Geophysics Open-File Report 61
Geoscience Department and
Geophysical Research Center
New Mexico Tech
Socorro, NM 87801
May, 1989

Microearthquake Reflection Phases off a Mid-Crustal Magma Body in the Socorro Area, New Mexico

By

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Submitted in Partial Fulfillment of
the Requirements for the
Masters Degree of Science
Department of Geosciences

New Mexico Institute of Mining and Technology
Socorro, New Mexico
May, 1989

Introduction

The primary purpose of this study was to acquire a special data set of microearthquakes with exceptionally clear reflection phases, and from it determine limits on the geographical extent of the mid-crustal magma body located in the Rio Grande rift near Socorro, New Mexico. The data used to achieve the purpose come from seismograms of 204 locally recorded microearthquakes. Three sharp arrivals, one that follows the direct P-wave and two that follow the direct S-wave were identified. The recognized reflection phases off the mid-crustal magma body were P to P reflections (PzP), S to P reflections (SzP), and S to S reflections (SzS). The observation of these exceptionally strong microearthquake reflections phases continues to support the existence of a mid-crustal magma body in the Socorro area.

Data used to determine the areal extent of the magma body were recorded on the New Mexico Tech Seismic Network. The data used begins November 1, 1981, and continues through to October 31, 1988. Each microearthquake used had a hypocenter which was an integral part of the data set and study. From the new data set, geographical coordinates for reflection points from the magma body were calculated and utilized in determining the lateral extent of the mid-crustal magma body. This study compares new results and interpretations with those previously published. The purpose of this study is to refine our knowledge of the areal extent of the magma body.

Geological and Geophysical Characteristics of the Rio Grande Rift

Figure 1 shows the Rio Grande rift with the major physiographic features of the study area. For in depth geological and geophysical interpretations of the area and specifically the Rio Grande rift, see Chapin (1971), Cordell (1978), *Rio Grande Rift: Tectonics and Magmatism* edited by Riecker (1979), Baldridge et al., (1984), as well as the special section on the Rio Grande rift in the *Journal of Geophysical Research 91,* , B6 (1986). Other works of interest include Cather (1983), Osburn et al. (1983), Rinehart et al. (1979), Reiter et al. (1977), Sanford et al. (1979), Machette et al. (1982), Sanford et al. (1972), Sanford et al. (1962), Sanford et al. (1983), Shuleski (1976), Johnston (1978), Ward (1980), and Sanford et al. (1980). For a recent study of crustal structure in the Rio Grande rift near Socorro, see Singer (1989).

Data

The data used in this study come from seismograms recorded by the New Mexico Tech Seismic Network (figure 2). The microearthquakes selected for the data set have at least one of three distinctly sharp, reflected arrivals off the mid-crustal magma body. The three reflected arrivals are: a P to P reflection (PzP), a S to S reflection (SzS), and a S to P reflection (SzP). Examples of microearthquakes with these reflection phases are given in figure 3. Though included in the data set, the SzP reflections were not used in this study. All microearthquakes have documented hypocentral solutions and a Richter magnitude of 1.3 or less. The microearthquakes have hypocentral locations which qualify them as local events with respect to the New Mexico Tech Seismic Network (hypocentral distance <100 km).

Selection of a data set began with the visual examination of every recorded seismogram from November 1, 1981 through October 31, 1988. Approximately 21,000 seismograms were visually examined for this study. The

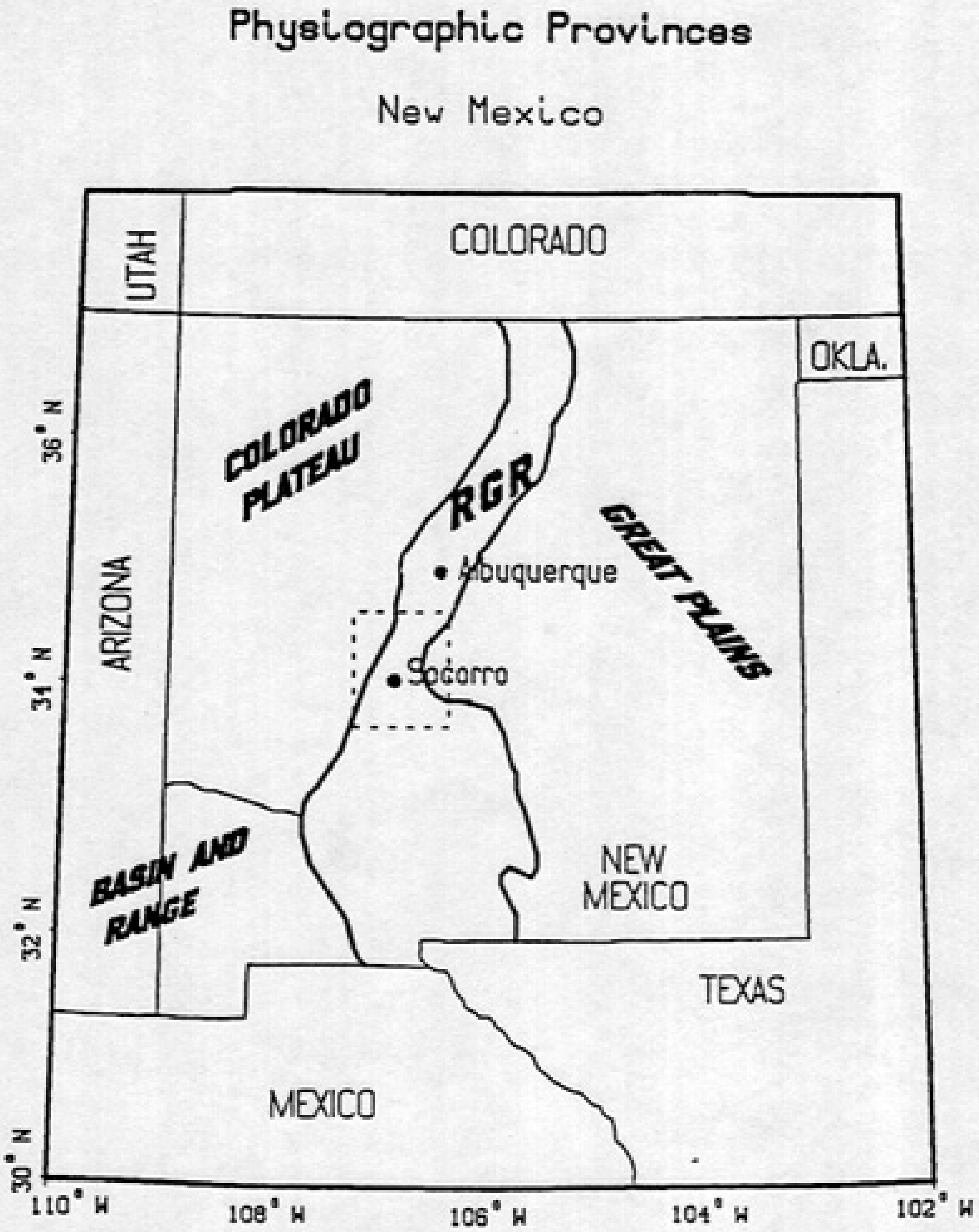


Figure 1. Physiographic provinces in New Mexico (after Singer, 1989). Boundaries of the study area are shown with dashed lines.

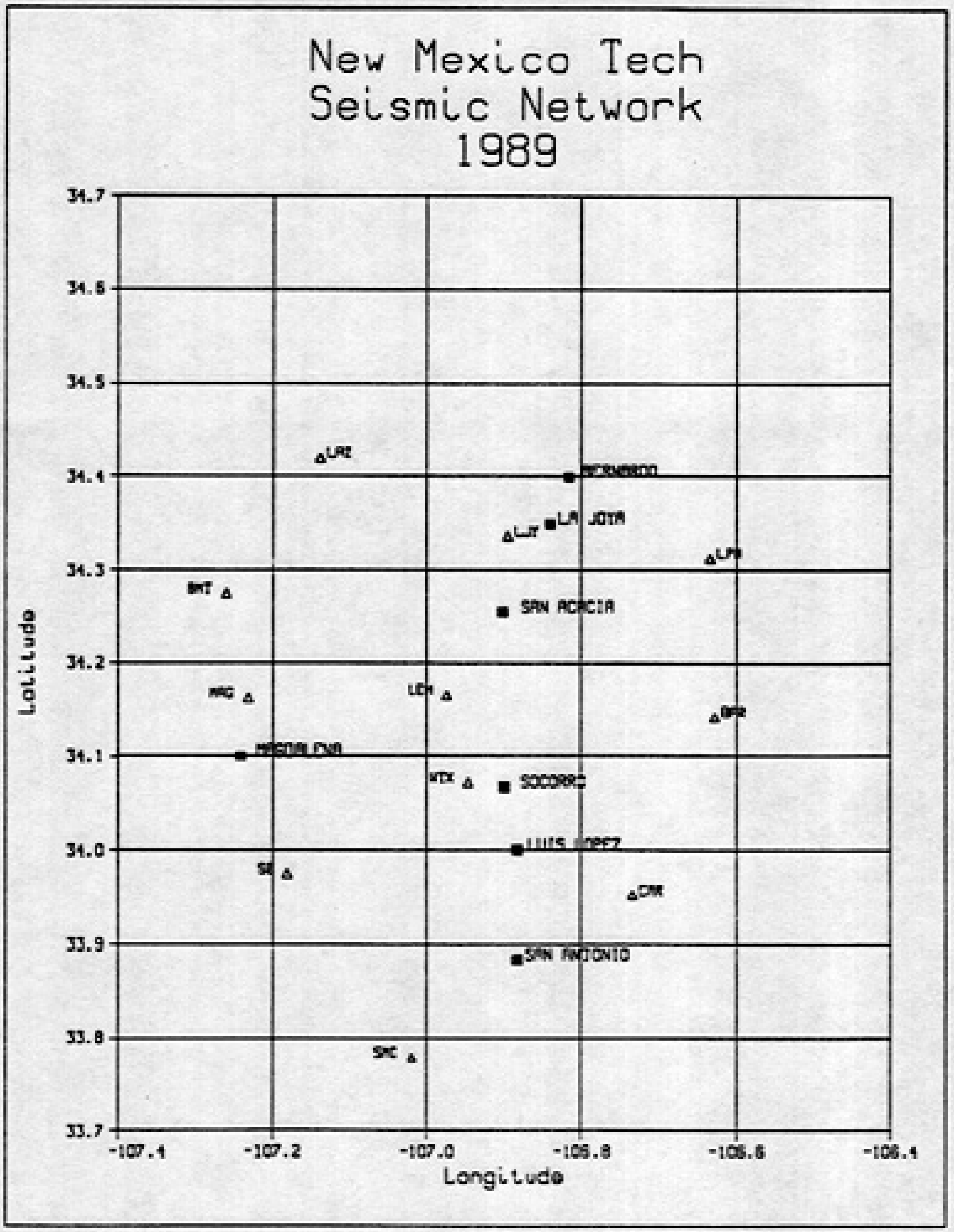


Figure 2. Location of stations in the New Mexico Tech Seismic Network. The stations are designated by open triangles, the towns and villages by solid squares.

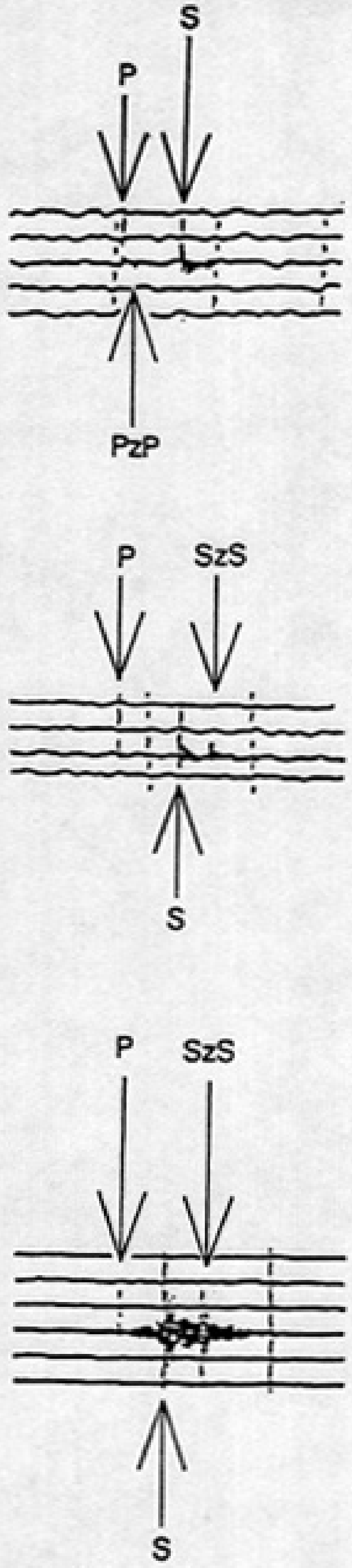


Figure 3. Microearthquakes with reflected phases PzP and SzS.

seismograms were inspected for microearthquakes which had clearly defined reflected arrivals. Each recording station was considered independent of the others. The visual examination was aided by graphed theoretical time curves for the PzP and SzS reflections (figure 4 and Appendix III). The curves were developed for the specific purpose of showing expected reflected phase times at specified distances as indicated by the S-P interval.

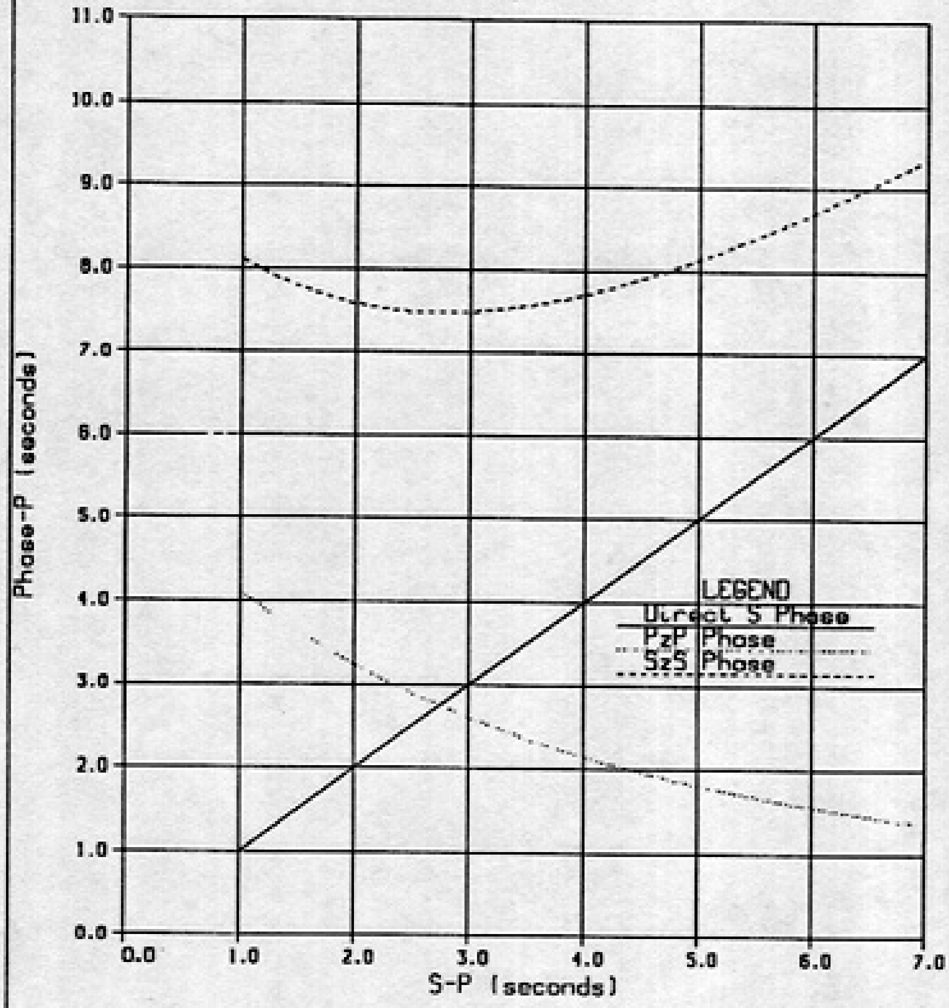
Upon complete examination of a recording station, hypocentral locations were retrieved. Then, a more critical examination of the microearthquake seismograms with their locations was completed by A. R. Sanford and myself. Every microearthquake finally placed into the data set was agreed upon by both parties.

The selection process was applied to the ten recording stations in the New Mexico Tech Seismic Network: SB, MAG, BMT, LAZ, LJY, LPM, LEM, WTX, CAR, and BAR. At least one event from each recording station was included in the data set. The microearthquakes have been photocopied (enlarged 141%) and compiled into a documented data set for convenience in further study (Appendix I). The associated hypocentral solutions have been placed into a user computer file (Appendix II). Univariate statistics have been calculated for all the data and the data by recording stations when appropriate (Appendix IV).

Spacial Distribution of Microearthquakes

Figure 5 is a map showing epicenters for the 204 microearthquakes in the data set. The highest concentration of shocks is west and southwest of Socorro. In addition, areas north of San Acacia and west of recording station LPM have notable concentrations of epicenters.

Figure 4
Plot of Phase-P vs S-P
Hypocentral Depth of 8 km
Reflector Depth of 19.5 km



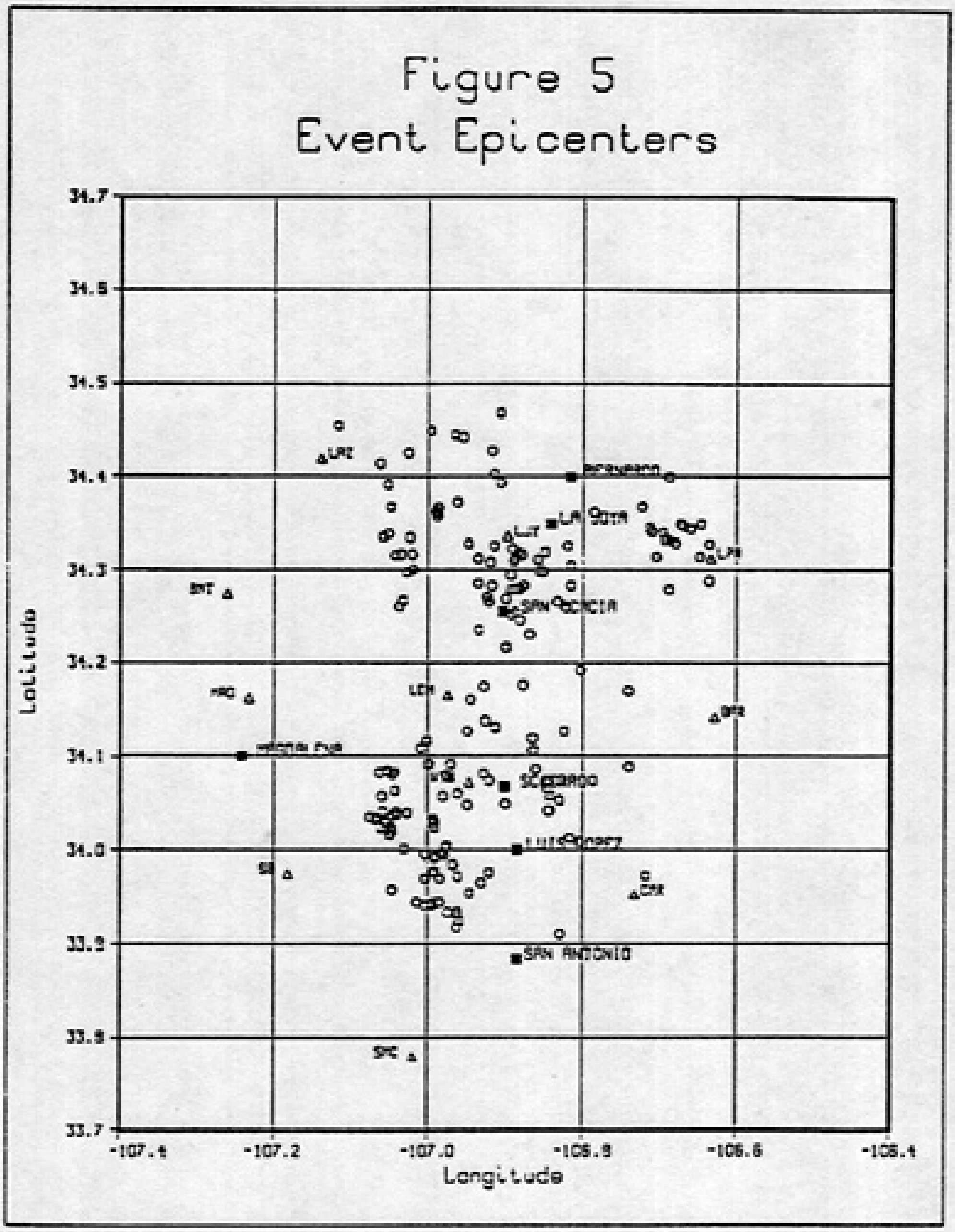
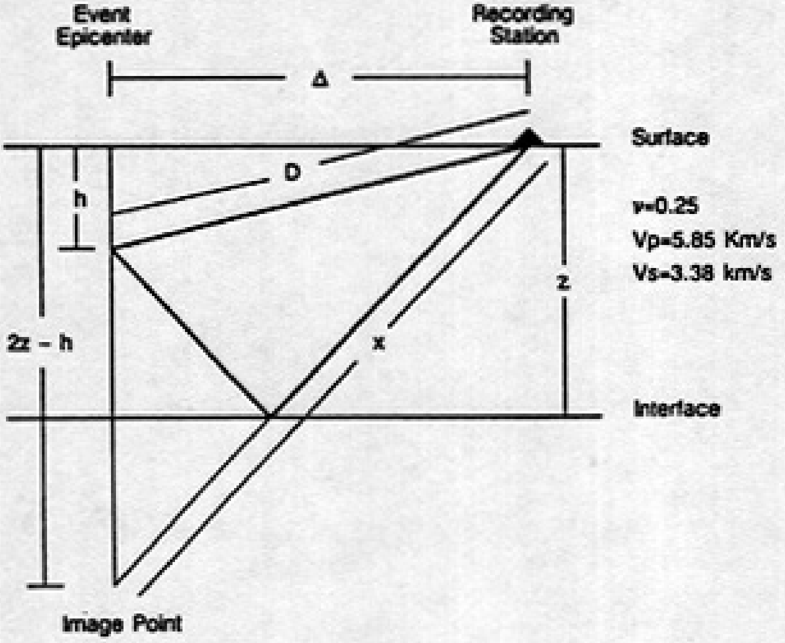


Figure 5. Epicenters for the 204 microearthquakes having exceptionally clear reflection phases.

Theoretical Arrival Times for the Reflection Phases

Assuming a flat-earth model, a Poisson's ratio of 0.25 (Caravella, 1976; and Fender, 1978), and crustal velocities of Vp = 5.85 km/s and Vs = 3.38 km/s, the equations needed for the model calculations can be derived as below. Given the diagram below



where,

h = Hypocentral depth (km).
Z = Interface depth (Km).
Δ = Distance from epicenter to recording station (km).
D = Distance from hypocenter to station (direct phase) (km).
x = Distance of the travel path fo the reflected phase (km).
To = Origin time of the event.
Tp = Transit time of the direct P-phase.
Ts = Transit time of the direct S-phase.
TPzP = Transit time of the reflected P-phase.
TSzS = Transit time of the reflected S-phase.
ν = Poison's ratio (0.25).
Vp = P-wave velocity (5.85 km/s), and
Vs = S-wave velocity (3.38 km/s).

$$T_S - T_P = \frac{D}{1.37\ V_P}\ , \qquad (1)$$

$$x = (\ \Delta^2 + (2z - h)^2\ )^{1/2}\quad \text{, and} \qquad (2)$$

$$D = (\ \Delta^2 + h^2\ )^{1/2}\ . \qquad (3)$$

The transit times for the reflected phases are

$$T_{PzP} = \frac{x}{V_P}\quad \text{, and} \qquad (4)$$

$$T_{SzS} = \frac{x}{V_S}\ . \qquad (5)$$

Substituting equation (2) into equations (4) and (5)

$$T_{PzP} = \frac{(\Delta^2 + (2z - h)^2)^{1/2}}{V_P} \text{, and} \qquad (6)$$

$$T_{SzS} = \frac{(\Delta^2 + (2z - h)^2)^{1/2}}{V_S} . \qquad (7)$$

The time difference between transit times of the refleted phases and the direct P phase are

$$T_{PzP} - T_P = \frac{(\Delta^2 + (2z - h)^2)^{1/2}}{V_P} - \frac{(\Delta^2 + h^2)^{1/2}}{V_P} \text{, and} \qquad (8)$$

$$T_{SzS} - T_P = \frac{(\Delta^2 + (2z - h)^2)^{1/2}}{V_S} - \frac{(\Delta^2 + h^2)^{1/2}}{V_S} . \qquad (9)$$

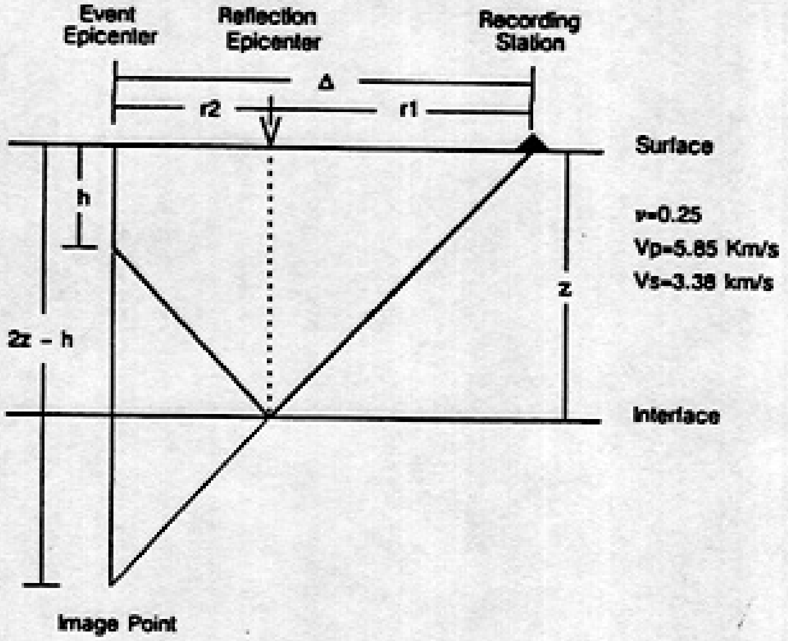
For theoretical calulations, the reflector depth (z) was 19.5 km. Graphs of Tpzp - Tp and Tszs - Tp as a function of Ts - Tp were generated for hypocenter depths beginning at 1 km and continuing to 15 km at 1 km intervals. In addition, the Ts - Tp time was plotted for each graph (figure 4, Appendix III). These graphs were used during the review of the data as controls in determining the existence of the reflected and the direct arrivals given the model conditions.

Determination of the Geographical Position of Reflection Points

The method used in this study to determine the extent of the magma body assumes that the depth to that body is known. Sanford et al. (1977) determined a depth range to the upper surface of the magma body of 18-20 km. Using a two layered model, Rinehart (1979) found the depth to the reflector to be 19.2 +- 0.6 km. For this study, a depth of 19.5 km to the surface of the magma body was assumed.

A constant focal depth was assumed for all earthquakes in the data set. The focal depth adopted was 8.34 km, the mean depth for quality A/A and A/B solutions. Two standard deviations were added to and subtracted from the mean to give a conservative hypocenter depth range of 4.56 to 12.12 km (Table 2). The depth range appears to be geologically and geophysically reasonable and agrees with Rinehart and Sanford (1981).

With an assumed magma body depth of 19.5 km and a hypocentral depth range of 4.56 to 12.12 km a line of possible reflection points for each observed reflection phase can be calculated. Additional information needed for the calculations are: the hypocenter location, the recording station location, the hypocenter distance and the azimuth from the recording station to the hypocenter location. This information comes directly out of the HYPO71 location program. Note that the reflection point is the same for either PzP or SzS. Given the diagram below,



where,

h = Hypocentral depth (km),
Z = Interface depth (km),
Δ = Distance from epicenter to recording station (km),
$r1$ = Distance from recording station to reflection epicenter (km),
$r2$ = Distance from event epicenter to reflection epicenter (km),
ν = Poison's ratio (0.25),
Vp = P-wave velocity (5.85 km/s), and
Vs = S-wave velocity (3.38 km/s).

$$\frac{r2}{(z-h)} = \frac{\Delta}{(2z-h)} \quad \text{, and}$$

therefore,

$$r2 = \frac{\Delta\ (z-h)}{(2z-h)}$$

TABLE 1
STATISTICS FOR ALL DATA

	Depth (km)	Magnitude	Hypocenter Distance (km)
Mean	8.1	-0.1	33.6
Standard Deviation	4.5	0.4	14.3
Skewness	2.2	0.1	-0.2
Kurtosis	14.0	0.4	-0.7
Minimum	0.1	-1.2	1.7
Maximum	41.2	1.1	62.6
Range	41.2	2.3	60.9
Coeficient Variable	0.6	-7.3	0.4
Count	204.0	204.0	204.0

TABLE 2
STATISTICS FOR A/A AND A/B SOLUTIONS

	Depth (km)	Magnitude	Hypoceter Distance (km)
Mean	8.34	-0.16	29.5
Standard Deviation	1.89	0.37	13.6
Skewness	-0.59	-0.43	-0.2
Kurtosis	-0.33	0.52	-1.1
Minimum	3.69	-1.21	7.1
Maximum	11.34	0.58	55.6
Range	7.65	1.79	48.5
Coeficient Variable	0.22	-2.26	0.5
Count	65.00	65.00	65.0

Extent of the Magma Body

Figure 6 is a map showing the spacial distribution of reflection points assuming a constant 19.5 km reflector depth and a constant 8.34 km focal depth. The data are fairly well distributed within the boundaries of the network. Areas of best coverage are (1) the area southwest of La Joya and (2) the area between Socorro and Magdalena. The area between Socorro and Magdalena is important because no one has documented reflection epicenters there before.

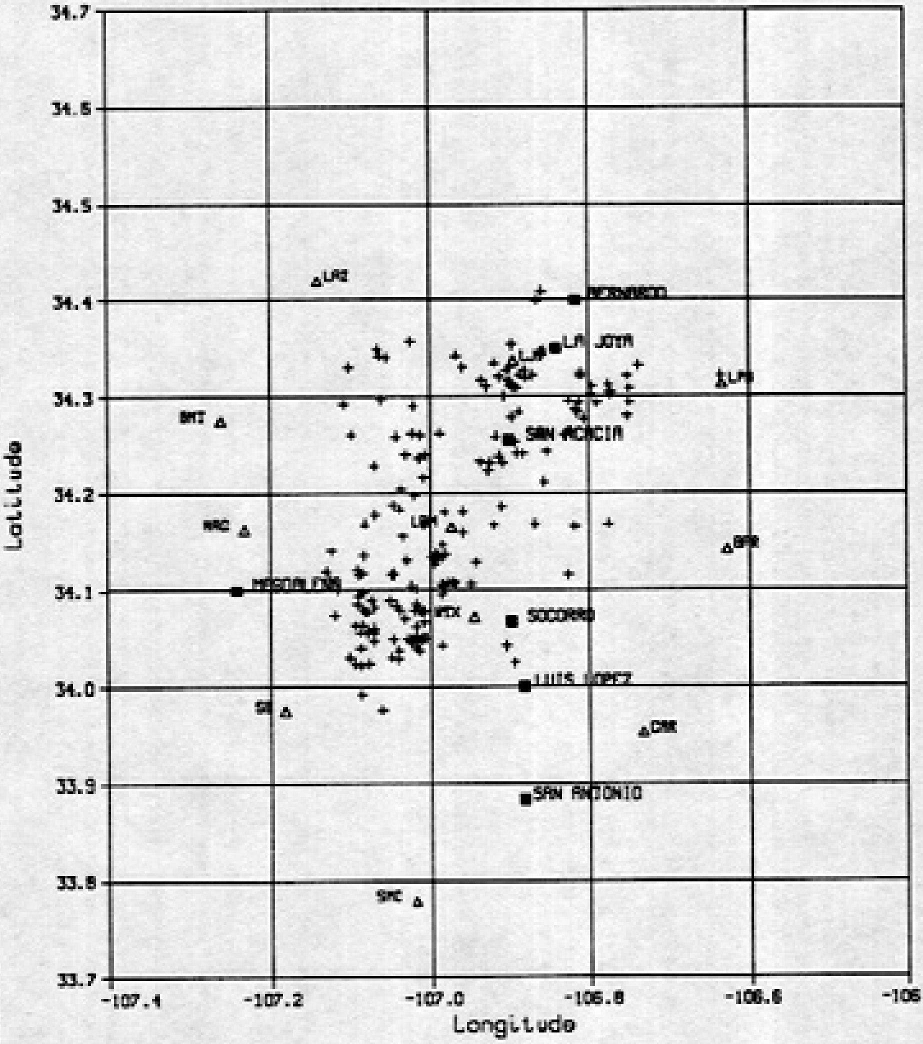
Presented in Figure 7 is an interpretation of the lateral extent of the magma body from the results of this study. The margin of the magma body has been extended significantly west, south and east with respect to the boundaries proposed by Rinehart (1979).

Figure 8a is a map showing the line of possible reflection points for each observed reflection when a two standard deviation uncertainty in focal depth is assumed. On the map, the line of possible reflection points is along the azimuth between the recording station and the event epicenter. Notice that some of the lines are longer than others because it is a function of the hypocentral distance.

In the area north of Bernardo, no data were available in this study. No one has documented a significant amount of reflection data for this area which is probably because of the event and the recording station distributions. The northern boundary of the magma body in figures 7 and 8b is adopted from Rinehart (1979).

The revised boundary for the magma body is more rounded and smoother than those proposed in earlier studies. As in an earlier study, the posistion of the magma body is approximately centered beneath an area of documented uplift (Reilinger et al., 1980, figure 3).

Figure 6
Reflection Epicenters
h=8.34 km z=19.5 Km



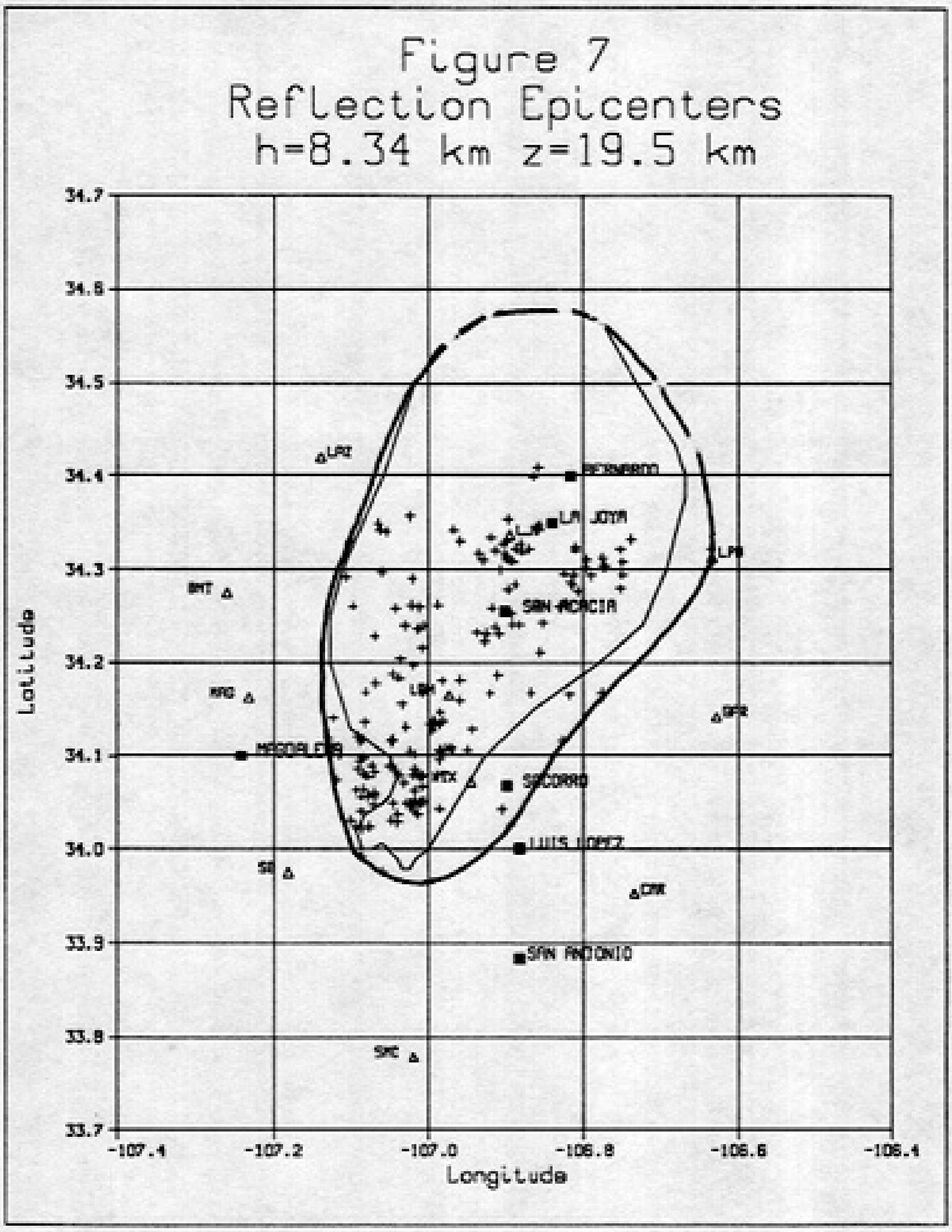


Figure 7. Location of reflection points. The black line is the intrpretation of the extent of the magma body from Rinehart (1981). The red line is the interpretation of the extent of the magma body from reflection data presented in this study.

Figure 8a

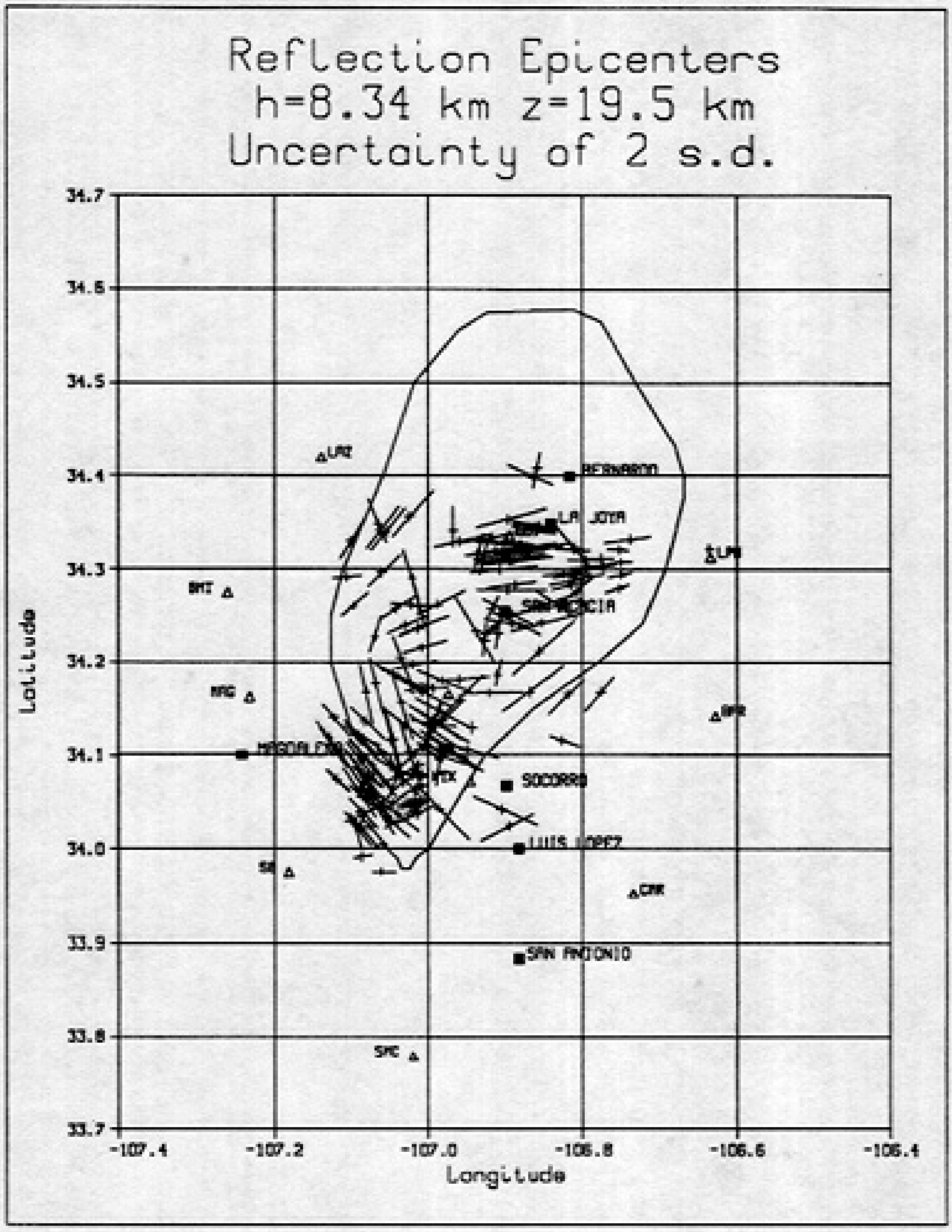
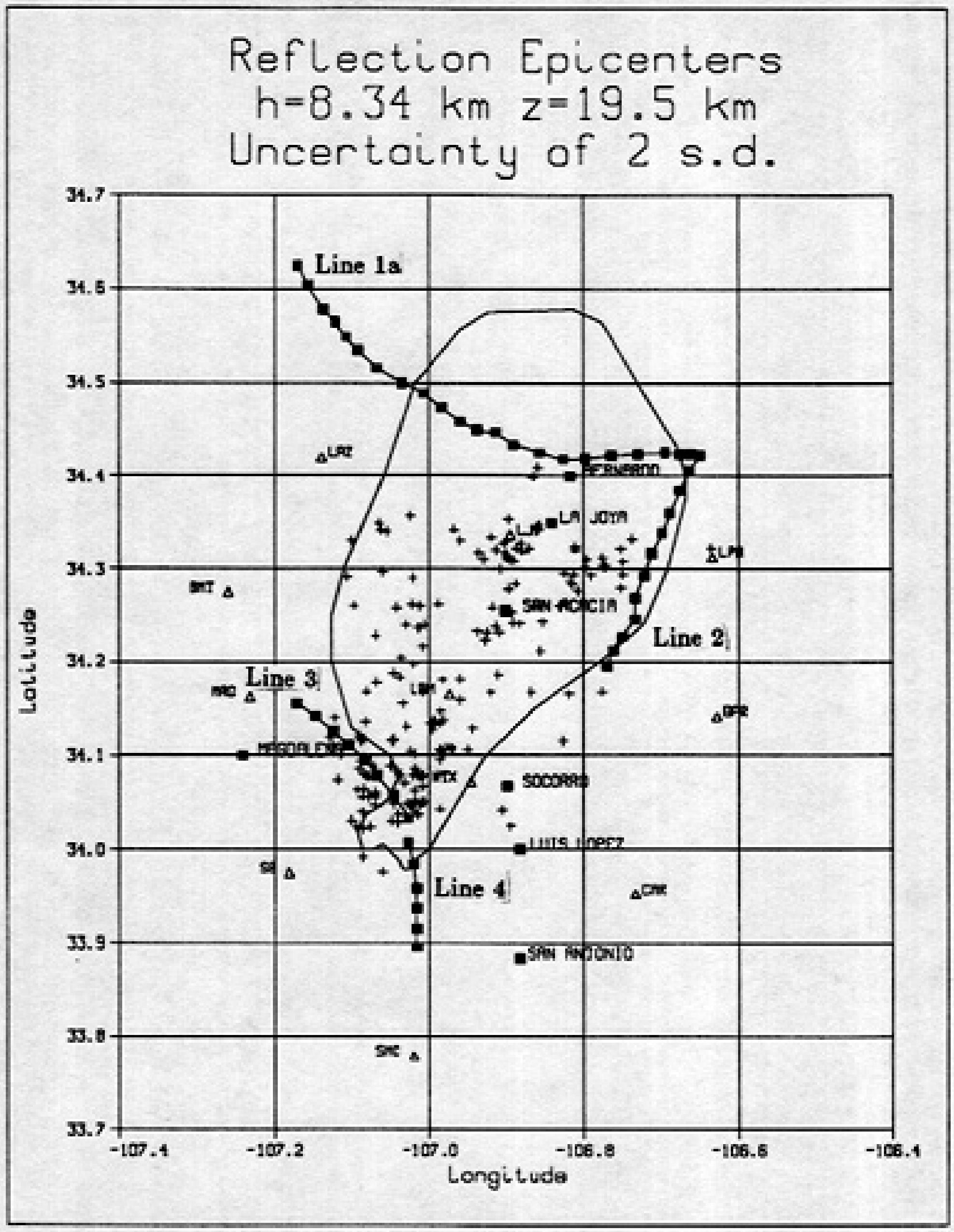

Reflection Epicenters
h=8.34 km z=19.5 km
Uncertainty of 2 s.d.
34.7
34.6
34.5
34.4
34.3
34.2
34.1
34.0
33.9
33.8
33.7
Latitude
-107.4
-107.2
-107.0
-106.8
-106.6
-106.4
Longitude
LAZ
BERNARDO
LA JOYA
LPM
BMT
SAN ACACIA
MAG
BAR
MAGDALENA
WTX
SOCORRO
LUIS LOPEZ
SB
CAR
SAN ANTONIO
SMC

Figure 8b


Reflection Epicenters
h=8.34 km z=19.5 km
Uncertainty of 2 s.d.
Latitude
Longitude
34.7
34.6
34.5
34.4
34.3
34.2
34.1
34.0
33.9
33.8
33.7
-107.4
-107.2
-107.0
-106.8
-106.6
-106.4
Line 1a
Line 2
Line 3
Line 4
LAZ
BERNARDO
LA JOYA
LPM
BKT
SAN ACACIA
MAG
MAGDALENA
WTX
SOCORRO
LUIS LOPEZ
SB
CAR
SAN ANTONIO
SMC

Inspection of the COCORP seismic sections indicates agreement with the interpretation of microearthquake reflection data. Line 1A shows a very strong mid-crustal reflector existing between VP's 15 and 248 (Appendix VI). This coincides in general with the interpreted extent of the magma body by Rinehart (1979). The mid-crustal magma body is a very distinct reflector throughout the entire length of line 2A with the exception of the northeastern most end of the line. On COCORP line 3, a strong reflector is conservatively interpreted to exist between VP's 28 and 138. Line 4 was difficult to interpret.

An additional data set to consider is the distribution of possible reflection points for all microearthquakes in the study area. This determines if the boundary drawn from observed reflection points is the true boundary or simply the lateral extent of all the possible reflection points.

Assuming the reflector and focal depths of 19.5 km and 8.34 km, hypothetical reflection points were calculated and plotted on a map for all located microearthquakes in the area for the years 1986, 87, and 88. Figure 9 shows reflection points to each of the 10 recording stations for every located event during the three year period, approximately 10000 points. Note that the opportunity for reflections beyond the boundary established by the observed reflections was very good except in the north and northeast.

Figure 9

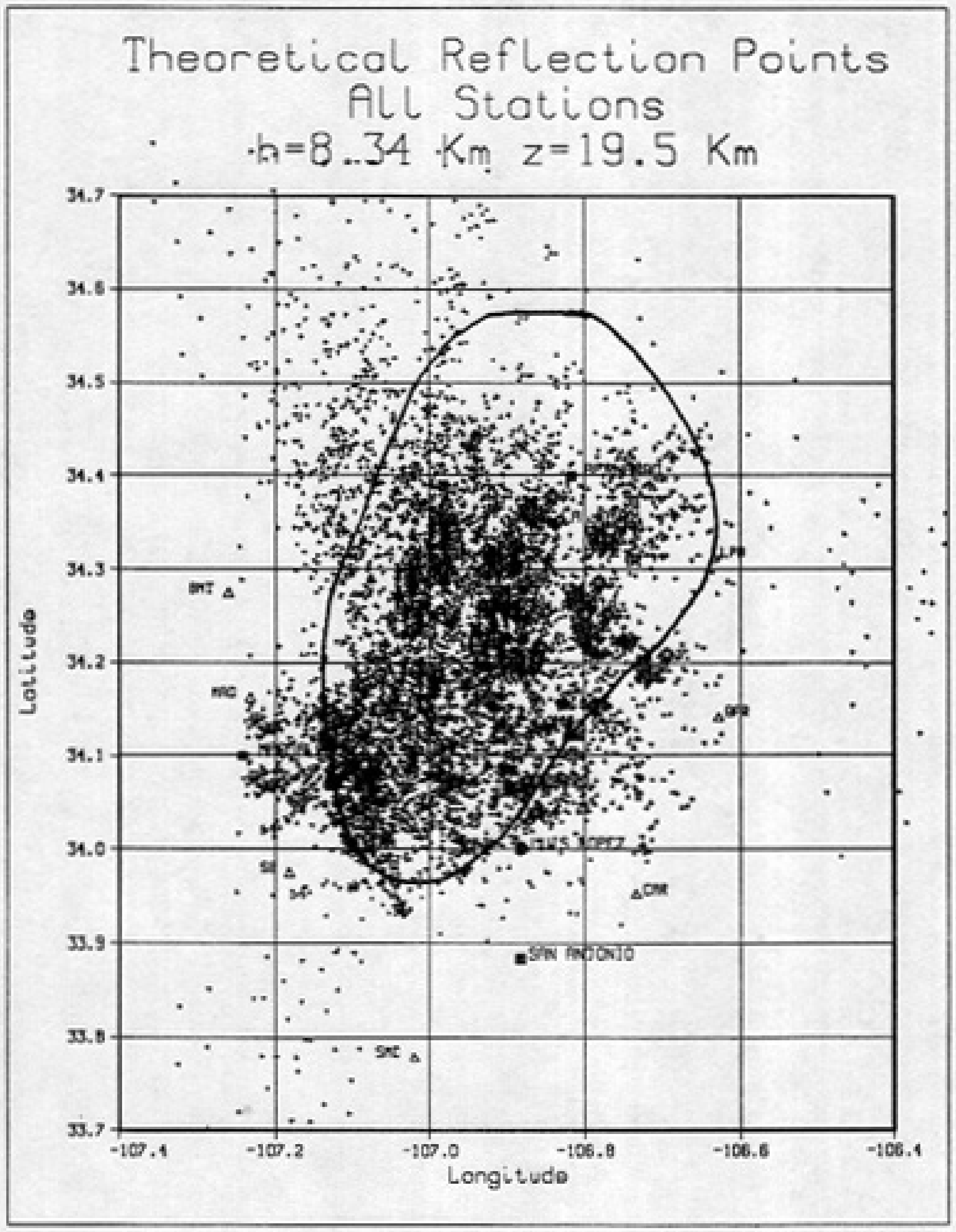


Figure 9. Map of the theoretical reflection points with the boudary of the lateral extent of the magma body presented in this study.

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The data is presented in the following order:

Date, Origin time, Latitude,Longitude

Depth, Magnitude, No. of Readings, Min. Stat. Distance, Gap, M, RMS, ERH, ERZ, Quality, SQD

ADJ, IN, NR, AVR, AAR, NM, AVXM, SDXM, NF, AVFM, SDFM, I

Station, Distance, Azimuth, P arrival, S arrival

```
85 115  031 17.58 34 19.70 106 56.82
 7.04    0.42 14  5 144 1 0.14  0.5  1.0 B A!C
 1.34 10 17 0.00 0.11  0   0.0 ****  5  0.4  0.2 3
BAR 35.9 125 23.70 28.50

85 321  917 51.16 34 25.67 106 54.93
 7.00    0.37 10 21 142 1 0.33  1.7  7.8 C C!C
 7.02 10 11 0.00 0.30  0   0.0 ****  5  0.4  0.2 3
BAR 41.3 140 58.10 63.30

85 324 11 5 47.05 34 17.85 107  1.68
 7.00    0.73 13 13 112 1 0.26  1.0  4.8 B B!B
 0.54 10 14 0.00 0.21  0   0.0 ****  8  0.7  0.2 4
BAR 40.7 115 54.00 59.00

85 329  913  6.01 34 18.95 107  2.63
11.03    0.26 14 13  92 1 0.18  0.7  1.4 B B!B
 0.47 10 15 0.00 0.12  0   0.0 ****  5  0.3  0.3 5
BAR 42.9 117 13.30 18.50

88 125  318 49.43 33 57.47 107  2.82
 7.00   -0.17 19 12 106 1 0.15  0.4  1.5 B A!B
 0.44 10 20 0.00 0.11  0   0.0 ****  9  0.2  0.2 4
BAR 43.8  62 57.00 62.00

82 919 2225 36.19 34  1.77 107  3.30
 4.11    0.26 13 11  86 1 0.26  0.9  3.5 C B!C
 0.38 10 13 0.00 0.20  0   0.0 ****  7  0.3  0.6 4
BMT 33.2 325 41.70 46.10

83 421 1222 59.77 34 20.42 106 41.84
 3.58    0.52 10  7 198 1 0.14  1.4  3.3 C B!D
 0.28 10 10 0.00 0.11  0   0.0 ****  5  0.5  0.4 4
BMT 52.3 262  8.70 15.30

83 421 1222 59.77 34 20.42 106 41.84
 3.58    0.52 10  7 198 1 0.14  1.4  3.3 C B!D
 0.28 10 10 0.00 0.11  0   0.0 ****  5  0.5  0.5 4
BMT 52.3 262  8.70 15.30

83 428  210 21.38 34  6.39 106 51.76
 7.66    0.58 13  9  81 1 0.14  0.5  1.3 B A!B
 3.97 10 16 0.00 0.11  0   0.0 **** 10  0.6  0.1 3
BMT 41.1 297 28.80  0.00

831028 21 0  4.29 33 56.52 106 59.81
 9.12   -0.20 16 15  99 1 0.18  0.6  1.6 B B!B
 2.12 10 20 0.00 0.12  0   0.0 ****  5  0.2  0.3 4
BMT 44.2 327 12.20 17.90

831030 1231 10.28 33 54.62 106 49.75
 0.72   -0.68  8 21 258 1 0.54  4.7 57.6 D D!D
 5.74 10 10 0.00 0.37  0   0.0 ****  2  0.7  0.2 5
BMT 56.7 315 20.90 28.20

87 919 2137 46.21 34 18.04 107  1.19
 0.54   -0.35  8 12 117 1 0.07  0.6 20.2 C C!C
 0.30 10 11 0.06 0.00  0   0.0 ****  7  0.3  0.3 6
BMT 22.3 263 50.25  0.00
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8711 3  211 15.17 33 59.86 106 59.00
 8.06  -0.39 18  9  85 1 0.15  0.5  1.0 B A!B
 0.36 10 20 0.00 0.12  0  0.0 ****  8  0.4  0.6 4
BMT 40.0 320 22.40  0.00

8711 4 1020 47.68 33 59.04 106 57.98
 6.21  -0.17 16 10  93 1 0.09  0.3  1.0 B A!B
 0.81 10 18 0.00 0.07  0  0.0 ****  9  0.2  0.4 4
BMT 42.2 320  0.00 60.60

871113  645 53.44 33 59.71 106 58.95
10.71  -0.47 12  9 132 1 0.11  0.5  1.0 B A!B
 0.40 10 13 0.00 0.09  0  0.0 ****  7  0.5  0.4 4
BMT 40.3 320  7.20 14.16

871113  646 31.87 33 59.49 106 59.45
10.52  -0.57 12 10 135 1 0.11  0.5  1.0 B A!C
 0.50 10 13 0.00 0.10  0  0.0 ****  7  0.6  0.4 3
BMT 40.1 322 39.20  0.00

871124  352  1.65 33 58.58 106 59.62
 7.69  -0.12 16 12  90 1 0.05  0.1  0.4 B A!B
 0.83 10 18 0.00 0.03  0  0.0 ****  9  0.1  0.6 3
BMT 41.3 323  9.00 14.30

871124  422 20.75 33 58.17 106 59.04
 6.73  -0.19 14 12  94 1 0.03  0.1  0.4 B A!B
 0.27 10 18 0.00 0.02  0  0.0 ****  9  0.2  0.4 4
BMT 42.4 323 28.30 33.70

871125  835  5.17 34  1.99 106 59.59
 1.67  -0.51 15 12 139 1 0.15  0.5  6.7 C C!C
 1.67 10 16 0.00 0.10  0  0.0 ****  7  0.5  0.5 4
BMT 36.4 317 11.70 15.80

871127 11 0 24.02 34 20.67 106 39.62
11.21   0.03 16  4 227 1 0.13  0.7  1.0 C A!D
 5.83 10 19 0.00 0.11  0  0.0 ****  8  0.0  0.3 2
BMT 55.8 262 33.70 40.90

871215 1031 22.79 34  4.43 106 49.65
13.82   0.02 11 11 201 1 0.16  1.2  1.7 C B!D
 2.18 10 11 0.00 0.14  0  0.0 ****  3  0.0  0.2 4
BMT 45.7 299 31.30 37.10

871215 1316 33.12 34  3.21 106 49.79
 5.12  -0.20 11 11 139 1 0.09  0.5  1.6 B A!C
 1.88 10 14 0.00 0.06  0  0.0 ****  4  0.2  0.1 4
BMT 46.7 302 41.30 47.00

871215 21 7 45.82 34  2.54 106 50.60
 7.00   0.17 13 10  74 1 0.17  0.6  1.7 B B!B
 4.63 10 15 0.00 0.15  0  0.0 ****  2  0.2  0.1 3
BMT 46.3 304 54.10 59.90

871217 1341 12.57 34  3.52 106 50.53
 7.00  -0.03 15 10  75 1 0.10  0.3  1.0 B A!B
 5.24 10 16 0.00 0.09  0  0.0 ****  4  0.0  0.2 3
BMT 45.4 302 20.60 26.60
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871218  125 44.83 34  8.27 106 55.40
 5.16   0.13 18  6 100 1 0.11  0.3  0.8 B A!B
 1.84 10 18 0.00 0.08  0  0.0 ****  8  0.1  0.2 3
BMT 34.6 296 51.20 55.30

871226 14 2 38.20 33 58.32 106 57.63
 5.77  -0.09 17 11  98 1 0.13  0.4  1.5 B A!B
 1.35 10 18 0.00 0.11  0  0.0 ****  7  0.1  0.2 3
BMT 43.5 321 45.90 51.50

871226 1433  3.22 34 19.87 106 41.26
 9.18   0.18 15  5 192 1 0.12  0.6  1.0 C A!D
 1.19 10 15 0.00 0.09  0  0.0 ****  5  0.2  0.4 3
BMT 53.1 263 12.80 19.60

88 117 2127 58.88 33 55.84 106 57.69
 7.00  -0.12 13 16 127 1 0.10  0.3  1.4 B A!C
 1.65 10 16 0.00 0.07  0  0.0 ****  3  0.1  0.3 3
BMT 47.1 324 67.20 73.00

88 117 2144 59.62 33 56.02 106 58.41
 7.00  -0.08 12 16 131 1 0.13  0.5  2.0 B A!C
 0.36 10 15 0.00 0.10  0  0.0 ****  4  0.1  0.1 4
BMT 46.2 325  7.80 13.70

88 126  331  1.66 34 20.73 106 42.90
 9.26  -0.17 11  8 197 1 0.12  0.9  1.2 C A!D
 1.96 10 12 0.00 0.10  0  0.0 ****  4  0.2  0.3 4
BMT 50.8 261 10.60 17.10

88 127 1359 25.92 34  3.80 107  2.61
 8.04  -0.27 19  9  87 1 0.13  0.4  0.9 B A!B
 0.44 10 20 0.00 0.11  0  0.0 **** 10  0.3  0.3 4
BMT 30.8 320 31.60 35.50

88 2 4 2354 26.27 34  2.96 106 53.84
10.14  -0.64 11  5 121 1 0.12  0.6  0.9 B A!B
 1.38 10 11 0.00 0.10  0  0.0 ****  6  0.6  0.3 3
BMT 41.8 307 33.60 39.30

88 2 7  211 19.11 34  1.00 107  2.93
 8.18  -0.02 18 11  76 1 0.13  0.4  0.9 B A!B
 1.18 10 18 0.00 0.11  0  0.0 ****  9  0.0  0.2 4
BMT 34.7 326 25.40 29.90

88 210 14 4  0.11 33 56.05 106 57.73
 7.00  -0.54 12 15 127 1 0.23  0.9  3.0 C B!C
 1.36 10 12 0.00 0.22  0  0.0 ****  6  0.5  0.4 3
BMT 46.7 324  8.10 14.10

88 213  910 13.89 34  3.43 106 58.80
 9.28  -0.72 13  4 127 1 0.12  0.5  0.7 B A!B
 0.67 10 16 0.00 0.09  0  0.0 ****  4  0.7  0.2 3
BMT 35.4 313 20.50 25.00

88 3 6  419 16.68 34  1.49 106 59.46
11.30  -0.27 13  7  77 1 0.15  0.6  1.0 A A!A
 1.83 10 12 0.00 0.22  0  0.0 ****  6  0.3  0.4 3
BMT 37.2 318 23.50 28.10
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88 3 6  419 16.68 34  1.49 106 59.46
11.30  -0.27 13  7  77 1 0.15  0.6  1.0 A A!A
 1.83 10 14 0.00 0.12  0  0.0 ****  6  0.3  0.4 3
BMT 37.2 318 23.50 28.10

88 330 1454  2.00 34 23.98 106 41.37
10.95   0.43 10 11 194 1 0.13  1.1  2.0 C B!D
 4.86 10 15 0.00 0.08  0  0.0 ****  7  0.4  0.4 3
BMT 54.3 255 11.60  0.00

88 330 1454 14.54 34 23.98 106 41.37
10.95   0.43 10 11 194 1 0.13  1.1  2.0 C B!D
 4.86 10 15 0.00 0.08  0  0.0 ****  7  0.4  0.4 3
BMT 54.3 255 11.60  0.00

88 4 4  954  1.09 34 15.74 107 55.66
 7.00  -0.25  7 61 315 1 0.13  3.3 20.2 D C!D
 1.59 10  8 0.00 0.09  0  0.0 ****  4  0.3  0.5 4
BMT 61.5  89 11.80 19.50

88 4 5 1651 43.55 34 20.10 106 41.67
 2.79   0.41 11  6 193 1 0.10  1.2  4.0 C B!D
 0.27 10 11 0.00 0.09  0  0.0 ****  7  0.4  0.3 4
BMT 52.5 263 52.70  0.00

88 416 2123 54.41 34  0.78 106 49.01
 7.00   0.06 16 10  84 1 0.11  0.4  0.9 B A!B
 2.67 10 16 0.00 0.09  0  0.0 ****  8  0.1  0.3 3
BMT 50.2 305 63.20 69.60

88 419 2314 52.18 34  0.51 106 48.29
 3.77   0.00 16  9  86 1 0.20  0.6  2.6 B B!B
 3.23 10 16 0.00 0.17  0  0.0 ****  6  0.0  0.3 4
BMT 51.1 305 61.00 67.30

88 419 2314 52.18 34  0.51 106 48.29
 3.77   0.00 16  9  86 1 0.20  0.6  2.6 B B!B
 3.23 10 16 0.00 0.17  0  0.0 ****  6  0.0  0.3 4
BMT 51.4 305 61.00 67.30

88 421 1436  9.71 33 56.66 106 59.02
10.97   0.09 16 15 134 1 0.16  0.6  1.3 B B!B
 0.39 10 16 0.00 0.13  0  0.0 ****  8  0.1  0.3 4
BMT 44.7 325 17.50 23.30

88 428 1613 17.98 33 58.55 106 55.10
 7.00   0.47 15 11 104 1 0.10  0.4  1.5 B A!B
 0.23 10 15 0.00 0.08  0  0.0 ****  7  0.5  0.3 4
BMT 45.8 316 26.00 31.80

88 5 3 2134  3.65 34  7.60 106 49.45
10.69   0.13 12 13  84 1 0.13  0.6  1.4 B A!B
 0.31 10 12 0.00 0.11  0  0.0 ****  6  0.1  0.2 4
BMT 43.4 292 11.50 16.60

88 622  011 34.81 34 18.87 106 42.37
 7.00  -0.30  9  7 168 1 0.13  1.3  2.8 C B!C
 1.37 10 10 0.00 0.10  0  0.0 ****  6  0.3  0.3 3
BMT 51.2 265 43.70 50.50
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88 622  052  5.27 34 19.89 106 41.67
 7.82   0.36 13  6 189 1 0.15  1.0  1.7 C B!D
 1.72 10 14 0.00 0.11  0  0.0 ****  8  0.4  0.4 3
BMT 52.4 263 14.50 21.00

88 622  056 13.49 34 20.96 106 38.84
13.49  -0.21 10  4 245 1 0.11  1.1  1.4 C B!D
 1.74 10 10 0.00 0.08  0  0.0 ****  6  0.2  0.3 4
BMT 57.0 262 23.70 31.00

88 625  550  0.70 34  0.10 107  1.87
 7.00  -0.09 14 11  81 1 0.28  1.0  4.1 B B!B
11.11 10 17 0.00 0.23  0  0.0 ****  6  0.1  0.2 2
BMT 37.0 325  8.30 12.30

88 7 9  725 43.59 34 19.73 106 40.83
 8.18  -0.17  9  5 151 1 0.10  1.0  1.6 B A!C
 1.11 10 10 0.00 0.07  0  0.0 ****  5  0.2  0.4 3
BMT 53.7 264 53.00  0.00

88 722  810 59.91 34 16.77 106 41.38
 7.66   0.30 11  6 105 1 0.15  1.0  2.6 B B!B
 2.26 10 14 0.00 0.12  0  0.0 ****  5  0.3  0.5 3
BMT 52.5 269  9.30 16.10

88 8 1 2321 46.18 34 20.98 106 40.46
10.81   0.72 14  6 178 1 0.11  0.6  1.1 B A!C
 0.94 10 17 0.00 0.09  0  0.0 ****  8  0.7  0.3 3
BMT 54.6 261 56.00 62.70

88 8 4  5 9 45.93 34 15.28 106 53.18
12.80   0.08 12 21 129 1 0.13  0.7  2.2 B B!B
 1.94 10 15 0.00 0.10  0  0.0 ****  6  0.1  0.3 4
BMT 34.5 274 52.20 57.20

88 8 8 1427  7.32 34 21.74 106 47.20
11.16   0.40  9 15 194 1 0.15  1.2  3.2 C B!D
 0.29 10  9 0.00 0.13  0  0.0 ****  5  0.4  0.3 5
BMT 44.7 257 15.40 21.50

88 818 1611 50.49 33 55.05 106 57.70
 8.38   0.06 15 16 120 1 0.17  0.6  1.7 B B!B
 1.38 10 17 0.00 0.15  0  0.0 ****  8  0.1  0.4 4
BMT 48.3 325 59.10 65.00

88 828 2227 37.28 34 22.10 106 43.50
19.79   0.31  9 10 211 1 0.11  1.2  1.2 C B!D
 3.57 10 14 0.00 0.10  0  0.0 ****  7  0.3  0.3 4
BMT 50.3 258 46.70 53.50

88 828 2227 37.28 34 22.10 106 43.50
19.79   0.31  9 10 211 1 0.11  1.2  1.2 C B!D
 3.57 10 14 0.00 0.10  0  0.0 ****  7  0.3  0.3 4
BMT 50.3 258 46.70 55.50

88 930 1428 26.87 34  7.87 106 54.65
10.03   0.19 17  7  61 1 0.09  0.3  0.6 A A!A
 1.91 10 20 0.00 0.07  0  0.0 **** 10  0.2  0.2 3
BMT 35.9 269 33.40 38.30
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88 930 1428 26.87 34  7.87 106 54.65
10.03   0.19 17  7  61 1 0.09  0.3  0.6 A A!A
 1.91 10 20 0.00 0.07  0  0.0 **** 10  0.2  0.2 3
BMT 35.9 296 33.40 38.30

871227 2212 55.61 34 23.55 107  3.19
 5.20   0.57 14  8 185 1 0.12  0.7  1.9 C A!D
 4.31 10 14 0.00 0.09  0  0.0 ****  9  0.6  0.3 3
CAR 57.0 149 65.30 72.70

84 9 2 2157 39.52 33 56.64 106 59.58
 9.72   0.05 11 15 131 1 0.15  0.6  1.3 B B!B
 0.39 10 12 0.00 0.12  0  0.0 ****  7  0.2  0.2 4
LAZ 52.6 345 48.80 55.50

84 910  630  3.37 33 56.50 106 59.65
11.34  -0.45 16 15 100 1 0.14  0.5  1.0 B A!B
 0.30 10 17 0.00 0.11  0  0.0 ****  9  0.4  0.4 4
LAZ 52.8 345 12.80 19.40

85 7 8  434 18.89 34  4.82 106 58.58
 0.94   0.25 15  3  64 1 0.33  1.0  5.6 B C!A
 1.96 10 17 0.00 0.27  0  0.0 ****  8  0.3  0.3 3
LAZ 38.7 337 25.30 29.60

85 822  457 48.63 33 56.49 106 59.75
 9.72  -0.07 16 15 100 1 0.15  0.5  1.4 B A!B
 2.85 10 18 0.00 0.12  0  0.0 ****  6  0.1  0.2 3
LAZ 52.8 345 57.50 64.50

8611 6 1857 59.84 34  0.25 106 58.48
10.76   0.41 18  8  85 1 0.14  0.4  0.8 A A!A
 0.22 10 18 0.00 0.10  0  0.0 ****  8  0.4  0.2 5
LAZ 46.7 341  7.90 13.80

88 427 21 5 48.78 34  1.48 107  2.90
10.17  -0.60 16 11  79 1 0.15  0.5  1.0 B A!B
 3.40 10 19 0.00 0.11  0  0.0 ****  8  0.6  0.4 3
LAZ 42.7 349 61.00 64.00

88 516 1521  6.97 34  2.36 107  1.65
11.66   0.18 18 15 106 1 0.21  0.8  1.3 B B!B
 0.58 10 16 0.00 0.16  0  0.0 ****  8  0.2  0.2 2
LAZ 41.5 346 14.50 19.80

88 918 1624  3.90 33 55.44 106 57.55
 8.62   0.58 18 16 118 1 0.13  0.4  1.1 B A!B
 0.21 10 20 0.00 0.11  0  0.0 ****  9  0.6  0.4 4
LAZ 55.6 343 13.70 20.50

85 713 2226 44.40 34  2.43 107  2.56
 7.00  -0.15  6 10 131 1 0.14  1.5  5.1 C C!B
 3.31 10  7 0.00 0.12  0  0.0 ****  3  0.1  0.4 3
LEM 11.2  34 46.90  0.00

85 719  014 25.47 34 16.78 106 52.80
 0.42  -0.31  7  6 126 1 0.28  1.2 27.5 C C!B
 0.31 10  7 0.00 0.23  0  0.0 ****  4  0.3  0.2 6
LEM 19.4 207 28.60 31.10
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85 730  840  8.08 34 16.16 106 53.85
 1.67  -0.33  8  7  84 1 0.17  0.9  8.7 C C!B
 5.46 10  9 0.00 0.14  0  0.0 ****  5  0.3  0.2 3
LEM 17.6 204 11.00 13.20

8510 2  917 11.36 34  1.82 106 59.71
 7.66  -0.08 14  6 141 1 0.12  0.5  0.9 B A!C
 2.51 10 16 0.00 0.10  0  0.0 ****  6  0.1  0.3 3
LEM 15.1   7 14.20 16.10

86 212  045 34.41 34 20.50 106 42.75
 9.39  -0.01  9  8 194 1 0.12  0.9  1.3 C A!D
 2.51 10 10 0.00 0.09  0  0.0 ****  4  0.0  0.3 3
LEM 31.0 231 40.10 43.80

86 917  646 15.14 34 23.64 106 54.24
 7.00   0.14  9 22 198 1 0.25  1.6  5.9 D C!D
 1.07 10  9 0.00 0.19  0  0.0 ****  5  0.1  0.2 4
LEM 26.2 194 19.40 23.40

86 917  653 51.31 34 24.22 106 54.78
13.63   0.05 10 21 202 1 0.27  1.7  3.8 C B!D
 0.59 10 11 0.00 0.22  0  0.0 ****  5  0.1  0.1 4
LEM 27.0 192 56.20 60.50

86 919  641 35.91 34 26.69 106 57.88
10.91   0.23  9 14 222 1 0.08  0.6  1.6 C A!D
 0.43 10 11 0.00 0.07  0  0.0 ****  4  0.2  0.1 5
LEM 30.8 183 50.00 53.70

8712 2  848  9.61 34 27.30 107  7.05
 4.68  -0.04 10  6 143 1 0.14  0.8  1.6 B A!C
 2.32 10 11 0.00 0.12  0  0.0 ****  5  0.0  0.4 3
LEM 34.7 158 15.70 20.10

8712 4  538  2.39 34  5.33 106 44.51
 7.00   0.30  7 12 117 1 0.07  0.5  2.1 B B!B
 2.68 10  7 0.00 0.06  0  0.0 ****  5  0.3  0.3 3
LEM 23.1 292  6.60  9.60

88 121 1519 26.79 34 18.79 106 53.18
 7.00  -0.47 15  3 109 1 0.14  0.5  0.8 B A!B
 2.96 10 16 0.00 0.11  0  0.0 ****  5  0.5  0.2 2
LEM 18.3 206 30.10 32.40

85 825 1244  3.75 34  4.60 106 58.26
 7.88  -0.99  5  2 236 1 0.01  0.2  0.1 C A!D
 0.44 10  6 0.00 0.01  0  0.0 ****  2  0.1  0.5 4
LEM  9.9 358  5.90  7.50

88 128 1749 54.71 34  1.30 107  2.84
 8.90   0.98 18 11  78 1 0.15  0.5  1.1 B B!B
 1.98 10 20 0.00 0.13  0  0.0 ****  9  1.0  0.3 3
LJY 37.6  22  1.70  7.30

88 130  833  9.08 34  1.00 107  3.07
 8.47  -0.05 17 12 103 1 0.14  0.5  1.0 B A!B
 1.51 10 18 0.00 0.10  0  0.0 ****  7  0.1  0.3 4
LJY 38.3  22 16.20 21.90
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83 212 14 7 23.90 34 17.00 106 48.97
 7.00  -0.24  9 17 145 1 0.08  0.3  1.7 B A!C
 0.06 10 10 0.00 0.06  0  0.0 ****  5  0.2  0.2 4
LPM 17.1  79 26.80 28.90

83 331 1354 20.32 34 19.55 106 54.74
 7.00  -0.41  6 26 295 1 0.15  2.8 10.6 D C!D
 4.70 10  6 0.00 0.13  0  0.0 ****  3  0.4  0.1 4
LPM 25.7  93 24.70 27.80

83 522 1534  1.64 34 18.68 106 51.41
 4.07  -0.24 14 18 158 1 0.22  0.7  5.1 C C!C
 0.44 10 16 0.00 0.16  0  0.0 ****  8  0.2  0.2 4
LPM 20.5  90  4.90  7.40

83 6 5  846 26.48 34 17.17 106 56.02
 7.00  -0.45  8 23 140 1 0.45  2.2 13.4 C C!C
15.05 10 12 0.00 0.32  0  0.0 ****  2  0.5  0.4 3
LPM 27.8  84 30.90 35.20

84 516  351 22.95 34 19.56 106 49.22
 7.00  -0.38  6 17 169 1 0.14  1.6  8.6 C C!C
 5.97 10  8 0.00 0.14  0  0.0 ****  3  0.4  0.1 3
LPM 17.2  95 25.90  0.00

84 527 1926 58.84 34 20.16 107  3.55
 7.00   0.13 10 10 139 1 0.14  0.7  3.1 C B!C
 2.89 10 11 0.00 0.12  0  0.0 ****  6  0.1  0.3 3
LPM 39.2  94 65.55 70.20

84 615  127 26.72 34 20.38 107  3.14
 5.21  -0.52  9 11 168 1 0.07  0.4  1.7 B A!C
 1.82 10 14 0.00 0.04  0  0.0 ****  7  0.5  0.7 4
LPM 38.6  94 35.00 41.50

84 9 8  145 10.34 34 15.61 106 49.28
 7.00  -0.27  6 18 133 1 0.22  1.8  9.2 C C!C
10.24 10  8 0.00 0.21  0  0.0 ****  1  0.3  0.0 3
LPM 18.2  71 13.20 15.80

85 720  523 27.13 34 15.65 107  2.30
 3.09  -0.29  8 16 171 1 0.18  1.4  9.1 C C!C
 3.91 10 10 0.00 0.12  0  0.0 ****  3  0.3  0.2 4
LPM 37.7  95 33.30  0.00

85 720  529 17.96 34 16.05 107  2.03
 2.79  -0.04 11 15 166 1 0.24  1.1  9.8 C C!C
 4.21 10 13 0.00 0.19  0  0.0 ****  5  0.0  0.2 4
LPM 37.2  82 24.00 28.20

851014  421 28.37 34  4.88 106 55.54
 2.97   0.20 10  2 112 1 0.18  0.8  1.8 B B!B
 0.83 10 12 0.00 0.15  0  0.0 ****  4  0.2  0.2 3
LPM 37.2  46 34.30 38.70

851018  616  5.63 34 17.94 106 51.38
 5.78  -0.17 10  6 127 1 0.12  0.6  1.6 B A!B
 1.46 10 12 0.00 0.09  0  0.0 ****  6  0.2  0.2 3
LPM 20.5  86  9.00  0.00
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8511 3  240 23.95 34  5.17 106 51.55
 7.81   0.30 10  8 116 1 0.05  0.2  0.7 B A!B
 0.83 10 13 0.00 0.04  0  0.0 ****  5  0.3  0.1 4
LPM 32.6  40 29.40 33.20

86 310  458 30.66 34 16.28 106 55.31
 8.08  -0.10 11  8  72 1 0.09  0.4  1.0 A A!A
 0.24 10 12 0.00 0.08  0  0.0 ****  6  0.1  0.1 4
LPM 26.9  80 35.10 38.50

86 411 1229 24.85 34 16.88 106 52.83
 7.00  -0.11 11  6  94 1 0.10  0.4  1.2 B A!B
 0.38 10 11 0.00 0.06  0  0.0 ****  6  0.1  0.3 3
LPM 23.0  81 28.60 31.50

86 620 1743 34.27 34 14.14 106 55.94
 1.27  -0.13  8  9 108 1 0.08  0.5  7.1 C C!B
 1.27 10  8 0.00 0.06  0  0.0 ****  2  0.1  0.1 6
LPM 28.8  73 39.00 42.50

86 8 7  3 1 50.86 34 17.72 106 53.50
 0.32   0.12  9  5  90 1 0.09  0.4 10.9 C C!B
 0.04 10 10 0.00 0.06  0  0.0 ****  5  0.1  0.2 4
LPM 23.8  85 54.70 57.50

86 820 10 3 57.51 34 17.92 106 51.09
 4.60   0.06 11  6 130 1 0.10  0.5  1.6 B A!B
 2.40 10 11 0.00 0.08  0  0.0 ****  6  0.1  0.3 3
LPM 20.1  86  0.80  0.00

86 831 2051 29.83 34 26.96 106 59.82
 1.00  -0.40 10 14 226 1 1.02  6.7119.4 D D!D
 5.07 10 10 0.00 0.74  0  0.0 ****  6  0.4  0.5 4
LPM 36.7 114 35.90 40.50

86 921 1216 32.97 34 18.31 106 48.95
 5.88   0.08  9  8 152 1 0.06  0.3  1.4 B A!C
 0.90 10 11 0.00 0.04  0  0.0 ****  5  0.1  0.3 5
LPM 16.8  87 35.80 38.60

87 116 1820 59.78 34 15.94 106 55.17
 1.63  -0.62  8  8  87 1 0.05  0.3  3.7 B B!B
 1.59 10  9 0.00 0.05  0  0.0 ****  6  0.6  0.6 5
LPM 28.6  79  4.20  8.60

87 2 7 2133 41.51 34 20.11 107  1.46
 4.34   0.20 11 12 144 1 0.11  0.4  2.3 C B!C
 2.66 10 13 0.00 0.08  0  0.0 ****  5  0.2  0.2 4
LPM 36.0  94 47.50 51.90

87 5 9 1759 32.22 34 17.02 106 54.95
 0.57  -0.47 10  6  82 1 0.05  0.2  3.5 B B!B
 0.57 10 10 0.00 0.05  0  0.0 ****  5  0.5  0.2 4
LPM 26.2  83 36.50 39.50

88 520  948 21.56 34 21.71 106 59.28
 4.99  -0.36  8  9 172 1 0.14  1.3  3.0 C B!C
 2.01 10 10 0.00 0.12  0  0.0 ****  6  0.4  0.4 4
LPM 33.1  99 27.10 31.50
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88 6 7 23 5 26.01 34 22.06 106 59.19
 6.22  -0.19 11  9 175 1 0.17  1.2  1.9 C B!C
 4.78 10 12 0.00 0.16  0  0.0 ****  5  0.2  0.1 3
LPM 33.0 101 31.70 35.60

88 6 7 2350 26.01 34 22.06 106 59.19
 6.22  -0.19 11  9 175 1 0.17  1.2  1.9 C B!C
 4.78 10 12 0.00 0.16  0  0.0 ****  5  0.2  0.1 3
LPM 33.0 101 31.70 35.60

88 629  335 50.61 34 21.81 106 59.39
 6.67   0.83 14  9 172 1 0.23  1.0  3.0 C B!C
 0.52 10 20 0.00 0.19  0  0.0 ****  7  0.8  0.3 4
LPM 33.3 100 56.50 60.50

88 629 1612 18.55 34 21.50 106 59.27
 0.80   0.15 11  9 170 1 0.15  1.1  9.8 C C!C
 0.92 10 12 0.00 0.12  0  0.0 ****  6  0.2  0.1 5
LPM 33.0  99 24.00 28.00

83 224  428 49.22 34 19.66 106 38.13
 7.00  -0.85  5  2 342 1 0.35  0.8  0.3 D C!D
 1.46 10  6 0.00 0.30  0  0.0 ****  3  0.9  0.2 2
LPM  1.7 174 50.00 51.60

83 224  428 49.22 34 19.66 106 38.13
 7.00  -0.85  5  2 342 1 0.35  0.8  0.3 D C!D
 1.46 10  6 0.00 0.30  0  0.0 ****  3  0.9  0.2 2
LPM  1.7 175 50.00 51.60

831024 1718 20.21 34 19.18 106 50.88
13.55  -0.32 13 20 163 1 0.19  0.8  2.9 C B!C
 0.57 10 16 0.00 0.15  0  0.0 ****  6  0.3  0.3 5
MAG 39.4 244 27.10 32.50

84 227  530 41.48 34  1.79 106 59.70
 6.74  -0.75 14  7  86 1 0.10  0.4  0.6 A A!A
 0.25 10 18 0.00 0.07  0  0.0 ****  5  0.8  0.1 4
MAG 26.4 304 46.10 49.50

84 716 1612 15.44 34  4.28 106 50.63
 9.38  -0.09 13  9  74 1 0.14  0.5  1.0 B A!B
 0.27 10 13 0.00 0.09  0  0.0 ****  7  0.1  0.1 5
MAG 37.2 286 22.00  0.00

84 722 14 1 41.16 34  4.41 106 50.78
 7.00  -0.34  9 17  79 1 0.10  0.6  3.0 C B!C
 0.22 10  9 0.00 0.08  0  0.0 ****  6  0.3  0.3 4
MAG 36.9 286 47.60  0.00

84 722 1655 37.90 34  4.43 106 50.59
10.86  -0.21 12  9  74 1 0.13  0.5  1.4 A A!A
 0.28 10 12 0.00 0.10  0  0.0 ****  8  0.2  0.3 3
MAG 37.2 285 44.50  0.00

84 9 3  640 46.78 33 56.63 106 59.25
 7.00   0.15  9 15 133 1 0.09  0.5  1.5 B A!C
 2.37 10  9 0.00 0.08  0  0.0 ****  5  0.2  0.1 3
MAG 33.1 317 52.60 56.60
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84 9 4 1038  8.14 34 18.75 106 56.00
 7.00  -0.51  7 21 152 1 0.19  1.4  7.2 C C!C
 1.42 10  8 0.00 0.17  0  0.0 ****  5  0.5  0.1 4
MAG 32.2 239 14.00 17.90

8410 7 1148 43.20 34 10.56 106 52.53
 7.00   0.94 14 13  62 1 0.19  0.6  3.5 B B!B
13.13 10 15 0.00 0.15  0  0.0 **** 10  0.9  0.3 2
MAG 32.9 267 49.00 52.90

8410 7 1349  5.41 33 59.68 106 58.71
10.51  -0.05 13  9  87 1 0.27  1.1  1.7 B B!A
 0.58 10 14 0.00 0.22  0  0.0 ****  9  0.1  0.4 3
MAG 29.9 309 11.00 14.00

841029  9 8 24.97 34  7.15 106 51.79
 8.36   0.59 15  9  64 1 0.28  1.0  2.6 B B!B
 4.21 10 15 0.00 0.21  0  0.0 ****  9  0.6  0.3 3
MAG 34.4 278 30.90 35.20

841124 2258 13.87 33 57.25 106 56.67
19.22  -0.09  6 13 112 1 0.39  4.0 13.5 C C!B
 6.53 10  7 0.00 0.33  0  0.0 ****  4  0.1  0.3 4
MAG 35.2 311 21.00 25.50

85 3 1 22 6  6.94 34  5.53 106 59.92
16.99  -0.03 11  5 110 1 0.25  1.3  2.9 B B!B
 4.06 10 12 0.00 0.18  0  0.0 ****  5  0.0  0.2 3
MAG 22.9 290 11.80 15.00

85 419  718  0.52 33 58.18 107  0.18
 9.63   0.23  9 21 131 1 0.15  0.7  3.2 C B!C
 2.63 10 12 0.00 0.11  0  0.0 ****  5  0.2  0.3 4
MAG 30.1 315  6.00  9.80

85 419 12 8 42.08 34 13.02 106 53.85
16.47  -0.03  7 13 150 1 0.47  4.8 11.6 C C!C
 4.03 10  8 0.00 0.34  0  0.0 ****  3  0.0  0.3 4
MAG 31.4 259 48.10  0.00

85 517 1148 58.73 34 14.76 106 52.75
 7.00   0.24 11 10  96 1 0.22  1.0  4.2 B B!B
 0.92 10 12 0.00 0.18  0  0.0 ****  6  0.2  0.2 3
MAG 33.8 254  4.60  8.80

85 518  846 14.17 34 25.55 107  1.56
10.31  -0.39  6 11 123 1 0.07  0.6  1.2 B A!B
 0.24 10  7 0.00 0.04  0  0.0 ****  3  0.4  0.3 5
MAG 34.8 213 20.40 24.90

85 826  516 14.42 34 28.13 106 54.26
17.88   0.36  9 23 234 1 0.12  1.0  2.0 C A!D
 4.78 10 10 0.00 0.10  0  0.0 ****  4  0.4  0.3 4
MAG 45.4 222 22.80 29.00

85 9 8 1123 13.92 34  4.43 106 47.26
 7.00  -0.02  9 14 109 1 0.36  1.7  7.0 C C!C
 1.73 10 11 0.00 0.25  0  0.0 ****  4  0.0  0.1 3
MAG 42.2 283 18.30 23.60
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85 916  649 22.88 33 56.48 107  0.21
 9.46  -0.05 14 15 135 1 0.10  0.4  1.0 B A!B
 0.20 10 16 0.00 0.08  0  0.0 ****  6  0.1  0.2 4
MAG 32.3 319 28.70 33.00

85 916  649 22.88 33 56.48 107  0.21
 9.46  -0.05 14 15 135 1 0.10  0.4  2.0 B A!B
 0.20 10 16 0.00 0.08  0  0.0 ****  6  0.1  0.2 4
MAG 32.3 319 28.70 33.00

8512 2  244 33.69 33 56.67 107  0.87
 7.00   0.93 17 16 101 1 0.14  0.4  1.7 B A!C
15.63 10 18 0.00 0.10  0  0.0 **** 10  0.9  0.5 2
MAG 31.4 320 39.10 43.20

86 219  732 51.22 33 59.60 106 59.42
11.17  -0.01 16 10  86 1 0.19  0.6  1.3 B B!A
 0.71 10 17 0.00 0.14  0  0.0 ****  9  0.0  0.4 3
MAG 29.1 310 56.60 59.90

86 220 1444 41.58 34  1.79 106 59.49
10.08  -0.05 12  6 118 1 0.13  0.6  0.9 B A!B
 0.32 10 16 0.00 0.08  0  0.0 ****  3  0.1  0.2 5
MAG 26.6 304 46.50 50.00

86 4 5 1452 20.76 34 19.02 107  1.24
 9.45   0.25 10 12 128 1 0.11  0.6  1.4 B A!B
 1.10 10 11 0.00 0.09  0  0.0 ****  6  0.3  0.1 4
MAG 25.9 229 25.60  0.00

86 7 8  522 55.41 34 18.87 106 38.90
19.77  -0.27  7  1 176 1 0.21  3.3  2.6 C C!C
 1.18 10  8 0.00 0.14  0  0.0 ****  4  0.3  0.4 4
MAG 56.4 253  5.70  0.00

86 7 9  024 57.64 34 17.30 106 38.13
15.63   0.23  8  3 174 1 0.41  4.1  6.4 C C!C
 5.08 10  9 0.00 0.35  0  0.0 ****  5  0.2  0.3 3
MAG 56.7 256  8.00  0.00

86 730 1319 35.00 34  1.47 107  3.31
10.34  -0.08 12 11 140 1 0.08  0.4  0.7 B A!C
 0.58 10 12 0.00 0.05  0  0.0 ****  5  0.1  0.3 4
MAG 22.4 313 39.30 42.40

86 730 1323 53.63 34  1.36 107  3.29
10.89  -0.08 16 11  73 1 0.11  0.4  0.8 B A!B
 3.96 10 16 0.00 0.08  0  0.0 ****  7  0.1  0.3 3
MAG 22.5 313 58.00 61.00

86 730 2242 55.60 34  3.88 106 50.68
 8.03   0.37 11 16  80 1 0.08  0.3  1.1 B A!C
 1.08 10 13 0.00 0.06  0  0.0 ****  5  0.4  0.3 4
MAG 37.3 287  2.40  6.60

86 8 8  7 8  0.28 33 59.74 107  0.22
 5.95   0.25 15 10  83 1 0.13  0.4  1.5 B A!B
 0.10 10 16 0.00 0.20  0  0.0 ****  8  0.2  0.4 4
MAG 28.0 311  5.20  8.90
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86 814  241 53.35 34 11.55 106 48.21
 4.23   0.07 13 16 103 1 0.10  0.4  3.1 C B!C
 0.25 10 13 0.00 0.09  0  0.0 ****  7  0.1  0.4 5
MAG 39.6 265  0.10  4.80

86 823  445 38.92 34 22.39 106 57.71
 6.87   0.19  9  7 181 1 0.06  0.3  0.9 C A!D
 0.12 10 10 0.00 0.04  0  0.0 ****  3  0.2  0.3 4
MAG 34.1 227 45.00 49.50

86 919  641 35.91 34 26.69 106 57.88
10.91   0.23  9 14 222 1 0.08  0.6  1.6 C A!D
 0.43 10 11 0.00 0.07  0  0.0 ****  4  0.2  0.1 5
MAG 39.8 218 43.10 48.30

86 919  831 44.35 34 26.54 106 57.23
 7.00  -0.17 10 18 139 1 0.20  1.0  6.6 C C!C
 2.41 10 14 0.00 0.14  0  0.0 ****  4  0.2  0.1 3
MAG 40.2 220 51.30 56.50

8611 3  9 0 10.78 34  2.86 106 56.85
 2.94  -0.52 12  3 131 1 0.64  2.6  6.3 C D!B
 4.06 10 14 0.00 0.34  0  0.0 ****  6  0.5  0.4 3
MAG 29.2 296 15.60 21.00

8611 3 1236 57.06 34  0.21 106 58.62
10.80  -0.44 16  8  85 1 0.29  0.9  1.8 B B!A
 2.49 10 17 0.00 0.17  0  0.0 **** 10  0.4  0.2 3
MAG 29.4 307  2.40  0.00

87 224  045 48.55 33 58.36 106 43.16
41.22  -0.37  9  3 188 1 1.24 13.4 11.5 D D!D
 8.28 10 12 0.00 0.79  0  0.0 ****  4  0.4  0.2 8
MAG 51.8 294 59.80  0.00

87 324  034  9.72 33 57.93 106 55.75
11.79  -1.01 12 12 147 1 0.25  1.2  2.3 C B!C
 5.18 10 14 0.00 0.20  0  0.0 ****  6  1.0  0.6 3
MAG 35.5 308 16.50 20.80

87 5 9 1759 32.22 34 17.02 106 54.95
 0.57  -0.47 10  6  82 1 0.05  0.2  3.5 B B!B
 0.57 10 10 0.00 0.05  0  0.0 ****  5  0.5  0.2 4
MAG 32.1 245 37.80 41.90

87 512  622 48.14 34 17.01 106 52.54
 0.82  -0.42 12  6  99 1 0.07  0.2  3.5 B B!B
 0.09 10 12 0.00 0.06  0  0.0 ****  6  0.4  0.4 4
MAG 35.5 248 54.30 58.70

87 714 1445 11.93 34 16.80 106 53.12
 0.79  -0.41 13  6  90 1 0.08  0.2  3.9 B B!B
 0.79 10 13 0.00 0.06  0  0.0 ****  7  0.4  0.3 4
MAG 34.5 248 17.90 22.40

87 822  2 9 49.63 34 10.20 106 44.55
 7.00  -0.23 15 11 144 1 0.15  0.5  1.9 C B!C
 0.36 10 17 0.00 0.11  0  0.0 ****  6  0.2  0.3 4
MAG 45.1 269 57.60 63.00
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87 825 2020 41.61 34 16.74 106 53.45
 0.06  -0.73  8 15 140 1 0.25  1.3355.5 C C!C
 7.32 10  8 0.00 0.17  0  0.0 ****  4  0.7  0.1 3
MAG 34.0 248 47.50 51.80

8212 6 2212 34.59 34 15.97 106 50.00
 2.27  -0.19  8 23 261 1 0.20  1.2 12.6 D C!D
 0.58 10 10 0.00 0.15  0  0.0 ****  5  0.2  0.1 5
SB  45.5 225 42.90 48.40

85 111  954  5.08 34  3.62 106 57.62
 8.99  -0.28  7  2 161 1 0.02  0.2  0.2 B A!C
 0.26 10  9 0.00 0.02  0  0.0 ****  4  0.3  0.2 3
SB  22.4 245  9.50 12.70

85 112 1751 32.71 34  5.48 106 58.20
10.98  -0.12  8  3 152 1 0.05  0.3  0.6 B A!C
 0.10 10  9 0.00 0.04  0  0.0 ****  5  0.1  0.2 3
SB  23.3 236 37.40 40.80

85 321 1526 33.81 33 58.61 106 59.48
10.50  -0.28  7 17 152 1 0.13  1.2  3.3 C B!C
 0.62 10  8 0.00 0.11  0  0.0 ****  2  0.3  0.2 4
SB  17.5 269 37.60 40.40

85 4 7  028 44.26 34 13.84 106 52.03
11.31   1.09 16 12  80 1 0.23  0.9  2.4 B B!B
 1.57 10 16 0.00 0.19  0  0.0 ****  8  1.1  0.3 5
SB  40.5 226 51.30 56.40

85 5 1 1219 25.85 34  4.43 106 55.09
 4.99   0.57 15  3  74 1 0.19  0.6  1.4 B B!A
 2.01 10 15 0.00 0.13  0  0.0 ****  6  0.6  0.3 3
SB  26.6 246 30.70 34.30

851026 2153 22.37 34 10.48 106 55.54
 3.04   0.44 16  5  98 1 0.22  0.7  1.9 B B!B
 2.46 10 16 0.00 0.17  0  0.0 ****  7  0.4  0.2 3
SB  32.3 227 28.00 33.00

88 326 1224 15.23 34 20.85 106 40.23
12.80   0.74 16  5 179 1 0.13  0.6  1.1 B A!C
 7.58 10 18 0.00 0.09  0  0.0 ****  8  0.7  0.4 2
SB  62.6 229 26.10 35.50

88 326 1224 15.23 34 20.85 106 40.23
12.80   0.74 16  5 179 1 0.13  0.6  1.1 B A!C
 7.58 10 19 0.00 0.09  0  0.0 ****  8  0.7  0.4 2
SB  62.6 262 26.10 35.50

88 625  550  0.70 34  0.10 107  1.87
 7.00  -0.09 14 11  81 1 0.28  1.0  4.1 B B!B
11.11 10 17 0.00 0.23  0  0.0 ****  6  0.1  0.2 2
SB  14.1 258  3.10  8.40

88 722  810 59.91 34 16.77 106 41.38
 7.66   0.30 11  6 105 1 0.15  1.0  2.6 B B!B
 2.26 10 14 0.00 0.12  0  0.0 ****  5  0.3  0.5 3
SB  56.5 233 11.60 17.40
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88 722  810 59.91 34 16.77 106 41.38
 7.66   0.30 11  6 105 1 0.15  1.0  2.6 B B!B
 2.26 10 14 0.00 0.12  0  0.0 ****  5  0.3  0.5 3
SB  56.6 233 11.60 17.40

88 722  810 59.91 34 16.77 106 41.38
 7.66   0.30 11  6 105 1 0.15  1.0  2.6 B B!B
 2.26 10 14 0.00 0.12  0  0.0 ****  5  0.3  0.5 3
BMT 52.5 269  9.30 16.10

881027  426 48.95 34  7.60 106 56.85
 7.98  -0.01 13  6 115 1 0.13  0.7  0.9 B A!B
 0.59 10 14 0.00 0.11  0  0.0 ****  7  0.0  0.4 4
SB  27.3 232 54.00 57.70

82 919 1848 21.82 34  2.11 107  4.55
 9.88  -0.45 12 12 104 1 0.11  0.4  0.9 B A!B
 0.23 10 14 0.00 0.09  0  0.0 ****  7  0.8  0.9 4
WTX 12.7  71 24.50 26.40

84 425  942 20.14 34 15.10 106 53.43
18.80  -0.18 11 21 128 1 0.20  1.0  2.1 B B!B
 0.55 10 12 0.00 0.12  0  0.0 ****  6  0.2  0.2 6
WTX 20.6 194 24.50 28.10

841010 2052 43.66 34  4.96 107  3.81
 8.88  -0.12 13 11 118 1 0.32  1.1  2.4 C C!B
 1.88 10 15 0.00 0.24  0  0.0 ****  8  0.1  0.4 4
WTX 10.9  96 46.00 47.60

841010 2052 43.66 34  4.96 107  3.81
 8.88  -0.12 13 11 118 1 0.32  1.1  2.5 C C!B
 1.88 10 15 0.00 0.24  0  0.0 ****  8  0.1  0.4 4
WTX 10.9  96 46.00 47.60

851010 2123 22.35 34 22.07 107  2.95
 7.00   0.32 14  9 164 1 0.21  1.0  2.7 C B!C
 3.01 10 15 0.00 0.17  0  0.0 ****  6  0.3  0.2 3
WTX 34.1 164 28.30 32.60

86 222 1158  6.64 34  1.92 107  4.16
 9.55   0.24 15 12  75 1 0.11  0.4  0.8 B A!B
 0.89 10 16 0.00 0.06  0  0.0 ****  8  0.2  0.3 5
WTX 12.2  69  9.10 11.20

86 325  9 2  9.39 34  1.98 107  4.00
10.84  -0.07 15 12  75 1 0.16  0.5  1.2 B B!B
 0.59 10 18 0.00 0.11  0  0.0 ****  7  0.1  0.2 4
WTX 12.0  69 12.00 14.00

86 4 7  757 18.79 34  2.05 107  2.99
10.94  -0.15  8 10 203 1 0.09  0.7  1.0 C A!D
 0.16 10  8 0.00 0.05  0  0.0 ****  4  0.2  0.3 4
WTX 10.5  66 21.20 23.30

86 511 1058 13.20 34  9.65 106 56.61
 0.20  -0.16 11  3  89 1 0.14  0.6 13.9 B C!A
 0.20 10 11 0.00 0.10  0  0.0 ****  6  0.2  0.4 7
WTX  9.8 181 14.70 16.00
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86 531  031  8.06 34  1.38 107  3.65
 9.15  -0.07 16 12  72 1 0.07  0.2  0.5 B A!B
 0.14 10 16 0.00 0.05  0  0.0 ****  9  0.1  0.2 5
WTX 11.9  63 10.60 14.50

86 822 1911 43.69 34 24.87 107  3.83
 7.32   0.76 16  7 207 1 0.09  0.6  1.2 C A!D
 0.32 10 17 0.00 0.07  0  0.0 ****  7  0.8  0.5 4
WTX 39.5 164 50.50 55.60

86 9 1 1849 18.06 34  6.50 107  0.56
 9.01  -0.51 10  7 130 1 0.08  0.5  0.7 B A!B
 0.58 10 11 0.00 0.06  0  0.0 ****  4  0.5  0.2 5
WTX  7.1 124 19.90 21.40

861026  223 47.53 34  5.11 107  3.26
 8.73  -0.68 14 10  74 1 0.15  0.5  1.1 B A!B
 2.81 10 17 0.00 0.08  0  0.0 ****  6  0.7  0.3 3
WTX 10.1  98 49.60 51.40

88 317  815 53.92 34  3.43 107  3.61
 8.69  -0.21 12 11  92 1 0.12  0.4  1.0 B A!B
 1.76 10 16 0.00 0.10  0  0.0 ****  7  0.2  0.1 3
WTX 10.7  87 56.10 58.00

88 317  815 53.92 34  3.43 107  3.61
 8.69  -0.21 16 11  92 1 0.12  0.4  1.0 B A!B
 1.76 10 16 0.00 0.10  0  0.0 ****  7  0.2  0.1 3
WTX 10.7  81 56.10 58.00

88 324 14 6 24.05 34  2.10 107  4.08
10.82  -0.49 11 12 175 1 0.13  0.7  1.1 B A!C
 0.60 10 12 0.00 0.10  0  0.0 ****  3  0.5  0.3 4
WTX 12.0  70 26.90 28.50

88 326  519  6.85 34  2.43 107  3.58
10.09  -1.21  9 11  98 1 0.11  0.5  1.2 B A!B
 3.20 10 14 0.00 0.09  0  0.0 ****  3  1.2  0.3 3
WTX 11.0  72  9.30 11.00

88 326  519  6.85 34  2.51 107  3.58
10.09  -1.21  9 11  98 1 0.11  0.5  1.2 B A!B
 3.20 10 14 0.00 0.09  0  0.0 ****  3  1.2  0.3 3
WTX 13.4 236 10.00 12.30

88 6 2  929 29.18 34 19.39 106 53.35
 3.69  -0.27  8  2 115 1 0.07  0.5  0.8 B A!B
 3.79 10  8 0.00 0.06  0  0.0 ****  4  0.3  0.2 2
WTX 28.3 191 34.10 37.40

88 618 1658 13.08 34 18.52 106 55.06
 5.59   0.44 15  4  96 1 0.12  0.5  1.2 B A!B
 1.41 10 15 0.00 0.11  0  0.0 ****  8  0.4  0.4 3
WTX 26.4 186 17.50 20.80

85 815 1834 43.24 34  7.00 107  0.09
 9.05  -0.35  8  6 150 1 0.03  0.3  0.3 B A!C
 2.03 10  8 0.00 0.02  0  0.0 ****  3  0.4  0.4 3
WTX  7.1 134 45.10 46.40
```
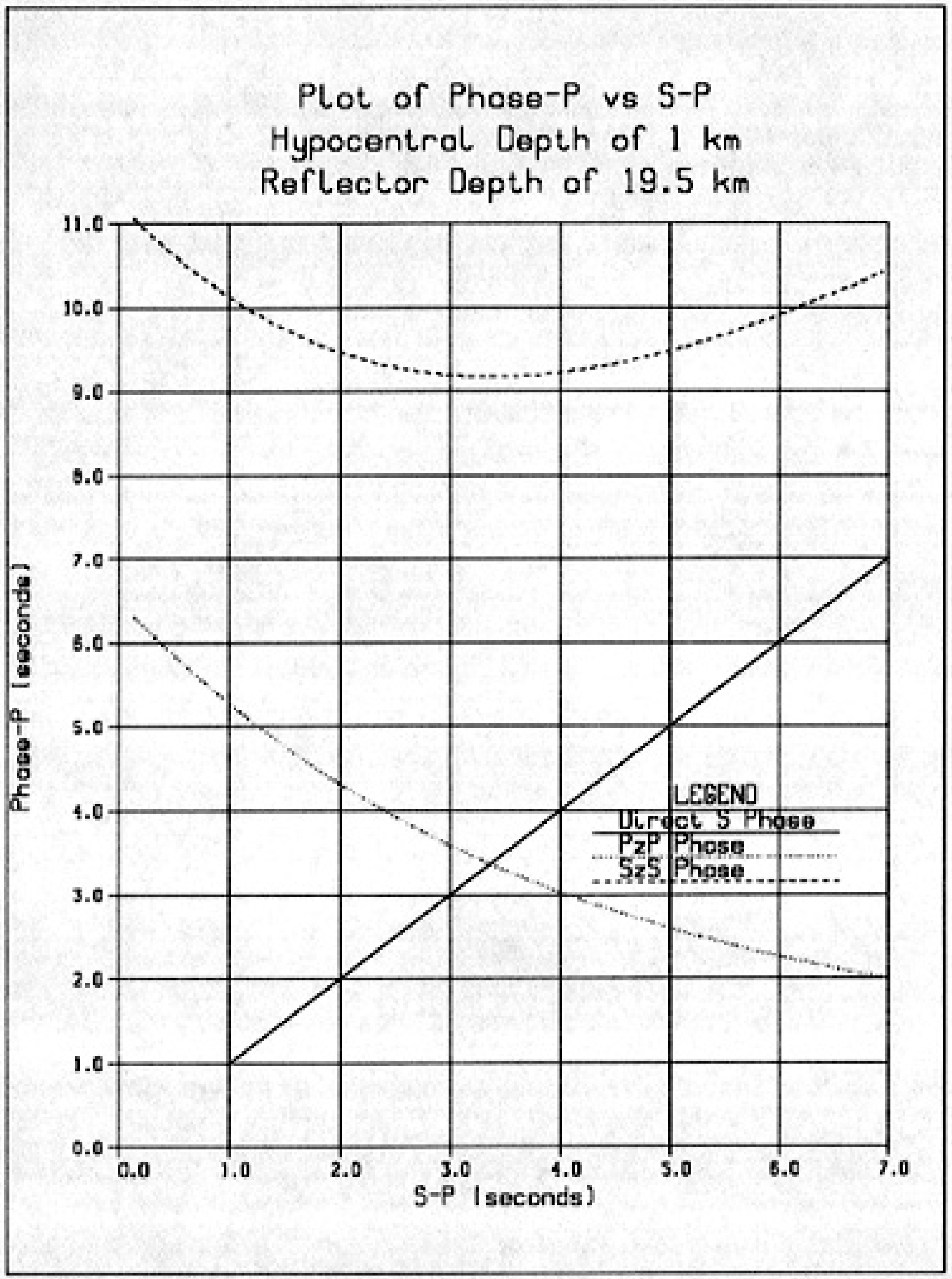
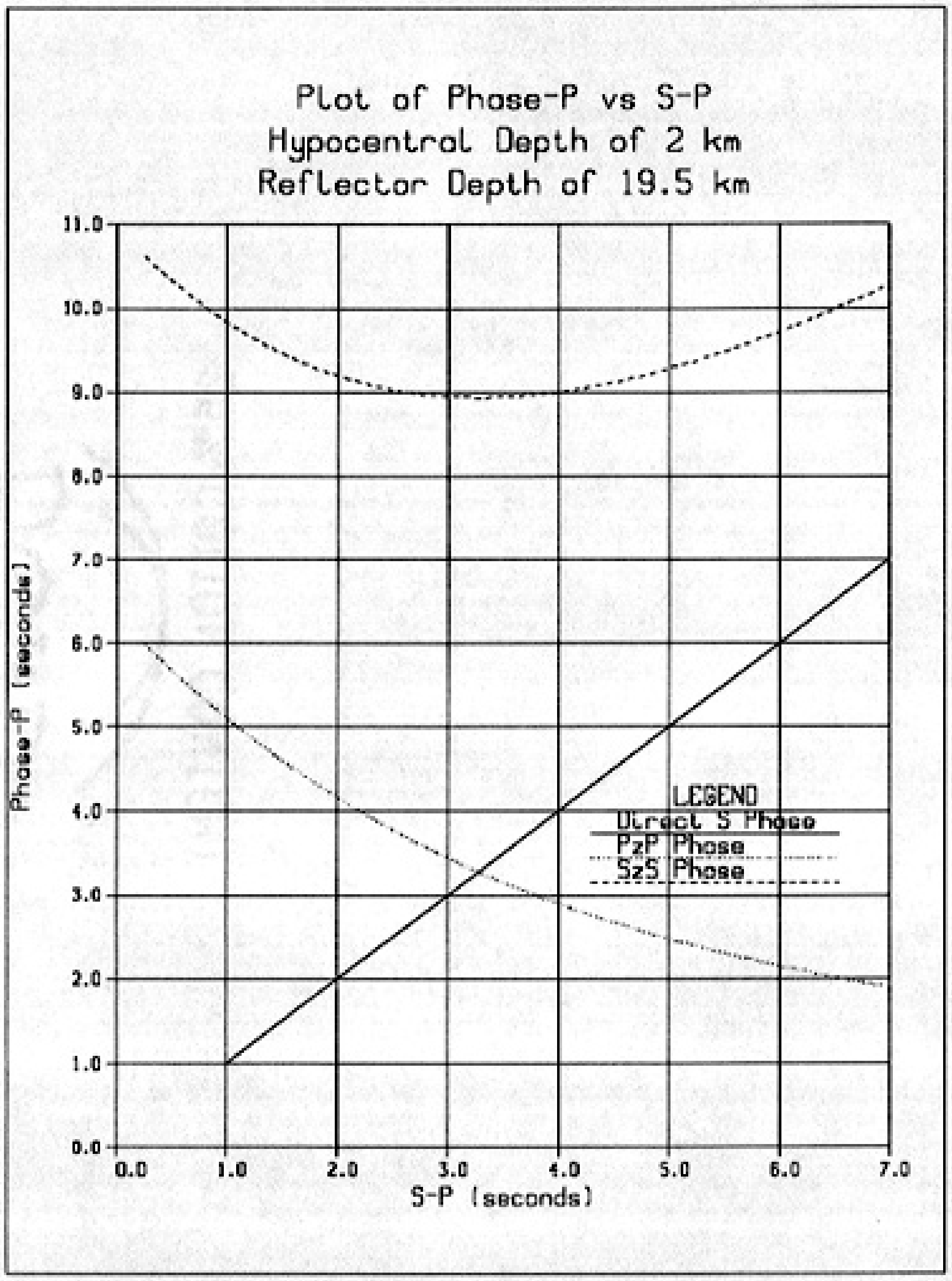

```
86 511 1058 13.20 34  9.65 106 56.61
 0.20  -0.16 11  3  89 1 0.14  0.6 13.9 B C!A
 0.20 10 11 0.00 0.10  0  0.0 ****  6  0.2  0.4 7
WTX  9.8 181 14.70 16.00

86 9 1 1849 18.06 34  6.50 107  0.56
 9.01  -0.51 10  7 130 1 0.08  0.5  0.7 B A!B
 0.58 10 11 0.00 0.06  0  0.0 ****  4  0.5  0.2 5
WTX  7.1 124 19.90 21.40

88 127 1359 25.92 34  3.80 107  2.61
 8.04  -0.27 19  9  87 1 0.13  0.4  0.9 B A!B
 0.44 10 20 0.00 0.11  0  0.0 **** 10  0.3  0.3 4
WTX  9.1  84 28.10 29.20

88 424  918 39.67 34  2.25 107  2.48
 9.97   0.00 16 10  81 1 0.11  0.4  0.8 A A!A
 3.07 10 19 0.00 0.08  0  0.0 ****  9  0.0  0.3 3
WTX  9.6  66 42.00 43.40

88 424  918 39.67 34  2.25 107  2.84
 9.97   0.00 16 10  81 1 0.11  0.4  0.8 A A!A
 3.07 10 19 0.00 0.08  0  0.0 ****  9  0.0  0.3 3
WTX  9.6  66 42.00 43.40

8810 3  4 2  7.41 34  4.97 107  3.12
 9.17  -0.46 12 10 122 1 0.11  0.5  0.8 B A!B
 4.13 10 12 0.00 0.08  0  0.0 ****  6  0.5  0.3 3
WTX  9.9  97  9.60 11.30

8810 4  017 51.97 34  4.83 107  2.77
 8.73   0.03 15  9  98 1 0.15  0.5  1.1 B B!B
 0.32 10 16 0.00 0.13  0  0.0 ****  8  0.0  0.3 4
WTX  9.3  96 54.00 55.70

881030  433 44.38 34  5.01 107  2.66
 9.24  -0.41 12  9 124 1 0.09  0.4  0.7 B A!B
 0.34 10 14 0.00 0.06  0  0.0 ****  6  0.4  0.2 4
WTX  9.2  98 46.
```

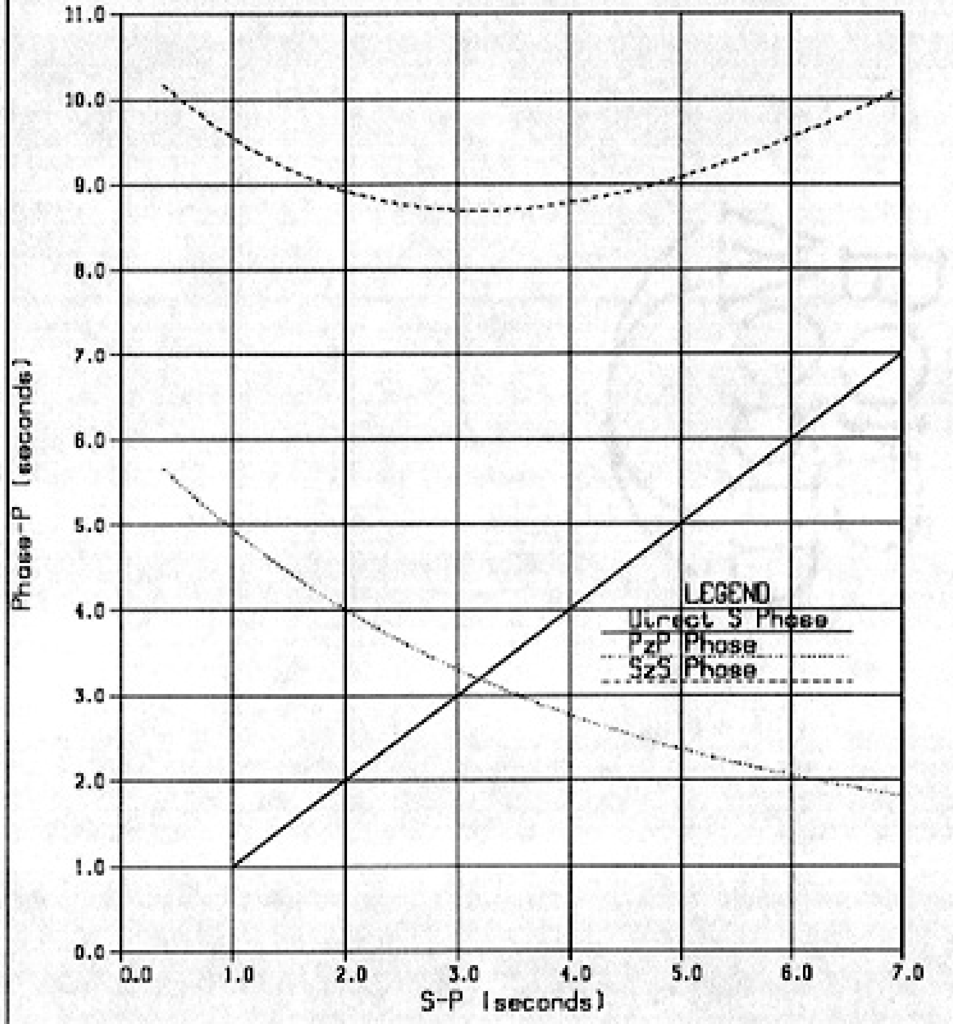
APPENDIX III

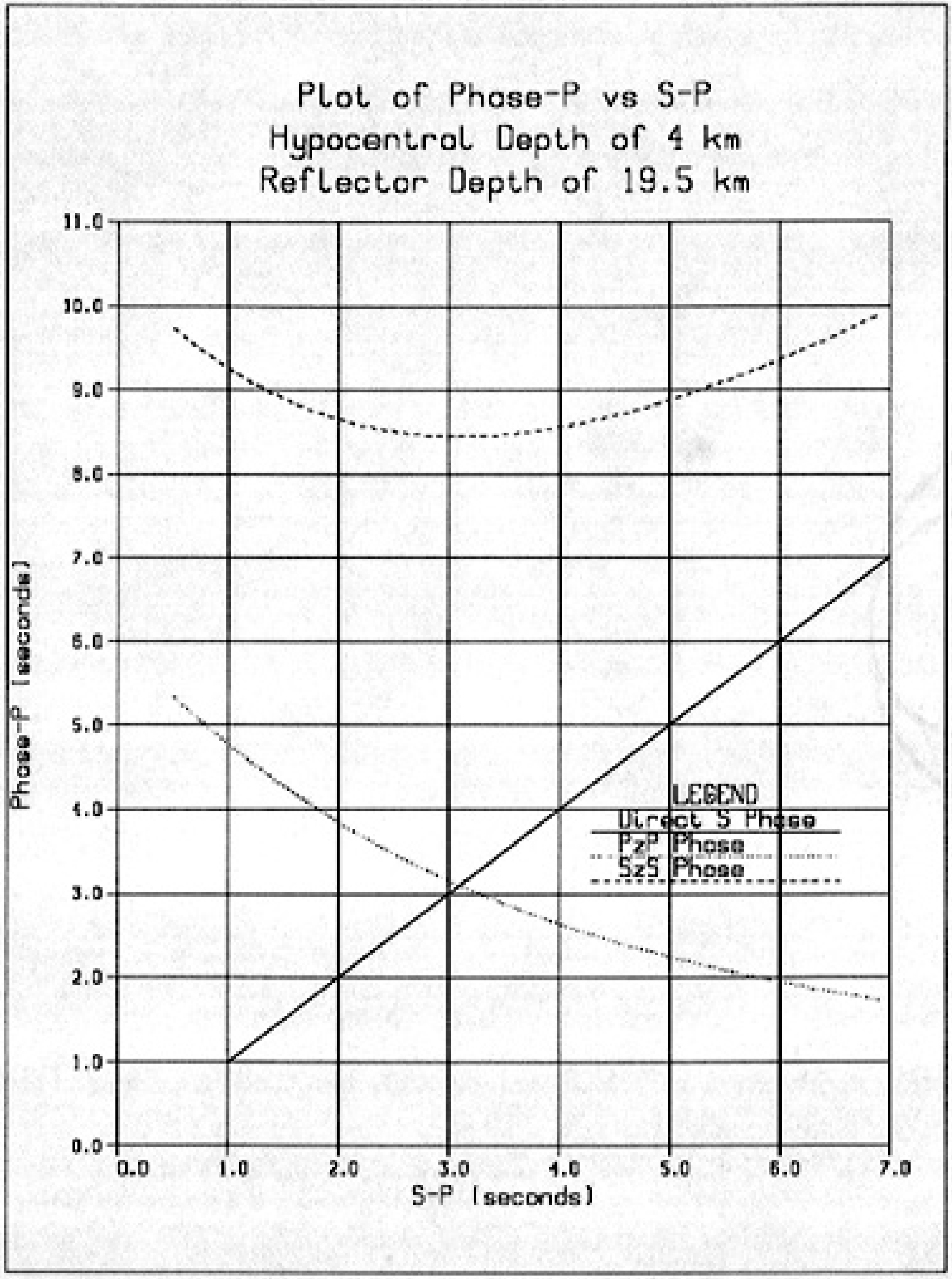
THEORETICAL TIME CURVES


Plot of Phase-P vs S-P
Hypocentral Depth of 1 km
Reflector Depth of 19.5 km
Phase-P (seconds)
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
S-P (seconds)
LEGEND
Direct S Phase
PzP Phase
SzS Phase

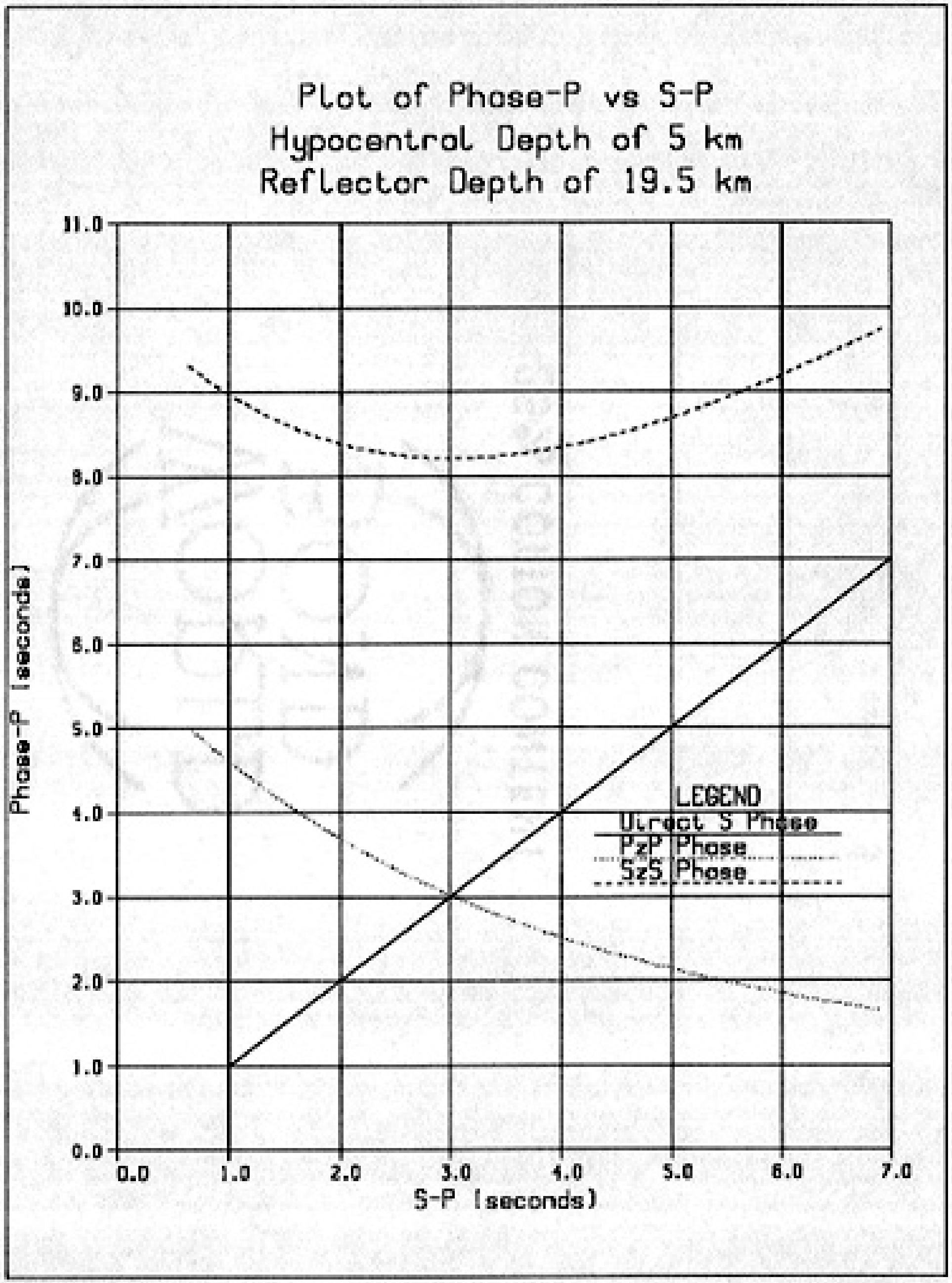

Plot of Phase-P vs S-P
Hypocentral Depth of 2 km
Reflector Depth of 19.5 km
Phase-P (seconds)
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
S-P (seconds)
LEGEND
Direct S Phase
PzP Phase
SzS Phase

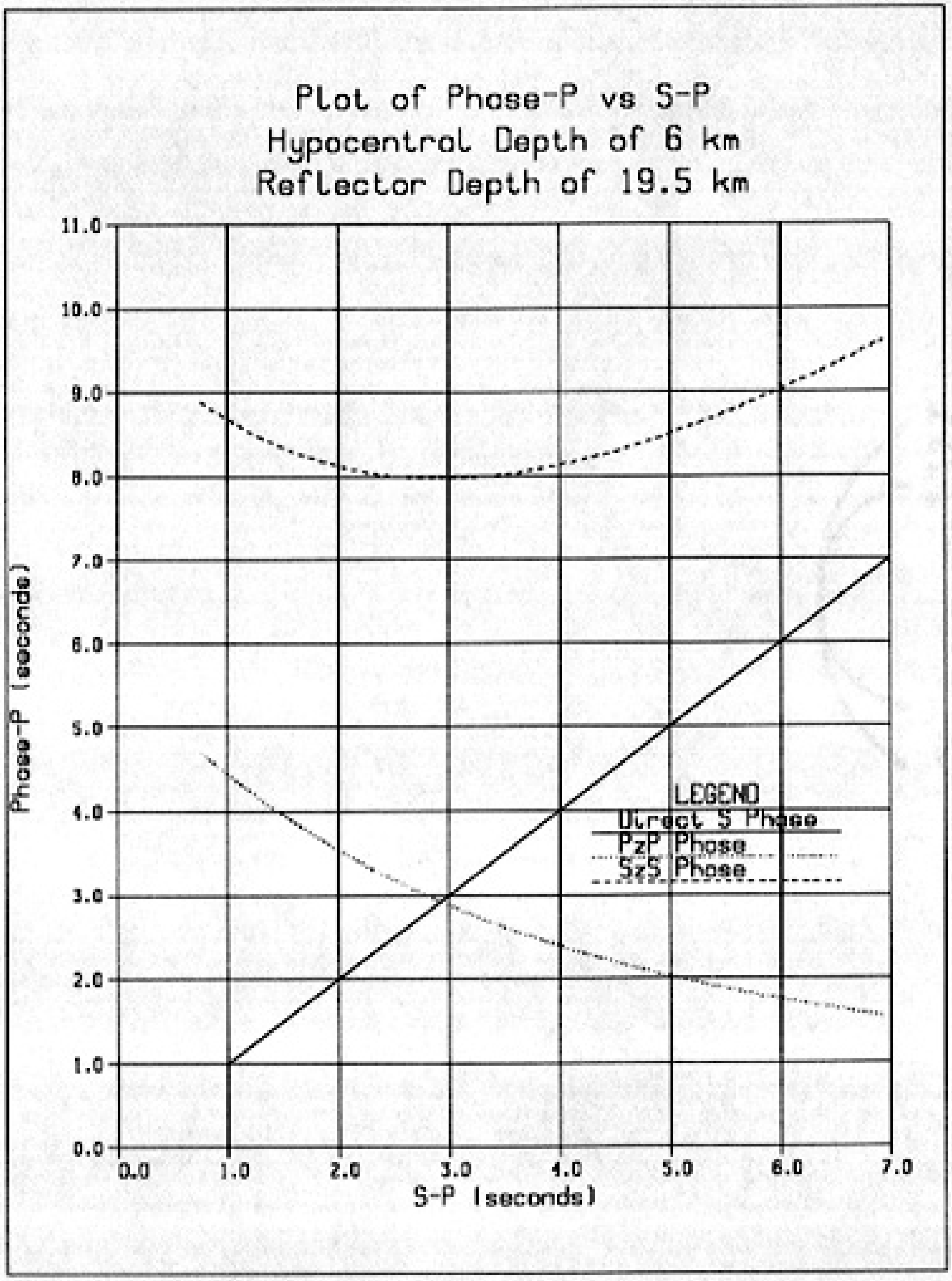
Plot of Phase-P vs S-P
Hypocentral Depth of 3 km
Reflector Depth of 19.5 km

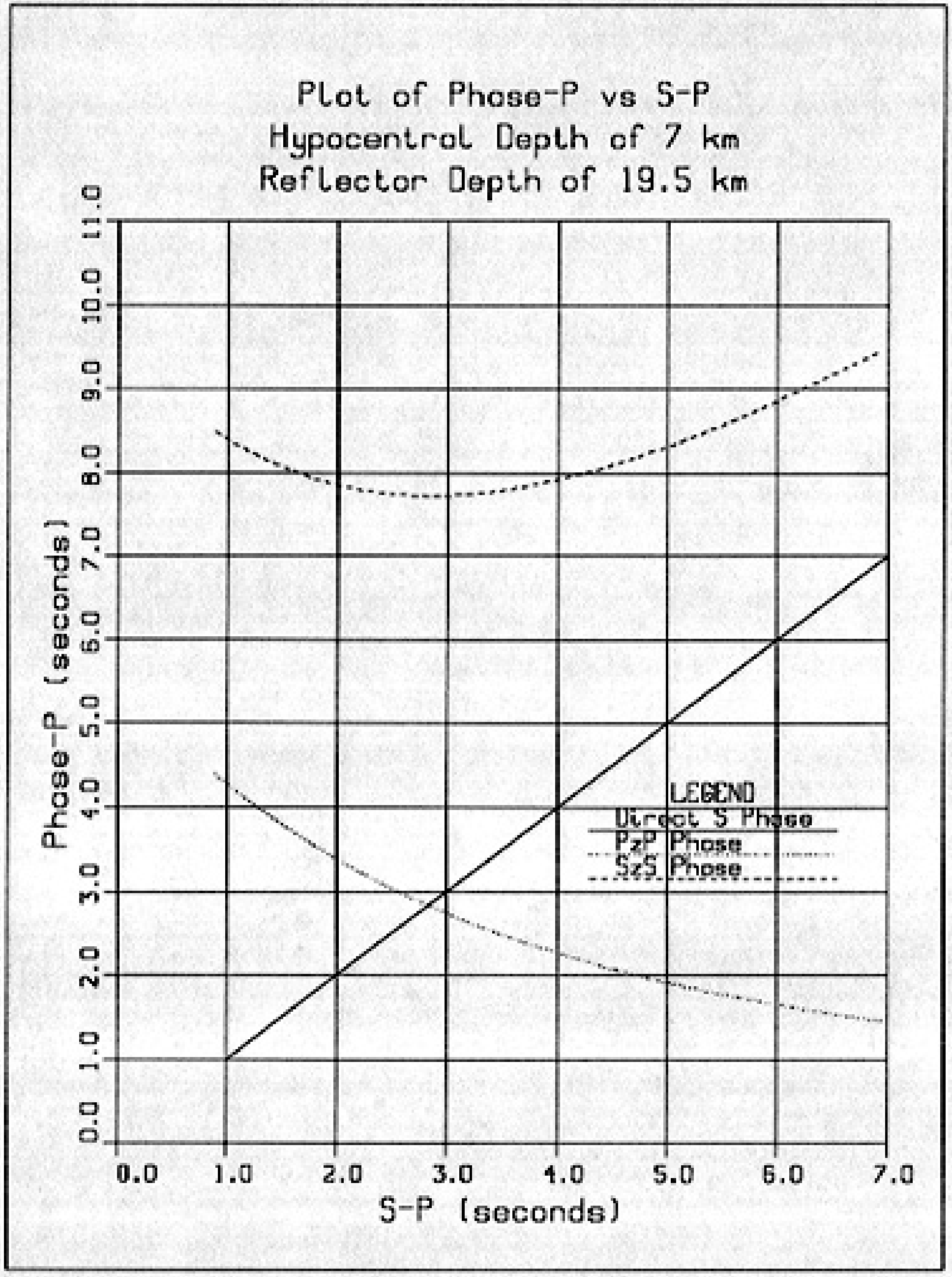




Plot of Phase-P vs S-P
Hypocentral Depth of 4 km
Reflector Depth of 19.5 km

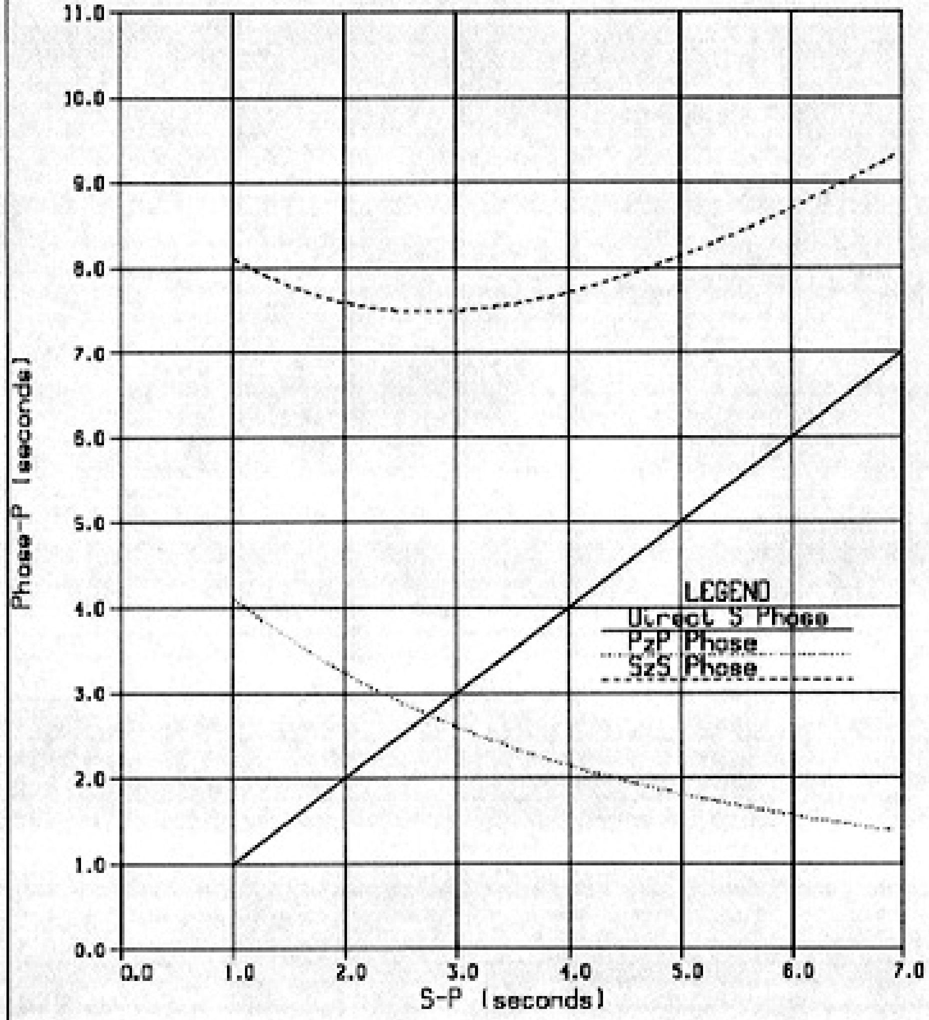

Plot of Phase-P vs S-P
Hypocentral Depth of 5 km
Reflector Depth of 19.5 km
Phase-P (seconds)
S-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
LEGEND
Direct S Phase
PzP Phase
SzS Phase

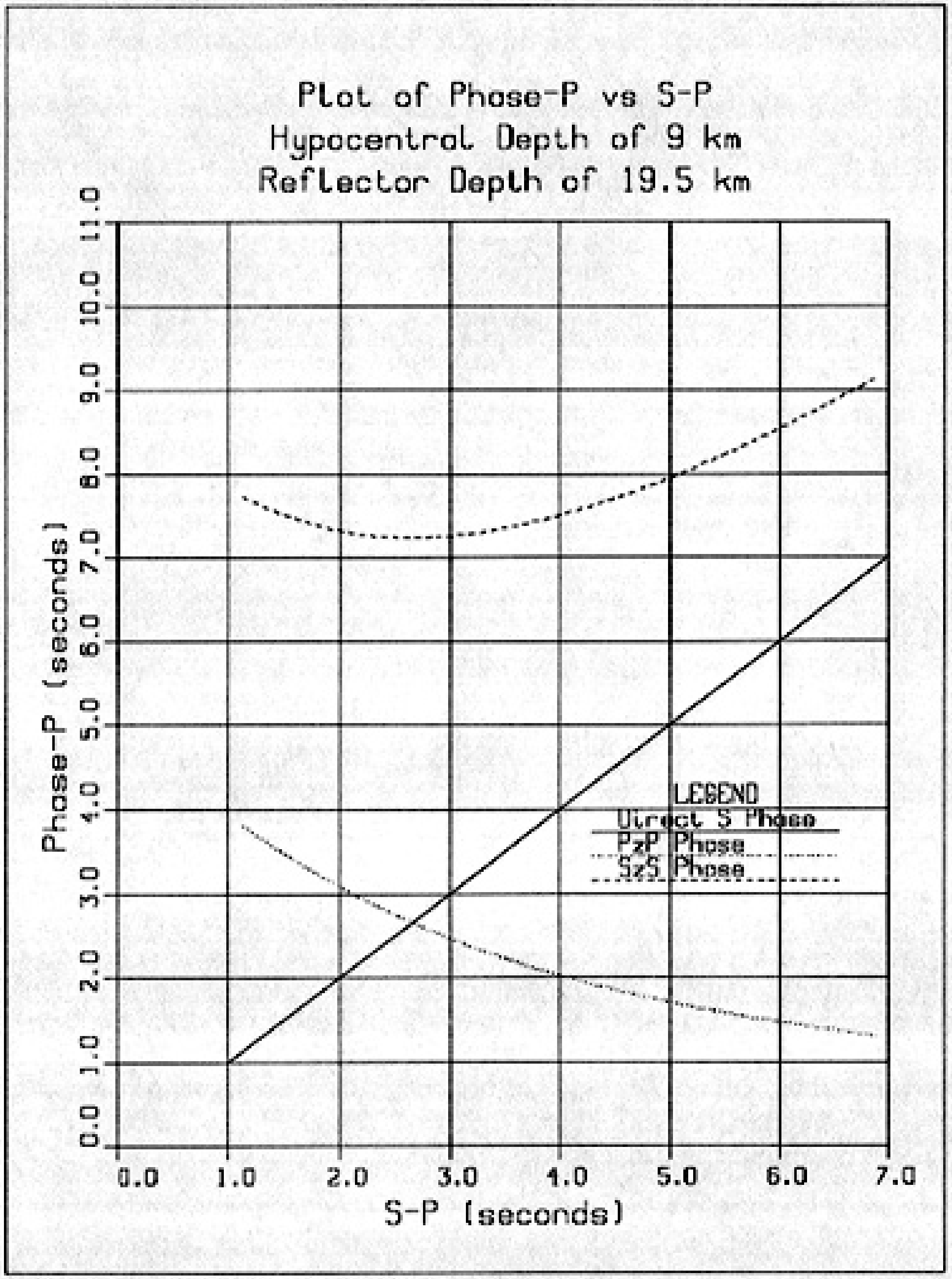

Plot of Phase-P vs S-P
Hypocentral Depth of 6 km
Reflector Depth of 19.5 km
Phase-P (seconds)
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
S-P (seconds)
LEGEND
Direct S Phase
PzP Phase
SzS Phase

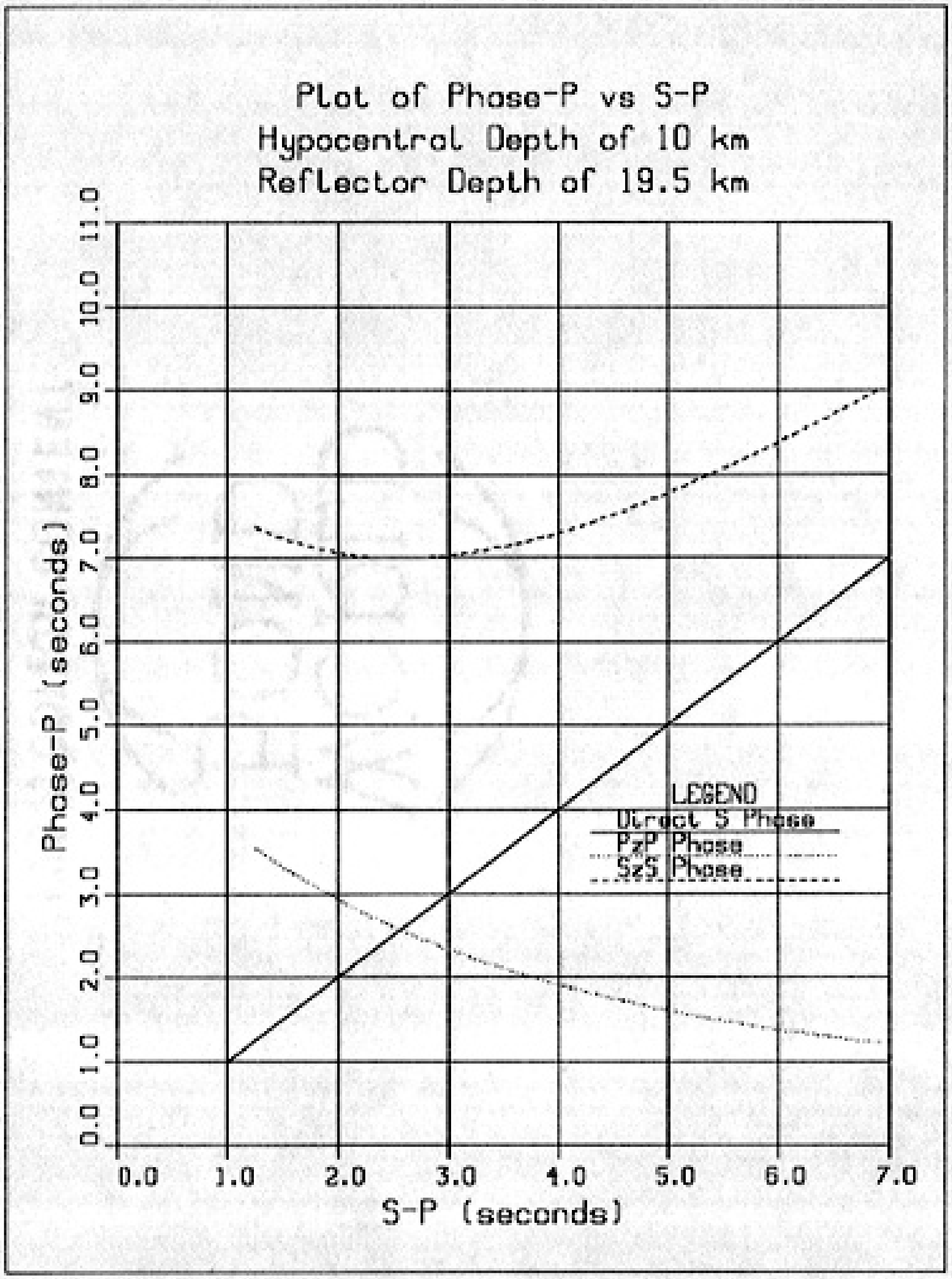


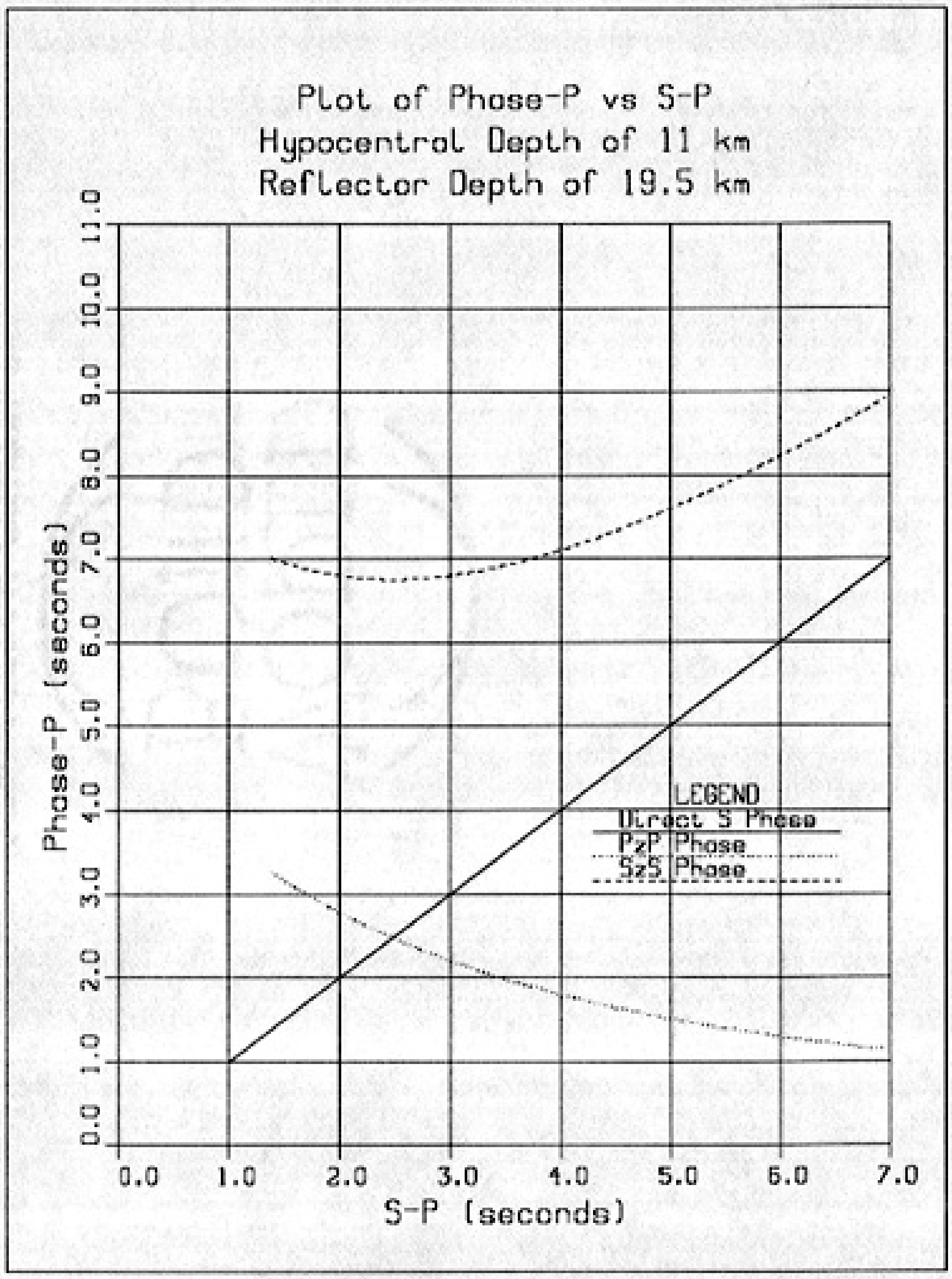
Plot of Phase-P vs S-P
Hypocentral Depth of 7 km
Reflector Depth of 19.5 km

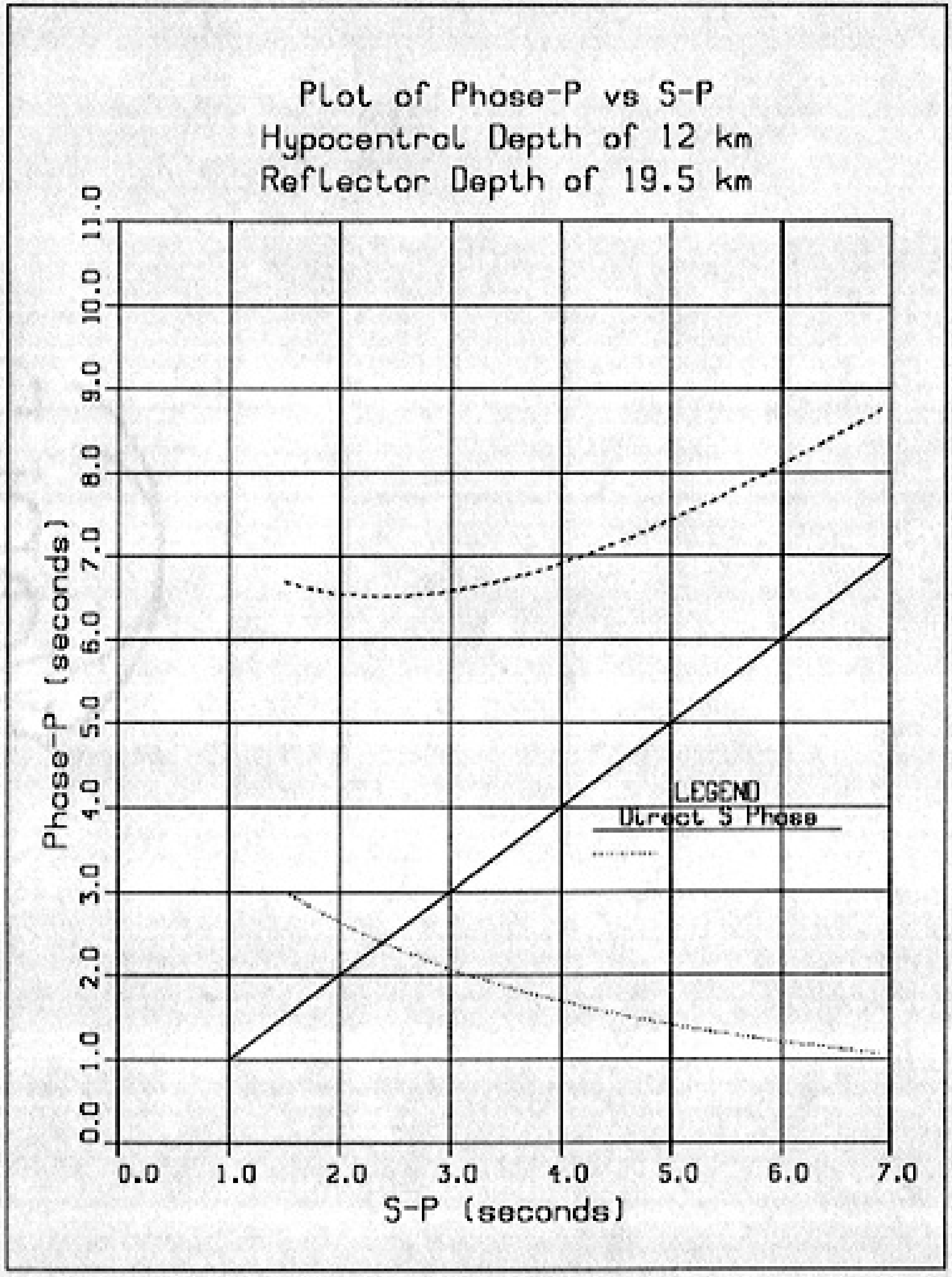
Plot of Phase-P vs S-P
Hypocentral Depth of 8 km
Reflector Depth of 19.5 km

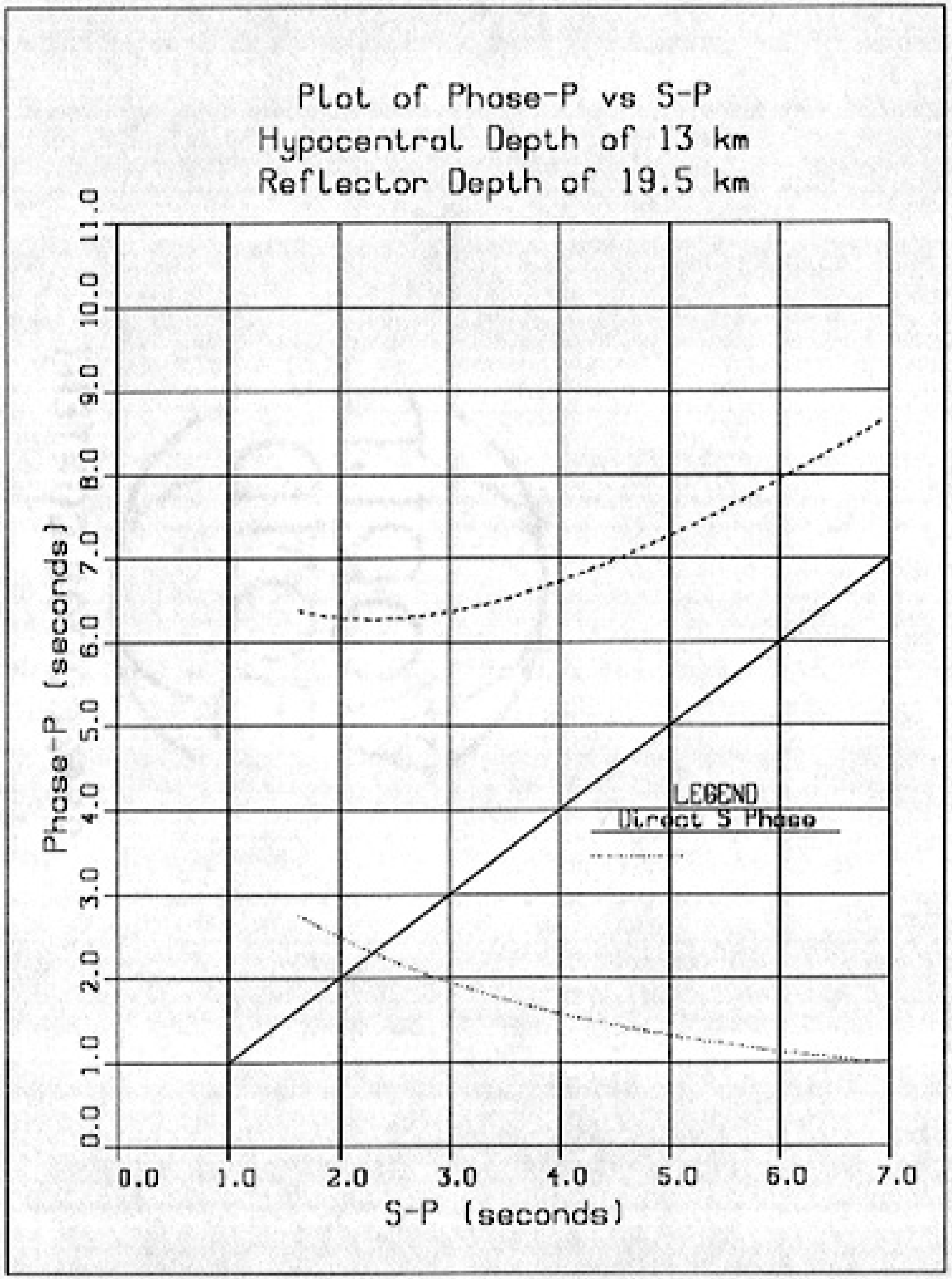


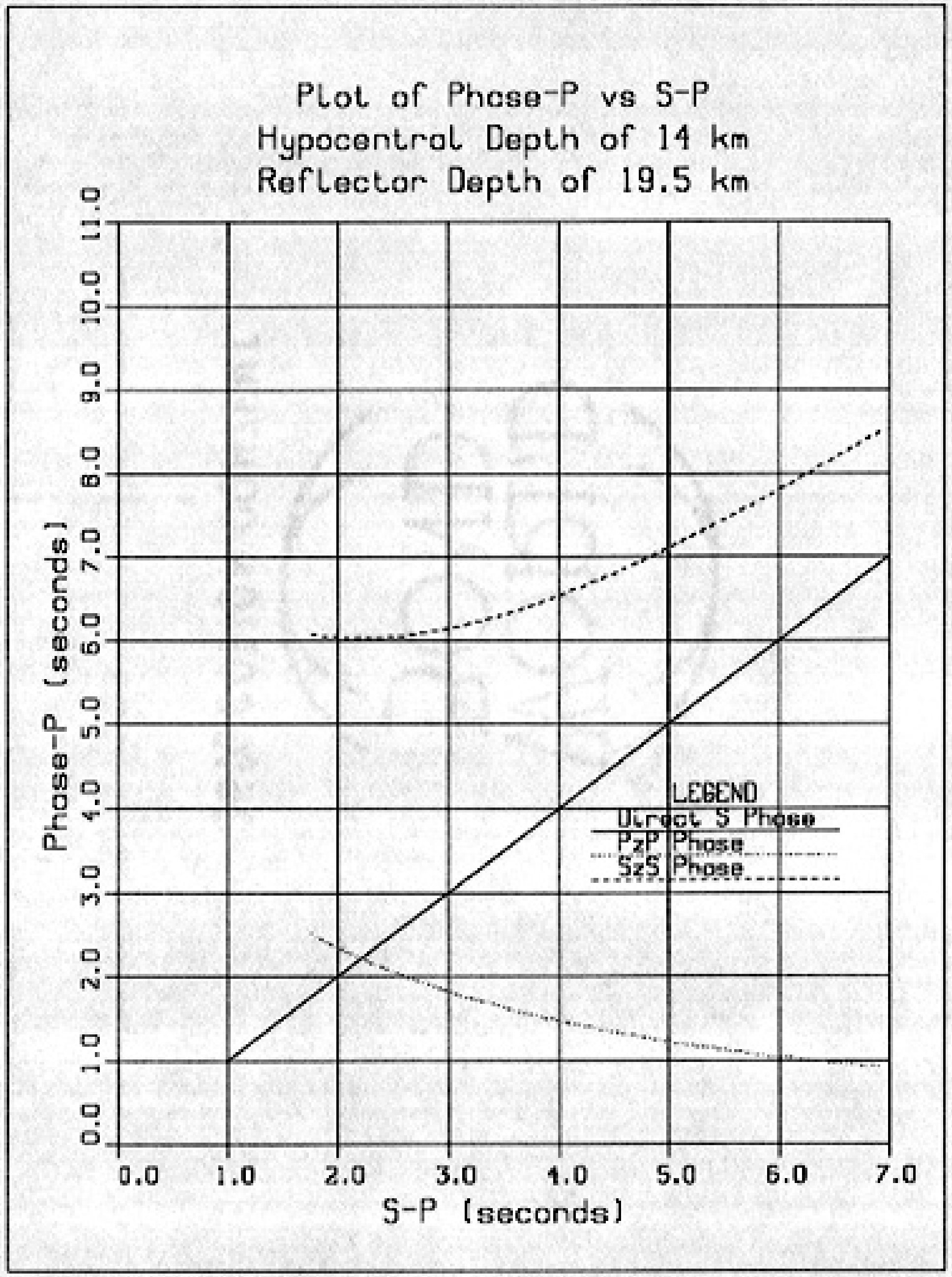

Plot of Phase-P vs S-P
Hypocentral Depth of 9 km
Reflector Depth of 19.5 km
Phase-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
S-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
LEGEND
Direct S Phase
PzP Phase
SzS Phase

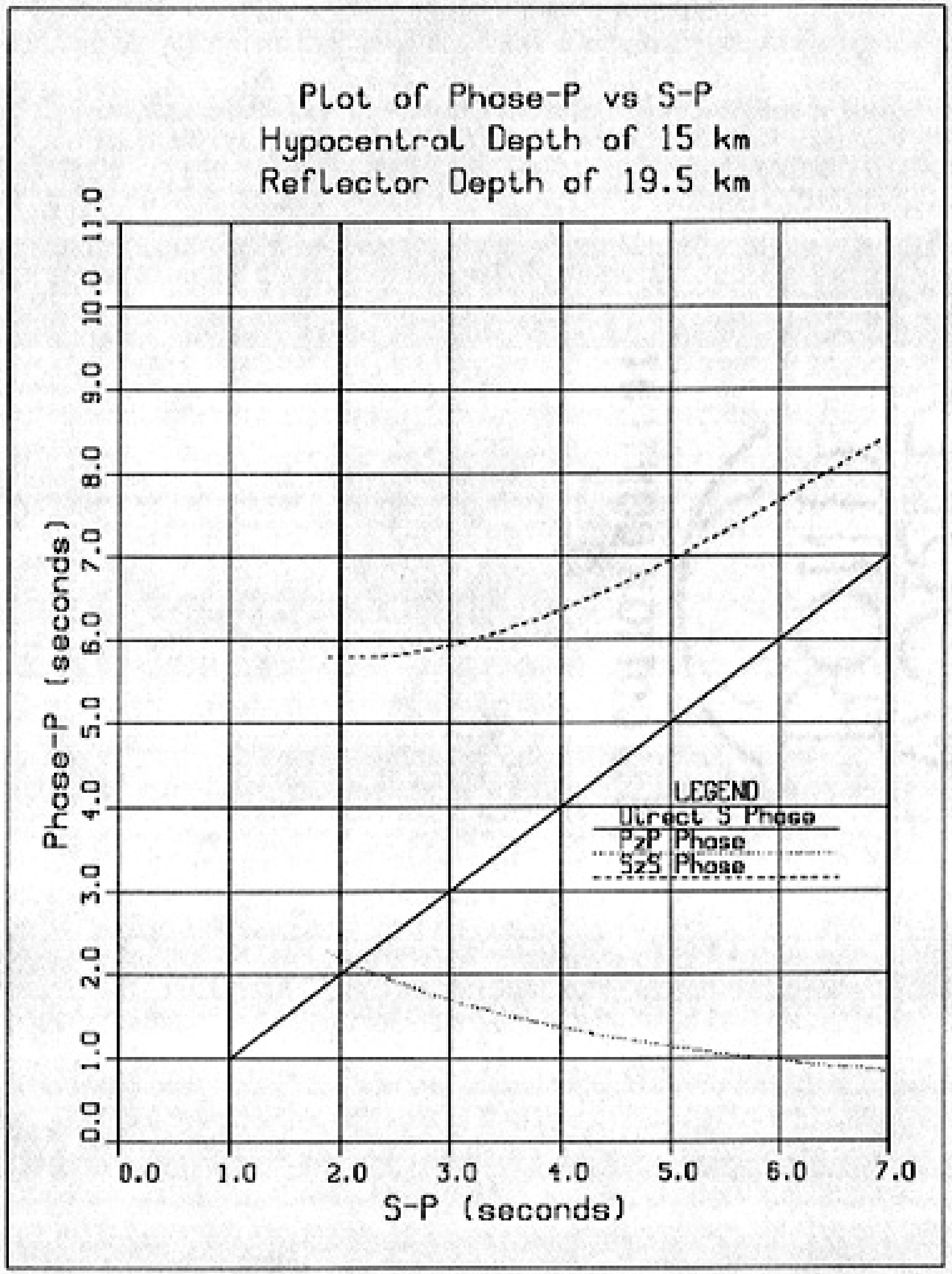

Plot of Phase-P vs S-P
Hypocentral Depth of 10 km
Reflector Depth of 19.5 km
Phase-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
S-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
LEGEND
Direct S Phase
PzP Phase
SzS Phase


Plot of Phase-P vs S-P
Hypocentral Depth of 11 km
Reflector Depth of 19.5 km
Phase-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
S-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
LEGEND
Direct S Phase
PzP Phase
SzS Phase


Plot of Phase-P vs S-P
Hypocentral Depth of 12 km
Reflector Depth of 19.5 km
Phase-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
S-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
LEGEND
Direct S Phase


Plot of Phase-P vs S-P
Hypocentral Depth of 13 km
Reflector Depth of 19.5 km
Phase-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
S-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
LEGEND
Direct S Phase


Plot of Phase-P vs S-P
Hypocentral Depth of 14 km
Reflector Depth of 19.5 km


Plot of Phase-P vs S-P
Hypocentral Depth of 15 km
Reflector Depth of 19.5 km
Phase-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
S-P (seconds)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
LEGEND
Direct S Phase
PzP Phase
SzS Phase

APPENDIX IV

UNIVARIATE STATISTICS

TABLE OF DATA STATISTICS

Univariate Statistics for All Stations All Data

	Depth	Magnitude	Distance	Azimuth
Mean	8.1	-0.1	33.6	215.0
Standard Deviation	4.5	0.4	14.3	98.0
Skewness	2.2	0.1	-0.2	0.0
Kurtosis	14.0	0.4	-0.7	-1.0
Minimum	0.1	-1.2	1.7	1.0
Maximum	41.2	1.1	62.6	358.0
Range	41.2	2.3	60.9	357.0
Coeficient Variable	0.6	-7.3	0.4	0.0
Count	204.0	204.0	204.0	204.0

Univariate Statistics for A/A and A/B Solutions

	Depth	Magnitude	Distance	Azimuth
Mean	8.43	-0.16	29.5	213.0
Standard Deviation	1.89	0.37	13.6	115.0
Skewness	-0.59	-0.43	-0.2	0.0
Kurtosis	-0.33	0.52	-1.1	-2.0
Minimum	3.69	-1.21	7.1	1.0
Maximum	11.34	0.58	55.6	349.0
Range	7.65	1.79	48.5	348.0
Coeficient Variable	0.22	-2.26	0.5	1.0
Count	65.00	65.00	65.0	65.0

Univariate Statistics for Station BMT

	Depth	Magnitude	Distance	Azimuth
Mean	8.19	-0.01	45.3	288.0
Standard Deviation	3.72	0.11	7.8	46.0
Skewness	0.66	0.34	-0.4	-3.0
Kurtosis	1.71	-0.09	-0.2	10.0
Minimum	0.54	-0.55	22.3	85.0
Maximum	19.79	-0.72	61.5	327.0
Range	19.25	1.44	39.2	242.0
Coeficient Variable	0.45	-50.25	0.2	0.0
Count	58.00	58.00	58.0	58.0

Univariate Statistics for Station MAG

	Depth	Magnitude	Distance	Azimuth
Mean	9.86	−0.07	34.8	276.0
Standard Deviation	6.77	0.40	7.8	33.0
Skewness	2.33	0.32	1.0	0.0
Kurtosis	8.93	0.60	1.3	−1.0
Minimum	0.06	−1.01	22.4	213.0
Maximum	41.22	0.94	56.7	320.0
Range	41.16	1.95	34.3	107.0
Coeficient Variable	0.69	−5.43	0.2	0.0
Count	43.00	43.00	43.0	43.0

Univariate Statistics for Station LPM

	Depth	Magnitude	Distance	Azimuth
Mean	4.87	−0.19	26.9	89.1
Standard Deviation	2.42	0.36	9.7	31.1
Skewness	−0.59	0.42	−1.0	0.4
Kurtosis	−1.02	0.71	0.7	3.5
Minimum	0.32	−0.85	1.7	1.0
Maximum	8.08	0.83	39.2	175.0
Range	7.76	1.68	37.5	174.0
Coeficient Variable	0.50	−1.88	0.4	0.3
Count	31.00	31.00	31.0	31.0

Univariate Statistics for Station WTX

	Depth	Magnitude	Distance	Azimuth
Mean	8.57	−0.22	13.9	116.0
Standard Deviation	3.23	0.41	8.1	57.0
Skewness	−0.20	−0.26	1.9	1.0
Kurtosis	3.80	0.91	0.7	0.0
Minimum	0.20	−1.21	2.5	17.0
Maximum	18.80	0.76	39.5	250.0
Range	18.60	1.97	32.4	233.0
Coeficient Variable	0.38	−1.88	0.6	0.3
Count	31.00	31.00	31.0	31.0

Univariate Statistics for Station SB

```
                          Depth      Magnitude      Distance      Azimuth
Mean                       8.31         0.25           37.5         240.0
Standard Deviation         3.41         0.45           17.5          14.7
Skewness                  -0.36         0.39            0.3           0.8
Kurtosis                  -0.87        -1.06           -1.4          -0.7
Minimum                    2.27        -0.28           14.1         225.0
Maximum                   12.80         1.09           62.6         269.0
Range                     10.53         1.37           48.5          44.0
Coeficient Variable        0.41         1.81            0.5           0.1
Count                     13.00        13.00           13.0          13.0
```

Univariate Statistics for Station LEM

```
                          Depth      Magnitude      Distance      Azimuth
Mean                       7.02        -0.14           22.0         189.0
Standard Deviation         3.61         0.35            8.1          95.0
Skewness                  -0.18        -1.08            0.0           0.0
Kurtosis                  -0.12         0.85           -1.2           0.0
Minimum                    0.42        -0.99            9.9           7.0
Maximum                   13.63         0.30           34.7         358.0
Range                     13.21         1.29           24.8         351.0
Coeficient Variable        0.51        -2.55            0.4           1.0
Count                     12.00        12.00           12.0          12.0
```

Univariate Statistics for Station LAZ

```
                          Depth      Magnitude      Distance      Azimuth
Mean                       9.12         0.04           47.9         343.0
Standard Deviation         3.44         0.41            6.4           3.6
Skewness                  -1.92        -0.40           -0.2          -0.7
Kurtosis                   2.27        -0.99           -1.2          -0.1
Minimum                    0.94        -0.60           38.7         337.0
Maximum                   11.66         0.58           55.6         349.0
Range                     10.72         1.18           16.9          12.0
Coeficient Variable        0.38         9.28            0.1           0.0
Count                      8.00         8.00            8.0           8.0
```

Univariate Statistics for Station BAR

	Depth	Magnitude	Distance	Azimuth
Mean	7.81	0.32	40.9	111.8
Standard Deviation	1.80	0.33	3.1	29.5
Skewness	1.50	-0.41	-0.9	-1.1
Kurtosis	0.25	-0.60	-0.5	-0.2
Minimum	7.00	-0.17	35.9	62.0
Maximum	11.03	0.73	43.8	140.0
Range	4.03	0.90	7.9	78.0
Coeficient Variable	0.23	1.01	0.1	0.3
Count	5.00	5.00	5.0	5.0

APPENDIX V

FORTRAN PROGRAMS USED

```
*======================================================================
* This program reads the header list and then calculates the point of
* reflection using the hypocentral depth from the Hypo71 solution, and
* an assumed reflector depth.  The program also produces a plot of the
* data using Disspla.
*======================================================================
*       Written By James Gridley.  Spring 1989.
*======================================================================
*       To Compile, you must be on a machine that has grafix then type:
*
*             f77 -w66 -f68881 file.f -o file -ldisspla
*
*======================================================================
* Initialize variables.  If you want to know what they mean figure it
* out yourself!
*
      integer orh,orm,latd,lond,no,dm,gap,m,in,nr,nm,nf,i,azm,l(100)
      real orsec,latm,lonm,depth,mag,rms,erh,erz,adj,avr,aar,avxm
      real sdxm,avfm,sdfm,ts,tp,dist,latmi,lonmi
      real long,lat
      real nlat1,nlat2,nlat3,nlong1,nlong2,nlong3
      real rdist1,rdist2,rdist3,h1,h2,h3
      character*1 q,anrf,anvec,anevt
      character*3 sqd,statn,statin
      character*10 filin
      character*60 title
      real lat,long
      real vp,vs,rdist1,rdist2,rdist3
      real z,tmp,klam,kphi
      real stlat,stlong,a(100),b(100)
      real a1(100),a2(100),a3(100),a4(100)
      real b1(100),b2(100),b3(100),b4(100)
*======================================================================
* Enter the datafile name.
*
      write(6,*)
      write(6,*)'Enter the name of the data file'
      write(6,*)'containing the data to be plotted.'
      write(6,*)'Current filename is "data.dat".'
      write(6,*)
      read(5,*)filin
      write(6,*)
*======================================================================
* Open the file specified by the user above with the header list.
*
        open (unit=10,file=filin,access='sequential')
        open (unit=11,file='Rinehart',access='sequential')
        open (unit=12,file='ccorp.dat',access='sequential')
*======================================================================
        do 35 k=1,29
        read(11,36) a(k),b(k)
35      continue
36      format(f8.3,1x,f6.3)
        do 37 k=1,26
        read(12,38) l(k),a1(k),b1(k)
37      continue
38      format(i3,1x,f7.4,1x,f9.4)
        do 39 k=1,13
        read(12,38) l(k),a2(k),b2(k)
39      continue
```

```
        do 40 k=1,8
        read(12,38) l(k),a3(k),b3(k)
40      continue
        do 41 k=1,6
        read(12,38) l(k),a4(k),b4(k)
41      continue
*-----------------------------------------------------------------------
* Enter station of interest, or all the data.
*
        write(6,*)
        write(6,*) 'Enter station name to be used'
        write(6,*) 'For all stations, enter "all"'
        write(6,*) 'For station names be sure to use UPPER CASE LETTERS!'
        write(6,*)
        read(5,*) statin
        write(6,*)
        write(6,*) 'Enter "y" if you want reflection epicenters plotted'
        read(5,*) anrf
        write(6,*) 'Enter "y" if you want uncertainties  plotted'
        read(5,*) anvec
        write(6,*) 'Enter "y" if you want event epicenters plotted'
        read(5,*) anevt
*-----------------------------------------------------------------------
* Initalize some values just for the heck of it.
*
        pi=3.1415927
        vp=5.85
        vs=3.38
*-----------------------------------------------------------------------
* Enter the assumed reflector depth.
*
        write(6,*)
        write(6,*) 'Specify the reflector depth in Km.'
        write(6,*)
        read (5,*) z
        write(6,*)
*-----------------------------------------------------------------------
* Begin the subroutine calls for the plot.
*
       call comprs
       call hwrot('movie')
       call popnam ('net.plt$',100)
       write(6,*)
       write(6,*) 'The plot-filename is "net.plt"'
       write(6,*)
*
* Note that the area used has been scaled to the values given by
* Richter (1958).
*
       call area2d (7.,8.42)
c       call frame
       call xname('Longitude$',100)
       call yname('Latitude$',100)
       write(6,*)
       write(6,*)'Enter the title of the plot, add "$" at'
       write(6,*)'the end of the title.'
       write(6,*)
       read(5,25)title
       write(6,*)
 25    format(a60)
```

```
c       call headin ('Figure 8a$',100,2.,4)
      call headin ('Reflection Epicenters$',100,2.,3)
      call headin ('h=8.34, km z=19.5 Km$',100,2.,3)
c       call headin ('New Mexico Tech$',100,2.,3)
c       call headin ('Seismic Network$',100,2.,3)
c       call headin ('1989$',100,2.,3)
      call headin ('Uncertainty of 2 s.d.$',100,2.,3)
      call thkfrm (0.03)
      call xticks (1)
c       call yticks (5)
      call yaxang (0.)
      call graf (-107.4,0.20,-106.4,33.7,0.10,34.7)
      jj=0
*======================================================================
      write(6,*)
      write(6,*)'The program knows when the end of the data is reached'
      write(6,*)
*======================================================================
* Set up loop to read the datafile
* Automatic read statement keeps track of the end of the file
*
   20 read(10,21,end=100) dty,dtm,dtd,orh,orm,orsec,latd,latm,lond,lonm,
     +depth,mag,no,dm,gap,m,rms,erh,erz,q,sqd,
     +adj,in,nr,avr,aar,nm,avxm,sdxm,nf,avfm,sdfm,i,statn,dist,azm,tp,ts
   21 format(1x,i2,i2,i2,1x,i2,i2,1x,f5.2,1x,i2,1x,f5.2,1x,i3,1x,f5.2,
     +2x,f5.2,2x,f5.2,1x,i2,i3,1x,i3,1x,i1,1x,f4.2,f5.1,f5.1,1x,a1,1x,
     +a3,f5.2,1x,i2,1x,i2,1x,f4.2,1x,f4.2,1x,i2,1x,f4.1,1x,f4.1,
     +1x,i2,2x,f3.1,2x,f3.1,1x,i1,1x,a3,1x,f4.1,1x,i3,1x,f5.2,1x,f5.2)
*======================================================================
*      write(6,21) dty,dtm,dtd,orh,orm,orsec,latd,latm,lond,lonm,
*     +depth,mag,no,dm,gap,m,rms,erh,erz,q,sqd,
*     +adj,in,nr,avr,aar,nm,avxm,sdxm,nf,avfm,sdfm,i,statn,dist,azm,tp,ts
*       write(6,*)ji
*======================================================================
* Check for correct station, or all stations
*
       if (statin .EQ. 'all' .OR. statin .EQ. statn) then
       goto 80
       else
       goto 99
       endif
*======================================================================
* This part of the program changes the read longitude and latitiude
* into decimal form, the form necessary for Disppla plotting.
*
80      latmi=latm/60.
        lat=latd+latmi
        lonmi=lonm/60.
        long=(lond+lonmi)
        h1=8.34
        h2=4.56
        h3=12.12
        jj=jj+1
*======================================================================
* Get the correct station location for calculations of the reflection point
*
        if (statn .EQ. 'LAZ') then
        stlat=34.4200
        stlong=107.1393
        else if (statn .EQ. 'BAR') then
```

```
       stlat=34.1420
       stlong=106.6280
       else if (statn .EQ. 'LPM') then
       stlat=34.3128
       stlong=106.6338
       else if (statn .EQ. 'SB ') then
       stlat=33.9742
       stlong=107.1807
       else if (statn .EQ. 'WTX') then
       stlat=34.0722
       stlong=106.9458
       else if (statn .EQ. 'BMT') then
       stlat=34.2750
       stlong=107.2602
       else if (statn .EQ. 'MAG') then
       stlat=34.1625
       stlong=107.2320
       else if (statn .EQ. 'LJY') then
       stlat=34.3365
       stlong=106.8958
       else if (statn .EQ. 'LEM') then
       stlat=34.1645
       stlong=106.9742
       else if (statn .EQ. 'SMC') then
       stlat=33.7787
       stlong=107.0193
       else if (statn .EQ. 'CAR') then
       stlat=33.9525
       stlong=106.7345
       endif
*
*======================================================================
*  phi=longitude  lam=latitude
*======================================================================
*      write(6,*) stlong,stlat,long,lat
*======================================================================
* Make the inital calcultions of the distance from the station
* to the reflection point.
*
       rdist1=((dist*(z-h1))/((2.*z)-h1))
       rdist2=((dist*(z-h2))/((2.*z)-h2))
       rdist3=((dist*(z-h3))/((2.*z)-h3))
*======================================================================
* Calculate the longitude and latitude of the reflection point using
* the calculated distance from the station, the read azimuth from the station
* to the event, and the station location.
*
       if (azm .gt. 0 .and. azm .le. 90) then
       tmp=float(azm)
       tmp=(tmp*pi)/180.
       angle=tmp
       dphi0=abs(stlong-long)
       dlam0=abs(stlat-lat)
       dphi1=(rdist1*dphi0)/dist
       dlam1=(rdist1*dlam0)/dist
       dphi2=(rdist2*dphi0)/dist
       dlam2=(rdist2*dlam0)/dist
       dphi3=(rdist3*dphi0)/dist
       dlam3=(rdist3*dlam0)/dist
       kphi=-1
```

```
        klam=1
        nlong1=long + (kphi*dphi1)
        nlat1= lat  + (klam*dlam1)
        nlong2=long + (kphi*dphi2)
        nlat2= lat  + (klam*dlam2)
        nlong3=long + (kphi*dphi3)
        nlat3= lat  + (klam*dlam3)
*
        else if (azm .gt. 90 .and. azm .le. 180) then
        azm=180-azm
        tmp=float(azm)
        tmp=(tmp*pi)/180.
        angle=tmp
        dphi0=abs(stlong-long)
        dlam0=abs(stlat-lat)
        dphi1=(rdist1*dphi0)/dist
        dlam1=(rdist1*dlam0)/dist
        dphi2=(rdist2*dphi0)/dist
        dlam2=(rdist2*dlam0)/dist
        dphi3=(rdist3*dphi0)/dist
        dlam3=(rdist3*dlam0)/dist
        kphi=-1
        klam=-1
        nlong1=long + (kphi*dphi1)
        nlat1= lat  + (klam*dlam1)
        nlong2=long + (kphi*dphi2)
        nlat2= lat  + (klam*dlam2)
        nlong3=long + (kphi*dphi3)
        nlat3= lat  + (klam*dlam3)
*
        else if (azm .gt. 180 .and. azm .le. 270) then
        azm=270-azm
        tmp=float(azm)
        tmp=(tmp*pi)/180.
        angle=tmp
        dphi0=abs(stlong-long)
        dlam0=abs(stlat-lat)
        dphi1=(rdist1*dphi0)/dist
        dlam1=(rdist1*dlam0)/dist
        dphi2=(rdist2*dphi0)/dist
        dlam2=(rdist2*dlam0)/dist
        dphi3=(rdist3*dphi0)/dist
        dlam3=(rdist3*dlam0)/dist
        kphi=1
        klam=-1
        nlong1=long + (kphi*dphi1)
        nlat1= lat  + (klam*dlam1)
        nlong2=long + (kphi*dphi2)
        nlat2= lat  + (klam*dlam2)
        nlong3=long + (kphi*dphi3)
        nlat3= lat  + (klam*dlam3)
*
        else
        azm=360-azm
        tmp=float(azm)
        tmp=(tmp*pi)/180.
        angle=tmp
        dphi0=abs(stlong-long)
        dlam0=abs(stlat-lat)
        dphi1=(rdist1*dphi0)/dist
```

```
        dlam1=(rdist1*dlam0)/dist
         dphi2=(rdist2*dphi0)/dist
         dlam2=(rdist2*dlam0)/dist
        dphi3=(rdist3*dphi0)/dist
         dlam3=(rdist3*dlam0)/dist
        kphi=1
        klam=1
        nlong1=long + (kphi*dphi1)
        nlat1= lat  + (klam*dlam1)
        nlong2=long + (kphi*dphi2)
        nlat2= lat  + (klam*dlam2)
        nlong3=long + (kphi*dphi3)
        nlat3= lat  + (klam*dlam3)
*
        endif
*=======================================================================
* Make sure that all distances and signs are correct
*
        nlong1=-abs(nlong1)
        nlong2=-abs(nlong2)
        nlong3=-abs(nlong3)
        long=-abs(long)
*=======================================================================
* Plot the reflectin point
*
        if (anrf .EQ. 'y') then
        call marker (3)
        call curve (nlong1,nlat1,1,-1)
        endif
c       call height(0.025)
c       call rlint(jj,nlong1,nlat1)
*=======================================================================
        if (anvec .EQ. 'y') then
        call rlvec(nlong2,nlat2,nlong3,nlat3,0)
        endif
*=======================================================================
* Plot the event
*
        if (anevt .EQ. 'y') then
        call marker (16)
        call curve (long,lat,1,-1)
        endif
*=======================================================================
* End the read loop
*
99      goto 20
100     continue
        write(6,*)
        write(6,*) 'The number of data used is ',jj
        write(6,*)
*=======================================================================
* Plot a grid on the map
*
        call grid (1,1)
*=======================================================================
*
*       plot the seismic network and a few cities
*

       call marker (2)
```

```
      call height(0.085)
       call curve(-107.1393,34.4200,1,-1)
      call rlmess('LAZ$',100,-107.130,34.4200)
      call marker (2)
      call curve(-106.6280,34.1420,1,-1)
      call rlmess('BAR$',100,-106.6187,34.1420)
      call marker (2)
      call curve(-106.6338,34.3128,1,-1)
      call rlmess('LPM$',100,-106.6245,34.3128)
      call marker (2)
      call curve(-107.1807,33.9752,1,-1)
      call rlmess('SB$',100,-107.2182,33.9752)
      call marker (2)
      call curve(-106.9458,34.0722,1,-1)
      call rlmess('WTX$',100,-106.9958,34.0722)
      call marker (2)
      call curve(-107.2602,34.2750,1,-1)
      call rlmess('BMT$',100,-107.3102,34.2750)
      call marker (2)
      call curve(-107.2320,34.1625,1,-1)
      call rlmess('MAG$',100,-107.2820,34.1625)
      call marker (2)
      call curve(-106.8958,34.3365,1,-1)
      call rlmess('LJY$',100,-106.8865,34.3365)
      call marker (2)
      call curve(-106.9742,34.1655,1,-1)
      call rlmess('LEM$',100,-107.0242,34.1655)
      call marker (2)
      call curve(-107.0193,33.7787,1,-1)
      call rlmess('SMC$',100,-107.0693,33.7787)
      call marker (2)
      call curve(-106.7345,33.9525,1,-1)
      call rlmess('CAR$',100,-106.7252,33.9525)
      call height(0.1)
      call marker (18)
      call curve(-106.901,34.255,1,-1)
      call rlmess('SAN ACACIA$',100,-106.88,34.255)
      call marker (18)
      call curve(-106.9,34.067,1,-1)
      call rlmess('SOCORRO$',100,-106.88,34.067)
      call marker (18)
      call curve(-107.241667,34.1,1,-1)
      call rlmess('MAGDALENA$',100,-107.221,34.1)
      call marker (18)
      call curve(-106.81667,34.4,1,-1)
      call rlmess('BERNARDO$',100,-106.80,34.4)
      call marker (18)
      call curve(-106.88333,33.88333,1,-1)
      call rlmess('SAN ANTONIO$',100,-106.87333,33.88333)
c      call marker (18)
c      call curve(-107.33333,33.63333,1,-1)
c      call rlmess('DUSTY$',100,-107.32333,33.63333)
c      call marker (18)
c      call curve(-106.36666,33.90000,1,-1)
c      call rlmess('BINGHAM$',100,-106.47966,33.91000)
      call marker (18)
      call curve(-106.88333,33.99986,1,-1)
      call rlmess('LUIS LOPEZ$',100,-106.87000,33.99986)
      call marker (18)
      call curve(-106.84167,34.34967,1,-1)
```

```
        call rlmess('LA JOYA$',100,-106.83000,34.34967)
c        call marker (6)
c        call curve(-107.01,34.50,1,-1)
c        call marker (6)
c        call curve(-107.06,34.07,1,-1)
c        call marker (6)
c        call curve(-106.75,34.22,1,-1)
c        call marker (6)
c        call curve(-106.68,34.35,1,-1)
c        call marker (6)
c        call curve(-106.690,34.42,1,-1)
c        call marker (6)
c        call curve(-106.695,34.44,1,-1)
         call curve (a,b,29,0)
         call curve (b1,a1,24,1)
         call curve (b2,a2,12,1)
         call curve (b3,a3,8,1)
         call curve (b4,a4,6,1)
*-----------------------------------------------------------------------
* Close the datafile and end the plot
*
         close (unit=10)
          call endpl (0)
         call donepl
         end
```

```
*======================================================================
* This program reads the header list and then calculates the point of
* reflection using the hypocentral depth from the Hypo71 solution, and
* an assumed reflector depth.  The program also produces a plot of the
* data using Disspla.  Note that this program is used on NON-REFLECTION
* DATA !!!!!
*======================================================================
*       Written By James Gridley.  Spring 1989.
*======================================================================
*       To Compile, you must be on a machine that has grafix then type:
*
*            f77 -w66 -f68881 file.f -o file -ldisspla
*
*======================================================================
* Initialize variables.  If you want to know what they mean figure it
* out yourself!
*
      integer orh,orm,latd,lond,no,dm,gap,m,in,nr,nm,nf,i,ij
      real orsec,latm,lonm,depth,mag,rms,erh,erz,adj,avr,aar,avxm
      real sdxm,avfm,sdfm,dist(90000),latmi,lonmi,azm(90000)
      real dl(90000),dp(90000),lamdist(90000),phidist(90000)
      real lat(90000),long(90000)
      real nlatl(90000),nlongl(90000)
      real rdistl(90000),hl,angle(900000)
      real dphi0(90000),dlam0(90000)
      real dphil(90000),dlaml(90000)
      character*l q
      real lat,long
      real vp,vs,rdistl(900000)
      real z,tmp(90000),klam,kphi
      real stlat(100),stlong(100)
*======================================================================
        open (unit=10,file='thry.dat',access='old')
        pi=3.1415927
        vp=5.85
        vs=3.38
        z=19.5
       call comprs
       call hwrot('movie')
       call popnam ('thry.plt$',100)
c       call area2d (6.,7.22)
        call area2d (7.,8.42)
       call frame
       call xname('Longitude$',100)
       call yname('Latitude$',100)
       call headin ('Theoretical Reflection Points$',100,2.,3)
       call headin ('All Stations$',100,2.,3)
       call headin ('h=8.34 Km z=19.5 Km$',100,2.,3)
       call thkfrm (0.03)
       call xticks (1)
c       call yticks (5)
       call yaxang (0.)
       call graf (-107.4,0.20,-106.4,33.7,0.10,34.7)
        call grid (1,1)
*======================================================================
*
*       plot the seismic network and a few cities
*


       call marker (2)
```

```
      call height(0.085)
      call curve(-107.1393,34.4200,1,-1)
      call rlmess('LAZ$',100,-107.130,34.4200)
      call marker (2)
      call curve(-106.6280,34.1420,1,-1)
      call rlmess('BAR$',100,-106.6187,34.1420)
      call marker (2)
      call curve(-106.6338,34.3128,1,-1)
      call rlmess('LPM$',100,-106.6245,34.3128)
      call marker (2)
      call curve(-107.1807,33.9752,1,-1)
      call rlmess('SB$',100,-107.2182,33.9752)
      call marker (2)
      call curve(-106.9458,34.0722,1,-1)
      call rlmess('WTX$',100,-106.9958,34.0722)
      call marker (2)
      call curve(-107.2602,34.2750,1,-1)
      call rlmess('BMT$',100,-107.3102,34.2750)
      call marker (2)
      call curve(-107.2320,34.1625,1,-1)
      call rlmess('MAG$',100,-107.2820,34.1625)
      call marker (2)
      call curve(-106.8958,34.3365,1,-1)
      call rlmess('LJY$',100,-106.8865,34.3365)
      call marker (2)
      call curve(-106.9742,34.1655,1,-1)
      call rlmess('LEM$',100,-107.0242,34.1655)
      call marker (2)
      call curve(-107.0193,33.7787,1,-1)
      call rlmess('SMC$',100,-107.0693,33.7787)
      call marker (2)
      call curve(-106.7345,33.9525,1,-1)
      call rlmess('CAR$',100,-106.7252,33.9525)
      call height(0.1)
      call marker (18)
      call curve(-106.901,34.255,1,-1)
      call rlmess('SAN ACACIA$',100,-106.88,34.255)
      call marker (18)
      call curve(-106.9,34.067,1,-1)
      call rlmess('SOCORRO$',100,-106.88,34.067)
      call marker (18)
      call curve(-107.241667,34.1,1,-1)
      call rlmess('MAGDALENA$',100,-107.221,34.1)
      call marker (18)
      call curve(-106.81667,34.4,1,-1)
      call rlmess('BERNARDO$',100,-106.80,34.4)
      call marker (18)
      call curve(-106.88333,33.88333,1,-1)
      call rlmess('SAN ANTONIO$',100,-106.87333,33.88333)
c      call marker (18)
c      call curve(-107.33333,33.63333,1,-1)
c      call rlmess('DUSTY$',100,-107.32333,33.63333)
c      call marker (18)
c      call curve(-106.36666,33.90000,1,-1)
c      call rlmess('BINGHAM$',100,-106.47966,33.91000)
      call marker (18)
      call curve(-106.88333,33.99986,1,-1)
      call rlmess('LUIS LOPEZ$',100,-106.87000,33.99986)
      call marker (18)
```

```
       call curve(-106.84167,34.34967,1,-1)
       call rlmess('LA JOYA$',100,-106.83000,34.34967)
       jj=0
        stlat(1)=34.4200
        stlong(1)=107.1393
        stlat(2)=34.1420
        stlong(2)=106.6280
        stlat(3)=34.3128
        stlong(3)=106.6338
        stlat(4)=33.9742
        stlong(4)=107.1807
        stlat(5)=34.0722
        stlong(5)=106.9458
        stlat(6)=34.2750
        stlong(6)=107.2602
        stlat(7)=34.1625
        stlong(7)=107.2320
        stlat(8)=34.3365
        stlong(8)=106.8958
        stlat(9)=34.1645
        stlong(9)=106.9742
        stlat(10)=33.9525
        stlong(10)=106.7345
*------------------------------------------------------------------------
   20 read(10,21,end=100) dty,dtm,dtd,orh,orm,orsec,latd,latm,lond,lonm,
     +depth,mag,no,dm,gap,m,rms,erh,erz,q,sqd,
     +adj,in,nr,avr,aar,nm,avxm,sdxm,nf,avfm,sdfm,i
   21 format(1x,i2,i2,i2,1x,i2,i2,1x,f5.2,1x,i2,1x,f5.2,1x,i3,1x,f5.2,
     +2x,f5.2,2x,f5.2,1x,i2,i3,1x,i3,1x,i1,1x,f4.2,f5.1,f5.1,1x,a1,1x,
     +a3,f5.2,1x,i2,1x,i2,1x,f4.2,1x,f4.2,1x,i2,1x,f4.1,1x,f4.1,
     +1x,i2,2x,f3.1,2x,f3.1,1x,i1)
        jj=jj+1
        do 5 ii=1,10
        latmi=latm/60.
        lat(ii)=latd+latmi
        lonmi=lonm/60.
        long(ii)=(lond+lonmi)
5       continue
        h1=8.34
*
*------------------------------------------------------------------------
*  phi=longitude  lam=latitude
*------------------------------------------------------------------------
* Calculate the azimuth and distance from the chosen station
* to the event.
*
        do 50 ij=1,10
        if(long(ij) .LT. stlong(ij) .AND. lat(ij) .GT. stlat(ij)) then
        dp(ij)=abs((stlong(ij)-long(ij))*60.)
        dl(ij)=abs((stlat(ij)-lat(ij))*60.)
        phidist(ij)=abs(dp(ij)*1.8487295)
        lamdist(ij)=abs(dl(ij)*1.5365)
        dist(ij)=sqrt((phidist(ij)*phidist(ij))+(lamdist(ij)*lamdist(ij)))
        azm(ij)=atan(phidist(ij)/lamdist(ij))
        azm(ij)=(azm(ij)*180.)/pi
*
        else if (long(jj) .LT. stlong(ij) .AND. lat(jj) .LT. stlat(ij)) then
        dp(ij)=abs((stlong(ij)-long(ij))*60.)
        dl(ij)=abs((stlat(ij)-lat(ij))*60.)
        phidist(ij)=abs(dp(ij)*1.8487295)
```

```
        lamdist(ij)=abs(dl(ij)*1.5365)
        dist(ij)=sqrt((phidist(ij)*phidist(ij))+(lamdist(ij)*lamdist(ij)))
        azm(ij)=atan(lamdist(ij)/phidist(ij))
        azm(ij)=(azm(ij)*180.)/pi
        azm(ij)=azm(ij)+90.
*
        else if (long(ij) .GT. stlong(ij) .AND. lat(ij) .LT. stlat(ij)) then
        dp(ij)=abs((stlong(ij)-long(ij))*60.)
        dl(ij)=abs((stlat(ij)-lat(ij))*60.)
        phidist(ij)=(dp(ij)*1.8487295)
        lamdist(ij)=(dl(ij)*1.5365)
        dist(ij)=sqrt((phidist(ij)*phidist(ij))+(lamdist(ij)*lamdist(ij)))
        azm(ij)=atan(phidist(ij)/lamdist(ij))
        azm(ij)=(azm(ij)*180.)/pi
        azm(ij)=azm(ij)+180.
*
        else
c       else if (long .GT. stlong(ij) .AND. lat .GT. stlat(ij))
        dp(ij)=abs((stlong(ij)-long(ij))*60.)
        dl(ij)=abs((stlat(ij)-lat(ij))*60.)
        phidist(ij)=(dp(ij)*1.8487295)
        lamdist(ij)=(dl(ij)*1.5365)
        dist(ij)=sqrt((phidist(ij)*phidist(ij)) + (lamdist(ij)*lamdist(ij)))
        azm(ij)=atan(lamdist(ij)/phidist(ij))
        azm(ij)=(azm(ij)*180.)/pi
        azm(ij)=azm(ij)+270.
*
        endif
*
        rdistl(ij)=((dist(ij)*(z-hl))/((2.*z)-hl))
*
        if (azm(ij) .gt. 0 .and. azm(ij) .le. 90) then
        tmp(ij)=float(azm(ij))
        tmp(ij)=(tmp(ij)*pi)/180.
        angle(ij)=tmp(ij)
        dphi0(ij)=abs(stlong(ij)-long(ij))
        dlam0(ij)=abs(stlat(ij)-lat(ij))
        dphil(ij)=(rdistl(ij)*dphi0(ij))/dist(ij)
        dlaml(ij)=(rdistl(ij)*dlam0(ij))/dist(ij)
        kphi=1
        klam=-1
        nlongl(ij)=long(ij) + (kphi*dphil(ij))
        nlatl(ij)= lat(ij)  + (klam*dlaml(ij))
*
        else if (azm(ij) .gt. 90 .and. azm(ij) .le. 180) then
        azm(ij)=180-azm(ij)
        tmp(ij)=float(azm(ij))
        tmp(ij)=(tmp(ij)*pi)/180.
        angle(ij)=tmp(ij)
        dphi0(ij)=abs(stlong(ij)-long(ij))
        dlam0(ij)=abs(stlat(ij)-lat(ij))
        dphil(ij)=(rdistl(ij)*dphi0(ij))/dist(ij)
        dlaml(ij)=(rdistl(ij)*dlam0(ij))/dist(ij)
        kphi=1
        klam=1
        nlongl(ij)=long(ij) + (kphi*dphil(ij))
        nlatl(ij)= lat(ij)  + (klam*dlaml(ij))
*
        else if (azm(ij) .gt. 180 .and. azm(ij) .le. 270) then
        azm(ij)=270-azm(ij)
```

```
        tmp(ij)=float(azm(ij))
        tmp(ij)=(tmp(ij)*pi)/180.
        angle(ij)=tmp(ij)
        dphi0(ij)=abs(stlong(ij)-long(ij))
        dlam0(ij)=abs(stlat(ij)-lat(ij))
        dphil(ij)=(rdistl(ij)*dphi0(ij))/dist(ij)
        dlaml(ij)=(rdistl(ij)*dlam0(ij))/dist(ij)
        kphi=-1
        klam=1
        nlongl(ij)=long(ij) + (kphi*dphil(ij))
        nlatl(ij)= lat(ij)  + (klam*dlaml(ij))
*
        else
        azm(ij)=360-azm(ij)
        tmp(ij)=float(azm(ij))
        tmp(ij)=(tmp(ij)*pi)/180.
        angle(ij)=tmp(ij)
        dphi0(ij)=abs(stlong(ij)-long(ij))
        dlam0(ij)=abs(stlat(ij)-lat(jj))
        dphil(ij)=(rdistl(ij)*dphi0(ij))/dist(ij)
        dlaml(ij)=(rdistl(ij)*dlam0(ij))/dist(ij)
        kphi=-1
        klam=-1
        nlongl(ij)=long(ij) + (kphi*dphil(ij))
        nlatl(ij)= lat(ij)  + (klam*dlaml(ij))
*
        endif
*=====================================================================
* Make sure that all distances and signs are correct
*
        nlongl(ij)=-abs(nlongl(ij))
        long(ij)=-abs(long(ij))
c       write(6,*) long(ij),lat(ij),nlongl(ij),nlatl(ij),ij
50      continue
*=====================================================================
* Plot the reflectin point
*
c       call height(0.05)
        call sclpic (0.5)
c       call marker (16)
c       call marker (3)
        call marker (15)
        call curve (nlongl,nlatl,10,-1)
c       write(6,*) nlongl,nlatl,long,lat
*=====================================================================
* Plot the event
*
c        call marker (3)
c        call curve (long,lat,1,-1)
*=====================================================================
* End the read loop
*
c       write(6,*) 'Data line number ',jj
99      goto 20
100     continue
c        write(6,*)
c       write(6,*) 'The number of data used is ',jj
c        write(6,*)
*=====================================================================
        call grid (1,1)
```

```
*-------------------------------------------------------------------------
*
*-------------------------------------------------------------------------
* Close the datafile and end the plot
*
        close (unit=10)
        call endpl (0)
        call donepl
        end
```

```
      integer orh,orm,latd,lond,no,dm,gap,m,in,nr,nm,nf,i,azm,ii
      real orsec,latm,lonm,depth,mag,rms,erh,erz,adj,avr,aar,avxm
      real sdxm,avfm,sdfm,ts,tp,dist,stat1(1000)
        real x1(1000),x2(1000),x3(1000),x4(1000),x5(1000)
        real x6(1000),stat2(1000),stat3(1000),stat5(1000),stat6(1000)
        real stat4(1000)
      character*1 q
      character*3 sqd,statn,statin
c      write(6,*)'Enter station name to be used'
c      write(6,*)'For all the stations at one time enter "all"'
c      read(5,*) statin
*
c      write(6,*)'enter file name to be altered'
c      read(5,15)fnamin
*

        open (unit=10,file='data.bak',access='sequential')
        open (unit=11,file='AB.dat',access='sequential')

*
*
        ii=0
   20 read(10,21,end=100) dty,dtm,dtd,orh,orm,orsec,latd,latm,lond,lonm,
     +depth,mag,no,dm,gap,m,rms,erh,erz,q,sqd,
     +adj,in,nr,avr,aar,nm,avxm,sdxm,nf,avfm,sdfm,i,statn,dist,azm,tp,ts
   21 format(1x,i2,i2,i2,1x,i2,i2,1x,f5.2,1x,i2,1x,f5.2,1x,i3,1x,f5.2,
     +2x,f5.2,2x,f5.2,1x,i2,i3,1x,i3,1x,i1,1x,f4.2,f5.1,f5.1,1x,a1,1x,
     +a3,f5.2,1x,i2,1x,i2,1x,f4.2,1x,f4.2,1x,i2,1x,f4.1,1x,f4.1,
     +1x,i2,2x,f3.1,2x,f3.1,1x,i1,1x,a3,1x,f4.1,1x,i3,1x,f5.2,1x,f5.2)
c       if (dist .GT. 70.) write(6,*)dty,dtm,dtd,orh,orm
c       if (dist .GT. 90.) goto 99
c       if (sqd .EQ. 'A!A' .OR. sqd .EQ. 'A!B') then
*-----------------------------------------------------------------------------
c      write(11,22) dty,dtm,dtd,orh,orm,orsec,latd,latm,
c     +lond,lonm,depth,mag,no,dm,gap,m,rms,erh,erz,q,sqd,
c     +adj,in,nr,avr,aar,nm,avxm,sdxm,nf,avfm,sdfm,i,statn,dist,azm,tp,ts
c   22 format(1x,i2,i2,i2,1x,i2,i2,1x,f5.2,1x,i2,1x,f5.2,1x,i3,1x,f5.2,
c     +2x,f5.2,2x,f5.2,1x,i2,i3,1x,i3,1x,i1,1x,f4.2,f5.1,f5.1,1x,a1,1x,
c     +a3,f5.2,1x,i2,1x,i2,1x,f4.2,1x,f4.2,1x,i2,1x,f4.1,1x,f4.1,
c     +1x,i2,2x,f3.1,2x,f3.1,1x,i1,1x,a3,1x,f4.1,1x,i3,1x,f5.2,1x,f5.2)
c       endif
*-----------------------------------------------------------------------------
        statin='CAR'
        if (statin .EQ. 'all' .OR. statin .EQ. statn) then
        go to 25
        else
        go to 99
25      ii=ii+1
        x1(ii)=depth
        x2(ii)=mag
        x3(ii)=erh
        x4(ii)=erz
        x5(ii)=dist
        x6(ii)=azm
c       write(6,*) x1(ii),x2(ii),x3(ii),x4(ii),x5(ii),x6(ii)

        endif
99      go to 20
100     continue
        if (statin .EQ. 'all') then
```

```
write (6,*) 'Stats for all stations'
else if (statin .NE. statn) then
write (6,*) 'Stats for station ',statin
endif
write(6,*)'Depth'
call uvsta(0,ii,1,x1,1000,0,0,1,0,0,1,stat1,1000,0)
write(6,*)'Magnitude'
call uvsta(0,ii,1,x2,1000,0,0,1,0,0,1,stat2,1000,0)
write(6,*)'Error in h'
call uvsta(0,ii,1,x3,1000,0,0,1,0,0,1,stat3,1000,0)
write(6,*)'Error in z'
call uvsta(0,ii,1,x4,1000,0,0,1,0,0,1,stat4,1000,0)
write(6,*)'Distance'
call uvsta(0,ii,1,x5,1000,0,0,1,0,0,1,stat5,1000,0)
write(6,*)'Azimuth'
call uvsta(0,ii,1,x6,1000,0,0,1,0,0,1,stat6,1000,0)

stop
end
```

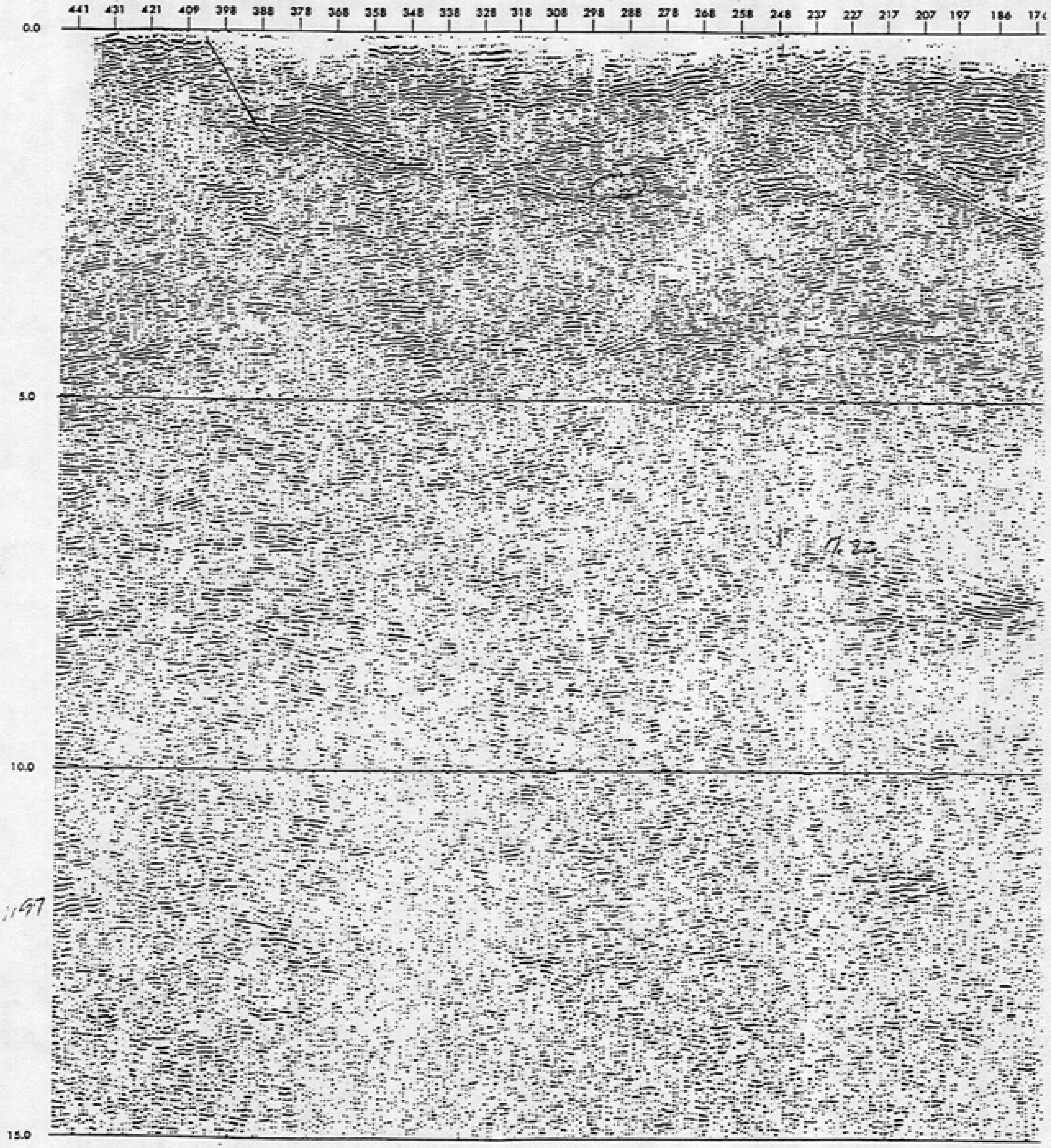
```
       character string(100)
*
      dimension xl(1000),yl(1000),zl(1000),temp(100),templ(100)
       double precision d,sp,sxs,pxp,sxsp,pxpp,z,vp,vs,dref,k
*
*
c   ******************************************************
c   *      program to model reflection phases given      *
c   *      certain information.  all results assume      *
c   *      a p-wave arrivial of 0.0 seconds, and a       *
c   *      depth to reflector of 19 km                   *
c   *----------------------------------------------------*
c   *      created by Jim Gridley                        *
c   *      August 25, 1988                               *
c   ******************************************************
c  For the S-phase
c
       temp(1)=1.0
       temp(2)=2.0
       temp(3)=3.0
       temp(4)=4.0
       temp(5)=5.0
       temp(6)=6.0
       temp(7)=7.0
       templ(1)=1.0
       templ(2)=2.0
       templ(3)=3.0
       templ(4)=4.0
       templ(5)=5.0
       templ(6)=6.0
       templ(7)=7.0
c
      call comprs
      call popnam ('ref.plt$',100)
      call area2d (7.,8.)
      call height(0.15)
      call xname('S-P (seconds)$',100)
      call yname('Phase-P (seconds)$',100)
       call height(0.20)
      call headin('Plot of Phase-P vs S-P$',100,1.,3)
      call headin('Hypocentral Depth of 7 km$',100,1.,3)
      call headin('Reflector Depth of 19.5 km$',100,1.,3)
       call graf(0.0,1.0,7.0,0.0,1.0,11.0)
      call height (0.15)
c      write (6,*)'Enter hypocentral depth in kilometers (e.g. 8.00)'
c      read(5,*)z
c      write (6,*)'Enter P-wave velocity (usually 5.85 km/s)'
c      read (5,*) vp
c      write (6,*)'Enter S-wave velocity (usually 3.38 km/s)'
c      read (5,*) vs
c      write (6,*)'Enter depth to reflector (usually 19.50 km)'
c      read (5,*) dref
       z=7.0
       vp=5.85
       vs=3.38
       dref=19.5
       a=0.00
       ii=1
50     d=dsqrt(a*a + z*z)
       sp=(d/ (vp *1.3660254))
```

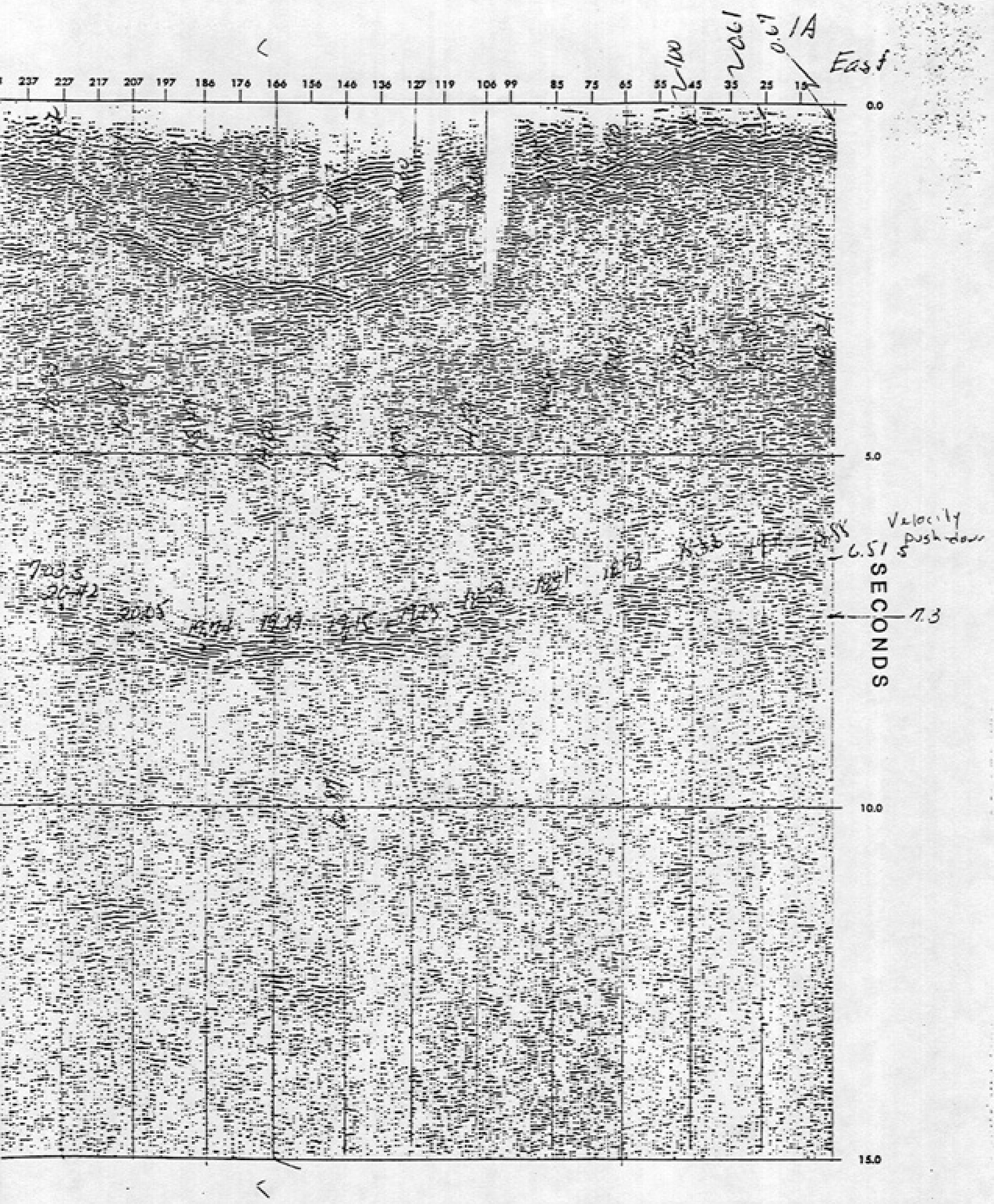
```
        k=(2.0 * dref) -z
        x=dsqrt(d*d + k*k)
       sxs=x/vs
       pxp=x/vp
       xl(i)=sp
       zl(i)=sxs-(1.3660254*sp)
       yl(i)=pxp-(1.3660254*sp)
c       write (6,70) xl(i),yl(i),zl(i)
c       write(6,*)a,i
60     format (3(f6.3,5x))
70     format (3(f6.3,5x))
       a=a+0.5
        i=i+1
        if (sp .GE. 6.9) then
        go to 105
        else if (a .LE. 60.00) then
        go to 50
        endif

c  ** plot reflection model graph **

105    call leglin
       call curve (temp,templ,7,0)
       call grid (1,1)
       call leglin
       call dot
       call curve (xl,yl,i-1,0)
        call leglin
        call dash
       call curve (xl,zl,i-1,0)
c
c
c
        maxline=linest (string,100,40)
        call lines ('Direct S Phase$',string,1)
        call lines ('PzP Phase$',string,2)
        call lines ('SzS Phase$',string,3)
        call legend (string,3,4.3,2.25)
c
       call endpl (0)
       call donepl
       end
```

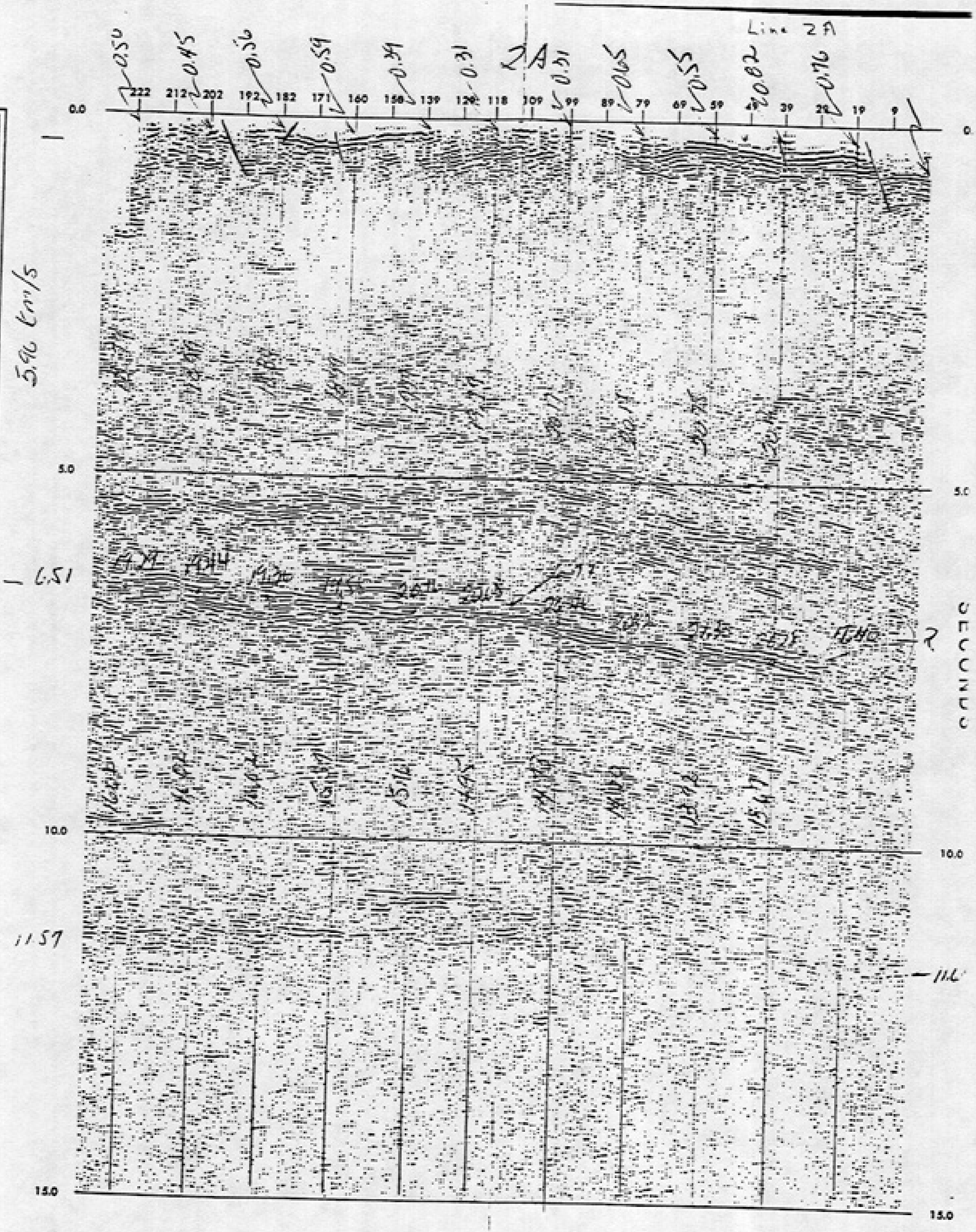
APPENDIX VI

COCORP LINES

1A
West


441
431
421
409
398
388
378
368
358
348
338
328
318
308
298
288
278
268
258
248
237
227
217
207
197
186
0.0
5.0
10.0
15.0
7.22
,,97

1A
East
237
227
217
207
197
186
176
166
156
146
136
127
119
106
99
85
75
65
55
45
35
25
15
0.0
5.0
10.0
15.0
SECONDS
Velocity push-down
6.51
7.3
2033
2042
2005
1919
1915
1923
1851
1873
1836
1855


Line 2A
2A
0.50
0.45
0.56
0.59
0.59
0.31
0.51
0.65
0.55
0.82
0.76
222
212
202
192
182
171
160
150
139
129
118
109
99
89
79
69
59
49
39
29
19
9
0.0
5.0
10.0
15.0
5.96 km/s
6.51
11.57
11.6
SECONDS

ORP
NIVERSITY

·E ⟶

CO LINE 1

OUNTY, NM
-283

NEW MEXICO

RAMETERS
RECORDING INSTRUMENT: MDS 8
NO. OF RECORDING CHANNELS: 48
RECORDING FILTER: 31.25 hz
SAMPLE RATE: 8 ms
SWEEP LENGTH: 20 sec
FIELD RECORD LENGTH: 40 sec
SWEEP FREQUENCIES: 10-32 hz
NO. OF SWEEPS PER VP: 16
NO. OF VIBRATORS: 5 or 4 (mm)
VIBRATOR SPACING: 33.4 m
VIBRATOR MOVEUP: 6.7 m

URATION

48
5331.8 m

m. vado array)

RAMETERS

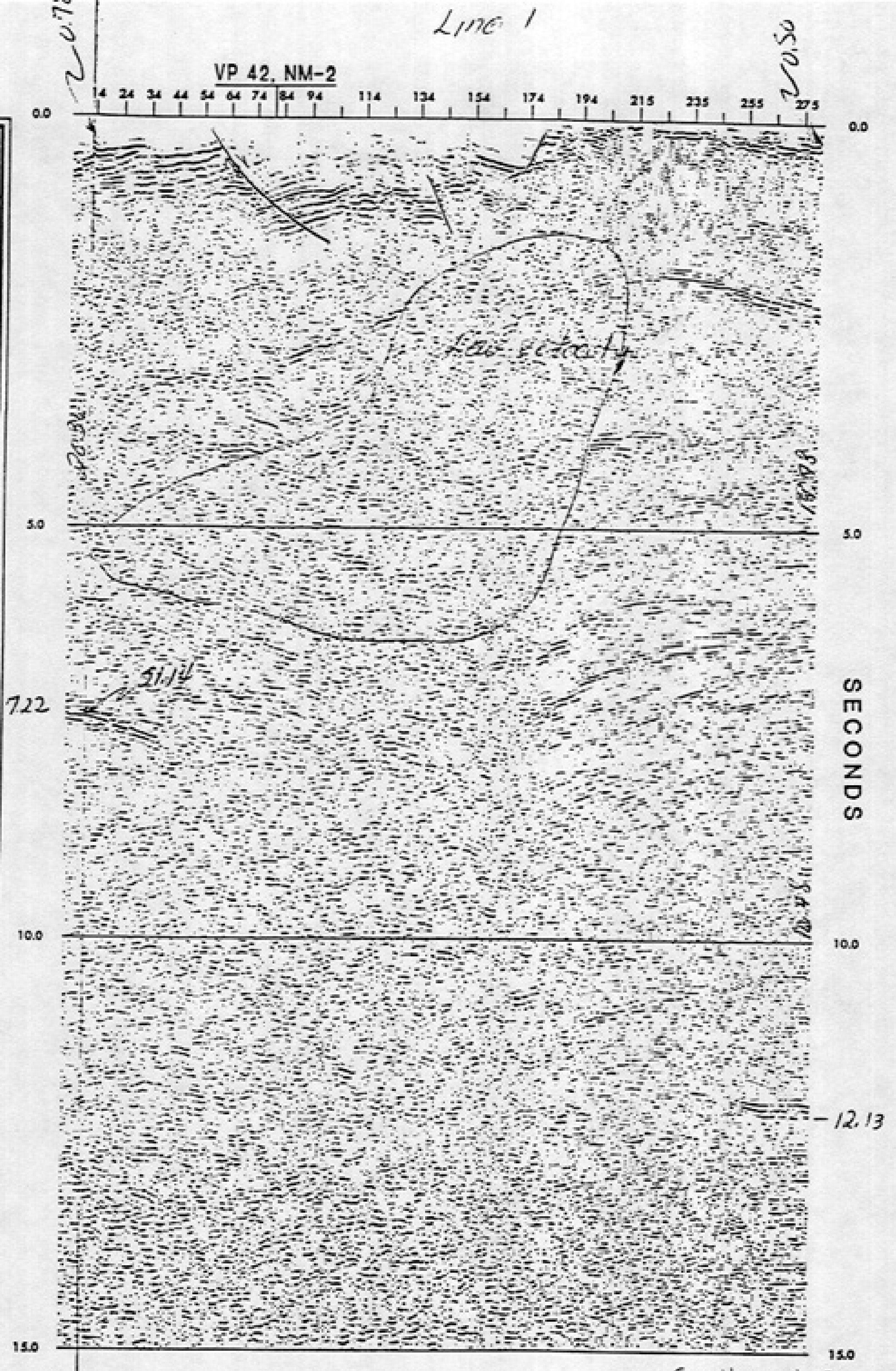
20 sec (15 sec displayed)

E MUTE
TIME 0 ms
TIME 720 ms
TIME 1800 ms
TIME 3400 ms

COVERAGE

:1 at 6 km/sec

DATA PROCESSED AT CORNELL
UNIVERSITY WITH A:
Megaseis
SD Seiscom Delta United



Gridley 4-89

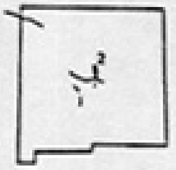
Sanford 12-88

Line 2

COCORP
CORNELL UNIVERSITY

N

NEW MEXICO LINE 2
SOCORRO COUNTY, NM
S.P. 1-94



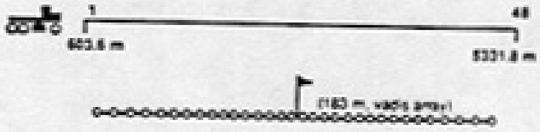
NEW MEXICO

RECORDING PARAMETERS

RECORDED BY: PETTY-RAY 6604
DATE: 11/09/75 TO 11/12/75
ENERGY SOURCE: VIBROSEIS
GEOPHONE TYPE: ETL-EV 22 B
GEOPHONE FREQUENCY: 7.5 Hz
NO. GEOPHONES PER CHANNEL: 32
CHANNEL SPACING: 100.6 m
SOURCE SPACING: 100.6 m
DIRECTION OF PROGRESSION: North

RECORDING INSTRUMENT: MDS 8
NO. OF RECORDING CHANNELS: 48
RECORDING FILTER: 31.25 Hz
SAMPLE RATE: 8 ms
SWEEP LENGTH: 20 sec
FIELD RECORD LENGTH: 40 sec
SWEEP FREQUENCIES: 10-32 Hz
NO. OF SWEEPS PER VP: 16
NO. OF VIBRATORS: 5 or 4 (m-n)
VIBRATOR SPACING: 33.4 m
VIBRATOR MOVEUP: 6.7 m

CABLE CONFIGURATION



PROCESSING PARAMETERS

DATE PROCESSED: 1985
SAMPLE RATE: 8 ms
CORRELATED RECORD LENGTH: 20 sec (15 sec displayed)
1. DEMULTIPLEX
2. VIBROSEIS CORRELATION
3. TRACE EDIT
4. MUTE
5. DATUM STATICS
   ELEVATION 1524 m
6. CMP GATHER
   CMP INTERVAL= 50 m
7. DESPIKE
8. TAB. WINDOW 16000 ms
7. VELOCITY ANALYSIS
8. NORMAL MOVEOUT
9. MUTE:

REPRESENTATIVE MUTE

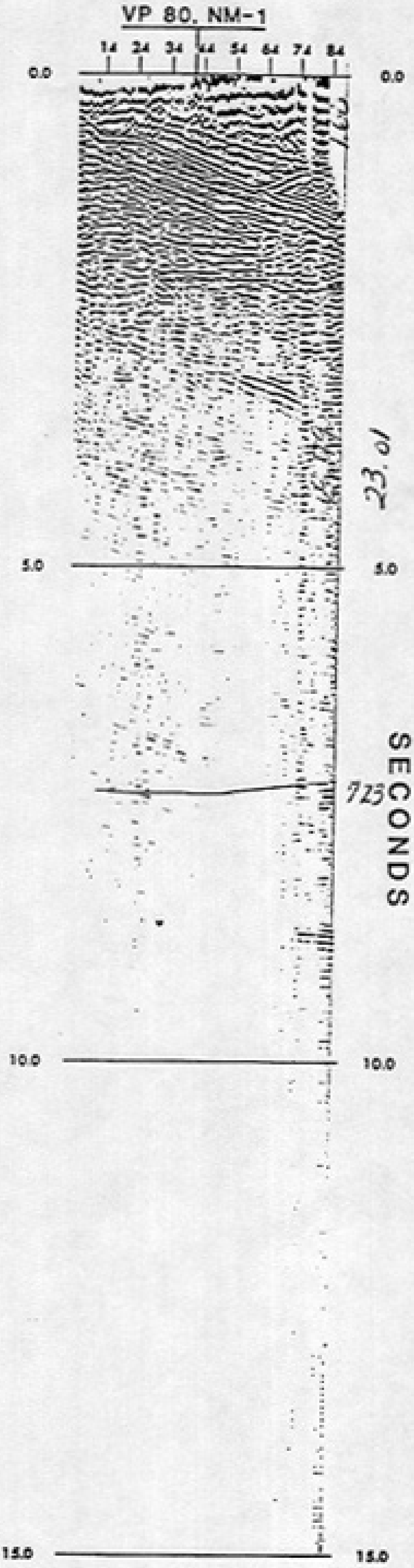
DIST. 604 m TIME 0 ms
DIST. 2012 m TIME 2150 ms
DIST. 5335 m TIME 3200 ms

10. STACK 2400% NOMINAL COVERAGE
11. COHERENCY FILTER
12. SUM ADJACENT TRACES
13. DISPLAY, VA, NO WIGGLE , 1:1 at 6 km/sec

DATA ACQUISITION BY:
Petty-Ray Geophysical .
GEOSOURCE

DATA PROCESSED AT CORNELL UNIVERSITY WITH A:
Megaseis
SD Seiscom Delta United

JUN 1988



[illegible] velocity pull-up

COCORP

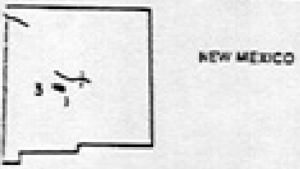
CORNELL UNIVERSITY

E ⟶

MEXICO LINE 3

SOCORRO COUNTY, NM

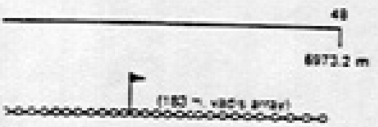
S.P. 1-146



RECORDING PARAMETERS

RAY 6804	RECORDING INSTRUMENT: MDS 8
	NO. OF RECORDING CHANNELS: 48
POSES	RECORDING FILTER: 31.25 hz
EV 22 B	SAMPLE RATE: 8 ms
CY 7.5 hz.	SWEEP LENGTH: 25 sec
CHANNEL: 32	FIELD RECORD LENGTH: 50 sec
34.1 m	SWEEP FREQUENCIES: 10-32 hz
4.1 m	NO. OF SWEEPS PER VP: 16
ESSION: West	NO. OF VIBRATORS: 5 or 4 (min)
	VIBRATOR SPACING: 26.8 m
	VIBRATOR MOVEUP: 8.9 m

CABLE CONFIGURATION



PROCESSING PARAMETERS

1985

RD LENGTH: 25 sec (15 sec displayed)

RRELATION

BANDPASS FILTER

TION

/ 3000 ms

TE

DS

1738 m

VAL= 67 m

LYSIS

EOUT

REPRESENTATIVE MUTE

DIST.	805 m	TIME	50 ms
DIST.	1073 m	TIME	1050 ms
DIST.	2951 m	TIME	2150 ms
DIST.	6976 m	TIME	4800 ms

NOMINAL COVERAGE

BANDPASS FILTER

LTER

TRACES

WIGGLE , 1:1 at 6 km/sec

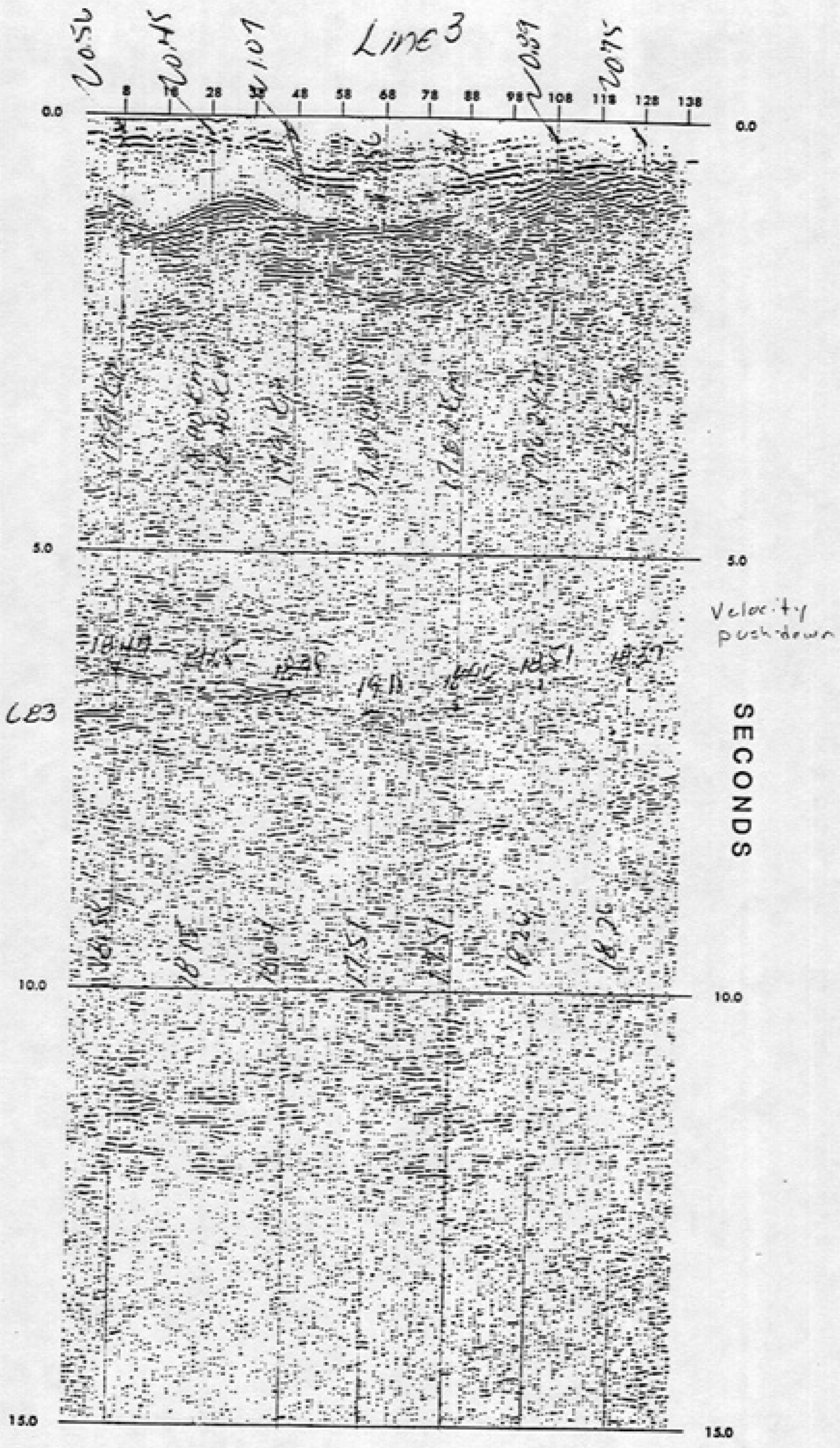
DATA PROCESSED AT CORNELL UNIVERSITY WITH A:

Megaseis

SD Seiscom Delta United

SOURCE

Line 3

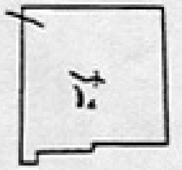


JUN

COCORP
CORNELL UNIVERSITY

S

NEW MEXICO LINE 4
SOCORRO COUNTY, NM
S.P. 1-101



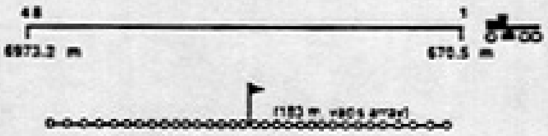
NEW MEXICO

RECORDING PARAMETERS

RECORDED BY: PETTY-RAY 6834
DATE: 1/31/77 TO 2/5/77
ENERGY SOURCE: VIBROSEIS
GEOPHONE TYPE: ETL-EV 22 B
GEOPHONE FREQUENCY: 7.5 hz.
NO. GEOPHONES PER CHANNEL: 32
CHANNEL SPACING: 134.1 m
SOURCE SPACING: 134.1 m
DIRECTION OF PROGRESSION: South

RECORDING INSTRUMENT: MDS 8
NO. OF RECORDING CHANNELS: 48
RECORDING FILTER: 31.25 hz
SAMPLE RATE: 8 ms
SWEEP LENGTH: 25 sec
FIELD RECORD LENGTH: 50 sec
SWEEP FREQUENCIES: 10-32 hz
NO. OF SWEEPS PER VP: 16
NO. OF VIBRATORS: 5 or 4 (min)
VIBRATOR SPACING: 25.8 m
VIBRATOR MOVEUP: 8.6 m

CABLE CONFIGURATION



PROCESSING PARAMETERS

DATE PROCESSED: 1985
SAMPLE RATE: 8 ms
CORRELATED RECORD LENGTH: 25 sec (15 sec displayed)

1. DEMULTIPLEX
2. VIBROSEIS CORRELATION
3. TAIL MUTE
4. TAB. WINDOW 20000 ms
5. TAB. WINDOW 2000 ms
6. TIME VARYING BANDPASS FILTER
7. DECONVOLUTION
8. TIME VARYING BANDPASS FILTER
9. TRACE EDIT
10. DATUM STATICS
    ELEVATION 1738 m
11. CMP GATHER
    CMP INTERVAL= 67 m
12. VELOCITY ANALYSIS
13. NORMAL MOVEOUT
14. MUTE:

REPRESENTATIVE MUTE

DIST. 670 m	TIME 50 ms
DIST. 4421 m	TIME 1450 ms
DIST. 6707 m	TIME 3050 ms

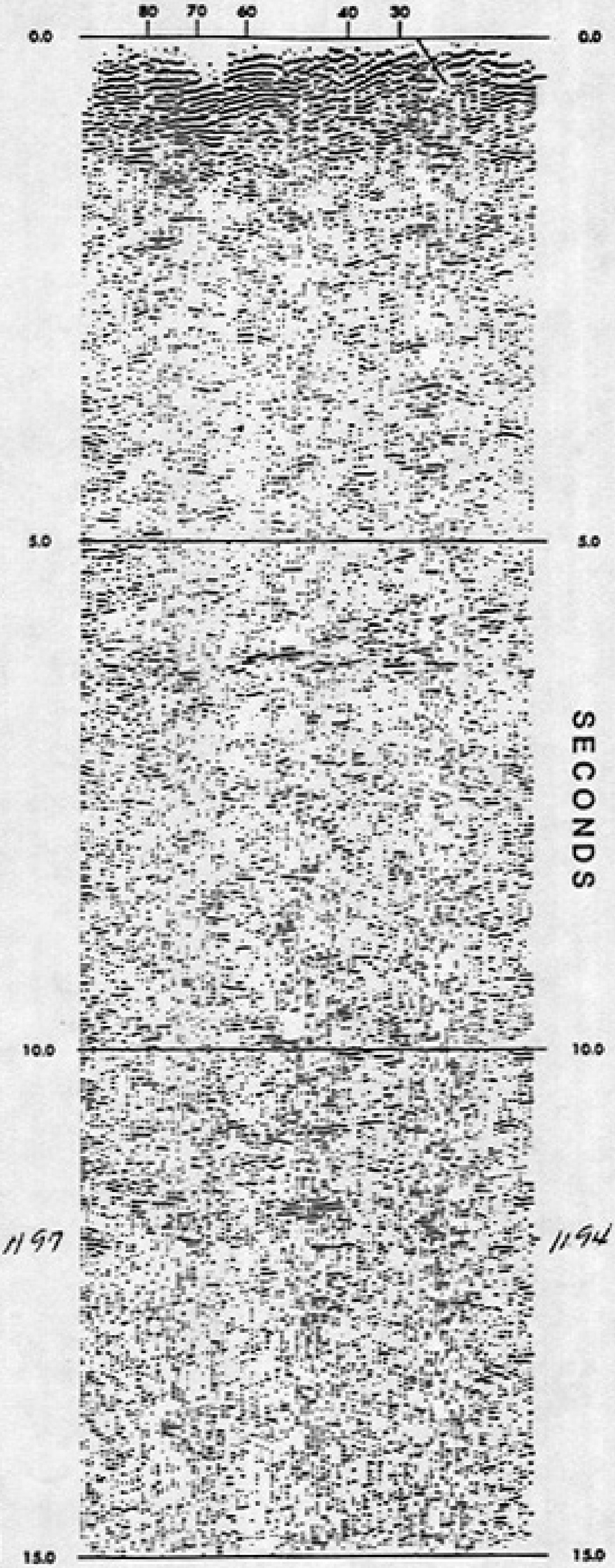
15. RESIDUAL STATICS
16. STACK 2400% NOMINAL COVERAGE
17. TIME VARYING BANDPASS FILTER
18. COHERENCY FILTER
19. SUM ADJACENT TRACES
20. DISPLAY, VA, NO WIGGLE , 1:1 at 6 km/sec

DATA ACQUISITION BY:
Petty-Ray Geophysical
GEOSOURCE

DATA PROCESSED AT CORNELL UNIVERSITY WITH A:
Megaseis
Seiscom Delta United

JUN 1988

Line 4



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