

U. S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

**HOMESTEAD VALLEY, CALIFORNIA, AFTERSHOCKS
(MARCH 17-18, 1979)
RECORDED ON PORTABLE SEISMOGRAPHS**

by

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Open-File Report 94-710

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1994

INTRODUCTION

On March 15, 1979, four moderate earthquakes (ML 4.9, 5.3, 4.5, 4.8) occurred in the Homestead Valley area of the Mojave Desert (Figure 1). At that time, they were noteworthy for a vigorous aftershock sequence and for off-fault epicentral locations that formed a cruciform pattern (Hutton, et al., 1980; Stein and Lisowski, 1983). More recently, there is renewed interest in the Homestead Valley sequence because of its proximity and possible relationship to the June 28, 1992 Landers earthquake (Mw 7.3). The Homestead Valley earthquakes fall within the Landers aftershock zone, and many of the Homestead Valley epicenters align with the Landers surface rupture (Figure 2).

DATA

On March 17 and 18, 1979, the U. S. Geological Survey deployed seven three-component seismographs in the epicentral area (Table I; Figure 2), to record on five-day FM tape recorders (Criley and Eaton, 1978). More than 300 earthquakes were played back from recordings of these close-in stations, then P- and S-wave arrival times were picked from the resulting analog records. The seismographs continued recording until March 24, 1979 but those FM tapes have not been played back.

Hutton et al. (1980) made use of some of the data from these portable instruments. In this study, phase data from the portable instruments have been fully merged with those from Southern California Seismic Network (SCSN) stations (Figure 1) and the events have been relocated with the program HYPOINVERSE (Klein, 1989). We used a one-dimensional P-wave velocity model (Table II) and station corrections developed from Landers data; and a P- to S-wave velocity ratio of 1.73 km/sec.

METHOD

For plotting the figures in this report, events were deleted if they were not within the study area (Figure 1); if they were recorded on fewer than four stations; and if the merger of SCSN and portable instrument data produced unreasonable results. Among the portable instrument data, P-picks with residuals greater than 0.60 sec and S-picks with residuals greater than 1.00 sec were not used. Additionally, some changes were made to the SCSN phase data, to ensure having only one P and S arrival from each station. For each event where multiple picks existed for the same station, generally the lowest-residual picks were used.

RESULTS

The addition of stations close to the aftershock area has resulted in refined epicentral locations (Figure 2) and depth resolution for 256 aftershocks. The relocated hypocenters are shown in cross sections oriented approximately parallel (Figure 3) and perpendicular (Figure 4) to the NW-SE trending arm of the cruciform seismicity pattern. For comparison, locations determined without portables data are plotted in Figure 5.

Location parameters for these 256 earthquakes are listed in Appendix A. The HYPOINVERSE files used for this report, plus the file containing SCSN and portable instrument merged phase data without the changes made for this report, can be obtained from the Southern California Earthquake Center Data Center (in the "anonymous ftp" site on scec.gps.caltech.edu. The files are *homestead.hyp* and *homestead.phase* in [/pub/ca.earthquakes/homestead](http://pub/ca.earthquakes/homestead)). The paper records and field notebooks from 1979 are stored at the U.S. Geological Survey, Pasadena, CA.

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Sieh, Kerry, L. Jones, E. Hauksson, K. Hudnut, D. Eberhart-Phillips, T. Heaton, S. Hough, K. Hutton, H. Kanamori, A. Lilje, S. Lindvall, S. F. McGill, J. Mori, C. Rubin, J. A. Spotila, J. Stock, H. K. Thio, J. Treiman, B. Wernicke, J. Zachariasen, Near-field investigations of the Landers earthquake sequence, April to July 1992, *Science*, 260, 171-176, 1993.

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TABLE 1. STATION LOCATIONS

STATION CODE	STATION NAME	LATITUDE North	LONGITUDE West	ELEVATION in meters	STATION ON	PLAYBACKS END
CRM2	Creole	34° 21.611'	116° 25.084'	802	3/17 02:02	3/18 04:52
GROK	Giant Rock	34° 20.196'	116° 23.887'	842	3/17 03:56	3/18 05:20
LNP2	Landers Peak	34° 18.814'	116° 27.863'	1017	3/17 02:02	3/18 07:02
MEAN	Means Lake	34° 21.586'	116° 29.805'	1006	3/17 22:16	3/18 09:02
PIPE	Pipes Wash	34° 19.038'	116° 25.307'	895	3/18 04:52	3/18 08:27
RCHM	Reche Mtn.	34° 18.576'	116° 20.842'	838	3/17 02:02	3/18 05:20
RCH2	Reche Wells	34° 17.854'	116° 24.278'	901	3/18 02:41	3/18 07:14

TABLE II. ONE-DIMENSIONAL P-WAVE VELOCITY MODEL

DEPTH TO TOP OF LAYER km	VELOCITY OF LAYER km/sec
0.0	4.69
2.0	5.61
4.0	5.98
6.0	6.05
8.0	6.12
10.0	6.22
13.0	6.37
17.0	6.56
21.0	6.76
25.0	7.05
31.0	7.70

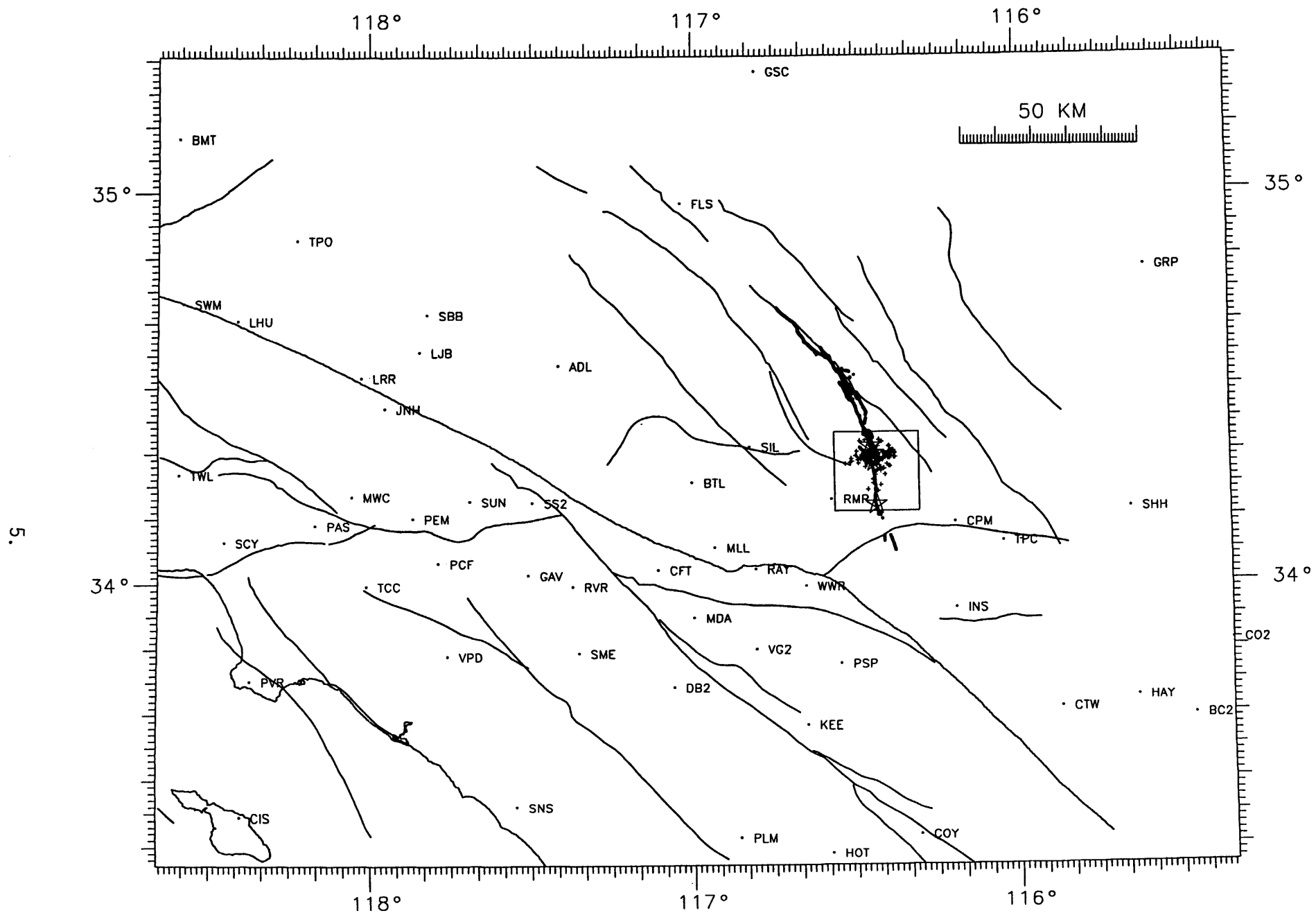


Figure 1. Locations of study area, epicenters in Homestead Valley (rectangle), and SCSN permanent network stations used in this report. Bold line is Landers surface rupture.

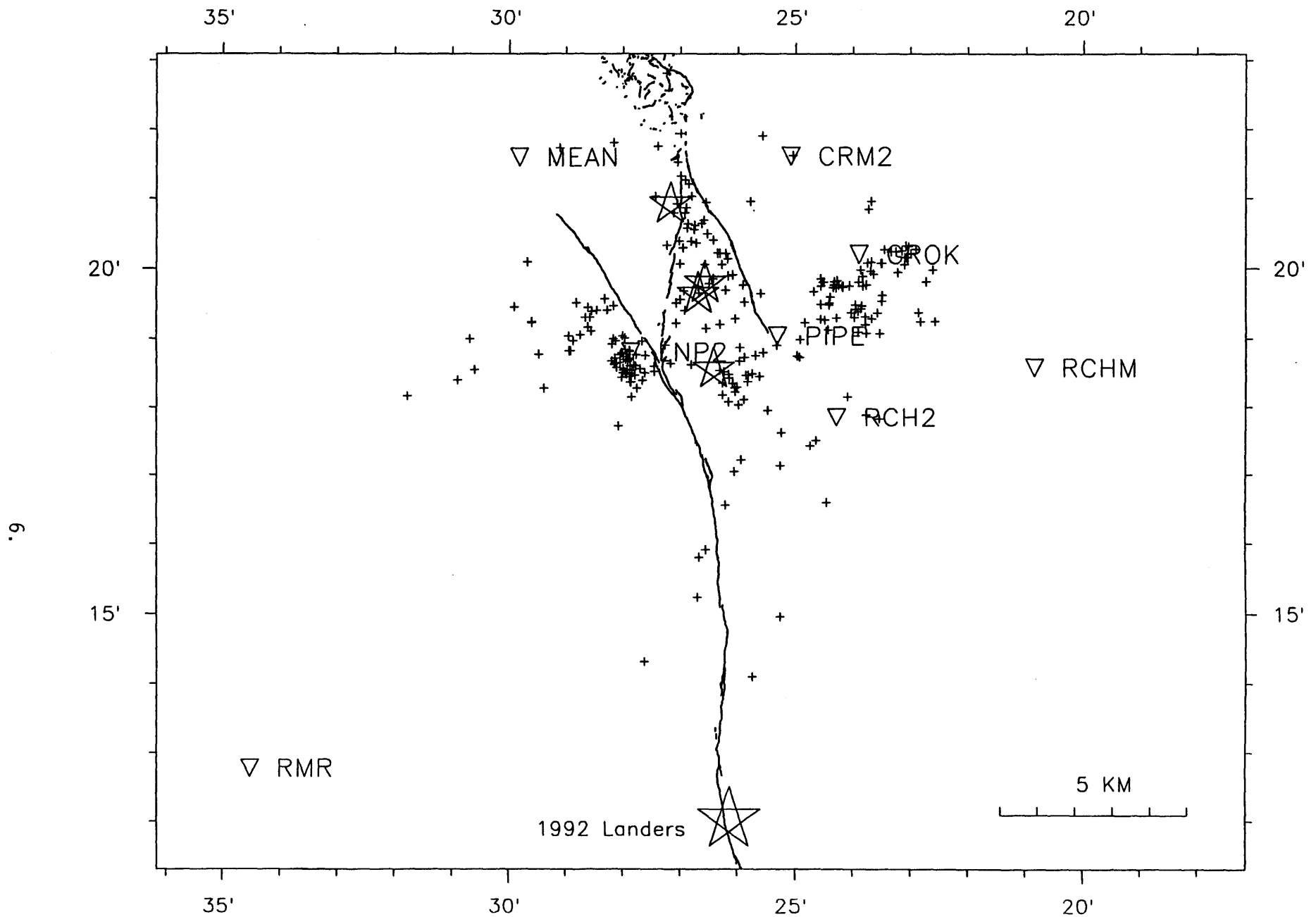


Figure 2. Relocated epicenters (crosses) and portable seismograph deployment sites (inverted triangles), shown here with Homestead Valley and Landers mainshocks (stars) and Landers surface rupture (bold line). Station RMR is a SCSN permanent station.

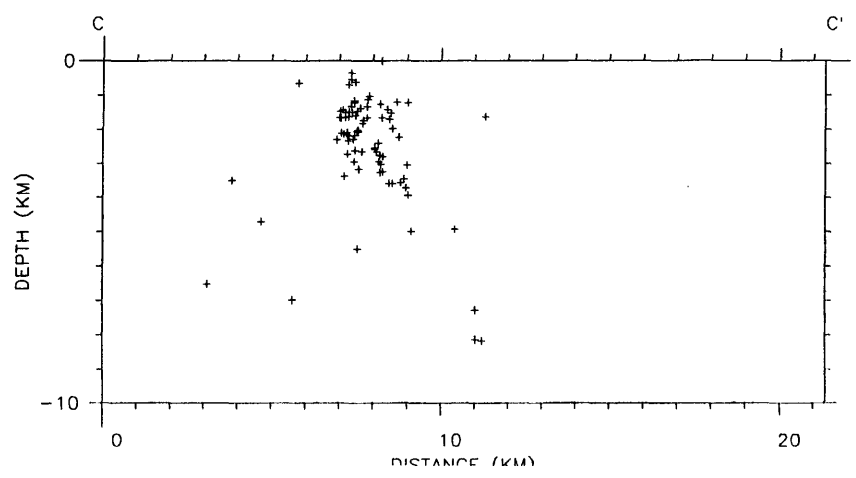
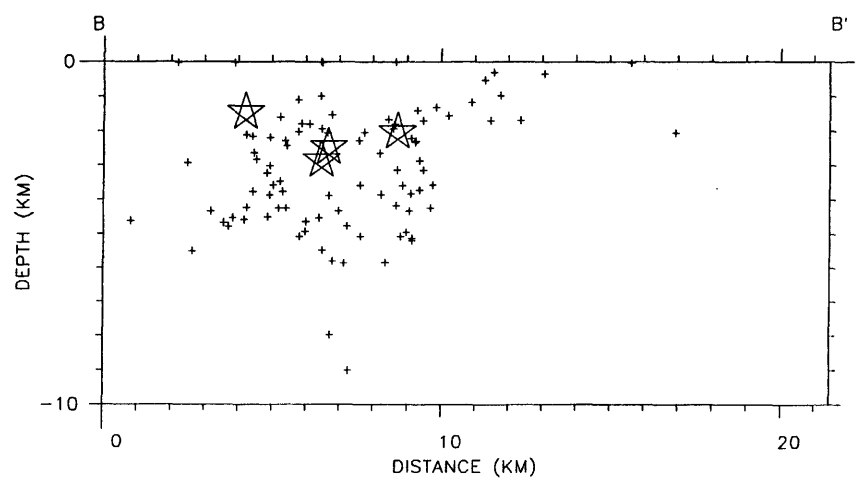
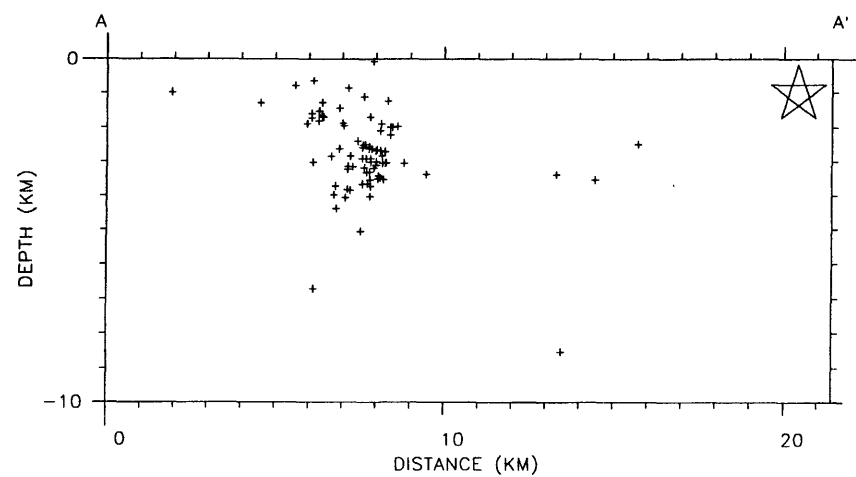
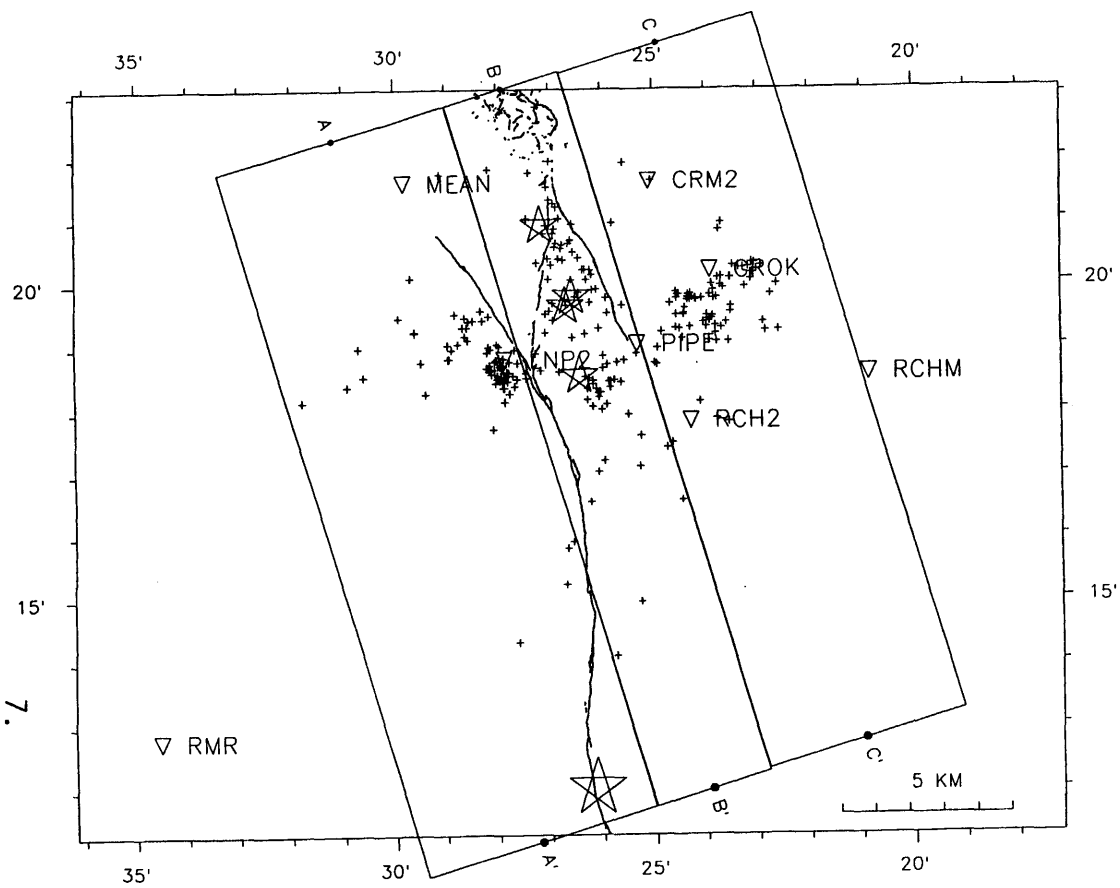


Figure 3. (above) Map showing orientations and events for cross sections. Homestead Valley and Landers mainshocks are indicated by stars. (right) Cross sections, oriented approximately parallel to the NW-SE trend of seismicity and to the Landers surface rupture (bold line).

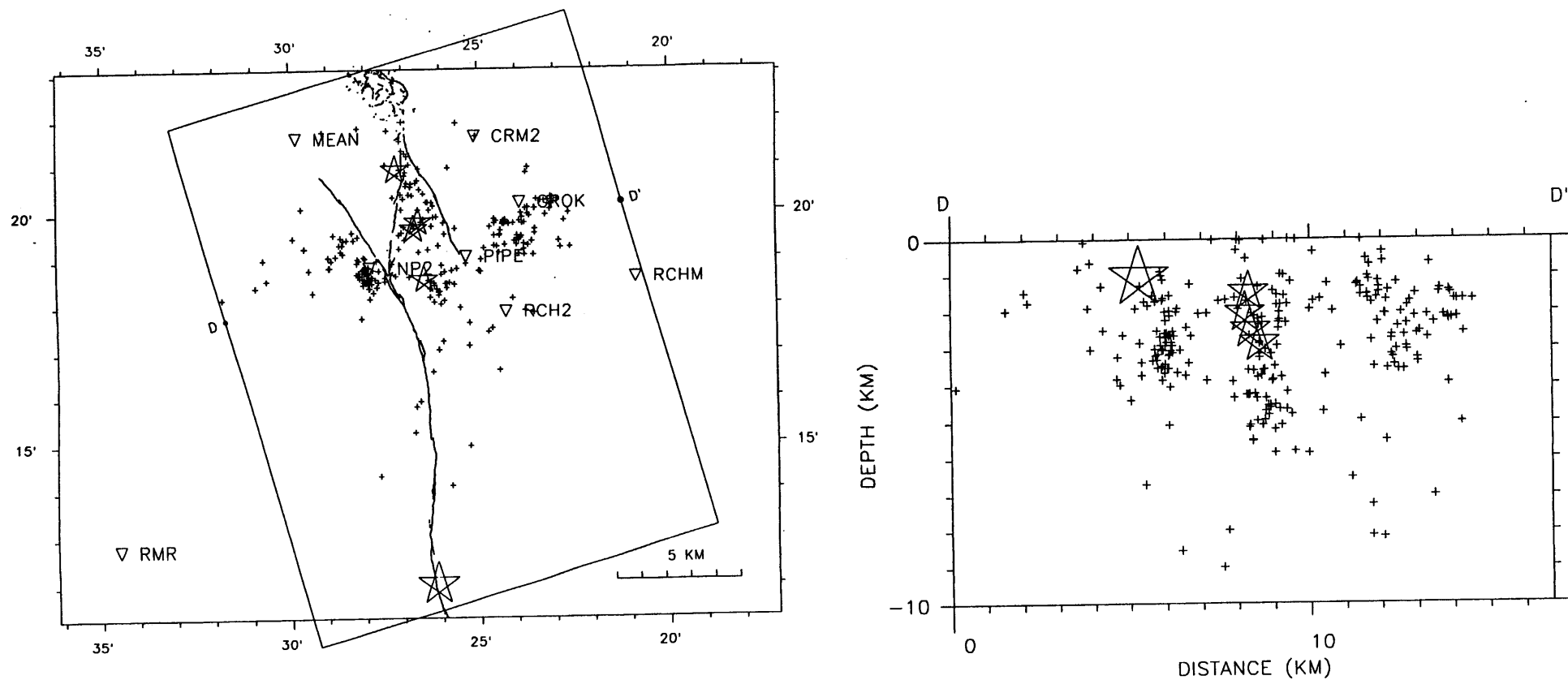


Figure 4. (left) Map showing orientation and events for cross section. Homestead Valley and Landers mainshocks are indicated by stars. (right) Cross section oriented approximately perpendicular to NW-SE trend of seismicity, and to the Landers surface rupture (bold line).

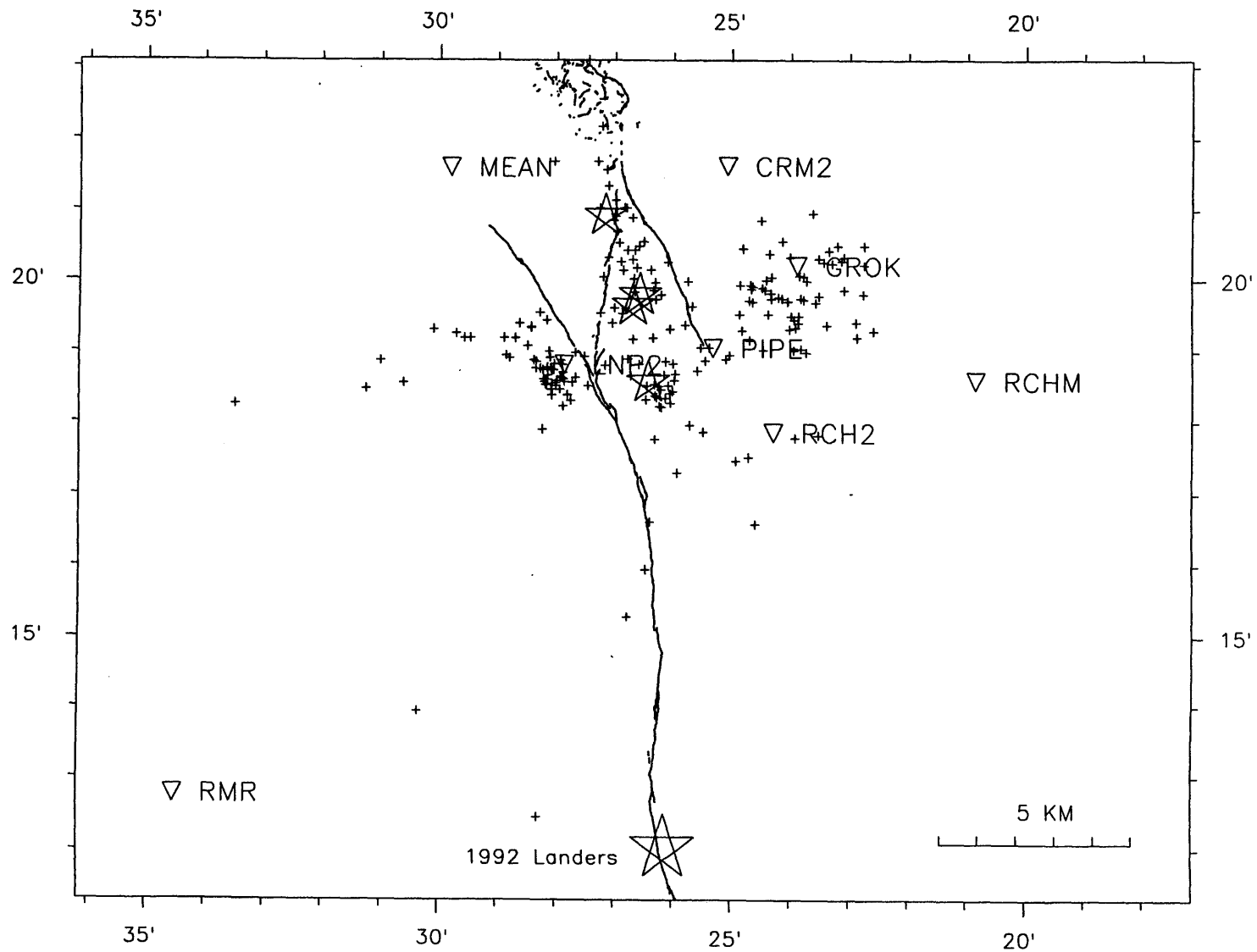
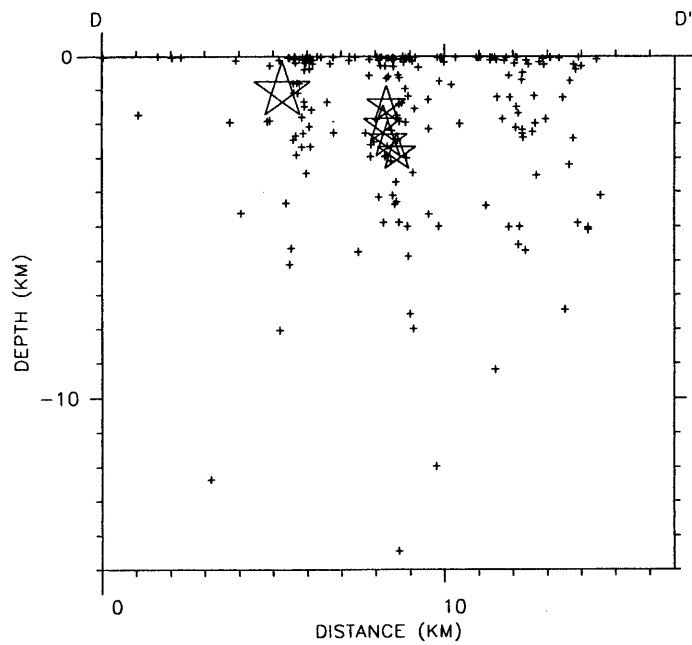
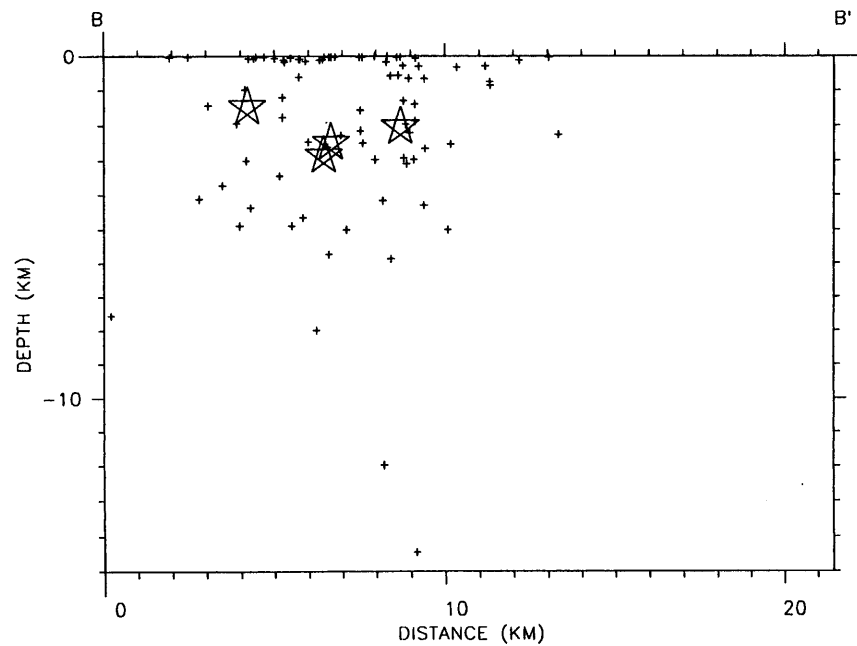
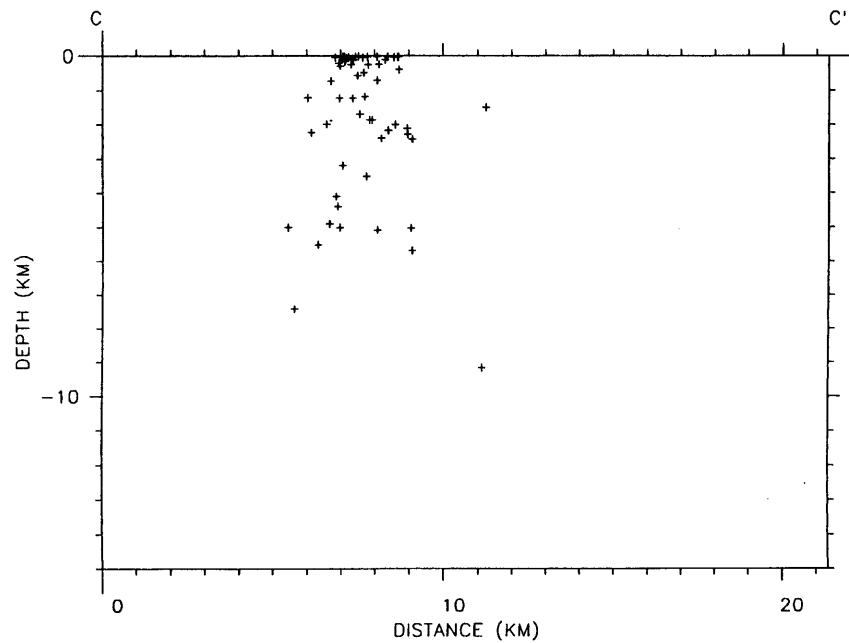
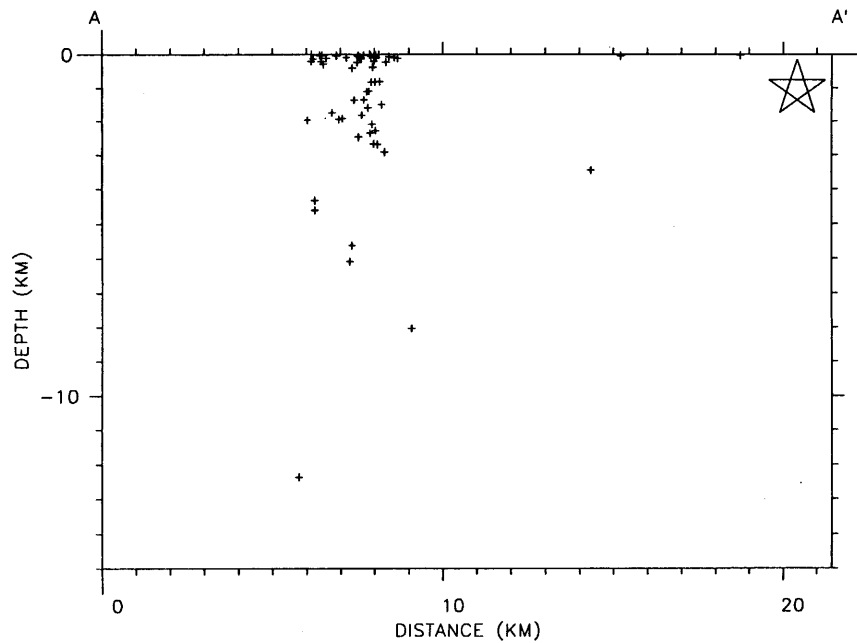


Figure 5. (*this page*) Epicenters and (*next page*) hypocenters determined from network phase data alone. Forty-seven events were deleted because they could not be located solely using network data. Compare epicenters to those in Figure 2; cross-sections A, B, C to Figure 3, cross-section D to Figure 4.



APPENDIX A. LOCATION PARAMETERS

EVENT DATE			EVENT TIME		MINUTES LATITUDE	MINUTES LONGITUDE	EVENT DEPTH	MAXIMUM AZIMUTHAL	RMS TRAVEL TIME	TOTAL P & S PICKS
YR	MO	DY	HR:MN	SEC	34 N	116 W	(KM)	GAP	RESIDUAL	USED
79	03	17	02:02	00.66	19.77	23.77	1.84	98	0.09	10
79	03	17	02:02	16.83	21.52	27.05	4.35	119	0.05	12
79	03	17	02:08	35.74	18.70	27.95	2.57	172	0.04	13
79	03	17	02:09	22.93	19.28	24.56	1.27	72	0.04	13
79	03	17	02:55	53.73	18.54	27.84	2.12	79	0.08	21
79	03	17	03:00	36.45	18.47	25.82	5.20	48	0.18	33
79	03	17	03:03	22.68	18.97	28.87	2.64	125	0.06	16
79	03	17	03:10	23.23	20.86	26.90	2.16	191	0.19	20
79	03	17	03:10	40.00	19.49	24.42	1.04	89	0.13	13
79	03	17	03:23	49.01	20.79	27.11	2.65	112	0.11	21
79	03	17	03:24	11.75	19.53	25.88	4.77	130	0.06	17
79	03	17	03:24	38.73	18.38	25.83	1.42	85	0.11	14
79	03	17	03:42	09.60	20.09	23.68	3.38	68	0.11	35
79	03	17	03:50	36.91	18.18	26.26	1.70	143	0.09	16
79	03	17	03:56	49.03	19.76	24.55	0.55	53	0.20	40
79	03	17	03:57	42.69	19.52	24.41	1.13	90	0.19	28
79	03	17	04:13	12.54	21.62	25.04	3.51	155	0.14	10
79	03	17	04:13	09.39	21.75	27.39	5.50	208	0.04	8
79	03	17	04:15	50.94	18.56	27.70	1.91	55	0.16	61
79	03	17	04:15	46.65	18.77	27.77	3.66	101	0.03	10
79	03	17	04:17	04.20	21.90	25.57	6.52	198	0.03	8
79	03	17	04:38	03.03	21.93	26.99	2.93	199	0.14	17
79	03	17	04:38	13.18	18.40	30.90	1.97	206	0.08	10
79	03	17	04:38	40.38	20.14	26.18	4.64	164	0.03	10
79	03	17	04:39	25.55	22.81	27.25	4.62	94	0.10	23
79	03	17	04:49	08.33	18.78	27.94	3.18	176	0.04	15
79	03	17	04:56	21.51	19.54	23.50	3.27	69	0.07	22
79	03	17	04:58	33.59	19.89	23.83	2.96	90	0.03	12
79	03	17	05:09	12.89	19.31	28.58	1.71	186	0.07	17
79	03	17	05:10	51.80	18.08	26.16	4.25	73	0.10	24
79	03	17	05:33	51.07	17.43	24.74	1.70	58	0.09	17
79	03	17	05:36	48.49	19.48	23.85	2.41	57	0.10	32
79	03	17	05:40	00.18	19.37	23.58	1.71	51	0.14	39
79	03	17	05:46	37.90	18.16	31.77	4.07	147	0.04	6
79	03	17	05:49	35.92	20.84	23.73	0.66	188	0.13	8
79	03	17	05:52	16.99	18.76	25.69	4.18	98	0.15	12
79	03	17	06:00	32.19	19.77	24.32	1.17	57	0.19	40
79	03	17	06:01	37.41	19.82	24.32	1.34	59	0.19	37
79	03	17	06:01	22.61	20.63	26.87	3.24	197	0.02	9
79	03	17	06:02	11.37	19.77	24.24	0.62	92	0.03	9
79	03	17	06:02	48.78	20.79	26.92	2.83	202	0.03	10
79	03	17	06:12	45.91	20.06	26.28	1.80	165	0.16	14
79	03	17	06:17	50.06	19.74	24.34	1.60	94	0.03	11
79	03	17	06:17	42.84	19.73	24.29	1.47	93	0.02	9
79	03	17	06:21	50.95	18.87	25.96	5.84	106	0.03	14
79	03	17	06:30	26.50	18.35	26.09	2.35	86	0.09	11
79	03	17	06:31	14.87	19.77	25.91	5.79	95	0.06	20
79	03	17	06:40	31.72	21.02	27.43	0.03	81	0.20	22
79	03	17	06:50	40.95	19.31	28.66	1.29	70	0.10	28
79	03	17	06:51	10.79	20.32	27.23	1.60	214	0.02	7
79	03	17	06:51	16.32	20.07	27.01	1.09	69	0.14	25
79	03	17	06:52	50.15	21.72	29.10	1.00	244	0.25	11
79	03	17	06:53	43.96	20.21	26.21	1.79	110	0.17	21
79	03	17	07:22	53.67	18.68	28.20	3.33	100	0.10	23
79	03	17	07:26	25.94	19.49	23.96	2.65	33	0.09	29
79	03	17	07:31	30.51	19.43	23.95	2.76	41	0.10	27
79	03	17	07:35	17.86	19.08	23.54	3.05	65	0.07	20
79	03	17	07:41	01.27	19.76	24.06	3.17	77	0.05	15
79	03	17	07:45	30.04	18.47	25.86	3.84	59	0.14	24
79	03	17	07:46	09.18	18.52	27.45	1.24	75	0.17	21
79	03	17	07:45	44.90	19.00	28.17	0.88	220	0.09	10

EVENT DATE			EVENT TIME		MINUTES LATITUDE	MINUTES LONGITUDE	EVENT DEPTH	MAXIMUM AZIMUTHAL GAP	RMS TRAVEL TIME RESIDUAL	TOTAL P & S PICKS USED
YR	MO	DY	HR:MN	SEC	34 N	116 W	(KM)			
79	03	17	07:56	41.86	18.03	25.99	1.31	74	0.12	19
79	03	17	08:01	14.43	19.98	23.86	2.33	78	0.26	23
79	03	17	08:07	59.28	18.80	25.56	0.02	92	0.18	16
79	03	17	08:12	42.67	17.51	24.64	1.64	39	0.13	83
79	03	17	08:27	02.16	19.27	24.49	0.02	88	0.31	15
79	03	17	08:32	51.96	19.05	28.75	4.39	191	0.10	13
79	03	17	08:45	41.08	17.83	23.54	8.17	60	0.03	16
79	03	17	08:51	05.93	18.43	26.15	4.35	55	0.08	19
79	03	17	08:51	31.28	18.15	24.09	4.93	130	0.09	11
79	03	17	09:03	54.24	17.88	23.77	8.13	57	0.07	21
79	03	17	09:42	29.02	20.25	23.15	1.44	85	0.10	26
79	03	17	09:43	03.57	20.55	26.76	3.59	192	0.03	7
79	03	17	09:46	15.38	18.77	28.05	1.12	59	0.11	24
79	03	17	09:58	41.20	19.15	26.56	3.60	84	0.13	23
79	03	17	09:59	07.64	19.04	28.95	3.98	194	0.06	13
79	03	17	10:18	53.92	18.62	27.81	3.11	49	0.16	52
79	03	17	10:19	21.48	18.70	27.88	4.03	145	0.07	10
79	03	17	10:19	50.17	18.84	27.96	5.08	178	0.05	10
79	03	17	10:31	01.44	20.92	27.06	2.11	175	0.15	24
79	03	17	10:34	24.96	18.48	27.94	3.05	51	0.09	20
79	03	17	10:45	03.89	18.49	25.75	2.22	89	0.07	22
79	03	17	10:46	01.80	18.29	26.05	2.87	46	0.14	44
79	03	17	10:46	16.96	14.10	25.74	2.05	176	0.35	12
79	03	17	10:46	50.26	20.95	25.78	4.70	179	0.24	9
79	03	17	10:48	40.39	19.81	24.53	1.64	95	0.07	18
79	03	17	10:50	07.13	19.83	24.27	0.35	59	0.13	36
79	03	17	10:50	01.99	20.08	23.51	2.10	87	0.04	9
79	03	17	10:53	41.71	19.96	23.69	1.51	67	0.06	22
79	03	17	11:04	36.79	18.62	26.81	1.66	66	0.11	26
79	03	17	11:15	34.04	20.49	26.53	3.48	71	0.18	56
79	03	17	11:16	34.08	19.30	24.28	2.79	102	0.02	9
79	03	17	11:24	59.73	19.38	22.86	2.22	61	0.11	25
79	03	17	11:25	23.88	18.99	30.69	1.74	125	0.14	17
79	03	17	12:10	00.78	19.57	28.32	1.62	71	0.20	30
79	03	17	12:11	57.94	18.64	28.14	1.71	59	0.10	36
79	03	17	12:11	54.59	20.22	26.31	5.07	112	0.09	13
79	03	17	12:12	38.17	19.52	28.82	1.91	200	0.04	6
79	03	17	12:14	13.64	19.48	28.17	1.55	115	0.19	17
79	03	17	12:16	07.85	19.40	28.55	1.82	117	0.05	15
79	03	17	12:18	53.45	18.90	25.32	1.93	36	0.10	47
79	03	17	12:23	54.69	19.41	28.46	1.54	70	0.16	20
79	03	17	12:44	07.18	20.24	23.34	1.47	68	0.18	57
79	03	17	12:45	10.53	20.08	23.50	2.72	87	0.08	12
79	03	17	12:53	59.20	19.86	24.56	1.52	54	0.15	40
79	03	17	12:54	29.17	19.75	26.69	5.47	169	0.02	9
79	03	17	13:15	58.88	16.59	24.46	0.36	63	0.12	18
79	03	17	13:16	24.77	19.23	24.84	2.95	103	0.04	9
79	03	17	13:18	03.05	19.41	26.92	4.33	105	0.07	17
79	03	17	13:35	22.93	20.39	27.02	4.26	112	0.09	18
79	03	17	13:37	04.29	20.27	23.45	2.30	68	0.08	18
79	03	17	13:49	01.25	17.22	25.94	0.54	43	0.20	25
79	03	17	14:09	35.42	18.37	27.86	2.24	116	0.11	19
79	03	17	14:10	25.61	18.28	27.75	1.98	76	0.13	20
79	03	17	14:13	41.30	18.54	27.99	3.52	114	0.07	18
79	03	17	14:14	00.66	18.11	25.89	3.58	119	0.04	11
79	03	17	14:38	37.38	20.22	26.35	2.02	62	0.11	28
79	03	17	14:41	10.82	15.24	26.70	3.55	91	0.10	24
79	03	17	15:04	41.74	19.46	28.62	6.71	72	0.22	35
79	03	17	15:09	39.52	17.95	25.48	1.56	58	0.19	31
79	03	17	15:13	48.93	18.80	28.02	2.59	59	0.11	53
79	03	17	15:18	41.63	19.56	27.00	3.89	115	0.09	16

EVENT DATE			EVENT TIME		MINUTES LATITUDE	MINUTES LONGITUDE	EVENT DEPTH	MAXIMUM AZIMUTHAL GAP	RMS TRAVEL TIME	TOTAL P & S PICKS
YR	MO	DY	HR:MN	SEC	34 N	116 W	(KM)		RESIDUAL	USED
79	03	17	15:25	46.35	19.69	26.94	1.93	111	0.16	18
79	03	17	15:27	07.66	20.94	26.56	3.78	110	0.06	13
79	03	17	15:27	39.71	20.24	23.25	2.12	121	0.04	8
79	03	17	15:30	30.09	18.50	27.88	2.83	63	0.07	20
79	03	17	15:33	05.34	18.50	27.62	3.04	53	0.15	21
79	03	17	15:34	49.00	19.20	26.31	5.08	45	0.12	38
79	03	17	15:35	06.92	17.89	23.77	7.27	57	0.10	21
79	03	17	15:48	39.79	19.23	29.59	0.65	131	0.06	16
79	03	17	15:49	24.63	18.90	27.26	2.04	79	0.20	19
79	03	17	15:58	33.83	20.68	26.59	4.52	110	0.15	15
79	03	17	16:15	59.32	18.99	24.92	1.98	37	0.14	59
79	03	17	16:17	01.95	17.04	26.06	0.31	169	0.17	8
79	03	17	16:25	08.23	18.65	28.11	3.31	115	0.07	18
79	03	17	16:36	53.54	18.79	28.01	3.67	178	0.03	10
79	03	17	16:37	06.17	18.92	28.19	3.16	115	0.10	21
79	03	17	16:56	51.24	19.29	26.04	2.28	47	0.12	25
79	03	17	16:57	13.46	19.20	23.78	1.20	67	0.12	20
79	03	17	16:59	52.08	15.81	26.67	8.53	218	0.14	5
79	03	17	17:01	31.44	19.81	24.50	0.71	54	0.24	37
79	03	17	17:02	11.54	20.38	26.81	3.78	137	0.17	27
79	03	17	17:06	42.72	19.79	26.50	0.03	56	0.16	25
79	03	17	17:06	40.76	18.97	28.13	3.85	182	0.02	7
79	03	17	17:11	09.59	18.60	27.45	2.66	52	0.28	24
79	03	17	17:21	03.02	18.96	27.67	2.42	73	0.18	32
79	03	17	17:21	22.54	18.69	27.92	3.55	160	0.09	7
79	03	17	17:21	43.10	19.01	27.97	2.84	181	0.08	8
79	03	17	17:26	37.48	19.31	23.97	1.42	70	0.13	21
79	03	17	17:35	22.46	18.74	27.99	2.91	58	0.09	47
79	03	17	17:36	10.14	19.04	28.01	3.14	63	0.10	16
79	03	17	17:36	16.21	18.64	27.17	3.86	59	0.22	14
79	03	17	17:51	05.87	19.44	23.86	3.02	38	0.13	69
79	03	17	17:52	28.20	19.90	26.17	0.99	103	0.11	16
79	03	17	17:53	49.32	19.32	23.78	3.58	128	0.03	11
79	03	17	17:53	53.29	19.40	23.91	3.24	63	0.07	20
79	03	17	17:54	35.44	19.11	28.56	3.73	190	0.01	9
79	03	17	18:00	50.89	17.62	25.24	1.18	74	0.21	15
79	03	17	18:07	31.41	19.75	24.17	5.49	134	0.02	7
79	03	17	18:07	42.40	19.98	22.61	1.68	102	0.07	13
79	03	17	18:08	04.10	19.38	24.03	1.68	101	0.02	8
79	03	17	18:21	16.48	18.82	27.88	2.53	59	0.17	61
79	03	17	18:21	50.19	19.17	28.62	2.85	192	0.13	11
79	03	17	18:30	04.54	18.83	27.89	2.91	75	0.08	16
79	03	17	18:45	31.54	19.46	29.90	0.81	211	0.05	8
79	03	17	18:48	38.86	19.25	22.57	5.00	69	0.15	70
79	03	17	18:52	08.11	19.78	24.33	2.29	58	0.14	51
79	03	17	19:13	45.56	18.65	28.05	2.91	115	0.07	12
79	03	17	19:14	12.94	18.72	28.14	2.52	115	0.12	20
79	03	17	19:17	32.91	18.15	27.85	3.05	134	0.04	10
79	03	17	19:29	26.24	18.75	24.97	3.72	141	0.03	8
79	03	17	19:29	28.83	20.95	23.68	7.00	93	0.04	13
79	03	17	19:30	07.34	19.24	22.82	3.93	59	0.13	34
79	03	17	19:54	00.08	19.75	24.19	2.06	79	0.06	16
79	03	17	19:58	59.30	18.39	27.66	2.01	112	0.10	14
79	03	17	19:59	27.86	20.64	26.63	3.87	192	0.05	11
79	03	17	20:04	36.74	18.68	25.97	3.15	61	0.08	17
79	03	17	20:24	00.70	19.82	22.73	2.58	111	0.05	13
79	03	17	20:31	48.30	21.20	26.86	4.54	111	0.07	19
79	03	17	20:33	34.29	18.58	28.11	3.19	118	0.07	16
79	03	17	20:35	09.56	19.91	26.09	0.00	152	0.37	11
79	03	17	20:35	25.42	18.61	27.87	2.68	114	0.09	18
79	03	17	20:36	43.97	20.57	26.88	2.20	111	0.15	20

EVENT DATE			EVENT TIME		MINUTES LATITUDE	MINUTES LONGITUDE	EVENT DEPTH	MAXIMUM AZIMUTHAL GAP	RMS TRAVEL TIME RESIDUAL	TOTAL P & S PICKS USED
YR	MO	DY	HR:MN	SEC	34 N	116 W	(KM)			
79	03	17	20:45	51.27	20.16	23.10	1.50	95	0.10	14
79	03	17	20:46	00.03	20.16	23.07	2.20	100	0.07	9
79	03	17	20:49	32.13	19.41	28.28	1.68	69	0.16	30
79	03	17	20:57	36.21	20.92	27.05	4.24	229	0.03	7
79	03	17	20:57	43.47	20.40	26.43	2.44	176	0.14	15
79	03	17	20:59	48.65	16.56	26.22	1.69	61	0.19	34
79	03	17	21:08	16.66	19.66	26.68	2.05	107	0.05	11
79	03	17	21:17	14.56	19.08	23.77	3.45	66	0.06	18
79	03	17	21:26	31.18	18.73	24.93	1.23	113	0.09	14
79	03	17	21:26	59.82	14.96	25.26	0.04	171	0.43	6
79	03	17	21:31	04.23	18.73	25.88	1.81	63	0.08	25
79	03	17	21:38	31.95	20.31	23.03	1.68	67	0.11	40
79	03	17	21:39	21.25	20.21	22.99	2.16	119	0.04	8
79	03	17	21:40	57.28	20.09	29.67	1.30	219	0.11	8
79	03	17	21:50	32.97	19.86	26.43	4.54	107	0.10	21
79	03	17	22:06	18.94	18.72	27.88	2.64	113	0.06	17
79	03	17	22:09	33.08	19.76	23.82	2.65	61	0.05	19
79	03	17	22:16	27.99	19.50	24.56	1.34	71	0.11	18
79	03	17	22:16	35.73	18.82	28.94	3.83	128	0.06	9
79	03	17	22:31	54.92	18.44	28.02	3.53	67	0.15	20
79	03	17	22:43	31.04	21.80	28.17	0.03	80	0.23	34
79	03	17	23:10	54.46	19.92	23.64	2.61	83	0.10	22
79	03	17	23:19	32.53	19.29	23.67	3.58	107	0.07	20
79	03	17	23:21	21.24	19.52	27.07	7.98	60	0.07	21
79	03	17	23:25	59.41	18.55	30.60	1.46	124	0.07	16
79	03	17	23:35	28.69	19.24	29.59	3.03	68	0.09	31
79	03	17	23:37	05.34	17.13	25.26	0.97	90	0.16	12
79	03	17	23:37	08.98	20.08	23.74	2.14	72	0.12	20
79	03	17	23:44	58.64	19.10	23.91	3.56	55	0.06	18
79	03	17	23:45	55.22	18.61	27.78	2.66	54	0.11	23
79	03	17	23:46	21.29	18.30	26.01	3.73	115	0.04	14
79	03	17	23:48	38.27	18.55	27.92	3.43	106	0.10	19
79	03	17	23:49	02.03	17.72	28.08	3.38	147	0.14	8
79	03	17	23:52	16.31	18.37	27.87	2.00	51	0.11	22
79	03	18	00:14	57.82	18.63	28.15	3.01	59	0.10	23
79	03	18	00:31	58.13	20.27	22.90	1.67	66	0.13	23
79	03	18	00:32	25.19	20.06	23.10	2.18	94	0.03	12
79	03	18	01:40	13.67	20.32	23.08	1.67	97	0.09	17
79	03	18	01:44	19.59	18.45	27.89	2.71	56	0.15	29
79	03	18	02:41	08.96	19.74	24.17	2.08	47	0.14	73
79	03	18	02:45	56.76	19.13	24.43	1.53	63	0.06	17
79	03	18	02:52	42.59	20.29	26.95	4.26	112	0.06	16
79	03	18	02:58	38.34	18.52	26.24	3.61	88	0.08	17
79	03	18	02:59	06.27	18.77	29.47	1.90	140	0.05	8
79	03	18	03:12	02.65	20.06	26.57	4.93	74	0.08	24
79	03	18	03:12	16.17	18.36	26.26	5.13	93	0.07	13
79	03	18	03:37	08.92	18.51	27.96	3.48	34	0.16	75
79	03	18	03:39	07.92	18.23	26.04	3.14	45	0.10	25
79	03	18	03:40	53.81	21.26	26.91	4.78	82	0.13	24
79	03	18	03:59	05.89	18.54	26.31	5.07	41	0.12	41
79	03	18	04:10	19.49	18.67	27.91	2.64	34	0.14	62
79	03	18	04:10	56.21	18.76	27.61	3.73	116	0.13	10
79	03	18	04:11	03.16	19.22	27.07	9.00	104	0.21	8
79	03	18	04:18	41.53	19.81	23.90	2.03	78	0.14	21
79	03	18	04:19	04.39	18.45	25.62	2.30	85	0.04	13
79	03	18	04:29	18.82	18.48	26.16	4.95	53	0.05	19
79	03	18	04:38	38.26	18.47	27.79	3.05	105	0.07	14
79	03	18	04:52	27.12	18.57	27.99	3.01	111	0.05	11
79	03	18	04:52	31.90	18.50	28.00	2.69	108	0.06	22
79	03	18	05:20	15.66	19.60	24.39	1.75	62	0.09	26
79	03	18	06:07	54.88	20.61	26.75	3.03	79	0.08	17

EVENT DATE			EVENT TIME		MINUTES LATITUDE	MINUTES LONGITUDE	EVENT DEPTH	MAXIMUM AZIMUTHAL	RMS TRAVEL TIME	TOTAL P & S PICKS
YR	MO	DY	HR:MN	SEC	34 N	116 W	(KM)	GAP	RESIDUAL	USED
79	03	18	06:17	15.67	14.31	27.62	2.50	217	0.08	5
79	03	18	06:21	25.34	21.02	26.80	4.59	81	0.10	15
79	03	18	06:43	50.19	15.92	26.56	3.39	38	0.17	69
79	03	18	07:02	05.66	19.94	23.22	1.39	66	0.18	19
79	03	18	07:14	34.65	20.36	26.72	2.30	76	0.13	16
79	03	18	07:27	58.16	21.32	26.99	4.67	74	0.20	31
79	03	18	08:02	27.18	19.65	25.60	5.85	114	0.01	6
79	03	18	08:11	39.05	18.82	28.92	3.23	118	0.07	16
79	03	18	08:12	02.37	18.28	29.38	0.08	129	0.03	6
79	03	18	08:27	20.93	19.63	23.49	2.54	65	0.11	14
79	03	18	08:59	40.68	19.68	24.68	1.22	68	0.14	44
79	03	18	09:02	16.67	19.70	26.22	1.53	71	0.13	24