E.H.

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THE SOUTHERN CALIFORNIA NETWORK BULLETIN
JULY 01 THROUGH DECEMBER 31 1985

by

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This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

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I. INTRODUCTION

The second half of 1985 began a period of transition for the Southern California Seismic Network. A number of changes were made in network management and data processing equipment, and new equipment was received that will be placed in the field in 1986.

On October 1 Dr. Tom Heaton became Scientist in Charge at the Pasadena office of the U.S. Geological Survey, Dr. Lucy Jones assumed responsibility for the management of seismic operations, and Chuck Koesterer became the manager of network operations. Dr. Carl Johnson who managed the USGS operations of the cooperative network since 1979 is transferring to the USGS Hawaiian Volcano Obsevatory in July, 1986. All associated with the Southern California Seismic Network are grateful to Dr. Johnson for his years of dedicated service, especially in the development of the Caltech-USGS Seismic Processing (CUSP) system.

Seismic data is now being processed on a new DEC VAX750 minicomputer running the CUSP system (Johnson, 1983). The installation of the VAX750 required several months. There was no routine processing of off-line seismic data from August 1 through November 10, and the large accumulation of unprocessed on-line data will require several months to eliminate.

Seismic activity in Southern California ranged from moderately high to very low during the period. The lack of major earthquake swarms was fortunate, as any such activity would have added considerably to the bulk of unprocessed seismic data which accumulated during the transition to the new computer.

II. EARTHQUAKE DATA PROCESSING, JULY 1 THROUGH DECEMBER 31 1985

During the first few months of 1985, a decision was made to replace the DEC PDP 11/70 used for processing of seismic data with a VAX750. The decision was prompted by the increasing unreliability of the 11/70, as well as a need for greater capacity to process seismic data than was possible with that system. In 1985 CUSP was revised to run on VMS operating systems, and by the end of the year it was running on both the Caltech VAX750 and the VAX750 at the Hawaii Volcano Observatory (HVO).

The Caltech and USGS computers have been linked with a DECNET software system which operates over an ETHERNET connection. This allows seismic data and programs to be readily transferred between the two VAX computers. Other links have been planned to connect the two on-line PDP 11/34 computers with the Caltech VAX750, which will allow earthquakes recorded by the on-line systems to be located within a few minutes of real time.

Processing with the 11/70 ended during the last week of August 1985 and resumed on November 11. Although there was no off-line processing of digital seismic data within this period, many earthquakes were read by hand from helicorder records and hardcopy from the online systems. The locations obtained from these readings comprise an interim earthquake catalog, which is complete at the magnitude 2.5 level. Many smaller earthquakes are included as well. The interim catalog is being superseded by the completed version as the digital seismic data obtained during this period is processed.

The estimated time for completion of the backlog is June or July of 1986. Other backlogs exist from previous years, and once the 1985 data is complete they will be worked on in turn. These other backlogs have resulted from periods when the volume of incoming seismic data exceeds the capacity of Laboratory staff to process it, or from modifications to off-line processing systems that make it difficult to read seismic data recorded on the previous system. Table 1 provides a summary of all periods of unprocessed digital data from 1977 to the present.

The present goal is to substantially reduce all backlogs by the end of 1986. The VAX750 can support the operation of both of the Tektronix 4014 graphics terminals in the Laboratory, allowing two analysts to work simultaneously. This capability, and a continuation of the current low seismicity levels, should allow rapid progress to be made on the backlogs. Once they are eliminated, users of Southern California seismic data will have a consistently processed set of data available for use in research.

During the August - November period, the backup data recording system became very important. Most southern California stations do not have any visible output; they are recorded only during triggers of the on-line computers. The backup system consists of an Ampex tape recorder, which continuously records the output of 32 of the 48 phone lines that carry seismic data from the field to the Seismology Laboratory. The recordings consist of multiplexed, frequency-modulated seismic signals on 1-inch tape, and are referred to as "FM" tapes. During periods of incomplete or absent on-line data, the recordings can be used to obtain seismograms from stations that do not have any continuous visual output.

In periods of normal operation, each of these tapes is held in storage until all the seismic data for the month in which it was recorded has been completed, to cover possible periods of incomplete or absent on-line data. When all earthquake data has been obtained for that month, they are sent to the Menlo Park office of the USGS. When they are received, the earthquakes contained on each are duplicated, or "dubbed", on a similar tape which is stored permanently in Menlo Park. Following the dubbing procedure, the tapes are returned to Pasadena where they are degaussed and reused.

At present the tapes are needed in Pasadena to fulfill their backup role, as most contain data that was recorded during the August - December 1985 period. Only a limited number of tapes are available for recording current data. For this reason the dubbing process has been discontinued, and no permanent analog recordings of Southern California earthquakes are being made. As the backlog is reduced, more FM tapes will be freed for reuse; eventually enough will be available to allow the dubbing process to resume. This may not be possible until well into 1986.

III. OBTAINING SOUTHERN CALIFORNIA SEISMIC DATA

During the 54 years of its operation, many hundreds of thousands of earthquakes have been located by the Network. There is a great deal of interest on the part of researchers to gain access to this immense data set. In the first issue of the Bulletin (Norris et al., 1986), there was a brief section describing the types of data available for research use, with a note that formal procedures for obtaining access to the data had not been finalized at that time. In recent weeks, policies have been established and they are presented in this section.

Brief questions concerning a recent earthquake may be directed to the Seismology Laboratory office (818) 356-6912; the calls will be transferred to Laboratory staff, who will handle the inquiry. If there is some brief written material pertaining to a question, it may be copied and sent to the inquirer upon request.

A. CATALOG DATA

Requests which involve generating listings of all events in some geographic region require the use of staff and computer time. As a result, Caltech charges a $20 handling fee for each request. This charge is waived for requests from academic or government institutions, and members of Caltech's Earthquake Research Affiliates.

The requests must include the geographic area to be searched, the magnitude range, and the time period of interest to the inquirer. It is preferred that the geographic specification be given as the latitude and longitude values of the corners of a polygon surrounding the area. A description of the area is acceptable if it is clear.

Copies of the catalog from 1932 through 1985 can be made in EBCDIC format on a computer tape, which the user supplies. This version of the catalog contains summary data only, no phase data or seismograms. The tape should be mailed to Dr. Kate Hutton at the Seismology Laboratory; the address is listed on the title page of the Bulletin.

The catalog has also been published in a set of three volumes (Hileman et al., 1973, Friedman et al., 1976, Hutton et al., 1984). The volumes contain hypocentral data from 1932 through 1984, as well as detailed station information and references to a number of important publications on the seismicity of southern California. Several copies are available for use in Room 269 of the South Mudd building, and copies are available in limited amounts for purchase at the Caltech Student Book Store.

B. ANALOG SEISMOGRAMS ON PAPER, FILM AND MAGNETIC TAPE

Requests for copies of seismograms from helicorders and photographically recording seismographs should be directed to Paul Roberts at (818) 356-6955, or 356-6966. The Laboratory has a Mita copier which can make full-size copies of paper seismograms, and at present Caltech charges $4 per copy.

From July 1971 to February 1983 most Network stations were recorded on develocorder films. These films, in addition to a microfilm reader, are stored at the Kresge Laboratory. Kresge is located a few miles from campus in the west part of Pasadena, and visits may be arranged through Paul Roberts. No original records of any kind may be removed from either of the Laboratories.

Seismograms from many Southern California earthquakes from February 1979 through July 1985 are available in analog form on the 1-inch "FM" magnetic tapes described in the Earthquake Data processing section. The person to contact for information on these is Jack Tomey at the Menlo Park office of the USGS at (415) 323-8111, ext 2632.

C. DIGITAL SEISMOGRAMS

Computerized digital recording of seismograms in southern California began in 1977 (Johnson, 1979). Changes in computer systems since then along with the processing backlogs mentioned earlier have left the data in various degrees of accessibility. A summary of the present state of seismic data from Southern California from 1932 to the present is given in Table 1.

Digital seismograms on magnetic tape are stored at Caltech for all time periods that have been processed (see Table 1). Information and computer programs are available for deciphering the different formats used. However, accessing this data takes considerable computer and user time. If you are interested in using the seismogram data, you are encouraged to come to Caltech and obtain it personally. Computer time and programs will be made available to you on the VAX750. If this is not feasible and only one or two earthquakes are involved, it might be possible to arrange for a tape to be made; such requests will be considered with regard to the other obligations of our technical staff at the time. The people to contact for seismic data are Dr. Kate Hutton, or Dr. Lucy Jones at the addresses listed on the title page of the Bulletin.

D. PHASE DATA

Arrival times and other phase information are available on cards for earthquakes recorded from 1927 to 1977. From 1960 onward, phase data are also available in some sort of computerized format. The previous edition of the Bulletin (Norris et al., 1986) contains a description of these formats, which vary due to changes in computers and data processing systems over time.

From 1981 to the present, the primary data storage has been in the CUSP data base. These data require some computer translation to be read by a non-CUSP computer. Efforts are being made to prepare HYPOELLIPSE-format phase files for distribution of CUSP data, but the work has not yet been completed.

If only a few events are involved it may be possible for our staff to send Xerox copies of phase data from lists generated by location programs. Many time periods between 1977 and 1985 are covered; write or call Kate Hutton or Lucy Jones to inquire about specific events. For requests involving larger volumes of data it is probably best for researchers to come to Caltech; as with digital seismograms, programs and computer time will be made available.

IV. NETWORK OPERATION, JULY 1 THROUGH DECEMBER 31 1985

Station performance was good throughout the period, and the Network finished the year in top condition. An extensive maintenance effort during the final months of 1985 brought nearly 99% of all stations in operation by the end of the year, including most of the stations in the Mojave Desert that were damaged by lightning in July 1985.

A new station, Jawbone Canyon (JAW) was installed in September. The site is located near the Garlock fault in the extreme southeastern section of the Sierra Nevada, about 87 km. east of Bakersfield. In addition, four new stations operated by the University of Southern California were added to the on-line computers in addition to four previously received from USC. Location coordinates and elevations for these eight stations are listed in Table 2.

During the summer and fall months, the assembly of equipment required to operate the new microwave telemetry system was completed. The antennas and their support towers were installed at the relay sites, along with racks to support receivers, amplifiers, and other electronic equipment. The final steps required prior to activating the system are approval for use of the microwave frequencies from federal agencies, and the installation of modems to link telephone lines with the microwave system. Operation of the system is planned to begin during the first half of 1986.

Another project requiring much work during this period was the construction and preparation of fifty new VCO's (Voltage Controlled Oscillators) which will be installed in the field in 1986. The VCO's, in addition to new discriminators to be added next year, will substantially improve the quality of incoming seismic data. These improvements will include increased dynamic range and a decrease in background noise.

The J502's have several design features that should result in improved performance over the J402 and J302 models currently in use, including the following:

1. They will be powered from the radio batteries, which are external from the VCO casing. The earlier models have been powered from internal batteries, and experience has shown that waste gases from the

internal batteries cause corrosion of the circuit elements, leading to eventual failure. The external power design will extend the life of the VCO.

2. The center frequency is less prone to drift than previous models, which will decrease the background noise at stations where they are installed.

The J402 models presently in use in the field will eventually be modified to use an external power supply, which will give them the extended operating life of the J502.

Most of the VCO models currently in use contain a calibration circuit, which generates a brief signal at regular intervals that contains information about the VCO, as well as tests of the VCO electronics and the seismometer damping. The signals are useful for checking the condition of the VCO and the seismometer.

Each station generates its calibration pulse at one of four times in the pre-dawn hours, when the background noise is lowest. There are plans to capture these signals on the backup on-line 11/34 so they can be routinely examined. On this system they can be recorded on tape without interfering with the normal operation of the primary on-line system. At present the pulses are not sufficiently synchronized to be successfully processed by the VAX750, but this should be feasible within the next few months.

A series of six modified J101 discriminators were tested in the Seismology Laboratory to evaluate several features being designed into new discriminators to be installed in 1986. Six stations in the Walker

Pass area of the southern Sierra Nevada were selected to have duplicate signals for comparison during the period; one from the test discriminator and the other from the standard discriminator assigned to it. The stations affected are listed in Table 2.

The test discriminators were in use from August through December 1985. Seismologists are currently examining seismograms recorded from the output of both the standard and modified discriminators to make decisions on the characteristics of the production models. No decisions have been made at this time, but under consideration at present is an increase of the rolloff from the present value of 3 hz to 20 hz, and doubling the signal output voltage from 2.5 volts/125 hz deviation to 5 volts. The response characteristics of the production models will be described in a future issue of the Bulletin.

The signals from both the test discriminators and the standard ones were recorded on archive tapes. Users of data from this period (August through December 1985) should be aware of these duplicate signals, which are identified by the addition of the numeral 1 or 2 following the three letter station code.

6. SYNOPSIS OF SEISMICITY, JULY 1 THROUGH DECEMBER 31 1985

Seismicity in Southern California was generally moderate during most of this period, but low in November and December. There were 99 earthquakes above magnitude 3 located by the Network, and felt reports were received for 24 events. The locations of the magnitude 3 events are given in Table 3, and Figures 1 and 2 display epicenters of earthquakes located during the period. Figures 3 and 4 show the cumulative count of all earthquakes above M = 2.5 in 11 regions of Southern California over the 48-month period ending December 31. They provide a context in which to view the seismic activity of this six month period.

Significant activity in July included a swarm in the southern Mojave Desert beginning on July 15, centered at approximately 34° 25'N, 116° 34'W. This is approximately 15 km northwest of the 1979 Homestead Valley earthquakes (Stein and Lisowski, 1983). The largest event was a M = 4.1 located on the southeast side of the swarm center on July 18. Figure 5 displays the epicentral area and a focal mechanism for the M = 4.1 event, which suggests it was generated by left-lateral slip on a northeast-trending, nearly vertical fault plane.

August had moderately high activity. Most notable were two swarms; one below the Salton Sea near the intersection of the Brawley seismic zone and the San Andreas Fault, and a fairly short but intense swarm in the Indian Wells Valley section of the Owens Valley. The locations of these swarms are shown in Figures 6 and 7 respectively with the focal mechanisms of the largest events in each.

The greatest activity from the Salton Sea swarm was seen on August 20, which included ten earthquakes of M 2.0 or greater within the epicentral area. During the ten days following this swarm there were eight events of M = 2.0 or above on the Imperial Valley fault south of the area shown in Figure 7.

The Indian Wells swarm peaked on August 22 with a M = 4.6 followed by intense earthquake activity. The swarm center is located near the Airport Valley graben, which is subparallel to the Sierra Nevada frontal fault.

Seismicity in September and October was somewhat lower than August, but October contained the two most significant earthquakes of the entire six month period. On October 2 a M = 4.9 earthquake disturbed the eastern Los Angeles Basin, the largest event in Southern California since October 1982. The epicentral area was in the city of Redlands, 6 mi. SE of the downtown area of San Bernardino. There was an aftershock of M = 2.7 one hour after the main shock.The focal mechanism indicates right-lateral slip on a fault striking N 20° W, probably the San Jacinto fault (figure 8). The epicenter is near the intersection of the San Jacinto and Banning faults, very close to the location of a M = 6.0 in 1923.

Another earthquake of unusual interest occurred on October 31, a M = 3.7 located within 1 km. of the surface trace of the San Andreas fault just west of Palmdale (figure 9). The last significant activity in this area was a M = 3.0 in 1984. A M = 2.0 foreshock occurred 20 minutes prior to the 3.7, and there were two aftershocks, also M = 2.0, later that same day. The focal mechanism for the 3.7 is consistent with those from other earthquakes that occur near the San Andreas fault between Fort Tejon and Cajon Pass; it shows oblique reverse right-lateral slip on a plane oriented at N 50° W with a NE dip of 50 degrees. This event follows three others of magnitude 2.5 to 3.0 that occurred along this section of the fault in July. This amount of activity is not commonly observed.

November and December were relatively quiet months, which was the general trend for 1985 as a whole in southern California. Only eight events of M = 4.0 or greater occurred within the Network during the year; locations and focal mechanisms of these events are displayed in

Figure 10. The decrease in activity can be seen in Figure 4, which displays the cumulative count of earthquakes of M = 2.5 and greater in each of 11 regions in southern California. Reductions in seismicity during the July - December 1985 period are most noticeable in the Los Angeles, Kern County, and Elsinore areas. A notable exception is the Santa Barbara area, which continues at the increased level of activity that began early in 1984.

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TABLE 1
DIGITAL DATA STATUS
1977-1985

FROM	TO	PROCESSING STATUS AND DESCRIPTION
1977	5/10/80	CEDAR system - already processed; tapes can be read but would like to translate to CUSP format; recorded at 800 bpi.
5/80	7/80	Mammoth Lakes swarm; large number of earthquakes already processed on UNIX system but tapes not readable on present sytem.
7/80	3/81	Unprocessed raw data tapes.
3/81	3/83	Early CUSP "Q" tapes, not finalized. Due to some bugs in loading long files, some earthquakes -primarily large ones - have not been processed.
mid-4/83	6/83	Unprocessed data; Coalinga swarm.
7/83	9/85	Finalized CUSP data.
10/85	12/20/85	Unprocessed; transition to VAX750.
12/20/85	present	Processed

TABLE 2
CHANGES TO NETWORK, JULY 1 - DECEMBER 31 1985

The following station was added to the Southern California network during this period:

CODE	STATION NAME	LAT	LON
JAW	JAWBONE CANYON	35 18.96	118 02.69

The following stations, operated by the University of Southern California, were added to the on-line computer during this period. They are only recorded when the on-line computer triggers on a seismic event.

CODE	STATION NAME	LAT	LON
CIW	CATALINA IS. WEST	33 27.92	118 33.10
DHB	DOWNHOLE BALDWIN HILLS	34 01.05	118 23.13
GFP	GRIFFITH PARK	34 07.76	118 18.59
GFPN	GRIFFITH PARK, N-S	34 07.76	118 18.59
GFPE	GRIFFITH PARK, E-W	34 07.76	118 18.59
PVP	PALOS VERDES	33 47.20	118 24.15
RCP	REC. PARK, LONG BCH.	33 46.66	118 08.00
SBI	SANTA BARBARA IS.	33 28.84	119 01.72

The following stations had duplicate signals from August through December 1985, during the operation of the test discriminators described in the Network Operation section.

CODE	STATION NAME	LAT	LON
WKT	KERN TULARE	35 47.64	118 26.55
WHV	HAVILAH	35 30.60	118 31.07
WOR	ONYX RANCH	35 41.79	118 14.52
WLH	LITTLE HORSE	36 09.14	118 18.70
WRV	ROSE VALLEY	36 00.47	117 53.42
WCH	CHIMNEY PEAK	35 52.98	118 04.48

TABLE 3
SOUTHERN CALIFORNIA EARTHQUAKES, MAG. 3 AND ABOVE
JULY 1 THROUGH DECEMBER 31, 1985

The following table contains hypocentral data. The CUSP-ID column lists the unique number assigned to each event by the CUSP system during processing on the off-line computer. All magnitude values are expressed as ML.

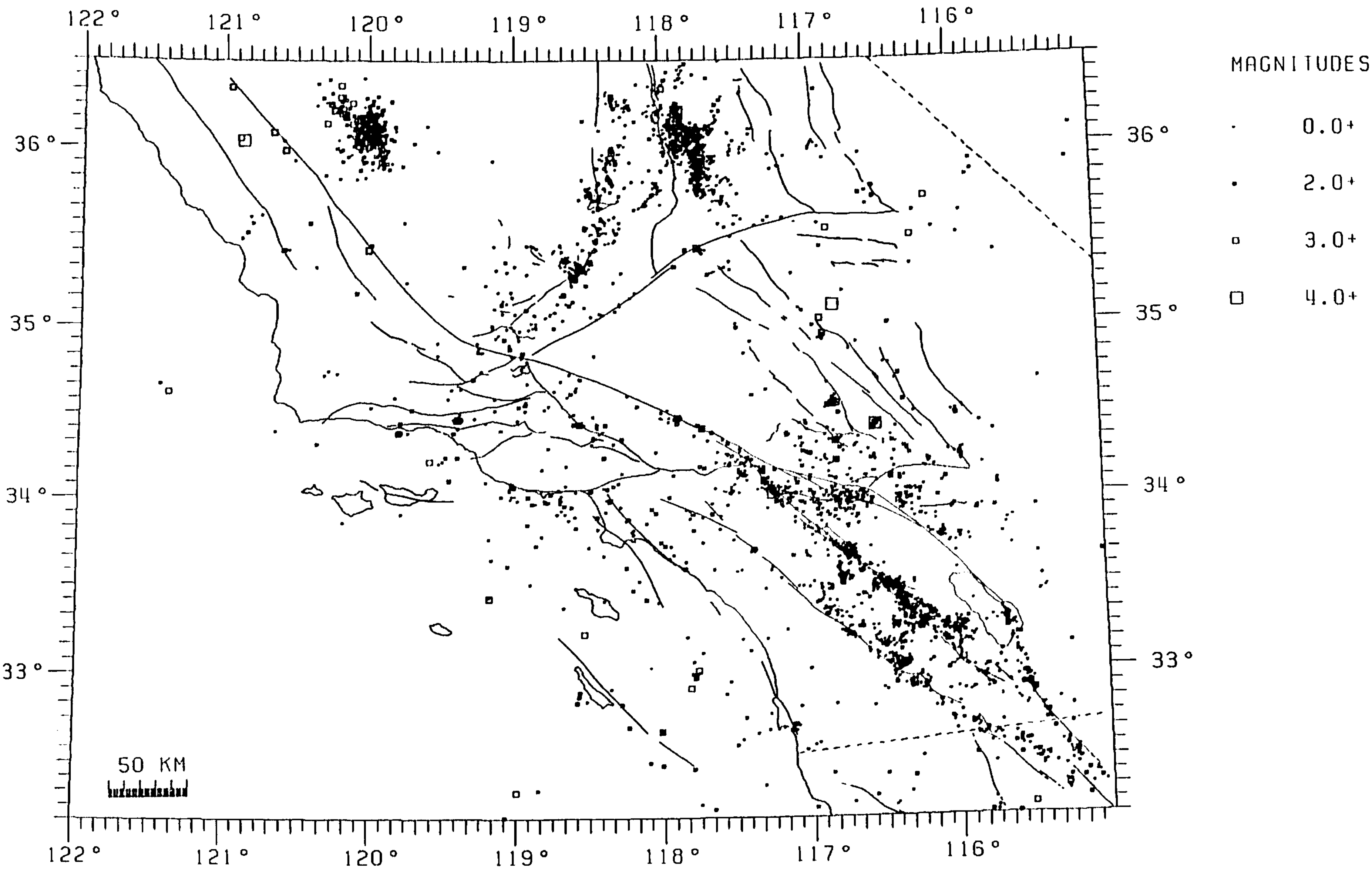
MON	DA	HRMN	SEC	LATITUDE	LONGITUDE	DEP.	MAG.	Q	CUSP-ID
JUL	11	0243	33.63	36 03.14	117 43.43	1.95	3.11	A	70728
JUL	12	0047	22.93	35 58.92	120 35.05	6.00	3.40	C	70409
JUL	13	1235	57.66	36 20.67	120 58.00	6.00	3.20	D	70385
JUL	16	1757	50.97	34 32.60	116 50.53	0.01	3.91	A	68278
JUL	18	1405	25.78	34 25.30	116 32.52	6.00	4.18	C	70912
JUL	23	2016	44.91	36 00.62	114 38.31	6.00	3.64	D	71219
JUL	24	1545	43.48	36 13.01	120 14.62	6.00	3.60	C	71273
JUL	26	0602	54.48	36 13.41	120 11.28	6.00	3.27	C	71368
AUG	03	1357	11.19	36 09.15	120 05.26	6.00	3.73	C	108253
AUG	04	1129	15.37	36 08.72	120 03.10	6.00	4.34	C	69892
AUG	04	1129	25.86	35 06.53	116 48.80	14.06	4.35	D	110292
AUG	04	1129	27.49	36 05.00	120 00.00	6.00	4.20	C	110349
AUG	04	1130	41.17	36 15.51	120 07.20	6.00	3.59	D	69713
AUG	04	1201	56.03	36 09.07	120 02.92	6.00	5.80	C	69717
AUG	04	1208	41.81	36 07.14	119 59.35	6.00	4.12	C	108316
AUG	04	1309	19.24	36 08.99	120 02.60	6.00	3.30	C	108362
AUG	04	1318	37.86	36 10.06	119 59.09	6.00	3.35	D	110293
AUG	04	1318	38.45	36 07.79	119 59.36	6.00	3.43	C	108331
AUG	04	1334	37.95	35 03.40	119 57.58	6.00	3.30	C	108362
AUG	04	1515	39.53	36 03.10	119 58.69	6.00	4.44	C	108420
AUG	04	1551	50.33	36 02.71	119 58.04	6.00	3.34	C	108423
AUG	04	2215	00.56	36 03.57	119 57.73	6.00	3.16	C	108501
AUG	04	2345	51.49	36 02.67	119 58.73	6.00	3.11	C	108512
AUG	05	1445	38.29	36 07.88	119 59.83	6.00	4.35	C	108618
AUG	05	1522	24.73	36 08.47	119 59.31	6.00	3.45	C	108584
AUG	06	0345	36.24	35 26.00	117 44.52	11.64	3.08	A	108662
AUG	06	1811	13.98	36 03.65	119 59.43	6.00	3.03	C	108737
AUG	07	0016	03.53	36 01.65	120 03.35	6.00	4.40	C	108769
AUG	07	0028	12.73	36 01.89	120 05.15	6.00	3.30	C	108771
AUG	07	2128	44.28	35 29.48	116 16.24	6.00	3.07	D	108887
AUG	09	0847	10.07	36 06.60	119 56.92	6.00	3.32	C	109067
AUG	09	0900	36.57	36 06.63	119 56.92	6.00	3.05	C	109068
AUG	09	0931	21.28	36 06.20	119 56.81	6.00	3.42	C	109161
AUG	09	0933	09.10	36 06.43	119 56.78	6.00	3.41	C	109072
AUG	09	0955	07.61	36 03.02	119 57.14	6.00	3.30	C	109081
AUG	09	1115	33.85	36 06.50	119 56.64	6.00	3.31	C	109086
AUG	09	1242	19.51	36 06.83	120 02.30	6.00	3.59	C	109162
AUG	09	1243	05.57	36 05.00	120 00.00	6.00	3.37	C	110347
AUG	11	0630	25.50	36 08.23	120 07.03	6.00	3.03	C	109415
AUG	12	2116	40.00	34 24.46	117 43.55	14.00	3.43	C	070249
AUG	14	0612	56.47	35 01.97	116 54.47	7.61	3.35	A	109571
AUG	16	0151	21.17	36 12.27	117 51.94	5.00	4.22	A	109668
AUG	19	2240	23.66	34 32.94	116 47.96	6.00	3.56	C	110022

MO	DA	HRMN	SEC	LATITUDE	LONGITUDE	DEP	MAG	Q	CUSP-ID
AUG	19	2310	26.16	34 56.72	116 53.51	3.87	3.22	A	110026
AUG	21	0019	03.75	32 07.34	116 23.48	6.00	3.23	C	110127
AUG	22	0019	42.88	35 53.44	117 44.18	3.30	3.50	B	533453
AUG	22	0020	02.53	35 55.00	117 43.00	6.00	3.91	C	533454
AUG	22	0021	44.06	35 53.00	117 43.00	6.00	4.55	C	533455
AUG	27	1830	52.36	36 10.16	120 00.65	6.00	3.04	C	112910
AUG	27	1902	07.60	36 00.73	120 00.34	6.00	3.30	C	112911
AUG	29	0455	05.26	32 53.23	115 30.56	4.90	3.20	A	113549
AUG	29	0759	08.68	34 19.34	116 48.91	6.29	3.84	A	113567
AUG	31	1325	52.05	36 02.87	119 54.66	6.00	3.24	C	113886
SEP	05	1433	49.00	33 58.25	116 57.47	15.21	3.10	A	116335
SEP	08	1217	17.65	36 01.96	120 04.16	6.00	3.23	C	116884
SEP	14	0302	45.28	36 12.59	120 14.96	6.00	3.29	C	117934
SEP	14	1918	42.30	34 24.43	119 47.64	8.94	3.10	C	100075
SEP	15	0248	55.87	33 57.81	115 44.87	19.45	3.13	A	100074
SEP	19	0735	03.64	34 27.58	119 22.64	15.27	3.37	A	100060
SEP	20	0805	06.53	34 23.39	119 47.67	10.05	3.05	C	100050
SEP	27	1924	33.73	32 20.92	119 05.41	6.00	3.22	D	100026
OCT	02	2344	12.43	34 01.69	117 14.95	15.26	4.89	A	100001
OCT	07	2015	. 35.85	32 25.41	119 16.54	6.00	3.21	C	107715
OCT	08	2217	42.10	36 11.33	120 09.70	6.00	4.26	C	107672
OCT	11	0016	27.12	35 37.62	116 15.66	6.00	3.75	C	107675
OCT	12	0904	47.14	34 26.64	118 33.50	3.78	3.34	A	107689
OCT	12	1934	35.99	32 19.00	118 59.75	6.00	3.44	D	107753
OCT	14	1504	40.97	32.08.06	115 51.18	6.00	3.03	C	107695
OCT	28	0132	50.58	36 00.67	119 56.75	6.00	3.22	D	107800
OCT	28	0142	30.49	35 59.16	119 54.99	6.00	3.00	D	107802
OCT	31	1955	04.17	34 28.19	117 53.76	6.67	3.73	C	107846
NOV	01	0008	51.47	32 00.43	116 20.10	6.00	3.31	C	107881
NOV	03	1251	02.08	32.54.77	117 49.15	12.00	3.13	C	108065
NOV	04	1509	27.98	32 40.13	118 00.99	6.00	3.48	D	108072
NOV	10	0325	17.37	33 13.39	118 32.01	6.00	3.58	D	109400
NOV	11	1617	44.09	33 25.28	116 22.42	16.01	3.01	C	109179
NOV	12	1529	24.23	36 05.00	120 00.00	6.00	3.15	C	109403
NOV	16	1206	49.51	35 48.47	114 29.58	6.00	3.10	D	109525
NOV	18	0631	44.34	33 28.36	116 23.44	4.99	3.15	A	109216
NOV	19	1244	56.72	32 13.64	115 31.58	6.00	3.66	D	109294
NOV	23	1446	45.39	35 46.55	117 43.91	4.84	3.19	A	109353
NOV	24	1256	15.60	36 21.59	120 12.32	6.00	3.33	D	109495
NOV	24	1921	39.84	36 02.17	120 52.85	6.00	4.40	D	109497
NOV	24	2308	15.06	36 03.01	120 54.10	6.00	3.21	C	109419
NOV	25	2344	21.51	33 25.78	119 10.49	6.00	3.60	C	109503
NOV	28	1030	30.63	33 04.28	115 59.15	6.00	3.01	C	109419
NOV	30	1221	38.70	33 00.63	117 45.93	6.00	3.08	C	109430
DEC	01	1735	17.76	34 09.20	117 19.42	1.51	3.36	A	109531
DEC	02	0322	38.29	36 05.82	119 58.08	6.00	3.00	D	109535
DEC	02	1953	16.89	34 37.42	121 22.92	6.00	3.16	D	109544
DEC	09	0256	35.28	33 25.55	119 10.67	6.00	3.65	C	112269
DEC	12	0743	34.18	35 32.17	116 51.06	5.03	3.09	D	112282
DEC	14	2241	44.71	36 04.96	120 40.12	6.00	3.32	C	110729

SOUTHERN CALIFORNIA EARTHQUAKES, MAG. 3 AND ABOVE (CONTINUED)

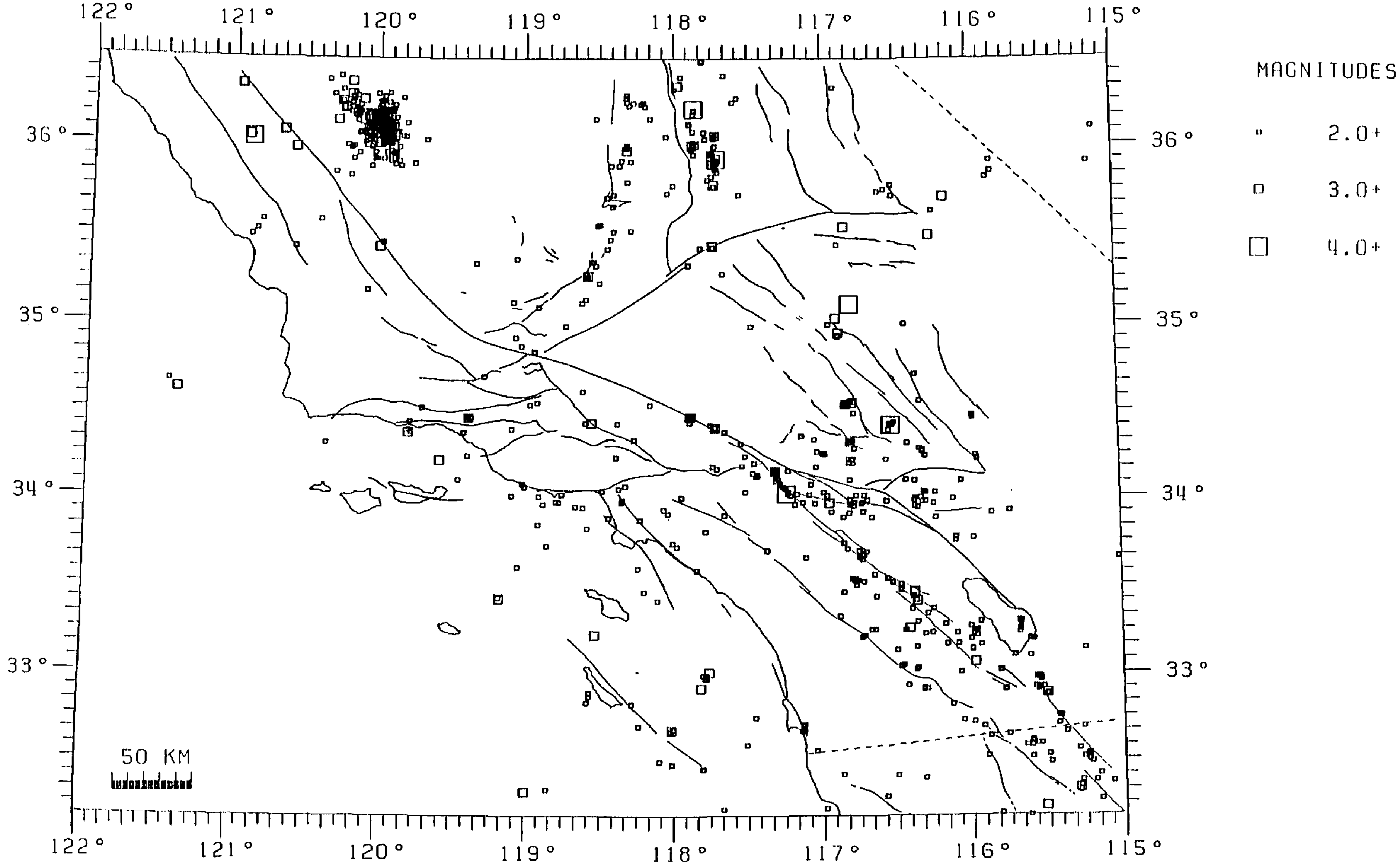
MO	DA	HRMN	SEC	LATITUDE	LONGITUDE	DEP	MAG	Q	CUSP-ID
DEC	16	0909	52.06	36 20.11	117 58.55	6.00	3.19	C	110821
DEC	16	2347	06.37	35 59.68	117 52.59	3.54	3.29	A	110889
DEC	25	1121	49.65	33 15.95	116 25.54	2.27	3.06	A	111791
DEC	30	0454	46.07	35 25.75	120 00.17	9.19	3.24	A	111954

FIGURE 1:
SOUTHERN CALIFORNIA, MAG. 0 AND ABOVE, JULY 1 - DECEMBER 31 1985



The epicenters of earthquakes of M = 0.0 and greater located by the Network from July through December of 1985. Note that this epicentral display is incomplete for earthquakes below the M = 2.5 level due to the backlog of unprocessed seismic data discussed in Section II.

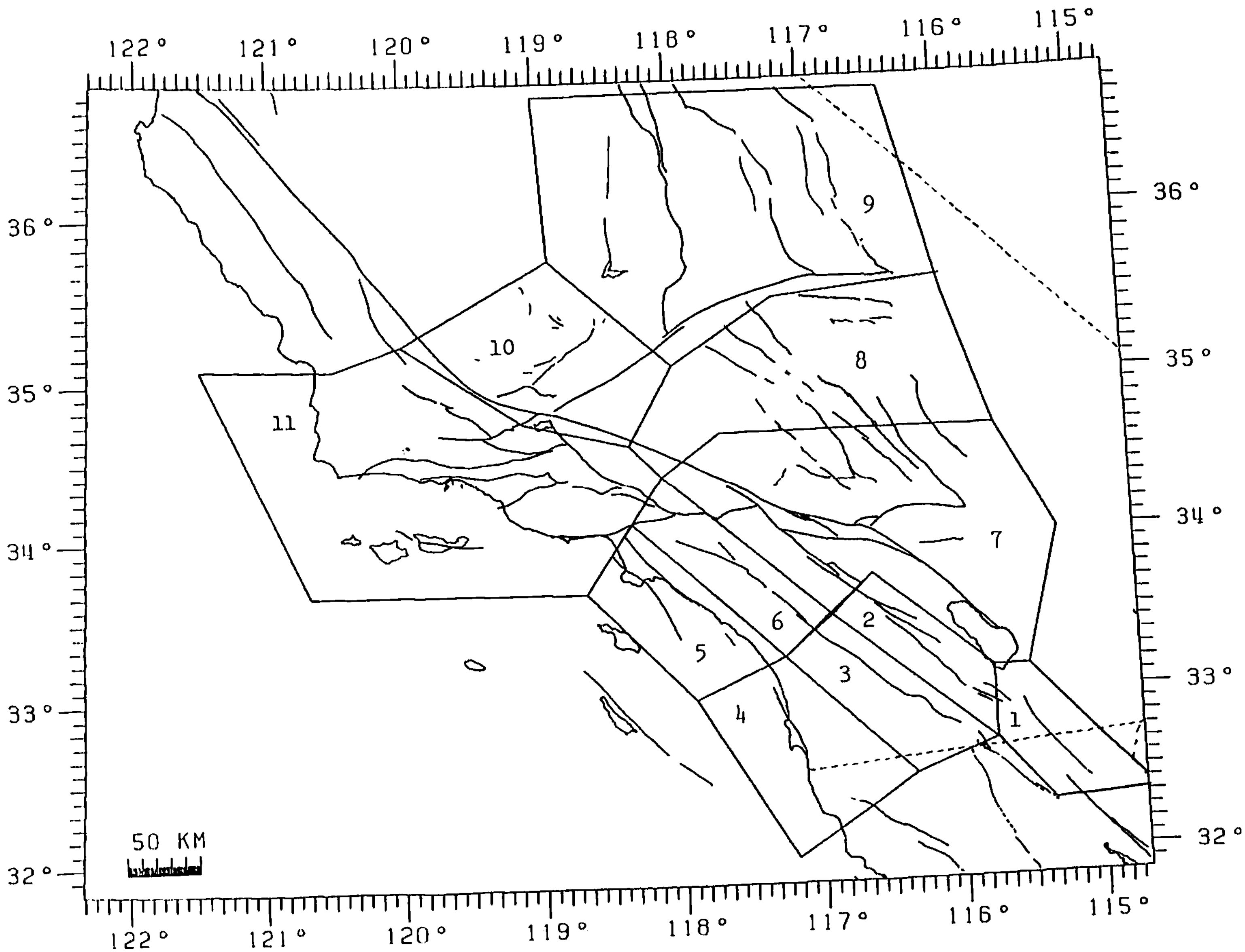
FIGURE 2:
SOUTHERN CALIFORNIA, MAG. 2 AND ABOVE, JULY 1 - DECEMBER 31 1985



The epicenters of earthquakes of M = 2.0 and greater located by the Network from July through December of 1985. Note that this epicentral display is incomplete for earthquakes below the M = 2.5 level due to the backlog of unprocessed seismic data discussed in Section II.

FIGURE 3

MAP OF REGIONS FOR SEISMICITY RATES



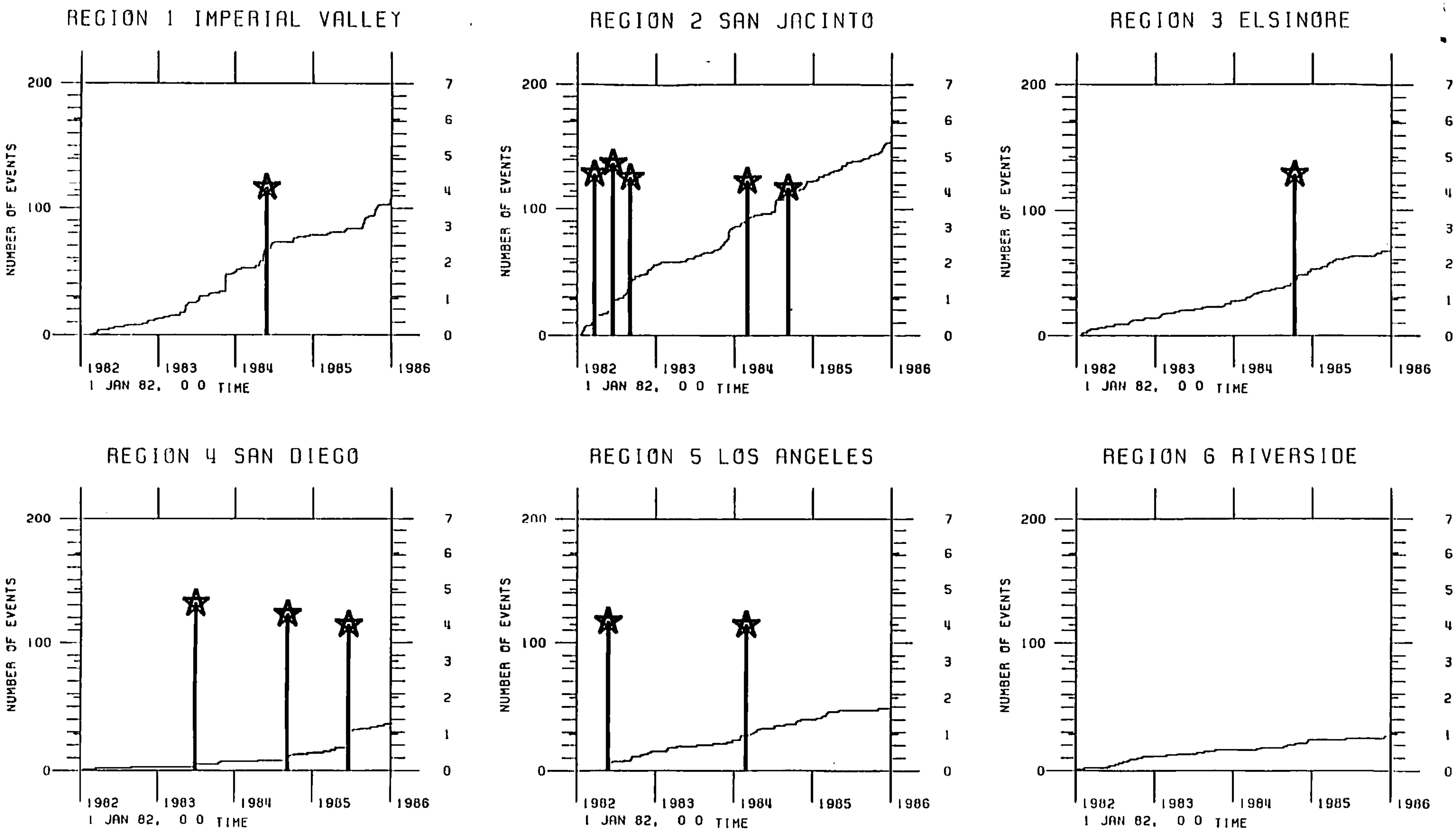


Figure 4: The cumulative number of earthquakes that occurred in regions 1-6 shown in figure 3 over the 48-month period ending December 31, 1985. All events of M = 2.5 or greater are included. The starred vertical lines denote earthquakes of M = 4.0 or greater (magnitude scales at right). Note that some regions extend beyond the area of complete station coverage.

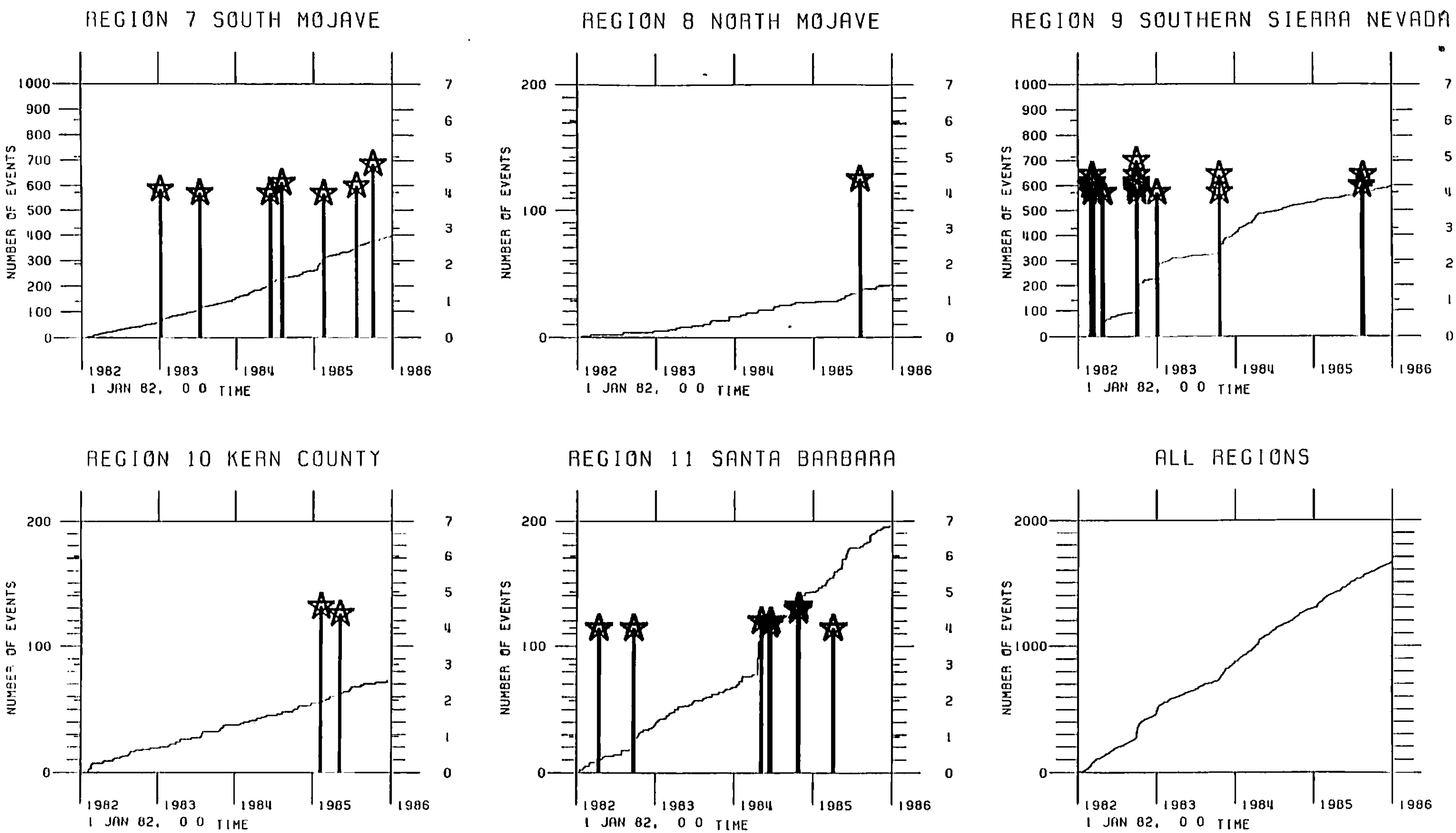
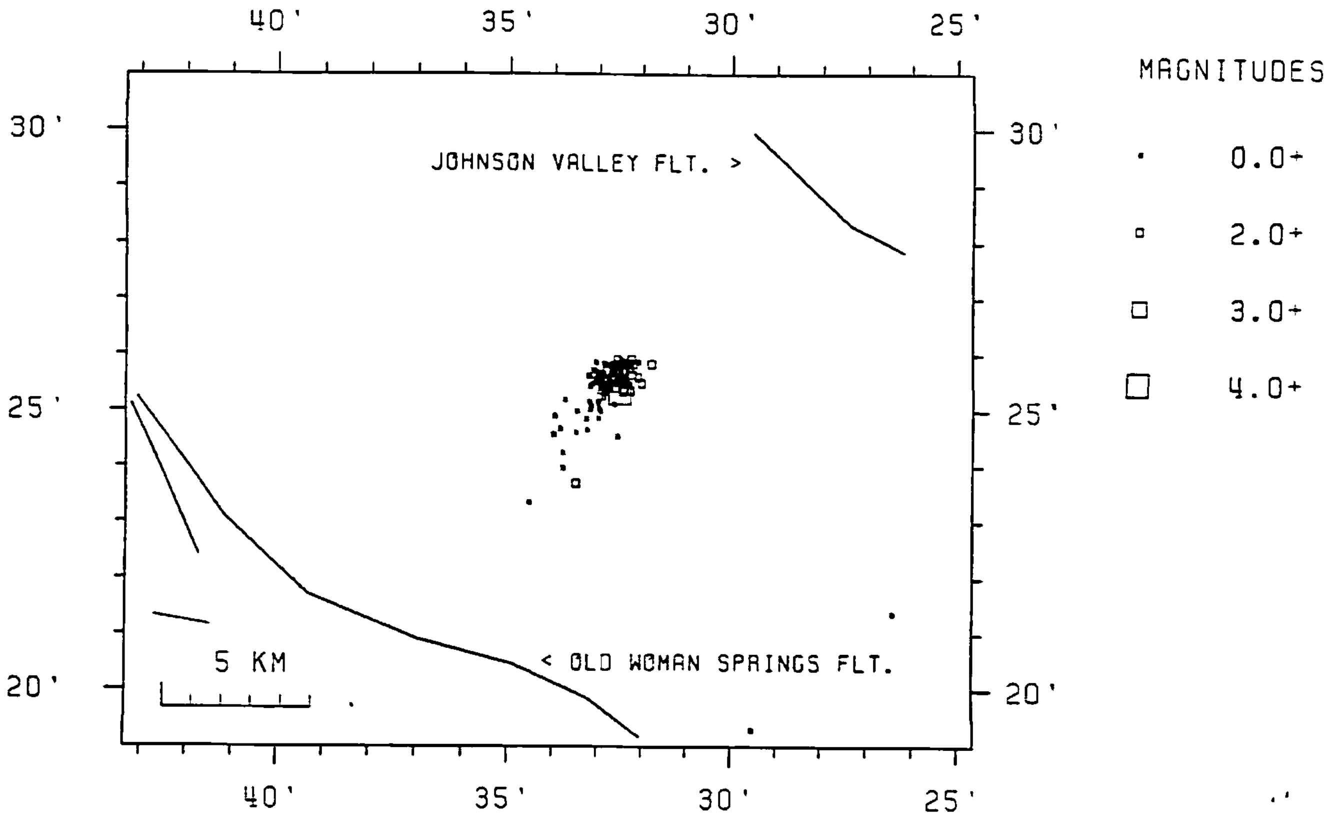
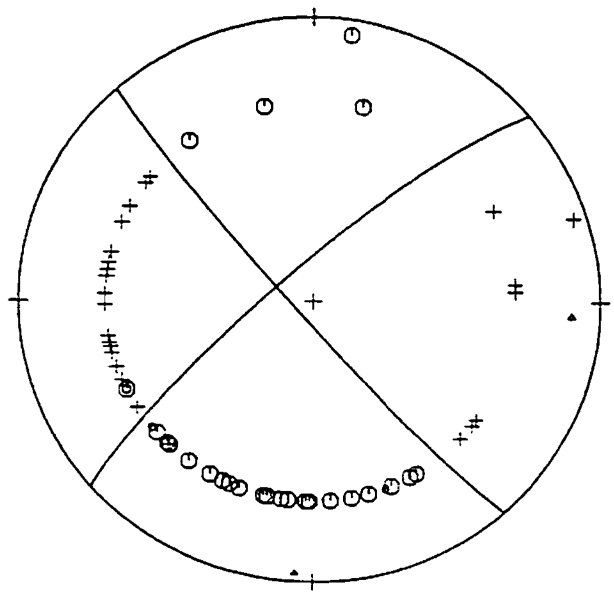


Figure 4: The cumulative number of earthquakes that occurred in regions 7-11 shown in Figure 3 over the 48-month period ending December 31, 1985. All events of M = 2.5 or greater are included. The twelfth plot displays the cumulative data from all 11 regions. The starred vertical lines denote earthquakes of M = 4.0 and greater (magnitude scales at right). Note that regions 7 and 9 have a different count scale than others, and that some regions extend beyond the area of complete stations coverage.

FIGURE 5:
SOUTHERN MOJAVE SWARM AREA, JULY 1985



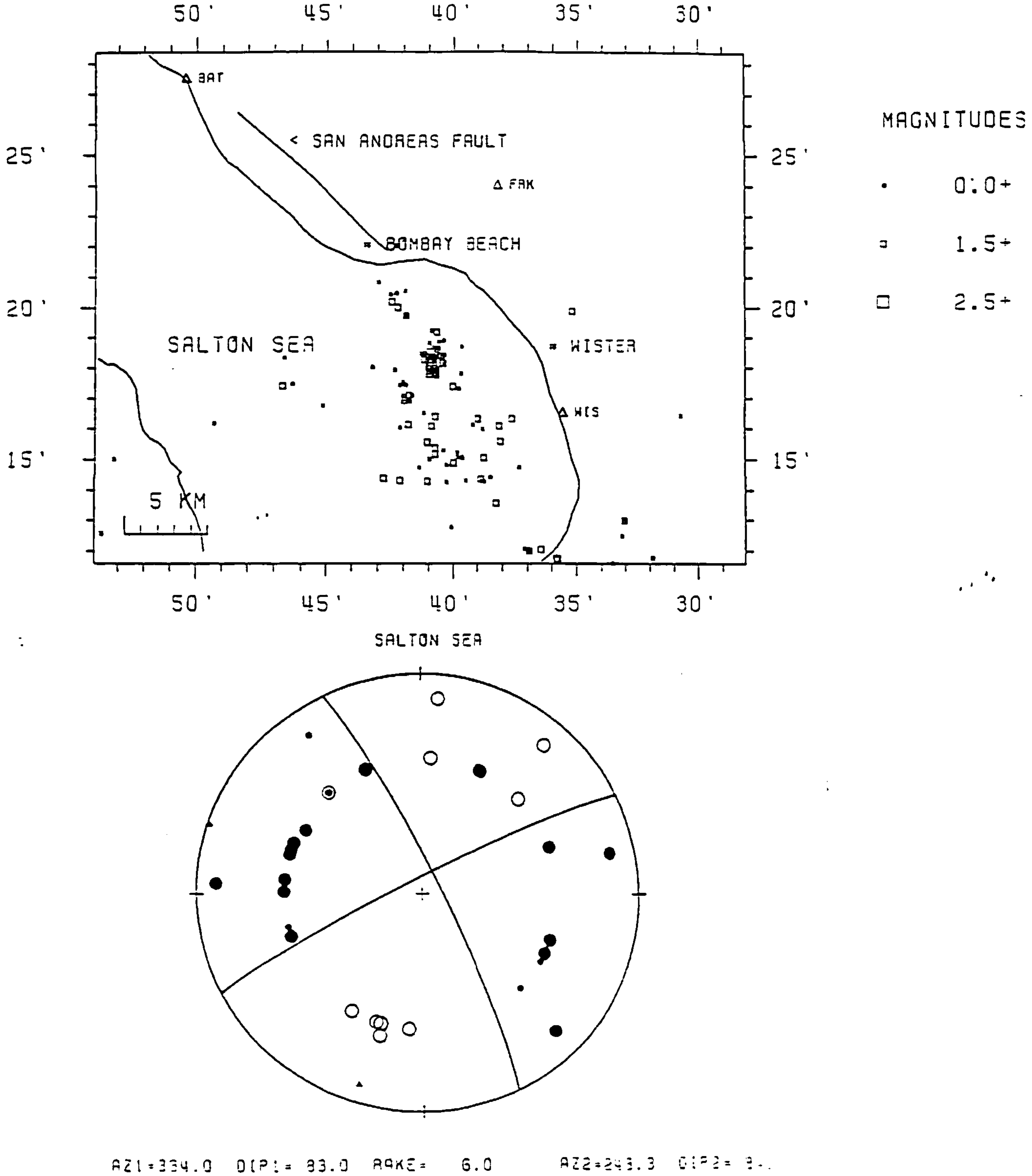
SOUTHERN MOJAVE M = 4.1



AZ1=138.0 DIP1= 85.0 RAKE= -10.0 AZ2=228.9 DIP2= 80.0

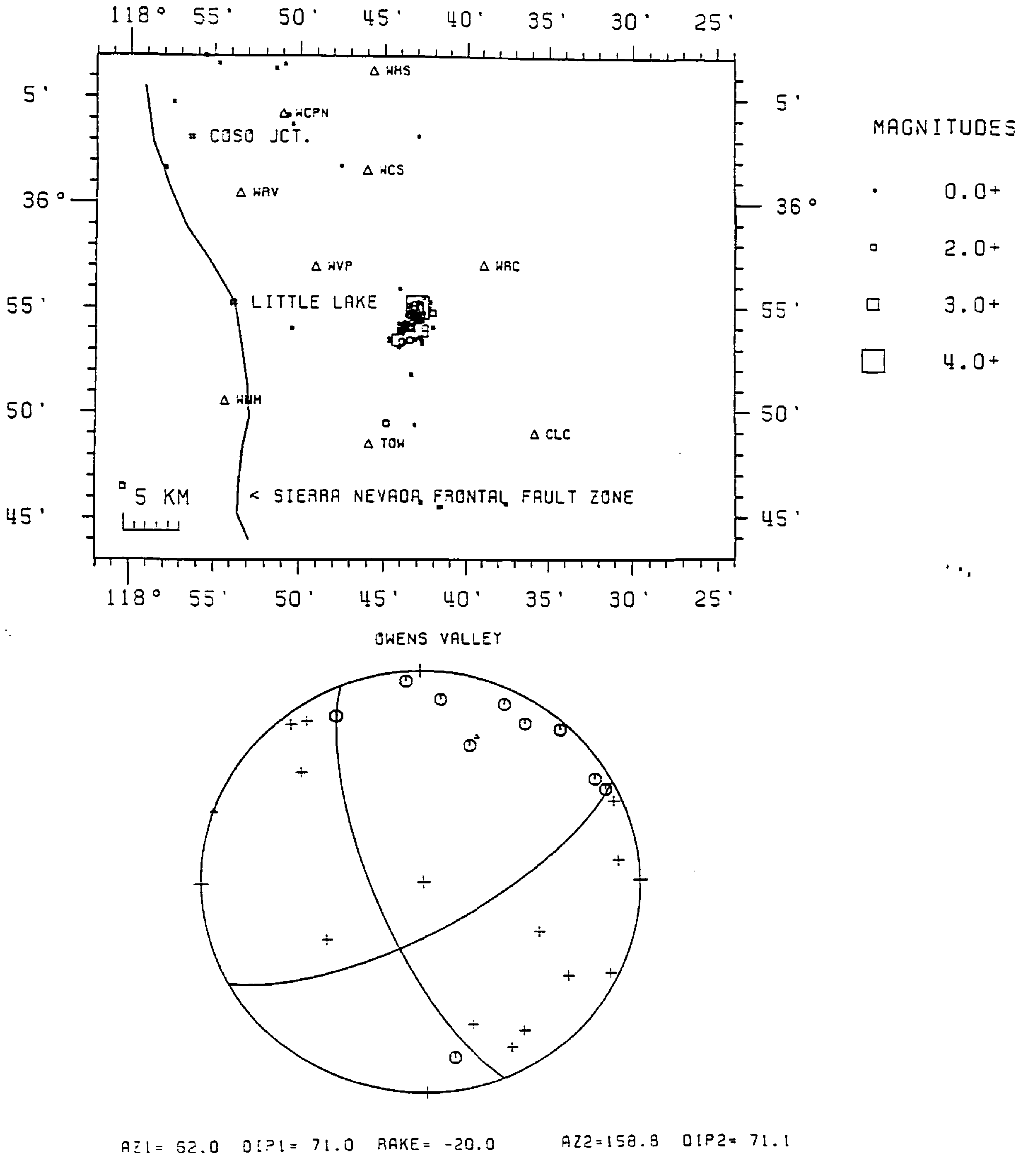
Epicentral area of the July 1985 swarm in the southern Mojave Desert, and the focal mechanism for the M = 4.1 event on July 18. The labels refer to the significant mapped faults in the area.

FIGURE 6:
SALTON SEA SWARM AREA



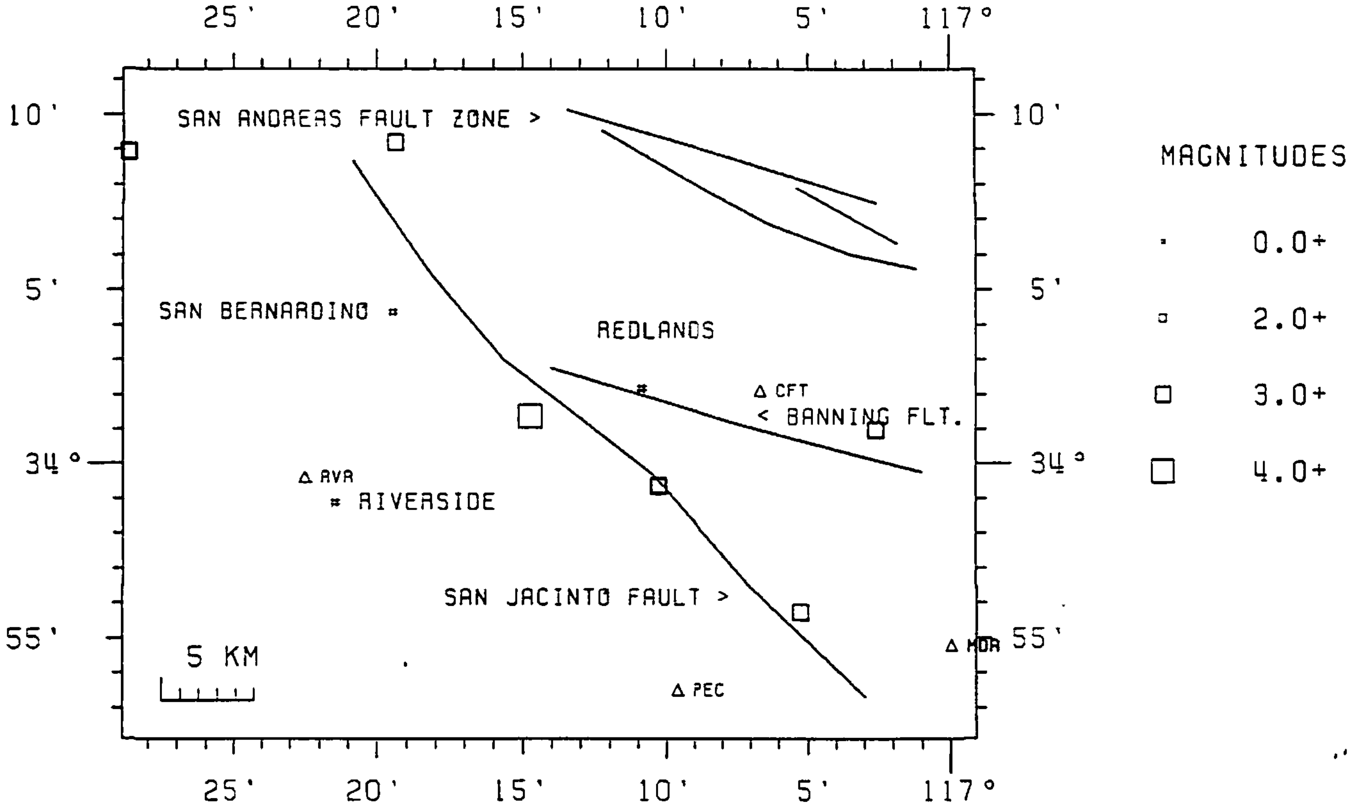
Epicentral area of the August 1985 earthquake swarm below the Salton Sea, and the focal mechanism for its largest event (M = 2.6). The labels refer to cultural and geological features in the area. Pound signs indicate population centers and triangles denote sites of Network stations.

FIGURE 7:
INDIAN WELLS VALLEY ACTIVITY, AUG. 15 - 31 1985

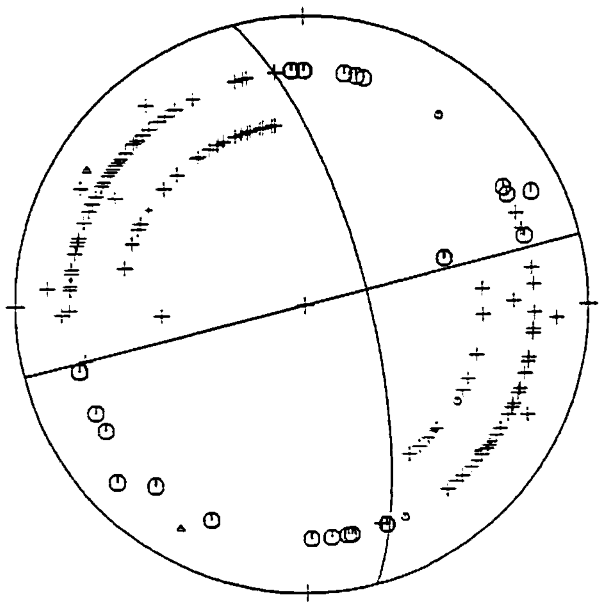


Epicentral area of the earthquake swarm in the Indian Wells Valley area of the Owens Valley, August 1985. The focal mechanism is for the M = 4.6 event on August 20. The labels refer to geological and cultural features in the area. Pound signs indicate populations centers; triangles denote sites of Network stations.

FIGURE 8:
EPICENTER OF 10/2 REDLANDS EARTHQUAKE, M = 4.9



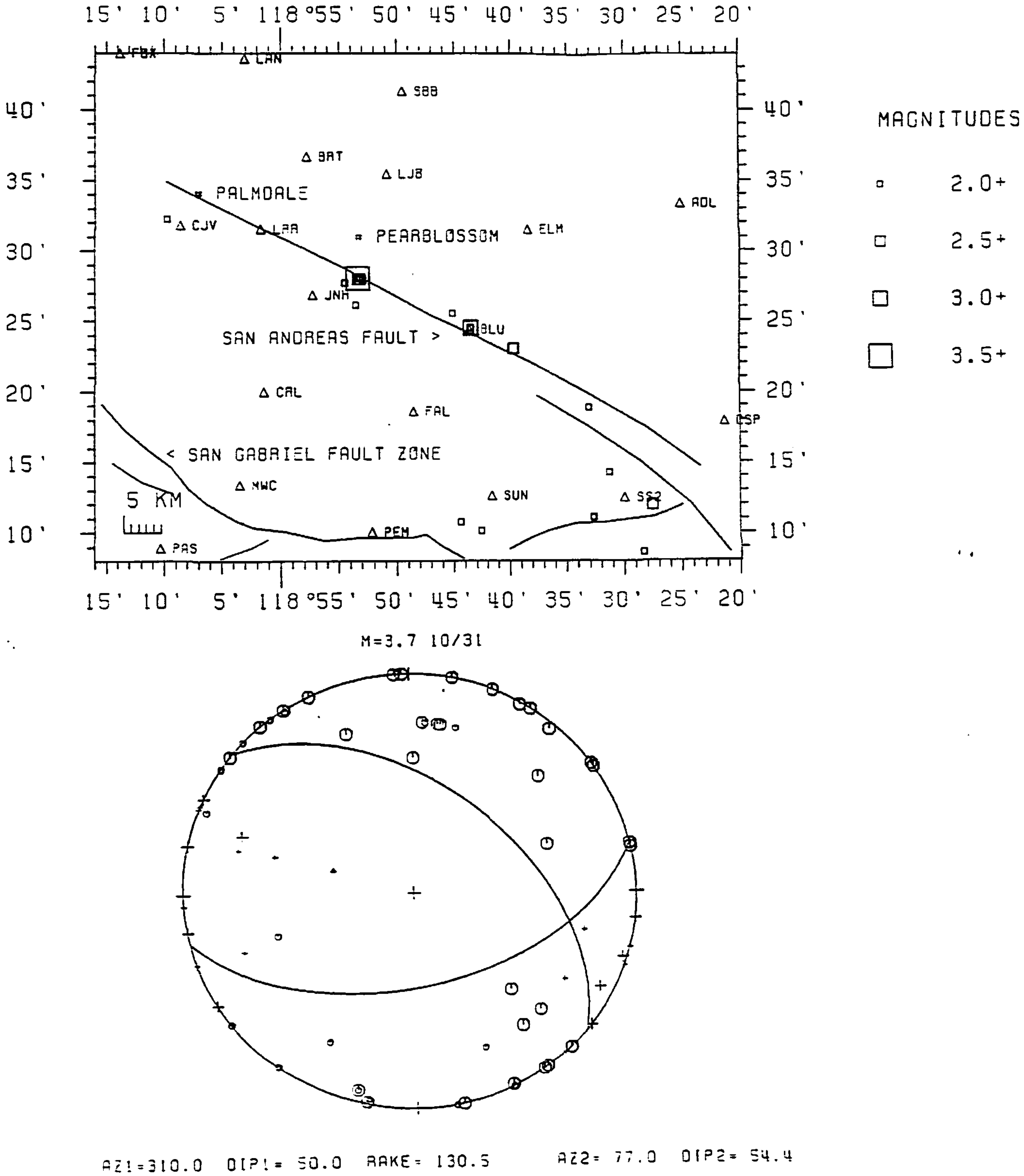
REDLANDS M=4.9



AZ1=256.0 DIP1= 90.0 RAKE= 342.0 AZ2=346.0 DIP2= 72.0

Epicenter and focal mechanism for the Redlands earthquake. The lables refer to geological and cultural features in the area. Pound signs indicate population centers; triangles denote sites of Network stations.

FIGURE 9:
EARTHQUAKES ALONG SAN ANDREAS FAULT, JUL. - DEC. 1985



Epicenters of earthquakes along the San Andreas fault during the July-December 1985 period. The focal mechanism shown is for the largest of these events.

FIGURE 10:

MAGNITUDE 4.0 AND GREATER EARTHQUAKES IN 1985