42:31,2 h = 76 km; M = 5,4 (GS) Tonga islands
5	ZT ET	Pn Sn	12 12	59 59	11,1 45,0		Ep.: 43,2 N; 0,6 W; H = 12:58:28,4 h = 6 km; M = 3,0 (LDG) Pau, F.
6	ZT	P	05	35	54,3	1.195	Ep.: 43,65 N; 16,87 E; H = 05:33:12,2 h = 10 km; M = 4,9 (GS) Yugoslavia
7	ZT	P	13	08		5.400	Ep.: 25,92 N; 58,97 E; H = 12:59:33,5 h = 16 km; M = 5,7 (GS) Southern Iran
7	ZT	P	13	57		14.715	Ep.: 6,44 S; 146,38 E; H = 13:38:44,8 h = 104 km; M = 6,0 (GS) East Papua New Guinea region
9	ZT	Pn	07	44			Ep.: See pag. 111
9	ZT	P	20	56		12.495	Ep.: 0,14 N; 123,34 E; H = 20:38:08,5 h = 151 km; M = 6,2 (GS) Minahassa peninsula
14	ZT	P	19	33		15.950	Ep.: 10,45 S; 161,28 E; H = 19:13:53,8 h = 38 km; M = 5,6 (GS) Solomon islands
15	ZT	P	19	02		12.065	Ep.: 8,34 N; 126,73 E; H = 18:43:45,0 h = 24; M = 6,2 (GS) Mindanao, Philippine islands
18	ZT	P	07	21		5.510	Ep.: 0,94 N; 28,98 W; H = 07:13:01,0 h = 10 km; M = 5,7 (GS) Central mid-Atlantic ridge
20	ZT	P	04	17	11,0	980	Ep.: 37,29 N; 7,33 W; H = 04:15:06,0 h = 32 km; M = 5,2 (IGN) Ayamonte, H.



SEISMIC OBSERVATIONS

1989

Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
23	ZT	Pn	17	03	09,5		Ep.: 43,1 N; 0,1 W; H = 17:02:30,9 h = 11 km; M = 3,2 (LDG) Pau, F.
23	ZT	Pg	17	54	43,1		Ep.: See pag. 111
	ZT	Sg	17	55	03,0		
25	ZT	P	14	33		5.345	Ep.: 60,08 N; 73,45 W; H = 14:24:32,6 h = 5 km; M = 6,2 (GS) Northern Quebec
26	ZT	Pn	20	01	00,7		Ep.: 43,5 N; 7,5 E; H = 20:00:00,1 h = — km; M = 4,5 (LDG) Nice, F.
30	ZT	P	05	02		16.830	Ep.: 16,18 S; 167,97 E; H = 04:42:51,1 h = 184 km; M = 5,5 (GS) Vanuatu islands

