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PRELIMINARY CATALOG OF EARTHQUAKES IN NORTHERN IMPERIAL VALLEY, CALIFORNIA JANUARY 1978 - MARCH 1978

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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CONTENTS

ILLUSTRATIONS

INTRODUCTION

The northern section of the Imperial Valley region in southern California is an area of known geothermal resources and an area of high seismicity. To study in detail the relationship between geothermal areas and earthquakes, the U.S. Geological Survey has been monitoring seismicity in the Imperial Valley with a 16-station network since 1973. Six new stations were added to the network in November 1976. This catalog contains a description of the network and a list of preliminary data on earthquakes recorded by the network from January 1978 through March 1978.

AREA COVERED AND INSTRUMENTATION

Earthquakes reported in this catalog are located in the area indicated in Figure 1. Major faults are shown. Locations of most of the seismographic stations used in locating earthquakes reported here are shown on Figure 8 and are listed in Table 1.

The telemetered seismographic network in the Imperial Valley employs the same type of instrumentation developed by the U.S. Geological Survey for use in the central California network (see Wesson and others, 1974). Seismometers are vertical-component Mark Products [1/] seismometers (T_{seis} = 1 sec.) Model L - 4C . Signals from these instruments are filtered in the field (T_{filter} = 0.1 sec.) and telemetered to the California Institute of Technology in Pasadena, California, where they, (along with a WWVB time code) are recorded on 16mm films using Develocorders [1/] (T_{galvo} = 0.06 sec.). Peak magnification

1/ Any use of trade names and trademarks in this publication is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.

ranges from 10^5 to about 10^6 and occurs at T_{peak} = 0.06 sec (or 14 Hz). (Refer to Wesson and others, 1974, or Hill and others, 1975, for a somewhat more detailed description of this instrumentation.) In addition to film recordings, digital recordings are made by the Caltech Earthquake Detection and Recording System (CEDAR) (Johnson, 1978). An earthquake detection algorithm is used in CEDAR, and only "detected" earthquakes are saved. CEDAR is described more fully below.

DATA ANALYSIS

During this quarter, all analysis has been based on digital recordings by CEDAR. The data reduction procedure used is as follows:

1) On-line processing. "On-line" processing refers to computer manipulation of signals at the time they are received. Signals from all stations are digitized continuously at 50 bits per second. The signal amplitude at each station is averaged in a 40-second interval of time which moves continuously keeping its leading edge at the present time. In addition, an average of amplitudes in the leading 5 seconds of this interval is made. Whenever the 5 second average exceeds the 40-second average by 50 percent for a given station, that station is considered to be triggered. Whenever 4 stations in a subarray of stations are simultaneously triggered, a "detection" is considered to be made. When a detection is made, digitized signals from all stations in southern California are transferred from a magnetic disc, which is being continuously erased, to a magnetic tape, from which they can be played back and examined by a data analyst at a later time. The subarrays of stations used for the detection of earthquakes in the Imperial Valley are indicated in Figures 2 - 7.

2) Off-line processing. "Off-line" processing refers to interactive computer-human manipulation of signals from detected events at some time after they have been saved and stored on magnetic tape by the on-line system. (Separate computers are used for on-line processing (Data General Eclipse S/230 with 32K core) and off-line processing (Data General Nova 820 with 32K core); but their roles can be interchanged.) All events detected in a day by the on-line system are played back the following day on the off-line system; hard copies of the seismograms from each triggered station are made for each event. A data analyst reviews these seismograms to determine which events are noise events and which are earthquakes. Earthquakes are then played back a second time onto a cathode ray tube viewer (CRT) equipped with movable vertical and horizontal cross-hairs. The data are played back in 2 stages. First, seismograms from all stations in southern California are displayed on the screen, 32 at a time. During this stage the data analyst selects stations to be reviewed for timing during the second stage. During the second stage, seismograms from individual stations are played back onto the CRT, and P and S wave arrivals are timed. During this stage it is possible to amplify or attenuate the signals for visual inspection so that optimum picks can be made.

3) At the completion of timing of a day's worth of earthquakes, arrival-time data are processed using a version of the computer program HYPO71 (Lee and Lahr, 1975) that has been abbreviated and modified to be accommodated by the off-line computer. During this step, a simple velocity structure is used in the location of all events in southern California (*see* **Discussion**); no station delays are used. The preliminary epicenters that result from this step determine in which geographic areas the events fall and hence which velocity structures and associated station delays should be used for

subsequent refinement of the locations. For this catalog, however, we do not attempt to refine the preliminary locations. This task will be performed for the final catalog, making use of new, improved, and regionalized velocity models to be obtained from 6 upcoming refraction-calibration explosions in the Imperial Valley.

4) Richter magnitudes are routinely calculated for earthquakes of $M_L \gtrsim 3.0$, but would here be listed only for earthquakes of $M_L \geq 4.0$, had any occurred this quarter. No magnitudes are presently being calculated for earthquakes of $M_L \leq 3.0$; however, research is nearing completion on a method for calculating magnitudes from the digital CEDAR recordings. The final catalog will include magnitudes for all earthquakes.

5) The preliminary location parameters for all earthquakes in northern Imperial Valley are listed in this catalog in Table 2; and the epicenters are plotted in Figure 8.

DISCUSSION

The velocity model used for the earthquake locations in this catalog is taken from Kanamori and Hadley, (1975):

VELOCITY (km/sec)	DEPTH TO TOP OF LAYER (km)
5.5	0.0
6.3	5.5
6.7	16.0
7.8	37.0

This model was obtained from refraction studies in the western Mojave Desert, Transverse Ranges, and Peninsular Ranges of southern California. For a discussion of the differences in earthquake location that result from

using this model rather than a more appropriate model for Imperial Valley (Biehler and others, 1964), refer to Fuis and others (1978).

The hypocentral parameters listed in Table 2 are the following:

1) Y, year of occurrence
2) M, month of occurrence
3) D, day of occurrence
4) H, hour of occurrence
5) M, minute of occurrence
6) SEC, second of occurrence

} Coordinated Universal Time

7) LAT, north latitude of epicenter, in degrees and minutes
8) LONG, west longitude of epicenter, in degrees and minutes
9) DEP, depth of hypocenter, in kilometers
10) MAG, magnitude
11) N, number of P arrivals used in locating the earthquake
12) GAP, maximum azimuthal gap, in degrees, between stations contributing P-arrivals
13) DM, distance from epicenter to nearest station used in locating the earthquake
14) RMS, root mean square of travel time residuals, R_i, in seconds

$$RMS = \sqrt{\sum_{i=1}^{N} R_i^2 / N}$$

15) ERH, standard error of the epicenter, in kilometers
16) ERZ, standard error of the focal depth, in kilometers
17) Q, solution quality of the hypocenter
18) M, model used in location. M = 0 throughout this preliminary catalog

A filter is applied to the events in this catalog to eliminate very bad hypocenter solutions. A solution was not listed or plotted unless RMS $\leq$ 0.50 seconds. No events have been reread to improve preliminary locations and preliminary RMS's.

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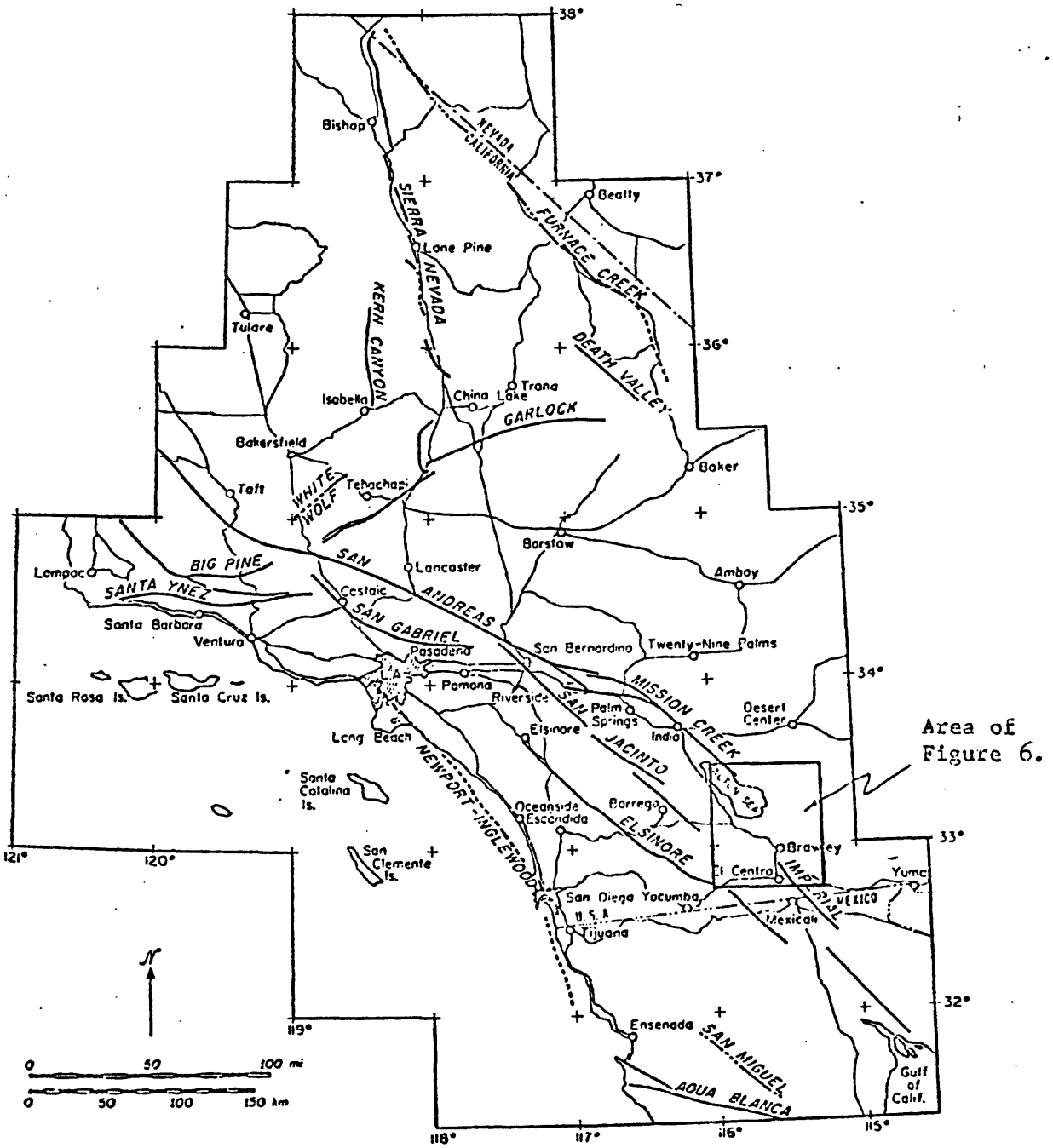
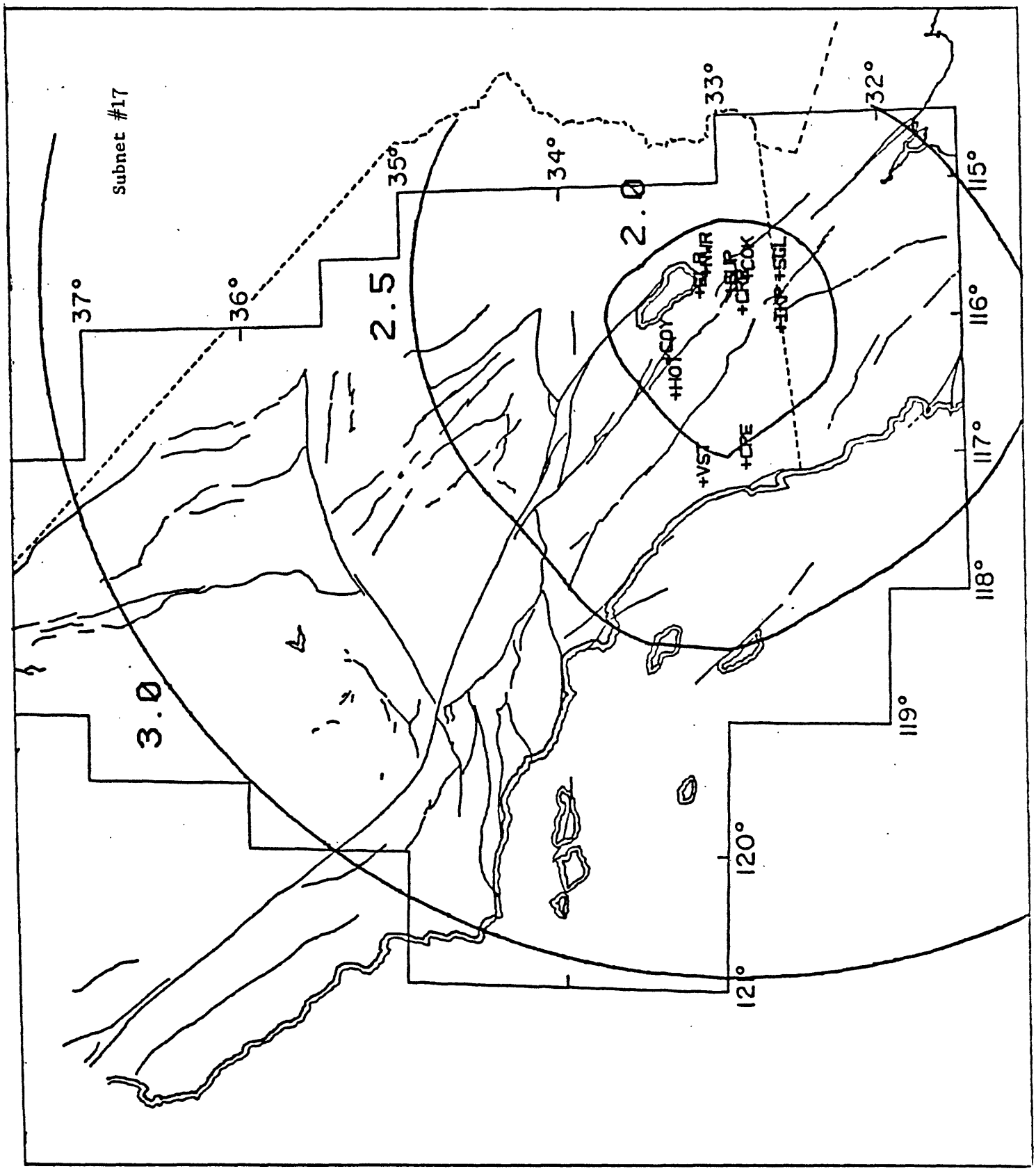


Area of Figure 6.

Figure 1. Base map of southern California region with major faults.

Figures 2 - 5. CEDAR subarrays for the Imperial Valley area.

Contours enclose regions in which the given CEDAR subarray detects 90% of earthquakes with magnitudes equal to or greater than the number on the contour (Johnson, 1978).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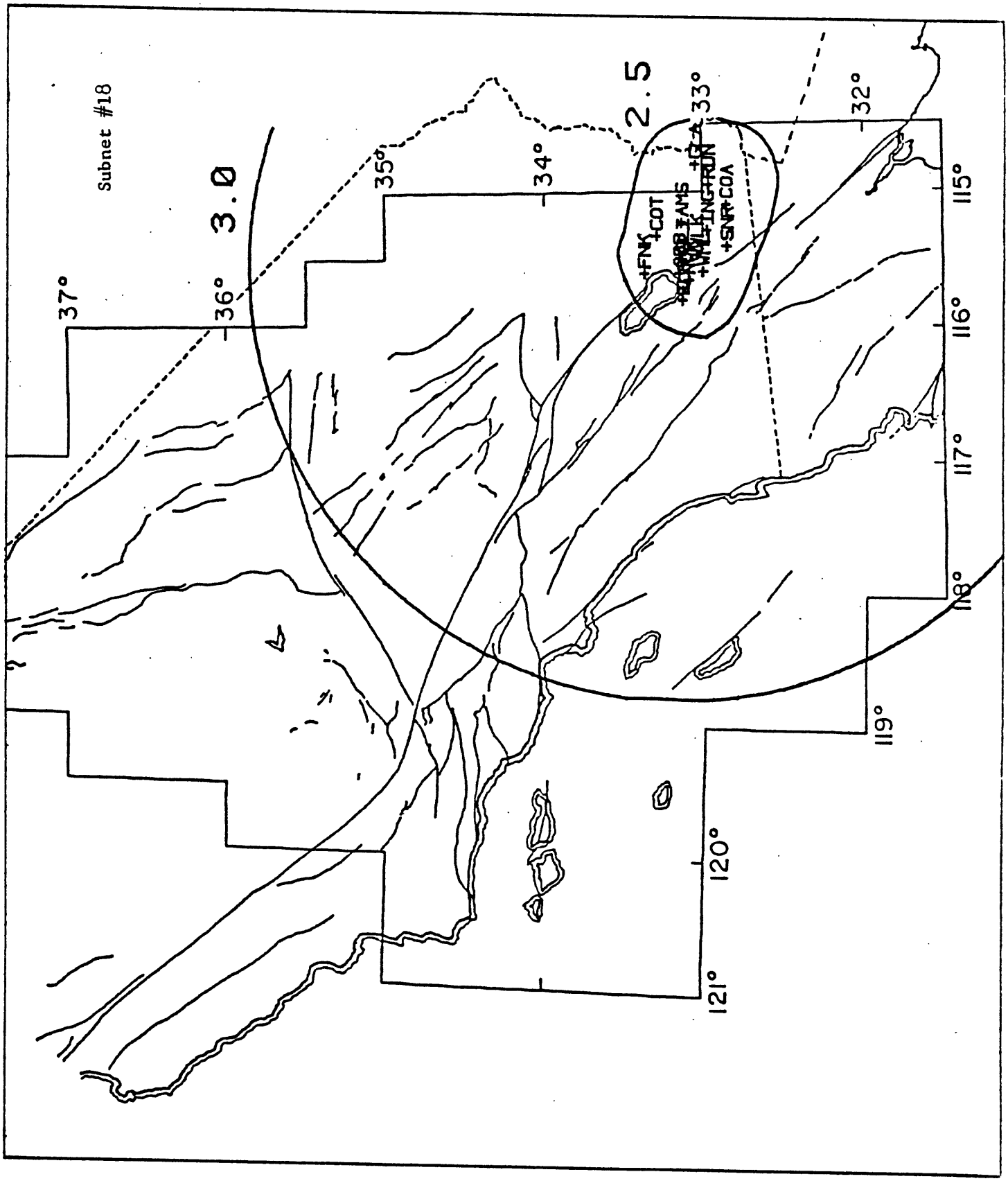
37°
36°
35°
34°
33°
32°
115°
116°
117°
118°
119°
120°
121°
2.0
2.5
3.0
+HOY
+CDY
+VST
+CRE
+SGL

Figure 2.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3.0
2.5
37°
36°
35°
34°
33°
32°
115°
116°
117°
118°
119°
120°
121°
+FNK
+COT
+SNP
+COA

Figure 3.

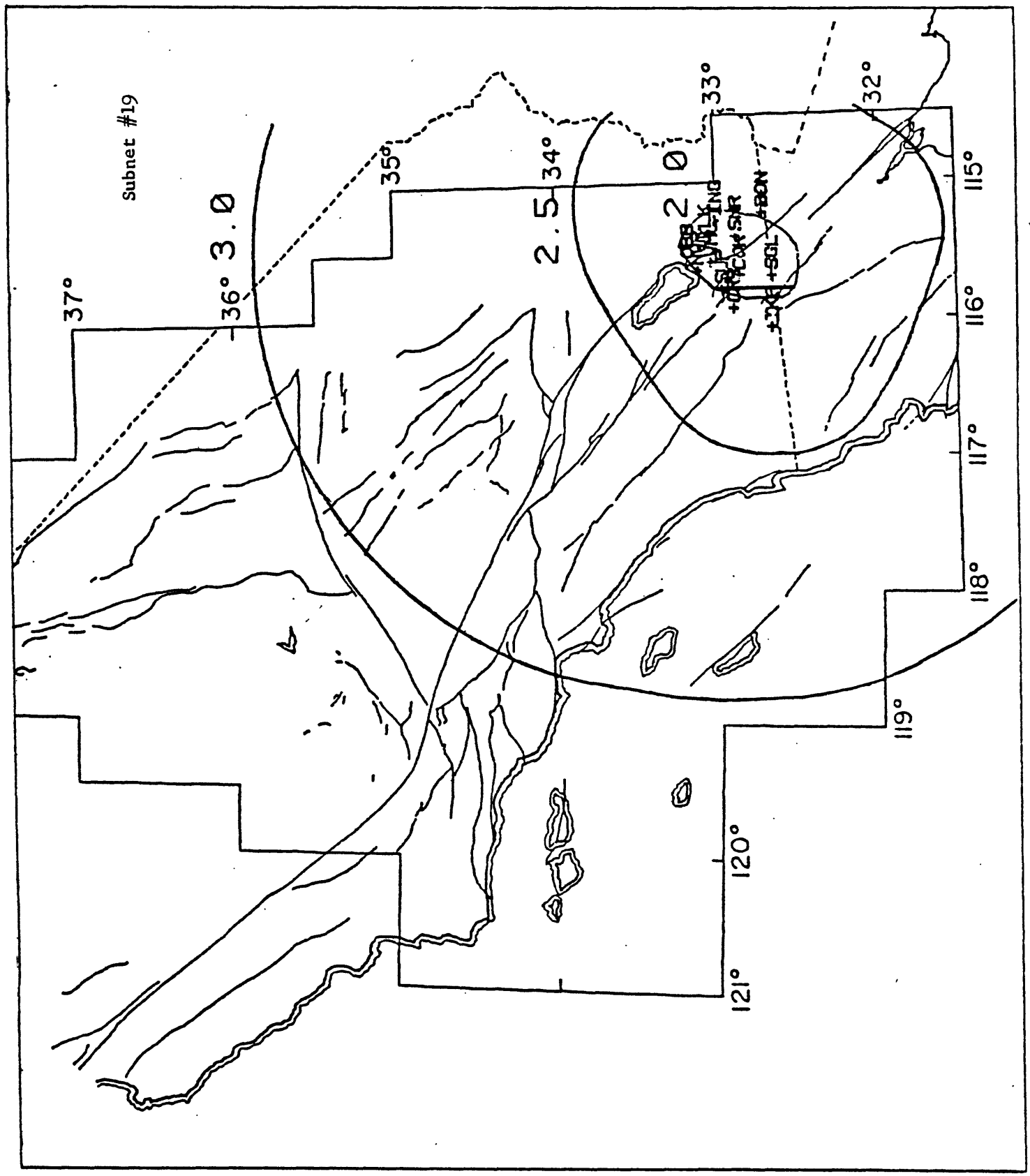

Figure 4.

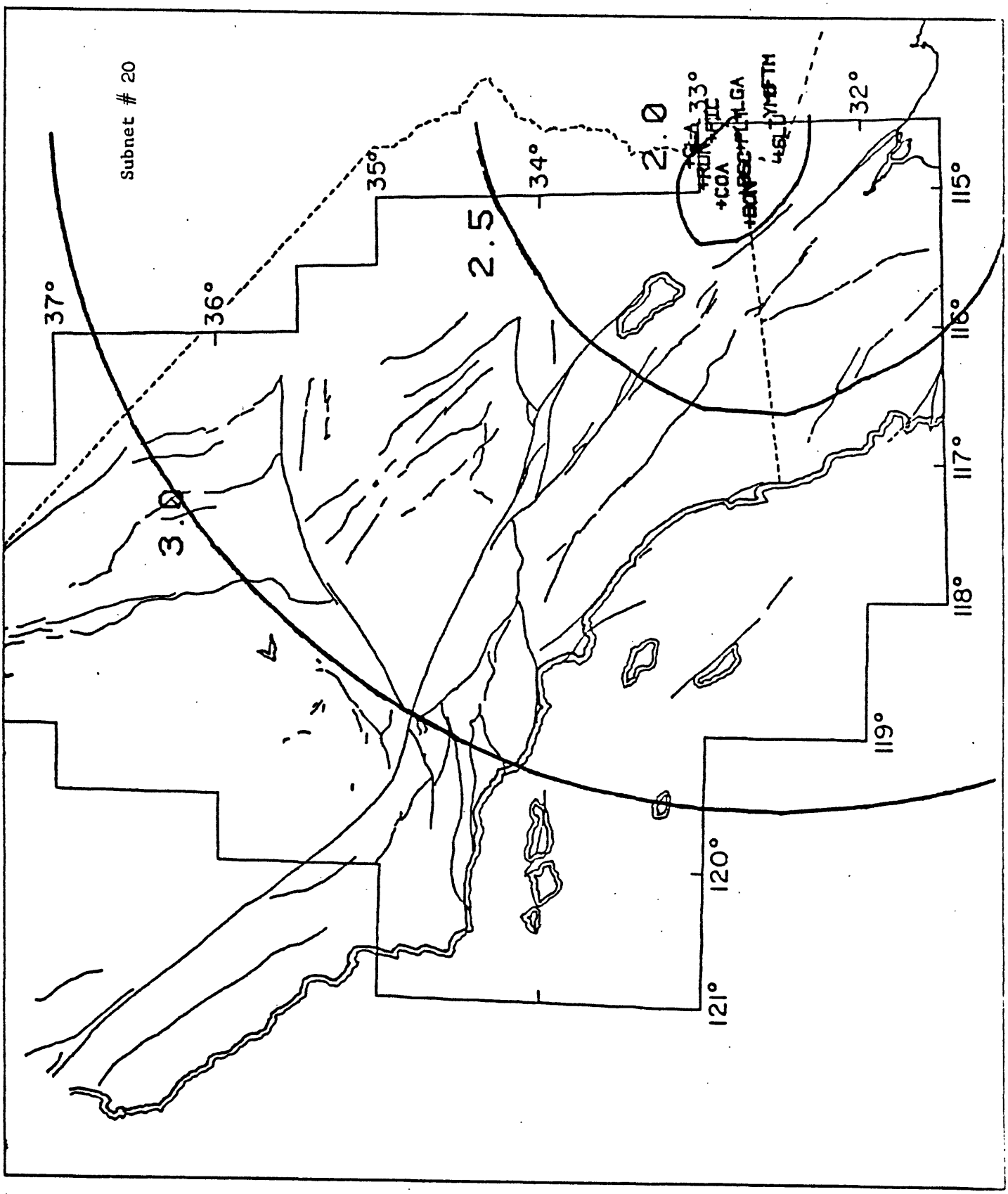

Figure 5.

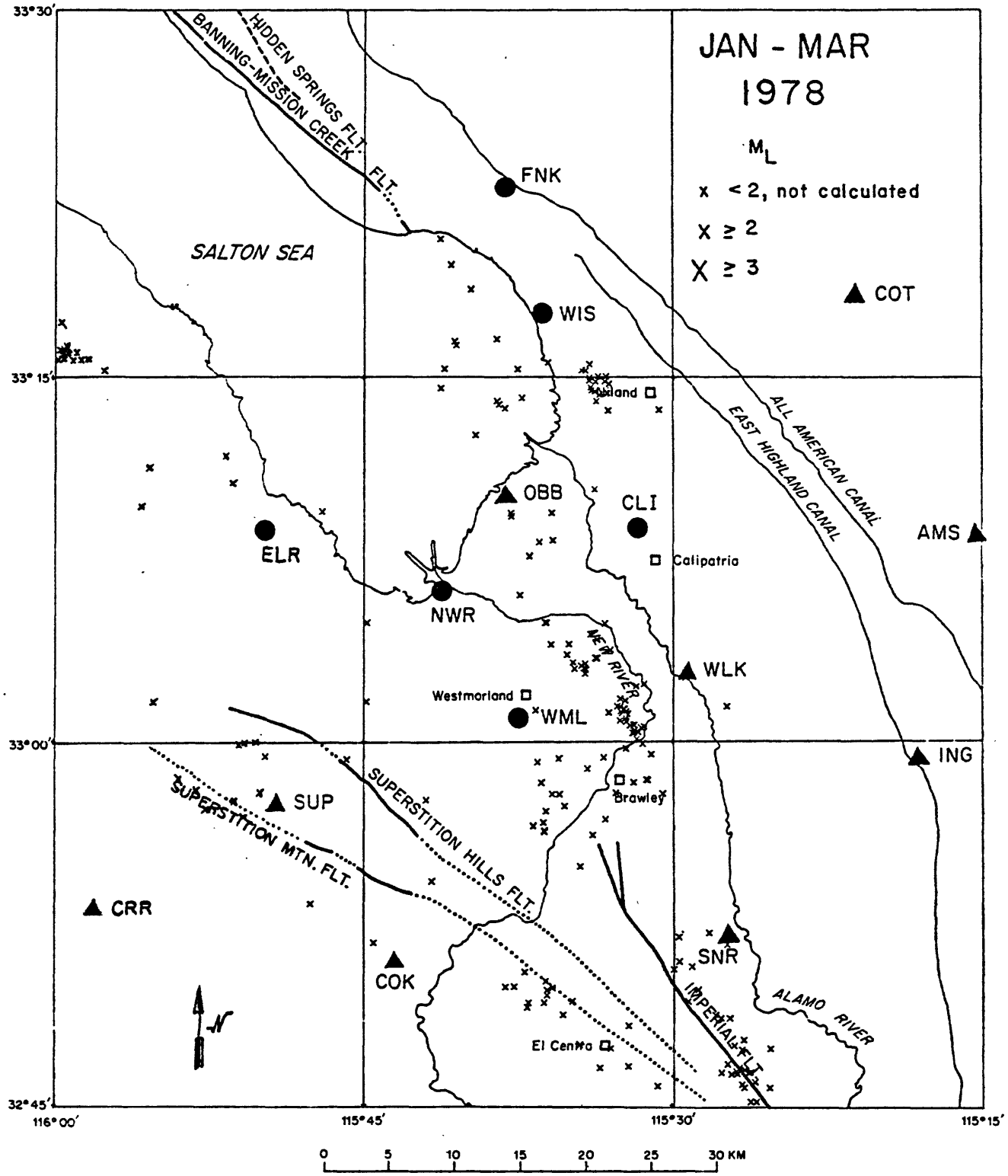

Figure 6. Locations of earthquake epicenters (X's) in the Imperial Valley with respect to major faults for the period January 1, 1978 through March 31, 1978. Solid triangles are seismograph stations in the Imperial Valley installed in 1973; solid circles are the seismograph stations installed in November 1976.

Table 1. STATION DATA

STATION	LATITUDE	LONGITUDE	ELEV.
AMS	33° 8.48'N	115°15.25'W	140 m
BC2	33°39.42'N	115°27.67'W	1185 m
BLU	34°24.40'N	117°43.61'W	1880 m
BON	32°41.67'N	115°16.11'W	14 m
BSC	32°43.49'N	115° 2.64'W	43 m
CH2	33°17.77'N	115°20.17'W	347 m
CLI	33° 8.45'N	115°31.64'W	-59 m
COA	32°51.81'N	115° 7.36'W	34 m
COK	32°50.95'N	115°43.61'W	-15 m
COY	33°21.63'N	116°18.56'W	232 m
CO2	33°50.83'N	115°20.68'W	276 m
CPE	32°52.80'N	117° 6.00'W	213 m
CPM	34° 9.24'N	116°11.80'W	937 m
CRR	32°53.18'N	115°58.10'W	98 m
ELR	33° 8.84'N	115°49.95'W	-63 m
FNK	33°22.98'N	115°38.26'W	12 m
FTM	32°33.29'N	114°20.01'W	263 m
GLA	33° 3.10'N	114°49.60'W	627 m
HOT	33°18.85'N	116°34.90'W	1963 m
IKP	32°38.93'N	116° 6.48'W	957 m
ING	32°59.30'N	115°18.61'W	2 m
INS	33°56.14'N	116°11.66'W	1700 m
KEE	33°38.30'N	116°39.19'W	1366 m
LTC	33°29.34'N	115° 4.20'W	458 m
LTM	33°54.90'N	114°55.10'W	744 m
NW2	33° 5.43'N	115°41.54'W	-68 m
OBB	33°10.04'N	115°38.20'W	-69 m
PIC	32°54.85'N	114°38.59'W	263 m
PLM	33°21.20'N	116°51.70'W	1692 m
PLT	32°43.87'N	114°43.76'W	61 m
PNM	33°58.64'N	115°48.05'W	1146 m
RUN	32°58.33'N	114°58.63'W	152 m
SGL	32°38.95'N	115°43.52'W	110 m
SHH	34°11.26'N	115°39.27'W	1122 m
SLU	32°30.10'N	114°46.64'W	41 m
SMO	33°32.15'N	116°27.70'W	2437 m
SNR	32°51.71'N	115°26.21'W	-30 m
SUP	32°57.31'N	115°49.43'W	219 m
TPC	34° 6.35'N	116° 2.92'W	761 m
VG2	33°49.91'N	116°48.55'W	1484 m
WIS	33°16.56'N	115°35.58'W	-68 m
WLK	33° 3.08'N	115°29.44'W	-48 m
WML	33° 0.91'N	115°37.35'W	-44 m
WWR	33°59.51'N	116°39.36'W	702 m
YMD	32°33.28'N	114°32.68'W	76 m

Table 2.

Preliminary hypocenter solutions
for earthquakes
January 1, 1978 through March 31, 1978

N	Y	M	D	H	M	SEC	LAT	LONG	DEP	MAG	N	GAP	DM	RMS	ERH	ERZ	Q	M
1	78	1	1	8	51	19.42	32-48.61	115-27.62	13.22	0.0	99	109	0.0	0.23	1.4	1.7	B	0
2	78	1	1	11	37	48.76	33-15.73	115-59.04	4.99	0.0	99	120	0.0	0.13	0.8	28.8	C	0
3	78	1	1	16	32	17.45	33-16.05	115-59.48	4.99	0.0	99	71	0.0	0.17	0.7	13.7	C	0
4	78	1	2	9	9	19.01	33-15.98	115-59.52	5.00	0.0	99	99	0.0	0.16	0.9	21.1	C	0
5	78	1	2	9	15	43.92	33-15.75	115-59.72	4.99	0.0	99	114	0.0	0.13	40.0	98.9	D	0
6	78	1	3	15	49	11.56	33-16.01	115-59.58	5.01	0.0	99	99	0.0	0.16	0.8	24.3	C	0
7	78	1	7	6	4	42.18	33-15.35	115-37.58	3.43	0.0	99	44	0.0	0.25	0.7	0.7	B	0
8	78	1	8	16	12	22.87	32-49.29	115-29.22	5.34	0.0	99	148	0.0	0.01	0.3	0.2	A	0
9	78	1	9	4	55	41.36	33-13.74	115-38.19	3.85	0.0	99	43	0.0	0.20	0.7	0.6	B	0
10	78	1	9	5	2	57.71	33-14.56	115-41.29	0.03	0.0	99	122	0.0	0.18	3.4	10.1	C	0
11	78	1	9	5	3	42.92	33-13.89	115-38.49	3.74	0.0	99	54	0.0	0.23	0.8	0.8	B	0
12	78	1	9	5	11	8.87	33-14.16	115-37.39	4.60	0.0	99	109	0.0	0.19	6.7	6.3	D	0
13	78	1	9	10	47	31.26	32-49.87	115-38.13	16.24	0.0	99	89	0.0	0.30	1.3	2.4	C	0
14	78	1	9	10	49	23.61	32-49.89	115-37.71	13.69	0.0	99	90	0.0	0.33	1.9	3.2	C	0
15	78	1	9	14	5	44.58	33-15.29	115-57.52	5.54	0.0	99	220	0.0	0.13	40.0	99.0	D	0
16	78	1	10	2	14	9.52	32-56.16	115-33.90	5.96	0.0	99	94	0.0	0.12	1.1	15.1	C	0
17	78	1	11	8	15	0.91	33-16.36	115-59.34	4.99	0.0	99	112	0.0	0.09	1.2	8.5	C	0
18	78	1	12	22	35	30.52	33-17.31	115-59.60	5.00	0.0	99	137	0.0	0.07	40.0	98.9	D	0
19	78	1	12	22	37	43.14	33-15.81	115-59.46	5.00	0.0	99	99	0.0	0.18	0.6	10.0	C	0
20	78	1	13	1	8	39.36	33- 9.50	115-47.02	1.58	0.0	99	241	0.0	0.12	13.6	20.0	D	0
21	78	1	13	5	44	56.34	32-47.49	115-34.51	16.39	0.0	99	112	0.0	0.28	1.6	2.1	B	0
22	78	1	13	9	38	39.84	33-15.76	115-58.33	4.99	0.0	99	222	0.0	0.11	2.7	19.0	C	0
23	78	1	13	19	58	28.42	32-49.29	115-34.88	6.05	0.0	99	131	0.0	0.04	0.6	21.9	C	0
24	78	1	14	3	22	17.66	32-58.48	115-53.96	5.34	0.0	99	149	0.0	0.01	40.0	98.9	D	0
25	78	1	14	9	19	40.83	32-48.73	115-35.33	6.29	0.0	99	102	0.0	0.36	1.5	13.4	C	0
26	78	1	15	6	42	58.94	33- 9.31	115-37.89	11.37	0.0	99	121	0.0	0.11	1.6	1.6	A	0
27	78	1	15	17	13	2.46	32-50.09	115-36.17	14.17	0.0	99	93	0.0	0.22	1.4	3.2	B	0
28	78	1	17	14	59	52.48	33- 4.24	115-33.72	9.78	0.0	99	51	0.0	0.21	0.9	1.9	B	0
29	78	1	17	18	23	34.61	33-15.73	115-58.65	5.10	0.0	99	175	0.0	0.38	40.0	98.9	D	0
30	78	1	21	9	28	6.03	33- 0.44	115-31.90	15.03	0.0	99	145	0.0	0.03	1.0	1.5	A	0
31	78	1	21	9	28	25.88	33- 0.48	115-31.86	13.52	0.0	99	145	0.0	0.01	40.0	98.9	C	0
32	78	1	21	9	28	34.84	33- 0.57	115-31.55	13.55	0.0	99	139	0.0	0.02	0.8	1.2	A	0
33	78	1	21	9	53	53.20	32-58.44	115-31.30	12.77	0.0	99	61	0.0	0.20	0.9	1.9	B	0
34	78	1	21	9	56	50.11	32-58.43	115-31.21	13.36	0.0	99	60	0.0	0.20	1.0	1.8	B	0
35	78	1	21	10	11	12.29	32-45.14	115-25.89	7.41	0.0	99	178	0.0	0.27	40.0	98.9	D	0
36	78	1	22	10	18	28.24	33- 3.02	115-34.31	11.63	0.0	99	109	0.0	0.14	1.6	2.2	B	0
37	78	1	22	10	20	55.40	33- 3.09	115-34.36	10.03	0.0	99	108	0.0	0.19	0.9	1.5	B	0
38	78	1	22	10	23	11.41	33- 3.14	115-34.49	10.53	0.0	99	82	0.0	0.17	0.9	1.3	B	0
39	78	1	22	10	24	31.74	33- 2.98	115-34.26	11.45	0.0	99	109	0.0	0.18	0.9	1.5	B	0
40	78	1	22	16	50	34.00	33- 2.82	115-34.30	10.65	0.0	99	82	0.0	0.16	0.9	1.3	B	0
41	78	1	23	2	8	18.60	32-54.86	115-34.54	14.75	0.0	99	92	0.0	0.14	0.7	0.9	A	0
42	78	1	23	3	50	52.71	33- 3.24	115-34.29	12.31	0.0	99	84	0.0	0.16	0.8	1.3	B	0
43	78	1	23	3	51	26.14	33- 4.06	115-35.09	5.00	0.0	99	182	0.0	0.04	2.5	30.2	C	0
44	78	1	23	17	23	34.99	33-16.20	115-59.46	5.61	0.0	99	112	0.0	0.12	1.1	99.0	C	0
45	78	1	23	21	5	32.21	33- 1.59	115-55.14	4.18	0.0	99	119	0.0	0.14	1.9	1.9	A	0
46	78	1	24	8	13	21.69	33-16.11	115-59.53	5.00	0.0	99	59	0.0	0.19	0.5	26.2	C	0
47	78	1	24	8	38	44.74	33-16.05	115-58.85	5.00	0.0	99	116	0.0	0.15	1.4	20.9	C	0
48	78	1	24	9	44	35.91	33- 9.44	115-35.91	6.35	0.0	99	131	0.0	0.04	0.9	1.4	A	0
49	78	1	24	9	59	26.15	33-16.04	115-59.25	5.00	0.0	99	70	0.0	0.16	0.6	10.7	C	0
50	78	1	24	18	19	47.97	33- 4.92	115-44.83	9.43	0.0	99	194	0.0	0.20	2.6	2.9	C	0

N	Y	M	D	H	M	SEC	LAT	LONG	DEP	MAG	N	GAP	DM	RMS	ERH	ERZ	Q	M
51	78	125		8	7	8.54	33-29.47	115-50.28	4.99	0.0	99	73	0.0	0.06	0.4	9.1	C	0
52	78	125		20	35	19.55	33-19.62	115-40.78	5.34	0.0	99	73	0.0	0.12	0.7	1.8	A	0
53	78	127		22	53	18.53	32-51.70	115-44.53	4.99	0.0	99	148	0.0	0.02	40.0	98.9	D	0
54	78	130		18	39	14.89	33- 1.28	115-36.68	4.60	0.0	99	169	0.0	0.06	2.5	1.5	C	0
55	78	131		7	53	31.93	32-59.34	115-33.39	8.87	0.0	99	144	0.0	0.15	1.1	2.0	B	0
56	78	131		12	9	49.73	32-50.49	115-37.21	14.44	0.0	99	89	0.0	0.29	2.1	4.5	B	0
57	78	131		12	16	10.97	32-49.74	115-36.10	6.33	0.0	99	95	0.0	0.38	1.5	11.4	C	0
58	78	131		12	17	13.21	32-49.03	115-37.08	13.22	0.0	99	96	0.0	0.12	0.8	2.1	B	0
59	78	131		13	6	13.04	32-49.52	115-36.10	6.39	0.0	99	96	0.0	0.41	1.2	10.5	C	0
60	78	131		13	8	29.90	32-49.22	115-37.02	9.23	0.0	99	170	0.0	0.27	1.8	4.7	B	0
61	78	2	1	5	32	58.85	32-57.88	115-32.79	13.96	0.0	99	67	0.0	0.18	1.0	1.6	B	0
62	78	2	1	15	9	59.92	33- 4.04	115-35.95	14.27	0.0	99	122	0.0	0.07	1.3	1.9	A	0
63	78	2	2	14	8	44.59	32-57.54	115-51.27	2.26	0.0	99	97	0.0	0.17	0.9	1.0	B	0
64	78	2	2	16	22	5.40	32-56.89	115-50.85	4.67	0.0	99	55	0.0	0.24	0.9	0.8	B	0
65	78	2	4	12	54	37.16	33-13.63	115-33.18	4.14	0.0	99	140	0.0	0.02	0.2	0.2	A	0
66	78	2	4	13	3	33.98	33-14.59	115-34.07	5.14	0.0	99	110	0.0	0.04	40.0	98.9	D	0
67	78	2	4	13	4	33.72	33-13.67	115-30.73	4.91	0.0	99	121	0.0	0.28	9.7	10.8	D	0
68	78	2	4	14	21	31.43	32-59.30	115-35.58	5.91	0.0	99	108	0.0	0.09	0.5	1.0	A	0
69	78	2	5	2	11	27.04	33-14.35	115-33.24	3.71	0.0	99	100	0.0	0.08	1.5	1.7	A	0
70	78	2	5	2	13	40.59	33-14.02	115-33.78	5.16	0.0	99	154	0.0	0.01	40.0	98.9	D	0
71	78	2	5	7	7	2.51	33-10.63	115-51.34	10.95	0.0	99	119	0.0	0.02	0.4	0.5	A	0
72	78	2	5	10	48	10.37	33- 1.44	115-32.71	10.44	0.0	99	190	0.0	0.08	1.9	3.2	B	0
73	78	2	5	13	4	45.77	32-56.33	115-36.26	10.88	0.0	99	99	0.0	0.21	1.1	2.6	B	0
74	78	2	5	13	13	34.79	32-56.29	115-36.25	12.93	0.0	99	100	0.0	0.17	0.8	1.3	B	0
75	78	2	5	13	38	53.53	33- 3.47	115-33.80	5.60	0.0	99	143	0.0	0.16	2.0	67.7	C	0
76	78	2	5	13	53	47.43	32-56.53	115-36.82	10.55	0.0	99	141	0.0	0.18	1.6	2.8	B	0
77	78	2	5	19	22	18.33	32-53.29	115-47.58	9.43	0.0	99	70	0.0	0.36	2.2	3.6	C	0
78	78	2	5	23	49	24.45	33- 3.02	115-34.82	13.42	0.0	99	156	0.0	0.12	2.1	3.5	B	0
79	78	2	5	23	51	32.52	33- 2.29	115-34.89	10.82	0.0	99	83	0.0	0.18	0.9	1.5	B	0
80	78	2	5	23	51	59.81	33- 3.61	115-35.19	15.62	0.0	99	118	0.0	0.05	1.6	2.1	B	0
81	78	2	6	2	9	27.48	33-16.59	115-38.59	3.89	0.0	99	67	0.0	0.21	1.2	1.7	B	0
82	78	2	6	8	57	0.18	32-57.37	115-35.28	14.23	0.0	99	75	0.0	0.17	0.8	1.0	B	0
83	78	2	6	12	35	1.57	33-15.05	115-33.70	3.33	0.0	99	34	0.0	0.22	0.6	0.7	B	0
84	78	2	6	12	38	47.23	33-15.04	115-33.32	1.58	0.0	99	44	0.0	0.25	0.9	1.4	B	0
85	78	2	6	12	56	14.19	33-14.99	115-34.12	3.57	0.0	99	30	0.0	0.24	0.5	0.5	B	0
86	78	2	6	13	4	30.64	33-14.43	115-33.86	4.98	0.0	99	109	0.0	0.02	3.6	4.2	C	0
87	78	2	6	13	4	50.93	33-15.28	115-34.31	4.94	0.0	99	118	0.0	0.01	40.0	98.9	D	0
88	78	2	6	13	7	39.92	33-14.46	115-34.03	5.29	0.0	99	110	0.0	0.05	2.1	2.3	B	0
89	78	2	6	13	12	7.89	33-14.73	115-33.16	0.95	0.0	99	65	0.0	0.16	0.7	1.6	B	0
90	78	2	6	13	15	30.72	33-14.84	115-33.38	2.14	0.0	99	43	0.0	0.16	0.6	0.8	B	0
91	78	2	6	13	18	39.52	33-14.28	115-33.64	3.98	0.0	99	76	0.0	0.16	0.9	1.0	B	0
92	78	2	6	13	18	56.78	33-15.62	115-36.12	11.47	0.0	99	187	0.0	0.06	1.9	1.8	A	0
93	78	2	6	18	53	24.67	33-14.87	115-34.13	5.58	0.0	99	109	0.0	0.05	1.4	2.2	B	0
94	78	2	6	18	53	58.24	33-15.30	115-34.49	6.89	0.0	99	114	0.0	0.08	2.5	4.0	C	0
95	78	2	6	23	29	45.06	33- 9.66	115-55.74	12.46	0.0	99	178	0.0	0.17	4.2	3.9	C	0
96	78	2	6	23	58	22.85	33- 7.65	115-37.00	7.07	0.0	99	57	0.0	0.22	1.0	1.6	B	0
97	78	2	7	6	15	29.13	33- 1.62	115-44.87	4.66	0.0	99	126	0.0	0.02	0.3	0.4	A	0
98	78	2	7	15	9	53.94	32-49.76	115-28.72	11.59	0.0	99	102	0.0	0.21	1.2	2.5	B	0
99	78	2	9	0	45	27.20	33-20.67	115-41.34	8.69	0.0	99	121	0.0	0.12	1.2	2.1	B	0
100	78	2	9	11	53	44.56	32-58.33	115-31.93	13.76	0.0	99	63	0.0	0.19	1.0	2.1	B	0

N	Y	M	D	H	M	SEC	LAT	LONG	DEP	MAG	N	GAP	DM	RMS	ERH	ERZ	Q	M
101	78	210		9	57	4.65	33- 0.35	115-31.99	8.65	0.0	99	93	0.0	0.19	0.8	1.6	B	0
102	78	210		11	59	39.19	32-50.70	115-29.06	10.15	0.0	99	97	0.0	0.20	1.1	2.0	B	0
103	78	210		16	0	6.70	33- 2.63	115-29.39	4.96	0.0	99	244	0.0	0.13	9.8	4.8	C	0
104	78	211		0	13	49.12	33- 1.02	115-32.30	8.15	0.0	99	89	0.0	0.11	1.0	1.1	A	0
105	78	211		1	45	30.54	33- 0.67	115-32.11	7.00	0.0	99	91	0.0	0.20	0.8	1.7	B	0
106	78	211		1	45	50.97	33- 1.33	115-32.39	4.86	0.0	99	154	0.0	0.01	40.0	98.9	D	0
107	78	211		2	9	12.60	33- 1.68	115-32.33	7.59	0.0	99	163	0.0	0.04	40.0	98.9	D	0
108	78	211		2	22	28.95	33- 0.94	115-32.34	7.54	0.0	99	111	0.0	0.18	0.9	1.6	B	0
109	78	211		2	25	51.42	33- 1.23	115-32.30	6.03	0.0	99	51	0.0	0.25	0.7	2.2	B	0
110	78	211		2	26	16.85	33- 2.39	115-31.41	6.99	0.0	99	94	0.0	0.15	2.6	4.5	C	0
111	78	211		2	49	18.05	33- 1.14	115-32.52	7.09	0.0	99	89	0.0	0.16	0.9	1.6	B	0
112	78	211		3	7	42.44	33- 1.13	115-32.24	7.80	0.0	99	156	0.0	0.07	7.4	8.7	D	0
113	78	211		3	56	24.59	33- 1.24	115-32.56	8.49	0.0	99	52	0.0	0.22	1.0	1.8	B	0
114	78	211		9	41	57.64	33- 0.68	115-32.11	4.94	0.0	99	176	0.0	0.10	5.0	2.7	D	0
115	78	211		9	42	7.80	33- 0.80	115-32.29	6.84	0.0	99	53	0.0	0.23	1.0	2.2	B	0
116	78	211		10	14	32.23	33- 0.68	115-31.90	7.65	0.0	99	52	0.0	0.18	1.1	1.7	B	0
117	78	211		14	10	8.47	33-14.84	115-33.81	4.98	0.0	99	101	0.0	0.05	40.0	98.9	D	0
118	78	211		15	22	56.10	33- 0.35	115-31.91	5.36	0.0	99	110	0.0	0.11	0.6	0.5	A	0
119	78	211		15	25	54.71	33- 0.68	115-31.95	6.06	0.0	99	91	0.0	0.19	0.7	2.3	B	0
120	78	211		15	34	27.35	33- 0.39	115-31.70	5.25	0.0	99	111	0.0	0.05	0.5	0.4	A	0
121	78	211		15	46	49.31	33- 1.42	115-32.57	5.90	0.0	99	140	0.0	0.15	5.3	5.2	D	0
122	78	211		16	1	16.92	32-59.45	115-31.07	7.21	0.0	99	199	0.0	0.06	0.8	0.8	A	0
123	78	211		16	59	7.48	33- 0.62	115-31.42	7.94	0.0	99	145	0.0	0.12	1.6	1.7	A	0
124	78	211		16	59	51.99	33- 0.86	115-32.59	10.70	0.0	99	153	0.0	0.23	2.6	3.5	C	0
125	78	212		6	46	56.01	32-57.83	115-35.52	5.31	0.0	99	142	0.0	0.08	2.0	2.1	B	0
126	78	213		1	40	58.45	33-10.38	115-33.86	4.89	0.0	99	152	0.0	0.08	40.0	98.9	D	0
127	78	213		4	22	0.48	32-59.92	115-50.79	4.66	0.0	99	91	0.0	0.24	1.7	1.6	B	0
128	78	213		4	30	35.19	32-59.37	115-49.76	3.90	0.0	99	94	0.0	0.04	0.5	0.8	A	0
129	78	213		5	40	15.67	32-59.95	115-50.23	4.27	0.0	99	89	0.0	0.18	2.1	2.1	B	0
130	78	213		7	26	43.42	32-59.85	115-51.06	4.18	0.0	99	92	0.0	0.24	1.5	1.3	B	0
131	78	214		17	37	19.89	32-59.70	115-32.31	11.13	0.0	99	147	0.0	0.15	1.2	2.1	B	C
132	78	218		7	51	32.74	32-58.31	115-36.40	10.39	0.0	99	111	0.0	0.15	1.6	2.4	B	0
133	78	218		8	49	28.02	32-56.66	115-36.30	5.33	0.0	99	157	0.0	0.06	0.7	0.5	A	0
134	78	218		17	16	32.56	33-16.23	115-59.31	6.52	0.0	99	227	0.0	0.35	40.0	98.9	D	0
135	78	219		9	37	33.39	33- 3.45	115-33.72	5.19	0.0	99	122	0.0	0.09	0.7	0.6	A	0
136	78	219		9	37	49.79	33- 3.44	115-33.76	5.42	0.0	99	122	0.0	0.08	1.1	1.0	A	0
137	78	219		15	4	52.34	32-47.36	115-25.20	5.04	0.0	99	115	0.0	0.37	4.4	21.7	C	0
138	78	221		4	25	22.57	33- 4.93	115-36.17	10.59	0.0	99	78	0.0	0.20	0.8	1.4	B	0
139	78	221		4	28	31.92	33- 4.93	115-36.23	5.04	0.0	99	85	0.0	0.10	0.7	3.1	B	0
140	78	221		6	45	45.68	32-59.90	115-31.49	10.46	0.0	99	191	0.0	0.13	2.6	2.4	C	0
141	78	223		1	58	58.48	33- 4.46	115-34.05	10.24	0.0	99	51	0.0	0.21	0.8	1.5	B	0
142	78	223		2	28	28.21	33-11.75	115-51.68	7.02	0.0	99	120	0.0	0.20	4.5	15.9	C	0
143	78	223		12	57	12.58	32-45.95	115-25.95	4.47	0.0	99	152	0.0	0.29	20.4	81.9	C	0
144	78	223		13	20	28.17	32-46.31	115-26.84	5.17	0.0	99	126	0.0	0.31	4.7	7.5	C	0
145	78	223		13	52	16.72	32-45.74	115-26.48	17.25	0.0	99	130	0.0	0.18	2.2	3.3	B	0
146	78	223		16	43	3.67	32-49.21	115-36.24	19.08	0.0	99	97	0.0	0.33	1.3	2.3	C	0
147	78	223		16	51	59.67	32-49.83	115-35.83	6.29	0.0	99	134	0.0	0.10	40.0	98.9	D	0
148	78	223		23	38	32.44	33- 9.42	115-37.92	9.14	0.0	99	113	0.0	0.10	2.0	1.7	B	0
149	78	224		0	44	22.94	33- 3.80	115-33.06	8.16	0.0	99	81	0.0	0.20	1.2	2.4	B	0
150	78	224		7	58	28.25	32-45.14	115-26.18	7.68	0.0	99	135	0.0	0.34	2.1	11.3	C	0

N	Y	M	D	H	M	SEC	LAT	LONG	DEP	MAG	N	GAP	DM	RMS	ERH	ERZ	Q	M
51	78	224	21	53	42.42	32-46.36	115-26.18	4.97	0.0	99	124	0.0	0.28	2.9	18.4	C	0
52	78	227	1	38	44.30	32-48.74	115-27.89	6.43	0.0	99	198	0.0	0.06	1.0	1.9	A	0
53	78	227	1	46	17.84	32-48.59	115-27.20	9.32	0.0	99	138	0.0	0.14	1.6	3.8	B	0
54	78	227	11	53	48.36	32-57.83	115-35.8713.41		0.0	99	65	0.0	0.21	0.8	1.2	B	0
55	78	227	18	45	17.99	33- 8.24	115-36.5310.16		0.0	99	94	0.0	0.18	1.3	1.7	B	0
56	78	3	2	2	57	11.35	32-52.08	115-28.2113.27	0.0	99	123	0.0	0.15	1.6	2.3	B	0
57	78	3	2	4	49	58.44	32-57.86	115-30.5011.26	0.0	99	175	0.0	0.13	4.1	4.9	C	0
58	78	3	2	14	38	58.20	33-18.62	115-39.85	4.37	0.0	99	156	0.0	0.05	0.5	0.4	A	0
59	78	3	3	2	35	19.94	33-15.54	115-34.10	4.44	0.0	99	112	0.0	0.02	2.2	2.2	B	0
60	78	3	3	10	48	2.03	33- 4.89	115-33.33	8.79	0.0	99	100	0.0	0.14	0.8	1.3	A	0
61	78	3	3	17	13	42.14	32-54.24	115-41.7313.90		0.0	99	103	0.0	0.13	1.7	2.3	B	0
62	78	3	6	3	43	58.64	32-57.15	115-36.19	7.84	0.0	99	155	0.0	0.11	1.9	4.1	B	0
63	78	3	6	6	14	51.97	33-15.36	115-41.10	4.15	0.0	99	184	0.0	0.02	40.0	98.9	D	0
64	78	3	6	8	2	31.74	33- 0.09	115-31.78	9.08	0.0	99	148	0.0	0.11	1.8	3.8	B	0
65	78	3	7	0	33	30.38	32-57.62	115-41.9811.18		0.0	99	83	0.0	0.21	1.3	2.5	B	0
66	78	3	8	23	34	39.47	32-50.91	115-29.66	4.28	0.0	99	137	0.0	0.22	2.8	1.9	C	0
67	78	3	9	6	41	32.91	32-51.91	115-29.68	4.46	0.0	99	128	0.0	0.18	1.4	1.3	B	0
68	78	3	9	10	6	12.34	32-46.55	115-26.7114.62		0.0	99	123	0.0	0.24	1.4	1.7	B	0
69	78	3	9	10	6	52.36	32-46.41	115-26.8815.19		0.0	99	125	0.0	0.20	1.1	1.1	B	0
70	78	3	9	10	7	50.07	32-46.36	115-27.59	8.90	0.0	99	125	0.0	0.01	40.0	99.0	D	0
71	78	3	9	10	9	25.23	32-45.85	115-26.5815.61		0.0	99	129	0.0	0.23	1.1	2.0	B	0
72	78	3	9	10	12	30.90	32-47.30	115-26.5812.12		0.0	99	162	0.0	0.29	2.8	3.5	C	0
73	78	3	9	10	17	28.44	32-46.46	115-26.4715.58		0.0	99	124	0.0	0.22	1.4	1.5	B	0
74	78	3	9	10	22	59.04	32-46.29	115-27.1115.57		0.0	99	126	0.0	0.20	1.4	1.3	B	0
75	78	3	9	10	24	57.50	32-46.34	115-26.2815.48		0.0	99	125	0.0	0.23	1.6	1.5	B	0
76	78	3	9	10	30	46.17	32-46.70	115-27.3014.66		0.0	99	123	0.0	0.19	1.3	1.9	B	0
77	78	310	19	59	30.22	33- 1.18	115-33.15	5.12	0.0	99	89	0.0	0.29	1.4	1.4	B	0
78	78	312	3	30	59.85	32-48.29	115-32.12	5.00	0.0	99	164	0.0	0.28	40.0	98.9	D	0
79	78	312	4	10	51.67	33-11.23	115-55.3910.79		0.0	99	123	0.0	0.19	1.7	2.3	B	0
80	78	312	16	30	22.23	32-47.69	115-26.53	6.22	0.0	99	115	0.0	0.39	3.1	10.1	C	0
81	78	312	21	50	53.08	32-56.80	115-33.2815.73		0.0	99	76	0.0	0.13	0.9	2.2	B	0
82	78	313	4	10	33.76	32-59.25	115-45.83	6.17	0.0	99	121	0.0	0.09	10.8	89.4	D	0
83	78	313	11	30	43.33	33- 2.28	115-31.80	7.75	0.0	99	135	0.0	0.17	2.9	2.8	C	0
84	78	315	4	2	49.39	32-46.62	115-32.15	5.01	0.0	99	122	0.0	0.39	3.1	50.4	C	0
85	78	315	4	9	31.41	32-47.33	115-33.00	5.00	0.0	99	115	0.0	0.41	5.8	49.2	D	0
86	78	315	4	9	39.69	32-46.55	115-33.54	5.00	0.0	99	120	0.0	0.20	1.1	12.0	C	0
87	78	315	4	17	35.77	32-45.78	115-30.70	5.01	0.0	99	208	0.0	0.33	3.7	22.6	C	0
88	78	316	13	31	43.55	33- 6.06	115-37.4911.33		0.0	99	66	0.0	0.12	1.6	2.5	B	0
89	78	318	10	52	26.60	33-12.62	115-39.60	6.92	0.0	99	185	0.0	0.18	40.0	99.0	D	0
90	78	321	4	38	13.98	32-45.74	115-25.24	5.01	0.0	99	153	0.0	0.01	40.0	98.9	D	0
91	78	321	12	19	16.21	32-50.59	115-29.92	4.31	0.0	99	139	0.0	0.19	1.6	1.6	B	0
92	78	325	6	53	7.36	33-16.24	115-40.54	5.33	0.0	99	134	0.0	0.04	1.2	0.6	A	0
93	78	325	8	40	27.49	33-16.49	115-40.62	4.84	0.0	99	159	0.0	0.04	40.0	98.9	D	0
94	78	325	11	27	38.98	32-59.15	115-36.56	5.00	0.0	99	87	0.0	0.25	0.7	0.7	B	0
95	78	326	5	35	17.83	33-16.15	115-59.66	5.00	0.0	99	113	0.0	0.13	0.9	14.6	C	0
96	78	326	23	57	57.63	33- 1.75	115-32.58	5.04	0.0	99	118	0.0	0.16	1.8	2.8	B	0
97	78	327	16	41	14.77	32-57.91	115-50.03	5.00	0.0	99	360	0.0	0.11	40.0	98.9	D	0
98	78	327	19	49	1.51	33- 8.31	115-35.87	9.85	0.0	99	173	0.0	0.09	1.1	1.2	A	0
99	78	328	2	35	47.92	32-58.89	115-34.17	4.99	0.0	99	156	0.0	0.20	40.0	98.9	D	0
200	78	328	10	15	10.66	33-14.03	115-38.58	4.64	0.0	99	187	0.0	0.10	4.6	2.5	C	0

N	Y	M	D	H	M	SEC	LAT	LONG	DEP	MAG	N	GAP	DM	RMS	ERH	ERZ	Q	M
01	78	329		4	53	6.03	32-47.46	115-26.97	5.11	0.0	99	301	0.0	0.04	40.0	98.9	D	0
02	78	329		18	1	7.44	32-58.00	115-53.08	7.01	0.0	99	93	0.0	0.09	3.9	5.2	C	0
03	78	329		18	1	54.42	32-57.22	115-52.67	4.99	0.0	99	219	0.0	0.01	40.0	98.9	D	0
04	78	330		1	29	25.13	33- 1.43	115-27.39	5.00	0.0	99	208	0.0	0.03	40.0	98.9	D	0
05	78	331		7	0	5.37	32-51.59	115-27.34	4.67	0.0	99	125	0.0	0.15	2.5	0.8	C	0

ND OF SET
ND OF JOB