

TECHNICAL REPORT 82-3

SEISMIC ACTIVITY NEAR THE V.C. SUMMER NUCLEAR STATION

**For the Period
July - September 1982**

by

Pradeep Talwani
Principal Investigator
Geology Department
University of South Carolina
Columbia, S.C. 29208
Contract No. N301315

Technical Report 82-3

SEISMIC ACTIVITY NEAR
THE V. C. SUMMER NUCLEAR STATION

For the Period
July - September
1982

by

Pradeep Talwani
Principal Investigator
Geology Department
University of South Carolina
Columbia, S.C. 29208

Contract No. N230519

INTRODUCTION

This report presents a summary of seismic activity near the V. C. Summer Nuclear Power Station in South Carolina for the three month period between July 1 and September 30, 1982. During this reporting period a total of 63 locatable events were recorded. The largest events were of magnitudes between 1.0 and 2.0 and are listed in Table 1.

SEISMIC NETWORK

The report is based on the data recorded by a four-station network operated by S.C.E. and G. In addition, data from a permanent station (JSC) of the South Carolina seismographic network is also used. Location of all these stations is shown in Figure 1, and their coordinates are listed in Appendix I.

DATA ANALYSIS

Location of the events is determined using HYP071 program (Lee and Lahr, 1972) and the velocity model given in Appendix II. The event magnitude (M_L) is determined from signal duration at Station JSC, using the following relation:

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

where D is the signal duration (seconds).

An estimate of daily energy release is determined using a simplified magnitude (M_L) energy (E) relation by Gutenberg and Richter, 1956.

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

RESULTS

The 63 locatable events recorded during this reporting period (July 1 - September 30, 1982) are listed in Appendix III. Five events had

TABLE 1

<u>Date</u>	<u>Magnitude</u>
July 29	1.42
July 29	1.12
July 30	1.15
August 27	1.32
September 18	1.44

magnitudes between 1.0 and 2.0 and the rest were small ($M_L \leq 1.0$). Their depth estimates indicate that 35% of the activity during this period occurred below 2.0 km depth, the deepest event being 4.7 km deep. However, in the past, relocation of these events with magnetic tape data suggests that these may be shallower than the true depths.

A sequence of 14 events occurred near Newberry, S.C., about 25 km west of the V. C. Summer station, in July and August. The main event ($M_L = 2.3$) occurred July 16 and was followed by eight smaller shocks between July 16 and July 22, and five on August 12 and 13. (See also Robinson *et al.*, 1982.)

A cumulative plot of the epicenters of the events located during this reporting period is shown in Figure 2. A cross section along the line AA' (Fig. 2) 48° NW including events within 0.5 km of the line is shown in Figure 3. The hypocentral locations are shallower below the Monticello Reservoir than outside it. The clusters of activity do not appear to define any fault plane. A monthly breakup of their locations is shown in Figures 4-6.

RESERVOIR WATER LEVEL AND ITS COMPARISON WITH SEISMICITY

Monticello Reservoir is a pumped storage facility. Any decrease in reservoir level associated with power generation is recovered when water is pumped back into the reservoir. There can be variations up to about 4 feet per day between the maximum and minimum water level. We have been monitoring this water level to see if there is any correlation between the daily or seasonal changes in the reservoir level and the local seismicity. Figure 7 shows the comparison of water level to seismicity. The top two graphs show the water level and the change of water level per day. The

number of events per day and log of energy released per day are shown on the lower two graphs. The histograms showing events per day and log of energy release, include the unlocated events around the reservoir.

CONCLUSIONS

This reporting period, July 1 through September 30, 1982, is characterized by a low level of seismic activity. Figure 8 shows a histogram of the number of events per month from December, 1977 through September, 1982, which suggests a long term seismic trend at Monticello Reservoir of discrete earthquake swarms separated by relatively quiet periods. The low level of seismicity for this three month period is in agreement with the long term trend in that it follows the large swarm that occurred during the previous reporting period.

REFERENCES

- Gutenberg, B. and Richter, C. F. (1956). Magnitude and energy of earthquakes, Ann. Geof. 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 HYPO 71, U.S.G.S. Open-File Report, 100 pp.
- Robinson, A. W., Rawlins, J. and Talwani, P. (1982). The Newberry County, S.C., earthquakes of July and August, 1982, Earthquake Notes, v. 53, no. 3, p. 33.

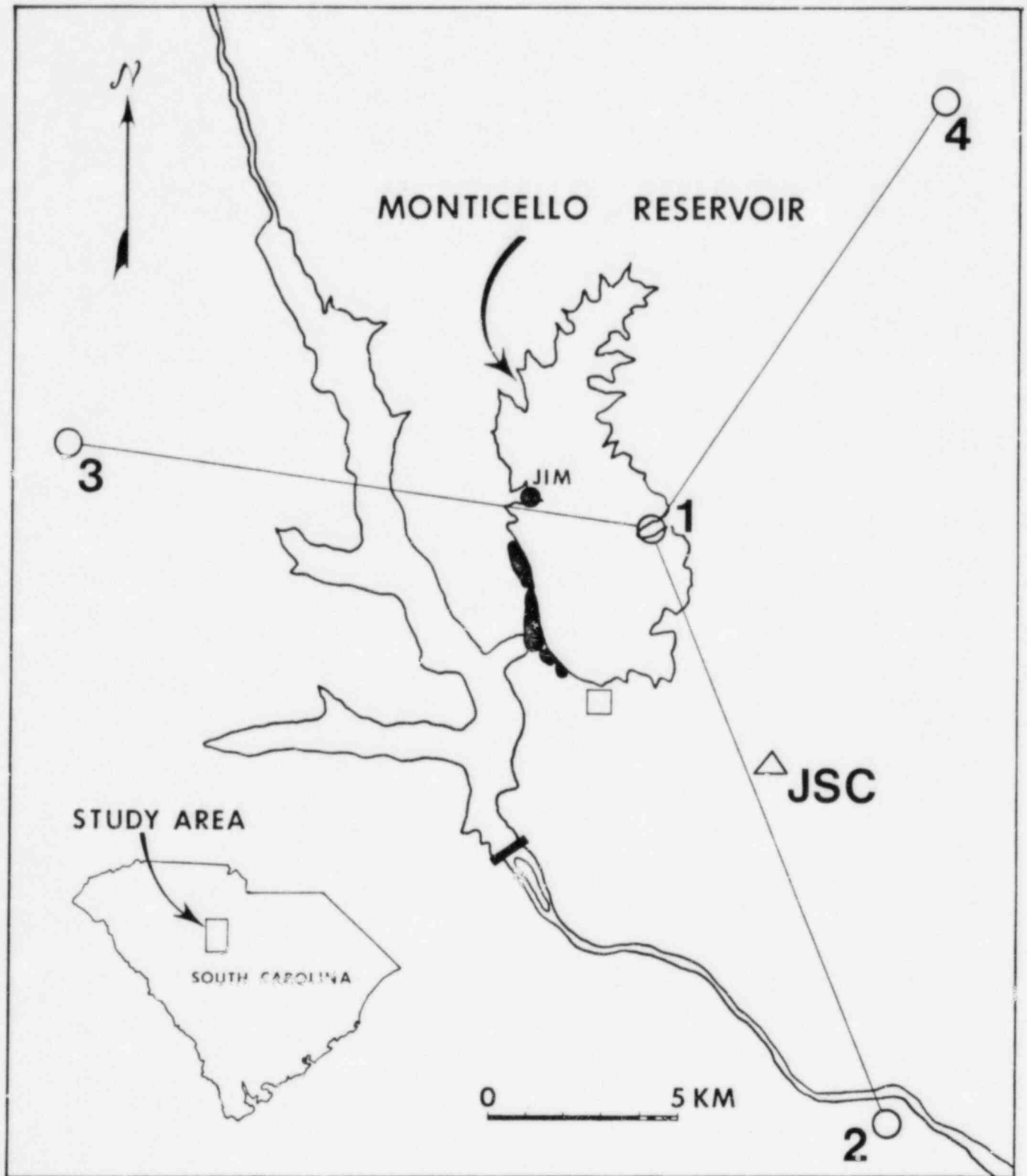


Figure 1

MONTICELLO EARTHQUAKES JULY - SEPTEMBER 1982

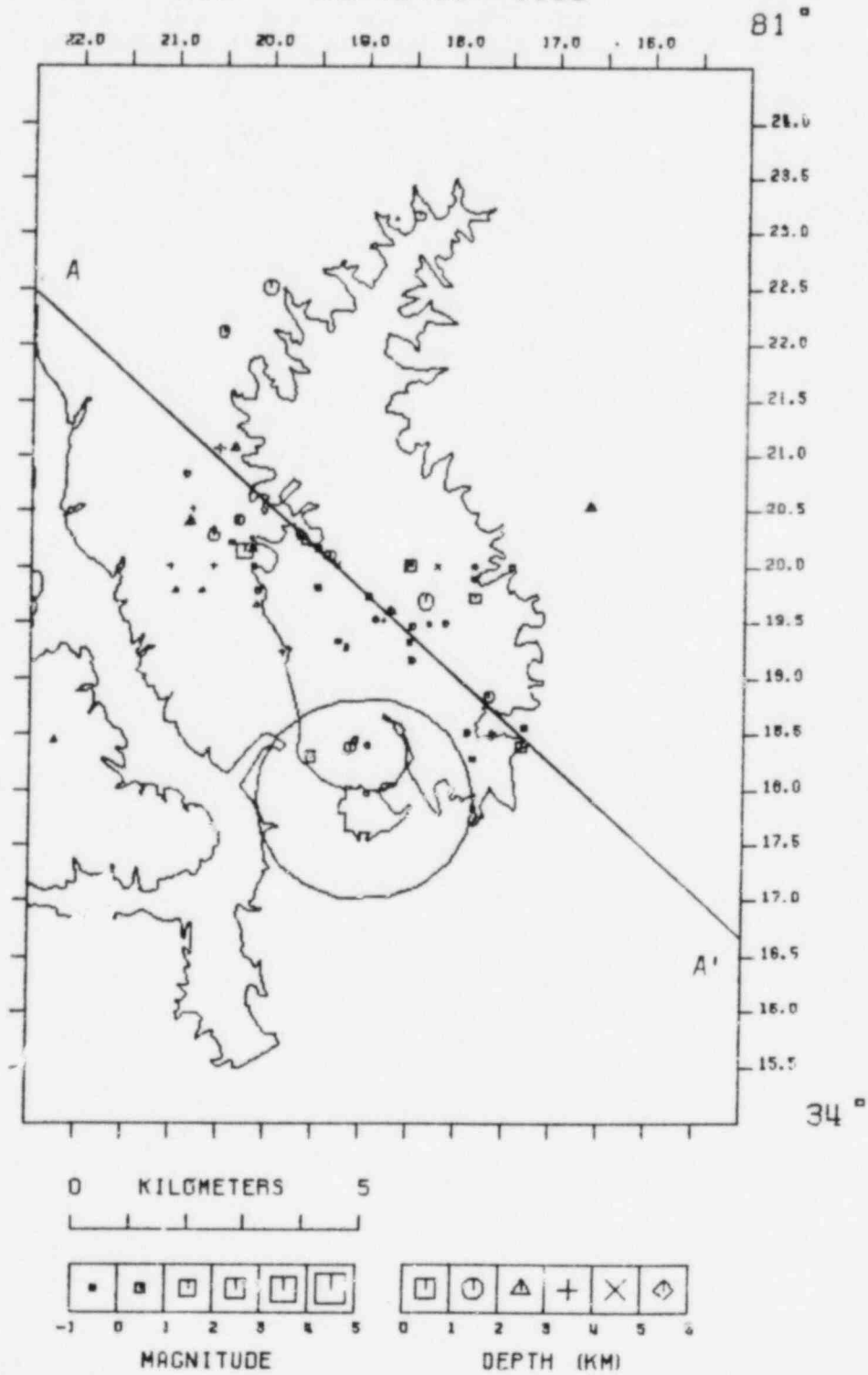


Figure 2

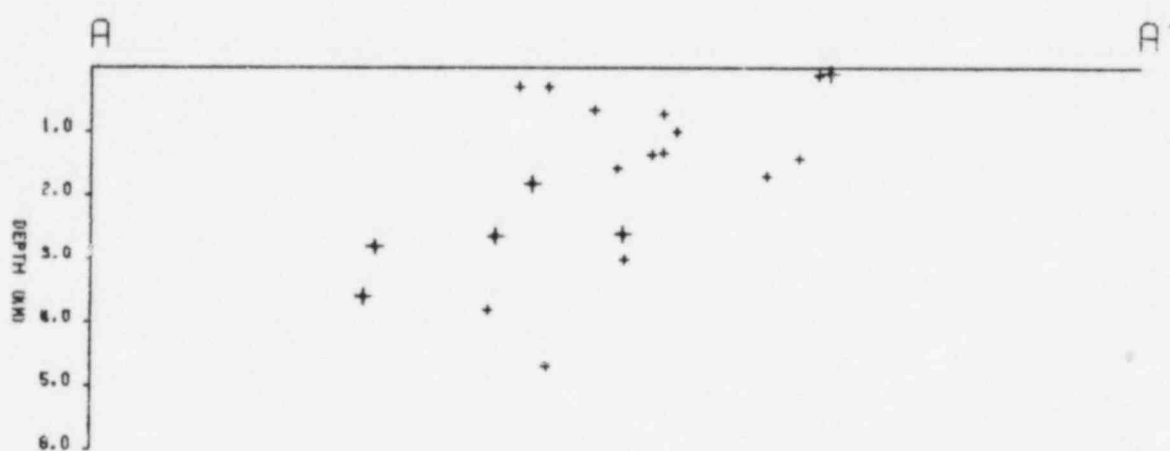


Figure 3

MONTICELLO EARTHQUAKES JULY 1982

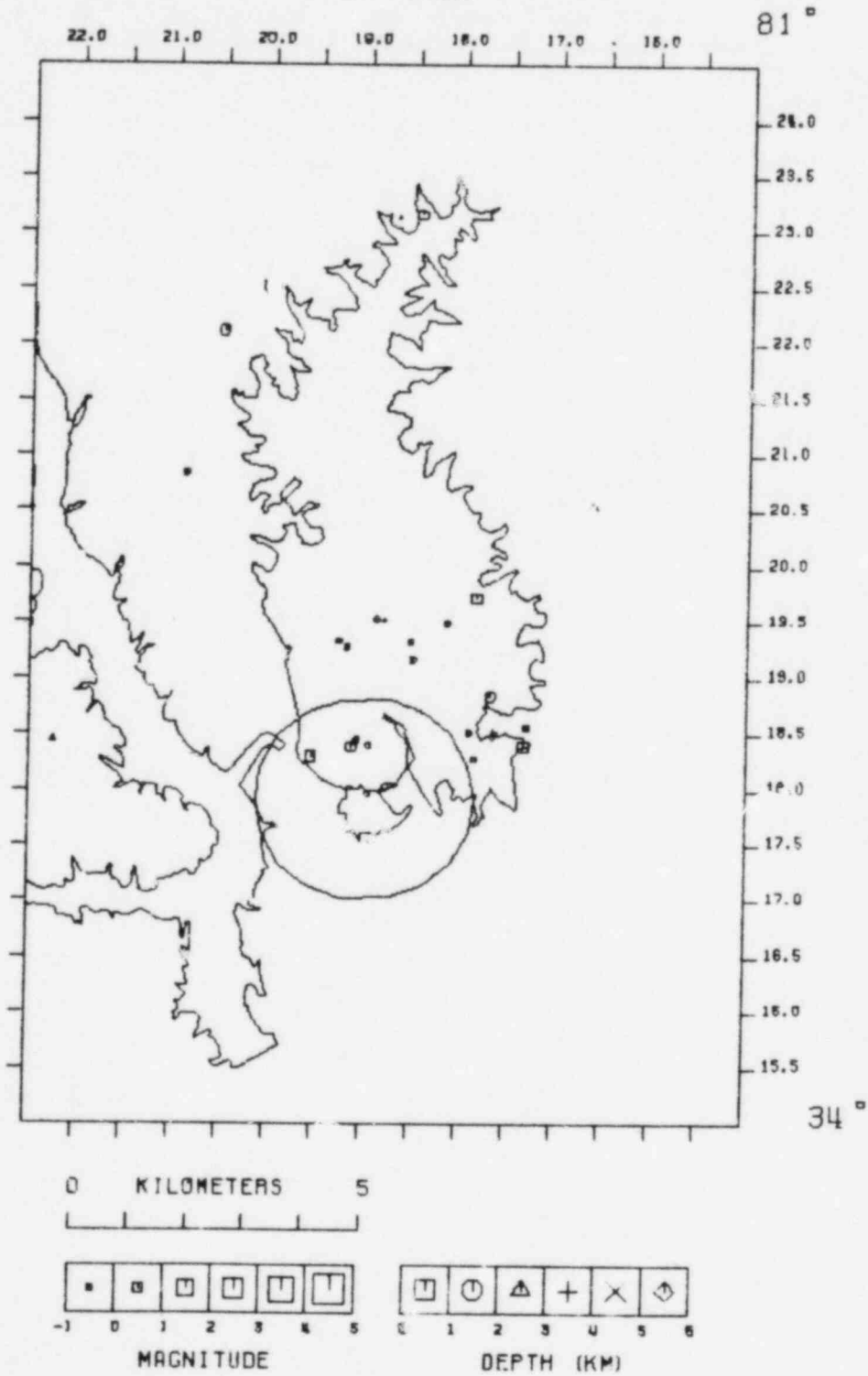


Figure 4

MONTICELLO EARTHQUAKES AUGUST 1982

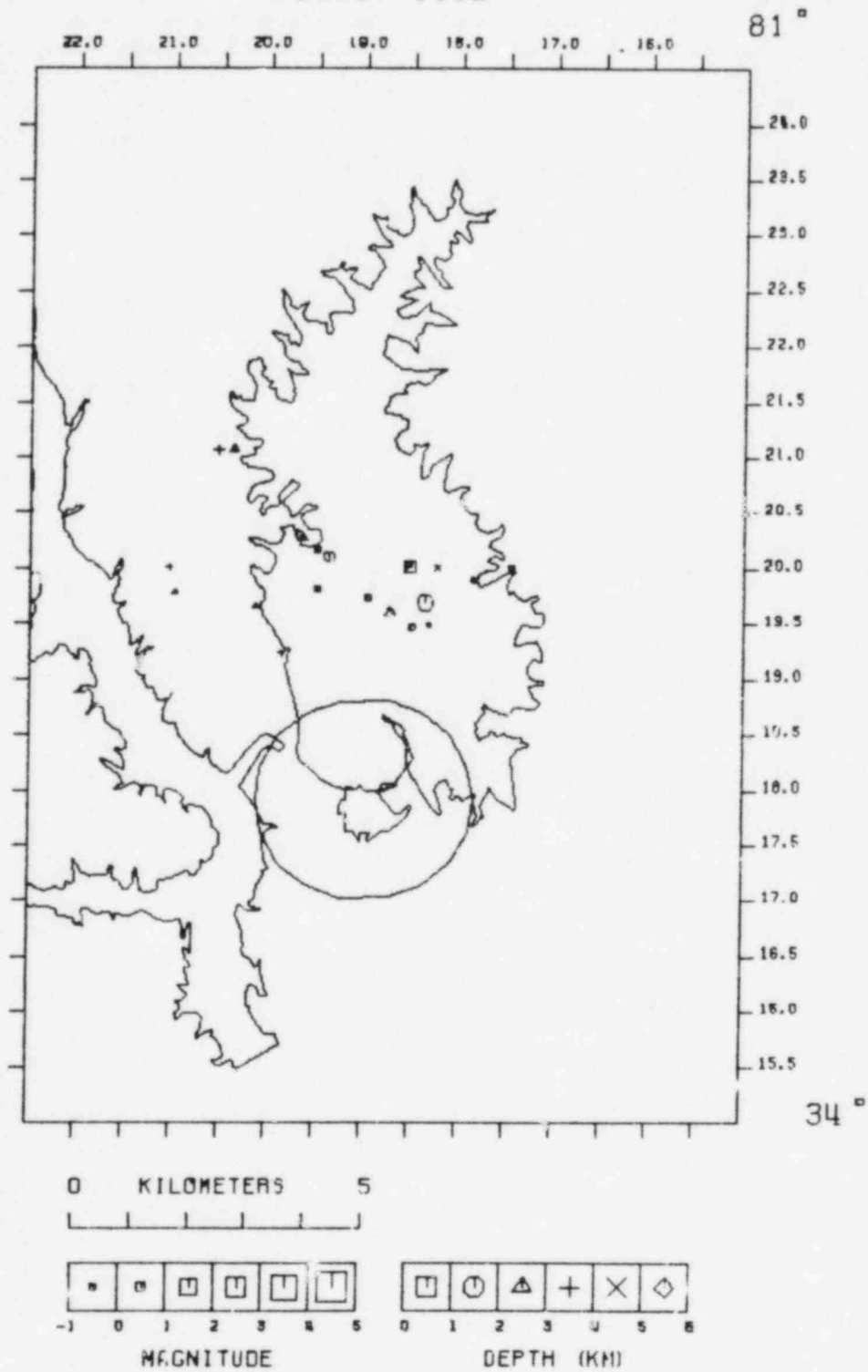


Figure 5

MONTICELLO EARTHQUAKES SEPTEMBER 1982

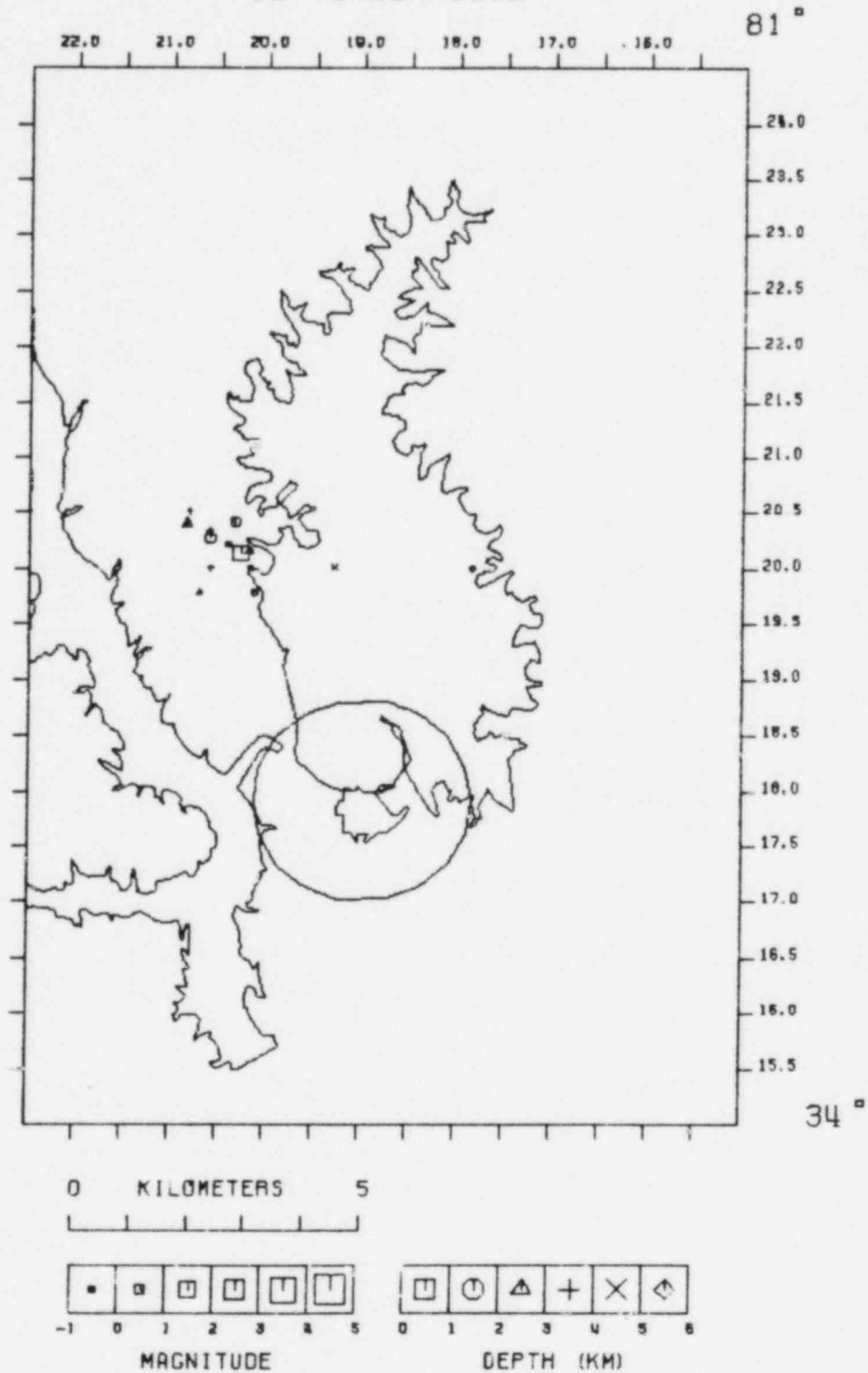


Figure 6

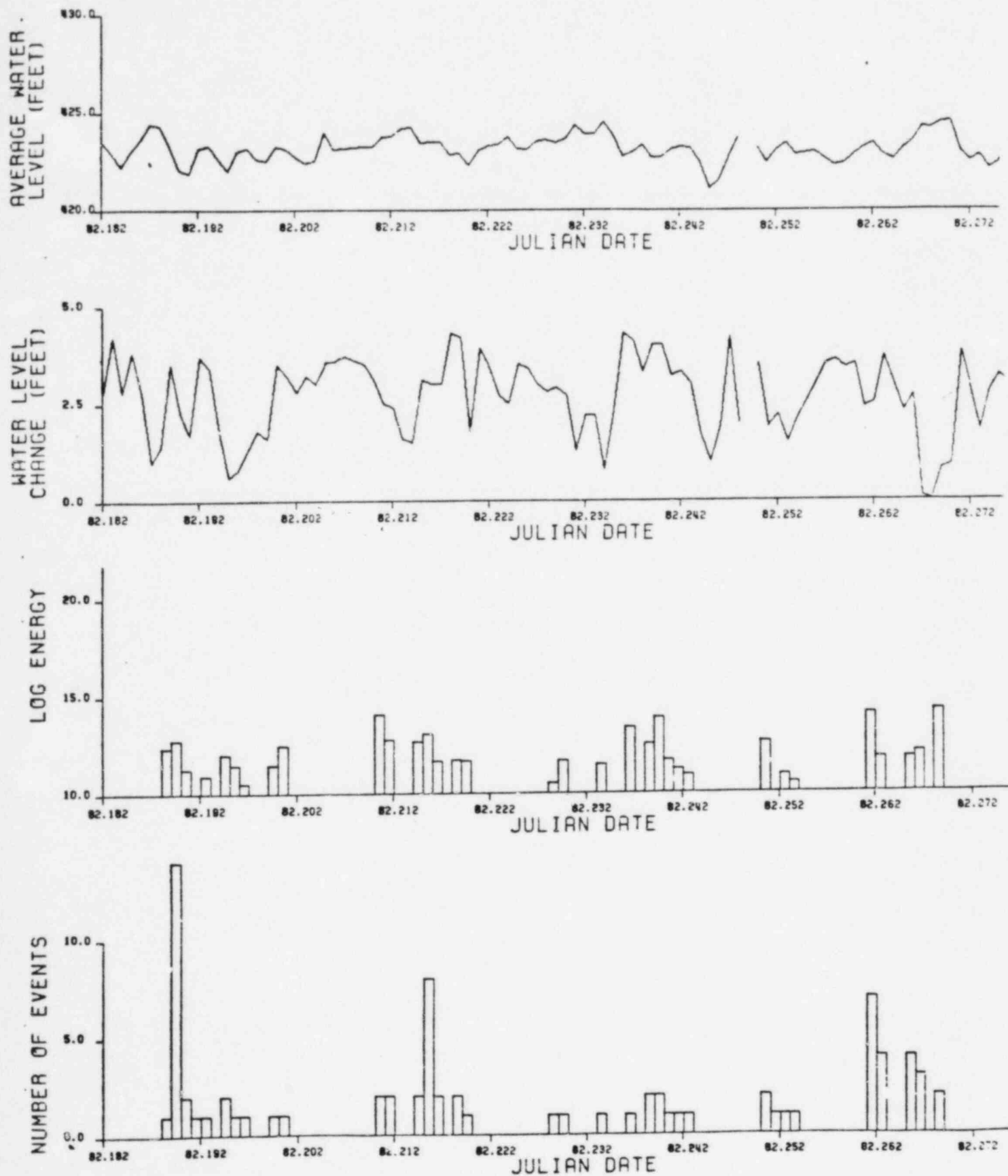


Figure 7

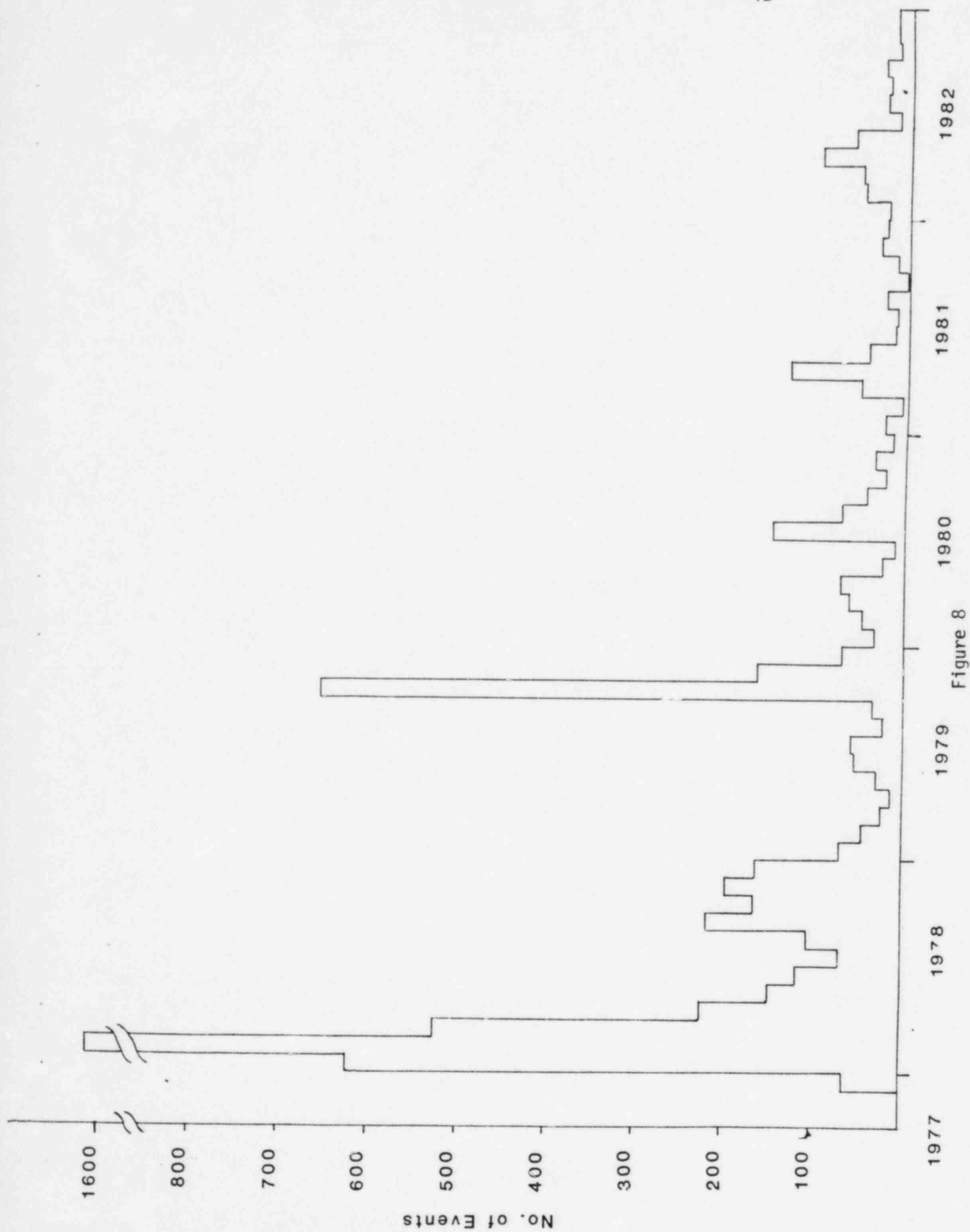


Figure 8

APPENDICES

APPENDIX I

STATION LOCATION

<u>NO.</u>	<u>STN.</u>	<u>LAT. N.</u>	<u>LONG. W.</u>
1	001	34°19.91'	81°17.74'
2	002	34°11.58'	81°13.81'
3	003	34°21.09'	81°27.41'
4	004	34°25.72'	81°12.99'
5	JSC	34°16.80'	81°15.60'
6	008	34°24.53'	81°24.55'

APPENDIX II

MONTICELLO RESERVOIR

VELOCITY MODEL

Velocity km/sec	Depth km
1.00	0.00
5.40	0.03
5.90	0.18
6.10	0.46
6.30	0.82
8.10	30.00

APPENDIX III

MONTICELLO EARTHQUAKES JULY - SEPTEMBER 1982

DATE	TIME	ORIGIN	LAT N	LONG W	DEPTH	MAG	NO	GAP	DMIN	RMS	ERH	ERZ	Q
820708	0333	55.82	34.19	81.18	3.03	-0.24	6	262	1.8	0.04	0.7	0.0	0.0
820708	548	35.64	34.18	81.18	1.34	-0.24	7	203	3.4	0.09	0.7	0.2	0.0
820708	651	1.69	34.17	81.18	1.85	-0.60	7	212	4.0	0.08	0.7	0.1	0.0
820708	656	2.43	34.19	81.19	1.85	-0.60	7	190	2.0	0.07	0.4	0.0	0.0
820708	848	3.07	34.18	81.19	1.90	-0.60	7	204	3.4	0.08	0.7	0.0	0.0
820708	848	3.39	34.18	81.17	1.55	-0.60	5	234	2.6	0.09	1.6	0.1	0.0
820708	849	3.29	34.18	81.19	1.99	-0.01	8	206	3.0	0.07	0.5	0.0	0.0
820708	853	3.35	34.18	81.19	0.56	-0.09	8	212	2.4	0.08	0.5	0.1	0.0
820708	854	1.08	34.18	81.17	1.43	-0.60	3	223	2.4	0.08	0.5	0.1	0.0
820708	856	1.17	34.18	81.17	0.12	-0.60	5	204	2.6	0.08	0.5	0.1	0.0
820708	1523	3.82	34.18	81.17	0.09	-0.61	8	178	2.2	0.08	0.5	0.1	0.0
820708	1172	7.36	34.19	81.18	1.34	-0.40	9	130	1.1	0.03	0.0	0.0	0.0
820708	1917	12.66	34.20	81.18	1.60	-0.60	5	246	2.1	0.05	1.1	0.0	0.0
820708	202	4.87	34.18	81.17	1.71	-0.22	7	246	2.0	0.05	0.0	0.0	0.0
820709	2339	4.11	34.18	81.17	0.55	-0.40	6	234	3.0	0.06	1.1	0.0	0.0
820709	1522	3.36	34.18	81.17	1.00	-0.63	3	355	1.8	0.01	0.0	0.0	0.0
820710	334	1.13	34.19	81.22	0.63	-0.60	6	236	1.7	0.04	0.4	0.1	0.0
820711	547	2.88	34.18	81.17	0.07	-0.67	7	183	0.4	0.06	0.7	0.0	0.0
820713	1023	3.95	34.19	81.18	1.00	-0.75	3	355	1.0	0.02	0.0	0.0	0.0
820714	449	5.03	34.19	81.18	0.99	-0.20	5	167	6.1	0.00	0.0	0.0	0.0
820715	1712	5.56	34.19	81.20	1.37	-0.60	7	249	2.5	0.06	0.0	0.0	0.0
820718	127	1.22	34.20	81.18	1.38	-0.24	10	173	5.1	0.06	0.0	0.0	0.0
820719	2014	3.87	34.23	81.18	1.80	-0.77	10	135	6.6	0.06	0.0	0.0	0.0
820722	1528	5.84	34.23	81.18	1.97	-0.44	9	360	6.6	0.05	0.0	0.0	0.0
820729	2020	3.59	34.22	81.20	1.98	-0.55	8	295	7.7	0.08	0.0	0.0	0.0
820730	2332	10.43	34.22	81.20	1.94	-0.21	8	154	5.9	0.05	0.0	0.0	0.0
820802	68	4.88	34.21	81.20	0.82	-0.30	8	143	4.4	0.00	0.0	0.0	0.0
820803	1518	3.81	34.21	81.20	0.44	-0.01	4	269	2.8	0.06	0.0	0.0	0.0
820803	845	2.76	34.21	81.18	0.60	-0.55	8	143	4.4	0.06	0.0	0.0	0.0
820803	1009	4.89	34.22	81.18	0.86	-0.24	10	244	1.1	0.06	0.0	0.0	0.0
820803	1010	5.78	34.22	81.18	0.60	-0.67	10	122	0.0	0.08	0.0	0.0	0.0
820803	1014	5.47	34.22	81.18	0.67	-0.01	10	243	1.1	0.00	0.0	0.0	0.0
820803	1115	1.33	34.22	81.19	0.31	-0.40	10	123	2.4	0.06	0.0	0.0	0.0
820803	1333	3.80	34.22	81.19	0.49	-0.37	10	268	2.2	0.06	0.0	0.0	0.0
820803	1840	2.73	34.22	81.19	0.83	-0.24	10	127	2.5	0.04	0.0	0.0	0.0
820803	2153	3.33	34.22	81.19	0.33	-0.24	8	162	3.3	0.00	0.0	0.0	0.0
820804	2154	2.88	34.22	81.19	0.49	-0.00	8	127	3.3	0.04	0.0	0.0	0.0
820804	2019	3.44	34.22	81.19	0.01	-0.05	7	136	5.5	0.00	0.0	0.0	0.0
820806	1159	8.56	34.22	81.19	0.79	-0.11	9	140	5.0	0.02	0.0	0.0	0.0
820817	836	1.10	34.20	81.17	0.01	-0.45	7	233	0.0	0.00	0.0	0.0	0.0
820821	311	1.78	34.20	81.17	0.94	-0.24	6	243	2.5	0.00	0.0	0.0	0.0
820824	2030	3.54	34.20	81.18	0.62	-0.60	9	127	2.3	0.04	0.0	0.0	0.0
820826	227	5.57	34.20	81.19	0.66	-0.27	10	128	3.0	0.00	0.0	0.0	0.0

[illegible]