A Report on the

Seismic Activity at Lake Jocassee

Between June 1, 1976 and February 28, 1977

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I.1. INTRODUCTION

In the first phase of seismic studies at Lake Jocassee a seismic network using four to seven stations was deployed from November 1975 to June 30, '76. In the second phase the University of South Carolina maintained one station in the vicinity from July 1 - October 27, '76. In the third phase from October 28, '76 to present, we have reoccupied the area with a network of four to five stations. The results of the first phase were submitted to Duke Power Company by Law Engineering and Testing Co. The University of South Carolina's program at Lake Jocassee is geared toward earthquake prediction and is sponsored by the National Science Foundation and the United States Geological Survey. A preliminary report of our findings from October 1975 to May 1976 was made to the U. S. G. S. in August, 1976. A copy of that report was provided to the Duke Power Company in October 1976.

In order to obtain a continuity in coverage, in this report we present results of the data collected since June 1, 1976. The results are thus divided into three parts;

1. June 1976
2. July 1, '76 - October 27, '76
3. October 28, '76 - February 28, '77.

I.2. SEISMIC STATIONS DEPLOYMENT

Sprengnether's portable seismographs MEQ 800 were used. The sites occupied (since October 1975) are listed in Appendix I. In identifying the sites in later discussion and in tables, the location number (first column) is used.

I.3. DEFINING AN EVENT

While cataloging, an 'event' was counted if its duration was at least

2 seconds (M_L = -1.2), or if it was recorded on at least two stations. Events were located by using a computer program HYPO71 (Lee and Lahr, 1972) and velocity model developed for the Clark Hill reservoir area (Appendix II). The location accuracy is about $\pm$ 200m while the depths are usually good to $\pm$ 400m.

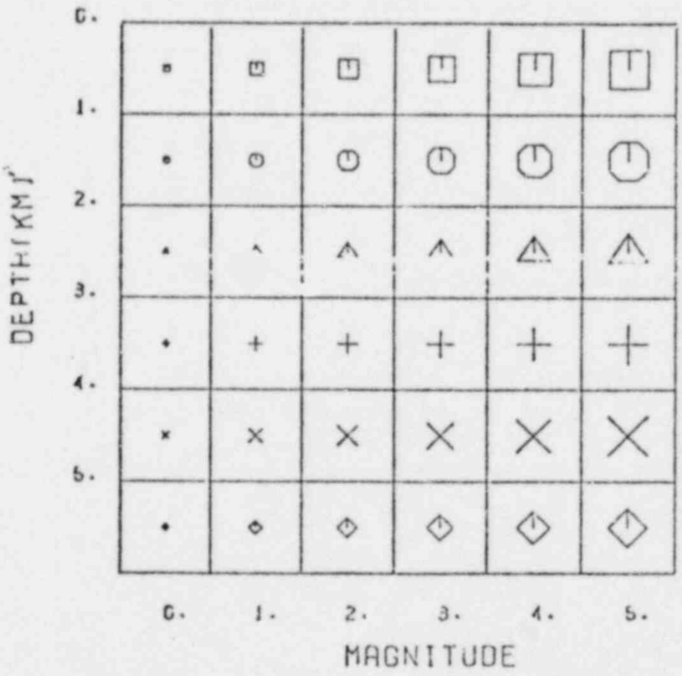
II. RESULTS

II.1. JUNE 1976

In June 1976 seven locations were occupied by seismographs - though at any time only four to six instruments were used. A total of 122 events were recorded (Appendix III) of which 46 were located (Fig. 1). Compared to earlier months the seismic activity spread further to the northwest and south and southwest. There were 6 events with $M_L \geqslant 1$, including felt events on June 2, 11 and 12. Another feature of the activity was generally deeper hypocenters, six events with depths greater than 3 km were recorded. One event (M_L = 1.6) recorded on June 22 at 06.36 (UCT) occurred far to the south of Lake Jocassee and is not shown on Fig. 1. Its epicenter was located within about 5 km from Keowee Dam. We could not ascertain if any blasting operations were underway at that time at that location.

II.2. JULY 1, 1976 - OCTOBER 27, 1976

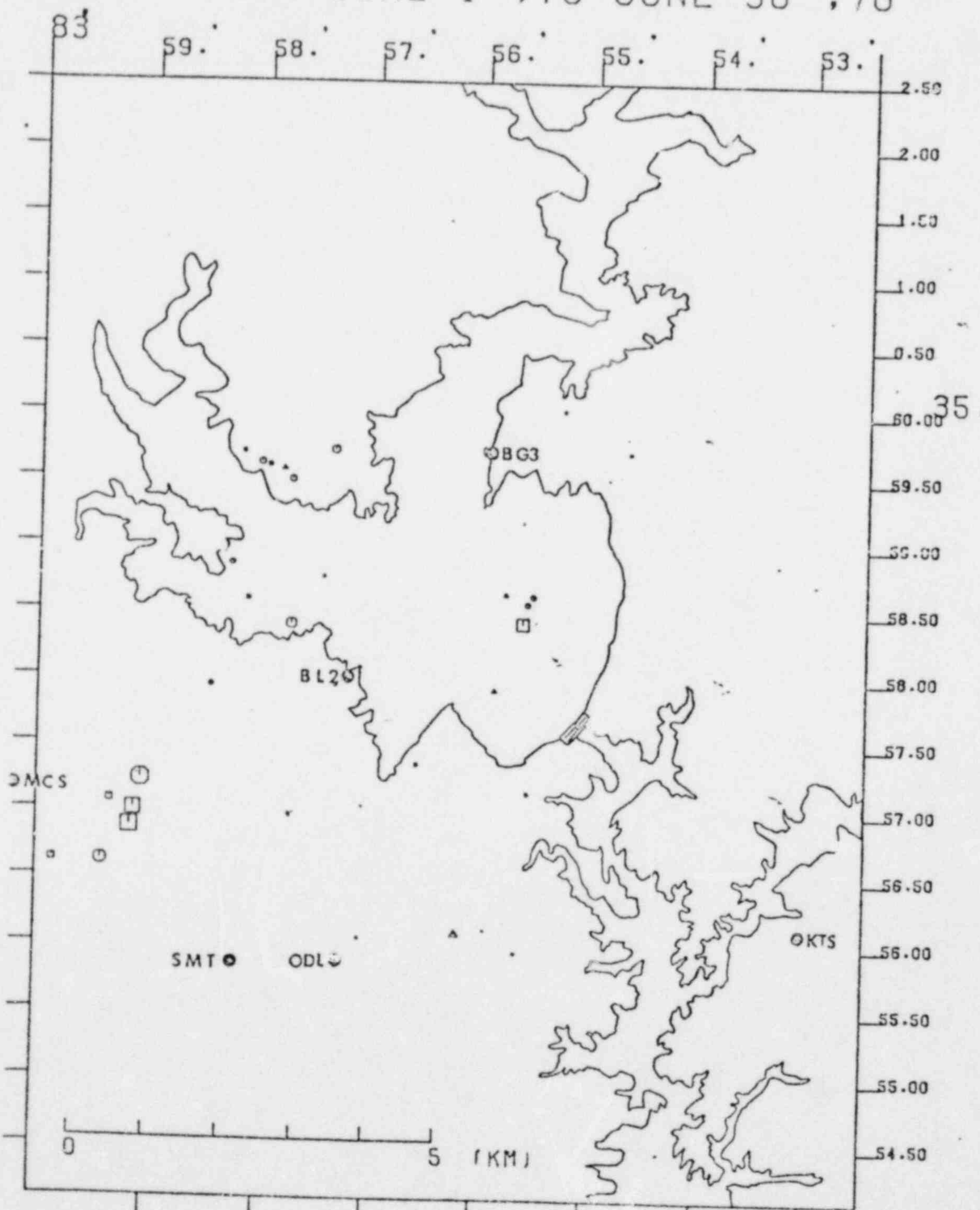
In this time period we maintained only one seismograph at SMT. This location was used as it was selected as the site for the permanent station that is planned to be installed. Data were not obtained for nine days due to malfunction of instruments and other logistical problems. Of the 100 events recorded - (an average of almost one per day), 88 appear to have occurred in the vicinity of Lake Jocassee (S-P $\leqslant$ 1 sec). (See also Table 1). Only three local events with $M_L \geqslant 1.0$ were recorded.



DEPTH(KM)
0.
1.
2.
3.
4.
5.
0.
1.
2.
3.
4.
5.
MAGNITUDE

JOCASSEE EARTHQUAKES

'FROM JUNE 1 ,TO JUNE 30 ,76'



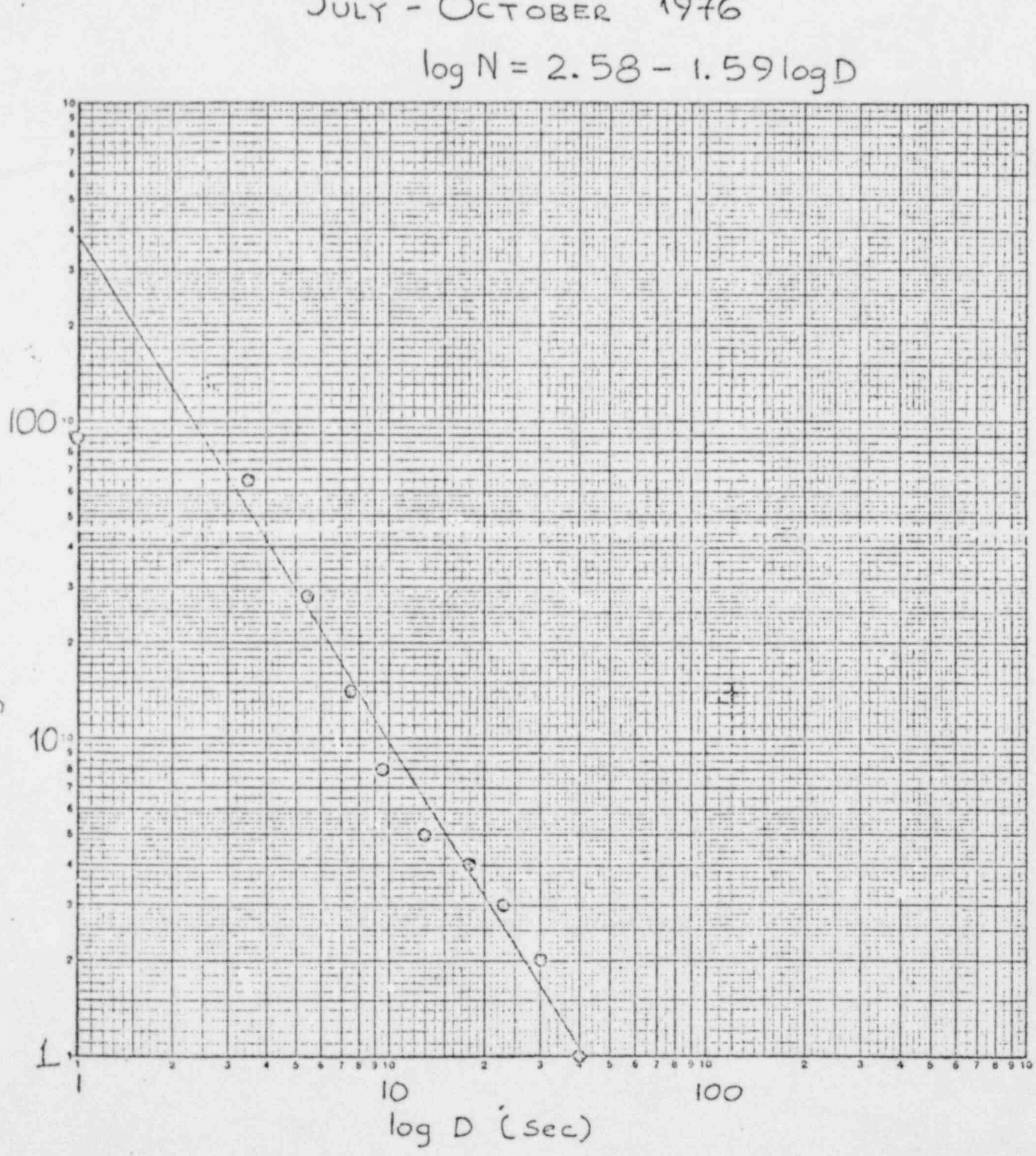

JULY - OCTOBER 1976
log N = 2.58 - 1.59 log D
100
10
1
log N
1
10
100
log D (sec)

Figure 2.

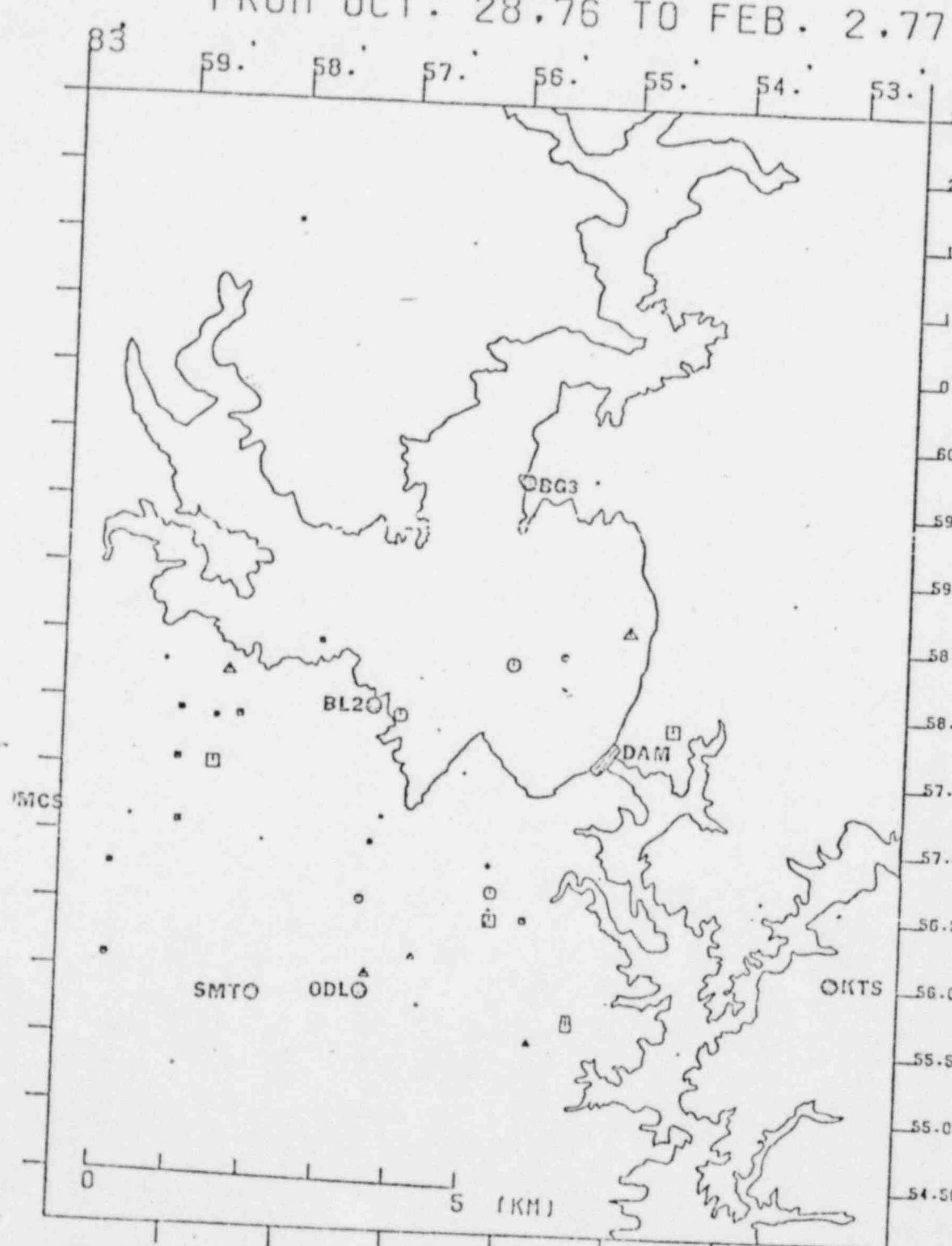
TABLE 1. DETAILS OF EVENTS RECORDED AT SMT BETWEEN JULY 01, 1976 AND OCTOBER 27, 1976.

S-P (sec)	No. of Events
$T \leq 0.25$	13
$0.25 < T \leq 0.50$	57
$0.50 < T \leq 0.75$	8
$0.75 < T \leq 1.0$	10 88
$1.0 < T \leq 1.5$	1?
$1.5 < T \leq 2.0$	4
$2.0 < T \leq 2.5$	1
$2.5 < T \leq 3.0$	1
$3.0 < T$	15 (Blasts?)

Using the 88 local events, a b-value of 1.59 was obtained (Figure 2). (See also Appendix VI).

II.3. OCTOBER 28, 1976 - FEBRUARY 28, 1977

In this time period seismic stations were maintained at BG3, KTS, ODL and MCS. Towards the end of February '77, BL2 was also occupied. Between October 28, '76 and February 2, '77, 107 events were recorded (Appendix VII) of which 38 were located (Appendix VIII) and are shown in Figure 3. The activity lies in a broad NW-SE band about 4 km south of the lake. A b-value of .94 was obtained (Fig. 4). In this period there were 13 events with $M_L \geq 1.0$, the largest one, felt, occurred on January 30, '77 ($M_L = 1.6$). Its location could not be obtained. This period was also characterized by a complete absence of seismicity between December 28, 1976 and January 14, 1977. Between February 4 and February 28, '77, 97 events were recorded and 42 were located. The most important event was a magnitude



JOCASSEE EARTHQUAKES
FROM OCT. 28.76 TO FEB. 2.77
83
59.
58.
57.
56.
55.
54.
53.
2.50
2.00
1.50
1.00
0.50
60.00
35.
59.50
59.00
58.50
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
BG3
BL2
DAM
MCS
SMTO
ODLO
OKTS
0
5 (KM)

Figure 3.

2.25 event on February 23, '77 (08:50 UCT). This was preceded by two weeks of foreshock activity (See Figure 5 and Appendix VIII).

III. DISCUSSION

Since June '76, low level seismic activity has continued (about one event a day). In June '76 the activity seemed to be spreading, and one event was located near Lake Keowee. There was a complete absence of activity in the first half of January 1977. The largest event in the reporting period occurred on February 23, 1977 (M_L = 2.25) and it was followed by 32 aftershocks in the next 24 hours.

IV. REFERENCES

Gutenberg, B. and Richter, C. F. (1956). Magnitude and energy of earthquakes, Ann. Geol. 9, p. 1-15.

Lee, W. H. K. and Lahr, J. C. (1972). A computer program for determining hypocenter, magnitude, and first motion pattern of local earthquakes. Revisions of HYPO71, USGS Open File report, 100pp.

Talwani, P. (1975). Crustal Structure of South Carolina, Second Technical Report, Contract No. 14-08-0001-14553, U. S. Geological Survey.

Talwani, P., D. Stevenson, J. Chiang, D. Amick (1976). The Jocassee Earthquakes - A Preliminary Report. Third Technical Report, Contract No. 14-08-0001-14553, U. S. Geological Survey.

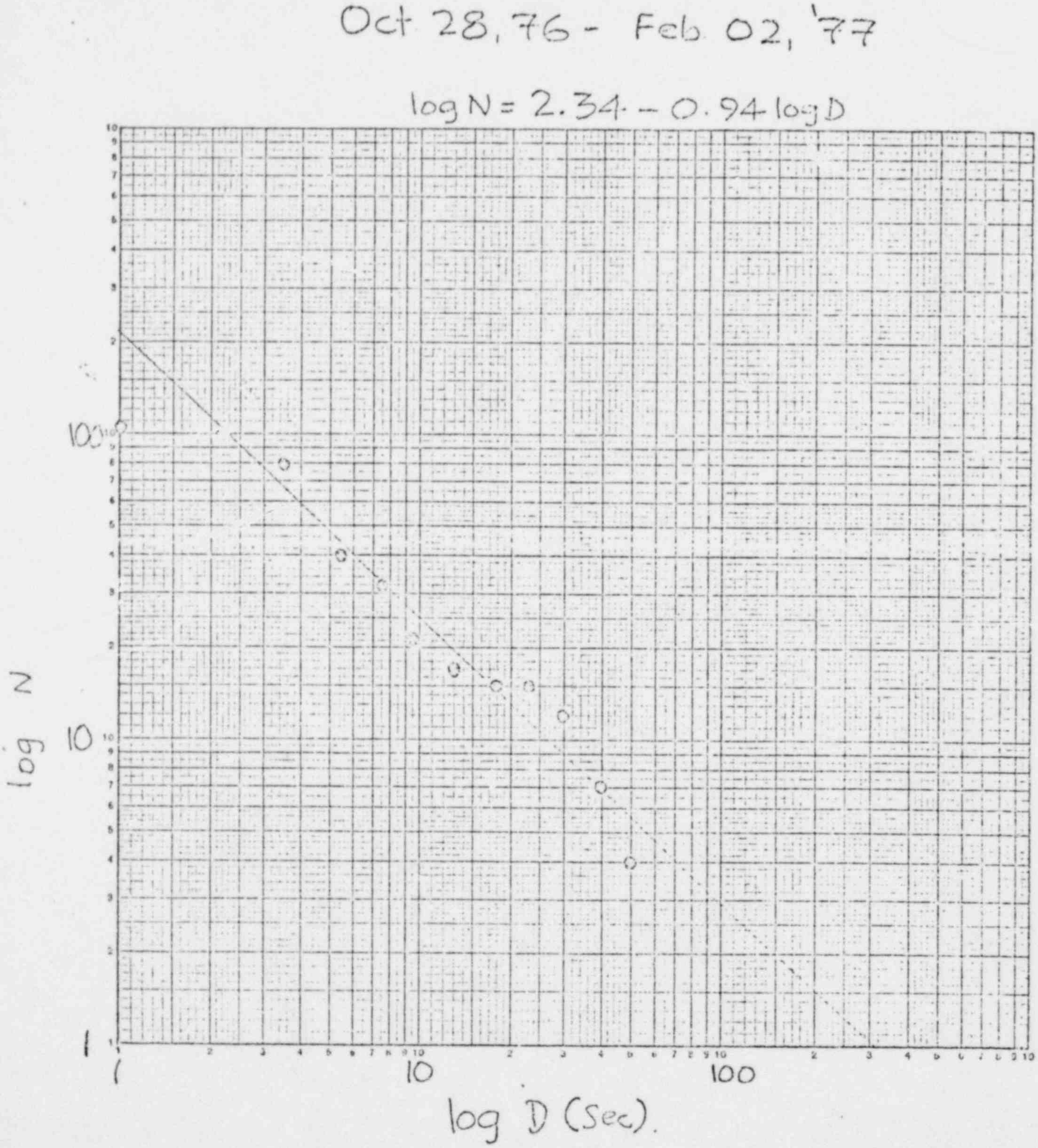

Oct 28, 76 - Feb 02, '77
log N = 2.34 - 0.94 log D
log N
100
10
1
10
100
log D (Sec).

Figure 4.

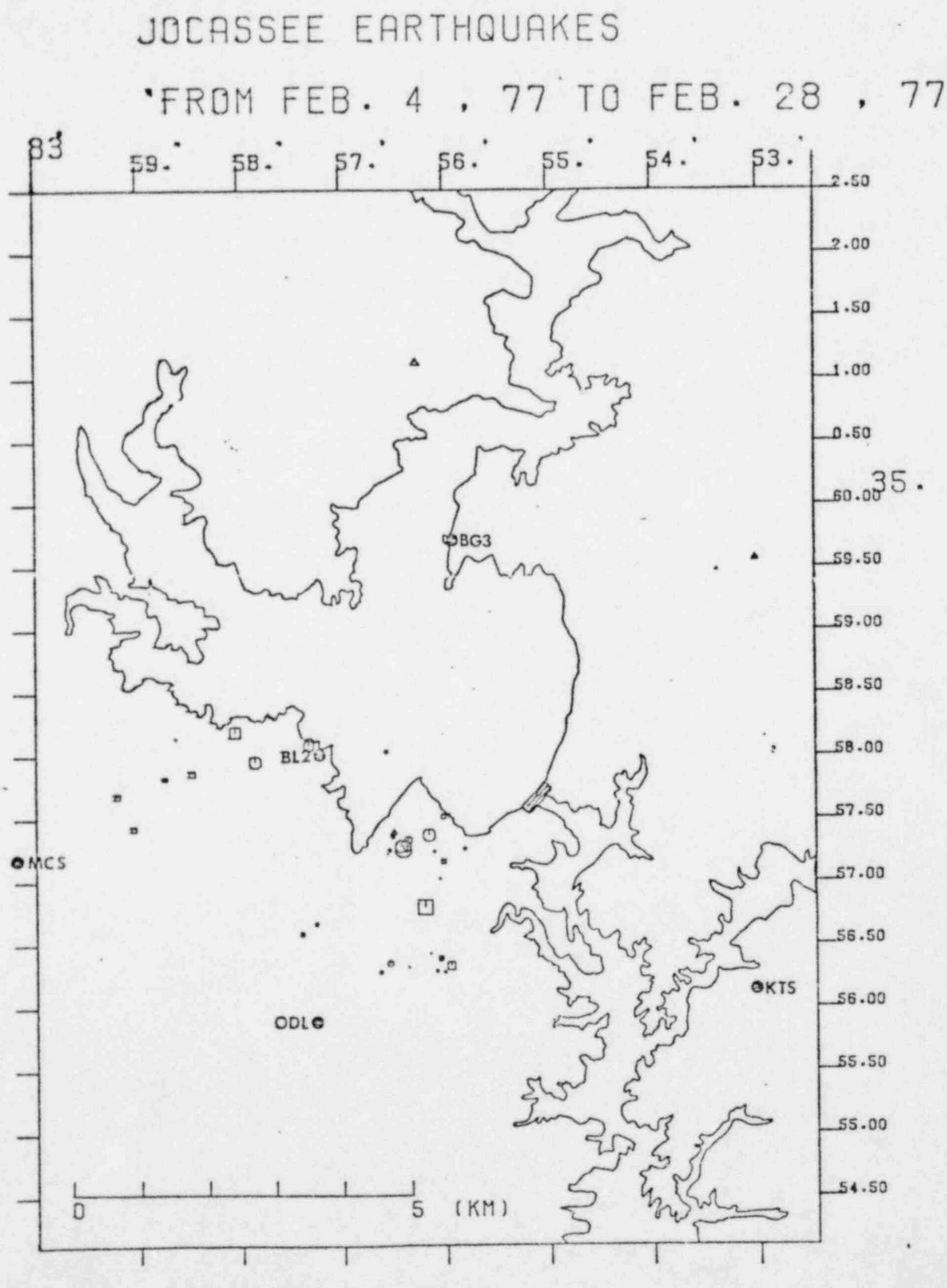

JOCASSEE EARTHQUAKES
FROM FEB. 4 , 77 TO FEB. 28 , 77
83
59.
58.
57.
56.
55.
54.
53.
2.50
2.00
1.50
1.00
0.50
60.00
35.
59.50
59.00
58.50
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
BG3
BL2
MCS
KTS
ODL
0
5 (KM)

Figure 5.

APPENDICES

APPENDIX I

STATION LOCATIONS

No.	Stn.	Lat.	Long.
1	BL2	3457.92N	8257.24W
2	KTS	3456.00N	825[illegible].08W
3	BG3	3459.58N	8255.90W
4	ODL	3455.82N	8257.26W
5	SD1	3457.25N	8255.85W
6	BCS	3455.90N	8257.86W
7	FMS	3456.43N	8257.56W
8	JI2	3500.59N	8254.31W
9	RRS	3454.28N	8257.08W
10	NSF	3500.14N	8254.32W
11	GCS	3456.50N	8254.91W
12	TFS	3459.69N	8252.96W
13	BGS	3459.32N	8256.19W
14	JIS	3501.73N	8254.63W
15	WWF	3459.13N	8256.78W
16	DQ2	3458.11N	8254.82W
17	BG2	3459.45N	8255.88W
18	VPS	3457.13N	8300.07W
19	LAW	3501.18N	8301.30W
20	SMT	3455.85N	8258.26W
21	FTC	3500.84N	8301.29W
22	MCS	3457.12N	8300.45W

APPENDIX II

VELOCITY MODEL

HYPO71 was used to locate various events. The crustal model used is

Velocity km/sec	Depth km
5.75	0
6.2	0.5
8.1	30.0

This model was developed for the Clark Hill reservoir - also located on gneissic rocks in the South Carolina Piedmont (Talwani, 1975).

APPENDIX III

LIST OF EVENTS IN JUNE 1976

In column 3 the "station of max. duration" refers to the location of a station where the recorded duration event was maximum. The station number corresponds to that listed in Appendix I. The maximum recorded duration for any event is given in column 4. In column 5 are listed the total number of stations recording the event. The daily energy release is listed in column 6. The daily energy is calculated using a simplified magnitude - energy relation (Gutenberg and Richter, 1956), i.e.,

$$\log_{10} E = 11.8 + 1.5 M_L$$

where M_L = calculated duration magnitude. For Jocassee (Talwani and others, 1976)

$$M_L = -1.83 + 2.04 \log D$$

where D = duration of event in seconds. Events with magnitude $\geqslant 1$ are listed in column 7.

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geq 1.0$
760601	03:52:33	22	3	4		
	07:21:14	22	2	1		
	11:23:04	22	30	4	3.7×10^{13}	1.32
760602	00:18:41	2	2	1		
	02:19:17	22	4	3		
	06:22:33	22	5	3		
	09:54:40	22	20	3		
	09:55:40	22	5	3		
	10:25:43	22	4	2		
	11:43:05	3	2	1		
	17:38:06					
	17:39:19	4	18	3		
	18:16:16	20	71	4		1.95
	18:21:01	22	5	1		
	18:29:35	22	5	1		
	20:00:25	22	3	1		
	20:17:21	22	7	1		
	20:25:14	22	4	1		
	20:51:55	22	10	4		
	21:13:29	22	3	1		
	21:23:12	22	4	1		
	21:57:56	22	8	1	6.4×10^{14}	
760603	03:22:02	22	2	1		
	04:17:13	22	4	3		
	06:15:20	22	4	3		
	09:45:46	22	5	3		
	11:46:58	22	3	1	3.1×10^{11}	
760604	00:53:21	22	2	4		
	04:20:53	22	2	1	1.8×10^{10}	
760605	04:54:12	22	2	3		
	14:14:56	2	4	2		
	14:34:28	2	3	2		
	14:45:26	2	3	4	1.5×10^{11}	
760606	12:47:19	22	4	1		
	16:07:14	3	2	1		
	16:56:13	22	6	5	3.1×10^{11}	
760607	04:29:04	22	4	1		
	17:04:53	3	4	3		
	22:16:35	22	4	4	2.4×10^{11}	
760608	07:00:48	22	2	3		
	07:34:15	22	2	4		
	19:26:43	3	2	1	2.9×10^{10}	

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geq 1.0$
760609	02:28:50	22	2	3		
	03:49:32	22	7	5		
	04:56:36	3	5	4		
	10:34:05	3	3	3		
	16:12:18	22	2	2	6.2×10^{11}	
760611	03:25:21	3	2	3		
	10:07:06	22	10	4		
	17:00:10	1	93	5	1.2×10^{15}	2.19
760612	04:21:51	2	56	5		1.74
	04:35:41	22	7	5		
	06:00:39	3	5	4		
	06:21:00	22	7	3		
	11:12:44	1	4	2		
	12:03:40	22	6	4		
	12:25:26	2	4	2		
	12:26:24	1	2	1		
	12:26:30	1	2	1		
	12:26:40	1	10	3		
	13:20:10	1	2	1		
	15:12:56	22	7	1		
	15:57:42	22	2	1		
	18:25:52	22	3	4		
	18:58:00	1	2	1	2.5×10^{14}	
760613	00:04:27	22	3	2		
	03:41:11	1	3	2		
	04:25:54	22	5	3		
	07:42:23	22	2	1		
	13:57:38	22	3	1		
	23:18:00	22	2	1		
	23:40:55	22	35	4	6.0×10^{13}	1.32
760614	04:42:07	3	2	1		
	08:37:35	22	3	4		
	22:12:24	3	2	1		
	22:13:35	22	3	3	7.6×10^{10}	
760615	05:15:01	22	3	3		
	06:28:28	22	3	1		
	12:49:30	1	2	1		
	13:25:27	1	3	2		
	21:41:44	22	4	3	2.3×10^{11}	
760616	13:16:03	3	3	3		
	14:03:46	3	2	2		
	14:46:11	3	2	1		
	22:30:29	22	7	5		
	23:52:00	1	2	1	4.9×10^{11}	

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geqslant 1.0$
760617	02:00:21	1	3	1		
	04:10:02	3	4	1		
	11:06:18	3	4	1		
	19:34:04	1	6	5	1.0×10^{12}	
760618	07:00:11	1	7	5		
	07:01:32	1	2	1		
	07:20:11	1	3	1		
	12:29:39	1	8	5		
	13:27:20	22	9	5		
	13:30:05	3	4	3		
	18:55:38	1	3	3		
	22:27:24	22	9	5	3.1×10^{12}	
760619	00:59:22	1	5	5		
	01:09:21	1	5	5		
	01:51:00	1	13	5		
	02:05:04	1	3	4		
	03:47:23	1	6	4		
	03:49:07	1	8	5		
	10:21:28	1	4	5		
	19:15:32	22	2	1		
	21:06:49	20	2	1	4.3×10^{12}	
760620	23:49:02	3	3	3	3.3×10^{10}	
760622	06:36:29	1	50	5	1.8×10^{14}	1.64
760623	11:25:13	1	2	2	9.5×10^{14}	
760624	14:15:26	1	2	4	9.5×10^{9}	
760625	00:37:44	1	2	1		
	05:47:16	1	3	3	4.2×10^{10}	
760626	01:38:04	1	2	1		
	04:16:07	1	17	5		
	06:59:00	22	3	5		
	10:32:01	1	2	1	6.6×10^{12}	
760627	01:10:14	22	4	2		
	12:20:57	1	2	2	4.22×10^{10}	
760628	11:00:00	1	2	1		
	12:28:59	1	2	1		
	17:19:15	1	2	2		
	18:05:59	3	3	2	1.9×10^{10}	

APPENDIX IV

LOCATION OF EVENTS IN JUNE 1976

Computer printout of HYPO71 showing data for location of events.

Column 1	Date.
Column 2	Origin time (UCT) h.m.sec.
Column 3	Latitude (N) degrees, min.
Column 4	Longitude (W) degrees, min.
Column 5	Depth (km).
Column 6	Local duration magnitude.
Column 7	No. of station readings used to locate event. P and S arrivals from same stations are regarded as 2 readings.
Column 8	Largest azimuthal separation in degrees between stations.
Column 9	Epicentral distance in km to nearest station.
Column 10	Root mean square error of time residuals in sec. RMS $=\sqrt{R_i^2/NO}$, where R_i is the time residual for the ith station.
Column 11	Standard error of the epicenter in km*.
Column 12	Standard error of the focal depth in km*.

*Statistical interpretation of standard errors involves assumptions which may not be met in earthquake locations. Therefore standard errors may not represent actual error limits.

If ERH or ERZ is blank, this means that it cannot be computed, because of insufficient data.

JOCASSEE EARTHQUAKES FROM JUNE 1 , 76 TO JUNE 30 , 76

DATE	ORIGIN	LAT N	LONG W	DEPTH	MAG	NO	GAP	DMIN	RMS	ERH	ERZ	QM
760601	352 32.09	34-54.45	82-56.49	0.75	-.86	6	253	2.8	0.04	0.7	4.0	C1
760601	1123 3.94	34-56.54	82-59.41	1.57	1.18	6	330	2.2	0.02	1.6	1.5	C1
760602	622 32.03	34-58.54	82-58.14	0.50	-.40	4	238	3.9	0.00			C1
760602	954 40.45	34-58.35	82-57.75	1.95	.82	6	222	3.6	0.05	0.5	1.2	C1
760602	1025 42.84	34-58.71	82-57.46	0.53	-.60	4	223	2.9	0.02			C1
760602	1816 15.94	34-56.80	82-59.16	0.86	2.00	6	317	2.2	0.05	3.0	8.2	D1
760602	2051 55.29	34-57.00	82-59.34	0.42	.21	8	265	2.7	0.03	0.4	0.8	C1
760603	945 45.63	34-55.87	82-55.66	3.75	-.40	4	271	2.4	0.01			C1
760606	1247 18.03	34-59.26	82-56.00	2.27	-.86	6	183	0.6	0.03	1.2	0.4	C1
760606	1656 11.85	34-57.88	82-58.46	1.25	-.24	8	236	3.8	0.03	0.2	0.8	C1
760607	17 4 51.07	35- 0.00	82-55.28	1.00	-.60	3	331	1.2	0.01			C1
760607	2216 33.81	34-59.68	82-54.68	3.61	-.60	8	256	1.9	0.19	1.8	1.8	C1
760608	7 0 46.38	34-58.35	82-56.39	2.99	-.99	4	220	1.5	0.01			C1
760608	734 13.61	34-58.74	82-57.30	3.05	-.99	6	219	1.5	0.02	1.1	0.3	C1
760609	349 30.72	34-58.52	82-55.59	1.75	-.11	8	154	2.0	0.02	0.1	0.3	B1
760609	456 34.82	34-57.29	82-56.59	0.77	-.40	8	110	1.5	0.04	0.2	1.0	B1
760611	325 20.27	34-58.41	82-55.11	0.47	-.99	4	283	2.5	0.01			C1
760611	10 7 5.12	34-56.54	82-59.85	0.16	.21	6	289	2.7	0.05	0.8	0.9	C1
760611	17 0 8.43	34-57.16	82-59.07	1.96	2.19	4	254	2.7	0.00			C1
760612	421 50.83	34-56.93	82-59.13	0.30	1.74	8	259	2.4	0.04	0.2	0.2	C1
760612	6 0 38.36	34-57.08	82-55.57	1.88	-.40	6	124	4.3	0.13	0.8	4.3	B1
760612	621 0.14	34-58.58	82-55.54	1.70	-.11	6	158	1.9	0.00	0.0	0.1	B1
760612	12 3 38.77	34-57.89	82-57.34	1.67	-.24	6	277	0.2	0.02	0.2	0.2	C1
760612	1825 51.21	34-58.92	82-55.39	2.61	-.99	6	179	1.4	0.02	0.2	0.4	B1
760613	2340 53.91	34-58.37	82-55.63	0.62	1.32	6	149	2.3	0.02	0.2	2.8	C1
760614	637 33.72	34-59.14	82-55.64	5.17	-.86	6	172	0.9	0.09	1.1	1.2	C1
760614	2213 33.56	34-57.19	82-59.10	1.92	-.86	4	343	3.1	0.00			C1
760616	2230 25.11	34-58.81	82-58.29	1.59	-.11	8	249	2.3	0.02	0.2	0.3	C1
760617	1934 2.56	34-58.59	82-55.79	2.06	-.24	6	145	1.8	0.01	0.1	0.1	B1
760618	7 0 10.30	34-57.86	82-55.48	2.12	-.11	6	144	2.1	0.01	0.1	0.2	B1
760618	1229 39.14	34-59.53	82-57.84	2.00	.01	8	263	3.0	0.01	0.1	0.1	C1
760618	1327 19.24	34-59.58	82-58.04	1.80	.12	6	267	3.3	0.02	0.3	0.6	C1
760618	2227 23.63	34-59.45	82-57.76	1.70	.12	6	259	2.8	0.03	0.4	0.7	C1
760619	1 9 20.83	34-59.66	82-58.20	0.10	-.40	8	272	3.5	0.04	0.3	0.4	C1
760619	150 59.54	34-59.68	82-57.37	1.77	.44	8	264	2.2	0.07	0.7	0.8	C1
760619	347 22.35	34-59.56	82-57.97	1.04	-.24	6	290	3.2	0.01	0.1	0.3	C1
760622	636 26.78	34-49.64	82-55.93	3.83	1.64	8	321	11.7	0.02	0.3	0.7	C1
760624	1415 26.04	34-58.64	82-58.99	1.62	-.99	6	254	2.7	0.02	1.2	1.7	C1
760625	547 15.80	34-56.97	82-57.08	3.22	-.86	4	332	1.8	0.01			C1
760626	416 7.49	34-56.01	82-56.20	2.96	.68	8	174	3.1	0.07	0.4	0.8	B1
760626	658 59.96	34-56.04	82-55.94	2.55	-.86	8	173	3.5	0.07	0.4	1.0	B1
760627	110 13.37	34-55.97	82-57.09	2.78	-.60	4	267	1.8	0.00			C1
760627	1220 56.61	34-57.97	82-55.86	2.91	-.99	6	223	2.1	0.02	0.2	0.3	C1

POOR ORIGINAL

APPENDIX V

LIST OF EVENTS FROM JULY 01, 1976 TO OCTOBER 27, 1976

The list of events recorded at SMT is given on the following pages. In column 2 are listed the total number of events per day (on UCT). The daily energy release is listed in column 3. Events with $M_L \geqslant 1.0$ are listed in column 4 and their occurrence time (h.m.sec.) is given in column 5. The events with $M_L \geqslant 1.0$ and marked with an asterisk (*) are those with S-P times $\geqslant 1$ sec. and probably not local. However, they have been incorporated in energy calculations.

DATE	NO. OF EVENTS	ENERGY/DAY	$M_L \geq 1.0$	TIME
070176	3	1.4×10^{13}		
070276	3	3.8×10^{11}		
070376	1	9.5×10^{9}		
070476	1	4.4×10^{11}		
070576	1	1.8×10^{14}	*1.64	23:02:08
070776	1	9.5×10^{9}		
070876	1	9.5×10^{9}		
070976	2	1.8×10^{11}		
071076	1	9.5×10^{9}		
071176	5	3.8×10^{13}	*1.18	01:17:15
071276	2	2.8×10^{11}		12:24:51
071376	1	3.8×10^{13}	1.18	
071476	2	4.5×10^{14}	*1.65	04:
			*1.74	12:15:00
071776	2	2.4×10^{13}	*1.06	01:49:00
071876	1	9.5×10^{9}		
071976	1	7.8×10^{10}		
072076	1	2.1×10^{13}	*1.06	23:51:00
072176	1	7.9×10^{10}		
072276	1	3.8×10^{13}	*1.32	15:00:00
072376	2	1.5×10^{12}		
080176	2	1.1×10^{11}		
080276	2	1.1×10^{11}		
080376	1	4.4×10^{11}		
080476	3	1.7×10^{11}		
080576	2	8.9×10^{10}		

DATE	NO. OF EVENTS		ENERGY/DAY	$M_L \geq 1.0$	TIME
080876	1		3.3×10^{10}		
081076	1		3.3×10^{10}		
081276	1		2.7×10^{11}		
081376	1		7.9×10^{10}		
081476	1		9.5×10^{9}		
081576	1		7.9×10^{10}		
081676	1		3.3×10^{10}		
081776	2		1.8×10^{10}		
081876	4		1.3×10^{11}		
082576	1		3.3×10^{10}		
082676	2		2.8×10^{10}		
082876	1		3.3×10^{10}		
083076	1		7.9×10^{10}		
083176	1	29	9.5×10^{9}		
090376	1		3.3×10^{10}		
090476 --090776	NO DATA				
090976	2		1.9×10^{10}		
091476	2		7.9×10^{13}	1.37	01:20:22
091676	2		9.1×10^{13}	*1.44	19:55:00
091776	1		1.6×10^{10}		
091976	1		3.3×10^{10}		
092076	1		2.7×10^{11}		
092176	1		2.7×10^{11}		
092276	4		5.8×10^{10}		
092376	3		9.9×10^{10}		
092576	1		2.7×10^{11}		

DATE	NO. OF EVENTS	ENERGY/DAY	$M_L \geqslant 1.0$	TIME
092876	1	1.3×10^{12}		
100476	1	4.4×10^{11}		
101076	1	7.9×10^{10}		
101276	8	1.6×10^{12}		
101376	3	2.2×10^{13}	1.00	09:27:28
101576	1	6.6×10^{11}		
101676 -- 101876	NO DATA			
101976	1	1.6×10^{10}		
102076	1	3.3×10^{10}		
102176	1	3.3×10^{10}		
102276 -- 102376	NO DATA			
102476	1	4.4×10^{11}		

APPENDIX VI

A NOTE ON THE METHOD USED TO OBTAIN THE b-VALUE

The magnitude-recurrence relationship

$$\log N = a + bM_L$$

is used to define the 'b-value.'

N = cumulative number of events with magnitude $\geq M_L$. Instead of M_L we used log D, (D = duration of event in seconds) to which it is related. The following duration intervals were used: 0-2, 3-4, 5-6, 7-8, 9-10, 10-15, 16-20, 21-25, 26-35, 36-45, 46-55, 56-75, etc.; the data were plotted in the middle of the interval chosen. To obtain the b-value, a least square linear regression equation was used.

$$Y = a + bx$$

where

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$a = \frac{\sum y - b\sum x}{n}$$

where n = number of pairs of x and y values.

In our case

x = log Duration

y = log (Cumulative number of events)

n = number of data points being used, the first and last being neglected.

APPENDIX VII

LIST OF EVENTS BETWEEN OCTOBER 28, 1976 AND FEBRUARY 28, 1977

The data presented follow the format of Appendix III.

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geqslant 1.0$
102876	20:16:40	2	3	4	3.3×10^{10}	
102976	03:36:11	22	3	4		
	06:35:28	22	10	3		
	16:22:40	3	3	1	9.6×10^{11}	
110176	08:13:57	2	9	3		
	14:00:03	3	2	1	9.4×10^{11}	
110376	03:08:43	22	8	4		
	03:14:23	22	4	4		
	03:17:16	22	8	4	9.4×10^{12}	
110476	07:53:35	4	2	1	3.3×10^{10}	
110776	07:53:35	4	2	1		
	23:00:00	3	3	1	4.5×10^{10}	
110876	23:06:22	3	24	4		1.0
	23:06:42	4	6	4	2.0×10^{13}	
110976	02:57:46	3	10	4		
	04:42:52	4	3	4		
	06:18:19	4	2	2		
	06:53:13	4	3	3	1.4×10^{12}	
111076	00:32:16	3	3	1		
	14:43:26	22	3	1	6.6×10^{10}	
111176	12:54:48	3	3	1		
	14:39:14	3	3	1		
	15:29:18	4	2	1	7.6×10^{10}	
111276	12:16:04	4	2	1	9.5×10^{9}	

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO. OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geq 1.0$
111376	01:00:34	22	5	3		
	01:03:00	2	10	4		
	11:34:40	22	10	3		
	13:18:06	2	4	1		
	15:09:08	4	4	1		
	15:18:07	22	7	4		
	15:18:59	4	2	1		
	15:19:25	4	2	1		
	15:19:36	4	2	1		
	15:24:59	2	25	4		1.0
	15:28:01	3	2	2		
	15:42:42	2	15	4	3.0×10^{13}	
111576	14:43:35	22	9	4		
	22:16:25	2	4	4	1.0×10^{12}	
111776	06:49:39	3	2	1		
	18:16:06	3	5	2	1.6×10^{11}	
111876	05:34:02	2	3	3		
	05:35:04	4	2	2		
	06:03:07	4	2	1		
	13:23:31	4	1	1		
	22:16:55	3	3	2	5.0×10^{10}	
111976	04:22:19	22	2	1		
	23:18:41	22	4	2	7.9×10^{10}	
112476	18:23:39	2	5	3	1.6×10^{11}	
112576	02:34:38	4	3	2	3.3×10^{10}	
112776	06:49:06	3	3	3	1.3×10^{12}	
112876	02:15:11	2	50	3		1.64
	22:34:46	2	30	4	2.2×10^{14}	1.18
113076	16:51:15	2	4	3	8.8×10^{10}	
120276	10:02:12	22	7	4	4.4×10^{11}	
120376	15:55:29	22	6	3	2.7×10^{11}	
120476	14:21:42	3	35	4	6.0×10^{13}	1.32
120576	01:13:25	2	40	4		1.44
	03:53:24	2	4	4	9.1×10^{13}	
120676	04:31:40	22	7	3	4.4×10^{11}	

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geqslant 1.0$
120776	02:09:40	22	23	1		
	17:12:15	4	5	2	1.7×10^{13}	
120976	23:06:08	22	3	1	3.3×10^{10}	
121176	21:55:28	22	3	1	3.3×10^{10}	
121376	20:24:26	3	4	4		
	21:06:29	4	2	1	8.8×10^{10}	
121676	06:50:29	4	3	1		
	07:48:10	3	48	3		1.60
	09:38:00	3	30	3	2.0×10^{14}	1.18
121776	00:52:55	2	33	4	5.0×10^{13}	1.27
121876	06:28:03	4	5	3		
	06:22:22	3	2	4	2.5×10^{10}	
121976	03:52:48	3	4	3	7.9×10^{10}	
122076	17:42:09	22	4	1	7.9×10^{10}	
122476	02:21:00	22	3	3	1.1×10^{11}	
122876	03:21:15	3	3	3		
	05:35:15	22	5	4		
	09:02:32	2	3	4		
	09:40:14	22	7	4	1.2×10^{11}	
123176	17:50:37	3	8	1	6.6×10^{10}	
010177 - 011377		NO EVENTS				
011477	00:20:56	22	35	4		1.32
	00:26:24	4	50	4		1.64
	04:17:52	22	3	1		
	05:47:49	22	3	1	2.1×10^{14}	
011577	03:45:52	22	7	4	4.4×10^{11}	
011777	05:34:20	2	8	4		
	22:22:59	22	37	4		1.37
	22:51:57	22	1	1	7.8×10^{13}	
011877	00:12:12	22	2	2		
	01:27:42	22	2	1		
	03:16:08	22	4	2		
	03:18:30	22	3	1	4.1×10^{11}	

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO. OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geq 1.0$
01217	01:03:05	22	3	1		
	12:41:40	22	6	4		
	17:24:05	3	3	1	7.0×10^{10}	
012277	00:53:21	3	2	1		
	00:55:09	3	2	1		
	07:42:53	2	3	1		
	14:38:24	22	2	1	6.1×10^{10}	
012377	00:54:45	22	4	4	7.9×10^{10}	
012477	11:07:55	22	3	1	3.3×10^{10}	
012577	13:34:57	4	4	1		
	13:39:30	4	4	1	1.6×10^{10}	
012877	18:22:11	2	2	1	9.5×10^{9}	
013077	23:30:58	2	48	1	1.6×10^{14}	1.60
020177	11:57:35	4	2	2	9.5×10^{9}	
020277	17:25:21	22	37	4		1.37
	23:56:22	22	13	4	7.4×10^{13}	
020377	03:04:06	4	2	1		
	07:41:45	22	2	2		
	07:48:49	22	2	2		
	07:49:03	22	3	2		
	07:52:39	22	3	2		
	09:04:37	22	2	2	7.1×10^{10}	
020477	23:48:50	3	5	3	1.6×10^{11}	
020577	02:04:54	22	9	4		
	05:10:30	NOT LOCAL			6.6×10^{11}	
020677	21:54:12	2	70	4	5.0×10^{14}	1.93
020977	03:12:35	2	4	4		
	05:10:30	2	15	4	4.6×10^{12}	
021077	00:44:19	2	2	4		
	01:07:14	22	7	4		
	22:45:00	22	3	3	5.6×10^{11}	
021377	13:31:24	2	6	4		
	14:36:30	2	10	3	5.8×10^{12}	

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geqslant 1.0$
021477	06:21:07	2	20	4	1.1×10^{13}	
021777	22:07:08	22	30	4	3.8×10^{13}	1.32
021877	06:11:05	22	4	4		
	06:11:50	22	5	4		
	08:52:37	22	35	4		1.32
	09:39:03	22	5	4		
	10:07:15	22	3	1		
	23:09:11	3	2	1	6.1×10^{13}	
021977	11:22:20	3	3	1	7.9×10^{10}	
022077	03:46:15	4	5	3		
	09:37:49	4	5	3	3.2×10^{11}	
022177	17:43:42	2	35	3		1.32
	19:12:36	2	3	2		
	20:38:11	22	4	3		
	20:53:22	3	22	3		
	20:53:49	4	3	3		
	21:11:23	2	10	3		
	22:08:40	2	3	3		
	22:08:50	22	3	3	7.7×10^{13}	
022277	02:53:42	2	3	4		
	05:32:33	2	8	4		
	08:42:20	22	3	4		
	09:07:24	22	3	4	7.5×10^{11}	
022377	07:08:50	2	12	5		
	07:26:23	22	4	5		
	03:50:08	22	100	5		2.25
	08:50:31	?				
	08:50:39	?				
	08:51:05	1	3	4		
	08:55:05	1	3	5		
	08:58:41	1	3	2		
	09:04:33	2	12	4		
	09:11:25	1	2	4		
	09:12:08	1	3	5		
	09:14:14	1	3	1		
	09:34:47	1	3	3		
	09:51:54	1	3	2		
	11:08:53	1	2	1		
	12:58:45	1	3	1		
	13:01:23	NOT LOCAL				
	14:29:10	1	2	1		
	14:58:20	1	5	2		
	15:04:42	1	6	5		

DATE	TIME H:M:S	STN OF MAX DURATION	DURATION (SEC)	NO OF STN REC EVENT	ENERGY PER DAY (ERGS)	$M_L \geq 1.0$
022377 (cont.)	15:10:47	1	2	1		
	15:53:32	1	3	1		
	15:53:53	1	2	1		
	19:11:33	4	3	4		
	19:37:46	3	5	4		
	19:38:06	1	4	4		
	19:35:04	1	2	4		
	19:42:14	2	4	4		
	20:42:50	2	4	4		
	22:17:06	22	3	3		
	22:17:12	22	3	3		
	23:35:10	22	3	1	1.6×10^{15}	
022477	00:19:27	1	2	2		
	00:23:45	1	6	4		
	00:23:53	1	6	4		
	02:14:56	1	2	2		
	03:56:06	22	37	5		1.44
	03:56:20	?				
	06:33:56	1	25	4		1.00
	17:39:21	3	2	1	9.2×10^{13}	
022577	02:59:44	22	3	2		
	03:13:08	1	3	4		
	03:18:18	1	2	1		
	03:25:59	1	3	3		
	04:26:39	1	2	1		
	09:13:28	1	2	2		
	12:26:19	2	4	4		
	13:21:22	22	2	1		
	16:31:43	3	5	1		
	17:12:40	3	11	3		
	19:12:03	1	7	4	2.4×10^{12}	
022677	01:35:01	3	3	3		
	06:15:05	3	2	3		
	12:36:49	3	3	1	7.4×10^{10}	
022777	05:07:55	4	5	5		
	06:10:43	2	8	5		
	20:13:35	1	3	3	8.5×10^{11}	
022877	00:49:47	1	3	4		
	06:30:55	1	6	4		
	07:40:39	1	5	[illegible]		
	09:00:05	1	2	2		
	18:10:07	1	2	1		
	23:15:17	3	9	4	1.7×10^{12}	

APPENDIX VIII

LOCATION OF EVENTS BETWEEN OCTOBER 28, 1976 AND FEBRUARY 28, 1977

The location list is HYPO71 printout and follows the format of Appendix IV.

JOCASSEE EARTHQUAKES FROM OCTOBER 28, '76 TO FEBRUARY 28, '77

DATE	ORIGIN		LAT N	LONG W	DEPTH	MAG	NO	GAP	DMIN	RMS	ERH	ERZ	QM
761028	2016	39.29	34-57.77	82-56.65	0.89	-.86	6	223	4.3	0.05	0.5	4.4	C1
761029	635	27.82	34-58.35	82-55.54	1.03	.21	8	153	2.3	0.09	0.6	3.1	C1
761101	813	56.92	34-56.36	82-55.84	0.65	.12	6	182	4.3	0.03	0.1	2.2	C1
761103	3 8	43.20	34-56.70	82-59.54	1.39	.01	8	184	1.6	0.06	0.4	0.9	C1
761103	315	22.67	34-57.06	82-59.38	0.74	-.60	8	148	1.6	0.04	0.3	1.6	B1
761103	315	15.97	34-57.03	82-58.96	0.65	.01	8	144	2.3	0.04	0.3	2.9	C1
761108	23 6	20.92	34-55.92	82-57.24	2.56	1.00	7	105	0.2	0.07	0.5	1.1	B1
761109	257	44.85	34-56.06	82-56.83	2.76	.21	8	145	0.8	0.02	0.1	0.2	B1
761109	442	50.58	34-56.90	82-58.21	1.66	-.86	6	251	2.5	0.02	0.3	0.5	C1
761113	1 0	32.21	35- 1.58	82-58.05	0.58	-.40	6	295	4.9	0.25	0.2	5.9	D1
761113	1 2	58.73	34-55.44	82-55.76	2.39	.21	6	289	2.4	0.01	0.1	0.1	C1
761113	1134	39.24	34-56.01	82-59.56	1.14	.21	6	231	2.5	0.03	0.3	0.8	C1
761113	1524	58.17	34-55.58	82-55.41	0.09	1.00	8	202	2.8	0.02	0.2	0.3	C1
761113	1542	41.18	34-55.63	82-55.41	0.31	.57	8	198	2.8	0.02	0.1	0.2	C1
761115	1443	34.92	34-57.84	82-58.44	0.90	.12	8	164	3.3	0.01	0.1	0.6	B1
761115	2216	24.63	34-57.10	82-57.14	0.63	-.60	6	198	2.4	0.01	0.1	0.8	C1
761127	649	5.30	34-56.70	82-55.15	3.59	-.86	5	193	3.4	0.01	0.2	0.2	C1
761130	1651	13.30	34-58.23	82-59.11	1.68	-.60	6	198	2.9	0.04	0.5	1.3	C1
761202	10 2	10.11	34-58.41	82-57.73	0.42	-.11	7	172	3.5	0.11	0.6	2.6	C1
761204	1421	42.09	34-58.16	82-58.55	2.27	1.32	6	261	4.7	0.01	0.1	0.2	C1
761205	113	23.64	34-57.82	82-54.54	0.99	1.44	7	179	3.9	0.02	0.1	0.4	B1
761205	353	22.77	34-55.70	82-56.76	2.45	-.60	8	202	0.8	0.05	0.3	0.4	C1
761206	431	39.41	34-57.82	82-58.65	1.60	-.11	6	168	3.0	0.01	0.1	0.3	B1
761213	2024	24.77	34-56.43	82-56.15	0.34	-.60	6	136	2.0	0.02	0.2	0.7	B1
761216	938	0.13	34-56.56	82-56.14	1.44	1.18	6	227	2.2	0.01	0.2	0.3	C1
761217	052	53.91	34-56.35	82-56.14	0.94	1.27	6	142	2.0	0.01	0.1	0.5	B1
761218	629	1.75	34-56.[illegible]	82-56.14	0.50	-.40	8	143	1.9	0.01	0.[illegible]	11.1	C1
761219	352	47.31	34-57.65	82-56.41	2.31	-.60	6	192	3.3	0.02	0.2	0.3	C1
761228	940	13.08	34-56.76	82-56.17	3.57	-.11	8	117	2.4	0.05	0.3	0.6	B1
770114	020	54.71	34-58.28	82-56.00	1.78	1.32	7	130	2.4	0.04	0.4	1.1	B1
770114	026	22.52	34-58.54	82-54.95	2.96	1.64	6	186	2.4	0.02	0.3	0.4	C1
770115	345	24.32	34-57.87	82-58.96	0.65	-.11	8	177	2.6	0.03	0.1	1.8	B1
770117	534	18.18	34-57.50	82-58.98	0.76	.01	6	214	2.3	0.03	0.5	2.6	C1
770117	2222	59.01	34-57.47	82-58.67	0.73	1.32	6	151	2.8	0.06	0.1	1.7	B1
770121	1241	39.49	34-56.91	82-57.23	0.16	-.24	8	108	2.0	0.16	0.4	1.2	B1
770123	054	43.62	34-59.68	82-55.30	1.78	-.60	7	255	0.9	0.16	2.1	1.6	C1
770202	1725	20.35	34-57.87	82-57.00	1.76	1.37	8	133	3.6	0.04	0.2	0.8	B1
770202	2356	21.63	34-56.48	82-57.31	1.03	.44	8	108	1.2	0.02	0.2	0.4	B1
770204	2348	49.27	34-58.24	82-57.67	1.53	-.40	6	163	3.7	0.00	0.0	0.1	B1
770205	2 4	52.67	34-57.62	82-59.21	0.05	.12	8	170	2.1	0.04	0.3	0.7	B1
770206	2154	11.27	34-56.72	82-56.22	0.06	1.93	8	118	2.3	0.14	0.7	1.9	B1
770209	312	34.97	34-56.21	82-56.11	1.80	-.60	6	153	1.9	0.02	0.1	0.2	B1
770209	1943	7.98	34-56.25	82-55.97	0.34	.57	8	152	2.1	0.04	0.2	0.5	B1
770210	1 7	13.52	34-56.20	82-56.03	1.47	-.60	8	155	2.0	0.03	0.2	0.5	B1
770210	253	25.79	34-56.31	82-56.07	0.80	-.11	8	146	2.0	0.01	0.1	0.3	B1
770213	1331	23.39	34-57.76	82-58.74	0.49	-.24	8	167	2.9	0.02	0.1	0.3	B1
770213	1436	29.37	34-57.80	82-58.48	0.41	.21	6	257	4.1	0.02	0.3	0.6	C1
770214	621	5.43	35- 1.11	82-56.28	2.74	.82	7	292	2.9	0.03	0.5	0.3	C1
770217	22 7	6.73	34-58.13	82-58.06	0.02	1.18	5	168	6.1	0.02	0.1	29.8	D1
770218	852	36.18	34-57.89	82-57.86	1.75	1.32	8	154	3.9	0.09	0.4	1.8	B1
770218	611	4.43	34-59.43	82-53.41	2.70	-.40	6	261	3.0	0.01	0.1	0.2	C1
770218	939	2.76	34-57.97	82-56.59	1.92	-.40	8	125	3.2	0.04	0.2	0.6	B1
770220	346	13.77	34-56.20	82-56.65	0.51	-.40	6	139	1.2	0.02	0.3	3.0	C1
770220	937	43.17	34-57.18	82-56.56	1.68	-.40	6	190	2.7	0.02	0.2	0.5	C1
770221	1743	41.73	34-57.21	82-56.45	1.93	1.32	6	165	2.9	0.00	0.0	0.1	B1

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...CASSEE EARTHQUAKES FROM OCTOBER 28, '76 TO FEBRUARY 28, '77

770221	2111	21.88	34-57.19	82-56.39	1.10	.21	6	162	2.9	0.02	0.2	1.0	B1
770222	253	40.59	34-56.24	82-56.38	2.65	-.86	6	145	1.5	0.01	0.1	0.2	B1
770222	532	32.35	34-57.36	82-59.05	0.69	.01	8	151	2.2	0.03	0.1	1.4	B1
770222	842	19.54	34-56.95	82-56.08	0.05	-.86	7	110	2.8	0.23	0.1	0.4	B1
770223	7 8	49.08	34-59.52	82-53.05	2.75	.37	9	269	4.3	0.04	0.4	0.6	C1
770223	850	7.92	34-57.19	82-56.43	1.55	2.25	5	103	1.8	0.01	0.2	0.5	C1
770223	855	4.88	34-57.21	82-56.38	1.53	-.86	8	198	1.9	0.02	0.1	0.2	C1
770223	9 4	32.49	34-57.26	82-56.38	1.58	.37	10	105	1.8	0.02	0.1	0.1	B1
770223	1458	19.30	34-57.19	82-55.83	1.47	-.40	6	278	2.5	0.03	0.4	0.6	C1
770223	15 4	42.15	34-57.29	82-56.53	1.48	-.24	9	102	1.6	0.03	0.1	0.3	B1
770223	1937	45.31	34-57.18	82-56.39	2.40	-.40	6	198	1.9	0.01	0.2	0.2	C1
770224	356	5.98	34-57.30	82-56.18	1.03	1.37	10	111	2.0	0.04	0.2	0.6	B1
770224	633	55.38	34-58.02	82-57.34	1.00	1.02	11	147	0.2	5.92	24.0	28.5	D1
770225	259	43.64	34-58.08	82-58.64	0.94	-.86	6	179	2.2	0.01	0.3	0.7	B1
770225	32[illegible]	58.71	34-56.35	82-56.17	0.32	-.86	8	236	1.9	0.01	0.2	0.3	C1
770225	1226	19.03	34-57.17	82-56.13	1.72	-.60	8	111	2.2	0.02	0.1	0.4	B1
770225	1712	38.96	34-57.32	82-56.52	2.37	.29	6	189	1.6	0.02	0.4	0.4	C1
770225	1913	1.97	34-57.09	82-56.04	0.16	-.11	8	216	2.4	0.02	0.1	0.2	C1
770226	135	1.10	34-57.15	82-56.58	1.53	-.86	6	190	1.7	0.02	0.5	0.7	C1
770226	615	7.23	34-56.05	82-53.29	1.90	-.99	6	297	6.1	0.20	7.2	25.1	D1
770227	610	42.21	34-57.45	82-56.04	1.89	.01	10	118	2.0	0.09	0.3	1.0	B1
770228	049	47.13	34-57.47	82-55.98	1.07	-.86	6	120	2.1	0.01	0.1	0.3	B1
770228	632	54.29	34-56.51	82-57.41	0.36	-.24	8	196	1.3	0.09	1.0	1.2	C1
770228	740	38.51	34-56.59	82-57.27	0.61	-.40	8	182	1.4	0.01	0.1	0.6	C1
770228	2315	15.76	34-56.27	82-56.56	1.54	.12	8	137	1.3	0.04	0.3	0.7	B1