

SEISMOLOGICAL BULLETIN OF SYOWA STATION, ANTARCTICA, 1991

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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 a 1.0 s natural period of the pendulum and the other called LP (long-period) or PELS with a 12.0 s natural period. The SP and LP have been operating 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 a Press-Ewing type and was replaced by a PELS at Syowa Station in 1982. The coordinates of the seismographic vault are $69^{\circ}00' 31.7''$ S latitude and $39^{\circ}35' 31.6''$ E longitude. The elevation is 20 m above mean sea level.

A three-component Streckeisen Seismometer (STS) was installed in 1989 at Syowa Station for the broadband digital seismographs, based on the recommendation from the Working Group of Solid Earth Geophysics of SCAR (Scientific Committee on Antarctic Research). The observation by STS has been continuing since February 1989 (Nagasaka et al., 1992).

The STS system has two different outputs, Broad-Band (BRB) and Long-Period(LP). The BRB output has a natural period from 0.1s to 20 s or from 0.1s to 360 s. The LP output has a natural period of longer than 20 s.

All of these systems were maintained by M. Yamamoto throughout the wintering season of JARE-32 (February 1991 - January 1992).

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 (Universal Time Clock) from NNSS (Navy Navigation Satellite System) 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 teleseismic events was detected only on the SP monitoring seismograms and picked out from pen-monitor records. The arrival times of P- and S-phases are listed in Table 1. Most phases were scaled on the vertical component, and only clear phases were on the horizontal components. The phase K denotes the PKP phase and X is the clear phase but its wave type can not be identified. 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. The events with asterisks in the remarks of Table 1 have errors of less than 10s in their arrival times because equipment trouble occurred during 8-21 February 1991.

The teleseismic events reported in the PDE of NEIC are shown with the serial numbers (#-xxx) in the table. The serial numbers correspond to the numbers in Table 2 which list the big events detected at Syowa Station and are in the PDE. The events without the serial numbers are the teleseisms whose locations have not been determined by NEIC.

2.2. Teleseismic event

Outputs of digital records of some of the big events are given in the Appendix. The digital records of these events can be distributed upon request.

Only 39 events were well recorded by STS during the period. The three-component seismograms are shown and the scale of amplitude in the Appendix is arbitrary. The serial number of each output is in Table 2. The arrival time of the initial phase is given on the top of the panel, and the time is the same in Table 1.

It is regrettable that the phase readings of the events recorded at Syowa Station(SYO) have been reported to NEIS only once a week. However we could not find the reports of SYO on the Earthquake Data Report. This might be a result of the difficulty of telecommunications through the mother station from Syowa Station by the present system in Antarctica.

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. Mr. I. Karakama of National Institute of Polar Research has scaled and edited all events, and Ms. H. Mishina has prepared this manuscript. The authors express sincere thanks for their cooperation.

References

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- Nagasaka, K., Kaminuma, K. and Shibuya, K. (1992): Seismological observations by a three-component broadband digital seismograph at Syowa Station, Antarctica. In *Recent Progress in Antarctic Earth Science*, ed. by Y. Yoshida *et al.* Tokyo, TERRAPUB, 595-601.

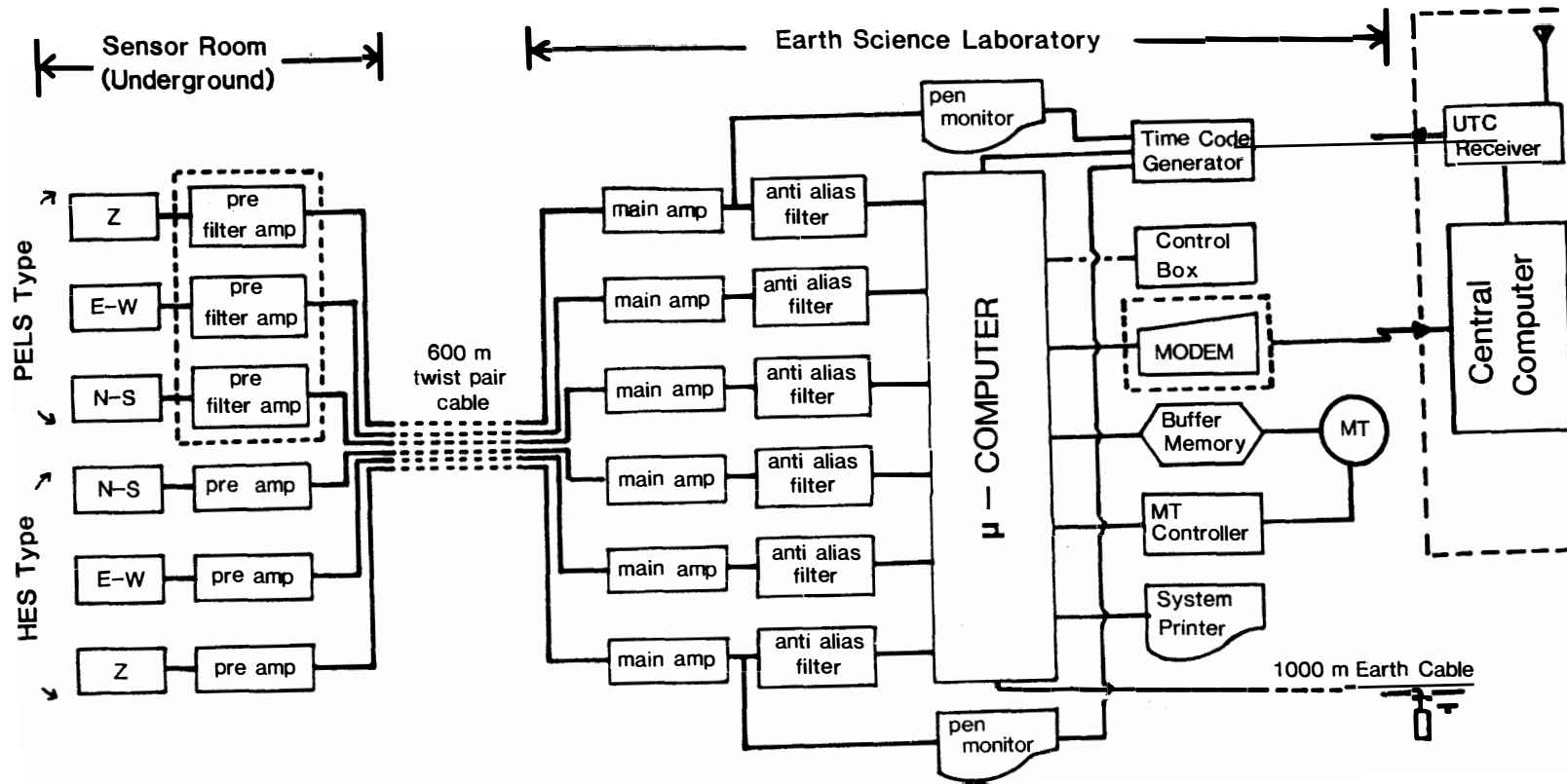


Fig. 1. The seismic observation system at Syowa Station.

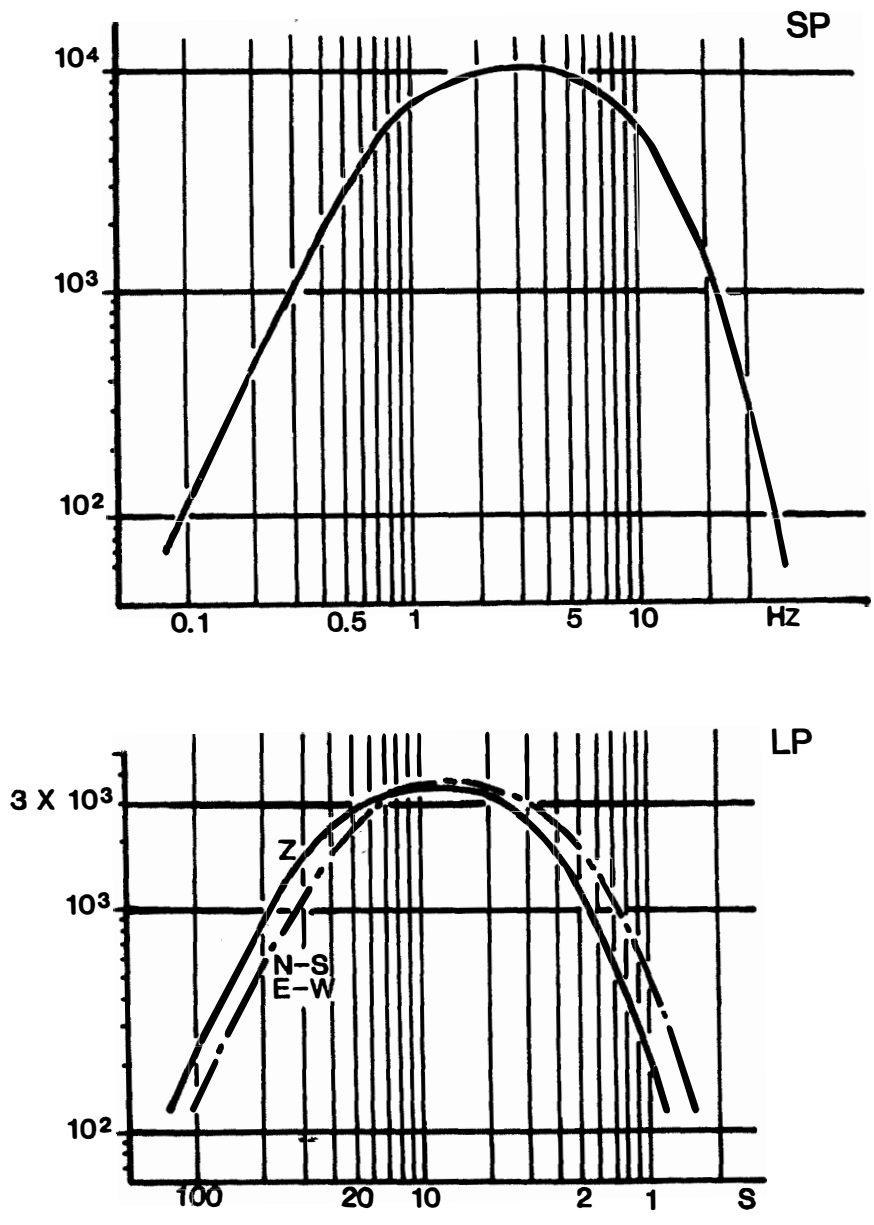


Fig. 2. Over-all frequency responses of the short-period and the long-period seismographs.

Table 1. Read-out data.

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
JAN 3	EPZ	01 53 31.7	#-1	JAN 19	EPZ	23 09 14.2	#-20
					XN	23 19 28.7	
3	-IPZ	13 31 48.8	#-2	20	+IPZ	11 45 11.0	#-21
	SE	13 42 40.2		25	EPZ	17 51 40.8	#-22
3	EPZ	15 31 42.5	#-3	26	EPZ	21 35 08.4	#-23
4	-IPZ	15 32 51.4	#-4	28	+IPZ	13 09 18.9	#-24
5	EPZ	15 10 59.7	#-5	28	+IPZ	18 11 24.9	#-25
6	+IPZ	11 29 08.1	#-6	31	EPZ	02 26 26.0	#-26
7	+IPZ	02 37 17.0	#-7	31	-IPZ	19 44 17.8	#-27
7	EPZ	07 00 38.1	#-8	31	EXZ	23 17 43.1	#-28
8	+IPZ	22 17 06.6	#-9	FEB 8	+IPZ	01 50 54.8	#-29 *
	SN	22 27 56.0		9	-IPZ	08 49 41.5	#-30 *
9	EPZ	15 22 03.9	#-10		SN	08 58 03.5	
10	EPZ	03 54 01.4	#-11	9	EPZ	16 31 46.4	#-31 *
12	EPZ	06 16 22.3	#-12		SE	16 42 55.0	
13	EPZ	12 06 04.4	#-13	10	EPZ	01 03 15.4	#-32 *
13	IPZ	17 50 22.7	#-14	12	+IPZ	11 42 03.2	#-33 *
14	+IPZ	14 23 28.2	#-15	12	-IPZ	21 54 48.0	#-34 *
	XE	14 32 48.0		14	+IPZ	01 12 35.8	#-35 *
15	-IPZ	01 52 20.6	#-16	14	EPZ	19 34 24.2	#-36 *
	SE	02 01 54.8		15	-IPZ	01 04 53.7	#-37 *
15	EPZ	13 54 55.5	#-17	15	+IPZ	10 58 38.9	#-38 *
16	+IPZ	19 26 10.8	#-18				
18	EPZ	10 53 46.2	#-19				

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
FEB 16	+IXZ	01 43 01.8	#-39 *	MAR 8	EKZ	11 56 22.8	#-58
17	-IPZ	07 11 26.7	#-40 *	8	-IPZ	12 15 24.4	
18	EPZ	02 50 55.0	#-41 *	8	+IPZ	12 16 55.1	#-59
18	EPZ	16 27 36.0	#-42 *	9	+IPZ	01 11 06.4	#-60
19	-IPZ	02 07 04.1	#-43 *	10	+IPZ	01 11 20.6	#-61
20	EPZ	05 00 48.5	#-44 *	11	+IPZ	21 20 17.7	#-62
20	-IPZ	21 59 12.0	#-45 *	12	+IXZ	03 36 09.0	#-63
21	EXZ	02 55 28.6	#-46 *	15	-IPZ	19 01 57.2	#-64
25	+IPZ SN	06 51 18.0 07 01 27.2	#-47	21	EPZ	06 06 15.3	#-65
25	+IPZ	21 24 35.6	#-48	21	EPZ	18 40 39.6	#-66
27	+IPZ	08 45 33.1	#-49	25	+IPZ	00 32 47.0	#-67
28	EPZ	13 42 38.6	#-50	28	EPZ	07 35 11.2	#-68
MAR 1	-IPZ	02 16 55.8		30	-IPZ	21 53 00.4	#-69
1	-IPZ	14 16 40.5	#-51	APR 1	EPZ	02 12 09.0	#-70
1	EXZ	17 44 14.2	#-52	1	+IPZ XZ	05 38 32.5 05 38 54.8	#-71
2	EPZ	23 18 40.5	#-53	2	+IPZ SN	06 33 24.4 06 33 35.8	#-72
3	+IPZ	15 33 06.2	#-54	4	EXZ	03 41 27.2	#-73
5	EPZ	22 47 35.4	#-55	4	+IPZ	15 19 42.0	#-74
6	EPZ	02 30 55.8	#-56	4	-IPZ	15 36 36.9	#-75
6	EPZ	15 55 58.7	#-57	4	+IKZ	19 19 39.4	#-76

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
APR 5	+IPZ	04 33 05.6	#-77	APR 25	EPZ	01 26 42.3	#-96
5	+IPZ	16 03 20.6	#-78	25	EPZ	18 47 10.0	#-97
5	EPZ	18 44 38.1	#-79	26	EPZ	17 50 13.9	#-98
6	+IPZ	05 00 14.9	#-80	29	EPZ	07 07 38.8	#-99
	SE	05 09 47.0		29	EXZ	09 31 21.0	#-100
6	EPZ	14 47 31.2	#-81		EXZ	09 42 29.5	
7	+IPZ	19 08 06.1	#-82	29	IPZ	18 25 11.8	#-101
7	+IXZ	23 22 14.4	#-83	29	EPZ	22 19 11.5	#-102
8	EPZ	01 38 40.7	#-84	30	EPZ	12 49 46.7	#-103
8	-IXZ	13 53 30.2	#-85	MAY 1	IXZ	07 38 34.4	#-104
9	-IPZ	06 15 07.5	#-86	3	+IXZ	02 32 13.9	#-105
11	EPZ	08 25 50.7	#-87	7	EXZ	13 28 42.0	#-106
13	EPZ	07 59 16.8	#-88	8	EPZ	20 05 47.5	#-107
13	EPZ	23 32 27.2	#-89	10	-IPZ	13 38 36.0	#-108
16	+IKZ	15 49 39.3	#-90	10	EPZ	13 46 47.0	#-109
18	+IPZ	09 53 01.5	#-91	11	+IPZ	08 16 09.3	#-110
	SE	10 02 44.3			SN	08 25 35.3	
19	+IXZ	22 00 50.7	#-92	11	EPZ	20 10 53.2	#-111
	XN	22 11 58.3		13	EPZ	16 39 34.3	#-112
21	EPZ	11 30 40.4	#-93	17	-IPZ	02 44 23.3	#-113
21	EPZ	23 21 22.2	#-94		SE	02 55 12.8	
22	EPZ	22 15 49.8	#-95	17	EPZ	06 49 41.9	#-114

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
MAY 17	EPZ	22 54 04.2	#-115	MAY 30	EKZ	13 37 39.4	#-133
					XN	13 49 18.7	
18	-IPZ	07 07 40.2	#-116	31	+IPZ	05 40 35.4	#-134
18	EPZ	22 06 57.7	#-117		ISN	05 50 48.5	
19	+IPZ	01 10 52.3	#-118	31	IPZ	22 27 03.8	#-135
19	EPZ	01 29 32.2	#-119	JUNE 2	-IPZ	16 36 54.0	#-136
19	EPZ	01 32 42.7	#-120	2	+IPZ	19 35 16.5	#-137
19	EPZ	01 54 41.8	#-121	3	-IPZ	05 15 29.4	#-138
19	EPZ	20 21 49.4	#-122	3	-IPZ	17 27 26.6	#-139
19	EPZ	20 45 11.3	#-123	4	-IPZ	15 14 28.7	#-140
20	-IPZ	10 02 21.9	#-124	4	EPZ	17 42 23.6	#-141
21	+IPZ	11 12 39.5	#-125	7	EPZ	12 02 43.3	#-142
	XE	11 21 58.5			ISE	12 12 12.9	
22	+IPZ	07 04 35.9	#-126	7	EPZ	12 21 23.2	
	XZ	07 14 05.0		7	IXZ	12 32 04.5	
22	EKZ	21 25 16.8	#-127	9	-IPZ	07 57 20.3	#-143
23	EPZ	06 57 07.3	#-128		ISE	08 07 38.2	
24	EPZ	18 35 18.8	#-129	9	+IPZ	11 12 09.8	#-144
	SN	18 40 44.0		11	-IPZ	14 44 37.5	#-145
24	-IPZ	21 03 00.7	#-130	12	EPZ	00 59 05.1	#-146
28	EPZ	12 52 45.0	#-131		EXZ	01 03 03.0	
29	IPZ	01 17 30.7		15	EPE	01 19 14.0	#-147
30	-IPZ	09 17 46.4	#-132	15	EPE	23 15 43.8	#-148
				16	EPN	08 24 38.7	#-149

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
JUNE 19	EPE	11 49 57.5	#-150	JULY 5	EPE	04 42 33.0	#-168
20	IPN	05 31 43.7	#-151	5	EXN	11 19 52.0	#-169
	ISN	05 42 28.1		6	EPN	04 24 25.5	
20	EPE	06 40 17.0	#-152	6	EPE	12 33 14.5	#-170
21	IPE	16 30 21.6	#-153		IXN	12 43 23.0	
23	IPN	21 32 43.3	#-154	6	EPN	19 12 55.5	#-171
23	IPN	23 24 57.9	#-155	6	EXE	23 44 33.5	#-172
	ISN	23 33 20.8		8	+IKZ	21 34 04.0	#-173
25	-IPZ	08 03 54.7		9	-IPZ	06 05 50.5	#-174
26	EPZ	15 30 16.4	#-156		EXN	06 15 53.5	
26	+IPZ	23 19 44.0	#-157	10	+IPZ	10 02 12.6	#-175
30	-IPZ	03 19 49.5	#-158	12	EPN	04 53 10.5	#-176
JULY 2	-IPZ	04 27 39.0	#-159	12	EPN	10 12 09.0	#-177
2	EPZ	05 26 28.0	#-160	13	EKN	03 10 11.0	#-178
2	-IPZ	06 19 53.7	#-161	13	EKN	12 34 40.2	#-179
	SE	06 29 39.0		14	-IXZ	09 27 18.7	#-180
2	EKZ	19 23 48.5	#-162		IXE	09 33 24.2	
2	EPZ	21 43 33.7	#-163	15	EPZ	11 48 48.1	
4	EPZ	07 05 49.7	#-164		ESE	11 49 18.6	
4	EPZ	07 20 43.6	#-165	15	-IPZ	16 09 18.7	#-181
4	EPZ	11 55 23.3	#-166	18	EPN	05 06 52.3	#-182
	IXN	12 05 35.4		21	EPN	23 12 18.5	#-183
5	EPN	04 00 40.5	#-167	23	EPE	11 35 12.2	#-184

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
JULY23	EPN	13 38 04.5	#-185	AUG 10	EPZ	13 41 43.0	#-205
23	EPN	17 47 28.0	#-186	10	EPZ	23 40 51.7	#-206
23	EPN	21 28 15.4	#-187	11	EPZ	09 14 54.7	
	ISE	21 37 49.5		11	EPZ	14 56 39.5	#-207
24	EPN	03 40 12.5	#-188	12	EPZ	13 13 07.6	#-208
24	EPN	14 03 50.0	#-189	14	EXZ	13 12 50.7	#-209
28	EPN	00 19 18.3	#-190		IXE	13 23 34.2	
29	EPN	14 05 06.0	#-191	14	-IPZ	17 56 05.2	#-210
AUG 1	EPZ	03 34 56.3	#-192	14	+IPZ	19 28 03.0	#-211
3	-IPZ	18 36 40.5	#-193		ISE	19 38 56.5	
5	EPZ	06 18 28.8	#-194	15	EPZ	04 48 37.8	#-212
5	+IPZ	10 55 20.2	#-195	15	EPZ	07 00 06.4	#-213
6	+IPZ	02 29 52.4	#-196	15	EPZ	09 55 47.8	#-214
6	-IXZ	15 08 32.5	#-197	15	EPZ	10 07 01.0	#-215
6	+IKZ	20 46 13.6	#-198	15	EPZ	12 25 45.3	#-216
6	-IPZ	23 34 59.4	#-199	15	+IPZ	13 48 29.1	#-217
8	EPZ	02 22 35.4	#-200		IXN	13 58 36.3	
	IXN	02 33 31.0		16	EPZ	22 46 11.3	#-218
8	EPZ	04 12 50.6	#-201	17	-IPZ	07 15 23.5	#-219
8	+IPZ	16 41 52.0	#-202	17	+IKZ	19 49 23.9	#-220
9	+IPZ	06 40 54.3	#-203	17	EKZ	22 37 04.5	#-221
9	+IPZ	20 27 40.5	#-204	18	-IPZ	11 04 45.6	#-222

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
AUG 18	+IPZ	22 02 57.9	#-223	AUG 28	+IPZ	21 44 07.4	#-241
					ISE	21 53 42.5	
19	EPZ	03 32 41.4	#-224	29	EPZ	01 56 19.0	#-242
21	+IPZ	16 14 28.0	#-225	29	+IPZ	05 33 14.4	#-243
22	-IPZ	07 19 15.4	#-226		ISE	05 43 16.0	
	ISE	07 28 49.6		29	EPZ	08 33 17.6	#-244
22	-IPZ	13 29 43.5	#-227	30	EPZ	01 55 27.5	
	ISE	13 39 18.0		31	-IPZ	16 55 19.3	#-245
23	EPZ	18 46 05.8	#-228	31	+IXZ	23 24 12.9	#-246
23	EPZ	20 28 28.7	#-229	SEP 1	EPZ	07 10 54.3	
24	EPZ	08 15 56.0	#-230	1	EPZ	08 34 44.7	#-247
24	+IPZ	11 25 38.3	#-231	2	EPZ	15 44 23.3	#-248
	ISE	11 35 55.0		3	-IPZ	07 10 57.6	#-249
25	EPZ	06 52 48.4	#-232		ESE	07 20 11.5	
26	EXZ	15 18 59.0	#-233	3	-IPZ	09 18 36.0	#-250
26	EPZ	20 55 05.8	#-234	3	EPZ	12 09 23.7	#-251
26	EPZ	21 06 57.4	#-235	4	EPZ	08 45 22.9	#-252
26	EPZ	23 05 06.0	#-236	6	EPZ	11 58 26.0	#-253
27	EPZ	08 45 54.0	#-237	6	EPZ	15 11 58.0	#-254
27	EPZ	09 02 50.3	#-238	7	EPZ	14 44 25.9	#-255
27	-IPZ	11 58 38.8	#-239		ISE	14 53 58.1	
27	-IPZ	12 09 59.6	#-240	7	EPZ	22 20 16.9	#-256
	IXN	12 19 53.8		8	-IPZ	14 01 09.8	#-257

Date	Phase	Arrival time h m s	Remarks
SEP 9	EPZ	02 58 15.6	#-258
11	EPZ	17 23 12.3	#-259
19	+IPZ	01 19 37.6	#-260
19	EKZ	02 01 14.7	#-261
20	EPZ ISN	14 59 58.5 15 10 07.0	#-262
21	+IPZ	15 32 56.5	#-263
22	+IKZ	06 52 09.2	#-264
24	EPZ	04 50 20.5	#-265
25	EPZ	11 29 14.0	#-266
25	EPZ	14 25 30.0	#-267
25	-IPZ ISN	17 55 02.3 18 04 47.8	#-268
25	EPZ	20 54 32.5	#-269
26	EPZ	22 29 32.5	#-270
27	EPZ	12 24 04.5	#-271
27	EPZ	23 14 17.5	#-272
28	EPZ ESN	20 40 03.4 20 51 01.0	#-273
29	EPZ	04 07 51.5	#-274
30	+IPZ IXN	00 33 29.5 00 42 55.5	#-275

Date	Phase	Arrival time h m s	Remarks
SEP 30	+IPZ ISN	00 54 06.5 01 03 49.9	#-276
30	+IPZ	12 21 16.0	#-277
OCT 1	EPZ	06 43 14.0	#-278
2	-IPZ	01 22 50.9	#-279
3	EPZ	19 19 04.7	#-280
3	EPZ	20 32 58.0	#-281
3	EPZ	20 37 05.5	#-282
3	EPZ	20 56 15.5	#-283
5	-IPZ	01 16 29.3	
5	-IPZ	13 21 02.7	#-284
6	+IPZ	02 54 27.0	#-285
6	-IPZ	17 01 13.2	#-286
7	EPZ	20 08 04.7	#-287
8	EXZ	03 50 13.7	#-288
8	+IPZ	05 46 02.0	#-289
9	EPZ	17 33 22.8	#-290
10	+IPZ	00 18 49.6	#-291
10	+IPZ	01 45 14.0	#-292
11	EPZ	02 28 29.3	#-293
11	EPZ	03 15 14.8	#-294

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
OCT 11	EPZ	07 34 33.5	#-295	OCT 19	EPZ	21 37 20.5	#-314
11	-IPZ	10 56 19.3	#-296		IXN	21 47 55.0	
12	+IPZ	16 39 18.3	#-297	20	-IPZ	04 43 55.2	#-315
13	EPZ	18 21 49.2	#-298	23	EPZ	12 37 48.4	#-316
14	EPZ	14 47 49.5	#-299	23	EPZ	14 49 26.5	#-317
14	EPZ	16 11 17.3	#-300	25	+IPZ	13 36 50.7	#-318
14	EPZ	16 30 01.5	#-301	25	-IPZ	21 16 43.0	#-319
15	EPZ	16 30 19.2	#-302	26	EPZ	02 45 45.3	#-320
	ISN	16 40 29.3		27	+IPZ	09 17 10.8	#-321
16	EPZ	03 13 07.9	#-303	27	EPZ	10 35 55.0	#-322
16	EPZ	10 17 26.3	#-304	27	+IPZ	16 28 55.7	#-323
17	EPZ	05 34 48.0	#-305		ISN	16 38 22.0	
17	EPZ	09 18 28.7	#-306	27	EPZ	22 11 06.6	#-324
17	EPZ	15 55 22.6	#-307		IXN	22 21 43.0	
17	EPZ	16 58 22.0	#-308	29	+IPZ	23 26 26.2	#-325
18	-IPZ	17 35 00.6	#-309		IXN	23 36 34.8	
	ISE	17 45 01.5		30	+IPZ	04 15 50.5	#-326
18	+IKZ	19 31 38.4	#-310	30	+IPZ	10 48 54.4	#-327
18	EPZ	19 40 28.4	#-311		IXN	10 59 25.0	
19	+IPZ	09 00 04.2	#-312	31	-IPZ	15 42 50.3	#-328
19	EPZ	16 56 46.0	#-313	NOV 1	EPZ	03 04 01.2	#-329
				1	+IPZ	16 35 17.2	#-330
					ISE	16 45 03.0	
				1	IPZ	16 44 50.1	#-331

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
NOV 1	EPZ	18 48 22.8	#-332	NOV 13	+IPZ	11 25 40.5	#-350
1	EPZ	23 38 01.3	#-333		ISE	11 36 53.4	
4	+IPZ	06 37 02.0	#-334	14	EPZ	17 09 03.5	
	IXN	06 47 26.5		16	EPZ	00 46 17.0	#-351
5	+IPZ	07 08 52.5	#-335	16	IPZ	10 45 05.8	#-352
5	+IPZ	07 24 28.7	#-336	17	-IPZ	04 46 28.4	#-353
	IXN	07 34 28.3		17	+EPZ	10 54 47.5	#-354
5	EPZ	17 59 28.3	#-337		EXN	11 04 59.0	
5	EPZ	21 25 37.3	#-338	18	EPZ	11 48 32.4	#-355
	IXN	21 33 22.6		19	+IPZ	13 38 52.5	#-356
7	-IPZ	06 11 28.5	#-339	19	EPZ	22 42 55.6	#-357
	ISN	06 21 19.2		20	EPZ	04 45 35.4	#-358
7	+IPZ	09 33 34.4	#-340	20	EPZ	04 50 44.0	#-359
	ISN	09 43 37.9		20	-IPZ	09 34 15.4	#-360
8	EPZ	17 24 27.8	#-341		IXE	09 44 25.5	
9	+IPZ	07 11 12.0	#-342	20	+IPZ	09 54 18.2	#-361
9	EPZ	19 45 40.3	#-343	21	-IPZ	12 51 42.0	#-362
0	EXZ	09 49 09.9	#-344		EXE	13 02 10.0	
10	EPZ	13 10 33.3	#-345	23	EPZ	20 13 06.1	#-363
11	-IPZ	16 27 58.9	#-346	23	EPZ	23 04 07.0	#-364
	ESN	16 38 01.5		24	+IPZ	11 42 21.6	#-365
11	EPZ	22 29 15.5	#-347	26	EKZ	11 01 20.5	#-366
11	EXZ	22 53 24.3	#-348		IXE	11 01 48.5	
12	EPZ	09 05 14.3	#-349				

Date	Phase	Arrival time h m s	Remarks	Date	Phase	Arrival time h m s	Remarks
NOV 26	EKZ	18 54 39.0	#-367	DEC 14	EPZ	00 19 12.8	#-386
					IXE	00 29 30.3	
26	EXZ	19 59 58.5	#-368	15	+IPZ	06 48 28.8	#-387
27	-IXZ	05 22 57.6	#-369		ESE	06 58 15.0	
29	EPZ	23 45 16.0	#-370	15	-IPZ	19 08 08.0	#-388
DEC 1	EPZ	22 51 55.6	#-371		EXN	19 18 53.0	
2	-IPZ	17 39 14.7	#-372	16	EPZ	08 36 11.4	#-389
	ISN	17 49 08.3		17	EPZ	02 02 06.0	#-390
2	EPZ	17 57 12.0	#-373	17	EPZ	03 48 53.2	#-391
3	+IPZ	10 44 52.8	#-374	19	EXZ	01 52 52.2	#-392
	ISN	10 54 07.3		19	+IPZ	12 46 43.0	#-393
5	EPZ	09 22 20.3	#-375	19	+IPZ	21 12 51.4	#-394
7	EPZ	19 28 56.0	#-376		ESE	21 22 24.5	
8	EPZ	11 13 32.0	#-377	21	EPZ	08 12 51.8	#-395
11	EPZ	06 42 16.3	#-378	22	EXZ	09 02 28.0	#-396
11	-IPZ	17 16 16.7	#-379	22	EPZ	21 27 25.3	#-397
11	-IPZ	20 51 51.4	#-380	23	EPZ	15 18 03.7	#-398
13	+IPZ	00 25 05.0	#-381	24	-IPZ	03 49 21.4	#-399
	ISN	00 35 09.0		26	EKZ	11 55 44.3	#-400
13	EXZ	02 53 06.0	#-382	27	EPZ	02 45 35.0	#-401
13	EXZ	19 18 23.5	#-383	27	-EPZ	04 12 14.2	#-402
13	EXZ	20 14 24.0	#-384	27	EXZ	09 28 45.5	#-403
13	EXZ	20 17 27.0	#-385	28	-IPZ	00 58 25.5	#-404

Date	Phase	Arrival time			Remarks
		h	m	s	
DEC 28	EPZ	02	26	50.9	#-405
28	EPZ	16	05	56.0	#-406
29	+IPZ	18	47	33.2	#-407
29	-IPZ	18	51	53.0	#-408
	ISN	19	02	26.0	
29	+IXZ	20	02	46.5	#-409

Table 2. List of 409 earthquakes.

Data No.	Origin time U T C				Geographic coordinates		Region	Depth (km)	M (Mb)	Epicentral distance (degree)	
	Date	h	m	s	Latitude	Longitude					
1	JAN	3	01	41	25.7	29.562 S	111.805 W	Easter Island Region	10	5.4	79.416
2		3	13	18	49.2	7.179 S	148.540 E	East Papua New Guinea Region	14	6.0	90.053
3		3	15	18	44.9	7.324 S	148.578 E	East Papua New Guinea Region	25	5.7	89.931
4		4	15	21	36.1	23.367 S	66.595 W	Jujuy Province, Arg.	206	5.0	73.919
5		5	14	57	11.5	23.613 N	95.901 E	Burma	20	6.2	100.935
6		6	11	25	08.0	52.585 S	27.707 E	South of Africa	10	4.8	17.355
7		7	02	32	12.2	55.446 S	1.689 W	Bouvet Island Region	10	5.6	22.842
8		7	06	55	33.1	55.36 S	1.41 W	Bouvet Island Region	10	5.3	22.814
9		8	22	04	09.4	18.057 S	173.534 W	Tonga Islands	33	6.1	89.965
10		9	15	08	53.5	5.396 S	151.837 E	New Britain Region	28	5.9	92.824
11		10	03	41	02.6	18.006 S	173.589 W	Tonga Islands	23	5.6	90.005
12		12	06	03	25.7	18.043 S	173.530 W	Tonga Islands	33	5.4	89.979
13		13	11	54	36.6	2.928 S	84.566 E	South Indian Ocean	10	5.9	72.504
14		13	17	38	29.6	18.234 S	178.031 W	Fiji Islands Region	591	5.0	88.907
15		14	14	12	10.0	25.187 S	178.314 E	South of Fiji Islands	555	5.3	81.392
16		15	01	40	50.8	23.168 S	179.685 W	South of Fiji Islands	586	5.5	83.774
17		15	13	43	47.5	5.990 S	154.460 E	Solomon Islands	58	5.6	93.127
18		16	19	14	53.4	25.229 S	178.269 E	South of Fiji Islands	571	5.4	81.341
19		18	10	45	18.4	51.145 S	139.415 E	South of Australia	10	5.7	46.701
20		19	22	56	26.0	5.576 S	148.331 E	New Britain Region	163	5.9	91.481
21		20	11	32	52.1	21.235 S	170.029 E	Loyalty Islands Region	78	5.8	83.232
22		25	17	38	36.5	2.152 S	139.020 E	Near N.Coast of West Irian	22	5.9	91.437
23		26	21	23	16.3	30.496 S	177.495 W	Kermadec Islands	43	5.6	77.098
24		28	12	58	48.7	41.985 S	171.701 E	South Islands, N.Z.	27	5.9	63.777
25		28	18	00	53.7	42.009 S	171.700 E	South Islands, N.Z.	19	5.6	63.754
26		31	02	13	31.9	0.511 N	126.082 E	Molucca Passage	37	5.6	89.273
27		31	19	32	46.6	23.630 S	179.800 W	South of Fiji Islands	534	5.1	83.302

28		31	23	03	33.6	35.993 N	70.423 E	Hindu Kush Region	142	6.4	107.236
29	FEB	8	01	38	52.1	7.547 S	128.765 E	Banda Sea	103	5.4	82.767
30		9	08	39	45.1	27.210 S	63.398 W	Santago Del Estero Prov., Arg.	573	5.0	69.296
31		9	16	18	58.3	9.929 S	159.139 E	Solomon Islands	10	6.4	90.897
32		10	00	51	16.0	4.698 S	129.178 E	Banda Sea	211	5.4	85.556
33		12	11	31	04.0	32.015 S	179.750 E	South of Kermadec Islands	365	5.3	75.081
34		12	21	42	29.6	21.280 S	169.964 E	Loyalty Islands Region	77	5.1	83.172
35		14	01	01	00.4	32.984 S	179.340 W	South of Kermadec Islands	33	5.4	74.323
36		14	19	22	15.1	6.279 S	154.697 E	Solomon Islands	45	5.8	92.933
37		15	00	55	33.0	4.210 N	124.235 E	Celebes Sea	32	5.5	84.232
38		15	10	48	11.5	42.097 S	171.654 E	South Island, N.Z.	31	5.5	63.660
39		16	01	23	40.4	48.268 N	154.328 E	Kuril Islands	39	6.3	142.729
40		17	06	59	12.6	21.189 S	169.831 E	Loyalty Islands Region	59	5.6	83.225
41		18	02	37	25.1	8.870 N	126.480 E	Mindanao, Philippine Islands	24	6.0	97.167
42		18	16	15	06.5	19.028 S	168.493 E	Vanuatu Islands	40	5.7	84.941
43		19	01	55	24.1	32.358 S	178.566 W	South of Kermadec Islands	33	5.3	75.082
44		20	04	08	07.0	22.626 S	113.022 W	Easter Island Region	10	5.6	86.412
45		20	21	46	22.5	4.659 S	143.256 E	Papua New Guinea	91	5.7	90.593
46		21	02	35	34.0	58.427 N	175.450 W	Bering Sea	20	6.2	161.646
47		25	06	39	04.9	7.388 S	128.922 E	Banda Sea	124	5.6	82.971
48		25	21	12	54.3	23.216 S	70.560 W	Near Coast of Northern Chile	41	4.9	75.352
49		27	08	34	35.1	30.218 S	68.760 W	San Juan Province, Arg.	35	5.4	68.261
50		28	13	30	13.5	20.118 S	175.830 W	Tonga Islands	220	5.6	87.518
51	MAR	1	14	04	45.2	19.691 S	69.981 W	Northern Chile	73	5.3	78.455
52		1	17	30	26.0	10.939 N	84.637 W	Costa Rica	197	6.1	111.948
53		2	23	06	03.7	21.996 S	175.031 W	Tonga Islands	44	5.6	85.843
54		3	15	20	24.7	21.867 S	175.057 W	Tonga Islands	16	6.0	85.963
55		5	22	35	48.1	3.984 S	102.369 E	Southern Sumatra	59	5.9	76.846
56		6	02	18	12.7	0.275 N	124.717 E	Minahassa Peninsula	102	5.2	88.564
57		6	15	44	25.9	30.515 S	178.589 W	Kermadec Islands	228	5.5	76.867
58		8	11	36	28.4	60.904 N	167.023 E	Eastern Siberia	13	6.4	157.177

59		8	12	05	24.6	24.541 S	69.901 W	Northern Chile	56	5.5	73.905
60		9	01	01	23.1	54.877 S	131.533 W	South Pacific Cordillera	10	5.7	56.172
61		10	00	59	46.9	21.856 S	179.315 W	Fiji Islands Region	613	5.4	85.124
62		11	21	15	56.4	51.154 S	29.255 E	South of Africa	10	5.8	18.546
63		12	03	24	45.3	33.508 S	179.089 W	South of Kermadec Islands	200	5.0	73.864
64		15	18	51	00.2	29.132 S	68.684 W	San Juan Province, Arg.	114	5.5	69.244
65		21	05	53	12.0	9.710 S	79.774 W	Off Coast of Northern Peru	25	5.4	90.944
66		21	18	27	36.0	11.668 S	166.544 E	Santa Cruz Islands	33	5.5	91.430
67		25	00	20	31.5	19.111 S	176.806 W	Fiji Islands Region	336	5.1	88.305
68		28	07	22	36.8	18.308 S	168.015 E	Vanuatu Islands	29	5.2	85.502
69		30	21	41	26.6	23.250 S	69.076 W	Northern Chile	78	5.1	74.841
70	APR	1	01	59	04.7	16.550 S	179.591 W	Samoa Islands Region	33	5.3	91.960
71		1	05	25	27.0	4.919 S	152.018 E	New Britain Region	90	6.0	93.331
72		2	06	21	33.2	31.169 S	177.848 W	Kermadec Islands Region	39	5.1	76.376
73		4	03	22	57.9	7.017 N	78.153 W	Panama	33	6.1	106.171
74		4	15	10	08.6	55.646 S	124.422 W	Easter Island Cordillera	10	5.3	55.018
75		4	15	23	20.7	6.038 S	77.130 W	Northern Peru	21	6.0	93.572
76		4	19	00	00.0	37.296 N	116.313 W	Southern Nevada	0	5.6	145.555
77		5	04	19	49.5	5.982 S	77.094 W	Northern Peru	20	6.5	93.613
78		5	15	50	47.3	14.230 S	75.511 W	Near Coast of Peru	50	5.7	85.351
79		5	18	34	53.2	54.592 S	132.516 W	South Pacific Cordillera	10	5.2	56.494
80		6	04	48	47.2	24.168 S	179.984 E	South of Fiji Islands	549	5.4	82.735
81		6	14	34	20.7	15.008 S	175.521 W	Tonga Islands	16	5.8	92.553
82		7	18	55	19.5	3.100 S	130.356 E	Ceram	29	5.6	87.460
83		7	23	16	27.0	6.048 S	77.184 W	Northern Peru	33	5.0	93.580
84		8	01	25	26.9	4.088 N	127.929 E	Talau Islands	26	5.6	93.253
85		8	13	34	04.4	52.433 N	157.903 E	Kamchatka	145	5.6	147.471
86		9	06	02	24.5	9.788 S	74.702 W	Peru	124	5.9	89.265
87		11	08	12	43.9	5.282 S	151.697 E	New Britain Region	55	5.3	92.885
88		13	07	46	49.0	20.116 S	169.055 E	Vanuatu Islands	32	5.8	84.050
89		13	23	20	50.9	7.618 S	108.077 E	Java	61	5.0	75.364

90		16	15	30	00.0	37.245 N	116.442 W	Southern Nevada	0	5.4	145.533
91		18	09	41	20.1	22.924 S	179.342 W	South of Fiji Islands	471	5.7	84.082
92		19	21	48	35.7	6.900 S	129.562 E	Banda Sea	127	5.9	83.653
93		21	11	17	46.2	4.380 S	143.774 E	Papua New Guinea	103	5.6	91.033
94		21	23	12	22.5	18.287 S	46.416 E	Malagasay Republic	19	5.8	50.934
95		22	21	56	51.8	9.685 N	83.073 W	Costa Rica	10	6.3	110.272
96		25	01	14	49.5	30.043 S	177.659 W	Kermadec Islands	60	5.4	77.507
97		25	18	35	43.5	25.516 S	179.858 E	South of Fiji Islands	479	5.1	81.402
98		26	17	36	54.5	7.525 N	126.577 E	Mindanao, Philippine Islands	74	5.5	95.955
99		29	06	54	54.2	20.762 S	174.146 W	Tonga Islands	39	5.2	87.212
100		29	09	12	48.1	42.453 N	43.673 E	Western Caucasus	17	6.2	111.253
101		29	18	12	23.2	11.258 S	77.672 W	Near Coast of Peru	58	5.7	88.830
102		29	22	06	02.0	5.623 N	125.330 E	Mindanao, Philippine Islands	74	5.3	93.745
103		30	12	36	50.6	6.386 S	147.213 E	East Papua New Guinea Region	59	5.5	90.345
104	MAY	1	07	18	43.9	62.476 N	151.413 W	Central Alaska	114	6.1	172.221
105		3	02	14	14.4	28.080 N	139.585 E	Bonin Islands Region	433	6.0	119.550
106		7	13	09	28.7	39.430 N	144.714 E	Off East Coast of Honshu, Japan	10	6.4	131.605
107		8	19	53	21.6	13.875 S	74.458 W	Peru	107	5.6	85.349
108		10	13	26	09.6	22.953 S	175.649 W	Tonga Islands Region	88	5.3	84.793
109		10	13	33	52.3	16.114 S	174.147 W	Tonga Islands	115	5.8	91.744
110		11	08	04	43.9	22.061 S	67.180 W	Chile-Bolivia Border Region	194	5.3	75.327
111		11	19	59	00.0	9.958 S	119.890 E	Sumba Island Region	33	5.3	77.347
112		13	16	28	15.4	3.463 S	82.824 E	South Indian Ocean	22	5.9	71.532
113		17	02	31	25.7	4.390 S	142.715 E	Papua New Guinea	59	5.8	90.655
114		17	06	37	47.0	9.941 S	119.780 E	Sumba Island Region	21	5.2	77.323
115		17	22	48	58.1	55.301 S	1.684 W	Bouvet Island Region	10	5.2	22.956
116		18	06	57	27.0	39.972 S	74.786 W	Off Coast of Central Chile	21	5.3	61.049
117		18	21	54	28.1	3.598 S	128.390 E	Ceram	114	5.2	86.292
118		19	00	58	01.7	1.156 N	122.957 E	Minahassa Peninsula	33	6.0	88.752
119		19	01	16	39.1	1.467 N	123.366 E	Minahassa Peninsula	33	5.0	89.187
120		19	01	19	50.9	1.333 N	123.009 E	Minahassa Peninsula	33	5.3	88.935

121	19	01	41	51.6	1.248 N	122.916 E	Minahassa Peninsula	45	4.8	88.823	
122	19	20	09	00.8	1.200 N	122.958 E	Minahassa Peninsula	38	4.7	88.793	
123	19	20	32	19.2	1.259 N	123.319 E	Minahassa Peninsula	33	4.8	88.977	
124	20	09	50	28.0	18.038 S	178.457 W	Fiji Islands Region	580	5.4	89.008	
125	21	11	00	19.0	7.517 S	126.539 E	Banda Sea	18	6.2	81.995	
126	22	06	53	05.9	33.802 S	179.604 W	South of Kermadec Islands	45	5.4	73.478	
127	22	21	05	22.5	51.770 N	175.883 E	Rat Islands. Aleutian Islands	33	5.5	153.307	
128	23	06	44	21.4	14.940 S	166.845 E	Vanuatu Islands	63	5.4	88.396	
129	24	18	28	34.7	60.306 S	43.821 W	Scotia Sea	10	5.5	33.827	
130	24	20	50	55.8	16.506 S	70.701 W	Southern Peru	128	6.3	81.667	
131	28	12	40	16.6	5.729 S	130.895 E	Banda Sea	88	5.0	85.217	
132	30	09	06	22.2	23.531 S	67.907 W	Chile-Argentina Border Region	120	5.3	74.198	
133	30	13	17	41.9	54.567 N	161.606 W	Alaska Peninsula	28	6.3	162.630	
134	31	05	28	02.6	6.048 S	130.599 E	Banda Sea	33	6.0	84.815	
135	31	22	17	35.7	56.837 S	140.932 W	South Pacific Cordillera	10	5.1	54.384	
136	JUN	2	16	25	26.7	24.905 S	179.924 E	South of Fiji Islands	505	5.2	82.008
137	2	19	22	58.5	6.367 S	129.958 E	Banda Sea	138	5.1	84.289	
138	3	05	05	14.8	40.022 S	74.801 W	Off Coast of Southern Chile	10	5.7	61.007	
139	3	17	08	38.7	52.152 N	152.822 E	Northwest of Kuril Islands	420	4.8	145.417	
140	4	15	03	26.0	31.601 S	179.811 E	Kermadec Islands Region	399	5.2	75.495	
141	4	17	30	02.6	7.357 S	127.807 E	Banda Sea	30	5.3	82.599	
142	7	11	51	25.9	7.204 S	122.533 E	Flores Sea	536	6.2	80.845	
143	9	07	45	02.1	20.252 S	176.218 W	Fiji Islands Region	266	6.1	87.312	
144	9	11	01	33.9	40.100 S	174.393 E	Cook Strait, N.Z	109	5.4	66.167	
145	11	14	32	47.9	18.209 S	178.409 W	Fiji Islands Region	628	5.5	88.852	
146	12	00	45	40.0	2.285 S	78.884 W	Ecuador	94	5.7	97.665	
147	15	01	13	21.4	58.285 S	24.183 W	South Sandwich Islands Region	52	5.8	28.701	
148	15	23	02	14.3	10.098 N	125.855 E	Leyte, Philippine Islands	71	6.0	98.081	
149	16	08	13	03.9	21.415 S	179.200 W	Fiji Islands Region	624	4.9	85.575	
150	19	11	38	23.3	20.134 S	133.952 E	Northern Territory, Australia	10	5.2	72.976	
151	20	05	18	52.5	1.196 N	122.787 E	Minahassa Peninsula	31	6.2	88.728	

152		20	06	27	24.1	1.173 N	122.882 E	Minahassa Peninsula	21	5.6	88.741
153		21	16	17	29.9	1.093 N	123.045 E	Minahassa Peninsula	30	5.5	88.725
154		23	21	22	28.9	26.802 S	63.349 W	Santiago Del Estero Prov., Arg.	558	6.4	69.656
155		23	23	14	45.5	26.939 S	63.272 W	Santiago Del Estero Prov., Arg.	578	5.6	69.504
156		26	15	18	34.7	21.056 S	69.561 W	Northern Chile	114	4.7	77.044
157		26	23	07	06.2	0.079 S	123.558 W	Minahassa Peninsula	114	5.5	87.821
158		30	03	08	14.2	14.371 S	13.562 W	South Atlantic Ridge	10	5.3	63.896
159	JUL	2	04	16	46.0	28.922 S	67.278 W	La Rioja Province, Arg.	145	4.7	68.987
160		2	05	14	30.1	1.068 S	99.843 E	Southern Sumatera	54	5.8	78.775
161		2	06	08	09.2	23.233 S	179.126 W	South of Fiji Islands	429	5.7	83.827
162		2	19	14	15.2	56.09 S	142.28 W	South Pacific Cordillera	10	5.0	55.127
163		2	21	24	03.8	72.961 N	12.309 E	Norwegian sea	10	5.4	142.917
164		4	06	54	16.1	8.439 S	111.021 E	Java	114	5.3	75.617
165		4	07	08	31.9	8.146 S	124.689 E	Timor	29	5.4	80.747
166		4	11	43	10.4	8.099 S	124.681 E	Timor	29	6.2	80.788
167		5	03	47	46.8	3.755 S	135.864 E	West Irian Region	37	5.4	88.807
168		5	04	30	52.5	9.585 S	114.673 E	South of Bali Islands	54	5.7	75.835
169		5	10	58	28.5	47.892 N	145.796 E	Sea of Okhotsk	468	5.6	139.352
170		6	12	19	49.5	13.108 S	72.187 W	Peru	105	6.2	85.333
171		6	19	00	12.5	16.713 S	167.518 E	Vanuatu Islands	26	5.0	86.890
172		6	23	32	34.2	21.442 S	69.394 W	Northern Chile	35	5.2	76.630
173		8	21	14	22.1	53.162 N	159.885 E	Near East Coast of Kamchatka	42	5.4	148.774
174		9	05	54	07.1	20.599 S	68.803 W	Chile-Bolivia Border Region	101	5.3	77.223
175		10	09	49	25.7	12.525 N	93.874 E	Andaman Islands Region	117	5.2	89.830
176		12	04	42	23.6	39.368 S	175.902 E	North Island, N.Z	67	5.3	67.189
177		12	10	00	42.2	33.632 S	179.536 W	South of Kermadec Islands	52	5.1	73.656
178		13	02	50	14.6	42.182 N	125.641 W	Off Coast of Oregon	11	6.2	151.979
179		13	12	15	13.3	48.738 N	154.933 E	Kuril Islands	41	5.7	143.343
180		14	09	09	11.9	36.334 N	71.119 E	Afghanistan-USSR Border Region	213	6.4	107.680
181		15	15	57	46.7	24.020 S	179.784 W	South of Fiji Islands	505	5.2	82.927
182		18	04	54	46.9	8.122 S	121.760 E	Flores Islands Region	32	5.4	79.718

183		21	22	59	09.6	3.008 N	128.434 E	North of Halmahera	34	5.9	92.433
184		23	11	22	10.0	5.826 N	125.983 E	Mindanao, Philippine Islands	147	5.6	94.167
185		23	13	25	47.3	3.775 N	95.932 E	Off W Coast of Northern Sumatera	47	5.8	82.130
186		23	17	41	45.8	42.239 S	42.382 E	Prince Edward Islands Region	10	4.6	26.887
187		23	21	16	43.3	24.766 S	179.592 W	South of Fiji Islands	467	5.0	82.244
188		24	03	27	51.5	16.028 S	73.657 W	Near Coast of Peru	56	5.1	83.072
189		24	13	54	52.0	18.274 S	34.856 E	Mozambique	32	5.2	50.839
190		28	00	07	42.1	21.409 S	179.117 W	Fiji Islands Region	613	5.0	85.599
191		29	13	52	39.8	14.220 S	73.945 W	Peru	96	5.5	84.860
192	AUG	1	03	22	42.1	27.073 S	176.313 W	Kermadec Islands Region	13	5.5	80.654
193		3	18	29	36.6	60.436 S	51.504 W	Scotia Sea	10	5.2	36.115
194		5	06	05	47.2	21.363 S	174.396 W	Tonga Islands	31	5.7	86.579
195		5	10	42	32.2	1.546 N	127.453 E	Halmahera	142	5.4	90.725
196		6	02	17	31.6	3.827 N	95.374 E	Off W Coast of Northern Sumatera	18	6.0	82.012
197		6	14	49	30.5	35.725 N	141.044 E	Near East Coast of Honshu, Japan	29	5.9	126.986
198		6	20	26	25.7	54.729 N	161.659 E	Near East Coast of Kamchatka	33	5.5	150.662
199		6	23	21	33.7	8.733 N	126.412 E	Mindanao, Philippine Islands	65	5.1	97.015
200		8	02	09	44.7	0.972 N	122.631 E	Minahassa Peninsula	12	5.9	88.465
201		8	04	00	01.4	1.294 N	122.663 E	Minahassa Peninsula	45	5.3	88.775
202		8	16	30	06.3	20.226 S	178.103 W	Fiji Islands Region	579	5.3	86.957
203		9	06	28	03.2	1.409 N	122.706 E	Minahassa Peninsula	37	5.5	88.897
204		9	20	16	01.0	23.320 S	179.185 W	South of Fiji Islands	465	5.4	83.731
205		10	13	33	11.2	63.037 S	164.391 W	South Pacific Cordillera	10	5.0	47.076
206		10	23	29	51.1	31.411 S	179.934 W	Kermadec Islands Region	431	4.8	75.731
207		11	14	43	54.2	3.141 S	130.320 E	Ceram	33	5.7	87.409
208		12	13	02	30.2	14.170 S	14.255 W	South Atlantic Ridge	10	5.5	64.301
209		14	12	53	26.0	54.389 N	169.296 W	Fox Islands, Aleutian Islands	275	5.7	160.337
210		14	17	43	07.4	3.159 N	127.949 E	Talau Islands	124	5.5	92.399
211		14	19	15	03.6	13.593 S	167.607 E	Vanuatu Islands	14	6.1	89.891
212		15	04	39	05.2	45.772 S	72.305 W	Near Coast of Southern Chile	10	5.3	54.997
213		15	06	50	35.7	45.558 S	72.233 W	Near Coast of Southern Chile	10	5.5	55.172

214	15	09	46	16.1	45.801 S	72.611 W	Near Coast of Southern Chile	13	5.4	55.057
215	15	09	57	28.7	56.28 S	141.43 W	South Pacific Cordillera	10	5.2	54.941
216	15	12	16	15.4	45.815 S	72.299 W	Near Coast of Southern Chile	10	5.4	54.956
217	15	13	35	59.4	16.064 S	168.010 E	Vanuatu Islands	171	5.9	87.643
218	16	22	26	17.2	41.697 N	125.385 W	Off Coast of Northern California	10	5.5	151.465
219	17	07	04	11.1	23.896 S	66.542 W	Jujuy Province, Arg.	211	4.5	73.410
220	17	19	29	40.0	40.235 N	124.348 W	Near Coast of Northern California	12	6.0	149.875
221	17	22	17	14.6	41.821 N	125.397 W	Off Coast of Northern California	14	6.2	151.589
222	18	10	52	51.3	17.994 S	178.542 W	Fiji Islands Region	578	5.4	89.026
223	18	21	52	06.0	31.939 S	71.483 W	Near Coast of Central Chile	46	5.4	67.518
224	19	03	23	27.5	51.091 S	159.355 E	North of Macquarie Island	10	5.0	52.309
225	21	16	03	25.8	30.689 S	72.101 W	Off Coast of Central Chile	38	4.9	68.871
226	22	07	07	43.1	23.728 S	179.819 W	South of Fiji Islands	521	5.3	83.203
227	22	13	18	12.6	23.834 S	179.790 W	South of Fiji Islands	535	5.3	83.106
228	23	18	34	11.2	21.859 S	177.981 W	Fiji Islands Region	400	4.6	85.396
229	23	20	16	24.5	9.209 S	123.526 E	Timor	31	5.4	79.345
230	24	08	03	11.2	14.607 S	166.869 E	Vanuatu Islands	84	5.3	88.720
231	24	11	13	19.7	6.065 S	130.368 E	Banda Sea	149	5.6	84.716
232	25	06	40	05.9	21.354 S	174.174 W	Tonga Islands	33	5.5	86.629
233	26	14	59	44.9	42.100 N	144.635 E	Hokkaido, Japan Region	29	5.8	133.930
234	26	20	42	31.8	6.937 N	94.531 E	Nicobar Islands Region	26	5.4	84.711
235	26	20	54	23.0	6.882 N	94.609 E	Nicobar Islands Region	22	5.8	84.682
236	26	22	52	36.8	14.601 S	167.274 E	Vanuatu Islands	232	5.0	88.838
237	27	08	39	31.7	55.767 S	27.013 W	South Sandwich Islands Region	33	5.2	31.631
238	27	08	50	57.4	18.037 S	178.485 W	Fiji Islands Region	599	5.2	89.003
239	27	11	46	22.3	16.278 S	73.278 W	Near Coast of Peru	74	5.3	82.716
240	27	11	58	22.1	21.657 S	68.506 W	Chile-Bolivia Border Region	116	5.1	76.139
241	28	21	32	35.0	22.230 S	179.639 E	South of Fiji Islands	599	5.5	84.539
242	29	01	45	21.0	38.379 S	93.640 W	West Chile Rise	10	4.7	67.401
243	29	05	21	11.6	20.710 S	177.749 W	Fiji Islands Region	376	5.4	86.560
244	29	08	21	15.2	20.704 S	177.747 W	Fiji Islands Region	379	5.2	86.566

245		31	16	43	46.7	22.425 S	68.311 W	Northern Chile	117	5.0	75.360
246		31	23	17	02.5	26.999 S	26.417 E	Republic of South Africa	5	-	42.767
247	SEP	1	08	22	28.3	22.436 S	170.257 E	Loyalty Islands Region	39	5.1	82.140
248		2	15	32	55.7	25.174 S	179.820 E	South of Fiji Islands	481	4.8	81.725
249		3	06	59	43.2	23.952 S	66.857 W	Jujuy Province, Arg.	183	5.0	73.462
250		3	09	05	28.3	17.910 S	116.001 W	Southern East Pacific Rise	9	6.0	91.488
251		3	11	56	16.2	17.921 S	115.992 W	Southern East Pacific Rise	11	5.8	91.476
252		4	8	32	33.5	10.746 N	92.843 E	Andaman Islands, India	33	5.1	87.844
253		6	11	46	06.8	6.124 S	130.622 E	Banda Sea	146	5.3	84.753
254		6	15	00	25.8	34.060 S	178.922 W	South of Kermadec Islands	10	4.9	73.361
255		7	14	32	56.4	24.103 S	179.836 W	South of Fiji Islands	534	5.3	82.836
256		7	22	07	36.7	21.139 S	174.295 W	Tonga Islands	59	5.2	86.816
257		8	13	50	30.8	40.250 S	175.053 E	North Island, N.Z.	88	5.6	66.163
258		9	02	50	01.2	64.862 S	170.883 W	Pacific-Antarctic Ridge	10	4.9	44.638
259		11	17	11	28.9	20.539 S	68.598 W	Chile-Bolivia Border Region	128	4.6	77.211
260		19	01	07	48.2	31.131 S	177.590 W	Kermadec Islands Region	59	5.2	76.462
261		19	01	41	48.0	48.818 N	154.870 E	Kuril Islands	35	5.6	143.388
262		20	14	47	46.4	6.486 S	129.850 E	Banda Sea	180	5.4	84.140
263		21	15	19	48.1	16.232 S	173.004 W	Tonga Islands	17	5.8	91.844
264		22	06	32	37.3	49.644 N	156.549 E	Kuril Islands	30	5.5	144.685
265		24	04	38	41.5	8.032 S	116.554 E	Sumbawa Reagion, Indonesia	182	4.5	77.943
266		25	11	16	30.2	20.747 S	174.834 W	Tonga Islands	33	5.2	87.097
267		25	14	14	17.3	33.692 S	179.628 E	South of Kermadec Islands	199	5.0	73.432
268		25	17	43	16.5	23.364 S	178.902 W	South of Fiji Islands	410	5.3	83.746
269		25	20	46	23.9	56.748 S	147.393 E	West of Macquarie Island	16	5.2	44.106
270		26	22	16	25.7	16.117 S	173.245 W	Tonga Islands	28	5.2	91.912
271		27	12	11	23.0	21.414 S	174.117 W	Tonga Islands	35	5.2	86.581
272		27	23	01	25.6	3.359 S	137.625 E	Irian Jaya, Indonesia	64	5.5	89.820
273		28	20	26	56.1	5.814 S	150.959 E	New Britain Reagion, P.N.G.	28	5.8	92.141
274		29	03	55	05.5	8.200 S	74.342 W	Peru-Brazil Border Region	166	5.0	90.639
275		30	00	21	46.4	20.878 S	178.591 W	Fiji Islands Region	566	6.3	86.224

276		30	00	42	25.3	20.941 S	178.713 W	Fiji Islands Region	591	5.6	86.137
277		30	12	08	50.6	6.751 S	130.442 E	Banda Sea	65	5.2	84.107
278	OCT	1	06	36	49.8	55.759 S	27.943 W	South Sandwich Islands Region	33	5.0	31.967
279		2	01	11	37.3	23.986 S	66.764 W	Jujuy Province, Arg.	200	4.8	73.400
280		3	19	07	38.7	33.948 S	179.622 E	South of Kermadec Islands	33	5.2	73.183
281		3	20	20	10.2	17.029 S	167.941 E	Vanuatu Islands	10	5.0	86.703
282		3	20	24	17.3	16.817 S	167.887 E	Vanuatu Islands	10	4.9	86.891
283		3	20	43	31.1	16.852 S	168.186 E	Vanuatu Islands	16	5.2	86.930
284		5	13	09	34.3	24.707 S	179.977 E	South of Fiji Islands	501	5.0	82.211
285		6	02	46	24.6	64.748 S	177.705 E	Balleny Islands Region	10	5.3	43.261
286		6	16	48	21.1	7.358 S	74.827 W	Peru-Brazil Border Region	143	5.4	91.587
287		7	19	56	21.1	10.553 S	117.161 E	South of Sumbawa, Indonesia	50	5.2	75.821
288		8	03	31	15.6	45.587 N	149.049 E	Kuril Islands	146	6.0	138.545
289		8	05	34	37.4	25.421 S	179.650 E	South of Fiji Islands	503	4.8	81.450
290		9	17	22	05.4	1.804 N	31.293 E	Uganda	33	5.7	70.940
291		10	00	06	14.4	13.950 S	167.242 E	Vanuatu Islands	200	5.1	89.450
292		10	01	32	29.4	17.505 S	174.535 W	Tonga Islands	152	5.3	90.314
293		11	02	16	30.3	29.573 S	177.535 W	Kermadec Islands, N.Z.	33	5.2	77.987
294		11	03	01	51.2	2.769 S	153.070 E	New Ireland Region, P.N.G.	28	5.4	95.695
295		11	07	21	30.2	5.585 S	154.298 E	Solomon Islands	113	5.2	93.455
296		11	10	44	50.0	7.599 S	117.454 E	Bali Sea	313	5.1	78.664
297		12	16	26	24.8	13.742 S	166.673 E	Vanuatu Islands	44	5.9	89.490
298		13	18	12	20.3	56.097 S	122.633 W	Southern East Pacific Rise	10	5.2	54.439
299		14	14	35	55.7	18.094 S	178.442 W	Fiji Islands Region	583	5.3	88.957
300		14	15	58	12.7	9.094 S	158.442 E	Solomon Islands	23	6.3	91.470
301		14	16	16	57.2	9.080 S	158.599 E	Solomon Islands	31	5.9	91.532
302		15	16	18	01.7	6.494 S	130.043 E	Banda Sea	137	5.9	84.202
303		16	03	06	14.9	9.633 S	119.806 E	Sumba Region, Indonesia	46	5.2	77.618
304		16	10	05	59.3	24.606 S	69.022 W	Northern Chile	100	4.6	73.561
305		17	05	20	57.8	4.524 S	135.375 E	Irian Jaya Region, Indonesia	23	5.6	87.938
306		17	09	05	20.2	15.300 S	173.556 W	Tonga Islands	36	5.6	92.650

307		17	15	43	25.6	17.971 S	178.654 W	Fiji Islands Region	556	5.2	89.031
308		17	16	46	24.5	28.925 S	178.006 W	Kermadec Islands Region	31	5.0	78.526
309		18	17	22	55.1	24.295 S	177.561 W	South of Fiji Islands	198	5.8	83.114
310		18	19	12	00.0	37.063 N	116.045 W	Southern Nevada	0	5.2	145.275
311		18	19	27	59.1	24.009 S	175.830 W	South of Tonga Islands	18	5.3	83.729
312		19	08	48	19.2	9.012 S	117.170 E	Sumbawa Region, Indonesia	97	5.8	77.252
313		19	16	45	06.6	20.992 S	178.599 W	Fiji Islands Region	604	5.1	86.111
314		19	21	23	14.3	30.780 N	78.774 E	Northern India	10	6.5	103.656
315		20	04	31	42.1	4.831 S	129.169 E	Banda Sea	231	4.9	85.429
316		23	12	24	56.3	11.343 S	166.403 E	Santa Cruz Islands	136	5.3	91.700
317		23	14	38	43.9	37.317 S	177.036 E	Off E.Coast of N.Island, N.Z.	257	4.9	69.400
318		25	13	25	02.6	31.479 S	177.773 W	Kermadec Islands Region, P.N.G.	33	5.1	76.089
319		25	21	06	04.0	38.202 S	175.949 E	North Island, N. Z.	229	4.6	68.321
320		26	02	27	31.5	18.506 N	145.668 E	Mariana Islands	192	5.5	112.952
321		27	09	05	04.2	18.696 S	177.855 W	Fiji Islands Region	432	4.8	88.494
322		27	10	22	46.5	5.198 S	152.691 E	New Britain Region, P.N.G.	64	5.5	93.292
323		27	16	17	31.0	22.086 S	67.400 W	Chile-Bolivia Border Region	178	5.4	75.376
324		27	22	05	03.5	57.761 S	25.370 W	South Sandwich Islands Region	33	5.4	29.515
325		29	23	13	57.4	16.184 S	167.990 E	Vanuatu Islands	177	5.3	87.523
326		30	04	02	42.5	5.657 S	153.899 E	New Ireland Region, P.N.G.	69	5.7	93.258
327		30	10	35	41.4	15.310 S	173.187 W	Tonga Islands	18	5.8	92.710
328		31	15	31	47.7	29.603 S	71.264 W	Near Coast of Central Chile	71	4.9	69.622
329	NOV	1	02	51	12.7	1.235 N	122.105 E	Minahassa Peninsula, Sulawesi	37	5.6	88.521
330		1	16	23	22.3	30.255 S	177.981 W	Kermadec Islands, N.Z.	21	6.4	77.238
331		1	16	32	53.7	30.430 S	177.731 W	Kermadec Islands, N.Z.	10	5.7	77.116
332		1	18	36	27.1	30.37 S	177.71 W	Kermadec Islands, N.Z.	10	-	77.179
333		1	23	26	11.3	30.880 S	177.873 W	Kermadec Islands, N.Z.	33	4.9	76.652
334		4	06	24	02.6	6.072 S	148.198 E	New Britain Region, P.N.G.	50	5.7	90.973
335		5	06	56	03.0	6.237 S	146.444 E	Eastern New Guinea Region, P.N.G.	105	5.8	90.222
336		5	07	12	12.4	20.656 S	176.687 W	Fiji Islands Region	262	5.3	86.826
337		5	17	48	00.6	29.385 S	178.993 W	Kermadec Islands, N.Z.	295	4.7	77.884

338	5	21	16	16.0	16.908 S	66.162 E	Mid-Indian Ridge	10	5.6	54.744
339	7	05	59	35.5	26.309 S	177.877 W	South of Fiji Islands	200	5.6	81.094
340	7	09	21	23.7	7.320 S	128.550 E	Banda Sea	140	5.9	82.900
341	8	17	12	43.9	4.273 S	102.806 E	Southern Sumatera, Indonesia	80	5.7	76.718
342	9	07	04	51.7	56.189 S	27.150 W	South Sandwich Islands Region	33	5.3	31.351
343	9	19	35	36.1	44.769 S	166.847 E	Off W.Coast of S.Island, N. Z.	20	4.6	60.026
344	10	09	37	07.7	30.66 S	176.32 W	Kermadec Islands Region	33	5.3	77.159
345	10	13	04	39.3	59.449 S	26.183 W	South Sandwich Islands Region	33	5.2	28.544
346	11	16	15	50.3	24.216 S	177.393 W	South of Fiji Islands	178	5.5	83.224
347	11	22	17	38.5	20.997 S	178.959 W	Fiji Islands Region	615	5.0	86.031
348	11	22	34	40.9	24.705 N	142.570 E	Volcano Islands Region	25	6.0	117.541
349	12	08	53	34.8	31.114 S	178.552 W	Kermadec Islands Region	105	5.2	76.293
350	13	11	12	13.2	8.361 N	126.371 E	Mindanao, Philippine Islands	36	6.1	96.656
351	16	00	35	38.3	37.276 S	176.755 E	North Island, N.Z.	286	5.0	69.382
352	16	10	32	07.9	5.613 S	146.325 E	Eastern New Guinea Region, P.N.G.	54	4.9	90.763
353	17	04	34	50.4	8.868 S	116.706 E	Sumbawa Region, Indonesia	161	4.9	77.221
354	17	10	42	16.0	14.539 S	167.212 E	Vanuatu Islands	216	5.3	88.880
355	18	11	36	06.2	24.166 S	176.233 W	South of Fiji Islands	56	5.2	83.499
356	19	13	29	21.6	56.121 S	123.371 W	Southern East Pacific Rise	10	5.2	54.471
357	19	22	28	51.0	4.554 N	77.442 W	Near West Coast of Colombia	21	6.4	103.627
358	20	04	33	50.7	19.05 S	177.70 W	Fiji Islands Region	667	4.8	88.182
359	20	04	40	49.7	44.920 S	80.956 W	Off Coast of Southern Chile	10	5.3	58.142
360	20	09	23	09.4	36.515 S	178.385 E	Off E.Coast of N.Island, N.Z.	79	6.0	70.450
361	20	09	42	28.6	30.663 S	177.837 W	Kermadec Islands, N.Z.	68	5.5	76.870
362	21	12	38	28.5	5.782 N	126.832 E	Mindanao, Philippine Islands	73	6.0	94.430
363	23	20	00	41.7	26.759 S	114.939 W	Easter Island Region	10	5.2	82.631
364	23	22	52	04.1	0.346 S	98.091 E	Southern Sumatera, Indonesia	24	5.2	78.898
365	24	11	30	15.1	28.515 S	176.118 W	Kermadec Islands Region	33	5.1	79.286
366	26	10	41	32.0	51.400 N	176.000 W	Andreanof Islands, Aleutian Is.	24	5.8	155.678
367	26	18	35	00.0	37.096 N	116.070 W	Southern Nevada	0	4.6	145.312
368	26	19	40	48.5	42.051 N	142.523 E	Hokkaido, Japan Region	56	6.1	133.131

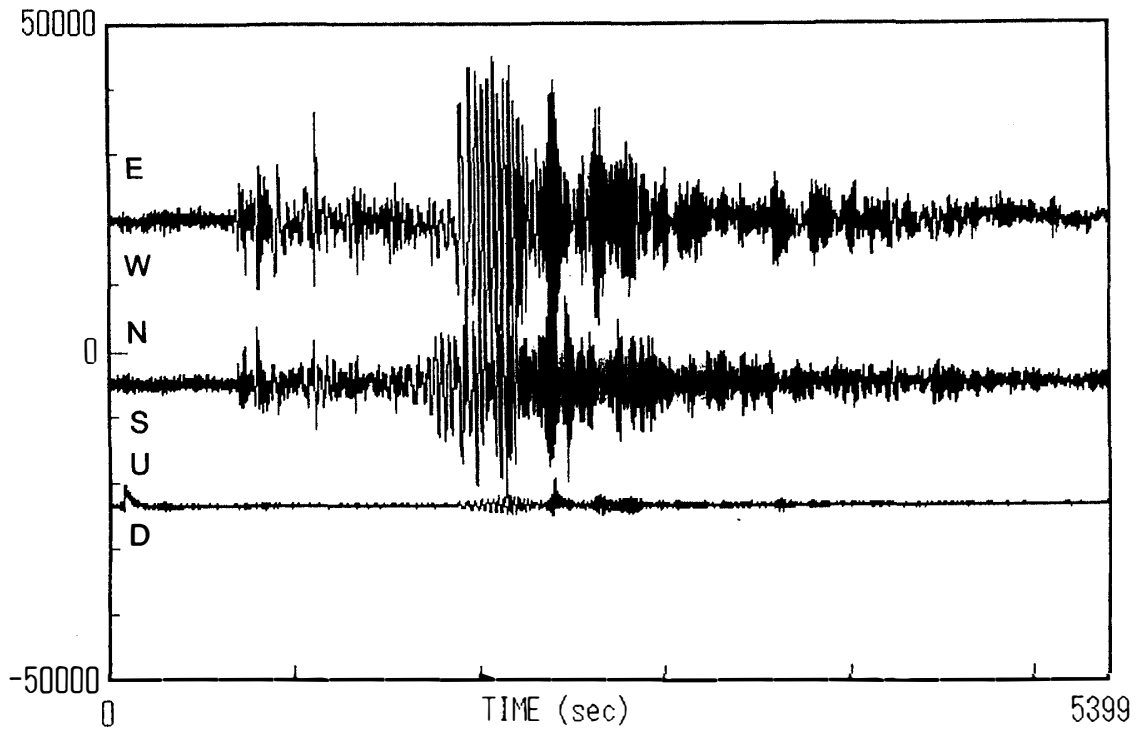
369		27	05	03	31.3	48.237 N	154.807 E	Kuril Islands	28	5.9	142.876
370		29	23	35	06.8	44.375 S	167.846 E	South Island, N.Z.	10	5.2	60.631
371	DEC	1	22	41	15.2	32.065 S	69.513 W	Mendoza Province, Arg.	115	5.2	66.787
372		2	17	27	21.7	15.867 S	69.288 W	Peru-Bolivia Border Region	241	5.1	81.799
373		2	17	45	23.5	9.074 S	119.382 E	Sumba Region, Indonesia	104	4.9	77.984
374		3	10	33	39.9	26.483 S	178.715 E	South of Fiji Islands	561	6.0	80.224
375		5	09	15	28.1	41.266 S	80.401 E	Mid-Indian Ridge	10	5.3	35.111
376		7	19	21	24.4	37.443 S	51.281 E	South Indian Ocean	10	5.1	32.302
377		8	11	02	49.2	32.685 S	67.712 W	Mendoza Province, Arg.	28	5.0	65.644
378		11	06	29	41.8	22.692 S	175.124 W	Tonga Islands Region	42	5.7	85.147
379		11	17	03	10.6	17.821 S	116.017 W	Southern East Pacific Rise	19	5.9	91.578
380		11	20	39	39.2	23.368 S	171.044 W	Loyalty Islands Region	37	5.8	81.446
381		13	00	12	56.5	7.270 S	128.621 E	Banda Sea	159	5.6	82.972
382		13	02	33	51.8	45.578 N	151.560 E	Kuril Islands	30	6.1	139.440
383		13	18	59	06.5	45.521 N	151.707 E	Kuril Islands	19	6.1	139.443
384		13	19	55	09.5	45.435 N	151.270 E	Kuril Islands	48	5.9	139.212
385		13	19	58	18.5	45.439 N	151.427 E	Kuril Islands	20	6.1	139.272
386		14	00	07	57.2	23.117 S	66.531 W	Jujuy Province, Arg.	210	5.0	74.130
387		15	06	36	38.4	30.434 S	177.921 W	Kermadec Islands, N.Z.	56	5.6	77.076
388		15	18	56	05.6	17.521 S	70.422 W	Near Coast of Peru	104	5.6	80.627
389		16	08	24	19.1	30.51 S	177.55 W	Kermadec Islands, N.Z.	33	5.1	77.073
390		17	01	50	19.0	3.611 S	102.034 W	Southern Sumatera, Indonesia	72	5.6	77.086
391		17	03	41	08.1	62.551 S	155.054 E	Balleny Islands Region	10	5.2	40.953
392		19	01	33	40.4	45.253 N	151.176 E	Kuril Islands	27	6.0	139.022
393		19	12	35	07.7	32.065 S	178.857 W	South of Kermadec Islands	94	5.4	75.310
394		19	21	01	21.5	24.001 S	179.871 E	South of Fiji Islands	529	5.0	82.873
395		21	08	01	18.3	22.680 S	64.207 W	Salta Province, Arg.	33	5.0	73.761
396		22	08	43	13.4	45.533 N	151.021 E	Kuril Islands	25	6.3	139.207
397		22	21	15	42.4	4.893 S	103.185 E	Southern Sumatera, Indonesia	59	5.8	76.262
398		23	15	06	50.5	36.393 S	179.764 E	Off E.Coast of N.Island, N.Z.	48	5.1	70.843
399		24	03	38	17.9	5.702 S	110.209 E	Java Sea	533	5.1	77.884

400	26	11	35	56.2	54.382 N	162.521 E	Near East Coast of Kamchatka	29	5.5	150.698
401	27	02	32	43.1	19.173 S	176.400 W	Fiji Islands Region	26	5.4	88.326
402	27	04	05	58.2	56.032 S	25.266 W	South Sandwich Islands Region	10	6.2	30.803
403	27	09	09	37.5	51.019 N	98.150 E	Russia-Mongolia Border Region	14	5.8	127.294
404	28	00	52	10.1	56.102 S	24.614 W	South Sandwich Islands Region	10	6.1	30.517
405	28	02	20	28.1	55.439 S	26.469 W	South Sandwich Islands Region	33	5.3	31.695
406	28	15	59	47.1	56.573 S	25.325 W	South Sandwich Islands Region	58	5.1	30.406
407	29	18	35	48.2	30.870 S	178.042 W	Kermadec Islands, N.Z.	71	5.2	76.629
408	29	18	39	09.4	4.421 S	132.727 E	Irian Jaya Region, Indonesia	37	6.0	87.086
409	29	19	43	17.4	49.673 N	155.977 E	Kuril Islands	48	5.0	144.503

APPENDIX

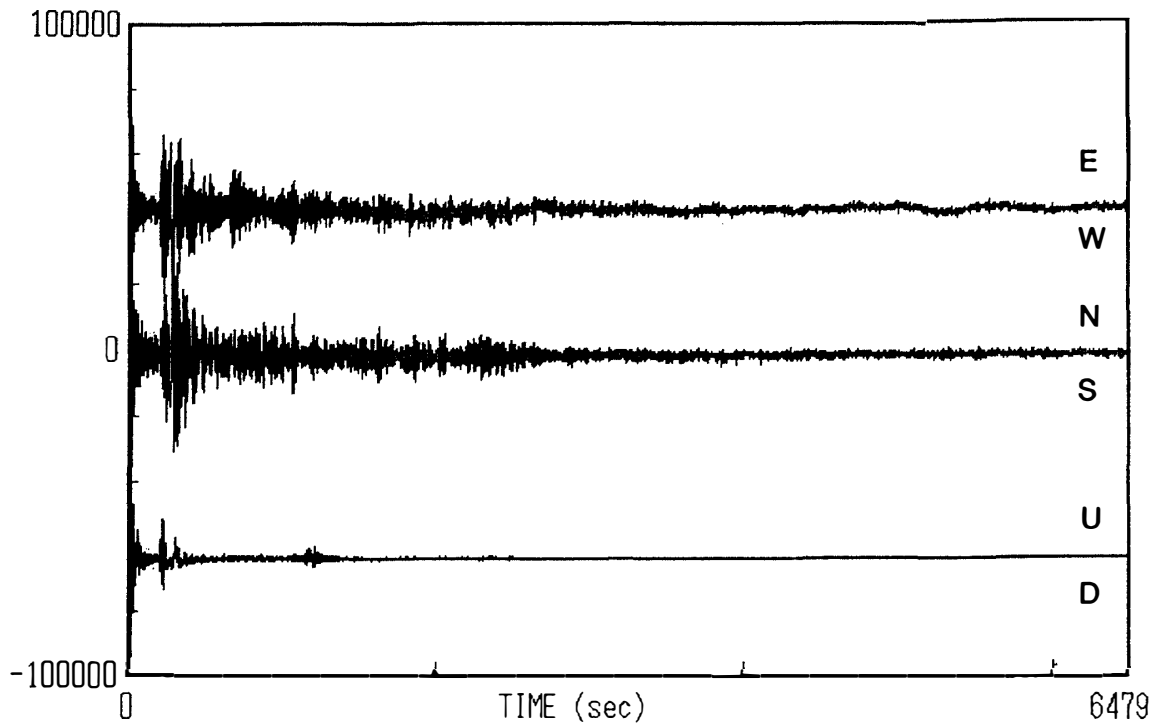
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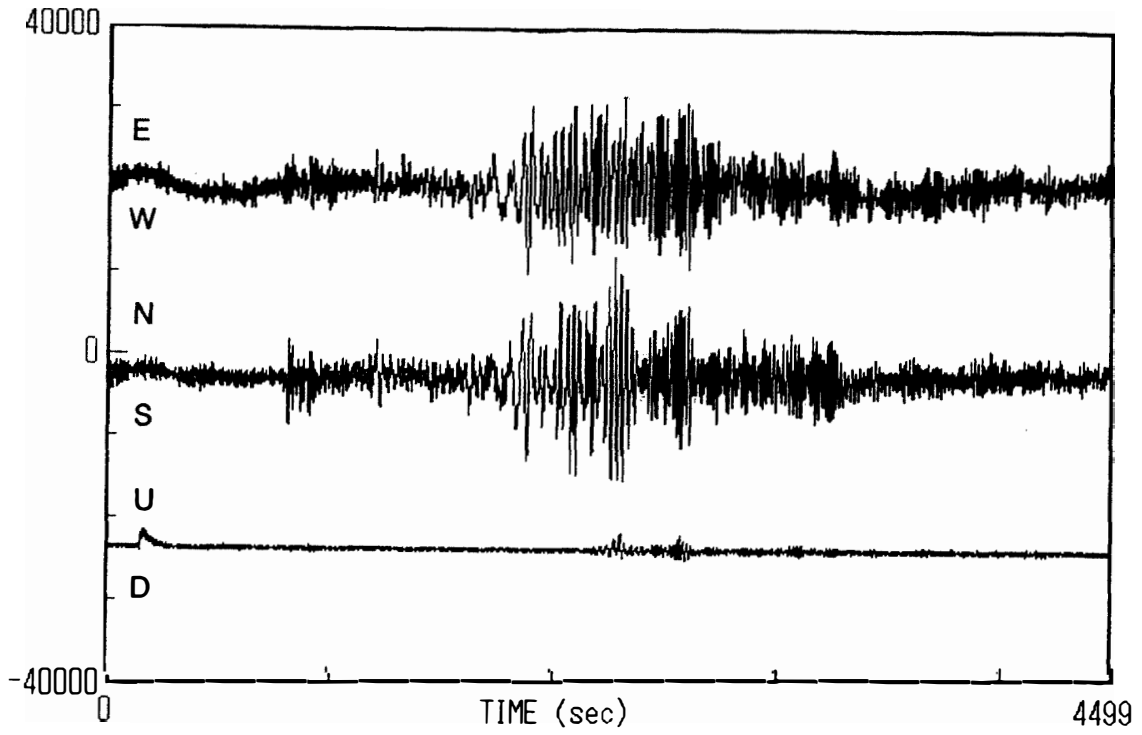
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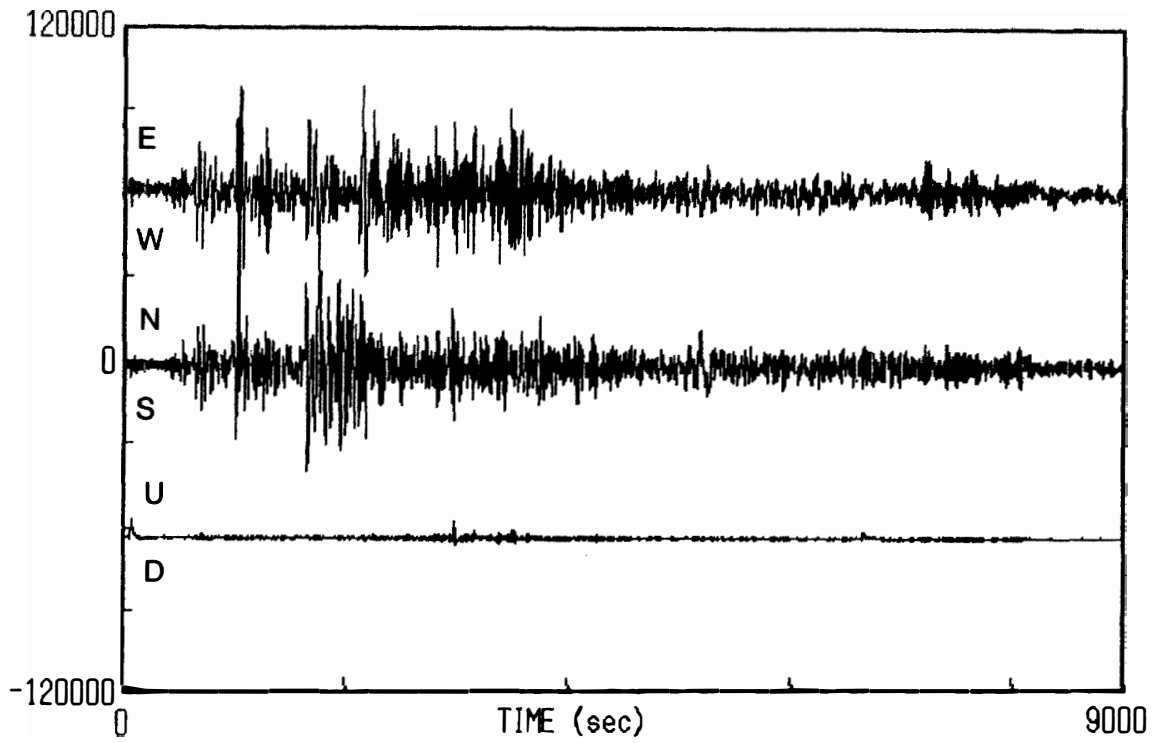
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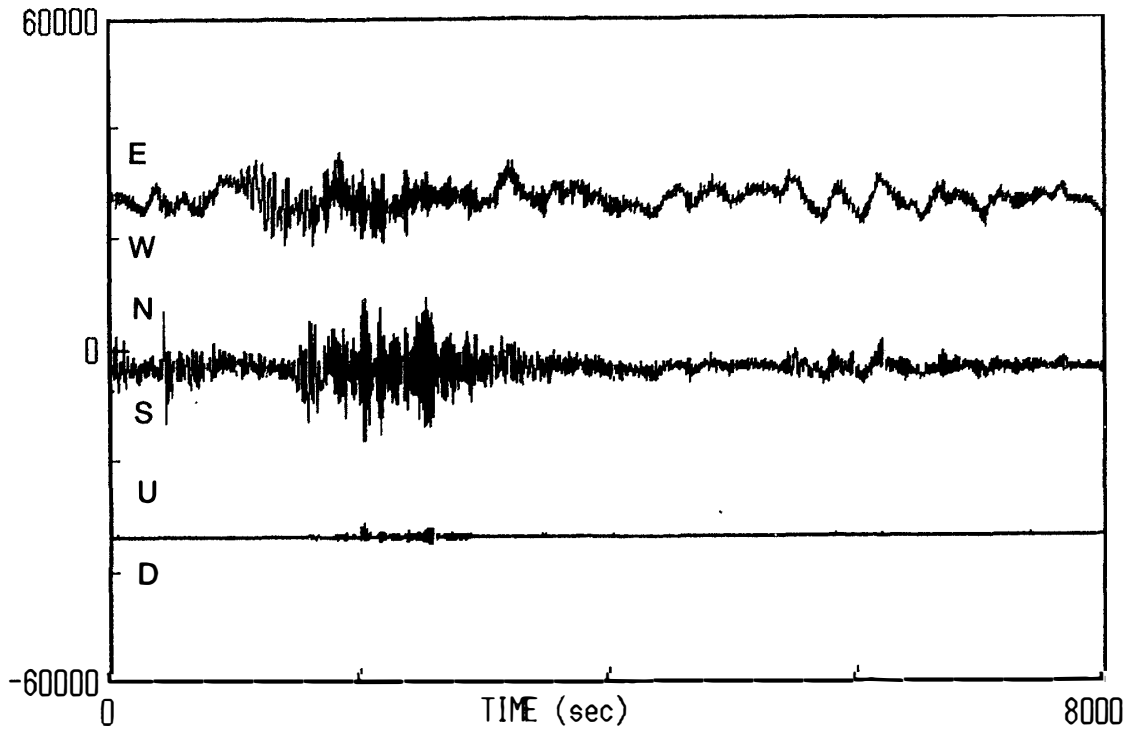
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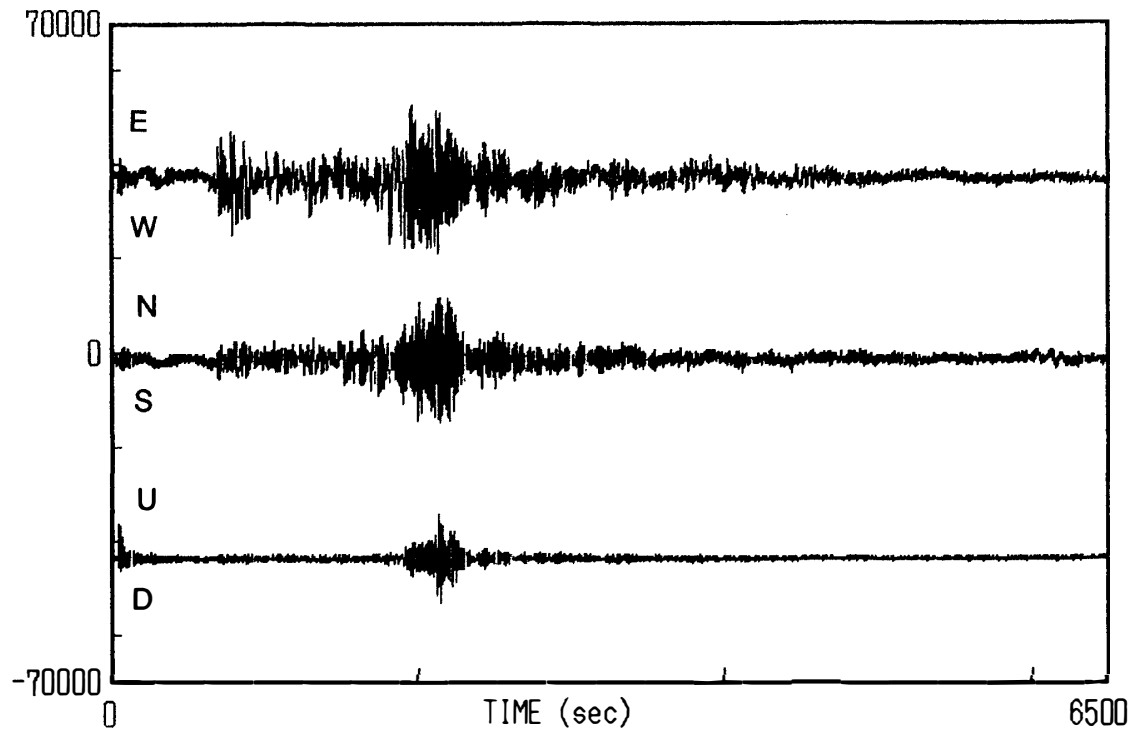
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#-100



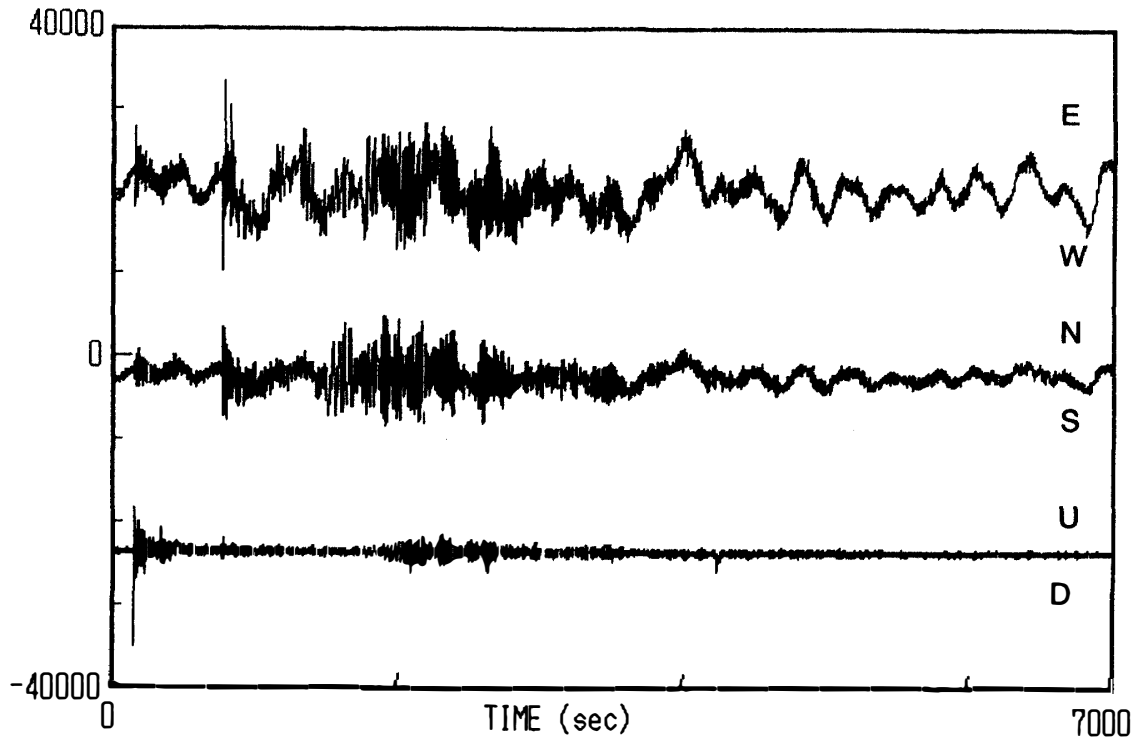
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#-118



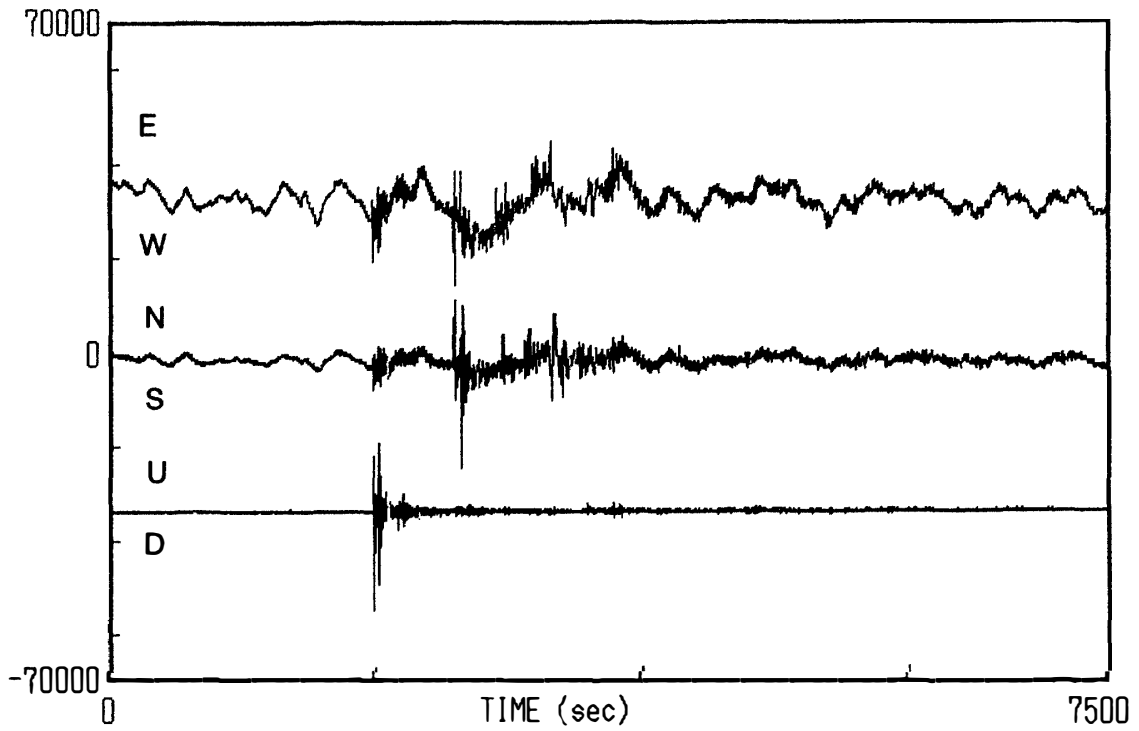
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#-125



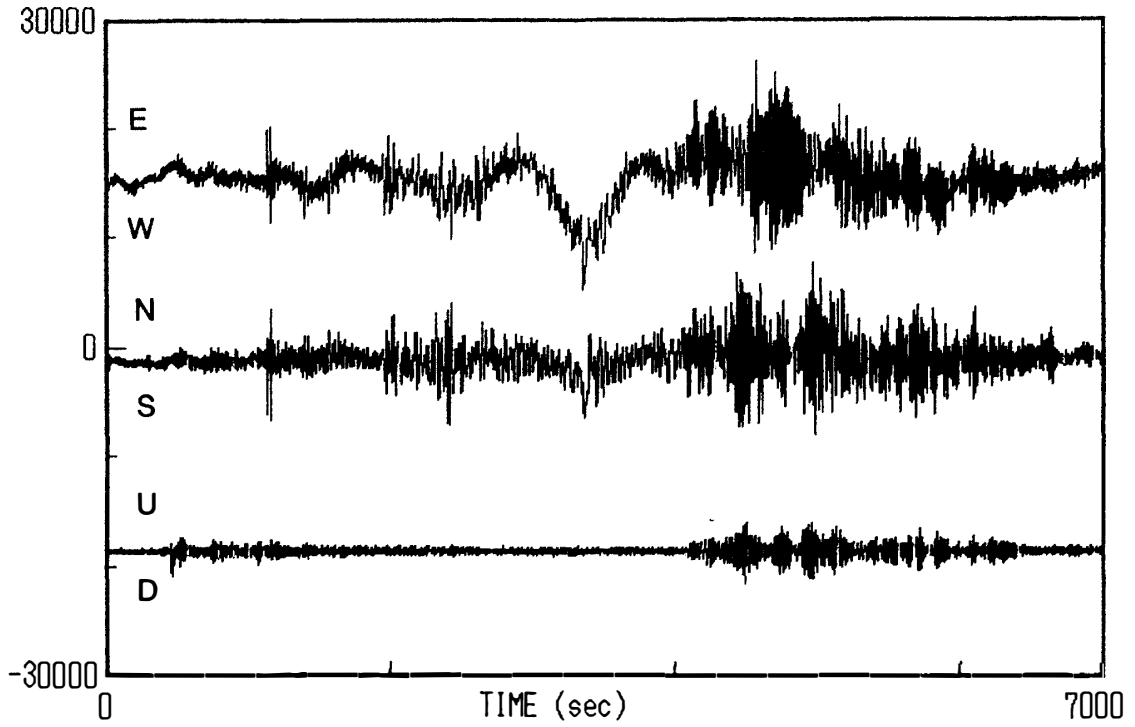
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#-130



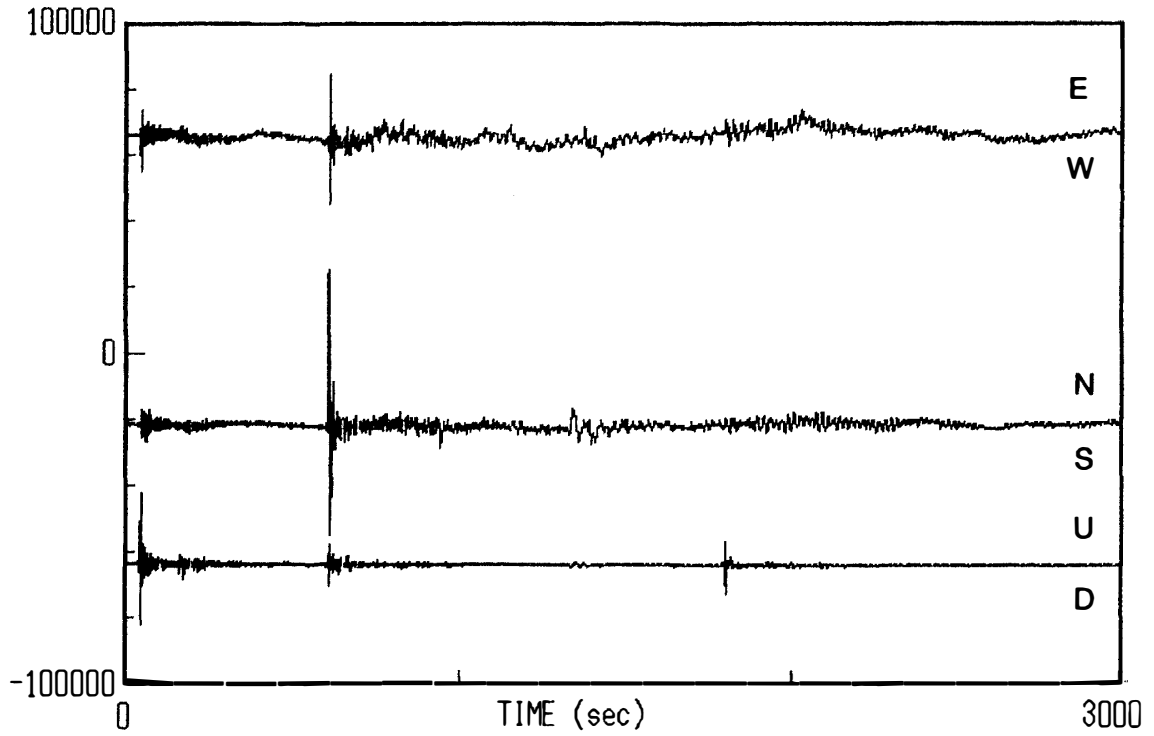
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#-133



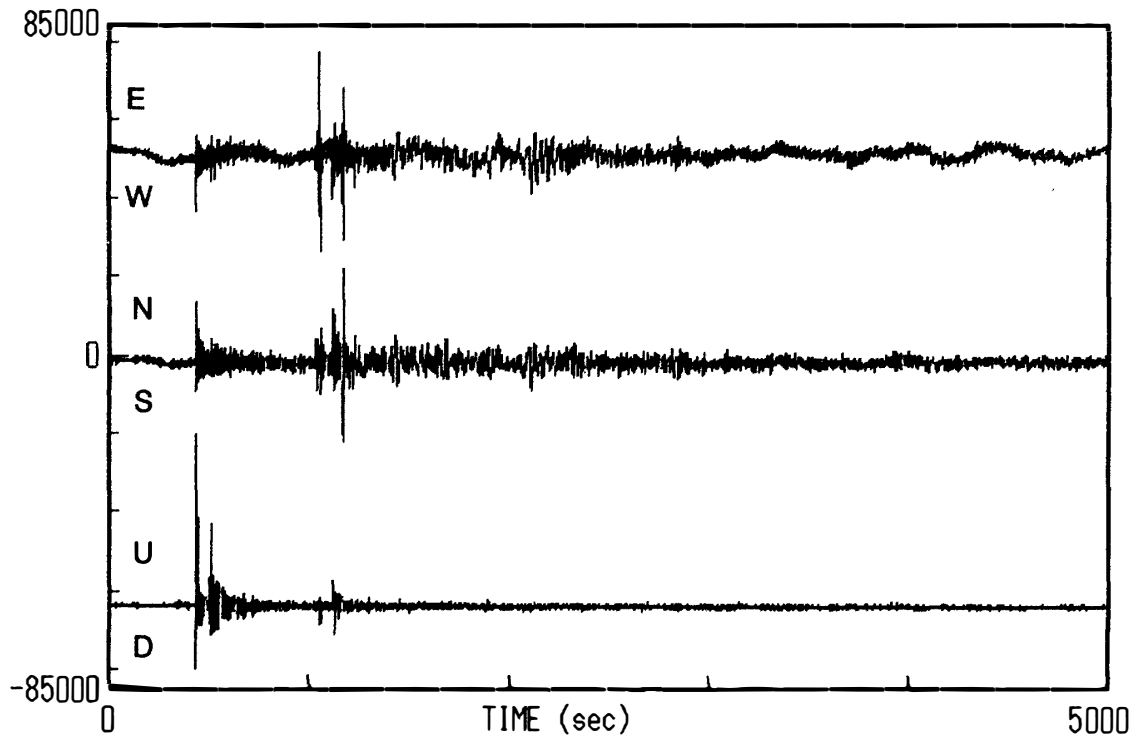
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#-142



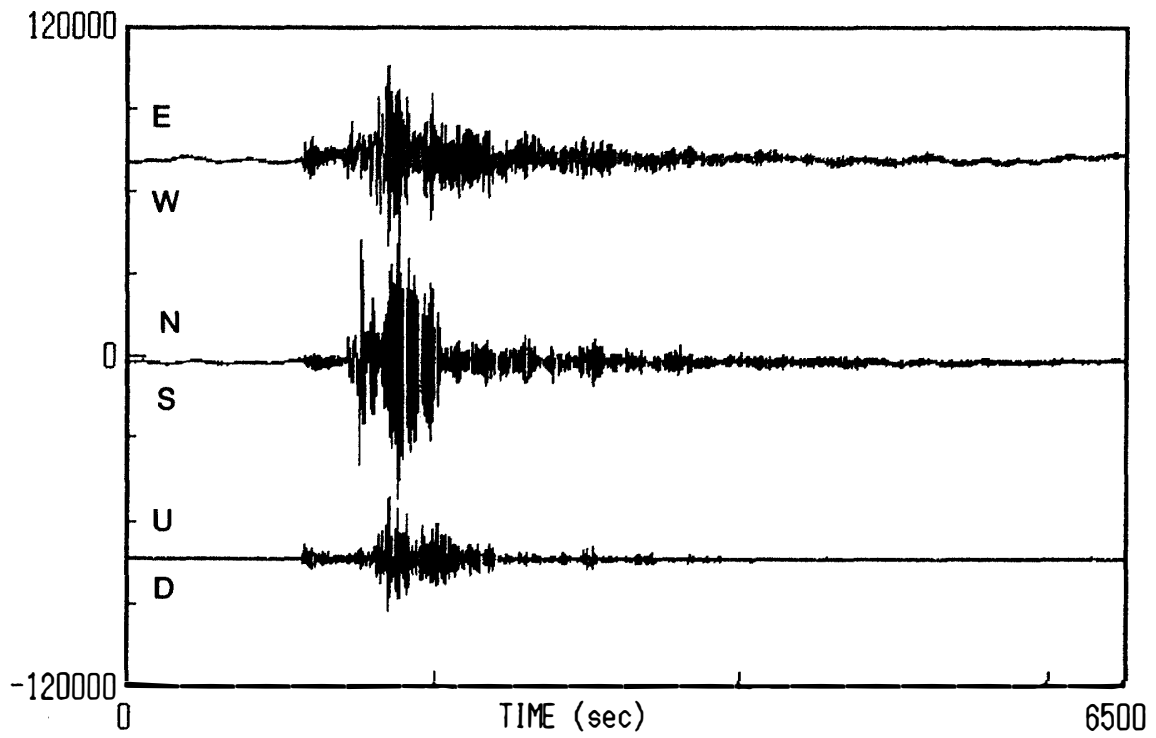
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#-143



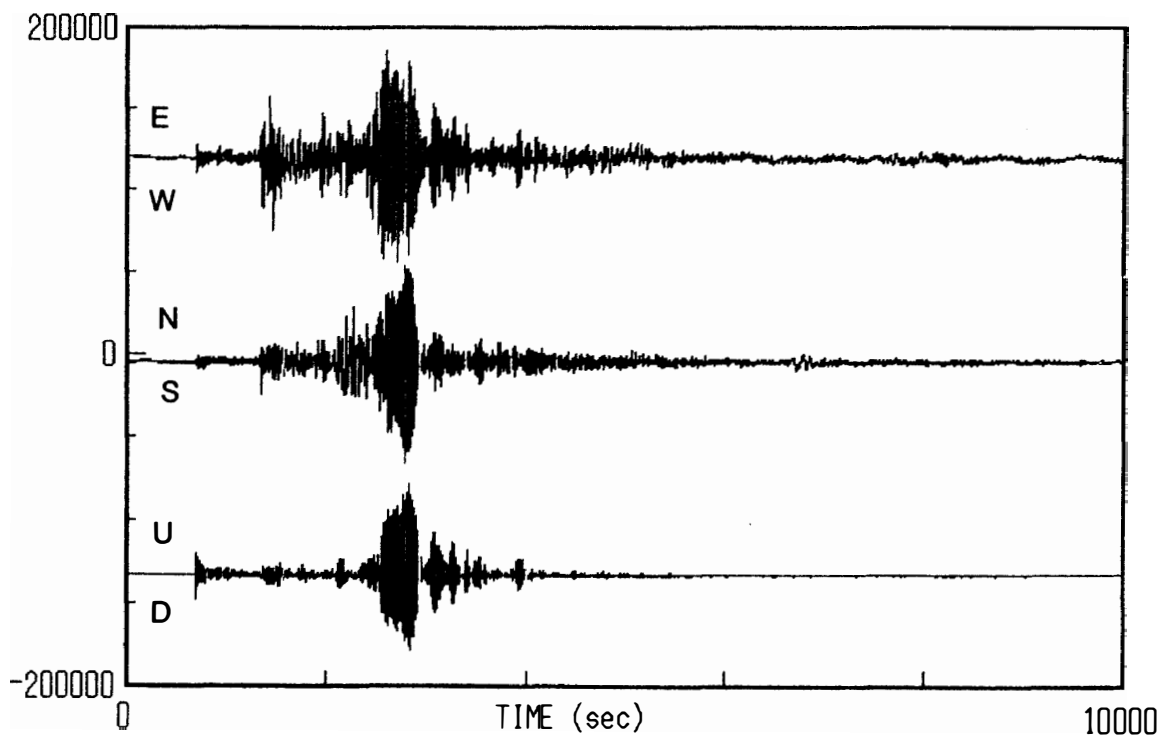
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#-147



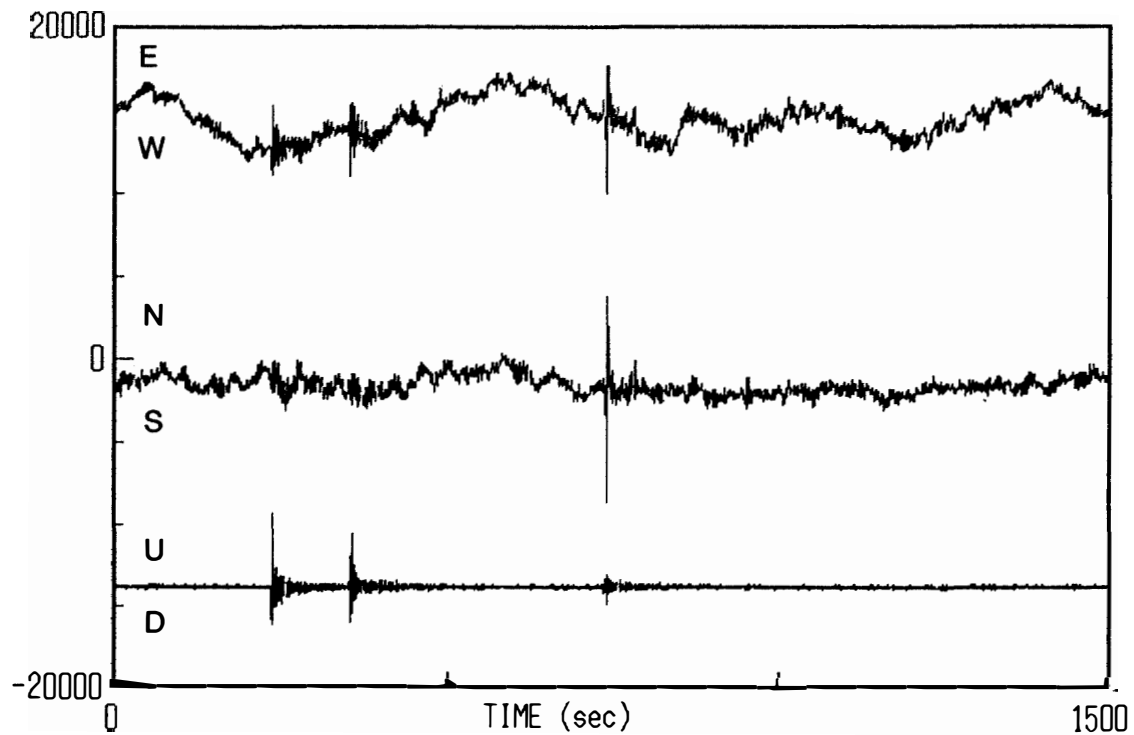
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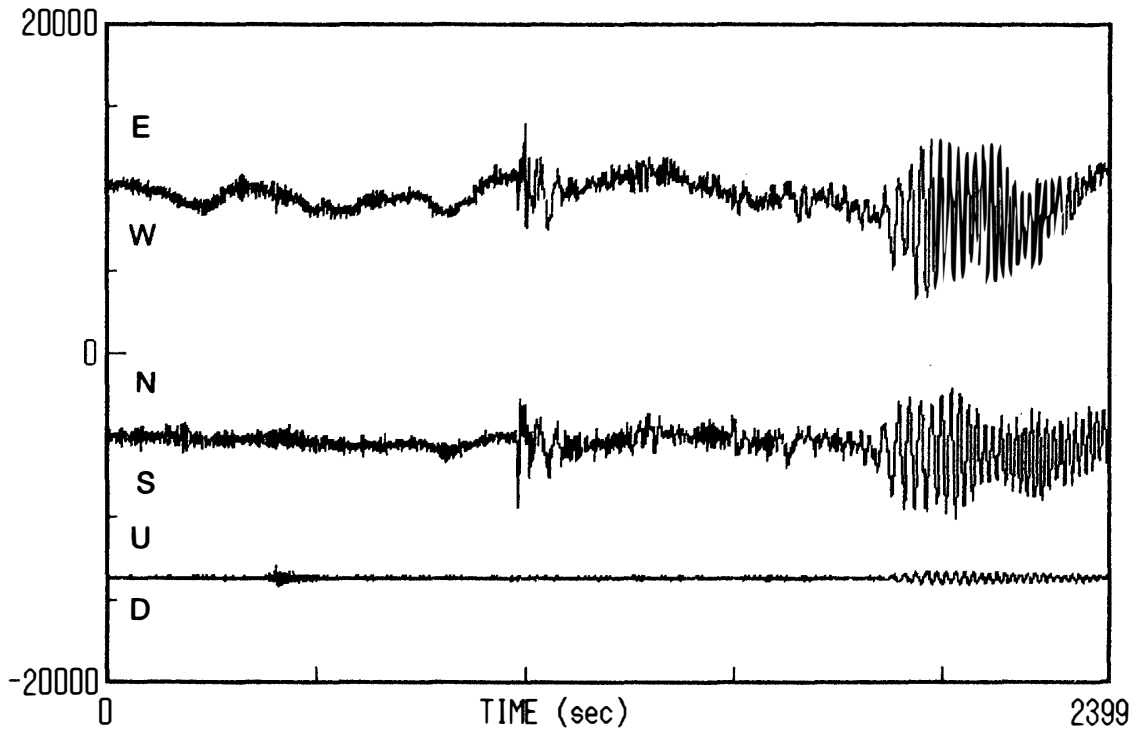
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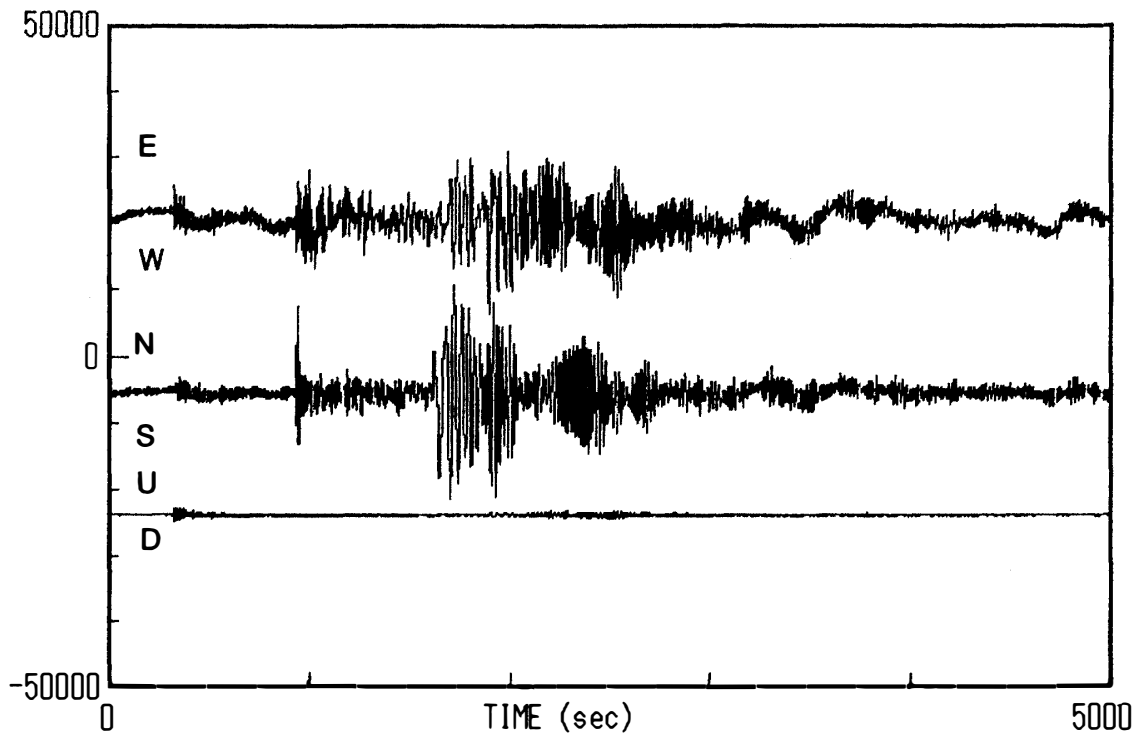
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#-160



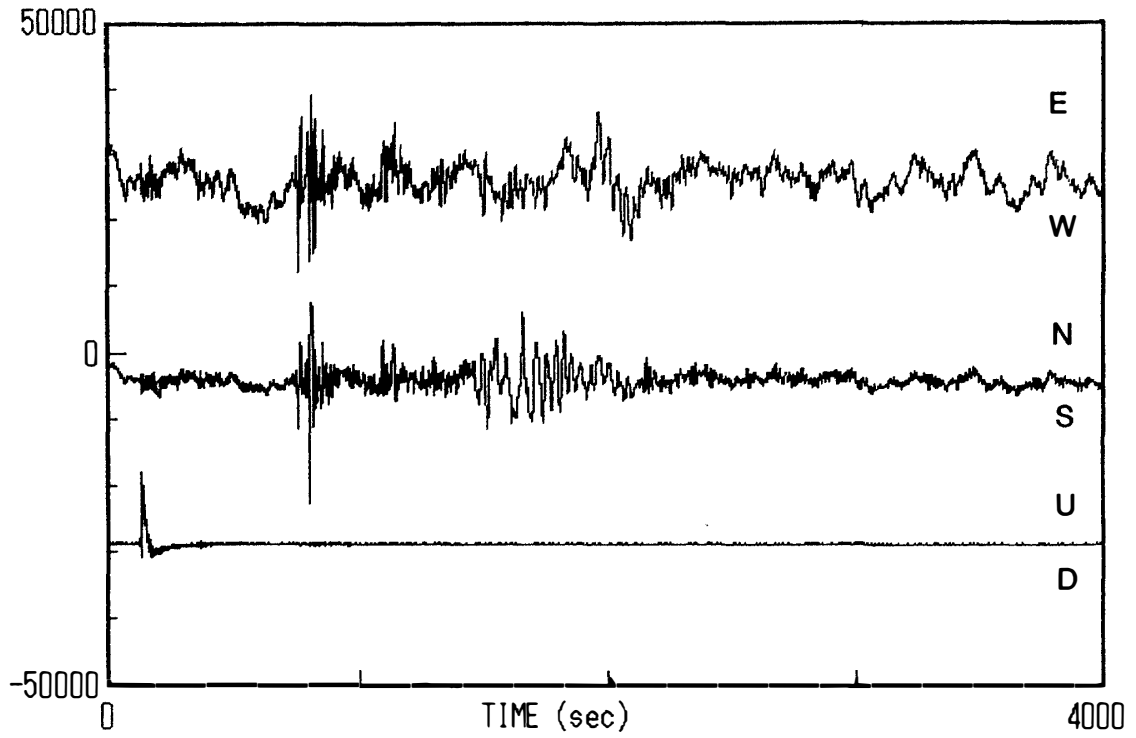
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#-166



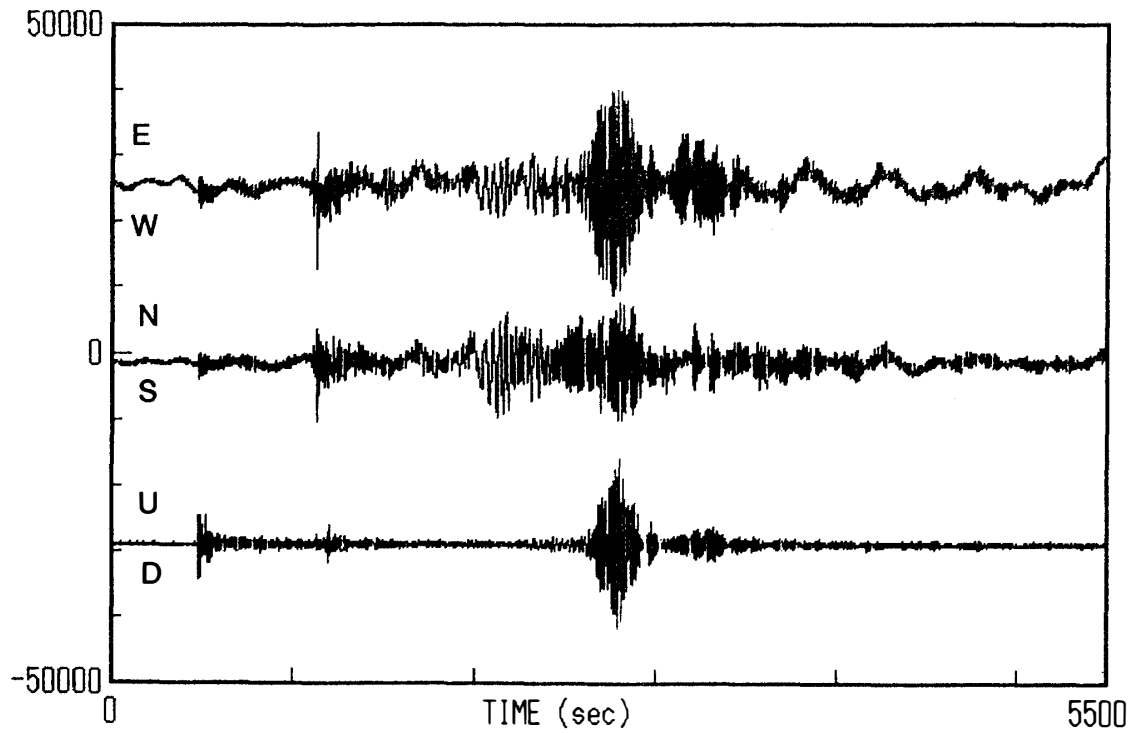
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#-170



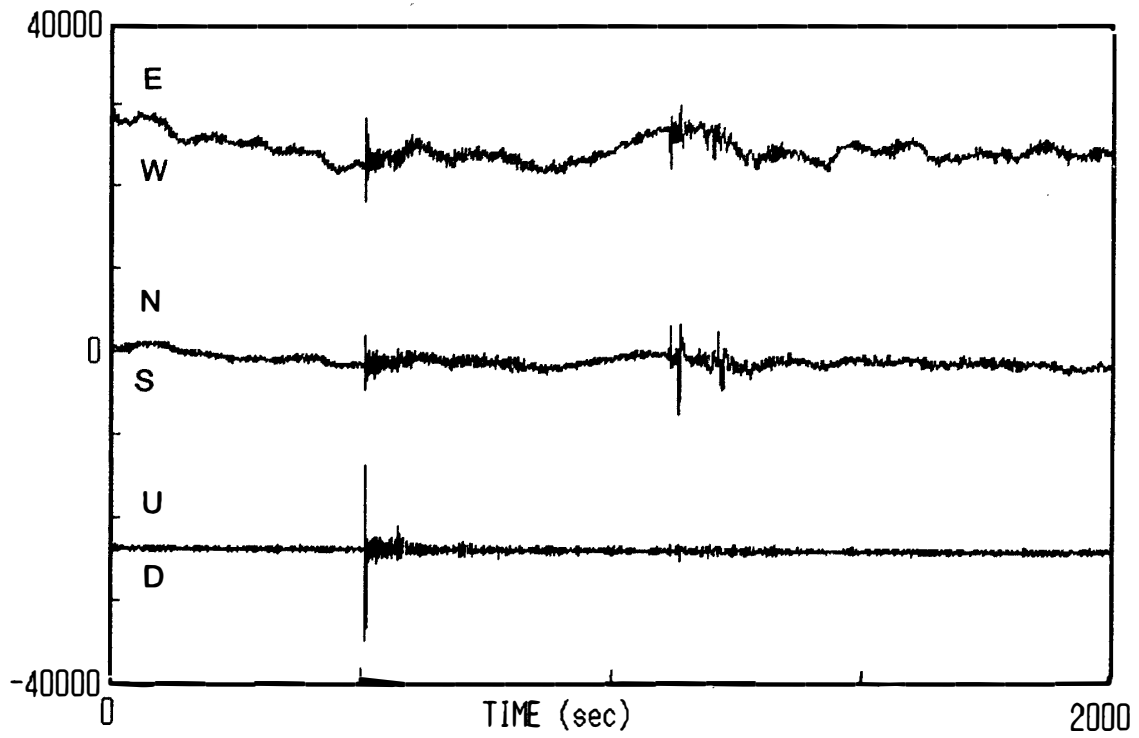
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#-211



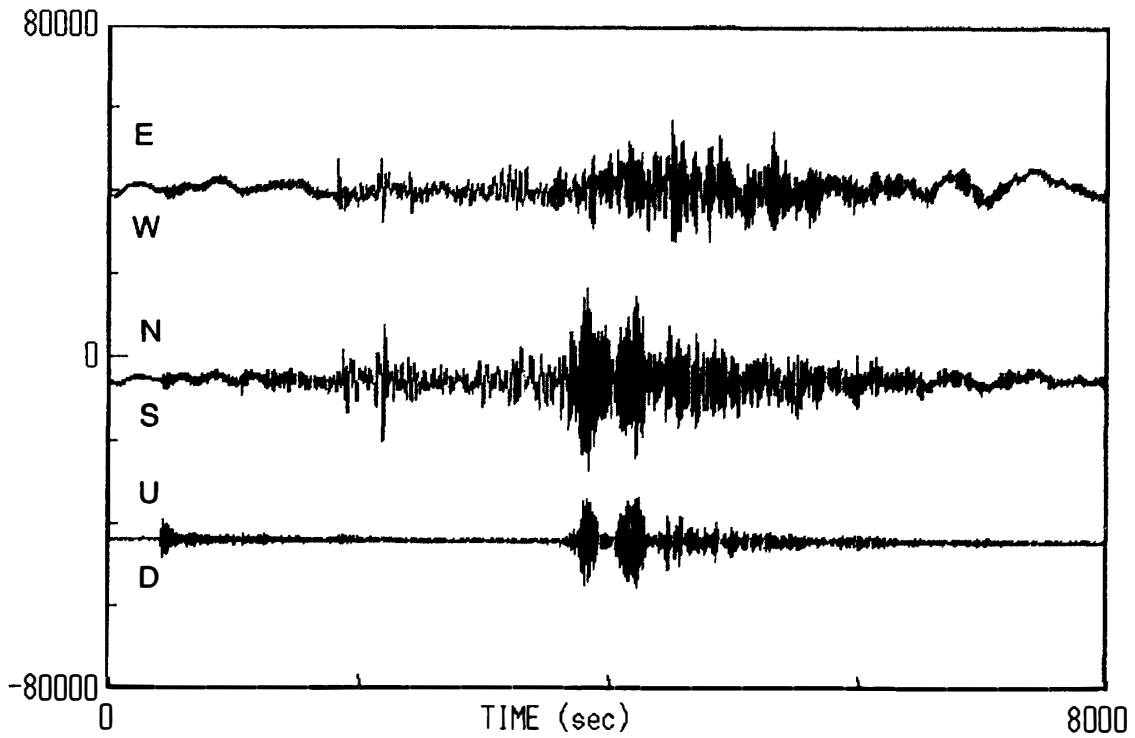
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#-217



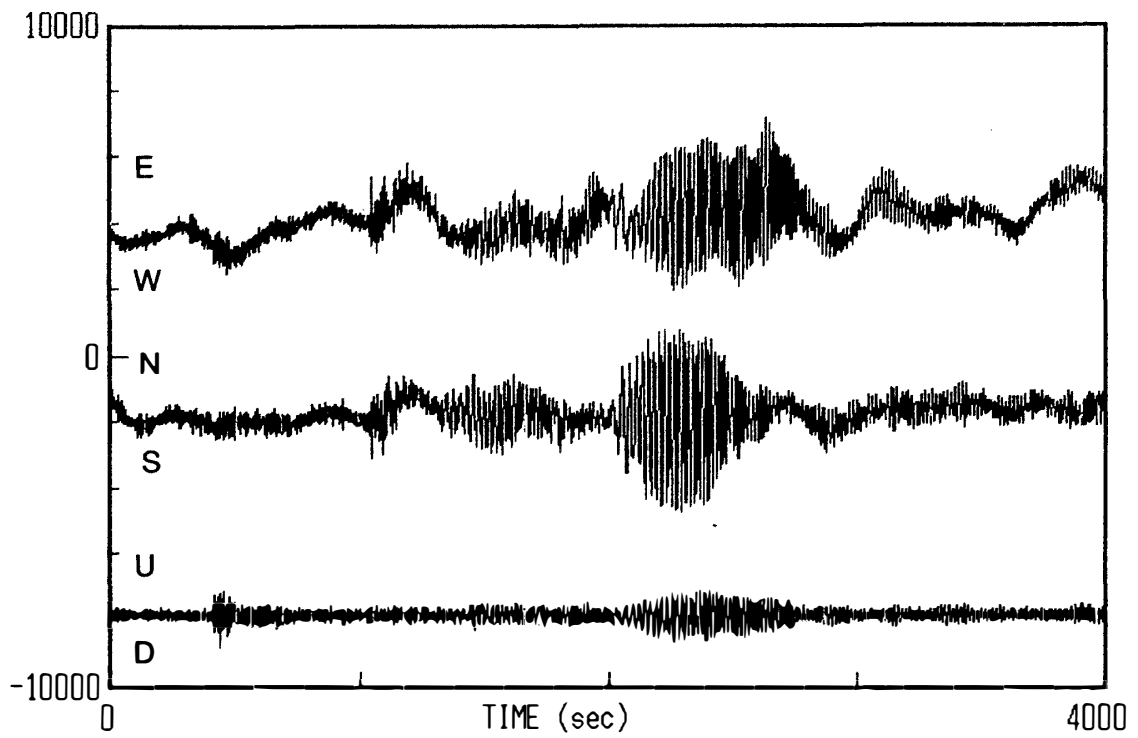
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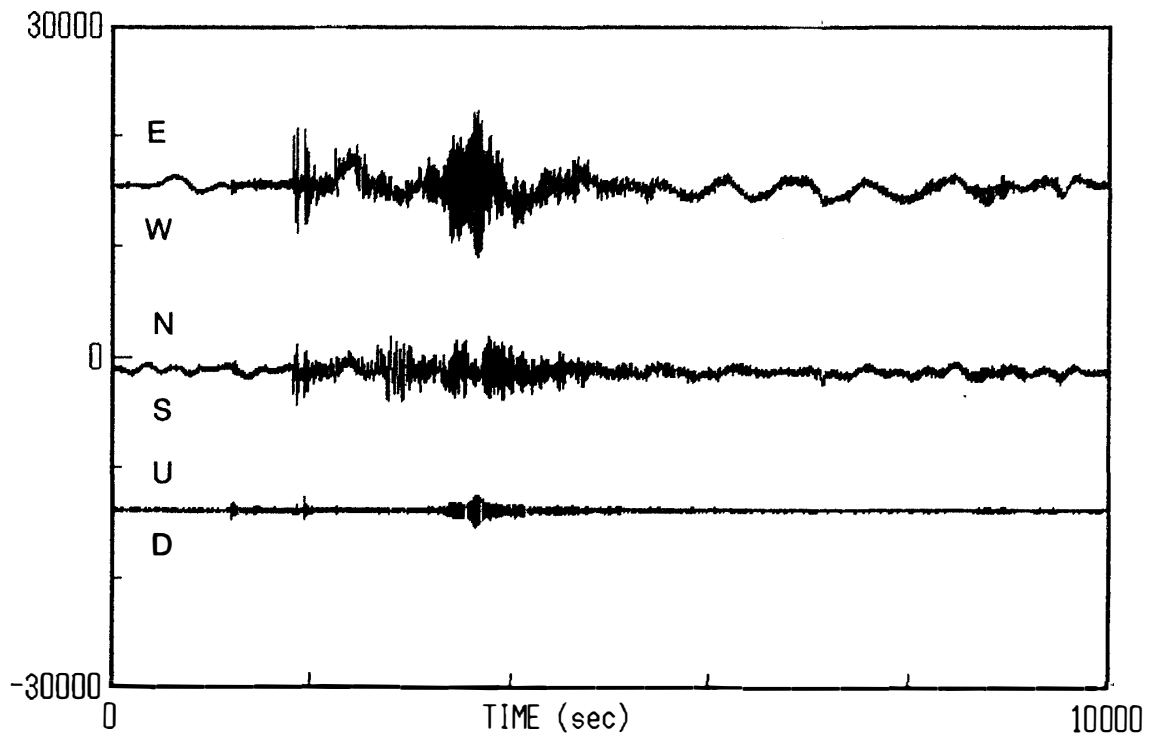
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#-235



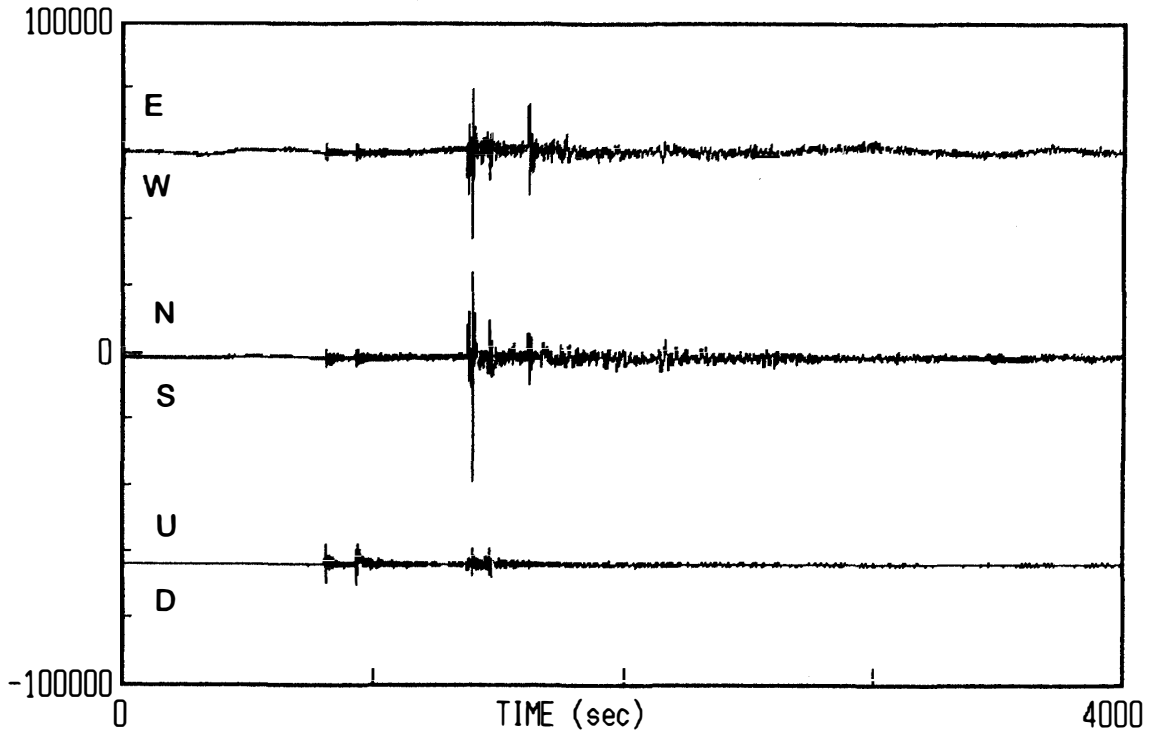
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#-273



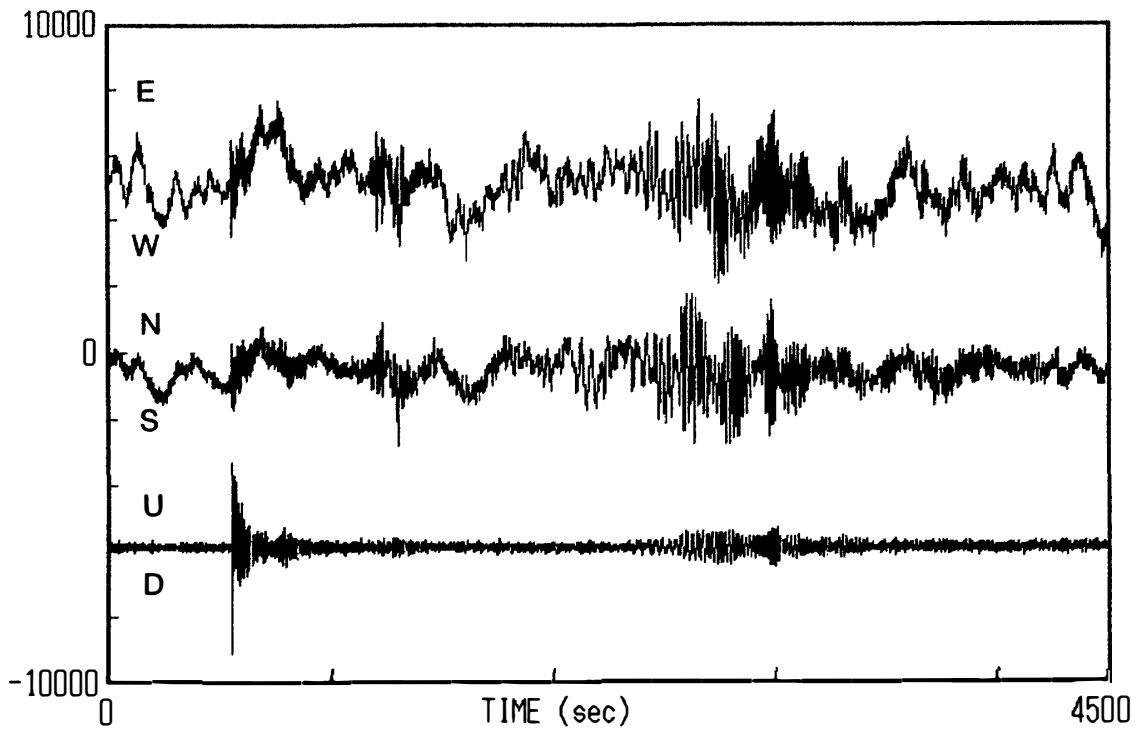
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#-275



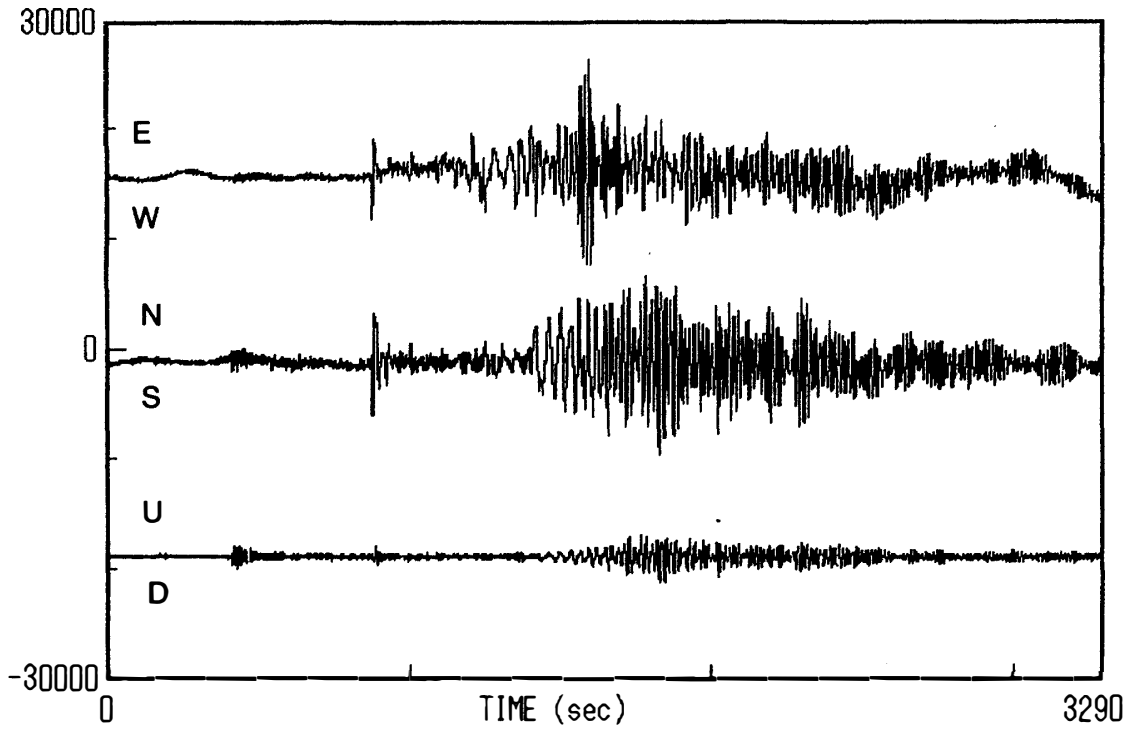
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#-297



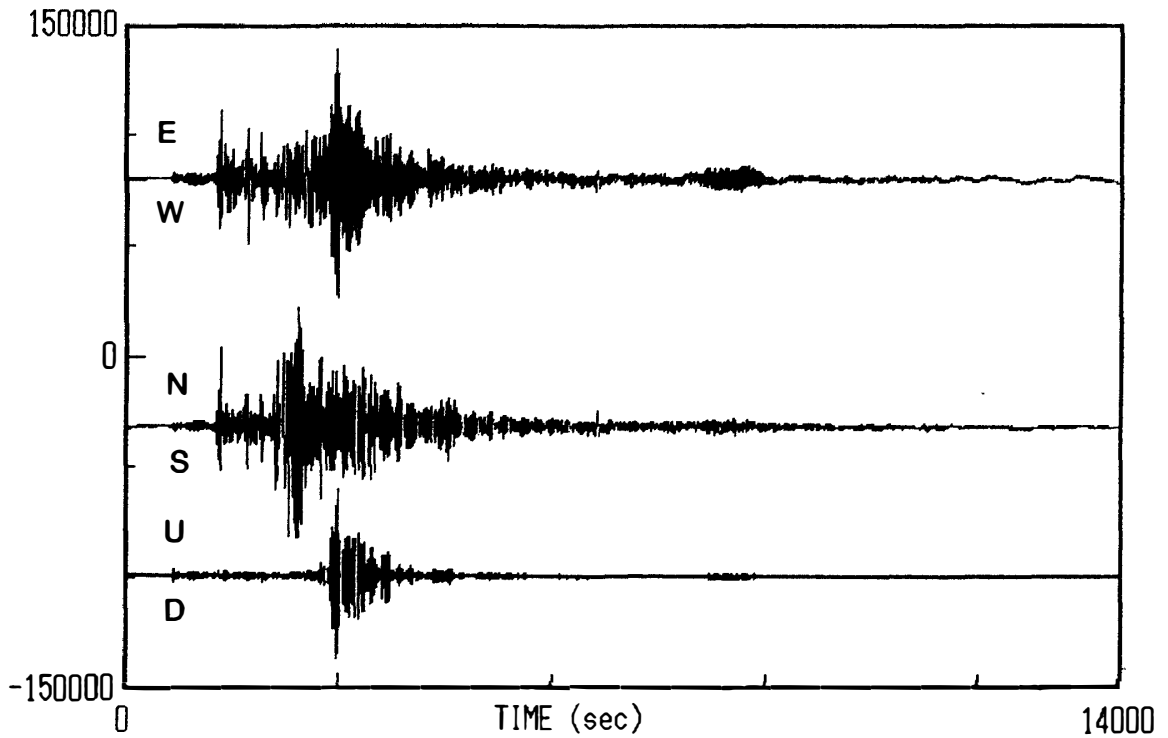
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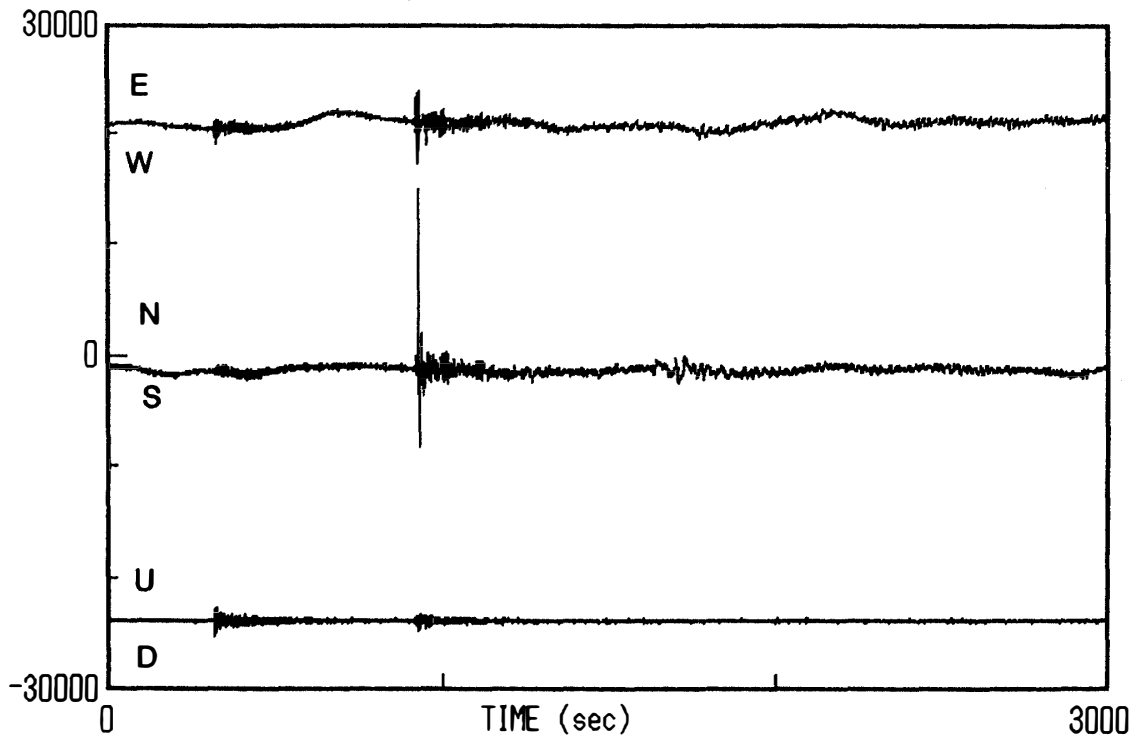
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#-300



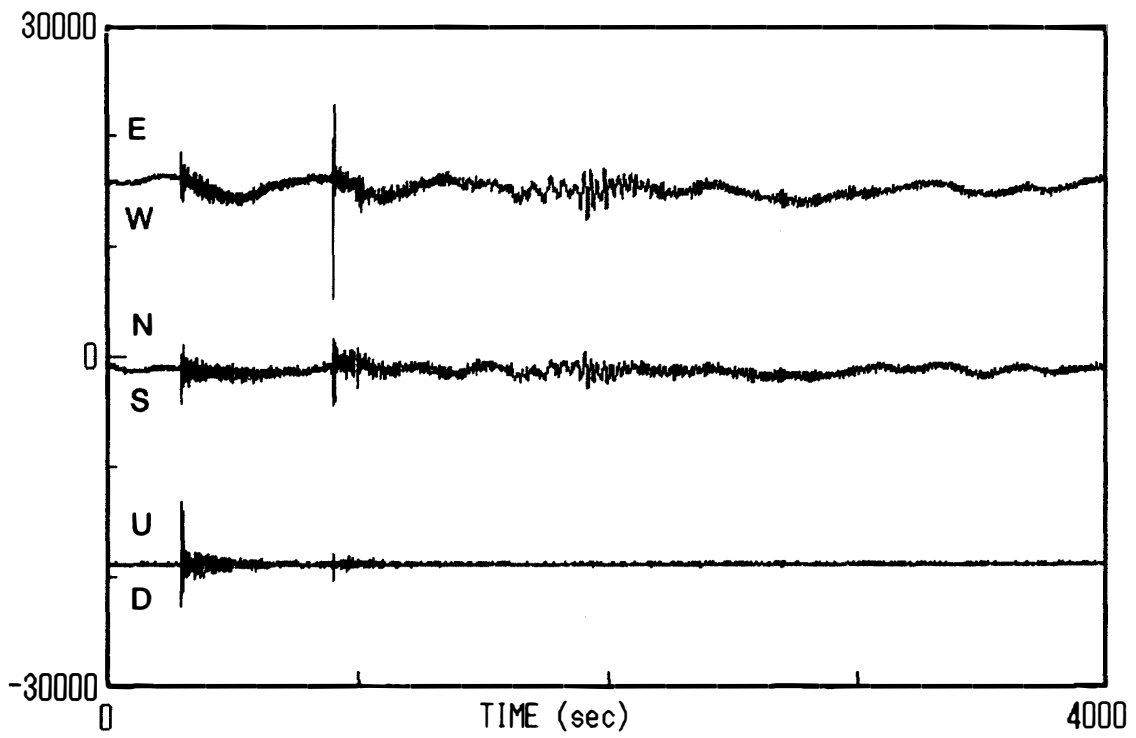
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#-302



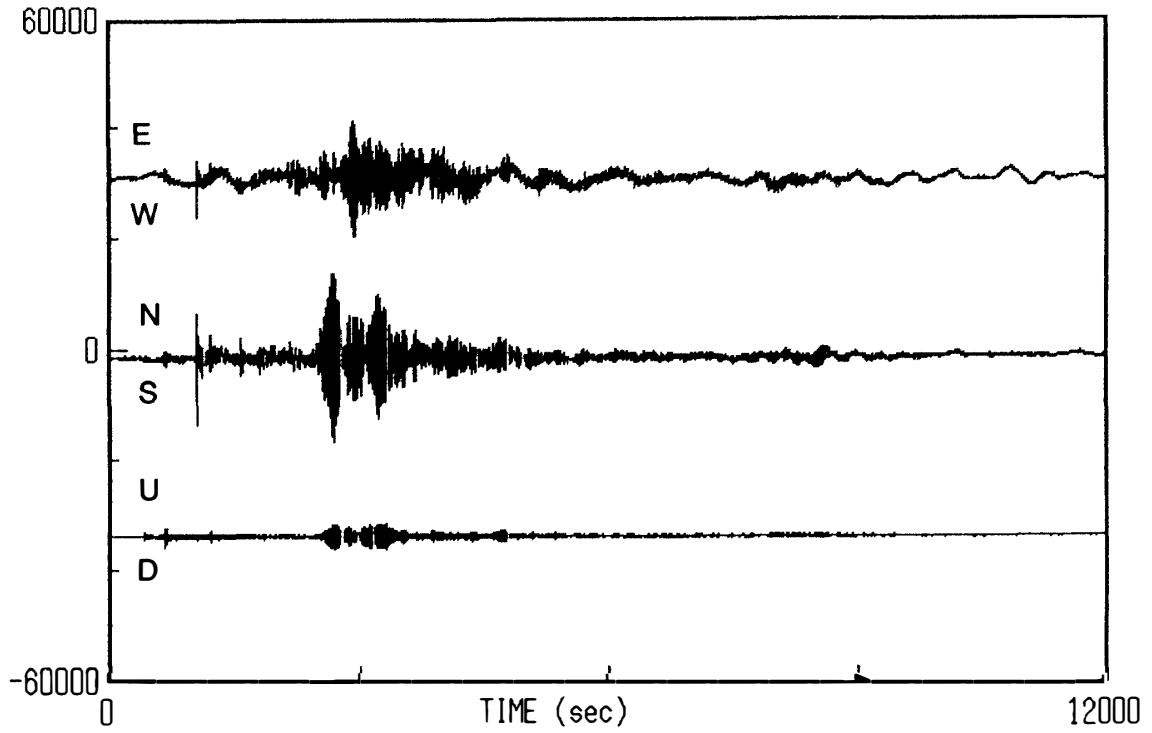
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#-309



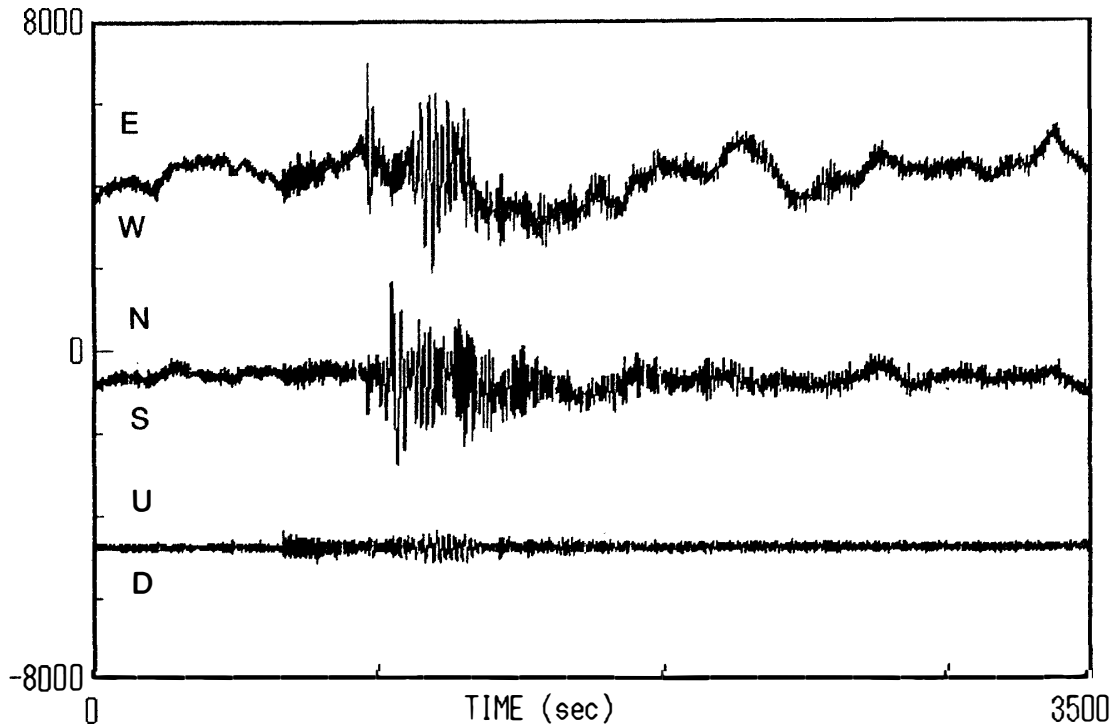
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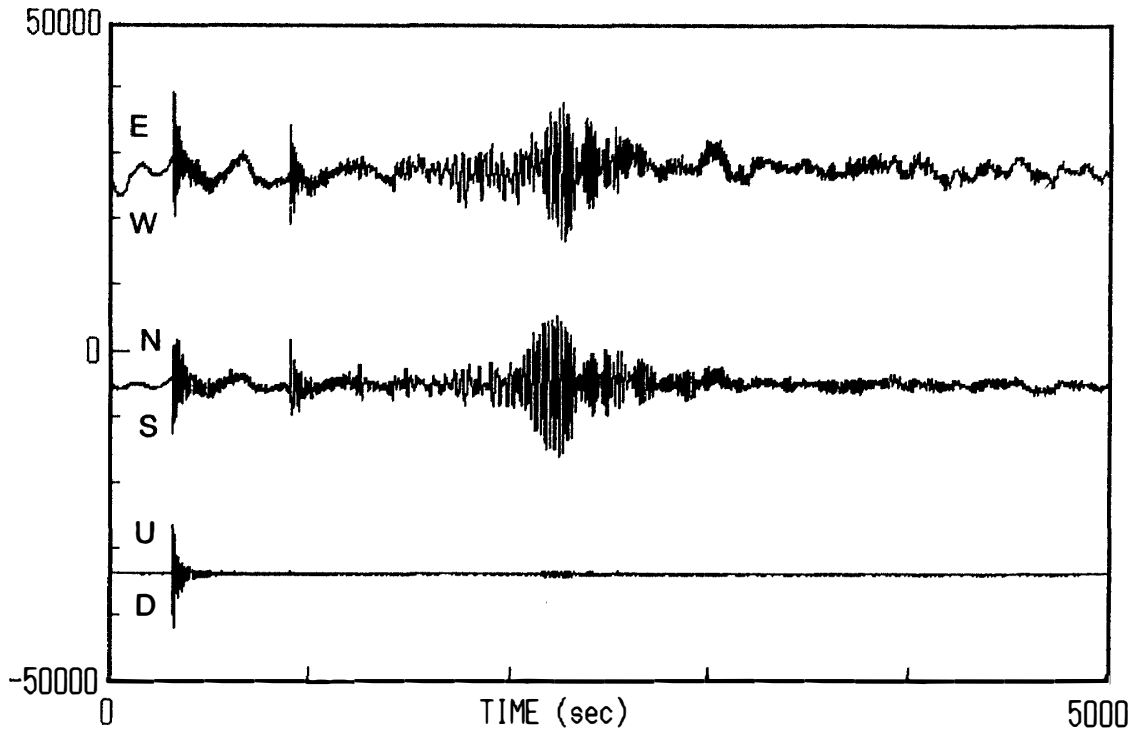
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#-324



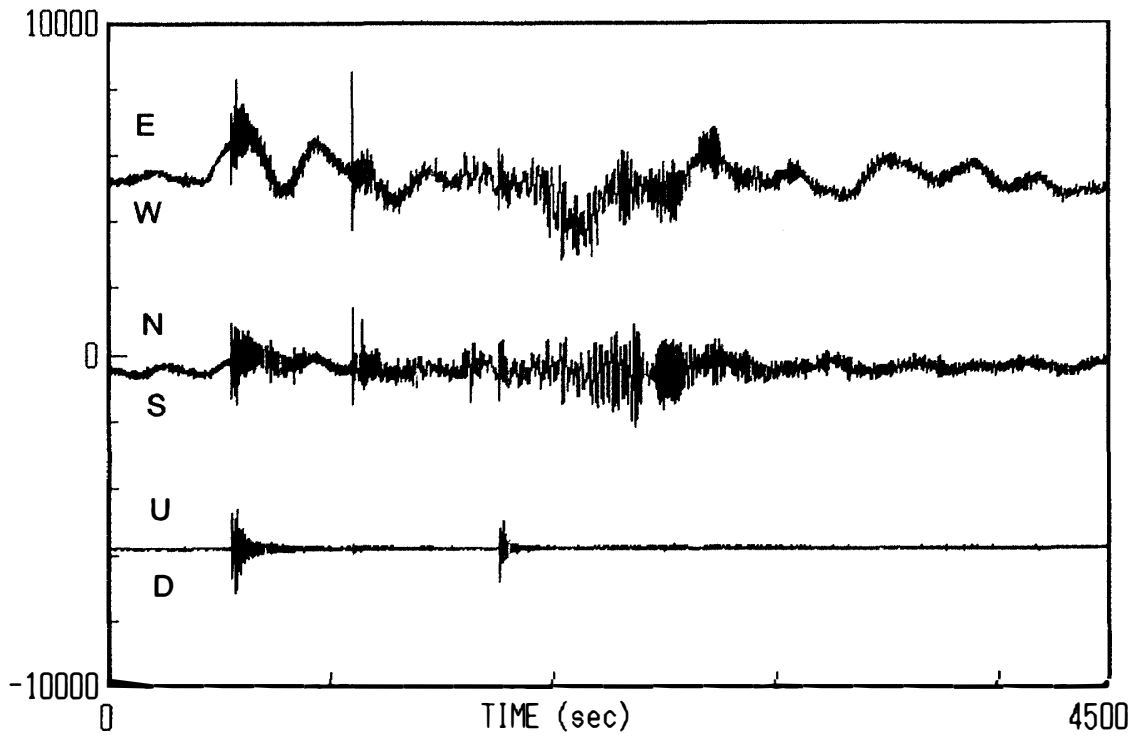
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#-330



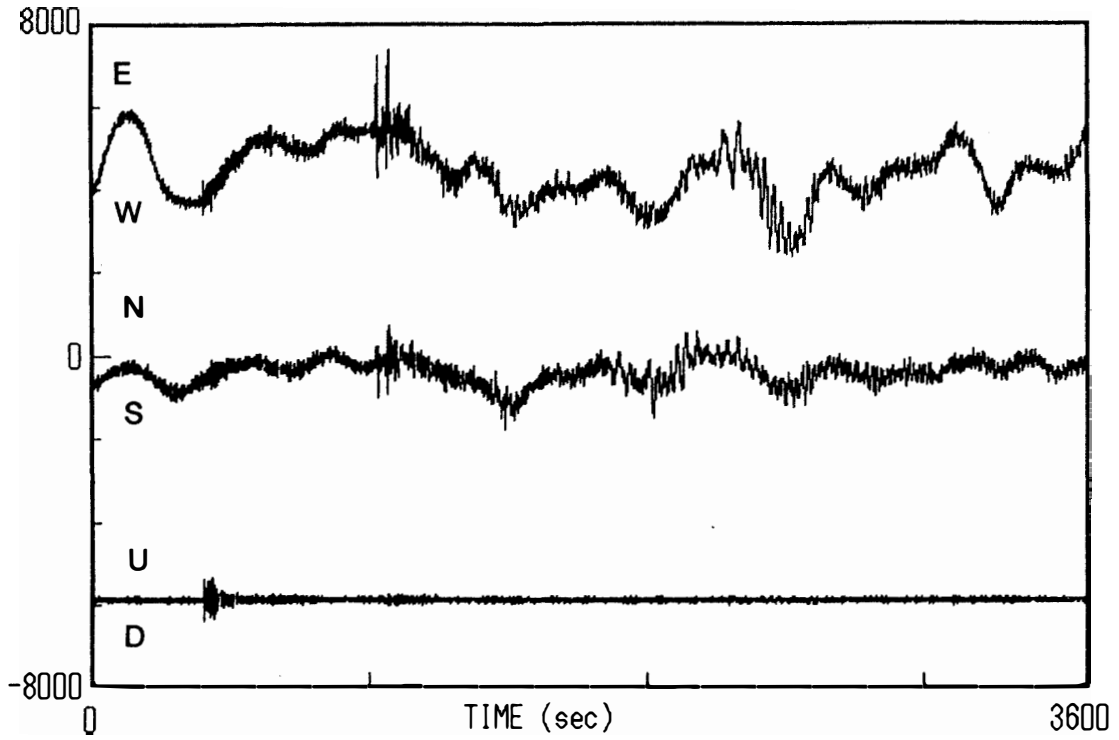
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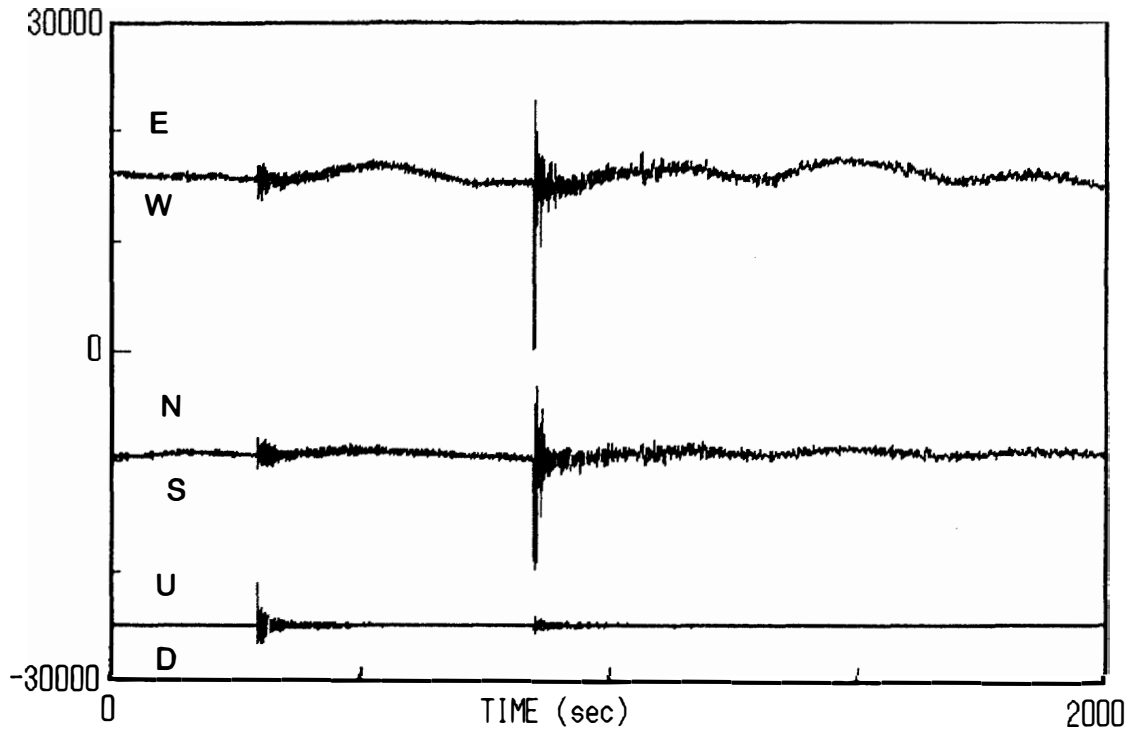
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#-362



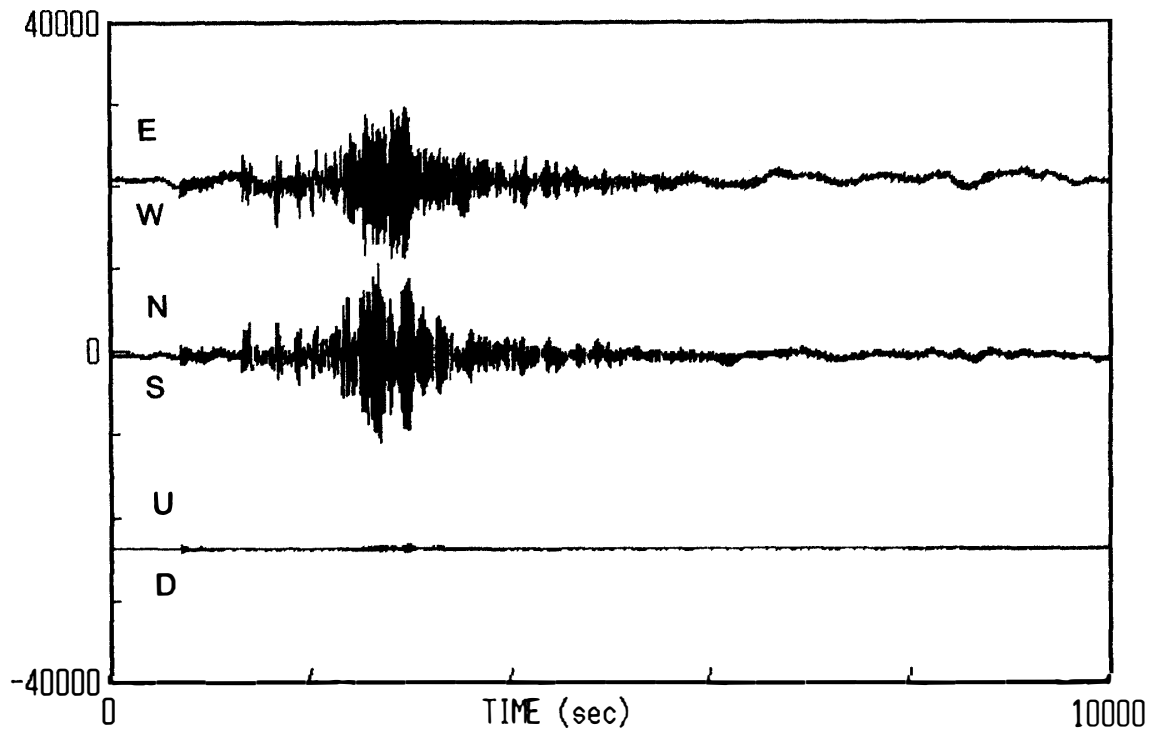
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#-374



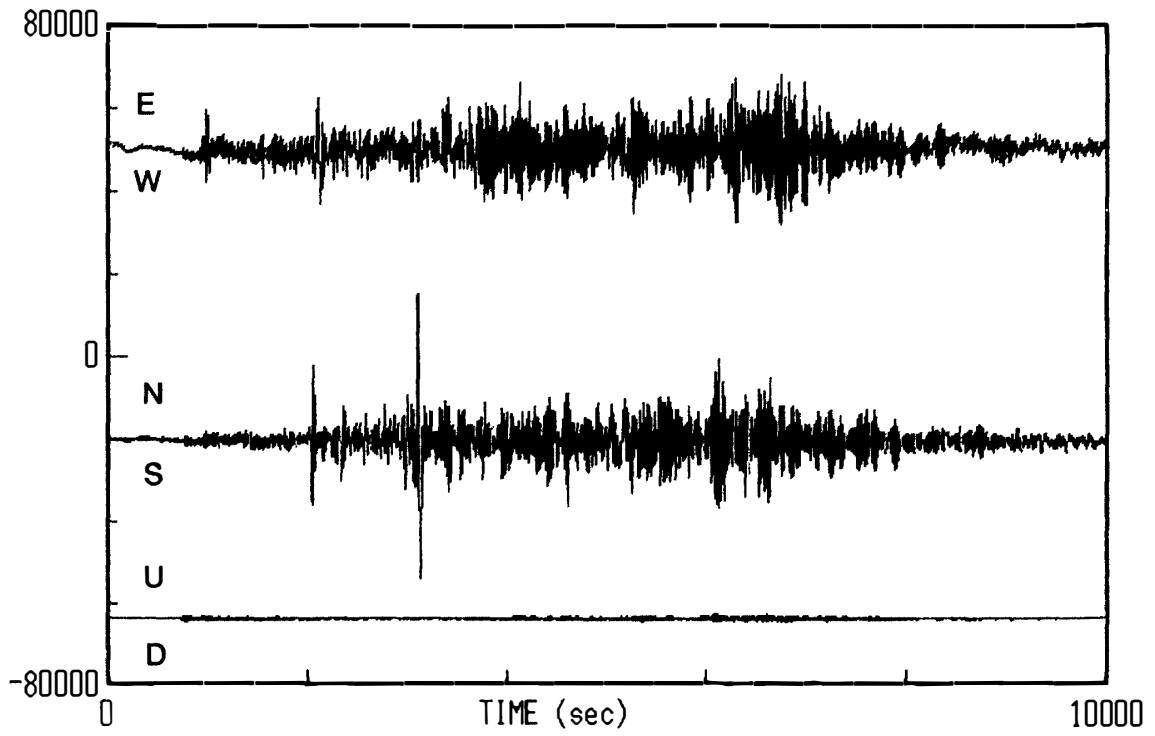
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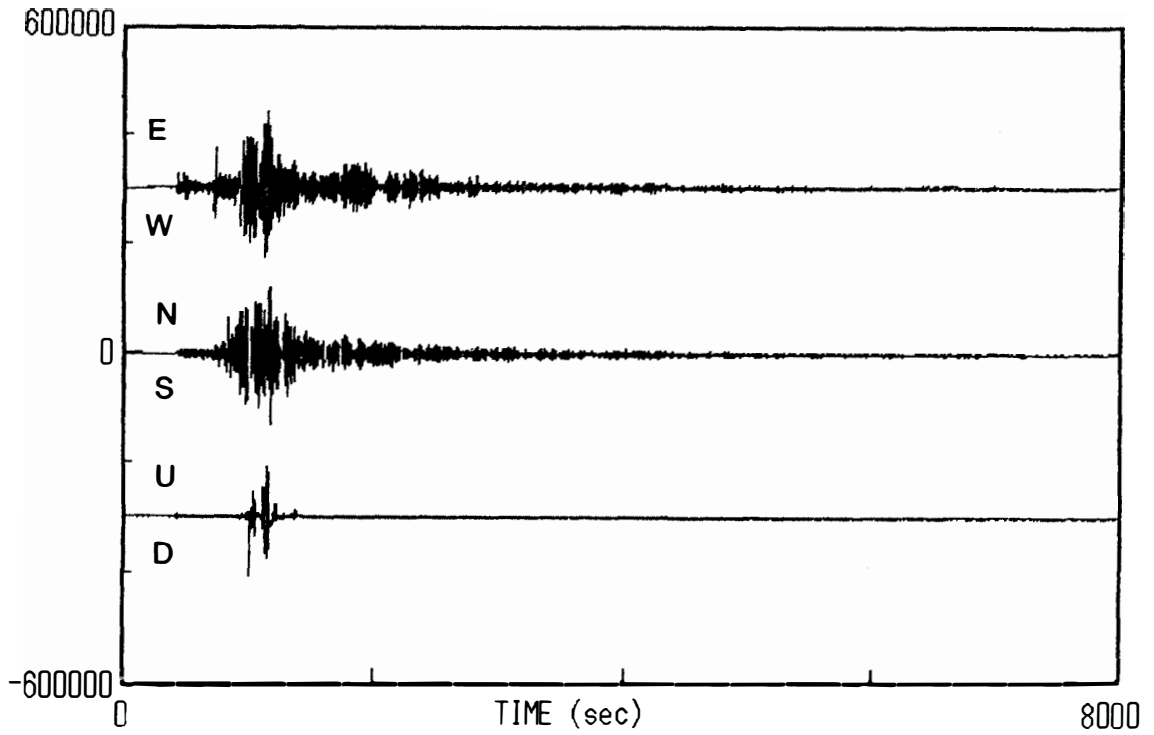
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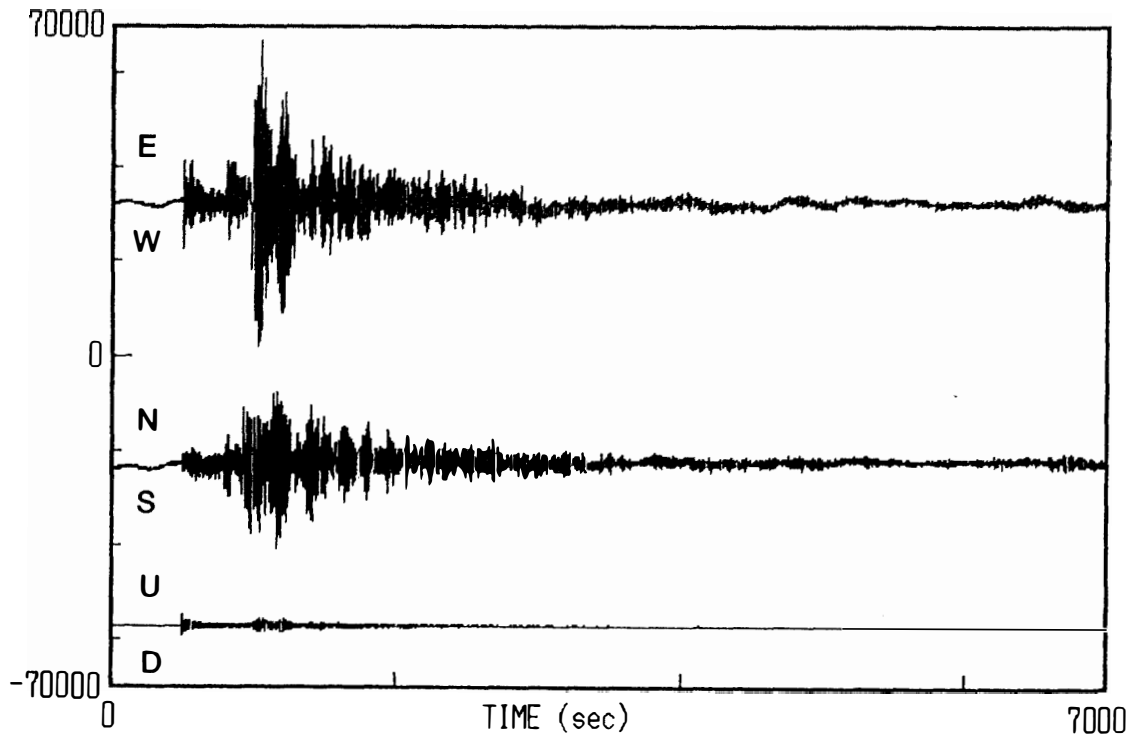
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#-402



DEC. 28 00h58m25.5s

#-404



DEC. 29 18h51m53.0s

#-408

