

SEISMOLOGICAL BULLETIN OF SYOWA STATION, ANTARCTICA,
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1. Introduction

The optical-electromagnetic seismographs at Syowa Station were replaced by the digital seismic data acquisition systems with event detection algorithm in February 1980. The outline of the introduced system is schematically illustrated in Fig. 1. There are two types of seismometers, called SP (short-period) with the natural period of 1 second and LP (long-period) with the natural period of 12 seconds. The seismic observation system was maintained by K. Abe through the wintering of JARE-23 (February 1982 - January 1983).

The coordinates of seismographic vault are $69^{\circ}00'31.7''S$ in latitude and $39^{\circ}35'31.6''E$ in longitude. The elevation is 20 m above the mean sea level.

2. Data

The over-all frequency response and the magnification of the short-period and long-period seismographs (Z, N-S and E-W components) are shown in Fig. 2. The system clock was not connected to the recovered UTC from NNSS satellites (see Fig. 1) and the calibration was made by the short-wave receiver. The accuracy of the read-out data can be estimated as ± 0.2

seconds. Considering the delay time of 1-2 years between the publication of this report and the observing wintering period, which is inevitable from the restriction of transport between Tokyo and Syowa Station, the PDE reports by NEIS were referred and the graphic display outputs of the local events around Syowa Station were excluded from this report.

2.1. Read-out data.

The onset of the events was picked from the pen-monitor records. Figure 3 shows examples of pen-monitor records of the Z component seismograph (4-mm/s pen-speed for SP and 2-mm/s pen-speed for LP). The onset times of tele-seismic P-arrivals were read by R. Sakai and they are listed in Table 1. Symbols E and I in the phase column denote weak and sharp onsets, respectively. The direction of ground motion is denoted by + for the upward direction and - for the downward direction. Arrival time is in UTC.

2.2. Digital data in a 9-track computer compatible tape

One of the main reason for the installation of the new seismic observation system to Syowa Station is the digital data acquisition of tele-seismic wave forms in a large computer compatible 9-track tape. Amplified seismic signals are analog-to-digital converted with the sampling rate of 10 points per second for the short-period and 1 point per second for the long-period components. The relation between the input voltage to the computer and the hexadecimal number is given in Table 2. The data acquisition system is controlled by the event-triggering method of STA/LTA ratio (Peterson et al., 1976)

which is programmed in a micro-computer. The obtained original data consisted of 16 volumes of 1200 ft (1600 bpi) magnetic tape and the tele-typewriter message of the triggered events (see an example in Fig. 4). There may be a lack of data acquisition during October 21 - November 20 because of malfunctioning of the micro-computer. There is also a lack of data acquisition of short-period NS component during July 31 - October 7 because of malfunctioning of the sensor. The original tapes were compiled by considering the PDE reports and edited into one volume of Non Label tape for the user. The edited tape contains tele-seismic wave forms of 79 events detected at Syowa Station. The 79 events are listed in Table 3 and their locations are mapped in Fig. 5.

The data on an edited tape has a block structure. The tape format is specified as follows:

- (1) Volume constitution of the edited tape is specified in Fig. 6-1.
- (2) The data structure in Fig. 6-1 is specified in Fig. 6-2.
- (3) Header of the event in Fig. 6-2 is specified in Fig. 6-3.
Numerals in content column are written usually by binary number.
- (4) One block of A/D data in Fig. 6-2 is specified in Fig. 6-4. It consists of 768 bytes and contains 10 seconds' wave data for short-period and 2 minutes' wave data for long-period (rec. 2 - rec. 11).
- (5) One data in Fig. 6-4 consists of 3 channels (N-S, E-W and Z components). Data format of each channel is specified

in Fig. 6-5.

(6) Time data in Fig. 6-3 (record number 6) and in Fig. 6-4 are specified in Fig. 6-6.

In the appendix, examples of waveform output of each event (10 blocks) to the graphic display are shown. Explanation of the output is given in the No. 1 sheet.

References

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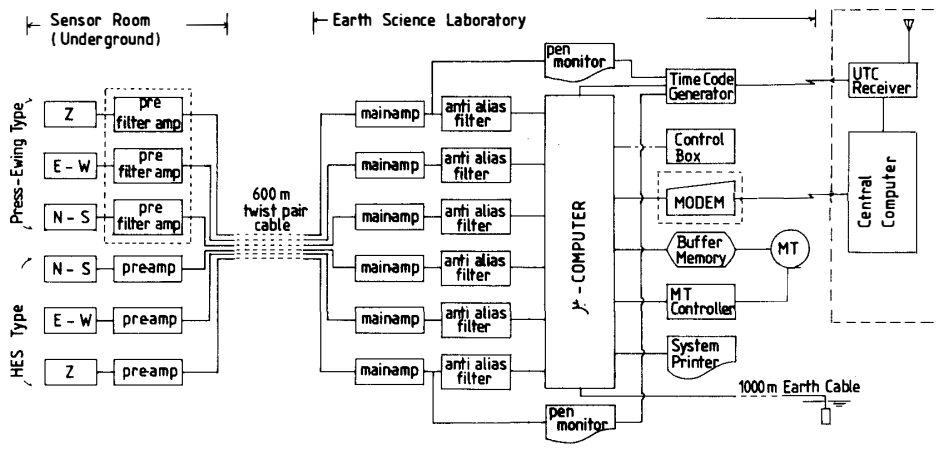


Fig. 1. The seismic observation system at Syowa Station.

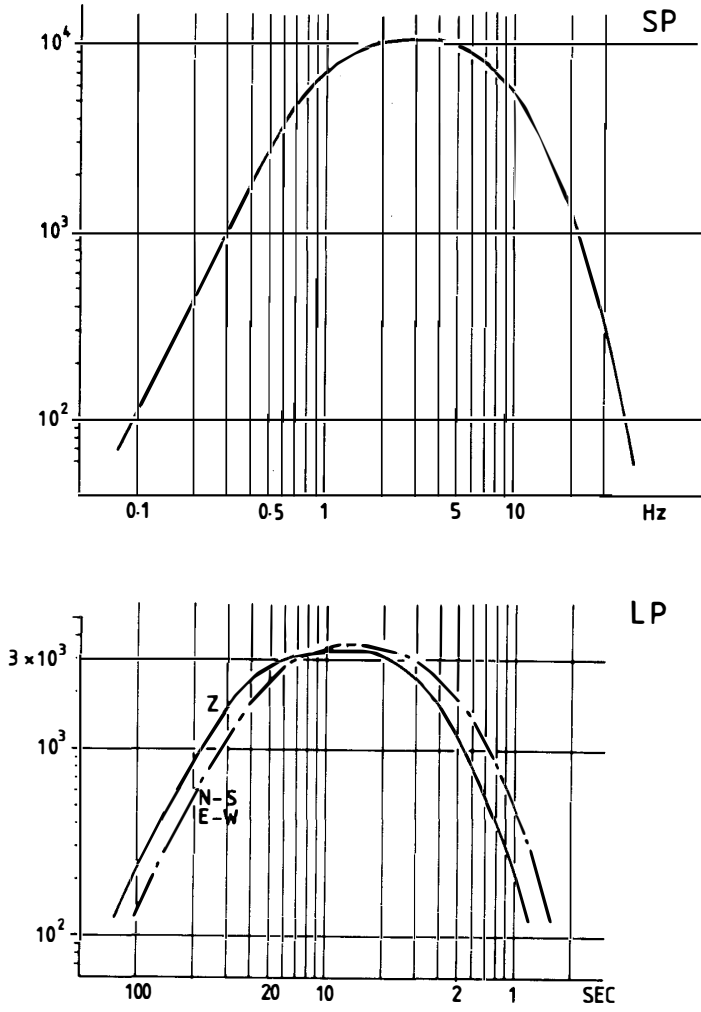


Fig. 2. Over-all frequency responses of the short-period and the long-period seismographs.

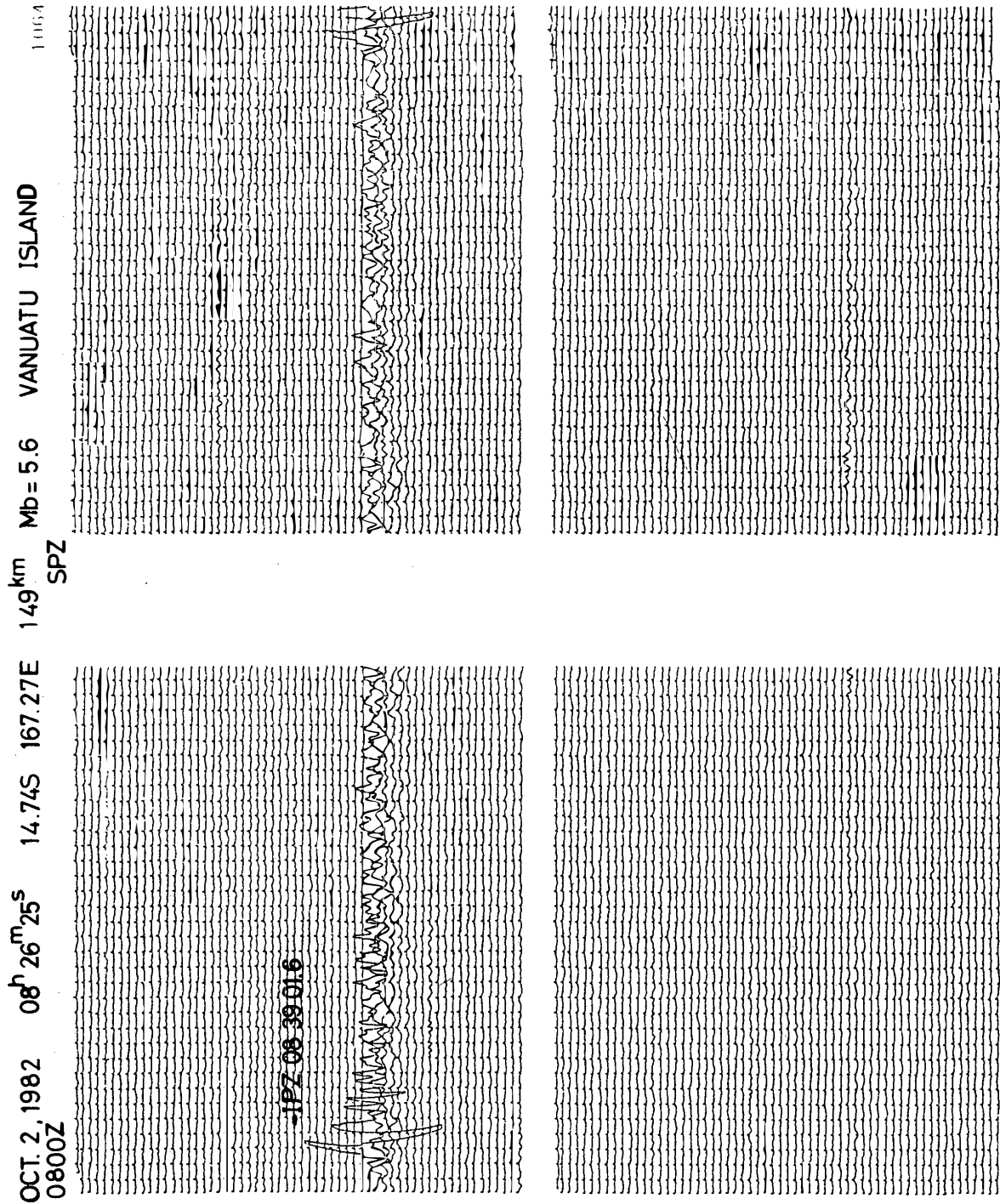


Fig. 3-1. A pen-monitor example of the short-period teleseismic event.

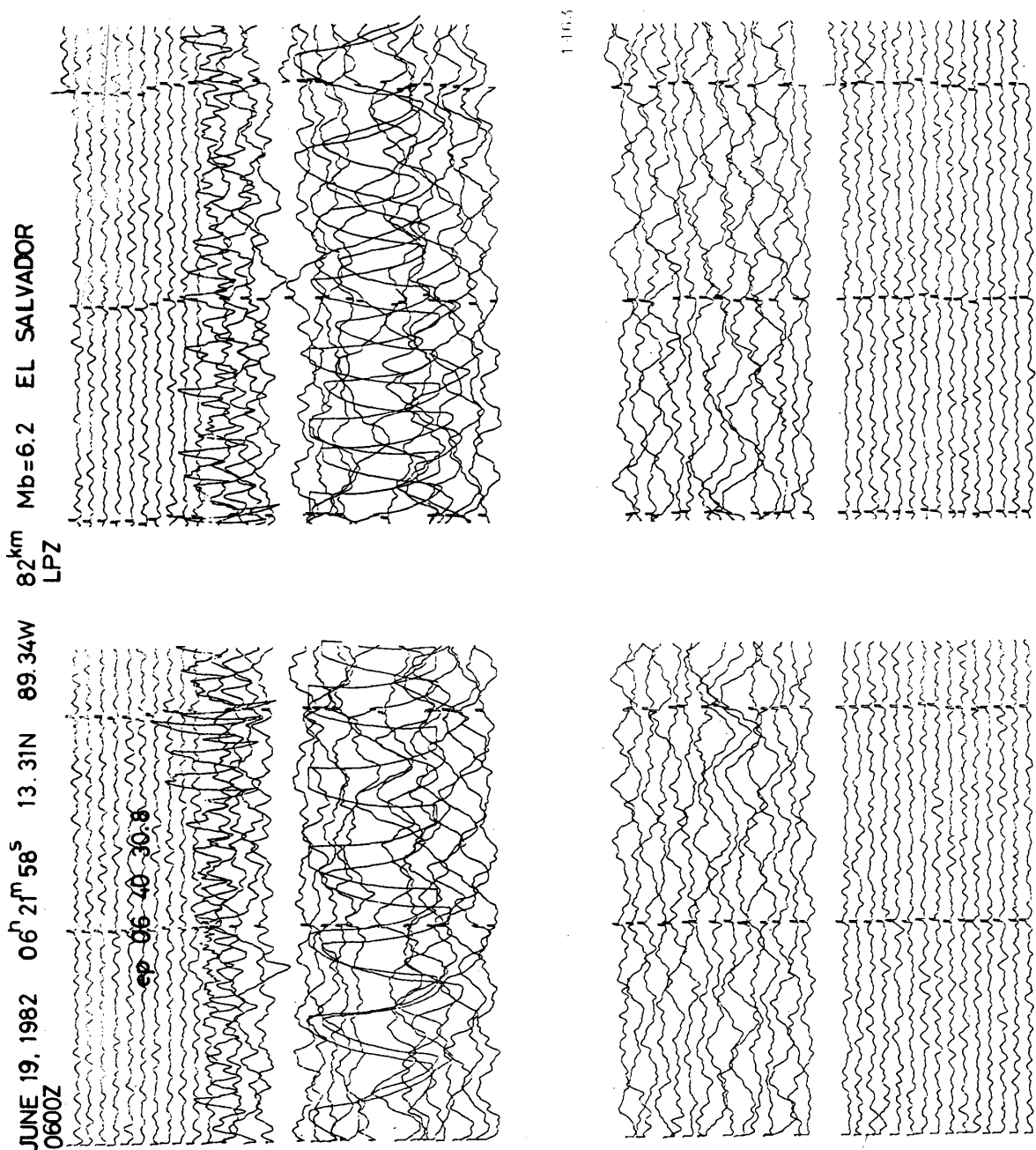


Fig. 3-2. A pen-monitor example of the long-period teleseismic event.


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KH-5
* CHANGE END *

KL-4
* CHANGE END *

DH-7
* CHANGE END *

DL-6
* CHANGE END *

NH-1800
* CHANGE END *

NL-300
* CHANGE END *

* SHORT PERIOD * TRIGGER ON AT CHANNEL = 3
  TIME = 280. 07. 27. 23.  NOISE LEVEL = 811  DETECT LEVEL = 8A1

* LONG PERIOD * TRIGGER ON AT CHANNEL = 3
  TIME = 280. 07. 27. 24.  NOISE LEVEL = 830  DETECT LEVEL = 916

* SHORT PERIOD * DETECTED AT TIME = 280. 07. 27. 23.
  SEPARATE EVENT NO. = 00001  TOTAL EVENT NO. = 00001
  NOISE LEVEL = 811  DETECT LEVEL = 8A1
  SAMPLE NO. = 10  LOGGING TIME = 1800SEC

WARNING ! NOISE LEVEL.LT.804 !

* SHORT PERIOD * TRIGGER ON AT CHANNEL = 3
  TIME = 280. 07. 28. 30.  NOISE LEVEL = 812  DETECT LEVEL = 85A

* LONG PERIOD * DETECTED AT TIME = 280. 07. 27. 24.
  SEPARATE EVENT NO. = 00001  TOTAL EVENT NO. = 00002
  NOISE LEVEL = 830  DETECT LEVEL = 916
  SAMPLE NO. = 01  LOGGING TIME = 9600SEC

* SHORT PERIOD * TRIGGER ON AT CHANNEL = 3
  TIME = 280. 10. 02. 19.  NOISE LEVEL = 811  DETECT LEVEL = 856

* SYSTEM CHECK *
CHECK TIME = 281. 07. 16. 14.
CHECK LEVEL  WES 990 NOISE LEVEL  WES 804 804 804
              HES 99E              HES 811 811 810
              L.P 99B              L.P 80B 80A 829
PIO-1  OK      PIO-2  OK      MAIN  OK      HOST  OK
* CHECK END *

* SYSTEM CHECK *
CHECK TIME = 282. 08. 16. 14.
CHECK LEVEL  WES 990 NOISE LEVEL  WES 804 804 804
              HES 99E              HES 810 810 810
              L.P 99C              L.P 80B 80A 828
PIO-1  OK      PIO-2  OK      MAIN  OK      HOST  OK
* CHECK END *

* SYSTEM CHECK *
CHECK TIME = 283. 09. 16. 14.
CHECK LEVEL  WES 990 NOISE LEVEL  WES 804 804 804
              HES 99E              HES 810 811 810
              L.P 99B              L.P 80B 80A 829
PIO-1  OK      PIO-2  OK      MAIN  OK      HOST  OK
* CHECK END *

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Fig. 4. Message outputs from the tele-typewriter.

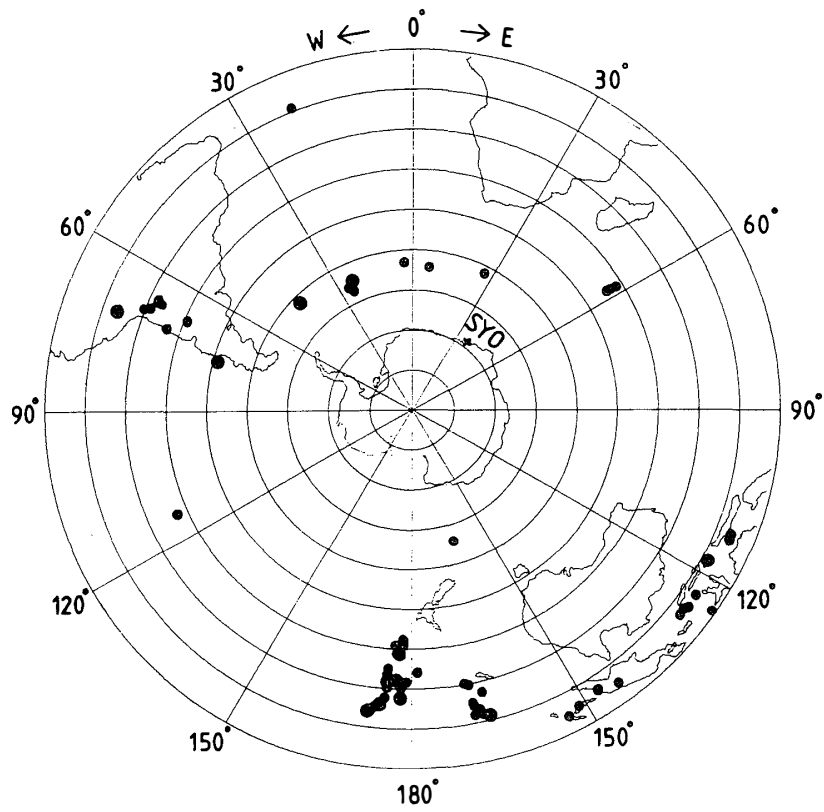
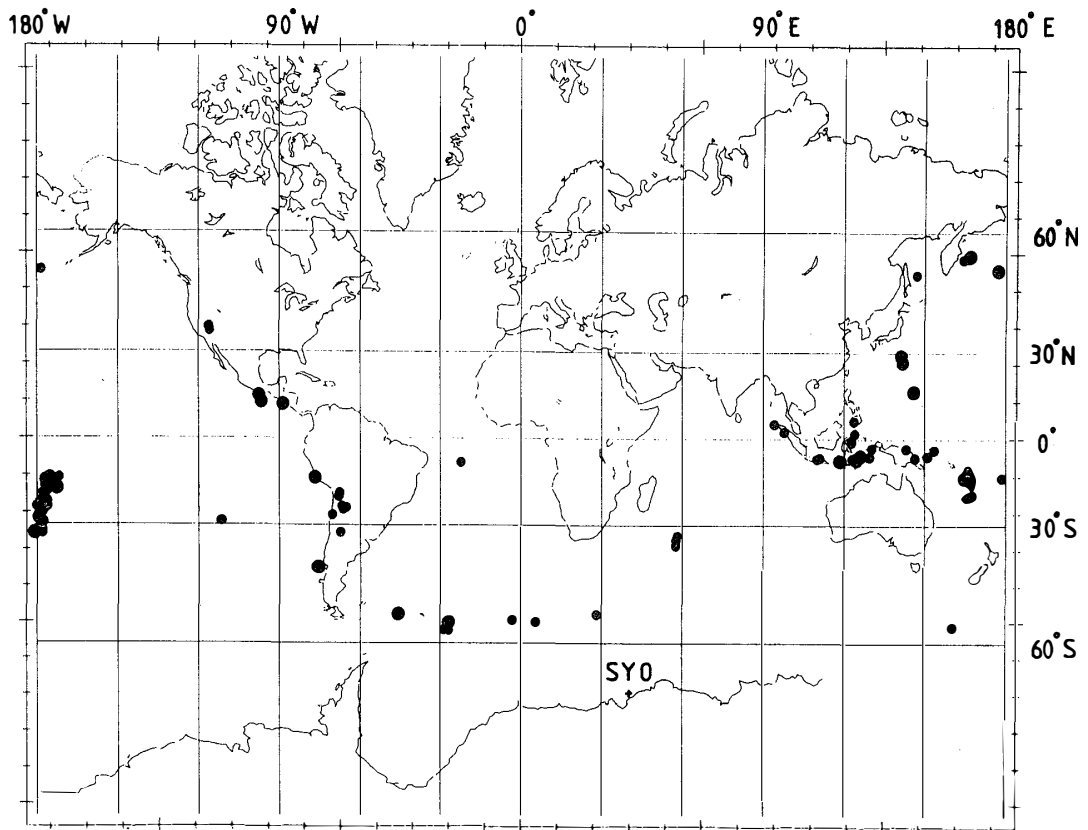


Fig. 5. Epicenters of the 79 events.

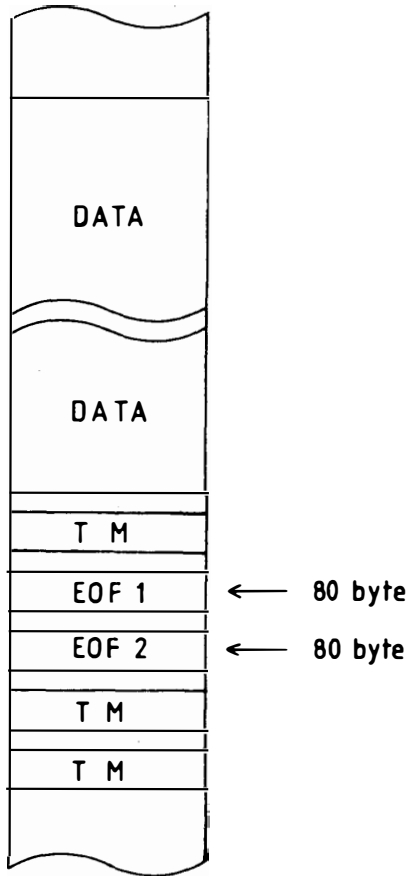


Fig. 6-1. Volume constitution.

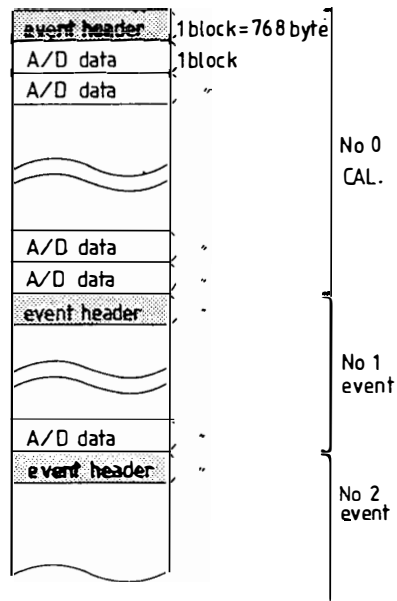
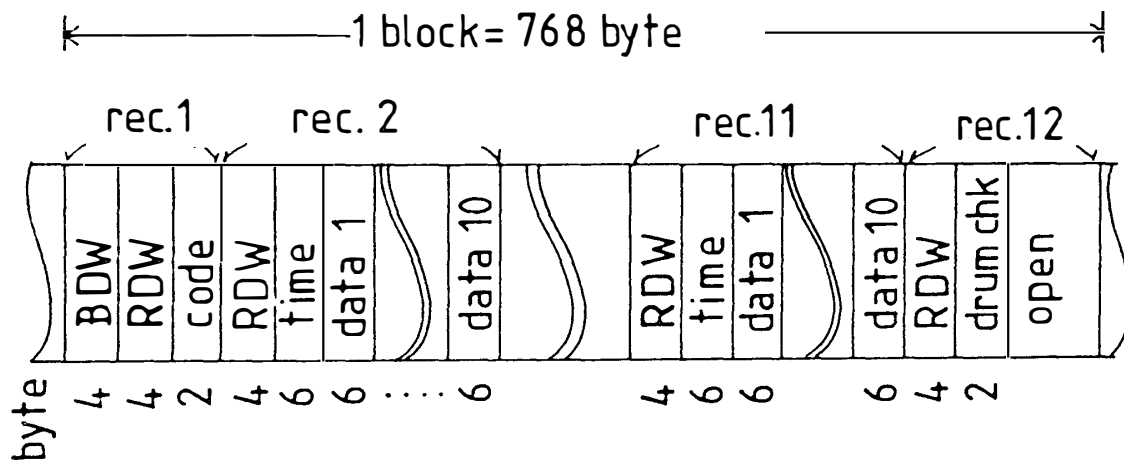


Fig. 6-2. Data constitution.

record	number	name	position	length	content
1	1	BDW	0-1 2-3	2 2	byte number (00) ₁₆
	2	RDW	4-5 6-7	2 2	byte number (00) ₁₆
	3	code	8-9	2	' B '
2	4	RDW	10-11 12-13	2 2	see no. 2
	5	event code	14-15	2	' HE '
	6	event no.	16-17	2	see Table 3
	7	total no.	18-19	2	dummy
	8	triggered time	20-25	6	see Fig. 6-6
	9	noise level	26-31	6	LTA
	10	K-value	32-33	2	threshold value
	11	triggered level	34-35	2	STA
	12	channel no.	36-37	2	3
	13	data acquisition time	38-39	2	1800 or 1200 or 440 s
	14	sample rate	40-41	2	10 samples/s
	15	block no.	42-43	2	181 or 121 or 45
	16	total block number	44-45	2	dummy
	3	17	RDW	46-47 48-49	2 2
18		origin time	50-67	18	PDE report
19		latitude	68-75	8	PDE report
20		longitude	76-85	10	PDE report
21		region name	86-109	24	PDE report
22		depth	110-117	8	PDE report
23		dummy	118-119	2	' '
24		magnitude	120-123	4	MB in PDE report
25		magnitude	124-125	4	MS in PDE report
26		dummy	126-127	2	' '
27		comment	128-143	16	see Table 3
4	28	open	144-767	622	(40) ₁₆

1 block length = 768 byte.

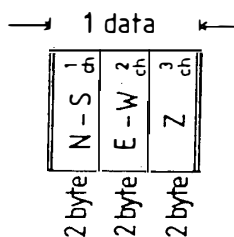
Fig. 6-3. Header of the event.



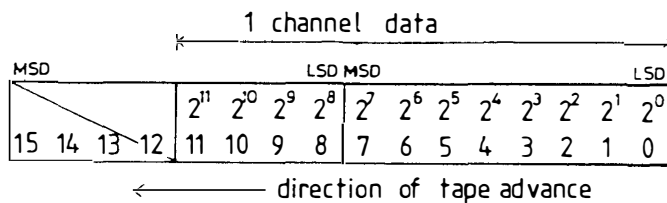
record	number	name	position	length	content
1	1	BDW	0-1 2-3	2 2	byte number (00) ₁₆ _____
	2	RDW	4-5 6-7	2 2	byte number (00) ₁₆ _____
	3	code	8-9	2	'HE'
2	4	RDW	10-11 12-13	2 2	see no. 2
	5	time	14-19	6	see Fig. 6-6
	6	data 1	20-25	6	see Fig. 6-5
	⋮				
	15	data 10	74-79	6	see Fig. 6-5
⋮					
11	112	RDW	640-641 642-643	2 2	see no. 2
	113	time	644-649	6	see Fig. 6-6
	114	data 1	650-655	6	see Fig. 6-5
	⋮				
	123	data 10	704-709	6	see Fig. 6-5
12	124	RDW	710-711 712-713	2 2	see no. 2
	125	drum check	714-715	2	(FF) ₁₆ : NG (00) ₁₆ : OK
	126	open	716-767	52	(40) ₁₆

Fig. 6-4. Constitution of A/D converted data in one block.

1. data sequence



2. data format



3. track number and bit

bit	2^2	2^0	2^4	p	2^5	2^6	2^7	2^1	2^3
track No	1	2	3	4	5	6	7	8	9
data name	5	7	3	p	2	1	0	6	4

Fig. 6-5. Data format of the sampled waveform.

No	item	1 byte				comment
		$2^7, 2^6, 2^5, 2^4$		$2^3, 2^2, 2^1, 2^0$		
		higher		lower		
1	dummy	$(40)_{16}$				
2	day	$(0)_{16}$		100-th digit 8, 4, 2, 1		max 399 day
3		10-th digit 8, 4, 2, 1		1-st digit 8, 4, 2, 1		
4	hour	10-th digit 2, 1		1-st digit 8, 4, 2, 1		max 23 hour
5	minute	10-th digit 4, 2, 1		1-st digit 8, 4, 2, 1		max 59 minute
6	second	10-th digit 4, 2, 1		1-st digit 8, 4, 2, 1		max 59 second

Time data — BCD number

Fig. 6-6. Format of the clock data.

Table 1. Read-out data.

DATE	PHASE	ARRIVAL TIME			DATE	PHASE	ARRIVAL TIME			DATE	PHASE	ARRIVAL TIME					
		H	M	S			H	M	S			H	M	S			
JAN	01	EPZ	02	54	06.0	JAN	06	EPZ	06	24	11.5	JAN	12	EPZ	09	14	41.4
		EPZ	06	46	06.2			EPZ	07	39	36.7			EPZ	09	32	15.4
	-IPZ	11	05	00.2	EPZ		08	37	15.6	EPZ	10		38	44.5			
	EPZ	11	52	10.4	IPZ		09	14	35.2	EPZ	11		03	21.9			
	EPZ	12	22	28.3	07		EPZ	04	01	45.0	13		EPZ	00	18	55.5	
	EPZ	12	58	47.2			IPZ	08	16	31.0			LP EPZ	00	18	57.8	
	EPZ	14	59	50.0	LP+IPZ		08	16	32.4	LP EXZ	00		19	27.8			
	EPZ	15	23	01.9	EPZ		08	39	00.4	EXZ	00		19	26.5			
	EPZ	15	50	08.0	+IPZ		09	35	11.4	EPZ	03		17	47.5			
	-IPZ	19	09	49.2	LP+IPZ		09	35	12.8	LP-IPZ	03		17	50.0			
	LP+IPZ	19	09	51.0	EPZ		10	48	14.7	EPZ	07		40	13.6			
	02	EPZ	06	46	01.8		EPZ	13	15	27.0	EPZ		09	29	57.8		
		EPZ	11	49	01.6		08	EPZ	04	35	49.3		EPZ	11	32	02.6	
	-IPZ	12	20	55.9	EPZ			07	50	32.0	EPZ		12	16	14.2		
	03	EPZ	01	36	27.0		EPZ	09	44	33.5	-IPZ		13	56	10.2		
		EPZ	04	23	09.1		EPZ	15	13	08.5	EPZ		14	13	03.0		
	EPZ	06	41	57.2	09		EPZ	06	23	25.8	14		LP EPZ	02	14	34.2	
	EPZ	14	21	58.8			LP+IPZ	08	44	48.2			EPZ	02	14	34.7	
	LP-IPZ	14	22	04.8	EPZ		12	28	47.6	EPZ	04		30	59.6			
+IPZ	17	54	01.0	EPZ	12	58	06.8	EPZ	10	06	37.3						
EPZ	22	17	39.7	EPZ	15	46	48.2	LP EPZ	10	06	39.0						
LP+IPZ	17	54	03.4	-IPZ	16	09	05.0	LP EXZ	10	38	27.8						
04	EPZ	00	41	06.2	LP-IPZ	16	09	06.4	15	EPZ	10	39	13.6				
	EPZ	01	59	04.4	EPZ	21	58	35.0		-IPZ	14	01	14.6				
EPZ	05	08	08.2	10	EPZ	23	29	33.8	LP-IPZ	14	01	14.2					
EPZ	05	11	29.4		EPZ	01	56	23.0	LP-IXZ	14	33	43.4					
LP EPZ	05	11	37.6	EPZ	07	43	18.3	16	EPZ	01	00	35.8					
LP ISZ	05	12	39.2	EPZ	08	43	56.3		18	+IPZ	04	36	17.0				
-IPZ	06	22	30.5	EPZ	08	50	27.5	EPZ		19	45	30.6					
LP-IPZ	06	22	32.4	EPZ	10	21	34.5	LP EPZ	19	46	20.2						
-IXZ	06	33	21.7	EPZ	15	12	05.6	LP EPZ	20	24	22.6						
-IPZ	22	33	04.7	11	EPZ	06	23	48.4	-IPZ	22	57	36.4					
LP-IPZ	22	33	06.0		LP+IPZ	06	23	50.2	LP-IPZ	22	57	36.6					
+IXZ	22	43	07.8	EPZ	11	48	41.9	19	EPZ	06	12	56.1					
05	EPZ	04	35	54.2	12	EPZ	01		09	56.5	20	EPZ	04	37	46.2		
	EPZ	05	38	45.5		EPZ	01	21	04.3	LP-IPZ		04	37	47.4			
EPZ	06	02	59.1	+IPZ	01	48	50.3	LP-EXZ	05	05	08.6						
EPZ	08	07	57.2	LP+IPZ	01	48	50.6	EPZ	05	26	03.0						
EPZ	13	56	54.3	EPZ	02	58	39.4	-IPZ	07	21	52.0						
06	EPZ	00	21	47.6	EPZ	07	51	29.5	LP-IPZ	07	21	52.2					

DATE	PHASE	ARRIVAL TIME	DATE	PHASE	ARRIVAL TIME	DATE	PHASE	ARRIVAL TIME
		H M S			H M S			H M S
JAN 20	LP+EXZ	07 49 52.6	JAN 27	LP-EPZ	21 57 20.1	FEB 10	LP-IPZ	20 49 18.6
	-IPZ	09 50 13.2	28	-IPZ	04 17 58.1		-IXZ	21 12 30.0
	-IPZ	12 54 06.4		+ISZ	04 20 13.4	12	-IPZ	15 14 39.1
21	EPZ	12 14 59.5		EPZ	06 04 59.7		-IPZ	15 44 39.3
	EPZ	13 56 09.3		EPZ	08 06 21.4	13	-IPZ	18 14 34.6
	EPZ	22 48 25.8		EPZ	09 17 42.5		LP-IPZ	18 14 35.4
22	EPZ	02 31 20.5		EPZ	10 19 02.4		EPZ	18 34 55.8
	EPZ	03 38 20.3		EPZ	13 08 10.0		+EPZ	20 08 35.2
	EPZ	05 43 40.5		+IPZ	16 19 38.3		+IPZ	23 36 06.4
	EPZ	08 24 27.7		LP+IPZ	16 19 39.2		-IPZ	23 57 45.1
	+IPZ	08 44 48.6	29	EPZ	00 41 56.0	14	+IPZ	05 23 45.6
	EPZ	10 45 55.5		EPZ	03 08 16.7	15	EPZ	15 02 44.8
	EPZ	16 17 56.9	30	EPZ	02 52 29.0	16	EPZ	20 14 38.8
	EPZ	20 08 20.6		EPZ	18 53 06.4		LP EPZ	20 15 00.7
23	EPZ	00 00 07.3	31	EPZ	08 49 11.3	20	-EPZ	13 39 58.8
	EPZ	00 12 05.7		LP EPZ	08 51 11.8		LP-EPZ	13 39 59.1
	EPZ	08 31 51.1	FEB 01	-EPZ	14 24 39.8		-IPZ	19 37 19.1
	EPZ	10 05 54.3		-IPZ	19 41 13.3		LP+IPZ	19 37 18.0
	EPZ	16 00 33.0	02	-IPZ	01 04 17.0	21	EPZ	05 16 25.0
	EPZ	16 19 31.6		LP-IPZ	01 04 16.4		LP EPZ	05 16 39.0
	EPZ	16 23 45.8	05	+IPZ	18 02 19.3		-EPZ	16 16 04.0
24	LP EPZ	18 30 08.2	06	EPZ	01 39 33.0		EPZ	19 25 02.0
	EPZ	02 13 21.9		+IPZ	12 22 57.6	22	EPZ	13 00 22.0
	EPZ	06 26 48.0		+IPZ	15 51 28.7		LP EPZ	13 01 49.0
	LP EXZ	06 36 55.4		LP EPZ	15 53 29.2	23	-IPZ	16 18 59.0
	LP IXZ	06 56 45.0	07	+EPZ	02 02 24.8		LP-IPZ	16 18 59.1
	+IPZ	10 39 24.3	08	-IPZ	00 06 02.7	24	+IPZ	04 35 04.3
	EPZ	19 42 52.5		-IPZ	12 16 23.5		LP+IPZ	04 35 03.8
	EPZ	19 52 25.7		LP+IPZ	12 16 23.4	26	-EPZ	11 30 09.2
25	EPZ	02 37 18.4	09	+IPZ	03 26 20.1		-IPZ	21 30 37.0
	EPZ	04 46 52.6		+IPZ	21 38 31.2		-IPZ	22 40 42.3
	-IPZ	05 49 23.8		LP-IPZ	21 38 31.0	27	-EPZ	16 38 44.8
	LP+IPZ	05 49 23.4		-IPZ	01 33 19.6	28	+IPZ	12 37 29.9
26	EPZ	00 25 38.6	10	LP+IPZ	01 33 20.8		-IPZ	17 13 03.0
	EPZ	08 41 32.4		EPZ	05 09 54.8		+IPZ	18 04 01.2
	+IPZ	13 35 47.2		LP EPZ	05 10 09.8	MAR 01	EPZ	01 48 25.0
	EPZ	17 23 48.0		+IPZ	10 19 32.7	02	+EPZ	06 50 39.7
27	EPZ	01 16 41.2		LP+IPZ	10 19 33.8		+EPZ	12 19 25.2
	EPZ	07 29 05.5		-EPZ	16 29 33.0	03	-EPZ	11 11 57.5
	-IPZ	21 57 20.2		-IPZ	20 49 18.1		-IPZ	19 53 21.8

DATE				ARRIVAL TIME				DATE				ARRIVAL TIME				DATE				ARRIVAL TIME			
DATE		PHASE	ARRIVAL TIME			DATE		PHASE	ARRIVAL TIME			DATE		PHASE	ARRIVAL TIME			DATE		PHASE	ARRIVAL TIME		
H	M	S	H	M	S	H	M	S	H	M	S	H	M	S	H	M	S	H	M	S			
MAR	03	-EPZ	22	45	34.8	MAR	24	EPZ	01	42	24.6	APR	16	LP EPZ	16	19	53.4						
	04	-IPZ	09	24	09.6			EPZ	02	03	59.2			EPZ	16	26	55.0						
		LP EPZ	09	23	57.4		25	-EPZ	05	13	21.6			LP EPZ	16	27	27.8						
	05	-IPZ	21	55	16.8			LP-IPZ	05	13	23.0		17	-EPZ	12	56	01.6						
	07	+IPZ	09	01	37.8			EPZ	12	00	01.5		18	+IPZ	11	43	11.0						
		LP-EPZ	09	01	38.0		26	EPZ	02	09	36.8			EPZ	16	57	48.6						
		-IPZ	12	23	23.3			+IPZ	05	08	41.8		19	-IPZ	08	06	24.2						
		LP+IPZ	12	23	24.0			-EPZ	06	35	26.4		21	-EPZ	09	40	44.0						
		-EPZ	13	31	06.0			EPZ	09	30	52.3			-EPZ	12	17	44.4						
		-IPZ	15	54	18.3			-IPZ	22	46	12.5		22	-IPZ	03	11	20.0						
		LP+IPZ	15	54	18.6		28	-IPZ	04	04	13.0			EPZ	19	30	02.2						
	08	-IPZ	15	36	11.0			LP+IPZ	04	04	11.8		23	EPZ	16	55	37.8						
		+IPZ	23	36	00.9			+IPZ	08	10	58.2		24	-EPZ	22	35	23.2						
	09	-EPZ	11	36	50.2			EPZ	16	20	33.2			LP EPZ	22	35	37.4						
		LP-EPZ	11	36	57.4			-IPZ	23	37	25.6		25	-IPZ	03	42	01.9						
	11	+EPZ	09	53	20.8		29	EPZ	08	06	28.6			LP+IPZ	03	42	00.6						
		LP EPZ	09	53	35.0			EPZ	12	34	30.7			EPZ	07	10	18.7						
		+IPZ	10	44	18.1			+IPZ	21	46	25.2			LP EPZ	07	14	03.0						
		LP+EPZ	10	44	14.6			LP+IPZ	21	46	25.0			+IPZ	10	17	01.2						
	12	+IPZ	02	51	11.6		30	EPZ	22	41	01.3			+IPZ	18	24	39.5						
		-IPZ	22	56	31.5		31	-IPZ	10	49	05.3			LP+IPZ	18	24	38.4						
		LP+EPZ	22	56	32.4		APR	03	-EPZ	12	15	57.7		26	+EPZ	21	44	12.1					
	13	-IPZ	09	10	56.3			07	EPZ	14	53	53.3		27	+EPZ	08	04	40.2					
	14	-EPZ	00	50	30.0			08	EPZ	00	53	19.0		28	-IPZ	10	34	01.1					
		EPZ	04	54	29.6				EPZ	01	32	17.2			EPZ	22	38	16.5					
		EPZ	07	46	29.3			09	-IPZ	13	49	34.5		30	+IPZ	07	52	59.1					
	16	EPZ	11	05	01.2			10	+IPZ	06	55	00.8			+ISZ	07	59	20.0					
	17	EPZ	13	53	12.1				-IPZ	07	07	17.3			+EPZ	10	18	06.2					
		+IPZ	14	00	16.4				+EPZ	20	39	49.3			+EPZ	10	39	49.2					
	21	-IPZ	02	51	19.0				-IPZ	21	37	02.0		MAY	01	+EPZ	11	30	57.6				
		LP+IPZ	02	51	19.0				-IPZ	00	46	39.1			02	-EPZ	11	30	57.6				
		EPZ	03	03	38.0			12	-IPZ	00	46	39.1			LP-EPZ	12	01	28.4					
		LP EPZ	03	03	38.2			14	EPZ	14	23	52.4			-EPZ	13	37	36.6					
		EPZ	06	59	34.5			15	LP EPZ	21	25	16.6			EPZ	18	56	59.5					
		+IPZ	13	47	36.4			16	-IPZ	08	26	39.0			-IPZ	03	39	52.6					
		EPZ	16	02	56.0				LP+IPZ	08	26	39.4			LP+EPZ	03	39	52.4					
	22	EPZ	18	52	15.6				-IPZ	14	17	59.8			+IPZ	07	37	29.0					
		EPZ	20	55	54.3				LP+IPZ	14	17	58.6			+EXZ	07	37	57.2					
	23	+IPZ	15	53	36.0				EPZ	16	07	52.4			LP-EPZ	07	37	28.8					
		EPZ	21	05	45.6				LP EPZ	16	08	10.2			+IPZ	16	33	32.8					
									EPZ	16	18	48.3			LP+EPZ	16	33	32.0					

DATE	PHASE	ARRIVAL TIME		
		H	M	S
MAY 04	+EPZ	08	09	58.5
	LP EPZ	08	09	52.4
05	+IPZ	13	13	22.0
	EPZ	20	20	05.4
07	LP EPZ	20	19	45.6
	+IPZ	05	44	04.8
08	LP+IPZ	05	44	04.4
	-IPZ	18	36	35.8
	LP+IPZ	18	36	36.4
10	EPZ	10	59	00.6
	EPZ	20	34	40.3
	EPZ	21	50	47.3
11	+IPZ	14	15	34.9
	LP EPZ	14	15	34.0
12	-EPZ	08	15	25.4
	+EPZ	12	20	36.4
	EPZ	20	52	05.4
	-IPZ	20	59	19.0
	LP-IPZ	20	59	17.6
	-EPZ	10	09	24.0
13	-IPZ	10	14	54.4
	LP EPZ	10	14	53.6
	ESZ	10	24	20.0
	LP EPZ	10	24	19.2
	-EPZ	12	53	37.0
	LP+EPZ	12	53	34.0
14	EPZ	21	28	49.4
	+EPZ	19	40	39.6
	+EPZ	23	58	33.0
15	EPZ	00	54	09.0
	-EPZ	02	29	27.8
	LP-EPZ	12	29	26.8
	-EPZ	02	45	27.2
16	LP-EPZ	02	45	28.2
	-IPZ	01	13	01.5
	LP EPZ	01	13	01.6
19	+EPZ	22	30	01.1
	+IPZ	18	29	35.8
20	LP-EPZ	18	29	34.8
	+IPZ	21	41	39.8

DATE	PHASE	ARRIVAL TIME		
		H	M	S
MAY 20	LP-IPZ	21	41	38.8
	+EPZ	23	07	48.4
22	LP+EPZ	23	07	47.2
	+EPZ	09	05	32.9
23	LP-IPZ	09	05	32.4
	+IPZ	06	52	25.1
24	+EPZ	03	07	34.4
	LP+EPZ	03	08	50.8
	-IPZ	07	44	59.0
26	LP+IPZ	07	44	57.6
	EPZ	04	46	44.4
27	LP EPZ	04	46	51.9
	EPZ	00	19	37.1
28	-IPZ	21	59	44.8
	LP EPZ	22	33	06.3
31	+IPZ	06	47	22.0
	LP+IPZ	06	47	21.6
	-IPZ	10	41	07.0
JUN 01	LP-IPZ	10	41	07.6
	-IPZ	15	32	35.3
	EPZ	02	45	58.2
	+IPZ	04	24	17.0
02	LP IPZ	04	24	16.0
	EPZ	04	53	16.9
	-IPZ	09	55	27.4
	-EPZ	10	21	05.2
03	+IPZ	12	50	30.0
	+EPZ	17	45	26.0
04	+IPZ	06	55	31.1
	+EPZ	07	18	31.4
06	+IPZ	02	08	19.7
	-EPZ	03	20	55.4
	LP+EPZ	03	20	56.0
07	-IPZ	15	34	04.9
	LP-IPZ	15	34	05.2
07	-EPZ	04	47	35.2
	LP-EPZ	04	47	34.4
07	EPZ	00	25	54.6
	LP EPZ	00	40	37.2
	LP EXZ	07	13	00.4

DATE	PHASE	ARRIVAL TIME		
		H	M	S
JUN 07	EXZ	11	18	27.6
	LP EPZ	11	18	34.2
09	EPZ	21	05	24.5
	+EPZ	23	53	10.3
	LP EPZ	23	53	08.8
	-IPZ	03	21	36.2
10	LP+IPZ	03	21	36.0
	EPZ	07	50	12.4
	+EPZ	14	29	39.8
	LP EPZ	14	29	03.2
11	EPZ	14	37	41.4
	LP EPZ	14	42	52.0
	EPZ	15	58	41.2
	+EPZ	11	54	34.3
12	LP EPZ	11	54	33.6
	-EPZ	13	16	50.0
	EPZ	16	50	01.3
	+IPZ	00	50	55.9
14	LP IPZ	00	50	54.8
	+EPZ	11	10	34.3
15	EPZ	10	27	16.9
	EPZ	14	00	36.3
16	-EPZ	16	52	47.7
	LP-EPZ	16	52	46.4
18	EPZ	11	11	42.2
	+IPZ	08	31	29.7
18	LP-IPZ	08	31	28.0
	-IPZ	03	11	12.7
19	LP+IPZ	03	11	11.6
	EPZ	07	22	30.3
	LP EPZ	07	22	12.0
	EPZ	13	38	18.5
19	LP EPZ	13	38	20.8
	-IPZ	18	30	12.1
	LP+EPZ	18	30	10.8
	EPZ	04	30	32.4
19	+EPZ	06	40	04.5
	LP EPZ	06	40	30.8
	-IPZ	11	25	11.8
	EPZ	22	15	51.7

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
JUN	19 LP EPZ	22	15	50.8	
	EPZ	23	01	39.4	
	LP EPZ	23	01	49.6	
	22	+IPZ	04	30	11.6
		LP-IPZ	04	30	10.8
		+ESZ	04	59	22.0
	23	EXZ	05	16	40.5
		EPZ	00	35	39.2
		EPZ	03	34	52.6
	24	LP EPZ	03	35	58.4
		+IPZ	23	36	04.8
		LP-IPZ	23	36	03.6
	24	EPZ	09	23	58.3
		LP EPZ	09	23	58.0
		EXZ	09	25	42.5
	25	-IPZ	14	34	38.4
		LP+IPZ	14	34	37.2
		-EPZ	07	53	01.2
	25	+EXZ	07	53	01.2
		LP-IPZ	07	53	10.8
		+IXZ	07	56	11.0
	27	LP+IXZ	07	56	01.2
		-IPZ	16	25	56.6
		LP+IPZ	16	25	56.0
	28	EPZ	14	59	35.9
	29	EPZ	17	10	57.2
	30	LP EPZ	17	11	14.0
		EPZ	02	16	14.6
		LP EPZ	02	16	25.5
	01	+IPZ	08	01	38.0
LP+IPZ		08	01	36.6	
EPZ		17	51	30.7	
03	EPZ	23	30	16.6	
04	+EPZ	01	34	19.1	
	LP EPZ	01	34	17.4	
	LP+IPZ	01	36	08.6	
05	-IXZ	01	37	53.0	
	LP+IXZ	01	37	52.6	
	+EXZ	02	52	40.4	
+EPZ	21	33	36.7		

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
JUL	05 LP EPZ	21	33	25.4	
	07 EPZ	10	51	22.3	
	LP EPZ	10	51	19.0	
	07	-IXZ	10	52	15.1
		LP EXZ	10	52	14.6
		-IPZ	12	26	08.8
	10	LP+IPZ	12	26	07.0
		-IPZ	13	19	05.2
		-IPZ	02	25	57.2
	11	LP+EPZ	02	25	55.0
		EPZ	17	18	18.7
		+EPZ	08	14	35.5
	14	+IPZ	12	36	48.0
		+EPZ	03	10	03.8
		LP EPZ	03	10	03.4
	15	LP EPZ	03	10	03.4
		EPZ	22	14	31.7
		LP+IPZ	22	14	34.2
	17	EPZ	10	10	35.3
		-IPZ	15	03	25.1
		LP+IPZ	15	03	24.2
	18	EPZ	16	50	39.3
		+IPZ	00	04	05.4
		LP+IPZ	00	04	04.2
	19	-IPZ	15	31	34.6
		LP+IPZ	15	31	33.0
		-IPZ	16	08	47.8
	20	LP+IPZ	16	08	46.6
		-EPZ	17	54	20.4
		LP EPZ	17	54	19.6
22	+EPZ	11	53	00.0	
	+EPZ	14	03	12.2	
	LP EPZ	14	03	10.0	
23	EPZ	14	42	54.2	
	LP EPZ	14	42	45.6	
	EPZ	18	13	04.1	
24	LP EPZ	18	12	58.0	
	EPZ	06	00	41.2	
	LP EPZ	06	02	18.4	
24	EPZ	09	21	40.0	
	EPZ	09	21	38.4	
	LP EPZ	09	21	38.4	

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
JUL	26 EPZ	03	47	05.7	
	LP EPZ	03	47	05.2	
	28	EPZ	13	34	39.6
		EPZ	03	53	44.4
	30	LP-IPZ	03	53	44.8
		EPZ	06	49	00.0
		LP+IPZ	06	49	00.0
	31	-IPZ	11	19	03.5
		LP+IPZ	11	19	02.8
		EPZ	10	55	41.1
	AUG	01 LP EPZ	10	55	49.6
		+IPZ	20	46	21.2
02		EPZ	16	54	42.3
		LP EPZ	16	54	50.0
03		-EPZ	05	23	12.5
		+IPZ	04	15	37.7
04		LP-IPZ	04	15	38.0
		EPZ	07	40	59.0
		+IPZ	09	28	02.3
05		LP-IPZ	09	28	02.4
		-IPZ	14	19	37.7
		LP+IPZ	14	19	36.8
06	+EPZ	20	44	32.6	
	LP EPZ	20	44	26.8	
	-ISZ	20	55	05.1	
07	EPZ	05	13	42.5	
	EPZ	20	52	46.3	
	LP-IPZ	20	52	54.4	
08	+IPZ	15	52	11.2	
	LP-IPZ	15	52	15.2	
	-IPZ	21	07	57.3	
09	LP-IPZ	21	07	57.6	
	-IPZ	06	33	30.6	
	LP+IPZ	06	33	30.4	
10	+IPZ	10	59	13.0	
	LP-IPZ	10	59	13.2	
	+EPZ	00	00	14.4	
10	LP-EPZ	00	00	14.8	
	+EPZ	07	32	21.0	
	LP-EPZ	07	32	20.8	

DATE	PHASE	ARRIVAL TIME		
		H	M	S
AUG 10	+EPZ	20	42	44.4
11	-IPZ	10	55	24.2
	-IPZ	20	43	18.2
	LP-IPZ	20	43	18.8
12	EPZ	02	26	14.5
	LP EPZ	02	26	14.8
13	+IPZ	00	37	15.9
	LP-IPZ	00	37	15.2
	+EPZ	02	34	45.4
14	EPZ	07	19	22.8
	-IPZ	14	40	29.9
	LP-IPZ	14	40	30.0
15	+IPZ	06	24	01.8
16	-IPZ	07	33	11.5
	LP+IPZ	07	33	11.2
	EPZ	15	31	57.3
	-IPZ	22	55	09.6
17	EPZ	22	31	02.8
	LP-IPZ	22	36	20.0
	LP EXZ	23	15	50.8
18	EPZ	21	55	51.4
19	+IPZ	04	53	20.6
	LP-IPZ	04	53	20.0
20	+IPZ	14	09	18.1
	LP-IPZ	14	09	17.6
22	-IPZ	03	55	01.0
	LP+IPZ	03	55	00.8
23	-IPZ	20	46	57.3
24	EPZ	05	18	03.8
	LP-IPZ	05	18	03.6
26	EPZ	01	35	04.6
	EPZ	05	36	21.2
27	EPZ	09	07	18.4
28	-EPZ	04	40	48.7
29	-IPZ	01	11	21.8
	LP+EPZ	01	11	21.6
	-IPZ	13	29	14.5
	LP+IPZ	13	29	14.0
31	-EPZ	18	27	09.8
SEP 01	-IPZ	15	25	26.3

DATE	PHASE	ARRIVAL TIME		
		H	M	S
SEP 01	LP+IPZ	15	25	25.8
	EPZ	22	11	54.7
02	+IPZ	16	09	44.6
	LP-IPZ	16	09	44.6
	EPZ	20	26	38.4
	LP-EPZ	20	26	38.6
	EPZ	22	51	16.4
	EPZ	23	54	19.1
03	EPZ	01	50	19.6
	+IPZ	20	25	43.5
	LP-IPZ	20	25	43.4
	ESZ	20	34	27.8
	-IPZ	23	52	48.0
	LP+IPZ	23	52	47.9
04	+IPZ	02	21	18.2
	LP+IPZ	02	21	17.2
	-IPZ	13	43	32.6
	LP+IPZ	13	43	32.0
	+EPZ	22	39	07.4
05	EPZ	10	17	23.2
	EPZ	18	40	03.0
	LP EPZ	18	40	20.0
	-IPZ	21	22	10.0
	LP-IPZ	21	22	08.8
06	+IPZ	02	05	33.4
	LP-IPZ	02	05	32.8
	EPZ	10	14	56.4
07	-IPZ	01	59	59.0
	-IPZ	14	54	19.4
	+EPZ	18	49	02.9
08	+EPZ	00	19	54.9
	-IPZ	21	19	30.8
	LP+IPZ	21	19	30.4
09	+IPZ	06	51	41.0
	+IPZ	16	52	31.0
	LP-IPZ	16	52	30.8
10	+EPZ	10	40	25.7
11	+IPZ	14	23	30.5
	LP-IPZ	14	23	30.0
	EPZ	14	32	46.5

DATE	PHASE	ARRIVAL TIME		
		H	M	S
SEP 11	+IPZ	14	38	45.5
	LP-IPZ	14	38	45.2
12	EPZ	00	02	30.6
	-IPZ	07	34	25.8
	+EPZ	08	58	15.6
	LP-IPZ	08	58	15.2
	+EPZ	09	42	01.4
	LP EPZ	09	42	01.6
13	EPZ	01	37	42.7
14	EPZ	04	05	36.3
	EPZ	05	23	29.3
	EPZ	10	11	00.5
	LP EXZ	19	02	30.0
15	-IPZ	01	11	39.3
	+IPZ	20	35	09.7
	LP-IPZ	20	35	09.0
16	EPZ	08	36	02.4
	EPZ	12	29	11.8
	EPZ	20	02	31.9
	EPZ	21	34	30.3
17	-IPZ	13	39	55.0
	LP+IPZ	13	39	54.4
	+ISZ	13	49	21.0
	LP+ISZ	13	49	21.6
18	-EPZ	00	24	21.5
	EPZ	12	51	49.0
	EPZ	15	12	40.6
	LP EPZ	15	12	43.2
	EPZ	18	42	02.6
	+IPZ	21	32	13.7
	LP-IPZ	21	32	20.0
19	+EPZ	07	34	33.4
	EPZ	17	48	15.4
	LP EPZ	17	48	37.5
20	EPZ	13	09	54.4
	LP EPZ	13	09	44.4
	+EPZ	14	00	41.3
	LP EPZ	14	00	25.2
	EPZ	14	04	19.0
	-IPZ	17	17	12.0

DATE	PHASE	ARRIVAL TIME				
		H	M	S		
SEP	20	LP-IPZ	17	17	12.0	
	21	-EPZ	00	59	21.0	
		LP-EPZ	00	58	11.2	
		-IPZ	01	41	10.6	
		LP+IPZ	01	41	11.2	
		-EPZ	02	15	21.7	
		LP EXZ	02	14	05.3	
	23	-IPZ	16	19	37.7	
		LP+IPZ	16	19	38.2	
		+IPZ	17	19	37.5	
	24	+IPZ	00	20	29.8	
		EPZ	08	00	02.6	
		-IPZ	19	59	48.7	
		LP+IPZ	19	59	49.2	
		EPZ	22	05	07.2	
	25	EPZ	16	17	03.2	
		-IPZ	18	20	24.5	
		LP+IPZ	18	20	24.6	
	26	+IPZ	01	29	01.2	
		LP-IPZ	01	29	02.0	
		EPZ	04	12	14.5	
		EPZ	08	45	32.5	
27	EPZ	09	07	08.4		
28	+IPZ	15	26	58.7		
		LP-IPZ	15	26	59.2	
		EPZ	20	15	27.5	
	29	EPZ	17	52	52.3	
		-IPZ	22	10	24.9	
		LP+IPZ	22	10	25.2	
	30	EPZ	09	55	10.4	
	OCT	01	+EPZ	14	48	42.0
		02	-IPZ	08	39	00.6
		03	LP+IPZ	08	39	00.8
			EPZ	02	31	50.1
		+EPZ	08	06	52.0	
		LP+EPZ	08	06	02.4	
		+IXZ	08	07	05.3	
		EPZ	15	35	41.0	
		LP EPZ	15	35	20.0	
		-IPZ	15	52	46.2	

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
OCT	05	+IPZ	04	58	46.1
		+IPZ	09	27	20.8
		LP+IPZ	09	27	21.6
		-IPZ	10	26	52.3
		LP-EPZ	10	26	50.4
		+EPZ	19	50	54.7
		EXZ	19	53	22.7
		+IPZ	20	38	10.5
		LP-IPZ	20	38	10.8
		+IPZ	21	54	37.4
	06	EPZ	09	04	00.0
		+EPZ	21	25	27.9
	07	+IPZ	07	27	21.7
		LP-IPZ	07	27	22.0
		EXZ	07	36	47.0
		EXZ	07	53	42.8
		+EXZ	07	56	14.2
		LP+EPZ	07	56	18.4
		EXZ	08	52	51.0
	09	EPZ	22	21	52.5
	10	EPZ	11	39	22.9
		+EPZ	17	54	56.5
	11	-IPZ	07	34	27.2
		LP+IPZ	07	34	27.2
		EPZ	10	33	38.6
		LP+IPZ	10	33	38.8
		-IPZ	16	46	54.0
		LP+IPZ	16	46	54.8
	12	EPZ	21	44	22.5
	13	EPZ	17	03	17.2
	14	+EPZ	09	05	26.7
	15	+IPZ	01	07	15.3
		+EPZ	03	08	34.1
		LP EPZ	03	08	32.0
	16	+EPZ	00	25	09.3
		-IPZ	02	06	25.8
		LP+IPZ	02	06	26.0
		EPZ	08	36	39.5
		LP+EPZ	08	36	13.2
		-IPZ	11	24	36.6

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
OCT	17	-IPZ	18	31	36.9
		LP+IPZ	18	31	37.2
		EPZ	23	04	06.5
	19	EPZ	03	47	26.8
		LP EPZ	03	47	21.2
		+IPZ	16	32	04.3
		LP-IPZ	16	32	04.8
		-IPZ	17	40	24.4
	20	+IPZ	18	20	03.5
		LP-IPZ	18	20	03.6
		EXZ	18	20	03.5
		-IPZ	19	01	36.3
		LP-IPZ	19	01	14.8
		-IPZ	20	10	28.0
	21	EPZ	13	31	46.2
	22	+IPZ	15	29	44.7
		LP+EPZ	15	29	44.0
	23	EPZ	00	20	29.3
		LP EPZ	00	20	30.0
	24	-EPZ	08	33	27.0
		LP EPZ	08	32	42.4
		-IPZ	09	01	49.0
		LP+IPZ	09	01	49.6
		-IPZ	10	55	25.7
		LP-EPZ	10	55	25.2
		-IPZ	15	48	09.9
		LP+IPZ	15	48	09.6
		-IPZ	16	21	49.3
	25	EPZ	13	55	20.6
		LP-IPZ	13	55	20.0
		EPZ	17	20	07.0
		+IPZ	19	35	17.1
		LP-IPZ	19	35	16.8
		+IPZ	22	45	40.8
		LP+IPZ	22	45	40.8
	26	+IPZ	03	35	31.8
		LP-IPZ	03	35	32.8
		EPZ	04	03	54.7
		-IPZ	12	55	50.5
		LP-IPZ	12	55	50.8

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
OCT	27	+IPZ	21	27	38.2
	28	-IPZ	20	25	40.8
		LP EPZ	20	25	41.2
	29	-IPZ	03	59	39.0
		LP+IPZ	03	59	39.6
	30	+IPZ	07	18	15.1
		LP-EPZ	07	18	15.6
	31	+IPZ	03	00	23.6
		LP-IPZ	03	00	24.0
		EPZ	05	49	48.4
		LP EPZ	05	49	37.6
	EPZ	06	21	36.7	
NOV	01	+IPZ	00	50	14.0
		LP-IPZ	00	50	28.8
	02	+IPZ	16	27	17.1
		LP-IPZ	16	27	17.6
		-IPZ	18	47	34.5
		LP-IPZ	18	47	37.2
	03	+IPZ	18	19	13.3
		LP-IPZ	18	19	12.8
	04	EPZ	00	17	12.4
		LP EPZ	00	16	56.4
		EPZ	04	43	04.0
		EPZ	14	52	27.0
		-IPZ	19	01	54.3
		LP+IPZ	19	01	55.2
	05	-IPZ	05	04	31.2
		LP+EPZ	05	04	31.6
	08	+IPZ	09	50	27.3
		LP-IPZ	09	50	27.6
	09	EPZ	07	34	25.0
		LP EPZ	07	34	14.8
		EPZ	22	01	31.0
	10	EPZ	15	41	37.3
	EPZ	21	32	50.7	
	LP EPZ	21	32	32.0	
11	+IPZ	00	55	17.7	
	LP-IPZ	00	55	18.0	
	EPZ	12	08	04.3	
	EPZ	15	18	51.7	

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
NOV	11	EPZ	21	33	58.5
		LP EPZ	21	33	28.4
	12	+IPZ	00	15	17.0
		LP-IPZ	00	15	17.6
		-IPZ	12	29	04.4
		-EPZ	21	01	17.0
		LP EPZ	21	01	10.0
	13	+IPZ	04	51	33.5
		LP+IPZ	04	51	32.8
		EPZ	14	03	47.0
		LP EPZ	14	03	46.0
		EPZ	15	18	29.9
		LP EPZ	15	18	26.0
	14	+IPZ	08	48	50.0
		LP+IPZ	08	48	51.2
		EPZ	15	29	09.2
		LP EPZ	15	29	42.0
		+IPZ	16	35	53.6
	LP-IPZ	16	35	53.4	
	+EXZ	17	41	41.0	
	EPZ	23	06	29.5	
15	+EPZ	07	19	02.6	
	EPZ	14	18	20.3	
	LP EPZ	14	18	41.6	
16	-IPZ	01	56	54.3	
	LP EPZ	01	56	53.2	
	EPZ	05	15	19.3	
	EPZ	15	31	22.4	
	-IPZ	17	38	44.9	
	LP+IPZ	17	38	44.2	
17	EPZ	10	09	57.6	
18	+IPZ	00	35	47.1	
	LP-IPZ	00	35	47.6	
	+IPZ	15	11	02.7	
	LP-IPZ	15	11	04.8	
	EXZ	15	45	32.2	
	LP EPZ	15	45	41.2	
	EPZ	20	49	01.3	
	+IXZ	20	50	23.1	
	LP-IXZ	20	50	23.6	

DATE	PHASE	ARRIVAL TIME			
		H	M	S	
NOV	18	-IXZ	20	51	01.4
		EPZ	22	52	27.6
		LP EPZ	22	52	14.0
	19	-IPZ	04	40	04.6
		LP-IPZ	04	40	05.2
		EPZ	11	05	32.0
		LP EPZ	11	05	08.8
		EPZ	11	30	06.8
	26	EPZ	15	59	53.9
		LP EPZ	15	59	40.4
		EPZ	17	55	06.6
		LP+EPZ	17	55	06.4
	27	-IPZ	02	30	45.5
		LP+IPZ	02	30	46.0
		-IXZ	02	36	04.3
		EXZ	03	00	21.0
		EXZ	03	40	16.3
		+IPZ	10	13	55.5
		LP+IPZ	10	13	55.6
		EXZ	10	25	06.0
		+IPZ	11	26	51.3
		EPZ	19	01	41.8
		LP EPZ	19	01	06.8
		-IPZ	22	27	47.2
		LP EPZ	22	27	47.6
	29	-IPZ	00	39	09.8
		LP+IPZ	00	39	10.0
		-IPZ	05	17	21.0
	30	+IPZ	02	28	29.0
		LP-IPZ	02	28	29.6
		EPZ	10	57	00.0
	-IPZ	14	14	38.3	
	LP+IPZ	14	14	38.8	
	EXZ	16	36	01.4	
	-EPZ	20	50	05.0	
	LP+IPZ	20	50	05.6	
	EPZ	22	06	01.0	
	LP EPZ	22	05	52.2	
	EPZ	06	21	36.7	
DEC	01	EPZ	23	49	32.1

DATE	PHASE	ARRIVAL TIME		
		H	M	S
DEC 02	EPZ	08	34	49.6
	+IPZ	14	20	04.0
03	EPZ	18	00	07.6
	EPZ	19	49	48.0
	LP EPZ	19	49	32.0
	-IPZ	22	42	30.0
04	LP+IPZ	22	42	30.4
	EXZ	22	43	27.2
	-IPZ	03	37	31.4
05	-IPZ	03	56	09.0
	LP+IPZ	03	56	08.4
	+IPZ	04	06	05.5
	-IPZ	06	01	20.0
	EPZ	16	03	50.0
06	EPZ	18	11	49.9
	LP EPZ	18	11	49.2
09	EPZ	01	53	47.3
	LP-IPZ	01	53	48.4
	EPZ	10	52	01.2
10	LP EPZ	10	52	01.2
	EPZ	17	33	12.0
11	EPZ	22	26	38.5
	EPZ	10	06	49.7
13	EPZ	09	25	19.3
	+IPZ	09	25	19.2
	LP-IPZ	09	25	19.2
14	EPZ	09	38	18.2
	LP EPZ	09	38	07.2
	EPZ	12	14	33.8
	LP EPZ	12	14	14.0
	EPZ	18	48	46.0
15	EPZ	10	29	08.4
	-IPZ	19	58	57.0
	LP-IPZ	19	58	58.0
16	+IPZ	09	09	23.8
	LP+EPZ	09	09	23.6
17	EPZ	03	01	25.2
	EPZ	13	44	04.4
	EPZ	14	13	06.2
18	-IPZ	00	54	14.4
	LP+EPZ	00	54	15.2

DATE	PHASE	ARRIVAL TIME		
		H	M	S
DEC 18	+IPZ	23	28	54.7
	LP+IPZ	23	28	56.4
19	-IPZ	00	17	58.0
	LP+IPZ	00	17	58.4
	+IPZ	00	45	27.1
	LP+IPZ	00	45	27.2
	+EPZ	03	17	53.7
	EPZ	13	12	41.4
	+IPZ	17	56	19.7
	LP-IPZ	17	56	22.8
	+IXZ	18	03	39.1
	LRZ	18	29	41.1
20	EPZ	23	53	25.7
	LP-EPZ	23	53	29.2
	EPZ	00	39	06.9
	LP-IPZ	00	39	07.6
	-IPZ	03	10	37.1
	LP+IPZ	03	10	37.6
	-IPZ	06	07	00.5
	LP+IPZ	06	07	00.2
	EXZ	08	09	04.9
	-IPZ	14	48	08.0
	LP+EPZ	14	48	08.8
	EPZ	17	57	45.6
21	LP EPZ	17	56	54.0
	EPZ	02	31	51.2
	EPZ	16	24	40.3
	LP-EPZ	16	24	36.8
	EPZ	18	12	55.0
23	-IPZ	00	22	54.0
	+EPZ	02	26	39.7
	EPZ	13	17	44.9
24	EPZ	10	26	34.1
	+IPZ	12	40	08.6
25	LP-IPZ	12	40	07.8
	EPZ	21	20	00.0
26	EPZ	02	32	34.7
	-IPZ	03	54	10.1
	EPZ	11	32	13.6
27	EPZ	12	52	38.6

DATE	PHASE	ARRIVAL TIME		
		H	M	S
DEC 29	-IPZ	00	23	05.8
	+IPZ	01	47	09.0
31	LP-IPZ	01	47	09.2
	+IPZ	03	59	06.3
	LP-IPZ	03	59	06.8
	EPZ	20	21	06.5
	EPZ	21	42	08.4

Table 2. A/D conversion of input voltage.

Input volt	Hexadecimal number
+10	FFF
+ 9	F33
+ 8	E66
+ 7	D99
+ 6	CCC
+ 5	C00
+ 4	B33
+ 3	A66
+ 2	999
+ 1	8CC
0	800
- 1	733
- 2	666
- 3	599
- 4	4CC
- 5	400
- 6	333
- 7	266
- 8	199
- 9	0CC
-10	000

Table 3. List of the 79 earthquakes.

DATA NO.	ORIGIN TIME			GEOGRAPHIC COORDINATES		REGION	DEPTH (km)	MAGNITUDE (Mb)	EPICENTRAL DISTANCE (deg)	AZIMUTH (deg)	COMMENT	
	UTC DATE	HR	MN	SEC	LATITUDE							LONGITUDE
1	01/01	18	51	01	26.823 N	142.557 E	BONIN ISLANDS?	22	6.4	119.471	88	
2	01/03	14	09	50	0.972 S	21.870 W	CENTRAL MID-ATLANTIC RIDGE	10	5.8	79.143	243	
3	01/04	06	05	01	18.014 N	145.626 E	MARIANA ISLANDS?	590	6.1	122.482	82	
4	01/04	22	20	53	23.165 S	177.312 W	SOUTH OF FIJI IS.	195	6.0	84.259	34	
5	01/07	08	03	44	12.070 S	166.707 E	SANTA CRUZ ISLANDS	156	5.8	91.091	51	
6	01/07	09	29	00	56.440 S	26.531 W	SOUTH SANDWICH IS.	80	5.7	30.937	280	
7	01/10	08	32	00	29.822 S	177.310 W	KERMADEC ISLANDS	33	5.4	77.785	32	
8	01/12	01	44	47	52.478 S	27.988 E	SOUTH OF AFRICA	10	5.8	17.421	204	LP only
9	01/18	04	23	37	17.288 S	167.814 E	VANUATU ISLANDS	44	5.4	86.419	49	
10	01/18	22	44	39	4.046 S	153.475 E	NEW IRELAND REGION	218	5.5	94.629	66	
11	01/20	04	25	11	6.946 N	94.002 E	NICOBAR ISLANDS	19	5.6	84.566	126	

12	01/26 13 23 09	7.182 S	146.036 E	EAST PAPUA NEW GUINEA	168	5.7	89.199	72	
13	01/27 21 46 24	6.096 S	111.673 E	JAVA	627	5.6	78.025	105	
14	01/28 16 00 00	37.091 N	116.051 W	SOUTHERN NEVADA	0	5.9	145.301	324	N
15	02/10 20 38 01	22.648 S	66.466 W	JUJUY PROVINCE, ARGENTINA	196	5.9	74.545	293	S, LP
16	02/13 23 45 55	30.179 S	177.897 W	KERMADEC ISLANDS	51	5.6	77.328	33	
17	02/24 04 22 40	4.374 N	97.755 E	NORTHERN SUMATERA	52	5.4	83.253	121	
18	03/07 15 41 57	20.096 S	175.569 W	SOUTH OF TONGA IS.	37	5.9	87.591	33	
19	03/10 21 58 44	56.037 S	27.291 W	SOUTH SANDWICH IS.	102	6.0	31.519	280	
20	03/11 10 32 27	9.265 S	118.479 E	SUMBAWA ISLANDS	33	6.1	77.484	97	
21	03/21 13 35 03	18.586 S	175.188 W	TONGA ISLANDS	203	5.9	89.135	33	
22	03/25 05 05 40	52.733 S	46.782 W	SOUTH ATLANTIC OCEAN	10	6.0	40.922	293	
23	03/28 03 52 35	31.485 S	178.660 W	KERMADEC ISLANDS	79	6.0	75.911	33	
24	03/29 21 33 55	0.088 N	123.332 E	MINAHASSA PENINSULA	187	6.0	87.895	96	S
25	04/10 06 47 52	33.910 S	58.027 E	SOUTH INDIAN OCEAN	10	5.6	36.697	154	
26	04/12 00 34 44	30.185 S	177.890 W	KERMADEC ISLANDS	35	5.7	77.324	33	

27	04/16	14 04 51	15.792 S	172.985 W	SAMOA ISLANDS	33	6.0	92.277	31	
28	04/18	11 30 55	28.185 S	114.069 W	EASTER ISLAND	10	5.9	81.105	337	
29	04/30	07 46 48	56.245 S	27.457 W	SOUTH SANDWICH IS.	106	5.7	31.416	281	
30	05/02	11 19 38	29.318 S	177.151 W	KERMADEC ISLANDS	25	6.0	78.309	32	
31	05/07	05 36 20	0.624 S	123.291 E	MINAHASSA PENINSULA	92	5.9	82.219	96	LP
32	05/10	14 04 19	7.329 S	123.749 E	BANDA SEA	571	5.3	82.166	93	
33	05/11	20 46 59	7.706 S	128.452 E	BANDA SEA	33	5.7	82.507	88	
34	05/12	10 03 31	24.636 S	179.223 E	SOUTH OF FIJI IS.	532	5.6	82.120	36	
35	05/20	21 29 15	20.283 S	168.220 E	LOYALTY ISLANDS	38	5.9	83.671	48	
36	05/31	10 21 15	55.138 N	165.401 E	KOMANDORSKY ISLANDS	33	6.0	152.330	88	
37	06/01	04 14 15	41.548 S	75.106 W	OFF COAST OF CHILE	33	6.0	59.681	308	
38	06/02	12 37 35	18.083 S	172.492 W	TONGA ISLANDS	33	6.4	90.131	30	LP
39	06/04	03 01 04	51.597 N	177.333 W	ANDREANOF ISLANDS	59	5.8	155.422	64	
40	06/04	15 21 33	4.093 N	124.523 E	CELEBES SEA	328	5.7	92.037	96	
41	06/07	06 52 37	16.607 N	98.149 W	OFF COAST OF GUE- RRERO, MEXICO	41	6.0	121.307	311	LP only
42	06/07	10 59 40	16.558 N	98.358 W	OFF COAST OF GUE- RRERO, MEXICO	34	6.3	121.317	311	LP only

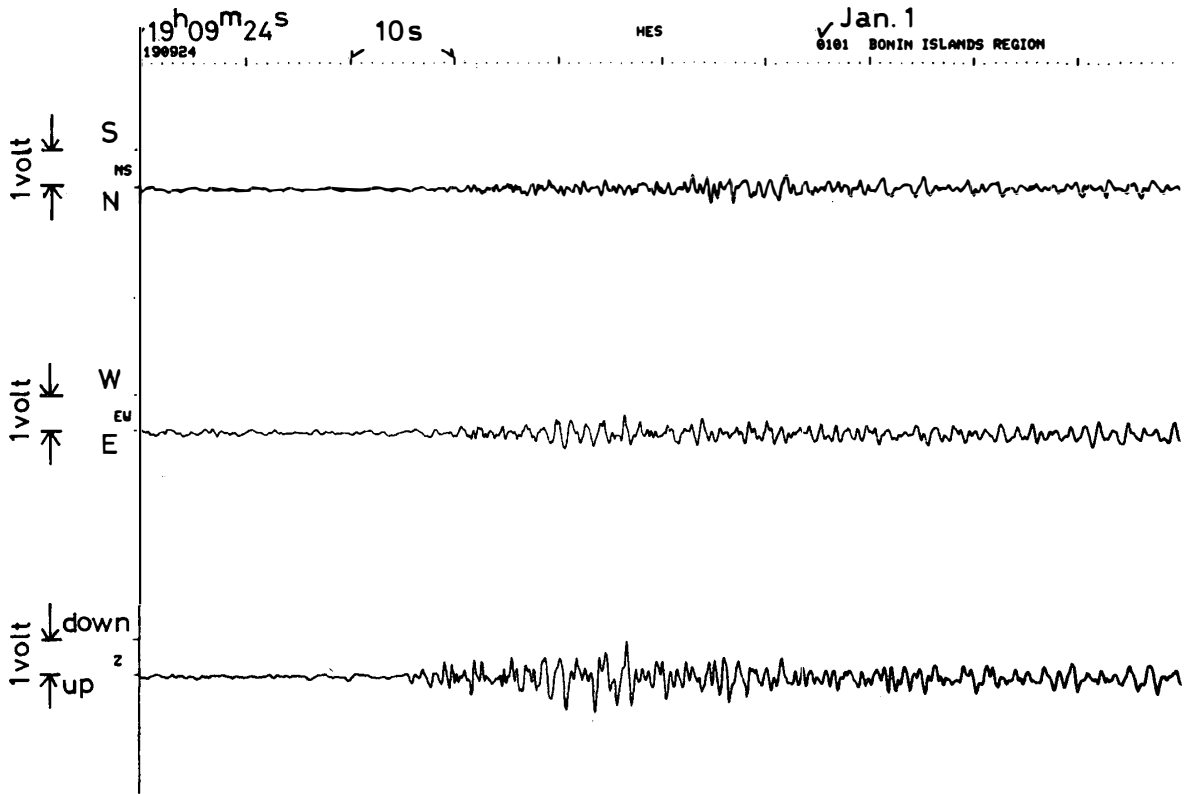
43	06/09 03 08 35	5.708 S	150.962 E	NEW BRITAIN	84	5.9	92.241	68	
44	06/11 00 38 10	17.616 S	174.414 W	TONGA ISLANDS	123	6.3	90.229	32	S, LP
45	06/18 03 04 06	34.023 S	58.370 E	SOUTH INDIAN OCEAN	10	5.5	36.642	153	
46	06/19 06 21 58	13.313 N	89.339 W	EL SALVADOR	82	6.2	115.641	303	LP
47	06/22 04 18 41	7.339 S	126.043 E	BANDA SEA	450	6.3	81.981	91	LP
48	06/23 23 23 34	4.067 N	124.532 E	CELEBES SEA	344	5.6	92.016	96	
49	06/24 14 15 00	37.236 N	116.370 W	SOUTHERN NEVADA	0	5.6	145.509	325	N
50	06/27 16 17 13	55.486 S	160.161 E	MACQUARIE ISLANDS	10	5.9	48.470	41	
51	07/05 21 22 27	20.828 S	178.801 W	FIJI ISLANDS	615	5.5	86.228	36	
52	07/31 06 29 16	51.755 N	176.137 E	RAT ISLANDS	38	6.2	153.381	72	
53	08/05 09 16 41	26.678 S	70.657 W	NORTHERN CHILE	40	5.4	72.155	298	
54	08/05 20 32 53	12.597 S	165.931 E	SANTA CRUZ ISLANDS	31	6.2	90.373	52	S
55	08/11 10 42 38	3.064 S	130.302 E	CERAM	21	5.6	87.474	88	
56	08/14 14 27 40	5.055 S	143.964 E	PAPUA NEW GUINEA	106	5.9	90.470	75	
57	08/22 03 42 36	20.553 S	169.451 E	VANUATU ISLANDS	34	5.6	83.735	46	
58	08/29 13 18 14	6.018 S	112.769 E	JAVA	597	5.8	78.480	104	

59	09/03 20 14 30	23.859 S	66.605 W	JUJUY PROVINCE, ARGENTINA	183	5.5	73.465	294	
60	09/03 23 39 39	15.296 S	173.089 W	TONGA ISLANDS	33	5.9	92.742	31	LP
61	09/05 21 09 47	15.828 S	167.979 E	VANUATU ISLANDS	232	5.4	87.859	49	
62	09/06 01 47 03	29.325 N	140.360 E	SOUTH OF HONSHU, JAPAN	176	6.5	120.961	92	
63	09/08 21 12 26	34.287 S	58.082 E	SOUTH INDIAN OCEAN	10	5.4	36.337	154	
64	09/11 14 12 15	24.173 S	66.996 W	SALTA PROVINCE, ARGENTINA	150	5.1	73.302	294	
65	09/15 20 22 55	14.493 S	70.785 W	PERU	128	6.0	83.577	294	
66	09/28 15 14 37	24.271 S	176.674 W	SOUTH OF FIJI IS.	40	6.0	83.312	33	LP
67	10/02 08 26 25	14.740 S	167.273 E	VANUATU ISLANDS	149	5.6	88.705	50	
68	10/05 09 14 33	15.591 S	168.004 E	VANUATU ISLANDS	18	5.8	88.092	49	
69	10/05 21 39 13	53.451 S	3.467 W	SOUTH ATLANTIC RIDGE	10	5.8	25.074	254	
70	10/07 07 15 57	7.156 S	125.876 E	BANDA SEA	515	6.2	82.091	91	LP
71	10/20 18 15 18	54.031 S	6.942 E	BOUVET ISLAND	10	5.4	21.131	242	LP
72	11/21 23 27 12	55.400 N	163.176 E	OFF COAST OF KAMCHATKA	35	5.6	151.734	90	
73	11/22 05 32 45	23.913 S	175.821 W	TONGA ISLANDS	33	5.5	83.825	32	

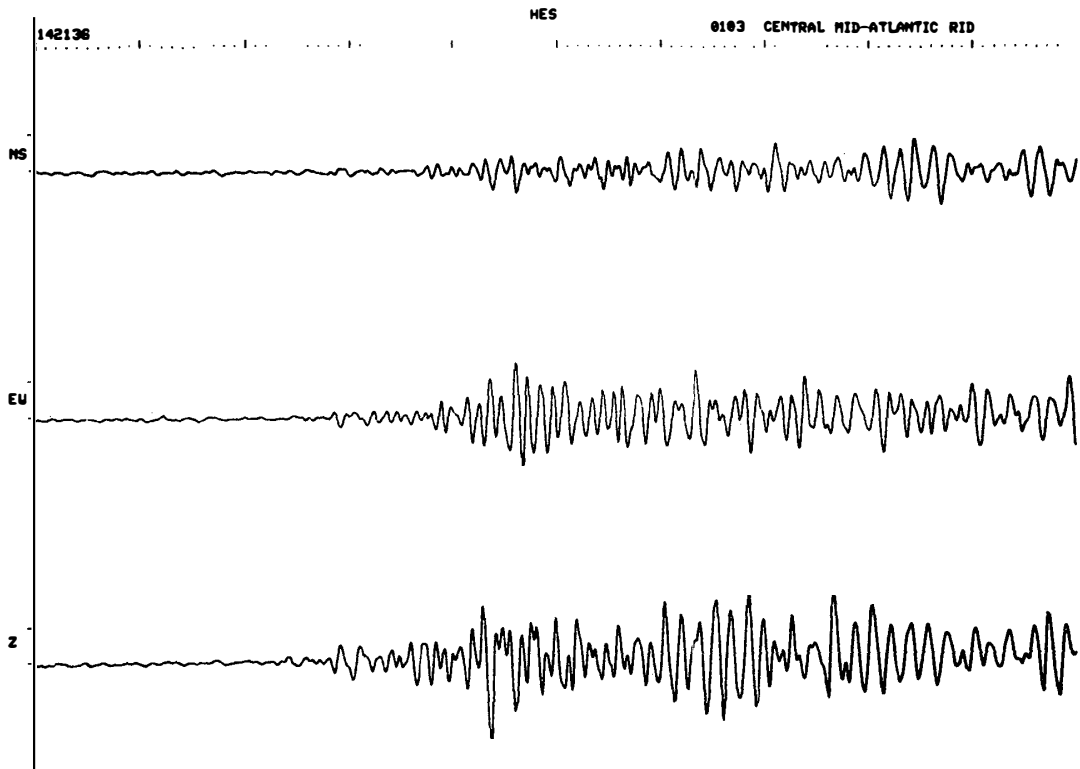
74	11/22 23 08 00	32.446 S	178.394 W	SOUTH OF KERMADEC ISLANDS	33	5.2	75.030	33	
75	11/27 09 55 39	50.205 N	147.727 E	SEA OF OKHOTSK	622	5.6	141.989	99	
76	12/03 22 30 00	13.323 S	167.205 E	VANUATU ISLANDS	257	5.7	90.037	50	LP
77	12/19 17 43 55	24.133 S	175.864 W	SOUTH OF TONGA IS.	33	5.9	83.602	32	S, LP
78	12/31 01 35 35	21.386 S	68.046 W	CHILE-BOLIVIA BORDER	130	5.3	76.241	294	
79	12/31 03 47 29	20.993 S	68.464 W	CHILE-BOLIVIA BORDER	118	5.7	76.744	294	

- (i) The events and the epicentral data are picked from the PDE reports.
- (ii) N in the comment column means nuclear explosion.
- (iii) LP in the comment column means that long-period seismograms were obtained.
- (iv) S in the comment column means that clear S-phase was obtained.
- (v) Azimuth indicates the anti-clockwisely measured angle from South Pole to Syowa Station to Epicenter.

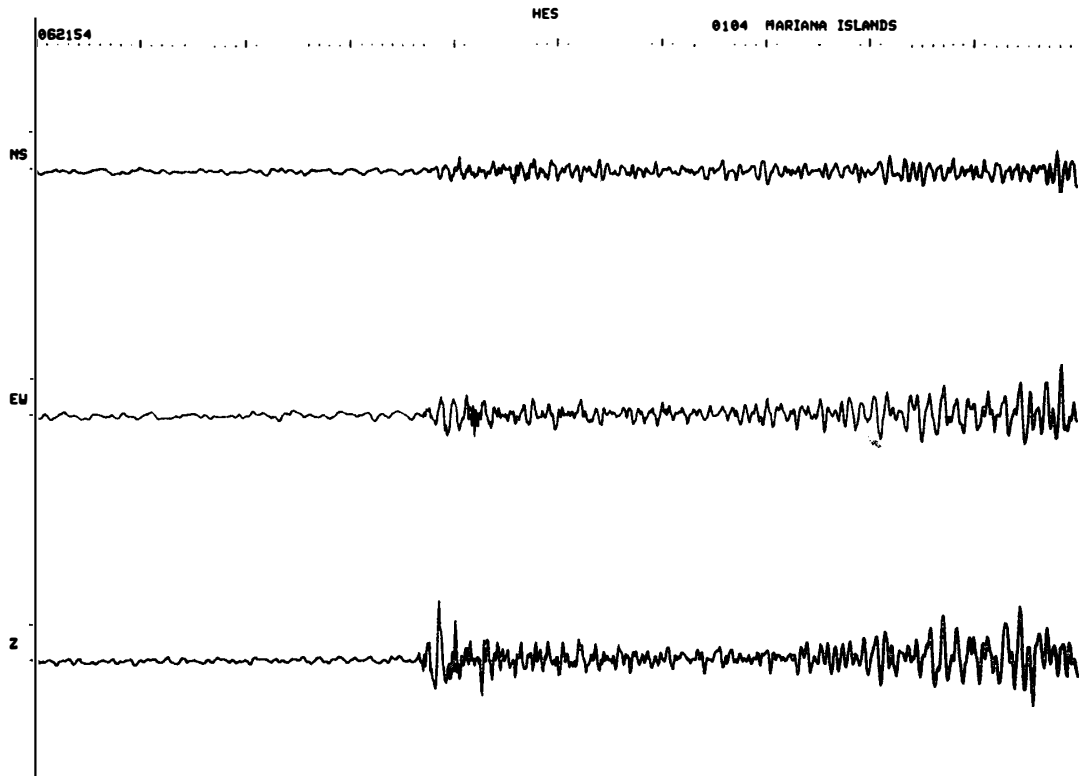
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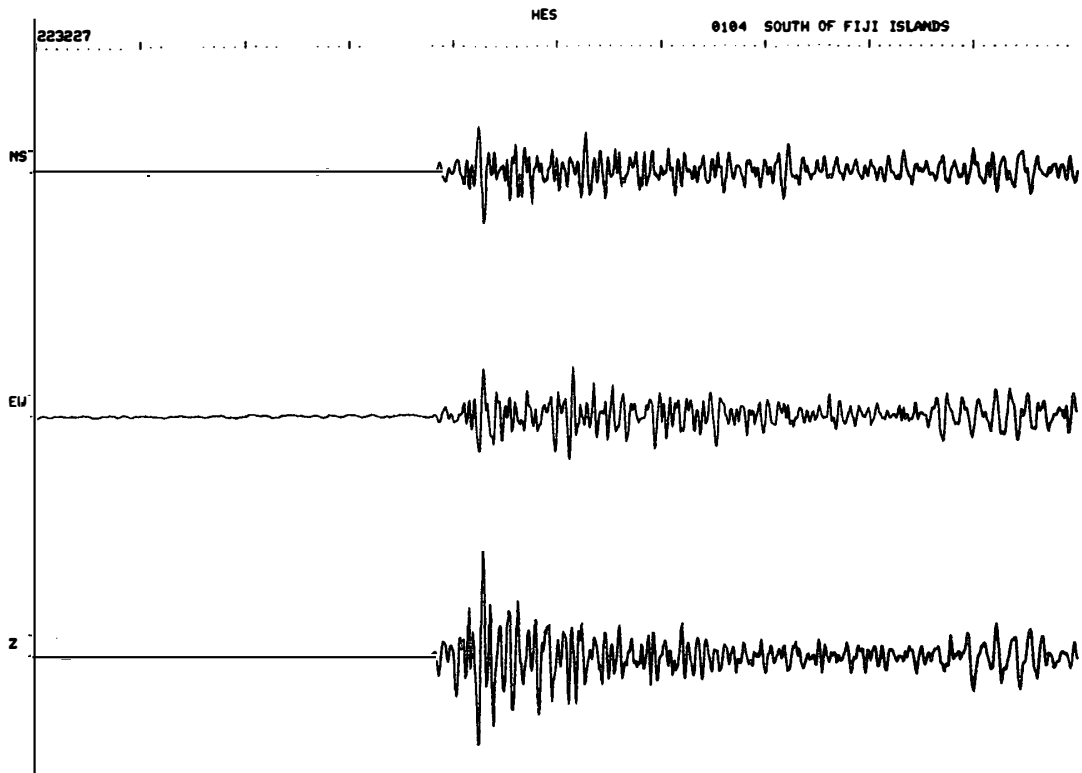
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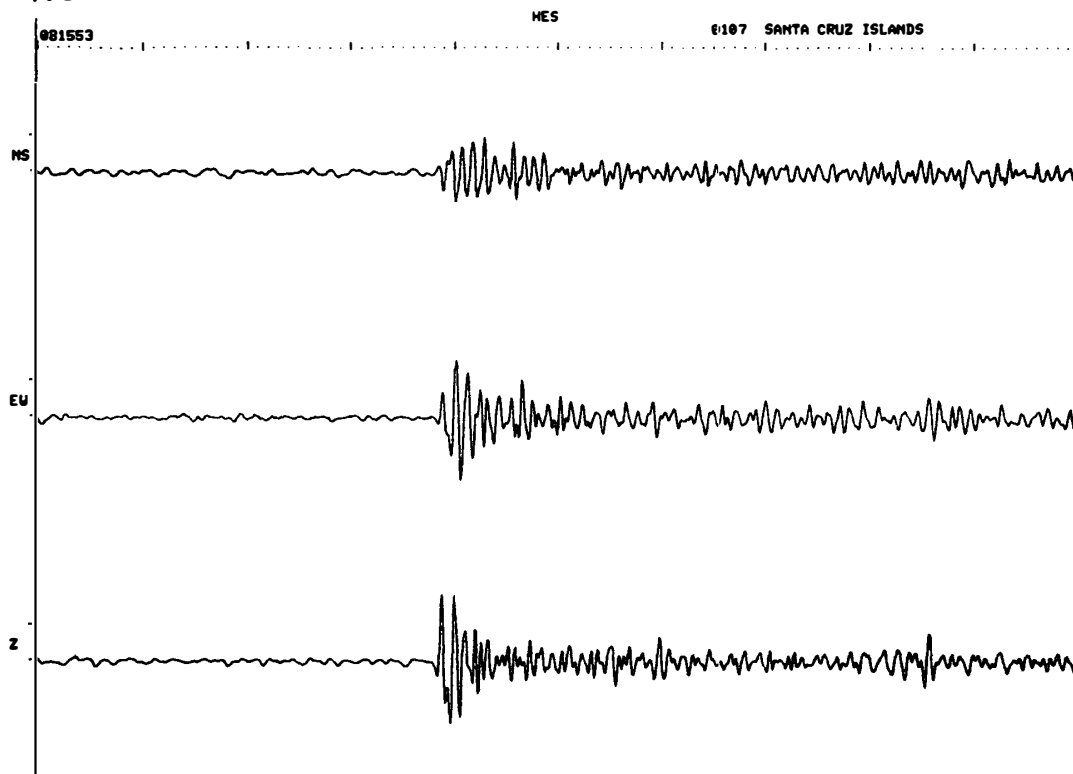
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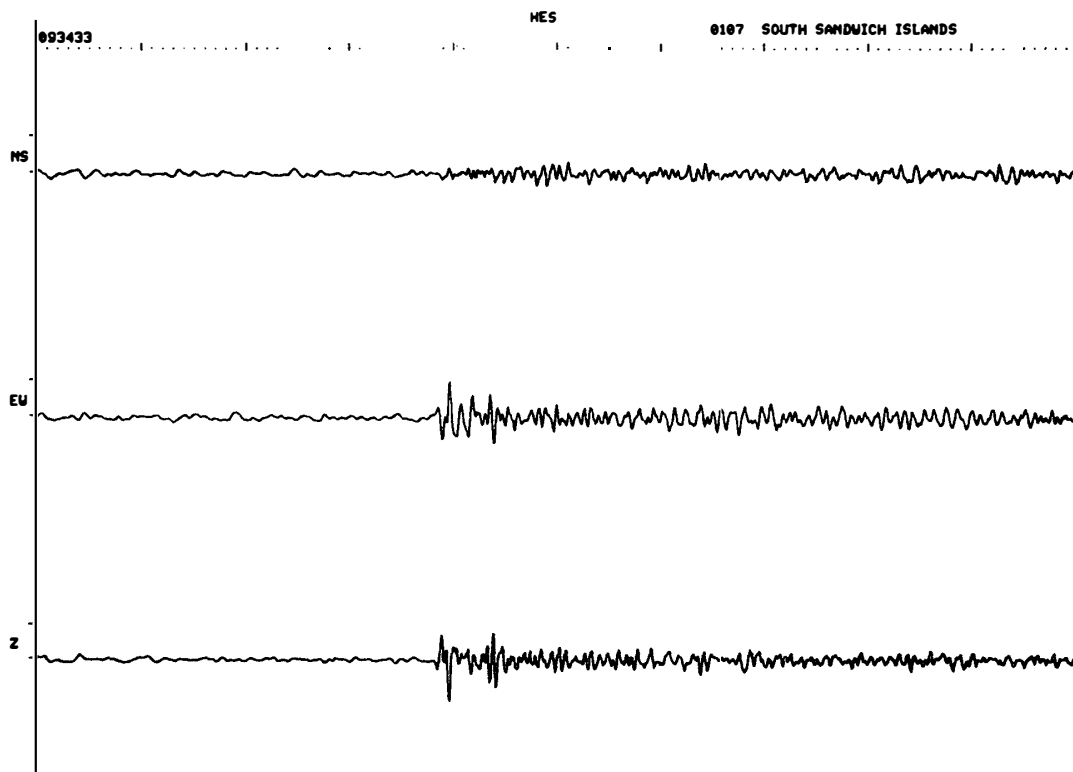
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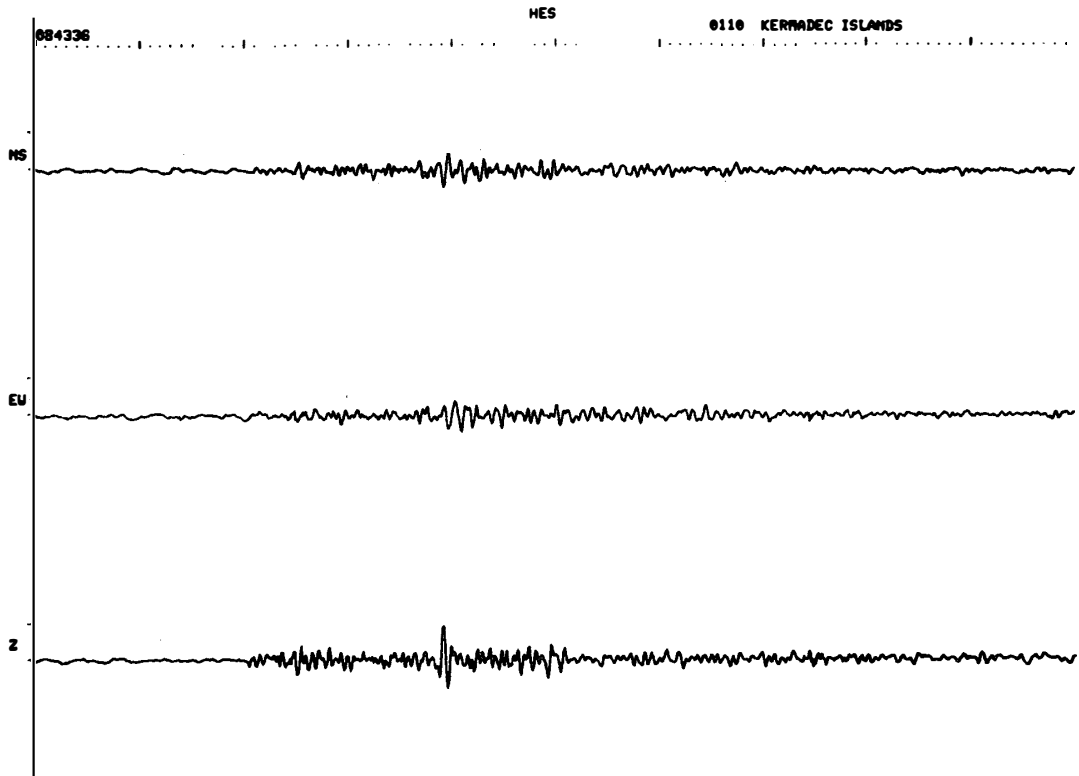
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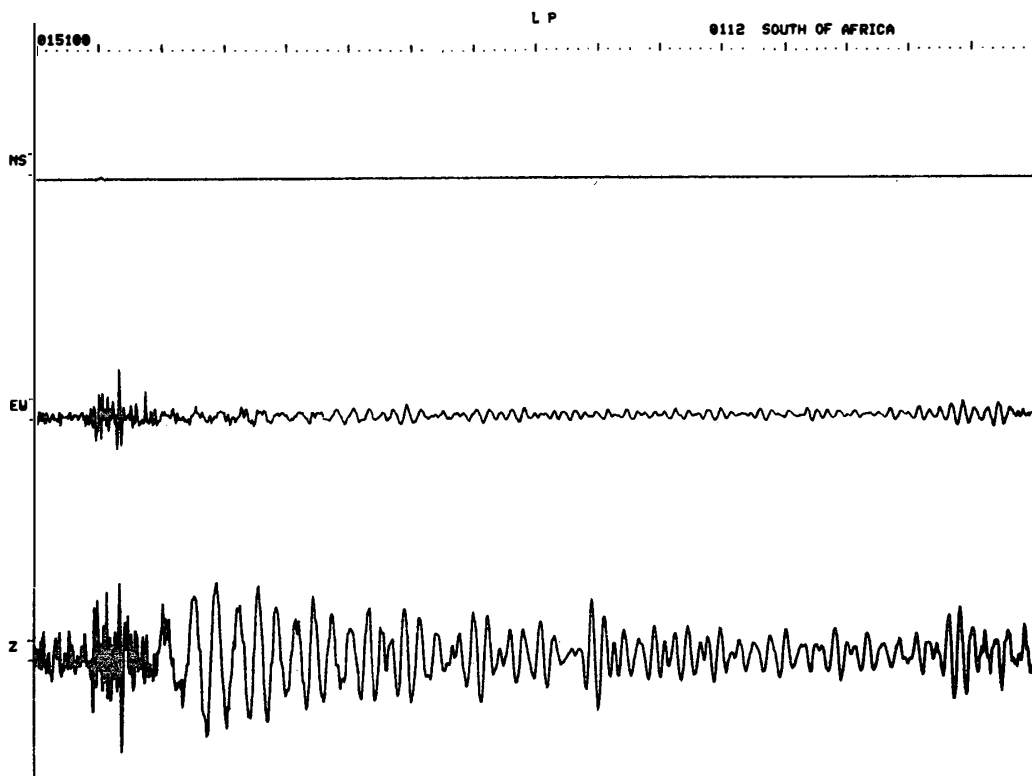
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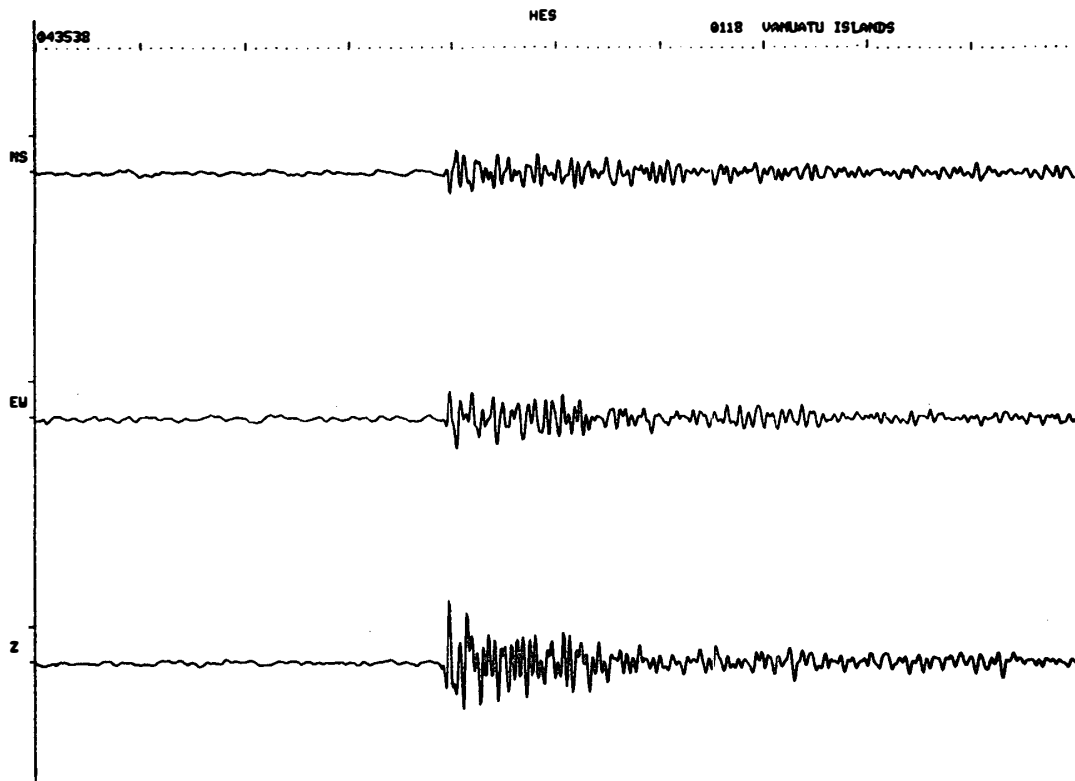
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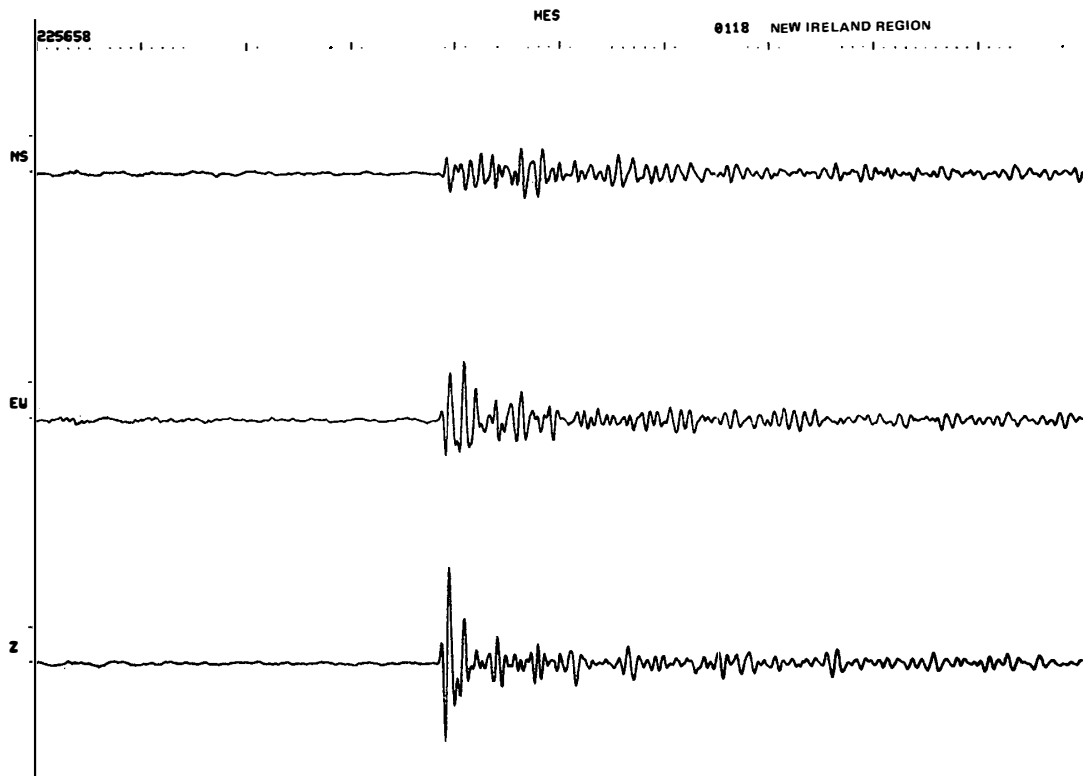
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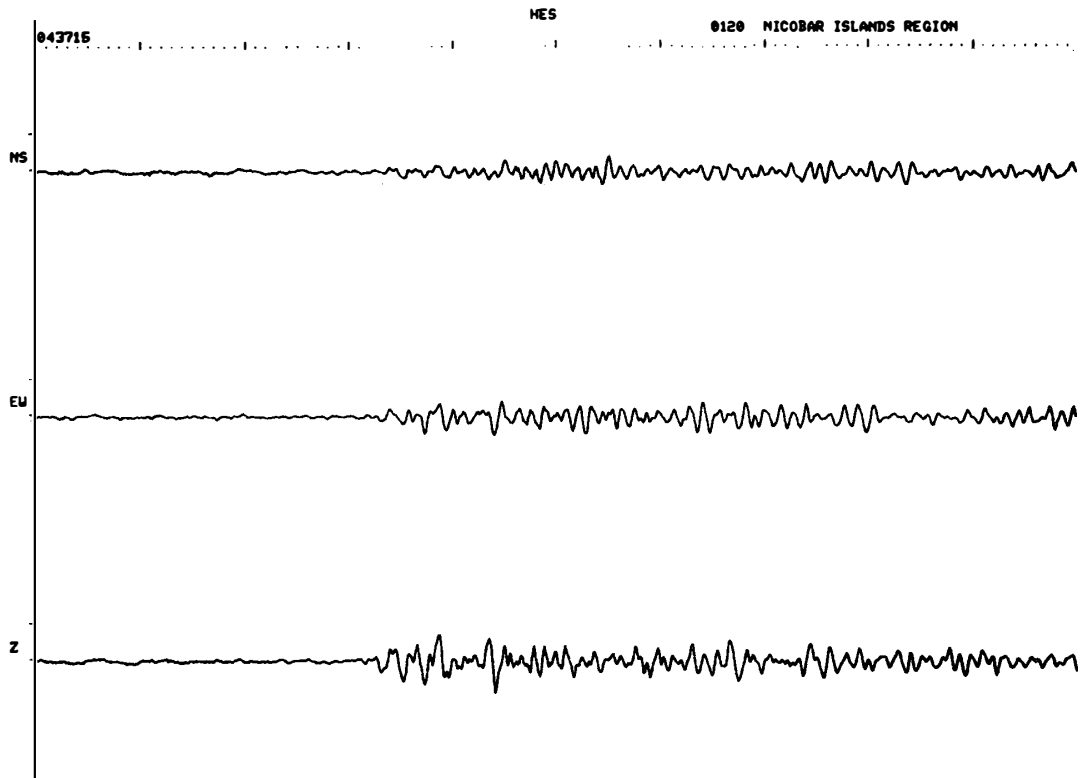
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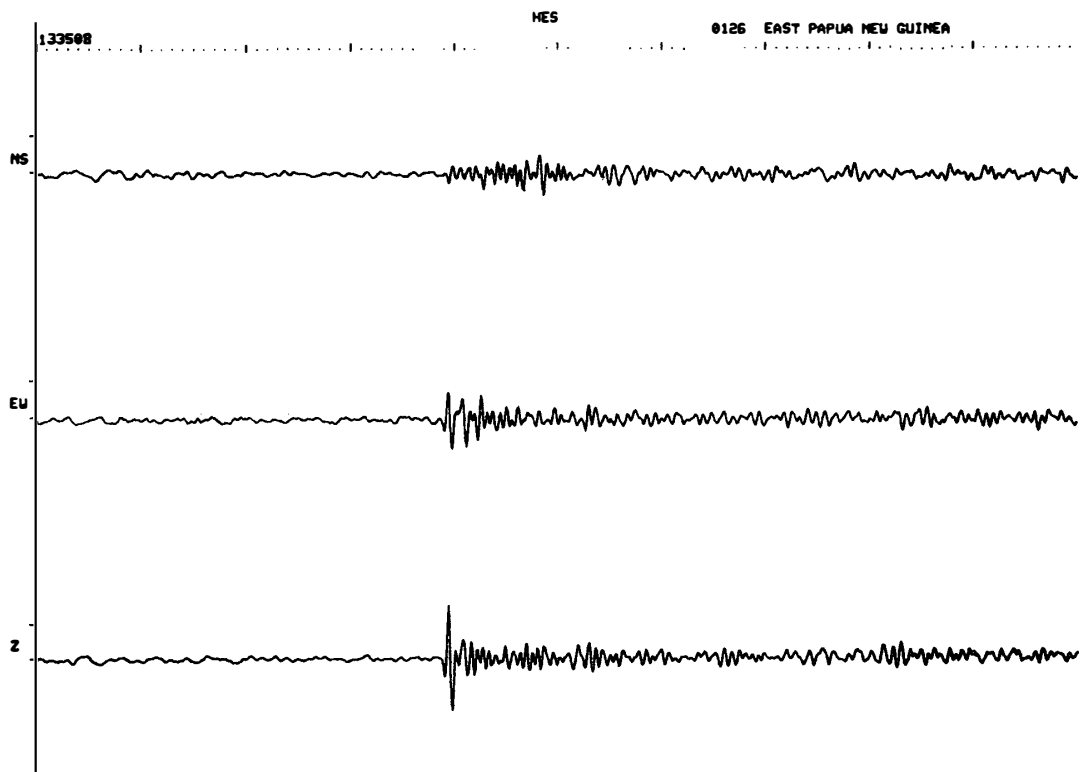
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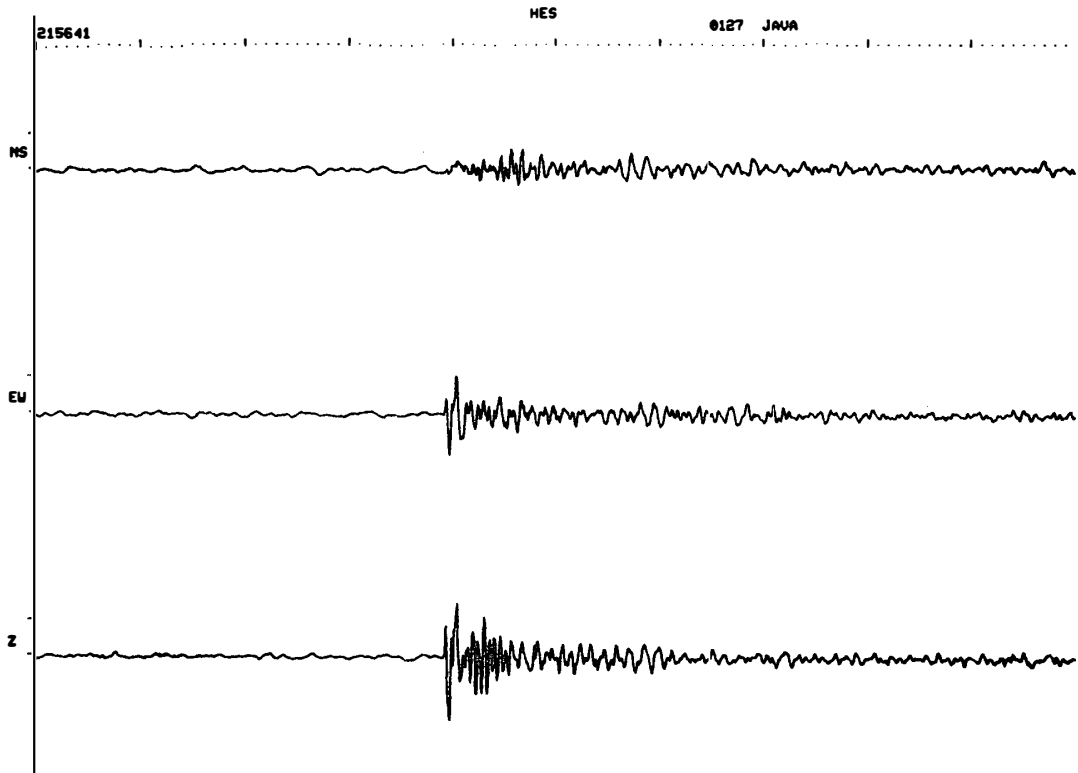
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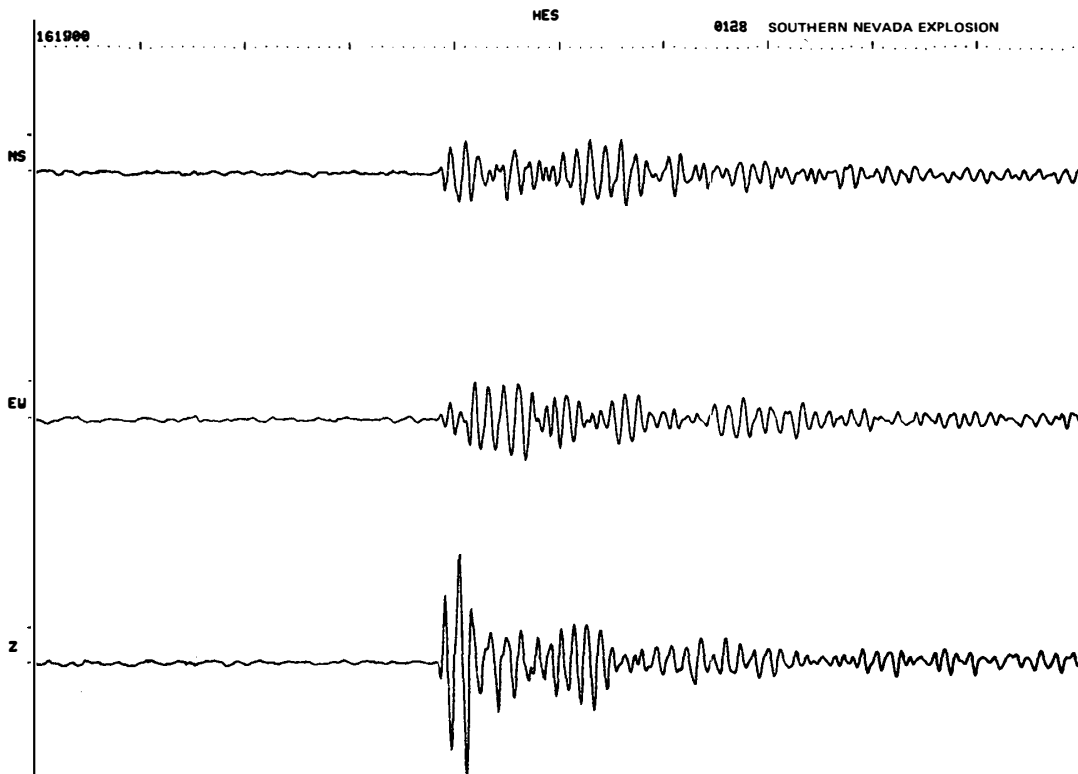
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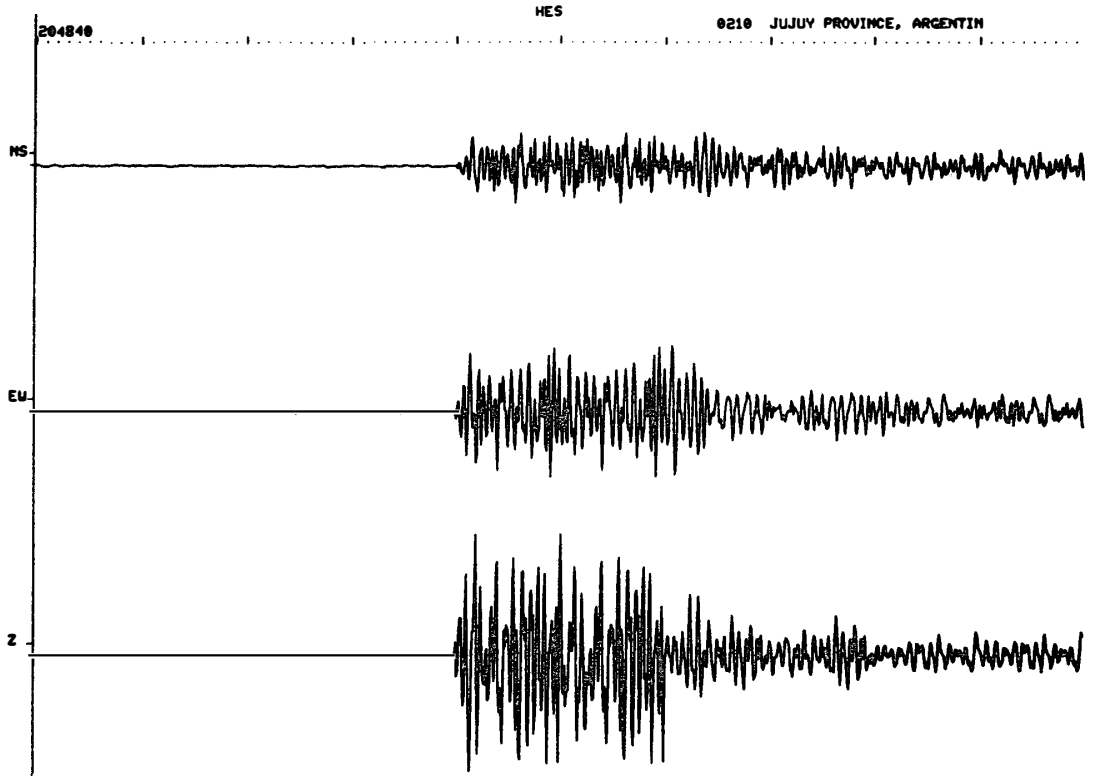
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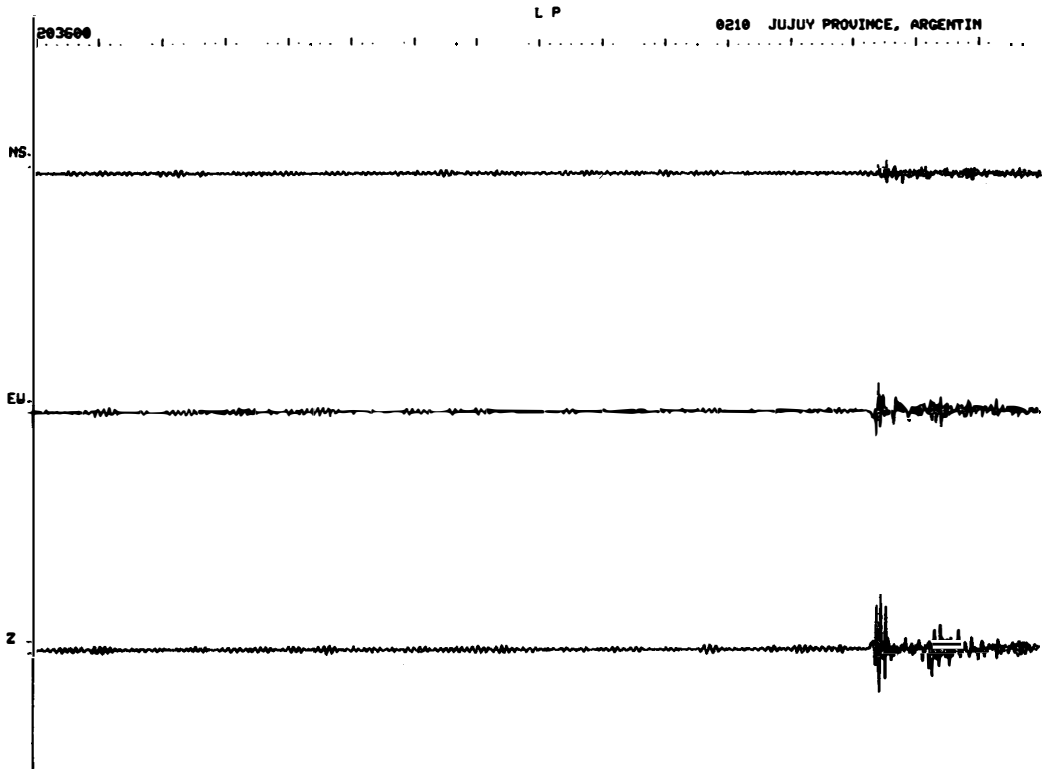
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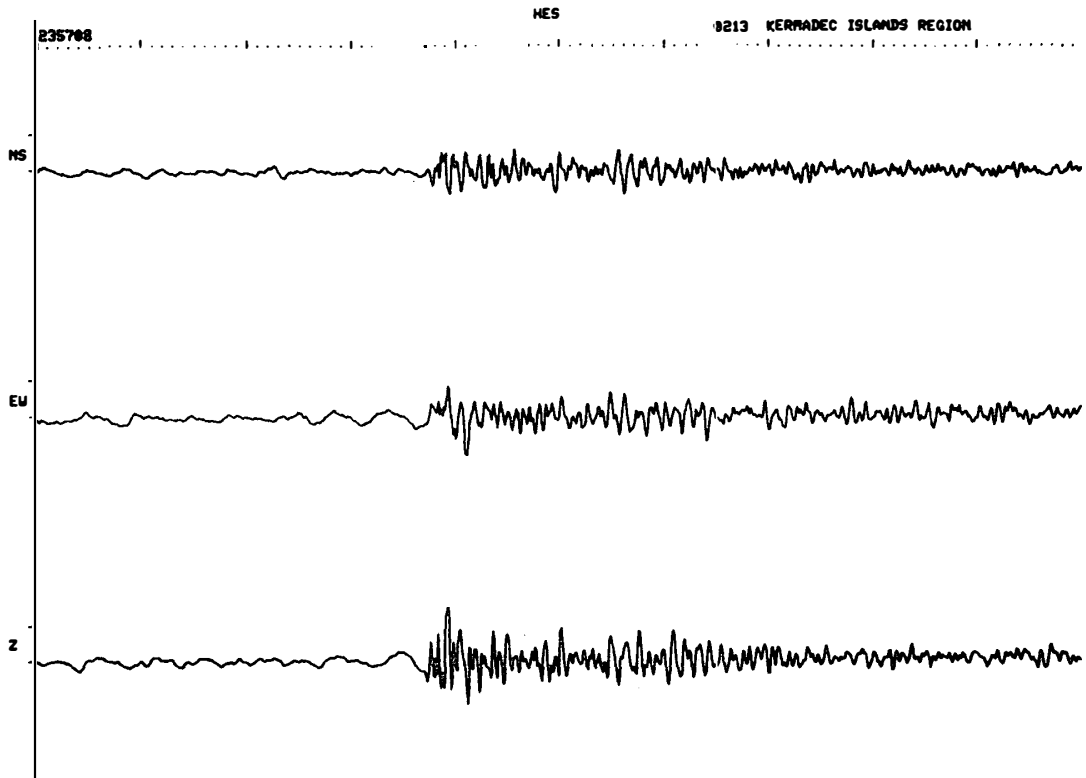
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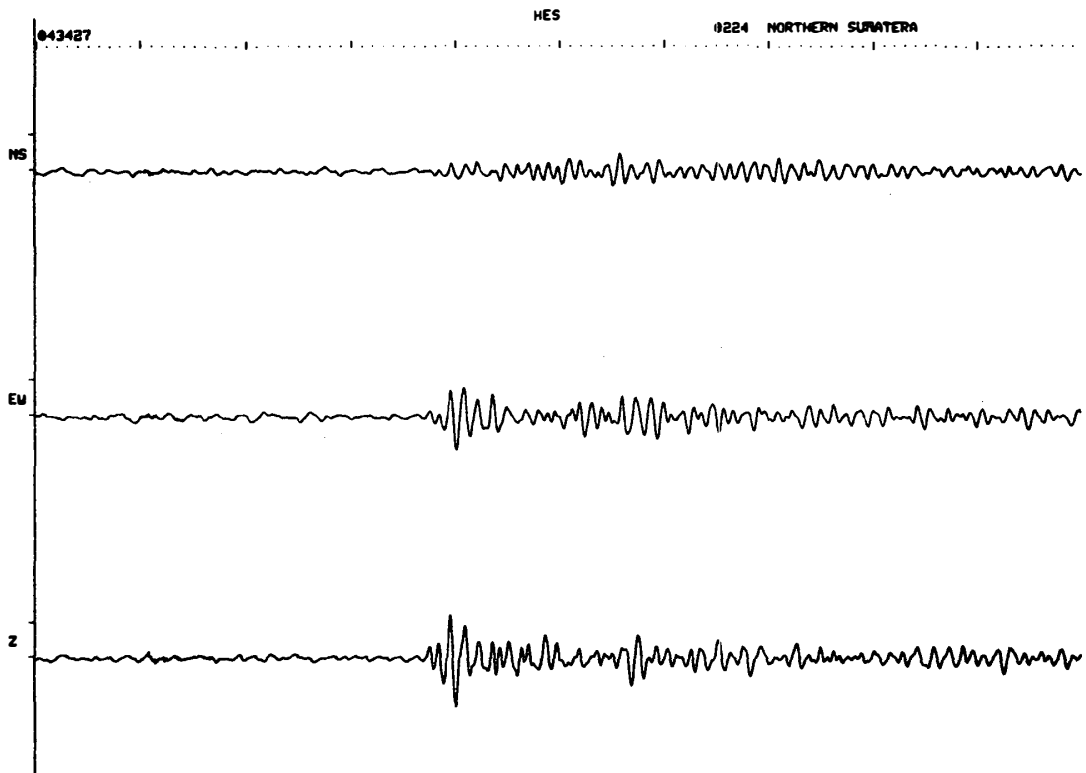
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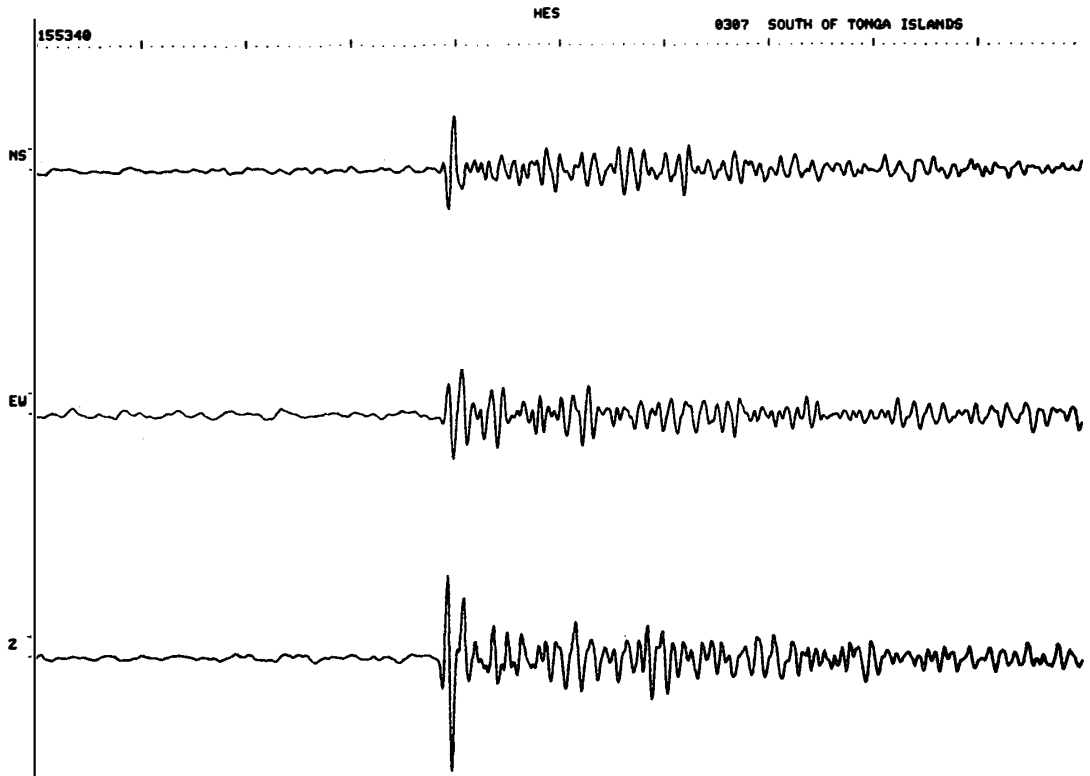
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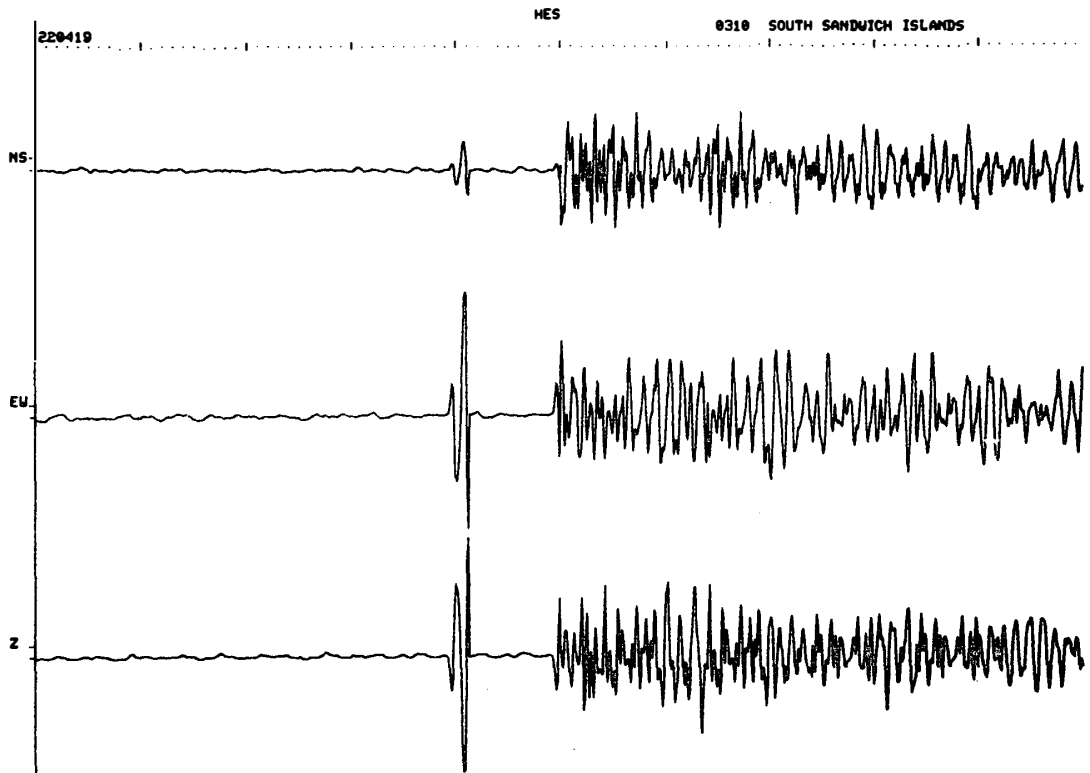
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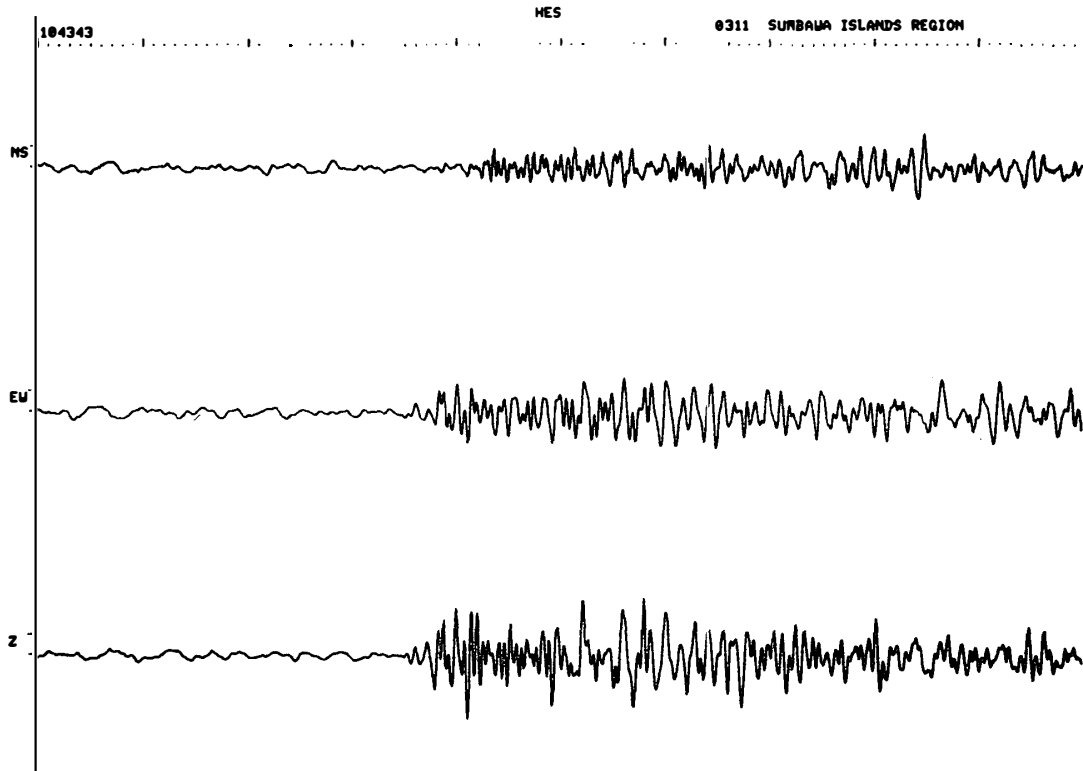
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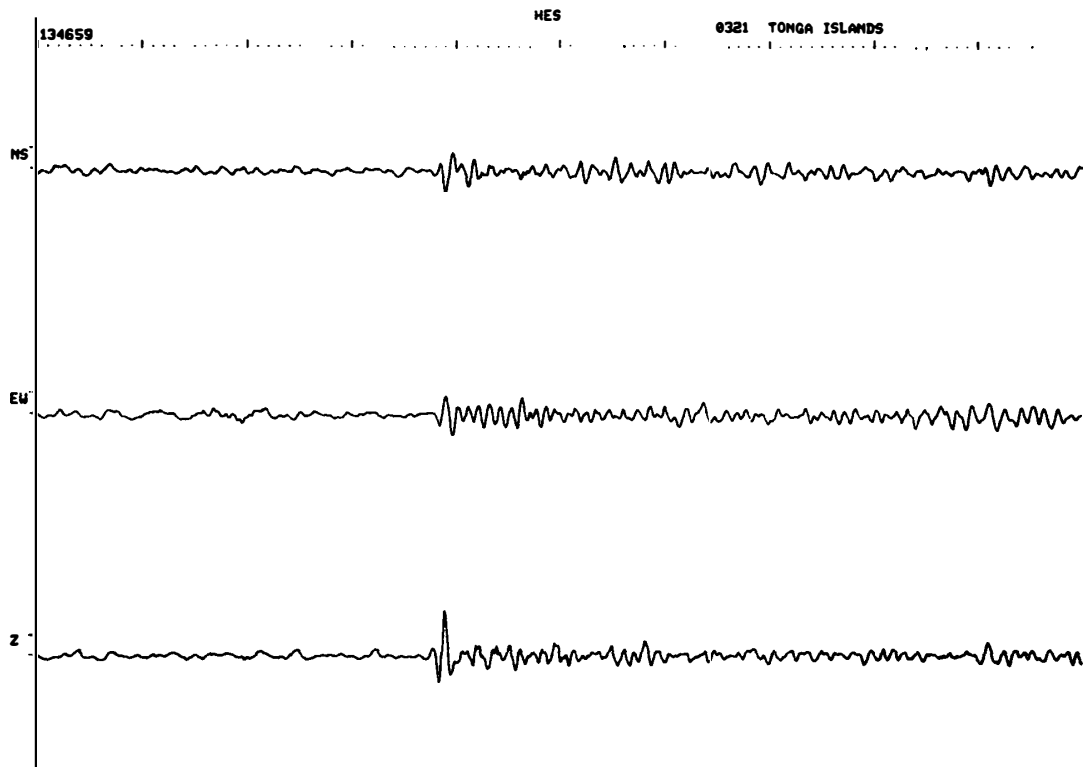
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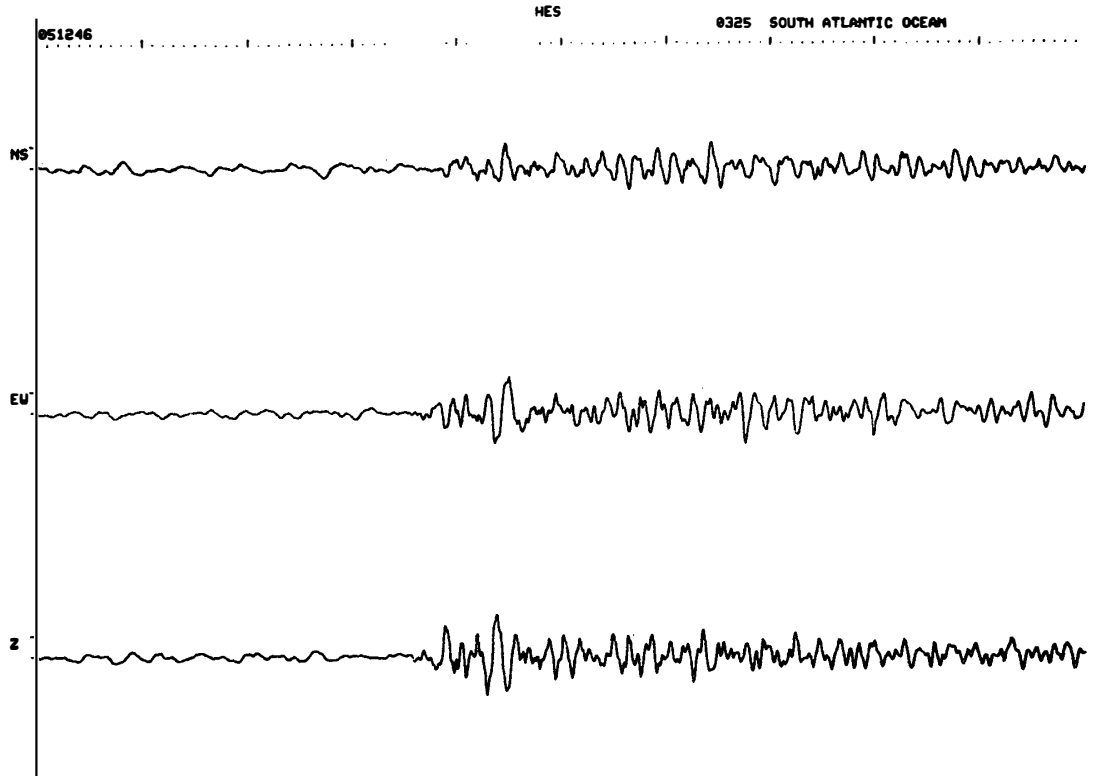
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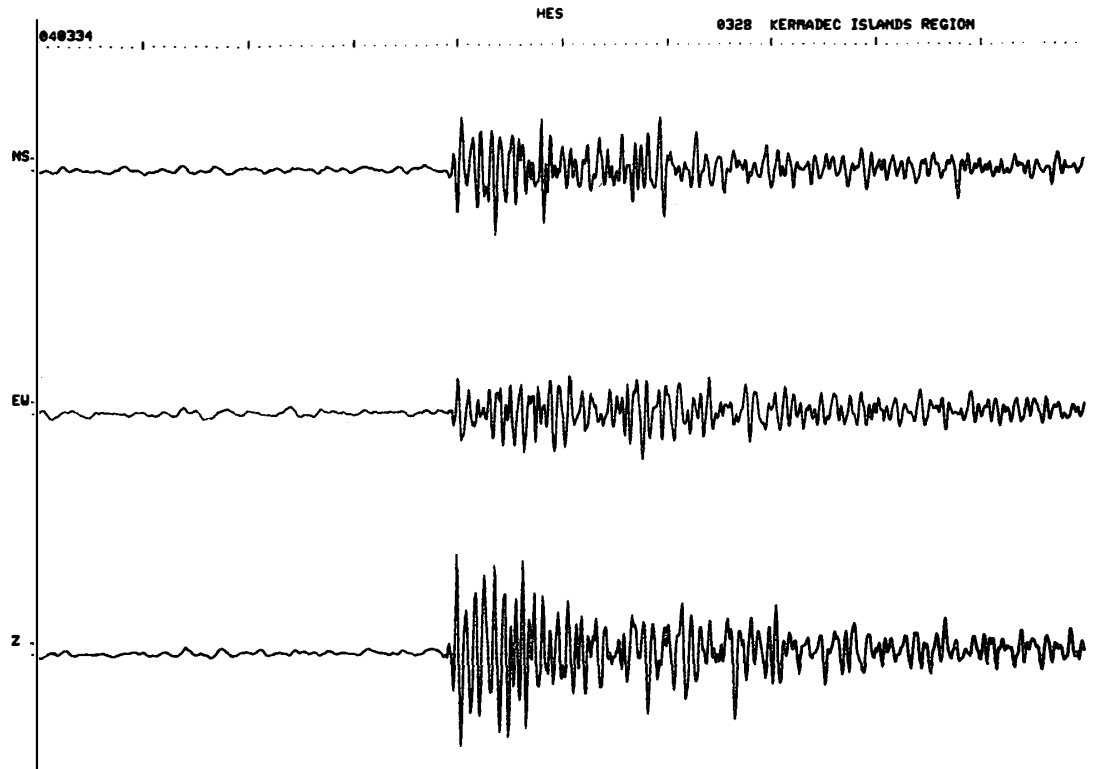
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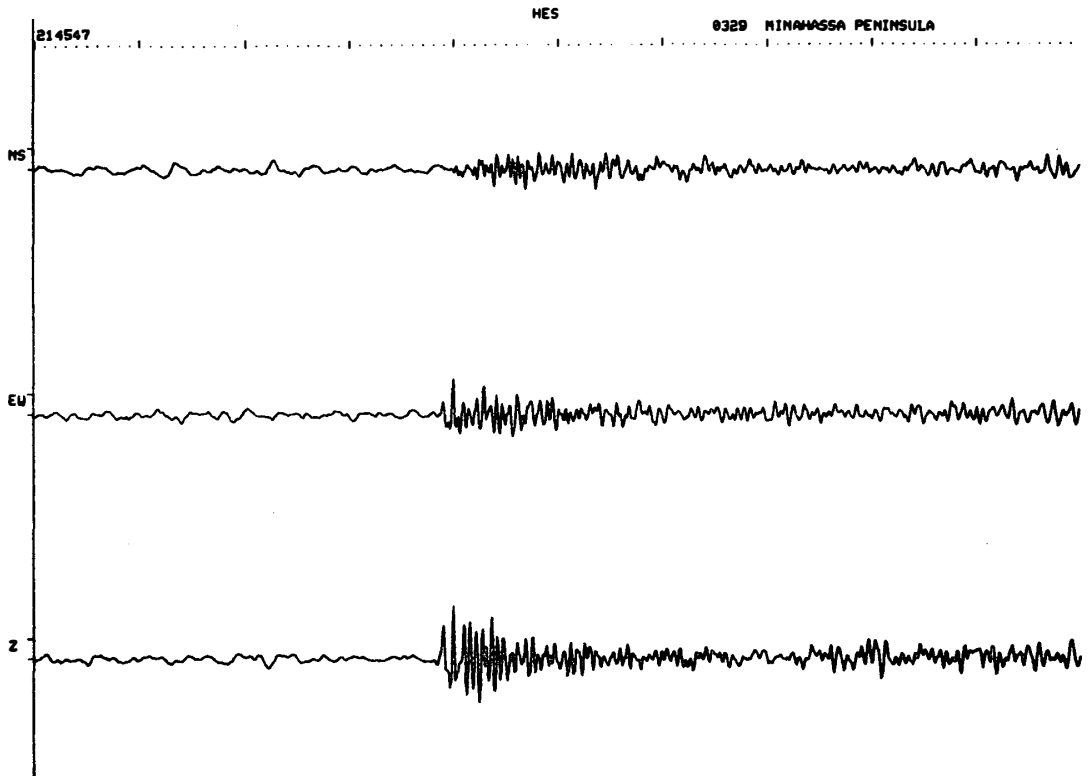
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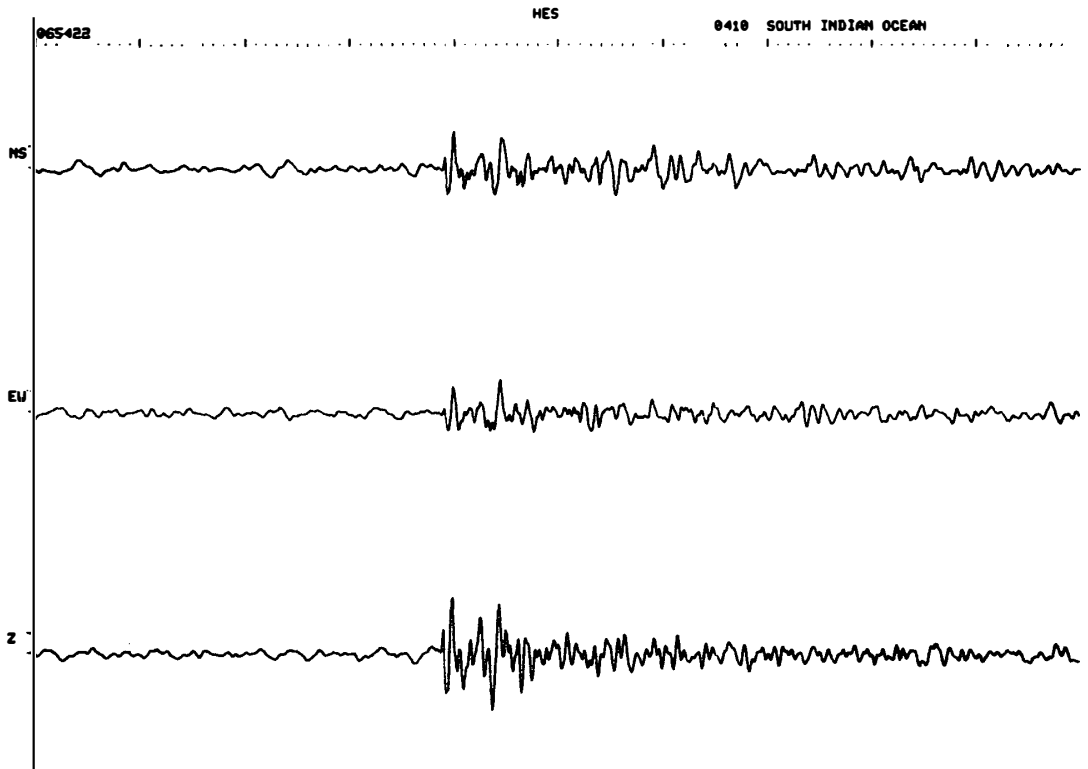
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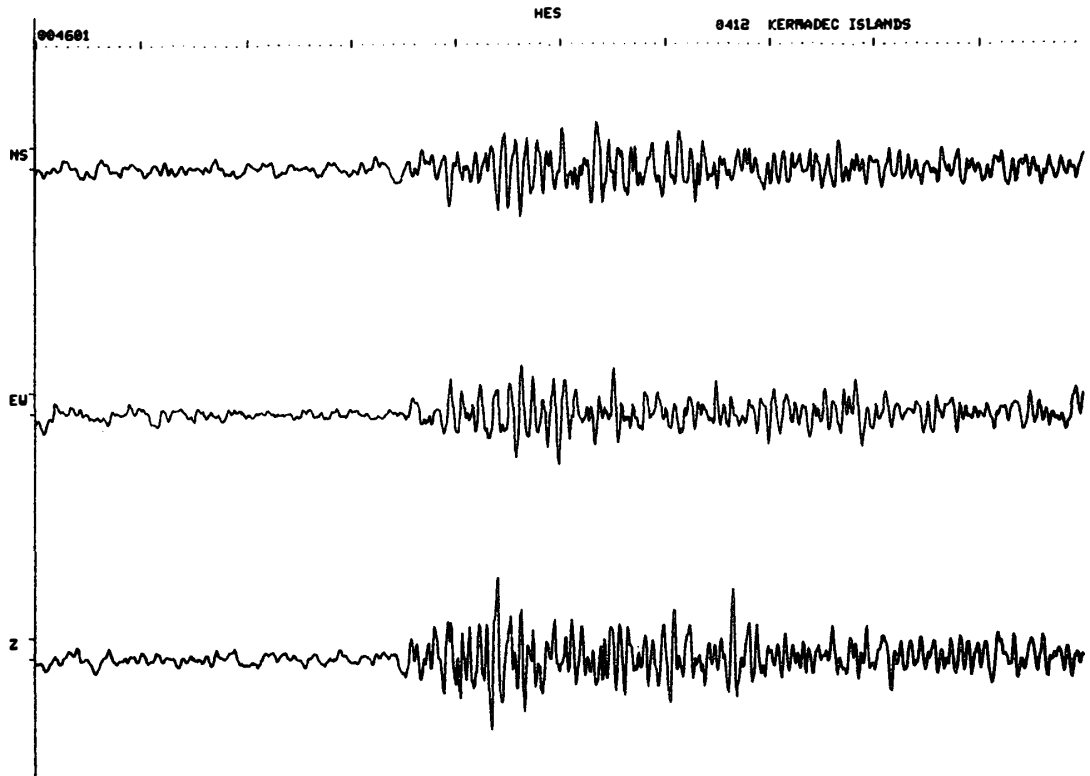
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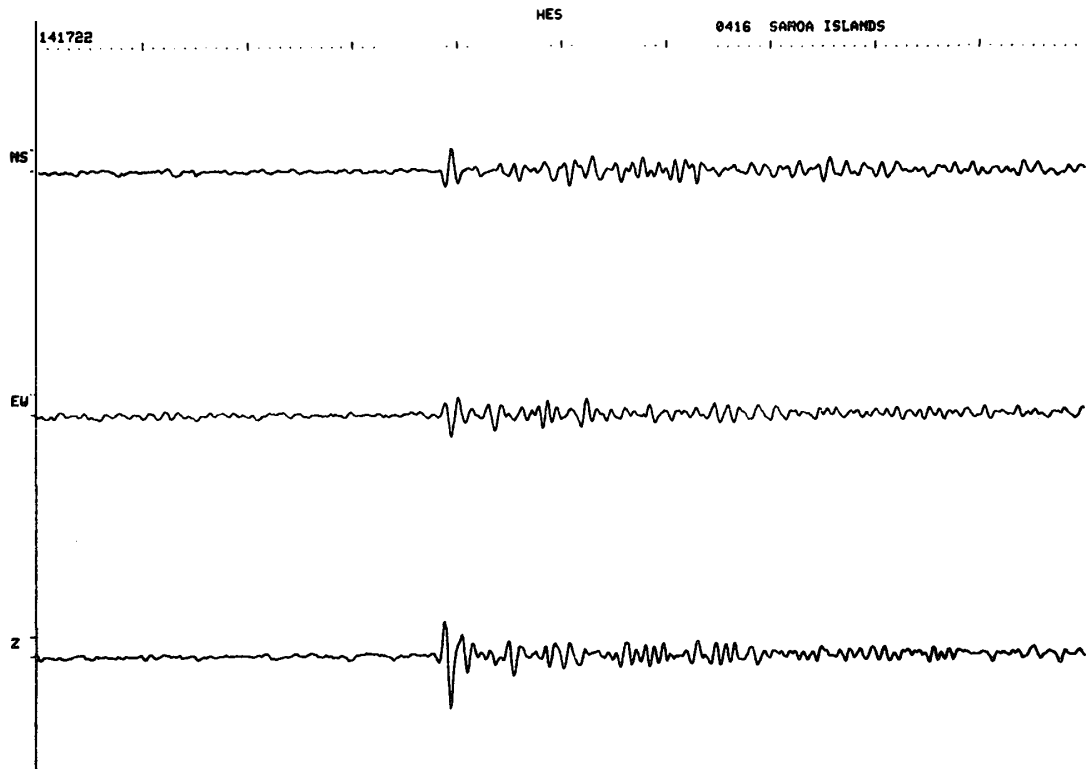
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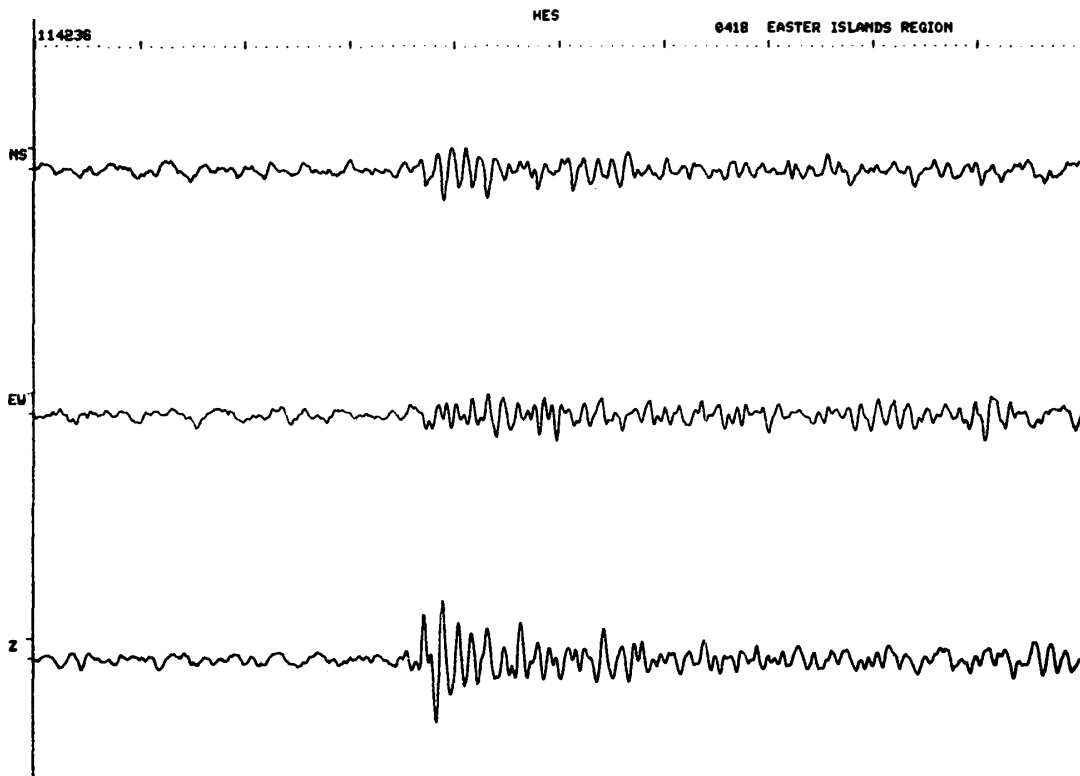
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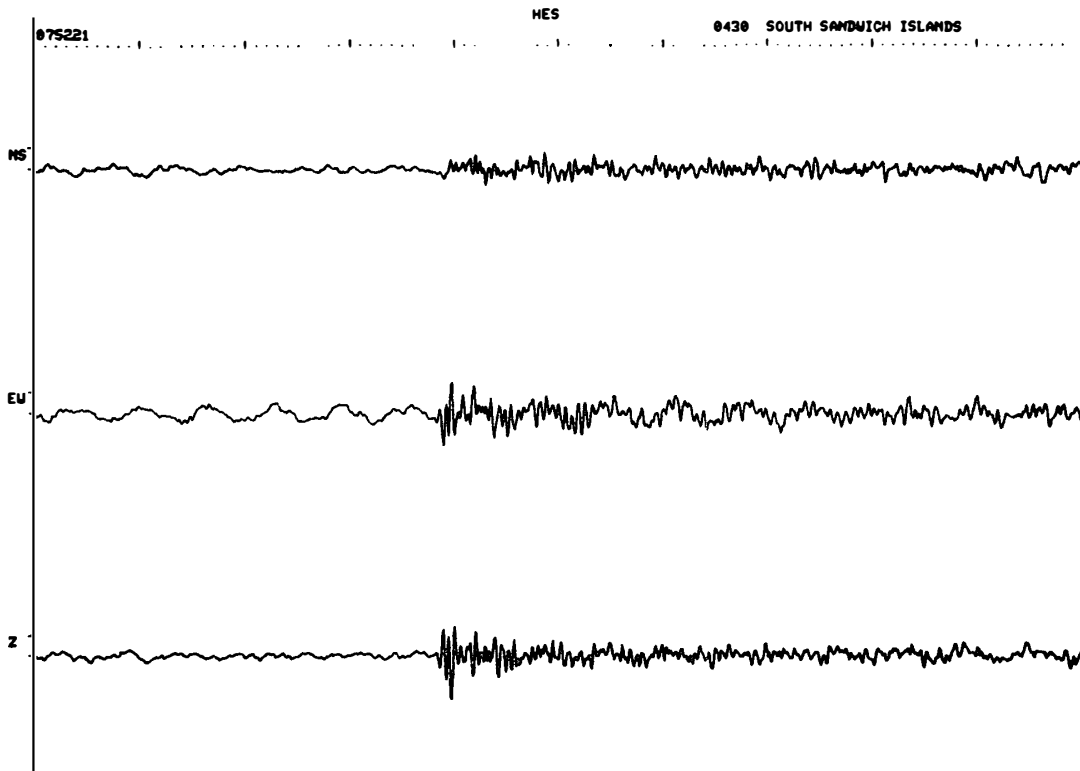
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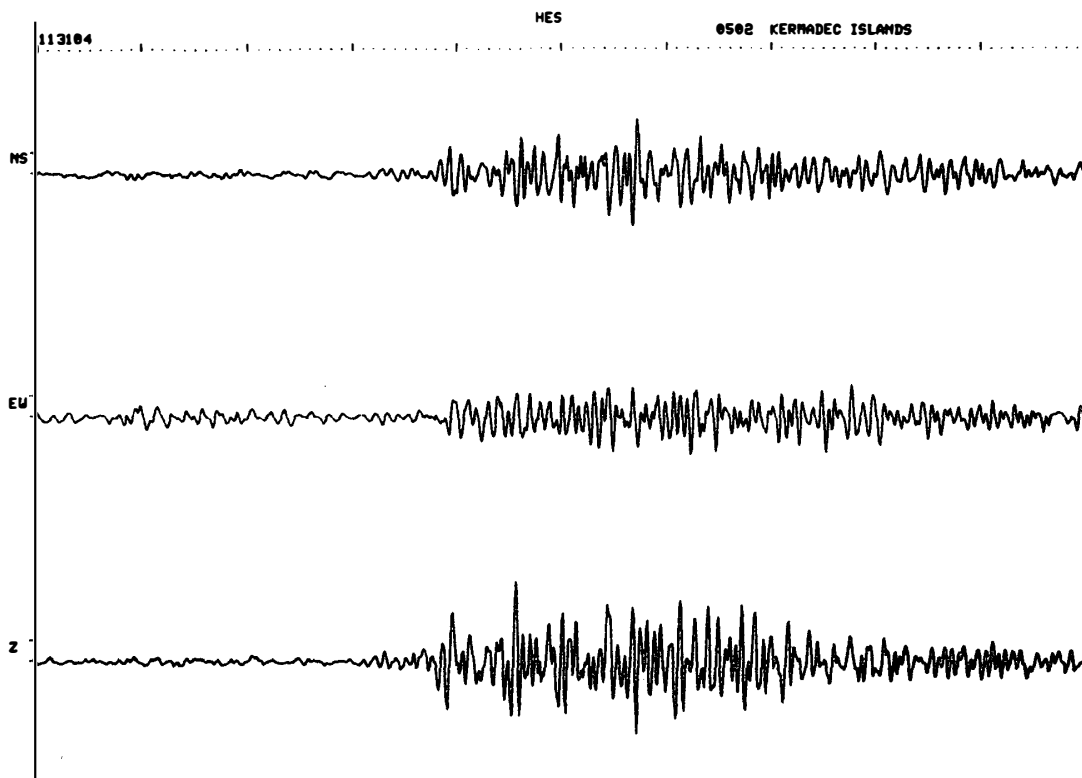
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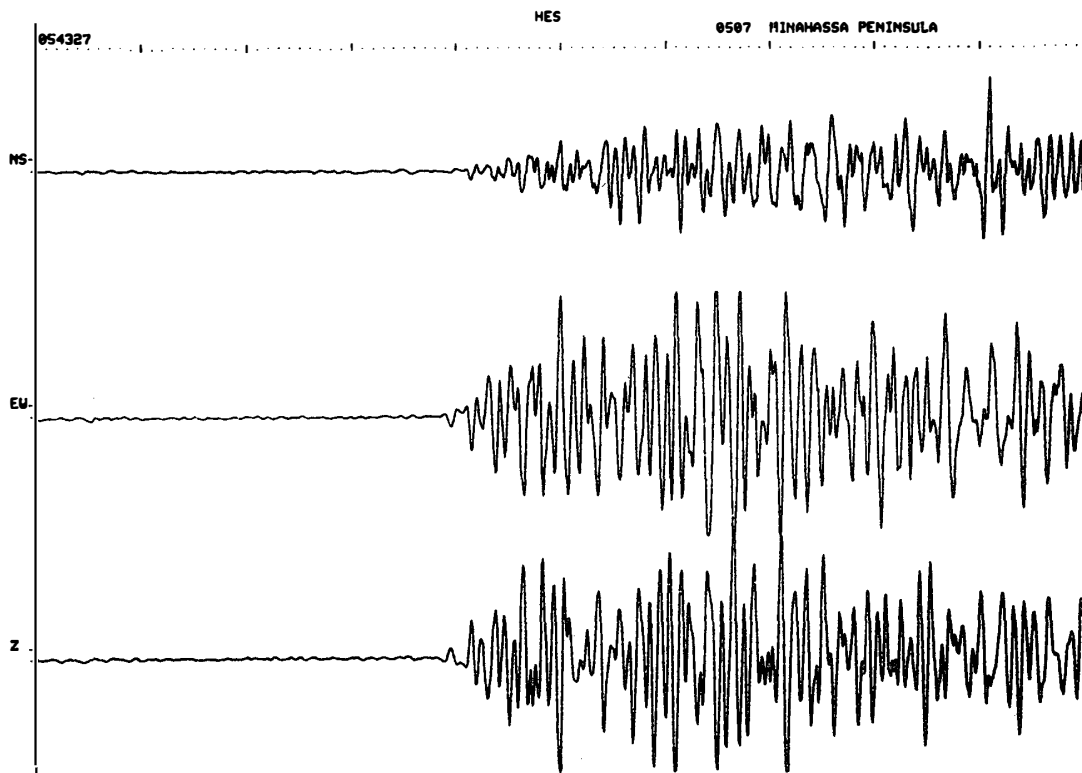
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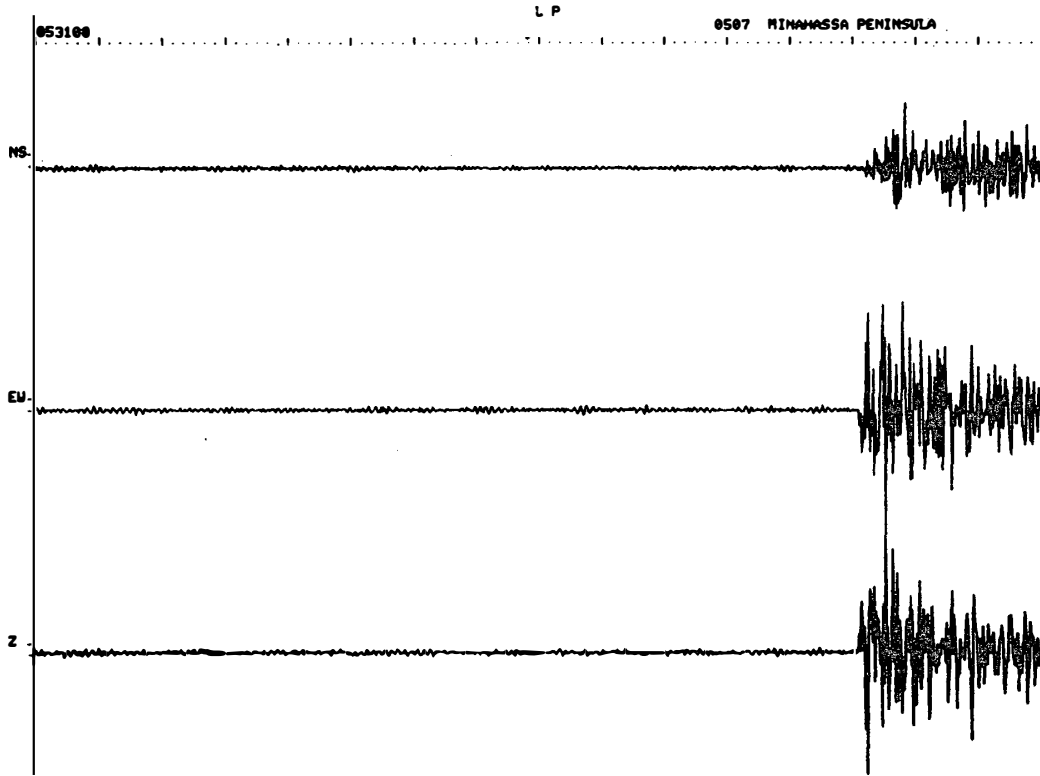
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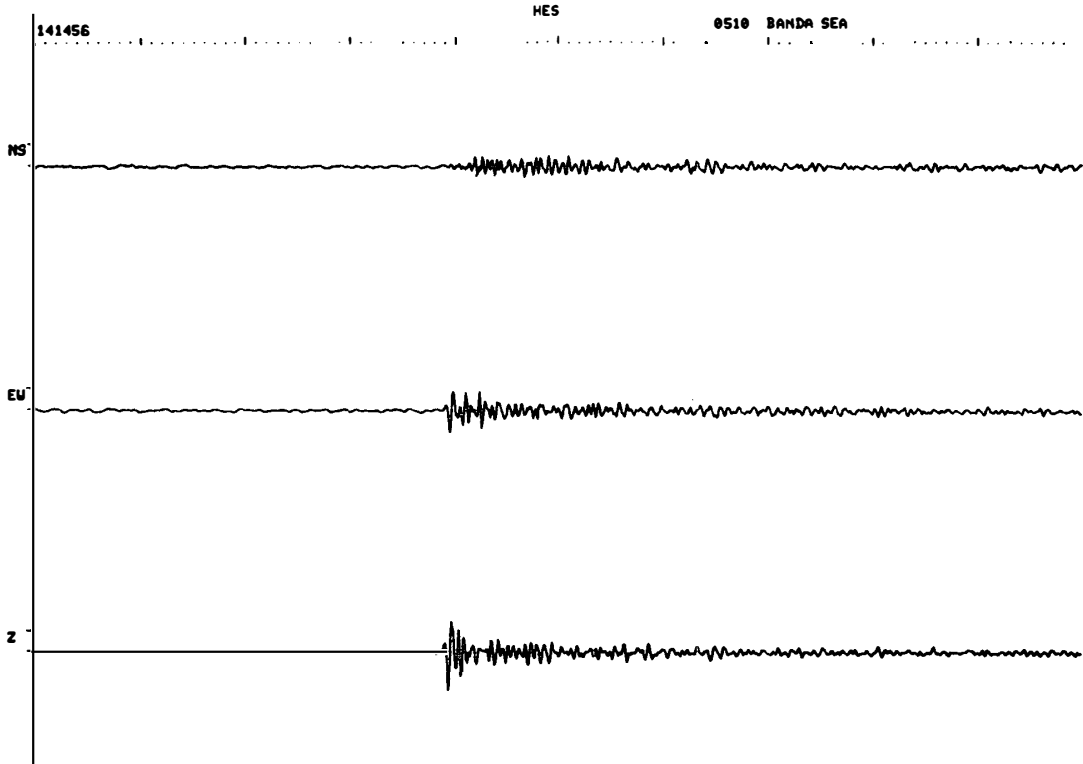
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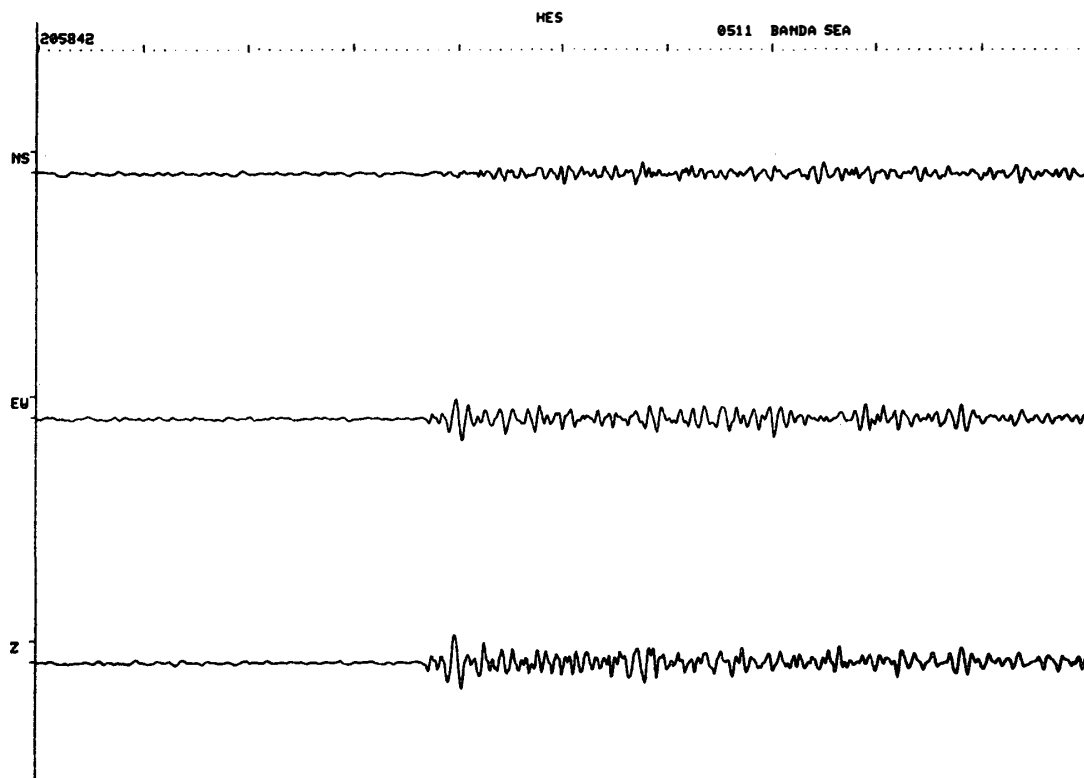
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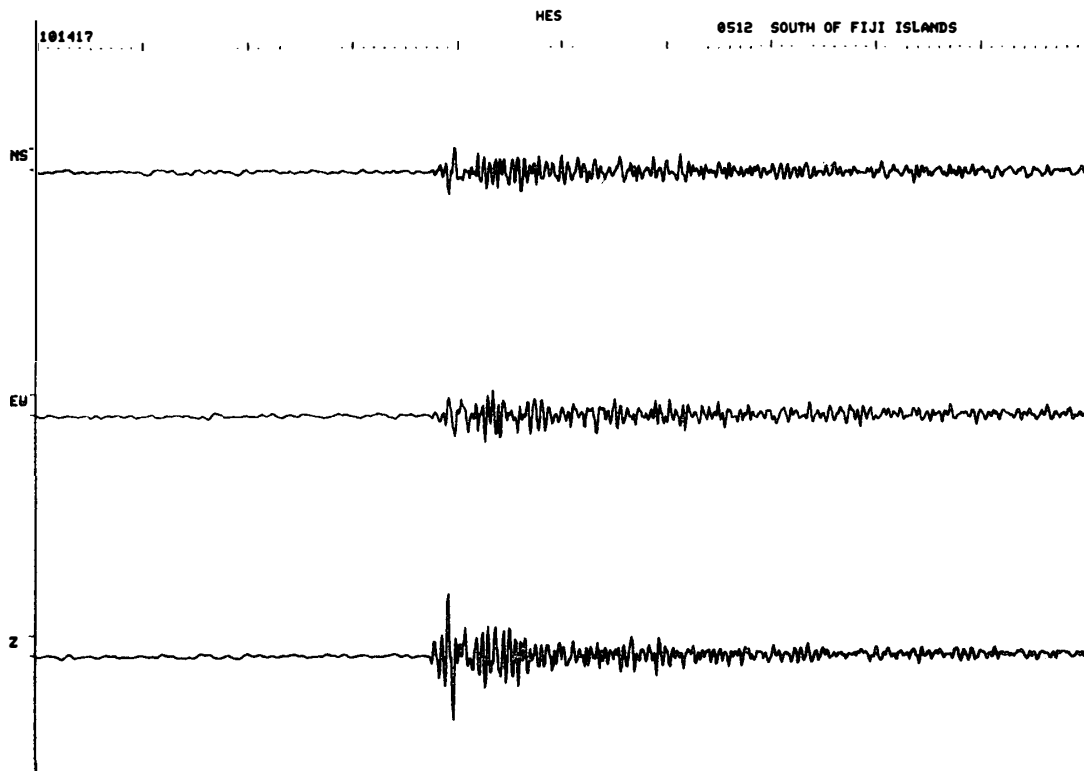
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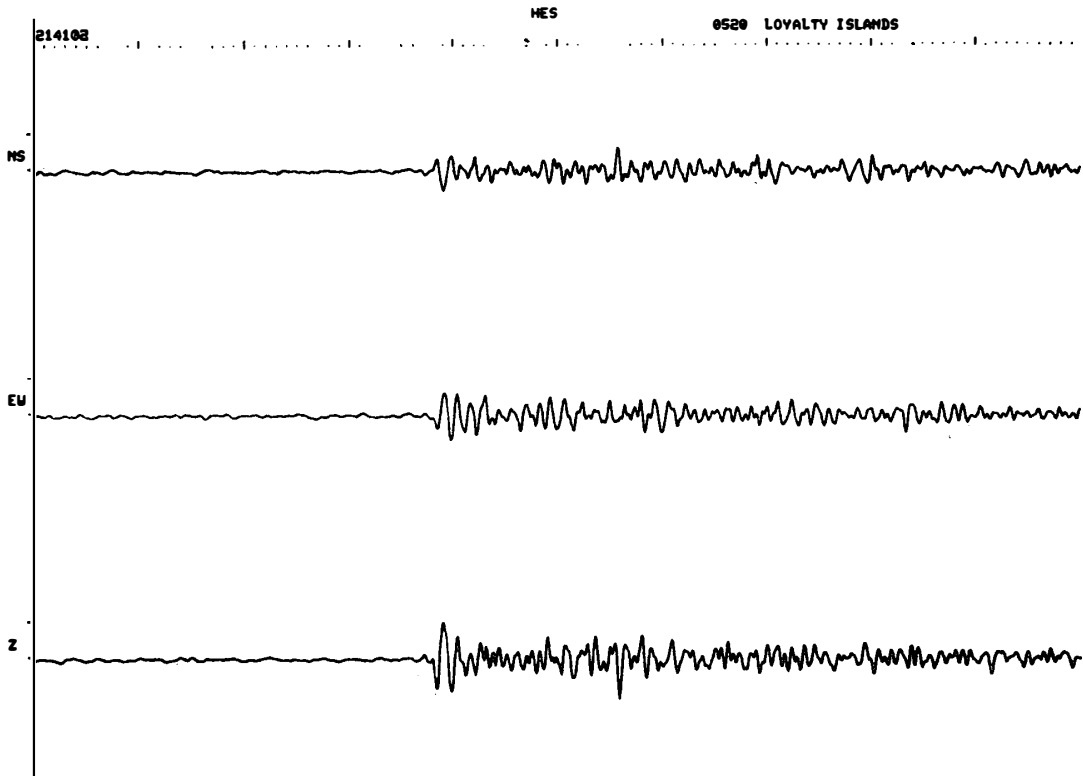
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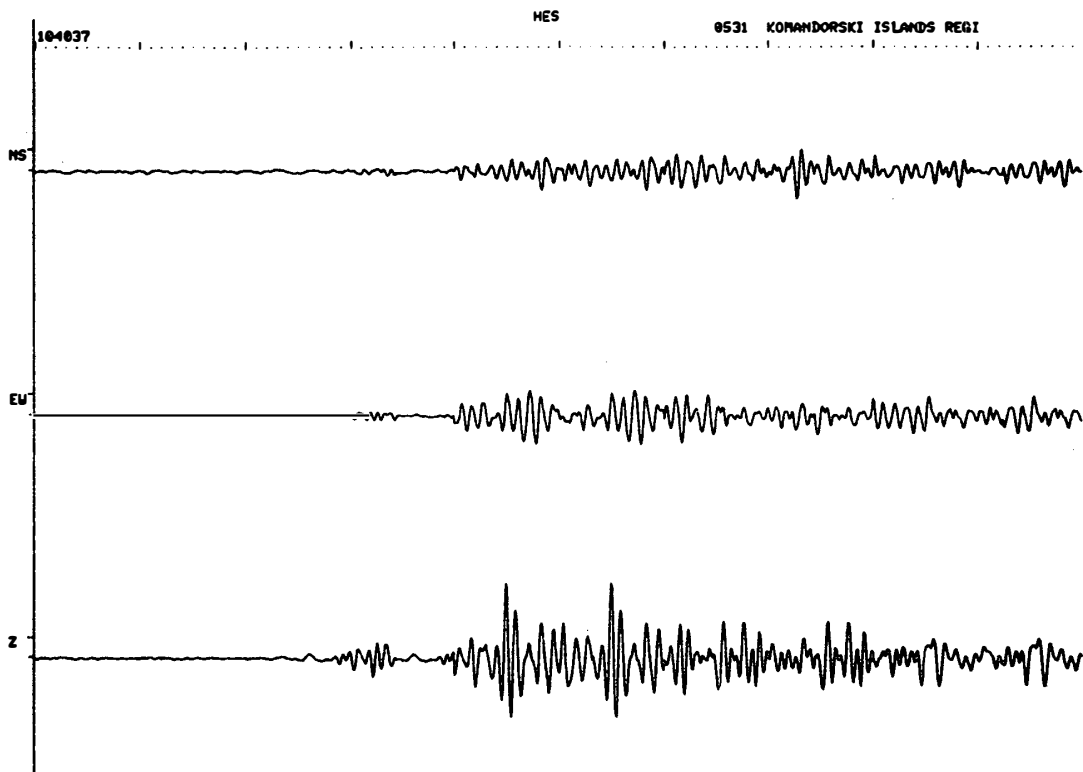
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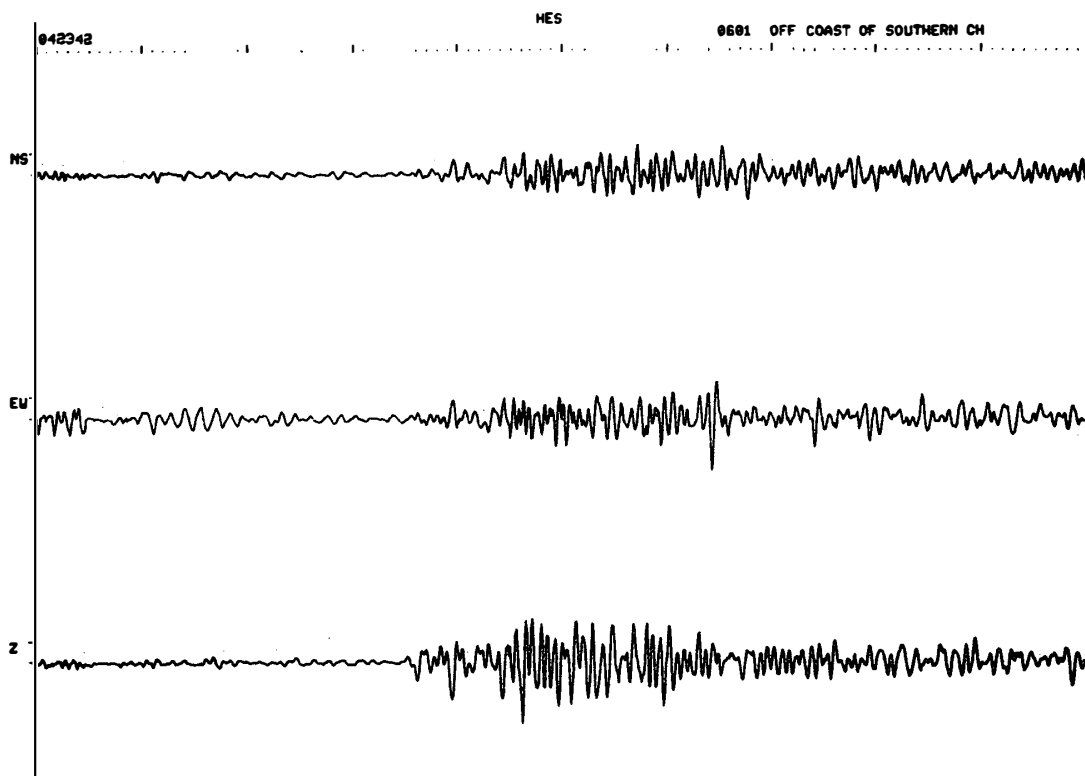
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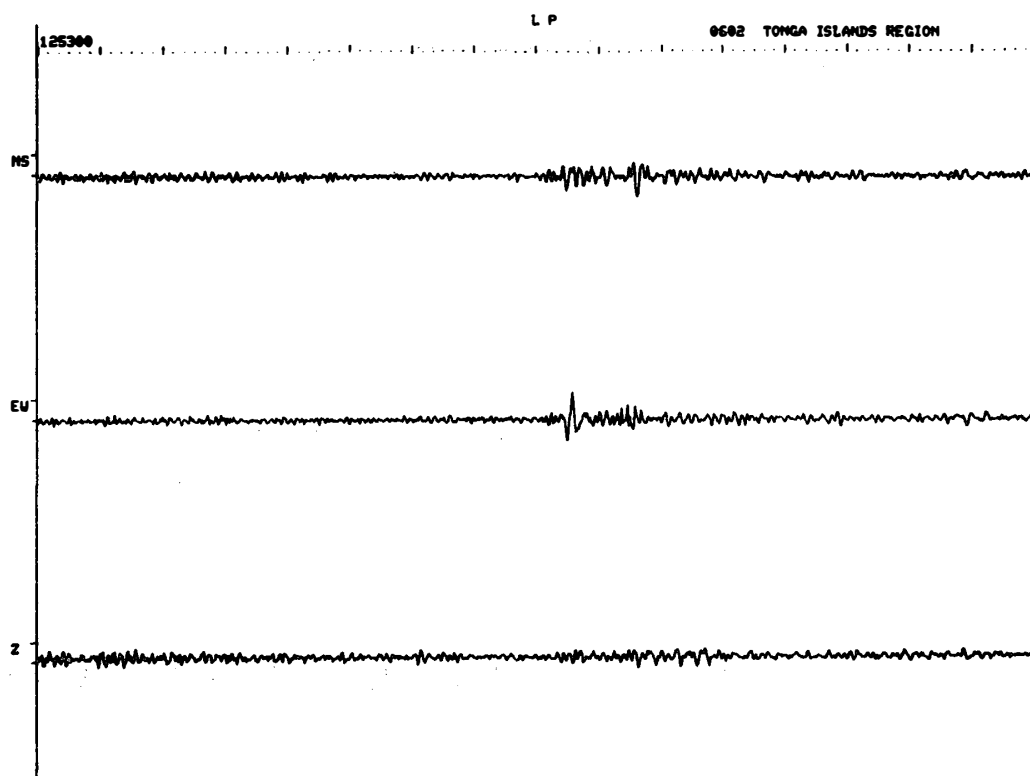
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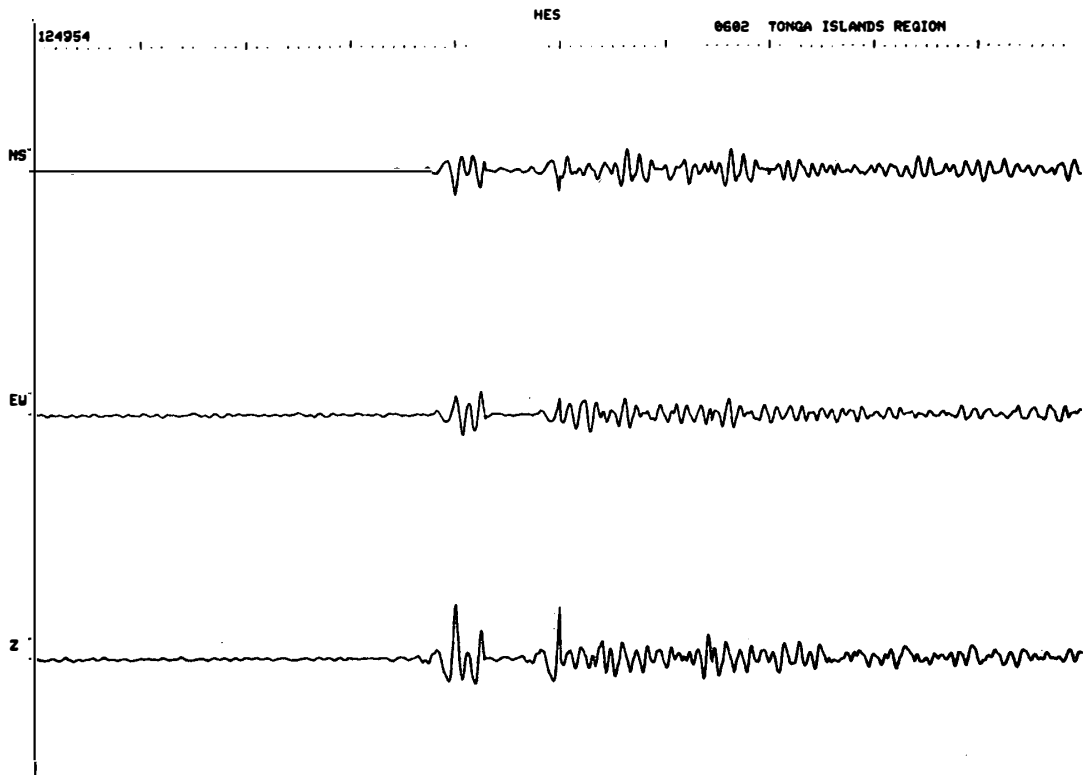
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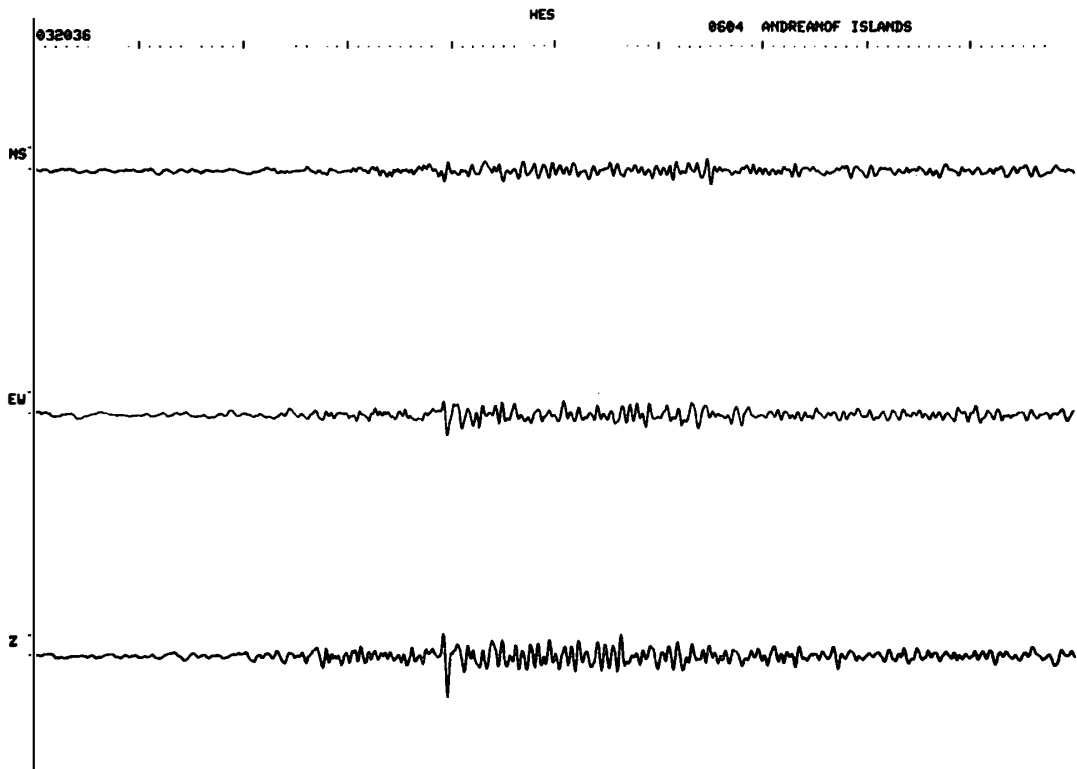
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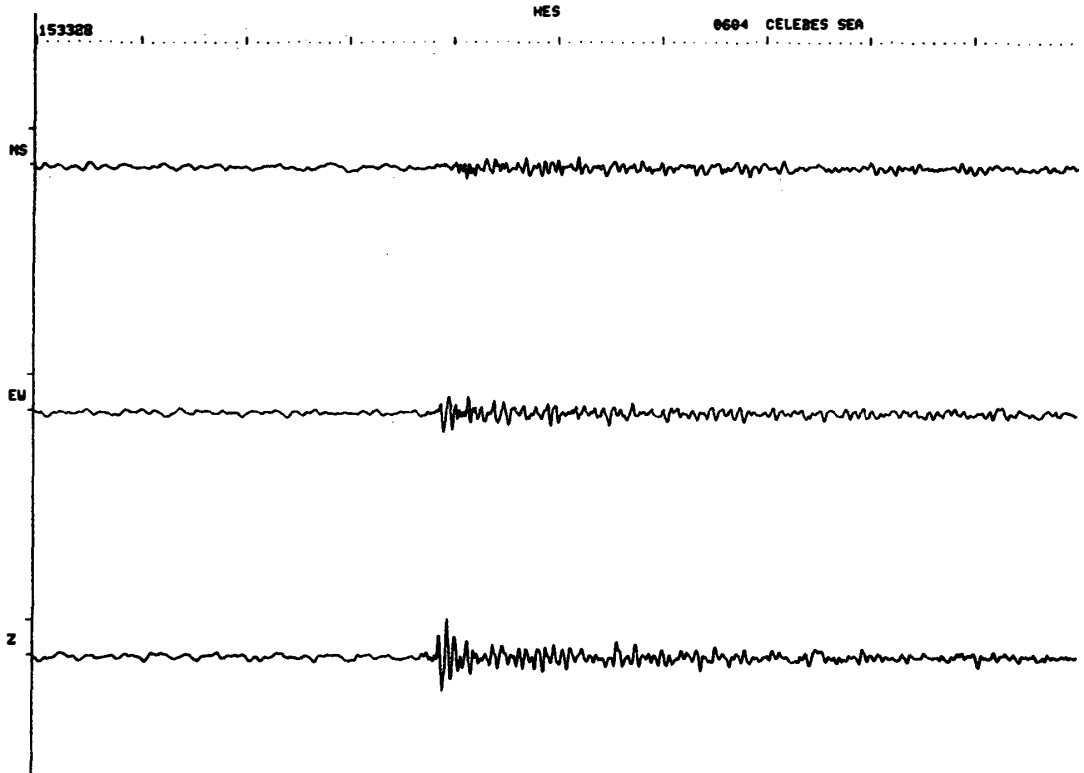
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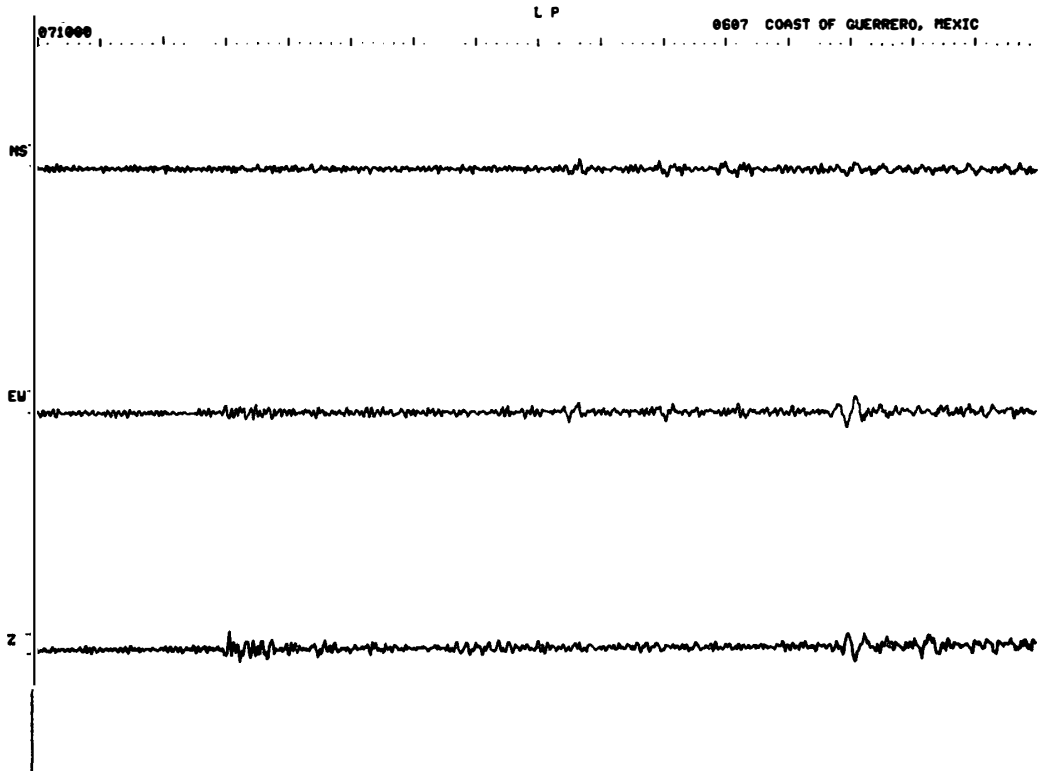
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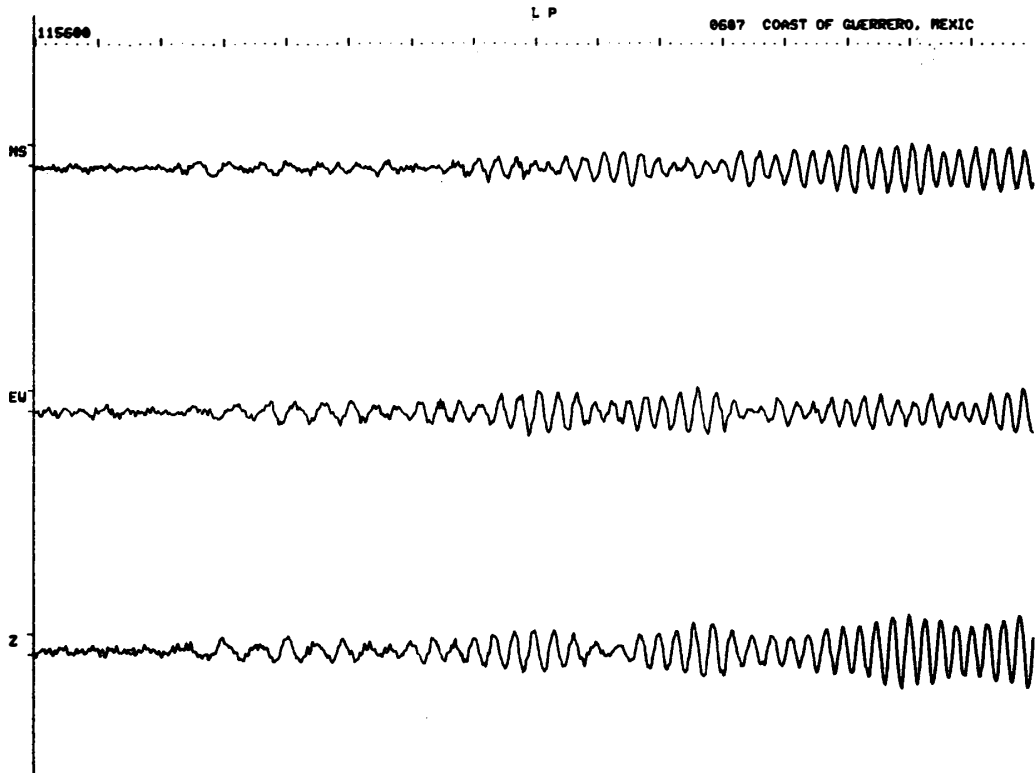
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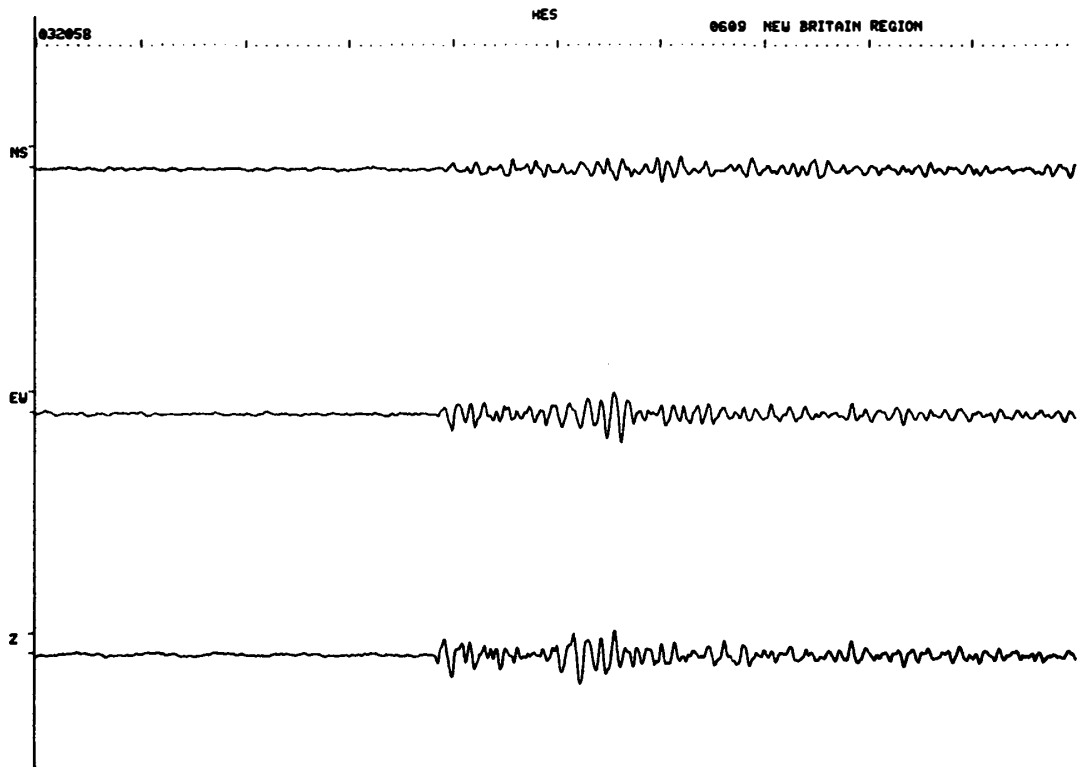
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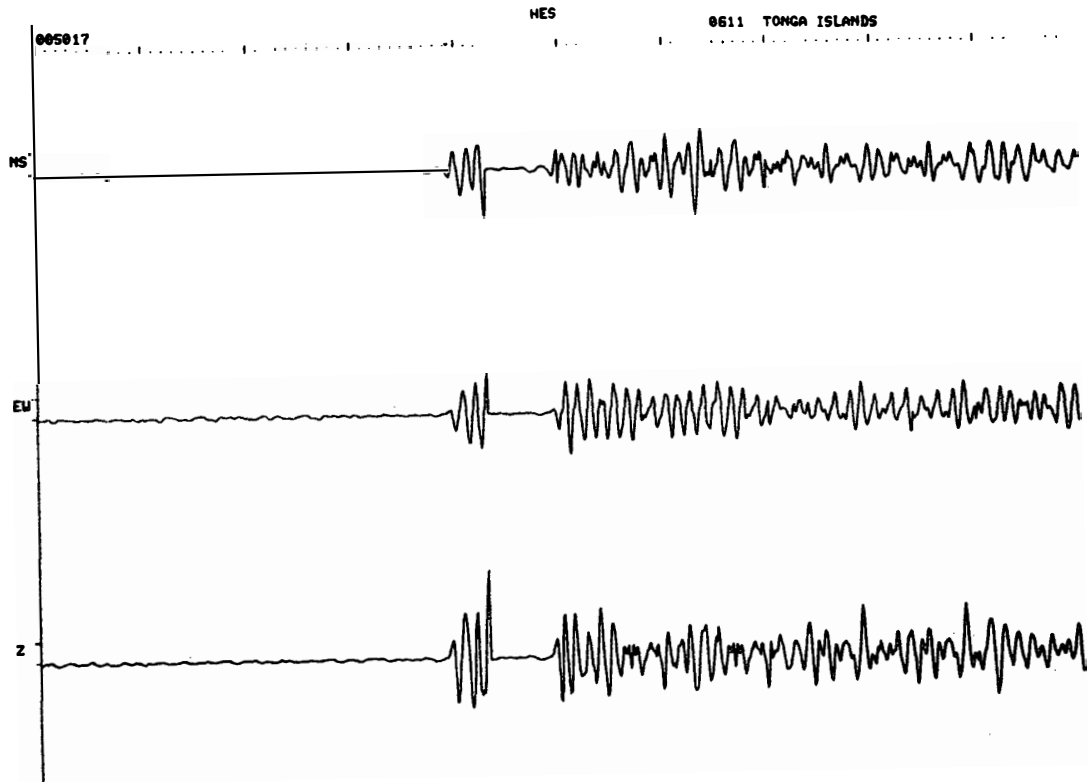
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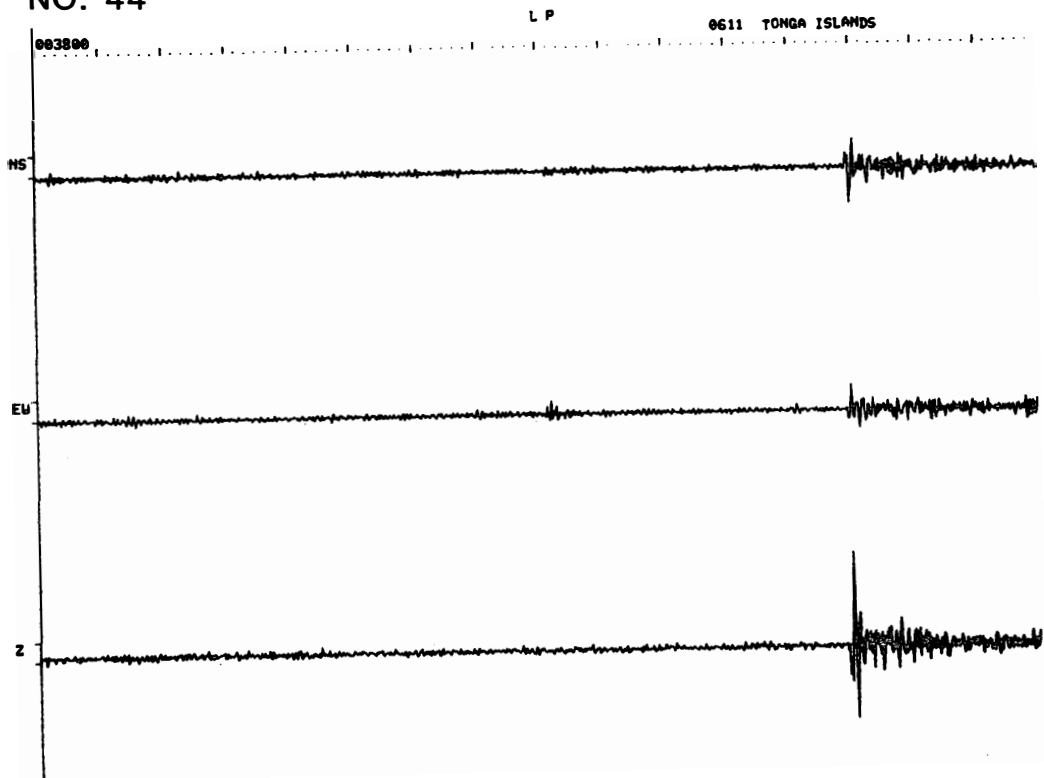
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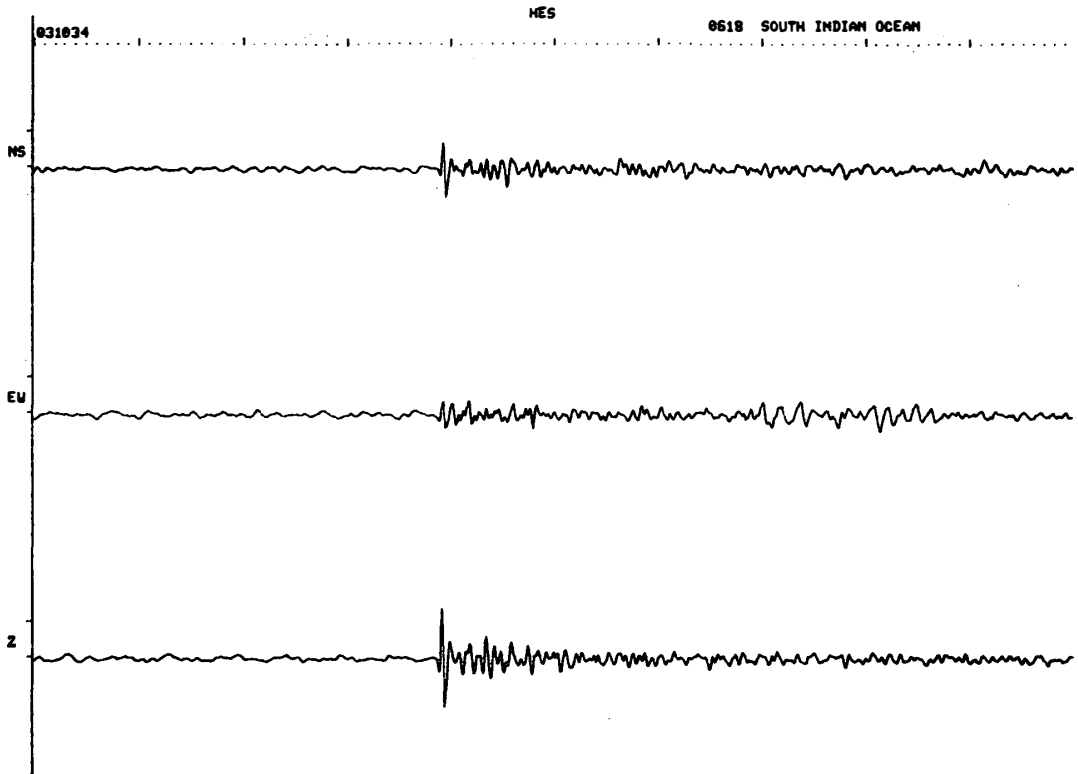
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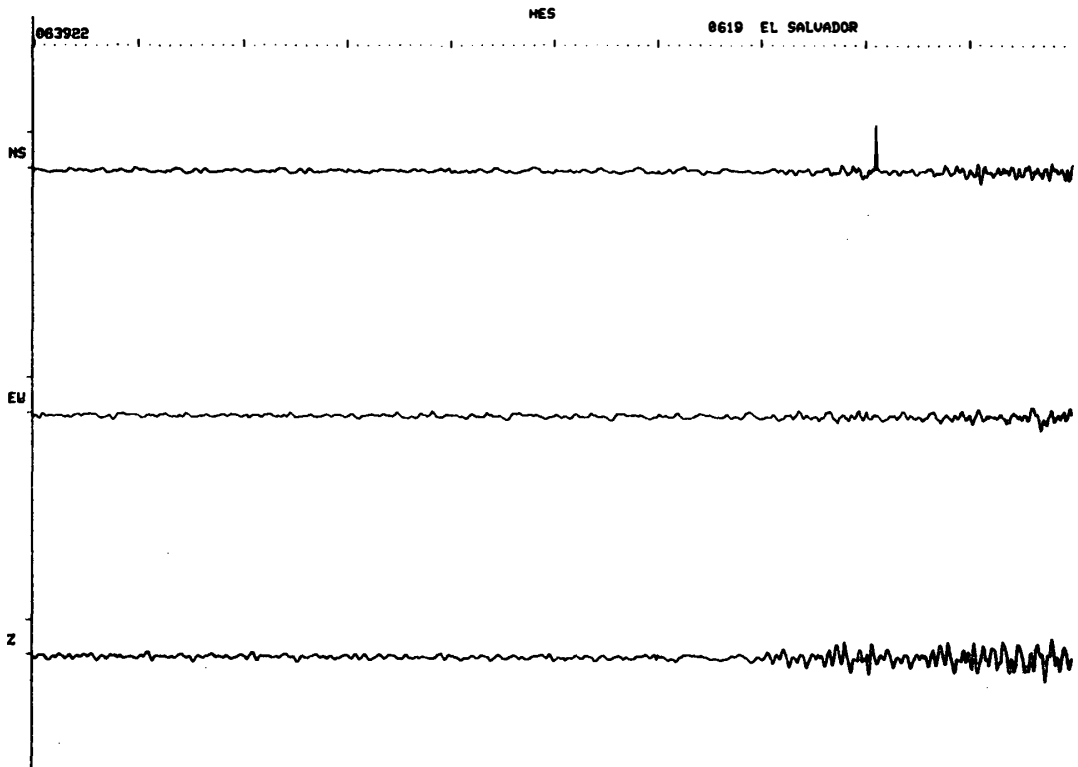
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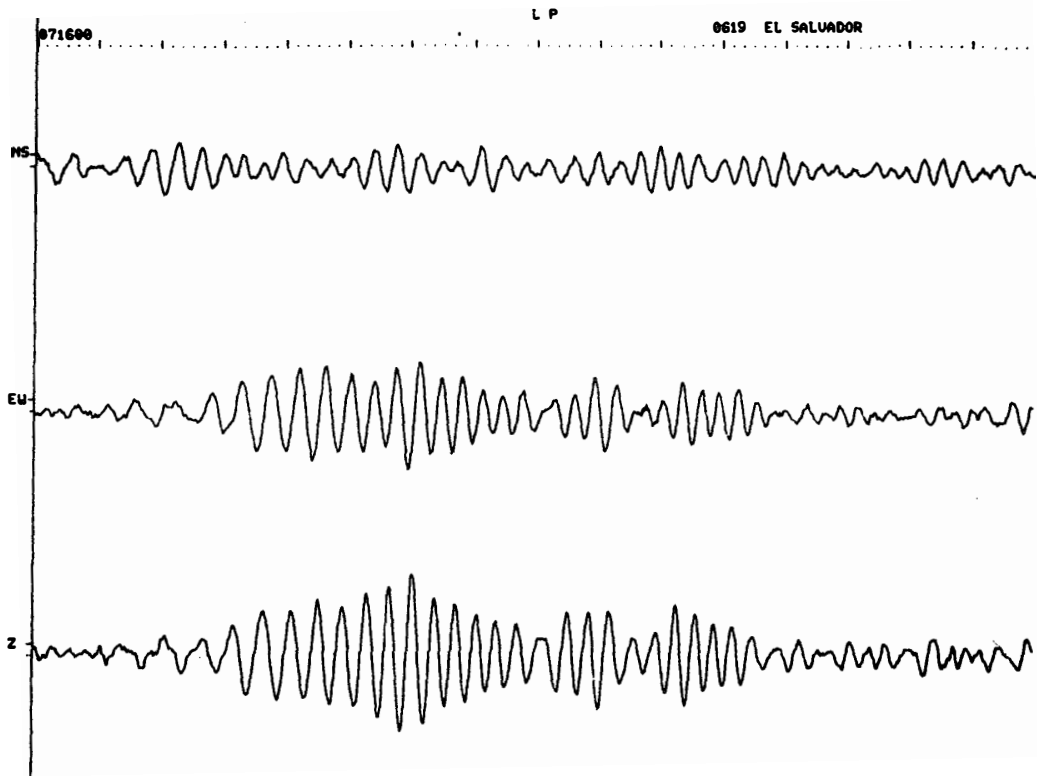
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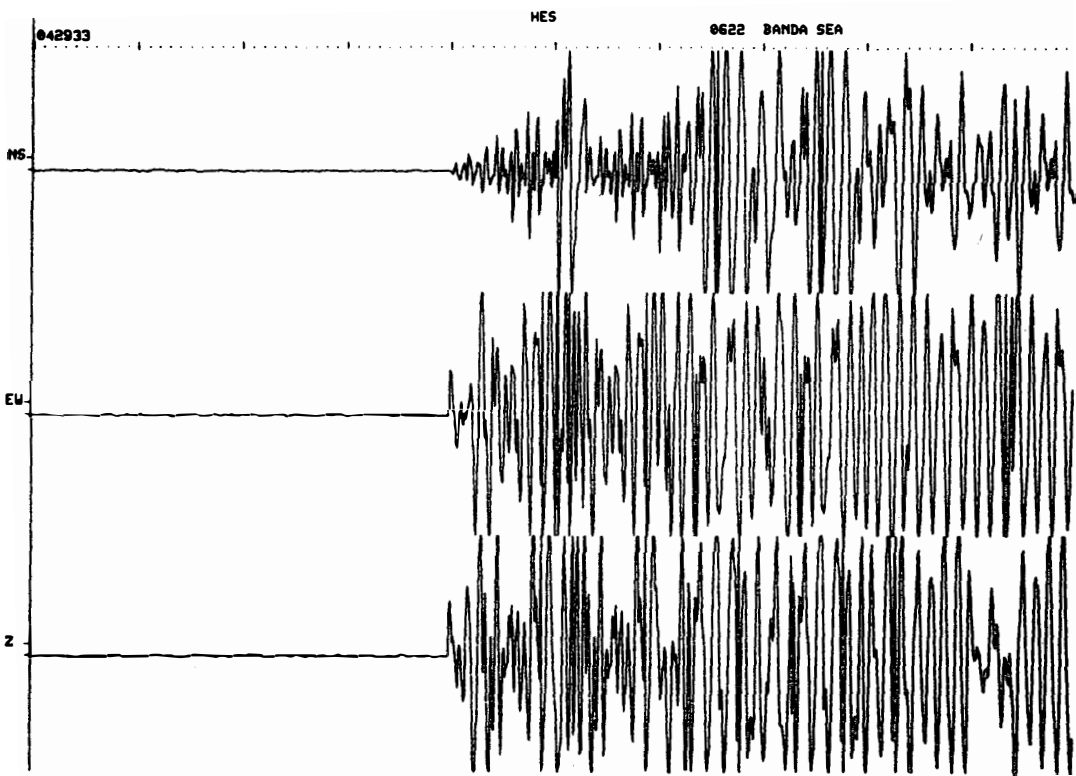
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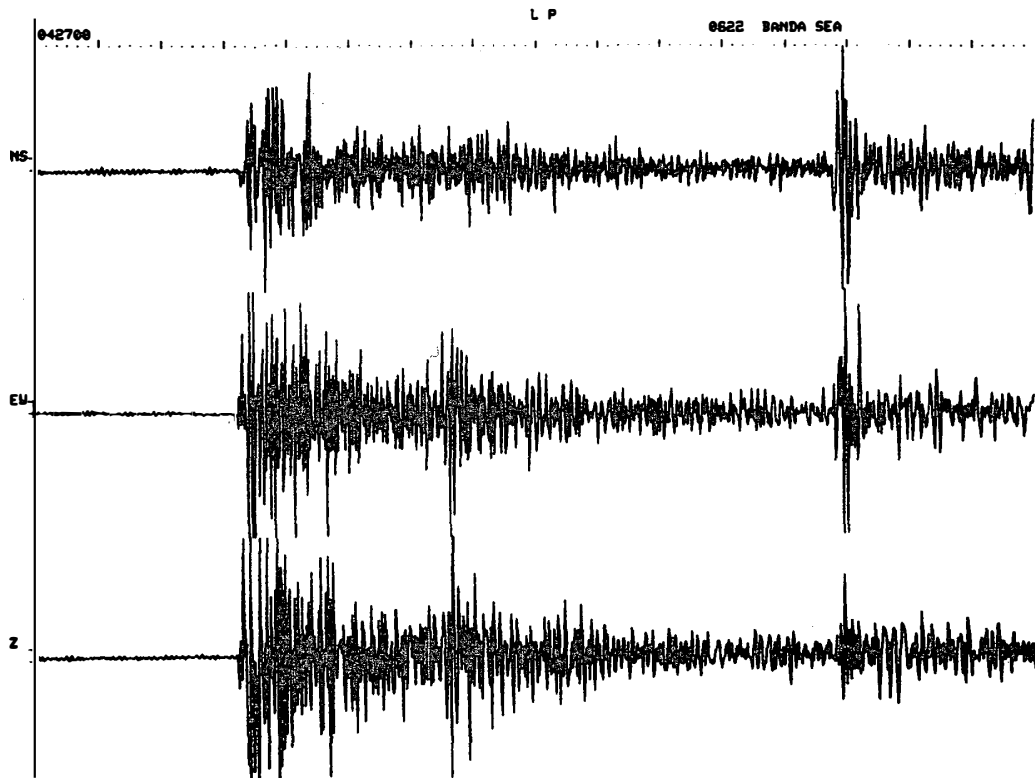
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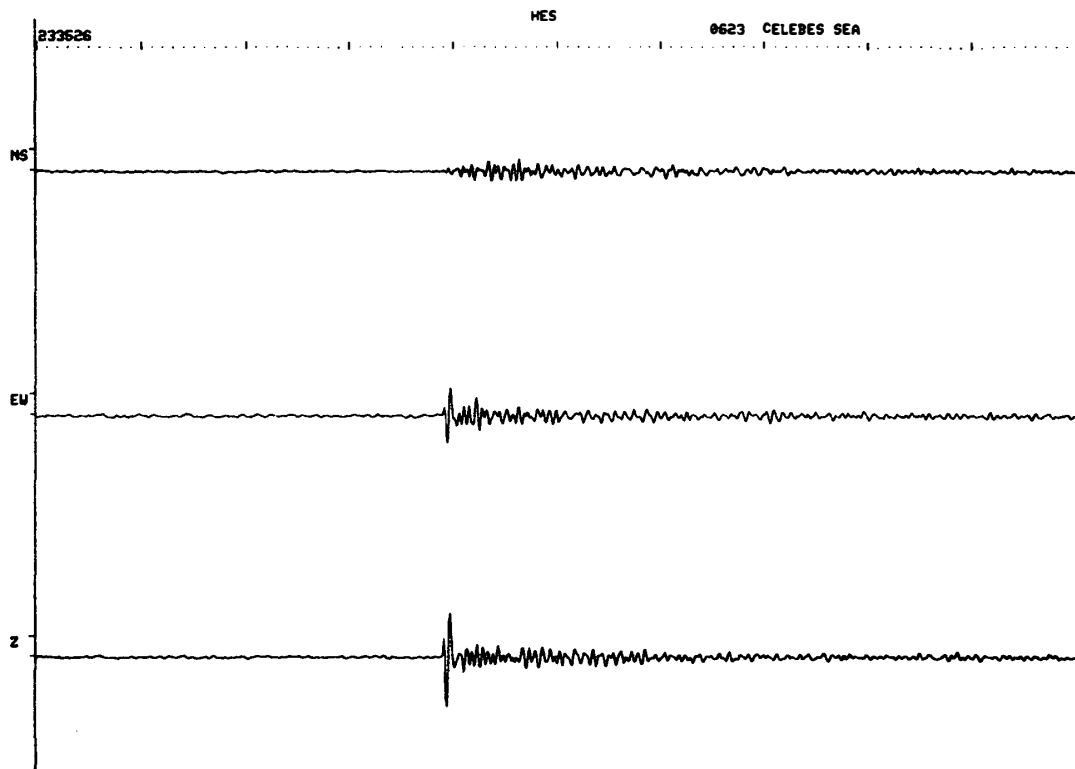
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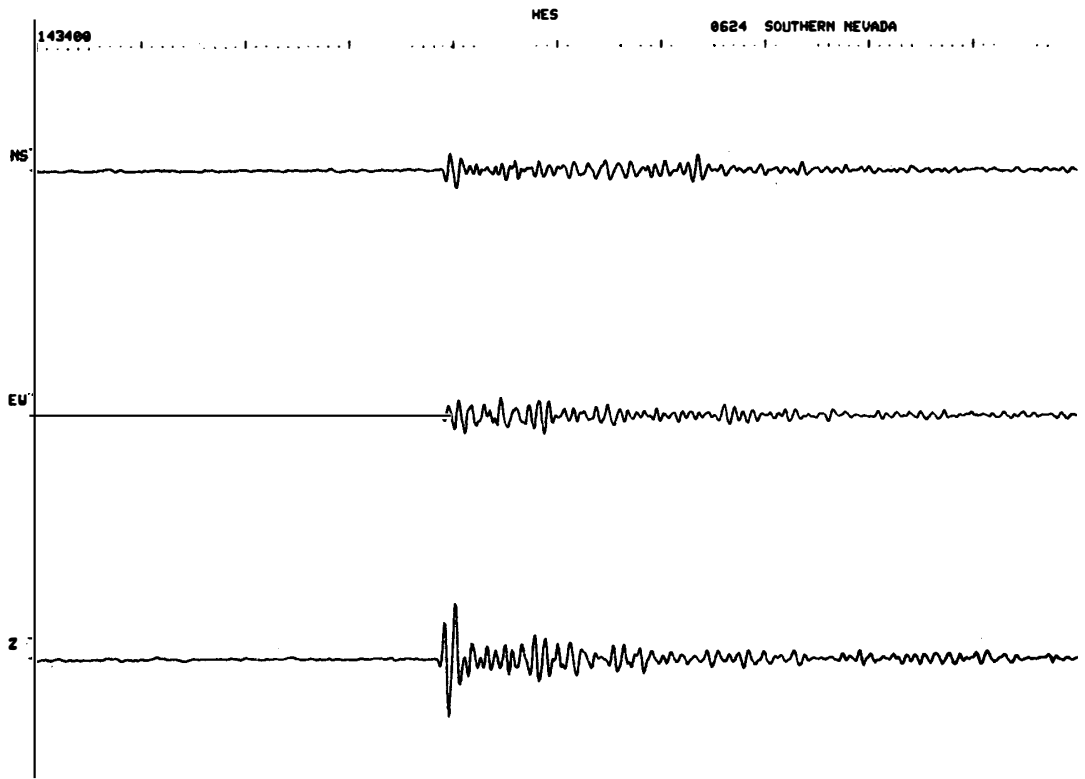
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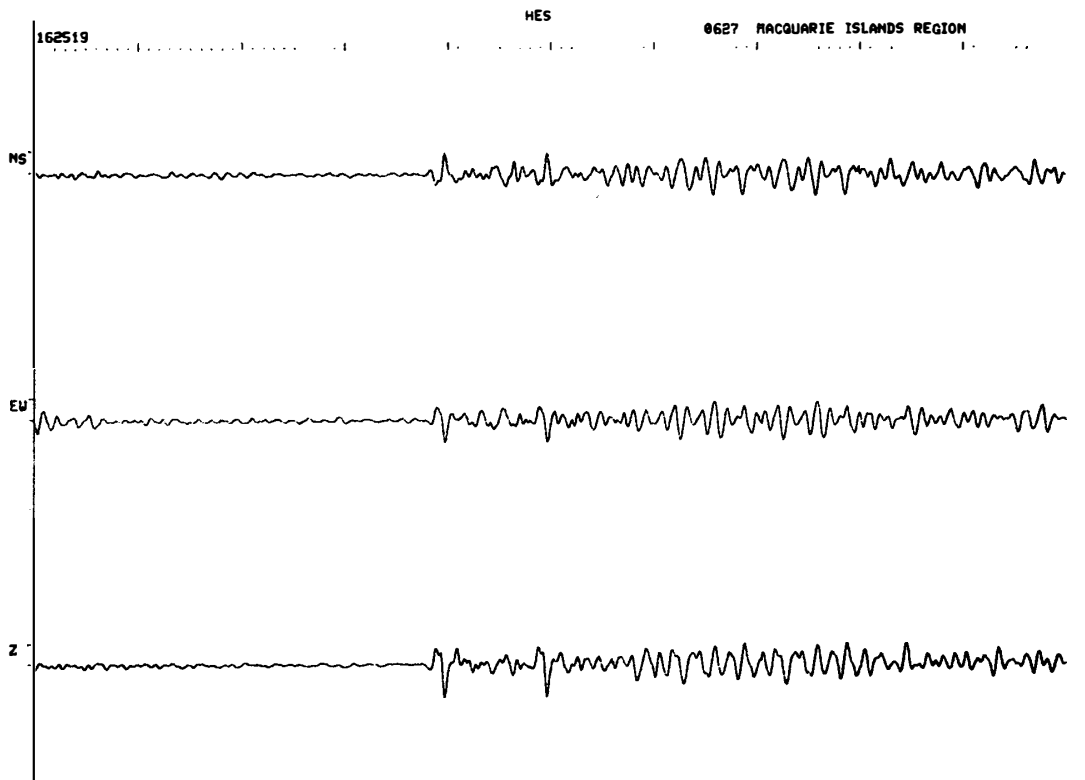
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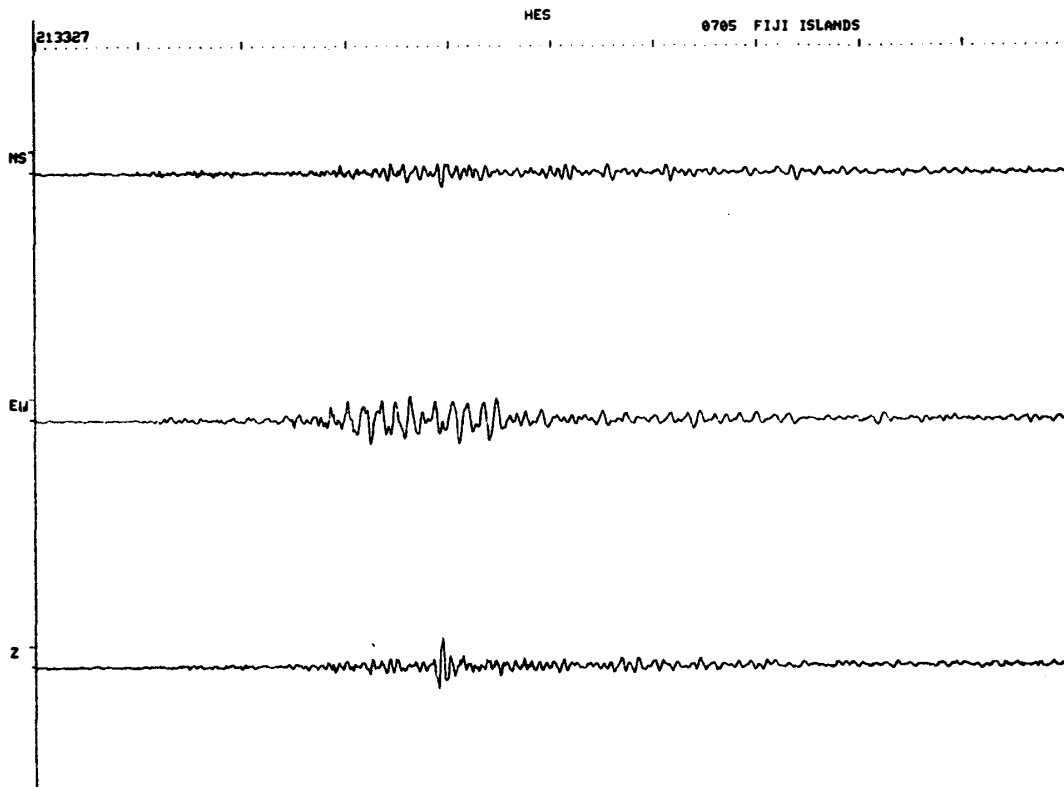
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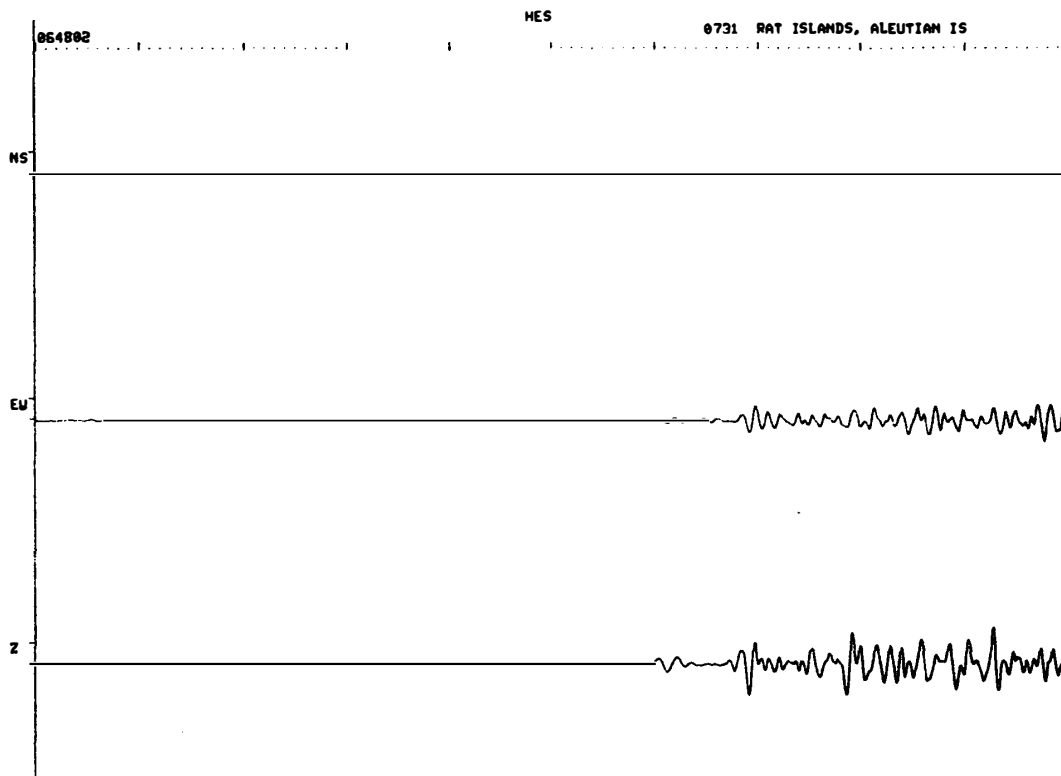
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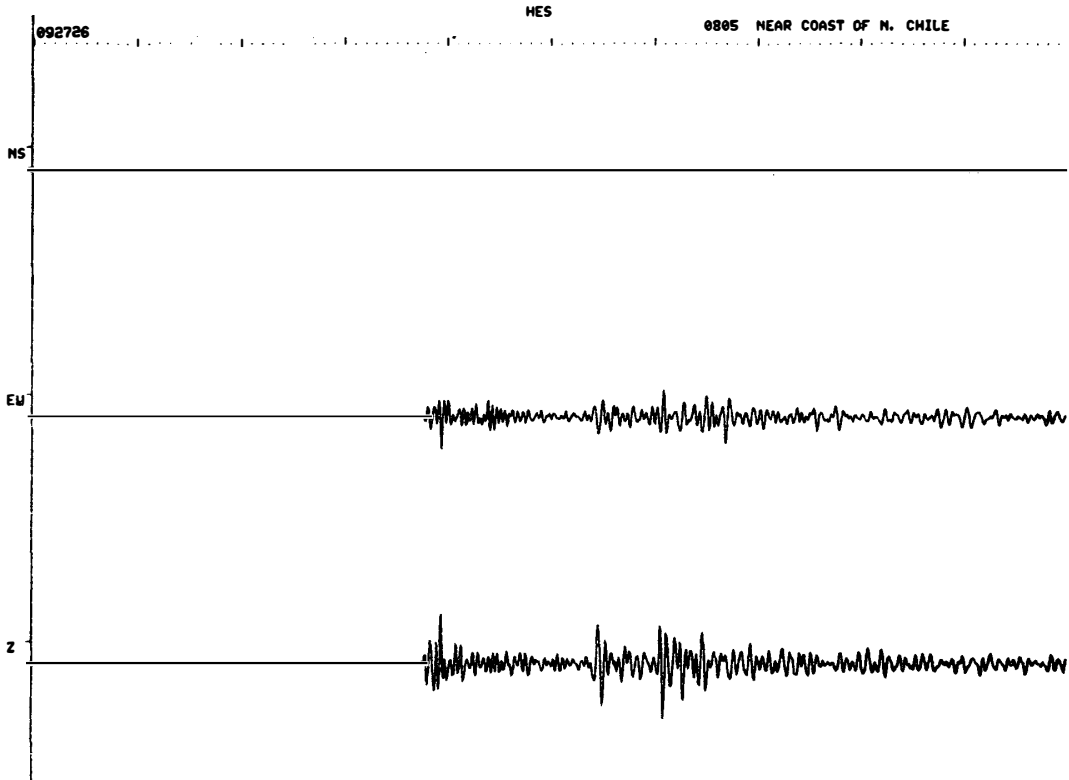
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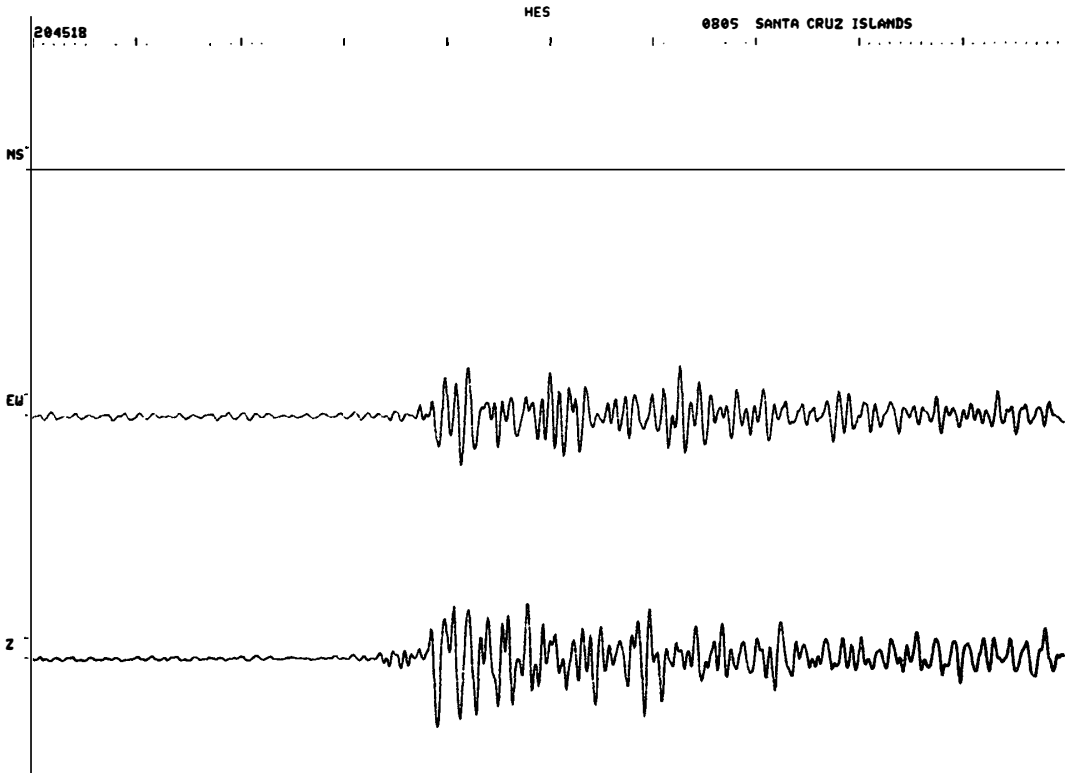
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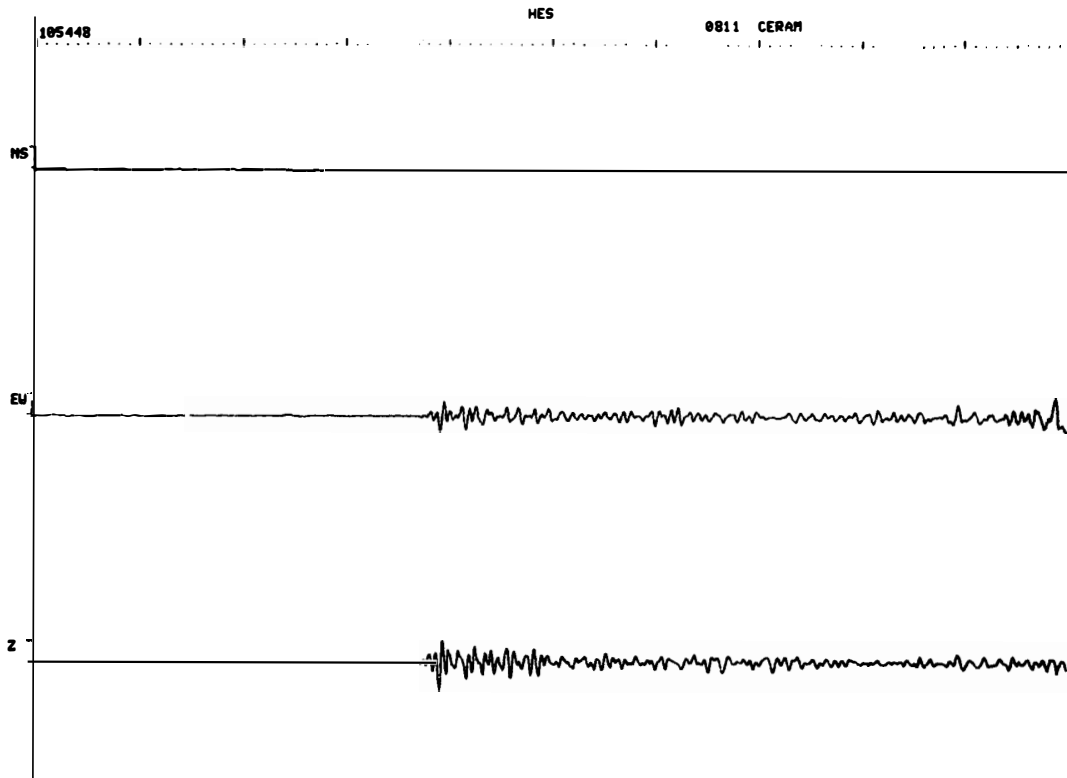
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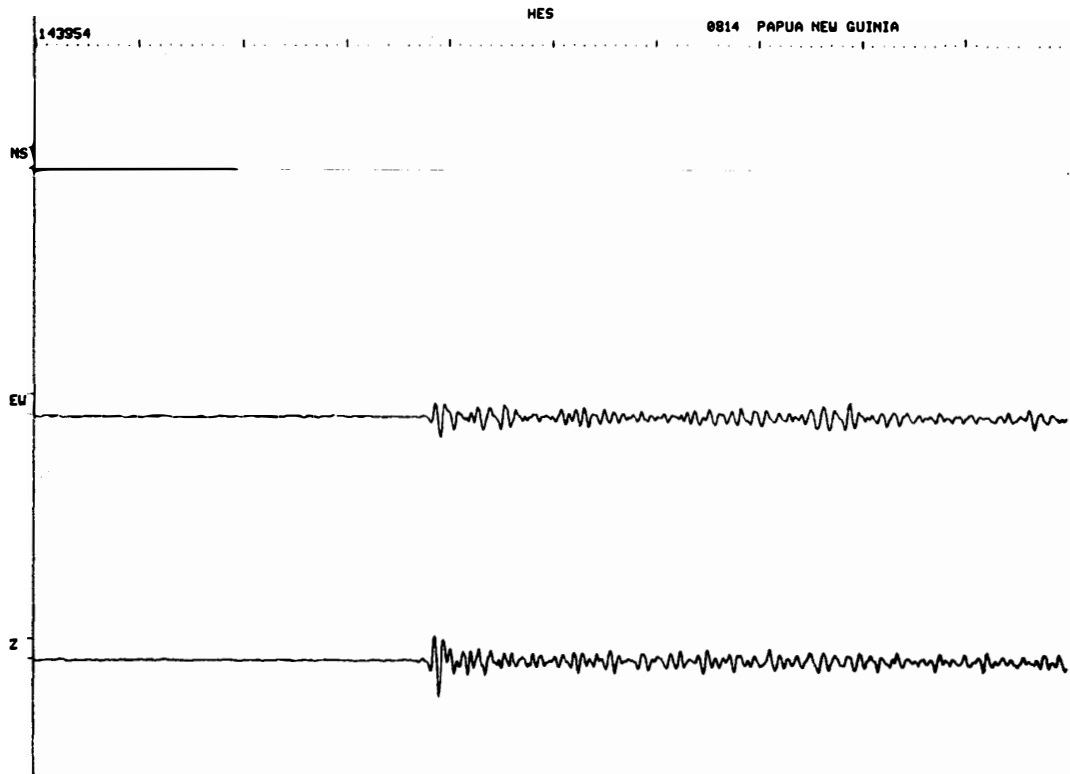
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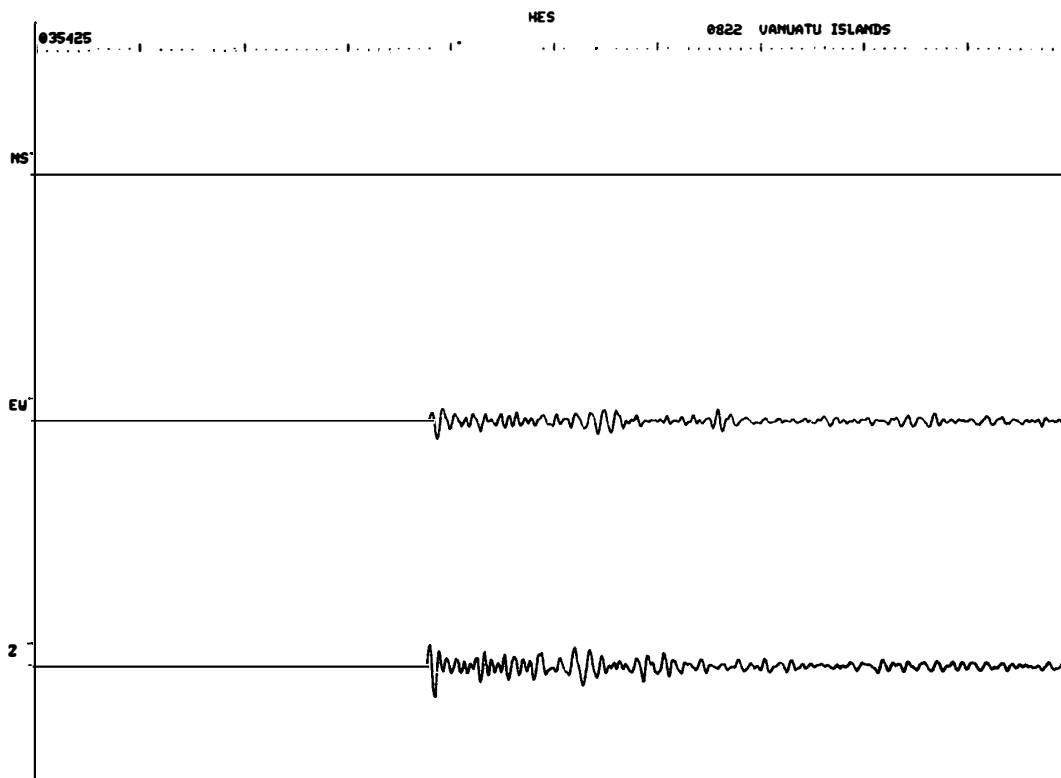
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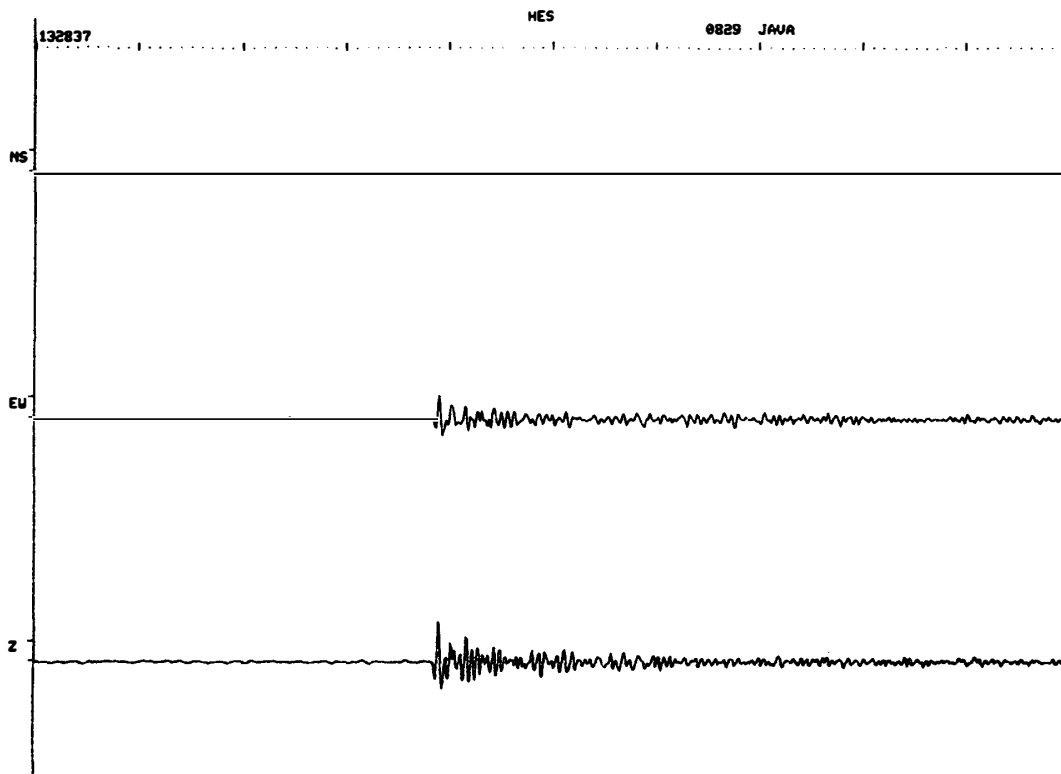
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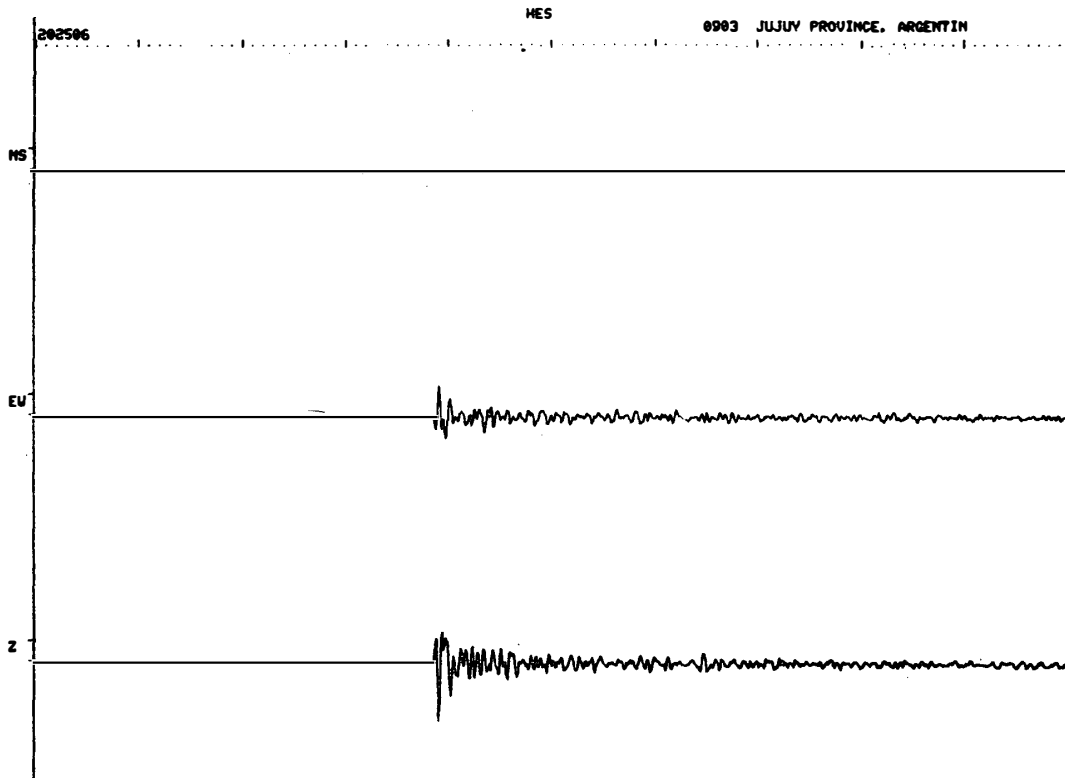
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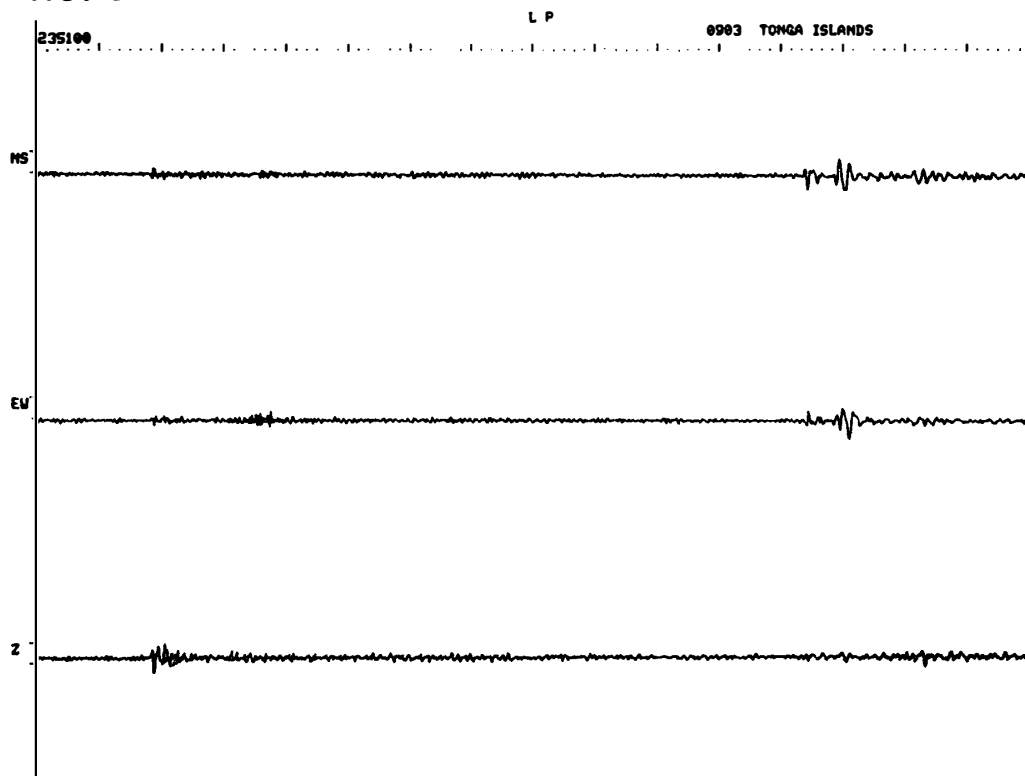
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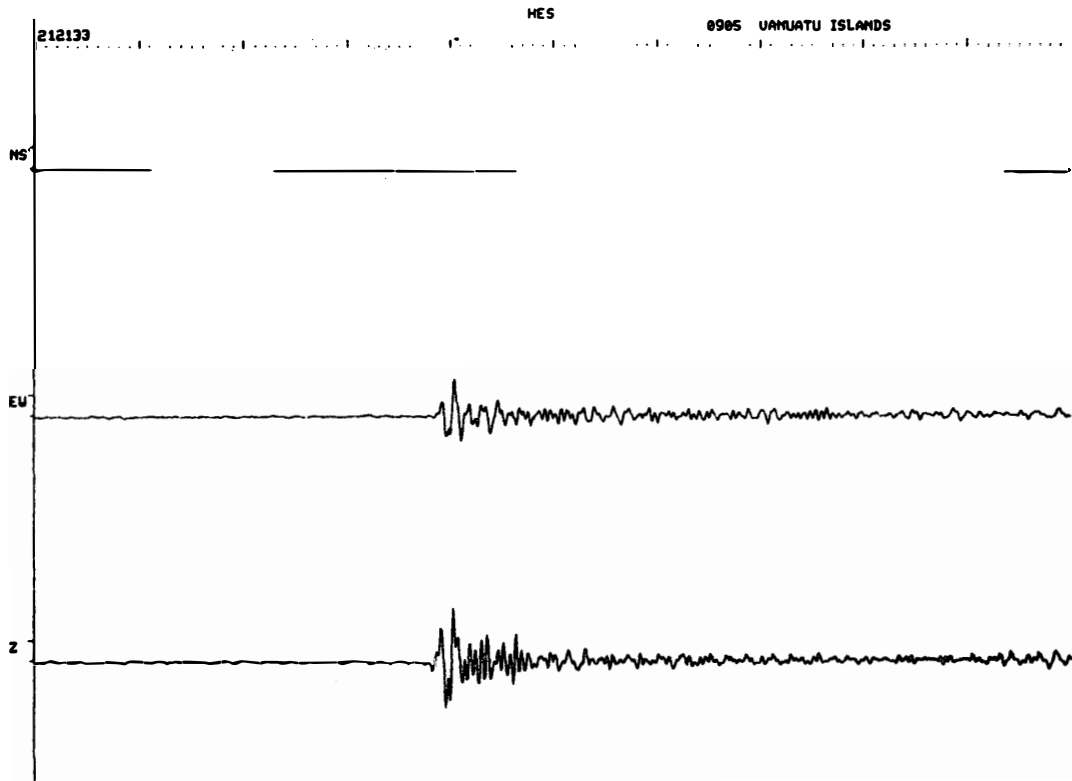
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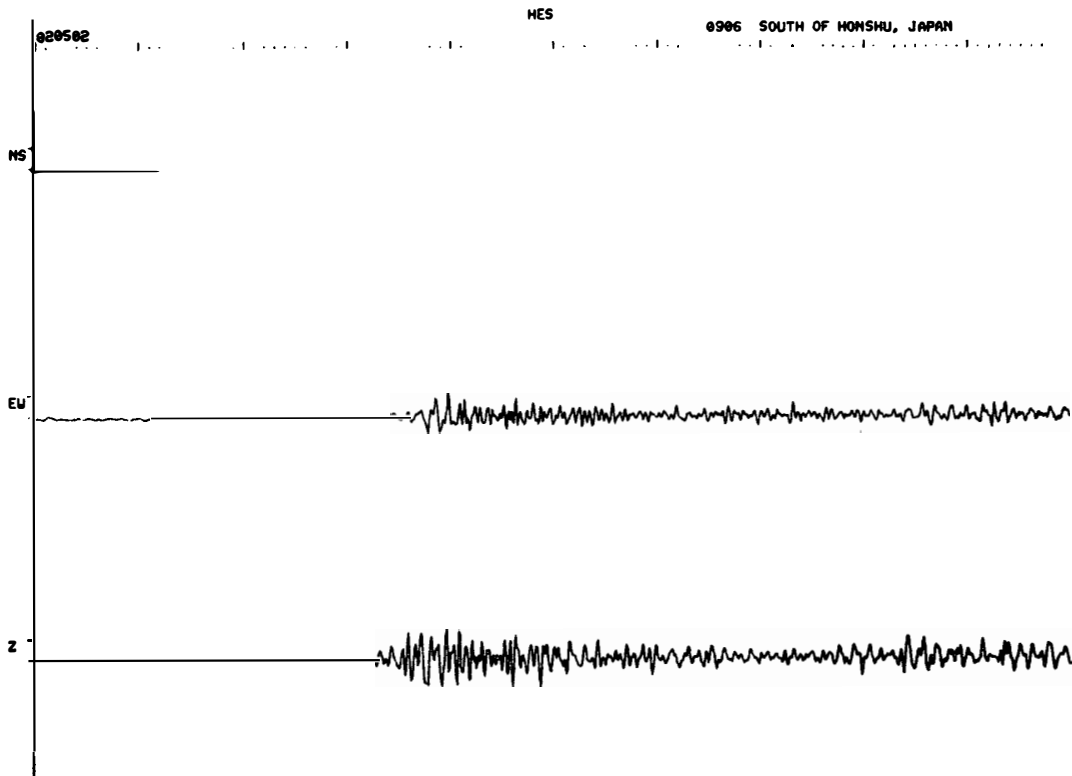
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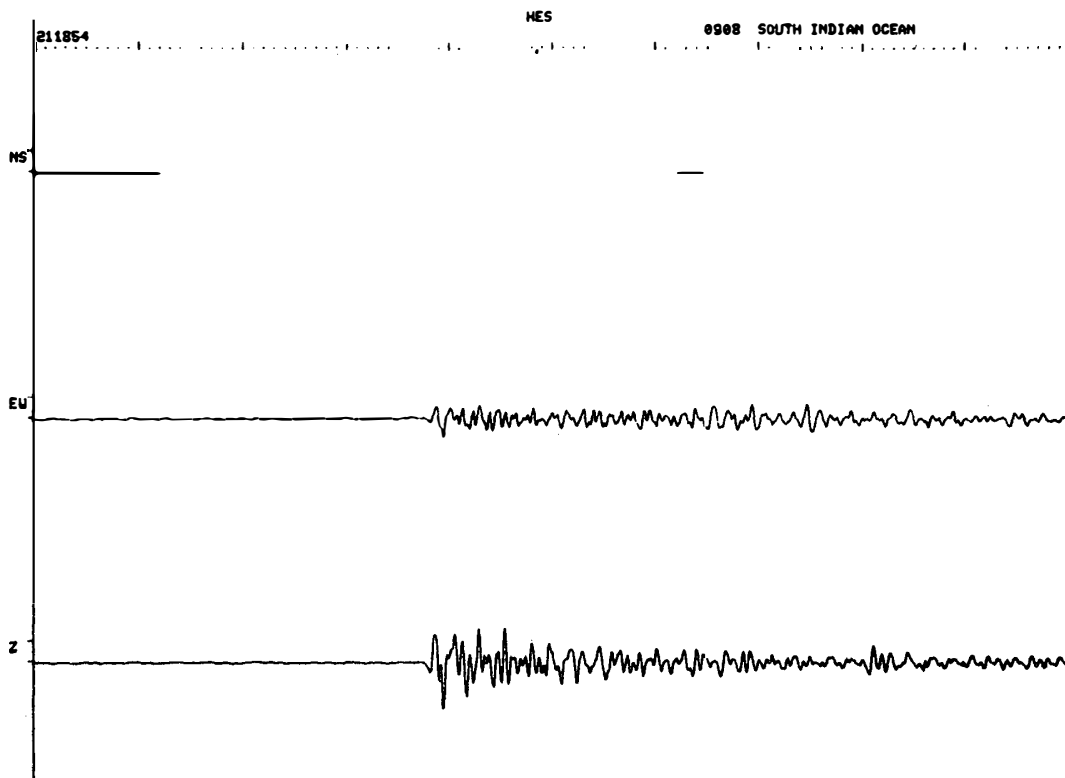
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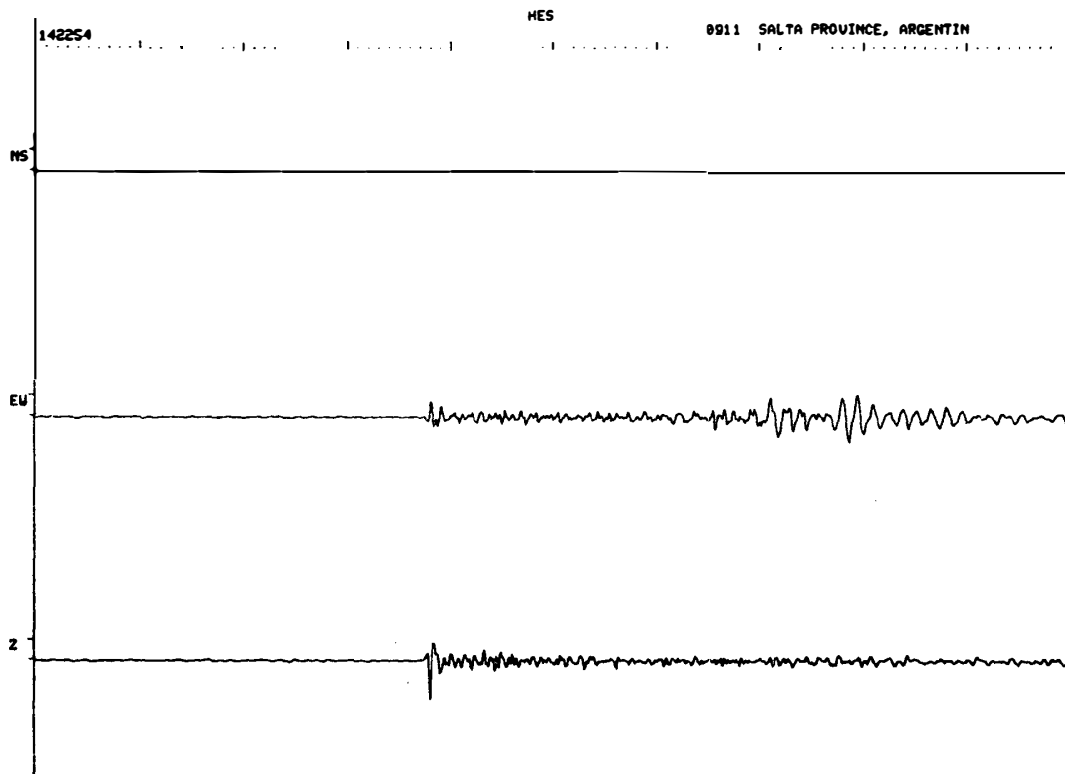
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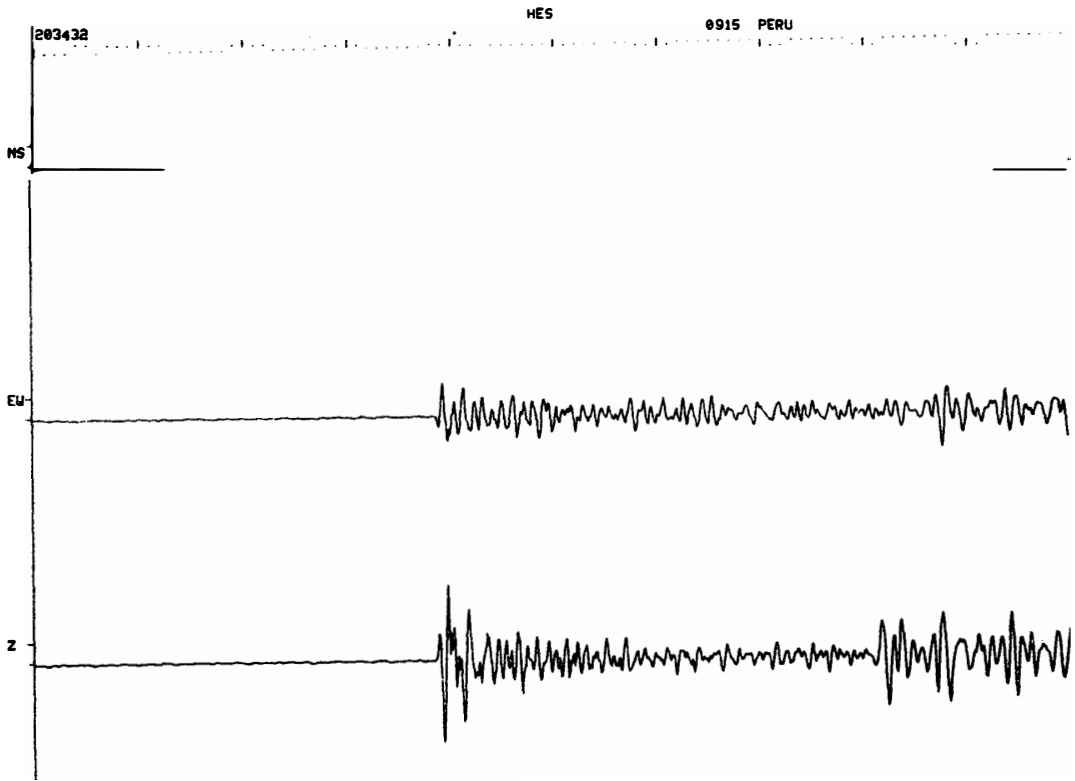
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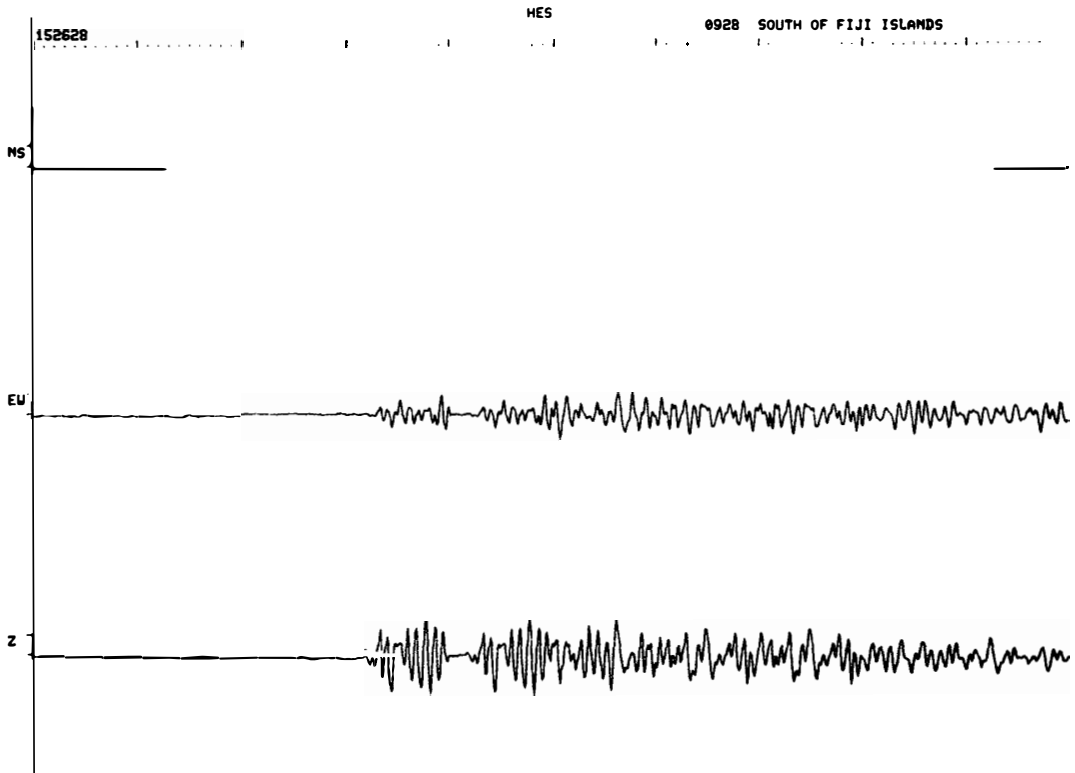
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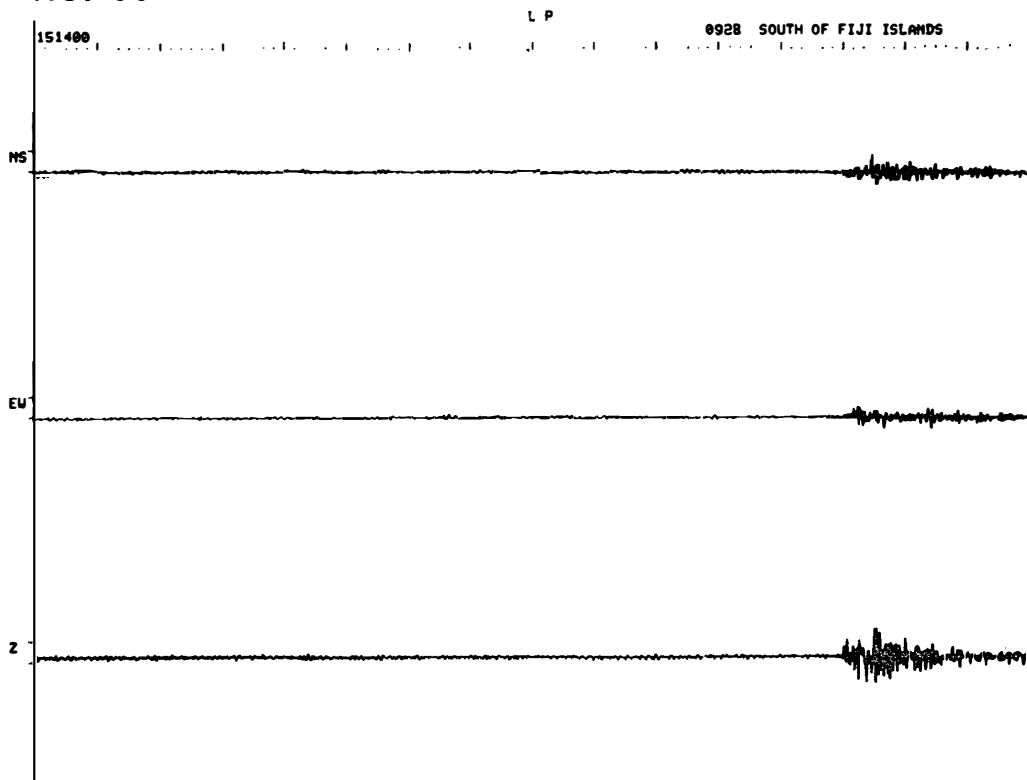
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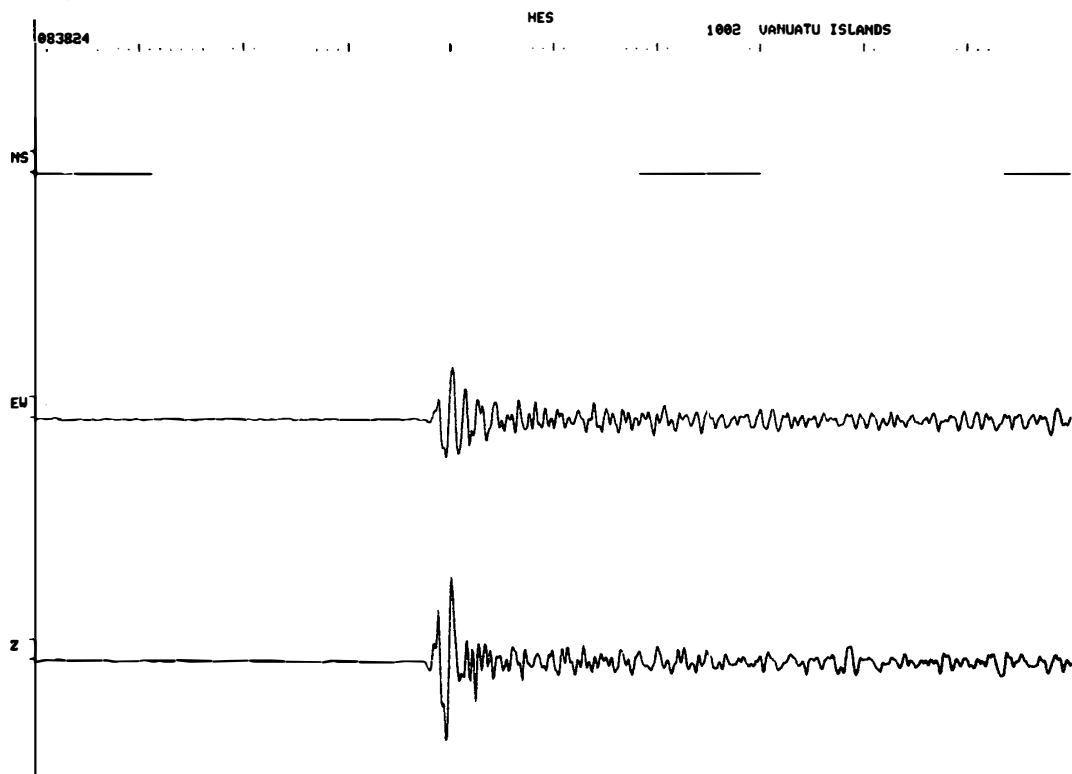
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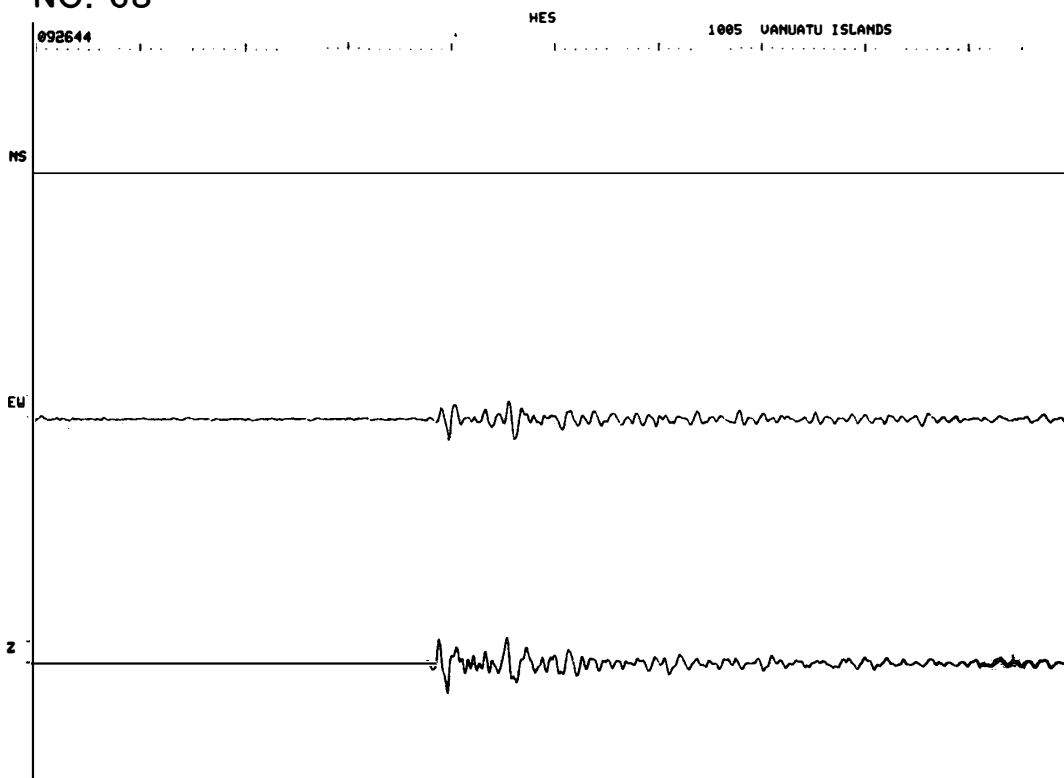
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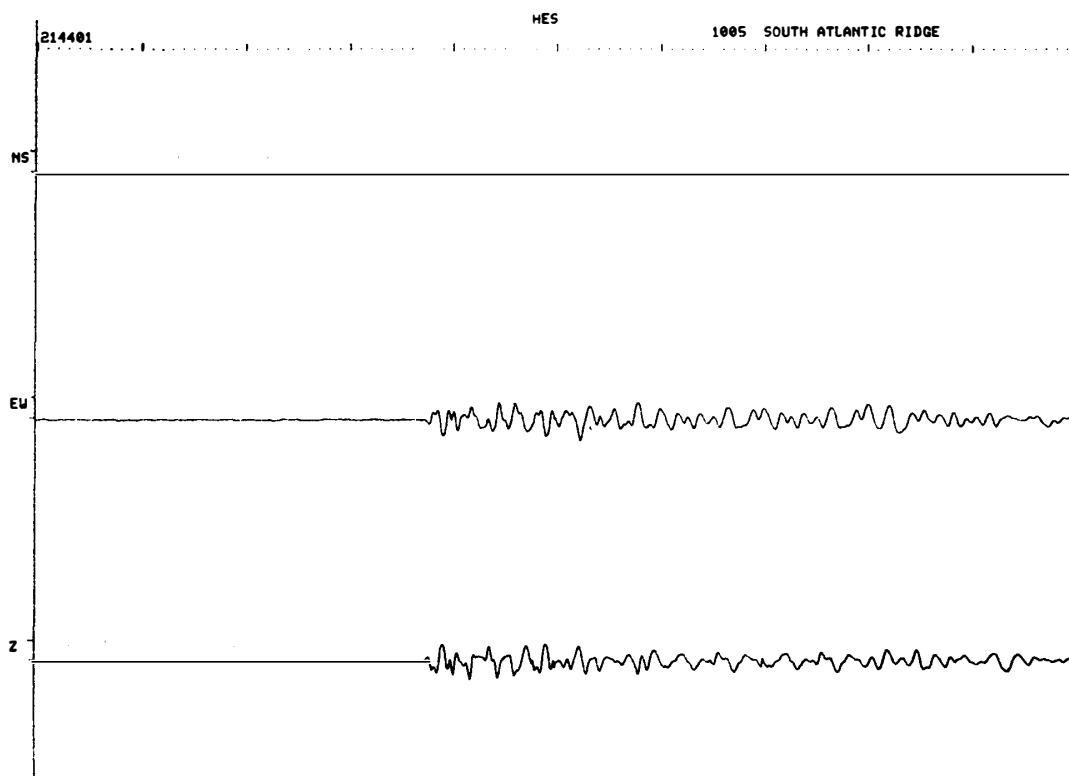
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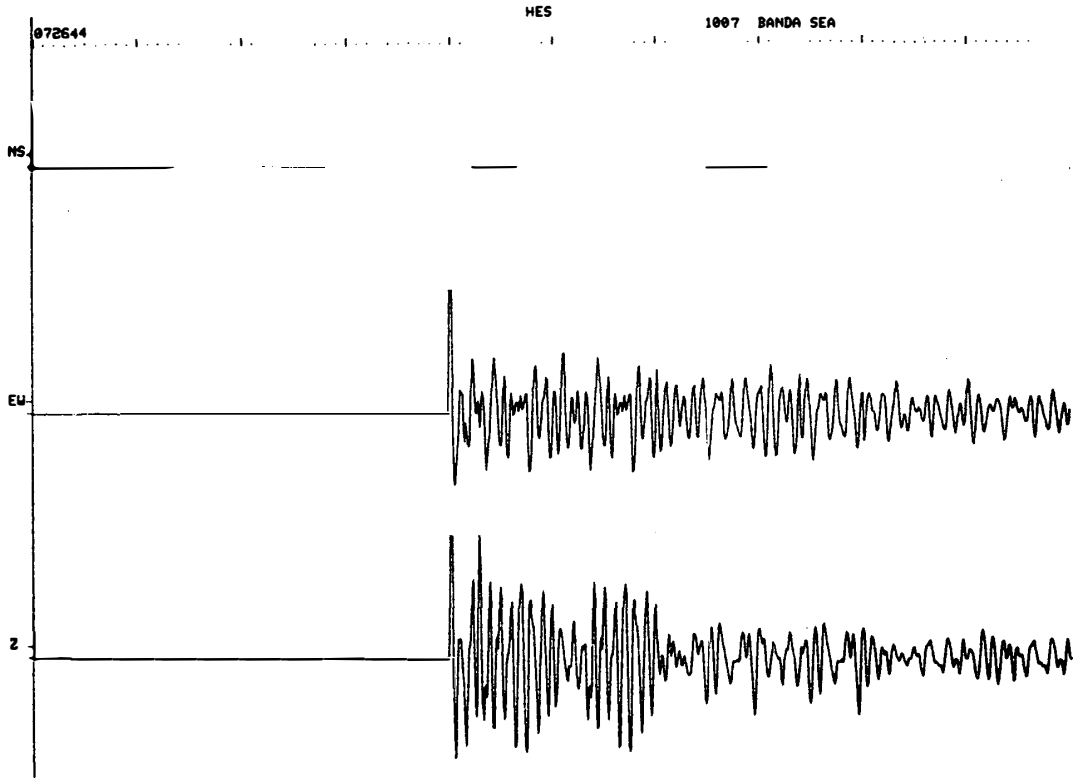
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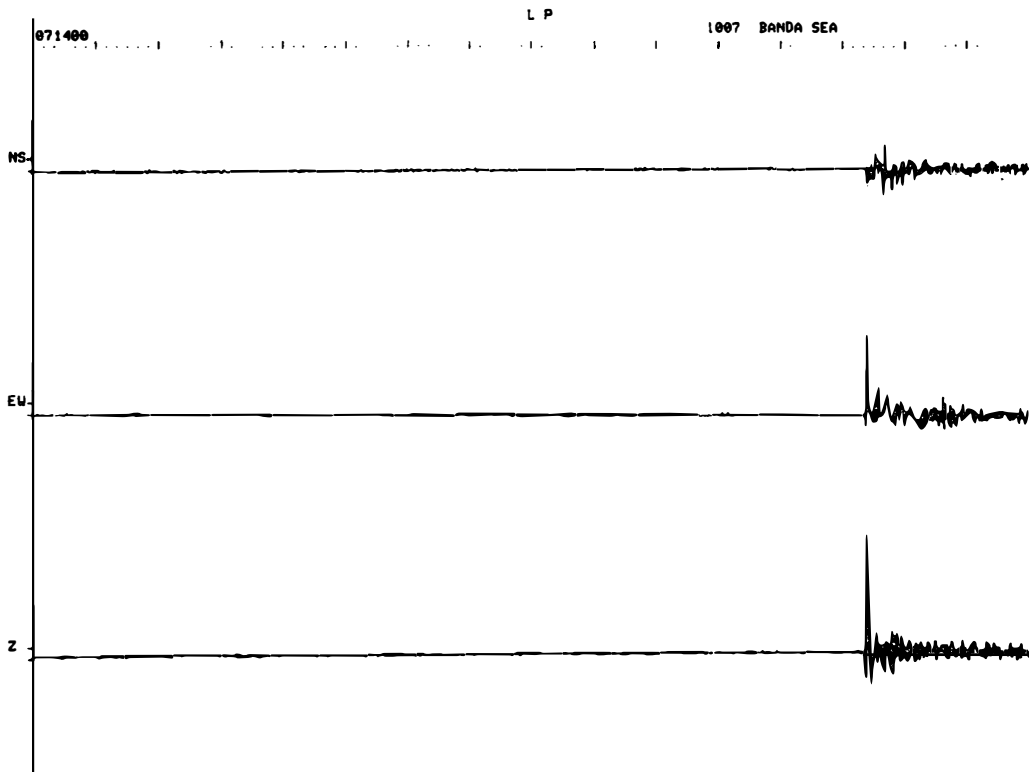
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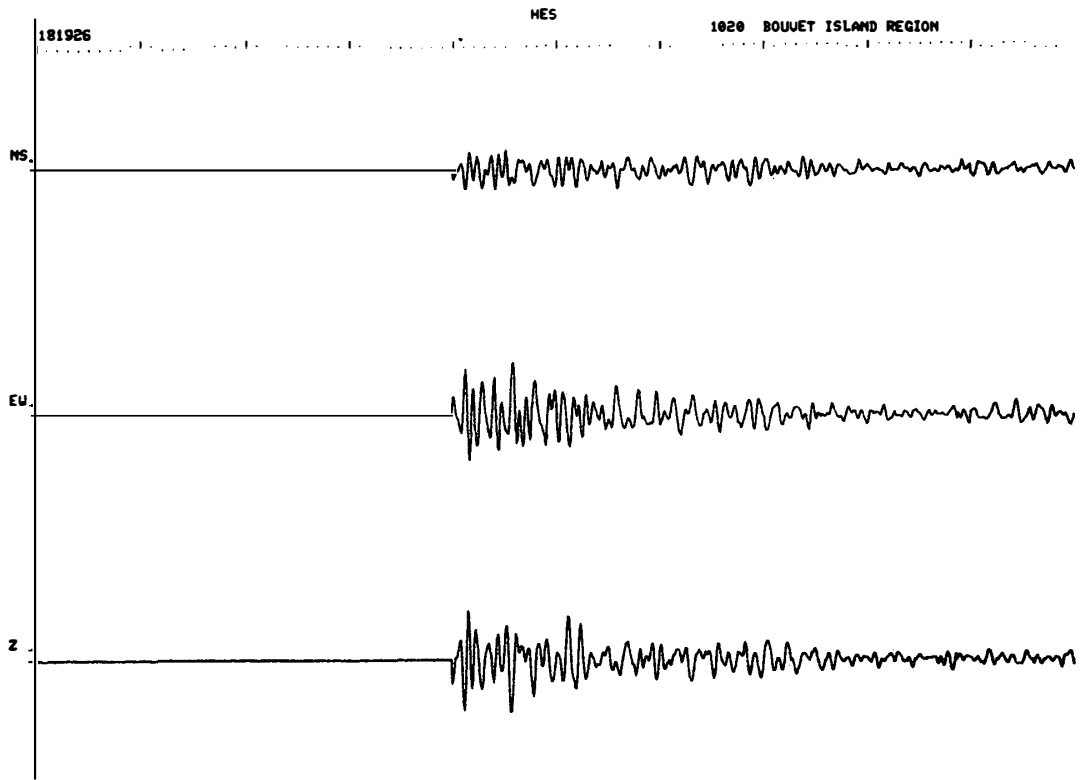
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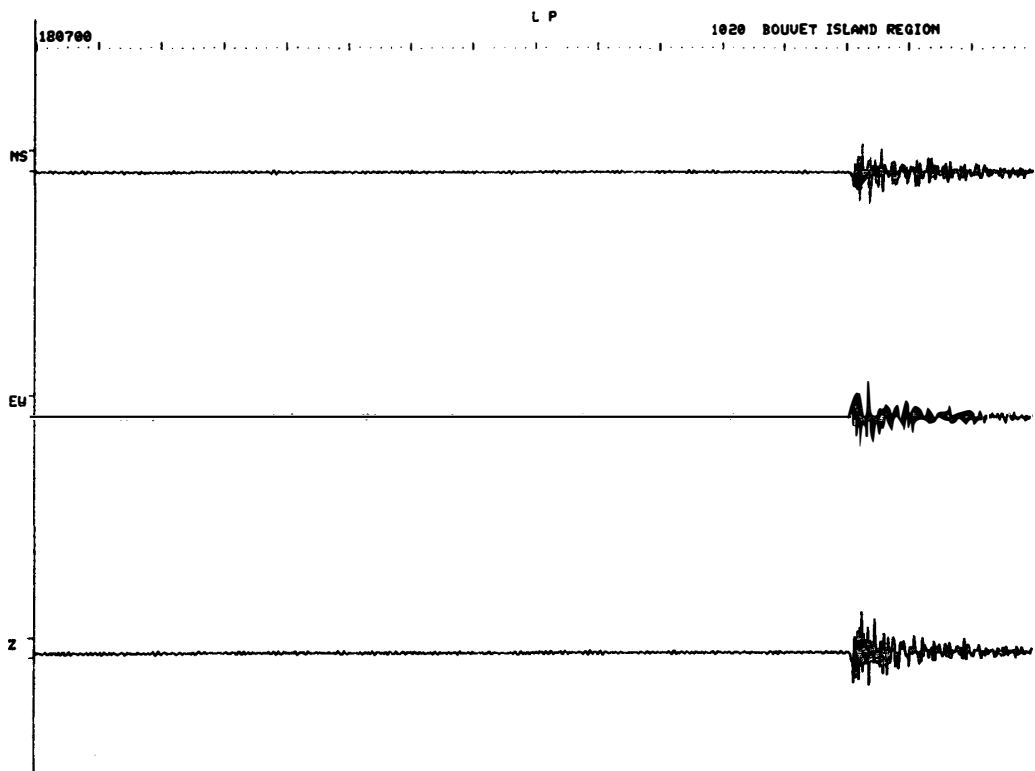
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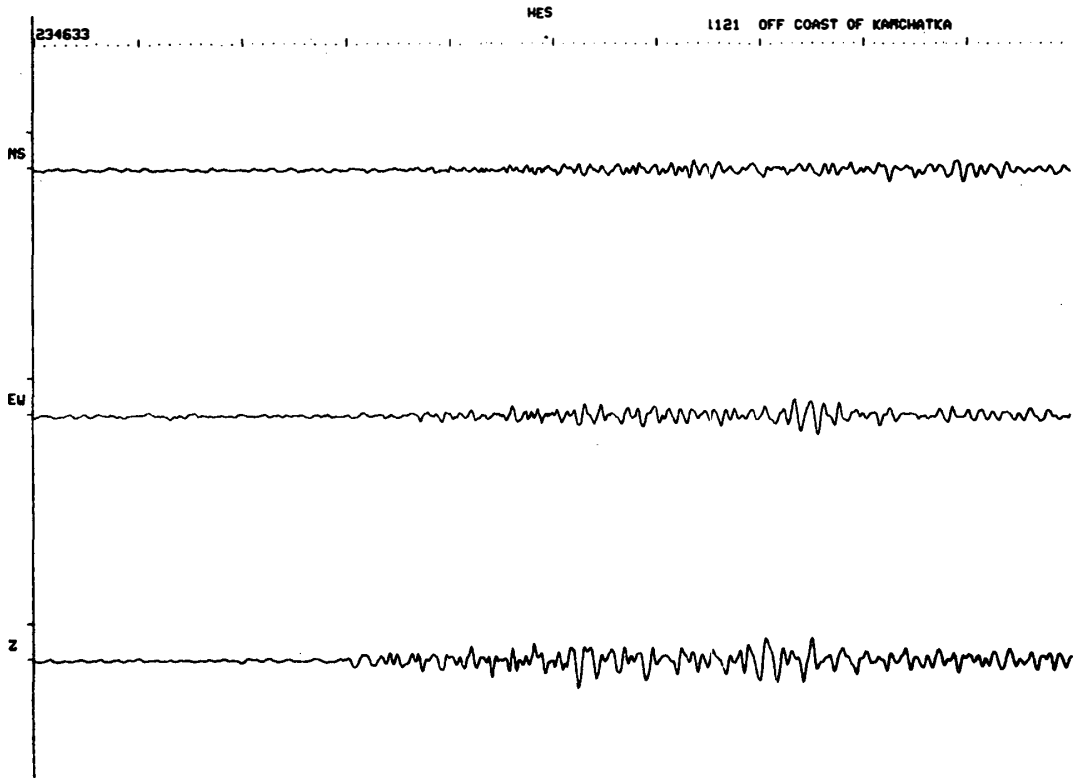
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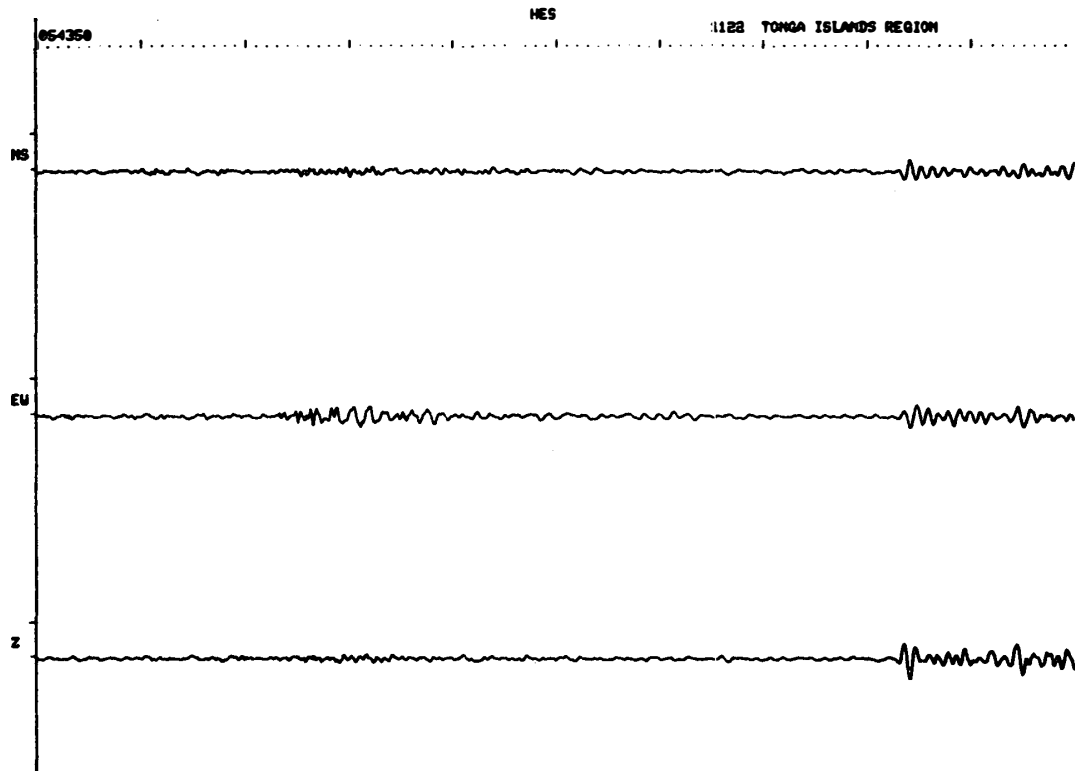
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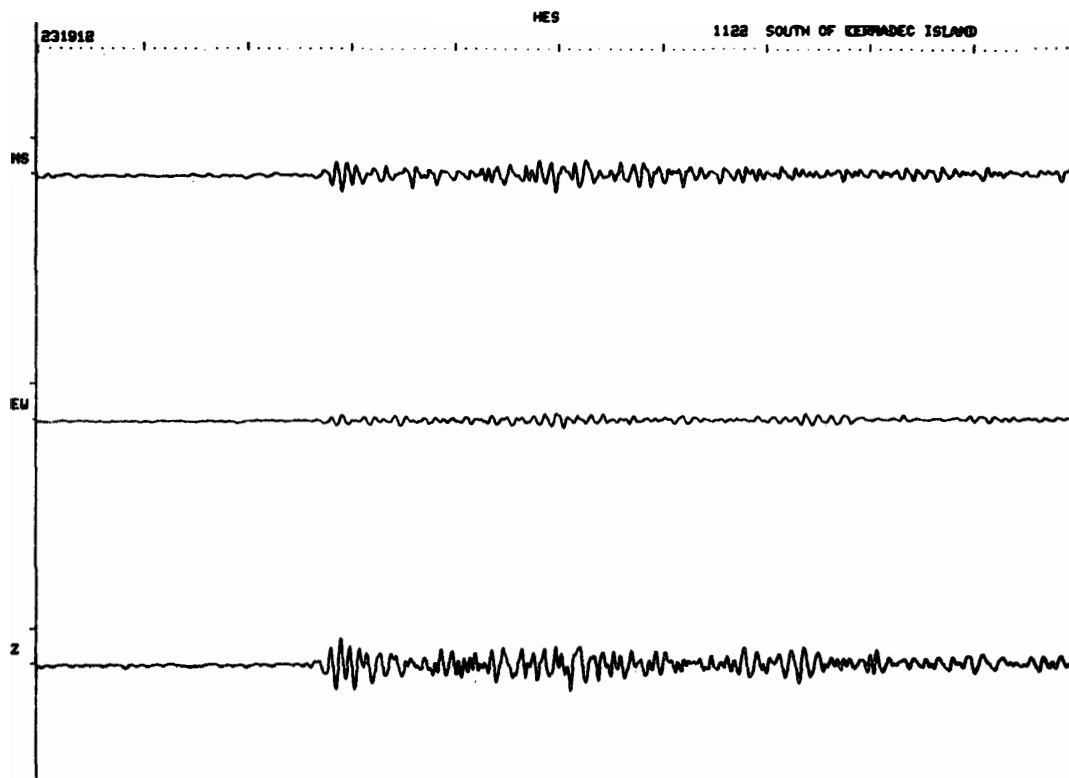
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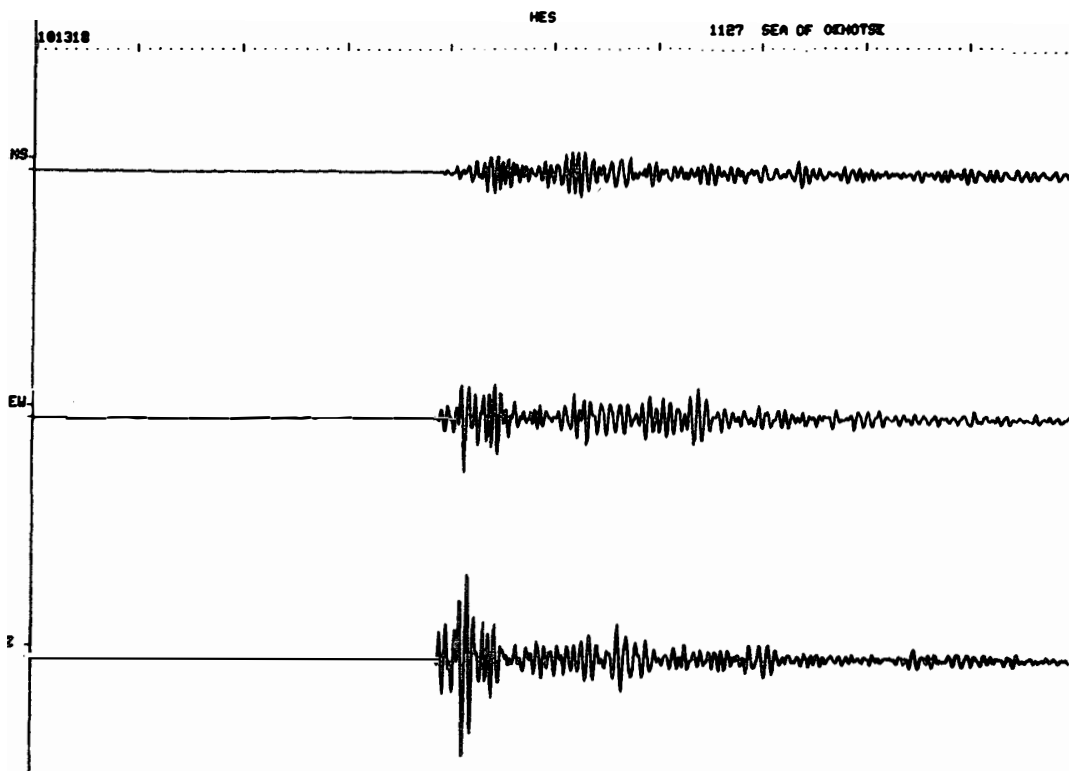
NO. 73



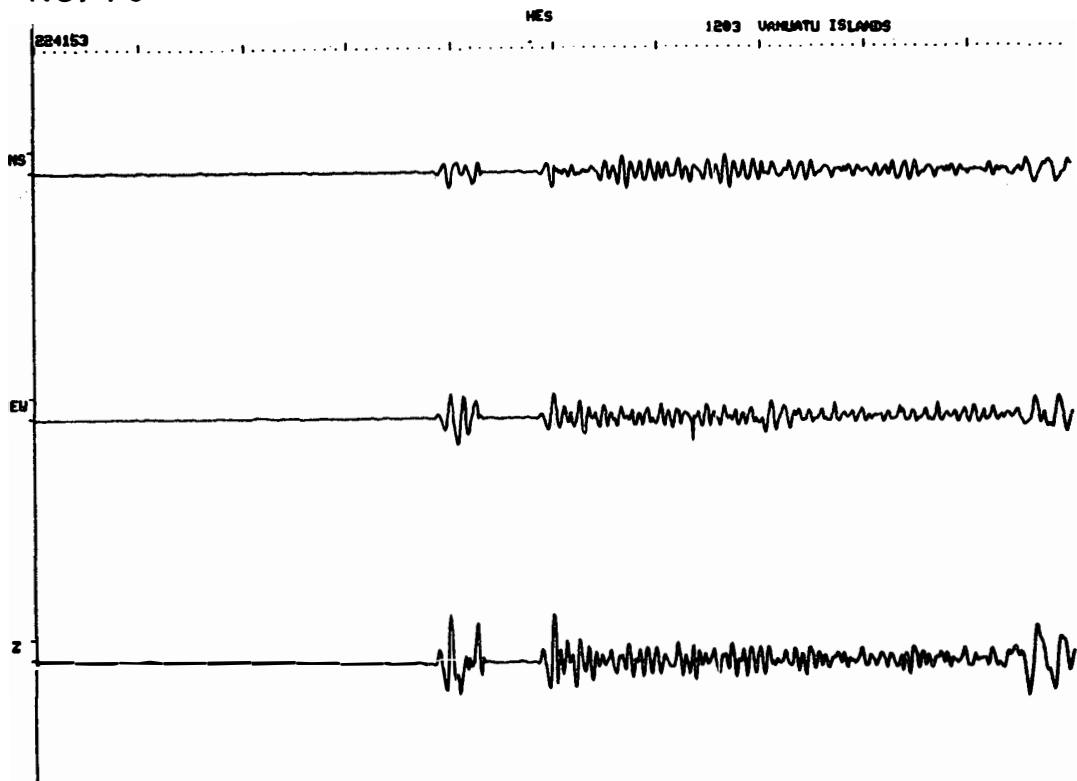
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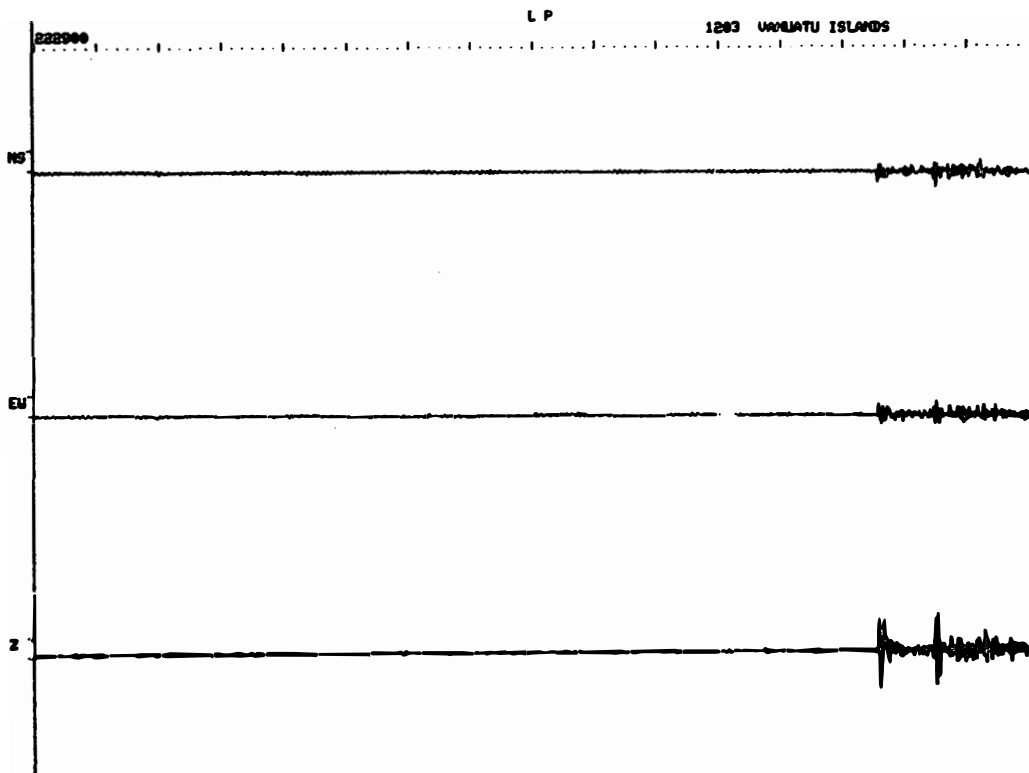
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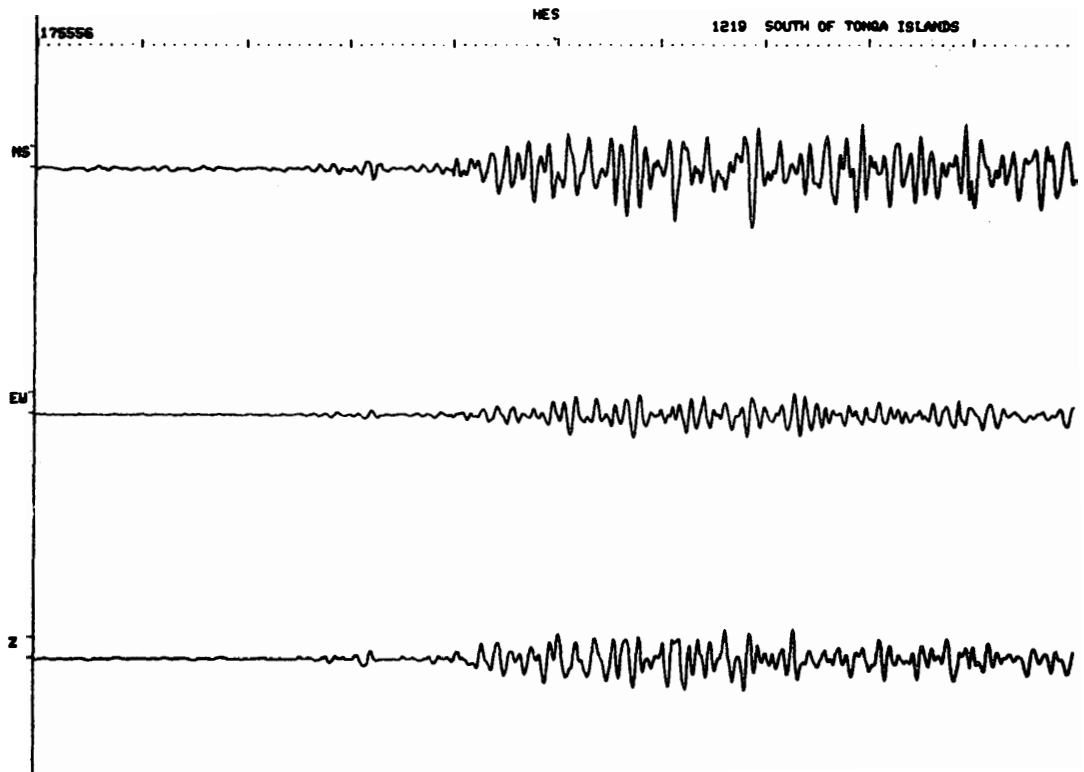
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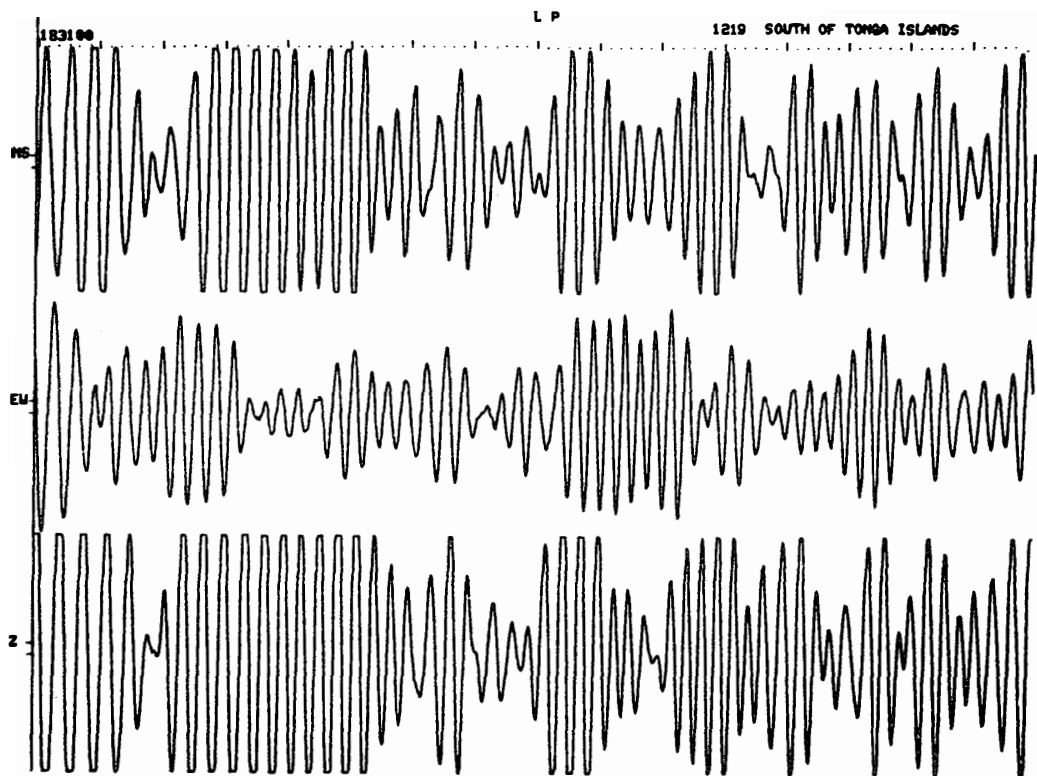
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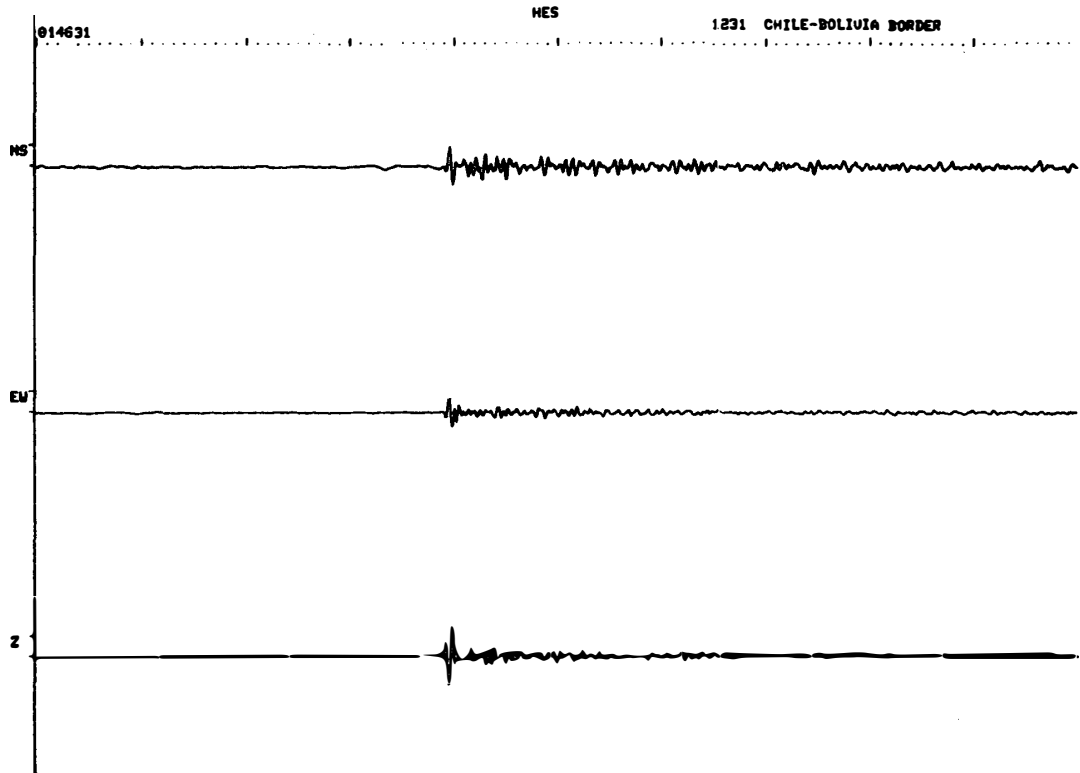
NO. 77



NO. 77



NO. 78



NO. 79

