

SEISMOLOGICAL BULLETIN OF SYOWA STATION, ANTARCTICA, 1989

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1. Introduction

The seismic observation system at Syowa Station is schematically illustrated in Fig. 1. There are two types of seismometers, the one called SP (short-period) or HES with the natural period of 1.0 s of the pendulum and the other called LP (long-period) or PELS with the natural period of 12.0 s. SP and LP have been operated since 1961 and 1967, respectively (Kaminuma *et al.*, 1968). A new vault for seismometers was built in March 1970 (Kaminuma and Chiba, 1973). The old LP was replaced by PELS at Syowa Station in 1982. The coordinates of the seismographic vault are $69^{\circ}00'31.7''\text{S}$ in latitude and $39^{\circ}35'31.6''\text{E}$ in longitude. The elevation is 20 m above the mean sea level.

The system was maintained by H. Murakami throughout the wintering season of JARE-30 (February 1989 - January 1990).

2. Data

The overall frequency response and the magnification of the short-period and long-period seismometers (Z, N-S and E-W components) are shown in Fig. 2. The system clock has been

connected to the recovered UTC from NNSS satellites since February 1987 (see Fig. 1). The accuracy of the read-out data can be estimated as 0.2 s.

Considering the delay time of 1-2 years between the publication of this report and the observing wintering period, which is inevitable due to the restriction of transport ability between Tokyo and Syowa Station, the PDE (Preliminary Determination of Epicenters) reports by NEIC (National Earthquake Information Center) are referred to and only the seismograms of teleseismic events are edited.

2.1. Read-out data

The onset of the all events detected on the monitoring seismograms of the short- and long-periods was picked out from the pen-monitor records. The onset times of P-arrivals are listed in Table 1. Symbols E and I in the phase column denote weak and sharp onsets, respectively. The direction of the initial ground motion is denoted by + for the upward direction and – for the downward direction. Arrival time is in UTC.

Some earthquakes were determined as the local events using the data of the tripartite array network which was installed around Syowa Station in 1987 (Akamatsu *et al.*, 1988). The local events are denoted with the symbol of the single asterisk in Table 1. The teleseismic events reported in the PDE of NEIC are shown with the serial numbers (#-xxx) in the table. The serial numbers are corresponded to the numbers in Table 2 which are listed the big events detected at Syowa Station and reported in the PDE. The events detected on the only long-period seismograms are shown with the double asterisks.

2.2. Teleseismic events

Figure 3 shows the location of 195 teleseismic events of which initial phases were detected at Syowa Station. The list of hypocenters of the teleseisms is shown in Table 2 with the same serial numbers as given in remarks of Table 1. The seismograms of these events are available from National Institute of Polar Research.

Pen-monitor examples of short- and long-period seismograms of 12 teleseismic events are given in the Appendix. Body wave magnitude of the events in the appendix is larger than 6.0. One block of long-period seismogram is shown for one hour record and that of short-period is for 30 minutes. The long-period is given for three component seismograms at Syowa Station. The

short-period is given for the vertical component at three sites (Syowa, Langhovde and Tottuki Point) of the tripartite array (Akamatsu *et al.*, 1988), but the event of #-144 is given for two components (vertical and E-W) at Syowa Station and vertical component at Langhovde. The events of #-166, #-177 and #-181 are given for three components at Syowa Station. The long-period seismogram of #-50 was scaled out and could not be detected any phases.

3. Staffs of Data Process

The seismic observations at Syowa Station are organized by one of the authors, K. Kaminuma, and Dr. K. Shibuya of National Institute of Polar Research. Information on the seismic observation at Syowa Station is available from them. Ms. Y. Shudo of National Institute of Polar Research has scaled and edited all events, and has prepared this manuscript. The authors express their thanks for her cooperation.

References

- Akamatsu, J., Yoshikawa, S. and Kaminuma, K. (1988): Preliminary report of local seismic activity around Syowa Station, East Antarctica. *Proc. NIPR Symp. Antarct. Geosci.*, **2**, 1-6.
- Kaminuma, K. and Chiba, H. (1973): Syowa Kiti no shin-jishinkeishitsu to jishin kenchiritsu (The new seismographic vault and the detection capability of Syowa Station, Antarctica). *Nankyoku Shiryô (Antarct. Rec.)*, **46**, 67-82.
- Kaminuma, K., Eto, T. and Yoshida, M. (1968): Syowa Kiti no jishin kansoku (Seismological observation at Syowa Station, Antarctica). *Nankyoku Shiryô (Antarct. Rec.)*, **33**, 65-70.

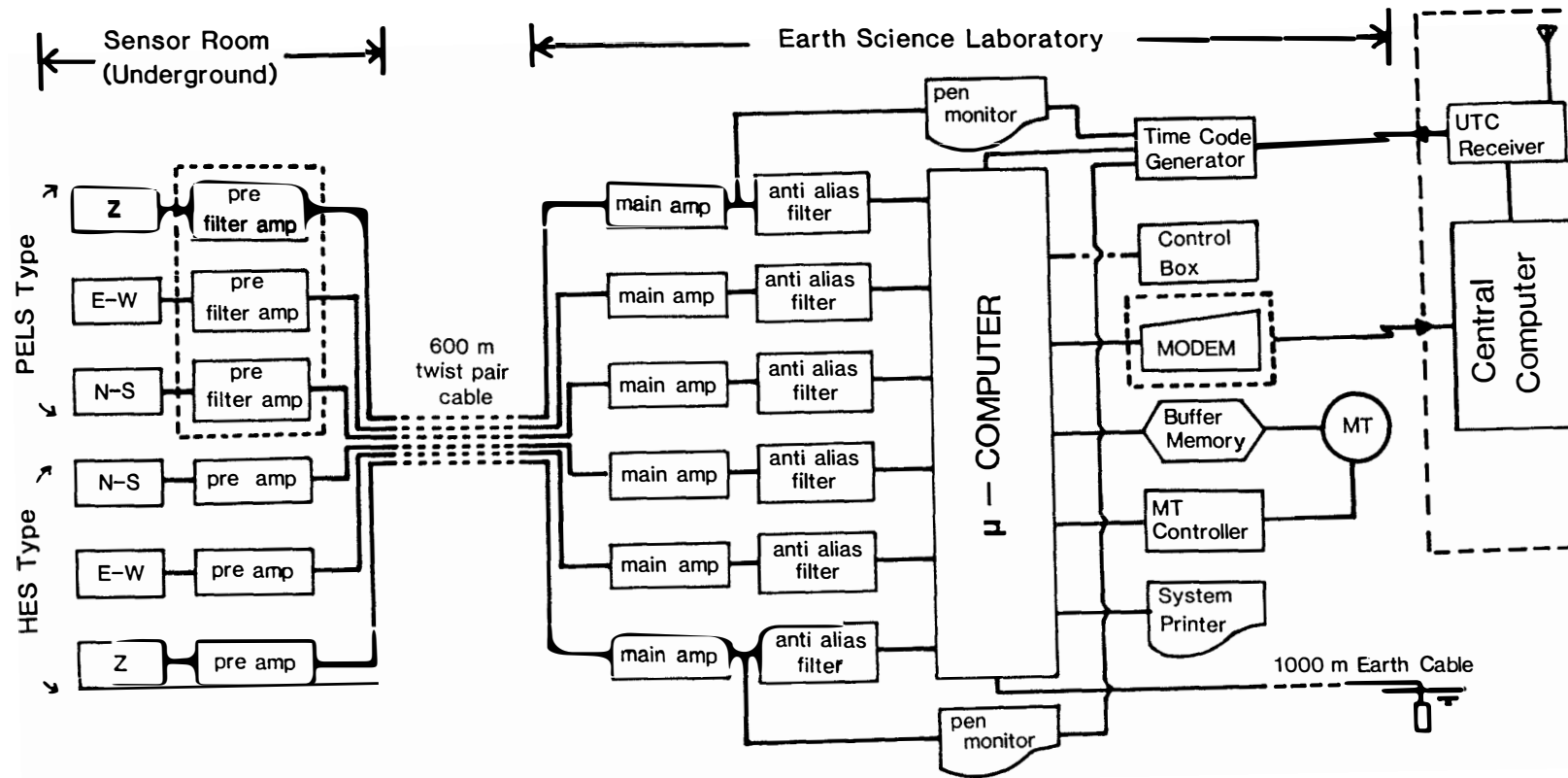


Fig. 1. The seismic observation system at Syowa Station.

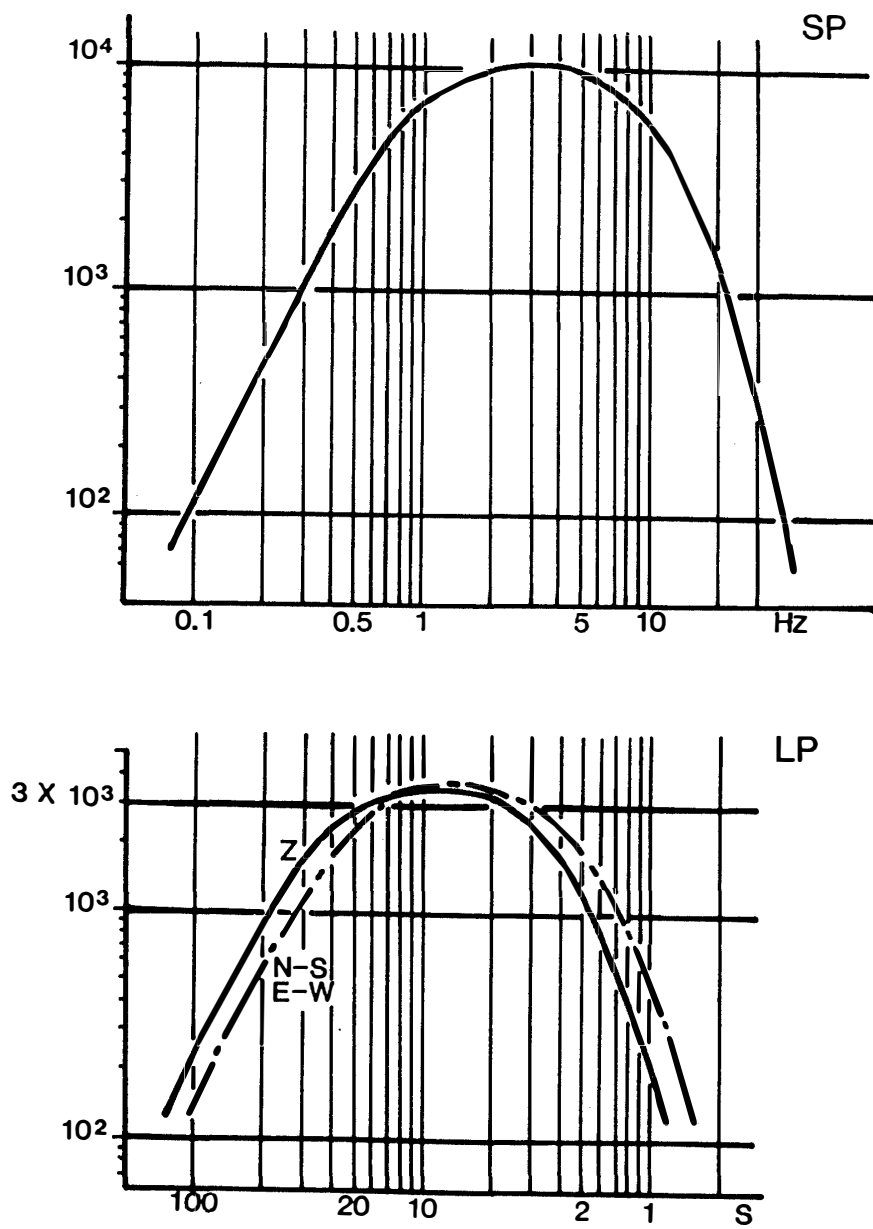


Fig. 2. Over-all frequency responses of the short-period and the long-period seismographs.

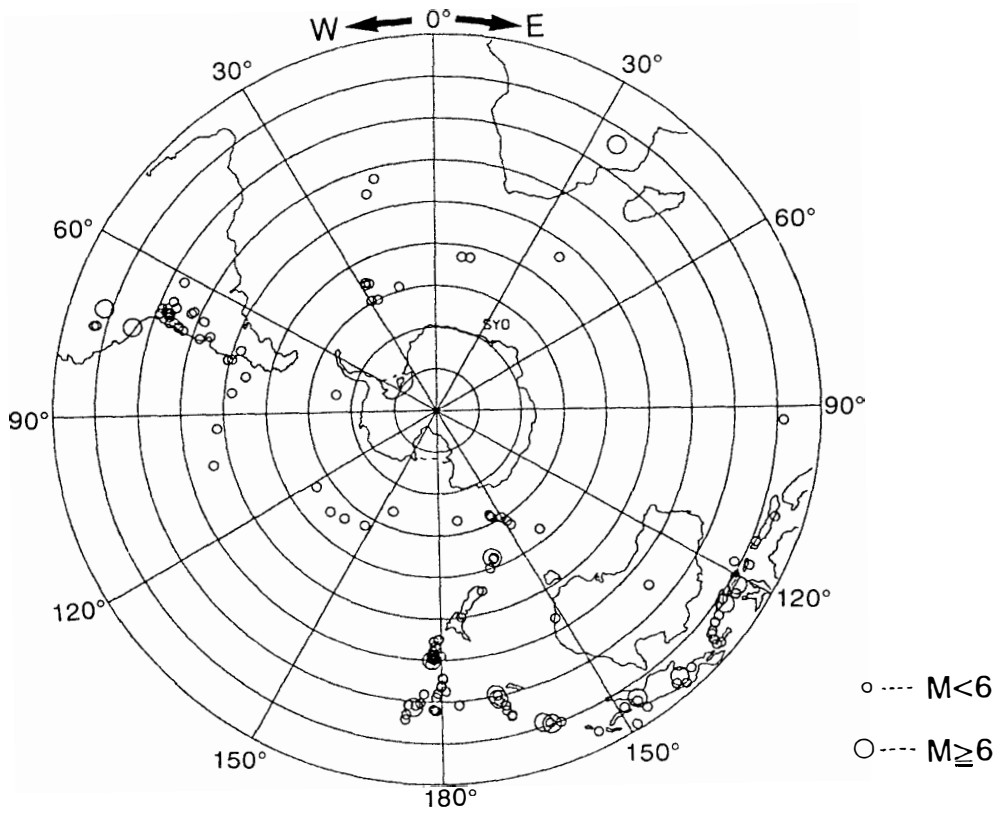
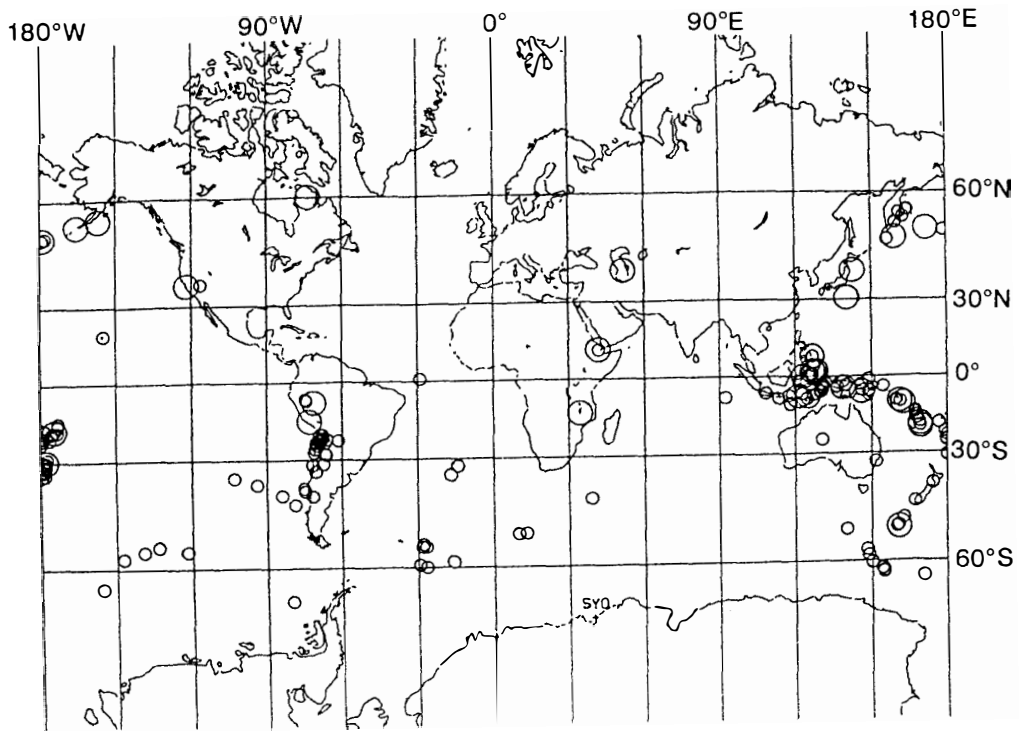


Fig. 3. Epicenters of the 195 events.

Table 1. Read-out data.

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
Jan. 02	-IPZ	00 12 27.6	#-1	Feb. 07	+IPZ	04 14 23.9	
	-IPZ	02 04 52.5	#-2		+IPZ	12 53 41.0	
	LP-IPZ	02 04 52.5			EPZ	13 46 54.6	
	LP ISH	02 15 37.1		08	+IPZ	23 53 05.5	#-9
	-IPZ	07 38 59.3		09	+IPZ	23 00 15.3	
04	-IPZ	10 27 13.0		10	+IPZ	11 28 25.3	#-10
05	EPZ	14 14 12.7			LP+IPZ	11 28 25.3	
07	-IPZ	07 37 40.2	#-3		LP ISH	11 39 25.0	
	LP-IPZ	07 37 40.2			-IPZ	12 20 46.6	
09	EPZ	03 13 40.2	*		+IPZ	12 25 06.5	
10	EPZ	06 07 44.9	#-4		-IPZ	12 29 53.6	
	LP+IPZ	06 07 44.9			+IPZ	13 12 34.2	
13	-IPZ	16 12 29.4		14	EPZ	06 33 22.4	
14	+IPZ	01 03 42.6			EPZ	21 51 12.2	
15	+IPZ	01 38 40.4	#-5	16	EPZ	07 09 23.3	
17	EPZ	00 48 24.4	#-6		+IPZ	13 35 05.7	
18	-IPZ	17 45 05.0	#-7		+IPZ	16 46 20.8	#-11
19	-IPZ	20 47 17.7			LP+IPZ	16 46 20.9	
20	EPZ	02 10 40.8		19	EPZ	13 01 51.2	#-12
22	EPZ	04 16 03.2			LP+IPZ	13 01 51.2	
24	-IPZ	04 06 57.6		21	+IPZ	13 27 15.4	
26	-IPZ	04 02 09.4			-IPZ	22 18 46.2	#-13
27	+IPZ	08 54 45.5	#-8	23	+IPZ	02 00 28.4	
31	EPZ	07 18 16.5			+IPZ	06 03 46.8	#-14
Feb. 03	EPZ	18 56 15.9		24	-IPZ	02 11 06.5	
06	+IPZ	23 41 09.3		25	+IPZ	11 38 30.0	#-15

#-No. --- Corresponds to that in Table 2.

* --- corresponds to local event.

** --- has no arrival time record on the short-period seismographs.

Date	Phase	Arrival time h m s	Remarks
Feb. 25	LP+IPZ	11 38 29.9	
	LP ISH	11 48 16.9	
28	+IPZ	13 12 27.3	#-16
	LP EPZ	13 12 27.4	
Mar. 06	-IPZ	14 58 42.6	
08	EPZ	11 57 28.8	#-17
10	EPZ	21 59 19.9	#-18
15	+IPZ	04 29 21.0	#-19
16	EPZ	07 31 03.7	
	+IPZ	09 45 48.9	#-20
	LP+IPZ	09 45 49.3	
17	+IPZ	13 51 38.2	#-21
	+IPZ	19 44 33.3	#-22
	LP+IPZ	19 44 33.4	
20	-IPZ	01 27 35.1	
22	EPZ	18 22 35.6	
23	-IPZ	21 33 30.8	
24	-IPZ	00 34 52.4	
	+IPZ	09 57 28.8	#-23
30	+IPZ	20 51 54.6	#-24
Apr. 01	-IPZ	22 08 51.1	
02	EPZ	10 56 09.9	
	-IPZ	21 03 08.7	#-25
05	+IPZ	11 39 41.7	
	-IPZ	23 59 27.3	#-26
	LP-IPZ	23 59 28.3	
06	LP ISH	00 09 07.3	
	-IPZ	08 18 15.0	#-27
	LP EPZ	08 18 15.1	
	EPZ	17 45 16.2	

Date	Phase	Arrival time h m s	Remarks
Apr. 06	+IPZ	22 45 32.0	
08	+IPZ	01 39 14.1	
	+IPZ	03 19 10.6	
11	EPZ	04 16 12.5	#-28
	LP-IPZ	04 16 12.9	
13	EPZ	00 53 26.4	#-29
	-IPZ	09 14 32.3	
14	+IPZ	01 28 19.9	
	-IPZ	13 14 41.2	#-30
	LP-IPZ	13 14 41.8	
	EPZ	13 16 30.9	
16	-IPZ	19 59 51.5	#-31
18	-IPZ	02 13 04.9	
	+IPZ	12 45 22.6	#-32
	EPZ	12 54 48.2	
19	+IPZ	00 20 08.7	#-33
20	+IPZ	08 21 51.3	
22	-IPZ	12 02 14.5	
24	+IPZ	20 53 50.8	#-34
	LP+IPZ	20 53 50.8	
25	-IPZ	00 43 03.5	
	EPZ	03 24 00.0	
27	-IPZ	02 38 49.8	#-35
	-IPZ	09 46 28.7	
	EPZ	12 49 20.3	
28	+IPZ	20 32 23.3	#-36
	LP+IPZ	20 32 23.5	
30	-IPZ	15 45 47.4	#-37
	LP EPZ	15 45 47.6	
May 01	-IPZ	08 57 07.9	

Date	Phase	Arrival time			Remarks
		h	m	s	
May 02	+IPZ	23	20	52.0	
04	+IPZ	13	26	42.9	#-38
	LP+IPZ	13	26	42.8	
	LP ISH	13	31	19.8	
	+IPZ	18	45	30.5	
05	+IPZ	13	42	27.1	
	-IPZ	18	40	35.2	#-39
	LP-IPZ	18	40	35.3	
	LP ISH	18	50	05.5	
08	+IPZ	14	40	00.7	#-40
	LP+IPZ	14	40	00.7	
09	-IPZ	15	43	08.8	
10	-IPZ	22	30	17.0	#-41
14	+IPZ	01	11	39.0	#-42
	LP+IPZ	01	11	39.1	
	-IPZ	08	14	57.4	
	EPZ	09	23	04.6	
	EPZ	09	50	39.0	
	+IPZ	17	17	16.9	
15	+IPZ	06	25	15.4	
	-IPZ	19	56	10.3	
	-IPZ	23	47	37.0	#-43
16	EPZ	17	32	24.5	#-44
	LP EPZ	17	32	23.3	
17	+IPZ	05	59	05.5	
	+IPZ	08	35	36.4	
	EPZ	16	20	40.7	#-45
	LP+IPZ	16	20	41.2	
19	-IPZ	02	41	42.4	#-46
	+IPZ	12	02	24.1	#-47

Date	Phase	Arrival time			Remarks
		h	m	s	
May 20	EPZ	16	13	32.2	#-48
	LP EPZ	16	13	33.1	
21	-IPZ	04	15	27.2	
	-IPZ	22	08	43.0	#-49
	LP-IPZ	22	08	42.8	
22	EPZ	11	27	46.4	
23	+IPZ	11	03	50.6	#-50
	+IPZ	16	17	03.7	
	+IPZ	17	20	51.2	#-51
	LP+IPZ	17	20	51.2	
24	EPZ	02	26	04.5	
	+IPZ	07	53	24.5	
	-IPZ	08	18	18.3	
	EPZ	13	51	10.1	#-52
	LP EPZ	13	51	09.7	
	EPZ	16	03	26.5	#-53
25	+IPZ	01	04	00.5	#-54
	LP+IPZ	01	04	00.5	
	+IPZ	04	52	18.3	
	EPZ	09	48	32.5	#-55
	LP EPZ	09	48	34.9	
	+IPZ	12	08	28.5	#-56
	+IPZ	20	33	24.4	
26	-IPZ	07	09	06.6	
27	EPZ	03	11	06.8	#-57
	LP EPZ	03	11	06.1	
	+IPZ	14	37	02.2	
28	+IPZ	03	06	15.6	#-58
	EPZ	09	59	32.0	#-59
29	+IPZ	22	34	07.9	#-60

Date	Phase	Arrival time			Remarks
		h	m	s	
May 31	+IPZ	06	04	23.9	#-61
	LP+IPZ	06	04	23.9	
June 01	EPZ	07	34	13.0	
	+IPZ	21	07	35.7	
06	EPZ	08	41	33.2	*
	+IPZ	13	29	21.8	
07	+IPZ	22	00	33.5	
08	EPZ	10	04	48.8	
09	-IPZ	15	45	46.5	#-62
11	EPZ	12	30	53.7	
12	+IPZ	05	59	58.9	
	+IPZ	13	23	35.0	#-63
	+IPZ	18	33	33.2	
13	EPZ	18	02	35.5	#-64
	EPZ	23	05	05.5	#-65
	LP EPZ	23	05	05.2	
17	+IPZ	15	08	38.0	#-66
	+IPZ	15	41	15.1	
	EPZ	18	38	15.6	#-67
19	-IPZ	16	12	10.1	#-68
	+IPZ	20	22	36.4	#-69
20	+IPZ	06	01	34.8	
	-IPZ	06	32	18.7	
22	EPZ	00	03	22.5	#-70
	+IPZ	21	34	39.2	#-71
24	EPZ	13	09	45.0	#-72
25	+IPZ	06	47	53.0	
26	EPZ	03	46	19.2	#-73
	LP EPZ	03	46	18.5	
27	EPZ	17	51	53.5	#-74

Date	Phase	Arrival time			Remarks
		h	m	s	
June 27	LP EPZ	17	51	55.1	
28	EPZ	21	33	32.0	#-75
	LP EPZ	21	33	34.9	
	+IPZ	23	56	54.5	#-76
29	EPZ	00	31	12.0	
	+IPZ	04	10	37.5	
July 03	EPZ	17	29	45.1	
07	EPZ	12	39	04.1	
08	-IPZ	10	45	54.2	
09	-IPZ	09	58	35.0	
11	EPZ	02	04	34.2	
13	+IPZ	02	15	00.7	
14	EPZ	15	55	11.0	
	+IPZ	20	54	56.3	#-77
	LP+IPZ	20	54	56.3	
	LP ISH	21	05	05.1	
16	+IPZ	22	22	36.9	#-78
18	+IPZ	09	47	18.7	
	+IPZ	11	00	58.6	
20	+IPZ	06	39	44.5	
	EPZ	12	22	19.8	
	+IPZ	17	35	00.0	
21	+IPZ	03	30	56.9	
22	+IPZ	05	15	03.6	#-79
	LP+IPZ	05	15	03.5	
	LP ISH	05	25	19.8	
	+IPZ	21	43	19.3	#-80
25	EPZ	22	05	34.3	#-81
	-IPZ	22	27	53.9	#-82
30	-IPZ	09	33	58.2	#-83

Date	Phase	Arrival time			Remarks
		h	m	s	
July 30	LP-IPZ	09	33	56.9	
	+IPZ	19	48	54.3	#-84
31	EPZ	17	19	26.5	#-85
	LP EPZ	17	19	27.2	
	EPZ	21	41	46.5	
Aug. 01	EPZ	00	31	01.2	#-86
	LP EPZ	00	31	01.2	
	EPZ	05	37	53.1	
	EPZ	22	35	35.5	
02	EPZ	03	50	09.5	
03	+IPZ	11	13	09.0	#-87
	LP+IPZ	11	13	09.1	
	+IPZ	15	05	40.2	
	+IPZ	22	37	24.9	#-88
	LP+IPZ	22	37	24.9	
	LP ISH	22	46	48.4	
05	EPZ	10	06	04.2	
06	+IPZ	06	49	22.4	
	-IPZ	08	31	24.7	#-89
07	-IPZ	08	48	13.6	
	+IPZ	23	19	16.4	
08	+IPZ	08	09	40.9	#-90
	LP+IPZ	08	09	40.9	
	-IPZ	23	55	37.1	#-91
10	EPZ	10	52	22.4	#-92
	LP EPZ	10	52	24.2	
12	+IPZ	00	53	04.9	#-93
	LP+IPZ	00	53	05.1	
	EPZ	20	59	26.3	
14	EPZ	18	03	49.6	#-94

Date	Phase	Arrival time			Remarks
		h	m	s	
Aug. 14	LP-IPZ	18	03	49.9	
15	EPZ	10	15	20.6	#-95
17	-IPZ	11	15	50.6	
18	EPZ	03	52	52.8	#-96
19	+IPZ	12	36	33.8	
	+IPZ	13	31	34.0	#-97
	-IPZ	17	40	55.2	
20	-IPZ	11	29	10.7	#-98
	LP EPZ	11	29	08.3	
	+IPZ	11	58	44.4	#-99
	LP+IPZ	11	58	45.2	
	EPZ	12	08	35.8	
	LP EPZ	12	08	33.7	
	EPZ	13	37	43.5	
	LP-IPZ	13	37	43.9	
	EPZ	13	38	35.6	
	LP+IPZ	13	38	35.0	
	-IPZ	19	38	12.5	#-100
	LP EPZ	19	38	12.1	
21	-IPZ	01	21	21.0	#-101
	LP-IPZ	01	21	21.2	
	EPZ	05	15	22.3	
	LP EPZ	05	15	21.4	
	-IPZ	18	38	09.9	#-102
	LP-IPZ	18	38	10.0	
	LP ISH	18	48	08.2	
26	-IPZ	20	22	11.4	
27	+IPZ	06	59	06.2	
30	+IPZ	03	26	44.6	#-103
	+IPZ	11	57	56.9	#-104

Date	Phase	Arrival time			Remarks
		h	m	s	
Aug. 30	LP+IPZ	11	57	57.3	
	+IPZ	16	38	40.3	
31	-IPZ	08	27	02.5	#-105
Sept. 01	-IPZ	12	08	47.9	#-106
	-IPZ	14	53	29.5	
02	+IPZ	14	32	51.4	
	EPZ	17	06	42.1	
03	+IPZ	19	37	32.3	
	+IPZ	21	03	17.1	
04	+IPZ	05	33	49.9	#-107
	LP+IPZ	05	33	51.2	
	+IPZ	07	30	09.7	#-108
	+IPZ	13	35	01.0	#-109
	LP+IPZ	13	35	01.6	
05	LP ISH	13	42	26.6	
	-IPZ	15	09	04.3	#-110
	-IPZ	06	05	06.4	#-111
06	+IPZ	19	57	23.2	#-112
	EPZ	09	22	04.7	#-113
07	LP EPZ	09	22	06.6	
	-IPZ	14	58	46.4	#-114
	LP+IPZ	14	58	46.8	
08	+IPZ	13	43	50.7	#-115
	LP+IPZ	13	43	51.1	
	-IPZ	20	13	38.6	
09	+IPZ	06	19	53.0	#-116
	LP+IPZ	06	19	53.0	
	+IPZ	08	37	29.2	#-117
12	-IPZ	22	59	00.2	
	EPZ	15	40	51.0	

Date	Phase	Arrival time			Remarks
		h	m	s	
Sept. 13	-IPZ	03	44	16.5	#-118
	+IPZ	11	49	05.8	#-119
14	LP EPZ	11	49	05.6	
	-IPZ	04	54	05.6	#-120
	-IPZ	09	35	29.2	
15	+IPZ	19	23	18.0	#-121
	LP+IPZ	19	23	18.2	
16	+IPZ	18	53	53.6	#-122
	EPZ	02	23	33.0	#-123
17	LP EPZ	02	23	34.2	
	+IPZ	04	11	38.8	#-124
	LP+IPZ	04	11	38.8	
19	+IPZ	05	55	53.2	#-125
	LP+IPZ	05	55	53.2	
20	EPZ	08	43	12.9	
	EPZ	17	00	44.1	
25	EPZ	13	39	19.8	#-126
	LP EPZ	13	39	19.2	
26	EPZ	14	30	13.1	#-127
	LP+IPZ	14	30	14.1	
Oct. 03	+IPZ	02	35	57.0	#-128
	-IPZ	21	44	49.9	#-129
04	+IPZ	06	57	44.0	
	+IPZ	07	08	07.7	#-130
07	LP EPZ	07	08	05.2	
	+IPZ	16	08	19.0	#-131
09	LP EPZ	16	08	19.1	
	EPZ	17	02	19.5	#-132
09	-IPZ	18	20	52.2	#-133
	LP-IPZ	18	20	52.2	

Date	Phase	Arrival time			Remarks
		h	m	s	
Oct. 10	+IPZ	06	57	19.7	
13	-IPZ	17	01	09.3	#-134
	EPZ	20	24	24.9	
14	EPZ	02	43	30.9	
15	+IPZ	10	12	55.7	#-135
	LP+IPZ	10	12	56.0	
18	+IPZ	00	23	55.1	#-136
	LP+IPZ	00	23	55.1	
	+IPZ	11	53	50.8	#-137
	LP+IPZ	11	53	50.8	
19	+IPZ	10	08	53.8	
20	+IPZ	07	56	06.6	
21	-IPZ	03	40	25.2	
22	+IPZ	20	47	49.5	#-138
23	EPZ	03	41	15.0	
	-IPZ	13	19	54.4	#-139
	LP-IPZ	13	19	54.4	
	LP ISH	13	29	22.0	
	-IPZ	13	38	58.7	
	-IPZ	23	52	20.5	#-140
27	+IPZ	21	17	54.3	#-141
	LP+IPZ	21	17	53.9	
	LP ISH	21	28	26.8	
30	-IPZ	23	58	11.1	
31	+IPZ	15	49	39.5	#-142
	LP+IPZ	15	49	39.5	
Nov. 01	-IPZ	06	52	05.8	#-143
	LP-IPZ	06	52	05.9	
	LP ISH	07	01	40.9	
	EPZ	10	02	32.0	

Date	Phase	Arrival time			Remarks
		h	m	s	
Nov. 01	EPZ	18	44	39.8	#-144
	LP+IPZ	18	44	43.2	
02	-IPZ	10	23	55.7	#-145
03	-IPZ	17	52	36.3	#-146
05	EPZ	22	39	57.8	
	LP EPZ	22	39	58.2	
06	EPZ	21	05	22.2	
	LP EPZ	21	05	21.2	
08	-IPZ	11	34	26.7	
09	EPZ	03	30	57.4	#-147
	+IPZ	09	18	30.6	#-148
	EPZ	22	13	24.7	#-149
	LP EPZ	22	13	23.8	
10	-IPZ	13	54	01.8	#-150
	LP-IPZ	13	54	02.1	
	SP ISH	14	03	15.4	
	+IPZ	23	12	50.2	#-151
	+IPZ	23	17	23.2	#-152
14	-IPZ	06	19	11.5	#-153
	EPZ	14	44	10.8	#-154
	LP-IPZ	14	44	11.8	
	+IPZ	19	38	22.1	
15	-IPZ	19	29	02.2	#-155
	LP EPZ	19	29	02.2	
16	EPZ	08	51	40.8	#-156
	LP+IPZ	08	51	41.2	
17	LP+IPZ	15	48	38.2	#-157**
	EPZ	22	52	01.6	#-158
	LP-IPZ	22	52	01.9	
19	LP EPZ	12	56	04.5	**

Date	Phase	Arrival time			Remarks
		h	m	s	
Nov. 21	LP+IPZ	03	22	20.8	#-159**
	+IPZ	14	46	57.7	#-160
	LP+IPZ	14	47	03.1	
22	+IPZ	23	39	21.2	#-161
24	EPZ	00	48	04.8	#-162
	EPZ	05	13	46.5	
	EPZ	06	48	01.1	#-163
	LP EPZ	06	48	01.2	
24	+IPZ	23	15	12.4	#-164
25	EPZ	08	02	47.3	#-165
	LP EPZ	08	02	47.4	
26	EPZ	23	07	15.9	
29	EPZ	01	12	33.6	#-166
	LP-IPZ	01	12	34.0	
	LP ISH	01	22	49.2	
	+IPZ	06	00	25.4	#-167
	LP+IPZ	06	00	25.5	
	LP ISH	06	09	51.8	
30	-IPZ	19	57	32.9	
Dec. 01	+IPZ	05	26	04.5	#-168
	+IPZ	19	11	43.2	#-169
	LP+IPZ	19	11	43.1	
03	-IPZ	11	23	33.7	#-170
	-IPZ	14	29	37.4	#-171
	LP-IPZ	14	29	38.2	
	+IPZ	20	07	20.0	
	+IPZ	21	40	23.0	#-172
	LP EPZ	21	40	22.6	
04	EPZ	06	55	36.2	#-173
06	+IPZ	05	32	09.7	#-174

Date	Phase	Arrival time			Remarks
		h	m	s	
Dec. 06	LP+IPZ	05	32	09.6	
	SP ISH	05	42	18.3	
07	+IPZ	13	51	33.2	#-175
	LP+IPZ	13	51	33.2	
	SP ISH	14	02	14.2	
08	EPZ	02	44	47.5	
	+IPZ	15	19	39.4	#-176
	LP+IPZ	15	19	39.3	
09	+IPZ	20	50	42.0	#-177
	LP+IPZ	20	50	42.0	
11	+IPZ	16	12	26.4	#-178
12	+IPZ	08	46	29.9	#-179
	LP+IPZ	08	46	30.1	
	SP ISH	08	57	47.8	
14	EPZ	19	26	42.2	#-180
15	EPZ	18	57	13.0	#-181
	LP EPZ	18	57	13.1	
16	+IPZ	02	53	34.0	#-182
17	+IPZ	03	23	24.2	#-183
18	EPZ	07	25	31.5	#-184
20	LP+IPZ	00	21	49.5	#-185**
	EPZ	01	39	58.5	
	-IPZ	04	35	07.8	#-186
	EPZ	08	48	47.2	#-187
	+IPZ	11	56	12.3	#-188
23	+IPZ	01	44	40.8	#-189
25	EPZ	14	44	18.0	#-190
	LP EPZ	14	44	18.2	
26	+IPZ	01	40	35.9	#-191
	LP+IPZ	01	40	36.1	

Date	Phase	Arrival time			Remarks
		h	m	s	
Dec. 26	EPZ	02	15	13.2	*
27	+IPZ	23	37	50.6	#-192
29	EPZ	17	48	08.4	*
30	+IPZ	04	55	18.7	#-193
	LP+IPZ	04	55	18.9	
	+IPZ	12	49	36.6	#-194
	EPZ	23	32	01.0	#-195
	LP EPZ	23	32	01.2	

Table 2. List of 195 earthquakes.

Data	Origin time			Geographic		Region	Depth	Magnitude		Epicentral distance	Azimuth	
No.	Date	h	m	s	Latitude			Longitude	(km)			(Mb)
1	01/02	00	00	39.1	18.173 S	178.412 W	Fiji Island Region	635	5.2		88.786	35.813 SE
2	01/02	01	52	08.0	18.589 S	174.559 W	Tonga Islands	108 G	6.1		89.156	32.151 SE
3	01/07	07	26	11.4	23.258 S	68.410 W	Northern Chile	122 D	5.5		74.571	65.016 SW
4	01/10	05	55	01.4	3.162 S	130.556 E	Ceram	47	5.9	6.5	87.398	87.961 SE
5	01/15	01	27	46.3	31.733 S	71.813 W	Near Coast of Central Chile	50	5.2	4.4	67.741	58.826 SW
6	01/17	00	35	23.1	6.151 S	148.947 E	New Britain Region	32 G	5.9	6.4	91.076	69.754 SE
7	01/18	17	32	11.6	7.025 S	74.598 W	Peru-Brazil Border Region	147 D	5.4		91.860	64.934 SW
8	01/27	08	34	51.1	56.202 N	164.375 E	Komandorsky Islands Region	28 D	5.4	6.2	152.814	90.427 SE
9	02/08	23	46	41.4	55.623 S	26.795 W	South Sandwich Islands Region	24 D	5.5	5.6	31.636	80.518 SW
10	02/10	11	15	24.6	2.305 N	126.760 E	Molucca Passage	44 G	6.2	6.8	91.130	93.472 SE
11	02/16	16	36	52.1	56.404 S	121.964 W	Easter Island Cordiller	10 G	5.4	6.0	53.994	12.498 SW
12	02/19	12	49	09.9	14.894 S	167.171 E	Vanuatu Islands	101 D	5.6		88.429	50.012 SE
13	02/21	22	08	54.7	44.462 S	78.766 W	Off Coast of Southern Chile	26 D	5.6	5.3	57.911	47.844 SW

14	02/23	05 51 11.4	14.771 S	167.300 E	Vanuatu Islands	155 D	5.4		88.583	49.927 SE
15	02/25	11 26 35.4	29.915 S	177.885 W	Kermadec Islands	31 G	6.1	6.7	77.446	32.704 SE
16	02/28	13 01 57.6	23.113 S	61.465 W	Paraguay	569 D	5.6		72.385	71.274 SW
17	03/08	11 44 32.3	1.031 N	126.189 E	Molucca Passage	32 G	5.9	5.6	89.736	93.546 SE
18	03/10	21 49 45.8	13.702 S	34.420 E	Malawi	30 G	6.2	6.1	55.278	173.883 SW
19	03/15	04 17 33.4	30.539 S	178.008 W	Kermadec Islands	57	5.2	4.9	76.814	32.666 SE
20	03/16	09 33 57.2	30.270 S	177.986 W	Kermadec Islands	37 G	5.7	5.5	77.080	32.709 SE
21	03/17	13 38 39.7	5.851 S	146.596 E	East Papua New Guinea Region	43 D	5.7	5.5	90.557	72.054 SE
22	03/17	19 33 08.6	34.479 S	178.394 W	South of Kermadec Islands	59	5.7		72.904	32.060 SE
23	03/24	09 49 31.3	58.887 S	148.783 E	West of Macquarie Island	10 G	5.3	5.6	42.486	46.265 SE
24	03/30	20 39 29.3	19.589 S	175.848 W	Tonga Islands	230 D	5.8		87.926	33.137 SE
25	04/02	20 52 02.6	30.941 S	179.998 E	Kermadec Islands Region	400	5.1		76.026	34.286 SE
26	04/05	23 47 49.3	20.857 S	69.028 W	Northern Chile	112 D	5.7		77.020	65.337 SW
27	04/06	08 05 57.1	19.306 S	169.002 E	Vanuatu Islands	166 G	6.1		84.692	47.081 SE
28	04/11	03 56 36.9	49.488 N	159.185 E	Kuril Islands Region	16 G	6.3	6.6	145.567	87.434 SE
29	04/13	00 43 11.2	39.533 S	75.002 W	Off Coast of Central Chile	33 N	5.8	5.5	61.438	52.983 SW
30	04/14	13 02 52.6	18.172 S	178.393 W	Fiji Islands Region	636	5.4		88.791	35.795 SE

31	04/16 19 48 14.6	21.039 S	178.942 W	Fiji Islands Region	610 D	5.7		85.881	35.659 SE
32	04/18 12 33 52.1	23.834 S	179.944 E	South of Fiji Islands	524 G	5.8		82.925	36.025 SE
33	04/19 00 08 19.6	31.310 S	177.815 W	Kermadec Islnads Region	11 G	5.6	5.9	76.100	32.321 SE
34	04/24 20 41 11.5	17.398 S	167.826 E	Vanuatu Islands	34 D	5.3	5.5	86.208	48.694 SE
35	04/27 02 20 04.7	30.601 N	140.589 E	South of Honshu, Japan	85 G	6.1		122.278	92.051 SE
36	04/28 20 26 17.9	59.515 S	29.397 W	South Sandwich Islands Region	22 D	5.5	5.7	29.609	73.439 SW
37	04/30 15 33 52.7	17.912 S	178.665 W	Fiji Islands Region	570 D	5.4		88.987	36.105 SE
38	05/04 13 15 08.0	21.963 S	179.305 W	Fiji Islands Region	591 D	5.4		84.905	35.779 SE
39	05/05 18 28 39.4	8.281 S	71.381 W	Western Brazil	593 G	6.4		89.614	67.523 SW
40	05/08 14 28 30.9	23.427 S	179.953 W	South of Fiji Islands	548 D	5.6		83.343	36.027 SE
41	05/10 22 18 46.1	23.282 S	69.190 W	Nothern Chile	96 D	5.3		74.803	64.312 SW
42	05/14 00 59 50.4	30.523 S	178.414 W	Kermadec Islands	44 G	5.9	6.6	76.750	33.019 SE
43	05/15 23 34 33.6	9.803 S	159.531 E	Solomon Islands	24 G	5.9	5.9	91.053	58.655 SE
44	05/16 17 22 52.9	56.329 S	139.125 W	South Pacific Cordillera	10 G	5.8	5.8	54.787	0.870 SW
45	05/17 16 12 54.5	62.104 S	154.634 E	Balleny Islands Region	10 G	5.0	5.3	41.143	40.111 SE
46	05/19 02 21 56.3	54.305 N	165.574 W	Fox Islands, Aleutian Islands	104 G	6.1		161.417	51.130 SE

47	05/19	11 50	54.3	24.839 S	70.019 W	Near Coast of Northern Chile	52 D	5.5		73.614	63.004 SW
48	05/20	16 01	43.6	30.508 S	178.270 W	Kermadec Islands	29 G	5.7	5.9	76.793	32.899 SE
49	05/21	21 56	48.6	17.952 S	178.593 W	Fiji Islands Region	584 G	5.7		88.964	36.029 SE
50	05/23	10 54	46.3	52.341 S	160.568 E	Macquarie Islands Region	10 G	6.4	8.2	51.304	42.157 SE
51	05/23	17 11	42.8	51.886 S	160.563 E	North of Macquarie Islands	10 G	5.9	6.0	51.721	42.390 SE
52	05/24	13 31	14.4	56.177 N	164.264 E	Komandorsky Islands Region	19 G	5.9	6.1	152.755	90.495 SE
53	05/24	15 43	34.3	56.173 N	164.185 E	Komandorsky Islands Region	36 D	5.5	5.4	152.723	90.562 SE
54	05/25	00 54	52.1	52.272 S	159.833 E	Macquarie Islands Region	10 G	5.7	5.6	51.189	42.721 SE
55	05/25	09 39	25.4	52.071 S	159.931 E	Macquarie Islands Region	10 G	5.5	5.5	51.397	42.753 SE
56	05/25	11 56	21.6	7.332 S	128.539 E	Banda Sea	171	5.5		82.780	88.335 SE
57	05/27	03 01	24.9	55.279 S	133.192 W	South Pacific Cordillera	10 G	5.5	5.7	55.728	4.967 SW
58	05/28	02 55	19.6	25.053 S	130.781 E	Northern Territory, Australia	10 G	5.8	5.1	67.155	79.363 SE
59	05/28	09 46	28.2	16.714 S	173.278 W	Tonga Islands	35 G	5.7	5.5	91.236	31.327 SE
60	05/29	22 22	30.7	23.897 S	70.337 W	Near Coast of Northern Chile	32 D	5.5	4.9	74.598	63.068 SW
61	05/31	05 54	20.5	45.383 S	167.086 E	South Island, New Zealand	23 G	5.8	6.3	59.339	40.379 SE
62	06/09	15 34	11.6	7.865 S	117.517 E	Bali Sea	245 G	5.8		78.328	98.455 SE

63	06/12	13 11	51.5	30.169 S	178.918 W	Kermadec Islands	82 *	5.6		76.995	33.537 SE
64	06/13	17 49	40.5	3.670 S	140.139 E	West Irian	71 D	5.4		90.350	78.845 SE
65	06/13	22 59	33.4	43.342 S	38.969 E	Prince Edward Islands Region	10 G	5.0	5.0	25.540	178.949 SW
66	06/17	14 57	48.4	31.419 S	67.550 W	San Juan Province, Argentina	28	5.3	4.5	66.694	62.613 SW
67	06/17	18 28	08.6	40.494 S	74.674 W	Off Coast of Southern Chile	33 N	5.6	5.0	60.453	52.837 SW
68	06/19	16 00	47.9	22.113 S	67.559 W	Chile-Bolivia Border Region	189 D	5.5		75.362	66.197 SW
69	06/19	20 16	10.5	55.672 S	28.247 W	South Sandwich Islands Region	33 N	5.6	5.1	32.113	79.253 SW
70	06/21	23 51	01.9	21.785 S	176.493 W	Fiji Islands Region	182 D	5.6		85.653	33.264 SE
71	06/22	21 15	00.8	37.283 N	116.412 W	Southern Nevada	0	5.3	4.8	145.789	35.135 SW
72	06/24	12 58	39.0	28.336 S	66.312 W	Catamarca Province, Argentina	22 D	5.4	5.2	69.154	64.928 SW
73	06/26	03 27	03.9	19.362 N	155.083 W	Hawaii	9	5.8	6.1	129.651	18.085 SE
74	06/27	17 43	09.0	63.72 S	156.10 W	South Pacific Cordillera	10 G	5.4	5.5	46.935	9.434 SE
75	06/28	21 24	12.4	57.788 S	147.449 W	South Pacific Cordillera	10 G	5.5	5.7	53.228	4.679 SE
76	06/28	23 44	51.3	7.604 S	127.342 E	Banda Sea	173 D	5.3		82.099	89.342 SE
77	07/14	20 42	40.0	8.081 S	125.129 E	Timor	10 G	6.4	6.2	80.857	91.231 SE

78	07/16	22 10 54.5	30.389 S	178.616 W	Kermadec Islands	115	5.2		76.841	33.225 SE
79	07/22	05 02 11.5	2.299 N	128.142 E	Halmahera	142 G	6.4		91.622	92.181 SE
80	07/22	21 35 53.6	66.10 S	79.99 W	Southern Pacific Ocean	10 G	5.1	4.3	38.668	34.326 SW
81	07/25	21 54 23.1	7.191 S	122.715 E	Flores Sea	620 G	5.6		80.818	93.817 SE
82	07/25	22 16 12.8	32.099 S	178.134 W	South of Kermadec Islands	33 N	5.3	4.9	75.270	32.409 SE
83	07/30	09 29 16.0	52.602 S	12.927 E	Southwest of Africa	10 G	5.6	5.7	20.506	128.915 SW
84	07/30	19 36 18.1	5.006 S	130.943 E	Banda Sea	57 *	5.3	4.9	85.817	86.934 SE
85	07/31	17 07 27.8	8.048 S	121.384 E	Flores Island Region	14 G	6.3	6.2	79.541	94.749 SE
86	08/01	00 18 04.8	4.511 S	139.022 E	West Irian	14 G	6.0	5.8	89.168	79.588 SE
87	08/03	11 07 17.9	59.994 S	26.680 W	South Sandwich Islands Region	33 D	5.7	5.7	28.320	74.809 SW
88	08/03	22 25 55.4	22.531 S	179.129 E	South of Fiji Islands	592 D	5.5		84.017	37.064 SE
89	08/06	08 19 56.1	23.157 S	68.321 W	Northern Chile	115 D	5.3		74.636	65.132 SW
90	08/08	07 59 06.1	40.121 S	174.330 E	Cook Strait, New Zealand	122 D	5.5		65.972	36.492 SE
91	08/08	23 44 04.4	22.723 S	68.478 W	Nouthern Chile	102 D	5.3		75.094	65.152 SW
92	08/10	10 44 36.8	61.895 S	154.623 E	Balleny Islands Region	10 G	5.2	5.6	41.322	40.275 SE
93	08/12	00 40 10.7	0.800 N	126.817 E	Molucca Passage	51 D	5.7		89.747	92.877 SE
94	08/14	17 51 08.7	19.016 S	176.652 E	South of Fiji Islands	33 N	5.8	5.9	86.872	40.167 SE

95	08/15	10 04 22.3	38.307 S	93.822 W	West Chile Rise	10 G	5.4	5.3	67.423	38.120 SW
96	08/18	03 46 26.0	55.053 S	27.846 W	South Sandwich Islands Region	33 N	5.6	5.5	32.455	80.309 SW
97	08/19	13 19 20.2	6.507 S	130.028 E	Banda Sea	165 G	5.7		84.089	87.241 SE
98	08/20	11 16 56.5	11.766 N	41.942 E	Ethiopia	12 G	5.8	6.3	80.663	177.669 SE
99	08/20	11 46 28.0	11.884 N	41.812 E	Ethiopia	10 G	6.1	5.6	80.780	177.799 SE
100	08/20	19 25 56.5	11.904 N	41.824 E	Ethiopia	12 G	6.2	5.7	80.800	177.788 SE
101	08/21	01 09 06.6	11.874 N	41.870 E	Ethiopia	16 G	6.3	6.2	80.770	177.742 SE
102	08/21	18 25 41.0	4.104 S	154.459 E	Solomon Islands	494 G	5.8		94.840	65.258 SE
103	08/30	03 06 55.1	54.597 N	162.793 E	Near East Coast of Kamchatka	31 D	5.5	5.2	151.003	89.737 SE
104	08/30	11 38 12.7	55.609 N	161.358 E	Near East Coast of Kamchatka	73 G	5.8		151.273	92.379 SE
105	08/31	08 17 22.5	41.850 S	71.678 W	Chile-Argentina Border Region	154 D	5.4		58.332	54.646 SW
106	09/01	11 57 22.5	6.699 S	108.426 E	Java	222 D	5.3		76.230	107.526 SE
107	09/04	05 20 55.9	4.219 S	136.667 E	West Irian Region	9 G	5.8	6.0	88.604	81.887 SE
108	09/04	07 18 32.8	33.329 S	178.805 W	South of Kermadec Islands	33 N	5.3		73.943	32.685 SE
109	09/04	13 14 58.2	55.543 N	156.835 W	South of Alaska	11 G	6.5	6.9	164.733	37.418 SE
110	09/04	14 57 28.1	33.262 S	178.689 W	South of Kermadec Islands	42 D	5.4		74.031	32.603 SE

111	09/05	05 51 55.2	4.260 N	127.408 E	Talau Islands	42 D	5.6	5.0	93.187	93.573 SE
112	09/05	19 49 03.8	52.810 S	140.316 E	West of Macquarie Island	10 G	5.3	5.4	45.364	56.576 SE
113	09/06	09 10 39.2	36.087 S	103.171 W	Southern Pacific Ocean	10 G	5.0	5.4	71.480	31.045 SW
114	09/06	14 45 51.0	0.976 N	126.106 E	Molucca Passage	37	5.8	5.0	89.655	93.604 SE
115	09/07	13 32 00.0	30.197 S	177.960 W	Kermadec Islands	33	5.7	5.4	77.156	32.704 SE
116	09/08	06 15 05.6	52.766 S	9.851 E	South of Africa	10 G	5.3	5.6	21.253	124.097 SW
117	09/08	08 25 39.8	30.178 S	177.844 W	Kermadec Islands	47 *	5.3	5.2	77.197	32.608 SE
118	09/13	03 31 35.9	19.009 S	174.921 W	Tonga Islands	122 D	5.6		88.675	32.401 SE
119	09/13	11 40 46.0	35.577 S	17.063 W	South of Atalntic Ridge	12 G	5.6	6.2	45.267	106.975 SW
120	09/14	04 42 39.8	26.141 S	70.746 W	Near Coast of Northern Chile	33 N	5.3	5.2	72.628	61.881 SW
121	09/14	19 10 25.7	1.644 N	127.322 E	Halmahera	103 G	6.0		90.716	92.710 SE
122	09/15	18 34 12.9	53.232 N	159.719 E	Near East Coast of Kamchatka	51 D	5.6		148.816	90.928 SE
123	09/16	02 05 08.9	40.337 N	51.534 E	Caspian Sea	55 D	6.4	6.5	109.578	170.363 SE
124	09/16	04 03 03.1	32.561 S	14.251 W	South Atlantic Ridge	10 G	5.7	5.8	47.061	111.637 SW
125	09/17	05 48 01.8	61.435 S	153.988 E	Balleny Islands Region	10 G	5.5	5.9	41.572	41.014 SE
126	09/20	13 19 31.9	51.184 N	178.821 E	Rat Island, Aleutian Islands	33 N	5.5	5.8	153.880	68.399 SE
127	09/25	14 17 47.0	20.355 S	169.277 E	Vanuatu Islands	34 G	6.1	6.3	83.757	46.537 SE

128	09/26	02 24 12.4	31.394 S	178.521 W	Kermadec Islands Region	33 N	5.4		75.881	32.906 SE
129	10/03	21 33 34.7	24.103 S	66.891 W	Salta Province, Argentina	155 D	5.4		73.284	66.052 SW
130	10/07	06 55 41.2	20.095 S	169.023 E	Vanuatu Islands	39 D	5.5	5.7	83.940	46.840 SE
131	10/07	15 48 29.0	51.314 N	179.028 W	Andreanof Islands, Aleutian Islands	20 G	6.1	6.7	154.704	65.927 SE
132	10/07	16 42 30.7	51.188 N	179.234 W	Andreanof Islands, Aleutian Islands	33 N	5.7	5.9	154.529	66.028 SE
133	10/09	18 01 07.8	51.780 N	171.869 E	Near Islands, Aleutian Islands	26 G	6.0	5.3	151.986	77.062 SE
134	10/13	16 49 36.8	32.766 S	179.009 W	South of Kermadec Islands	101 D	5.5		74.451	32.994 SE
135	10/15	10 05 04.7	60.320 S	150.091 E	West of Macquarie Island	10 G	5.2	5.8	41.585	44.329 SE
136	10/18	00 04 15.2	37.036 N	121.883 W	Central California	19	6.5	7.1	146.572	27.412 SW
137	10/18	11 40 50.2	10.155 S	161.063 E	Solomon Islands	45 G	6.1	5.7	91.186	57.111 SE
138	10/22	20 35 40.8	7.358 S	128.598 E	Banda Sea	156 D	5.4		82.781	88.262 SE
139	10/23	13 08 25.6	25.645 S	179.809 E	South of Fiji Islands	441 D	5.7		81.135	35.720 SE
140	10/23	23 41 26.3	27.916 S	66.856 W	Catamarca Province, Argentina	168 D	5.4		69.722	64.618 SW
141	10/27	21 04 51.8	11.022 S	162.350 E	Solomon Islands	25 G	6.1	7.0	90.746	55.641 SE
142	10/31	15 30 00.0	37.263 N	116.491 W	Southern Nevada	0	5.7		145.786	35.018 SW

143	11/01 06 40 30.3	20.995 S	67.954 W	Southern Bolivia	140 G	5.9		76.538	66.252 SW
144	11/01 18 25 34.9	39.837 N	142.760 E	Near East Coast of Honshu, Japan	29 G	6.4	7.4	131.346	95.170 SE
145	11/02 10 12 20.8	22.210 S	68.426 W	Northern Chile	114 D	5.4		75.556	65.386 SW
146	11/03 17 39 10.8	1.285 S	148.713 E	Admiralty Islands Region	17 G	5.7	5.7	95.571	71.636 SE
147	11/09 03 19 26.1	11.419 S	118.098 E	South of Sumbawa Island	37 D	5.3	4.5	75.223	96.584 SE
148	11/09 09 07 56.7	33.909 S	70.553 W	Chile-Argentina Border Region	96	5.0		65.328	59.028 SW
149	11/09 22 05 33.3	61.447 S	154.310 E	Balleny Islands Region	10 G	5.1	5.1	41.638	40.804 SE
150	11/10 13 42 51.1	22.772 S	65.936 W	Jujuy Province, Argentina	266 D	5.3		74.209	67.404 SW
151	11/10 22 53 20.0	48.995 N	156.260 E	Kuril Islnads Region	28 D	5.3	4.5	144.103	89.728 SE
152	11/10 22 57 51.9	48.992 N	156.265 E	Kuril Islands Region	21 D	5.4	5.2	144.102	89.720 SE
153	11/14 06 07 53.3	27.428 S	71.052 W	Near Coast of Northern Chile	33 N	5.5	4.8	71.522	61.133 SW
154	11/14 14 32 04.1	9.124 S	124.743 E	Timor	33 N	5.6	5.4	79.747	91.206 SE
155	11/15 19 19 57.6	52.204 S	160.031 E	Macquarie Islands Region	10 G	5.7	5.3	51.300	42.613 SE
156	11/16 08 39 42.7	17.760 S	178.990 W	Fiji Islands Region	538 G	5.7		89.066	36.441 SE
157	11/17 15 35 57.8	17.385 S	167.931 E	Vanuatu Islands	28 D	5.4	5.3	86.249	48.602 SE
158	11/17 22 46 33.8	58.909 S	16.056 W	Southwestern Atlantic Ocean	24 D	5.7	4.8	25.335	85.074 SW

159	11/21	03 10 23.6	28.975 S	177.529 W	Kermadec Islands Region	56 D	5.5		78.431	32.609 SE
160	11/21	14 37 42.6	50.053 S	162.592 E	Auckland Islrnads Region	27 D	5.6	5.8	53.904	41.792 SE
161	11/22	23 27 09.2	7.294 S	128.726 E	Banda Sea	128 D	5.3		82.887	88.166 SE
162	11/24	00 35 07.6	0.989 N	126.007 E	Molucca Passage	26	5.7	5.1	89.632	93.701 SE
163	11/24	06 39 55.6	63.211 S	170.551 E	Balleny Islands Region	10 G	5.5	5.2	43.427	29.678 SE
164	11/24	23 02 23.4	19.082 S	173.498 W	Tonga Islands	67 *	5.4		88.873	31.068 SE
165	11/25	07 49 44.2	2.179 S	138.862 E	West Irian	26 G	5.9	5.7	91.291	80.567 SE
166	11/29	01 00 14.8	15.808 S	73.242 W	Southern Peru	71 G	6.1		83.132	63.276 SW
167	11/29	05 48 59.8	25.374 S	179.629 E	South of Fiji Islands	487 D	5.7		81.361	35.944 SE
168	12/01	05 06 12.1	51.631 N	178.102 W	Andreanof Islands, Aleutian Islands	43 D	5.6	5.0	155.277	65.162 SE
169	12/01	18 59 12.3	14.457 S	167.271 E	Vanuatu Islands	216	5.1		88.876	50.044 SE
170	12/03	11 11 56.3	8.828 S	113.418 E	Java	95	5.6		75.975	101.985 SE
171	12/03	14 16 48.7	7.631 S	74.459 W	Peru-Brazil Border Region	153 G	5.9		91.242	64.865 SW
172	12/03	21 32 20.7	57.655 S	148.211 E	West of Macquarie Island	10 G	5.2	5.9	43.402	47.552 SE
173	12/04	06 42 31.2	15.471 S	173.156 W	Tonga Islands	76 D	5.4		92.478	31.455 SE
174	12/06	05 19 48.5	6.192 S	130.455 E	Banda Sea	120 D	5.7		84.536	86.958 SE

175	12/07	13 38 44.8	6.436 S	146.383 E	East Papua New Guinea Region	104 G	6.0		89.935	72.051 SE
176	12/08	15 00 00.0	37.231 N	116.409 W	Southern Nevada	0	5.5	4.2	145.738	35.115 SW
177	12/09	20 38 08.5	0.141 N	123.340 E	Minahassa Peninsula	151 G	6.2		87.883	95.886 SE
178	12/11	16 00 11.6	18.690 S	168.989 E	Vanuatu Islands	200 D	5.5		85.280	47.266 SE
179	12/12	08 33 56.2	4.684 S	130.827 E	Banda Sea	74 G	5.8		86.076	87.158 SE
180	12/14	19 13 53.8	10.445 S	161.275 E	Solomon Islands	38 D	5.6	5.8	90.974	56.823 SE
181	12/15	18 43 45.0	8.337 N	126.729 E	Mindanao, Philippine Islands	24 G	6.2	7.3	96.745	95.683 SE
182	12/16	02 40 47.4	3.610 S	131.180 E	West Irian Region	25 D	5.5	5.1	87.205	87.218 SE
183	12/17	03 12 18.0	8.486 S	92.233 E	South Indian Ocean	25 D	5.4	5.3	69.274	122.802 SE
184	12/18	07 13 01.0	0.939 N	28.976 W	Central Mid-Atlantic Ridge	10 G	5.7	5.3	83.318	110.431 SW
185	12/20	00 08 20.6	8.094 N	126.828 E	Mindanao, Philippine Islands	21 G	6.0	6.3	96.554	95.503 SE
186	12/20	04 23 45.2	35.067 S	179.642 W	East of North Islands, New Zealand	29	5.5	5.6	72.091	32.959 SE
187	12/20	08 35 20.3	8.192 N	126.852 E	Mindanao, Philippine Islands	39 D	5.8	5.3	96.654	95.516 SE
188	12/20	11 44 48.8	34.828 S	179.526 W	South of Kermadec Islands	32 D	5.2		72.345	32.922 SE
189	12/23	01 32 46.3	29.945 S	178.338 W	Kermadec Islands	37	5.3		77.328	33.089 SE
190	12/25	14 24 32.6	60.080 N	73.445 W	Northern Quebec	5 G	6.2	6.3	151.502	105.838 SW

191	12/26	01 30	13.8	41.714 S	83.954 W	West Chile Rise	10 G	5.9	5.8	61.830	44.889 SW
192	12/27	23 26	57.0	32.967 S	151.619 E	Near S.E. Coast of Australia	10 G	5.4		66.782	57.810 SE
193	12/30	04 42	51.1	16.177 S	167.967 E	Vanuatu Islands	184 D	5.5		87.417	48.911 SE
194	12/30	12 38	11.2	26.209 S	70.507 W	Near Coast of Northern Chile	32	5.3	5.0	72.489	62.066 SW
195	12/30	23 18	51.6	3.406 S	145.966 E	Near N. Coast of Papua New Guinea	38 D	5.6	6.6	92.635	73.488 SE

APPENDIX

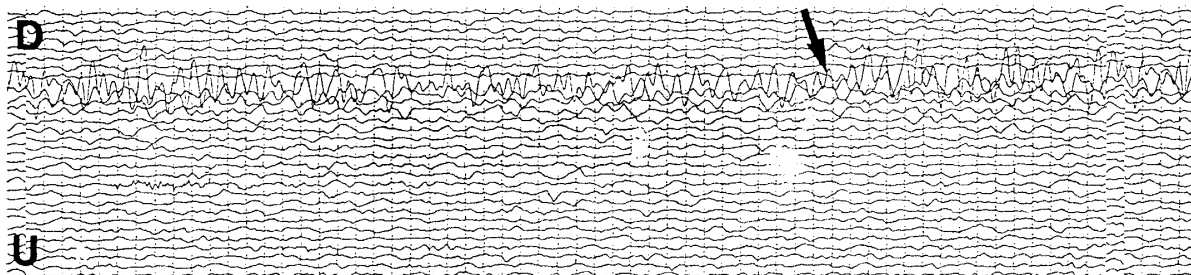
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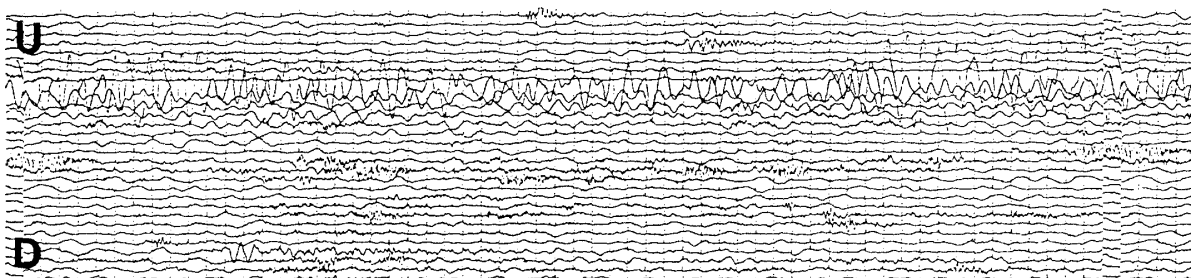
3.162 S 130.556 E 47km Mb 5.9 Ms 6.5

Ceram

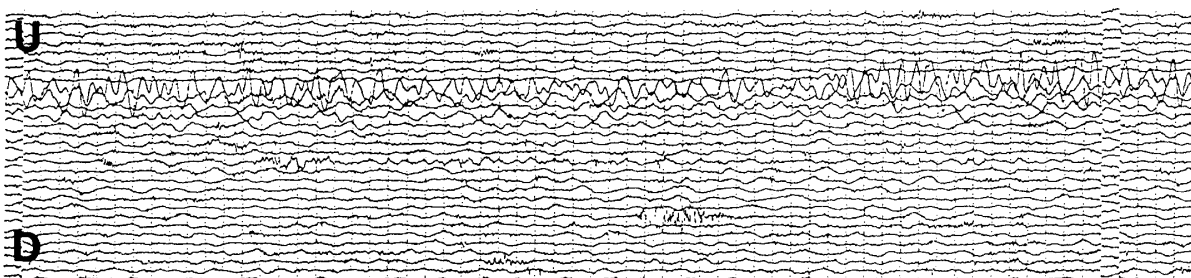
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Syowa



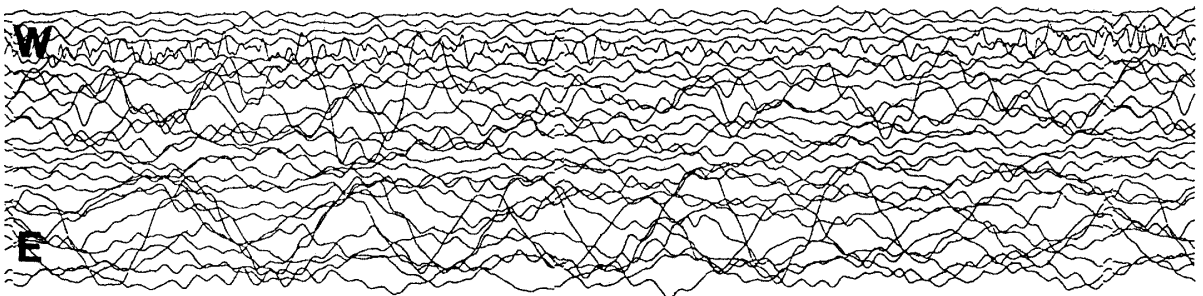
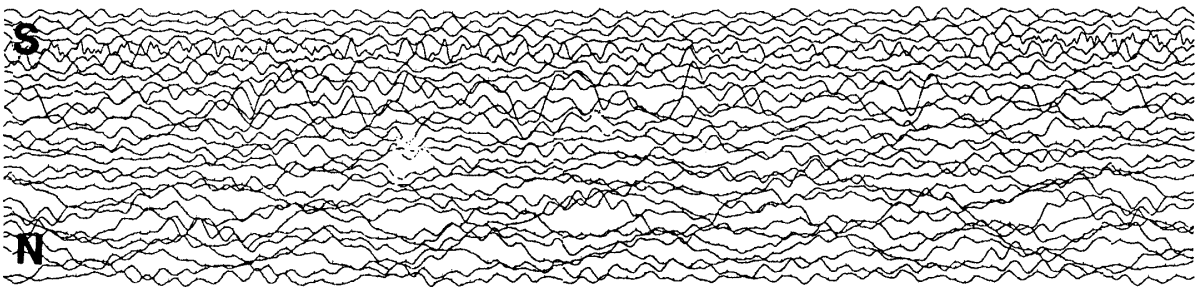
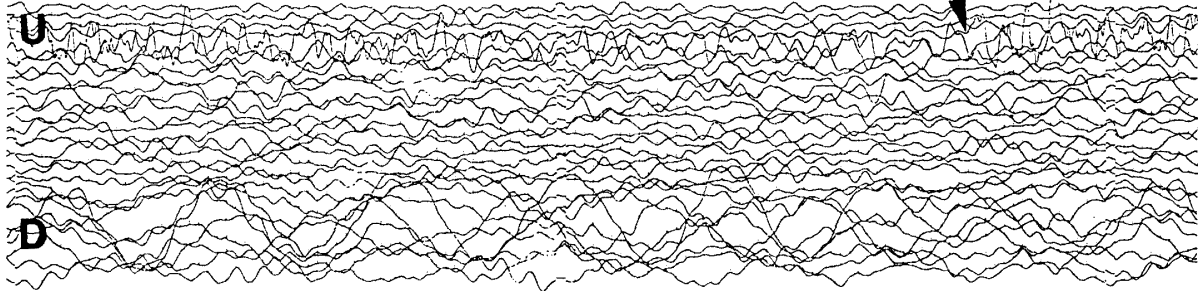
Langhovde



Tottuki Pt.



LP Syowa



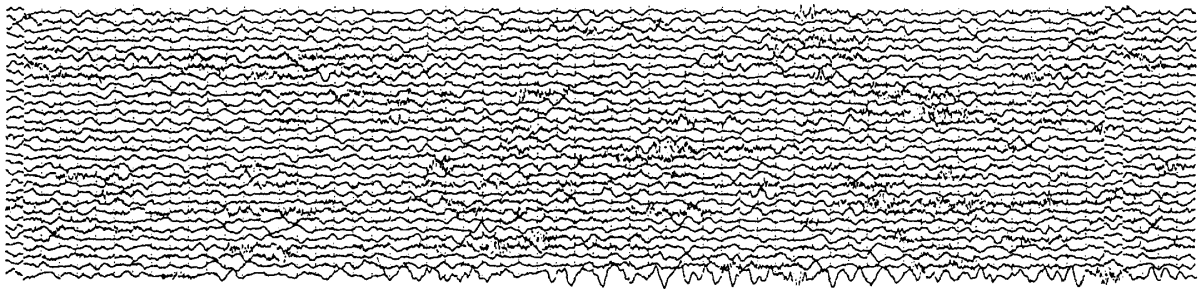
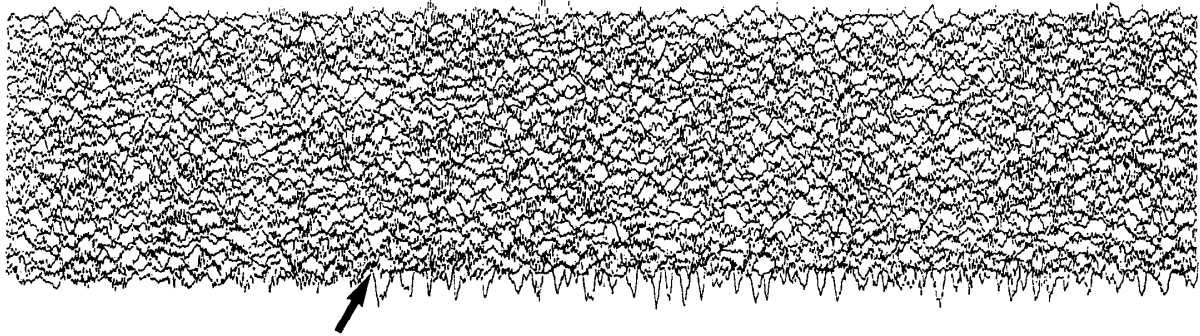
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MAR. 10 21h49m45.8s

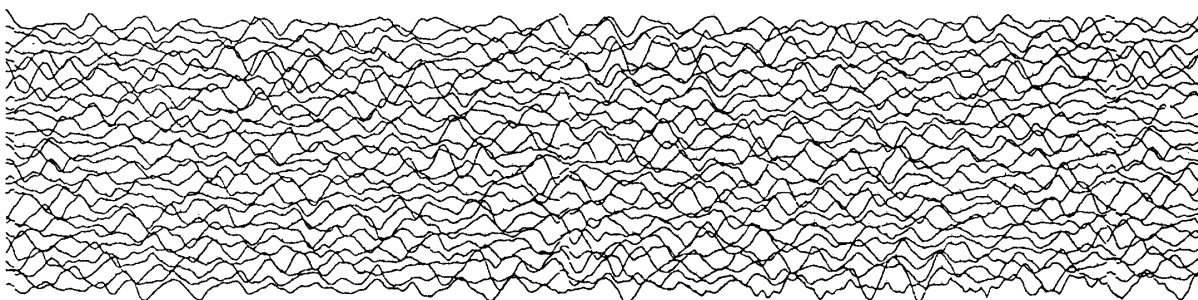
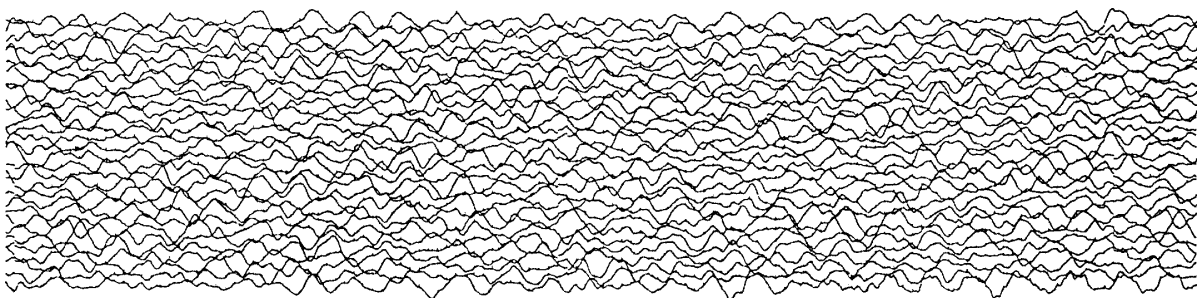
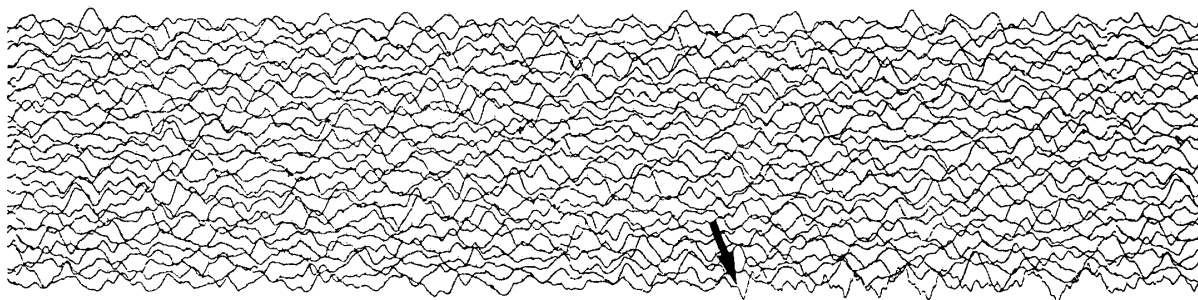
13.702 S 34.420 E 30 km Mb 6.2 Ms 6.1

Malawi

SP



LP



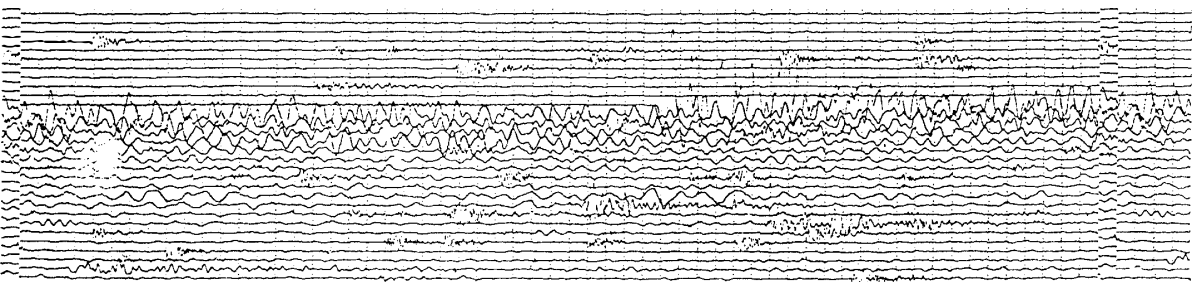
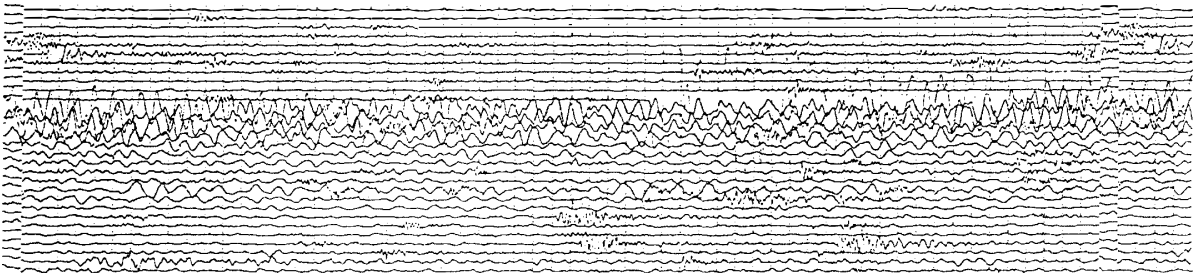
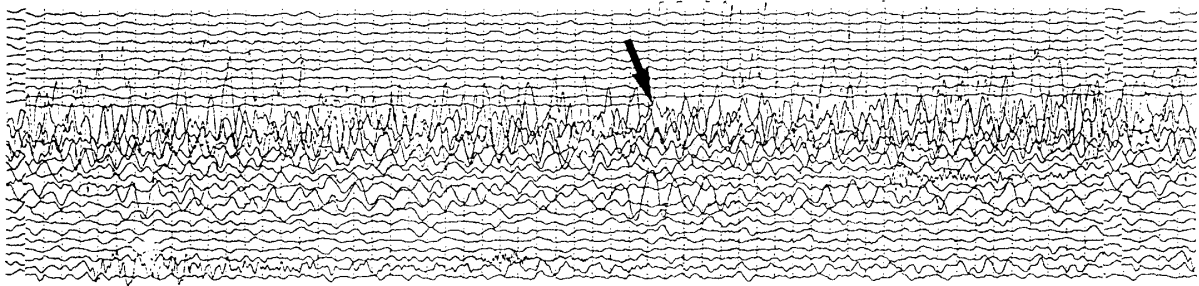
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MAY 05 18h28m39.4s

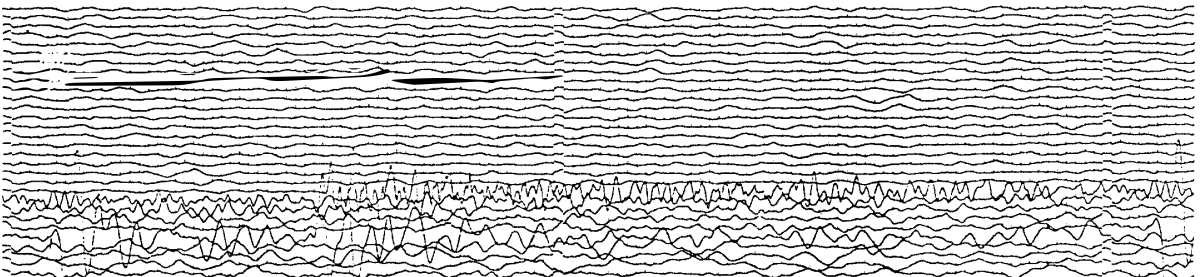
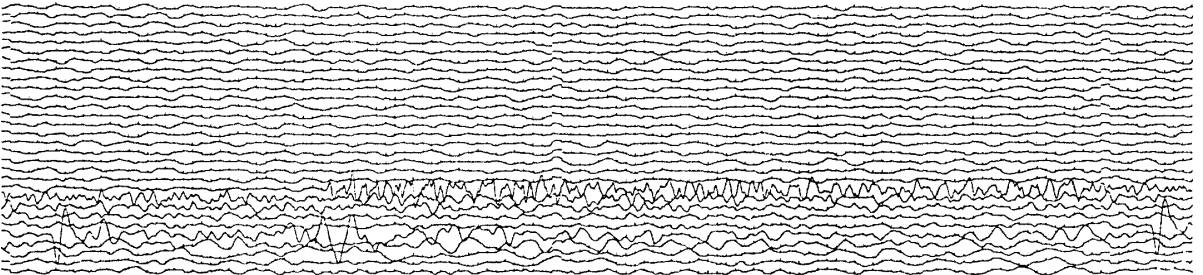
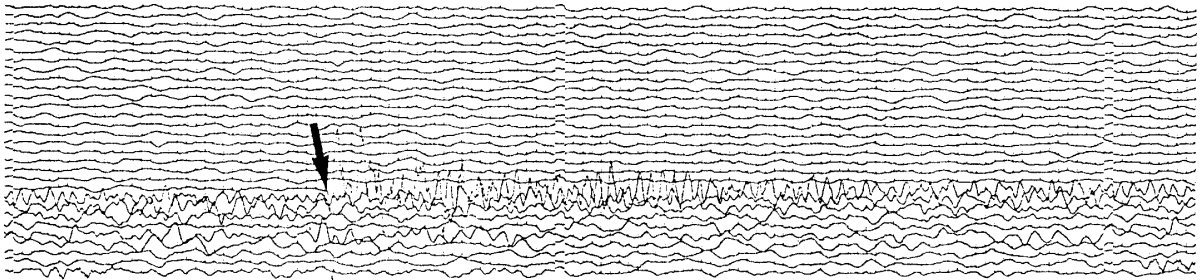
8.281 S 71.381 W 593 km Mb 6.4

Western Brazil

SP



LP



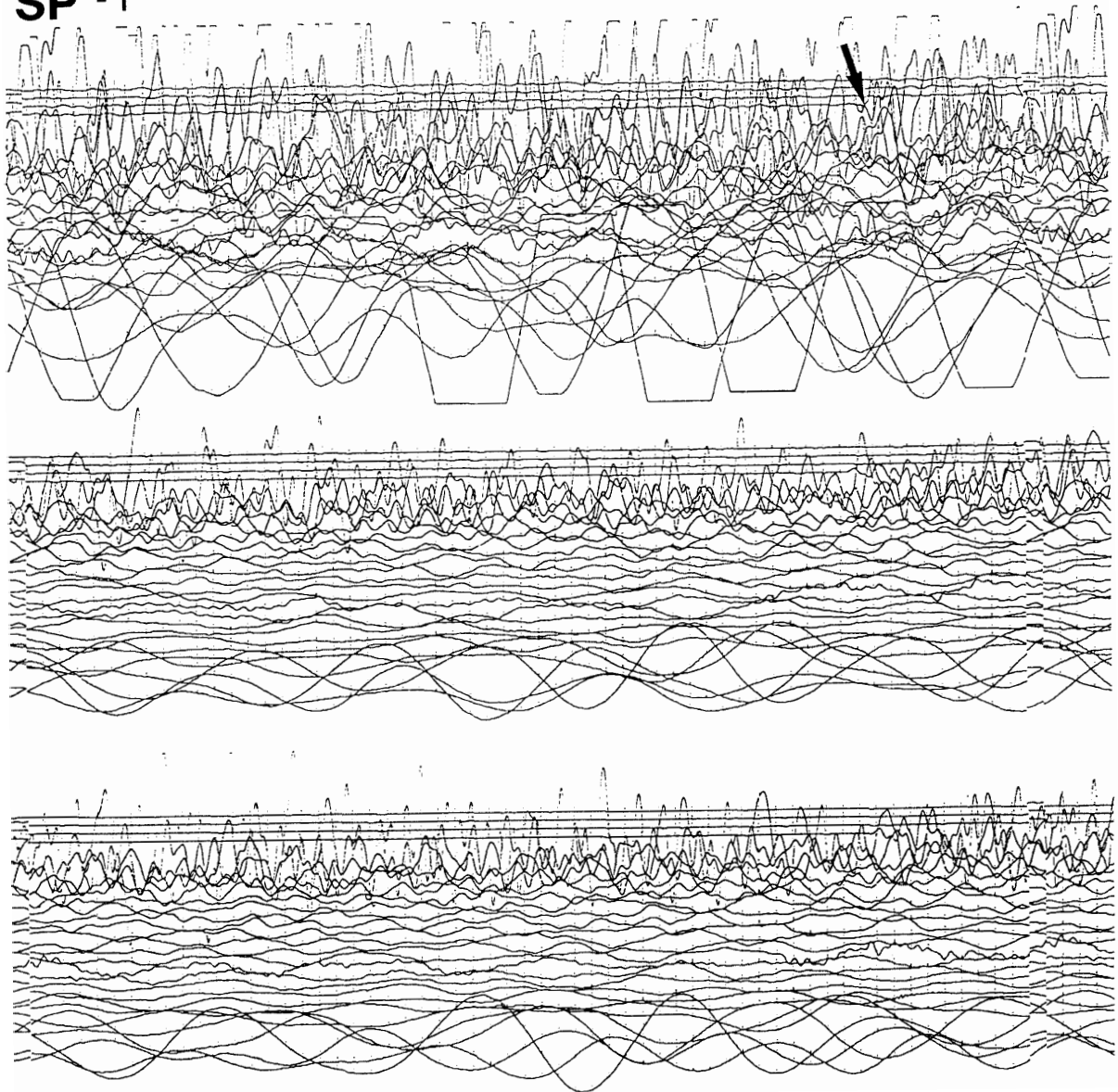
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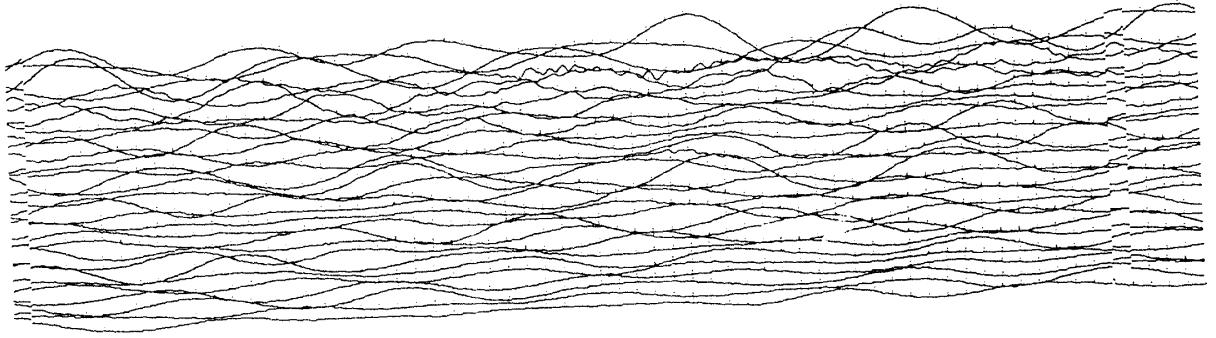
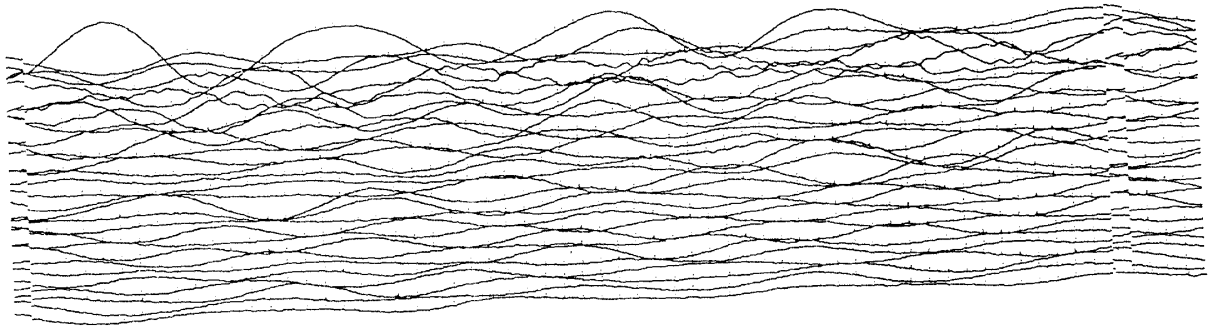
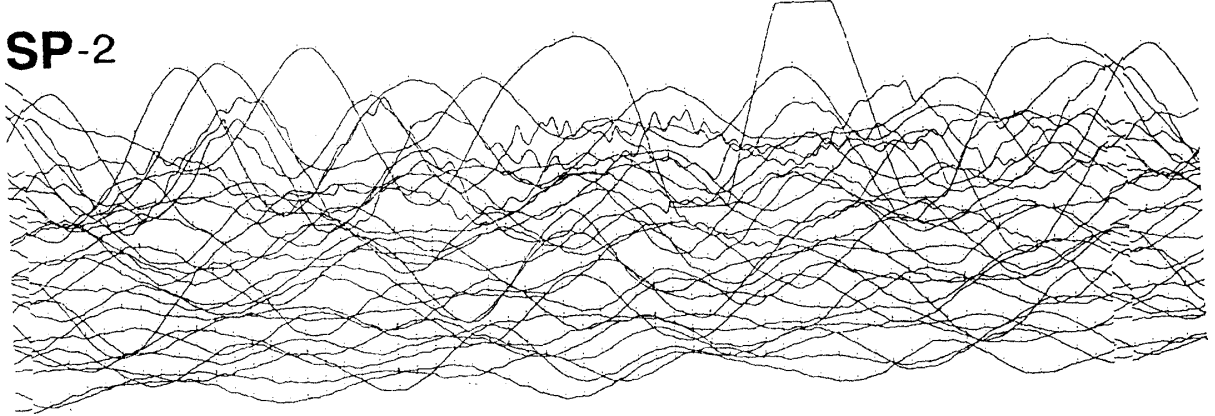
52.341 S 160.568 E 10km Mb 6.4 Ms 8.2

Macquarie Islands Region

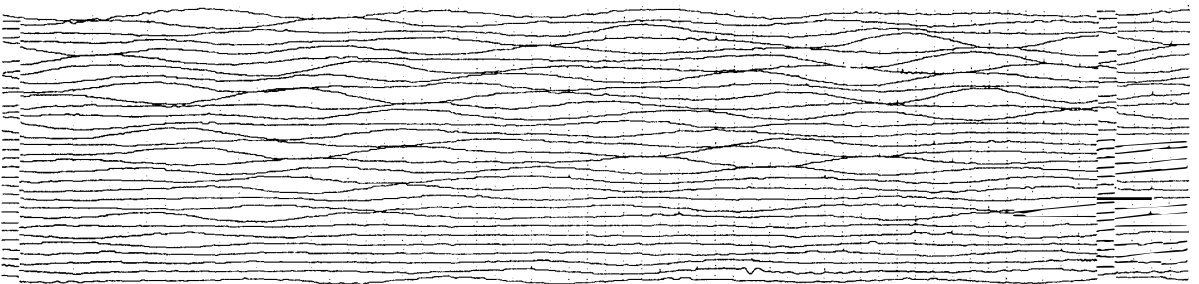
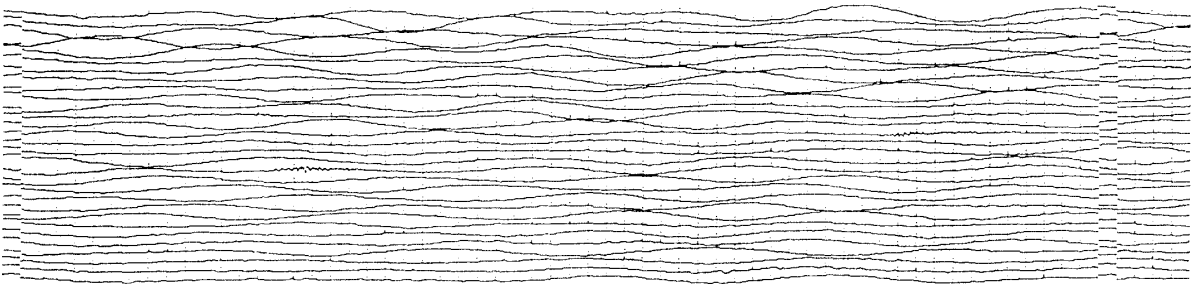
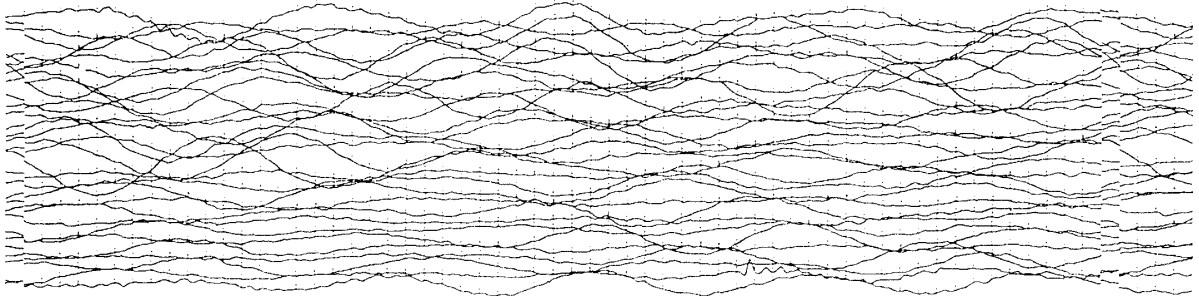
SP -1



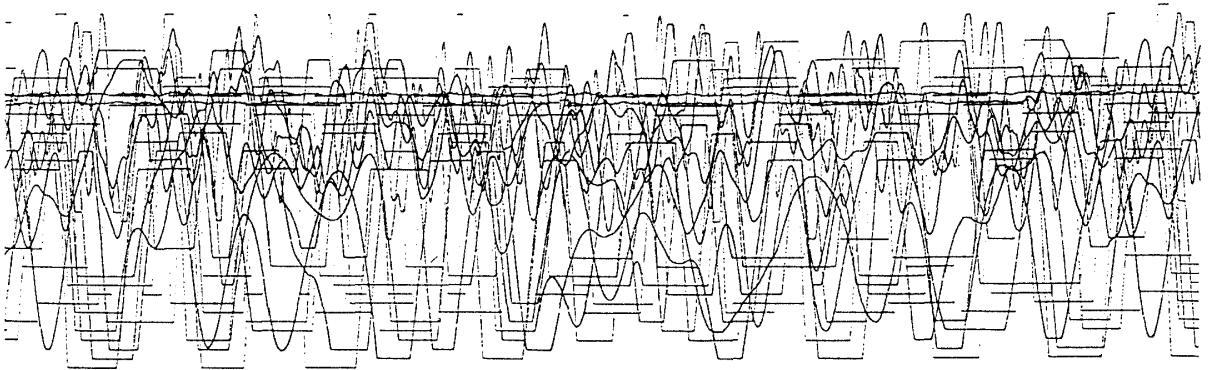
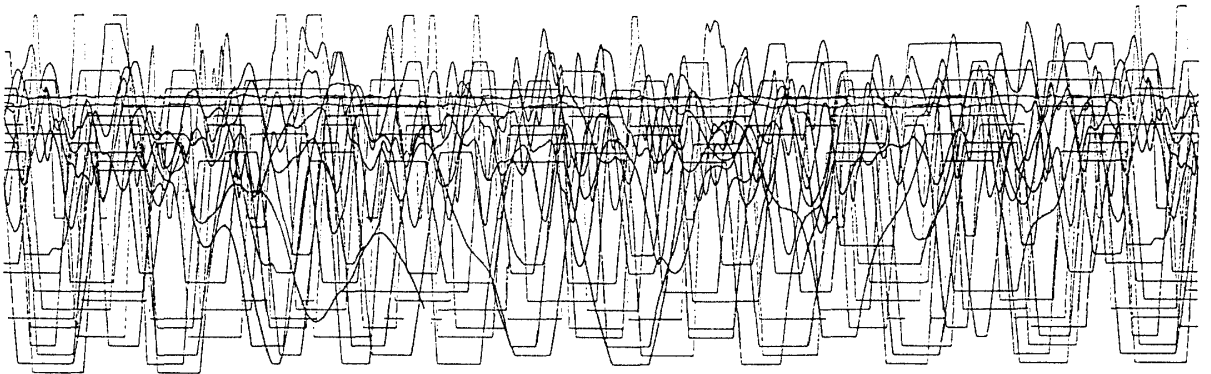
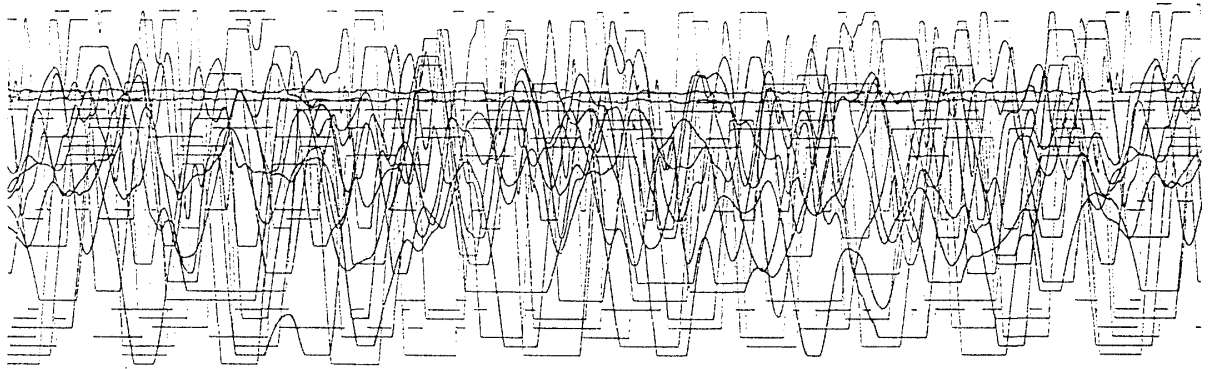
SP-2



SP-3



LP



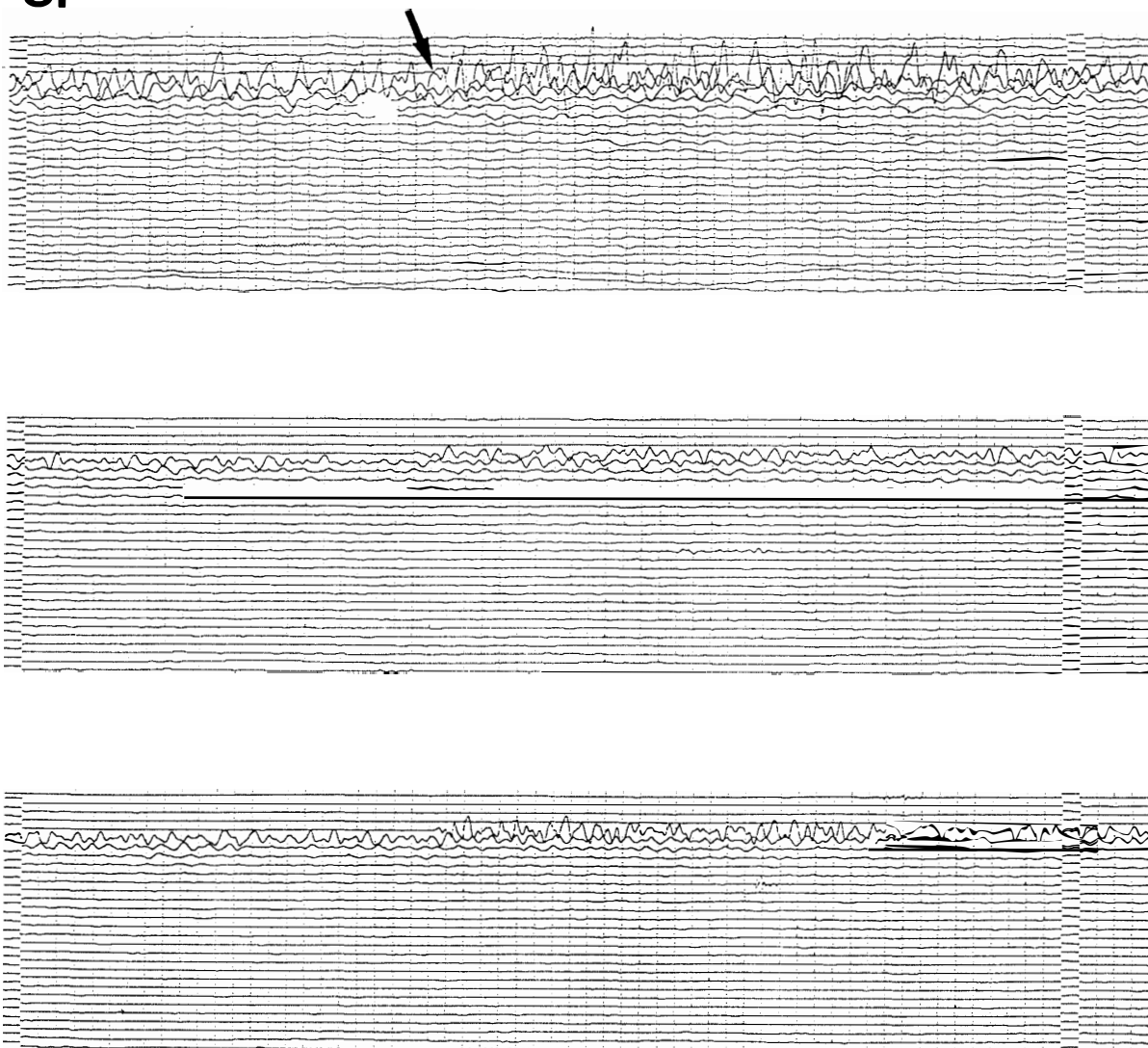
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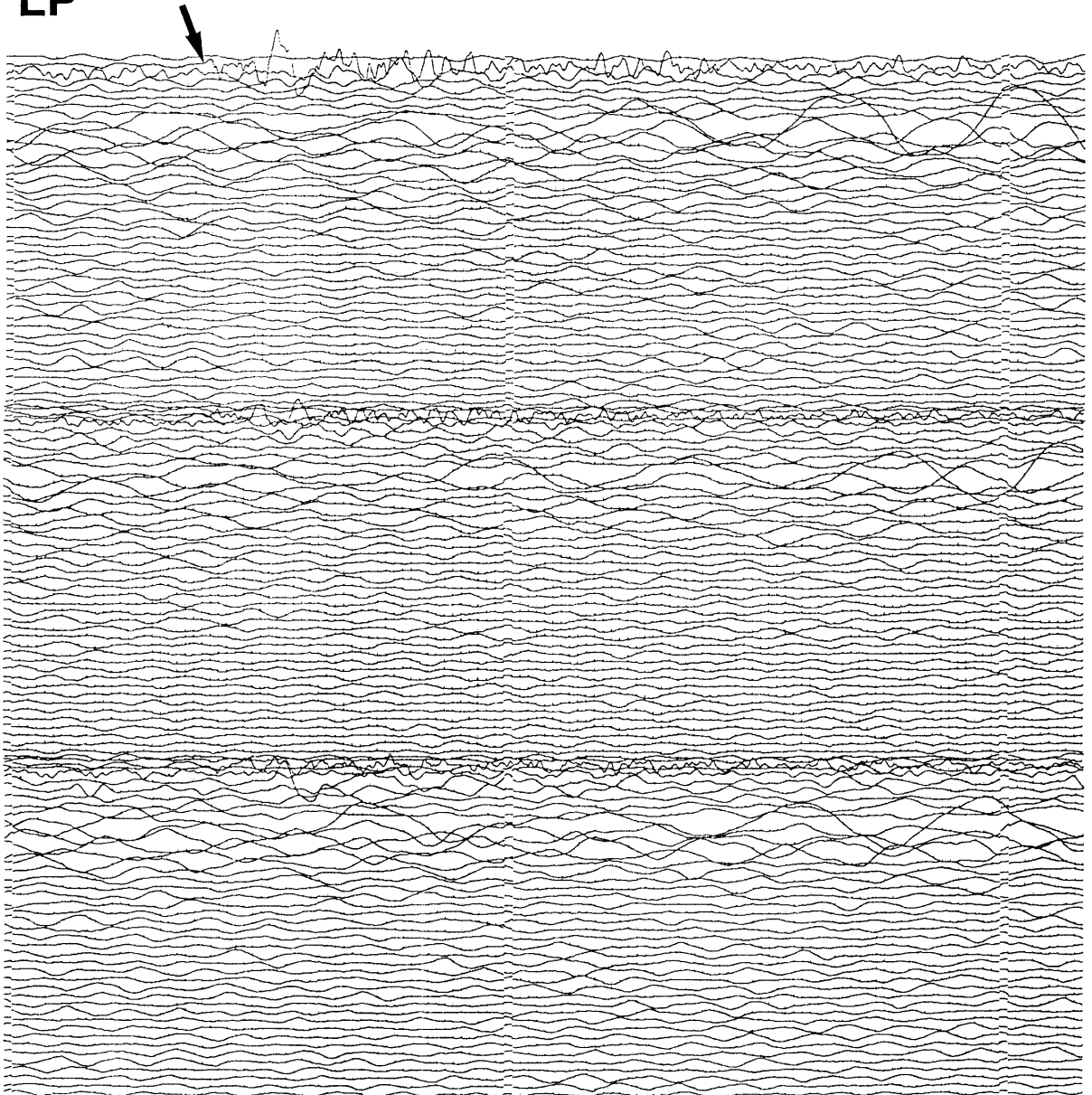
45.383 S 167.086 E 23 km Mb 5.8 Ms 6.3

South Island, New Zealand

SP



LP



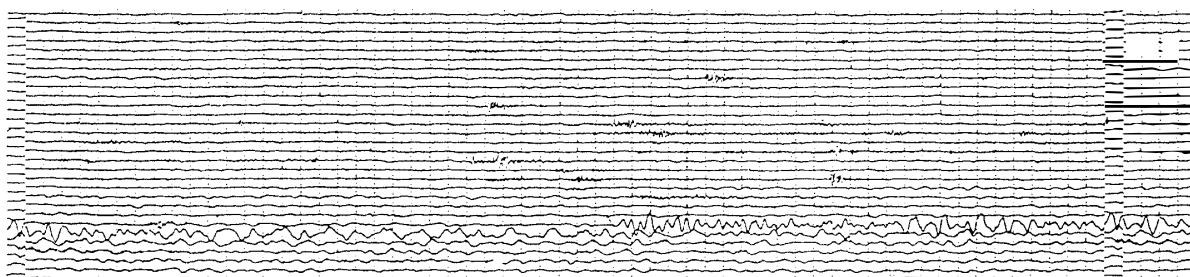
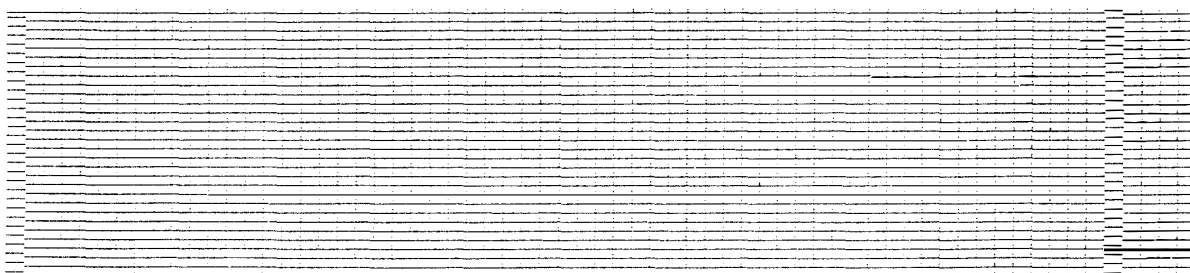
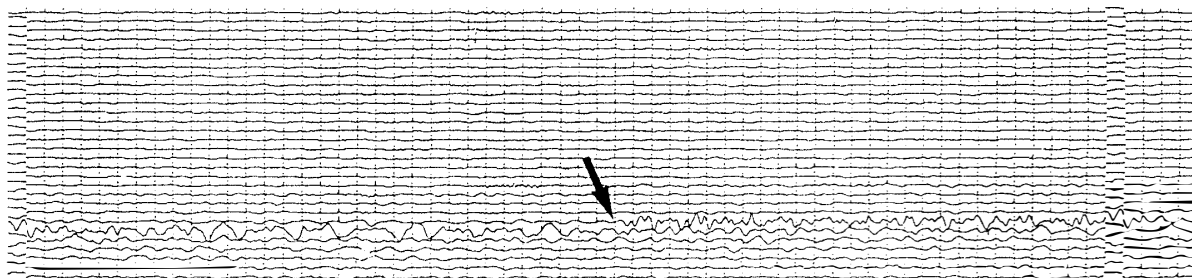
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SEPT. 16 02h05m08.9s

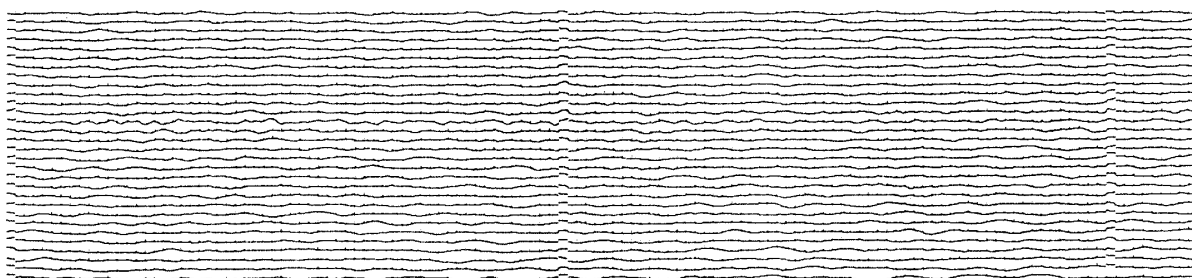
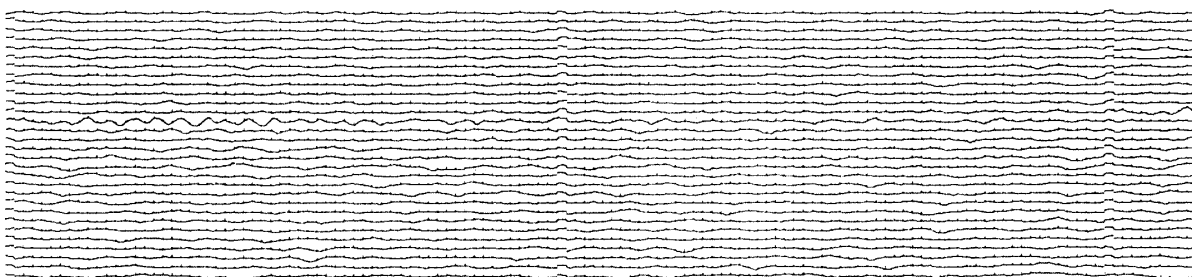
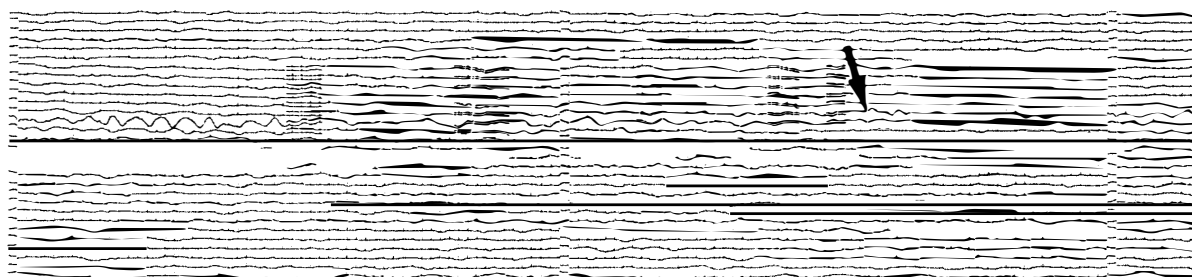
40.337 N 51.534 E 55km Mb 6.4 Ms 6.5

SP

Caspian Sea



LP



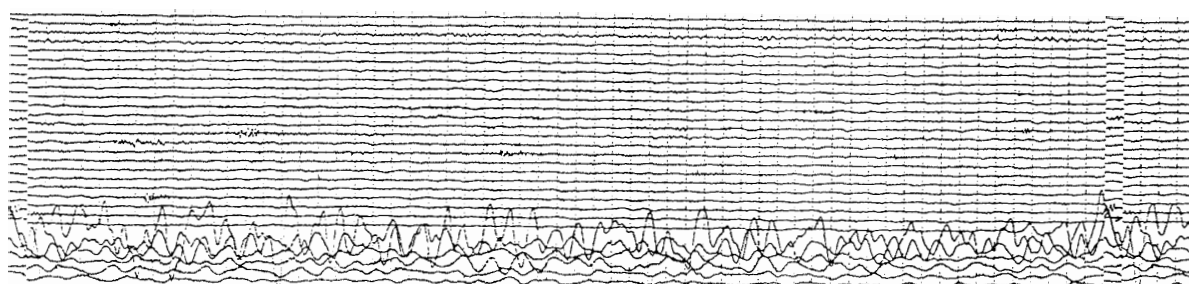
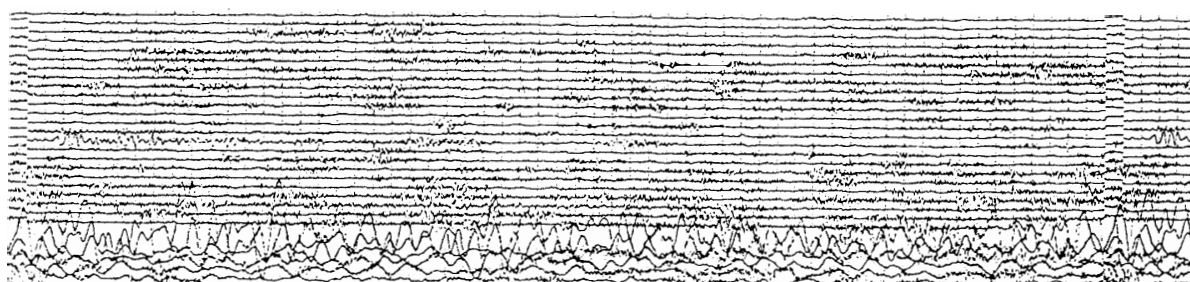
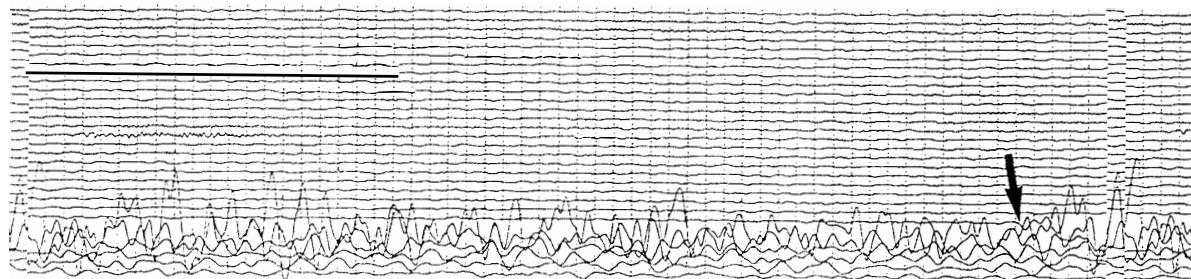
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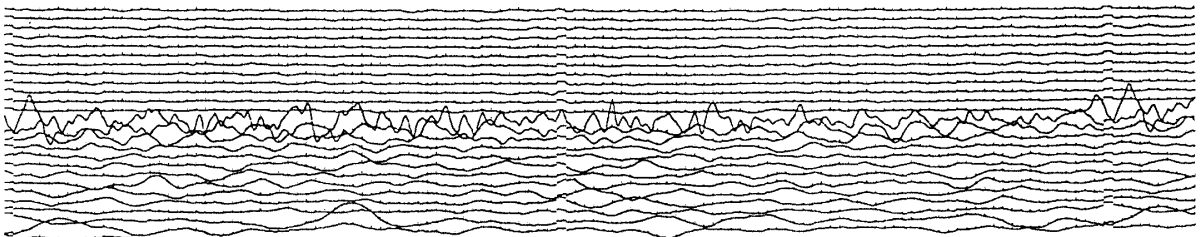
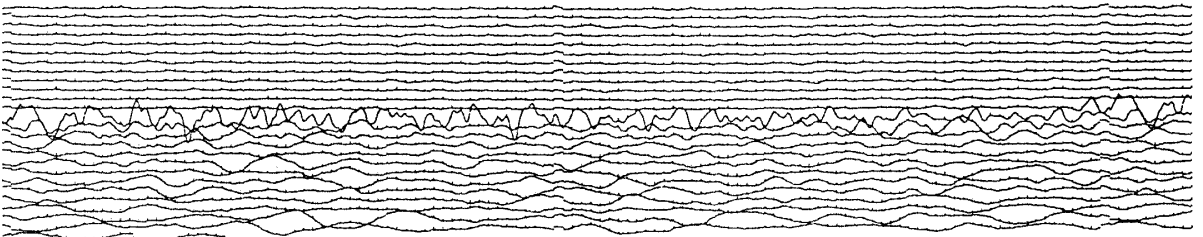
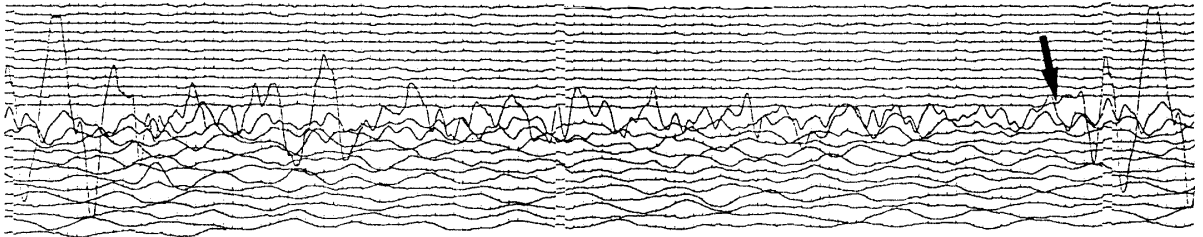
37.036 N 121.883 W 19km Mb 6.5 Ms 7.1

SP

Central California



LP



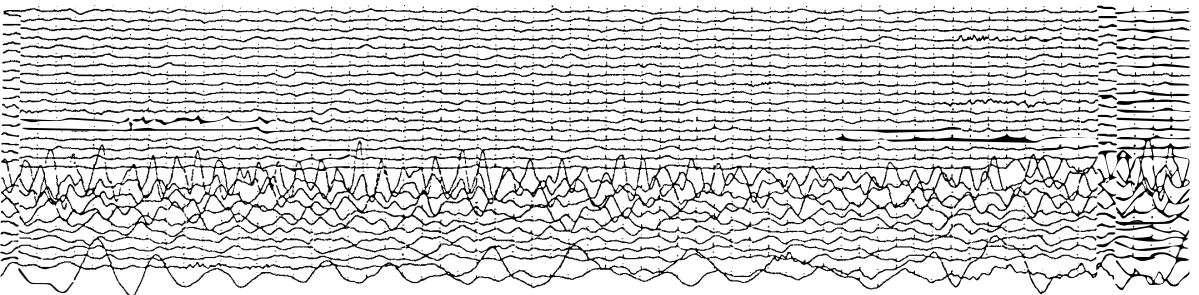
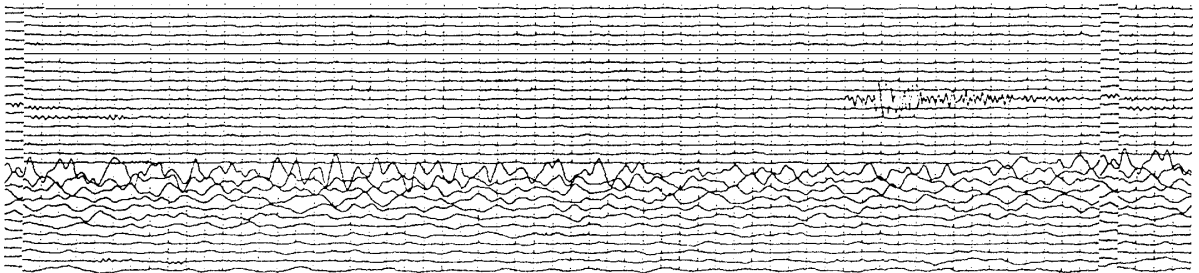
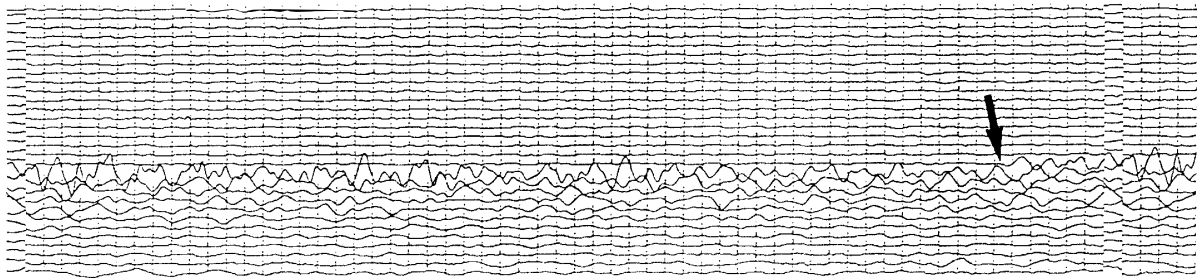
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OCT. 27 21h04m51.8s

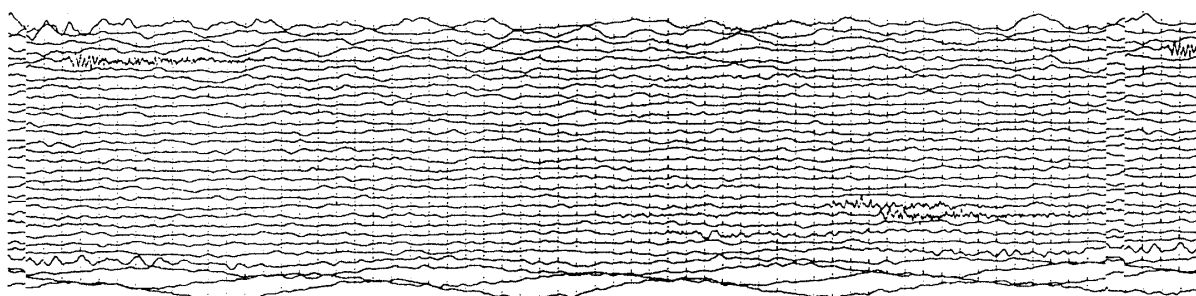
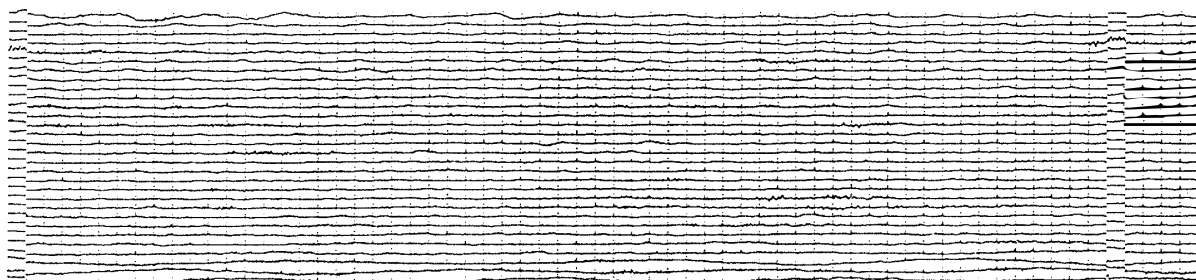
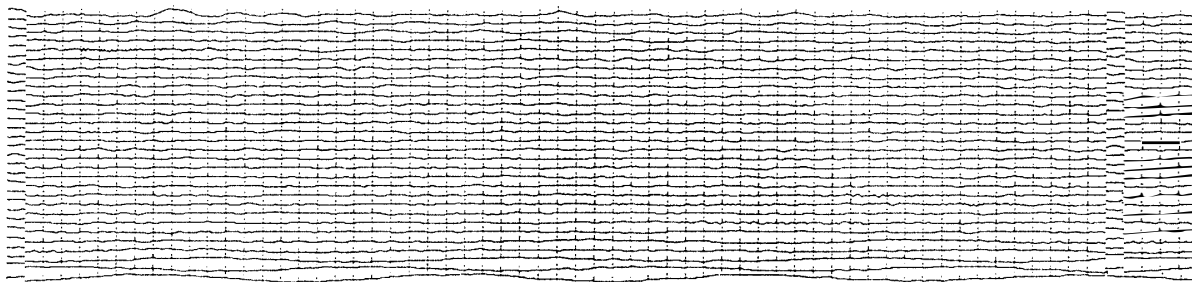
11.022 S 162.350 E 25 km Mb 6.1 Ms 7.0

SP -1

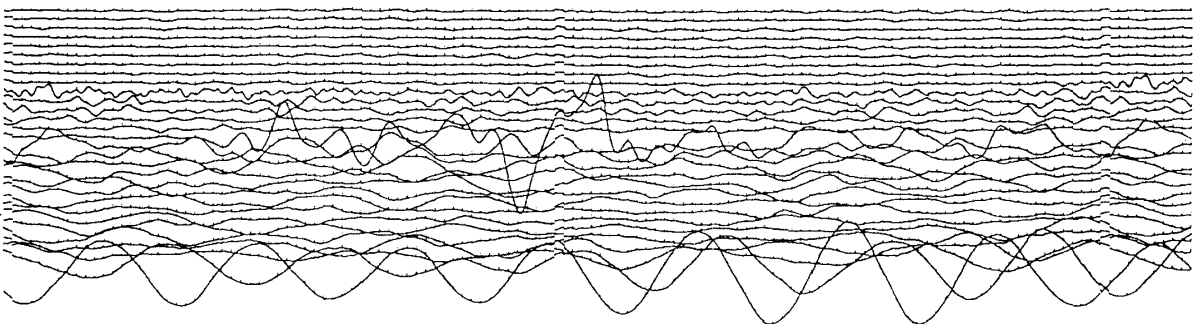
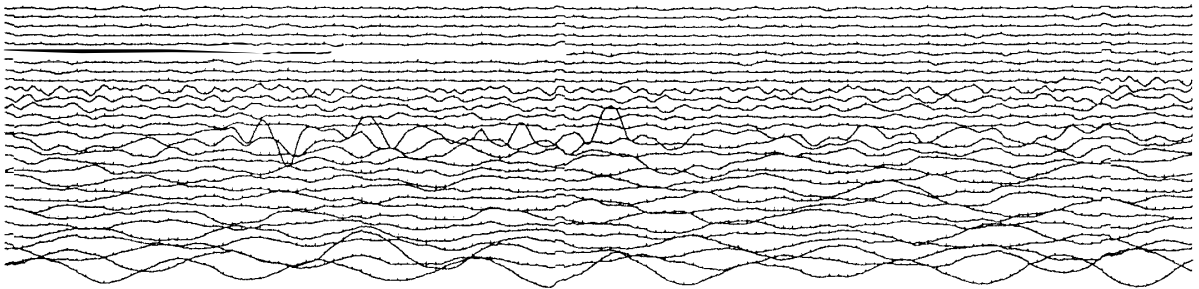
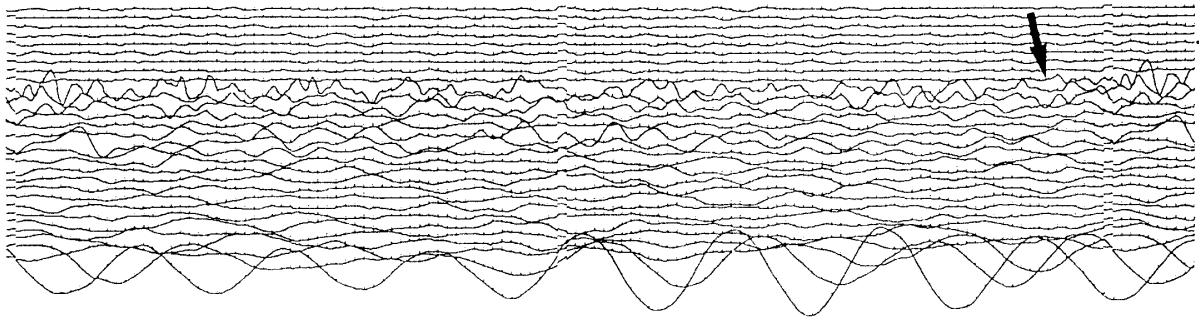
Solomon Islands



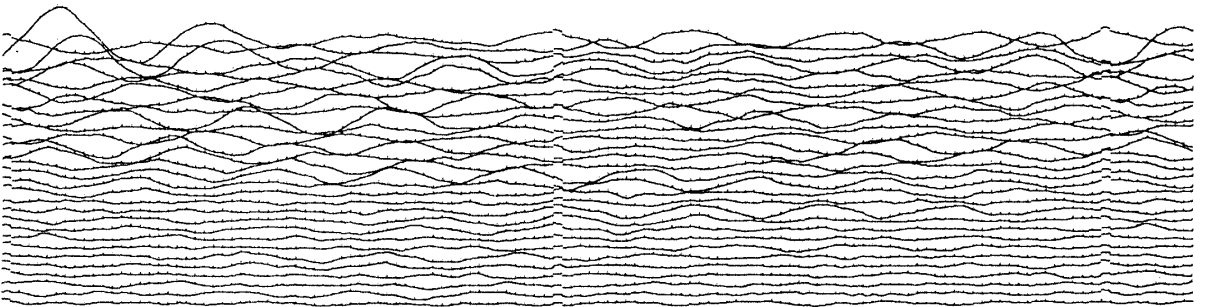
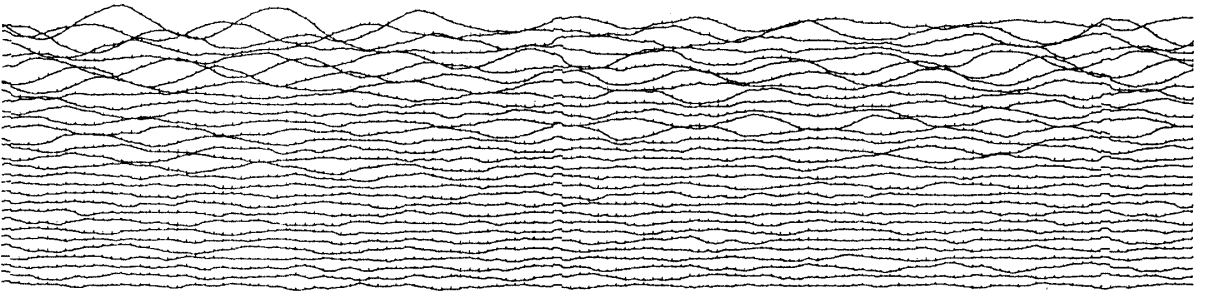
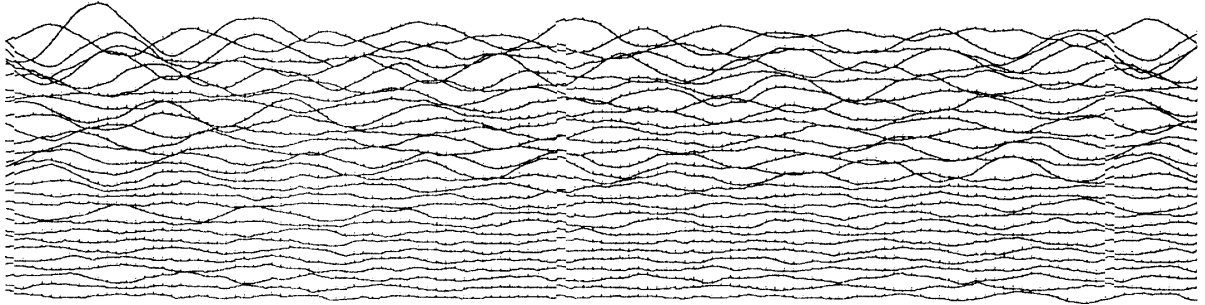
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LP -1



LP -2



#-144

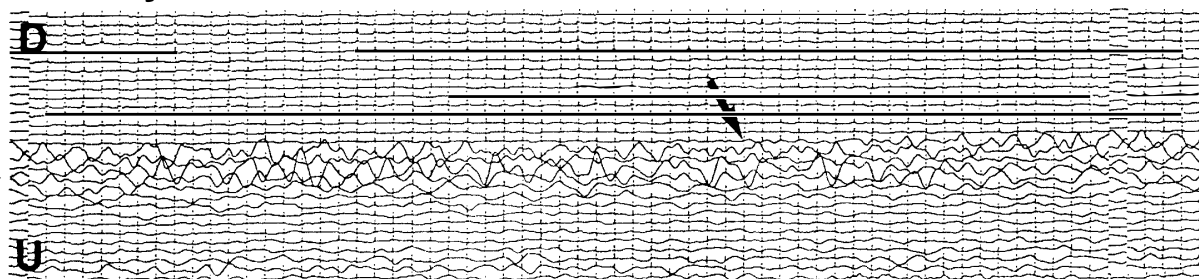
NOV. 01 18h25m34.9s

39.837 N 142.760 E 29 km Mb 6.4 Ms 7.4

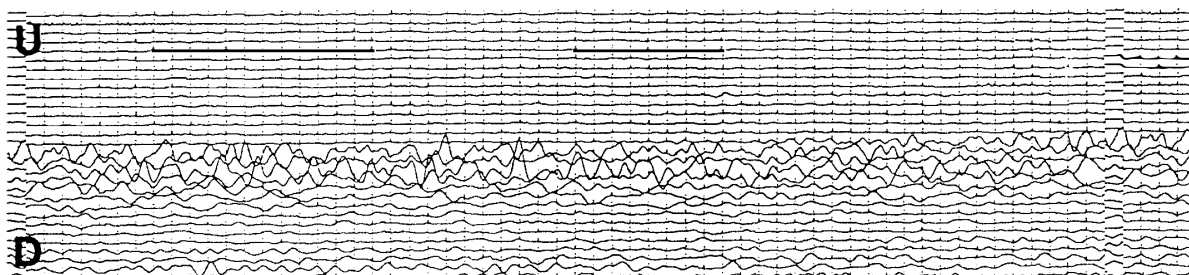
SP

Syowa

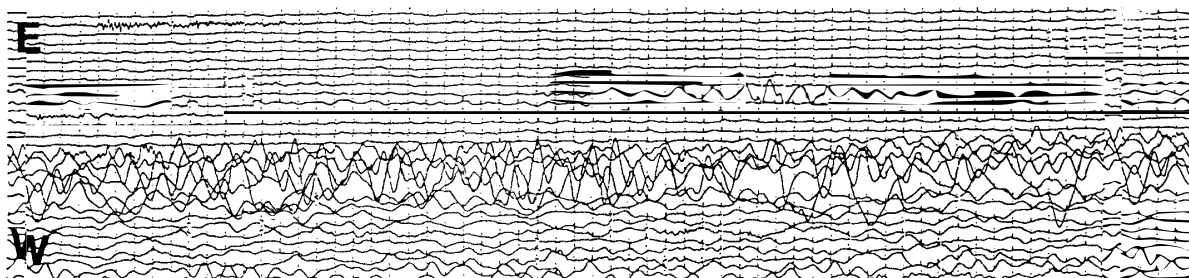
Near East Coast of Honshu, Japan



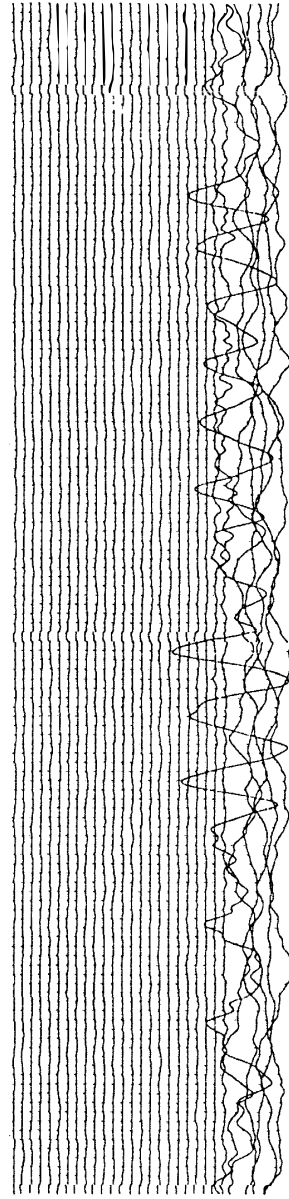
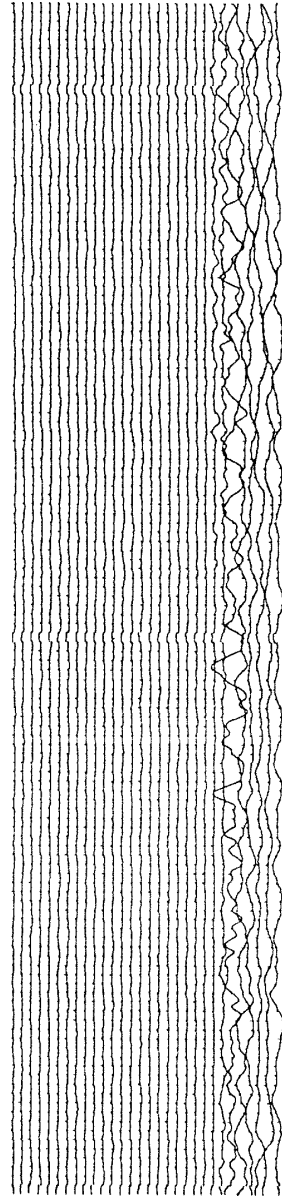
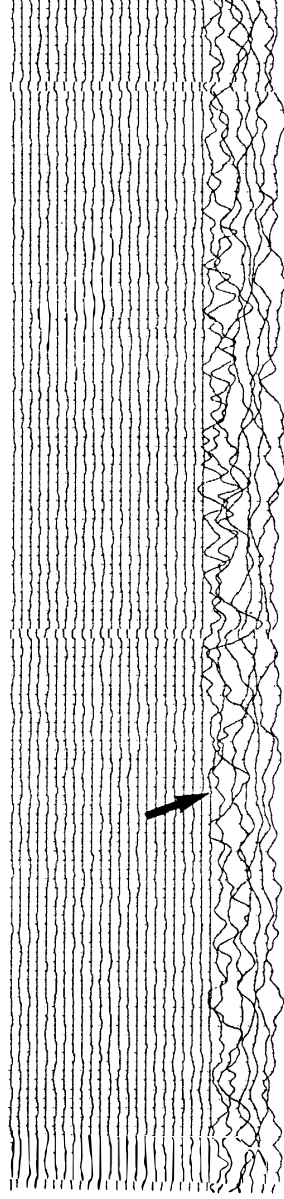
Langhovde



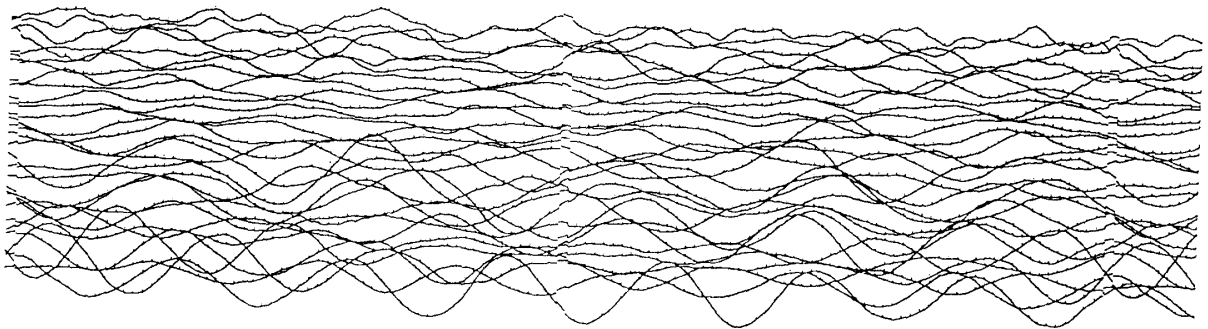
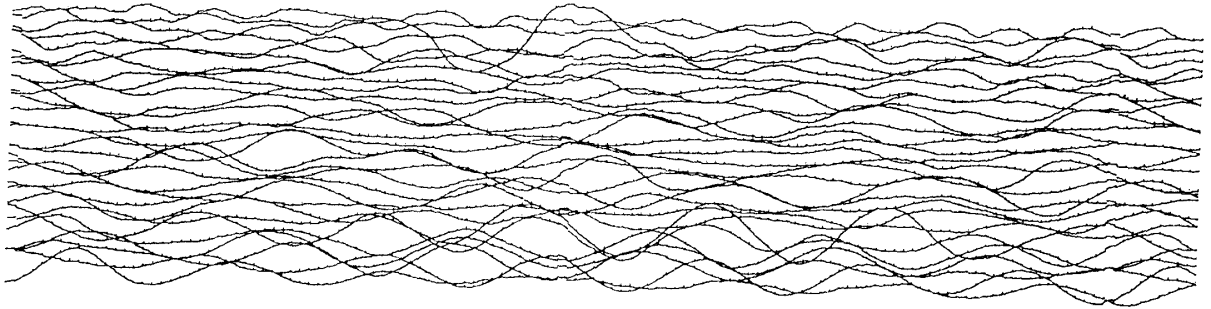
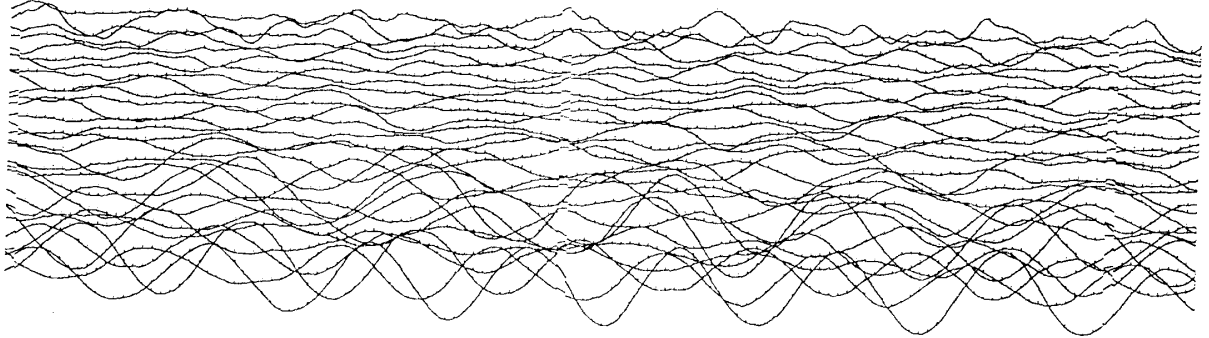
Syowa



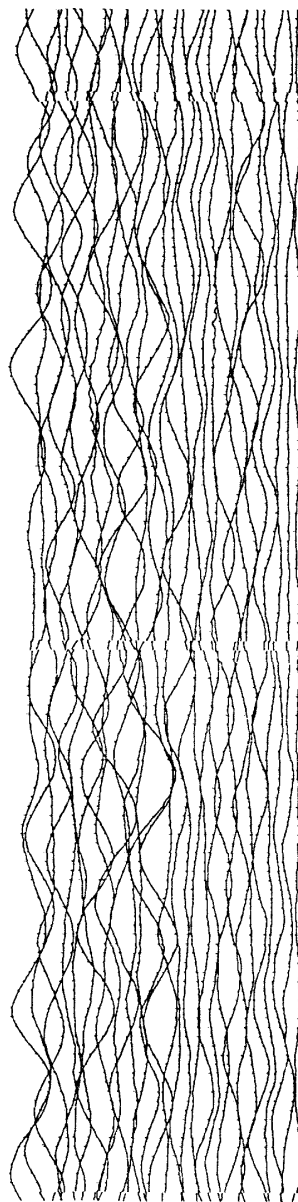
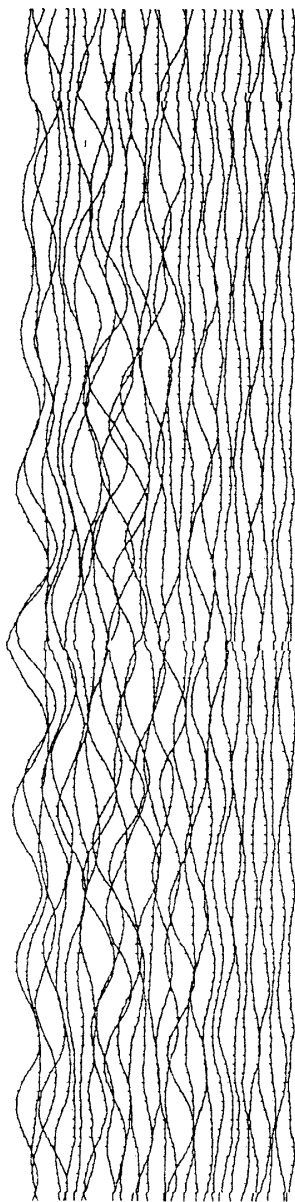
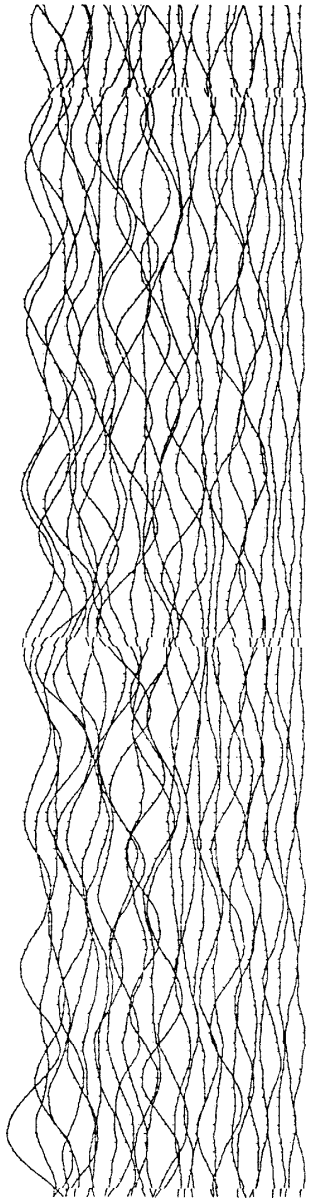
LP -1



LP-2



LP-3



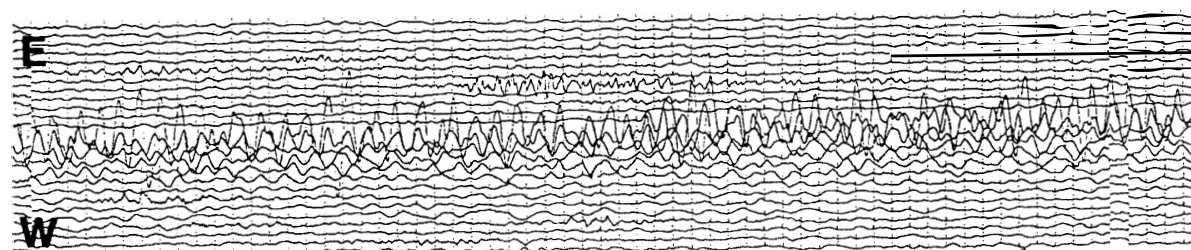
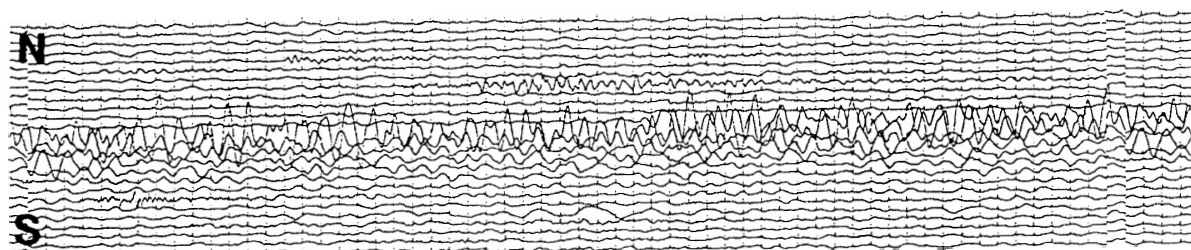
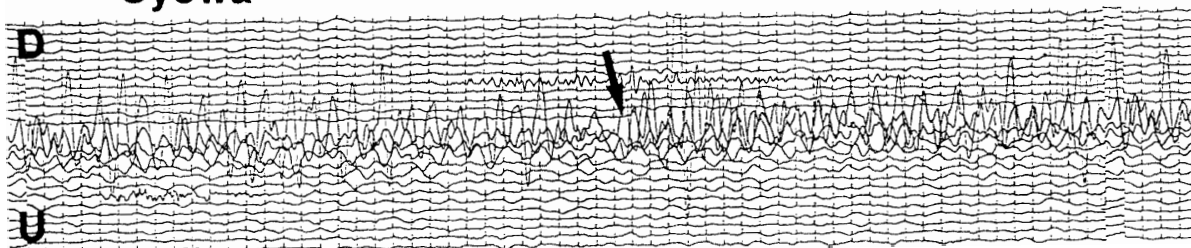
#-166

NOV. 29 01h00m14.8s

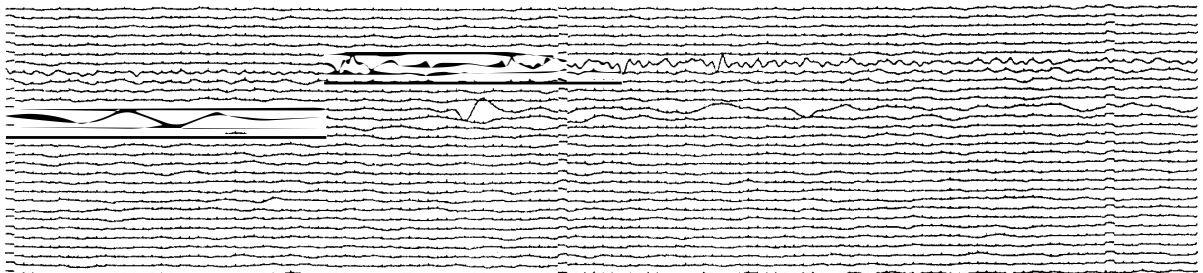
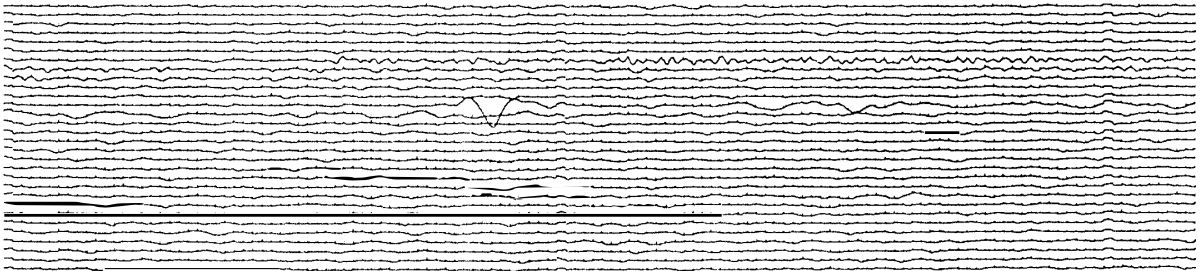
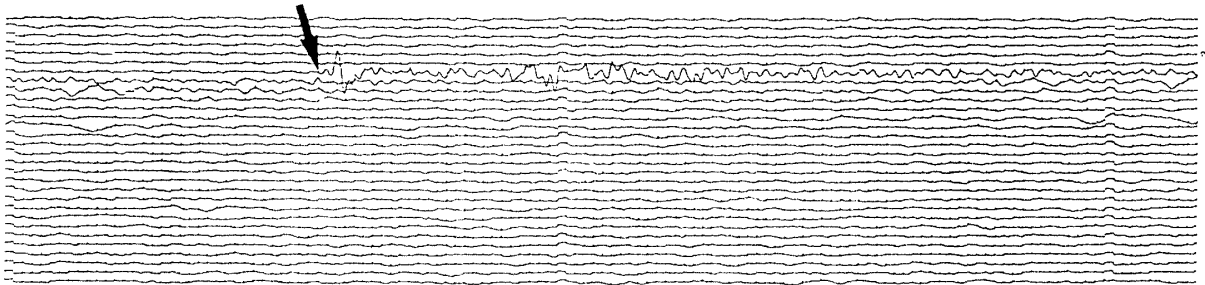
15.808 S 73.242 W 71km Mb 6.1

Southern Peru

SP Syowa



LP



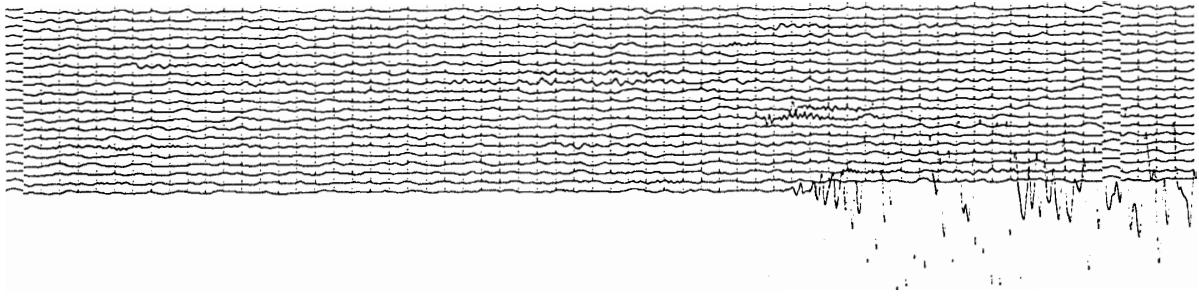
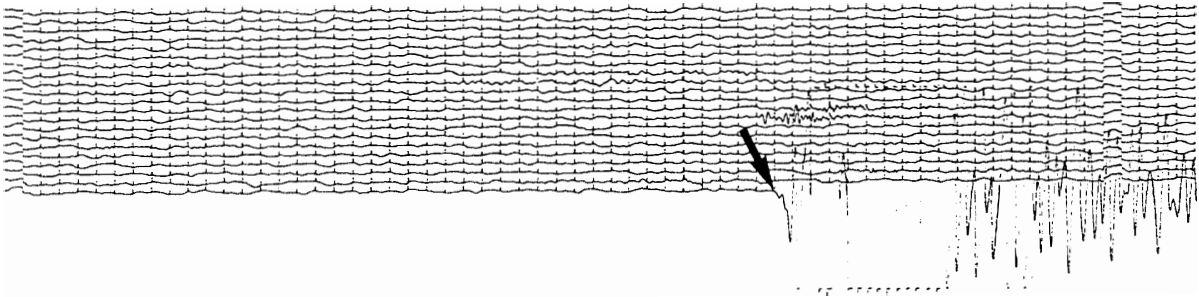
#-177

DEC. 09 20h38m08.5s

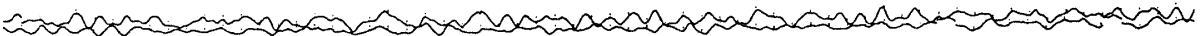
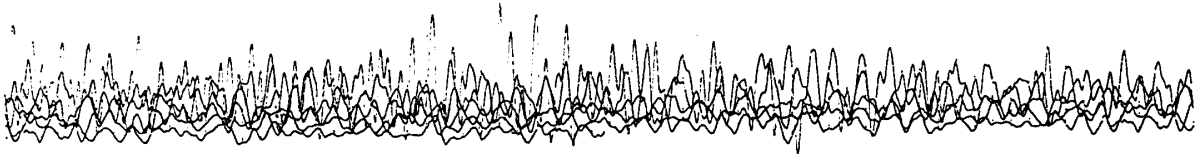
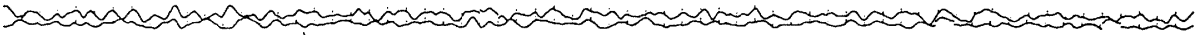
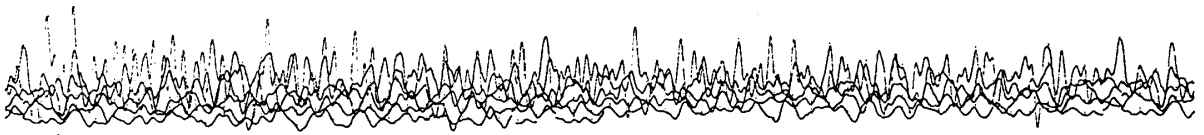
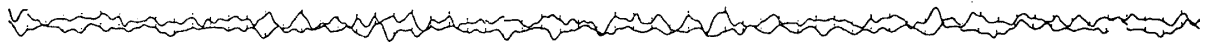
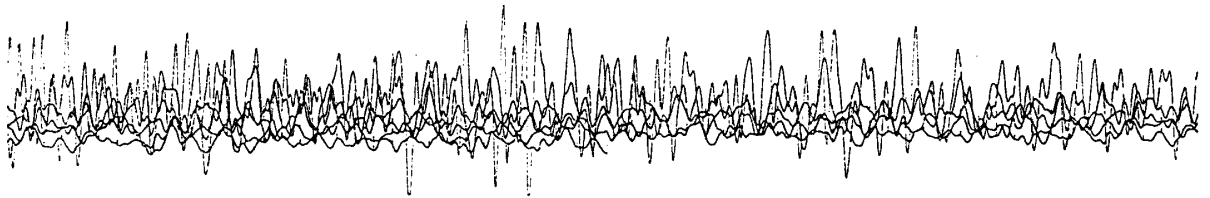
0.141 N 123.340 E 151km Mb 6.2

Minahassa Peninsula

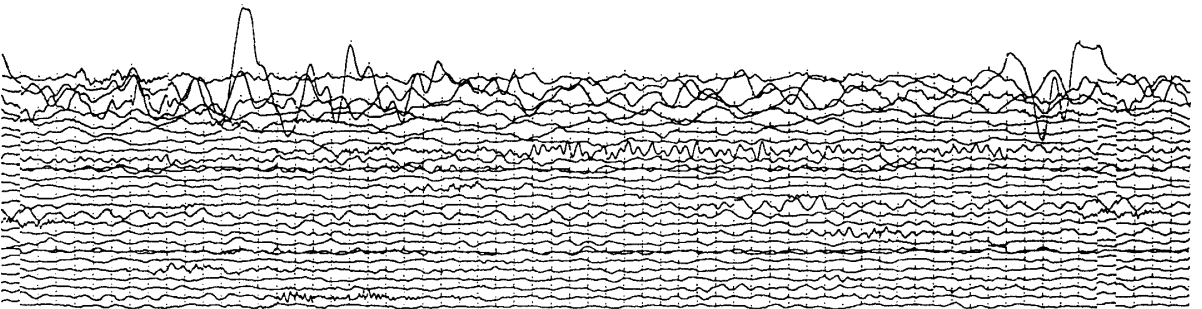
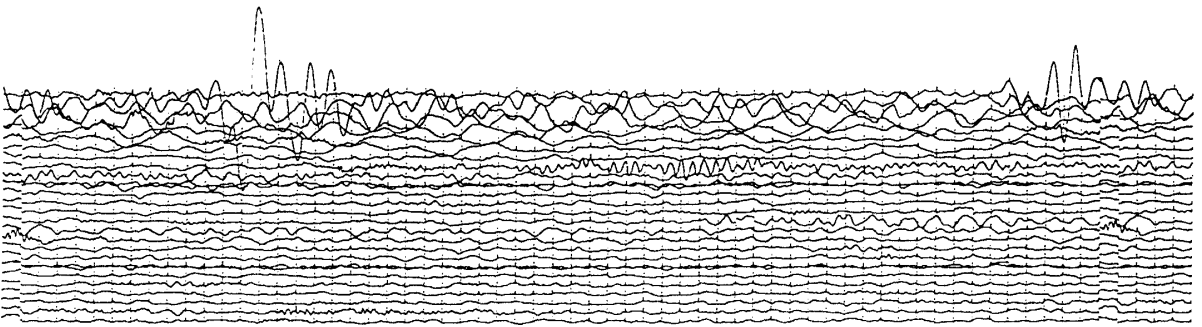
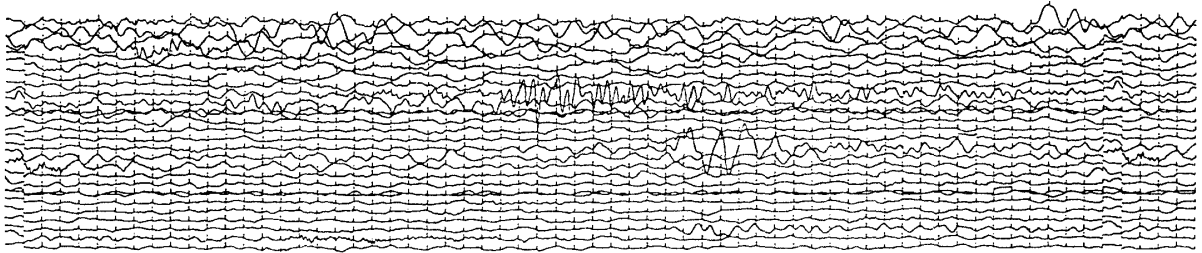
SP-1



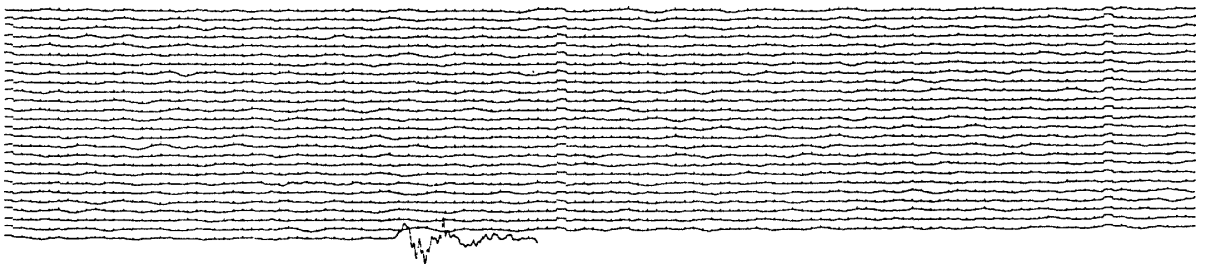
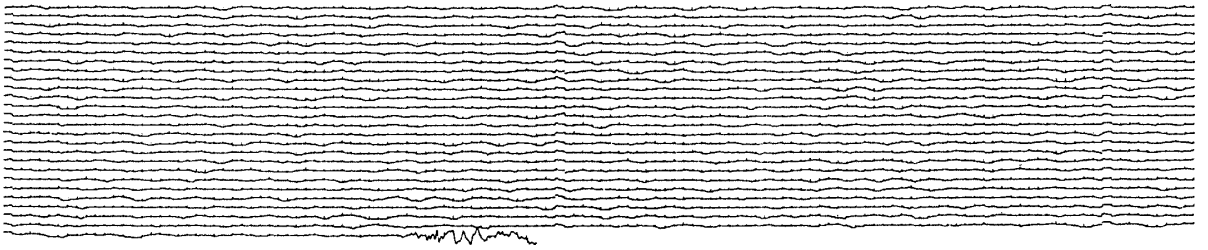
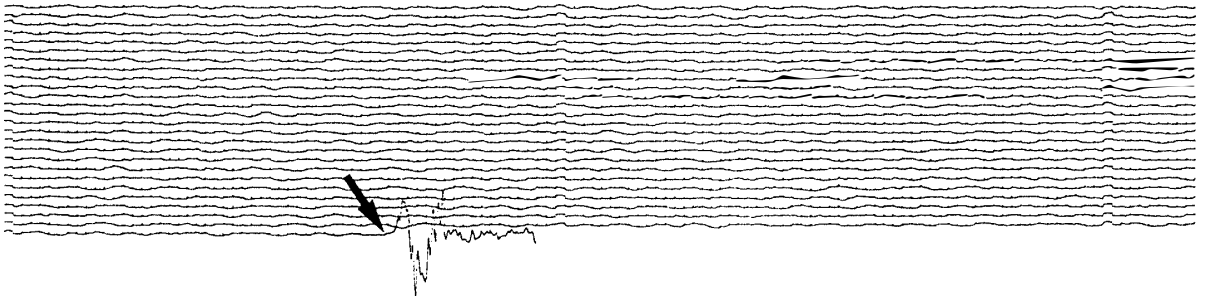
SP-2



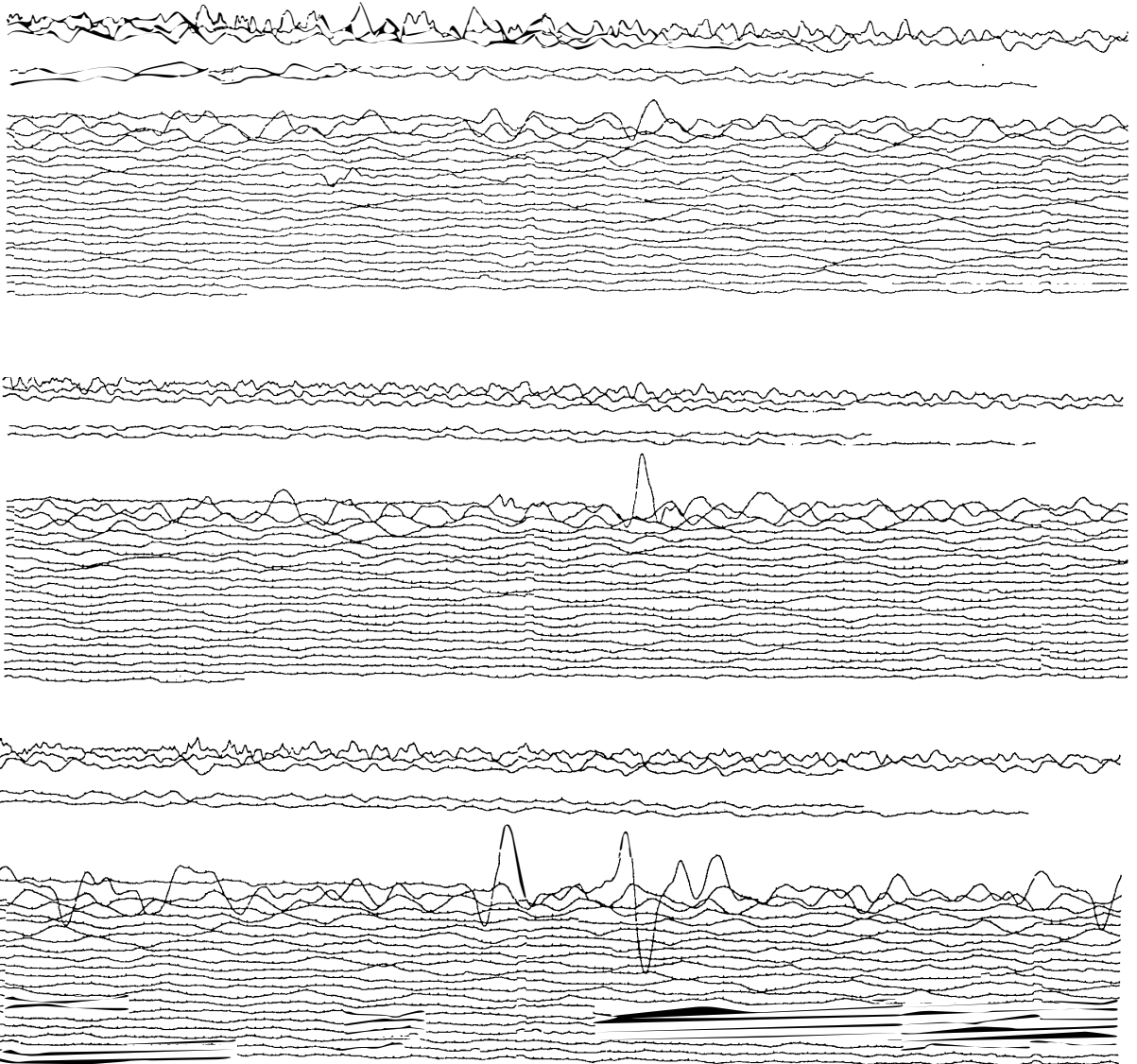
SP-3



LP-1



LP-2



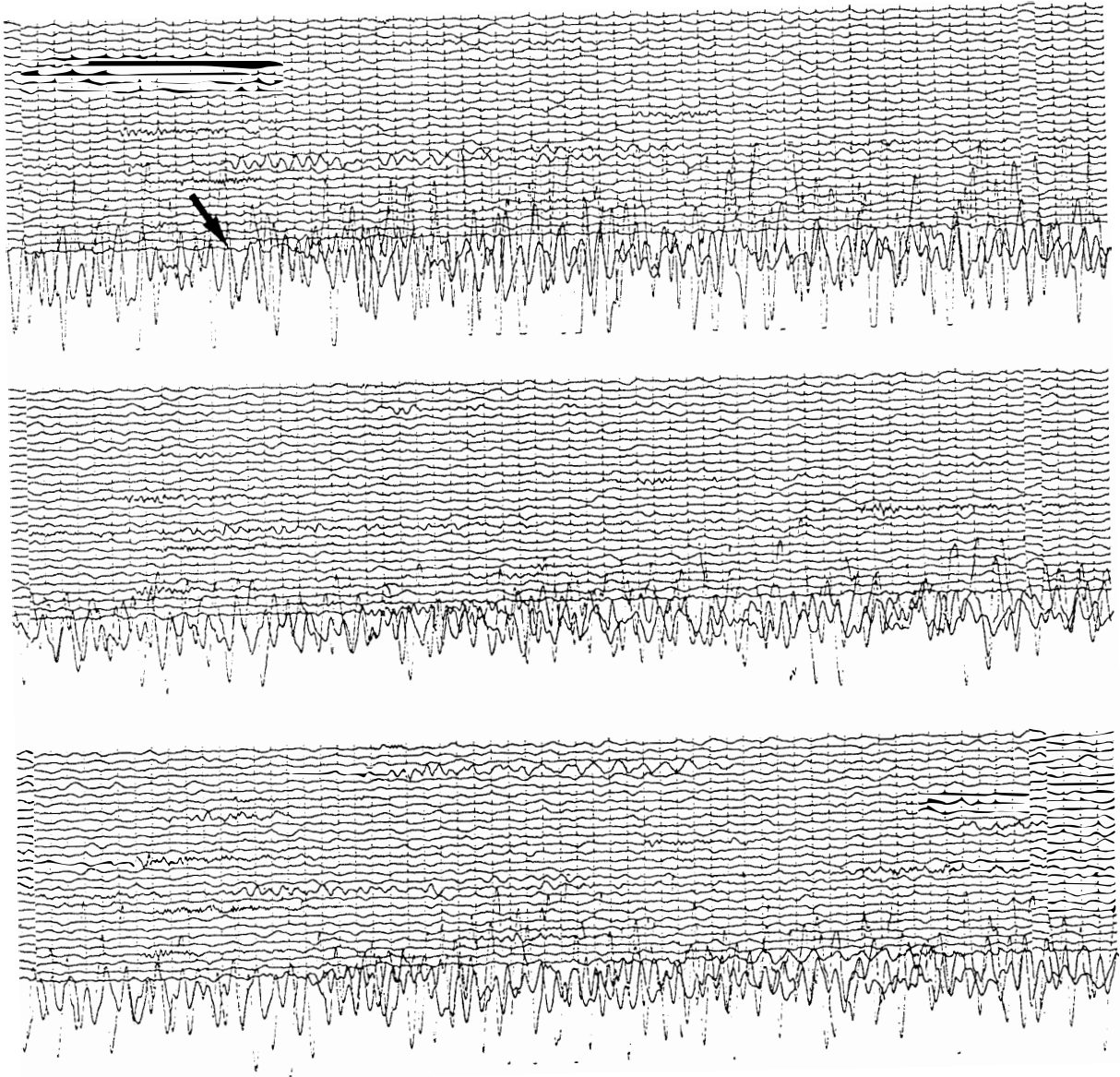
#-181

DEC. 15 18h43m45.0s

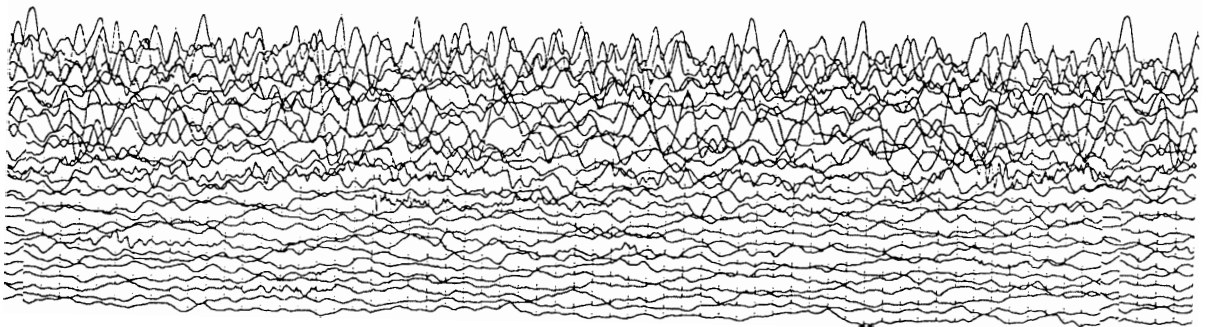
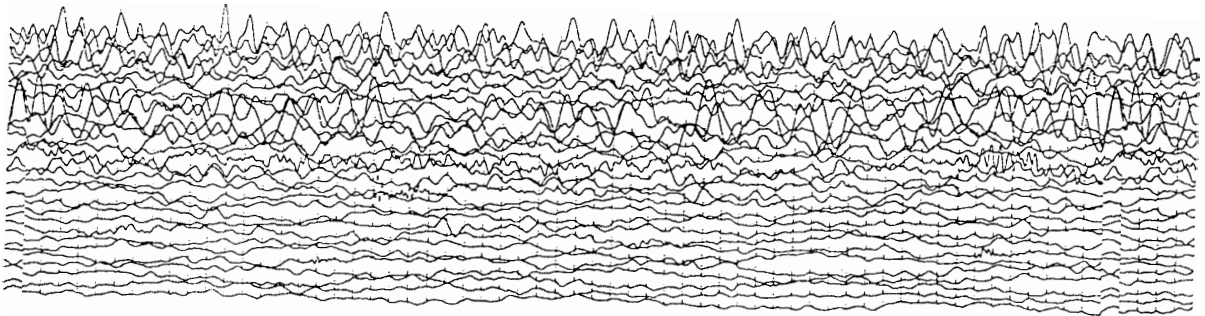
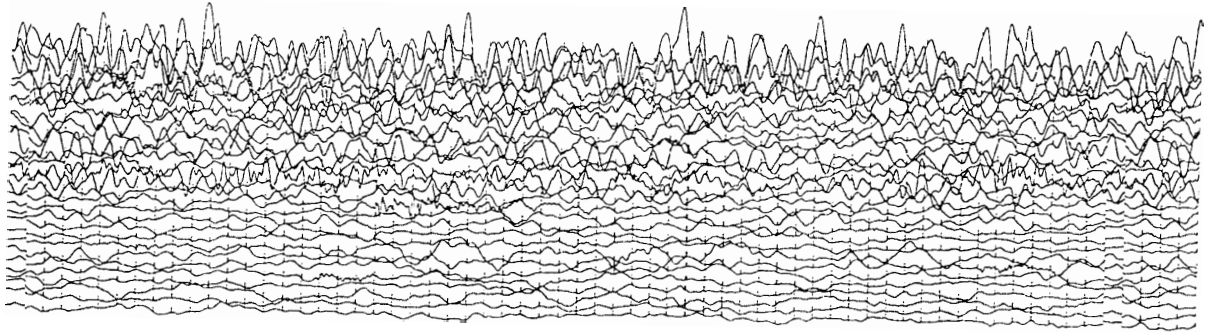
8.337 N 126.729 E 24km Mb 6.2 Ms 7.3

Mindanao, Philippine Islands

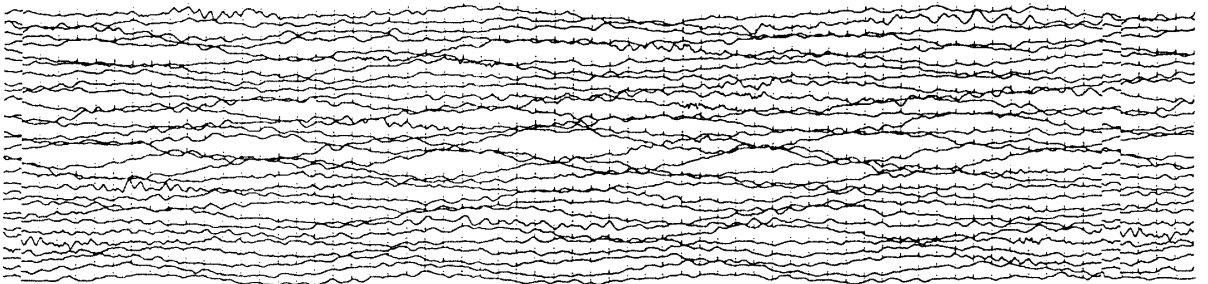
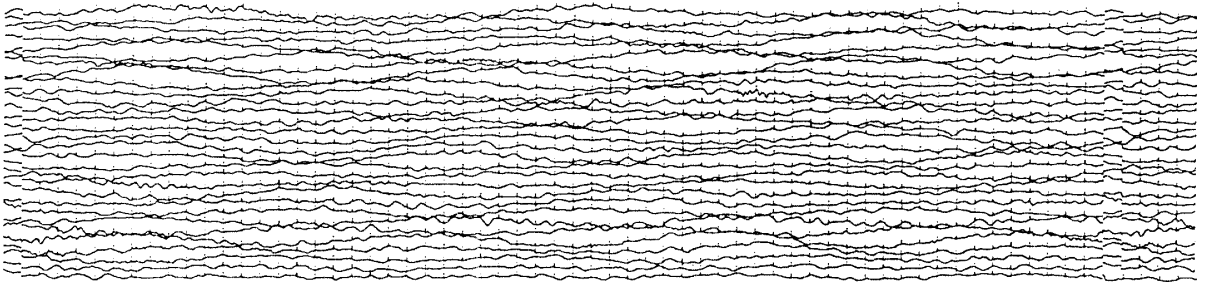
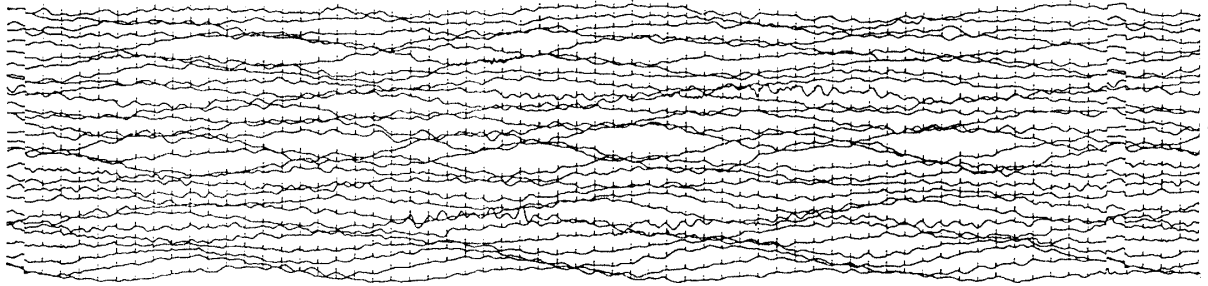
SP-1



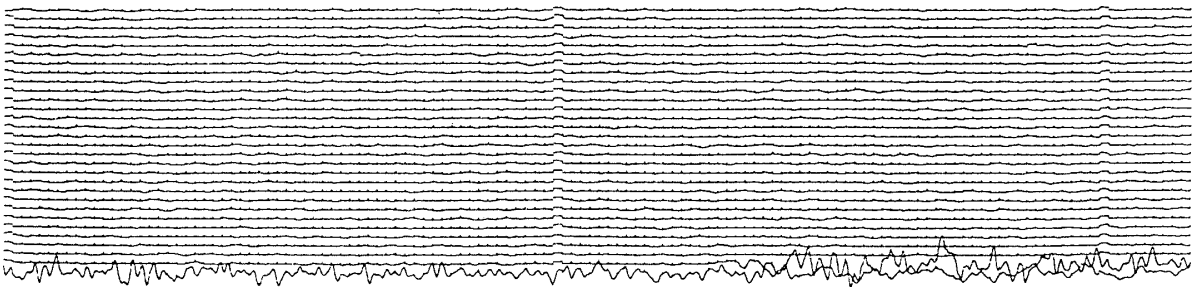
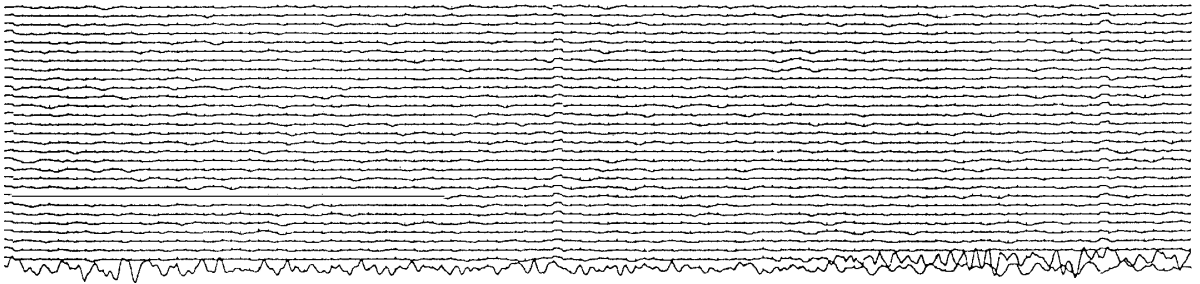
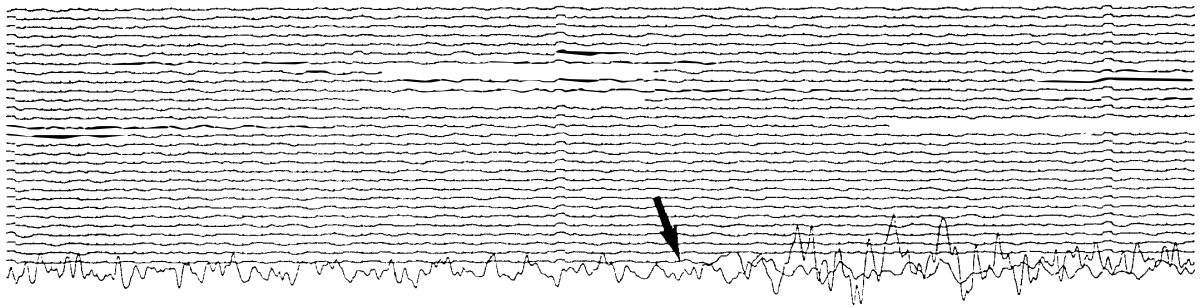
SP-2



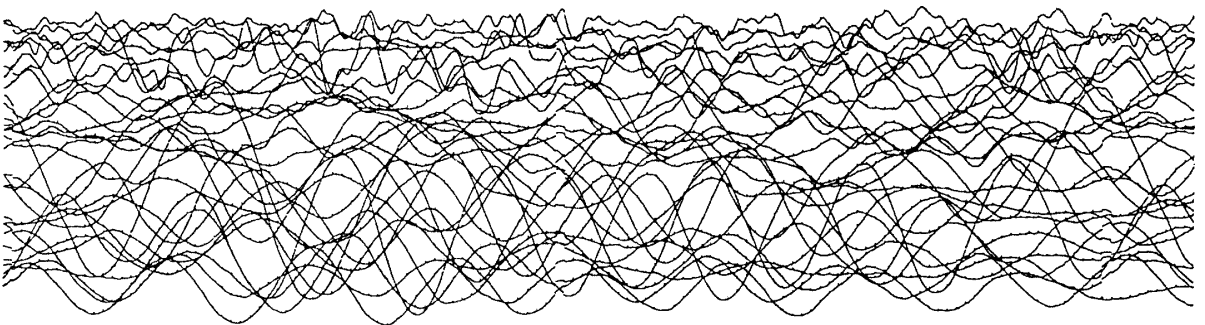
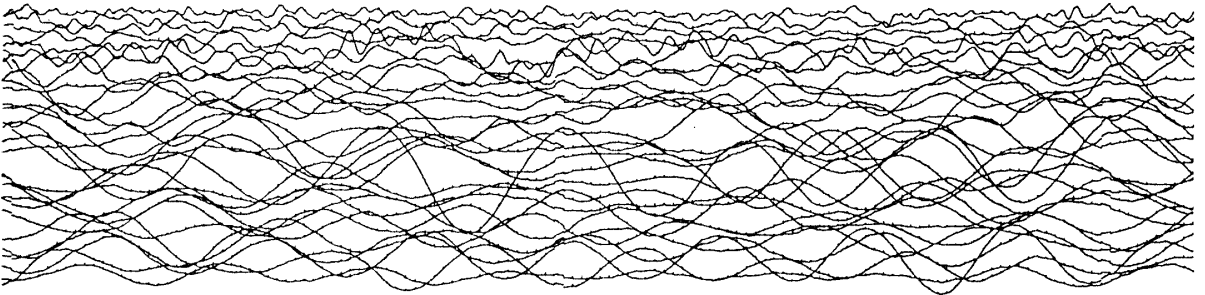
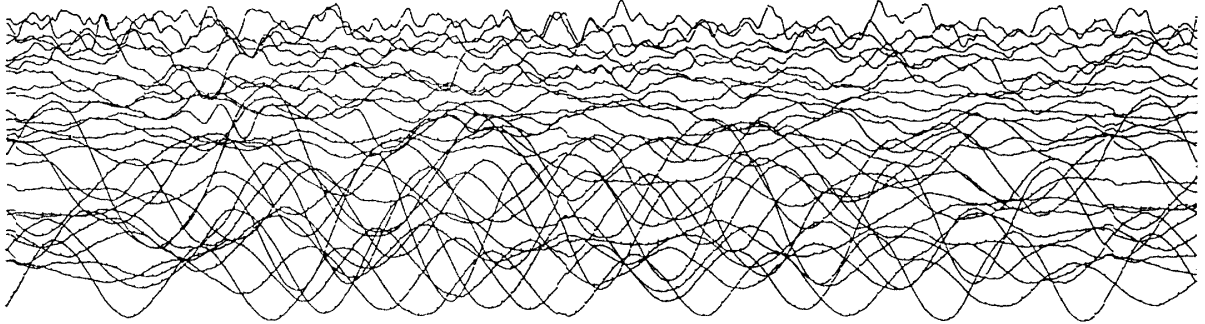
SP-3



LP-1



LP-2



LP-3

