SEISMOLOGICAL BULLETIN OF SYOWA STATION, ANTARCTICA, 1988

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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°00'31.7"S in latitude and 39°35'31.6"E in longitude. The elevation is 20 m above the mean sea level.

The system was maintained by N. Ichikawa throughout the wintering season of JARE-29 (February 1988 - January 1989).

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 164 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 16 teleseismic events are given in the Appendix. Body wave magnitude of the events in the appendix is larger than 6.0. The event of #-114 is given in only long-period seismogram and the other 15 events are given in both short- and long-period seismograms. 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 events of #-85 and #-87 are given for three components at Syowa

Station. Initial P phases on long-period seismograms of events #-2, #-22 and #-23 could not be identified due to extreme microseisms.

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 sincere thanks for her cooperation.

References

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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.

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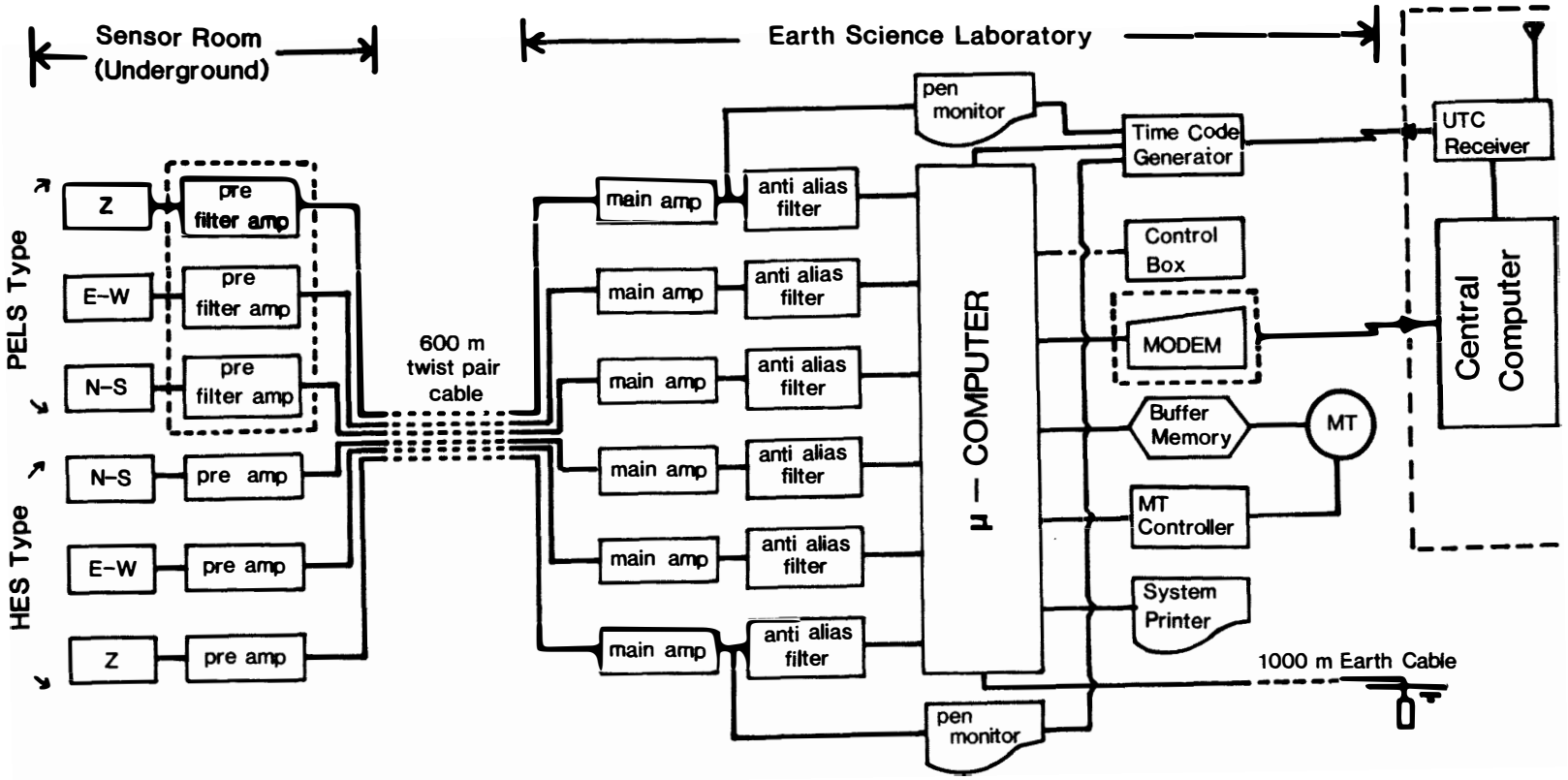


Fig. 1. The seismic observation system at Syowa Station.

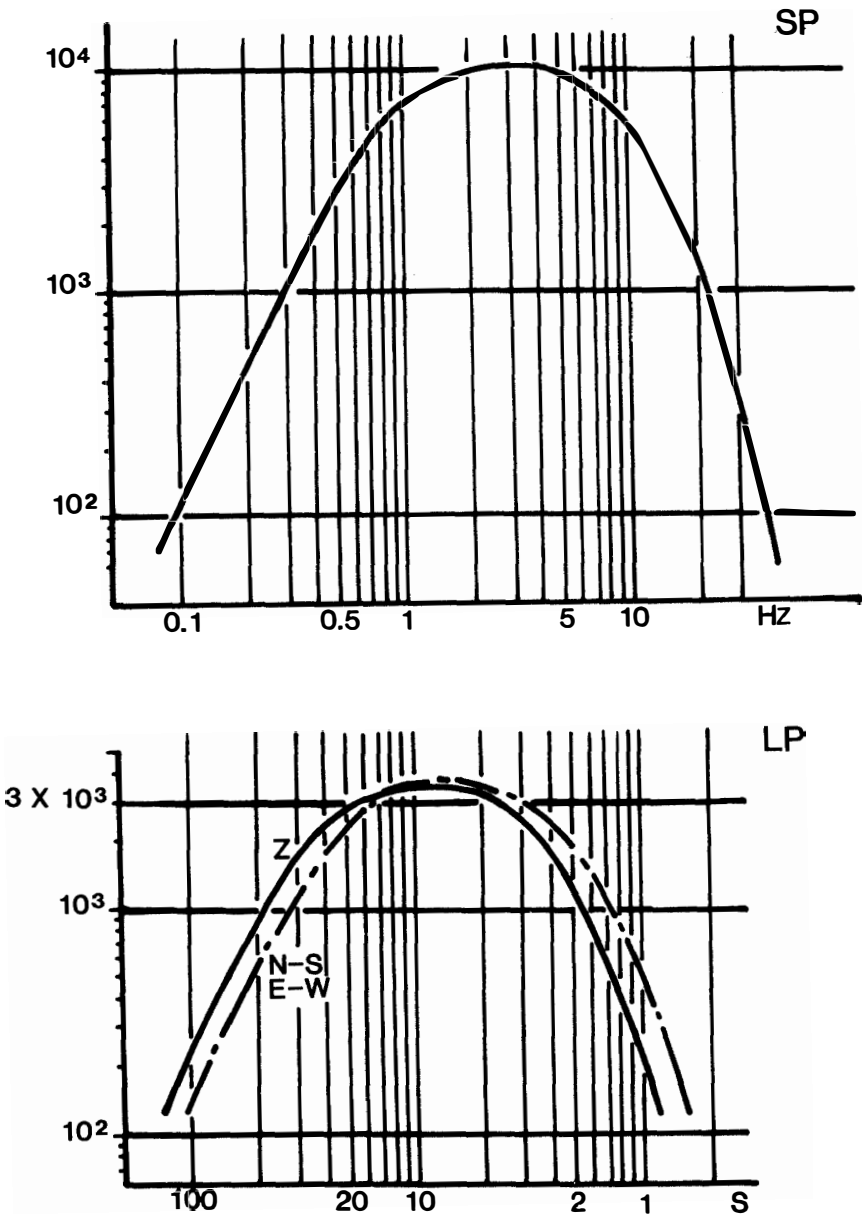


Fig. 2. Over-all frequency responses of the short-period and the long-period seismographs.

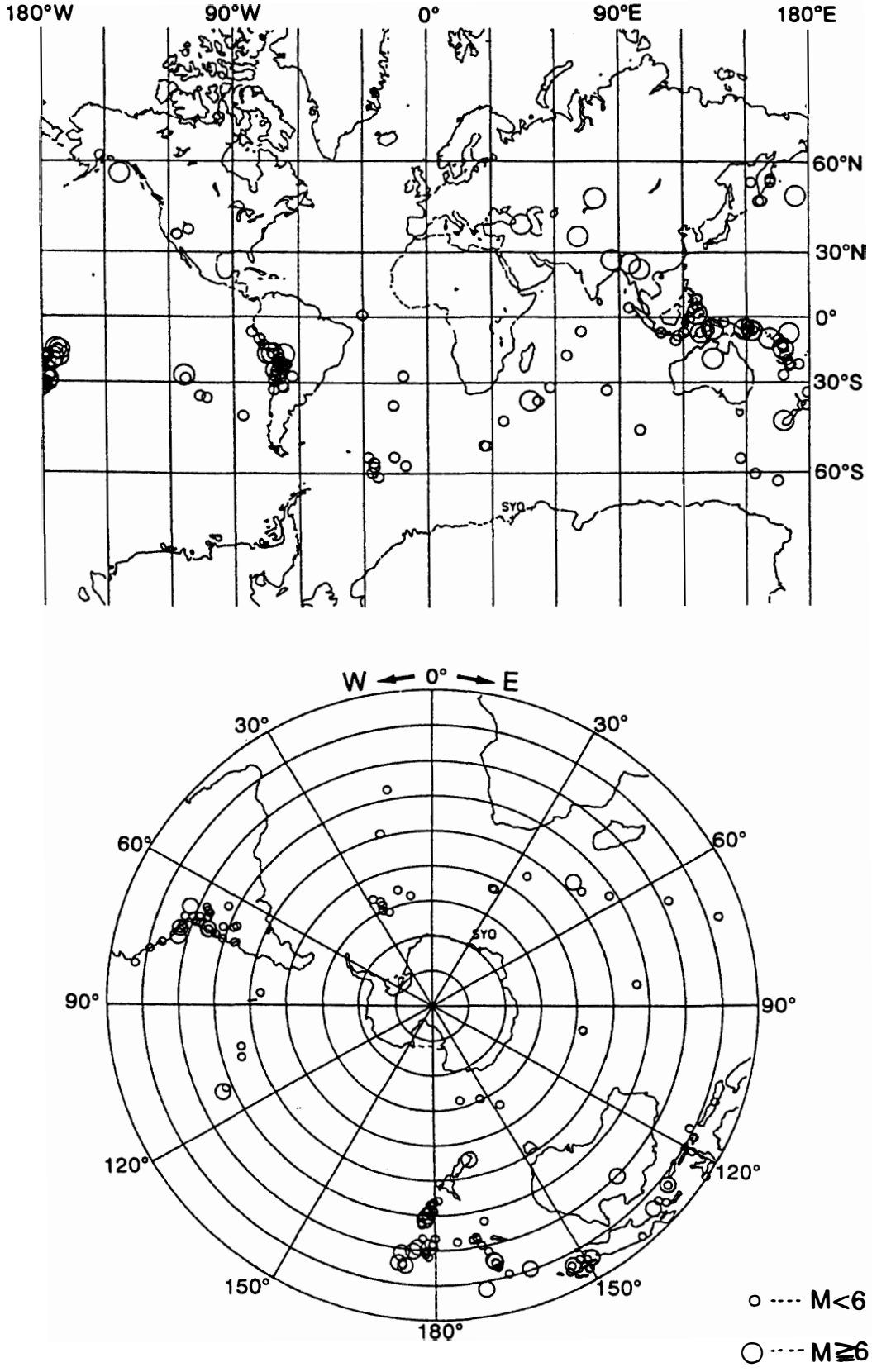


Fig. 3. Epicenters of 164 events which were detected at Syowa Station and were located by NEIC.

Table 1. Read-out data.

Date	Phase	Arrivel time h m s	Remarks
Jan. 01	EPZ	21 14 28.6	
02	-IPZ	06 48 25.5	
	+IPZ	13 04 12.6	
04	+IPZ	17 32 12.7	
06	EPZ	15 02 33.6	
07	+IPZ	09 30 09.6	
	LP+IPZ	09 30 09.5	
08	+IPZ	11 35 42.4	
09	+IPZ	23 19 11.4	
10	EPZ	04 17 23.4	
	+IPZ	06 28 28.8	
11	+IPZ	21 27 17.7	#-1
12	-IPZ	07 41 31.6	#-2
13	-IPZ	15 50 36.9	#-3
	+IPZ	22 28 23.1	
14	-IPZ	19 15 11.7	
15	LP EXZ	02 50 41.5	
	-IPZ	08 52 46.8	#-4
	LP-IPZ	08 52 46.9	
	LP ESH	09 02 51.9	
	-IPZ	21 16 17.8	#-5
	LP-IPZ	21 16 18.0	
16	EPZ	05 54 46.4	#-6
	LP EPZ	05 54 46.8	
17	-IPZ	17 27 21.2	
19	-IPZ	03 37 55.6	#-7
	+IPZ	07 42 05.8	#-8
	LP+IPZ	07 42 06.0	
	LP ESH	07 51 37.6	
20	+IPZ	15 13 02.5	#-9
Jan. 20	LP+IPZ	15 13 02.7	
21	EPZ	07 29 21.1	
	+IPZ	08 34 58.5	#-10
	LP+IPZ	08 34 58.6	
22	+IPZ	00 47 32.0	#-11
	LP+IPZ	00 47 32.6	
	+IPZ	04 08 59.6	#-12
	LP+IPZ	04 08 59.5	
	-IPZ	05 40 05.9	
	+IPZ	12 16 32.0	#-13
	LP+IPZ	12 16 32.0	
	+IPZ	12 51 08.4	
23	-IPZ	09 10 55.7	
	+IPZ	23 00 36.8	
24	-IPZ	16 12 00.4	
25	+IPZ	07 28 45.5	#-14
	LP+IPZ	07 28 45.5	
26	+IPZ	17 02 59.5	
27	+IPZ	11 38 50.0	
29	+IPZ	10 31 03.8	
Feb. 01	+IPZ	13 44 22.8	
05	+IPZ	14 12 33.4	#-15
	LP+IPZ	14 12 33.2	
	+IPZ	19 01 02.4	#-16
	LP+IPZ	19 01 02.4	
06	+IPZ	11 40 39.0	
	+IPZ	15 28 12.3	#-17
	LP+IPZ	15 28 12.3	
	LP ESH	15 38 30.2	
	+IPZ	18 15 26.5	#-18

Date	Phase	Arrivel time h m s	Remarks
Feb. 06	LP+IPZ	18 15 27.0	
	LP ESH	18 25 02.9	
	+IPZ	21 42 58.0	
07	EXZ	09 06 43.5	
	-IPZ	18 34 46.3	#-19
	LP-IPZ	18 34 46.8	
08	+IPZ	16 08 30.5	
	LP+IPZ	16 08 30.6	
09	+IPZ	04 44 02.2	
13	+IPZ	03 24 00.8	
18	+IPZ	00 33 34.6	
	-IPZ	14 03 55.3	#-20
	LP-IPZ	14 03 55.4	
22	-IPZ	19 25 03.9	#-21
26	+IPZ	06 23 58.9	#-22
Mar. 04	+IPZ	03 20 09.0	
	+IPZ	03 22 16.5	
06	-IPZ	22 55 41.0	#-23
08	EPZ	15 51 06.0	
	EPZ	16 47 13.0	
09	+IPZ	04 55 32.4	#-24
	-IPZ	05 11 18.5	
	-IPZ	21 46 11.8	#-25
10	+IPZ	10 36 41.2	#-26
	EPZ	21 06 38.4	
11	EPZ	02 43 25.7	
	-IPZ	09 20 48.9	
12	+IPZ	00 55 49.4	#-27
	+IPZ	08 58 39.1	#-28
13	EPZ	11 42 10.1	
Mar. 13	+IPZ	12 38 05.5	
	EPZ	13 05 44.3	#-29
14	+IPZ	11 11 15.0	
	-IPZ	12 42 41.7	
24	-IPZ	15 41 43.6	
25	-IPZ	05 33 35.0	#-30
	EPZ	15 16 20.9	*
	+IPZ	17 31 43.3	#-31
	+IPZ	19 58 10.0	
27	-IPZ	07 58 58.0	
	+IPZ	23 30 59.1	
28	+IPZ	18 47 49.7	#-32
31	+IPZ	00 02 27.5	#-33
	LP+IPZ	00 02 27.5	
	+IPZ	23 09 47.5	
Apr. 01	-IPZ	14 38 32.2	#-34
	LP-IPZ	14 38 32.2	
02	-IPZ	05 03 39.2	
	-IPZ	05 25 28.6	#-35
	-IPZ	07 27 54.2	
	-IPZ	14 39 38.8	#-36
03	+IPZ	01 52 01.5	#-37
	+IPZ	14 39 30.5	#-38
	LP+IPZ	14 39 30.3	
06	EPZ	16 42 32.2	
	+IPZ	20 04 41.5	
	-IPZ	21 18 43.5	
07	EPZ	18 20 42.6	#-39
08	+IPZ	11 32 35.8	#-40
	LP+IPZ	11 32 36.0	

Date	Phase	Arrivel time h m s	Remarks
Apr. 08	+IPZ	23 26 35.0	
11	-IPZ	21 04 14.4	
	-IPZ	22 47 58.1	#-41
12	-IPZ	05 14 42.8	#-42
	EPZ	20 33 24.1	
	+IPZ	23 32 09.5	#-43
	LP+IPZ	23 32 09.5	
13	EPZ	00 07 38.3	
	+IPZ	00 51 47.4	#-44
	+IPZ	08 10 00.5	
	+IPZ	23 13 53.4	
17	+IPZ	03 02 51.9	
	EPZ	05 17 32.0	#-45
	EPZ	12 35 53.8	
18	EPZ	12 33 02.3	
19	+IPZ	21 01 47.5	#-46
	+IPZ	23 22 18.5	
20	-IPZ	04 38 06.8	#-47
23	+IPZ	04 25 22.6	#-48
25	+IPZ	01 31 48.5	
	EPZ	10 23 38.0	
27	+IPZ	21 33 12.2	
28	EPZ	22 52 57.9	#-49
	LP-IPZ	22 52 57.2	
29	+IPZ	05 26 58.3	
	-IPZ	07 47 54.0	
May 01	-IPZ	10 26 16.0	#-50
	LP-IPZ	10 26 16.2	
	-IPZ	15 34 58.0	
	+IPZ	23 12 44.3	#-51
May 01	LP+IPZ	23 12 44.4	
03	-IPZ	23 34 24.0	#-52
	LP-IPZ	23 34 24.2	
04	-IPZ	00 11 03.8	
	+IPZ	01 16 02.0	#-53
05	EPZ	00 05 45.5	
	-IPZ	08 10 24.4	
	+IPZ	10 16 34.5	#-54
	LP+IPZ	10 16 34.6	
	+IPZ	17 50 24.8	#-55
	LP+IPZ	17 50 24.8	
	EPZ	22 45 08.9	
	LP+IPZ	22 45 09.1	
	+IPZ	23 43 06.5	
	LP+IPZ	23 43 06.5	
06	EPZ	15 04 42.5	
	+IPZ	16 46 42.3	#-56
	LP+IPZ	16 46 42.3	
	+IPZ	19 26 30.2	#-57
	LP+IPZ	19 26 30.2	
	LP ESH	19 36 02.9	
07	+IPZ	17 16 11.8	
	-IPZ	23 09 27.2	
09	+IPZ	12 33 52.2	#-58
	LP+IPZ	12 33 52.0	
10	-IPZ	10 17 34.0	
11	-IPZ	17 39 34.5	#-59
	LP-IPZ	17 39 34.8	
	+IPZ	20 08 33.7	
13	+IPZ	01 46 16.1	

Date	Phase	Arrivel time h m s	Remarks
May 13	-IPZ	02 08 25.1	
	EPZ	03 35 34.2	
	+IPZ	15 54 38.6	
15	EPZ	18 36 31.0	
17	+IPZ	09 18 06.1	
	-IPZ	20 52 38.7	
18	+IPZ	22 01 51.4	
	-IPZ	23 18 01.6	
20	-IPZ	03 31 50.6	#-60
	LP-IPZ	03 31 50.5	
	+IPZ	03 46 11.1	
	+IPZ	09 30 28.0	
	EPZ	15 12 00.5	
21	+IPZ	14 39 25.2	#-61
	EPZ	15 28 13.4	
22	EPZ	02 58 52.8	*
	+IPZ	12 59 19.9	
23	+IPZ	00 06 38.8	
	-IPZ	00 39 01.7	#-62
	LP-IPZ	00 39 01.6	
	EPZ	07 57 33.4	
	-IPZ	23 07 16.1	
24	+IPZ	05 11 02.7	
	EPZ	05 12 29.4	
	EPZ	23 03 08.4	*
25	EPZ	04 52 14.6	
	+IPZ	14 25 05.5	
26	EPZ	00 32 06.3	
	EPZ	23 06 10.4	*
27	+IPZ	02 56 34.3	

Date	Phase	Arrivel time h m s	Remarks
May 28	+IPZ	10 36 32.2	
	-IPZ	16 39 20.0	
	LP-IPZ	16 39 20.2	
29	+IPZ	12 05 42.0	
30	+IPZ	21 23 26.6	#-63
	LP+IPZ	21 23 26.6	
	-IPZ	21 32 56.0	
June 02	+IPZ	12 10 00.4	
	+IPZ	13 19 38.6	#-64
	LP+IPZ	13 19 38.7	
03	+IPZ	11 57 25.6	
	+IPZ	23 37 32.8	#-65
	LP+IPZ	23 37 32.8	
05	+IPZ	17 41 31.0	
	+IPZ	18 35 26.8	#-66
	LP+IPZ	18 35 26.8	
10	EPZ	05 19 23.6	
	-IPZ	11 42 35.8	#-67
	LP-IPZ	11 42 35.8	
	-IPZ	23 26 14.9	
11	+IPZ	12 30 32.8	
	LP+IPZ	12 30 33.2	
12	EPZ	13 52 47.4	
16	-IPZ	15 53 04.8	#-68
	-IPZ	23 50 52.9	
17	-IPZ	13 05 08.0	#-69
	LP-IPZ	13 05 08.2	
18	-IPZ	23 09 03.8	
	LP EPZ	23 09 03.2	
19	+IPZ	13 17 13.3	

Date	Phase	Arrivel time h m s	Remarks
June 22	+IPZ	22 05 57.0	
23	+IPZ	04 24 09.3	
24	-IPZ	06 10 38.2	
25	+IPZ	06 35 53.0	#-70
	LP+IPZ	06 35 53.0	
26	+IPZ	03 34 10.4	
27	-IPZ	06 20 13.0	#-71
	LP-IPZ	06 20 13.2	
	LP ESH	06 30 28.9	
	-IPZ	16 27 24.6	
28	+IPZ	14 44 01.6	
	+IPZ	16 48 28.4	#-72
	LP+IPZ	16 48 28.8	
29	-IPZ	09 13 24.3	
	EPZ	10 37 39.3	
	LP EPZ	10 37 39.0	
	+IPZ	15 09 22.3	#-73
30	-IPZ	15 10 18.5	
	EPZ	15 32 25.5	
July 01	+IPZ	03 08 33.4	
02	+IPZ	10 14 07.1	#-74
	LP+IPZ	10 14 07.1	
03	+IPZ	01 50 05.4	
	EPZ	05 21 05.8	
	-IPZ	11 57 03.7	
	LP-IPZ	11 57 04.0	
04	+IPZ	14 06 27.4	#-75
	LP+IPZ	14 06 27.4	
05	+IPZ	08 19 42.6	
	+IPZ	20 44 59.5	#-76
July 05	LP+IPZ	20 45 00.0	
	LP ESH	20 55 31.6	
06	+IPZ	01 22 50.5	
	EPZ	01 24 46.9	
	+IPZ	23 13 31.6	
07	+IPZ	13 24 33.2	
	+IPZ	15 25 08.0	#-77
	LP+IPZ	15 25 08.0	
08	-IPZ	16 48 40.0	
	LP-IPZ	16 48 40.1	
09	+IPZ	15 22 23.2	#-78
	LP+IPZ	15 22 23.2	
11	-IPZ	00 25 46.1	#-79
	LP+IPZ	00 25 45.2	
13	-IPZ	17 37 05.3	
	LP-IPZ	17 37 05.3	
16	-IPZ	08 45 39.8	#-80
	+IPZ	17 07 09.9	#-81
	LP+IPZ	17 07 09.9	
17	+IPZ	13 24 52.0	
18	+IPZ	02 42 15.4	#-82
19	+IPZ	01 12 54.5	#-83
	LP+IPZ	01 12 54.4	
	LP ESH	01 23 08.2	
	EPZ	16 36 47.2	
	-IPZ	23 54 05.1	
22	-IPZ	18 23 03.0	
23	-IPZ	14 38 02.0	#-84
	LP-IPZ	14 38 02.0	
	LP ESH	14 48 21.5	

Date	Phase	Arrivel time h m s	Remarks
July 23	-IPZ	15 30 15.5	#-85
	ESH	15 41 13.5	
	LP-IPZ	15 30 15.5	
	-IPZ	17 24 43.3	#-86
	LP-IPZ	17 24 43.3	
25	-IPZ	06 58 43.2	#-87
	LP-IPZ	06 58 43.3	
26	+IPZ	00 02 04.0	
	-IPZ	16 47 02.5	
	-IPZ	19 25 11.9	
	LP-IPZ	19 25 12.0	
27	+IPZ	22 07 49.0	#-88
	LP+IPZ	22 07 49.0	
	+IPZ	22 57 13.7	#-89
	LP+IPZ	22 57 13.6	
28	-IPZ	04 17 40.6	
	-IPZ	17 23 42.5	#-90
	ESH	17 32 56.5	
	LP-IPZ	17 23 42.5	
	LP ESH	17 32 56.5	
	-IPZ	17 32 51.9	
	LP-IPZ	17 32 51.9	
30	EPZ	02 57 49.5	
	LP EPZ	02 57 48.3	
	-IPZ	16 34 27.5	#-91
	EPZ	21 26 27.9	
31	+IPZ	13 02 23.3	#-92
	LP+IPZ	13 02 23.3	
	-IPZ	15 30 10.3	#-93
	LP-IPZ	15 30 10.3	

Date	Phase	Arrivel time h m s	Remarks
Aug. 03	+IPZ	12 00 45.7	
04	-IPZ	06 29 00.0	#-94
	LP-IPZ	06 29 00.0	
	EPZ	06 48 06.4	
	+IPZ	17 28 16.8	#-95
	LP+IPZ	17 28 17.2	
	+IPZ	21 39 19.0	
05	-IPZ	10 15 36.5	#-96
	LP-IPZ	10 15 36.8	
	-IPZ	17 47 29.6	
	+IPZ	21 53 45.3	
06	+IPZ	00 50 08.5	#-97
	LP+IPZ	00 50 08.5	
	EXZ	01 06 10.8	
	+IPZ	06 39 56.0	#-98
	LP+IPZ	06 39 56.1	
	EPZ	07 44 02.9	
	+IPZ	09 21 15.8	#-99
	LP+IPZ	09 21 15.6	
	-IPZ	14 06 30.7	#-100
07	+IPZ	15 46 14.9	
08	-IPZ	17 27 18.1	
	EPZ	20 18 38.5	
09	+IPZ	02 01 45.4	#-101
	EPZ	14 46 35.3	
10	+IPZ	01 10 11.5	
	-IPZ	04 51 25.5	#-102
	LP-IPZ	04 51 25.9	
	+IPZ	05 09 40.0	
	+IPZ	06 51 41.8	

Date	Phase	Arrivel time h m s	Remarks
Aug. 10	-IPZ	11 59 00.0	#-103
	LP-IPZ	11 59 00.0	
	LP ESH	12 09 10.8	
	+IPZ	13 23 56.6	#-104
	LP+IPZ	13 23 56.6	
	LP ESH	13 34 10.5	
	-IPZ	16 02 42.5	
11	+IPZ	03 24 45.8	
	LP+IPZ	03 24 45.8	
	+IPZ	13 38 40.6	#-105
	LP EPZ	13 38 41.9	
12	+IPZ	05 33 46.5	
	-IPZ	13 42 34.3	
13	EPZ	05 59 11.9	
	-IPZ	12 49 03.0	
	EPZ	14 29 10.8	
14	-IPZ	11 15 27.8	#-106
	LP-IPZ	11 15 27.9	
	+IPZ	13 23 26.4	
	EPZ	17 58 47.8	
	+IPZ	18 04 27.1	#-107
	LP+IPZ	18 04 27.2	
	-IPZ	20 22 40.2	#-108
	LP-IPZ	20 22 40.3	
15	+IPZ	10 12 48.2	#-109
	LP+IPZ	10 12 48.3	
16	-IPZ	08 53 42.5	
	+IPZ	14 10 57.6	
17	+IPZ	02 10 44.3	#-110
	LP+IPZ	02 10 44.3	

Date	Phase	Arrivel time h m s	Remarks
Aug. 17	LP ESH	02 20 16.5	
	+IPZ	08 27 41.8	
	LP+IPZ	08 27 42.0	
	+IPZ	11 46 09.4	#-111
	LP+IPZ	11 46 08.9	
	+IPZ	12 49 32.3	
	+IPZ	17 19 37.6	#-112
	LP+IPZ	17 19 37.6	
18	-IPZ	06 45 08.6	
19	+IPZ	18 33 55.0	#-113
	LP+IPZ	18 33 55.0	
	+IPZ	23 02 21.9	
20	-IPZ	08 32 20.1	
	LP-IPZ	08 32 20.1	
	LP-IPZ	23 23 09.9	#-114**
21	LP+IPZ	14 01 59.0	#-115**
22	EPZ	11 25 00.0	
23	-IPZ	04 30 30.5	
	+IPZ	20 06 38.3	#-116
	LP+IPZ	20 06 38.6	
24	-IPZ	09 34 53.6	
26	+IPZ	09 38 40.8	
27	EPZ	10 14 18.8	
	EPZ	10 27 47.3	
	+IPZ	16 43 23.0	#-117
	LP+IPZ	16 43 23.0	
29	EPZ	04 42 08.4	
	LP EPZ	04 42 09.4	
30	EPZ	12 59 42.2	
	+IPZ	18 19 36.7	

Date	Phase	Arrivel time h m s	Remarks
Sept.02	+IPZ	04 52 54.0	
	+IPZ	10 47 31.3	
	LP+IPZ	10 47 31.3	
	+IPZ	16 19 35.6	
	+IPZ	22 45 34.7	
03	+IPZ	00 41 12.6	
04	+IPZ	07 45 42.2	
	EPZ	17 23 07.7	*
	-IPZ	20 38 38.5	
05	+IPZ	09 27 09.4	
06	+IPZ	12 35 57.7	
	+IPZ	15 57 50.4	
08	-IPZ	13 00 48.8	
	+IPZ	22 39 05.0	
09	EPZ	17 03 23.2	#-118
	-IPZ	23 21 01.1	#-119
	LP-IPZ	23 21 01.1	
10	-IPZ	05 44 22.1	
	+IPZ	21 47 56.0	
	LP+IPZ	21 47 56.0	
11	+IPZ	06 29 03.3	
12	EPZ	11 57 35.8	
13	EPZ	06 39 03.2	
14	+IPZ	02 47 54.8	
	+IPZ	04 18 51.1	
	EPZ	10 45 55.6	
	-IPZ	22 25 29.7	#-120
	LP-IPZ	22 25 29.7	
	LP ESH	22 34 58.2	
16	EPZ	00 19 20.6	

Date	Phase	Arrivel time h m s	Remarks
Sept.16	EPZ	00 27 05.6	
	-IPZ	02 28 01.7	
	LP-IPZ	02 28 01.8	
	EPZ	06 40 07.6	
	LP+IPZ	06 40 07.6	
18	+IPZ	01 54 33.0	
19	EPZ	19 11 05.6	
	LP+IPZ	19 11 05.8	
	+IPZ	20 02 29.8	
	-IPZ	21 13 52.4	
20	-IPZ	14 55 42.9	#-121
	+IPZ	19 28 11.8	
21	EPZ	11 17 01.6	
22	+IPZ	00 12 31.7	
25	-IPZ	01 14 40.6	
	LP-IPZ	01 14 40.6	
	+IPZ	07 12 45.5	#-122
	+IPZ	09 07 39.3	
	+IPZ	20 12 38.1	
26	-IPZ	08 42 21.1	
	LP+IPZ	08 42 20.9	
	-IPZ	13 43 55.3	
	+IPZ	21 19 30.8	
	LP+IPZ	21 19 31.0	
30	-IPZ	03 35 36.5	#-123
	LP-IPZ	03 35 36.5	
	EPZ	05 58 50.8	
	+IPZ	08 40 02.3	#-124
	LP+IPZ	08 40 02.3	
	+IPZ	20 54 31.1	

Date	Phase	Arrivel time h m s	Remarks
Sept.30	-IPZ	21 56 52.3	#-125
	LP-IPZ	21 56 52.3	
Oct. 01	+IPZ	09 54 54.4	#-126
	LP+IPZ	09 54 54.8	
02	+IPZ	06 29 21.9	#-127
	+IPZ	12 04 56.2	
03	-IPZ	00 58 48.7	
04	+IPZ	15 19 28.6	
	EPZ	15 51 13.2	#-128
	LP EPZ	15 51 13.0	
05	+IPZ	01 12 43.0	#-129
	LP+IPZ	01 12 43.1	
	+IPZ	09 57 26.8	
08	+IPZ	04 59 17.1	#-130
	LP+IPZ	04 59 17.0	
	EPZ	21 45 13.3	
09	+IPZ	17 15 16.2	
10	EPZ	06 44 20.7	
	LP+IPZ	06 44 20.8	
	EPZ	07 31 39.4	
	LP-IPZ	07 31 38.8	
	+IPZ	18 32 27.3	#-131
	LP+IPZ	18 32 27.3	
	LP ESH	18 42 18.0	
	+IPZ	19 38 21.0	
11	+IPZ	02 04 37.6	
12	-IPZ	18 24 24.9	
13	+IPZ	14 19 38.2	#-132
	LP+IPZ	14 19 38.2	
14	-IPZ	19 23 11.4	#-133

Date	Phase	Arrivel time h m s	Remarks
Oct. 14	LP-IPZ	19 23 11.4	
15	+IPZ	18 16 21.5	
17	EPZ	06 16 30.2	
	LP+IPZ	06 16 29.2	
	-IPZ	20 44 54.8	
	+IPZ	21 50 56.6	
18	+IPZ	13 17 09.7	
19	EPZ	20 10 38.6	
20	-IPZ	01 20 19.7	
	EPZ	02 44 06.7	
21	+IPZ	09 04 30.5	
22	+IPZ	16 23 40.2	#-134
	LP+IPZ	16 23 40.2	
23	EPZ	00 35 51.6	
	+IPZ	06 57 14.3	#-135
	LP+IPZ	06 57 14.3	
	EPZ	13 51 21.7	
	EPZ	13 57 39.6	
24	+IPZ	12 08 17.7	#-136
	LP+IPZ	12 08 17.6	
25	-IPZ	03 54 58.7	
27	+IPZ	11 02 48.4	
	LP+IPZ	11 02 48.5	
	-IPZ	15 18 25.4	#-137
	LP-IPZ	15 18 25.4	
	-IPZ	19 52 15.6	
28	-IPZ	10 50 38.2	
	+IPZ	15 02 21.0	
	LP+IPZ	15 02 21.1	
31	-IPZ	02 19 27.7	

Date	Phase	Arrivel time h m s	Remarks
Oct. 31	+IPZ	18 01 06.0	
Nov. 01	EPZ	01 17 02.4	
	+IPZ	22 37 13.0	#-138
	LP+IPZ	22 37 13.0	
02	-IPZ	00 27 25.2	
	LP-IPZ	00 27 25.2	
03	EPZ	05 49 50.6	#-139
	LP+IPZ	05 49 50.9	
	+IPZ	15 05 47.0	
	LP EPZ	15 05 45.5	
04	+IPZ	03 01 39.8	
	LP+IPZ	03 01 39.4	
05	-IPZ	09 22 22.4	
	EPZ	12 28 08.4	#-140
	LP+IPZ	12 28 08.8	
06	EPZ	08 40 43.8	
	EPZ	13 17 16.1	#-141
	LP+IPZ	13 17 15.5	
07	-IPZ	03 59 25.2	#-142
	LP-IPZ	03 59 25.4	
	+IPZ	17 36 49.1	
	-IPZ	23 28 36.2	#-143
	LP-IPZ	23 28 36.2	
08	-IPZ	22 01 00.6	
13	+IPZ	02 49 51.1	#-144
	LP+IPZ	02 49 51.1	
14	+IPZ	02 28 52.4	#-145
	LP EPZ	02 28 52.2	
	+IPZ	04 41 27.9	
	+IPZ	17 06 22.3	

Date	Phase	Arrivel time h m s	Remarks
Nov. 15	EPZ	05 35 31.2	
	EPZ	09 01 35.7	
16	+IPZ	05 21 56.2	
	+IPZ	06 04 54.6	#-146
	LP+IPZ	06 04 54.6	
17	+IPZ	01 19 39.1	#-147
	LP+IPZ	01 19 39.1	
	EPZ	07 09 26.2	
18	-IPZ	19 51 54.4	#-148
	LP+IPZ	19 51 54.1	
19	+IPZ	23 40 53.7	
20	+IPZ	04 34 46.9	
	+IPZ	08 14 47.3	
	+IPZ	09 18 09.9	#-149
	LP+IPZ	09 18 09.9	
	+IPZ	15 32 25.6	#-150
	LP+IPZ	15 32 25.6	
21	+IPZ	12 37 43.0	
	+IPZ	15 45 37.9	
	LP+IPZ	15 45 38.2	
	-IPZ	18 02 56.2	
23	-IPZ	02 12 48.4	#-151
	-IPZ	05 34 19.9	
	+IPZ	09 38 52.4	#-152
	LP+IPZ	09 38 52.4	
25	-IPZ	08 42 39.5	#-153
	LP-IPZ	08 42 39.8	
	+IPZ	11 12 41.3	
26	+IPZ	11 41 13.3	
	+IPZ	20 59 53.3	

Date	Phase	Arrivel time h m s	Remarks
Nov. 27	+IPZ	02 11 58.6	
28	EPZ	00 11 29.6	
	-IPZ	00 42 59.8	
	LP-IPZ	00 42 59.9	#-154
29	+IPZ	07 57 36.3	
	-IPZ	08 04 00.1	
	-IPZ	20 28 37.5	
30	-IPZ	09 15 18.0	#-155
Dec. 04	+IPZ	05 39 22.3	
05	+IPZ	11 33 19.3	
	+IPZ	16 18 40.0	#-156
	LP+IPZ	16 18 40.0	
	LP ESH	16 29 09.1	
07	-IPZ	07 59 54.7	#-157
	LP-IPZ	07 59 54.8	
	EPZ	11 30 28.3	
	LP EPZ	11 30 39.4	
	-IPZ	14 13 09.5	
	-IPZ	18 51 16.5	
09	-IPZ	07 55 13.8	#-158
	LP-IPZ	07 55 13.9	
	-IPZ	16 17 09.9	
10	+IPZ	07 36 12.4	#-159
	LP+IPZ	07 36 12.4	
	-IPZ	20 49 37.9	
13	EPZ	04 21 07.3	
	LP EPZ	04 21 08.4	
15	+IPZ	09 40 53.2	
16	+IPZ	10 09 10.2	#-160
	LP+IPZ	10 09 10.2	

Date	Phase	Arrivel time h m s	Remarks
Dec. 16	LP ESH	10 18 57.5	
17	EPZ	01 10 03.2	#-161
	LP EPZ	01 10 03.4	
	+IPZ	04 36 01.8	
	+IPZ	20 32 27.0	
19	EPZ	06 48 40.4	
	LP EPZ	06 48 40.3	
	+IPZ	10 29 19.7	
20	EPZ	03 47 27.3	
	-IPZ	14 28 55.8	
	+IPZ	14 40 03.8	#-162
	LP+IPZ	14 40 03.8	
	-IPZ	20 37 27.9	
21	+IPZ	02 47 04.9	
	-IPZ	05 29 34.3	
22	+IPZ	02 03 42.8	
	-IPZ	02 38 10.8	
23	EPZ	04 43 11.5	
	+IPZ	22 01 36.3	
	LP+IPZ	22 01 36.4	
24	-IPZ	04 38 07.5	#-163
	LP-IPZ	04 38 07.5	
	EPZ	04 47 17.2	
	LP-IPZ	04 47 21.0	
	-IPZ	09 50 14.8	
	-IPZ	10 49 48.0	#-164
	LP-IPZ	10 49 48.0	
	LP ESH	10 58 07.4	
	-IPZ	13 22 08.6	
27	-IPZ	10 17 31.3	

Date	Phase	Arrivel time h m s	Remarks
Dec. 30	+IPZ	22 42 50.6	
31	+IPZ	11 29 29.7	
	+IPZ	15 23 58.8	
	+IPZ	20 36 55.4	
	+IPZ	21 57 34.4	

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

* ---- corresponds to local event.

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

Table 2. List of the 164 earthquakes.

Data No.	Origin time U T C Date	h	m	s	Geographic coordinates Latitude	Longitude	Region	Depth (km)	Magnitude (Mb)	(Ms)	Epicentral distance (degree)	Azimuth (degree)
1	01/11	21	07	29.7	54.779 N	161.656 E	Near East Coast of Kamchatka	43 D	5.8	4.9	150.736	91.026 SE
2	01/12	07	29	27.9	28.827 S	177.423 W	Kermadec Islands Region	15 D	6.1	6.4	78.596	32.551 SE
3	01/13	15	38	15.7	23.275 S	177.033 W	South of Fiji Islands	109 G	5.7		84.090	33.432 SE
4	01/15	08	40	23.9	20.789 S	175.993 W	Tonga Islands	214 D	6.2		86.725	33.019 SE
5	01/15	21	07	11.4	27.179 S	11.334 W	South Atlantic Ridge	10 G	5.4	5.4	51.088	117.432 SW
6	01/16	05	46	51.4	60.365 S	154.209 E	West of Macquarie Island	10 G	5.7	5.5	42.558	41.656 SE
7	01/19	03	25	21.1	4.241 N	124.640 E	Celebes Sea	335 D	5.7		92.176	96.144 SE
8	01/19	07	30	31.8	24.710 S	70.568 W	Near Coast of Northern Chile	33 N	6.3	6.7	73.911	62.566 SW
9	01/20	15	01	29.6	24.690 S	70.521 W	Near Coast of Northern Chile	33 *	5.3	5.1	73.914	62.615 SW
10	01/21	08	22	22.9	18.179 S	168.139 E	Vanuatu Islands	44 D	5.7	5.9	85.543	48.186 SE
11	01/22	00	35	58.0	19.847 S	133.803 E	Northern Territory, Australia	5 G	6.1	6.3	73.033	78.740 SE

12	01/22 03 57 25.2	19.798 S	133.910 E	Northern Territory, Australia	5	G	6.1	6.4	73.116	78.662 SE
13	01/22 12 04 57.8	19.829 S	133.882 E	Northern Territory, Australia	5	G	6.5	6.7	73.078	78.675 SE
14	01/25 07 15 53.4	10.584 S	78.083 W	Near Coast of Peru	53	D	5.6		89.608	60.522 SW
15	02/05 14 01 02.7	24.753 S	70.433 W	Near Coast of Northern Chile	37	D	6.2	6.7	73.827	62.670 SW
16	02/05 18 49 31.8	24.893 S	70.554 W	Near Coast of Northern Chile	31	D	6.0	6.1	73.735	62.511 SW
17	02/06 15 15 40.9	6.543 S	131.907 E	Tanimbar Islands Region	39	D	5.9	5.6	84.731	85.479 SE
18	02/06 18 03 54.7	17.756 S	66.958 W	Bolivia	285	D	6.0		79.238	68.318 SW
19	02/07 18 15 05.6	50.785 N	173.465 E	Aleutian Islands Region	33	N	6.2	6.0	151.717	74.129 SE
20	02/18 13 52 36.0	23.513 S	67.706 W	Chile-Argentina Border Region	142		5.7		74.102	65.548 SW
21	02/22 19 13 17.7	20.833 S	69.785 W	Northern Chile	70	D	5.9		77.289	64.666 SW
22	02/26 06 17 31.5	37.319 S	47.989 E	Atlantic-Indian Rise	10	G	6.1	6.7	31.896	167.303 SE
23	03/06 22 35 38.1	56.953 N	143.032 W	Gulf of Alaska	10	G	6.8	7.6	168.016	6.906 SE
24	03/09 04 42 52.6	4.662 S	131.137 E	Banda Sea	33	N	5.4	4.7	86.208	86.877 SE

25	03/09 21 33 53.7	17.327 S	74.154 W	Off Coast of Peru	32	D	6.0	5.9	81.992	61.934 SW
26	03/10 10 25 05.3	20.917 S	178.645 W	Fiji Islands Region	623	D	6.1		86.062	35.415 SE
27	03/12 00 44 14.8	32.714 S	178.975 W	South of Kermadec Islands	67		5.3		74.508	32.978 SE
28	03/12 08 38 49.2	54.711 N	161.607 E	Near East Coast of Kamchatka	20	*	5.7	4.5	150.665	90.985 SE
29	03/13 12 59 15.8	37.283 S	51.848 E	South Indian Ocean	10	G	5.7	5.9	32.305	161.576 SE
30	03/25 05 21 44.5	19.323 S	177.493 W	Fiji Islands Region	559	D	5.5		87.856	34.710 SE
31	03/25 17 20 53.1	31.336 S	67.822 W	San Juan Province, Argentina	26		5.3		66.857	62.412 SW
32	03/28 18 36 26.4	36.039 S	102.843 W	Southern Pacific Ocean	10	G	5.7	5.2	71.466	31.329 SW
33	03/30 23 50 56.9	24.926 S	70.461 W	Near Coast of Northern Chile	41	D	5.8	5.7	73.674	62.581 SW
34	04/01 14 26 40.6	18.782 S	177.853 W	Fiji Islands Region	573		5.7		88.309	35.161 SE
35	04/02 05 14 17.8	31.037 S	179.767 W	Kermadec Islands Region	333		5.0		75.981	34.060 SE
36	04/02 14 26 29.0	15.447 S	173.081 W	Tonga Islands	33	N	5.7	6.1	92.516	31.389 SE
37	04/03 01 33 05.8	49.917 N	78.945 E	Eastern Kazakh SSR	0	G	6.1		122.298	151.117 SE

38	04/03 14 27 09.0	4.687 N	94.419 E	Off West Coast of Northern Sumatera	30	D	5.9	5.7	82.493	124.742 SE
39	04/07 18 14 54.9	55.759 S	15.768 W	Southwestern Atlantic Ocean	10	G	5.3		27.577	90.060 SW
40	04/08 11 20 51.4	8.823 S	117.498 E	Sumbawa Islad Region	107	G	5.8		77.427	98.120 SE
41	04/11 22 36 25.0	21.460 S	179.336 W	Fiji Islands Region	619	D	5.6		85.388	35.922 SE
42	04/12 05 03 45.0	39.200 S	178.424 E	Off East Coast of Northern Island, New Zealand	21	D	5.6	4.7	67.705	33.459 SE
43	04/12 23 19 55.5	17.192 S	72.305 W	Near Coast of Peru	33	G	6.1	7.0	81.527	63.660 SW
44	04/13 00 39 31.1	17.256 S	72.518 W	Near Coast of Peru	16		5.9	6.2	81.535	63.445 SW
45	04/17 05 11 34.6	58.428 S	25.066 W	South Sandwich Islands Region	33	N	5.5	6.1	28.896	78.306 SW
46	04/19 20 48 51.7	1.886 N	127.279 E	Halmahera	75	G	5.7		90.926	92.837 SE
47	04/20 04 25 36.6	0.960 N	30.267 W	Central Mid-Atlantic Ridge	10	G	5.8	5.3	83.776	109.216 SW
48	04/23 04 13 37.9	30.851 S	177.999 W	Kermadec Islands	60	D	5.2		76.512	32.586 SE
49	04/28 22 41 08.8	18.029 S	178.457 W	Fiji Islands Region	629	D	5.3		88.917	35.886 SE
50	05/01 10 06 47.5	49.229 N	157.609 E	Kuril Islands Region	51	D	5.1		144.784	88.681 SE

51	05/01 23 06 33.5	55.897 S	27.672 W	South Sandwich Islands Region	138	D	5.9		31.735	79.460 SW
52	05/03 23 22 07.6	22.774 S	170.278 E	Loyalty Islands Region	11	G	5.9	5.8	81.691	44.958 SE
53	05/04 00 57 06.8	49.928 N	78.769 E	Eastern Kazakh SSR	0	G	6.1		122.278	151.250 SE
54	05/05 10 04 14.0	26.867 S	113.268 W	Easter Island Region	10	G	6.1	6.3	82.211	24.250 SW
55	05/05 17 39 20.2	29.418 S	71.656 W	Near Coast of Central Chile	54		5.4	5.2	69.852	59.855 SW
56	05/06 16 34 05.5	13.390 S	76.226 W	Near Coast of Peru	51	D	5.9		86.367	61.339 SW
57	05/06 19 14 57.1	32.986 S	178.750 W	South of Kermadec Islands	45	D	5.6	5.8	74.287	32.721 SE
58	05/09 12 22 03.7	29.907 S	177.860 W	Kermadec Islands	54	D	5.6		77.458	32.684 SE
59	05/11 17 27 58.3	11.125 S	116.274 E	South of Sumbawa Island	41	D	5.6	4.8	74.845	98.419 SE
60	05/20 03 19 54.1	17.473 S	69.470 W	Peru-Bolivia Border Region	125	D	5.5		80.338	66.138 SW
61	05/21 14 28 39.7	32.833 S	71.704 W	Near Coast of Central Chile	42		5.5	5.7	66.683	58.485 SW
62	05/23 00 28 04.8	28.439 S	68.634 W	La Rioja Province, Argentina	117	D	5.6		69.810	62.859 SW

63	05/30 21 11 11.3	7.501 S	128.325 E	Banda Sea	86	G	6.5		82.549	88.464 SE
64	06/02 13 00 00.0	37.260 N	116.441 W	Southern Nevada	0		5.4	4.2	145.773	35.084 SW
65	06/03 23 27 35.2	45.003 S	167.599 E	South Island, New Zealand	83	G	6.0		59.817	40.129 SE
66	06/05 18 22 48.3	15.397 S	167.578 E	Vanuatu Islands	110	G	6.0		88.059	49.492 SE
67	06/10 11 31 53.0	6.890 S	72.241 E	Chagos Archipelago Region	22	D	5.5	5.3	65.600	143.976 SE
68	06/16 15 42 30.9	31.965 S	67.181 W	San Juan Province, Argentina	134	D	4.8		66.070	62.706 SW
69	06/17 12 52 03.8	10.690 S	165.221 E	Santa Cruz Islands	48	*	5.6	5.5	91.904	53.048 SE
70	06/25 06 24 23.7	33.346 S	179.430 W	South of Kermadec Islands	53		5.4	5.1	73.804	33.209 SE
71	06/27 06 07 50.8	20.237 S	169.373 E	Vanuatu Islands	66	G	5.8		83.895	46.483 SE
72	06/28 16 40 19.0	56.432 S	147.147 E	West of Macquarie Island	10	G	5.7	5.9	44.179	49.153 SE
73	06/29 14 57 51.9	23.338 S	179.930 W	South of Fiji Islands	540		5.1		83.434	36.027 SE
74	07/02 10 01 28.8	14.278 S	167.180 E	Vanuatu Islands	143	G	5.9		89.022	50.179 SE
75	07/04 13 54 14.2	17.636 S	71.718 W	Near Coast of Peru	20	G	5.8	5.4	80.919	64.041 SW

76	07/05	20 32 07.2	5.964 S	148.780 E	New Britain Region	53 G	6.0	6.8	91.195	69.974 SE
77	07/07	15 05 30.0	37.252 N	116.377 W	Southern Nevada	0	5.6	4.3	145.752	35.168 SW
78	07/09	15 10 57.9	29.843 S	178.961 W	Kermadec Islands	262	5.5		77.304	33.652 SE
79	07/11	00 12 35.3	5.368 N	126.612 E	Mindanao, Philippine Islands	67	5.9		93.935	94.714 SE
80	07/16	08 34 17.7	7.342 S	120.190 E	Flores Sea	424	5.5		79.771	96.130 SE
81	07/16	16 55 00.5	27.285 S	176.758 W	Kermadec Islands Region	30 D	5.4	5.3	80.229	32.312 SE
82	07/18	02 30 29.3	22.068 S	69.961 W	Northern Chile	19	5.3	4.8	76.189	64.065 SW
83	07/19	01 00 19.6	19.576 S	175.038 W	Tonga Islands	137 G	6.1		88.097	32.393 SE
84	07/23	14 25 36.7	22.127 S	174.900 E	Loyalty Islands Region	19 G	5.9	6.4	83.450	40.979 SE
85	07/23	15 17 08.1	6.526 S	152.779 E	New Britain Region	17 G	6.7	6.7	92.002	66.040 SE
86	07/23	17 11 37.2	6.466 S	153.007 E	New Britain Region	28 D	5.6	5.5	92.133	65.846 SE
87	07/25	06 46 06.6	6.081 S	133.667 E	Aroe Islands Region	28 G	6.5	6.7	85.793	84.009 SE
88	07/27	21 55 09.6	13.112 S	167.051 E	Vanuatu Islands	172 G	5.9		90.104	50.633 SE
89	07/27	22 44 34.9	13.150 S	166.967 E	Vanuatu Islands	177 D	5.8		90.044	50.700 SE

90	07/28 17 12 33.3	22.062 S	65.716 W	Jujuy Province, Argentina	279	G	5.8		74.798	67.866 SW
91	07/30 16 26 23.9	33.119 S	83.820 E	Amsterdam-Naturaliste Ridge	10	G	5.3	5.1	43.454	121.853 SE
92	07/31 12 50 07.7	22.212 S	171.082 E	Loyalty Islands Region	56	G	5.8	6.3	82.435	44.393 SE
93	07/31 15 22 48.7	31.891 S	57.448 E	Atlantic-Indian Rise	10	G	5.8	5.9	38.371	155.203 SE
94	08/04 06 18 42.7	42.877 S	85.834 W	West Chile Rise	6	G	5.9	4.9	61.206	42.953 SW
95	08/04 17 16 45.3	33.720 S	179.791 W	South of kermadec Islands	10	G	5.5	5.0	73.369	33.421 SE
96	08/05 10 07 45.0	39.000 S	16.024 W	South Atlantic Ridge	10	G	5.4	4.9	41.825	105.896 SW
97	08/06 00 36 24.6	25.149 N	95.127 E	Burma-India Border Region	91	G	6.8	7.2	102.231	130.213 SE
98	08/06 06 26 55.6	7.136 S	151.057 E	New Britain Region	25	G	5.9	5.7	90.857	67.449 SE
99	08/06 09 03 21.9	36.461 N	71.043 E	Afghanistan-USSR Border Region	195	G	6.1		107.887	153.835 SE
100	08/06 13 55 31.3	34.166 S	179.098 E	South of Kermadec Islands	268	?	4.7		72.714	34.244 SE
101	08/09 01 56 31.5	44.769 S	35.379 E	Prince Edward Islands Region	30	D	5.1	5.1	24.208	172.692 SW

102	08/10 04 38 26.1	10.366 S	160.819 E	Solomon Islands	34	G	6.1	7.4	90.911	57.274 SE
103	08/10 11 46 46.6	28.194 S	112.648 W	Easter Island Region	10	G	5.9	5.9	80.810	24.572 SW
104	08/10 13 11 19.4	14.880 S	167.293 E	Vanuatu Islands	125	G	6.2		88.477	49.903 SE
105	08/11 13 29 20.6	18.062 S	65.418 E	Mascarene Islands Region	10	G	5.5	5.6	53.304	148.900 SE
106	08/14 10 56 57.5	54.618 N	152.678 E	Sea of Okhotsk	645	D	5.4		147.389	98.749 SE
107	08/14 17 53 09.7	27.260 S	71.092 W	Near Coast of Northern Chile	33	G	5.7	6.5	71.692	61.161 SW
108	08/14 20 03 03.9	39.128 N	110.869 W	Utah	10		5.5		146.289	43.559 SW
109	08/15 09 59 24.0	8.757 N	126.341 E	Mindanao, Philippine Islands	52	D	5.6		96.997	96.197 SE
110	08/17 01 59 07.7	7.698 S	107.150 E	Java	27	D	6.1	5.8	74.855	108.397 SE
111	08/17 11 34 52.2	27.001 S	70.948 W	Near Coast of Northern Chile	39	D	5.5	5.7	71.888	61.384 SW
112	08/17 17 00 00.0	37.297 N	116.307 W	Southern Nevada	0		5.5	4.2	145.781	35.285 SW
113	08/19 18 28 18.9	60.893 S	23.382 W	South Sandwich Islands Region	15	D	5.6	5.4	26.534	75.927 SW
114	08/20 23 09 09.5	26.755 N	86.616 E	Nepal-India Border Region	57	G	6.4	6.6	101.573	138.174 SE

115	08/21 13 51 42.8	42.903 S	85.773 W	West Chile Rise	10 G	5.9	5.4	61.166	42.991	SW
116	08/23 19 53 40.2	2.505 S	138.929 E	West Irian	54 D	5.4		91.010	80.388	SE
117	08/27 16 30 16.9	15.864 S	172.067 W	Samoa Islands Region	28 G	6.0	5.4	92.294	30.350	SE
118	09/09 16 59 19.3	52.583 S	26.441 E	South of Africa	10 G	5.1	4.9	17.431	152.517	SW
119	09/09 23 07 47.7	7.157 S	81.547 W	Off Coast of Northern Peru	36 D	5.6	4.8	93.937	58.348	SW
120	09/14 22 14 07.5	23.424 S	67.997 W	Chile-Argentina Border Region	123 G	5.7		74.281	65.322	SW
121	09/20 14 44 22.0	31.542 S	179.600 W	Kermadec Islands Region	188 D	5.4		75.523	33.795	SE
122	09/25 07 01 14.1	7.455 S	109.418 E	Java	151	5.3		75.863	106.304	SE
123	09/30 03 23 47.2	19.560 S	68.921 W	Chile-Bolivia Border Region	112 D	5.3		78.200	65.898	SW
124	09/30 08 27 53.5	7.406 S	128.371 E	Banda Sea	146 D	5.5		82.654	88.456	SE
125	09/30 21 45 01.2	19.374 S	177.492 W	Fiji Islands Region	552 D	5.8		87.806	34.698	SE
126	10/01 09 43 24.5	35.315 S	106.048 W	Easter Island Cordillera	10 G	5.6	5.7	72.751	28.831	SW
127	10/02 06 18 08.1	22.774 S	66.261 W	Jujuy Province, Argentina	238	4.9		74.315	67.113	SW

128	10/04 15 37 57.4	3.530 S	150.402 E	New Ireland Region	29	D	5.5	6.0	94.033	69.278 SE
129	10/05 01 00 06.9	14.776 S	167.335 E	Vanuatu Islands	149	D	5.4		88.588	49.893 SE
130	10/08 04 46 24.5	18.771 S	172.415 W	Tonga Islands Region	35	G	6.6	6.8	89.377	30.123 SE
131	10/10 18 20 25.0	28.644 S	177.553 W	Kermadec Islands Region	28	G	6.5	6.0	78.749	32.705 SE
132	10/13 14 00 00.0	37.089 N	116.049 W	Southern Nevada	0		5.9	4.4	145.526	35.540 SW
133	10/14 19 11 40.9	23.208 S	68.178 W	Northern Chile	97		5.3		74.542	65.241 SW
134	10/22 16 04 13.3	49.044 N	156.096 E	Kuril Islands	50	D	5.6	5.3	144.085	89.927 SE
135	10/23 06 37 44.5	49.100 N	156.122 E	Kuril Islands	30	D	5.6	5.6	144.141	89.955 SE
136	10/24 11 48 49.7	49.126 N	156.260 E	Kuril Islands	48	D	5.6	5.3	144.212	89.851 SE
137	10/27 15 07 17.5	7.381 S	120.295 E	Flores Sea	596		5.5		79.772	96.017 SE
138	11/01 22 31 09.3	57.293 S	25.135 W	South Sandwich Islands Region	33	N	5.9	6.1	29.768	79.791 SW
139	11/03 05 41 46.2	62.010 S	164.872 E	Balleny Islands Region	10	G	5.2	5.1	43.444	33.859 SE
140	11/05 12 15 51.4	21.990 S	170.139 E	Loyalty Islands Region	42	D	5.5	5.8	82.409	45.302 SE
141	11/06 13 03 19.3	22.789 N	99.611 E	Burma-China Border Region	18	G	6.1	7.3	101.263	125.486 SE

142	11/07	03 47 40.2	31.259 S	177.794 W	Kermadec Islands Region	33	N	5.2	76.154	32.315 SE
143	11/07	23 15 41.7	1.533 N	126.357 E	Molucca Passage	66	D	6.2	90.265	93.570 SE
144	11/13	02 37 15.2	0.239 S	122.949 E	Minahassa Peninsula	104	D	5.5	87.388	96.115 SE
145	11/14	02 15 39.1	3.527 S	150.120 E	New Ireland Region	33	N	5.9 6.6	93.941	69.544 SE
146	11/16	05 53 20.2	21.768 S	179.426 W	Fiji Islands Region	582	G	5.8	85.069	35.933 SE
147	11/17	00 59 50.1	55.572 N	161.766 E	Near East Coast of kamchatka	33	*	5.6 4.5	151.391	91.959 SE
148	11/18	19 38 54.6	6.125 S	149.785 E	New Britain Region	61	G	5.8 6.4	91.383	68.979 SE
149	11/20	09 11 09.7	47.766 S	99.723 E	Southeast Indian Rise	10	G	5.6 5.9	35.778	94.462 SE
150	11/20	15 19 19.9	5.171 S	153.826 E	New Ireland Region	91		5.6	93.625	65.503 SE
151	11/23	02 08 50.0	52.668 S	27.478 E	South of Africa	10	G	4.7	17.183	154.482 SW
152	11/23	09 27 07.4	19.766 S	177.973 W	Fiji Islands Region	595	D	5.6	87.324	35.055 SE
153	11/25	08 35 41.7	47.897 S	99.455 E	Southeast Indian Rise	10	G	5.5 6.2	35.571	94.602 SE
154	11/28	00 31 22.9	21.316 S	68.408 W	Chile-Bolivia Region	122	D	5.2	76.387	65.728 SW
155	11/30	08 55 30.6	61.348 N	152.270 W	Southern Alaska	144		5.5	170.998	39.041 SE
156	12/05	16 05 32.7	15.259 S	173.525 W	Tonga Islands	40	G	6.0 6.3	92.616	31.846 SE

157	12/07 07 41 24.2	40.987 N	44.185 E	Turkey-USSR Border Region	5	G	6.2	6.8	109.920	176.314 SE
158	12/09 07 49 25.7	59.873 S	25.983 W	South Sandwich Islands Region	33	N	5.5	5.6	28.164	75.517 SW
159	12/10 07 30 59.3	58.076 S	10.401 W	Southwestern Atlantic Ocean	10	G	5.4	5.2	23.903	91.597 SW
160	12/16 09 57 16.5	29.790 S	177.915 W	Kermadec Islands	31	G	6.1	6.2	77.562	32.758 SE
161	12/17 00 58 15.3	26.902 S	167.475 E	New Caledonia Region	33	N	5.6	5.3	77.011	46.248 SE
162	12/20 14 27 59.9	27.914 S	176.613 W	Kermadec Islands Region	36	D	5.3	5.2	79.643	32.046 SE
163	12/24 04 26 54.5	23.522 S	66.666 W	Jujuy Province, Argentina	194		5.7		73.752	66.471 SW
164	12/24 10 39 40.3	27.434 S	63.156 W	Santiago Del Estero Province, Argentina	581		5.5		68.948	68.060 SW

APPENDIX

#-2

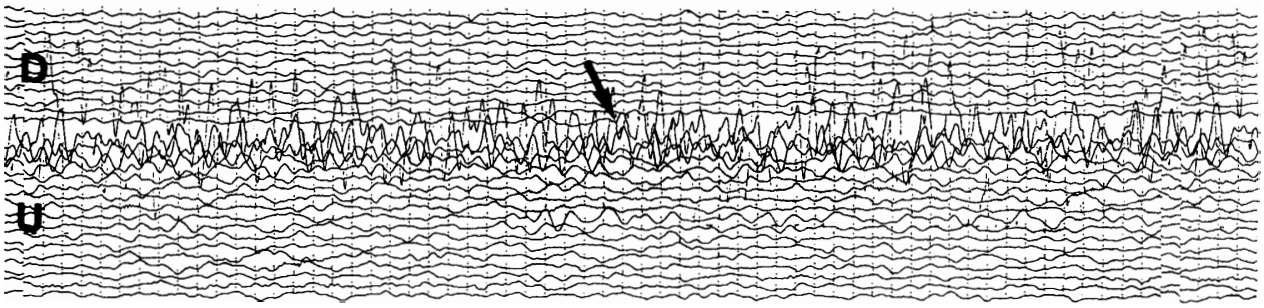
JAN. 12 07h29m27.9s

28.827 S 177.423 W 15 km Mb 6.1 Ms 6.4

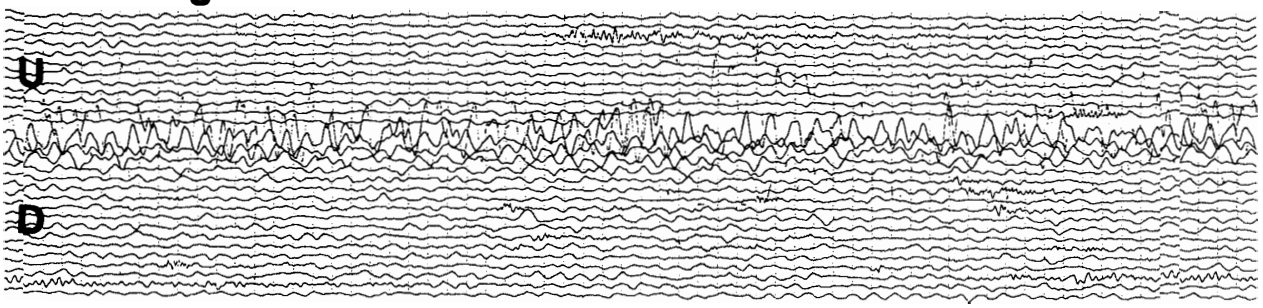
Kermadec Islands Region

SP

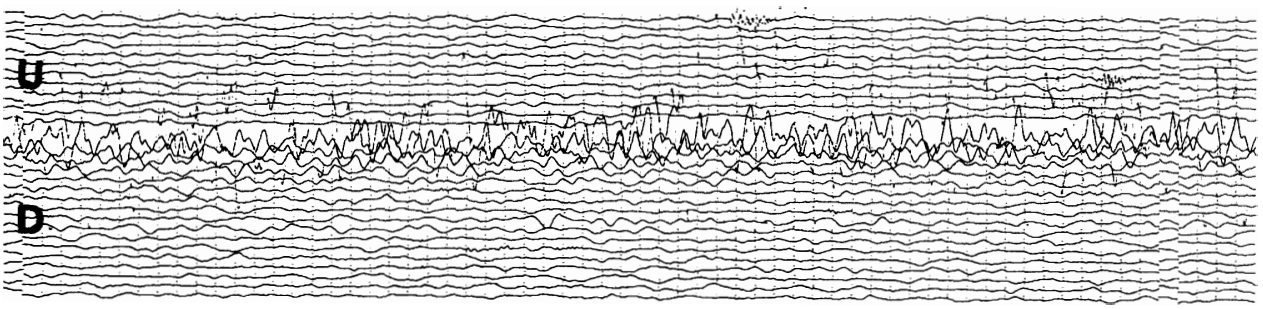
Syowa

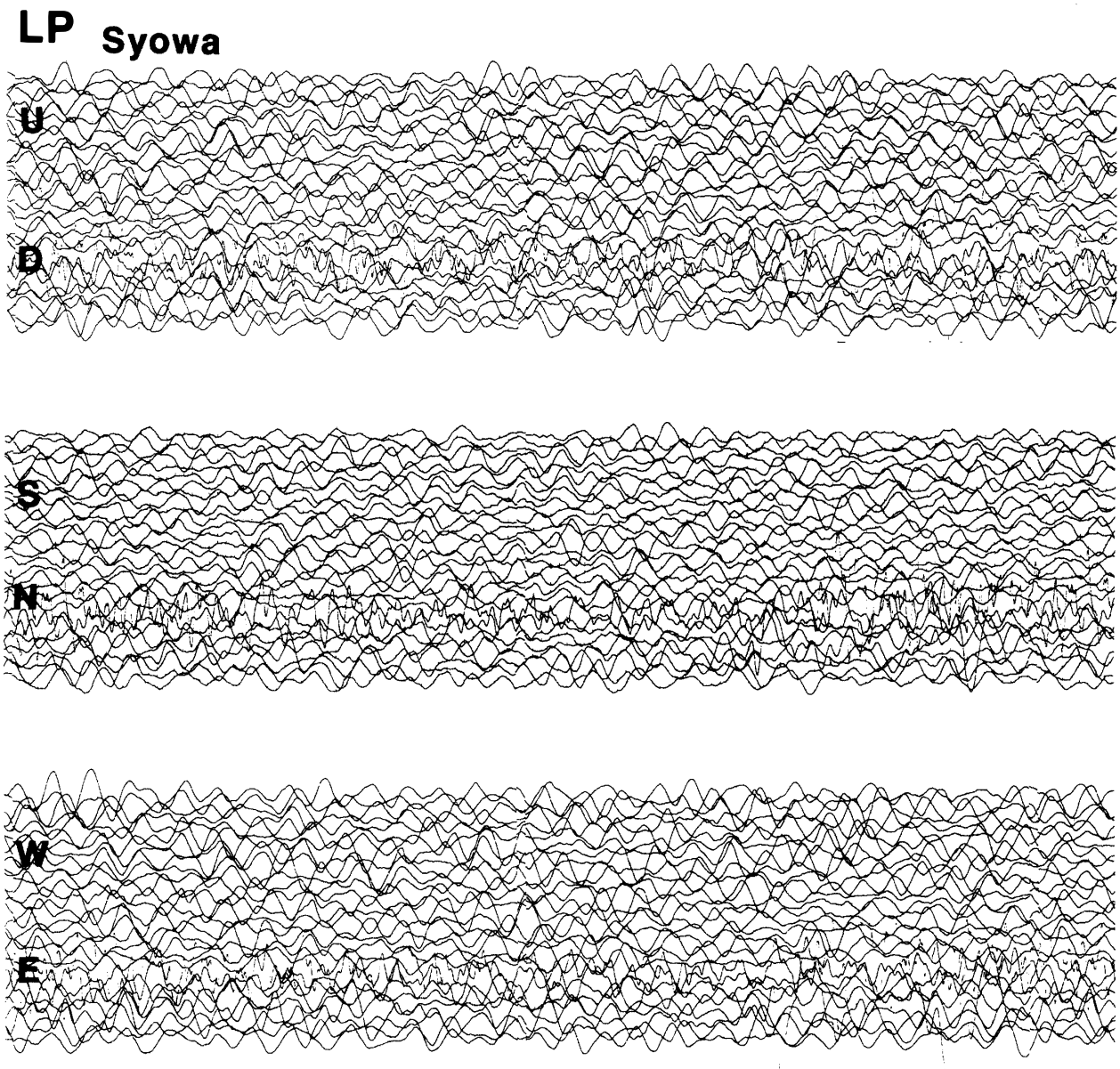


Langhovde



Tottuki Pt.




LP Syowa
U
D
S
N
W
E

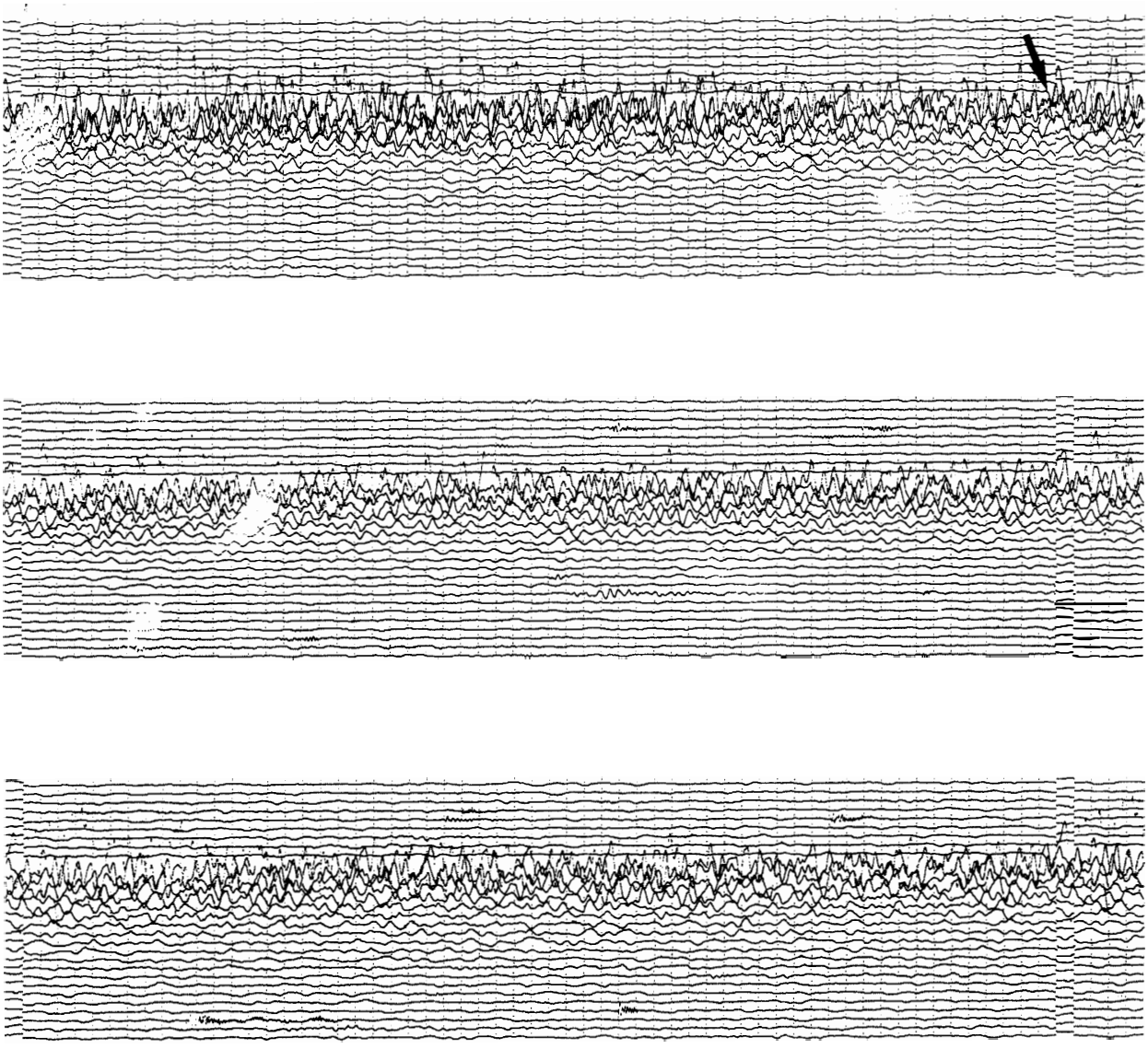
#-12

JAN. 22 03h57m25.2s

19.798 S 133.910 E 5 km Mb 6.1 Ms 6.4

Northern Territory, Australia

SP



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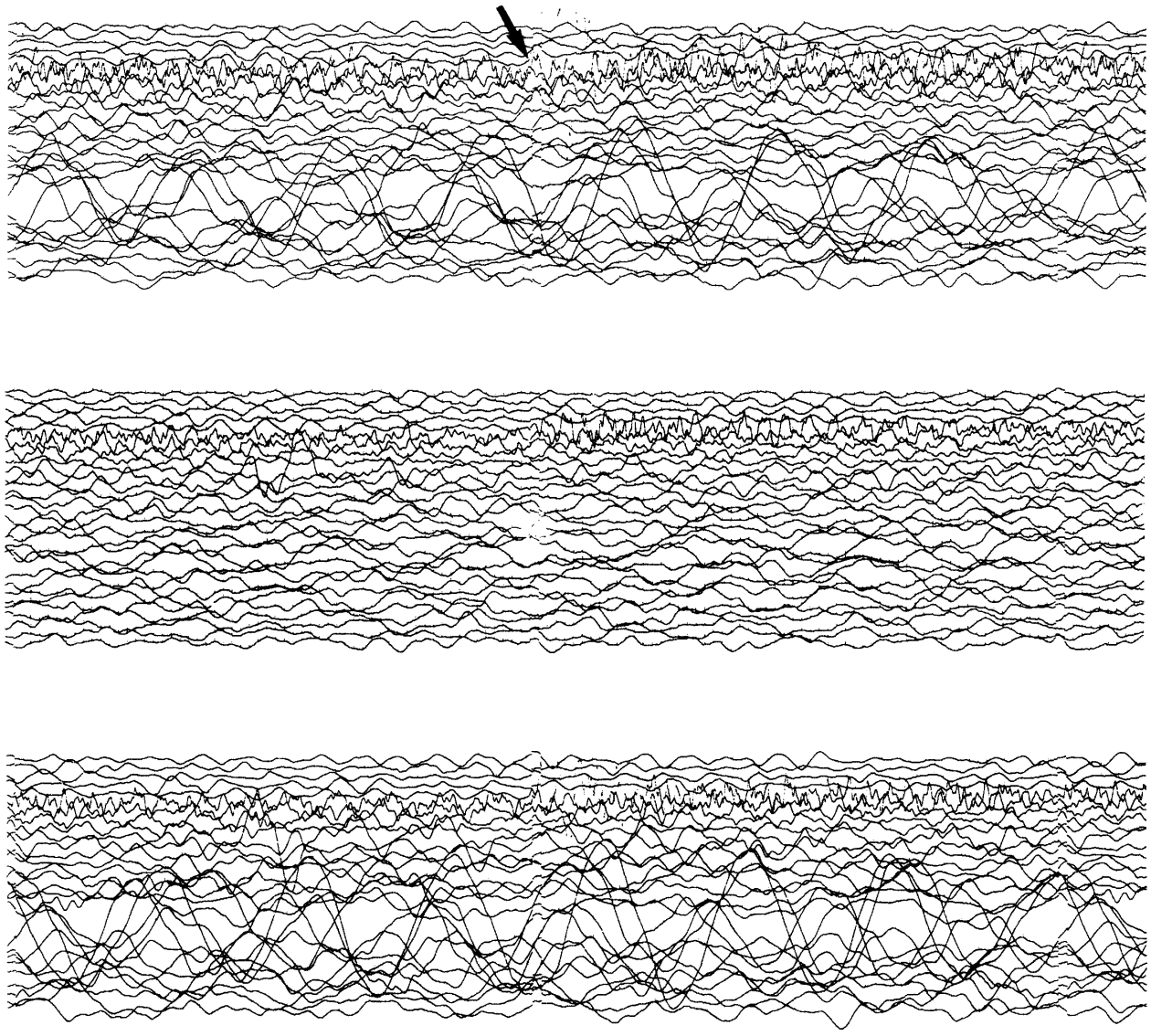

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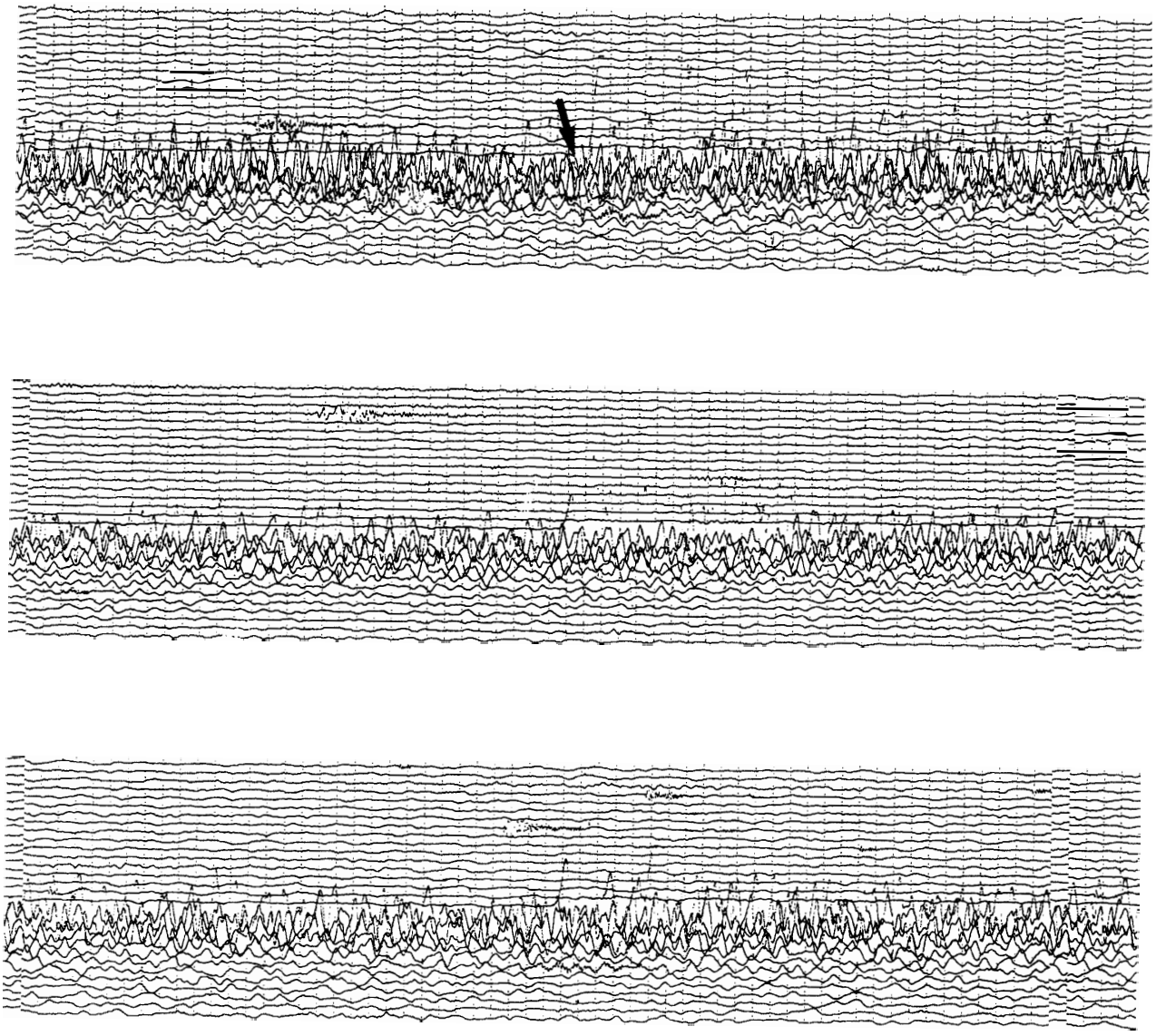
JAN. 22 12h04m57.8s

19.829 S 133.882 E 5 km Mb 6.5 Ms 6.7

Northern Territory, Australia

SP



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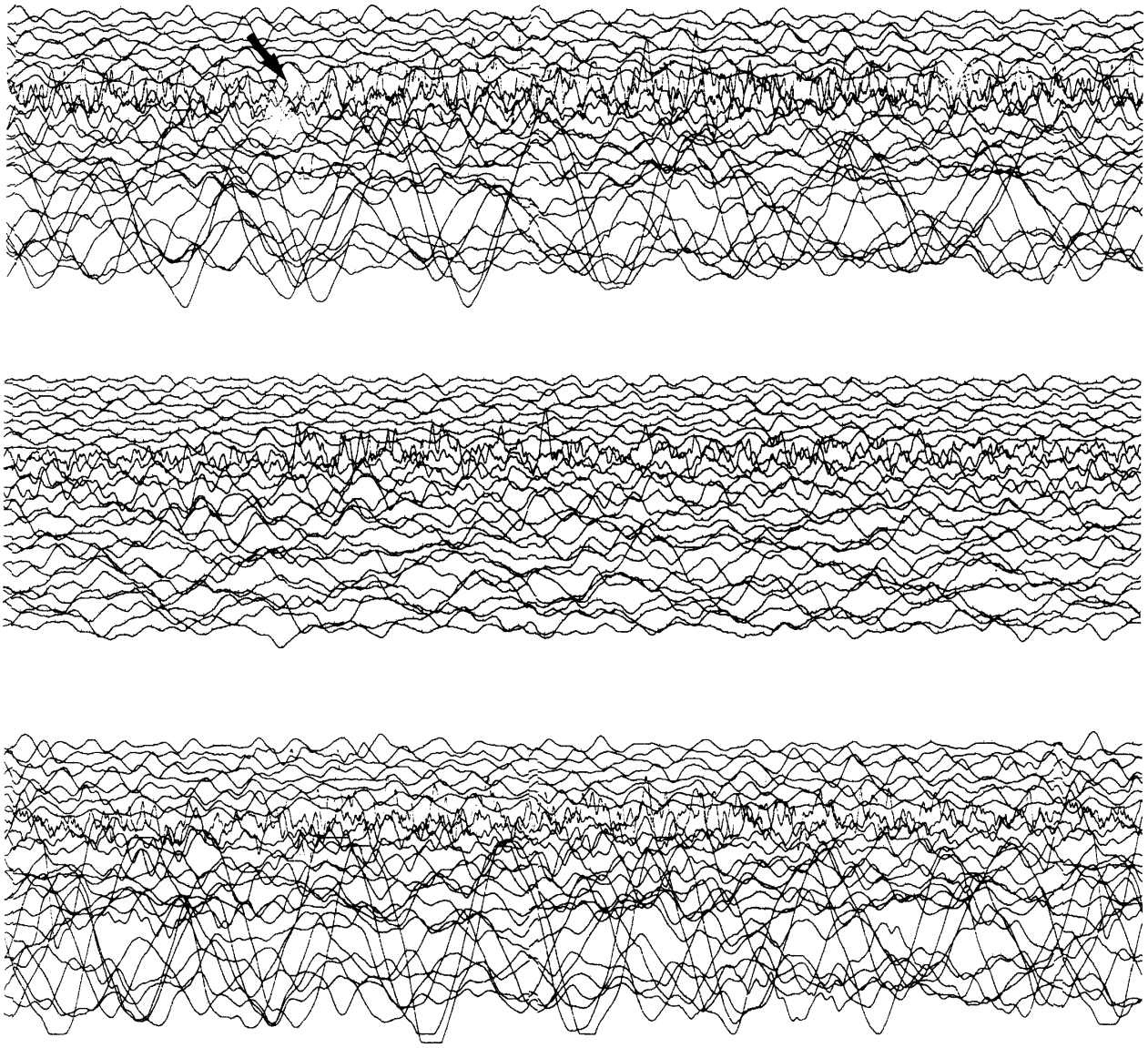


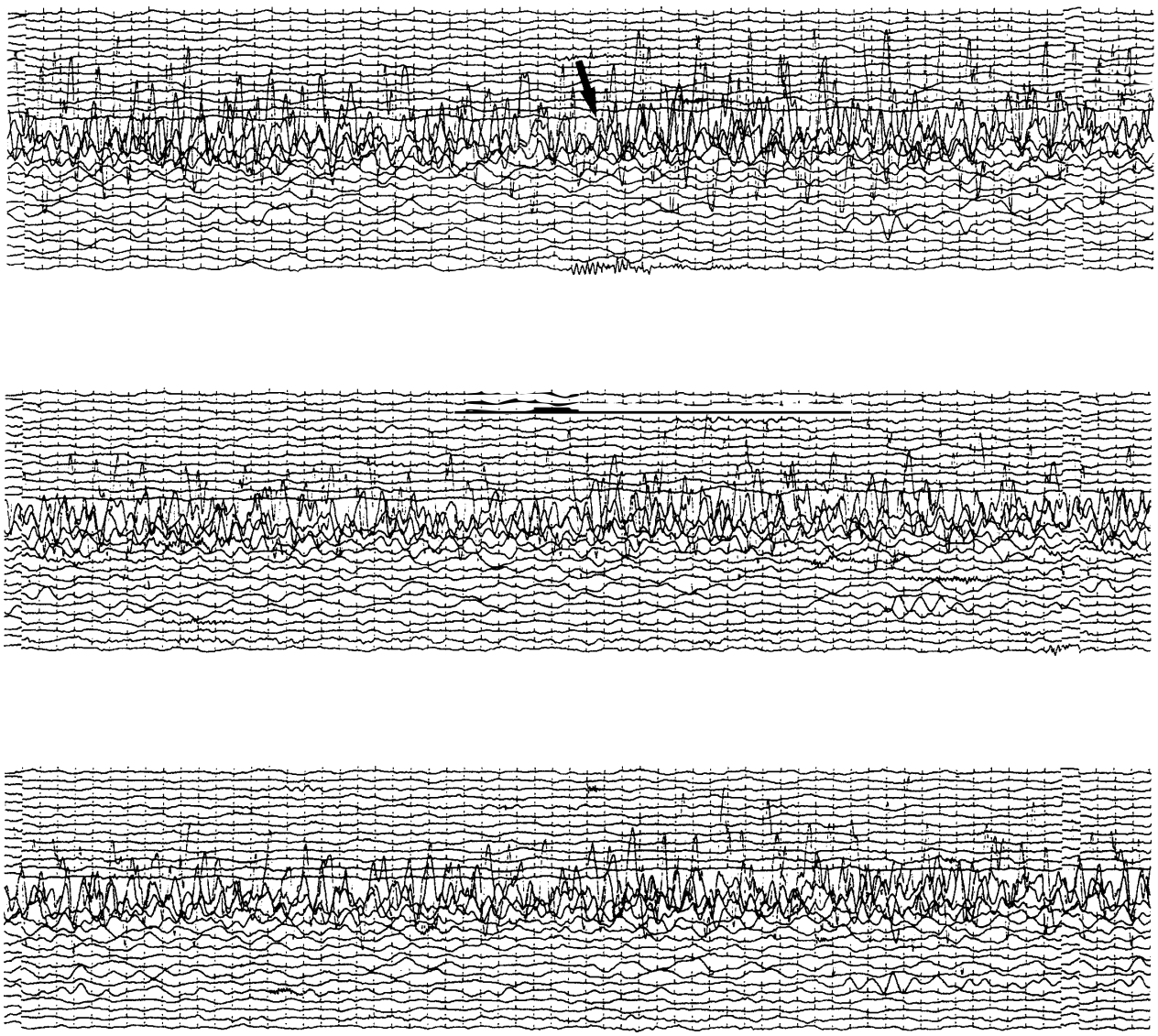
#-15

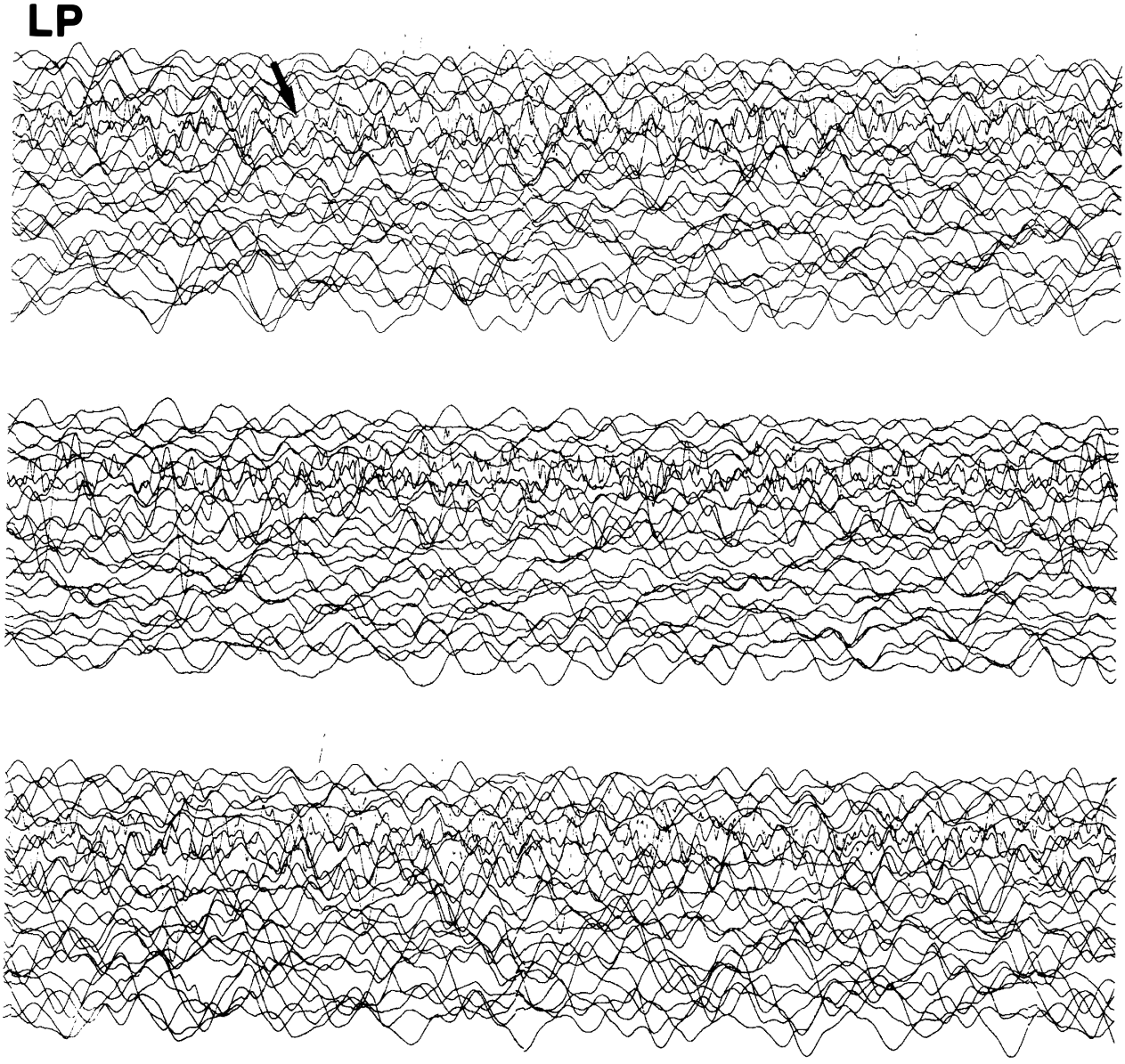
FEB. 5 14h01m02.7s

24.753 S 70.433 W 37 km Mb 6.2 Ms 6.7

Near Coast of Northern Chile

SP

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#-22

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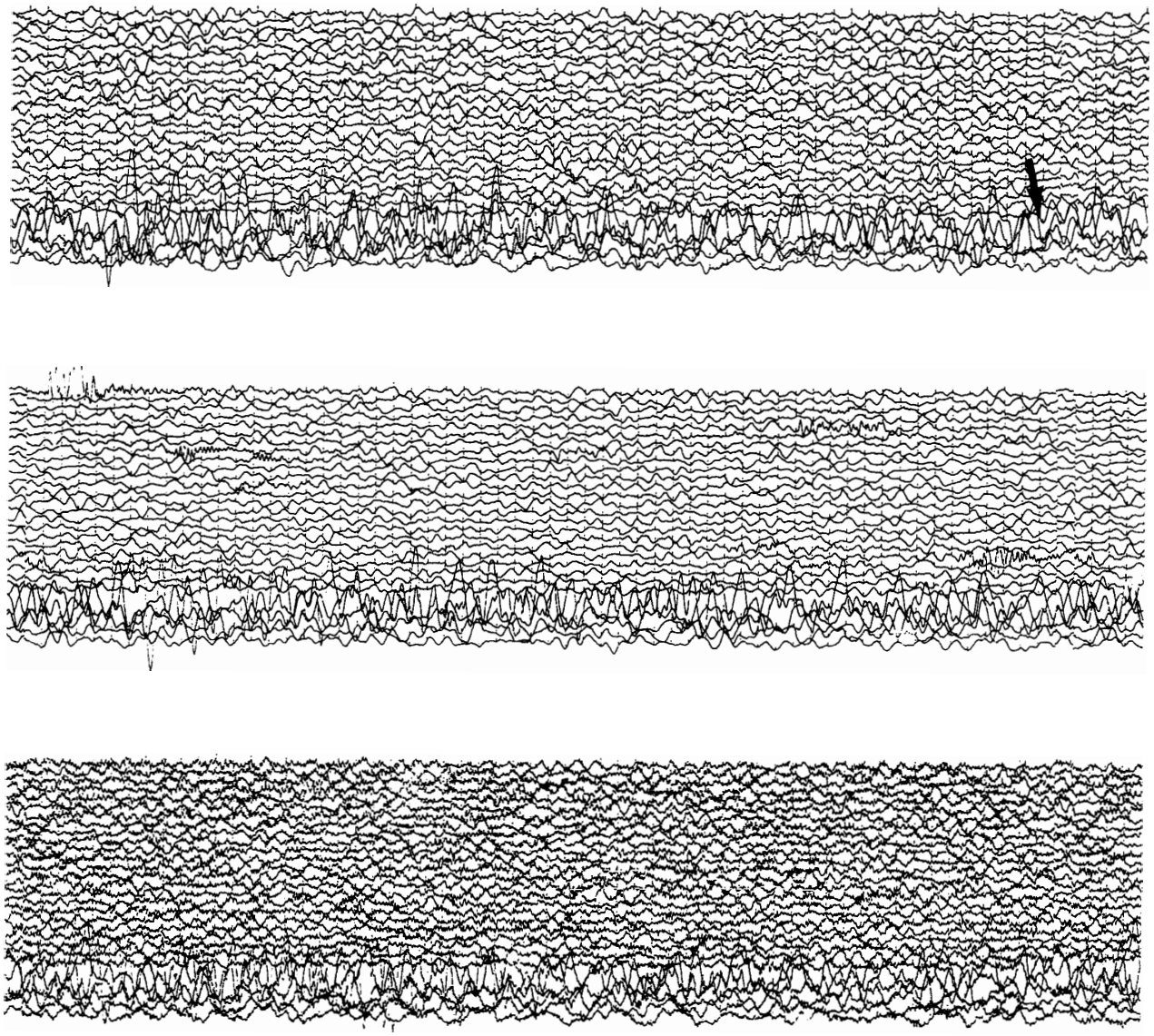
37.319 S 47.989 E 10 km Mb 6.1 Ms 6.7

Atlantic-Indian Rise

SP



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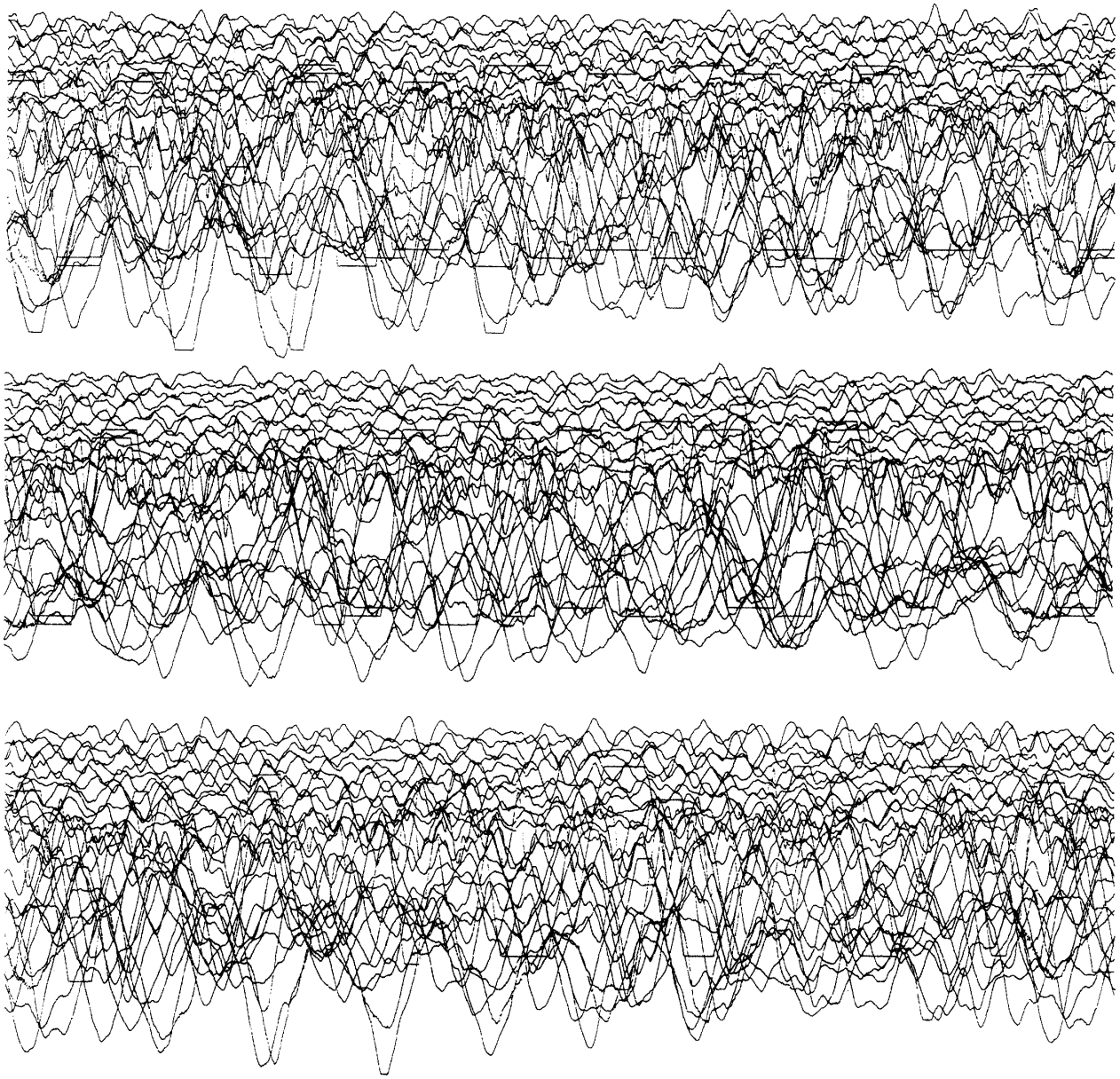

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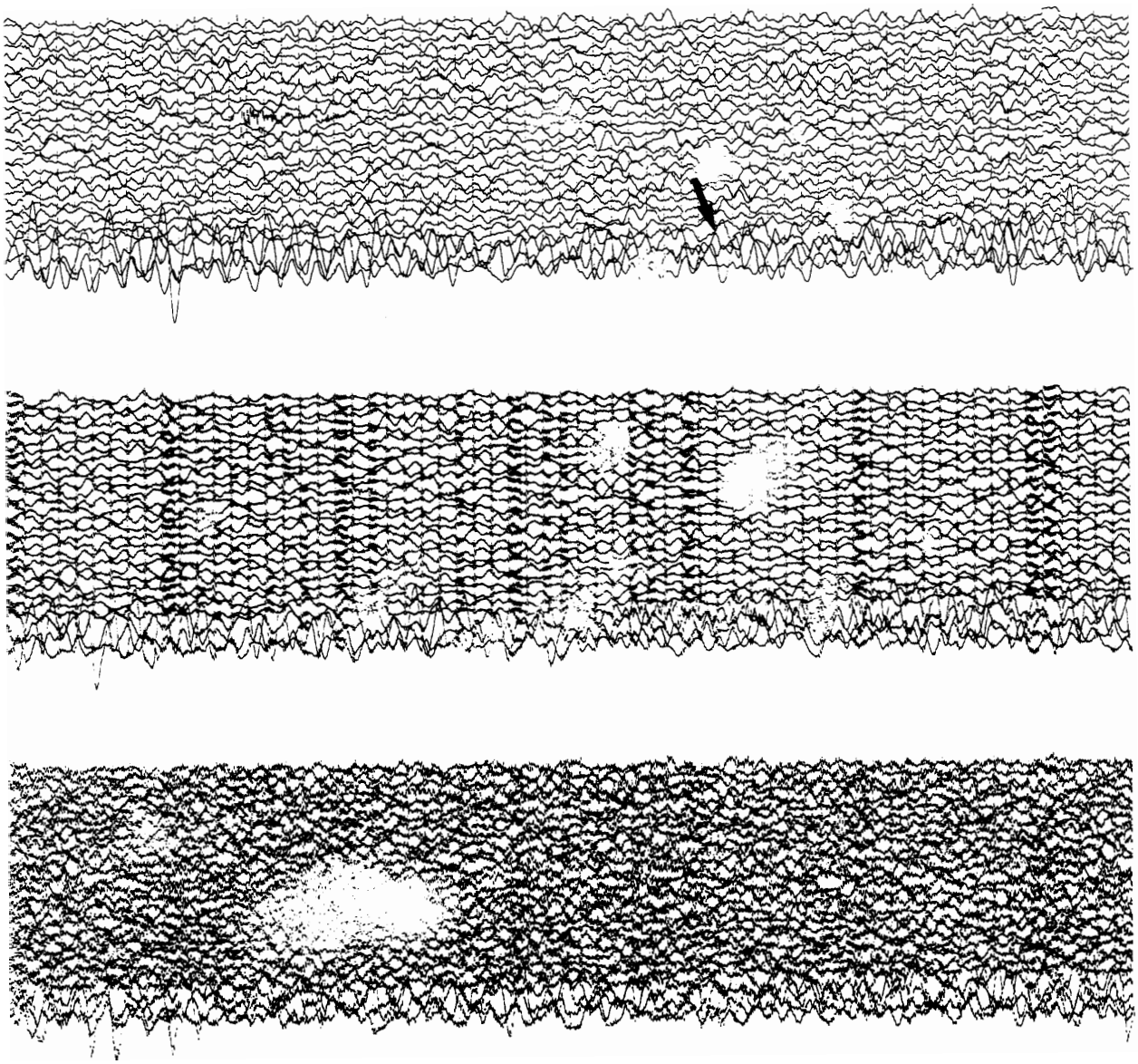
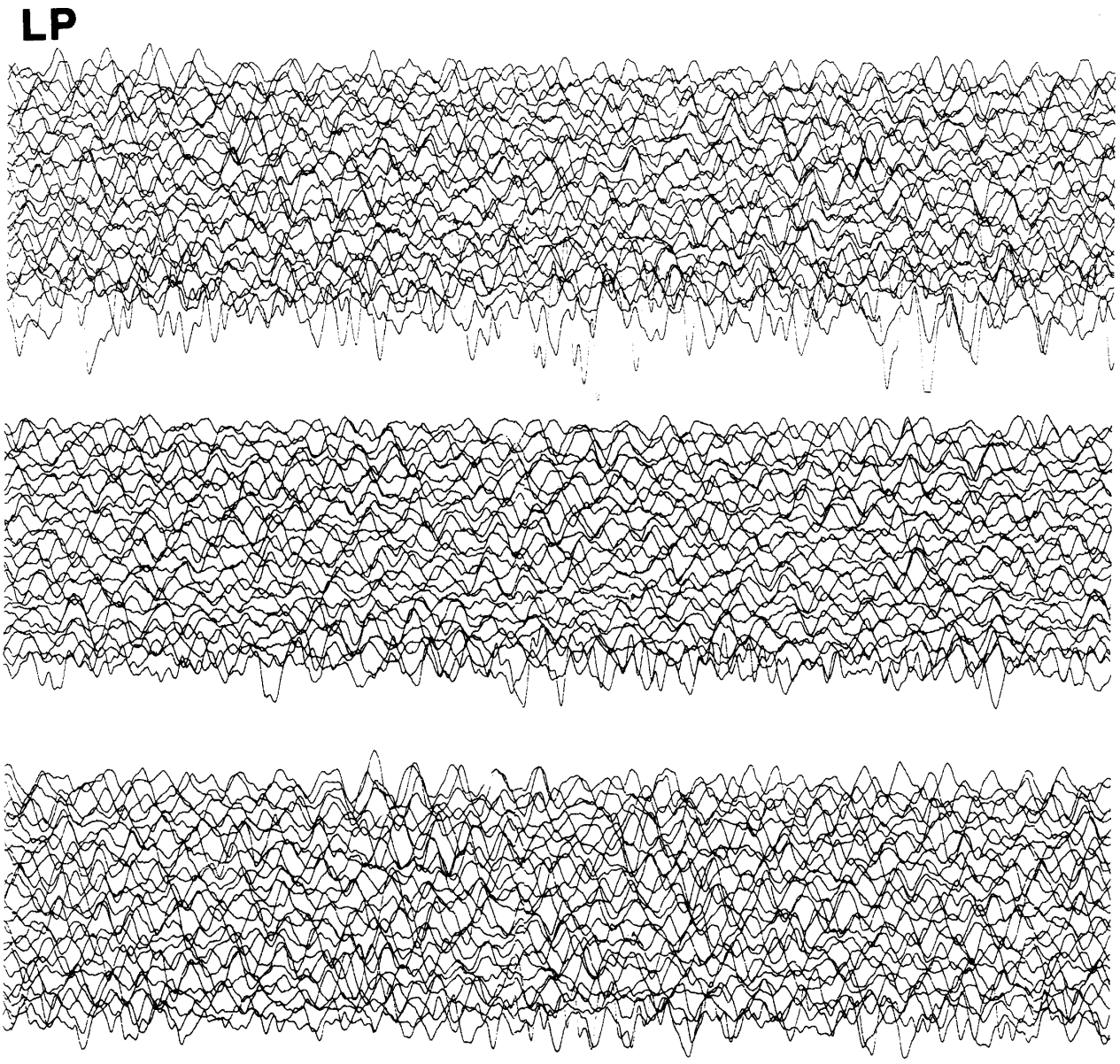
MAR. 6 22h35m38.1s

56.953 N 143.032 W 10 km Mb 6.8 Ms 7.6

Gulf of Alaska

SP

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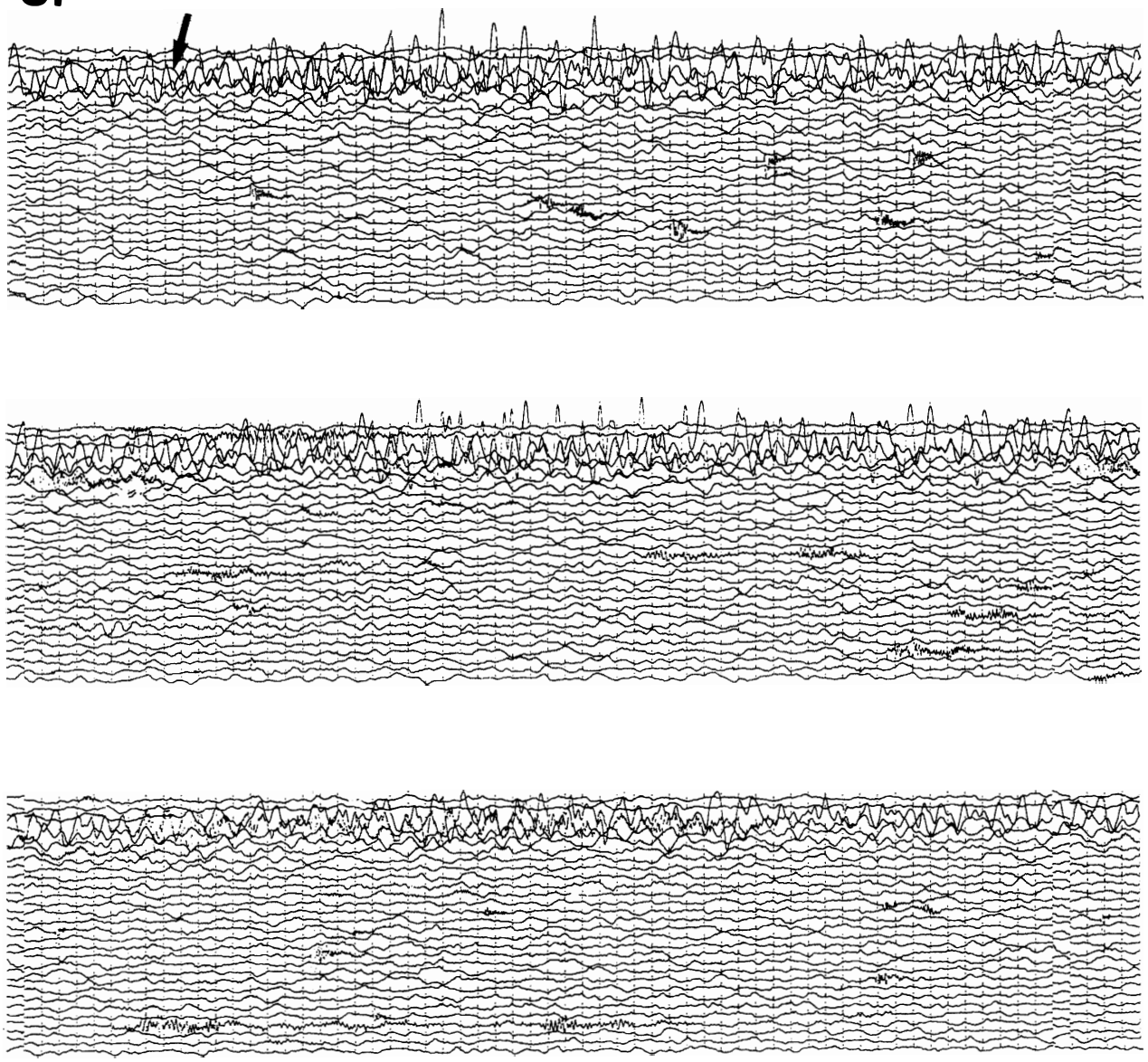
#-43

APR. 12 23h19m55.5s

17.192 S 72.305 W 33 km Mb 6.1 Ms 7.0

Near Coast of Peru

SP



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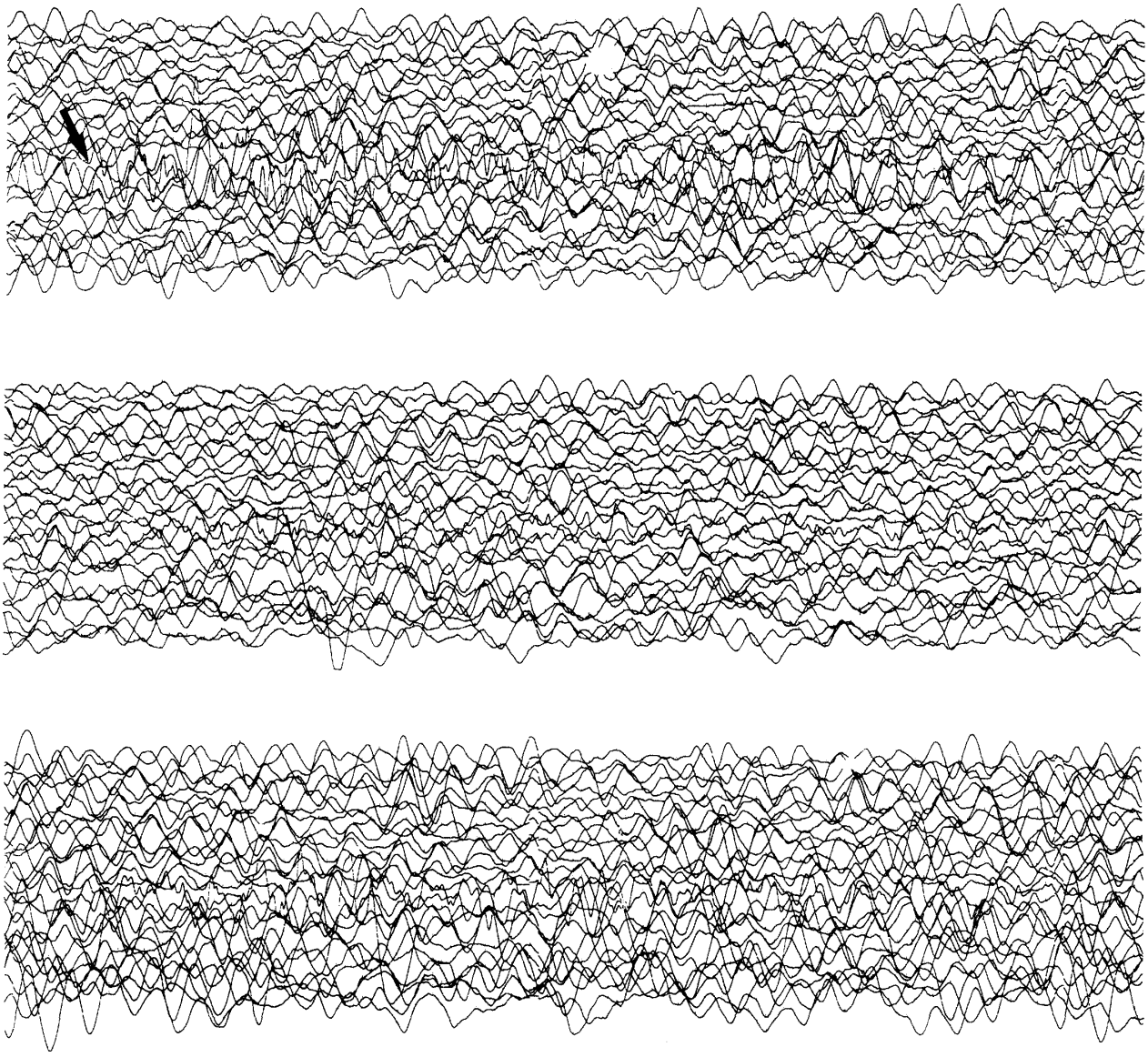


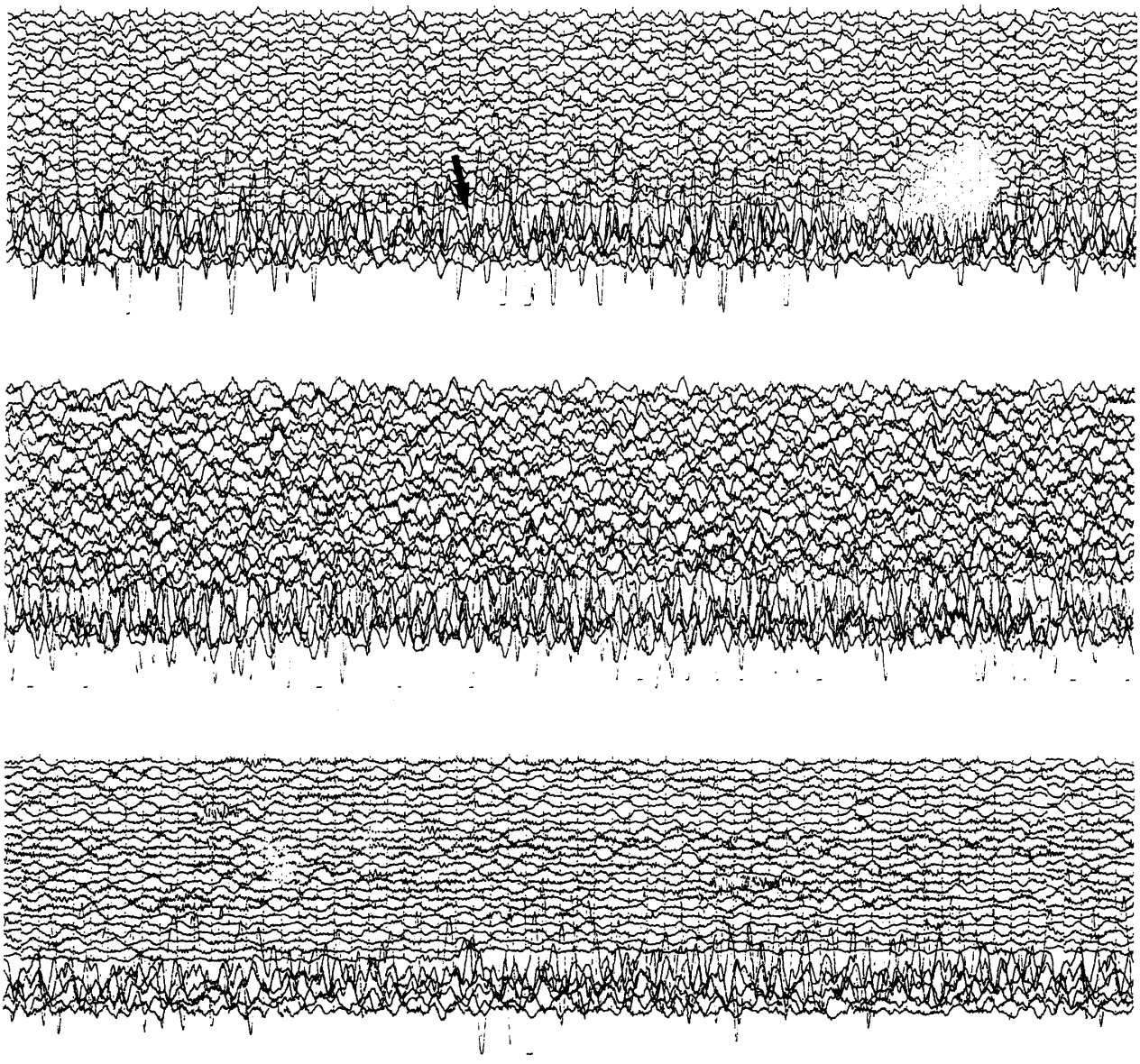
#-63

MAY 30 21h11m11.3s

7.501 S 128.325 E 86 km Mb 6.5

Banda Sea

SP



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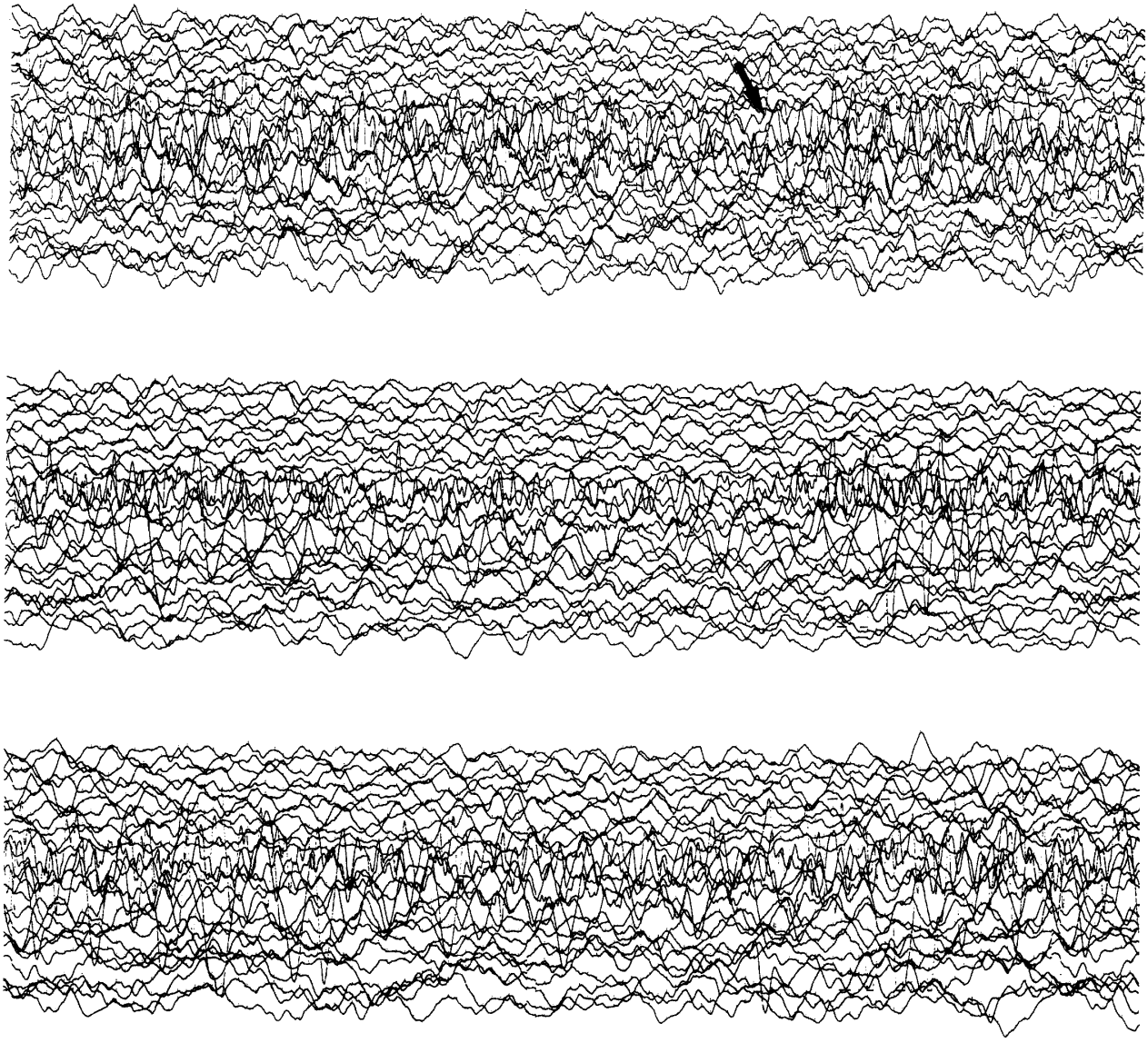

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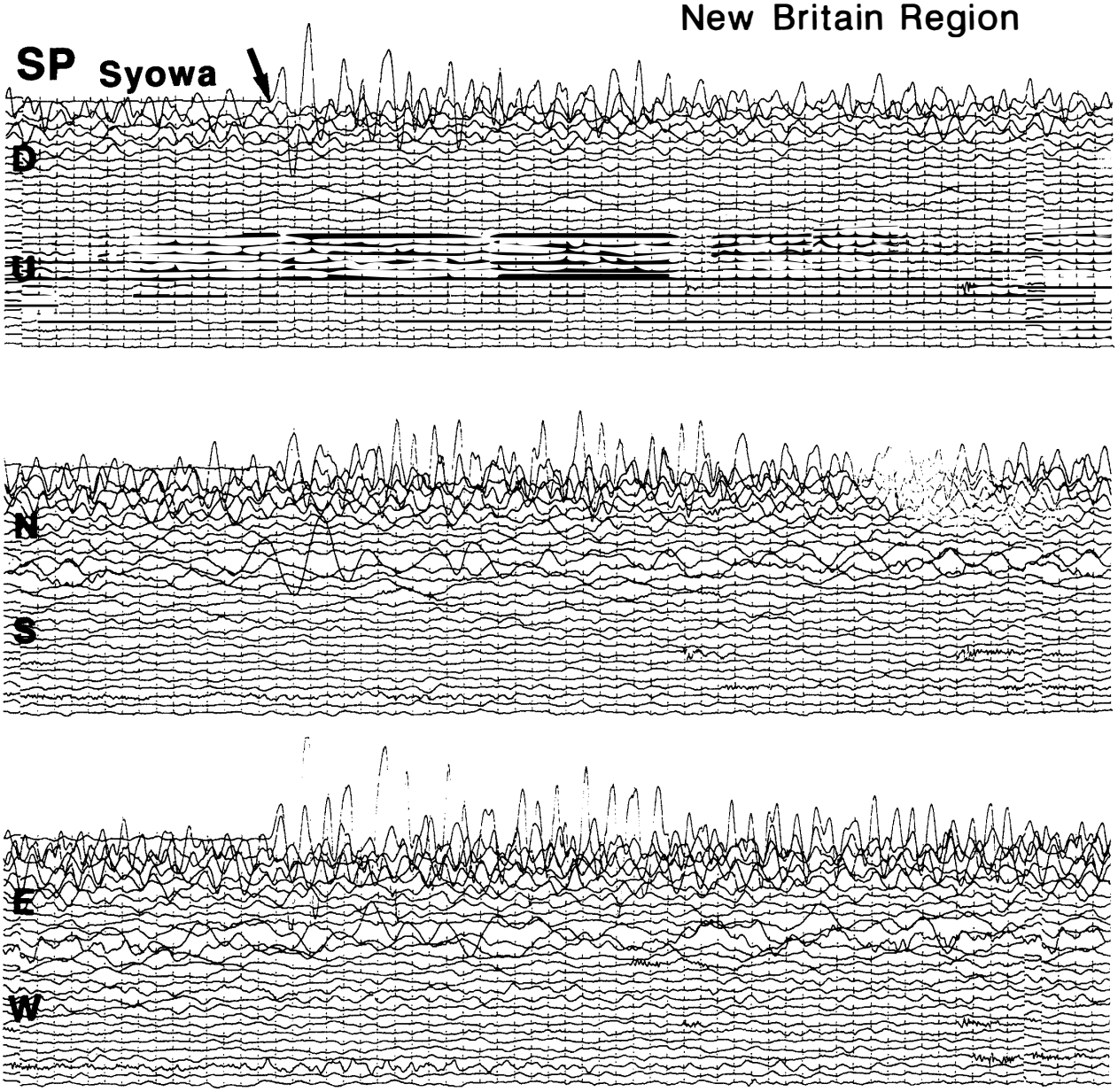
JULY 23 15h17m08.1s

6.526 S l52.779 E 17 km Mb 6.7 Ms 6.7

New Britain Region



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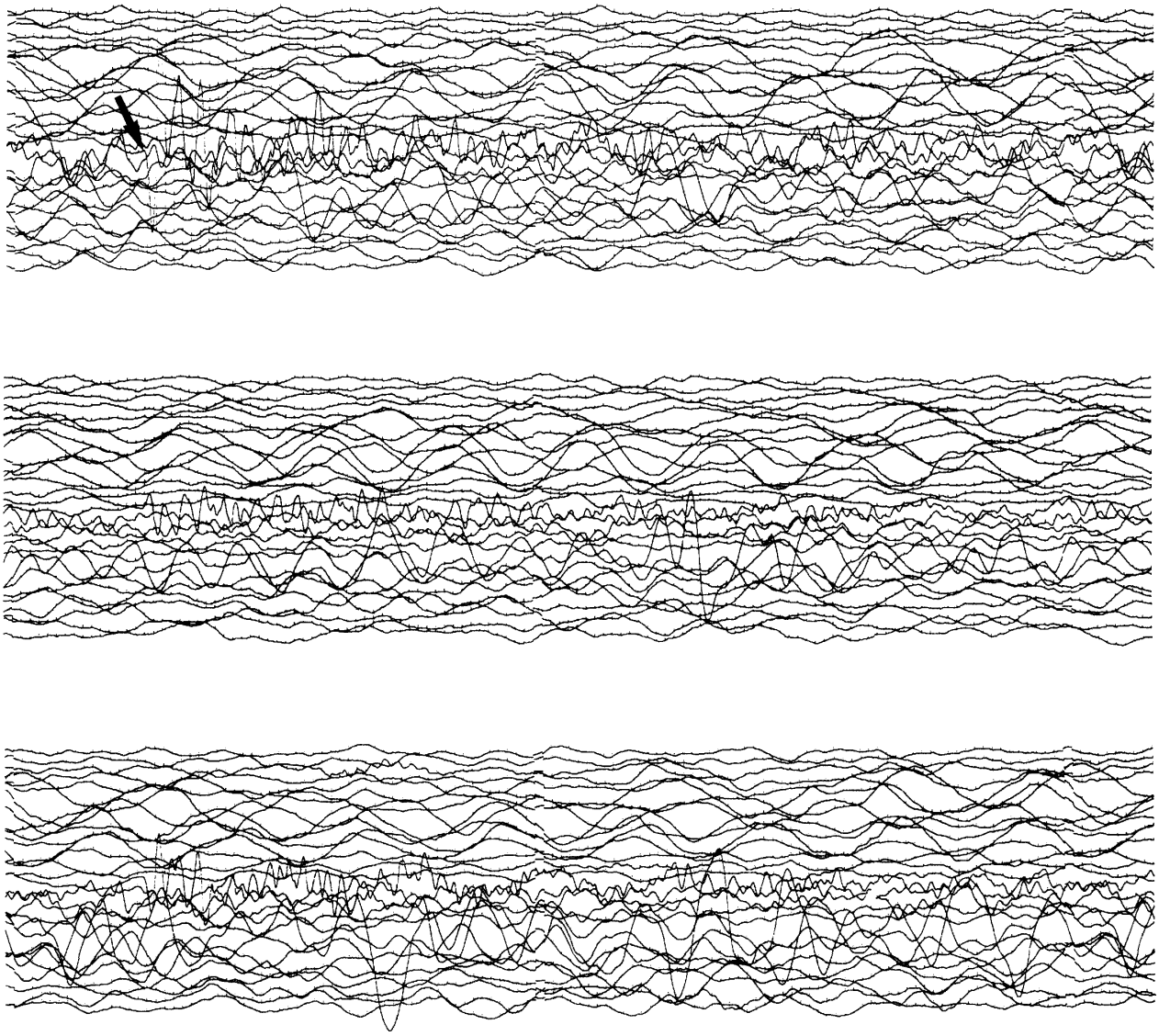

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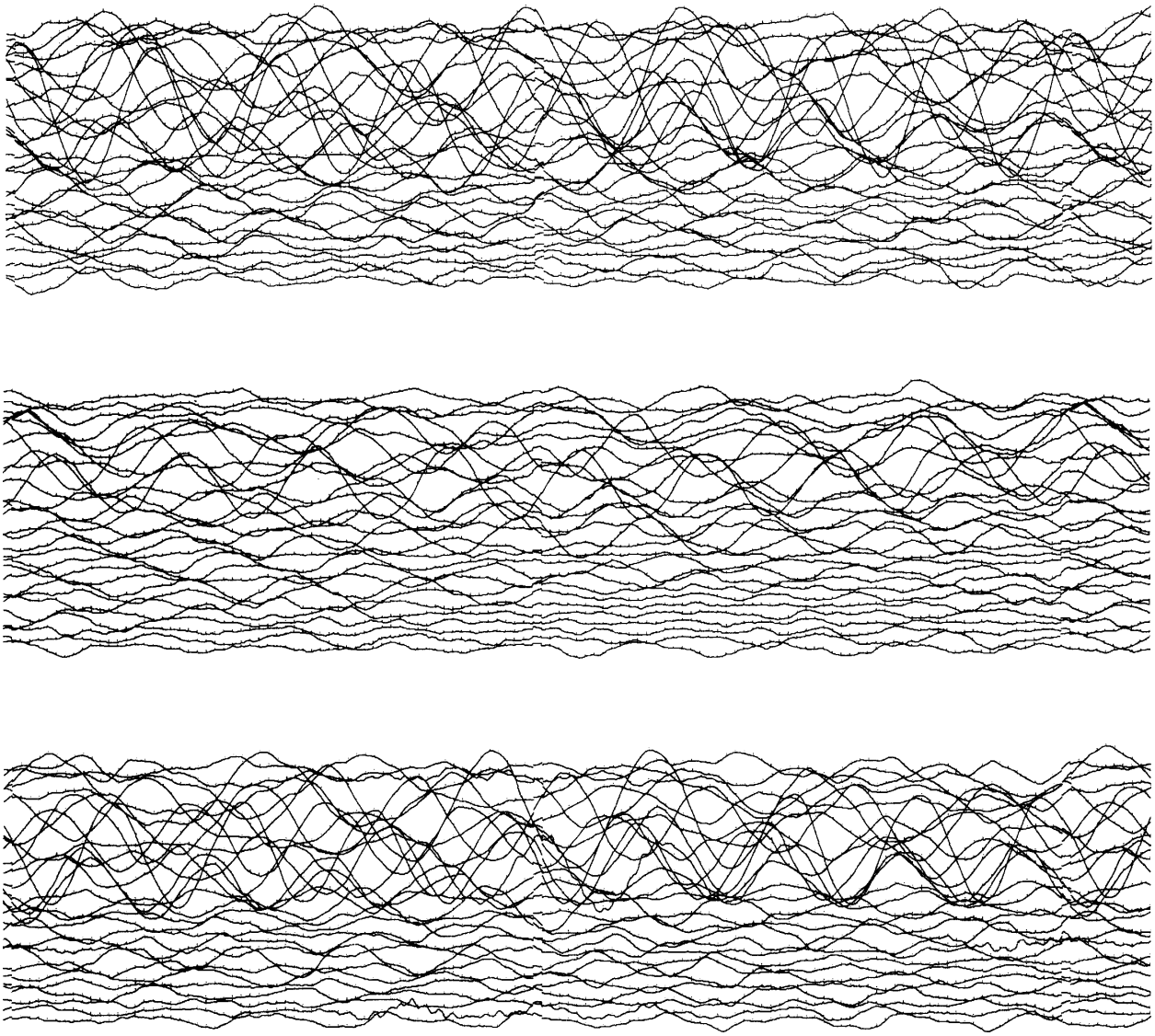

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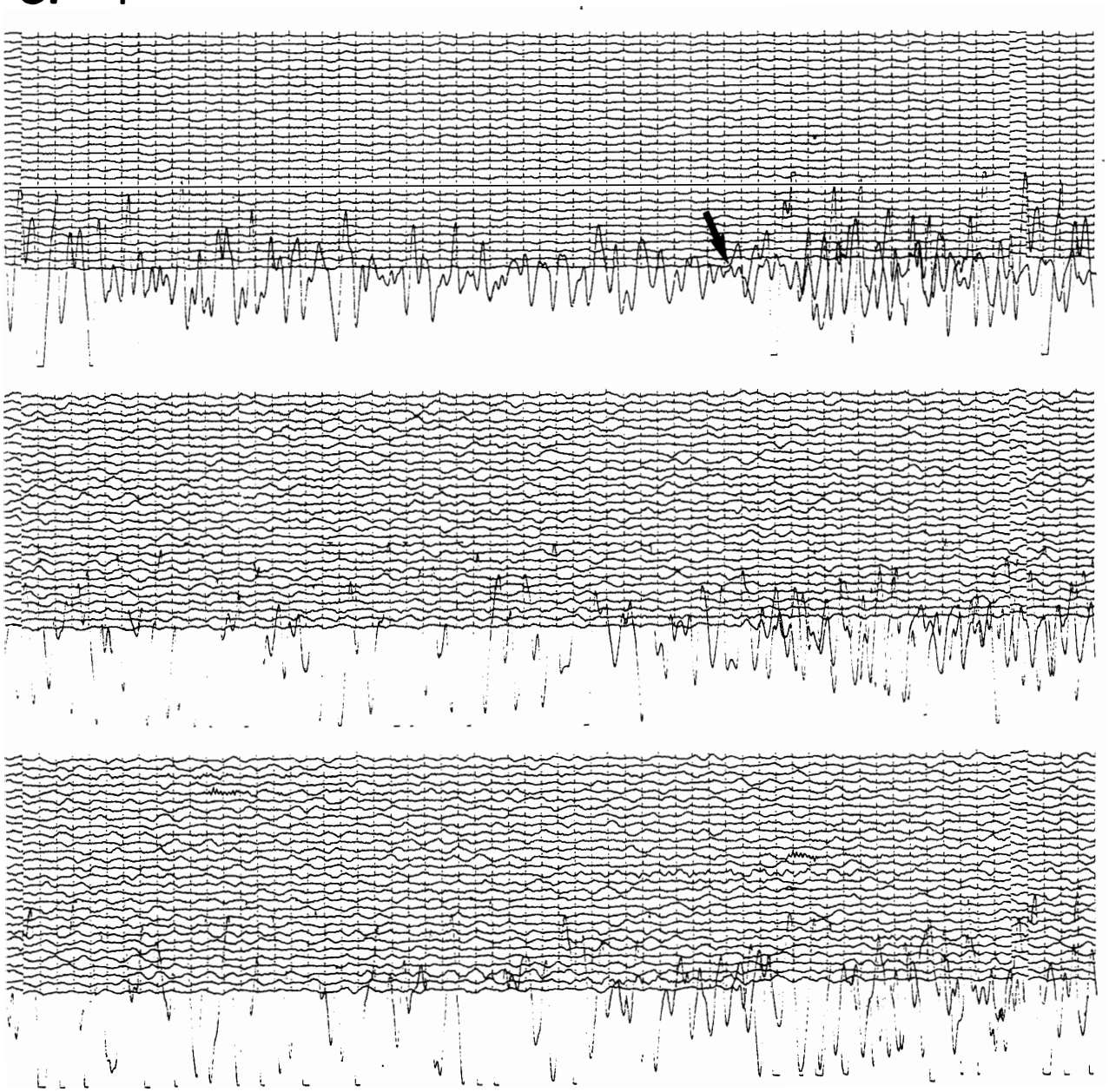
JULY 25 06h46m06.6s

6.081 S 133.667 E 28 km Mb 6.5 Ms 6.7

Aroe Islands Region

SP - 1



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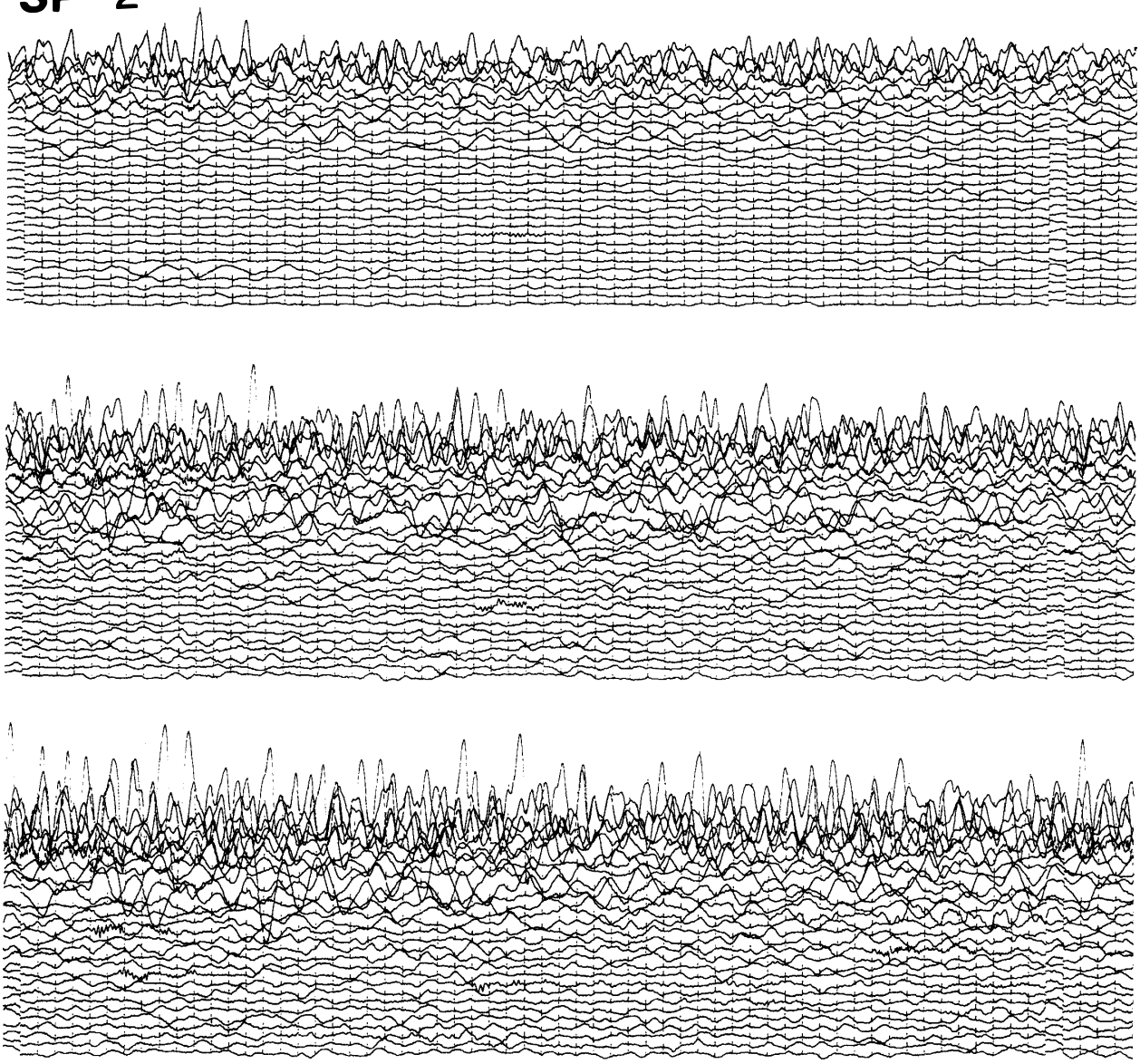

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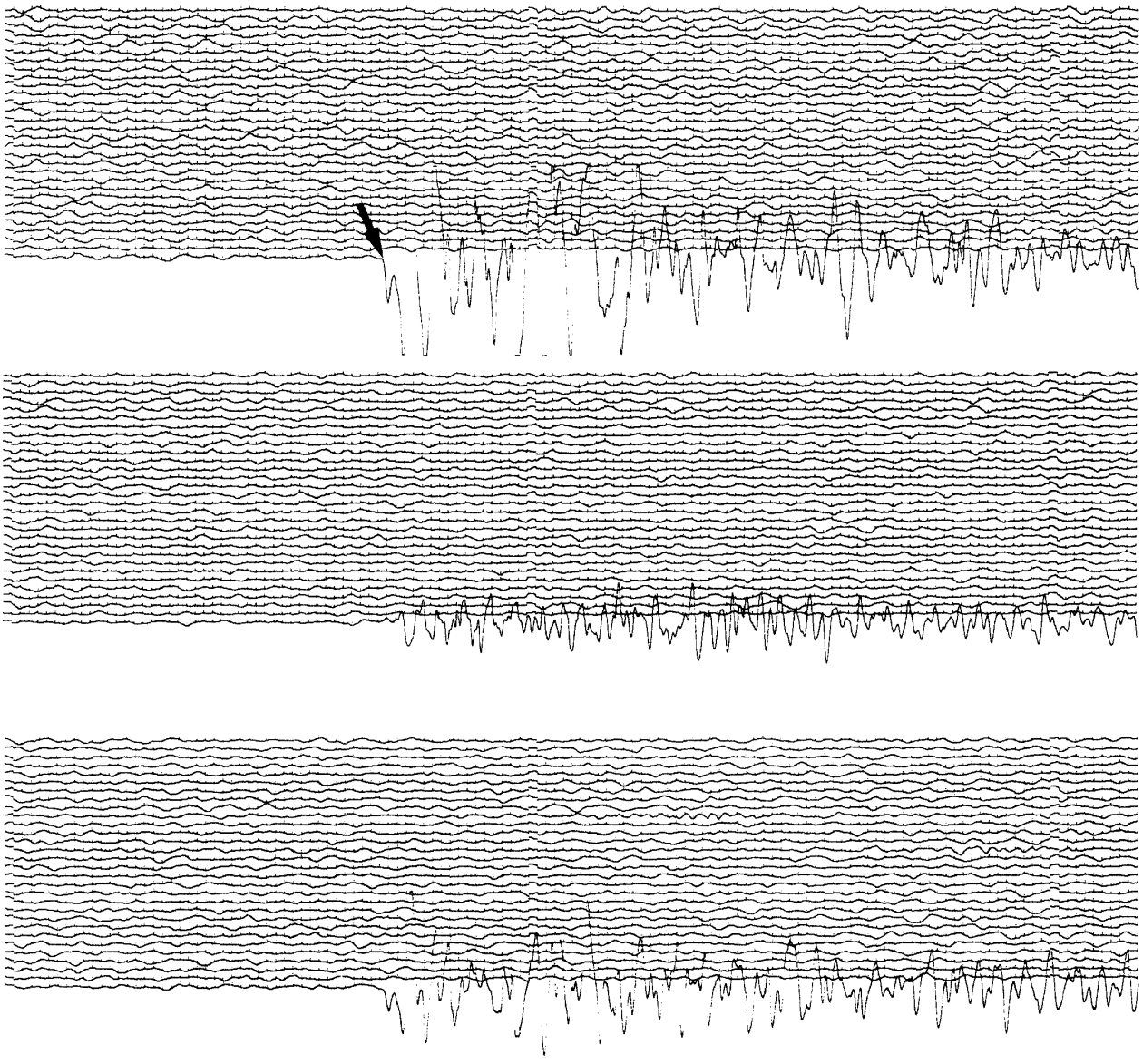

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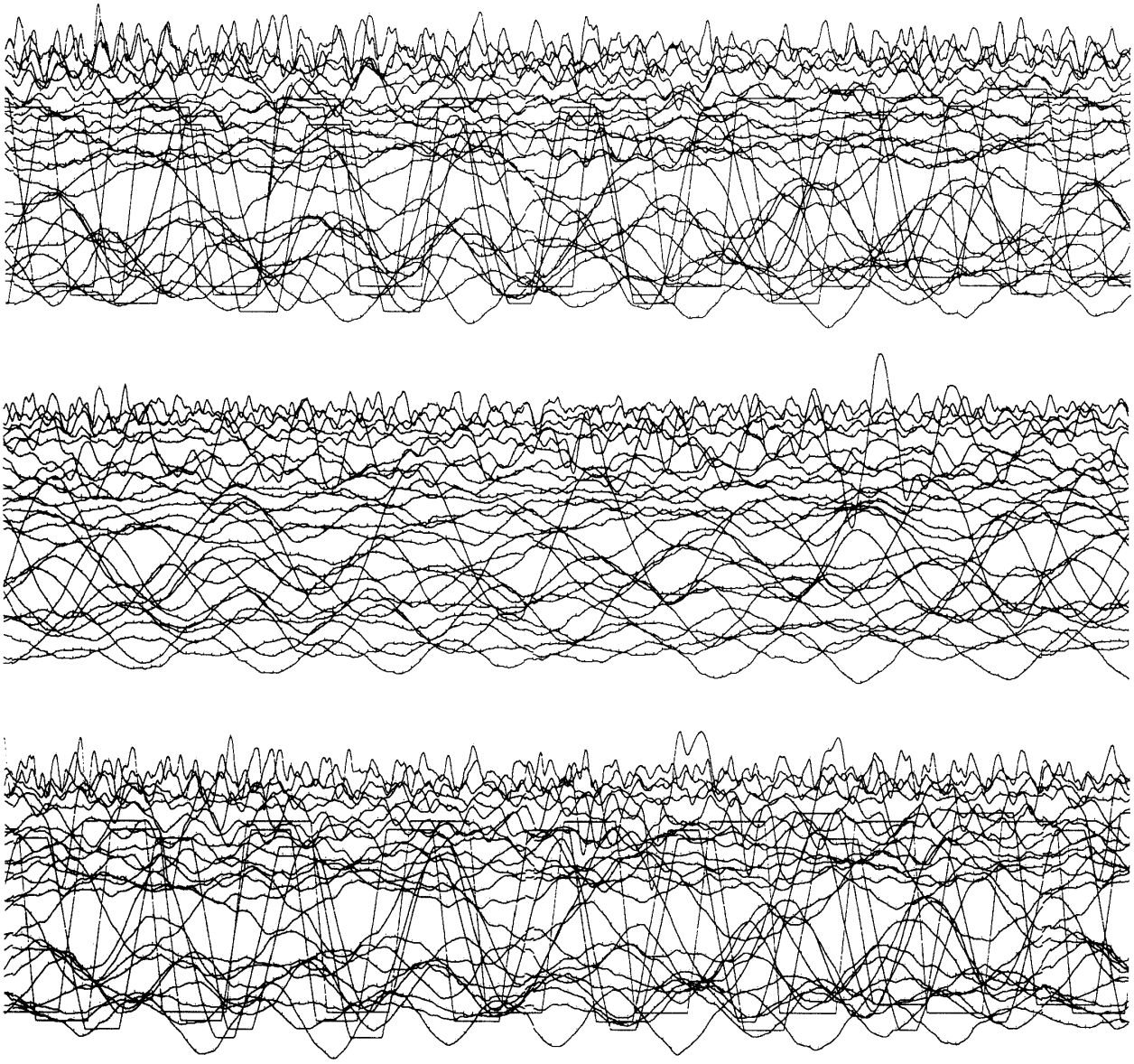

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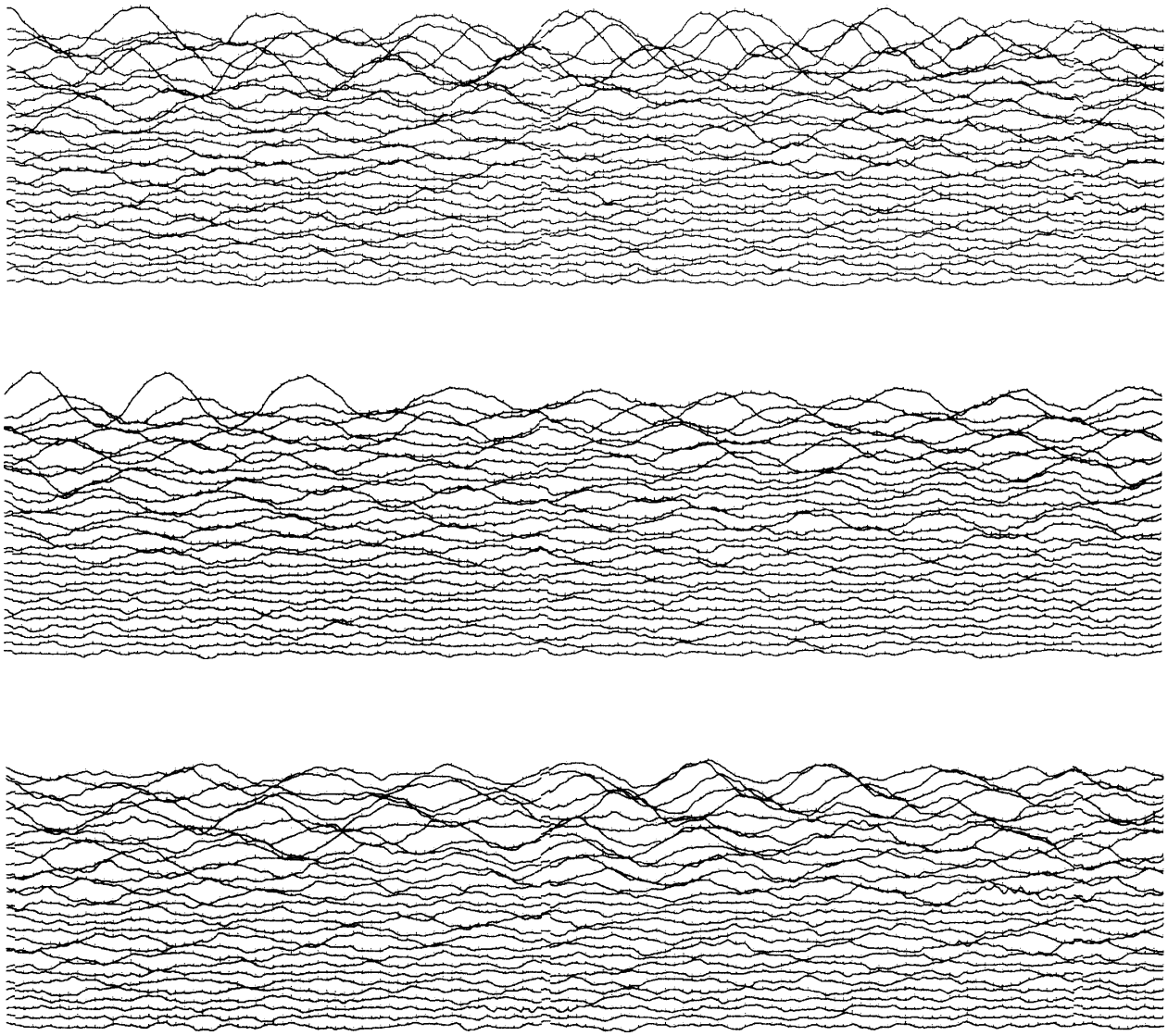


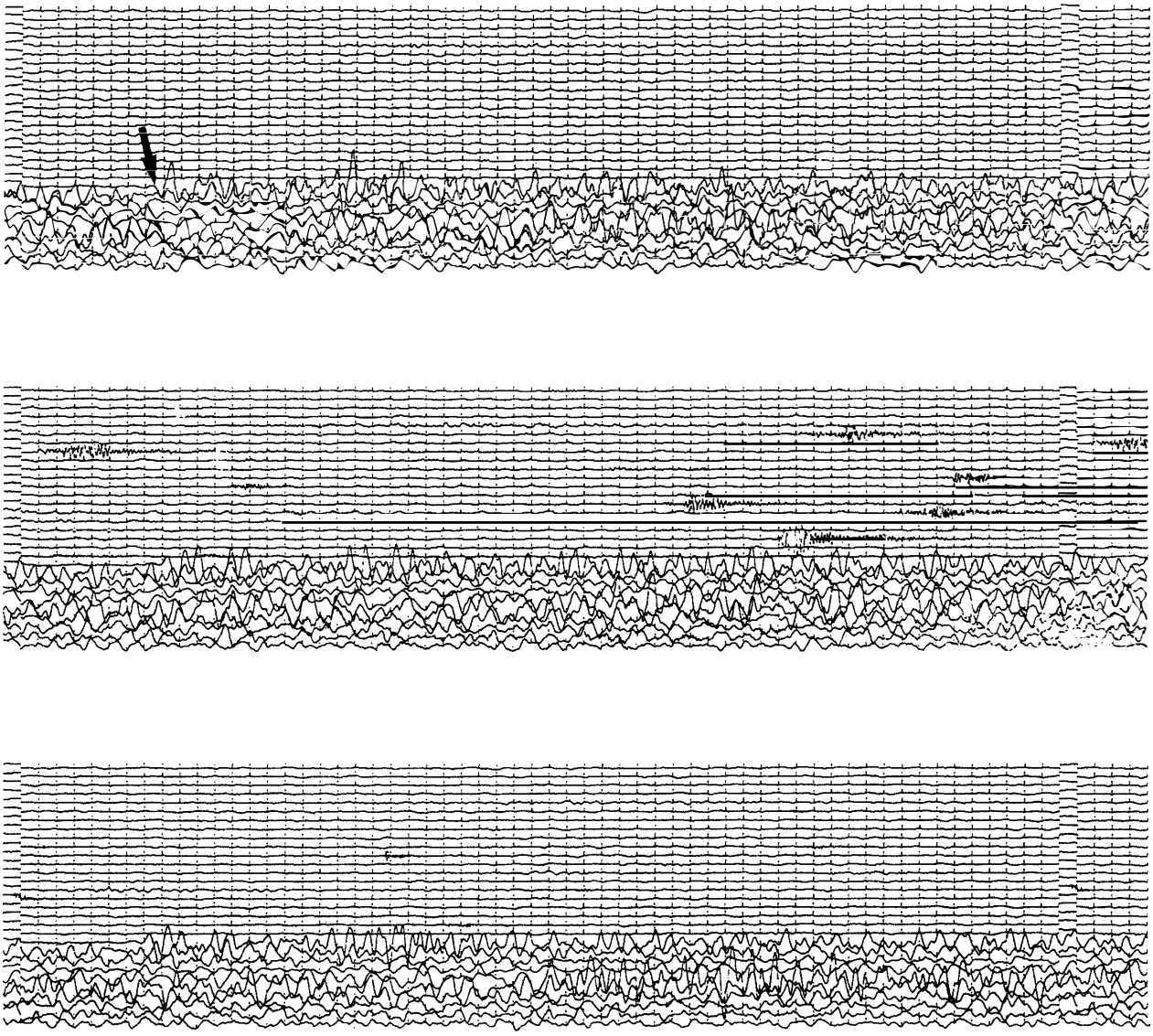
#-97

AUG. 6 00h36m24.6s

25.149 N 95.127 E 91 km Mb 6.8 Ms 7.2

Burma-India Border Region

SP



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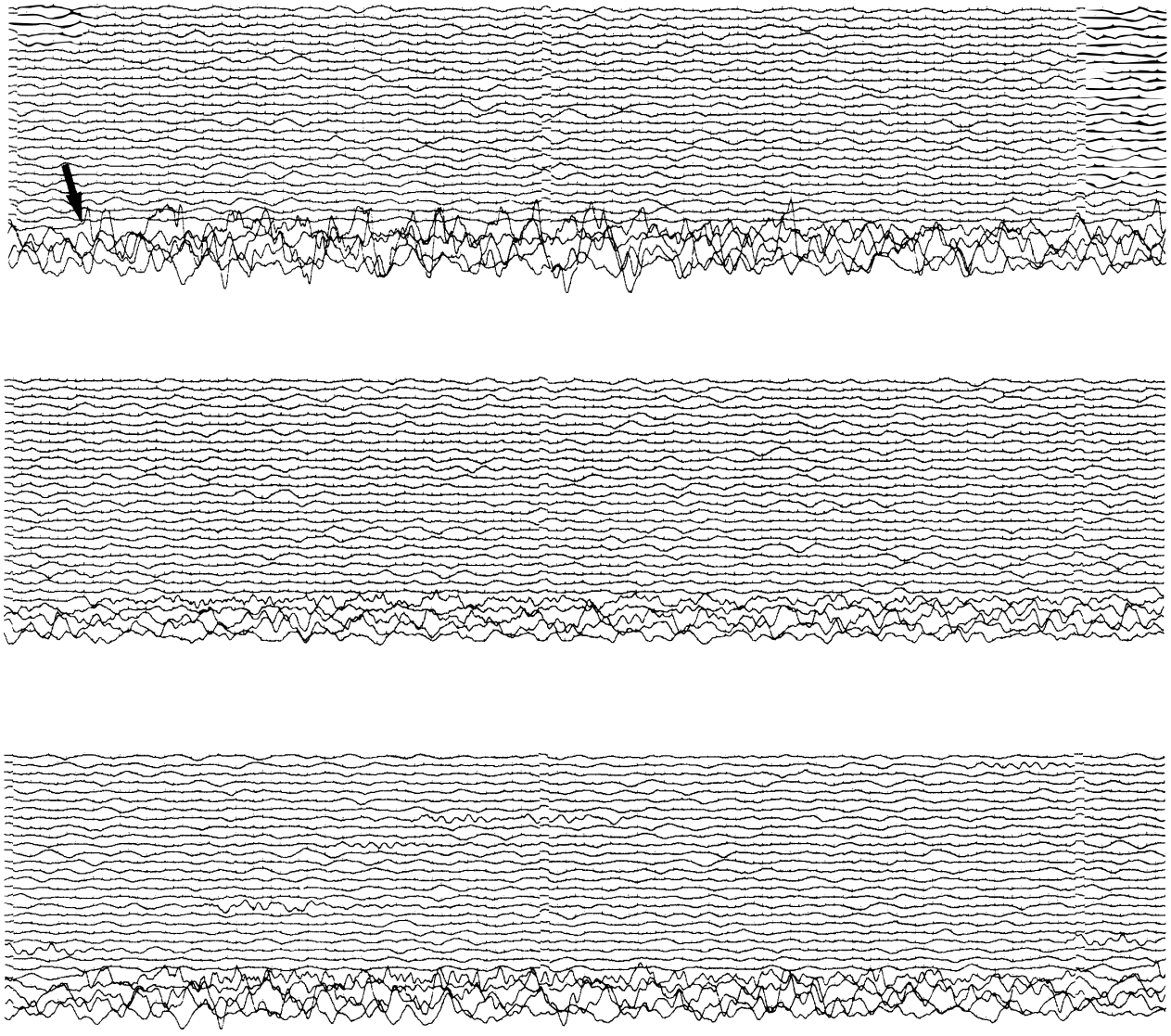

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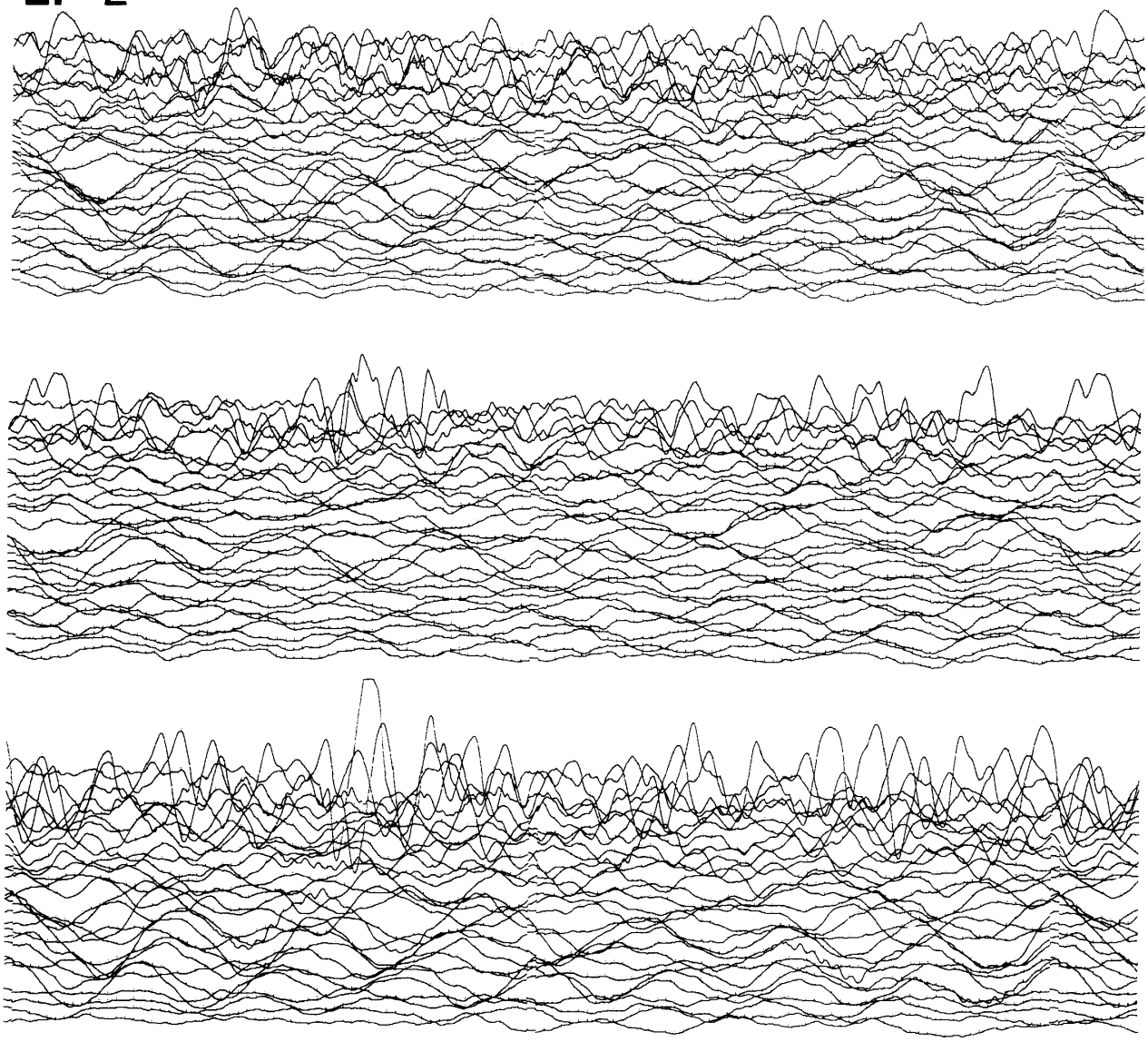

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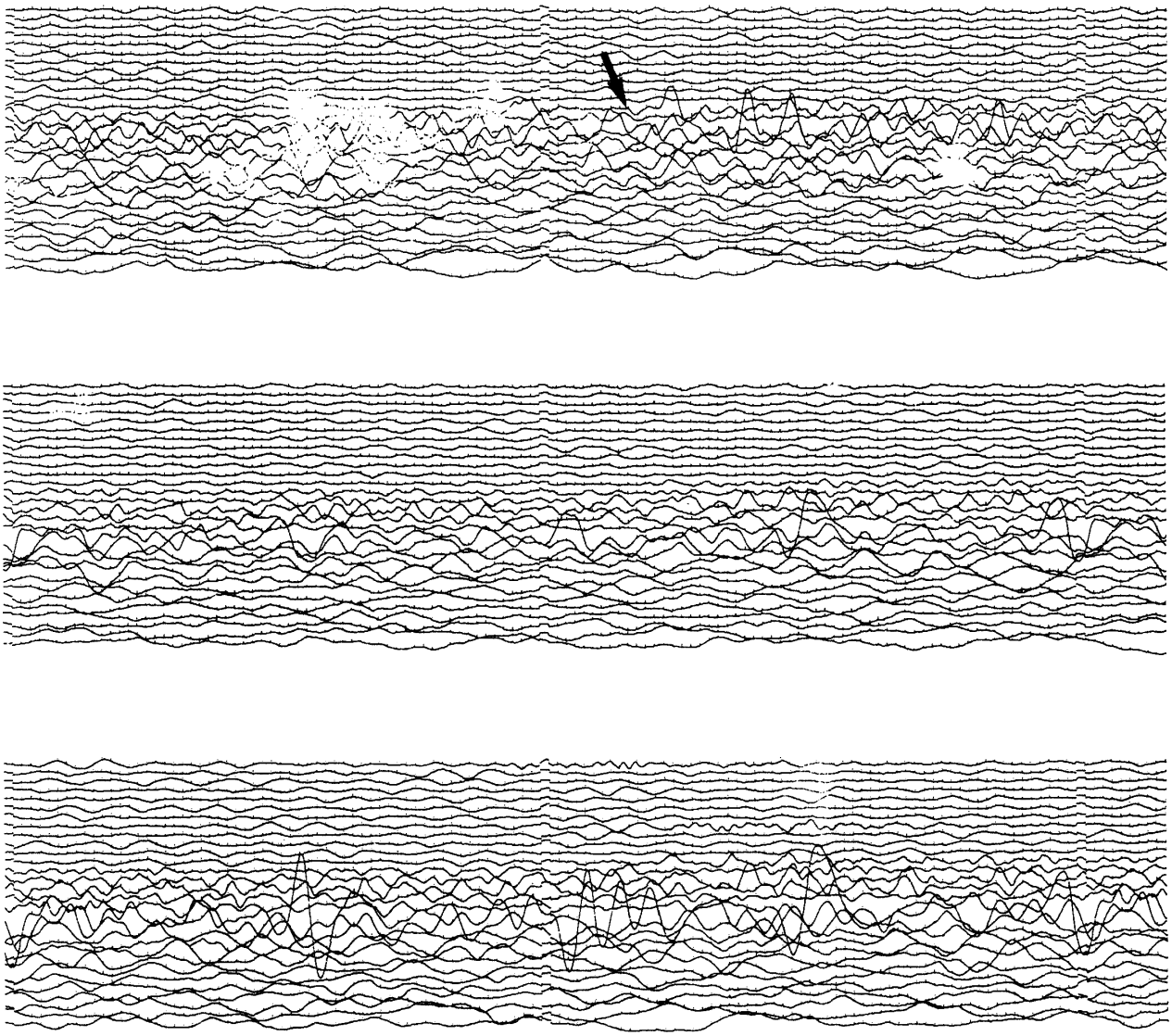
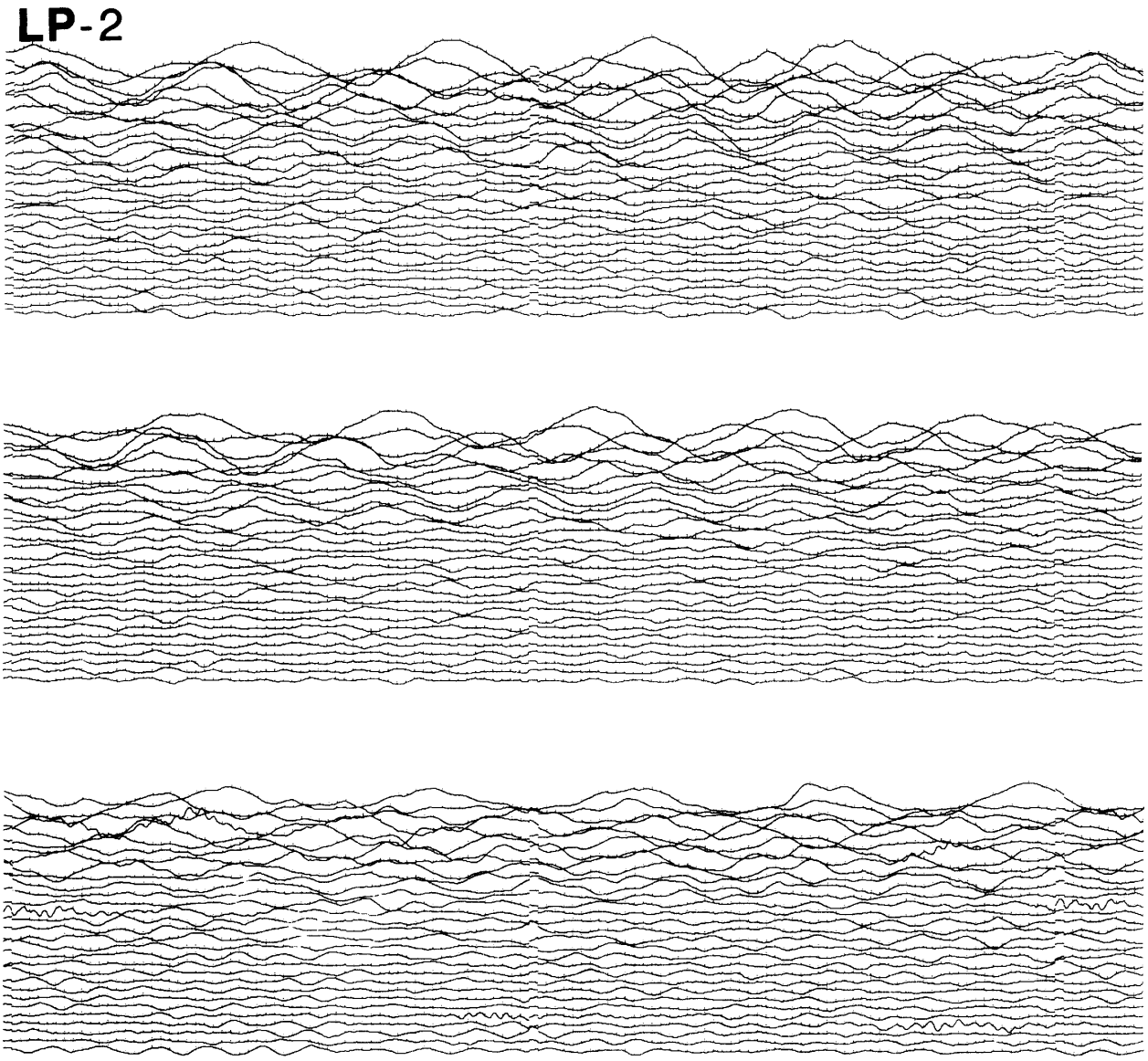
AUG. 20 23h09m09.5s

26.755 N 86.616 E 57 km Mb 6.4 Ms 6.6

Nepal-India Border Region

LP -1

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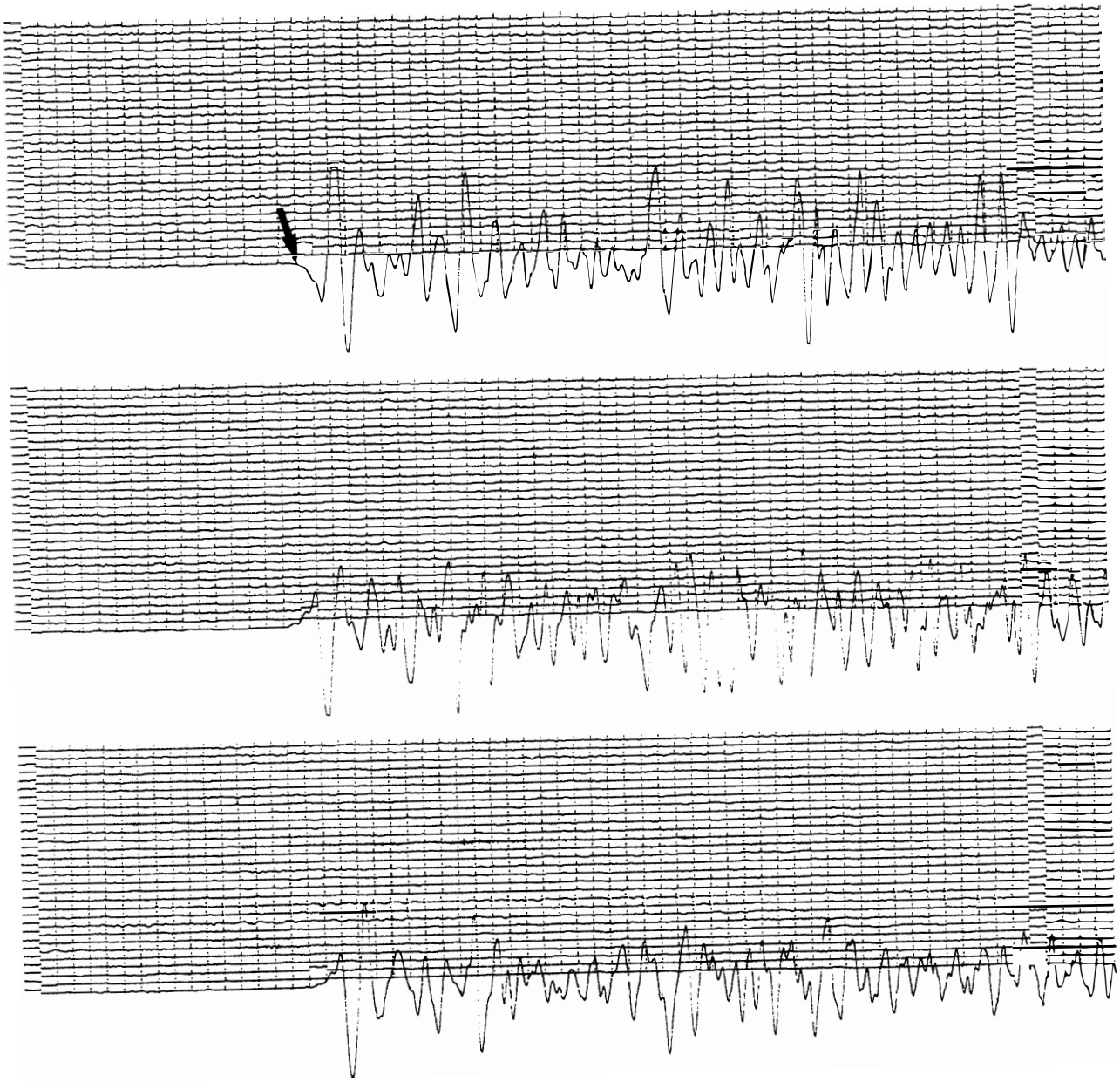
#-130

Oct. 8 04h46m24.5s

18.771 S 172.415 W 35 km Mb 6.6 Ms 6.8

Tonga Islands Region

SP -1



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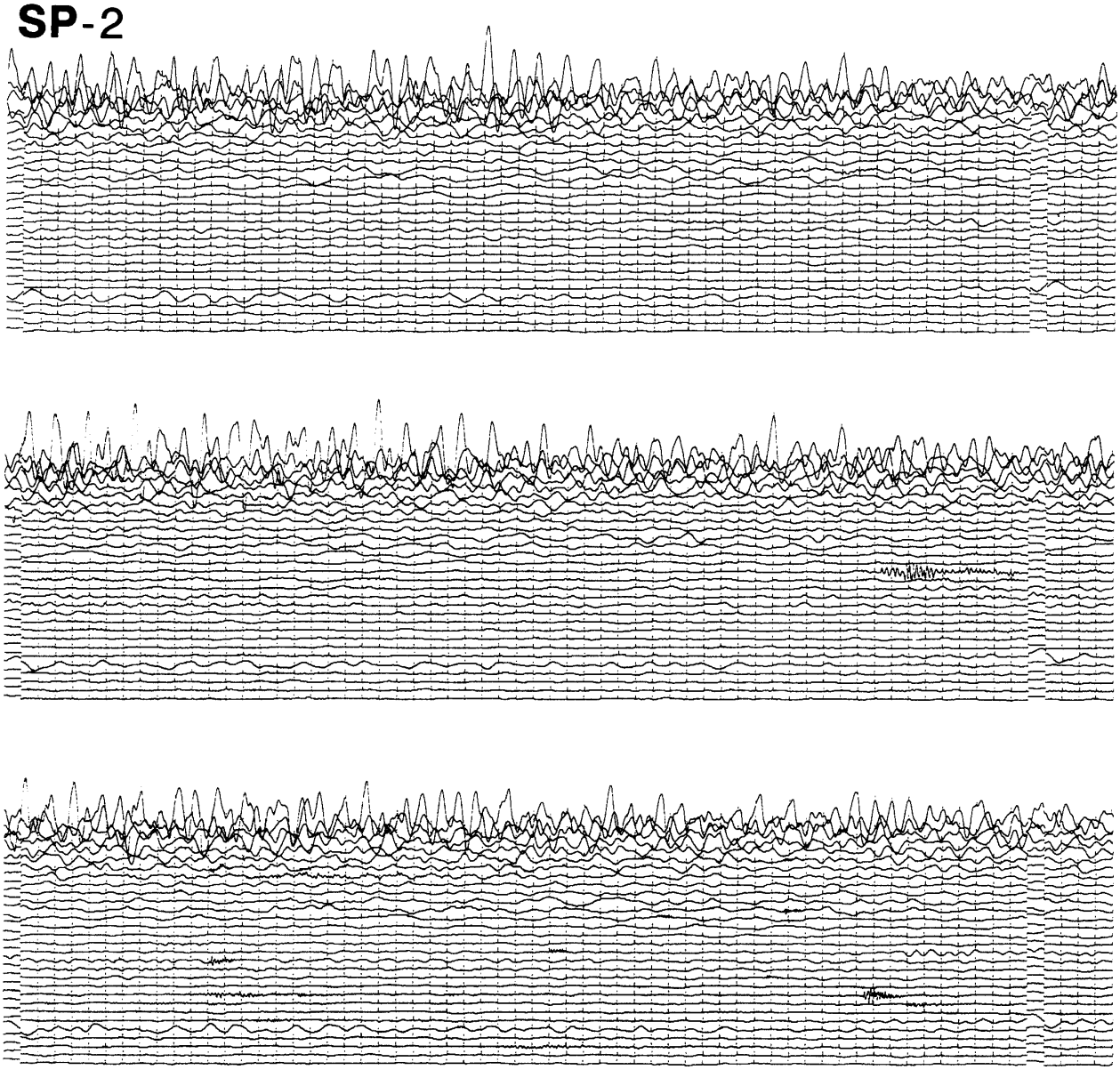
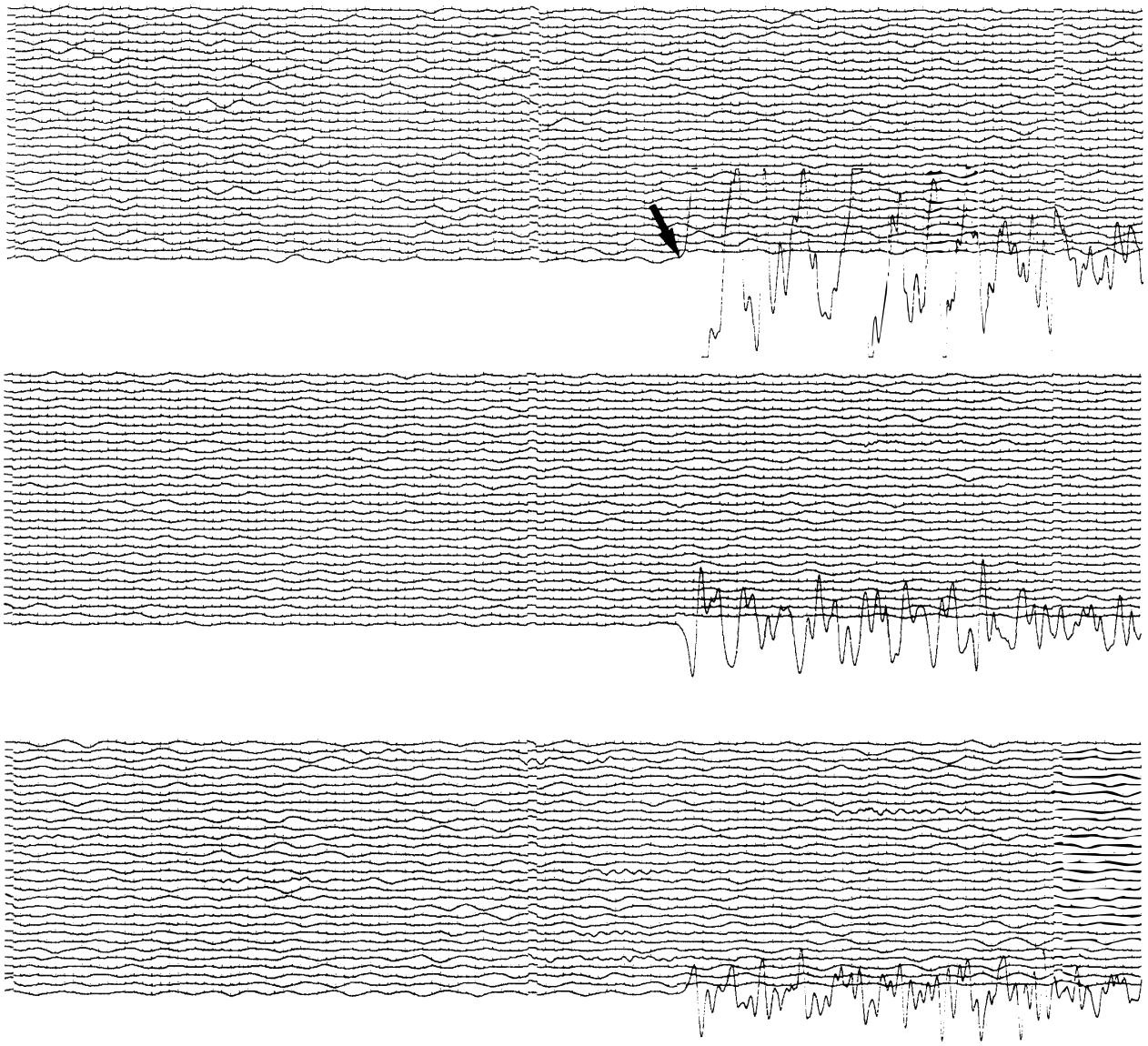
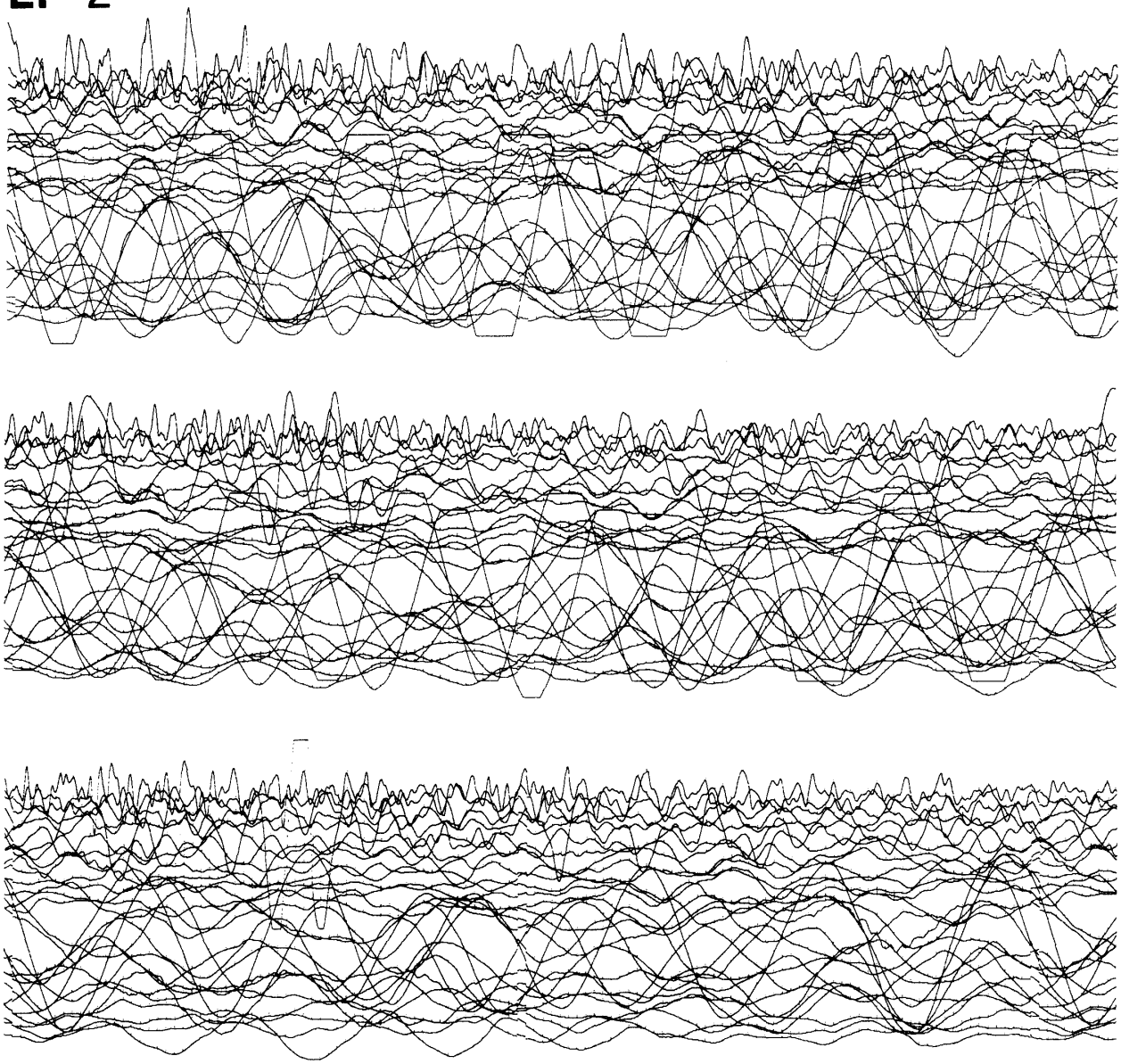


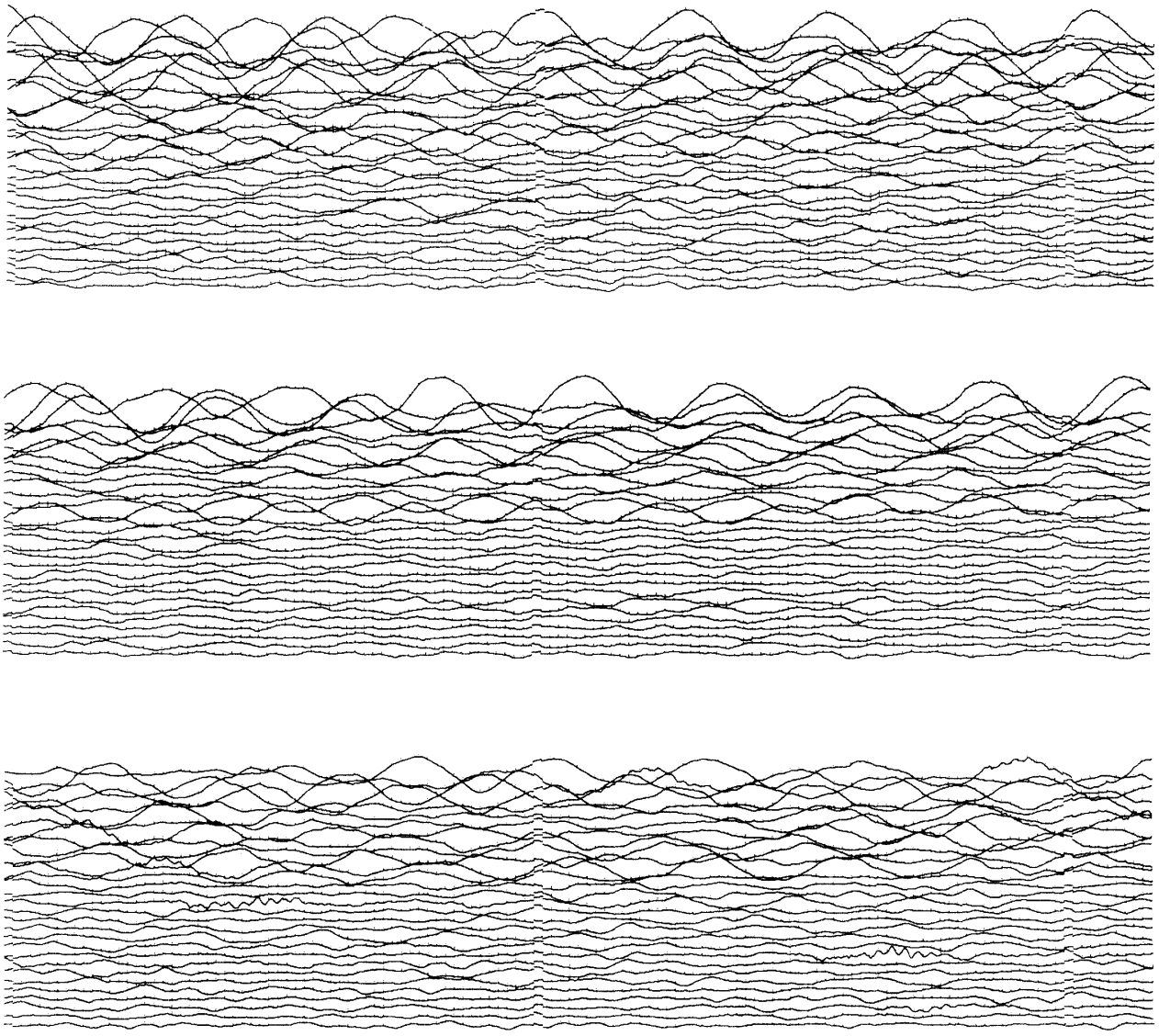
LP - 1



LP-2



LP-3



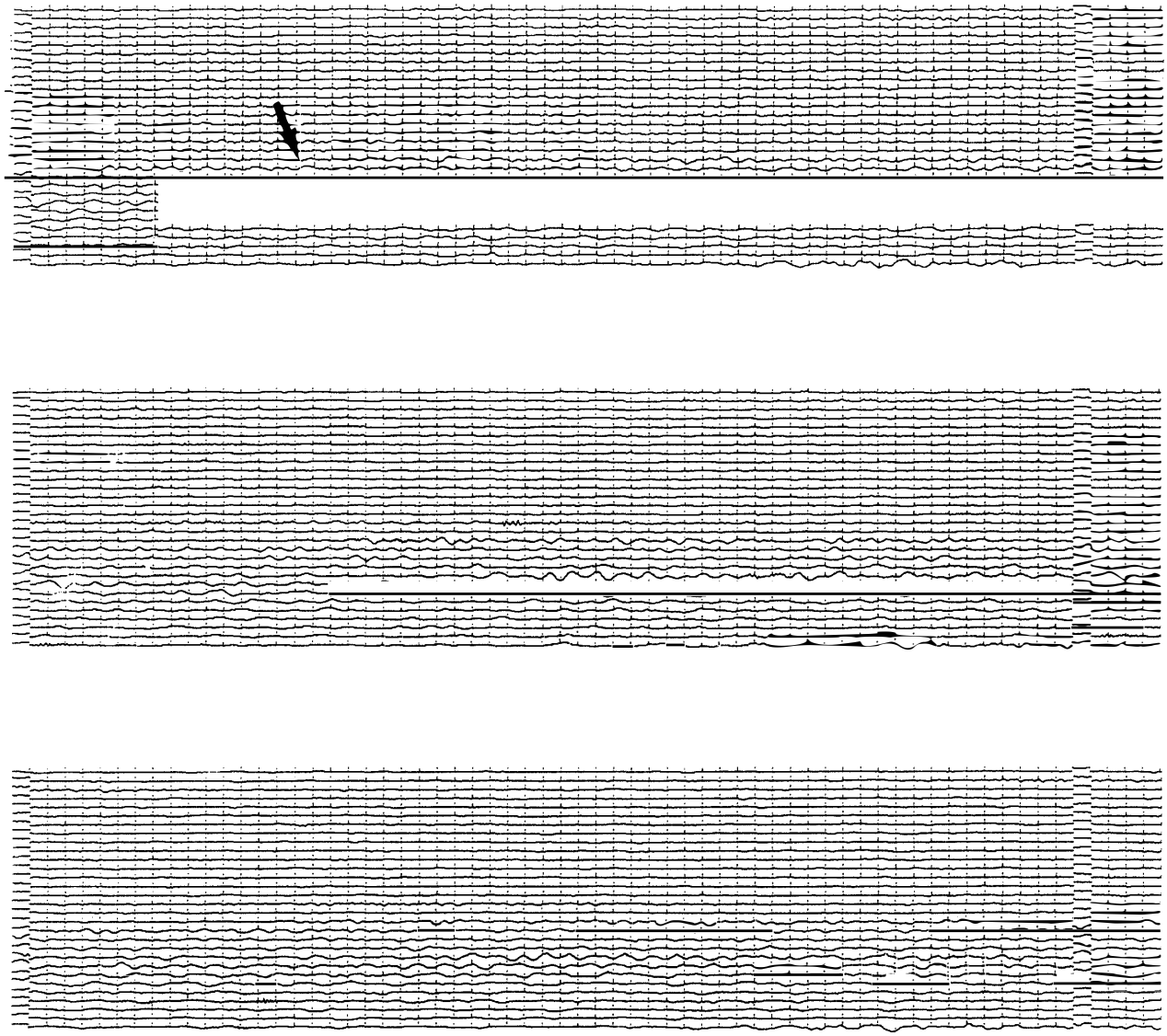
#-141

NOV. 6 13h03m19.3s

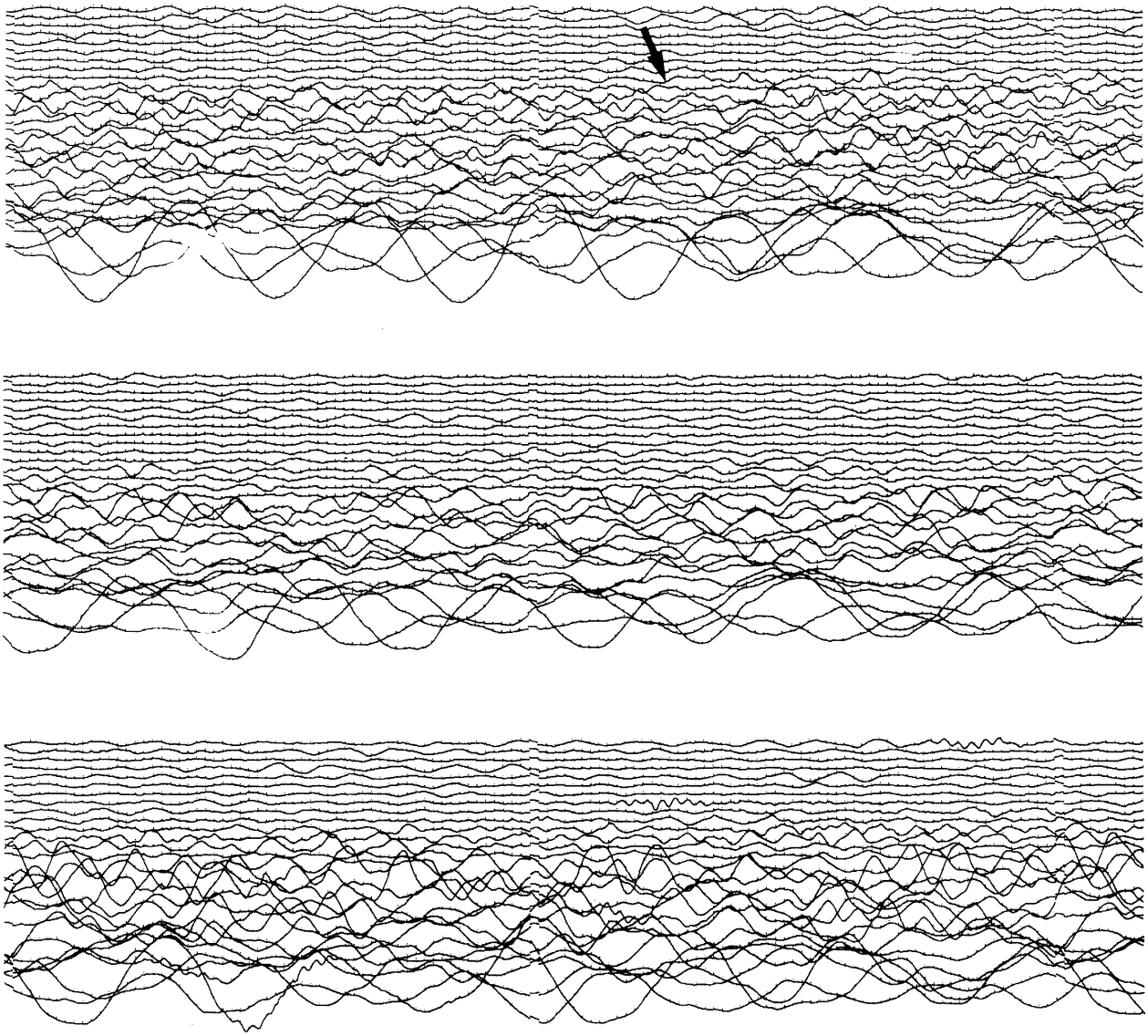
22.789 N 99.611 E 18 km Mb 6.1 Ms 7.3

Burma-Chaina Border Region

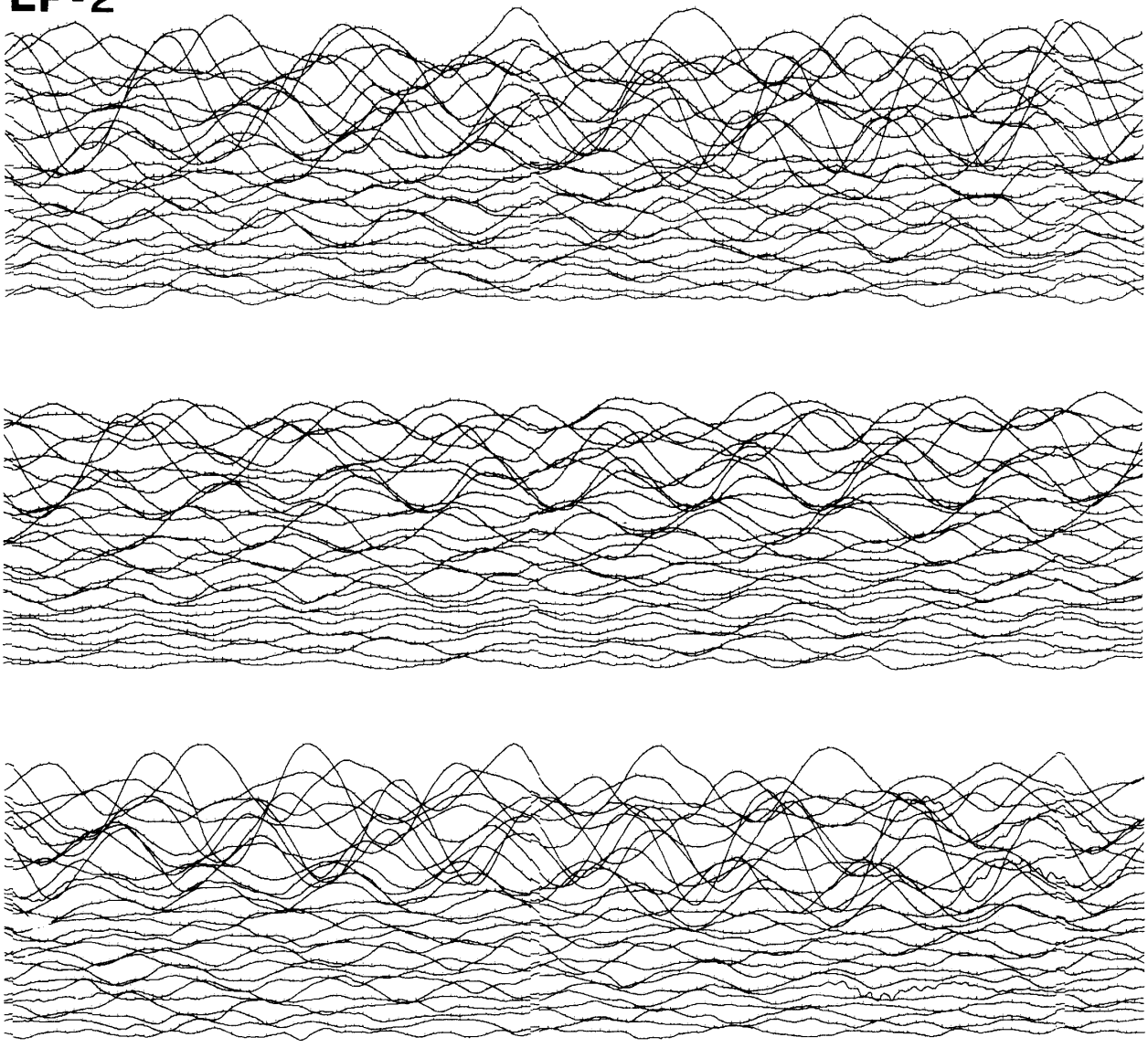
SP



LP - 1



LP-2



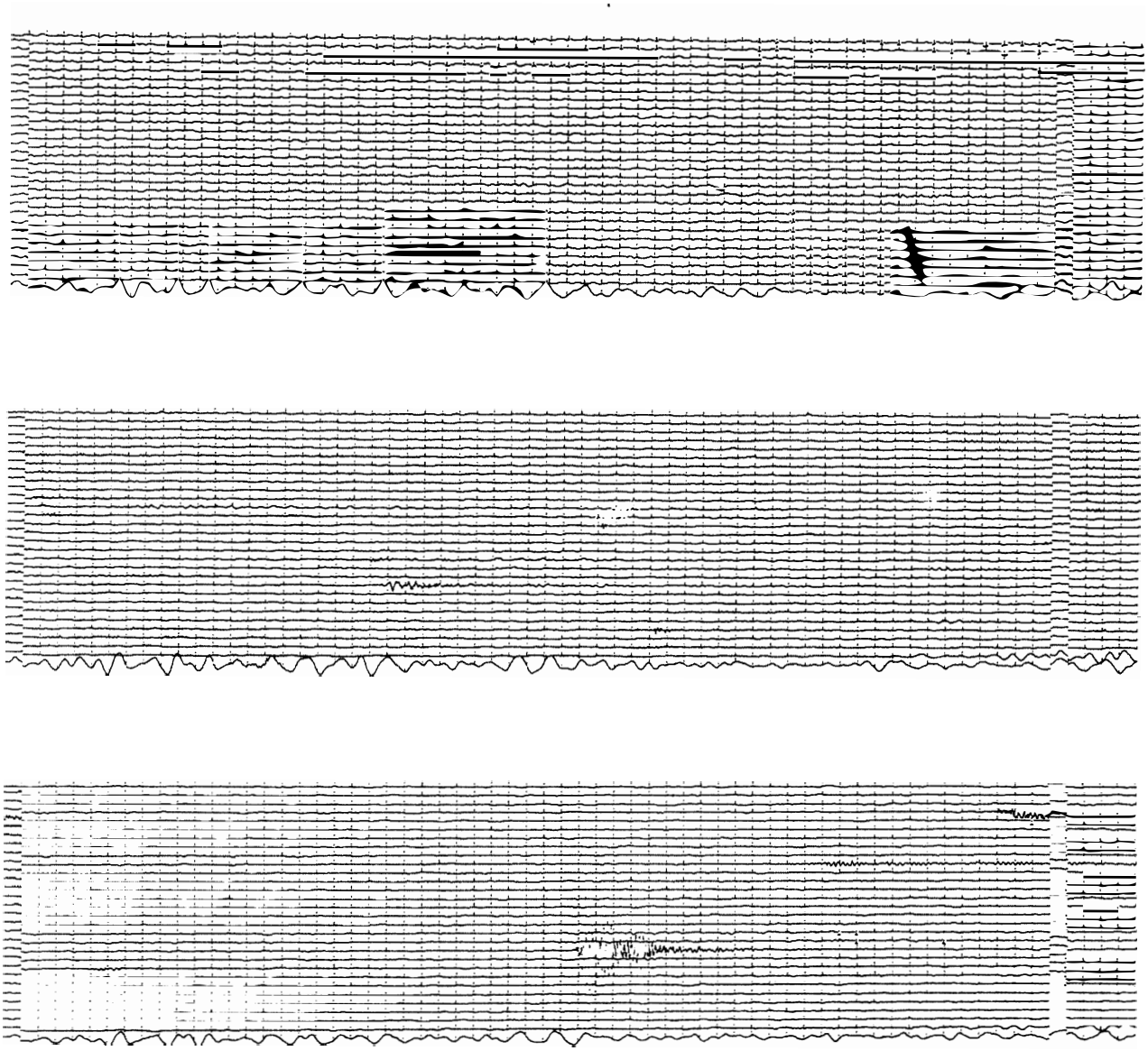
#-145

NOV. 14 02h15m39.1s

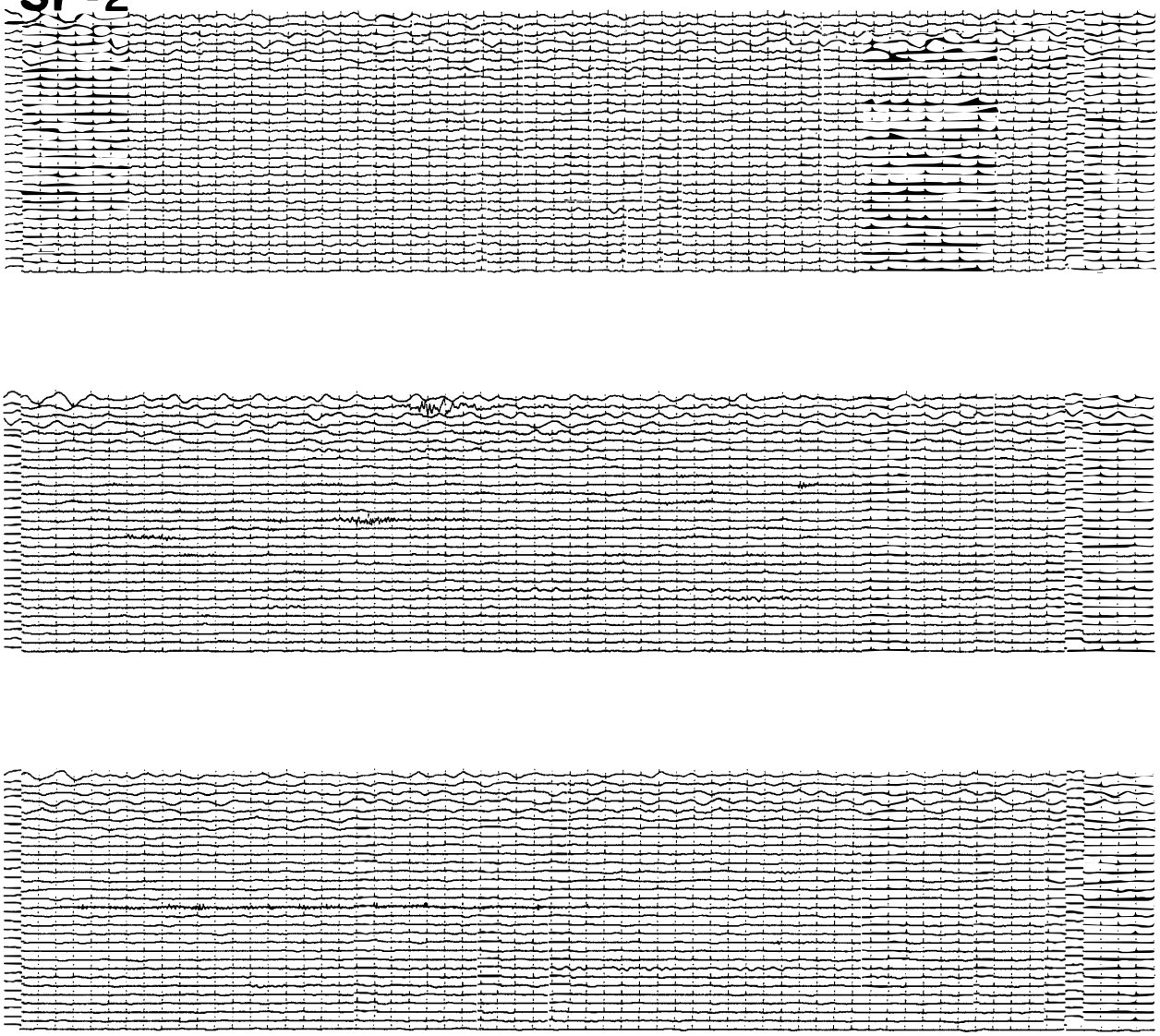
3.527 S 150.120 E 33 km Mb 5.9 Ms 6.6

New Ireland Region

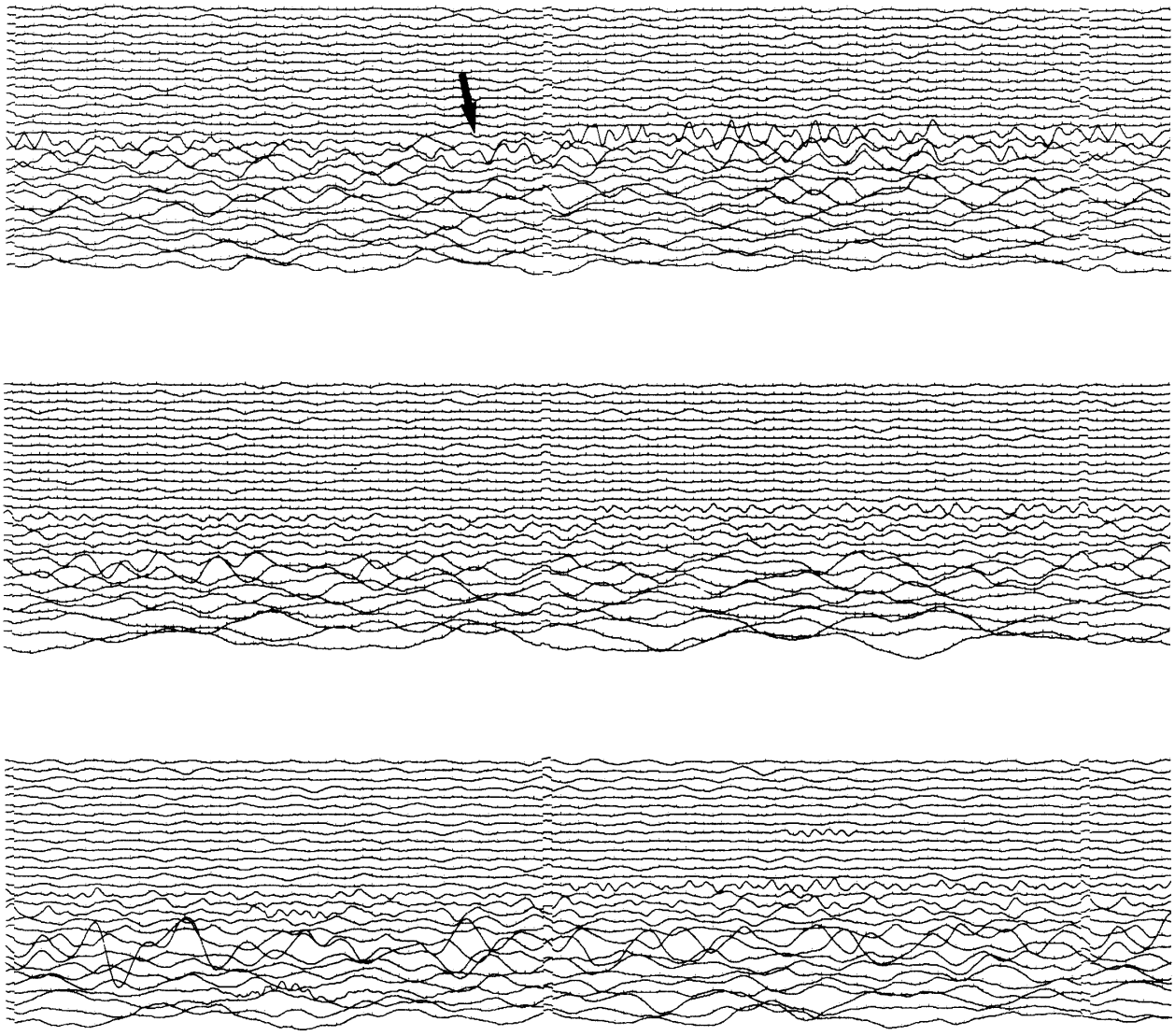
SP - 1



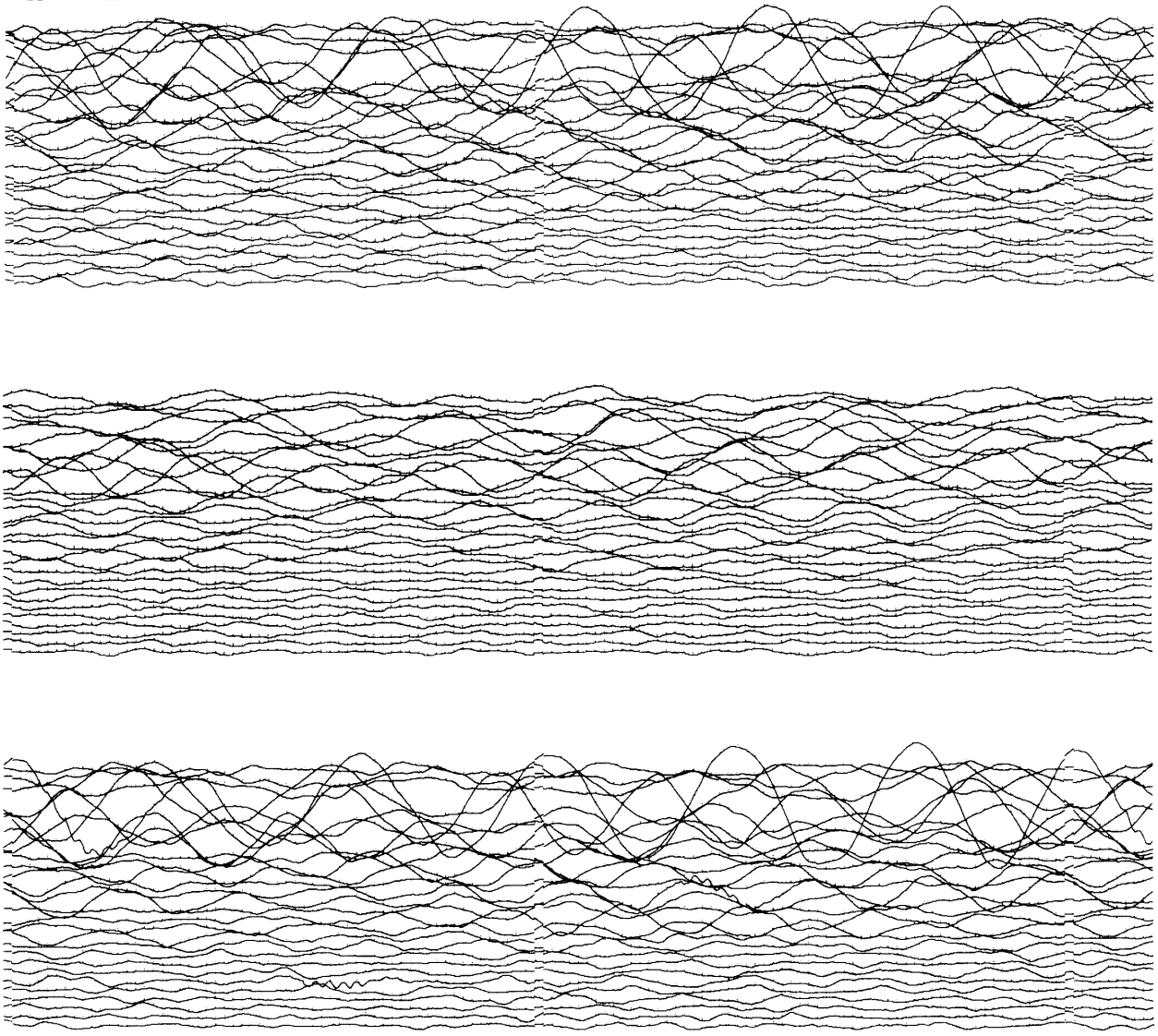
SP-2



LP - 1



LP-2



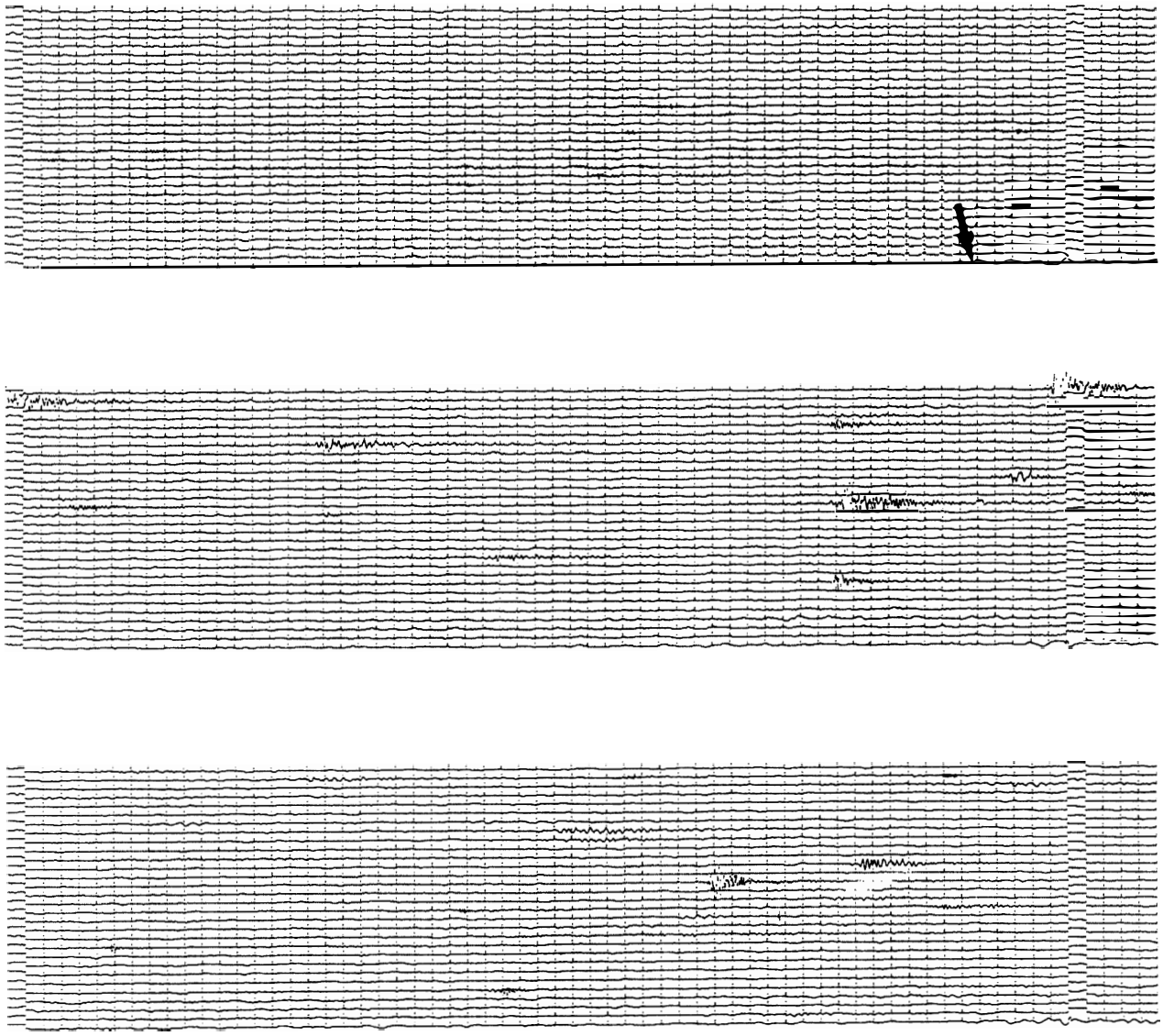
#-157

DEC. 7 07h41m24.2s

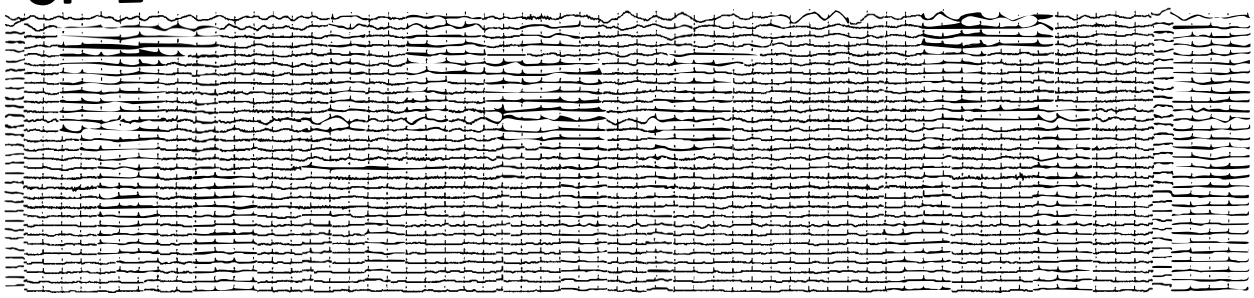
40.987 N 44.185 E 5 km Mb 6.2 Ms 6.8

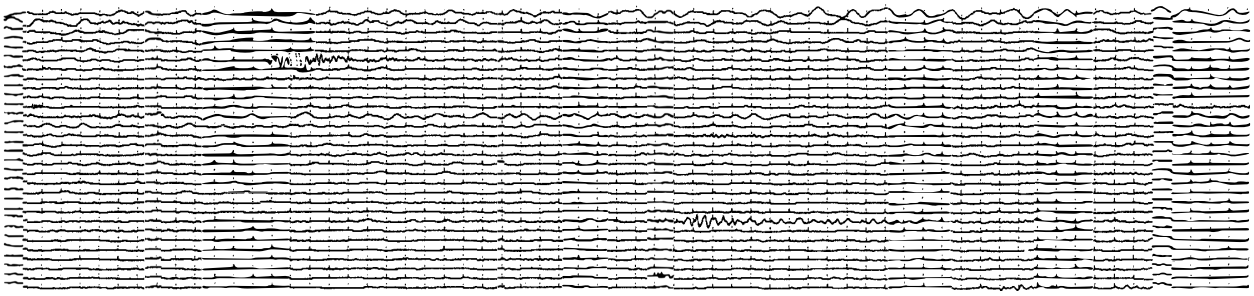
Turkey-USSR Border Region

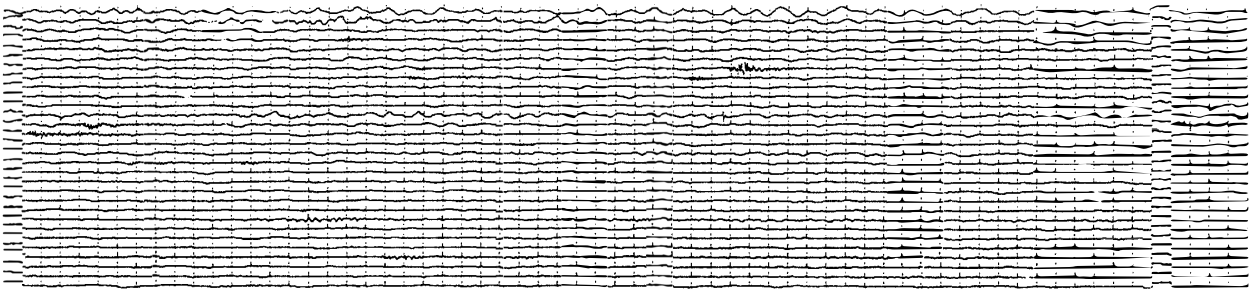
SP-1



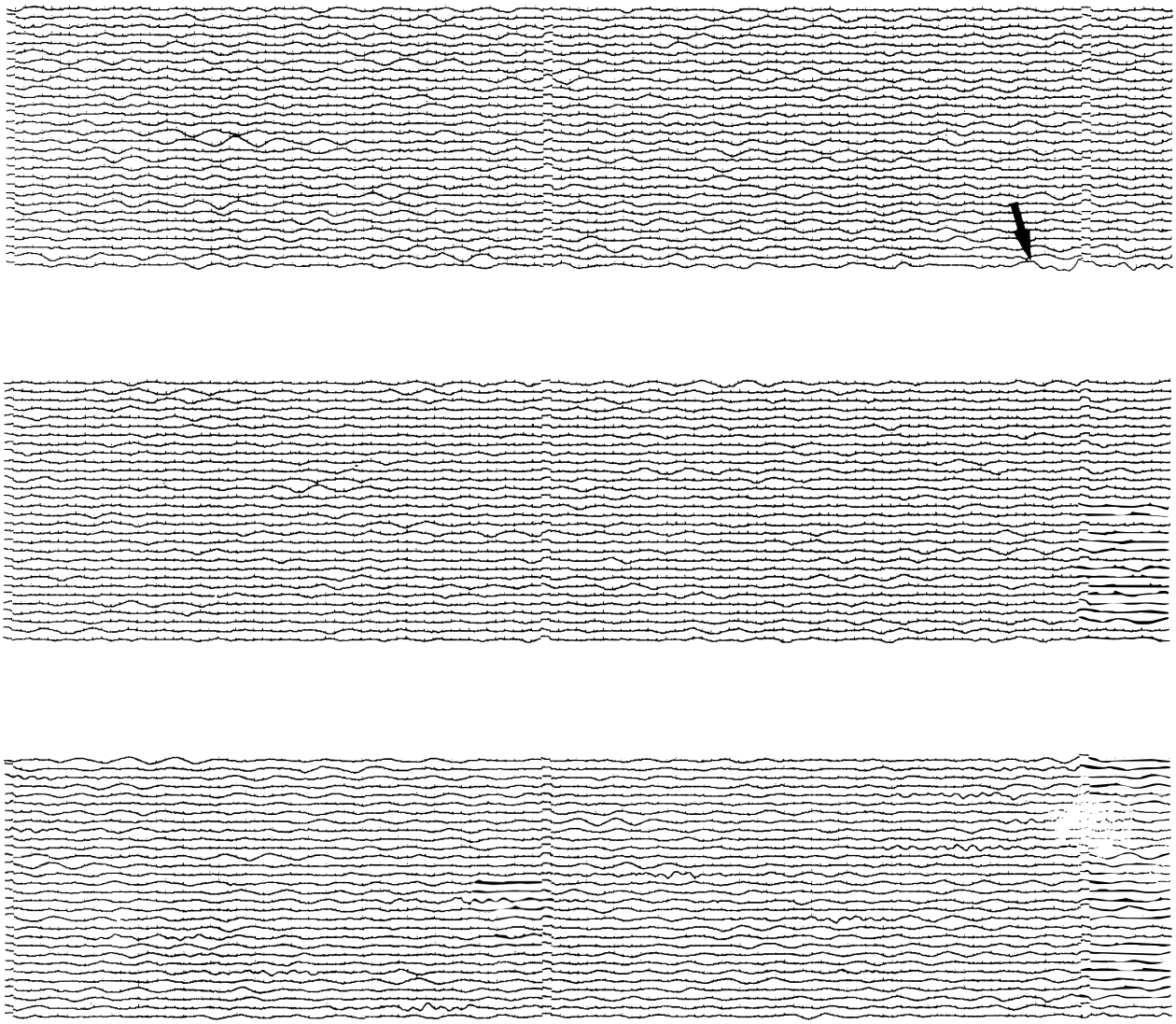
SP-2







LP - 1



LP-2