UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DATA REPORT FOR A THREE-DIMENSIONAL HIGH-RESOLUTION P-VELOCITY STRUCTURAL INVESTIGATION OF NEWBERRY VOLCANO, OREGON, USING SEISMIC TOMOGRAPHY

OPEN-FILE REPORT 86-352

Menlo Park, California
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Data Report for a Three-dimensional High-resolution P-velocity Structural Investigation of Newberry Volcano, Oregon, using Seismic Tomography

by

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INTRODUCTION

A three-dimensional high-resolution seismic study of the summit caldera of Newberry volcano, Oregon, was conducted by the U. S. Geological Survey during the summer of 1984. The experiment was designed to image seismic P-velocity anomalies in three dimensions throughout the upper 4 to 6 km of crust beneath the summit caldera. Resolution of anomalies as small as 1 to 2 km^3 is possible with this method (Nercessian et al., 1984).

Seismograms were obtained from 12 chemical explosions recorded by 120 seismographs deployed in and around the summit caldera. Figure 1 shows the location of Newberry volcano relative to the Cascade Mountain Range and the positions of the shots and seismic network. Shot times and locations, seismometer locations, and performance of each seismograph are listed in the appendices. P-wave first-arrival travel-times for seven of the shots are also listed.

Newberry volcano is a shield volcano located in central Oregon about 60 km east of the axis of the Cascade Range. The flanks of the volcano are covered with basalt and basaltic-andesite cinder cones and flows, the youngest of which give C-14 ages of 5800 years (MacLeod and Sammel, 1982). Rhyolitic domes, flows, and pumice rings also occur on the flanks of the volcano and yield K/Ar ages of 100,000 to 600,000 years, although some of the domes may be less than 10,000 years old on the southeast flank. The summit caldera is nearly circular (6-8 km across) and contains many rhyolitic domes, flows, ash flows, pumice falls, and explosion breccias which range from about 6700 to 1350 years old. The presence of these young rhyolitic flows suggests that the source of these lavas may be a silicic magma chamber in the shallow crust beneath the caldera (MacLeod and Sammel, 1982).

No previous seismic study has delineated a magma chamber in the Cascades although the region is typified by high heat flow and abundant young volcanic rocks. The USGS has conducted several seismic studies at Newberry volcano to map structure and locate possible magma chambers. Stauber et al. (submitted) conducted a teleseismic P-residual study to examine the crust beneath the volcano to a depth of 40 km with a spatial resolution of 5 to 10 km. They conclude that a zone of high P-velocities extends from within 10 km of the surface to at least 25 km depth beneath the caldera. These high velocities suggest that the fraction of magma in rocks beneath the volcano is limited to a few percent. Stauber and Berge (1984), interpreted data from a 100 km long seismic refraction line that traversed Newberry volcano from west to east. Their study reveals seismic velocities in the upper 6 km that are about 10Δ higher beneath the volcano than in adjacent areas at the same depth.

The results of these earlier experiments do not indicate a large substantially-molten magma chamber beneath Newberry volcano. Yet, episodic rhyolitic eruptions have occurred in the caldera region during the past 6000 years, indicating that magma may be present in the upper crust. Wells drilled in the Newberry volcano region have encountered relatively high temperatures at shallow depths. In particular, a temperature of about 265°C was measured in a 930 m well drilled by the USGS (Sammel, 1981), and a temperature of 158°C was measured in a well drilled by Sandia National Laboratories (Black et al., 1984).

The seismic experiment described in this report was designed to examine the three-dimensional P-wave velocity structure of the summit region and to

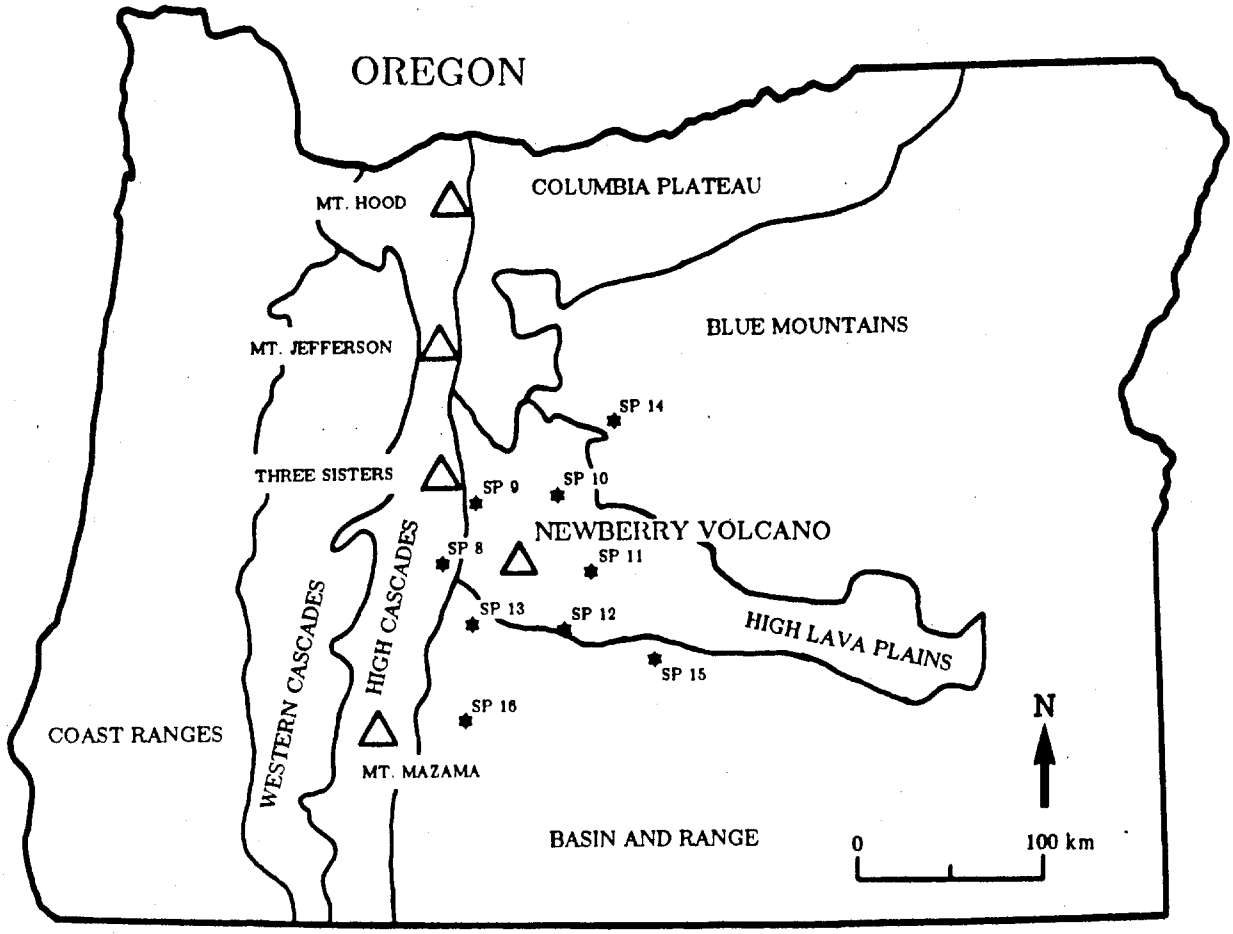

Figure 1. Map of Oregon showing the physiological provinces surrounding Newberry Volcano. Triangles indicate major Cascade stratovolcanoes and stars indicate shot locations. The asterisk within the triangle indicating Newberry volcano is the approximate location of the network. Not shown are the locations of three small shots near the summit of Newberry Volcano. Plate 1 shows the seismic array and locations of the three small shots.

image the source of recent volcanic flows and high well-bottom temperatures. Preliminary results and qualitative interpretations of traveltime data obtained from this experiment have been presented by Stauber et al., (1985). A quantitative analysis of the same data, using a damped-least-squares inversion of traveltime residuals, is underway.

DESCRIPTION OF SURVEY

The network employed for the experiment consisted of 120 seismic recorders deployed with a mean spacing of 1.6 km in a two-dimensional grid over the summit region of Newberry volcano (Figure 1, Plate 1). The 300 km^2 area covered by this grid extended 3 to 4 km beyond the ring fracture system and caldera rim of the volcano, but covers only a part of 1200 km^2 Newberry volcano shield. Instrument locations and elevations were determined to an accuracy of 15 m using USGS 1:24,000-scale topographic maps and USGS 1:24,000-scale orthophotos, as well as altimeters and a LORAN C navigational system. The recorder station location numbers, latitudes, longitudes, and elevations are listed in Table 1. Plate 1 shows a map view of the station locations.

A total of twelve shot points were selected to provide Pg and reflected P phases, as well as surface information (Figure 1). The term shot point refers to the physical location of the shot, and shot number refers to the order in which the shots were detonated. (Earlier refraction experiments done at Newberry volcano used shot point numbers 1 through 7, and shot numbers 1 through 10; to avoid confusion with the earlier experiments the shot points for this experiment are numbered 8 through 19 and the shot numbers are 11 through 22.) Shot points 8 through 13 were located 35 km from the summit and were spaced 60 degrees apart forming a circle centered on Newberry caldera. This shot point to netwok distance was chosen after analyzing the earlier refraction data which have strong Pg phases at that distance. Shot points 14 through 16 were located 85 km north-northeast, southeast, and south-southwest, of the caldera. At this distance refraction data recorded at Newberry shows a strong wide-angle reflected P-phase. Shot points 17 through 19 were 3 km outside the caldera rim on the southwest, east-southeast, and north sides of the volcano.

At each of shot points 8 through 16, 2720 kg of ammonium nitrate explosive was loaded into two holes 30 m apart, 55 m deep, and 20 cm in diameter. Shots points 17 through 19 were in single holes 45 m deep by 20 cm in diameter and used 227 kg of the same type of explosive. The shots were detonated at a preset clock time, with the double holes fired simultaneously. The shooting system has been described by Healy et al., (1982). The blasting cap break, WWVB time code, and the reference clock's IRIG E time are recorded on a strip chart recorder and we estimate the shot times are accurate to within 0.005 s. Table 2 lists the shot number, date, location, time, and size.

Each instrument (Healy et al., 1982) uses a 2-hz vertical-component geophone whose output passes through three parallel amplifiers, each with an adjustable gain setting. Three amplified seismic signals, a fixed reference frequency, and a frequency-modulated, internally-generated TCXO-based time code are recorded as a multiplexed analog signal on a cassette tape. The instruments contain a memory board that can be programmed for up to ten separate recording windows, and a crystal controlled clock (TCG) with an accuracy of about 1 part in 10^{-7}.

Before deployment, technicians program the recording times and synchronize the TCG of each instrument with a high-precision master clock which has a drift rate of approximately 1 millisecond a week, and is synchronized to a Rubidium standard reference or GOES satelite clock. After deployment and shooting the instruments are retrieved and the clock drift for each is measured relative to the master clock. The Rubidium clock, accurate to one part in 10^{-10}, is periodically set to an averaged WWVB reference signal. Both WWVB and the GOES signal are controlled by the National Bureau of Standards Cesium-beam clocks.

A need for precise timing control (± 5ms) and the relatively high TCG drift rates required that the deployment be done in one day, the shots detonated and recorded over night, and the instruments retreived and tested the following day. This strict schedule posed a considerable logistics problem in that access to the summit region of Newberry is limited to a few roads and several hiking trails. The area is also heavily forested which ruled out the use of helicopters. We decided to deploy many stations by foot, which required 35 people for backpacking instruments to and from their chosen sites. To facilitate this deployment three mule trains, each carrying 20 instruments, traversed the caldera rim trails and the northern access trail dropping off instruments at pre-selected sites. Backpackers then picked up the instruments and carried them to chosen locations. In addition, one train of llamas was used on the northwest side of the caldera to deploy six instruments at sites too difficult to backpack to and from the nearest trail or roadhead.

RECORD SECTIONS

Each event is digitized for 20 seconds starting at the reduced time

$$T = S-4 + X/V$$

where S is the shot time (s), X is the shot-to-receiver distance (km), and V is the reduction velocity (km/s). All events were digitized with V = 6.0 km/s. Three rows of numerical data appear at the end of each trace. The top row contains the instrument identification number (corresponding to those on Plate 1). The middle row lists the instrument attenuation (db) used, and the bottom row lists the maximum deviation of the trace (digitizer counts). Each trace is centered at the correct shot-to-receiver distance.

Normalized record sections for each shot are shown on Plates 2-77. Because the network is two-dimensional, a single plot would be inadequate to show the arrival pattern through the network; many traces would overlap and obscure one another. Thus, each plate represents one shot, and has 2 separate record sections. Each section consists of records from stations in a wedge of equal shot-recorder azimuth. The record sections progress from the wedge on the left side of the network (viewed from the shot) clockwise to the wedge on the right. Figure 2 is a schematic showing how the network is divided into these wedges for a shot to the southwest. Shot points 8 through 13 are plotted with a reduction velocity of 6.0 km/sec, shot points 14 through 16 are plotted with a reduction velocity of 6.8 km/sec, and shot points 17 through 19 are plotted with a reduction velocity of 4.0 km/sec.

Plates 2-49 show unfiltered normalized traces for all of the shots. Plates 50-77 show filtered normalized traces for shot numbers 12, 13, 16, 17, 18, 19, and 21 respectively. Also shown on plates 50-77 are picked arrivals

for these shots. The picks are usually peaks or troughs in the first cycle but in any case are the same point in all the filtered seismograms for a given shot (the points chosen for different shots may not be the same peak or trough). Table 3 is a listing of the relative travel times of these picks by shot number. Pick qualities are based on a subjective estimate of pick accuracy in seconds: 0) 0.00-0.02 s, 1) 0.02-0.04 s, 2) 0.04-0.08 s, 3) 0.08-0.16s, and 4) uncertain if the pick is the correct phase.

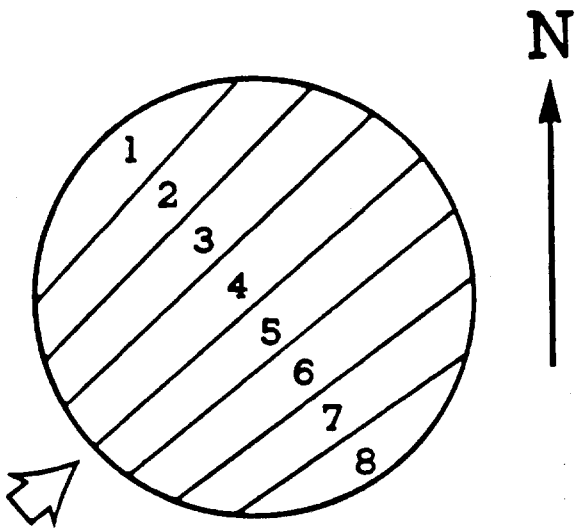

Figure 2. Schematic drawing of the network divided into wedge-shaped subarrays. On Plates 2 through 77, data from each subarray are plotted as seperate record sections. For a shot to the southwest, as shown here, the first subarray is on the NW side of the network and the last subarray is on the SE side of the network.

INSTRUMENT RESPONSE AND CALCULATION OF GROUND VELOCITY

Instrument Response

Standard response characteristics of the major components of the USGS short-period seismic refraction instrument were used with the frequency-response program RESPONSE (Stewart and O'Neill, 1980) to determine the theoretical transfer function of the USGS short period seismic refraction system. The component values are taken from Eaton (1980) and Stewart and O'Neill (1980). The system consists of a Mark Products L-4™ 2-Hz geophone and a USGS-designed amplifier-VCO in the recorder, and a 5-pole TRI-COM™ discriminator in the playback unit. Standard parameters for the individual components are listed below. Shown in Appendix B are the input parameters and the output of the program RESPONSE which lists, at specified frequencies, the amplitude spectrum, normalized amplitude spectrum, phase spectrum, and the normalized displacement and velocity responses of the transfer function in decibells. The displacement response for the system peaks at about 26 Hz, and the velocity response peaks at a lower frequency, about 6 Hz (Figure 3). The velocity response is relatively flat at frequencies between 2 and 20 Hz.

The following terms are used in Appendix B and in the following discussion of a simplified method for calculating approximate ground motion from the seismograms in plates 2-13:

"G_{LE}" is the effective motor constant (V/(cm/s)) of the seismometer-L-pad combination (assuming 10,000-ohm input impedance of the preamp). This system uses the L-4™ 2-hz seismometer and a custom L-pad which gives G_{LE} = 1.0 V/(cm/s).

"G" is the maximum gain (db) of the USGS J402 amplifier-VCO (about 104 db.)

"a" is the attenuation setting (db) of the preamp (usually 12, 30, or 48 db).

"G_{SA}" is the system gain (ratio of output voltage to input voltage). That is $G_{SA} = 10^{(G-a)/20}$. For attenuation settings of 12, 30, and 48 db, G_{SA} = 39,811, 5012, and 631 respectively.

"D_{VCO}" is the sensitivity of the J402 VCO (Hz/V). The VCO used in the refraction instrument has ± 125 Hz deviation for ± 5.00 V input, or 25 Hz/V.

"d_{DSC}" is the discriminator modulation sensitivity (V/Hz). The TRI-COM™ discriminator used is set for ± 5.0 V out for a deviation of ± 125 Hz, or 0.04 V/Hz.

"L_{REC}" is the digitizer sensitivity (counts/V). The sensitivity of the A/D convertor is 4095 counts for 0-5 V = 819.0 counts/V.

Calculation of Ground Velocity

Since the width of a normalized trace is 0.25 inches, the trace is scaled so the largest maximum deviation is 0.125 inches. True relative amplitudes of the traces can therefore be calculated straightforwardly from the information on the plot.

Let "d_{max}" be the maximum deviation (digitizer counts), "$A_{norm}(t)$" be

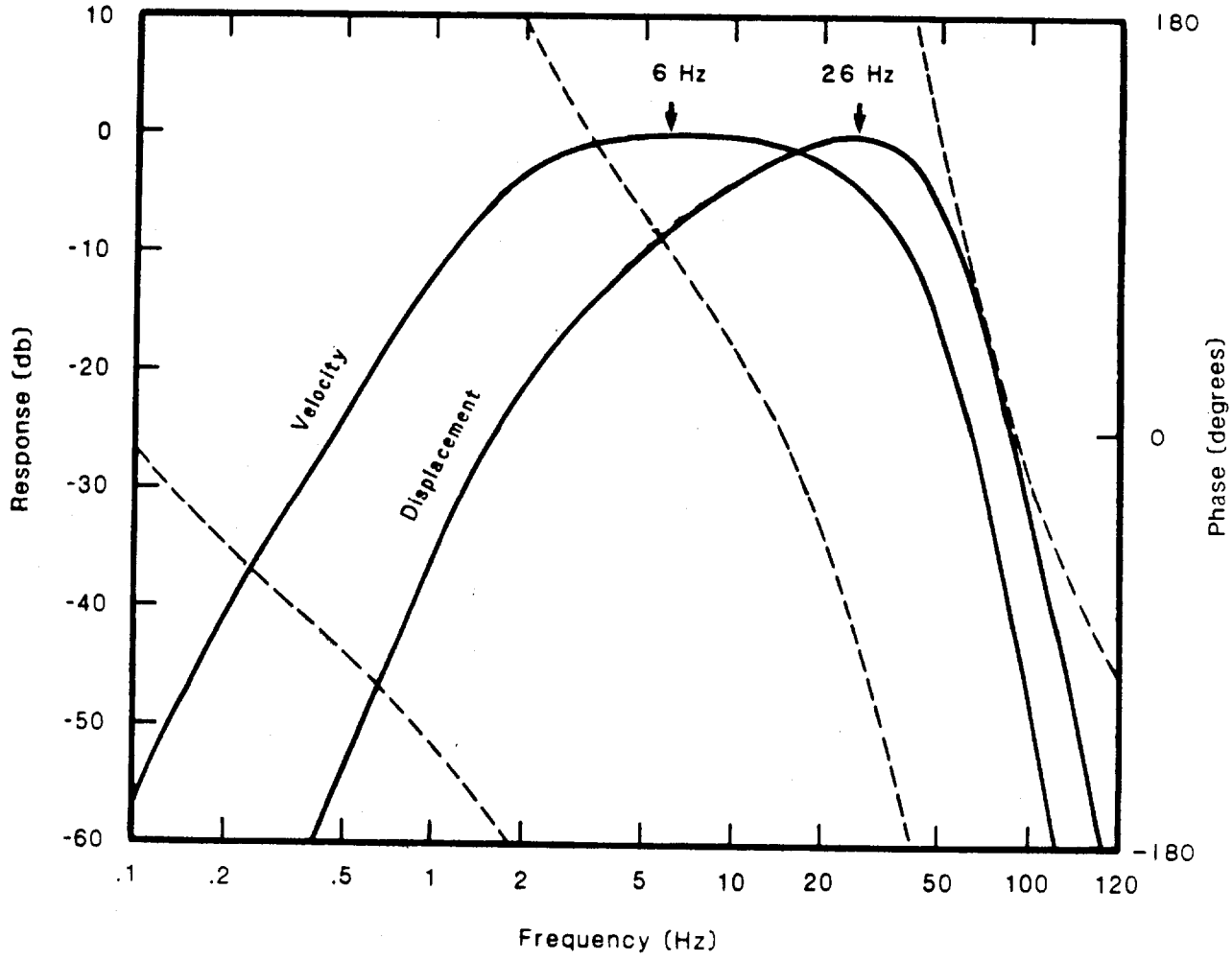

Figure 3. Theoretical transfer-function curves for the USGS short-period seismic refraction system. Solid line: displacement and velocity normalized amplitude; dashed line: phase (displacement). Maximum velocity response is at 6 Hz; maximum displacement response is at 26 Hz.

the plotted trace amplitude (inches), "A(t)" be the true relative amplitude of the trace (scaled digitizer counts), and "a" be the attenuation setting of the recorder as defined above. Then

$$A_{norm}(t) \approx A(t)\ 10^{\frac{-a}{20}}\ \frac{0.125}{d_{max}}$$

One also can calculate approximate ground velocity, $A_g(t)$ (cm/s) from $A_{norm}(t)$ by considering only simple amplifications and conversions. Since the phase is approximately linear (i.e. a group delay) in the flat part of the velocity transfer function centered near 6 Hz (Figure 3), $A_g(t)$ should correspond closely to true ground velocity in this frequency band. Thus:

$$A_{norm}(t) \approx \frac{0.125}{d_{max}}\ L_{REC}\ d_{DSC}\ D_{VCO}\ G_{SA}\ G_{LE}\ A_g(t)$$

or

$$A_g(t) \approx \frac{d_{max}}{0.125\ L_{REC}\ d_{DSC}\ D_{VCO}\ G_{SA}\ G_{LE}}\ A_{norm}(t)$$

As an example, for shot point 8, shot 16, the trace for station 597 (Plate 2, Section 1, second trace from the left), the attenuation setting is 12 db and the maximum deviation is 367 counts. Substituting the values listed above gives ground velocity

$A_g(t) \approx$

$$\frac{367\ \text{counts}}{0.125\ \text{in}\ \ 819\ \frac{\text{counts}}{\text{V}}\ \ 0.04\ \frac{\text{V}}{\text{Hz}}\ \ 25\ \frac{\text{Hz}}{\text{V}}\ \ 39{,}811\ \frac{\text{V}}{\text{V}}\ \ 1.0\ \frac{\text{V}}{\text{(cm/s)}}}\ A_{norm}(t)$$

$$= 9.00 * 10^{-5}\ A_{norm}(t).$$

Thus, the maximum ground velocity in the trace ($A_{norm}(t)$ = 0.125 in) is about $1.13 * 10^{-5}$ cm/s.

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Table 1: Seismic Recorder Locations

For a map of stations see Plate 1. Latitude and Longitude are north and west respectively.

LOCATION NUMBER	LATITUDE (DEG, MIN)	LONGITUDE (DEG, MIN)	ELEVATION (METERS)
501	43 39.54	121 14.92	1853
502	43 39.96	121 15.64	1855
503	43 40.05	121 16.13	1839
504	43 40.54	121 16.84	1884
505	43 41.42	121 17.87	1817
507	43 42.19	121 17.28	1875
508	43 42.07	121 17.94	1841
509	43 42.65	121 18.07	1817
510	43 42.66	121 17.36	1868
511	43 42.81	121 16.63	1932
512	43 42.28	121 16.41	1977
513	43 41.58	121 16.27	2085
514	43 41.14	121 16.54	2182
515	43 41.07	121 15.86	2243
516	43 41.35	121 15.20	2429
517	43 42.28	121 15.72	1957
518	43 42.47	121 14.94	1935
519	43 42.47	121 14.23	1951
520	43 43.10	121 14.41	1935
521	43 41.77	121 15.49	2042
523	43 43.01	121 13.11	1969
524	43 43.45	121 11.55	1955
525	43 43.89	121 11.57	1957
526	43 44.28	121 12.02	1960
527	43 43.17	121 11.11	1987
528	43 42.68	121 11.10	2033
529	43 42.19	121 11.53	2115
530	43 41.66	121 11.50	2124
531	43 41.16	121 11.59	2085
532	43 40.56	121 11.57	1990
533	43 39.95	121 11.68	1951
534	43 39.73	121 12.63	1945
535	43 41.89	121 10.83	2118
536	43 41.38	121 10.32	2027
537	43 41.57	121 9.56	1957
538	43 42.53	121 8.72	1942
539	43 43.47	121 8.73	1932
540	43 44.07	121 8.87	1890

Table 1 (cont.)

LOCATION NUMBER	LATITUDE (DEG, MIN)	LONGITUDE (DEG, MIN)	ELEVATION (METERS)
541	43 45.04	121 9.46	1899
542	43 44.76	121 10.14	2006
543	43 45.45	121 10.06	1899
544	43 40.83	121 15.15	2176
545	43 40.42	121 14.63	2079
546	43 41.02	121 14.50	2304
547	43 40.54	121 13.87	2167
548	43 40.98	121 13.77	2268
549	43 41.20	121 12.95	2286
550	43 41.00	121 12.42	2176
551	43 41.42	121 12.28	2213
552	43 41.92	121 12.15	2286
553	43 41.59	121 13.07	2173
554	43 41.61	121 13.72	2149
555	43 39.77	121 13.54	1953
556	43 40.18	121 12.84	1963
557	43 40.23	121 12.26	1990
558	43 42.19	121 14.00	1987
559	43 41.97	121 14.72	1969
560	43 41.42	121 14.49	2094
561	43 42.63	121 13.66	1945
562	43 42.19	121 13.27	1975
563	43 42.23	121 12.67	2024
564	43 42.82	121 12.53	1975
565	43 42.49	121 11.99	2018
566	43 42.87	121 11.64	2027
567	43 42.85	121 15.81	1939
568	43 43.38	121 16.45	1939
569	43 43.82	121 16.07	1935
570	43 43.91	121 15.19	1935
571	43 43.69	121 14.63	1935
572	43 43.35	121 14.70	1939
573	43 43.53	121 14.00	2006
574	43 43.18	121 12.47	1969
575	43 43.47	121 13.26	1948
576	43 44.08	121 13.55	1948
577	43 44.19	121 14.11	2048
578	43 44.21	121 12.81	1948
579	43 42.11	121 10.08	2060
580	43 42.45	121 10.72	2150

Table 1 (cont.)

LOCATION NUMBER	LATITUDE (DEG, MIN)	LONGITUDE (DEG, MIN)	ELEVATION (METERS)
581	43 42.59	121 9.86	2176
582	43 42.91	121 10.43	2152
583	43 43.12	121 9.79	2079
584	43 43.49	121 10.56	2158
585	43 43.68	121 9.67	2134
586	43 44.01	121 10.18	2097
587	43 43.86	121 11.02	2173
588	43 44.48	121 10.64	2071
589	43 44.41	121 11.23	2149
590	43 44.97	121 10.89	2173
591	43 44.86	121 11.67	2216
592	43 45.29	121 11.21	2109
593	43 44.94	121 12.80	2222
594	43 44.71	121 12.30	2057
595	43 47.00	121 12.79	1923
596	43 46.23	121 13.30	2070
597	43 46.00	121 14.19	2134
598	43 46.40	121 14.61	2091
599	43 45.66	121 13.32	2143
600	43 45.49	121 12.60	2173
601	43 45.87	121 11.78	2124
602	43 46.27	121 12.51	2045
603	43 45.14	121 13.65	2178
604	43 45.47	121 14.41	2219
605	43 45.77	121 14.91	2134
608	43 44.82	121 14.05	2262
609	43 44.54	121 13.46	2271
610	43 44.55	121 14.80	2271
611	43 45.10	121 15.14	2188
612	43 45.28	121 15.89	2124
614	43 44.78	121 16.31	2118
615	43 44.96	121 17.03	1951
616	43 44.41	121 17.23	1966
617	43 44.26	121 16.37	2091
618	43 43.74	121 17.08	1951
619	43 43.19	121 17.14	1914
620	43 46.77	121 13.50	1957

Table 2. Master Shot List

SHOT NUMBER	DATE	SHOT POINT	LATITUDE (DEG,MIN)	LONGITUDE (DEG,MIN)	ELEVATION (METERS)	SHOT TIME (D,H,M,S,)	SIZE (KG)
11	AUG 29, 1984	9	43 59.01	121 32.71	1672	242 05 00 00.009	2720
12	AUG 29, 1984	16	42 58.97	121 35.67	1378	242 05 02 00.013	2720
13	AUG 29, 1984	11	43 40.48	120 44.57	1466	242 05 04 00.011	2720
14	AUG 29, 1984	14	44 24.07	120 40.33	1082	242 05 06 00.006	2720
15	AUG 29, 1984	17	43 46.98	121 12.81	1926	242 05 08 00.010	227
16	AUG 29, 1984	8	43 42.91	121 44.06	1322	242 08 00 00.009	2720
17	AUG 29, 1984	12	43 24.01	121 4.36	1327	242 08 02 00.012	2720
18	AUG 29, 1984	15	43 15.09	120 24.12	1311	242 08 04 00.011	2720
19	AUG 29, 1984	10	44 3.84	121 4.91	1038	242 08 06 00.006	2720
20	AUG 29, 1984	18	43 41.56	121 9.53	1957	242 08 08 00.012	227
21	AUG 29, 1984	13	43 27.20	121 32.30	1335	242 10 00 00.009	2720
22	AUG 29, 1984	19	43 42.05	121 17.93	1841	242 10 02 00.011	227

TABLE 3: TRAVEL TIME PICKS

This tabel lists the shot numbers, recorder location number, subjective pick quality, traveltime picks, shot to station distance (km), and azimuth clockwise from the shot point toward the recorder (See Plates 50-77).

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
8	501	0	8.822	32.401	98.500
8	502	0	8.672	31.297	97.400
8	503	1	8.567	30.612	97.200
8	504	0	8.360	29.560	95.700
8	505	0	8.126	28.073	92.700
8	507	0	8.137	28.814	89.800
8	508	0	8.042	27.956	90.200
8	509	0	8.051	27.779	88.000
8	510	0	8.129	28.714	88.100
8	511	0	8.284	29.720	87.600
8	512	0	8.315	29.984	89.400
8	513	1	8.461	30.187	91.900
8	514	1	8.417	29.867	93.500
8	515	1	8.605	30.788	93.600
8	516	2	8.736	31.651	92.600
8	518	0	8.505	31.959	88.900
8	519	0	8.708	32.921	89.000
8	520	1	8.727	32.722	86.900
8	521	1	8.526	31.225	91.200
8	523	2	8.993	34.658	87.500
8	524	4	9.252	36.584	86.200
8	525	3	9.225	36.623	84.900
8	526	0	9.093	36.091	83.700
8	529	3	9.332	36.532	89.800
8	530	1	9.393	36.584	91.400
8	531	0	9.396	36.497	92.800
8	533	2	9.481	36.566	96.300
8	534	1	9.376	35.359	97.200
8	543	1	9.547	38.998	80.900
8	544	0	8.694	31.768	94.400
8	545	1	8.844	32.536	95.600
8	546	1	8.911	32.624	93.600
8	547	1	9.054	33.531	95.100
8	548	1	9.043	33.547	93.700
8	550	1	9.300	35.401	93.400
8	551	3	9.256	35.558	92.100
8	552	1	9.275	35.671	90.600
8	553	1	9.093	34.524	91.600
8	554	0	8.866	33.605	91.600
8	556	0	9.212	34.977	95.900
8	557	1	9.418	35.745	95.700
8	558	0	8.731	33.215	89.800

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
8	559	0	8.594	32.263	90.500
8	560	1	8.736	32.592	92.300
8	561	0	8.807	33.724	88.500
8	562	0	8.881	34.194	89.800
8	563	2	8.990	35.002	89.700
8	564	0	9.116	35.211	87.900
8	565	2	9.176	35.933	88.900
8	567	0	8.325	30.832	87.500
8	568	0	8.294	30.020	85.600
8	569	0	8.316	30.594	84.100
8	570	0	8.431	31.788	84.100
8	571	0	8.612	32.497	84.900
8	572	0	8.685	32.363	86.000
8	573	1	8.832	33.318	85.600
8	574	0	9.178	35.321	86.900
8	575	1	8.959	34.295	85.900
8	576	0	8.777	34.011	83.900
8	577	0	8.670	33.289	83.400
8	578	0	8.929	35.029	83.700
8	591	4	9.310	36.687	82.000
8	593	1	9.105	35.221	81.600
8	594	0	9.109	35.794	82.400
8	595	1	9.323	35.985	75.500
8	596	2	9.064	34.975	77.400
8	597	1	8.879	34.152	74.800
8	598	0	8.864	33.336	76.300
8	600	1	9.111	35.677	79.600
8	601	3	9.283	36.837	79.200
8	602	1	9.230	36.027	77.700
8	603	0	8.904	34.123	80.600
8	604	1	8.787	33.236	79.300
8	605	0	8.771	32.670	78.100
8	608	1	8.816	33.512	81.400
8	610	0	8.710	32.435	82.100
8	611	0	8.669	32.164	80.100
8	612	0	8.561	31.214	79.300
8	614	0	8.472	30.513	80.700
8	616	0	8.228	29.181	81.700
8	617	0	8.389	30.292	82.500
8	618	0	8.202	29.230	84.100
8	619	0	8.211	29.073	86.100
8	620	1	9.107	35.028	75.700
10	501	2	9.638	46.888	196.600
10	505	4	9.387	44.964	202.800
10	508	4	9.023	43.893	203.500
10	518	3	8.823	41.794	198.800
10	519	2	8.771	41.499	197.600
10	520	3	8.658	40.437	198.400

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
10	523	4	8.928	40.125	195.700
10	526	3	8.246	37.409	194.800
10	541	1	8.008	35.298	190.000
10	543	1	7.937	34.703	191.500
10	545	4	9.713	45.252	196.800
10	558	1	8.951	41.862	197.000
10	559	1	9.092	42.537	198.100
10	560	2	9.424	43.430	197.300
10	560	3	9.122	43.430	197.300
10	561	4	8.673	40.980	196.600
10	564	3	8.840	40.204	194.800
10	567	3	9.027	41.500	200.700
10	568	2	8.799	40.884	202.300
10	569	2	8.596	39.943	202.100
10	570	2	8.475	39.374	200.500
10	571	1	8.416	39.486	199.300
10	572	1	8.555	40.130	199.100
10	574	4	8.967	39.557	194.900
10	575	2	8.962	39.318	196.600
10	576	1	8.368	38.348	197.600
10	577	1	8.257	38.376	198.800
10	578	1	8.147	37.805	196.300
10	585	1	8.281	37.842	189.800
10	586	1	8.134	37.360	191.000
10	588	4	8.300	36.637	192.200
10	590	2	8.125	35.831	193.000
10	591	1	8.169	36.232	194.600
10	592	1	8.064	35.338	193.900
10	593	1	8.220	36.572	196.800
10	598	4	8.112	34.792	202.000
10	600	1	8.054	35.244	197.100
10	601	1	7.936	34.489	195.600
10	602	1	7.847	34.072	197.500
10	605	1	8.147	36.033	201.900
10	608	4	8.420	37.252	199.300
10	610	1	8.589	38.072	200.500
10	610	2	8.218	38.072	200.500
10	611	1	8.463	37.269	201.600
10	611	2	8.121	37.269	201.600
10	612	0	8.344	37.368	203.262
10	612	1	8.496	37.368	203.262
10	616	1	8.549	39.571	204.700
10	616	1	8.720	39.571	204.700
10	617	2	8.501	39.355	203.000
10	618	2	8.647	40.610	203.700
10	620	1	7.733	33.544	200.000
11	501	1	8.990	40.796	267.700
11	502	0	9.115	41.776	268.800

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
11	503	1	9.182	42.441	269.000
11	505	1	9.409	44.786	272.300
11	508	3	9.662	44.930	273.800
11	513	2	9.420	42.671	272.800
11	513	4	9.194	42.671	272.800
11	514	2	9.232	43.002	271.700
11	514	2	9.454	43.002	271.700
11	515	2	9.197	42.085	271.600
11	515	2	9.414	42.085	271.600
11	516	2	9.059	41.208	272.300
11	516	2	9.307	41.208	272.300
11	518	3	8.812	40.996	275.200
11	519	2	8.681	40.037	275.300
11	521	2	9.227	41.642	273.400
11	523	4	8.682	38.719	277.500
11	524	3	8.164	36.691	278.700
11	526	1	8.579	37.570	280.900
11	526	1	8.580	37.570	280.900
11	528	1	8.158	35.906	276.600
11	529	1	8.300	36.395	275.100
11	530	1	8.351	36.284	273.600
11	531	1	8.339	36.364	272.100
11	533	0	8.361	36.472	268.600
11	534	0	8.609	37.751	268.000
11	536	3	8.078	34.670	272.900
11	537	1	7.859	33.666	273.600
11	538	1	7.960	32.686	276.800
11	540	2	8.117	33.340	281.600
11	541	0	8.113	34.516	284.300
11	543	0	8.264	35.471	285.100
11	544	2	9.020	41.128	271.000
11	545	1	8.975	40.419	269.900
11	546	3	8.981	40.250	271.500
11	547	0	8.892	39.399	270.200
11	548	1	8.894	39.329	271.400
11	550	1	8.606	37.470	271.500
11	551	3	8.490	37.300	272.800
11	552	3	8.485	37.218	274.300
11	553	3	8.620	38.338	273.200
11	554	1	8.621	39.257	273.100
11	555	1	8.762	38.984	268.100
11	556	0	8.592	38.016	269.300
11	557	1	8.545	37.234	269.400
11	558	2	8.588	39.701	274.700
11	559	2	8.709	40.622	274.000
11	559	2	8.996	40.622	274.000
11	560	3	8.785	40.266	272.600
11	560	3	9.198	40.266	272.600
11	561	2	8.558	39.272	275.900

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
11	561	3	9.023	39.272	275.900
11	562	3	8.467	38.724	274.800
11	564	1	8.336	37.845	276.700
11	565	1	8.283	37.048	275.900
11	567	4	9.107	42.207	276.000
11	569	2	9.132	42.794	278.400
11	570	2	9.109	41.627	278.800
11	570	4	8.935	41.627	278.800
11	571	1	9.094	40.845	278.500
11	572	2	9.054	40.840	277.500
11	573	3	8.710	40.001	278.200
11	574	3	8.350	37.843	277.700
11	575	3	8.747	38.968	278.300
11	576	4	8.798	39.522	279.800
11	577	1	8.942	40.297	279.900
11	578	2	8.657	38.587	280.400
11	579	3	7.981	34.428	275.100
11	581	3	8.058	34.230	276.600
11	583	2	8.094	34.249	278.300
11	584	3	8.213	35.377	279.200
11	585	2	8.096	34.254	280.100
11	586	1	8.402	35.048	280.800
11	587	3	8.151	36.087	280.100
11	588	1	8.453	35.824	282.000
11	590	1	8.405	36.344	283.300
11	592	1	8.441	36.907	284.100
11	593	4	8.983	38.803	282.300
11	594	2	8.803	38.104	281.900
11	594	2	9.050	38.104	281.900
11	595	1	8.944	39.789	287.700
11	596	1	8.847	40.064	285.500
11	597	2	8.760	41.585	286.900
11	597	3	8.931	41.585	286.900
11	598	2	9.076	41.829	285.300
11	600	2	8.798	38.860	284.300
11	601	1	8.585	37.921	285.400
11	602	0	8.730	39.052	286.000
11	603	3	8.791	40.043	282.500
11	604	3	8.903	41.160	283.100
11	605	1	9.039	41.949	283.600
11	608	4	8.848	40.439	281.600
11	610	4	8.968	41.340	280.600
11	611	3	9.019	41.962	281.900
11	612	1	9.210	42.973	274.600
11	614	4	9.333	43.397	280.700
11	616	2	9.424	44.494	279.500
11	617	3	9.217	43.305	279.400
11	618	4	9.400	44.114	277.900
11	620	1	8.951	40.531	286.900

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
12	501	0	7.674	32.114	333.800
12	502	0	7.855	33.253	332.800
12	503	0	7.918	33.710	332.000
12	504	0	8.055	34.950	331.300
12	505	0	8.270	37.047	330.600
12	507	0	8.358	37.914	332.700
12	508	0	8.386	38.137	331.400
12	509	0	8.506	39.165	331.900
12	510	0	8.431	38.743	333.100
12	511	0	8.449	38.567	334.700
12	512	0	8.313	37.564	334.400
12	513	1	8.239	36.313	333.800
12	514	4	8.176	35.752	332.700
12	515	0	8.187	35.220	333.900
12	516	0	8.223	35.307	335.600
12	518	0	8.225	37.039	337.400
12	519	1	8.208	36.674	338.800
12	520	0	8.399	37.873	339.100
12	521	0	8.174	36.187	335.500
12	523	0	8.278	36.964	341.800
12	524	1	8.242	37.315	345.000
12	524	1	8.063	37.315	345.000
12	525	0	8.366	38.121	345.300
12	526	0	8.473	38.971	344.700
12	528	1	8.165	35.791	345.300
12	529	0	8.119	35.073	344.000
12	530	0	7.903	34.112	343.600
12	531	0	7.858	33.270	343.000
12	533	0	7.542	31.164	341.600
12	534	0	7.583	31.206	339.100
12	535	0	8.047	34.276	345.300
12	536	0	7.858	33.193	346.000
12	537	0	7.859	33.304	347.900
12	538	1	8.101	34.835	350.300
12	540	0	8.533	37.687	350.700
12	541	1	8.737	39.586	350.000
12	543	1	8.793	40.473	349.100
12	544	0	8.014	34.391	335.000
12	545	0	7.918	33.420	335.600
12	546	0	8.092	34.362	336.600
12	547	0	7.934	33.207	337.300
12	548	0	8.098	33.929	338.000
12	550	0	7.942	33.304	341.000
12	551	0	8.012	33.988	341.700
12	552	0	8.163	34.865	342.400
12	553	0	8.093	34.655	340.300
12	554	0	8.026	34.981	338.900
12	555	0	7.639	31.723	337.100
12	556	0	7.655	32.081	339.200

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
12	557	0	7.702	31.892	340.500
12	558	0	8.103	36.126	338.900
12	559	0	8.091	36.104	337.300
12	560	0	8.052	35.036	337.100
12	561	0.	8.199	36.672	340.100
12	562	0	8.045	35.773	340.400
12	563	0	8.067	35.571	341.700
12	564	0	8.173	36.568	342.500
12	565	0	8.133	35.779	343.300
12	567	0	8.303	38.156	336.200
12	568	0	8.493	39.428	335.600
12	569	0	8.556	39.966	336.800
12	570	0	8.563	39.640	338.500
12	571	0	8.581	39.017	339.300
12	572	0	8.489	38.438	338.800
12	573	0	8.524	38.418	340.200
12	574	0	8.267	37.162	342.900
12	575	0	8.469	38.007	341.600
12	576	1	8.534	39.203	341.600
12	577	0	8.643	39.650	340.700
12	578	1	8.434	39.152	343.100
12	579	1	8.035	34.411	347.100
12	580	0	8.228	35.254	345.900
12	581	2	8.231	35.224	347.900
12	582	0	8.310	35.980	346.900
12	583	0	8.293	36.169	348.400
12	584	0	8.436	37.055	347.000
12	585	0	8.469	37.145	348.900
12	586	0	8.488	37.888	348.100
12	587	2	8.489	37.865	346.300
12	588	1	8.525	38.864	347.400
12	589	2	8.617	38.919	346.200
12	590	3	8.670	39.815	347.300
12	591	1	8.699	39.910	345.700
12	592	3	8.733	40.506	346.800
12	593	3	8.797	40.366	343.700
12	594	0	8.636	39.818	344.400
12	597	3	9.599	44.580	342.800
12	597	2	9.181	44.580	342.800
12	598	3	9.334	43.718	341.600
12	600	1	8.879	41.560	344.500
12	601	2	8.938	41.736	346.200
12	602	4	9.095	42.677	345.100
12	603	3	8.866	41.117	342.300
12	604	3	9.037	42.015	341.200
12	605	1	9.194	42.749	340.600
12	608	2	8.418	40.727	341.300
12	610	3	8.891	40.589	339.700
12	611	2	8.981	41.702	339.700

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
12	612	2	9.023	42.360	338.500
12	614	3	8.904	41.737	337.300
12	616	0	8.847	41.580	335.400
12	617	1	8.744	40.856	336.700
12	618	0	8.643	40.382	334.900
12	619	1	8.574	39.497	334.200
12	620	3	9.335	43.959	343.900
13	501	0	7.412	32.736	45.700
13	502	0	7.394	32.574	43.500
13	503	0	7.329	32.238	42.400
13	504	0	7.295	32.277	40.100
13	505	0	7.296	32.715	36.400
13	507	0	7.471	34.305	36.100
13	508	0	7.386	33.639	35.100
13	509	0	7.459	34.409	33.800
13	510	0	7.529	34.948	35.100
13	511	0	7.674	35.767	36.100
13	512	0	7.613	35.160	37.400
13	513	0	7.610	34.253	39.000
13	514	0	7.482	33.397	39.400
13	515	0	7.624	33.883	40.700
13	516	0	7.790	34.861	41.300
13	518	0	7.795	36.631	39.600
13	519	0	7.936	37.249	40.700
13	520	1	8.065	38.008	39.300
13	521	0	7.683	35.197	39.900
13	523	0	8.219	39.073	41.700
13	524	0	8.432	41.027	42.800
13	525	0	8.542	41.621	42.000
13	525	0	8.545	41.621	42.000
13	526	0	8.597	41.758	40.800
13	528	0	8.422	40.428	44.800
13	529	0	8.345	39.377	45.200
13	530	0	8.305	38.716	46.200
13	531	0	8.211	37.999	47.100
13	533	0	8.041	36.421	49.600
13	534	0	7.932	35.195	48.800
13	535	0	8.456	39.657	46.700
13	536	0	8.435	39.534	48.400
13	537	0	8.579	40.537	49.000
13	538	0	8.851	42.567	48.200
13	540	0	8.966	44.373	45.200
13	541	0	9.050	45.099	42.900
13	543	0	9.101	45.126	41.500
13	544	0	7.630	34.166	42.400
13	545	0	7.644	34.110	44.200
13	546	0	7.839	35.038	43.100
13	547	0	7.839	34.980	45.100

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
13	548	0	7.944	35.613	44.300
13	550	0	8.096	36.960	46.300
13	551	1	8.162	37.649	45.600
13	552	0	8.283	38.428	44.800
13	553	0	8.060	37.176	44.200
13	554	0	7.885	36.544	43.100
13	555	0	7.707	34.312	47.300
13	556	0	7.855	35.531	47.500
13	557	0	8.042	36.169	48.200
13	558	0	7.874	37.090	41.500
13	559	0	7.759	36.154	40.800
13	560	0	7.768	35.583	42.300
13	561	0	8.026	37.998	41.300
13	562	0	7.971	37.739	42.700
13	563	0	8.054	38.340	43.500
13	564	0	8.242	39.278	42.600
13	565	0	8.260	39.350	44.000
13	567	0	7.706	36.480	37.500
13	568	0	7.765	36.767	35.400
13	569	0	7.887	37.720	35.300
13	570	0	7.995	38.544	36.700
13	571	1	8.157	38.684	37.900
13	572	0	8.110	38.119	38.400
13	573	1	8.255	38.919	39.100
13	574	0	8.331	39.811	42.000
13	575	0	8.355	39.522	40.400
13	576	0	8.332	40.148	38.900
13	577	0	8.265	39.851	37.900
13	578	0	8.483	40.984	39.700
13	579	0	8.561	40.672	47.300
13	580	0	8.545	40.488	45.800
13	581	0	8.707	41.495	46.700
13	582	1	8.648	41.367	45.300
13	583	0	8.698	42.256	45.800
13	584	0	8.710	42.000	44.100
13	585	0	8.816	43.089	44.900
13	586	0	8.771	43.042	43.700
13	587	2	8.753	42.081	42.900
13	588	1	8.814	43.249	42.300
13	589	1	8.832	42.612	41.600
13	590	2	8.967	43.697	41.200
13	591	0	8.867	42.891	40.300
13	592	1	8.997	43.876	40.200
13	593	0	8.732	41.992	38.700
13	595	0	9.184	45.071	35.600
13	597	0	8.702	43.972	33.600
13	598	0	8.731	42.755	33.800
13	600	1	8.796	43.175	37.800
13	601	1	9.022	44.220	38.600

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
13	602	0	9.012	44.192	37.000
13	603	0	8.563	41.604	37.000
13	604	1	8.540	41.500	35.400
13	605	0	8.577	41.551	34.200
13	608	0	8.461	40.818	36.900
13	610	0	8.336	39.806	36.200
13	611	0	8.378	40.389	34.800
13	612	0	8.338	40.074	33.383
13	614	0	8.198	39.018	33.400
13	616	0	7.969	37.743	32.500
13	617	1	8.045	38.151	34.200
13	618	0	7.815	36.824	33.700
13	619	0	7.703	35.944	34.500
13	620	0	8.989	44.247	34.900
15	501	0	15.716	81.943	303.500
15	502	0	15.875	83.204	303.500
15	503	0	15.956	83.853	303.400
15	505	0	16.292	87.182	303.900
15	507	1	16.291	87.334	305.000
15	508	0	16.372	87.923	304.600
15	509	0	16.472	88.686	305.000
15	510	0	16.367	87.929	305.400
15	511	0	16.331	87.290	305.900
15	512	0	16.210	86.490	305.500
15	513	1	16.157	85.593	304.900
15	514	1	16.170	85.431	304.300
15	515	0	16.124	84.601	304.600
15	516	0	16.100	84.164	305.200
15	518	0	16.014	85.077	306.500
15	519	0	15.915	84.303	306.900
15	520	2	16.098	85.212	307.400
15	521	1	16.035	84.941	305.500
15	523	0	15.893	83.505	308.100
15	524	0	15.739	82.618	309.400
15	525	1	15.837	83.163	309.800
15	526	0	15.964	84.085	309.900
15	528	0	15.641	81.259	308.900
15	529	0	15.657	81.151	308.100
15	531	1	15.465	80.060	307.000
15	533	3	15.263	78.948	305.700
15	534	0	15.445	79.751	304.900
15	535	3	15.474	80.065	308.200
15	536	1	15.349	79.056	308.000
15	537	1	15.236	78.467	308.700
15	538	2	15.558	78.706	310.200
15	540	2	15.806	80.628	311.700
15	541	0	16.037	82.416	312.200
15	543	1	16.128	83.508	312.200

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
15	544	0	15.944	83.558	304.700
15	545	0	15.823	82.557	304.500
15	546	1	15.958	83.043	305.200
15	547	0	15.793	81.841	305.100
15	548	0	15.859	82.245	305.600
15	550	1	15.582	80.758	306.400
15	551	2	15.645	81.070	306.900
15	552	1	15.758	81.542	307.500
15	553	1	15.759	82.098	306.700
15	554	0	15.743	82.840	306.300
15	556	0	15.487	80.331	305.300
15	557	0	15.451	79.870	305.600
15	558	0	15.812	83.782	306.700
15	559	0	15.886	84.308	306.100
15	560	0	15.861	83.462	305.700
15	561	0	15.885	83.846	307.400
15	562	0	15.710	82.993	307.100
15	563	0	15.685	82.389	307.500
15	564	0	15.758	82.919	308.200
15	565	0	15.688	81.971	308.200
15	567	0	16.103	86.428	306.400
15	568	0	16.322	87.722	306.600
15	569	0	16.363	87.804	307.200
15	570	0	16.288	86.939	307.800
15	571	0	16.281	86.125	307.900
15	572	0	16.180	85.794	307.500
15	573	1	16.218	85.283	308.000
15	574	1	15.845	83.255	308.600
15	575	1	16.069	84.425	308.400
15	576	1	16.075	85.429	308.900
15	577	0	16.250	86.148	308.700
15	578	0	15.965	84.823	309.400
15	579	2	15.458	79.618	308.900
15	580	1	15.648	80.600	308.900
15	581	2	15.580	79.958	309.500
15	582	1	15.692	80.820	309.500
15	583	1	15.608	80.401	310.100
15	584	1	15.817	81.631	310.000
15	585	1	15.757	80.945	310.800
15	586	0	15.841	81.873	310.800
15	587	2	15.913	82.536	310.100
15	588	1	15.918	82.904	310.900
15	591	2	16.143	84.437	310.700
15	592	1	16.145	84.471	311.400
15	593	1	16.131	85.612	310.100
15	594	0	16.095	84.879	310.200
15	595	3	16.542	88.137	312.000
15	596	4	16.535	87.732	311.000
15	597	4	16.599	89.530	311.200

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
15	598	3	16.799	89.248	310.400
15	600	3	16.341	86.274	310.900
15	601	4	16.285	85.759	311.600
15	602	3	16.460	86.965	311.500
15	603	4	16.367	86.786	309.800
15	605	1	16.701	88.821	309.700
15	608	3	16.387	86.821	309.300
15	610	1	16.589	87.294	308.600
15	611	1	16.614	88.272	308.900
15	612	0	16.808	89.263	308.691
15	614	1	16.693	89.143	308.000
15	616	1	16.658	89.690	307.200
15	617	1	16.564	88.601	307.500
15	618	2	16.497	88.796	306.600
15	619	1	16.435	88.255	306.100
15	620	1	16.688	88.553	311.400
16	501	0	15.337	80.257	20.500
16	502	1	15.366	80.633	19.700
16	503	1	15.336	80.566	19.200
16	505	1	15.709	82.252	17.000
16	507	1	15.876	83.823	17.300
16	508	0	15.793	83.377	16.700
16	509	1	15.935	84.344	16.400
16	510	1	15.933	84.625	17.000
16	511	0	16.096	85.201	17.600
16	512	3	15.926	84.361	18.000
16	513	1	15.840	83.182	18.400
16	514	1	15.579	82.298	18.300
16	515	1	15.699	82.463	19.000
16	516	1	15.823	83.247	19.400
16	518	3	15.853	85.283	19.200
16	520	1	16.305	86.644	19.400
16	521	1	16.012	83.857	19.000
16	523	1	16.196	87.059	20.700
16	523	3	15.944	87.059	20.700
16	523	1	16.201	87.059	20.674
16	528	2	16.338	87.516	22.300
16	529	1	16.235	86.459	22.200
16	530	2	16.181	85.558	22.500
16	531	1	16.069	84.664	22.600
16	533	2	15.735	82.547	23.200
16	534	0	15.691	81.680	22.400
16	535	1	16.309	86.292	22.900
16	536	2	16.126	85.700	23.600
16	537	3	16.362	86.437	24.100
16	543	2	17.297	92.794	21.900
16	544	1	15.634	82.337	19.700
16	545	1	15.605	81.880	20.400

Table 3 (cont.)

SHOT POINT	LOC	QUAL	TRAVEL-TIME	DIST (km)	AZIM
16	546	1	15.825	82.985	20.200
16	547	1	15.760	82.439	21.000
16	548	1	15.873	83.228	20.800
16	550	2	16.000	83.936	22.000
16	551	1	16.017	84.742	21.900
16	552	1	16.209	85.692	21.800
16	553	1	16.010	84.695	21.200
16	554	3	15.844	84.372	20.600
16	555	3	15.567	81.270	21.600
16	556	2	15.683	82.336	22.000
16	557	1	15.826	82.712	22.500
16	557	1	15.823	82.712	22.500
16	558	3	15.869	85.257	20.100
16	559	1	15.783	84.549	19.600
16	560	1	15.777	83.680	20.000
16	561	1	16.004	86.153	20.200
16	562	0	15.924	85.587	20.700
16	563	3	15.967	85.937	21.200
16	564	1	16.184	87.040	21.100
16	565	2	16.194	86.752	21.700
16	567	2	15.827	85.598	18.300
16	568	1	15.902	86.285	17.500
16	569	1	16.053	87.211	17.700
16	570	1	16.156	87.720	18.400
16	571	1	16.282	87.591	19.000
16	572	1	16.176	86.947	19.100
16	576	2	16.438	88.748	19.700
16	576	1	16.615	88.748	19.700
16	577	2	16.396	88.702	19.200
16	579	4	16.369	87.054	23.400
16	581	4	16.573	87.993	23.400
16	612	0	16.923	89.849	17.300
16	614	1	16.641	88.825	17.200
16	614	1	16.809	88.825	17.200
16	616	1	16.421	87.782	16.500
16	617	2	16.382	87.855	17.300
16	618	2	16.218	86.661	16.900

APPENDIX A

Instrument Performance

The following pages contain detailed information on the performance of the seismic recorders. The recorders are grouped into six teams of twenty instruments each. All teams for a given shot are listed together. The shot time is Julian day, hour, minute, and second (UTC). The column headings are defined as follows:

LOC	Field location number of the seismic recorder unit (Table 2.) If LOC has no entry the unit was not deployed.
DIST	Distance from the shot point to the recorder in kilometers.
AZIM	Azimuth from the shot point to the recorder measured clockwise from north.
UNIT	Identification (i.e. serial) number of the recording unit.
CHRON	Time correction (ms) for the recorder clock at shot time. The correction accounts for linear drift of recorder and master clock oscillators and is in the sense CHRON = Correct time - Recorder time. All times listed elsewhwere in this report have been corrected by this amount.
CHAN	Channel digitized. Amplifier attenuation is 30 db, 12 db, and 48 db for channels 1, 2, and 3, respectively.
TAPE GRADE	Number that denotes instrument performance. 0 - Seismic record digitized. 1 - Seismic record not digitized because of poor time code. 20 - Recorder not deployed or failed to operate.

Appendix A: Instrument Performance

SHOT NUMBER 11 SHOT POINT 9
SHOT TIME: 242: 5: 0: 0.009

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	38.82	137.8	1	15	2	0
534	44.71	142.9	2	-16	2	0
574	39.94	137.2	3	10	2	0
556	43.88	142.6	4	-66	2	0
566	41.12	136.6	5	14		1
533	45.16	141.4	6	4	2	0
577	37.06	137.7	7	-6	2	0
555	43.93	144.2	8	16	2	0
619	35.96	144.5	9	65	2	0
563	41.08	139.1	10	3	2	0
576	37.73	137.1	11	9	1	0
			12	-6		20
557	44.29	141.7	13	-25	2	0
			14	18		20
562	40.60	140.1	15	-55	2	0
612	33.98	138.4	16	-8	2	0
578	38.22	135.7	17	23	2	0
595	34.75	129.8	18	-10	1	0
558	39.97	141.1	19	19	2	0
620	34.32	131.2	20	12	2	0

TEAM 2

501	43.23	146.4	21	-3	2	0
502	42.04	147.0	22	11	2	0
503	41.54	147.6	23	17	1	0
504	40.28	148.1	24	-2		1
505	38.16	148.5	25	14	2	0
506	38.07	146.4	26	3		20
507	37.39	146.4	27	15	2	0
508	37.10	147.7	28	26	2	0
509	36.10	147.0	29	10	2	0
510	36.60	145.8	30	6	2	0
511	36.93	144.3	31	7	1	0
512	37.90	144.8	32	37	2	0
513	39.07	145.6	33	67	1	0
514	39.54	146.7	34	9	2	0
515	40.16	145.8	35	-28	2	0
516	40.25	144.3	36	0	2	0
517	38.45	143.7	37	12		20
518	38.82	142.1	38	2	2	0
520	38.34	140.2	39	1	2	0
519	39.42	141.0	40	5	2	0

TEAM 3

611	34.89	137.5	41	-11	2	0
604	35.06	135.6	42	7	2	0
605	34.20	135.8	43	3	2	0
			44	0		20
597	33.34	131.9	45	0	2	0
616	34.08	142.5	46	-6	2	0
598	33.67	133.9	47	-76	2	0
596	35.15	132.3	48	12	2	0
610	35.94	138.1	49	10	2	0
599	35.83	133.5	50	0		20
614	34.31	140.1	51	18	1	0
615	33.45	141.1	52	86		20
602	35.91	131.1	53	4	2	0
603	36.21	135.1	54	-12	2	0
618	35.18	143.4	55	21	2	0
609	37.19	136.1	56	0		20
600	36.61	132.6	57	19	2	0
601	37.12	130.9	58	12	2	0
608	36.26	136.4	59	-2	2	0
617	35.01	141.3	60	-8	2	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	43.04	140.8	61	10	1	0
549	42.31	141.2	62	105		1
548	41.91	142.8	63	7	2	0
552	41.91	138.9	64	15	1	0
551	42.55	139.9	65	-15	2	0
546	41.30	143.7	66	6	2	0
547	42.52	143.5	67	1	2	0
554	41.05	141.7	68	-8	2	0
553	41.63	140.7	69	-5	2	0
544	41.08	145.0	70	27	2	0
545	42.10	144.8	71	14	2	0
573	38.11	138.8	72	14	2	0
569	35.89	141.6	73	-13	2	0
571	37.30	139.5	74	-2	2	0
568	36.22	143.0	75	13	2	0
572	37.74	140.2	76	11	2	0
567	37.54	142.9	77	7	2	0
570	36.52	140.0	78	-9	2	0
561	39.69	139.9	79	29	2	0
559	39.71	142.6	80	9	2	0

TEAM 5

587	40.41	133.9	81	-12	2	0
586	41.02	132.6	82	-10	2	0
582	42.19	134.9	83	20	1	0
589	39.48	133.2	84	17	1	0
588	39.98	132.3	85	-7	2	0
579	43.59	135.9	86	0	2	0
584	41.32	134.0	87	1	1	0
590	39.13	131.6	88	21	1	0
580	42.51	136.1	89	1	2	0
583	42.54	133.7	90	36	2	0
593	37.34	134.3	91	15	1	0
594	38.06	134.1	92	0	2	0
592	38.40	131.4	93	14	1	0
585	41.95	132.6	94	19	2	0
581	43.16	134.8	95	22		1
591	38.46	132.9	96	-9	2	0
564	40.37	137.9	97	6	1	0
560	40.71	143.1	98	10	2	0
565	41.30	137.7	99	15	2	0
521	39.38	144.1	100	11		1

TEAM 6

522	38.88	138.9	101	0		20
523	39.82	138.3	102	10	3	0
524	40.42	135.4	103	0		1
525	39.82	134.6	104	-2	2	0
526	38.88	134.5	105	24	2	0
527	41.21	135.4	106	0		20
528	41.86	136.2	107	19	2	0
529	42.13	137.6	108	0	2	0
530	42.89	138.5	109	4	2	0
531	43.50	139.4	110	17	1	0
532	44.37	140.3	111	0		20
535	43.18	137.2	112	4	1	0
536	44.34	137.4	113	-10	2	0
537	44.78	136.1	114	0	1	0
538	44.33	133.5	115	8	1	0
539	43.13	131.8	116	0		20
540	42.25	130.9	117	-17	2	0
542	40.12	131.1	118	0		20
541	40.49	129.7	119	4	2	0
543	39.39	129.6	120	1	2	0

Appendix A (cont.)

SHOT NUMBER 12 SHOT POINT 16
SHOT TIME: 242: 5: 2: 0.013

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	87.81	20.2	1	15	2	0
534	81.68	22.4	2	-16	1	0
574	87.67	21.0	3	10	2	0
556	82.34	22.0	4	-67	2	0
566	87.57	21.8	5	14	2	0
533	82.55	23.2	6	4	1	0
577	88.70	19.2	7	-6	2	0
555	81.27	21.6	8	16	1	0
619	85.67	17.0	9	65	2	0
563	85.94	21.2	10	3	2	0
576	88.75	19.7	11	9	2	0
			12	-6		20
557	82.71	22.5	13	-25	1	0
			14	18		20
562	85.59	20.7	15	-55	2	0
612	89.85	17.3	16	-8	2	0
578	89.34	20.3	17	23	2	0
595	94.19	19.2	18	-10	2	0
558	85.26	20.1	19	19	2	0
620	93.54	18.7	20	12	2	0

TEAM 2

501	80.26	20.5	21	-3	2	0
502	80.63	19.7	22	11	2	0
503	80.57	19.2	23	17	1	0
504	81.11	18.3	24	-2		1
505	82.25	17.0	25	14	2	0
506	83.37	17.6	26	3		20
507	83.82	17.3	27	15	2	0
508	83.38	16.7	28	26	2	0
509	84.34	16.4	29	10	2	0
510	84.63	17.0	30	6	2	0
511	85.20	17.6	31	7	1	0
512	84.36	18.0	32	37	1	0
513	83.18	18.4	33	67	1	0
514	82.30	18.3	34	9	1	0
515	82.46	19.0	35	-28	2	0
516	83.25	19.4	36	0	2	0
517	84.64	18.6	37	12		20
518	85.28	19.2	38	2	2	0
520	86.64	19.4	39	1	2	0
519	85.60	19.8	40	5	1	0

TEAM 3

611	89.86	18.0	41	-11	2	0
604	90.81	18.5	42	7	2	0
605	91.11	17.9	43	3	2	0
			44	0		20
597	93.56	18.1	45	0	2	0
616	87.78	16.5	46	-6	2	0
598	92.35	18.0	47	-76	2	0
596	92.63	19.1	48	12	2	0
610	89.02	18.5	49	10	2	0
599	91.64	19.3	50	0		20
614	88.81	17.2	51	18	1	0
615	88.83	16.5	52	86		20
602	93.03	19.7	53	4	2	0
603	90.55	19.2	54	-12	2	0
618	86.66	16.9	55	21	2	0
609	89.58	19.6	56	--		20
600	91.86	19.9	57	19	2	0
601	92.68	20.4	58	12	2	0
608	89.83	19.0	59	-2	2	0
617	87.86	17.3	60	-8	2	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	83.94	22.0	61	10	1	0
549	84.01	21.5	62	105		1
548	83.23	20.8	63	7	1	0
552	85.69	21.8	64	15	1	0
551	84.74	21.9	65	-15	1	0
546	82.99	20.2	66	6	1	0
547	82.44	21.0	67	1	1	0
554	84.37	20.6	68	-8	2	0
553	84.69	21.2	69	-5	2	0
544	82.34	19.7	70	27	2	0
545	81.88	20.4	71	14	2	0
573	87.55	19.6	72	14	2	0
569	87.19	17.7	73	-13	2	0
571	87.58	19.0	74	-2	2	0
568	86.29	17.5	75	13	2	0
572	86.95	19.1	76	11	2	0
567	85.60	18.3	77	7	2	0
570	87.72	18.4	78	-9	2	0
561	86.15	20.2	79	30	2	0
559	84.55	19.6	80	9	1	0

TEAM 5

587	89.58	21.9	81	-12	2	0
586	90.25	22.5	82	-10	2	0
582	88.25	22.8	83	20	1	0
589	90.40	21.4	84	17		0
588	90.82	21.9	85	-7	2	0
579	87.05	23.4	86	0	2	0
584	89.17	22.4	87	1	1	0
590	91.53	21.5	88	21	1	0
580	87.32	22.7	89	1	1	0
583	88.94	23.2	90	36	2	0
593	90.55	20.0	91	15	1	0
594	90.40	20.5	92	0	2	0
592	91.94	21.1	93	14	2	0
585	89.95	23.0	94	19	2	0
581	87.99	23.4	95	22	1	0
591	91.01	20.9	96	-9	1	0
564	87.04	21.1	97	6	1	0
560	83.68	20.0	98	10	2	0
565	86.75	21.7	99	15	2	0
521	83.86	19.0	100	11	2	0

TEAM 6

522	87.14	20.0	101	0		20
523	87.06	20.7	102	10	2	0
524	88.60	21.6	103	0	2	0
525	89.37	21.4	104	-2	1	0
526	89.82	20.9	105	24	2	0
527	88.34	22.1	106	0		20
528	87.52	22.3	107	19	2	0
529	86.46	22.2	108	0	2	0
530	85.56	22.5	109	4	1	0
531	84.66	22.6	110	17	1	0
532	83.65	22.9	111	0		20
535	86.29	22.9	112	4	1	0
536	85.70	23.6	113	-10	1	0
537	86.44	24.1	114	0	1	0
538	88.53	24.3	115	8	3	0
539	90.11	23.9	116	0		20
540	91.06	23.5	117	-17	2	0
542	91.57	22.1	118	0		20
541	92.39	22.6	119	4	2	0
543	92.79	21.9	120	1	2	0

Appendix A (cont.)

SHOT NUMBER 13 SHOT POINT 11
SHOT TIME: 242: 5: 4: 0.011

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	38.97	278.3	1	16	1	0
534	37.75	268.0	2	-16	1	0
574	37.84	277.7	3	10	2	0
556	38.02	269.3	4	-67	2	0
566	36.65	277.0	5	14		1
533	36.47	268.6	6	4	1	0
577	40.30	279.9	7	-6	2	0
555	38.98	268.1	8	16	1	0
619	44.06	276.6	9	66	2	0
563	37.92	275.0	10	3	2	0
576	39.52	279.8	11	9	2	0
			12	-6		20
557	37.23	269.4	13	-25	1	0
			14	18		20
562	38.72	274.8	15	-55	2	0
612	43.03	282.0	16	-8	2	0
578	38.59	280.4	17	23	2	0
595	39.79	287.7	18	-10	1	0
558	39.70	274.7	19	19	2	0
620	40.53	286.9	20	12	2	0

TEAM 2

501	40.80	267.7	21	-3	1	0
502	41.78	268.8	22	11	1	0
503	42.44	269.0	23	17	1	0
504	43.39	270.2	24	-2		1
505	44.79	272.3	25	14	2	0
506	43.70	273.5	26	3		20
507	44.09	274.2	27	15	2	0
508	44.93	273.8	28	26	2	0
509	45.20	275.2	29	10	2	0
510	44.27	275.3	30	6	2	0
511	43.31	275.8	31	7	1	0
512	42.94	274.5	32	37	1	0
513	42.67	272.8	33	67	1	0
514	43.00	271.7	34	9	2	0
515	42.08	271.6	35	-28	1	0
516	41.21	272.3	36	0	1	0
517	42.01	274.6	37	-2653		20
518	41.00	275.2	38	2	2	0
520	40.40	277.0	39	1	2	0
519	40.04	275.3	40	5	2	0

TEAM 3

611	41.96	281.9	41	-11	2	0
604	41.16	283.1	42	7	2	0
605	41.95	283.6	43	3	2	0
			44	0		20
597	41.58	286.9	45	0	2	0
616	44.49	279.5	46	-6	2	0
598	41.83	285.3	47	-76	2	0
596	40.05	285.5	48	12	2	0
610	41.34	280.6	49	10	2	0
599	39.83	284.1	50	0		20
614	43.40	280.7	51	18	1	0
615	44.40	280.8	52	86		20
602	39.05	286.0	53	4	2	0
603	40.04	282.5	54	-13	2	0
618	44.11	277.9	55	21	2	0
609	39.56	281.0	56	0		20
600	38.86	284.3	57	19	2	0
601	37.92	285.4	58	12	2	0
608	40.44	281.6	59	-2	2	0
617	43.31	279.4	60	-8	2	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	37.47	271.5	61	10	1	0
549	38.19	272.1	62	105		1
548	39.33	271.4	63	7	1	0
552	37.22	274.3	64	15	1	0
551	37.30	272.8	65	-15	1	0
546	40.25	271.5	66	6	1	0
547	39.40	270.2	67	1	1	0
554	39.26	273.1	68	-8	1	0
553	38.34	273.2	69	-5	1	0
544	41.13	271.0	70	27	2	0
545	40.42	269.9	71	14	1	0
573	39.96	278.2	72	14	1	0
569	42.80	278.4	73	-13	2	0
571	40.85	278.5	74	-2	2	0
568	43.19	277.2	75	13	2	0
572	40.84	277.5	76	11	2	0
567	42.22	276.0	77	7	2	0
570	41.64	278.8	78	-9	2	0
561	39.27	275.9	79	30	2	0
559	40.62	274.0	80	9	2	0

TEAM 5

587	36.09	280.1	81	-12	1	0
586	35.05	280.8	82	-10	1	0
582	35.06	277.5	83	21	1	0
589	36.58	281.6	84	17		1
588	35.82	282.0	85	-7	1	0
579	34.43	275.1	86	0	1	0
584	35.38	279.2	87	1	1	0
590	36.34	283.3	88	21	1	0
580	35.36	276.0	89	1	1	0
583	34.25	278.3	90	36	1	0
593	38.80	282.3	91	15	1	0
594	38.10	281.9	92	0	1	0
592	36.91	284.1	93	14	1	0
585	34.25	280.1	94	19	1	0
581	34.23	276.6	95	22	1	0
591	37.33	282.7	96	-9	1	0
564	37.85	276.7	97	6	1	0
560	40.27	272.6	98	10	1	0
565	37.05	275.9	99	15	1	0
521	41.64	273.4	100	11	1	0

TEAM 6

522	39.41	277.4	101	0		20
523	38.43	276.9	102	10	1	0
524	36.69	278.7	103	0	2	0
525	36.85	280.0	104	-2	1	0
526	37.57	280.9	105	24	2	0
527	36.03	278.0	106	0		20
528	35.91	276.6	107	19	1	0
529	36.40	275.1	108	0	1	0
530	36.28	273.6	109	4	1	0
531	36.36	272.1	110	17	1	0
532	36.31	270.4	111	0		20
535	35.42	274.3	112	4	1	0
536	34.67	272.9	113	-10	1	0
537	33.67	273.6	114	0	1	0
538	32.69	276.8	115	8	1	0
539	32.95	279.8	116	0		20
540	33.34	281.6	117	-17	1	0
542	35.29	283.1	118	0		20
541	34.52	284.3	119	4	1	0
543	35.47	285.1	120	1	1	0

Appendix A (cont.)

SHOT NUMBER 14 SHOT POINT 14
SHOT TIME: 242: 5: 6: 0.006

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	86.83	210.4	1	16	2	0
534	92.48	207.8	2	-16	2	0
574	86.78	209.7	3	10	2	0
556	91.88	208.2	4	-67	2	0
566	86.72	208.8	5	14	2	0
533	91.54	207.2	6	4	1	0
577	86.25	211.5	7	-6	2	0
555	93.01	208.5	8	16	1	0
619	89.98	213.1	9	66	2	0
563	88.45	209.2	10	3	2	0
576	86.05	211.0	11	9	2	0
			12	-6		20
557	91.44	207.8	13	-25	1	0
			14	18		20
562	88.90	209.7	15	-55	2	0
612	85.83	213.6	16	-8	2	0
578	85.32	210.6	17	23	2	0
595	80.90	212.4	18	-10	1	0
558	89.37	210.2	19	19	2	0
620	81.69	212.8	20	12	2	0

TEAM 2

501	94.21	209.4	21	-3	2	0
502	94.04	210.1	22	11	2	0
503	94.23	210.5	23	17	1	0
504	93.94	211.3	24	-2		1
505	93.26	212.5	25	14	2	0
506	91.97	212.2	26	3		20
507	91.66	212.6	27	15	1	0
508	92.29	213.0	28	26	2	0
509	91.50	213.4	29	10	2	0
510	90.98	212.9	30	6	1	0
511	90.20	212.5	31	7	2	0
512	90.88	212.0	32	37	2	0
513	91.89	211.5	33	67	2	0
514	92.77	211.4	34	9	2	0
515	92.42	210.9	35	-28	2	0
516	91.52	210.6	36	0	2	0
517	90.41	211.5	37	12		20
518	89.59	211.1	38	2	2	0
520	88.20	211.1	39	1	2	0
519	89.11	210.5	40	5	2	0

TEAM 3

611	85.54	212.9	41	-11	2	0
604	84.45	212.6	42	7	2	0
605	84.36	213.2	43	3	2	0
			44	0		20
597	81.94	213.5	45	0	2	0
616	88.17	214.0	46	-6	2	0
598	83.16	213.4	47	-76	2	0
596	82.46	212.3	48	12	2	0
610	86.18	212.3	49	10	2	0
599	83.36	211.9	50	0		20
614	86.91	213.6	51	18	1	0
615	87.17	214.2	52	86		20
602	81.86	211.7	53	4	2	0
603	84.44	211.8	54	-13	2	0
618	89.08	213.4	55	21	2	0
609	85.26	211.3	56	0		20
600	82.94	211.3	57	19	2	0
601	81.98	210.8	58	12	2	0
608	85.22	211.9	59	-2	2	0
617	87.76	213.2	60	-8	2	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	90.30	208.4	61	10	1	0
549	90.31	208.9	62	105		1
548	91.21	209.4	63	7	2	0
552	88.59	208.7	64	15	1	0
551	89.51	208.5	65	-15	1	0
546	91.59	209.9	66	6	1	0
547	91.96	209.2	67	1	2	0
554	90.13	209.7	68	-8	2	0
553	89.68	209.2	69	-5	1	0
544	92.35	210.3	70	27	1	0
545	92.64	209.7	71	14	2	0
573	87.26	211.0	72	14	1	0
569	88.24	212.8	73	-13	2	0
571	87.41	211.6	74	-2	2	0
568	89.18	212.7	75	13	2	0
572	88.01	211.4	76	11	2	0
567	89.57	211.9	77	7	2	0
570	87.46	212.2	78	-9	2	0
561	88.45	210.2	79	30	2	0
559	90.20	210.6	80	9	2	0

TEAM 5

587	84.71	208.9	81	-12	1	0
586	83.95	208.4	82	-10	2	0
582	85.89	207.9	83	21	1	0
589	83.99	209.4	84	17		1
588	83.48	209.0	85	-7	1	0
579	87.02	207.2	86	0	2	0
584	85.03	208.3	87	1	1	0
590	82.85	209.5	88	21	1	0
580	86.83	207.9	89	1	1	0
583	85.15	207.5	90	36	1	0
593	84.20	211.0	91	15	1	0
594	84.21	210.5	92	0	1	0
592	82.54	210.0	93	14	1	0
585	84.17	207.7	94	19	1	0
581	86.08	207.3	95	22	1	0
591	83.51	210.1	96	-9	1	0
564	87.39	209.5	97	6	2	0
560	90.94	210.1	98	10	2	0
565	87.56	208.9	99	15	2	0
521	91.05	211.1	100	11	2	0

TEAM 6

522	87.55	210.6	101	0		20
523	87.46	209.9	102	10	1	0
524	85.73	209.1	103	0	2	0
525	85.02	209.4	104	-2	1	0
526	84.69	210.0	105	24	2	0
527	85.91	208.6	106	0		20
528	86.69	208.3	107	20	2	0
529	87.76	208.4	108	0	2	0
530	88.62	208.0	109	4	1	0
531	89.49	207.8	110	17	1	0
532	90.46	207.5	111	0		20
535	87.83	207.7	112	4	1	0
536	88.36	207.0	113	-10	2	0
537	87.58	206.5	114	0	1	0
538	85.49	206.3	115	8	1	0
539	83.93	206.9	116	0		20
540	83.02	207.3	117	-17	2	0
542	82.69	208.8	118	0		20
541	81.80	208.4	119	4	2	0
543	81.51	209.1	120	1	1	0

Appendix A (cont.)

SHOT NUMBER 15 SHOT POINT 17
SHOT TIME: 242: 5: 8: 0.010

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	6.53	185.3	1	16	2	0
534	13.42	178.9	2	-16	2	0
574	7.07	176.3	3	10	2	0
556	12.59	180.2	4	-67	2	0
566	7.77	168.3	5	14	3	0
533	13.10	173.4	6	4	2	0
577	5.44	198.6	7	-6	2	0
555	13.40	184.2	8	16	1	0
619	9.11	219.6	9	66	2	0
563	8.81	178.8	10	3	1	0
576	5.46	190.4	11	9	2	0
			12	-6		20
557	12.53	176.6	13	-25	1	0
			14	18		20
562	8.90	184.0	15	-56	2	0
612	5.20	232.6	16	-8	2	0
578	5.11	179.9	17	23	2	0
595	0.05	56.2	18	-10	3	0
558	9.01	190.3	19	19	2	0
620	0.92	247.7	20	12	3	0

TEAM 2

501	14.03	191.4	21	-3	2	0
502	13.53	196.3	22	11	2	0
503	13.57	199.2	23	17	2	0
504	13.10	204.4	24	-2		1
505	12.32	213.4	25	14	2	0
506	11.03	210.8	26	3		20
507	10.72	214.0	27	15	2	0
508	11.39	217.0	28	26	2	0
509	10.68	221.3	29	10	2	0
510	10.08	217.3	30	6	2	0
511	9.26	213.6	31	7	2	0
512	9.95	209.1	32	37	2	0
513	11.02	204.9	33	67	2	0
514	11.91	204.9	34	9	2	0
515	11.68	200.5	35	-28	2	0
516	10.90	197.1	36	0	2	0
517	9.55	204.2	37	12		20
518	8.85	198.8	38	2		1
520	7.51	196.6	39	1	2	0
519	8.60	192.8	40	5	2	0

TEAM 3

611	4.66	221.9	41	-11	2	0
604	3.53	217.5	42	7	2	0
605	3.62	231.4	43	3	2	0
			44	0		20
597	1.85	270.0	45	0	2	0
616	7.61	231.2	46	-6	2	0
598	2.64	245.7	47	-76		1
596	1.53	205.6	48	12	2	0
610	5.24	210.8	49	10	2	0
599	2.51	195.9	50	0		20
614	6.22	229.0	51	18	1	0
615	6.79	236.4	52	87		20
602	1.39	163.1	53	4	2	0
603	3.59	198.5	54	-13	2	0
618	8.30	223.7	55	21	2	0
609	4.61	190.9	56	0		20
600	2.54	173.6	57	19	2	0
601	2.47	146.1	58	12	2	0
608	4.33	202.7	59	-2	2	0
617	6.95	223.4	60	-8	2	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	11.10	177.4	61	10	1	0
549	10.73	181.0	62	106		1
548	11.20	186.9	63	7	2	0
552	9.37	174.8	64	15	1	0
551	10.33	176.1	65	-15	2	0
546	11.27	191.6	66	6	2	0
547	12.02	186.8	67	1	2	0
554	10.02	187.0	68	-8	2	0
553	9.95	181.8	69	-5	2	0
544	11.83	195.4	70	27	2	0
545	12.39	191.4	71	14	2	0
573	6.62	193.9	72	14	1	0
569	7.32	216.8	73	-13	2	0
571	6.57	201.9	74	-2	2	0
568	8.26	216.2	75	13	2	0
572	7.20	200.6	76	11	2	0
567	8.65	207.7	77	7	2	0
570	6.53	209.3	78	-9	2	0
561	8.17	187.8	79	30	2	0
559	9.62	195.4	80	9	2	0

TEAM 5

587	6.27	157.3	81	-12	1	0
586	6.54	147.3	82	-10	2	0
582	8.18	157.0	83	21	1	0
589	5.22	156.2	84	17		1
588	5.48	147.9	85	-7	2	0
579	9.75	157.9	86	0	2	0
584	7.14	154.9	87	1	1	0
590	4.54	145.4	88	21	1	0
580	8.83	161.5	89	1		1
583	8.22	150.4	90	36	2	0
593	3.83	179.4	91	15	1	0
594	4.27	171.0	92	0	1	0
592	3.80	145.6	93	14	1	0
585	7.44	145.4	94	19	2	0
581	9.05	154.1	95	22	1	0
591	4.18	158.6	96	-9	1	0
564	7.71	177.2	97	6	2	0
560	10.55	192.4	98	10	2	0
565	8.37	172.4	99	15	2	0
521	10.29	200.5	100	11	2	0

TEAM 6

522	7.12	189.1	101	0		20
523	7.47	181.5	102	10	2	0
524	6.75	165.5	103	0		1
525	5.95	163.7	104	-2	2	0
526	5.10	168.0	105	24	2	0
527	7.42	162.1	106	0		20
528	8.28	163.9	107	20	2	0
529	9.02	169.1	108	0	2	0
530	10.00	169.9	109	4	2	0
531	10.89	171.4	110	17	2	0
532	11.99	172.0	111	0		20
535	9.79	164.3	112	4	2	0
536	10.89	162.2	113	-10	2	0
537	10.92	156.5	114	0	2	0
538	9.90	146.3	115	8	2	0
539	8.50	139.8	116	0		20
540	7.55	135.5	117	-17	2	0
542	5.44	138.9	118	0		20
541	5.75	128.6	119	4	2	0
543	4.66	127.4	120	1	2	0

Appendix A (cont.)

SHOT NUMBER 16 SHOT POINT 8
SHOT TIME: 242: 8: 0: 0.009

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	34.29	85.9	1	17	1	0
534	35.36	97.2	2	-18	3	0
574	35.32	86.9	3	11	1	0
556	34.98	95.9	4	-74	3	0
566	36.42	87.8	5	15	2	0
533	36.57	96.3	6	5	3	0
577	33.29	83.4	7	-6	1	0
555	34.13	97.4	8	18	2	0
619	29.07	86.1	9	73	3	0
563	35.00	89.7	10	4	1	0
576	34.01	83.9	11	10	1	0
			12	-7		20
557	35.74	95.7	13	-28	1	0
			14	20		20
562	34.19	89.8	15	-62	1	0
612	31.21	79.2	16	-9	3	0
578	35.03	83.7	17	25	2	0
595	35.99	75.5	18	-11	2	0
558	33.22	89.8	19	22	1	0
620	35.03	75.7	20	14	1	0

TEAM 2

501	32.40	98.5	21	-3	1	0
502	31.30	97.4	22	12	1	0
503	30.61	97.2	23	19	3	0
504	29.56	95.7	24	-2	1	0
505	28.07	92.7	25	15	1	0
506	29.17	91.0	26	3		20
507	28.81	89.8	27	17	1	0
508	27.96	90.2	28	28	1	0
509	27.78	88.0	29	11	2	0
510	28.71	88.1	30	6	1	0
511	29.72	87.6	31	7	1	0
512	29.98	89.4	32	41	1	0
513	30.19	91.9	33	74	1	0
514	29.87	93.5	34	10	1	0
515	30.79	93.6	35	-31	1	0
516	31.65	92.6	36	0	1	0
517	30.91	89.5	37	14		20
518	31.96	88.9	38	2	1	0
520	32.72	86.9	39	1	1	0
519	32.92	89.0	40	6	1	0

TEAM 3

611	32.16	80.1	41	-12	2	0
604	33.24	79.3	42	8	2	0
605	32.67	78.1	43	4	2	0
			44	0		20
597	34.15	74.8	45	0	2	0
616	29.18	81.7	46	-7	2	0
598	33.34	76.3	47	-85	2	0
596	34.97	77.4	48	13	2	0
610	32.44	82.1	49	11	2	0
599	34.74	79.1	50	0		20
614	30.51	80.7	51	20	3	0
615	29.61	79.8	52	96		20
602	36.03	77.7	53	5	2	0
603	34.12	80.6	54	-14	3	0
618	29.23	84.1	55	23	3	0
609	34.22	82.5	56	0		20
600	35.68	79.6	57	21	2	0
601	36.84	79.2	58	14	2	0
608	33.51	81.4	59	-2	2	0
617	30.29	82.5	60	-9	1	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	35.40	93.4	61	11	3	0
549	34.68	92.9	62	117	2	0
548	33.55	93.7	63	8	1	0
552	35.67	90.6	64	17	1	0
551	35.56	92.1	65	-17	1	0
546	32.62	93.6	66	6	3	0
547	33.53	95.1	67	1	1	0
554	33.60	91.6	68	-8	1	0
553	34.52	91.6	69	-6	3	0
544	31.77	94.4	70	30	1	0
545	32.54	95.6	71	16	1	0
573	33.32	85.6	72	16	1	0
569	30.58	84.1	73	-14	1	0
571	32.49	84.9	74	-2	1	0
568	30.02	85.6	75	15	3	0
572	32.36	86.0	76	12	1	0
567	30.82	87.5	77	8	1	0
570	31.79	84.1	78	-9	1	0
561	33.72	88.5	79	33	1	0
559	32.26	90.5	80	10	1	0

TEAM 5

587	37.37	85.1	81	-13	2	0
586	38.50	84.8	82	-11	2	0
582	38.04	87.8	83	23	2	0
589	37.15	83.5	84	18	1	0
588	37.97	83.4	85	-8	2	0
579	38.49	90.1	86	0	2	0
584	37.93	86.2	87	1	1	0
590	37.75	82.0	88	23	1	0
580	37.62	89.1	89	2	2	0
583	38.93	87.3	90	40	2	0
593	35.22	81.6	91	17	2	0
594	35.79	82.4	92	0	2	0
592	37.41	81.0	93	15	1	0
585	39.14	85.8	94	21	2	0
581	38.79	88.8	95	25	1	0
591	36.69	82.0	96	-10	2	0
564	35.21	87.9	97	6	2	0
560	32.59	92.3	98	11	1	0
565	35.93	88.9	99	17	1	0
521	31.23	91.2	100	12	1	0

TEAM 6

522	33.75	86.7	101	0		20
523	34.66	87.5	102	11	1	0
524	36.58	86.2	103	0	2	0
525	36.62	84.9	104	-2	1	0
526	36.09	83.7	105	27	1	0
527	37.14	87.0	106	0		20
528	37.13	88.4	107	22	1	0
529	36.53	89.8	108	1	1	0
530	36.58	91.4	109	4	1	0
531	36.50	92.8	110	19	3	0
532	36.61	94.5	111	0		20
535	37.47	90.7	112	5	1	0
536	38.19	92.1	113	-12	1	0
537	39.20	91.5	114	0	1	0
538	40.33	88.9	115	9	1	0
539	40.37	86.5	116	0		20
540	40.27	84.9	117	-19	1	0
542	38.69	82.8	118	0		20
541	39.67	82.2	119	4	1	0
543	39.00	80.9	120	1	1	0

Appendix A (cont.)

SHOT NUMBER 17 SHOT POINT 12
SHOT TIME: 242: 8: 2: 0.012

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	38.01	341.6	1	17	1	0
534	31.21	339.1	2	-18	3	0
574	37.16	342.9	3	11	1	0
556	32.08	339.2	4	-74	1	0
566	36.31	344.4	5	15	2	0
533	31.16	341.6	6	5	3	0
577	39.65	340.7	7	-7	1	0
555	31.72	337.1	8	18	2	0
619	39.50	334.2	9	73	1	0
563	35.57	341.7	10	4	1	0
576	39.20	341.6	11	10	1	0
			12	-7		20
557	31.89	340.5	13	-28	3	0
			14	20		20
562	35.77	340.4	15	-62	1	0
612	42.36	338.5	16	-9	1	0
578	39.15	343.1	17	25	1	0
595	44.08	345.1	18	-11	2	0
558	36.13	338.9	19	22	1	0
620	43.96	343.9	20	14	2	0

TEAM 2

501	32.11	333.8	21	-3	1	0
502	33.25	332.8	22	12	2	0
503	33.71	332.0	23	19	3	0
504	34.95	331.3	24	-2	1	0
505	37.05	330.6	25	15	1	0
506	37.24	332.8	26	3		20
507	37.91	332.7	27	17	1	0
508	38.14	331.4	28	28	1	0
509	39.17	331.9	29	11	2	0
510	38.74	333.1	30	6	1	0
511	38.57	334.7	31	7	1	0
512	37.56	334.4	32	41	1	0
513	36.31	333.8	33	75	1	0
514	35.75	332.7	34	10	1	0
515	35.22	333.9	35	-31	1	0
516	35.31	335.6	36	0	1	0
517	37.16	335.7	37	14		20
518	37.04	337.4	38	2	2	0
520	37.87	339.1	39	1	1	0
519	36.67	338.8	40	6	3	0

TEAM 3

611	41.70	339.7	41	-12	2	0
604	42.01	341.2	42	8	2	0
605	42.75	340.6	43	4	2	0
			44	0		20
597	44.58	342.8	45	0	2	0
616	41.58	335.4	46	-7	2	0
598	43.72	341.6	47	-85	2	0
596	42.92	343.7	48	13	2	0
610	40.59	339.7	49	12	2	0
599	41.93	343.3	50	0		20
614	41.72	337.3	51	20	1	0
615	42.40	336.3	52	96		20
602	42.68	345.1	53	5	2	0
603	41.12	342.3	54	-14	2	0
618	40.38	334.9	55	23	2	0
609	39.97	342.2	56	0		20
600	41.56	344.5	57	21	2	0
601	41.74	346.2	58	14	2	0
608	40.73	341.3	59	-2	2	0
617	40.86	336.7	60	-9	2	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	33.30	341.0	61	11	3	0
549	33.88	340.0	62	117	2	0
548	33.93	338.0	63	8	1	0
552	34.87	342.4	64	17	1	0
551	33.99	341.7	65	-17	1	0
546	34.36	336.6	66	6	1	0
547	33.21	337.3	67	1	1	0
554	34.98	338.9	68	-8	1	0
553	34.65	340.3	69	-6	1	0
544	34.39	335.0	70	30	1	0
545	33.42	335.6	71	16	1	0
573	38.40	340.3	72	16	1	0
569	39.96	336.8	73	-14	2	0
571	39.01	339.2	74	-2	1	0
568	39.43	335.6	75	15	1	0
572	38.44	338.8	76	12	1	0
567	38.16	336.2	77	8	2	0
570	39.65	338.4	78	-9	2	0
561	36.67	340.1	79	33	1	0
559	36.10	337.3	80	10	1	0

TEAM 5

587	37.87	346.3	81	-13	1	0
586	37.89	348.1	82	-11	1	0
582	35.98	346.9	83	23	1	0
589	38.92	346.2	84	18	1	0
588	38.86	347.4	85	-8	1	0
579	34.41	347.1	86	0	1	0
584	37.06	347.0	87	1	1	0
590	39.81	347.3	88	23	1	0
580	35.25	345.9	89	2	1	0
583	36.17	348.4	90	40	1	0
593	40.37	343.7	91	17	1	0
594	39.82	344.4	92	0	1	0
592	40.51	346.8	93	15	1	0
585	37.15	348.9	94	21	1	0
581	35.22	347.9	95	25	1	0
591	39.91	345.7	96	-10	1	0
564	36.57	342.5	97	6	1	0
560	35.04	337.1	98	11	1	0
565	35.78	343.3	99	17	1	0
521	36.19	335.5	100	12	1	0

TEAM 6

522	37.67	340.6	101	0		20
523	36.96	341.8	102	11	1	0
524	37.31	345.0	103	0	2	0
525	38.12	345.3	104	-2	1	0
526	38.97	344.7	105	27	1	0
527	36.66	345.6	106	0		20
528	35.79	345.3	107	22	1	0
529	35.07	344.0	108	1	1	0
530	34.11	343.6	109	4	1	0
531	33.27	343.0	110	19	3	0
532	32.20	342.5	111	0		20
535	34.28	345.3	112	5	1	0
536	33.19	346.0	113	-12	1	0
537	33.30	347.9	114	0	1	0
538	34.83	350.3	115	9	1	0
539	36.55	350.8	116	0		20
540	37.69	350.7	117	-19	1	0
542	39.25	348.6	118	0		20
541	39.59	350.0	119	4	1	0
543	40.47	349.1	120	1	1	0

Appendix A (cont.)

SHOT NUMBER 18 SHOT POINT 15
SHOT TIME: 242: 8: 4: 0.011

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	84.43	308.4	1	17	1	0
534	79.75	304.9	2	-18	1	0
574	83.25	308.6	3	11	2	0
556	80.33	305.3	4	-75	1	0
566	82.03	308.8	5	15	2	0
533	78.95	305.7	6	5	1	0
577	86.15	308.7	7	-7	2	0
555	80.67	304.4	8	18	1	0
619	88.25	306.1	9	73	1	0
563	82.39	307.5	10	4	2	0
576	85.43	308.9	11	10	2	0
			12	-7		20
557	79.87	305.6	13	-28	1	0
			14	20		20
562	82.99	307.1	15	-62	2	0
612	89.26	308.7	16	-9	2	0
578	84.82	309.4	17	25	2	0
595	88.14	312.0	18	-11	2	0
558	83.78	306.7	19	22	2	0
620	88.55	311.4	20	14	2	0

TEAM 2

501	81.94	303.5	21	-3	1	0
502	83.20	303.5	22	12	1	0
503	83.85	303.4	23	19	1	0
504	85.14	303.5	24	-2		1
505	87.18	303.9	25	15	2	0
506	86.72	304.8	26	3		20
507	87.33	305.0	27	17	2	0
508	87.92	304.6	28	28	2	0
509	88.69	305.0	29	11	2	0
510	87.93	305.4	30	7	2	0
511	87.29	305.9	31	7	1	0
512	86.49	305.5	32	41	1	0
513	85.59	304.9	33	75	1	0
514	85.43	304.3	34	10	1	0
515	84.60	304.6	35	-31	1	0
516	84.16	305.2	36	0	1	0
517	85.73	305.9	37	-2653		20
518	85.08	306.5	38	2	2	0
520	85.21	307.4	39	1	2	0
519	84.30	306.9	40	6	2	0

TEAM 3

611	88.27	308.9	41	-12	2	0
604	87.95	309.7	42	8	1	0
605	88.82	309.7	43	4	2	0
			44	0		20
597	89.53	311.2	45	0	2	0
616	89.69	307.2	46	-7	2	0
598	89.25	310.4	47	-85	1	0
596	87.73	311.0	48	13	1	0
610	87.29	308.6	49	12	2	0
599	87.08	310.5	50	0		20
614	89.14	308.0	51	20	1	0
615	90.09	307.8	52	96		20
602	86.96	311.5	53	5	2	0
603	86.79	309.8	54	-14	1	0
618	88.80	306.6	55	23	1	0
609	85.87	309.3	56	0		20
600	86.27	310.9	57	21	1	0
601	85.76	311.6	58	14	1	0
608	86.82	309.3	59	-2	1	0
617	88.60	307.5	60	-9	1	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	80.76	306.4	61	11	1	0
549	81.54	306.3	62	117	2	0
548	82.25	305.6	63	8	1	0
552	81.54	307.5	64	17	1	0
551	81.07	306.9	65	-17	1	0
546	83.04	305.2	66	6	1	0
547	81.84	305.1	67	1	1	0
554	82.84	306.3	68	-8	1	0
553	82.10	306.7	69	-6	2	0
544	83.56	304.7	70	30	1	0
545	82.56	304.5	71	16	1	0
573	85.25	308.0	72	16	2	0
569	87.80	307.2	73	-14	2	0
571	86.12	307.9	74	-2	2	0
568	87.72	306.6	75	15	2	0
572	85.80	307.5	76	12	2	0
567	86.44	306.4	77	8	2	0
570	86.96	307.8	78	-9	2	0
561	83.85	307.4	79	33	2	0
559	84.31	306.1	80	10	2	0

TEAM 5

587	82.54	310.1	81	-13	1	0
586	81.87	310.8	82	-11	1	0
582	80.82	309.5	83	23	1	0
589	83.43	310.5	84	18	1	0
588	82.90	310.9	85	-8	1	0
579	79.62	308.9	86	0	1	0
584	81.63	310.0	87	1	1	0
590	83.75	311.3	88	23	1	0
580	80.60	308.9	89	2	1	0
583	80.40	310.1	90	40	1	0
593	85.61	310.1	91	17	1	0
594	84.88	310.2	92	0	1	0
592	84.47	311.4	93	15	1	0
585	80.94	310.8	94	21	1	0
581	79.96	309.5	95	25	1	0
591	84.44	310.7	96	-10	1	0
564	82.92	308.2	97	6	1	0
560	83.46	305.7	98	11	1	0
565	81.97	308.2	99	17	2	0
521	84.94	305.5	100	12	1	0

TEAM 6

522	84.51	307.9	101	0		20
523	83.50	308.1	102	11	1	0
524	82.62	309.4	103	0	2	0
525	83.16	309.8	104	-2	2	0
526	84.08	309.9	105	27	1	0
527	81.83	309.4	106	0		20
528	81.26	308.9	107	22	1	0
529	81.15	308.1	108	1	1	0
530	80.52	307.6	109	4	1	0
531	80.06	307.0	110	19	1	0
532	79.49	306.4	111	0		20
535	80.07	308.2	112	5	1	0
536	79.06	308.0	113	-12	1	0
537	78.47	308.7	114	0	3	0
538	78.71	310.2	115	9	1	0
539	79.85	311.1	116	0		20
540	80.63	311.7	117	-19	1	0
542	82.76	311.5	118	0		20
541	82.42	312.2	119	4	1	0
543	83.51	312.2	120	1	1	0

Appendix A (cont.)

SHOT NUMBER 19 SHOT POINT 10
SHOT TIME: 242: 8: 6: 0.006

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	39.32	196.6	1	17	2	0
534	45.79	193.1	2	-18	2	0
574	39.56	194.9	3	11	2	0
556	45.05	193.7	4	-75	2	0
566	39.82	193.2	5	15	2	0
533	45.12	191.7	6	5	1	0
577	38.38	198.8	7	-7	2	0
555	46.03	194.6	8	18	2	0
619	41.57	203.3	9	73	2	0
563	41.33	194.7	10	4	2	0
576	38.35	197.6	11	10	2	0
			12	-7		20
557	44.79	192.8	13	-28	1	0
			14	20		20
562	41.60	195.7	15	-62	2	0
612	37.37	203.3	16	-9	2	0
578	37.81	196.3	17	26	2	0
595	32.89	198.8	18	-11	2	0
558	41.86	197.0	19	22	2	0
620	33.54	200.0	20	14	2	0

TEAM 2

501	46.89	196.6	21	-3	2	0
502	46.45	198.1	22	12	2	0
503	46.51	198.9	23	19	1	0
504	45.99	200.4	24	-2		1
505	44.96	202.8	25	15	2	0
506	43.78	201.8	26	3		20
507	43.37	202.5	27	17	2	0
508	43.89	203.5	28	28	2	0
509	42.99	204.3	29	11	2	0
510	42.61	203.1	30	7	2	0
511	41.96	202.0	31	7	1	0
512	42.76	201.2	32	41	2	0
513	43.91	200.4	33	75	1	0
514	44.79	200.4	34	10	2	0
515	44.61	199.3	35	-31	2	0
516	43.83	198.4	36	0	2	0
517	42.45	200.0	37	14		20
518	41.79	198.8	38	2	2	0
520	40.44	198.4	39	1	2	0
519	41.50	197.6	40	6	2	0

TEAM 3

611	37.27	201.6	41	-12	1	0
604	36.29	200.6	42	8	1	0
605	36.03	201.9	43	4	1	0
			44	0		20
597	33.57	201.8	45	0		1
616	39.57	204.7	46	-7	1	0
598	34.79	202.0	47	-85	1	0
596	34.45	199.1	48	13	1	0
610	38.07	200.5	49	12	1	0
599	35.44	198.6	50	0		20
614	38.43	203.5	51	20		0
615	38.53	205.0	52	97		20
602	34.07	197.5	53	5	2	0
603	36.53	198.8	54	-14	1	0
618	40.61	203.7	55	23	2	0
609	37.51	197.9	56	0	2	0
600	35.24	197.1	57	21	1	0
601	34.49	195.6	58	14	1	0
608	37.25	199.3	59	-2	1	0
617	39.35	203.0	60	-9	1	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	43.46	193.5	61	11	1	0
549	43.28	194.5	62	117		1
548	43.96	195.8	63	8	2	0
552	41.67	193.6	64	17	1	0
551	42.65	193.5	65	-17	1	0
546	44.14	197.0	66	6	1	0
547	44.76	195.6	67	1	2	0
554	42.79	196.1	68	-8	2	0
553	42.55	194.9	69	-6	1	0
544	44.75	197.9	70	30	2	0
545	45.25	196.8	71	16	2	0
573	39.54	198.0	72	16	1	0
569	39.96	202.1	73	-14	2	0
571	39.49	199.3	74	-2	2	0
568	40.88	202.3	75	15	2	0
572	40.13	199.1	76	12	2	0
567	41.50	200.7	77	8	2	0
570	39.37	200.5	78	-10	2	0
561	40.98	196.6	79	33	2	0
559	42.54	198.1	80	10	2	0

TEAM 5

587	37.85	192.5	81	-13	1	0
586	37.36	191.0	82	-11	2	0
582	39.41	190.9	83	23	1	0
589	36.94	193.4	84	18	1	0
588	36.64	192.2	85	-8	1	0
579	40.81	189.8	86	0	1	0
584	38.40	191.4	87	1	1	0
590	35.83	193.0	88	23	1	0
580	40.32	191.2	89	2	1	0
583	38.88	189.7	90	40	1	0
593	36.57	196.8	91	17	1	0
594	36.77	195.7	92	0	3	0
592	35.34	193.9	93	15	1	0
585	37.84	189.8	94	21	1	0
581	39.87	189.7	95	25	1	0
591	36.23	194.6	96	-10	1	0
564	40.20	194.8	97	6	2	0
560	43.43	197.3	98	11	2	0
565	40.60	193.6	99	17	2	0
521	43.22	199.2	100	12	2	0

TEAM 6

522	39.97	197.1	101	0		20
523	40.13	195.7	102	11	2	0
524	38.76	193.4	103	0		1
525	37.96	193.7	104	-2	1	0
526	37.41	194.8	105	27	2	0
527	39.14	192.3	106	0		20
528	40.01	192.0	107	22	2	0
529	41.01	192.6	108	1	1	0
530	41.97	192.2	109	4	1	0
531	42.89	192.1	110	19	1	0
532	43.97	191.8	111	0		20
535	41.38	191.1	112	5	1	0
536	42.18	190.0	113	-12	1	0
537	41.66	188.7	114	0	1	0
538	39.74	187.4	115	9	1	0
539	38.02	187.8	116	0		20
540	36.94	188.3	117	-19	1	0
542	35.97	191.3	118	0		20
541	35.30	190.0	119	4	1	0
543	34.70	191.5	120	1	1	0

Appendix A (cont.)

SHOT NUMBER 20 SHOT POINT 18
SHOT TIME: 242: 8: 8: 0.012

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	6.13	304.9	1	17	2	0
534	5.39	230.8	2	-18	1	0
574	4.95	306.8	3	11	2	0
556	5.15	240.0	4	-75	1	0
566	3.72	310.3	5	15	2	0
533	4.18	224.1	6	5	1	0
577	7.84	308.3	7	-7	2	0
555	6.36	238.2	8	18	2	0
619	10.66	286.3	9	73	2	0
563	4.40	285.9	10	4	1	0
576	7.13	310.6	11	10	2	0
			12	-7		20
557	4.44	235.9	13	-28	1	0
			14	20		20
562	5.17	282.7	15	-62	1	0
612	10.96	308.7	16	-9	2	0
578	6.60	318.0	17	26	2	0
595	10.95	336.5	18	-11	2	0
558	6.13	280.8	19	22	2	0
620	11.01	331.4	20	14	2	0

TEAM 2

501	8.12	242.6	21	-3	1	0
502	8.73	250.1	22	12	1	0
503	9.31	252.5	23	19	1	0
504	10.02	259.0	24	-2		1
505	11.20	268.6	25	15	2	0
506	10.09	273.1	26	3		20
507	10.49	276.2	27	17	2	0
508	11.32	274.7	28	29	2	0
509	11.65	279.8	29	11		1
510	10.73	280.8	30	7		1
511	9.81	283.5	31	7	1	0
512	9.35	278.1	32	41	1	0
513	9.07	270.1	33	75	1	0
514	9.47	265.2	34	10	2	0
515	8.57	263.8	35	-31	2	0
516	7.64	266.9	36	0	2	0
517	8.43	278.9	37	14		20
518	7.46	282.6	38	2	2	0
520	7.14	293.2	39	1	2	0
519	6.53	284.4	40	6	1	0

TEAM 3

611	9.98	311.0	41	-12	1	0
604	9.76	317.7	42	8	1	0
605	10.62	316.9	43	4	2	0
			44	0		20
597	11.81	328.0	45	0		1
616	11.60	296.9	46	-7	2	0
598	11.24	322.6	47	-85	2	0
596	10.02	329.5	48	13	1	0
610	8.99	307.8	49	12	1	0
599	9.15	326.1	50	0		20
614	10.88	303.1	51	20		0
615	11.86	301.8	52	97		20
602	9.57	335.2	53	5	2	0
603	8.63	319.9	54	-14	1	0
618	10.92	291.6	55	23	2	0
609	7.63	316.0	56	0		20
600	8.56	331.1	57	21	1	0
601	8.52	339.1	58	14	1	0
608	8.56	314.7	59	-2	1	0
617	10.45	298.4	60	-9	1	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	4.05	254.6	61	11	1	0
549	4.67	261.2	62	117		1
548	5.87	259.1	63	8	1	0
552	3.63	280.8	64	17	3	0
551	3.72	265.6	65	-17	3	0
546	6.76	261.3	66	6	1	0
547	6.16	251.8	67	1	1	0
554	5.65	270.7	68	-8	1	0
553	4.73	270.8	69	-6	1	0
544	7.70	259.6	70	31	2	0
545	7.19	252.7	71	16	1	0
573	7.00	300.8	72	16	1	0
569	9.73	295.2	73	-14	2	0
571	7.91	299.7	74	-2	2	0
568	9.89	289.8	75	15	2	0
572	7.68	295.3	76	12	2	0
567	8.76	285.6	77	8	2	0
570	8.75	299.6	78	-10	2	0
561	5.85	289.2	79	33	1	0
559	7.02	276.1	80	11	1	0

TEAM 5

587	4.68	334.8	81	-13	1	0
586	4.60	348.9	82	-11	1	0
582	2.76	333.9	83	23	3	0
589	5.73	336.2	84	18	1	0
588	5.58	344.3	85	-8	1	0
579	1.23	322.6	86	0	3	0
584	3.81	338.6	87	1	3	0
590	6.54	343.7	88	23	1	0
580	2.30	315.3	89	2	3	0
583	2.89	353.0	90	40	3	0
593	7.58	324.7	91	17	1	0
594	6.90	327.1	92	0		1
592	7.25	341.7	93	15	1	0
585	3.90	357.2	94	21	1	0
581	1.93	346.3	95	25	3	0
591	6.77	334.7	96	-10	1	0
564	4.66	299.8	97	6	1	0
560	6.68	267.5	98	11	1	0
565	3.73	297.4	99	17	1	0
521	8.03	272.7	100	12	1	0

TEAM 6

522	6.29	298.3	101	0		20
523	5.27	298.9	102	11	1	0
524	4.42	321.9	103	0		1
525	5.11	327.4	104	-2	1	0
526	6.04	326.2	105	27	1	0
527	3.65	324.1	106	0		20
528	2.96	314.1	107	22	3	0
529	2.94	293.1	108	1	3	0
530	2.67	273.6	109	4	3	0
531	2.89	255.0	110	19	3	0
532	3.33	236.0	111	0		20
535	1.87	288.4	112	5	3	0
536	1.14	251.9	113	-12	3	0
537	0.05	270.0	114	0	3	0
538	2.08	31.4	115	9	3	0
539	3.68	16.9	116	0		20
540	4.72	10.7	117	-19	1	0
542	5.97	351.9	118	0		20
541	6.43	0.7	119	4	1	0
543	7.22	354.3	120	1	1	0

Appendix A (cont.)

SHOT NUMBER 21 SHOT POINT 13
SHOT TIME: 242:10: 0: 0.009

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	39.52	40.4	1	19	1	0
534	35.19	48.8	2	-20	3	0
574	39.81	42.0	3	12	1	0
556	35.53	47.5	4	-80	1	0
566	40.18	43.8	5	16	2	0
533	36.42	49.6	6	5	1	0
577	39.85	37.9	7	-7	1	0
555	34.31	47.3	8	19	3	0
619	35.94	34.5	9	78	1	0
563	38.34	43.5	10	4	1	0
576	40.15	38.9	11	11	1	0
			12	-7		20
557	36.17	48.2	13	-30	1	0
			14	21		20
562	37.74	42.7	15	-66	1	0
612	40.07	33.4	16	-10	1	0
578	40.98	39.7	17	27	2	0
595	45.07	35.6	18	-12	2	0
558	37.09	41.5	19	23	1	0
620	44.25	34.9	20	15	2	0

TEAM 2

501	32.74	45.7	21	-3	1	0
502	32.57	43.5	22	13	1	0
503	32.24	42.4	23	20	3	0
504	32.28	40.1	24	-2	1	0
505	32.72	36.4	25	16	1	0
506	34.05	37.1	26	3		20
507	34.31	36.1	27	18	1	0
508	33.64	35.1	28	30	1	0
509	34.41	33.8	29	11	2	0
510	34.95	35.1	30	7	1	0
511	35.77	36.1	31	8	1	0
512	35.16	37.4	32	44	1	0
513	34.25	39.0	33	80	3	0
514	33.40	39.4	34	11	1	0
515	33.88	40.7	35	-33	1	0
516	34.86	41.3	36	0	1	0
517	35.72	38.6	37	0		20
518	36.63	39.6	38	2	1	0
520	38.01	39.3	39	1	1	0
519	37.25	40.7	40	6	1	0

TEAM 3

611	40.39	34.8	41	-13	1	0
604	41.50	35.4	42	9	1	0
605	41.55	34.2	43	4	1	0
			44	0		20
597	43.97	33.6	45	0	1	0
616	37.74	32.5	46	-7	1	0
598	42.76	33.8	47	-91	1	0
596	43.52	35.9	48	14	1	0
610	39.81	36.2	49	12	1	0
599	42.67	36.7	50	0		20
614	39.00	33.4	51	22	3	0
615	38.75	32.0	52	103		20
602	44.19	37.0	53	5	1	0
603	41.60	37.0	54	-15	1	0
618	36.82	33.7	55	25	1	0
609	40.88	38.3	56	0		20
600	43.17	37.8	57	22	1	0
601	44.22	38.6	58	15	1	0
608	40.82	36.9	59	-2	1	0
617	38.15	34.2	60	-9	3	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	36.96	46.3	61	12	3	0
549	36.71	45.1	62	125	2	0
548	35.61	44.3	63	9	1	0
552	38.43	44.8	64	18	1	0
551	37.65	45.6	65	-18	1	0
546	35.04	43.1	66	7	1	0
547	34.98	45.1	67	1	3	0
554	36.54	43.1	68	-9	1	0
553	37.18	44.2	69	-6	3	0
544	34.17	42.4	70	32	1	0
545	34.11	44.2	71	17	1	0
573	38.95	39.2	72	17	1	0
569	37.70	35.3	73	-15	1	0
571	38.68	37.9	74	-2	1	0
568	36.77	35.4	75	16	1	0
572	38.12	38.4	76	13	1	0
567	36.47	37.4	77	8	1	0
570	38.54	36.6	78	-10	1	0
561	38.00	41.3	79	35	1	0
559	36.15	40.8	80	11	1	0

TEAM 5

587	42.08	42.9	81	-14	1	0
586	43.04	43.7	82	-12	1	0
582	41.37	45.3	83	24	1	0
589	42.61	41.6	84	20	1	0
588	43.25	42.3	85	-9	1	0
579	40.67	47.3	86	0	1	0
584	42.00	44.1	87	1	1	0
590	43.70	41.2	88	24	1	0
580	40.49	45.8	89	2	1	0
583	42.26	45.8	90	42	1	0
593	41.99	38.7	91	18	1	0
594	42.09	39.7	92	1		1
592	43.88	40.2	93	16	1	0
585	43.09	44.9	94	23	1	0
581	41.49	46.7	95	26	1	0
591	42.89	40.3	96	-11	1	0
564	39.28	42.6	97	6	1	0
560	35.58	42.3	98	12	1	0
565	39.35	44.0	99	18	1	0
521	35.20	39.9	100	13	1	0

TEAM 6

522	38.78	40.3	101	0		20
523	39.07	41.7	102	12	1	0
524	41.03	42.8	103	0	1	0
525	41.62	42.0	104	-2	1	0
526	41.76	40.8	105	28	1	0
527	41.05	43.9	106	0		20
528	40.43	44.8	107	23	1	0
529	39.38	45.2	108	1	1	0
530	38.72	46.2	109	5	3	0
531	38.00	47.1	110	21	3	0
532	37.28	48.4	111	0		20
535	39.66	46.7	112	5	3	0
536	39.53	48.4	113	-12	1	0
537	40.54	49.0	114	-2	1	0
538	42.57	48.2	115	9	1	0
539	43.73	46.5	116	0		20
540	44.37	45.2	117	-20	1	0
542	44.10	42.5	118	0		20
541	45.10	42.9	119	4	1	0
543	45.13	41.5	120	2	1	0

Appendix A (cont.)

SHOT NUMBER 22 SHOT POINT 19
SHOT TIME: 242:10: 2: 0.011

TEAM 1

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
575	6.80	67.3	1	19		1
534	8.32	121.0	2	-20	1	0
574	7.62	74.2	3	12	1	0
556	7.67	116.8	4	-80	1	0
566	8.60	79.8	5	16	2	0
533	9.25	114.8	6	5	1	0
577	6.49	52.3	7	-7	1	0
555	7.26	125.7	8	19	1	0
619	2.37	26.9	9	78	3	0
563	7.07	87.4	10	4	1	0
576	6.99	57.4	11	11	1	0
			12	-7		20
557	8.34	113.9	13	-30	1	0
			14	21		20
562	6.26	87.6	15	-66	1	0
612	6.57	24.6	16	-10	1	0
578	7.97	59.7	17	27	2	0
595	11.48	37.1	18	-12	2	0
558	5.28	87.1	19	23	1	0
620	10.65	34.5	20	15	2	0

TEAM 2

501	6.18	138.5	21	-3		1
502	4.94	141.3	22	13	1	0
503	4.41	146.7	23	20	3	0
504	3.16	152.3	24	-2	3	0
505	1.16	175.1	25	16	3	0
506	1.27	105.3	26	3		20
507	0.91	74.4	27	18	3	0
508	0.04	22.2	28	30	3	0
509	1.12	351.0	29	11	2	0
510	1.35	34.2	30	7	1	0
511	2.25	51.2	31	8	3	0
512	2.09	77.9	32	44	3	0
513	2.39	111.2	33	80	3	0
514	2.51	131.9	34	11	3	0
515	3.32	123.0	35	-33	3	0
516	3.90	109.4	36	0		1
517	3.00	81.9	37	0		20
518	4.08	79.5	38	2	1	0
520	5.12	67.8	39	1	1	0
519	5.03	81.5	40	6	1	0

TEAM 3

611	6.80	33.6	41	-13	1	0
604	7.91	36.7	42	9	1	0
605	7.98	30.5	43	4	1	0
			44	0		20
597	10.43	28.8	45	0	1	0
616	4.46	12.2	46	-7	3	0
598	9.20	29.0	47	-91	1	0
596	9.94	38.7	48	14	1	0
610	6.25	42.2	49	12	1	0
599	9.13	42.7	50	0		20
614	5.51	23.3	51	22	3	0
615	5.51	12.7	52	103		20
602	10.67	43.0	53	5	2	0
603	8.10	45.1	54	-15	1	0
618	3.33	20.1	55	25	1	0
609	7.57	52.5	56	0		20
600	9.75	47.3	57	22	1	0
601	10.88	49.4	58	15	1	0
608	7.32	45.4	59	-2	1	0
617	4.59	27.3	60	-9	3	0

TEAM 4

LOC	DIST	AZIM	UNIT	CHRON	CHAN	TAPE GRADE
550	7.65	104.8	61	12	1	0
549	6.88	103.4	62	125	1	0
548	5.88	109.8	63	9	1	0
552	7.73	91.5	64	18	1	0
551	7.68	98.8	65	-18	1	0
546	4.99	112.5	66	7	3	0
547	6.14	117.2	67	1	1	0
554	5.71	98.2	68	-9	1	0
553	6.62	97.1	69	-6	1	0
544	4.37	121.4	70	32	1	0
545	5.37	124.2	71	17	1	0
573	5.94	62.9	72	17	1	0
569	4.11	37.3	73	-15	1	0
571	5.37	55.6	74	-2	1	0
568	3.18	38.9	75	16	3	0
572	4.96	61.2	76	13	1	0
567	3.21	62.8	77	8	1	0
570	5.04	47.0	78	-10	1	0
561	5.87	79.8	79	35	1	0
559	4.32	91.8	80	11	1	0

TEAM 5

587	9.89	70.2	81	-14	1	0
586	11.02	70.8	82	-12	2	0
582	10.21	81.0	83	24	1	0
589	9.99	64.1	84	20	1	0
588	10.77	65.4	85	-9	1	0
579	10.55	89.5	86	0	1	0
584	10.26	75.0	87	1	1	0
590	10.88	60.3	88	24	1	0
580	9.71	85.5	89	2	1	0
583	11.13	79.7	90	42	1	0
593	8.71	52.5	91	18	1	0
594	9.00	56.9	92	1		1
592	10.84	56.4	93	16		1
585	11.51	74.8	94	23	2	0
581	10.89	84.8	95	27	1	0
591	9.90	58.1	96	-11	1	0
564	7.39	78.8	97	6	1	0
560	4.77	104.2	98	12	1	0
565	8.03	84.0	99	18	1	0
521	3.32	98.8	100	13	3	0

TEAM 6

522	6.13	70.0	101	0		20
523	6.89	76.0	102	12	1	0
524	8.95	73.2	103	0		1
525	9.20	68.2	104	-2	1	0
526	8.95	62.5	105	28	1	0
527	9.39	77.3	106	0		20
528	9.25	82.7	107	23	1	0
529	8.60	88.2	108	1	1	0
530	8.66	94.7	109	5	1	0
531	8.66	100.9	110	21	1	0
532	8.98	107.8	111	0		20
535	9.53	91.8	112	5	1	0
536	10.30	96.9	113	-12	1	0
537	11.28	94.5	114	-2	1	0
538	12.42	85.9	115	9	1	0
539	12.64	78.0	116	0		20
540	12.74	72.9	117	-20	2	0
542	11.60	64.3	118	0		20
541	12.65	64.0	119	4	2	0
543	12.32	59.2	120	2	2	0

APPENDIX B

Frequency Response of the USGS Short-Period Refraction System

Listed below is an explanation of the input terms and the input parameters to program RESPONSE (Stewart and O'Neill, 1980).

amp = amplitude factor (counts/(cm/s))
= $G_{SA} * G_{LE} * D_{VCO} * D_{DSC} * L_{REC}$.
ltype = 1 specifies one pole.
ltype = 2 specifies two poles.
n = the sum of ltype (total poles in system).
ln = power of the low-frequency falloff of the spectral element.
nl = the sum of ln.
f = corner frequency in hertz.
b = real, positive constant characterizing the shape of the spectral element. When ltype = 2 b is equivalent to the damping constant of a harmonic oscillator.
j = number of pole
al = complex number giving pole position, rad/sec
c = amplitude constant associated with al
wk = frequency (Hz).
gm = amplitude (absolute value of the system frequency response).
gmn = normalized amplitude (gm/maximum of gm).
gp = phase (degrees).
dis = normalized displacement response (db).
vel = normalized velocity response (db).

USGS Seismographic System: Refraction (volts/meter)
amp =0.3260e+07 amplitude factor

ltype	ln	f	b	comments
2	3	2.0000	0.8000	seismometer
2	2	0.0950	1.0000	amplifier
2	0	44.0000	1.0000	amplifier
1	0	45.0690	N/A	TRI-COM discriminator
2	0	46.6880	0.8870	TRI-COM discriminator
2	0	52.6600	0.5460	TRI-COM discriminator

n = 11 number of poles

nl = 5 power of low-frequency falloff

j	al		c
1	7.5398	10.0531	1.000
2	-7.5398	10.0531	1.000
3	0.	0.5969	1.000
4	0.	0.5969	1.000
5	0.	276.4602	276.460
6	0.	276.4602	276.460
7	0.	283.1769	283.177

Appendix B (cont.)

j	a1		c
8	135.4598	260.2009	293.349
9	-135.4598	260.2009	293.349
10	277.2001	180.6564	330.873
11	-277.2001	180.6564	330.873

Following is the output for program RESPONSE showing for specified frequencies in Hz: 1) Disp, the amplitude of the displacement function, 2) Norm Disp, the normalized amplitude of the displacement function, 3) Phase angle in degrees for the transfer function, 4) Disp, normalized displacement response in db, and 5) Vel, normalized velocity response in db. The * indicates the peaks in displacement and velocity response.

Freq (Hz)	Disp	Norm Disp	Phase (deg)	Disp (db)	Vel (db)
0.100e+00	0.269e+04	0.882e-05	-8.	-0.101e+03	-0.571e+02
0.120e+00	0.543e+04	0.178e-04	-20.	-0.950e+02	-0.525e+02
0.140e+00	0.961e+04	0.315e-04	-29.	-0.900e+02	-0.489e+02
0.160e+00	0.155e+05	0.507e-04	-37.	-0.859e+02	-0.459e+02
0.180e+00	0.233e+05	0.764e-04	-44.	-0.823e+02	-0.434e+02
0.200e+00	0.333e+05	0.109e-03	-50.	-0.793e+02	-0.412e+02
0.220e+00	0.458e+05	0.150e-03	-55.	-0.765e+02	-0.393e+02
0.240e+00	0.609e+05	0.200e-03	-60.	-0.740e+02	-0.375e+02
0.260e+00	0.790e+05	0.259e-03	-64.	-0.717e+02	-0.360e+02
0.280e+00	0.100e+06	0.329e-03	-67.	-0.697e+02	-0.346e+02
0.300e+00	0.125e+06	0.409e-03	-71.	-0.678e+02	-0.333e+02
0.320e+00	0.153e+06	0.502e-03	-74.	-0.660e+02	-0.321e+02
0.340e+00	0.185e+06	0.607e-03	-77.	-0.643e+02	-0.309e+02
0.360e+00	0.221e+06	0.725e-03	-80.	-0.628e+02	-0.299e+02
0.380e+00	0.262e+06	0.858e-03	-82.	-0.613e+02	-0.289e+02
0.400e+00	0.307e+06	0.100e-02	-85.	-0.600e+02	-0.280e+02
0.420e+00	0.356e+06	0.117e-02	-87.	-0.586e+02	-0.271e+02
0.440e+00	0.411e+06	0.135e-02	-89.	-0.574e+02	-0.262e+02
0.460e+00	0.470e+06	0.154e-02	-91.	-0.562e+02	-0.255e+02
0.480e+00	0.535e+06	0.176e-02	-93.	-0.551e+02	-0.247e+02
0.500e+00	0.606e+06	0.199e-02	-95.	-0.540e+02	-0.240e+02
0.520e+00	0.682e+06	0.224e-02	-97.	-0.530e+02	-0.233e+02
0.540e+00	0.764e+06	0.251e-02	-99.	-0.520e+02	-0.226e+02
0.560e+00	0.853e+06	0.280e-02	-101.	-0.511e+02	-0.220e+02
0.580e+00	0.947e+06	0.311e-02	-102.	-0.501e+02	-0.214e+02
0.600e+00	0.105e+07	0.344e-02	-104.	-0.493e+02	-0.208e+02
0.620e+00	0.116e+07	0.379e-02	-106.	-0.484e+02	-0.202e+02
0.640e+00	0.127e+07	0.417e-02	-107.	-0.476e+02	-0.197e+02
0.660e+00	0.139e+07	0.456e-02	-109.	-0.468e+02	-0.192e+02
0.680e+00	0.152e+07	0.498e-02	-111.	-0.461e+02	-0.187e+02
0.700e+00	0.166e+07	0.543e-02	-112.	-0.453e+02	-0.182e+02
0.720e+00	0.180e+07	0.590e-02	-114.	-0.446e+02	-0.177e+02
0.740e+00	0.195e+07	0.639e-02	-115.	-0.439e+02	-0.172e+02

Appendix B (cont.)

Freq (Hz)	Disp	Norm Disp	Phase (deg)	Disp (db)	Vel (db)
0.760e+00	0.211e+07	0.691e-02	-117.	-0.432e+02	-0.168e+02
0.780e+00	0.227e+07	0.745e-02	-118.	-0.426e+02	-0.164e+02
0.800e+00	0.245e+07	0.802e-02	-120.	-0.419e+02	-0.159e+02
0.820e+00	0.263e+07	0.862e-02	-121.	-0.413e+02	-0.155e+02
0.840e+00	0.282e+07	0.924e-02	-122.	-0.407e+02	-0.151e+02
0.860e+00	0.301e+07	0.988e-02	-124.	-0.401e+02	-0.148e+02
0.880e+00	0.322e+07	0.106e-01	-125.	-0.395e+02	-0.143e+02
0.900e+00	0.343e+07	0.113e-01	-127.	-0.389e+02	-0.140e+02
0.920e+00	0.366e+07	0.120e-01	-128.	-0.384e+02	-0.137e+02
0.940e+00	0.389e+07	0.127e-01	-129.	-0.379e+02	-0.134e+02
0.960e+00	0.412e+07	0.135e-01	-131.	-0.374e+02	-0.130e+02
0.980e+00	0.437e+07	0.143e-01	-132.	-0.369e+02	-0.127e+02
0.100e+01	0.462e+07	0.152e-01	-133.	-0.364e+02	-0.123e+02
0.100e+01	0.462e+07	0.152e-01	-133.	-0.364e+02	-0.123e+02
0.120e+01	0.761e+07	0.250e-01	-146.	-0.320e+02	-0.959e+01
0.140e+01	0.113e+08	0.372e-01	-158.	-0.286e+02	-0.748e+01
0.160e+01	0.157e+08	0.514e-01	-169.	-0.258e+02	-0.583e+01
0.180e+01	0.204e+08	0.670e-01	-179.	-0.235e+02	-0.455e+01
0.200e+01	0.255e+08	0.835e-01	179.	-0.216e+02	-0.355e+01
0.220e+01	0.306e+08	0.100e+00	162.	-0.200e+02	-0.281e+01
0.240e+01	0.357e+08	0.117e+00	154.	-0.186e+02	-0.220e+01
0.260e+01	0.408e+08	0.134e+00	147.	-0.175e+02	-0.172e+01
0.280e+01	0.458e+08	0.150e+00	140.	-0.165e+02	-0.139e+01
0.300e+01	0.506e+08	0.166e+00	134.	-0.156e+02	-0.110e+01
0.320e+01	0.554e+08	0.182e+00	129.	-0.148e+02	-0.865e+00
0.340e+01	0.601e+08	0.197e+00	124.	-0.141e+02	-0.704e+00
0.360e+01	0.647e+08	0.212e+00	119.	-0.135e+02	-0.563e+00
0.380e+01	0.692e+08	0.227e+00	115.	-0.129e+02	-0.439e+00
0.400e+01	0.736e+08	0.241e+00	111.	-0.124e+02	-0.365e+00
0.420e+01	0.780e+08	0.256e+00	107.	-0.118e+02	-0.264e+00
0.440e+01	0.823e+08	0.270e+00	103.	-0.114e+02	-0.206e+00
0.460e+01	0.865e+08	0.284e+00	100.	-0.109e+02	-0.153e+00
0.480e+01	0.907e+08	0.297e+00	96.	-0.105e+02	-0.133e+00
0.500e+01	0.948e+08	0.311e+00	93.	-0.101e+02	-0.880e-01
0.520e+01	0.989e+08	0.324e+00	90.	-0.979e+01	-0.730e-01
0.540e+01	0.103e+09	0.338e+00	87.	-0.942e+01	-0.333e-01
0.560e+01	0.107e+09	0.351e+00	85.	-0.909e+01	-0.214e-01
0.580e+01	0.111e+09	0.364e+00	82.	-0.878e+01	-0.103e-01
0.600e+01	0.115e+09	0.377e+00	79.	-0.847e+01	0.000e+00*
0.620e+01	0.119e+09	0.389e+00	77.	-0.820e+01	-0.126e-01
0.640e+01	0.123e+09	0.402e+00	74.	-0.792e+01	-0.288e-02
0.660e+01	0.126e+09	0.414e+00	72.	-0.766e+01	-0.147e-01
0.680e+01	0.130e+09	0.427e+00	70.	-0.739e+01	-0.542e-02
0.700e+01	0.134e+09	0.439e+00	67.	-0.715e+01	-0.165e-01
0.720e+01	0.138e+09	0.451e+00	65.	-0.692e+01	-0.269e-01
0.740e+01	0.141e+09	0.463e+00	63.	-0.669e+01	-0.368e-01
0.760e+01	0.145e+09	0.475e+00	61.	-0.647e+01	-0.462e-01
0.780e+01	0.148e+09	0.487e+00	59.	-0.625e+01	-0.551e-01
0.800e+01	0.152e+09	0.498e+00	57.	-0.606e+01	-0.810e-01

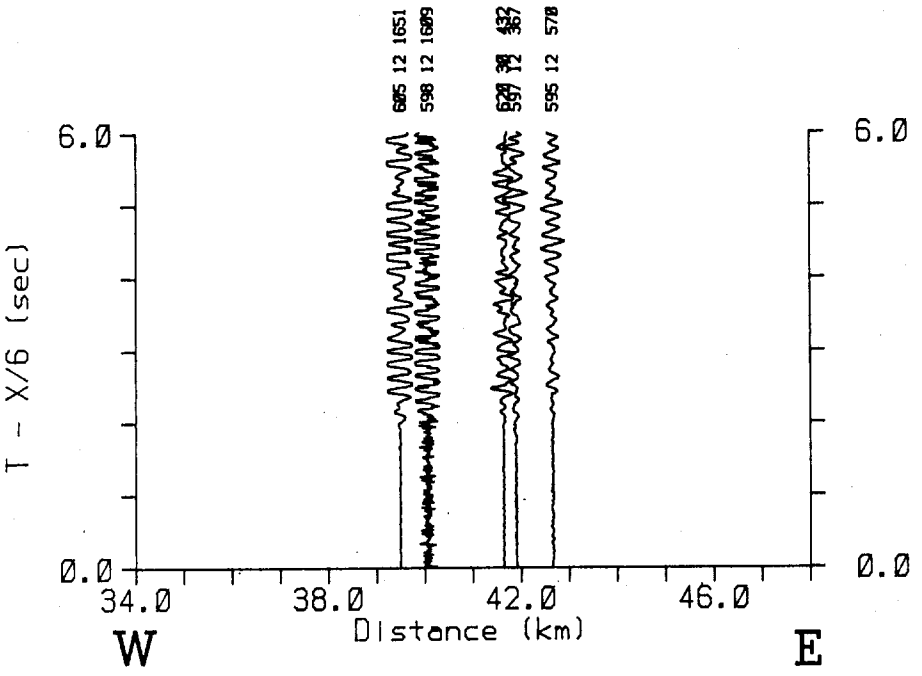
Appendix B (cont.)

Freq (Hz)	Disp	Norm Disp	Phase (deg)	Disp (db)	Vel (db)
0.820e+01	0.156e+09	0.510e+00	55.	-0.585e+01	-0.887e-01
0.840e+01	0.159e+09	0.521e+00	53.	-0.566e+01	-0.113e+00
0.860e+01	0.162e+09	0.533e+00	51.	-0.547e+01	-0.119e+00
0.880e+01	0.166e+09	0.544e+00	49.	-0.529e+01	-0.141e+00
0.900e+01	0.169e+09	0.555e+00	47.	-0.511e+01	-0.163e+00
0.920e+01	0.173e+09	0.566e+00	45.	-0.494e+01	-0.183e+00
0.940e+01	0.176e+09	0.577e+00	43.	-0.478e+01	-0.203e+00
0.960e+01	0.179e+09	0.587e+00	41.	-0.463e+01	-0.236e+00
0.980e+01	0.182e+09	0.598e+00	39.	-0.447e+01	-0.254e+00
0.100e+02	0.186e+09	0.608e+00	38.	-0.432e+01	-0.286e+00
0.100e+02	0.186e+09	0.608e+00	38.	-0.432e+01	-0.286e+00
0.120e+02	0.215e+09	0.706e+00	20.	-0.302e+01	-0.571e+00
0.140e+02	0.241e+09	0.790e+00	4.	-0.205e+01	-0.934e+00
0.160e+02	0.262e+09	0.860e+00	-12.	-0.131e+01	-0.136e+01
0.180e+02	0.279e+09	0.915e+00	-27.	-0.772e+00	-0.184e+01
0.200e+02	0.292e+09	0.956e+00	-42.	-0.391e+00	-0.238e+01
0.220e+02	0.300e+09	0.984e+00	-56.	-0.140e+00	-0.295e+01
0.240e+02	0.304e+09	0.998e+00	-70.	-0.174e-01	-0.359e+01
0.260e+02	0.305e+09	0.100e+01	-84.	0.000e+00*	-0.426e+01
0.280e+02	0.302e+09	0.991e+00	-98.	-0.785e-01	-0.499e+01
0.300e+02	0.296e+09	0.971e+00	-111.	-0.256e+00	-0.576e+01
0.320e+02	0.288e+09	0.943e+00	-124.	-0.510e+00	-0.658e+01
0.340e+02	0.277e+09	0.907e+00	-137.	-0.848e+00	-0.744e+01
0.360e+02	0.264e+09	0.864e+00	-150.	-0.127e+01	-0.836e+01
0.380e+02	0.249e+09	0.816e+00	-168.	-0.177e+01	-0.933e+01
0.400e+02	0.233e+09	0.765e+00	-174.	-0.233e+01	-0.103e+02
0.420e+02	0.217e+09	0.711e+00	174.	-0.296e+01	-0.114e+02
0.440e+02	0.200e+09	0.656e+00	162.	-0.366e+01	-0.125e+02
0.460e+02	0.183e+09	0.601e+00	151.	-0.442e+01	-0.136e+02
0.480e+02	0.167e+09	0.547e+00	140.	-0.524e+01	-0.148e+02
0.500e+02	0.151e+09	0.494e+00	130.	-0.613e+01	-0.161e+02
0.520e+02	0.136e+09	0.444e+00	120.	-0.705e+01	-0.173e+02
0.540e+02	0.121e+09	0.398e+00	110.	-0.800e+01	-0.186e+02
0.560e+02	0.108e+09	0.354e+00	101.	-0.902e+01	-0.199e+02
0.580e+02	0.960e+08	0.315e+00	92.	-0.100e+02	-0.213e+02
0.600e+02	0.851e+08	0.279e+00	83.	-0.111e+02	-0.226e+02
0.620e+02	0.752e+08	0.247e+00	75.	-0.121e+02	-0.240e+02
0.640e+02	0.664e+08	0.218e+00	68.	-0.132e+02	-0.253e+02
0.660e+02	0.586e+08	0.192e+00	60.	-0.143e+02	-0.267e+02
0.680e+02	0.517e+08	0.169e+00	53.	-0.154e+02	-0.281e+02
0.700e+02	0.456e+08	0.149e+00	47.	-0.165e+02	-0.294e+02
0.720e+02	0.402e+08	0.132e+00	41.	-0.176e+02	-0.307e+02
0.740e+02	0.355e+08	0.116e+00	35.	-0.187e+02	-0.321e+02
0.760e+02	0.313e+08	0.103e+00	29.	-0.197e+02	-0.333e+02
0.780e+02	0.277e+08	0.908e-01	24.	-0.208e+02	-0.346e+02
0.800e+02	0.245e+08	0.804e-01	19.	-0.219e+02	-0.359e+02
0.820e+02	0.217e+08	0.713e-01	14.	-0.229e+02	-0.372e+02
0.840e+02	0.193e+08	0.633e-01	9.	-0.240e+02	-0.384e+02
0.860e+02	0.172e+08	0.562e-01	5.	-0.250e+02	-0.397e+02

Appendix B (cont.)

Freq (Hz)	Disp	Norm Disp	Phase (deg)	Disp (db)	Vel (db)
0.880e+02	0.153e+08	0.501e-01	1.	-0.260e+02	-0.409e+02
0.900e+02	0.136e+08	0.446e-01	-3.	-0.270e+02	-0.421e+02
0.920e+02	0.122e+08	0.398e-01	-7.	-0.280e+02	-0.432e+02
0.940e+02	0.109e+08	0.356e-01	-11.	-0.290e+02	-0.444e+02
0.960e+02	0.973e+07	0.319e-01	-14.	-0.299e+02	-0.455e+02
0.980e+02	0.873e+07	0.286e-01	-18.	-0.309e+02	-0.467e+02
0.100e+03	0.784e+07	0.257e-01	-21.	-0.318e+02	-0.478e+02
0.120e+03	0.291e+07	0.953e-02	-48.	-0.404e+02	-0.580e+02
0.140e+03	0.122e+07	0.401e-02	-67.	-0.479e+02	-0.668e+02
0.160e+03	0.570e+06	0.187e-02	-81.	-0.546e+02	-0.746e+02
0.180e+03	0.289e+06	0.946e-03	-92.	-0.605e+02	-0.816e+02
0.200e+03	0.156e+06	0.512e-03	-101.	-0.658e+02	-0.878e+02

Section 1



Section 2

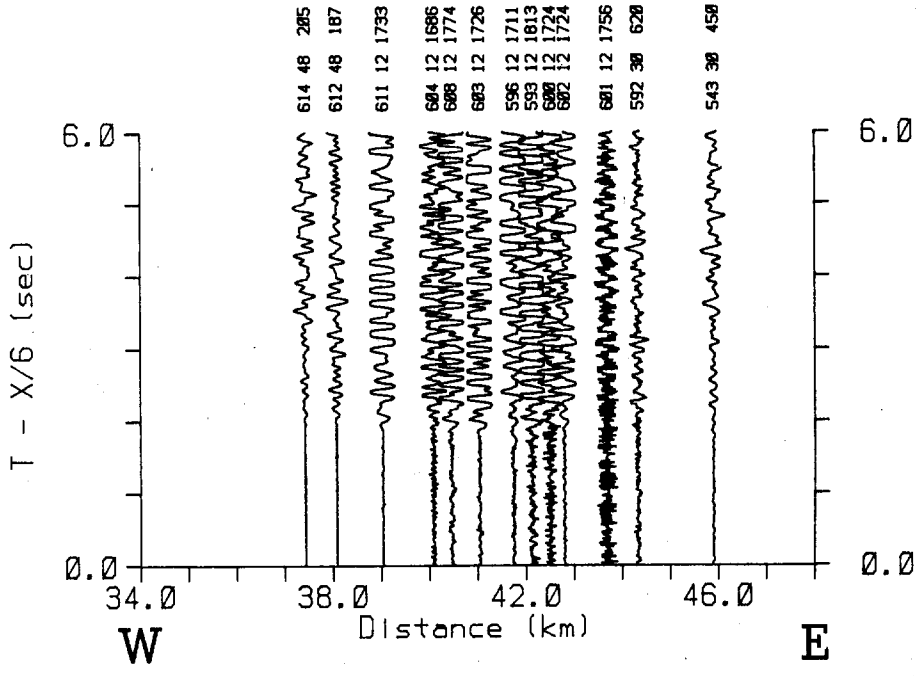
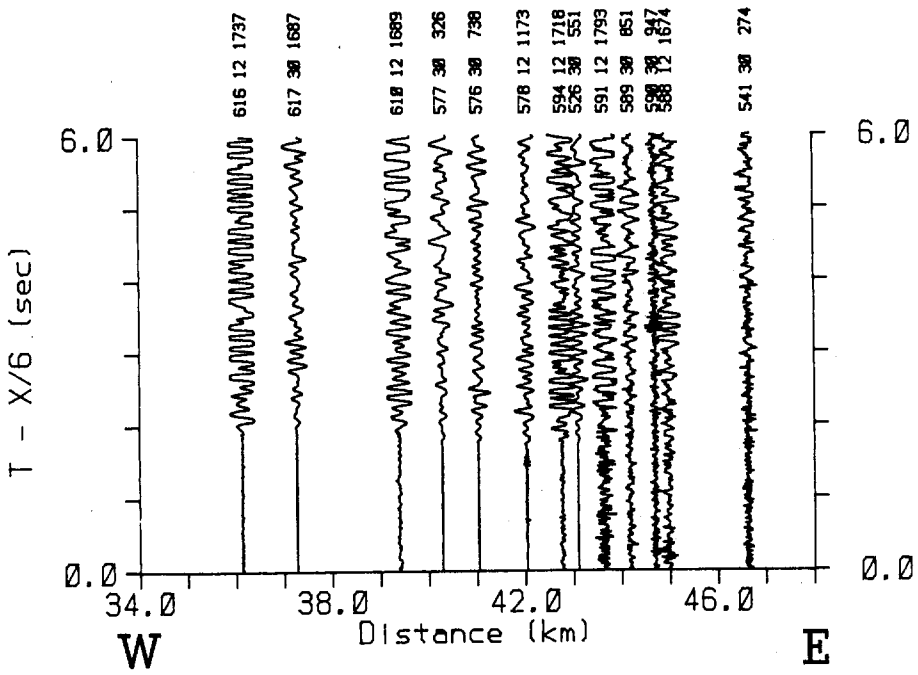


Plate 2. Shot point 8, Shot 16, Sections 1 and 2.

Section 3



Section 4

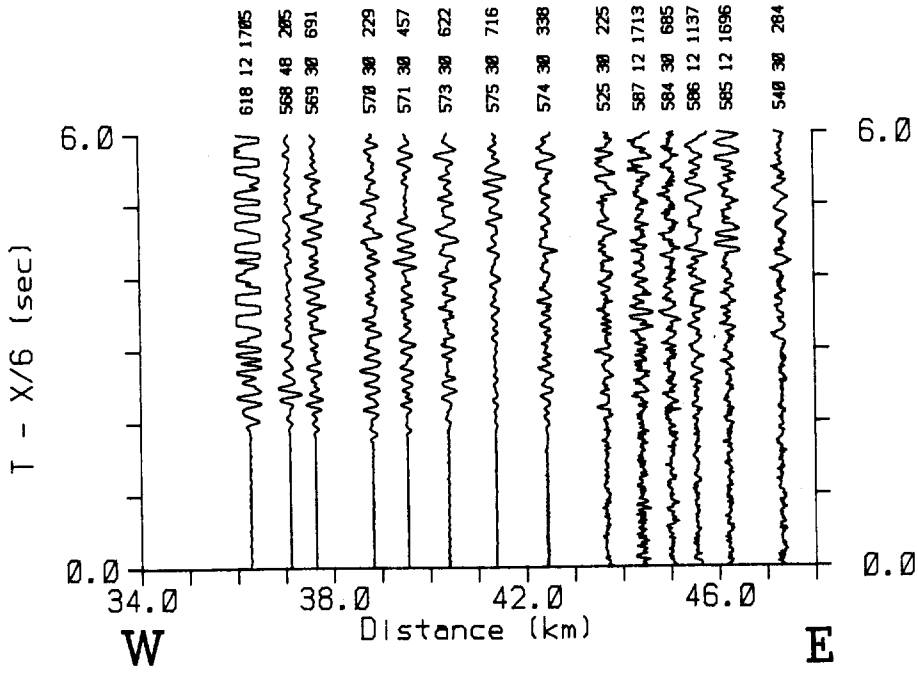
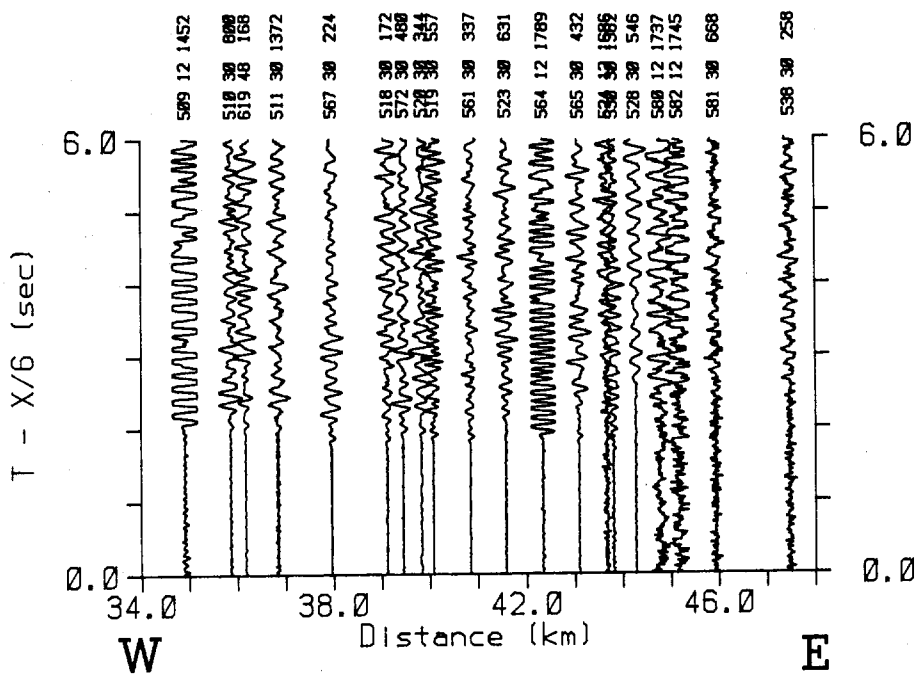


Plate 3. Shot point 8, Shot 16, Sections 3 and 4.

Section 5



Section 6

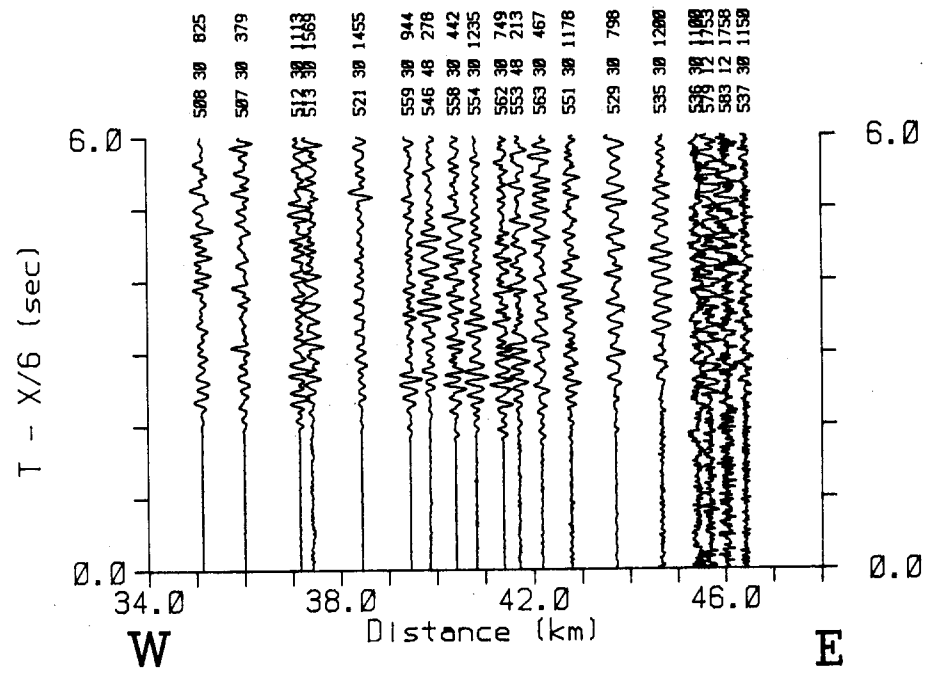
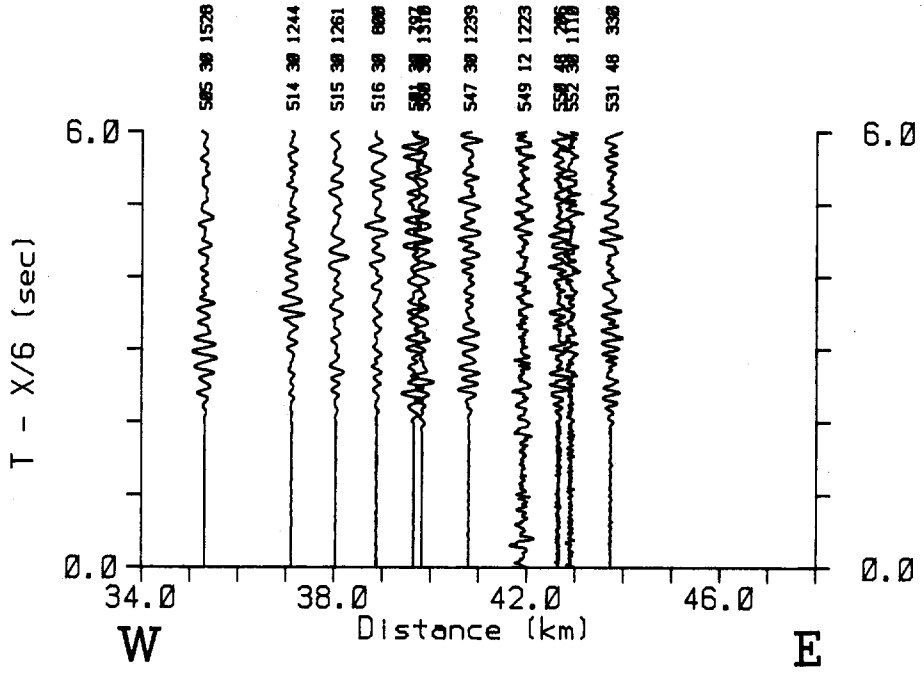


Plate 4. Shot point 8, Shot 16, Sections 5 and 6.

Made from best available copy

Section 7



Section 8

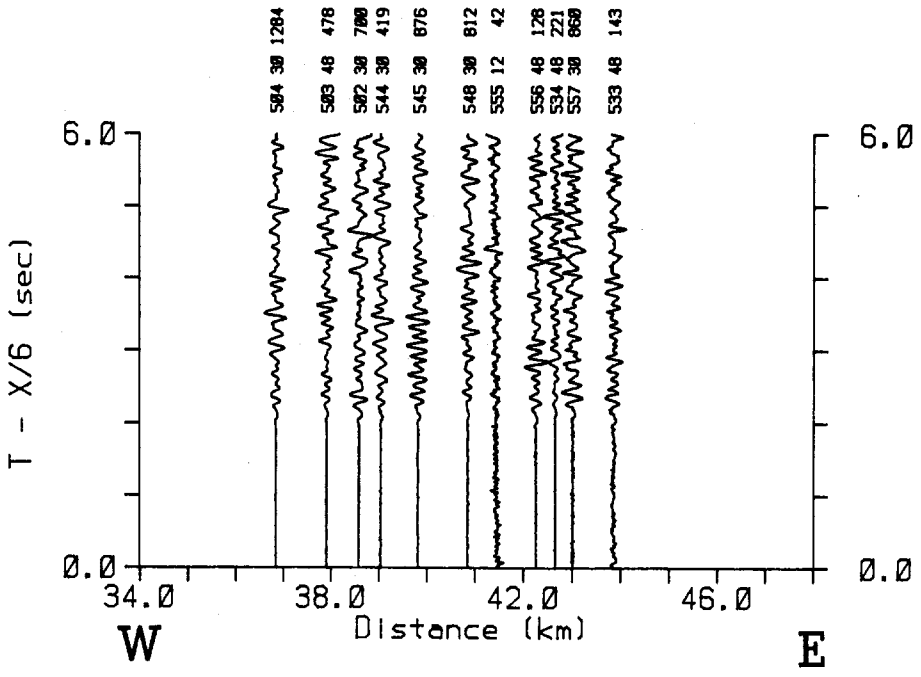
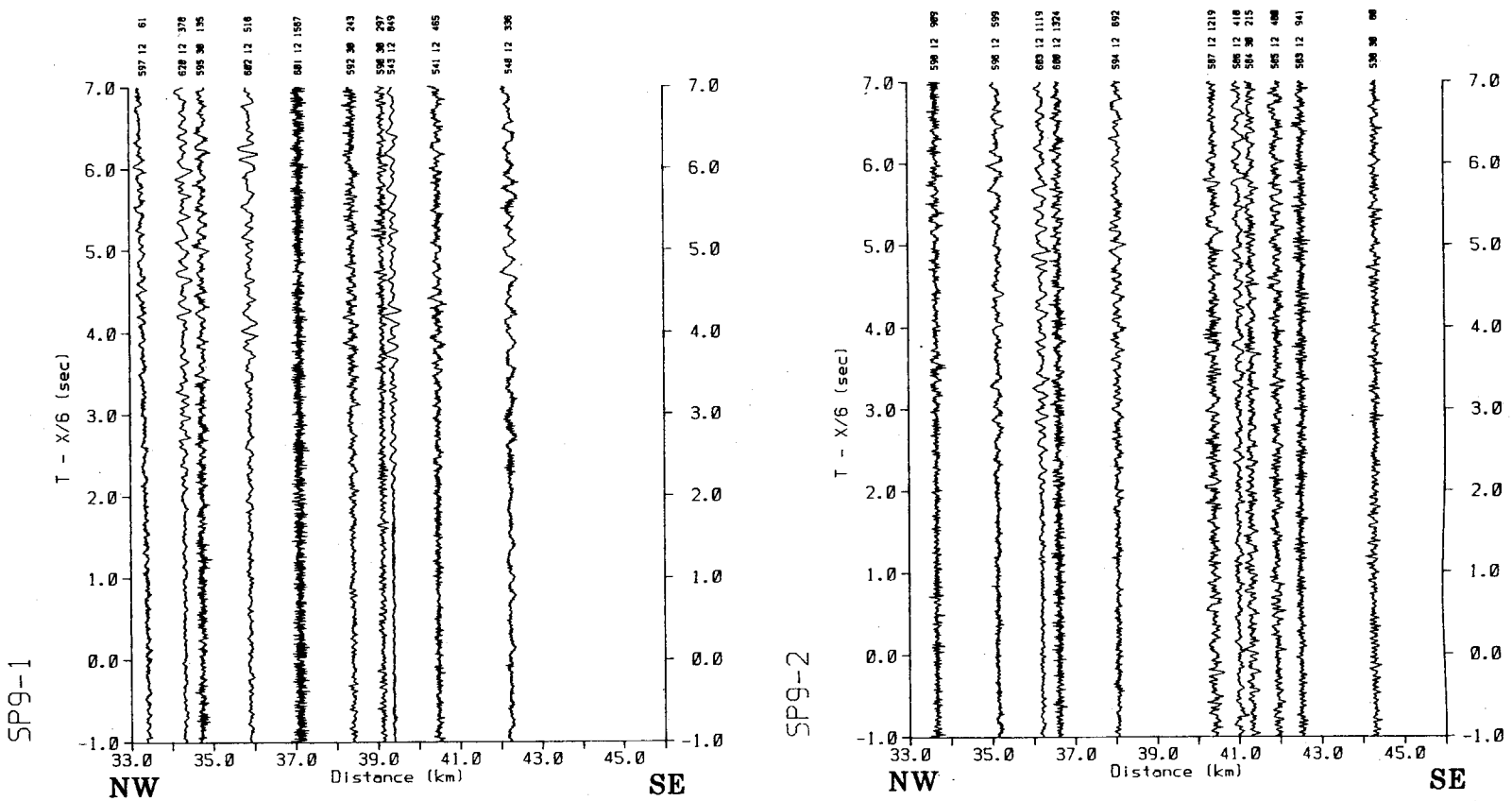


Plate 5. Shot point 8, Shot 16, Sections 7 and 8.



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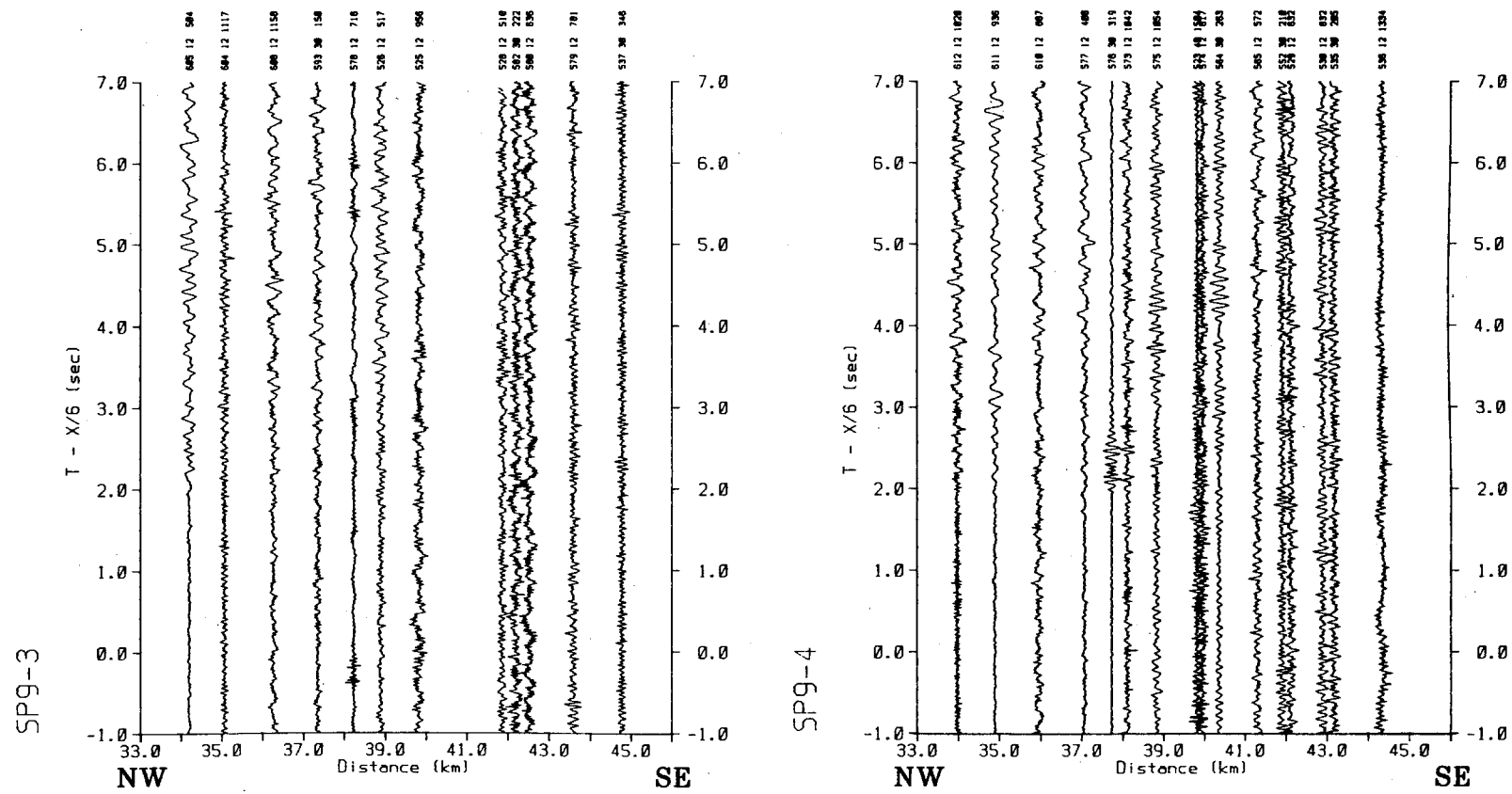

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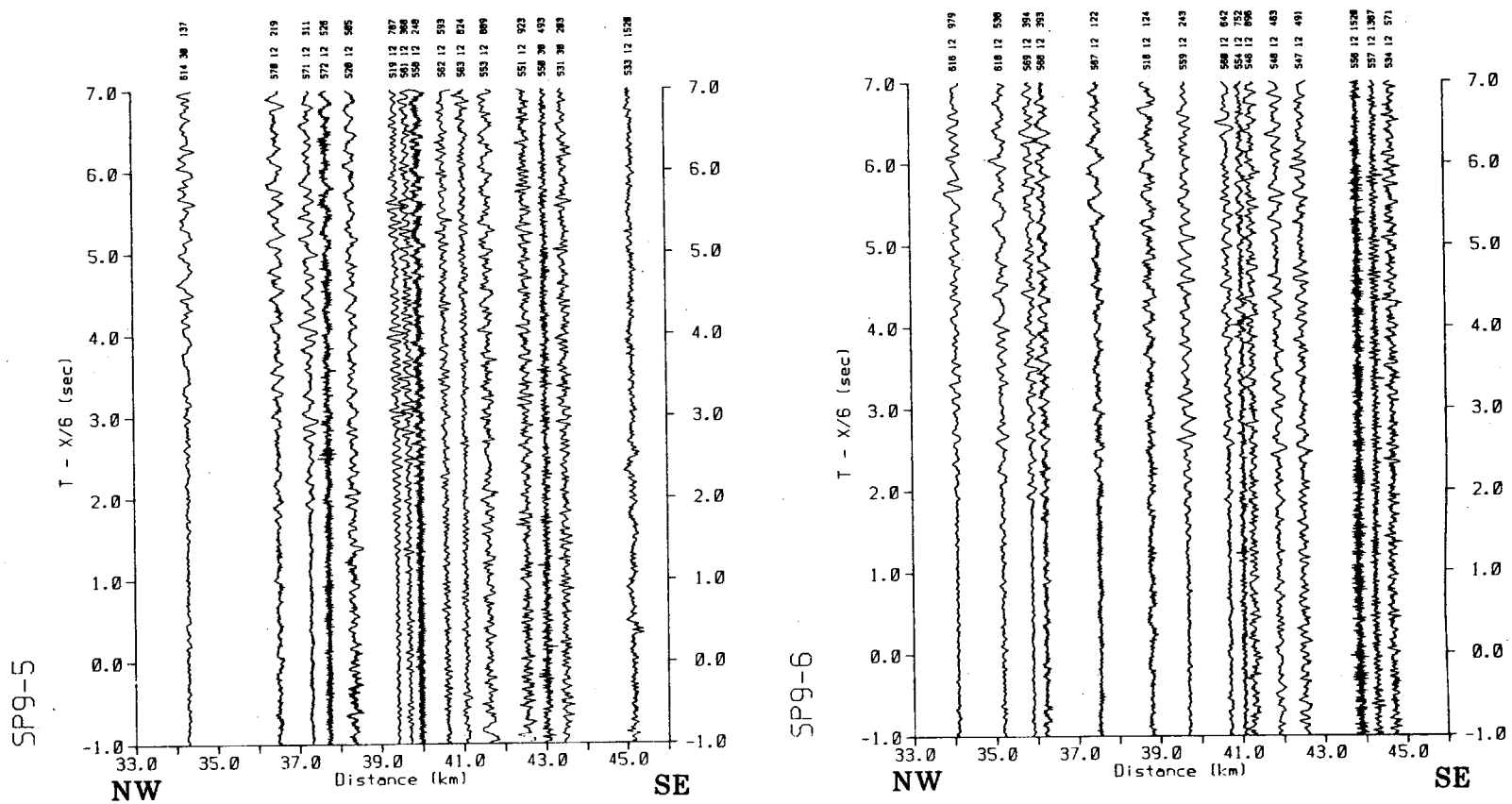

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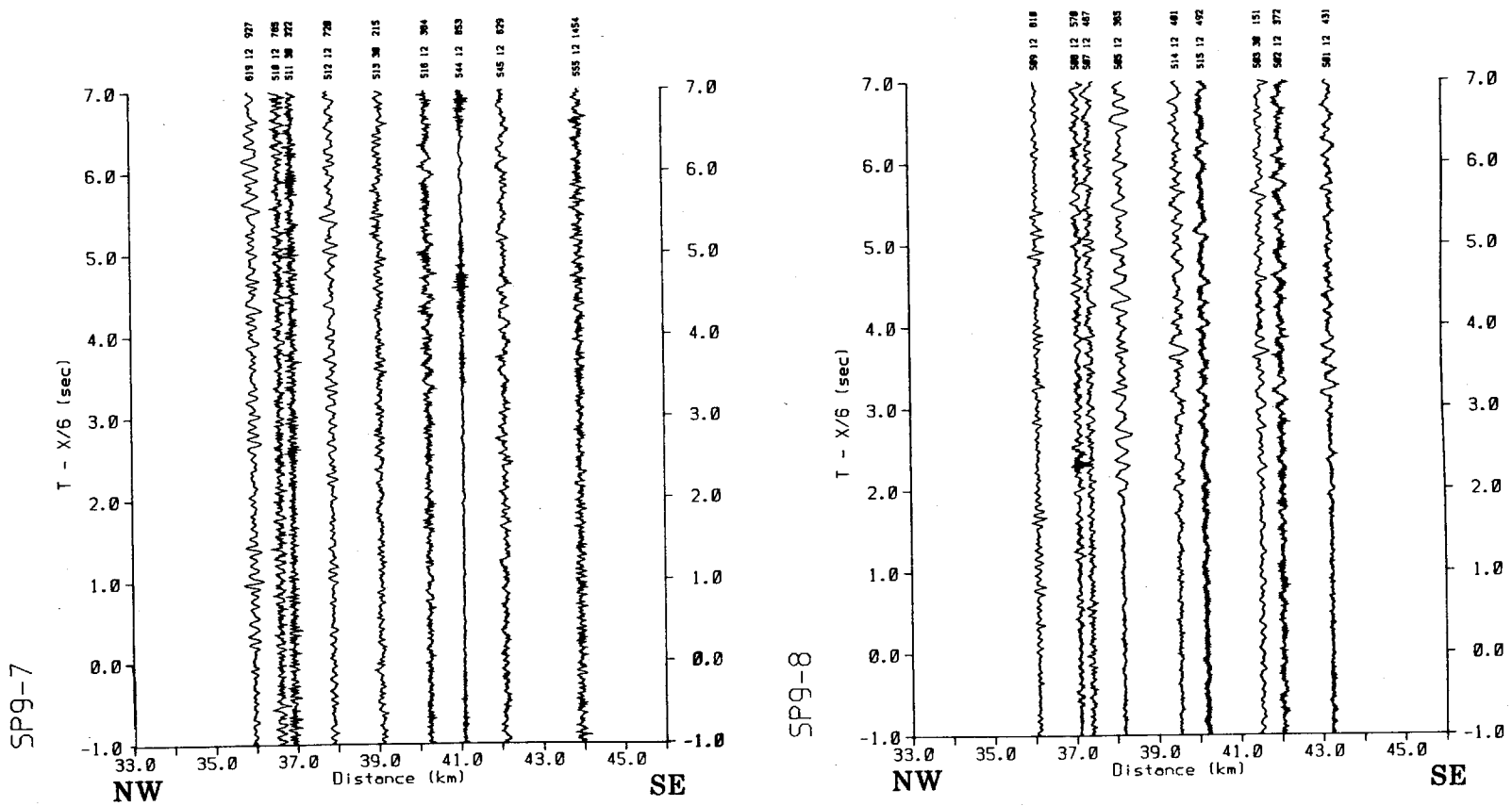


Plate 9. Shot point 9, Shot 11, Sections 7 and 8.

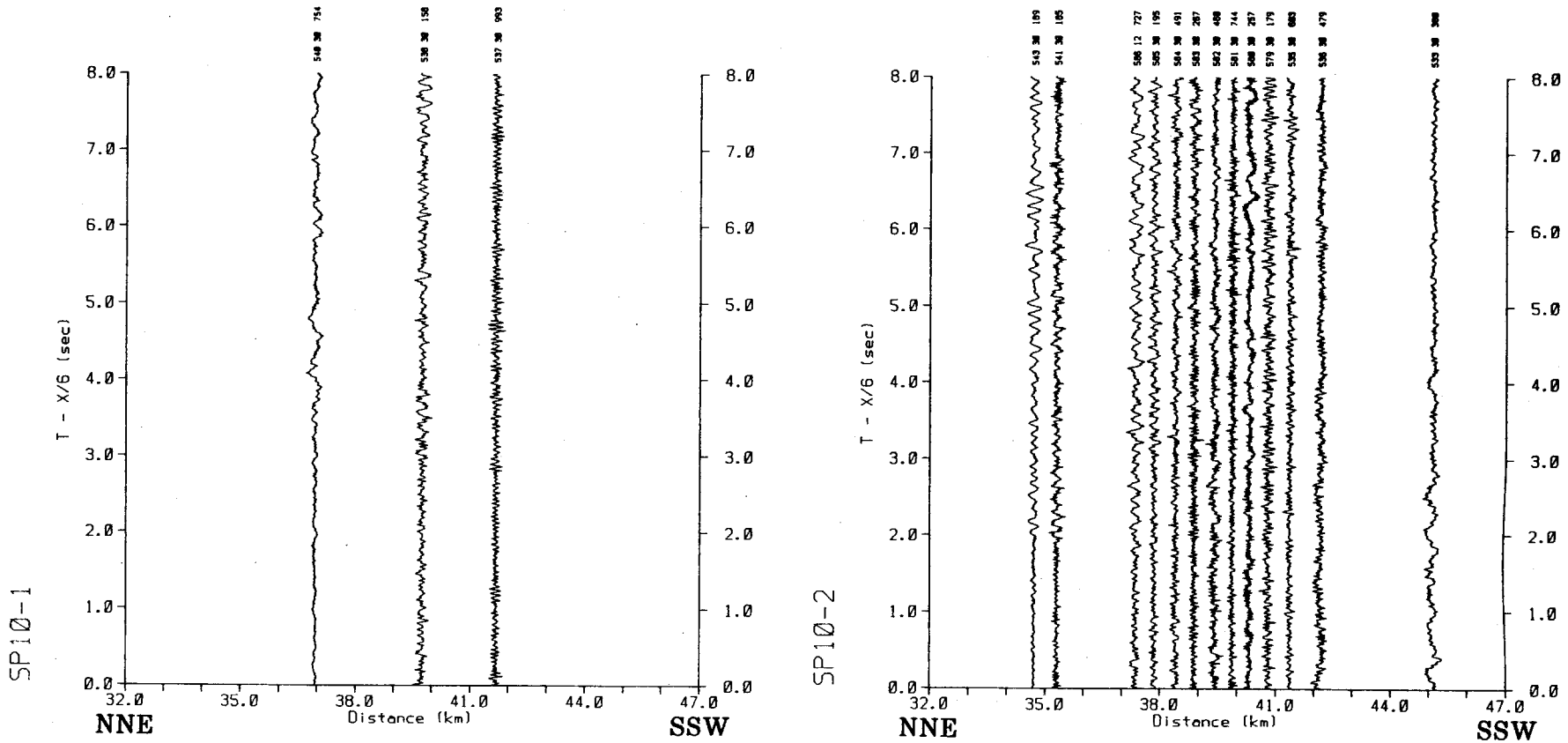


Plate 10. Shot point 10, Shot 19, Sections 1 and 2.

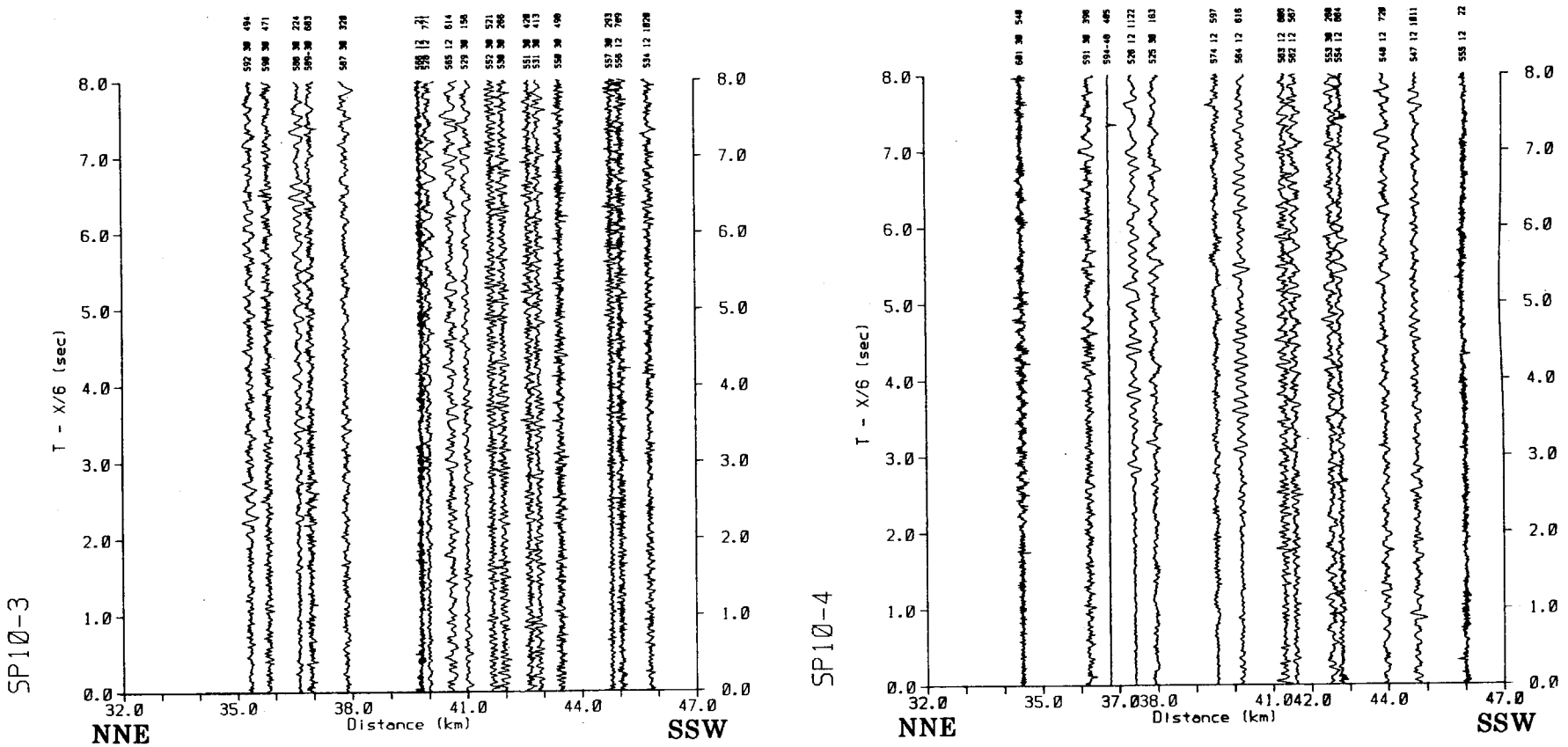
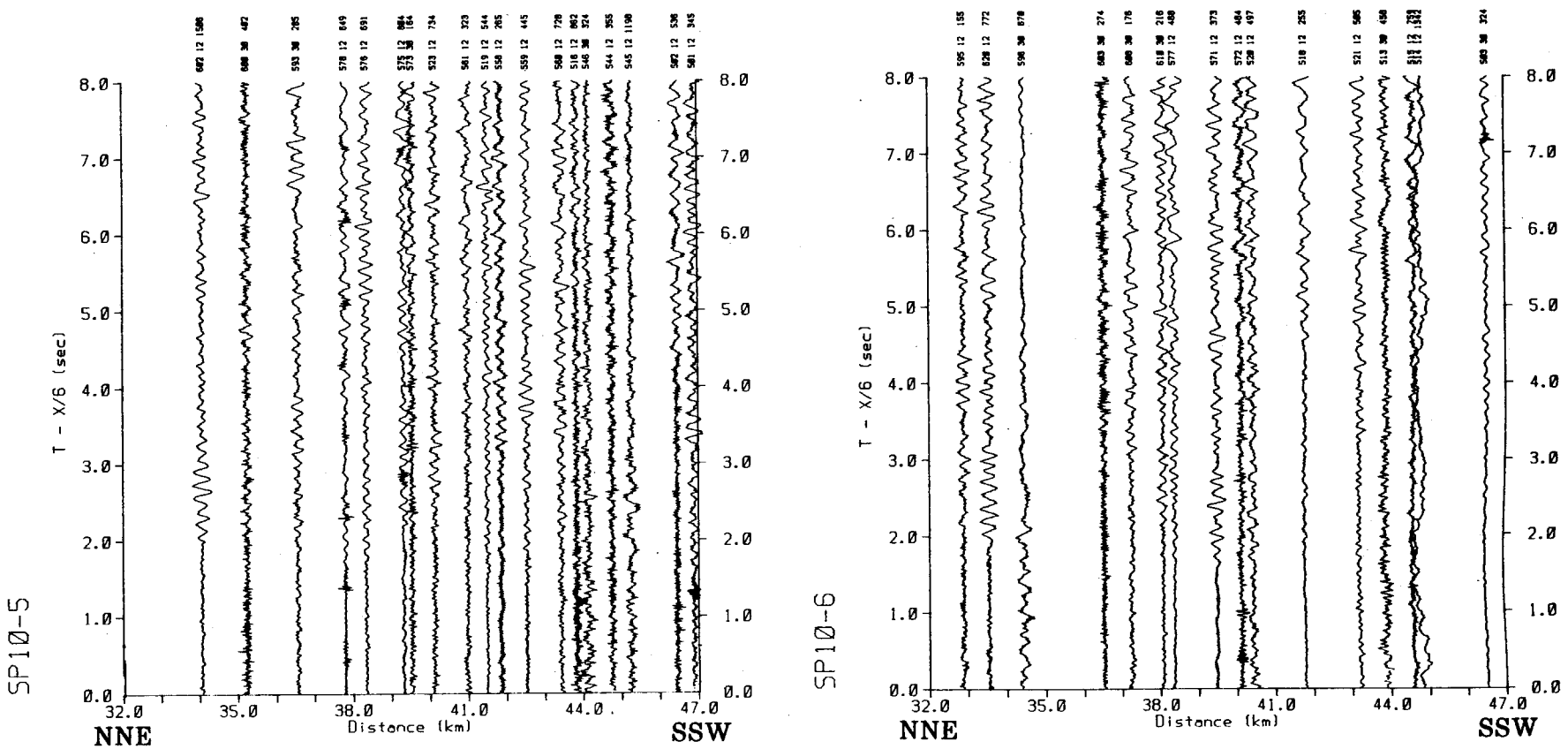


Plate 11. Shot point 10, Shot 19, Sections 3 and 4.



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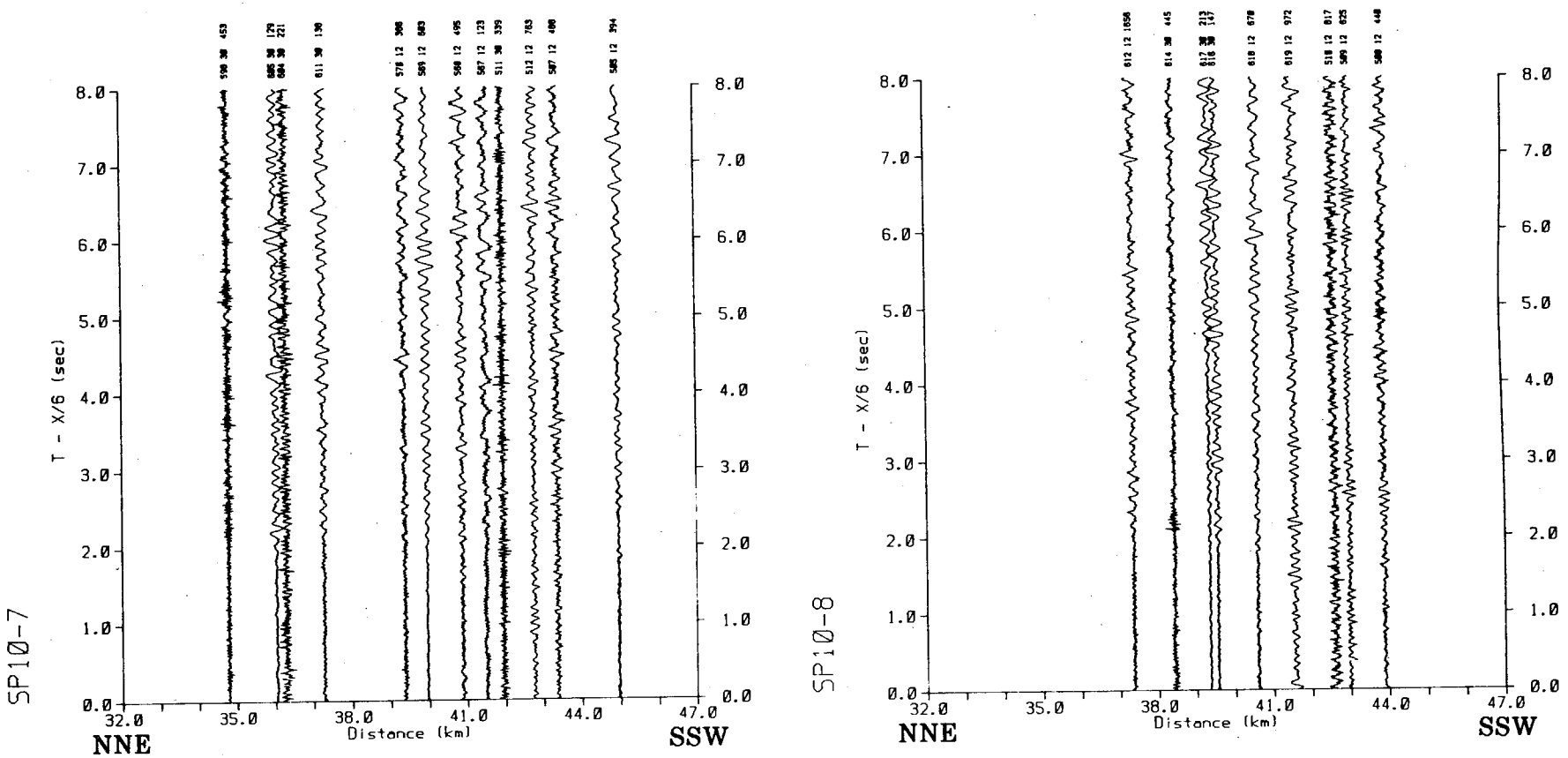

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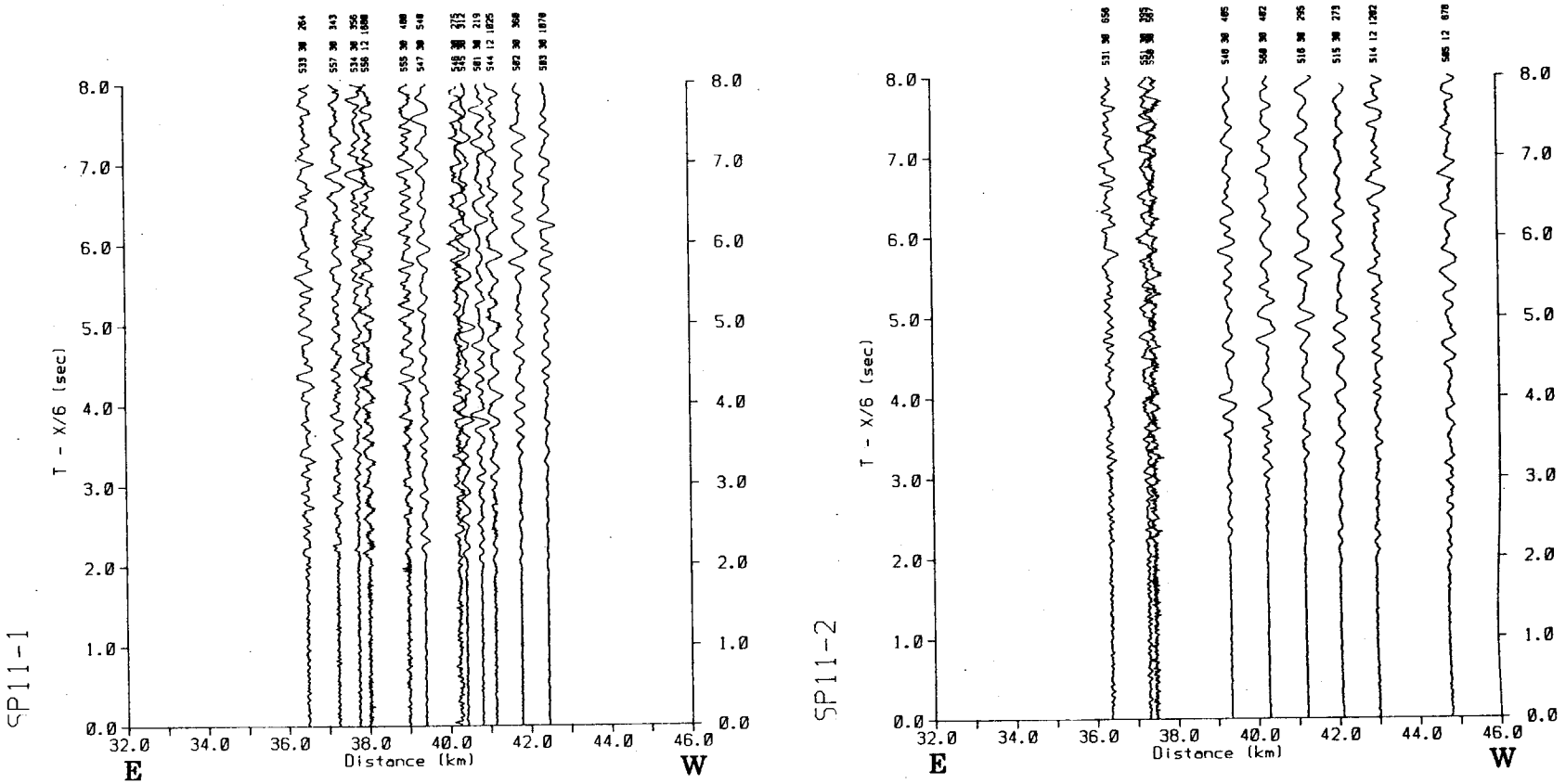

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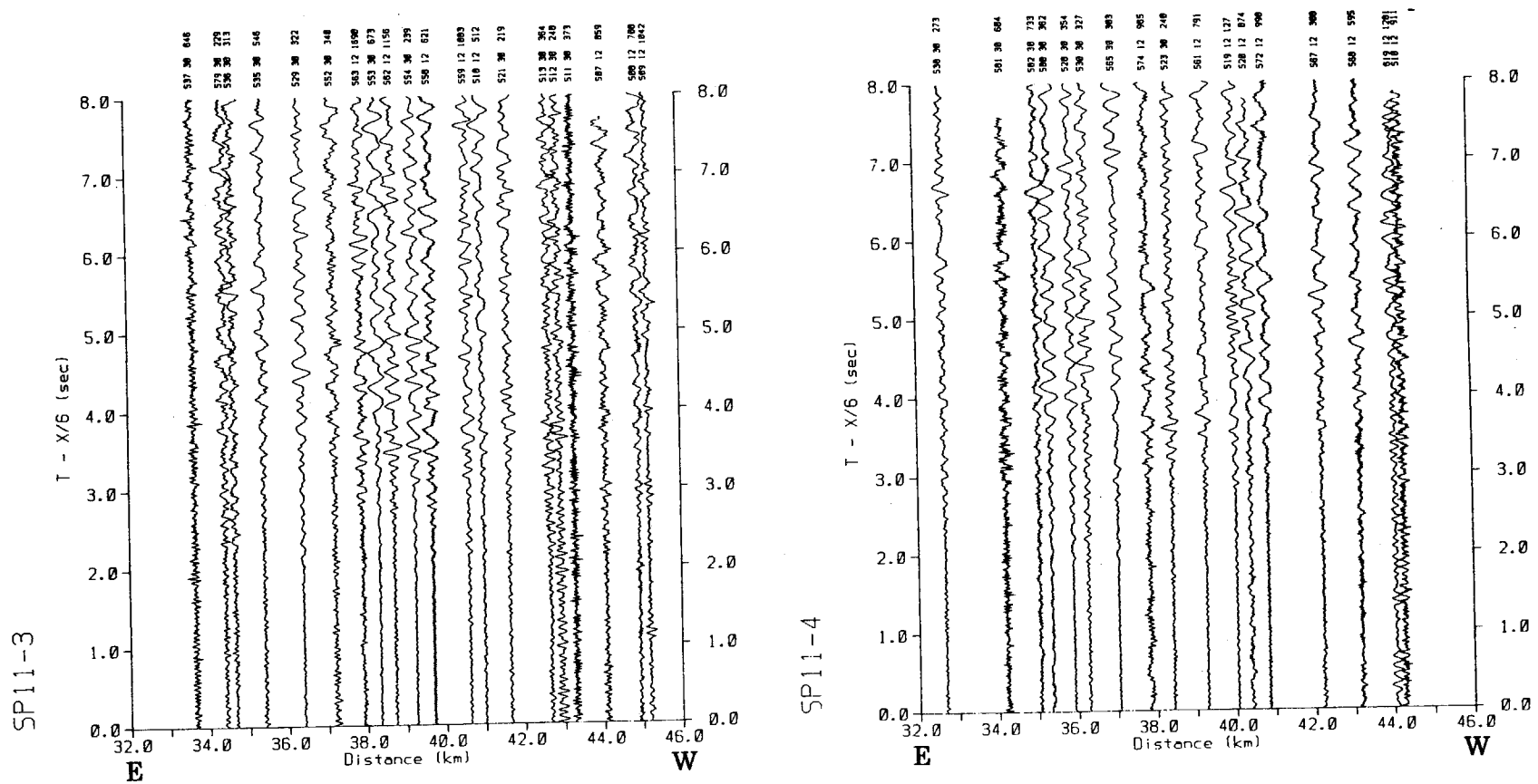

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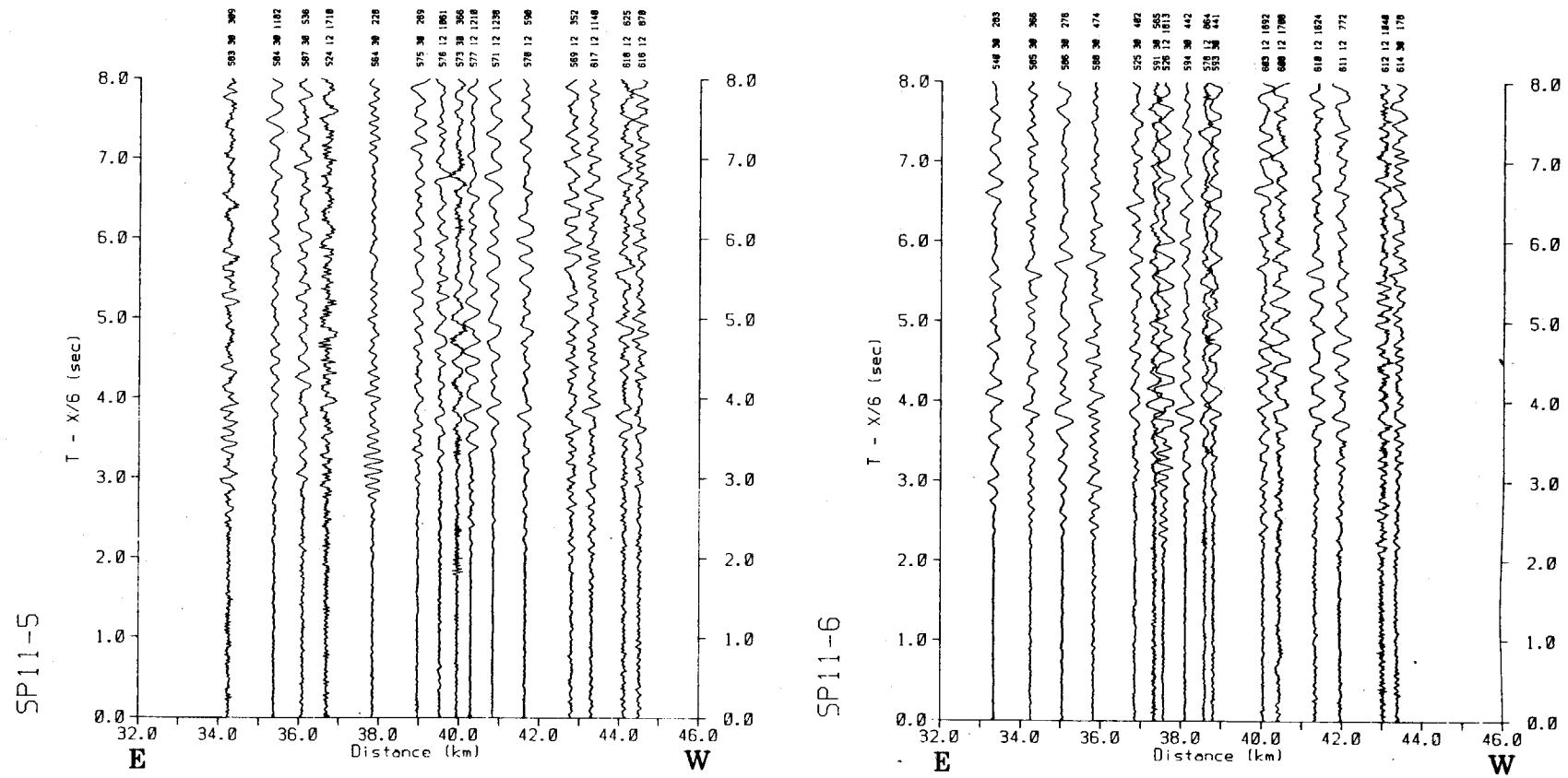
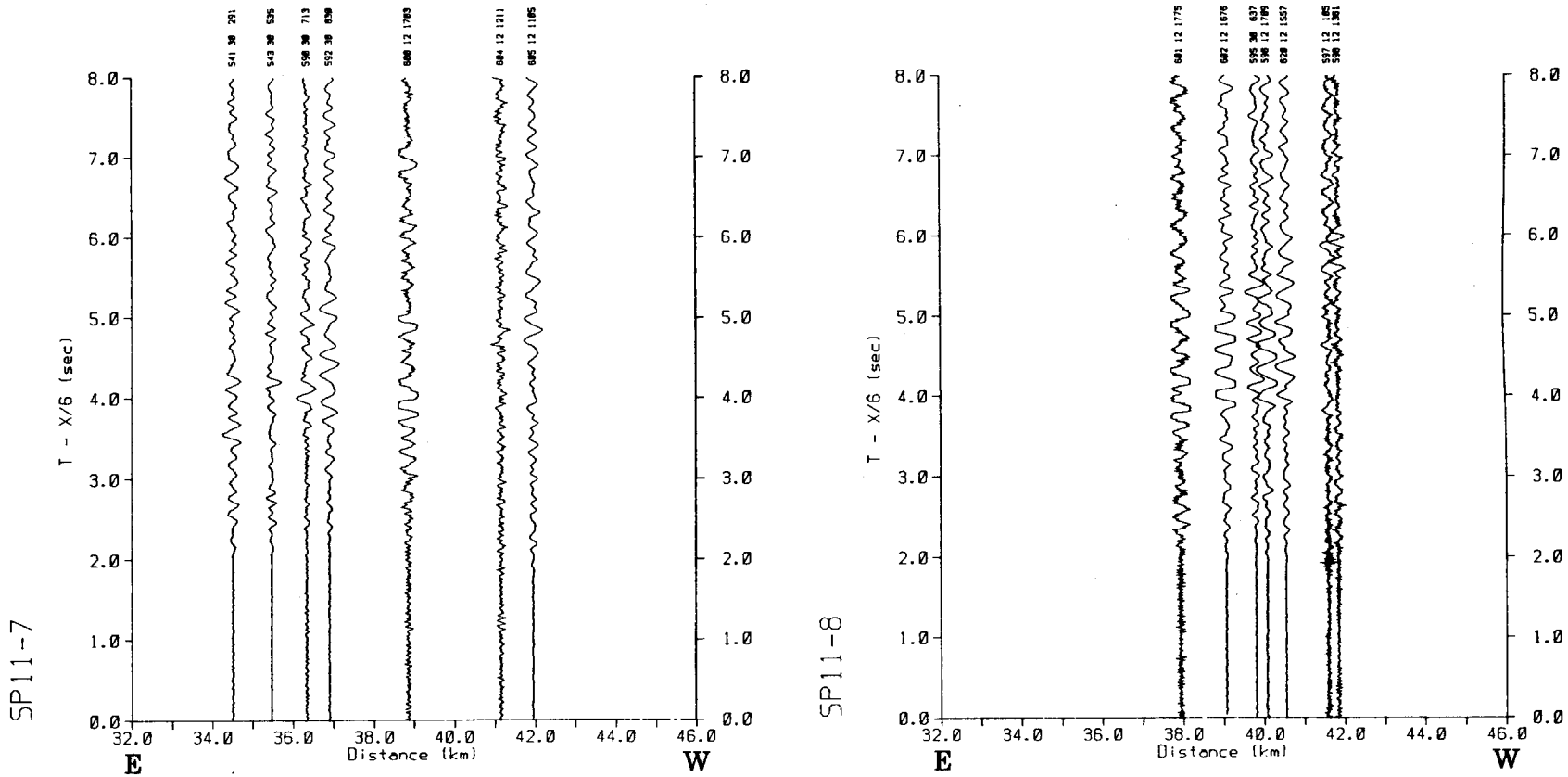


Plate 16. Shot point 11, Shot 13, Sections 5 and 6.



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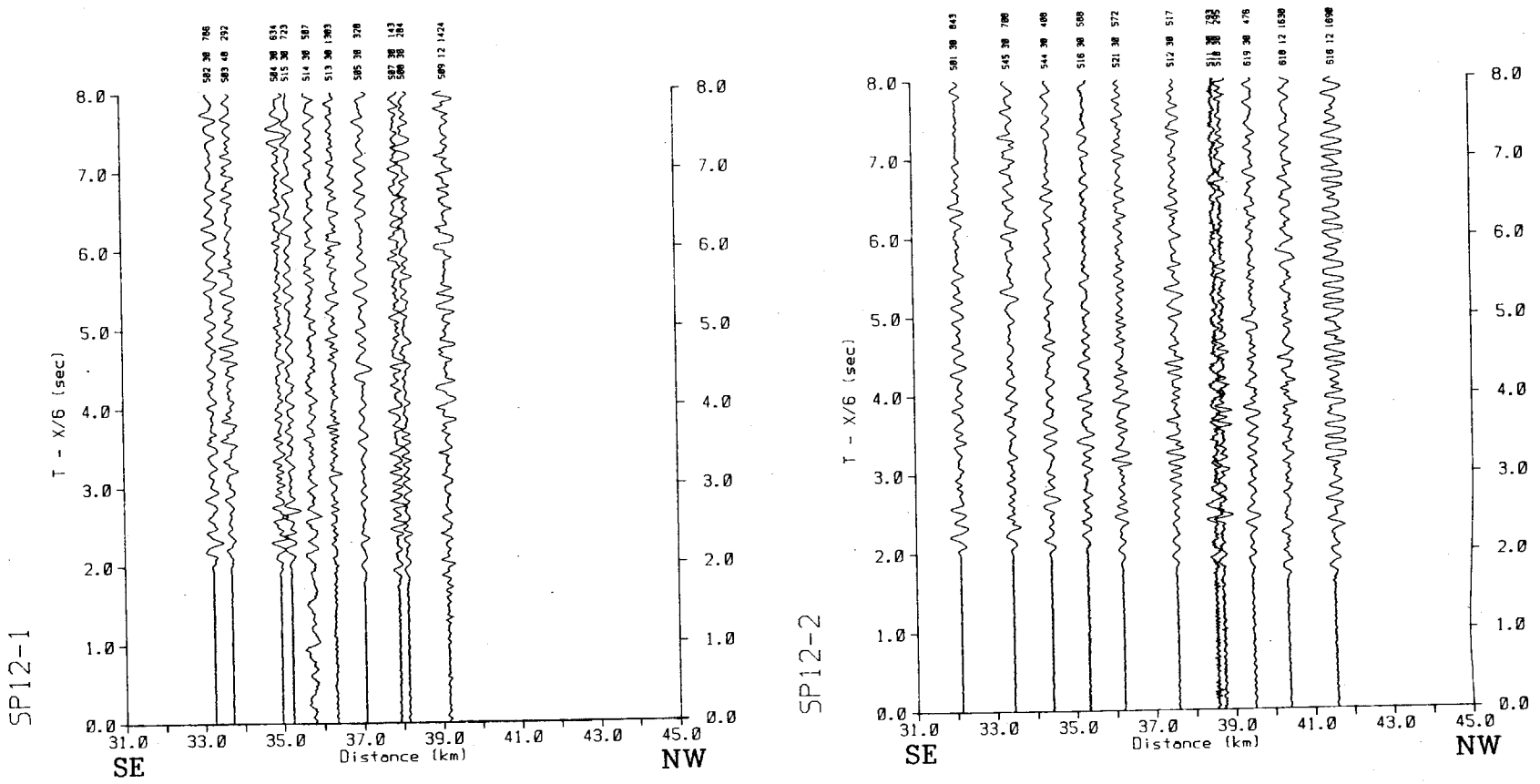


Plate 18. Shot point 12, Shot 17, Sections 1 and 2.

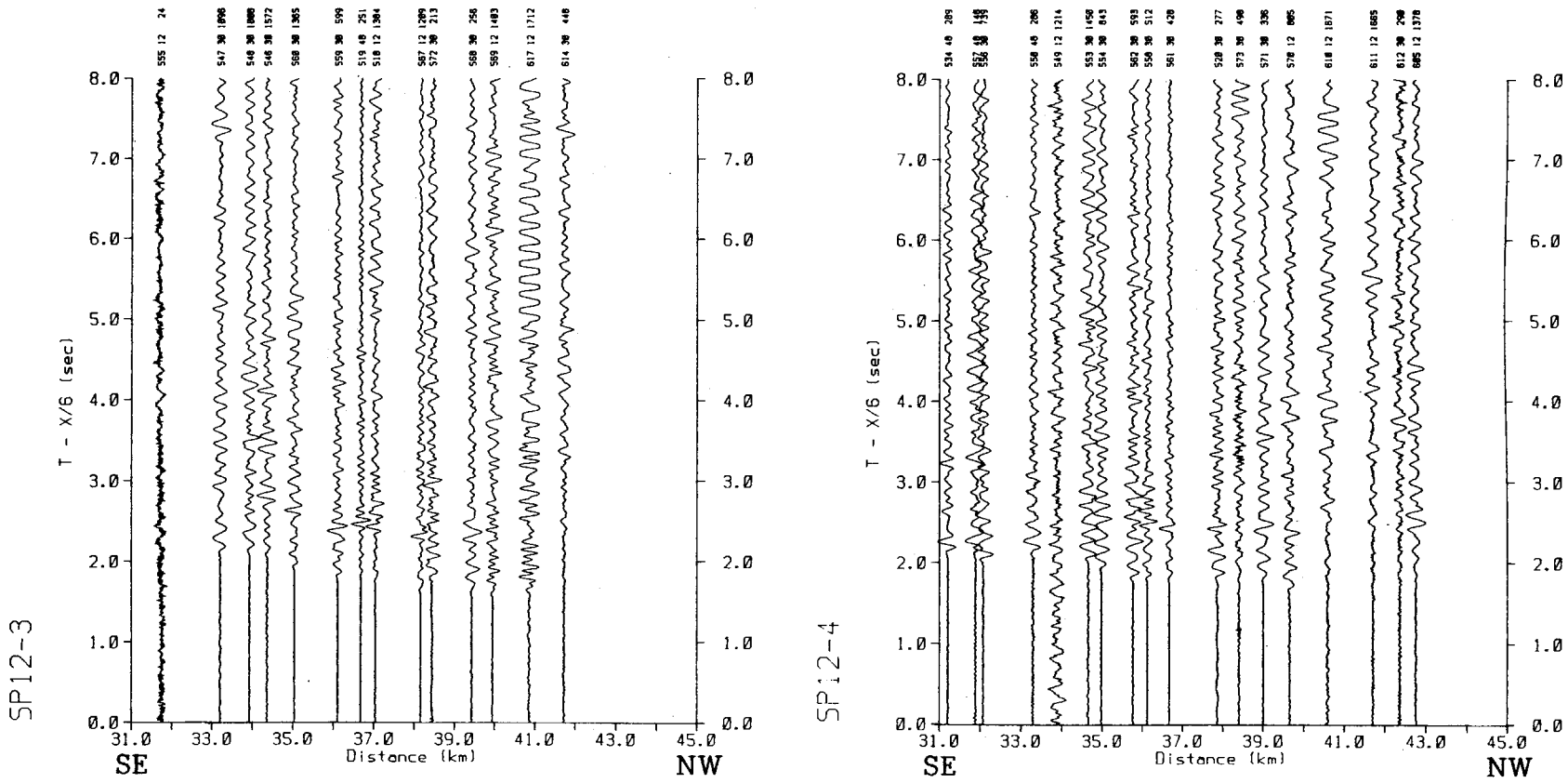


Plate 19. Shot point 12, Shot 17, Sections 3 and 4.

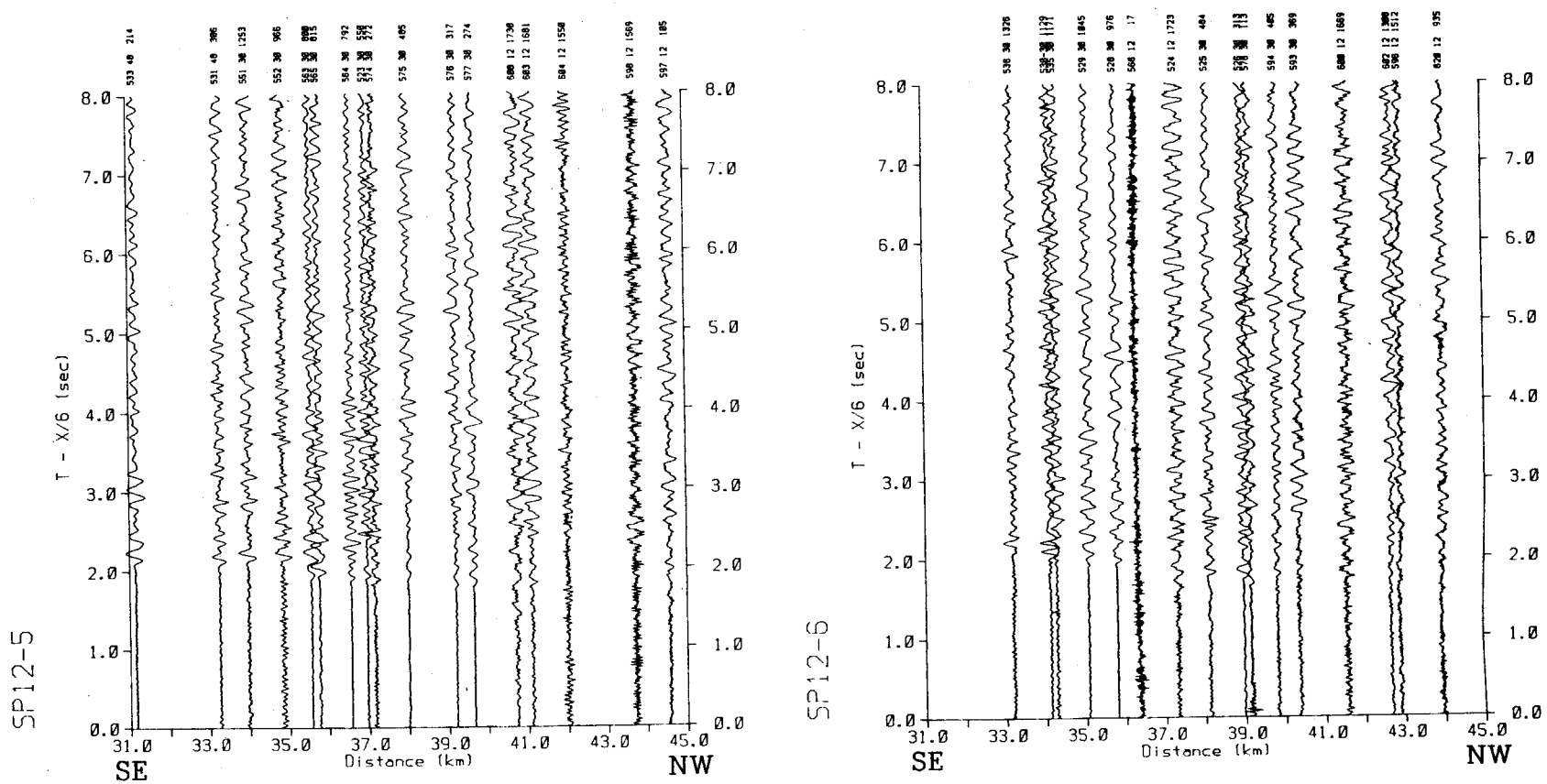


Plate 20. Shot point 12, Shot 17, Sections 5 and 6.

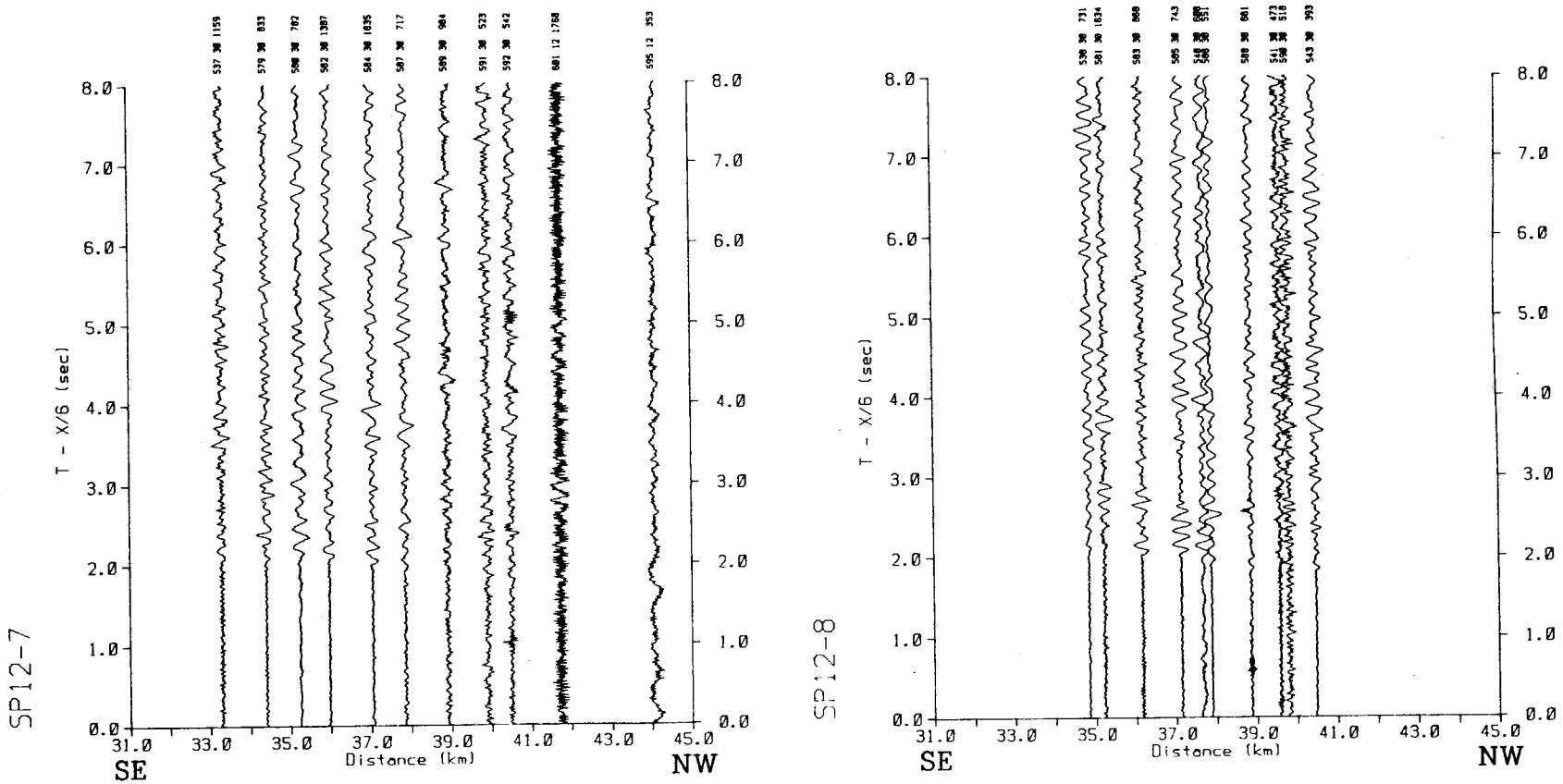
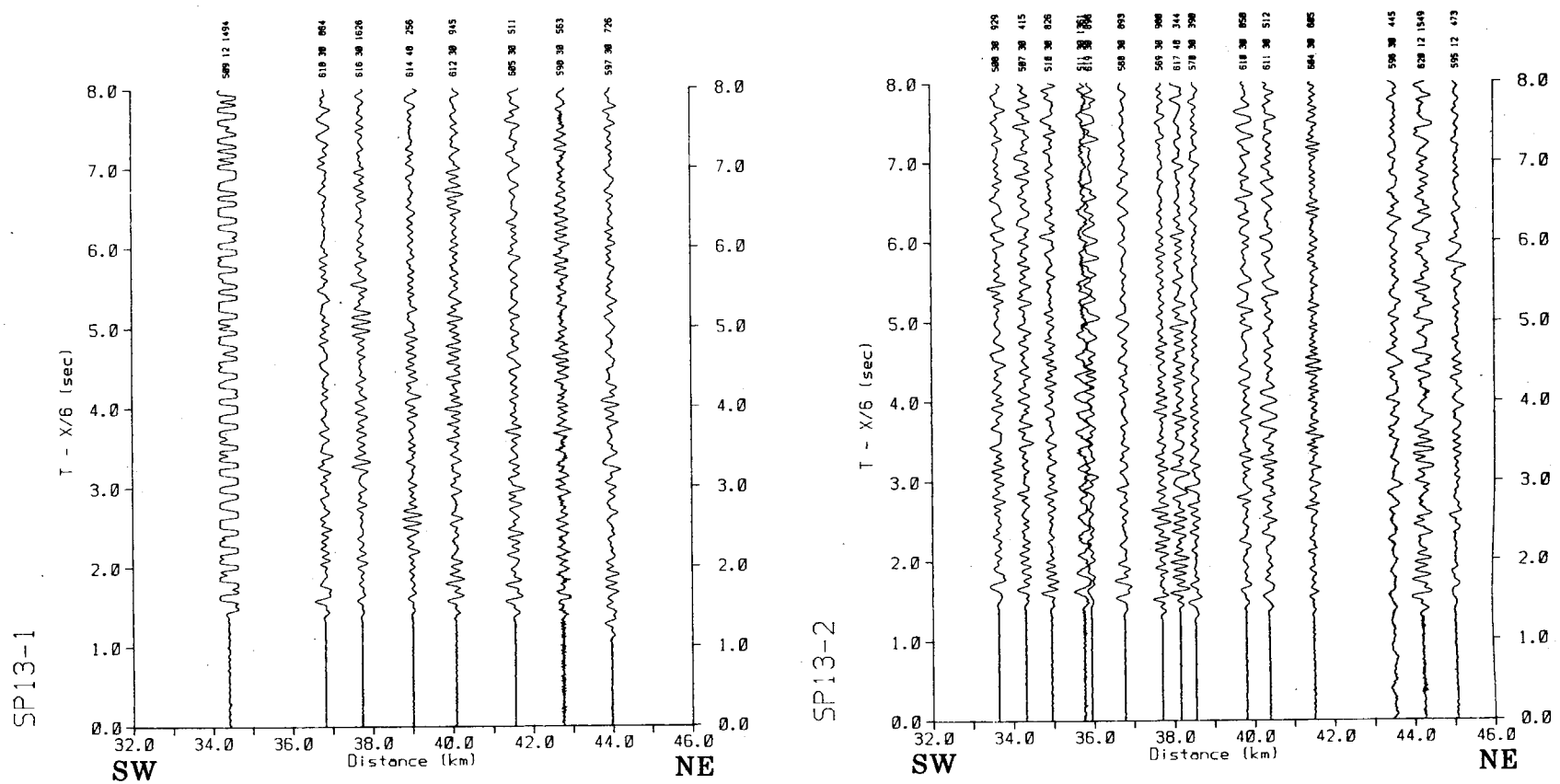


Plate 21. Shot point 12, Shot 17, Sections 7 and 8.



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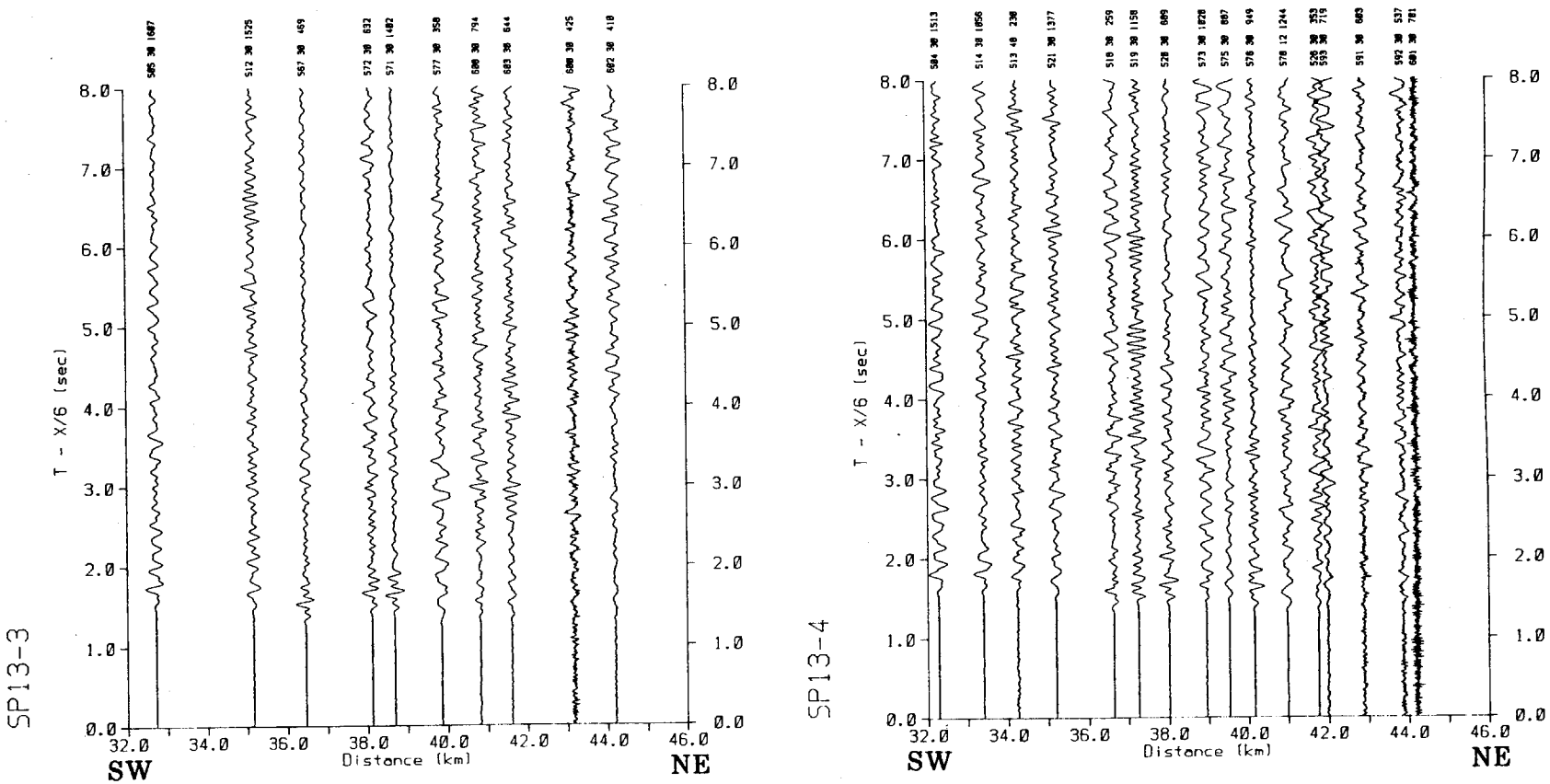


Plate 23. Shot point 13, Shot 21. Sections 3 and 4.

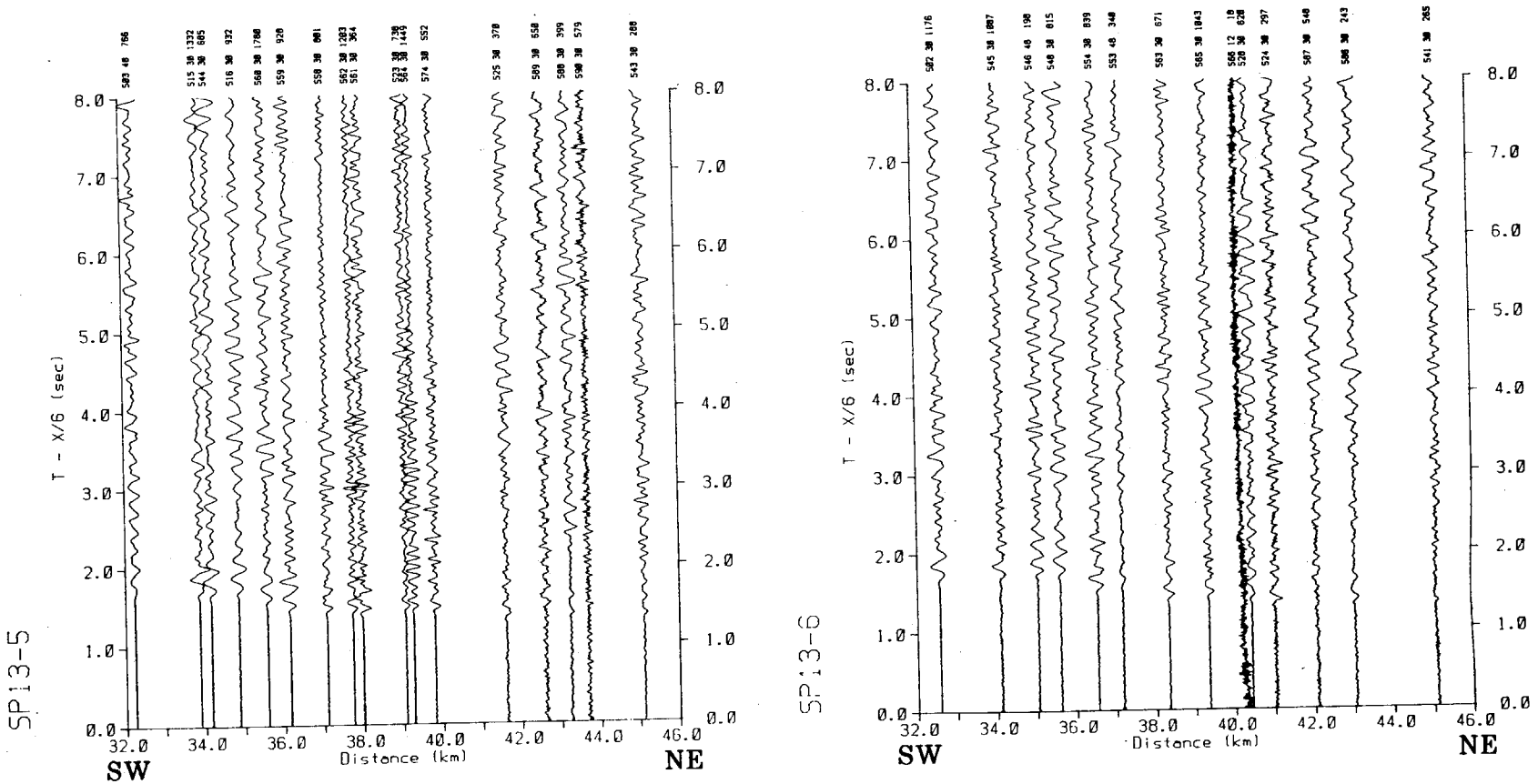


Plate 21. Shot point 13, Shot 21, Sections 5 and 6.

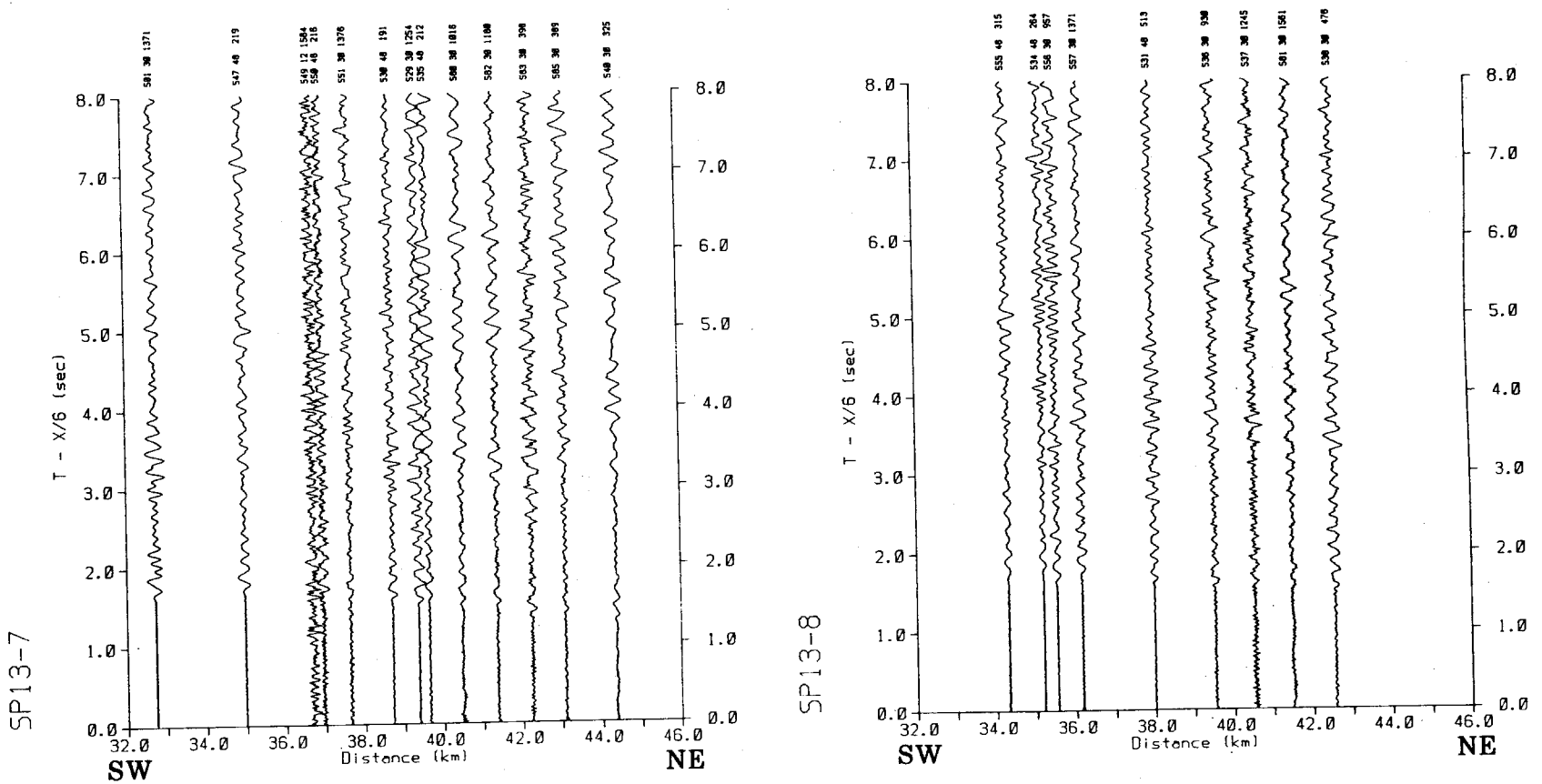


Plate 25. Shot point 13, Shot 21, Sections 7 and 8.

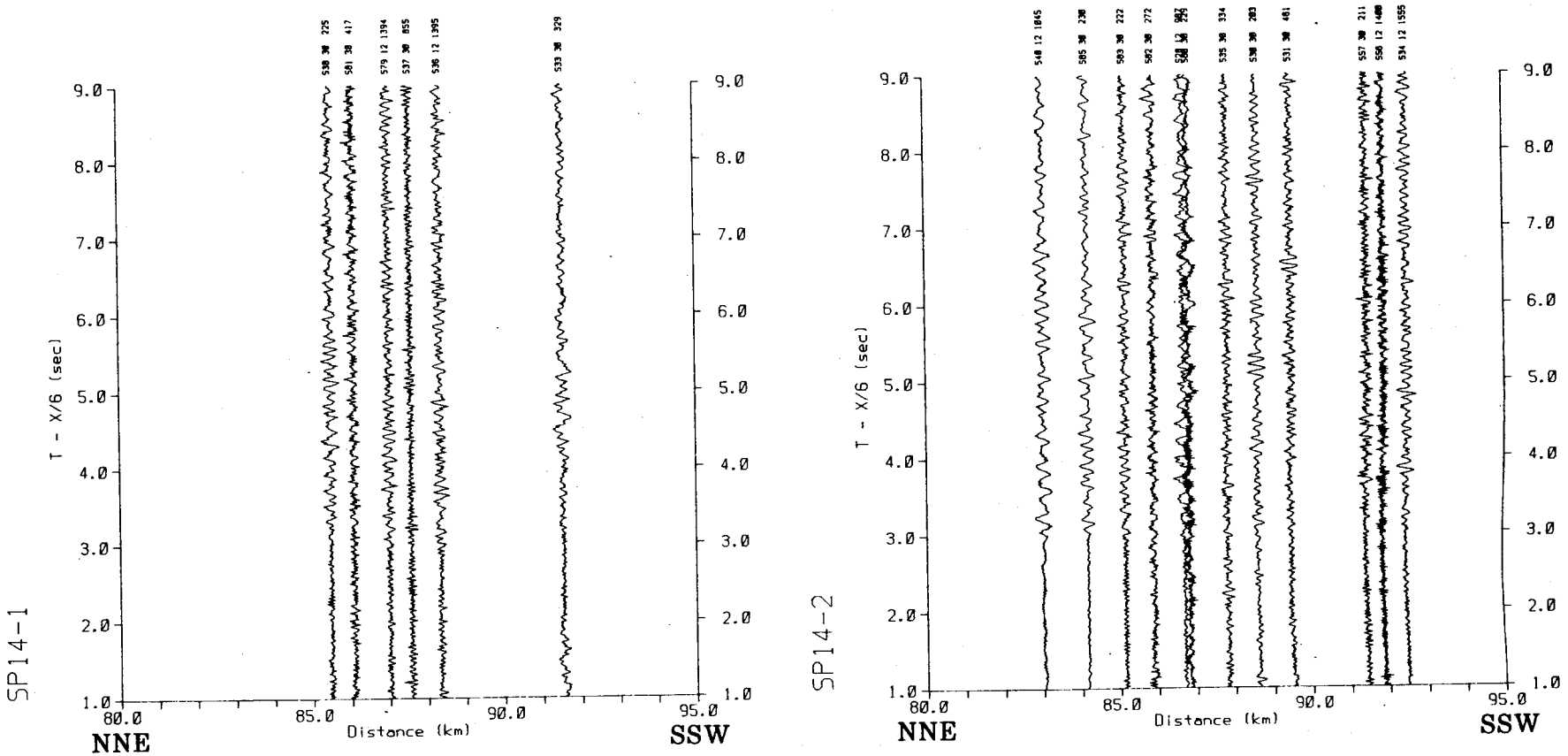


Plate 26. Shot point 14, Shot 14, Sections 1 and 2.

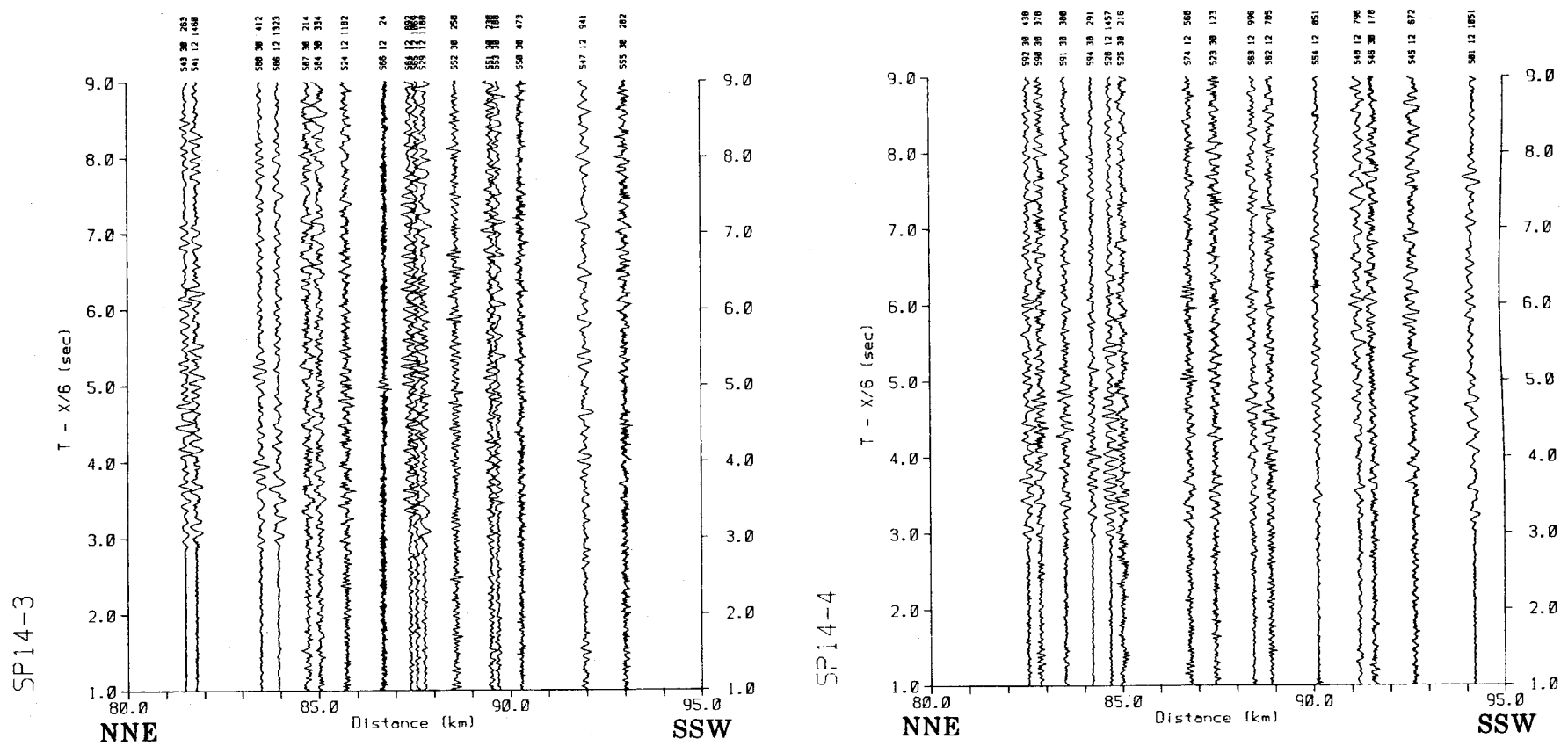


Plate 27. Shot point 14, Shot 14, Sections 3 and 4.

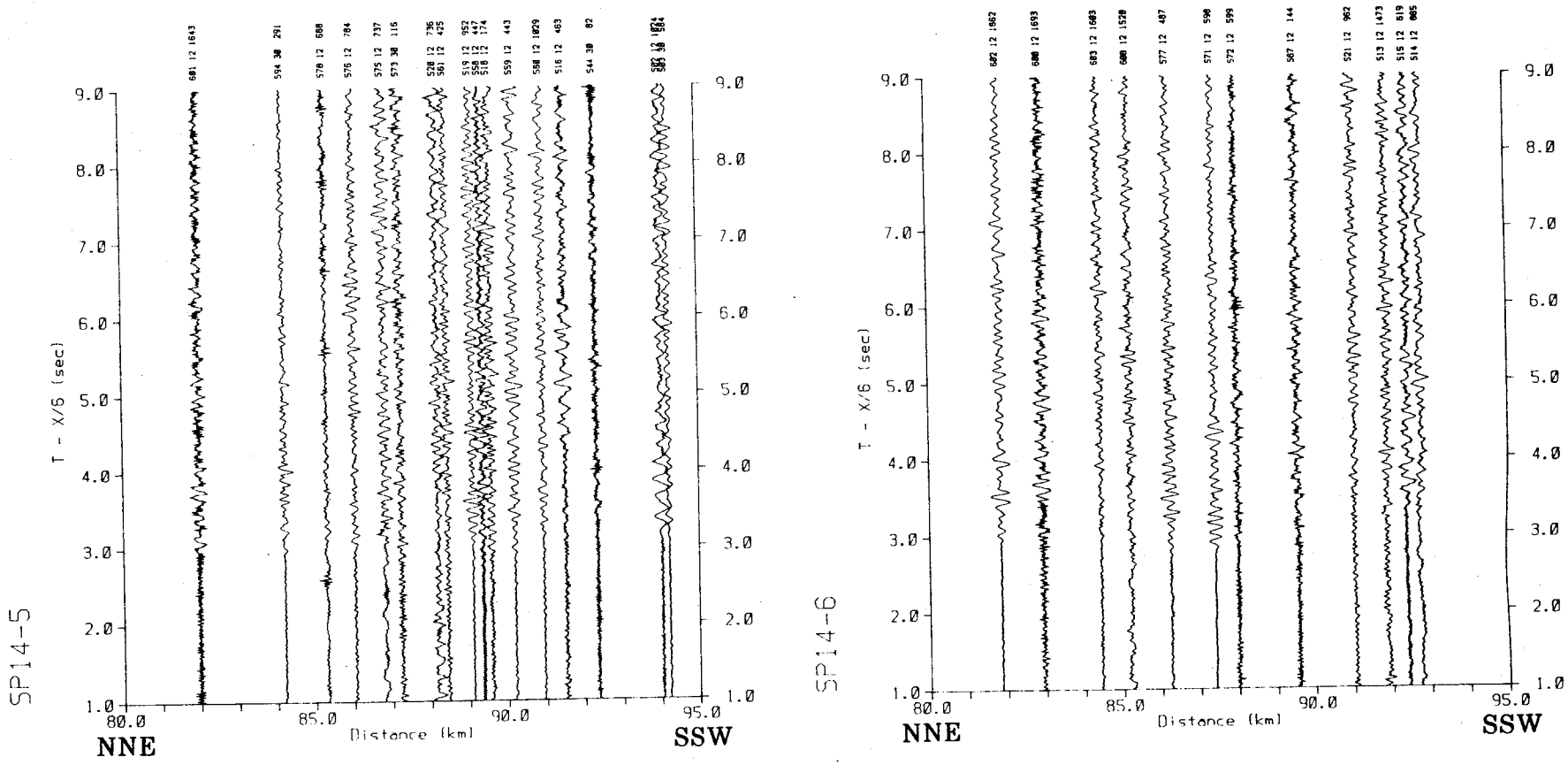


Plate 28. Shot point 11, Shot 11, Sections 5 and 6.

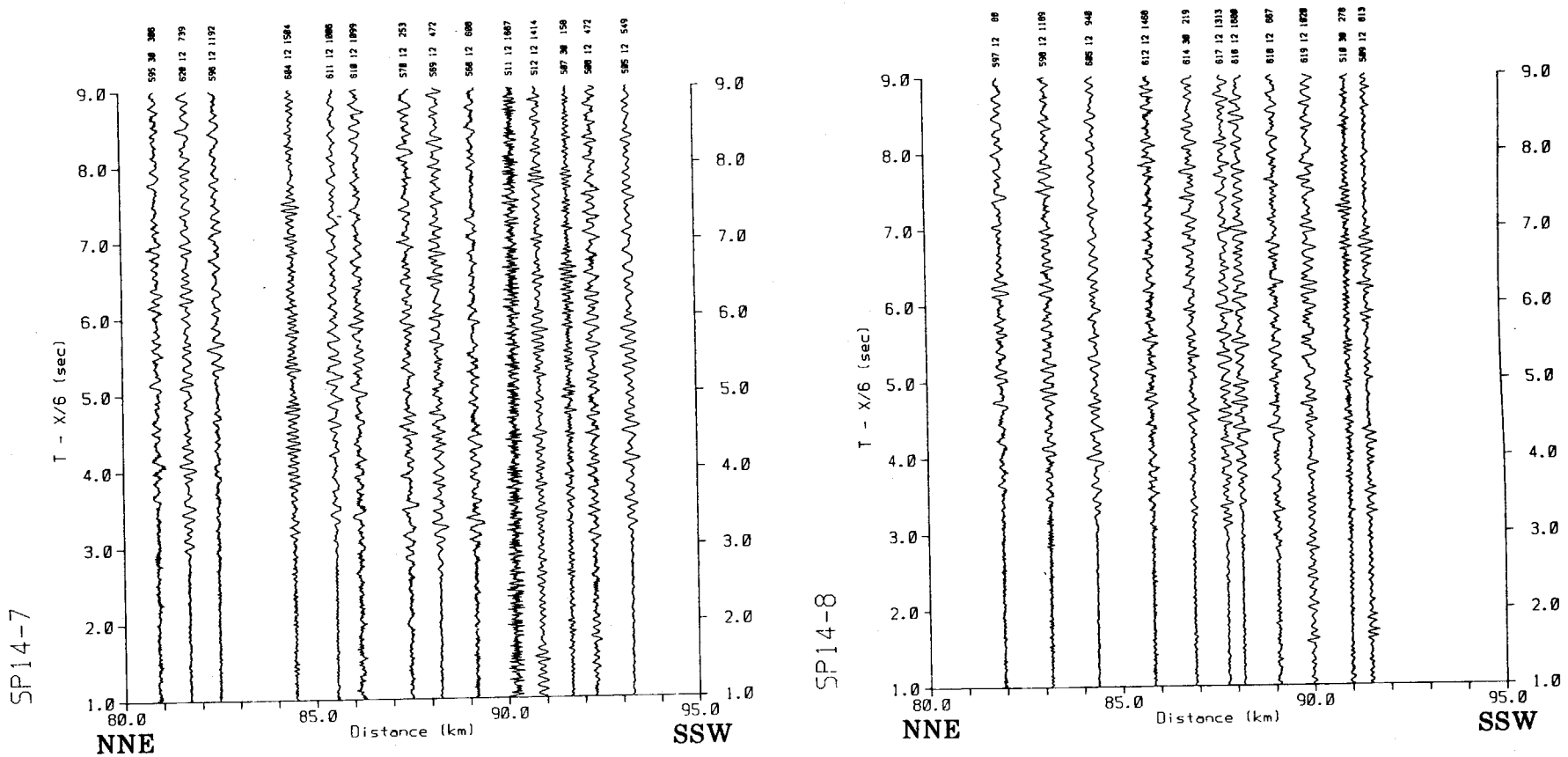


Plate 29. Shot point 14, Shot 14, Sections 7 and 8.

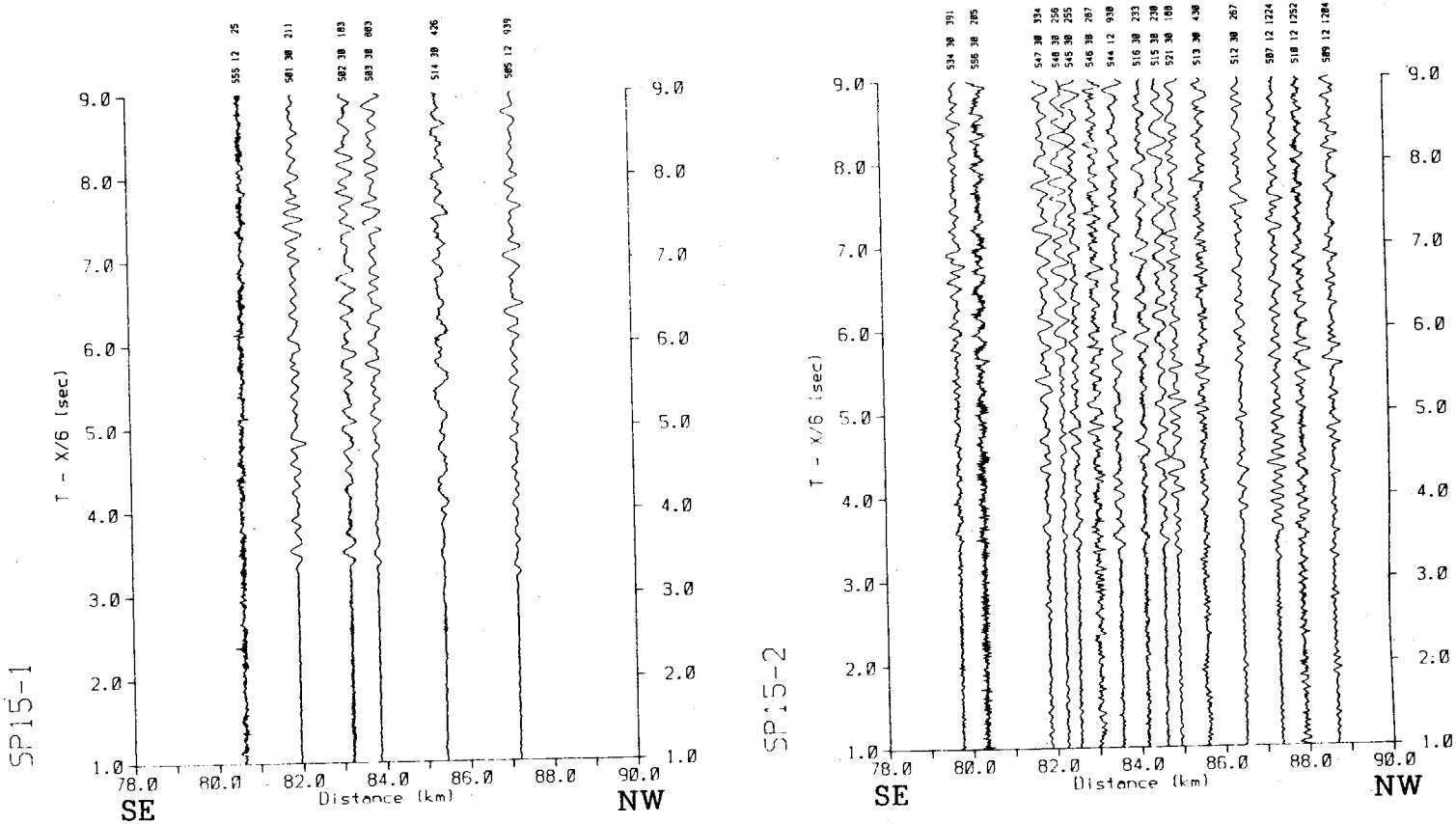


Plate 30. Shot point 15, Shot 18, Sections 1 and 2.

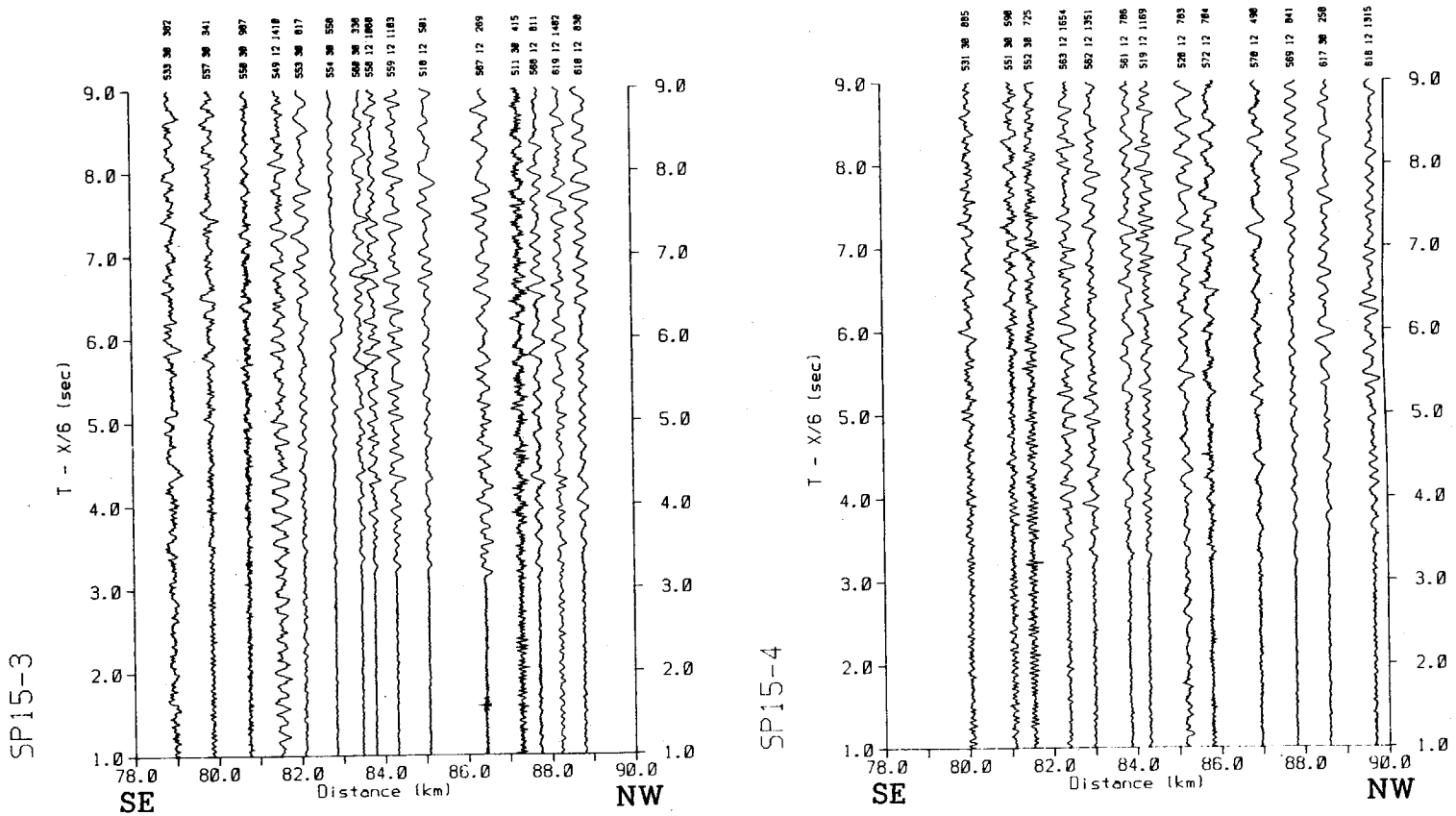


Plate 31. Shot point 15, Shot 18, Sections 3 and 4.

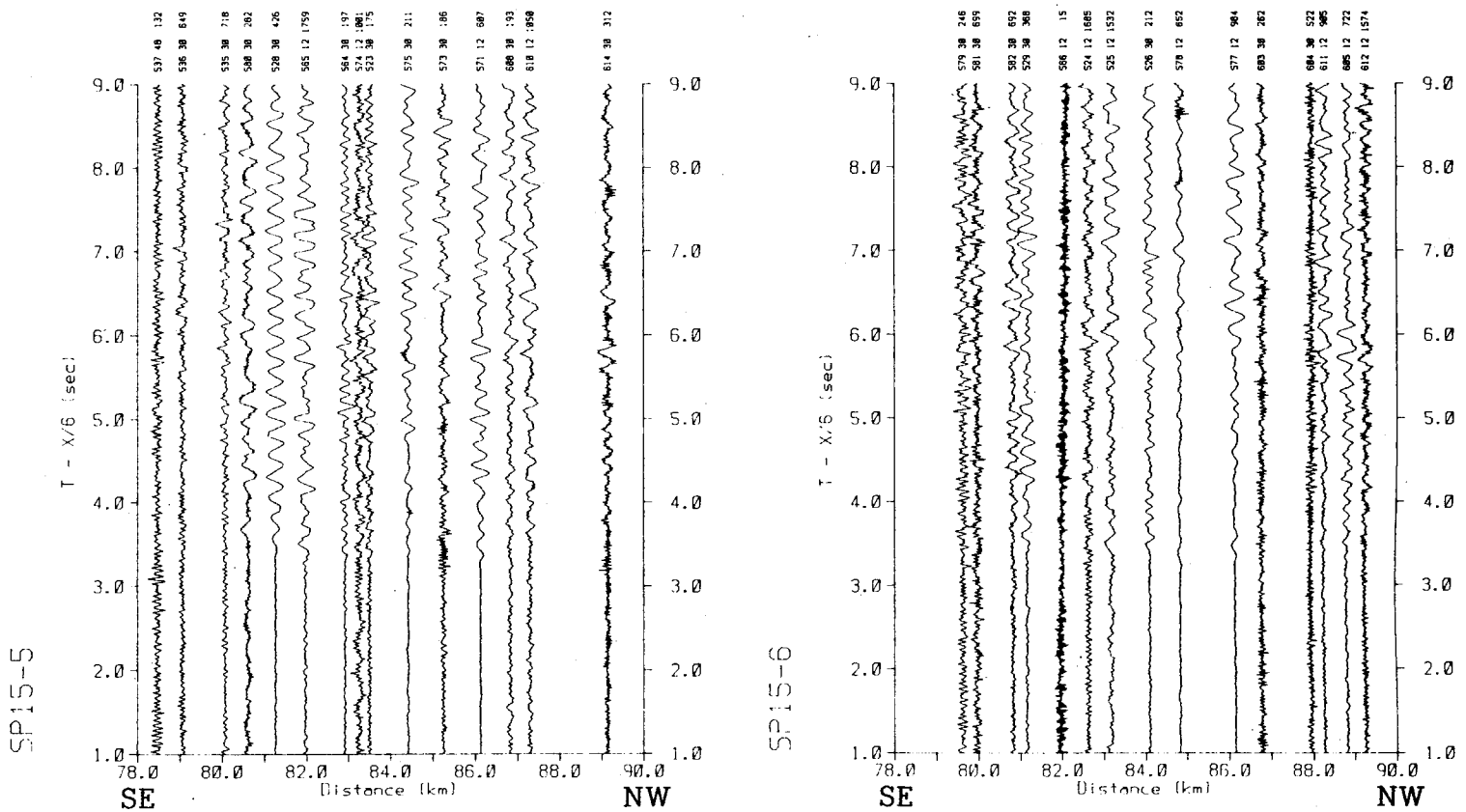


Plate 32. Shot point 15, Shot 18, Sections 5 and 6.

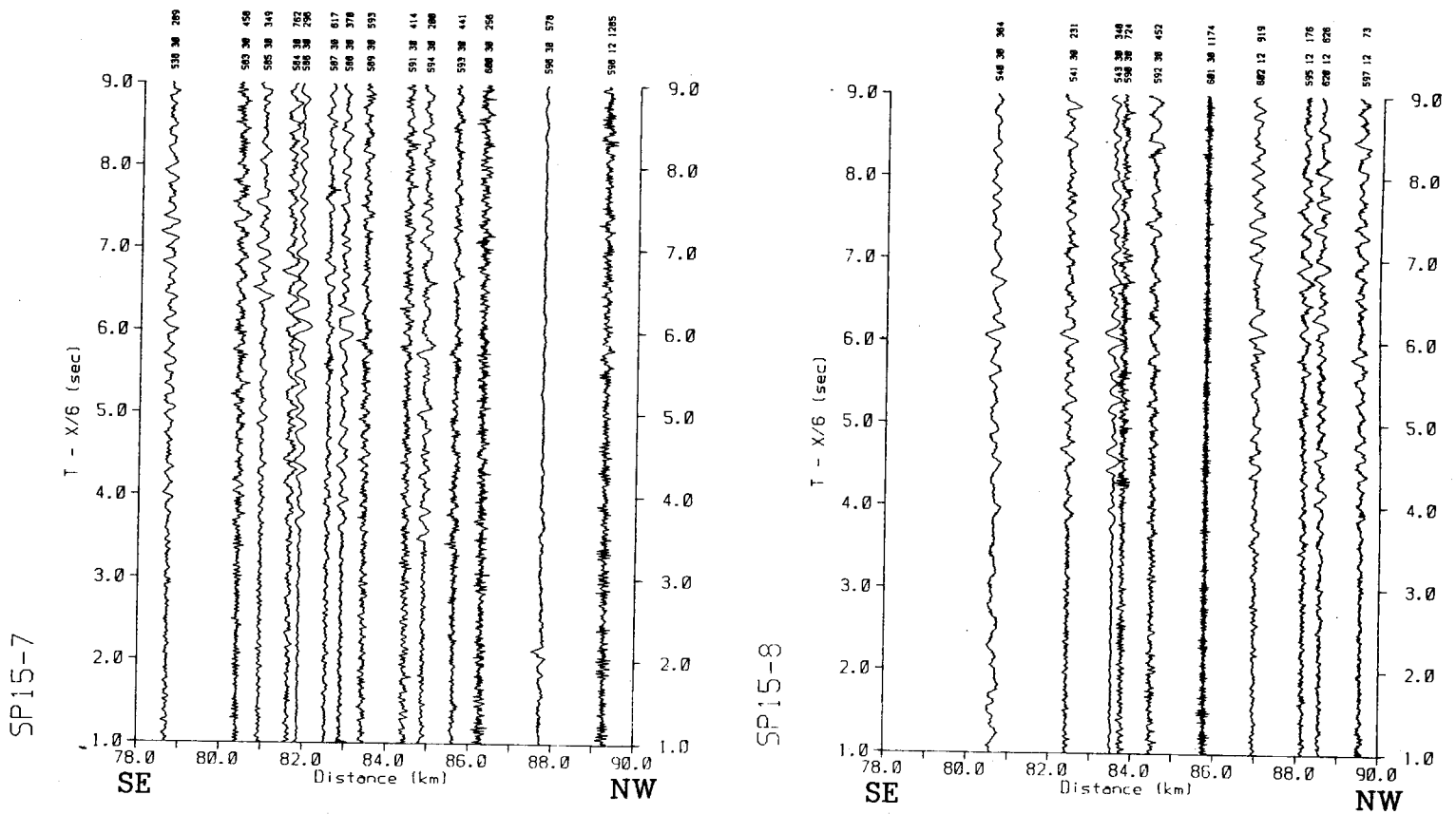


Plate 33. Shot point 15, Shot 18, Sections 7 and 8.

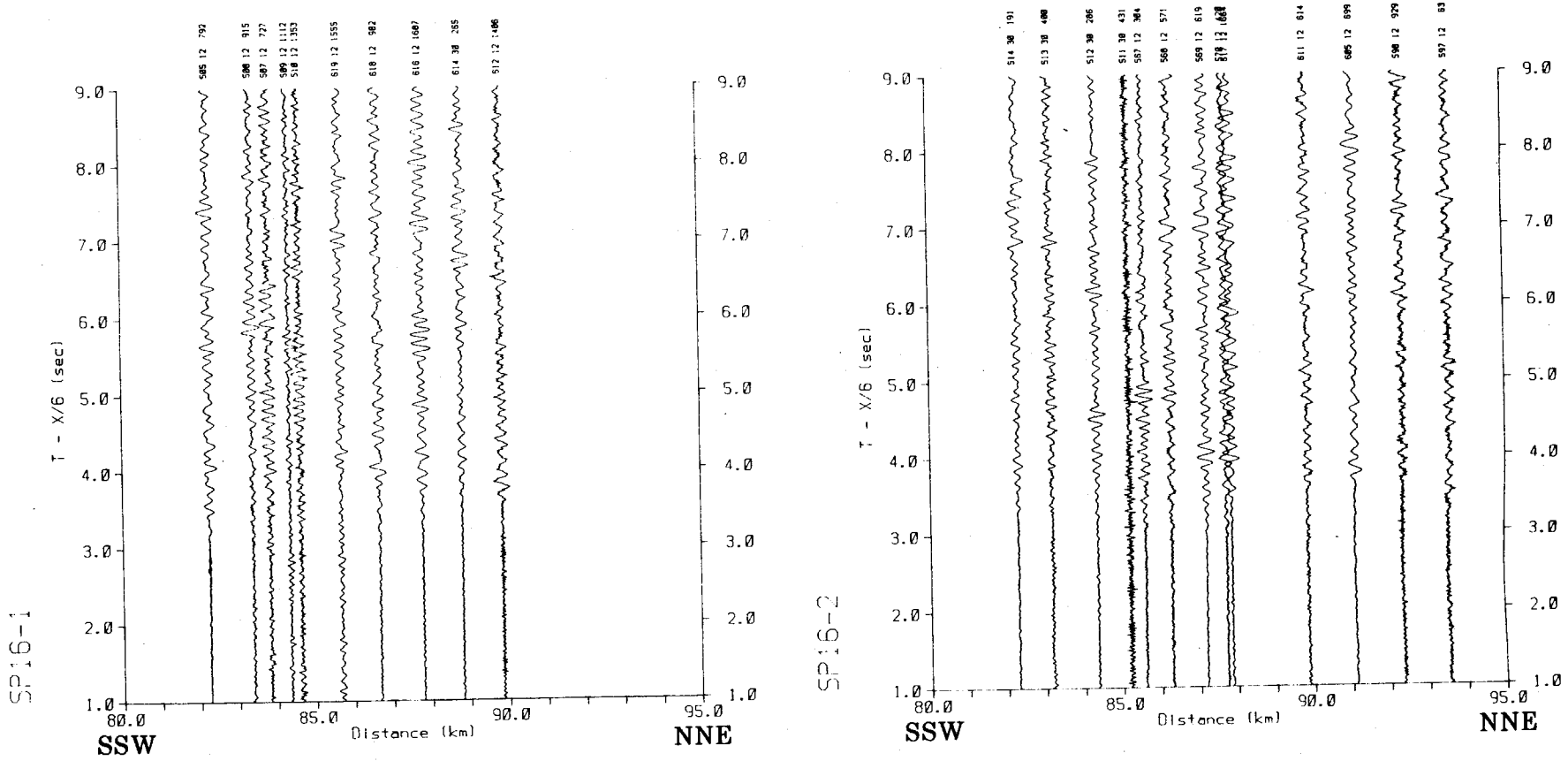


Plate 31. Shot point 16, Shot 12, Sections 1 and 2.

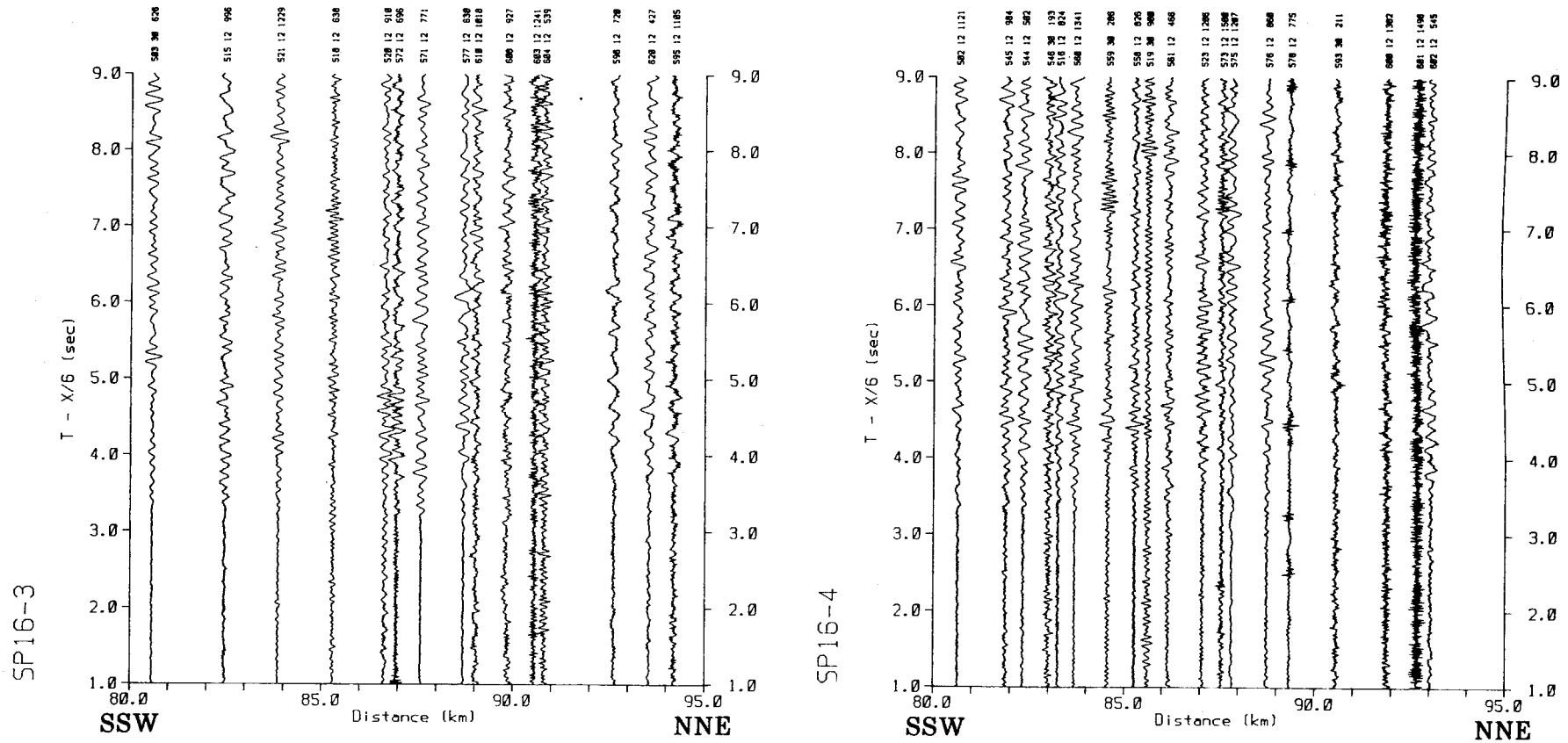


Plate 35. Shot point 16, Shot 12. Sections 3 and 4.

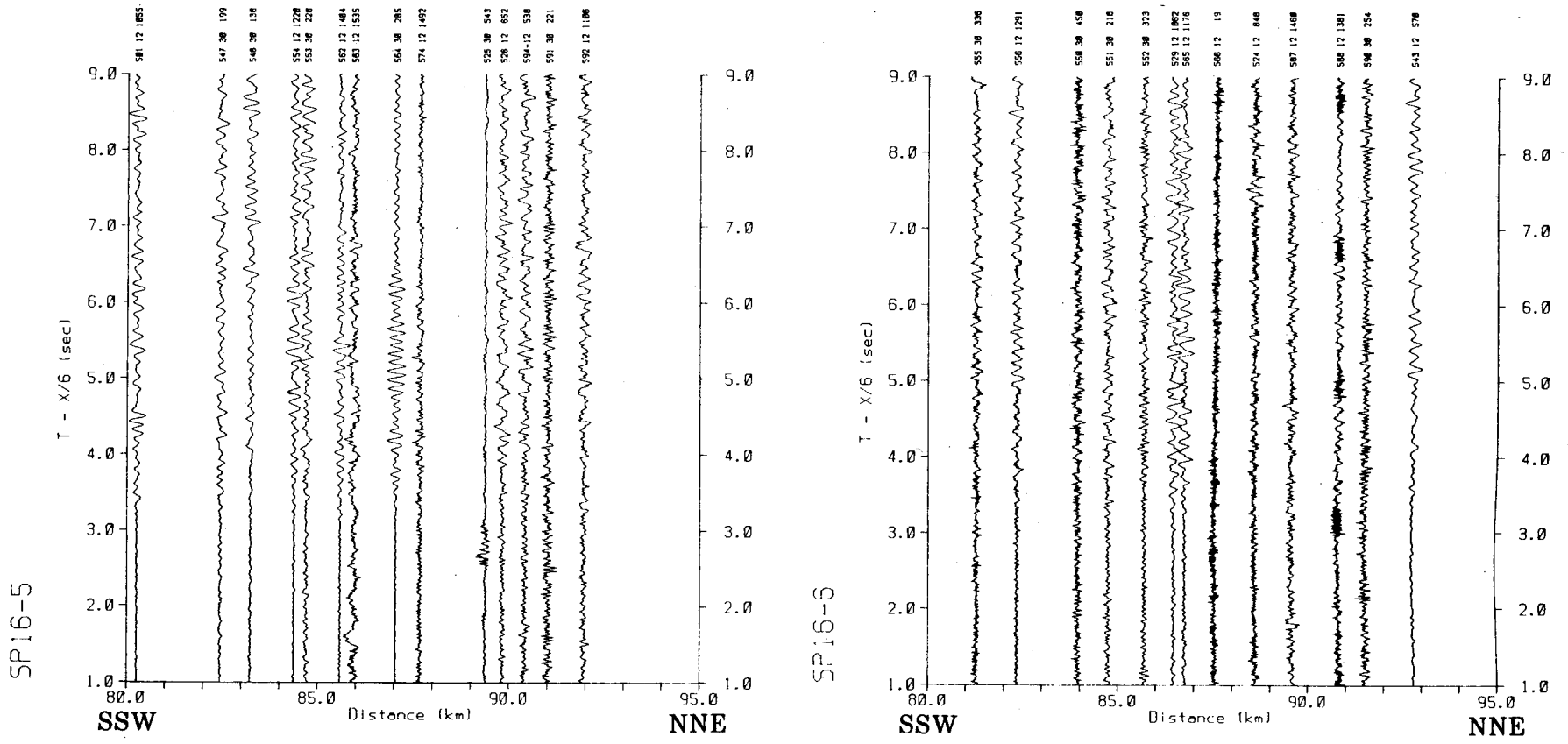


Plate 36. Shot point 16, Shot 12, Sections 5 and 6.

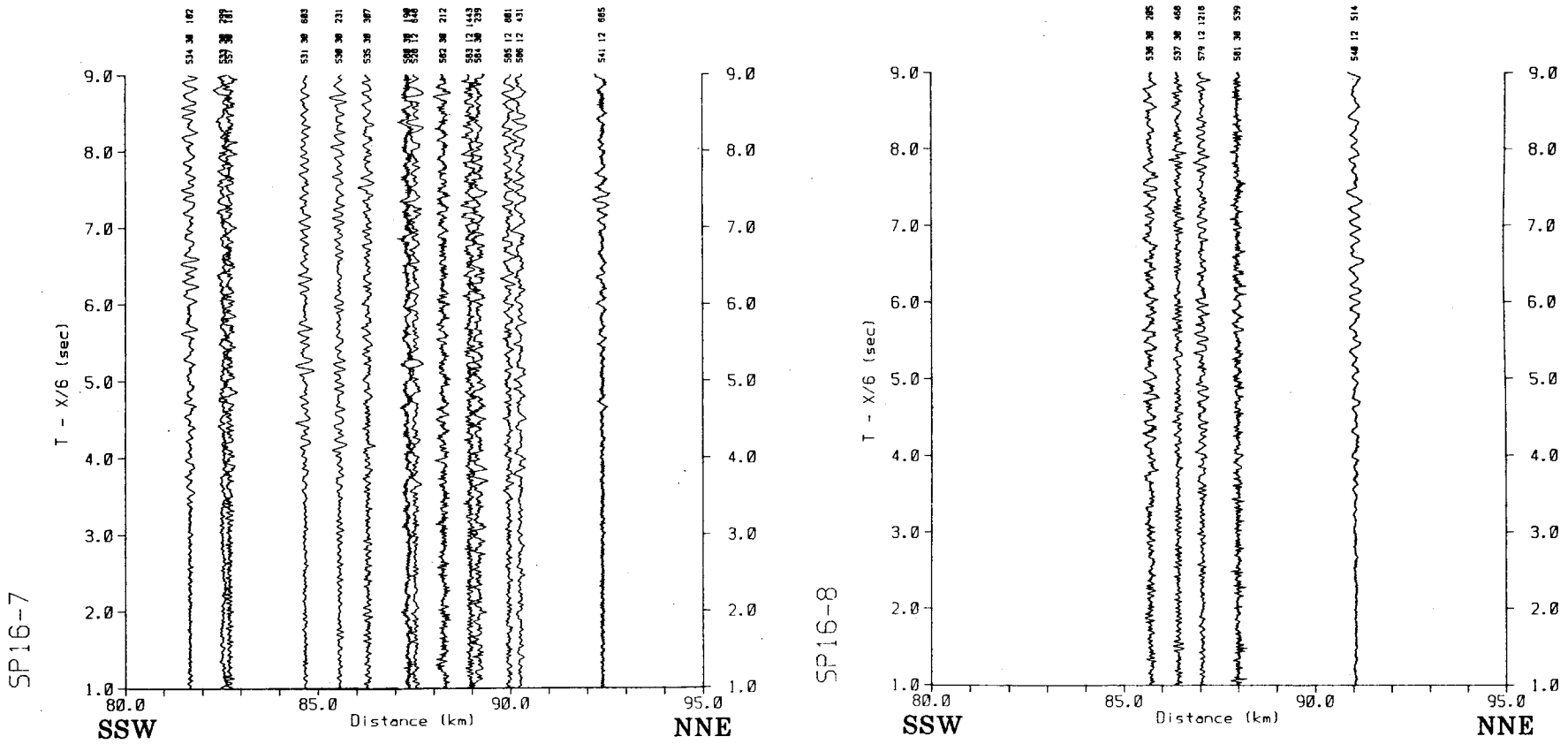


Plate 37. Shot point 16, Shot 12. Sections 7 and 8.

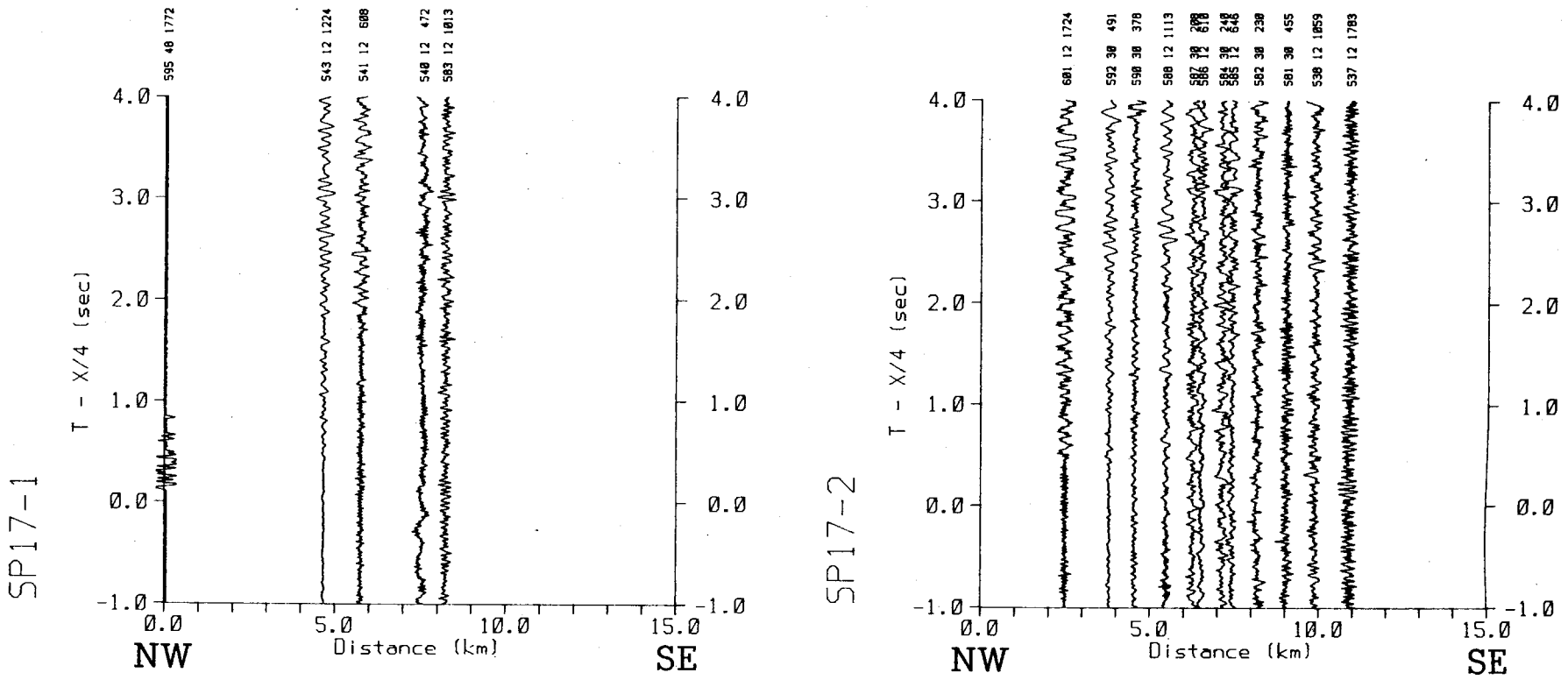


Plate 38. Shot point 17, Shot 15. Sections 1 and 2.

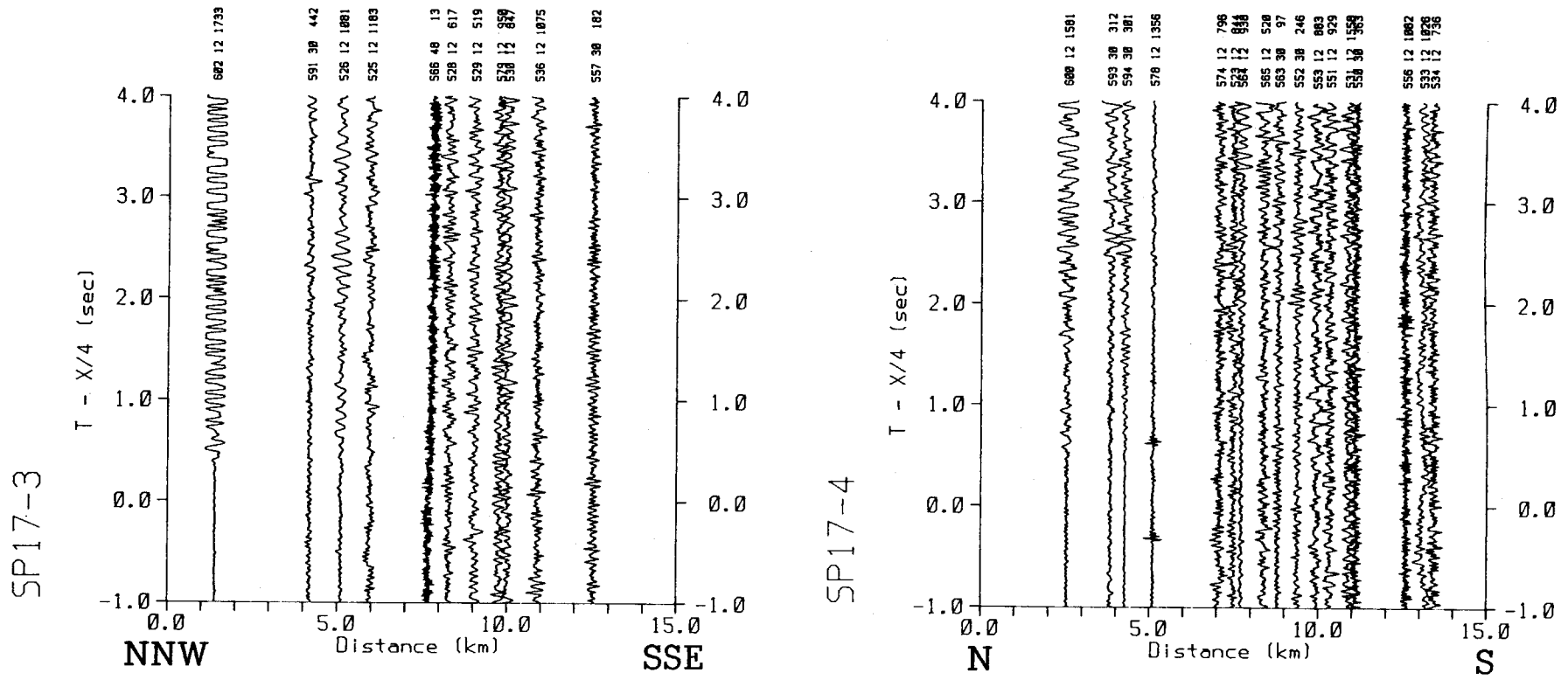


Plate 39. Shot point 17, Shot 15, Sections 3 and 4.

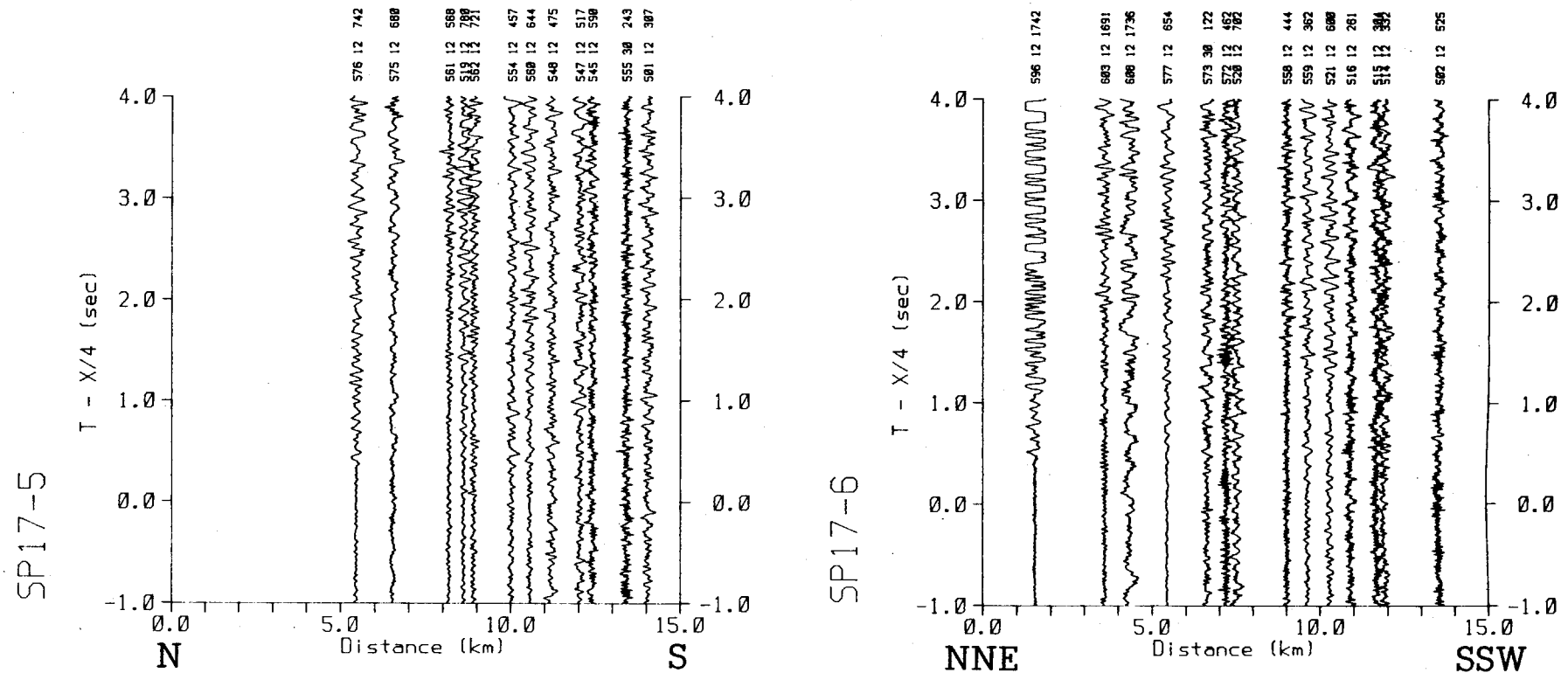


Plate 40. Shot point 17, Shot 15, Sections 5 and 6.

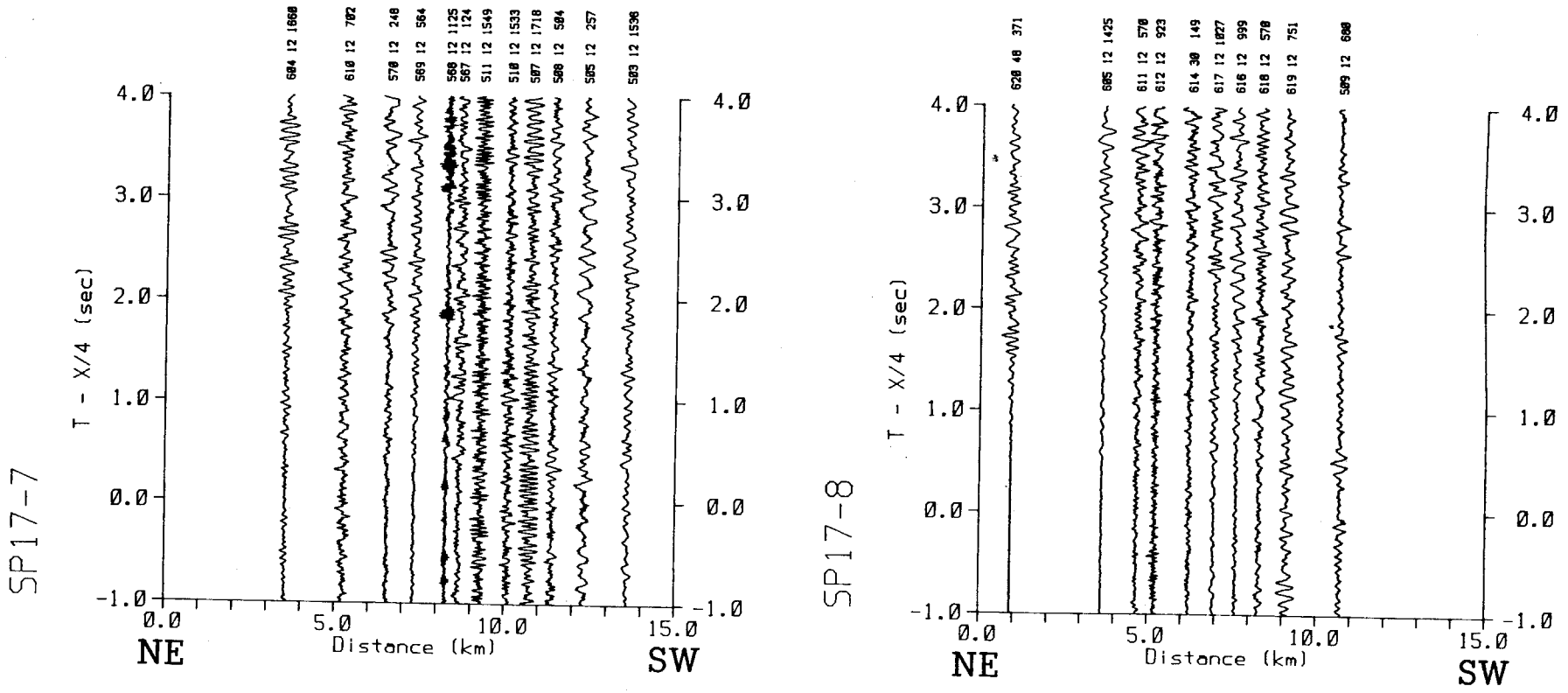


Plate 41. Shot point 17, Shot 15, Sections 7 and 8.

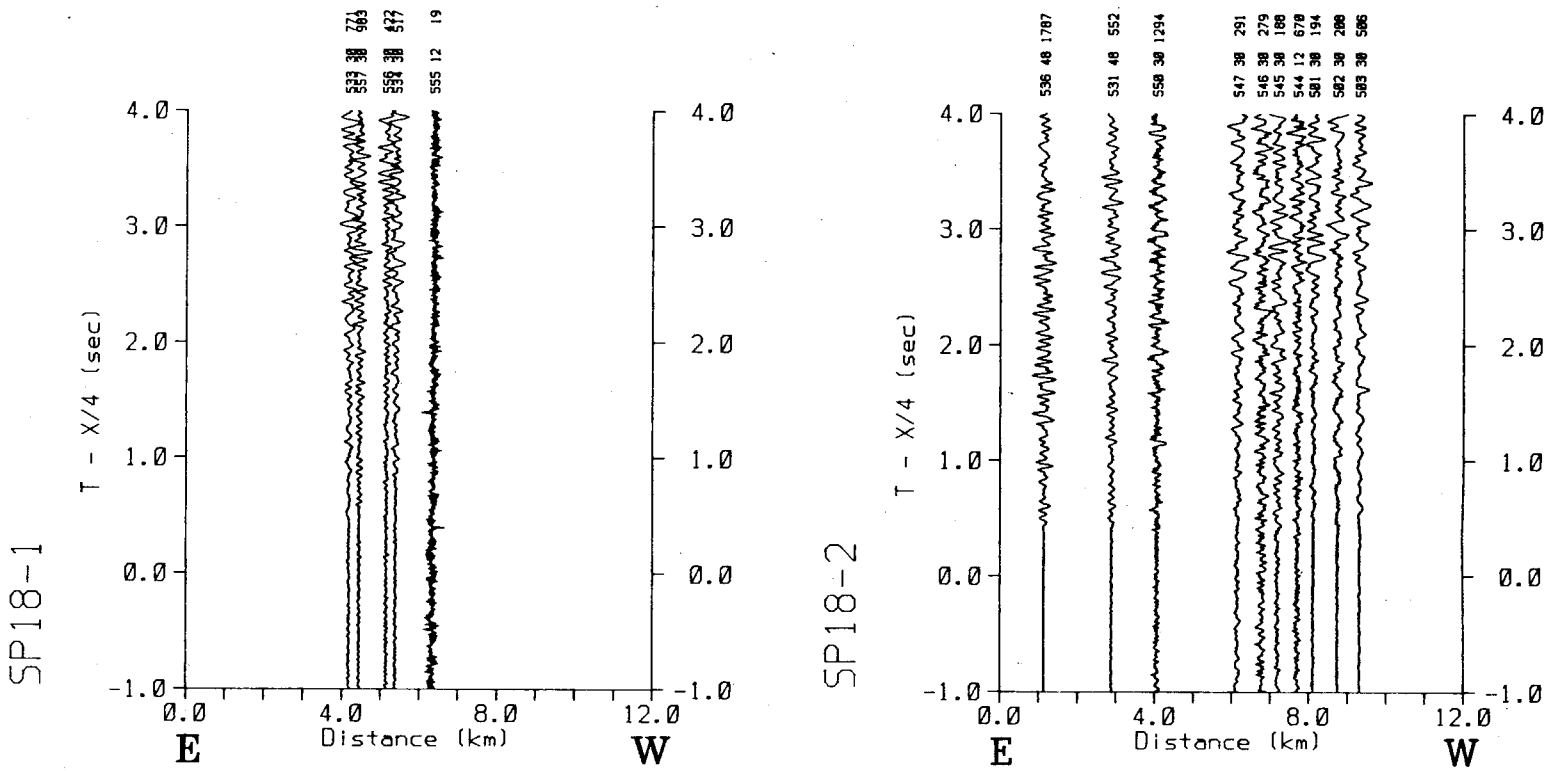


Plate 42. Shot point 18, Shot 20, Sections 1 and 2.

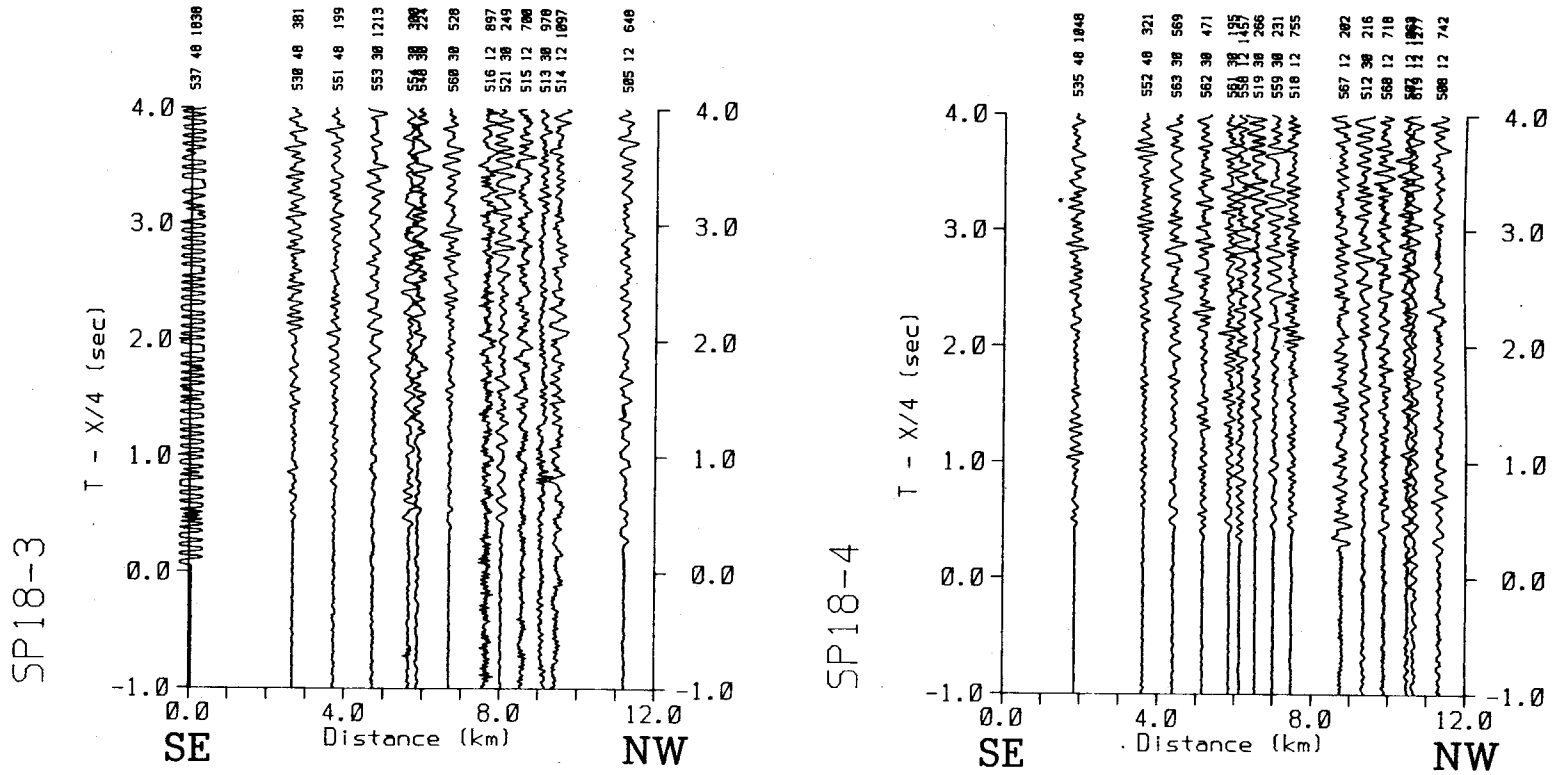


Plate 43. Shot point 18, Shot 20, Sections 3 and 4.

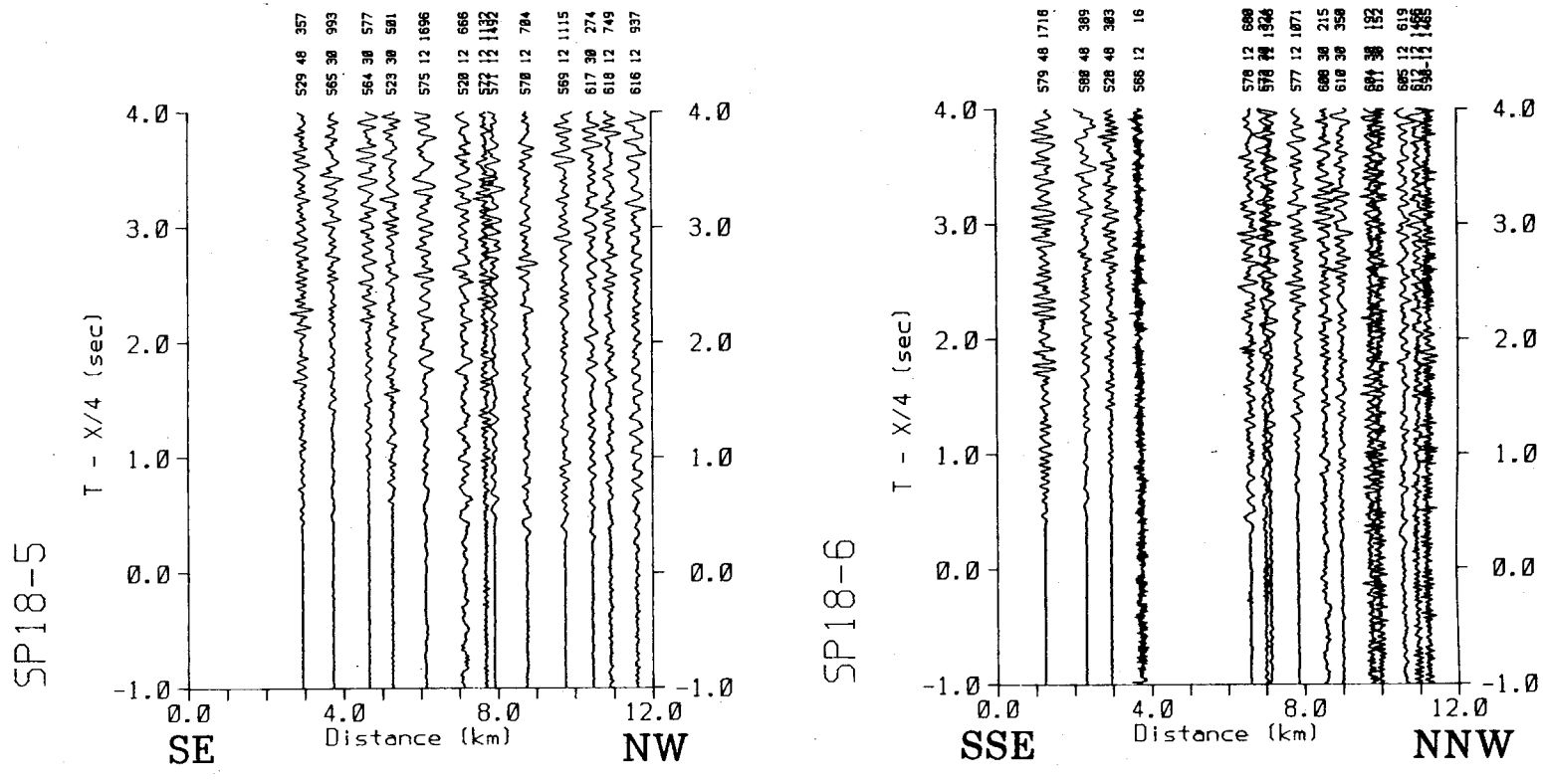


Plate 11. Shot point 18, Shot 20, Sections 5 and 6.

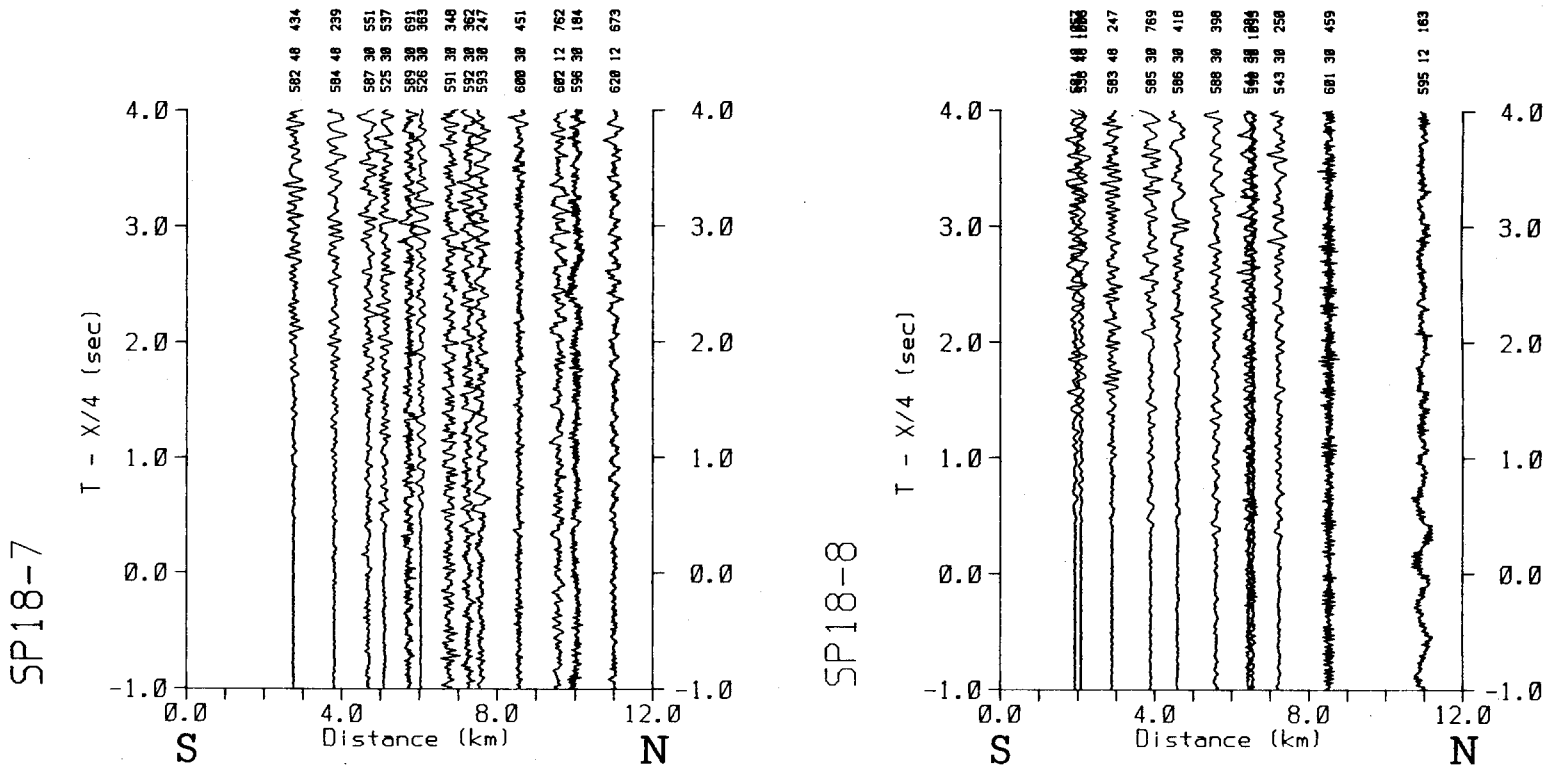


Plate 45. Shot point 18, Shot 20, Sections 7 and 8.

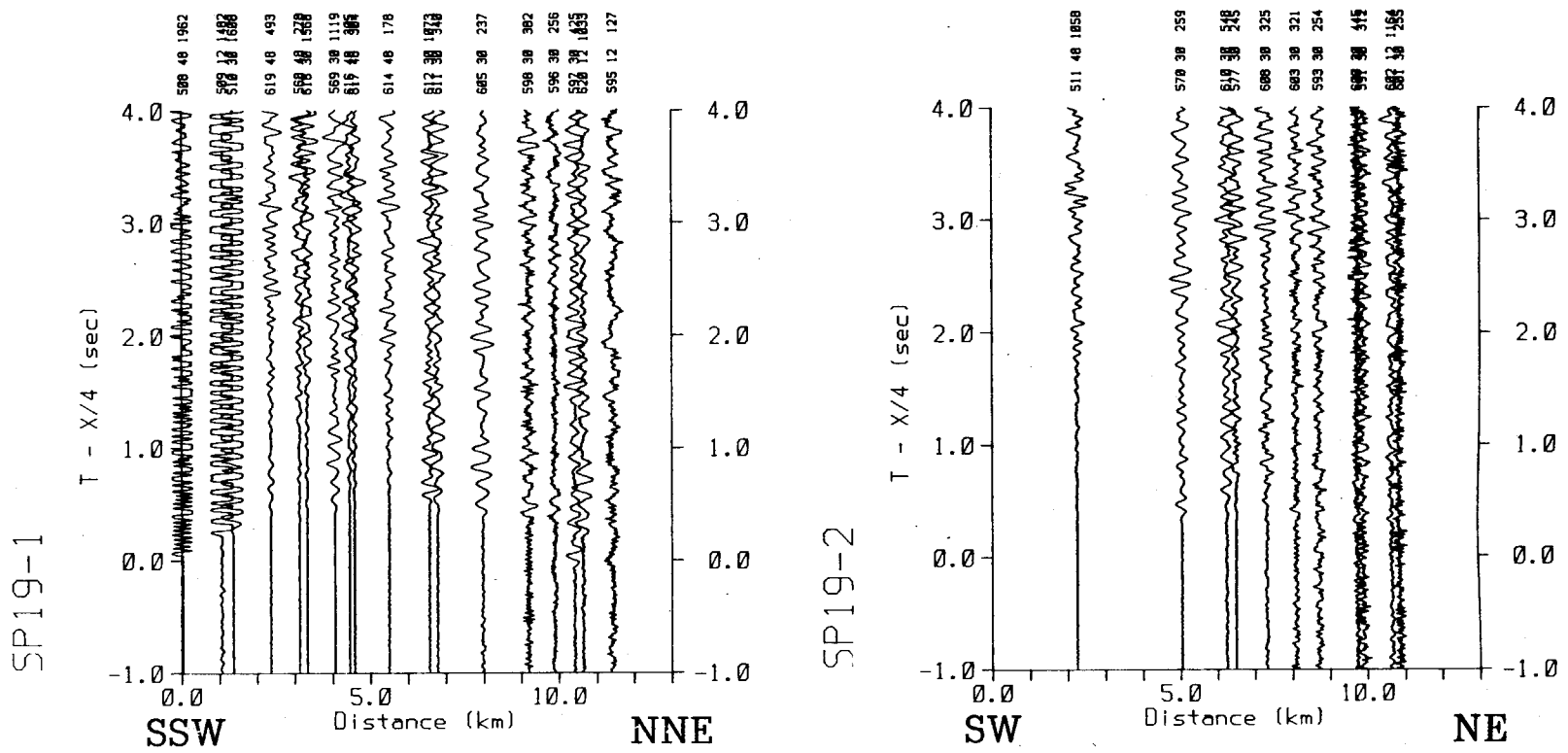


Plate 16. Shot point 19, Shot 22, Sections 1 and 2.

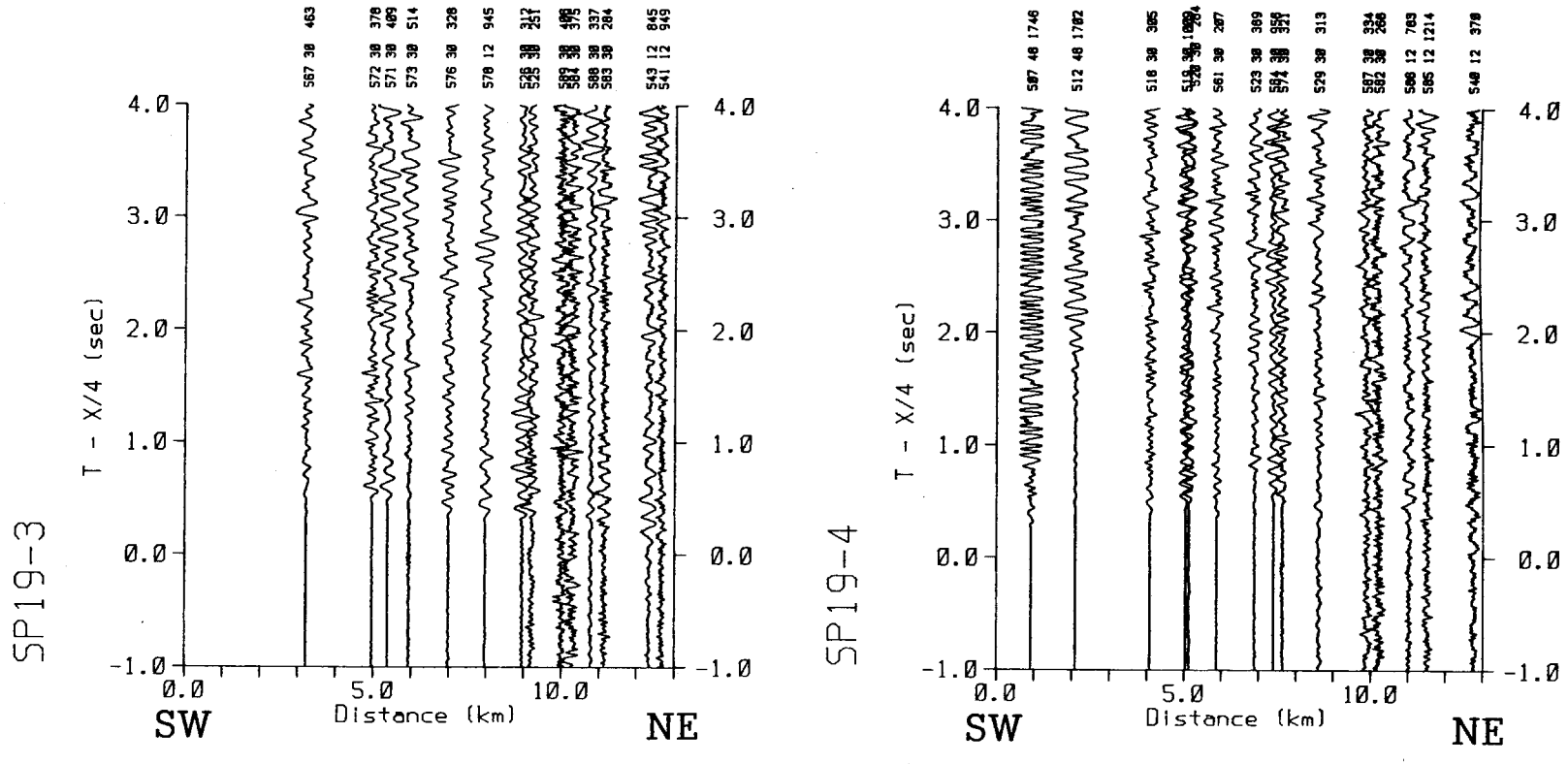


Plate 47. Shot point 19, Shot 22, Sections 3 and 4.

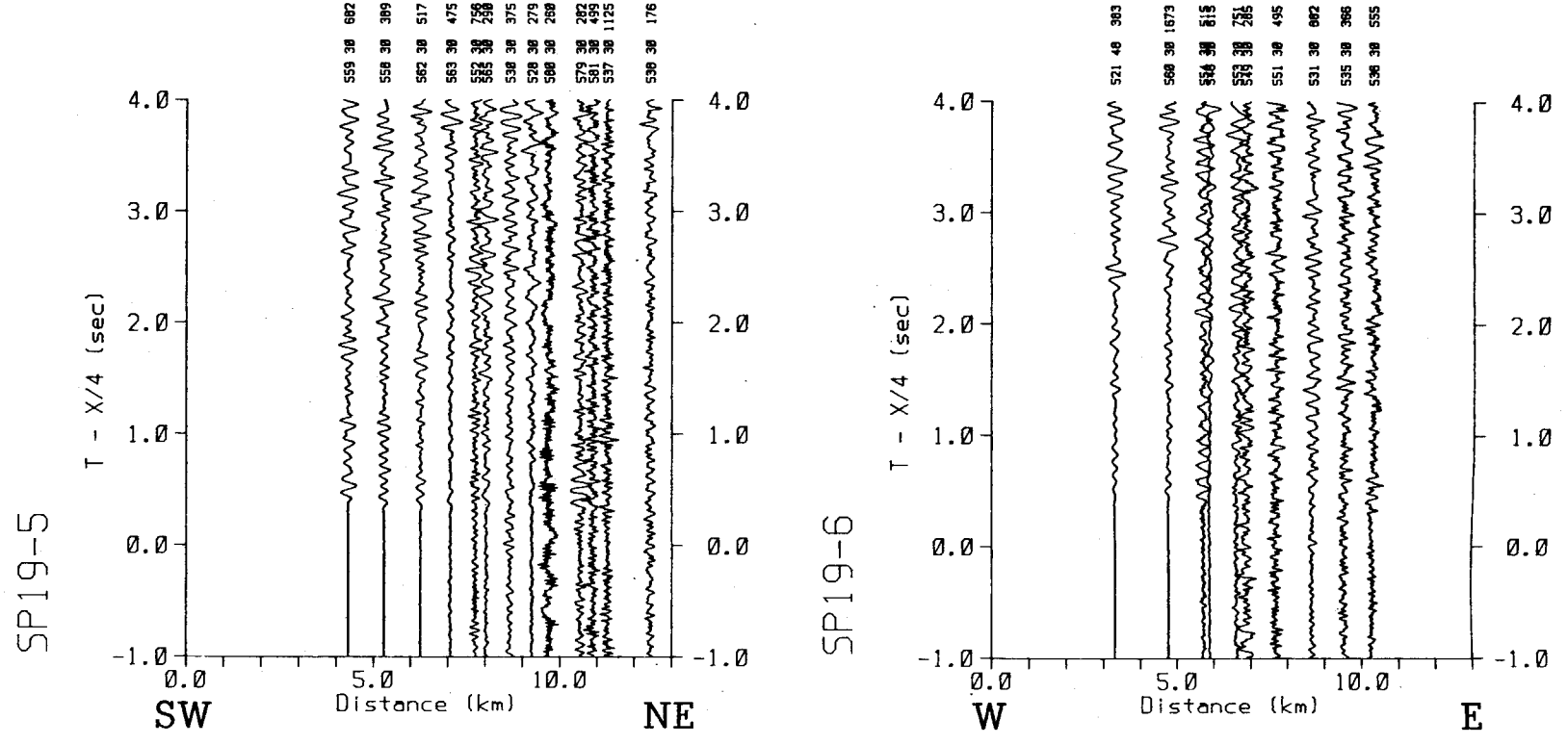


Plate 48. Shot point 19, Shot 22, Sections 5 and 6.

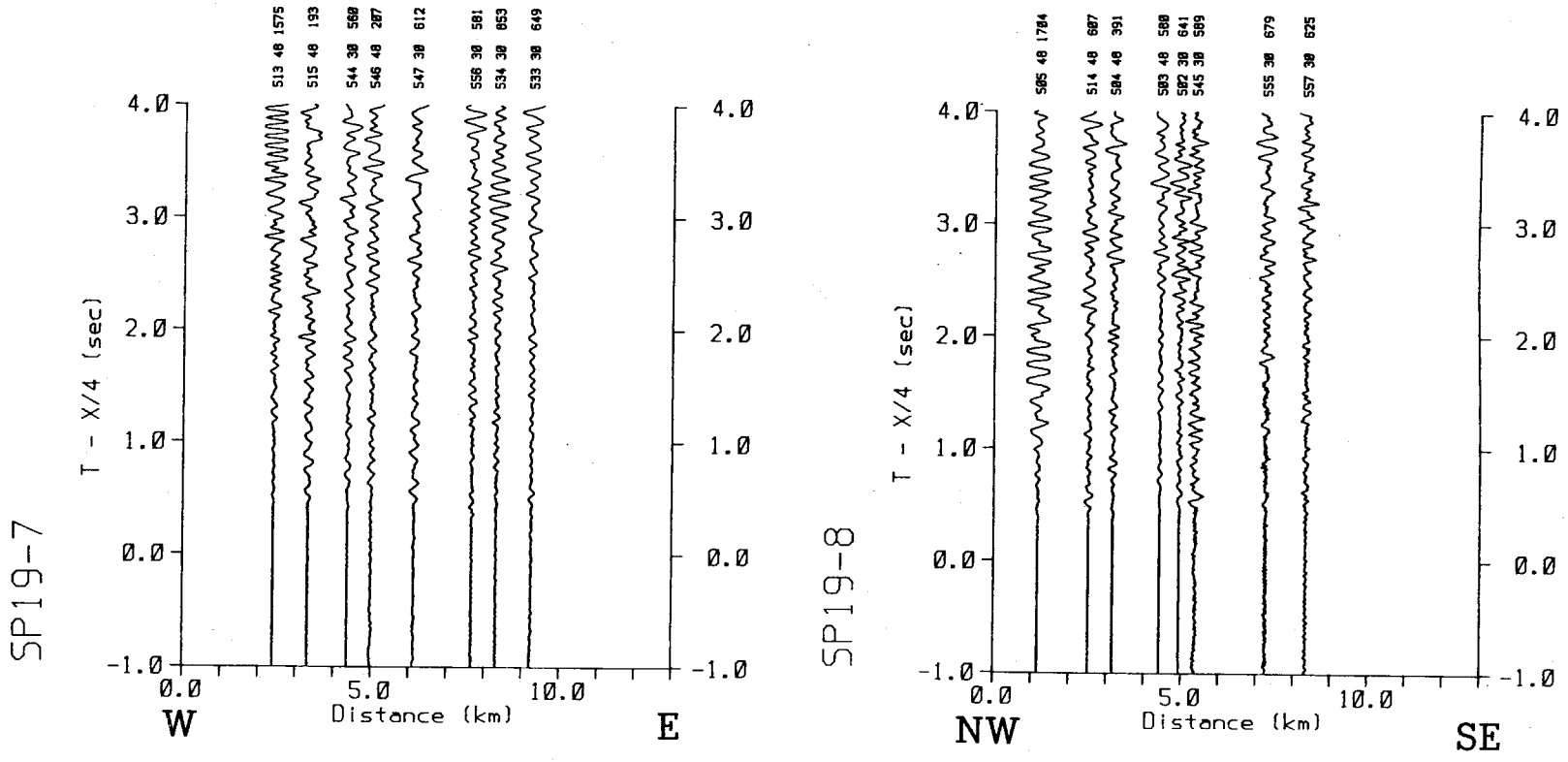
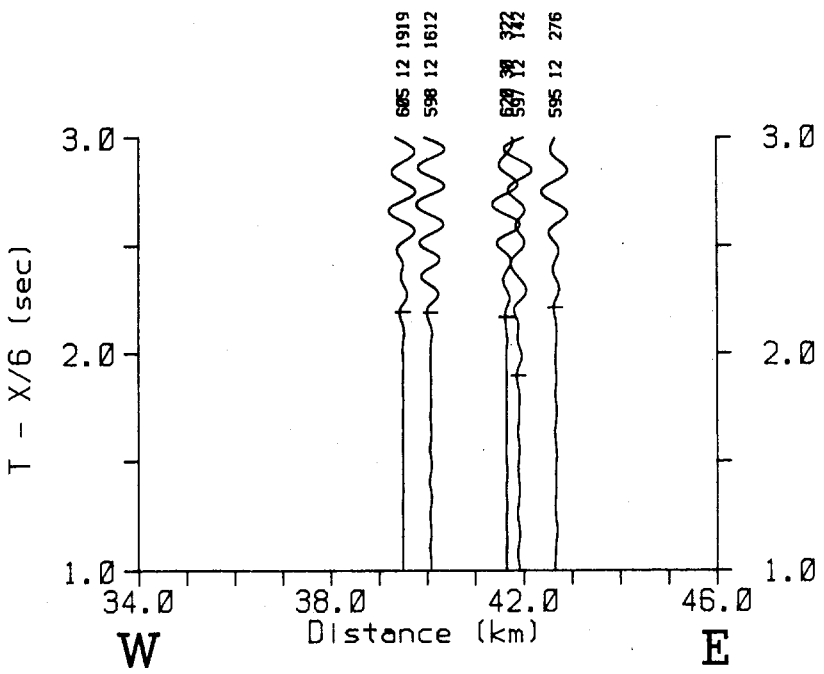


Plate 49. Shot point 19, Shot 22, Sections 7 and 8.

Section 1



Section 2

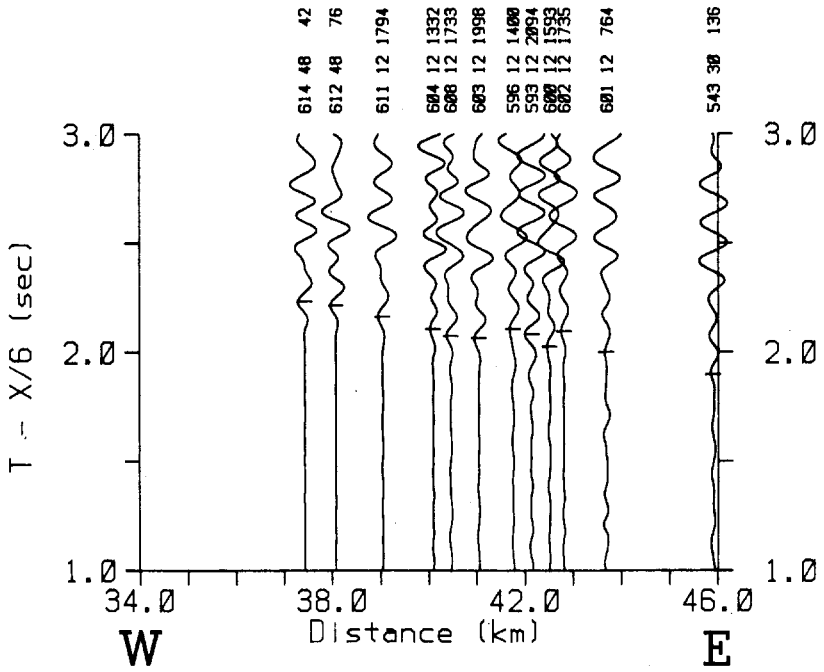
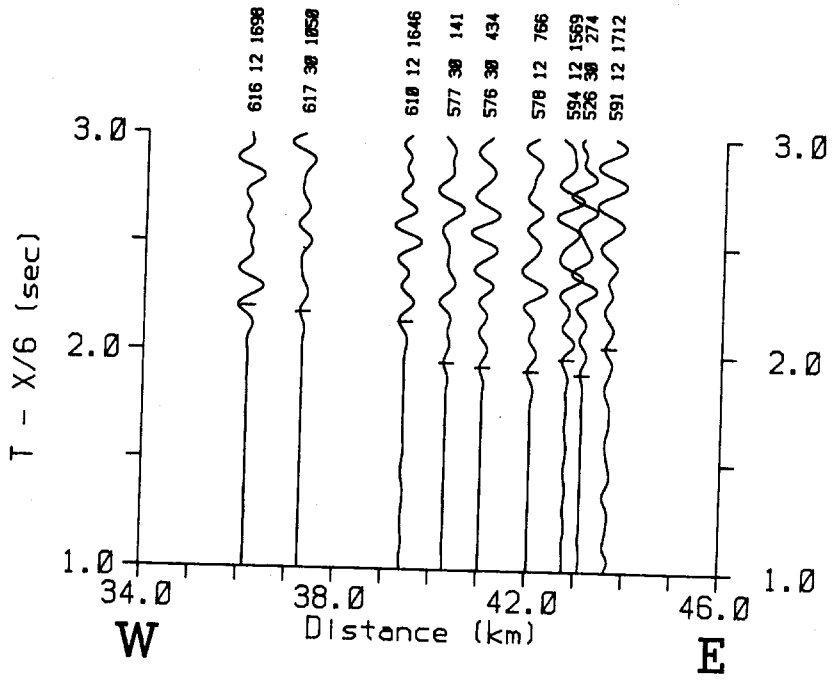


Plate 50. Shot Point 8, Shot 16, Sections 1 and 2. Filtered seismograms with picked arrivals.

Section 3



Section 4

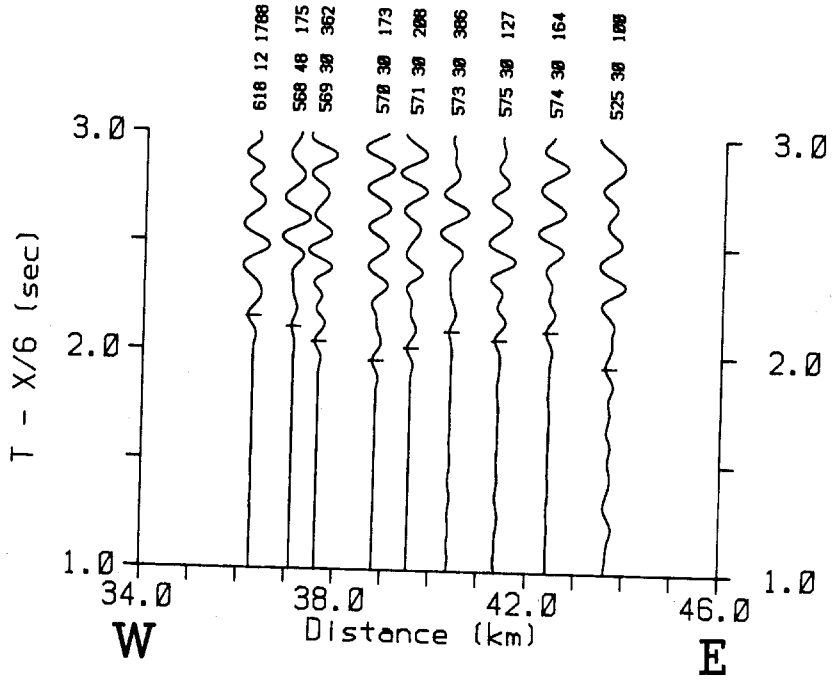
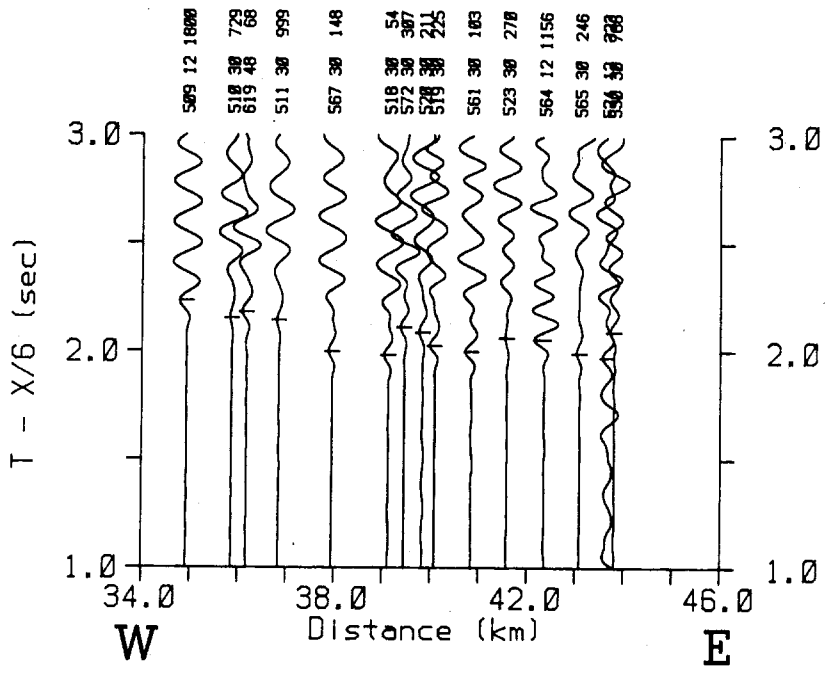


Plate 51. Shot Point 8, Shot 16, Sections 3 and 4. Filtered seismograms with picked arrivals.

Section 5



Section 6

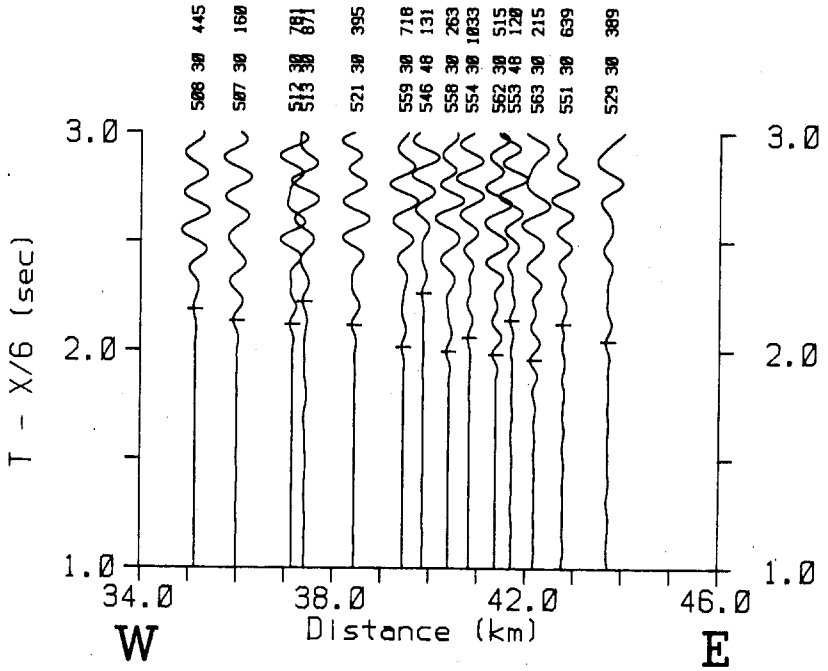
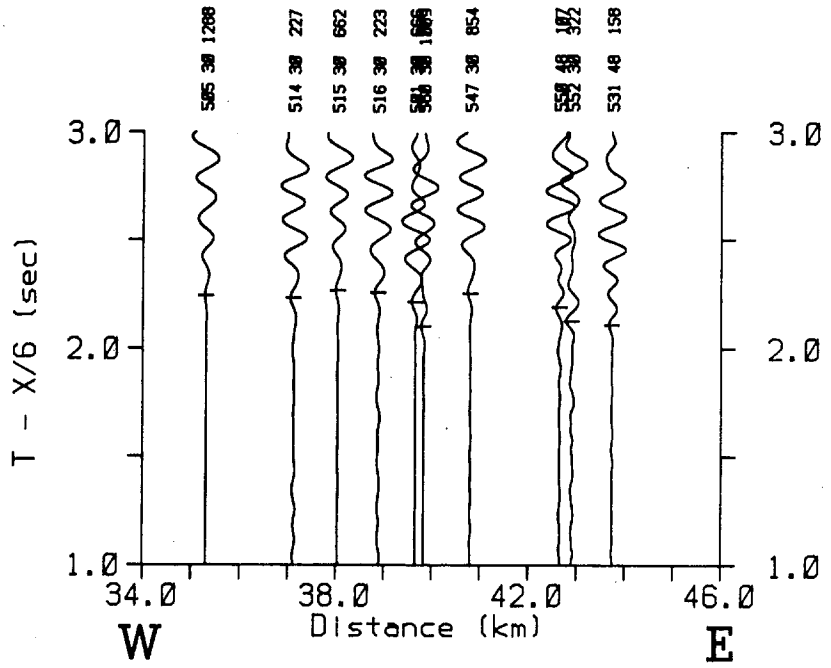


Plate 52. Shot Point 8, Shot 16, Sections 5 and 6. Filtered seismograms with picked arrivals.

Section 7



Section 8

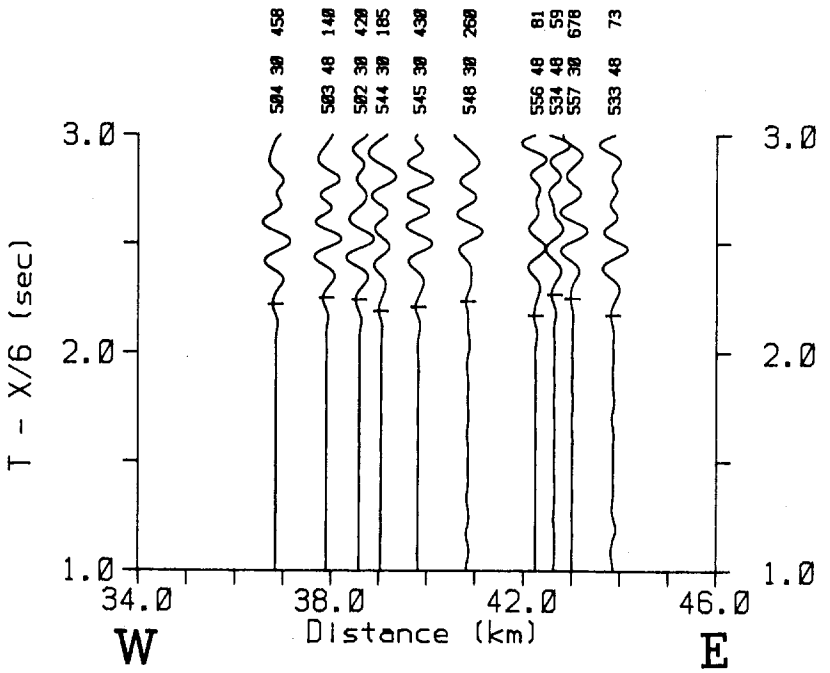


Plate 53. Shot Point 8, Shot 16, Sections 7 and 8. Filtered seismograms with picked arrivals.

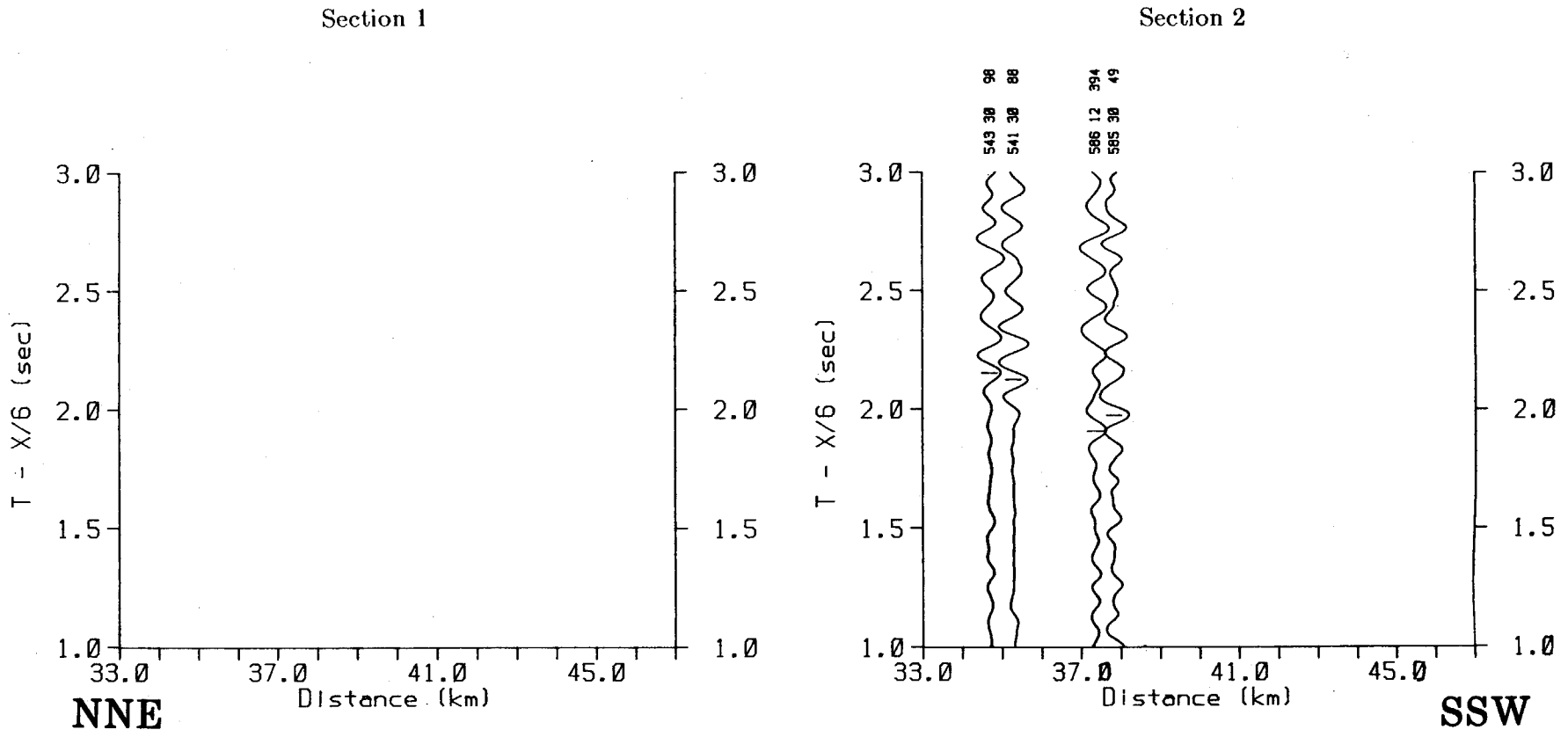


Plate 54. Shot Point 10, Shot 19, Sections 1 and 2.
Filtered seismograms with picked arrivals.

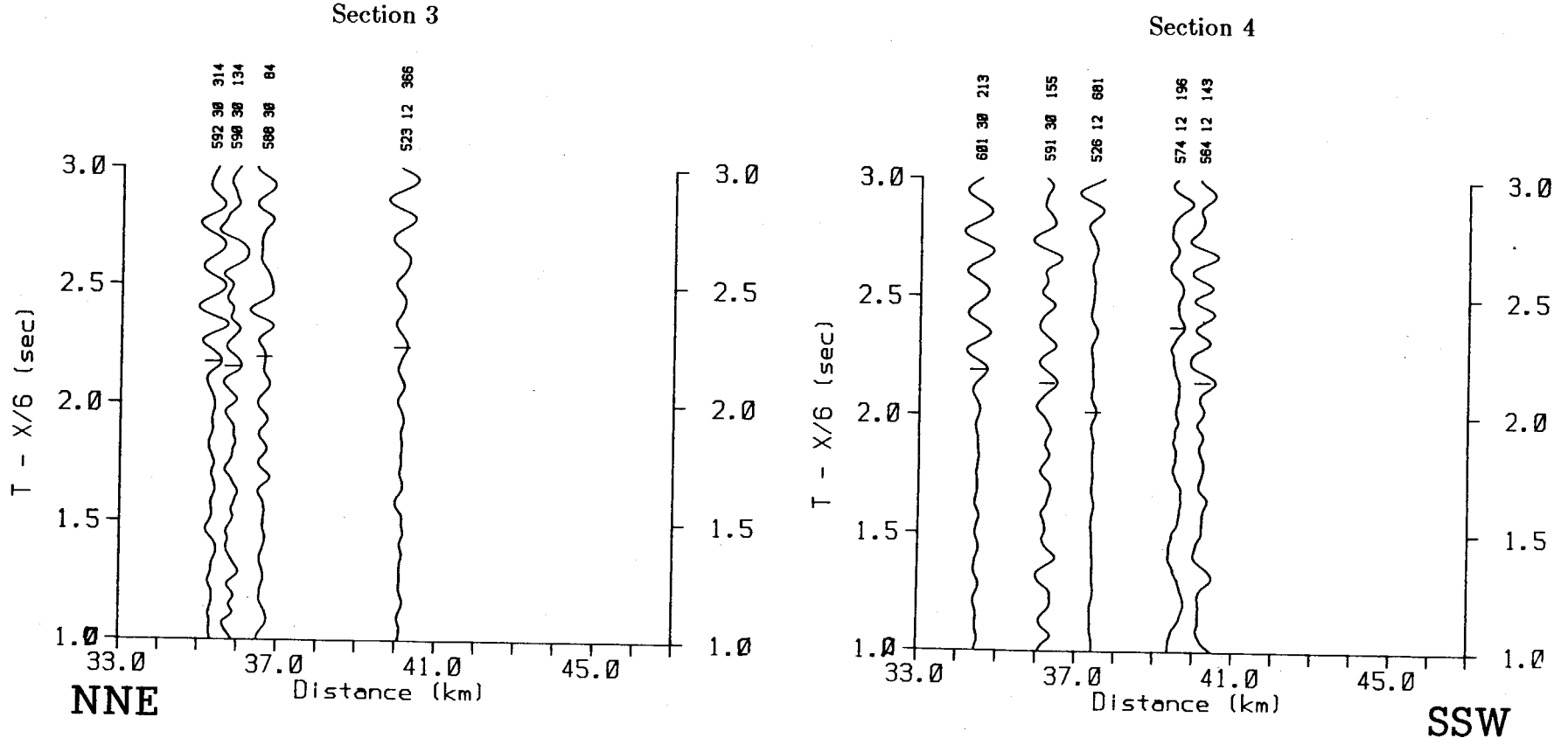


Plate 55. Shot Point 10, Shot 19, Sections 3 and 4.
Filtered seismograms with picked arrivals.

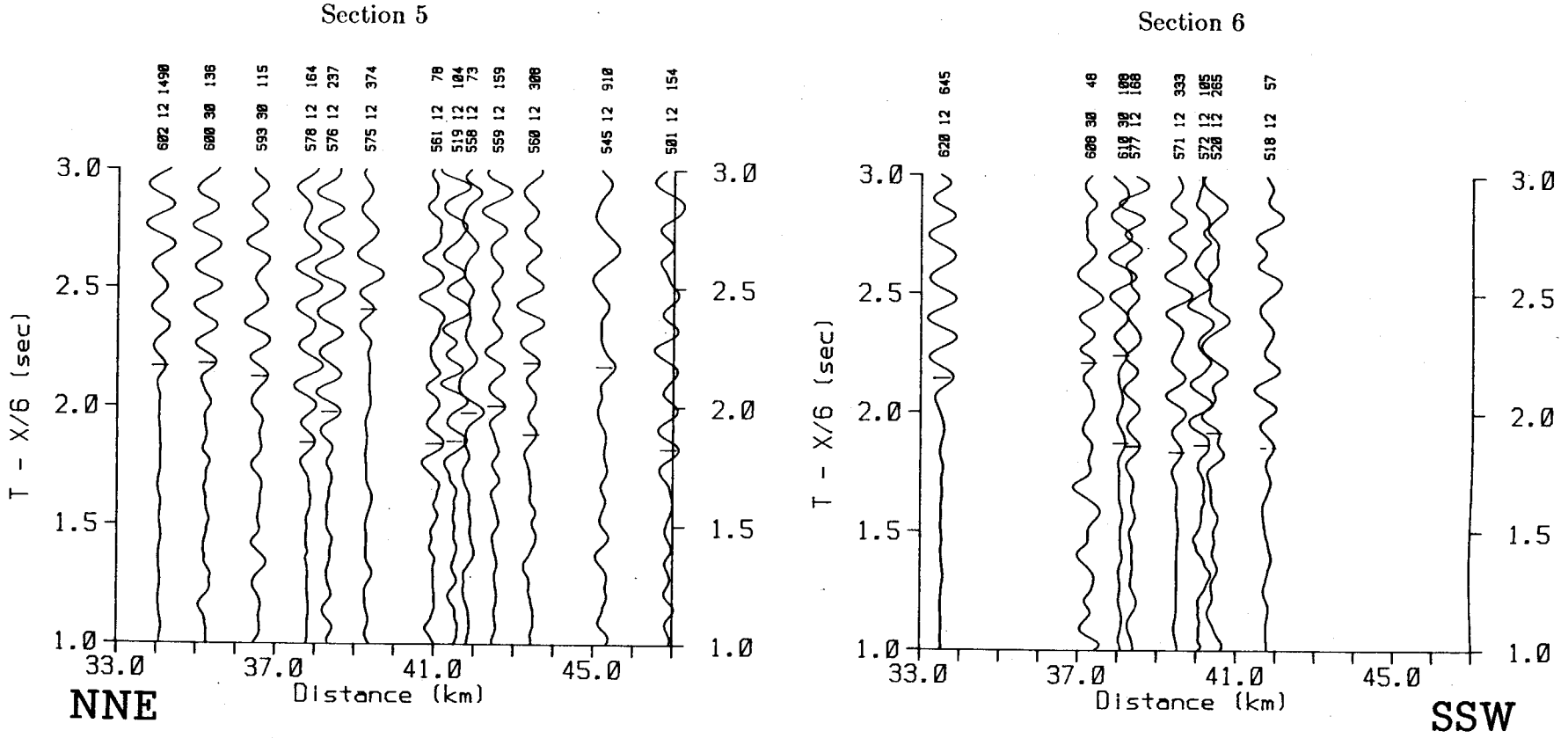


Plate 56. Shot Point 10, Shot 19, Sections 5 and 6.
Filtered seismograms with picked arrivals.

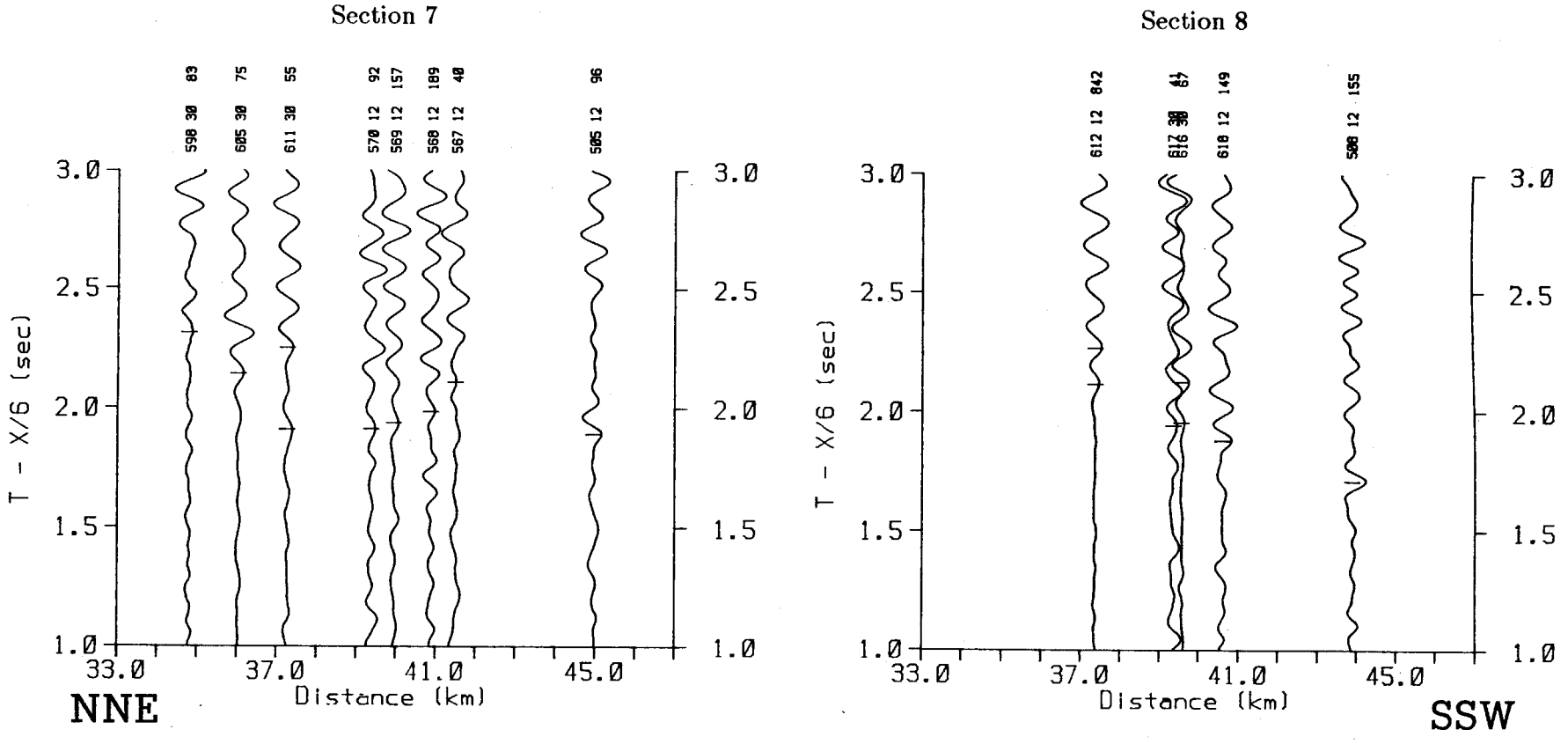


Plate 57. Shot Point 10, Shot 19, Sections 7 and 8.
Filtered seismograms with picked arrivals.

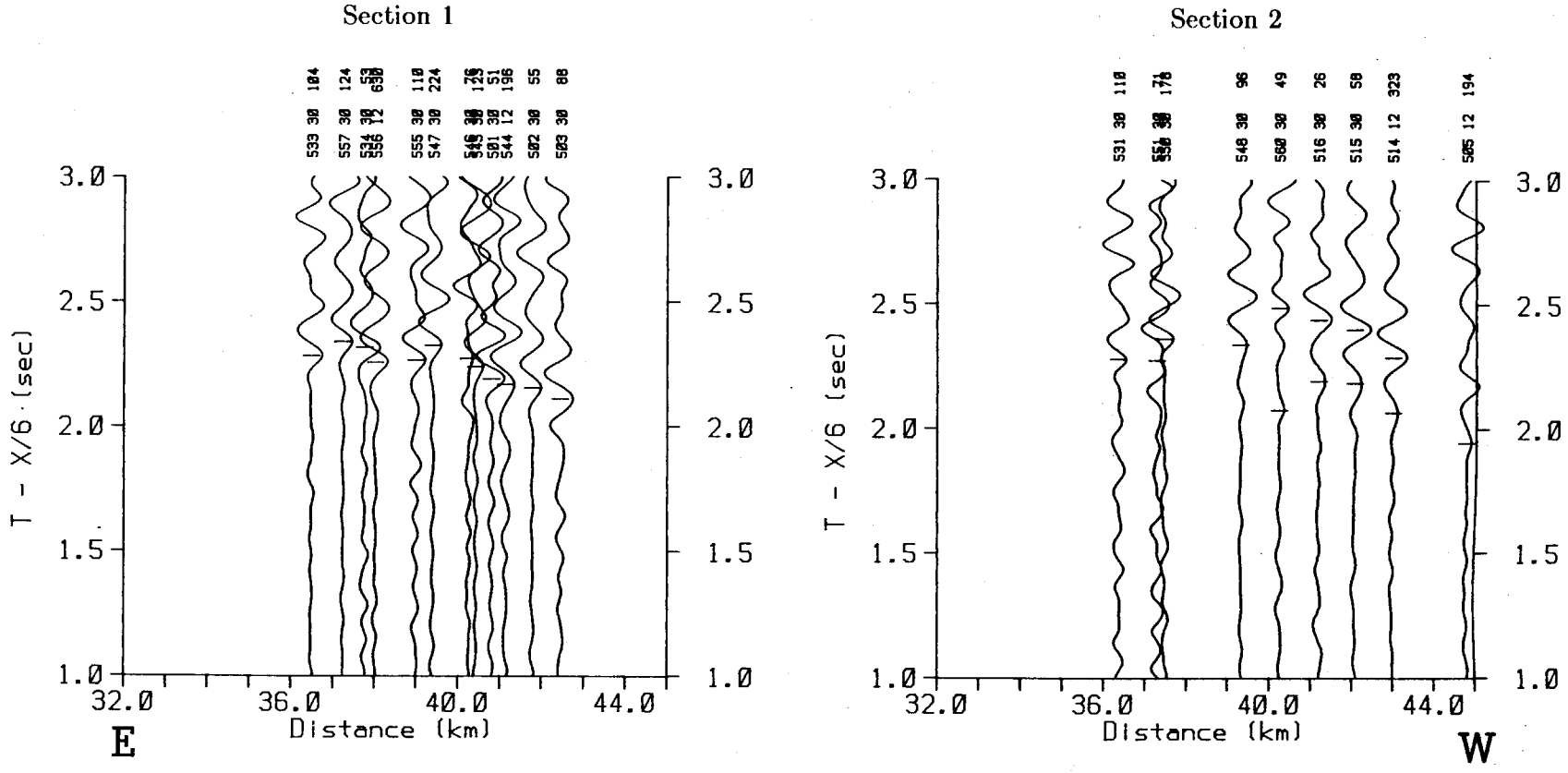


Plate 58. Shot Point 11, Shot 13, Sections 1 and 2.
Filtered seismograms with picked arrivals.

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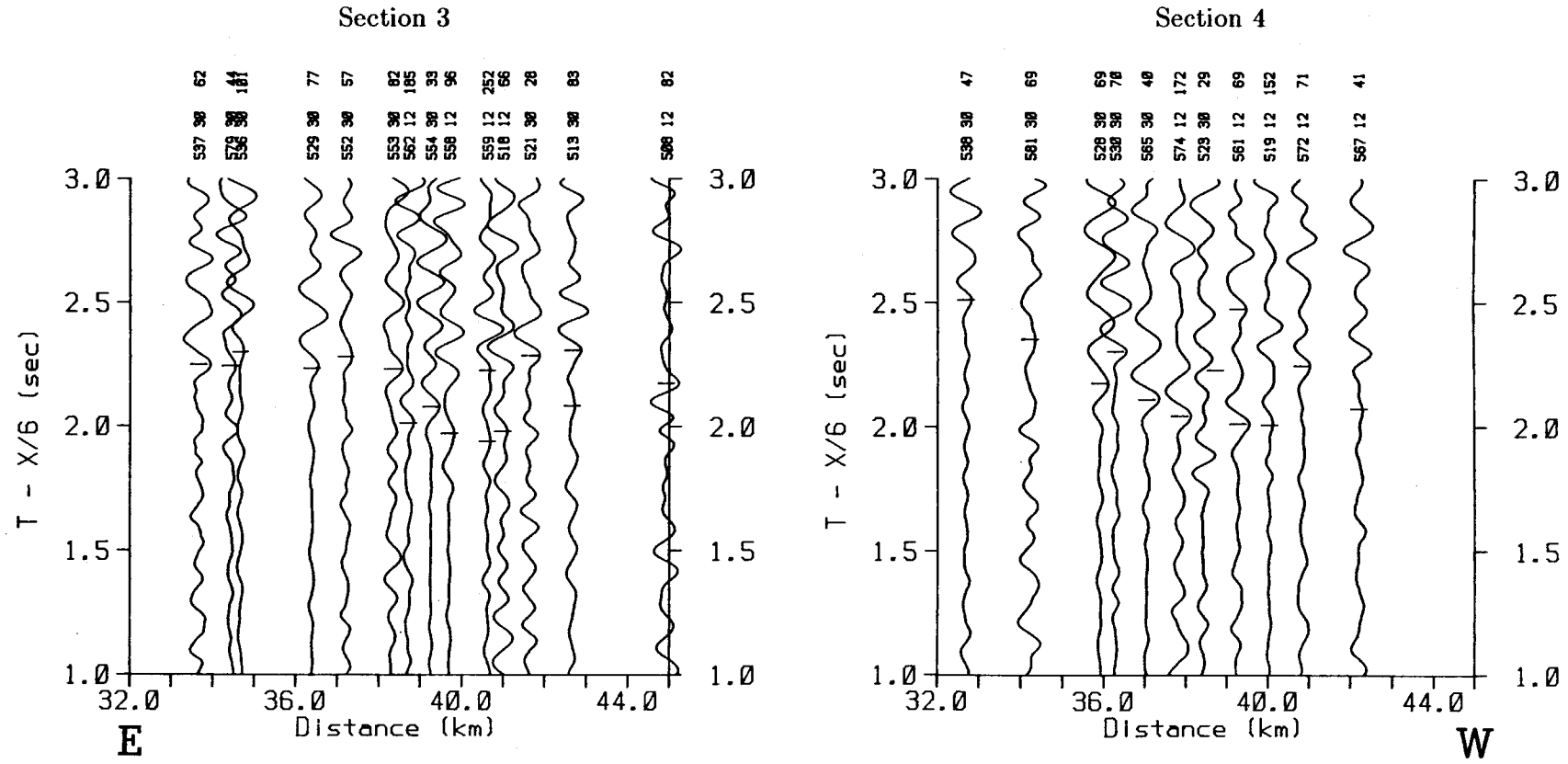

Plate 59. Shot Point 11, Shot 13, Sections 3 and 4.
Filtered seismograms with picked arrivals.

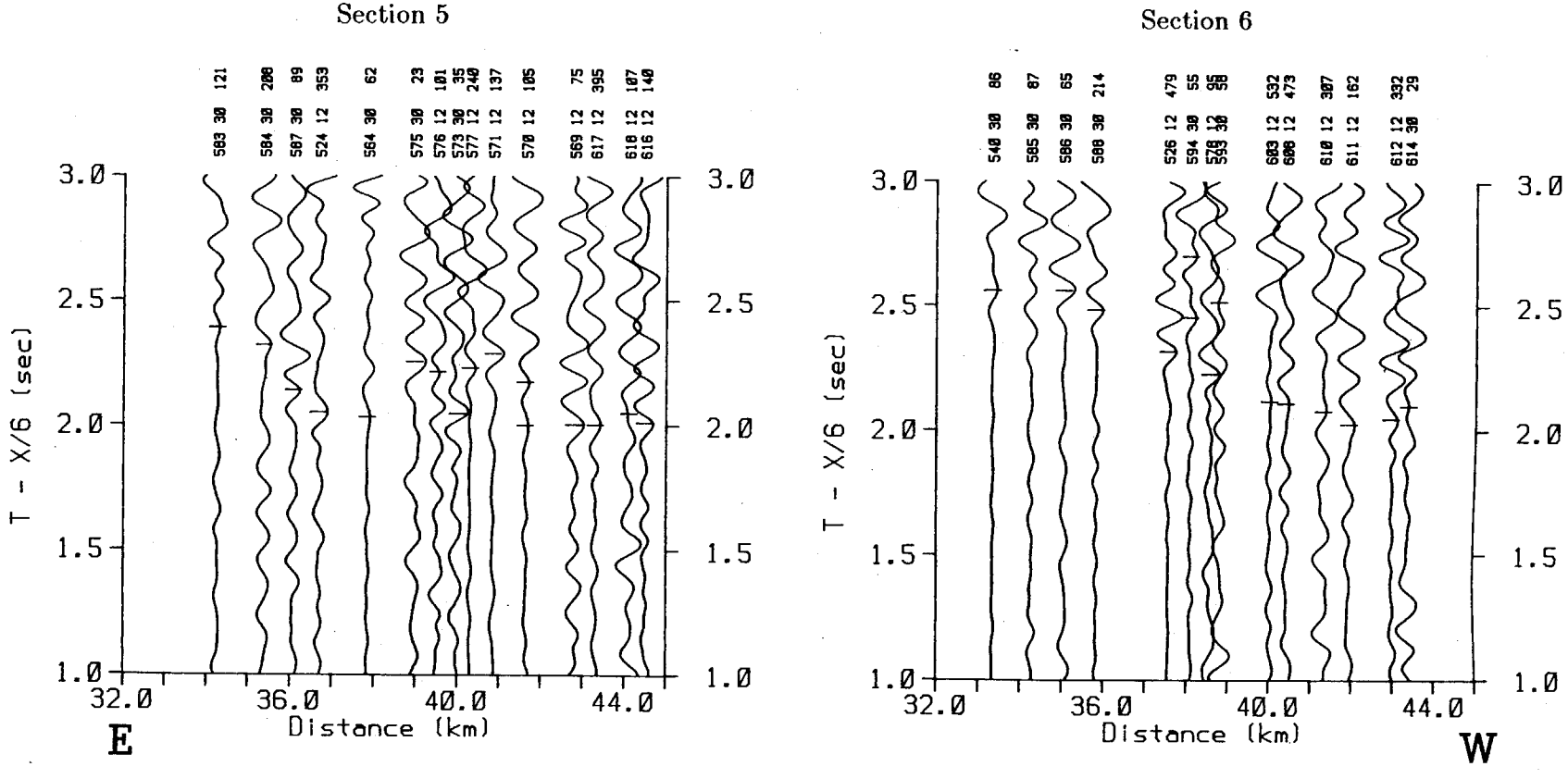

Plate 60. Shot Point 11, Shot 13, Sections 5 and 6.
Filtered seismograms with picked arrivals.

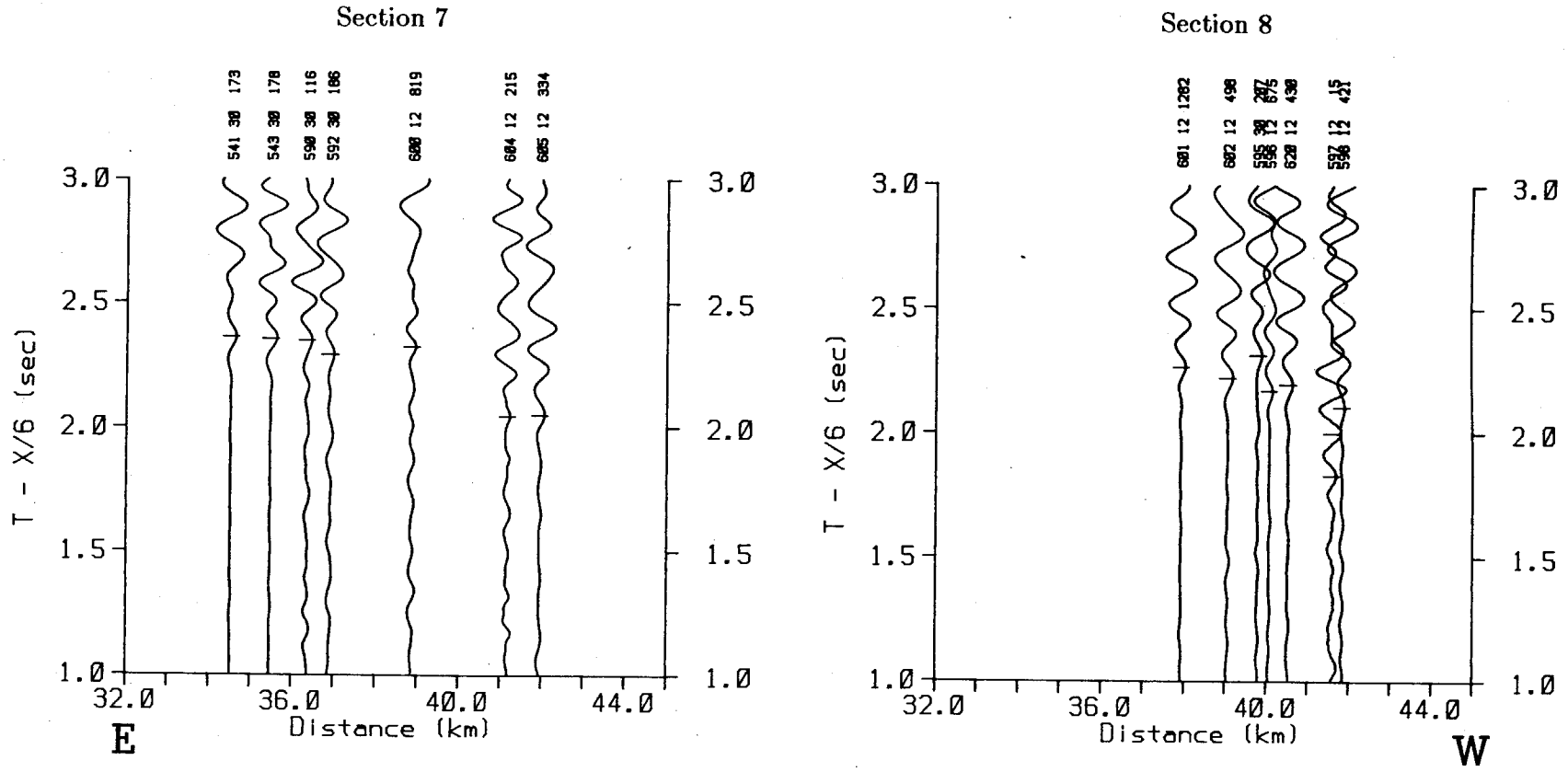

Plate 61. Shot Point 11, Shot 13, Sections 7 and 8.
Filtered seismograms with picked arrivals.

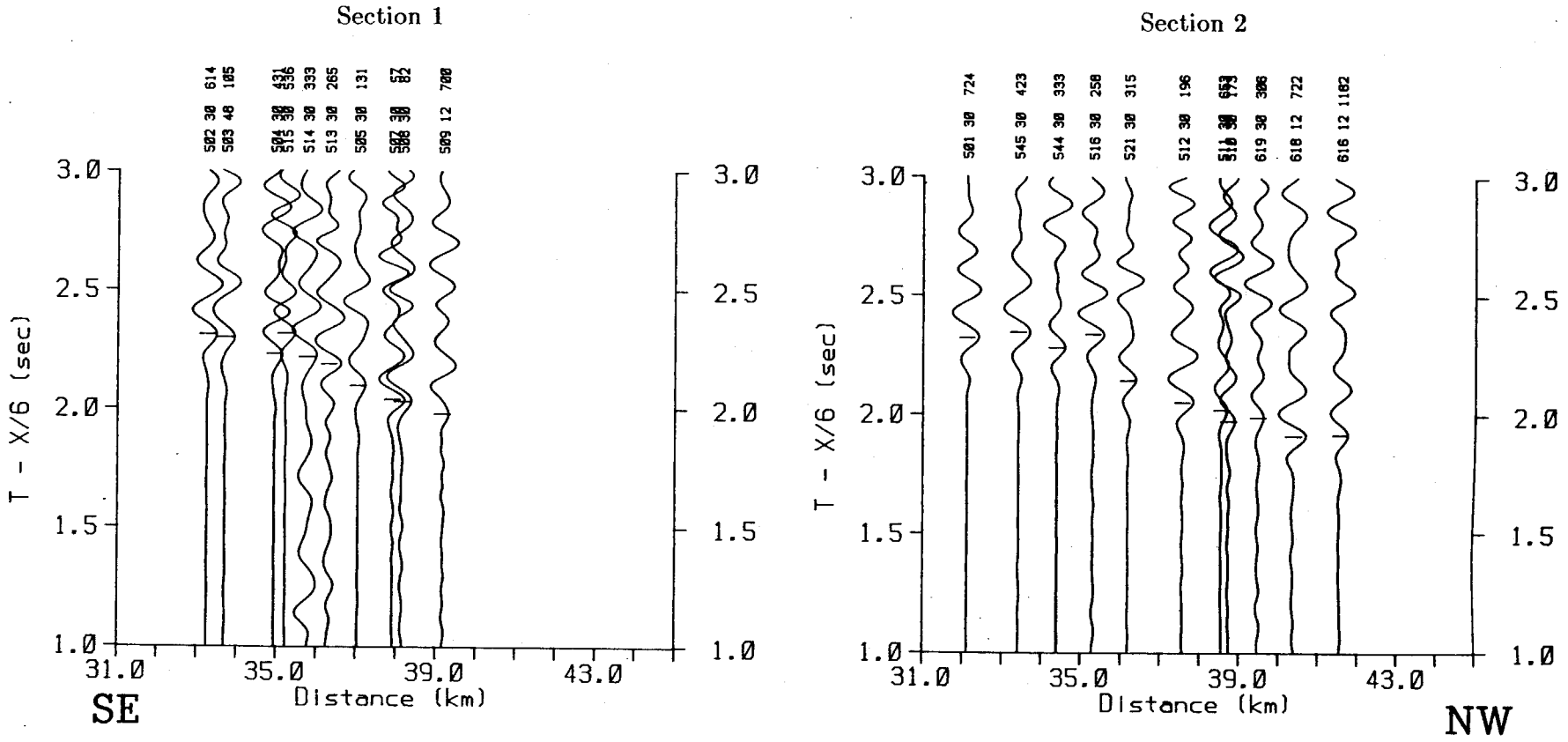

Plate 62. Shot Point 12, Shot 17, Sections 1 and 2.
Filtered seismograms with picked arrivals.

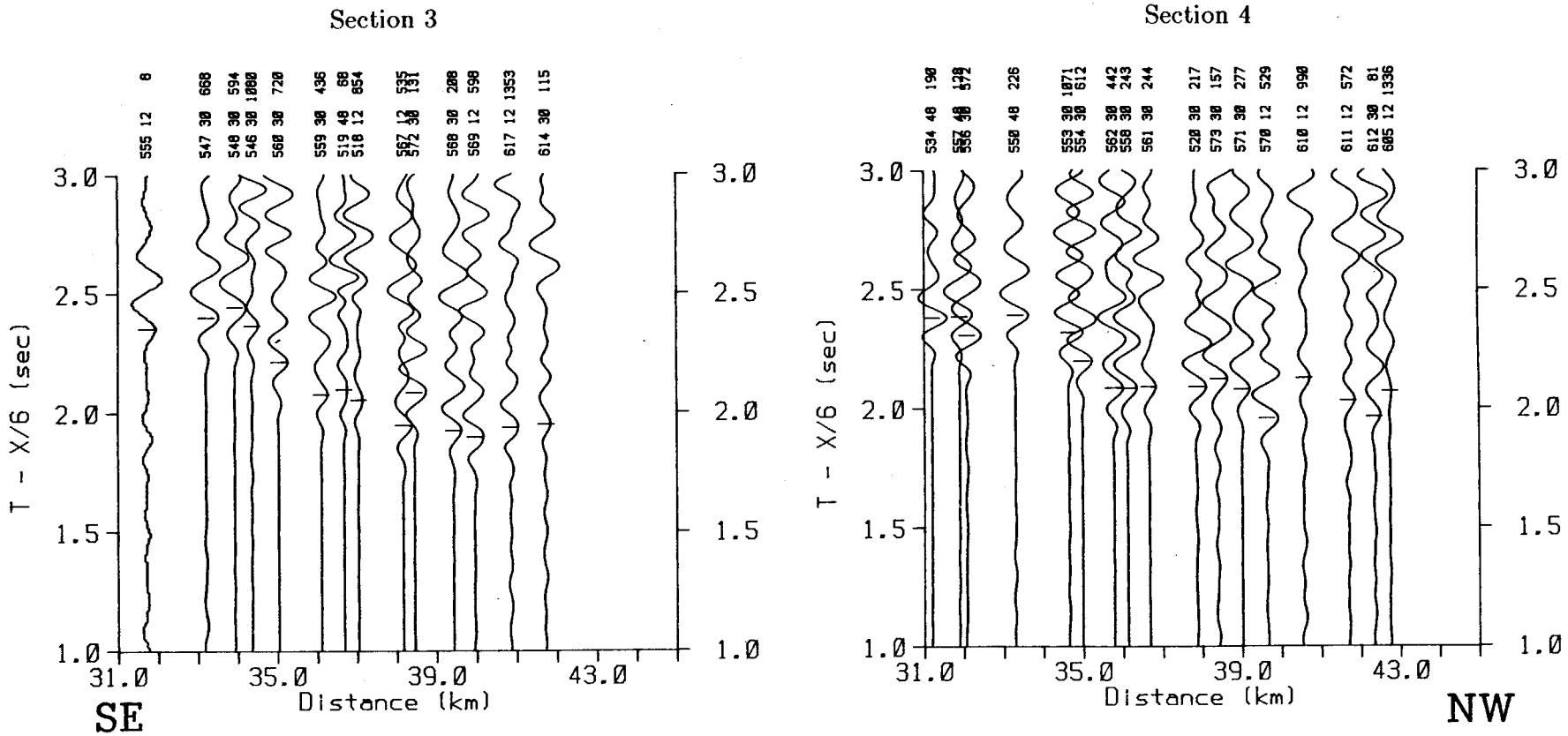

Plate 63. Shot Point 12, Shot 17, Sections 3 and 4.
Filtered seismograms with picked arrivals.

Made from best available copy

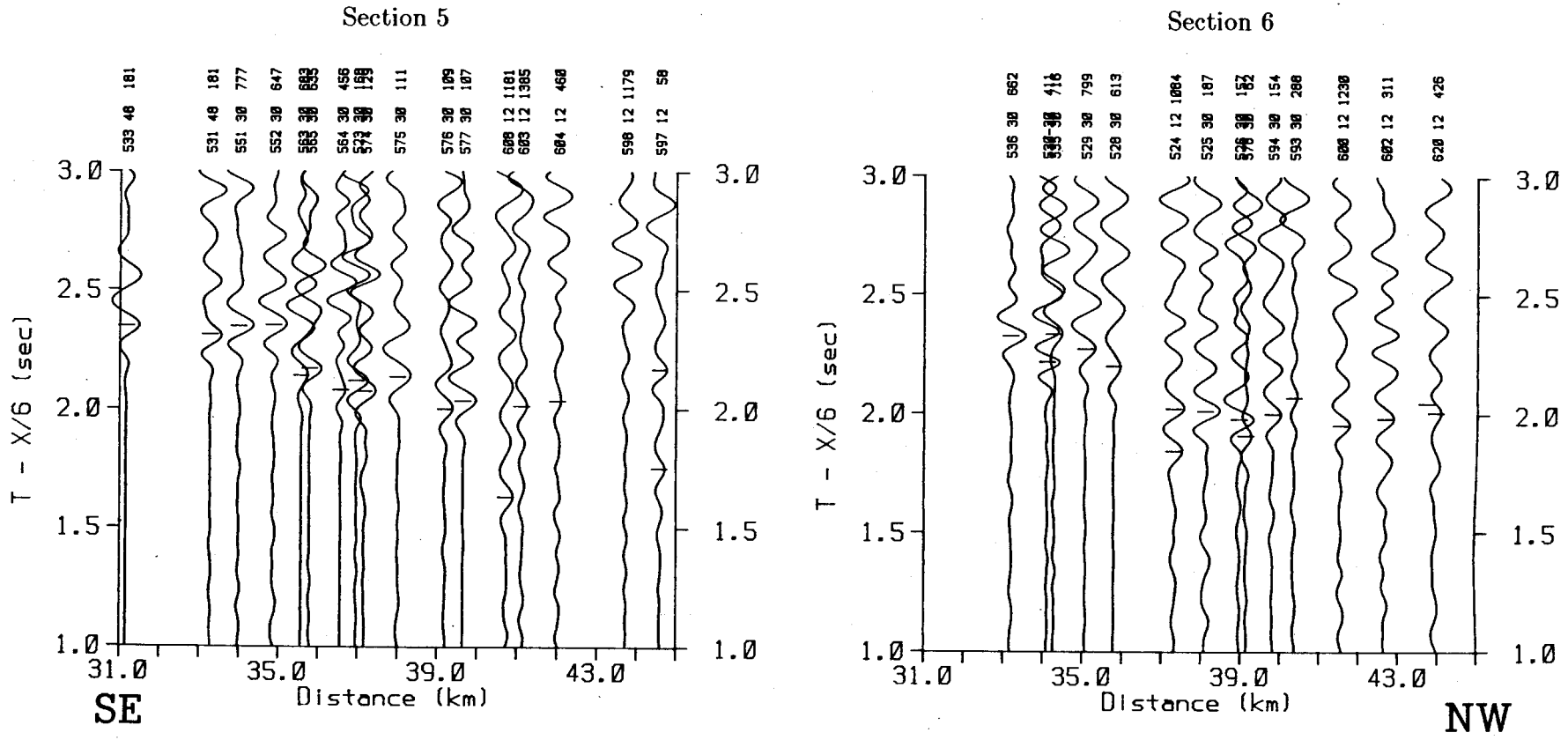

Plate 64. Shot Point 12, Shot 17, Sections 5 and 6.
Filtered seismograms with picked arrivals.

Made from best available copy

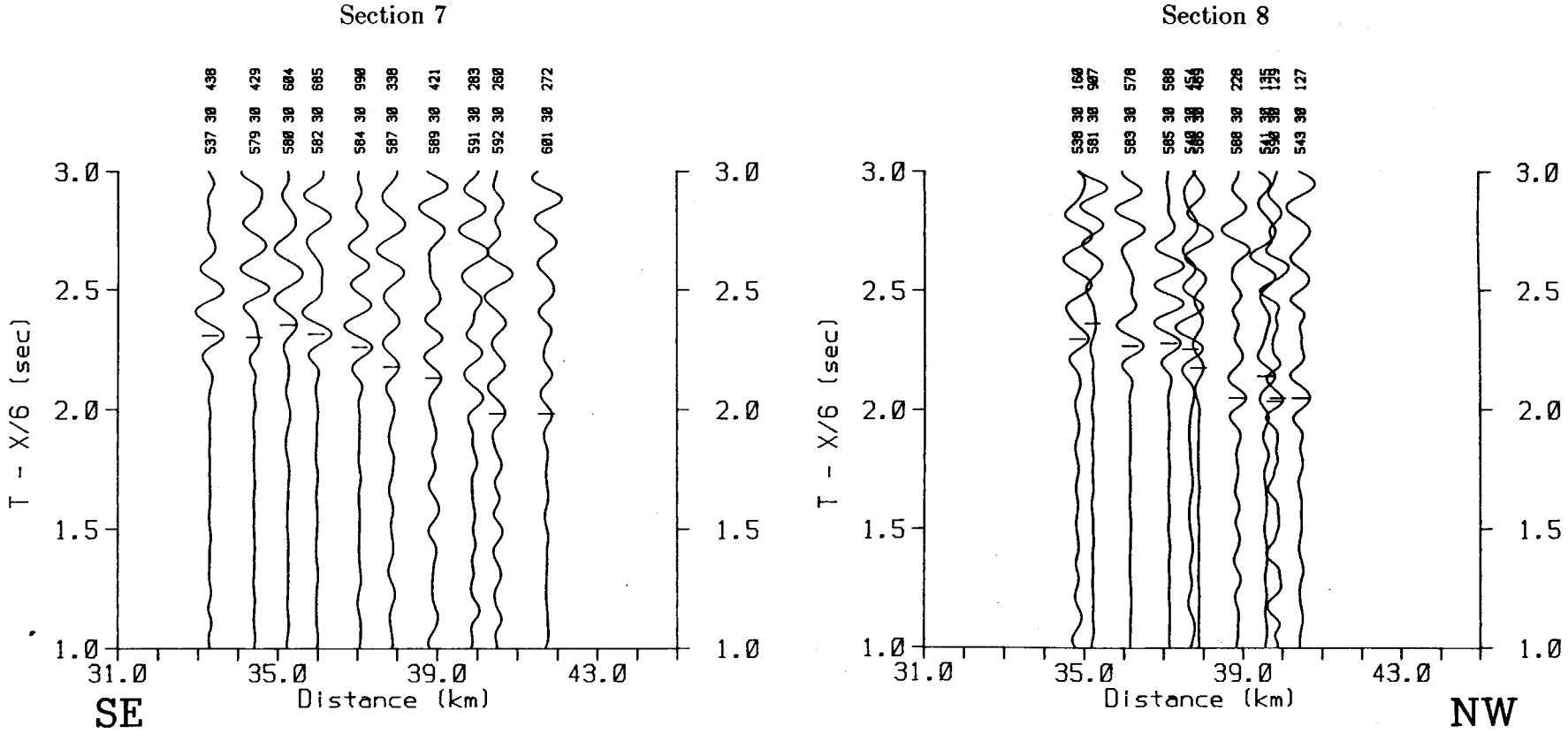

Plate 65. Shot Point 12, Shot 17, Sections 7 and 8.
Filtered seismograms with picked arrivals.

Made from best available copy

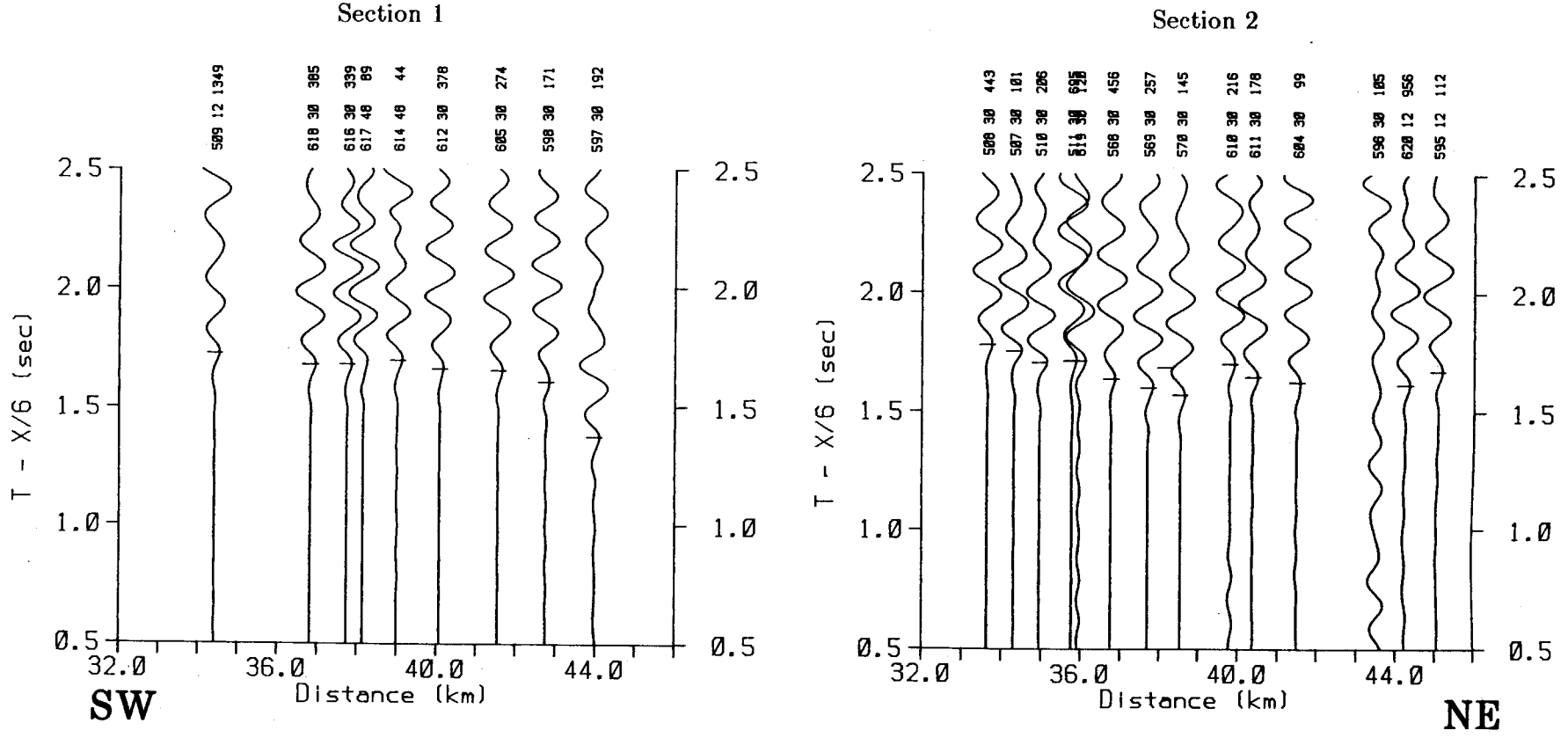

Plate 66. Shot Point 13, Shot 21, Sections 1 and 2.
Filtered seismograms with picked arrivals.

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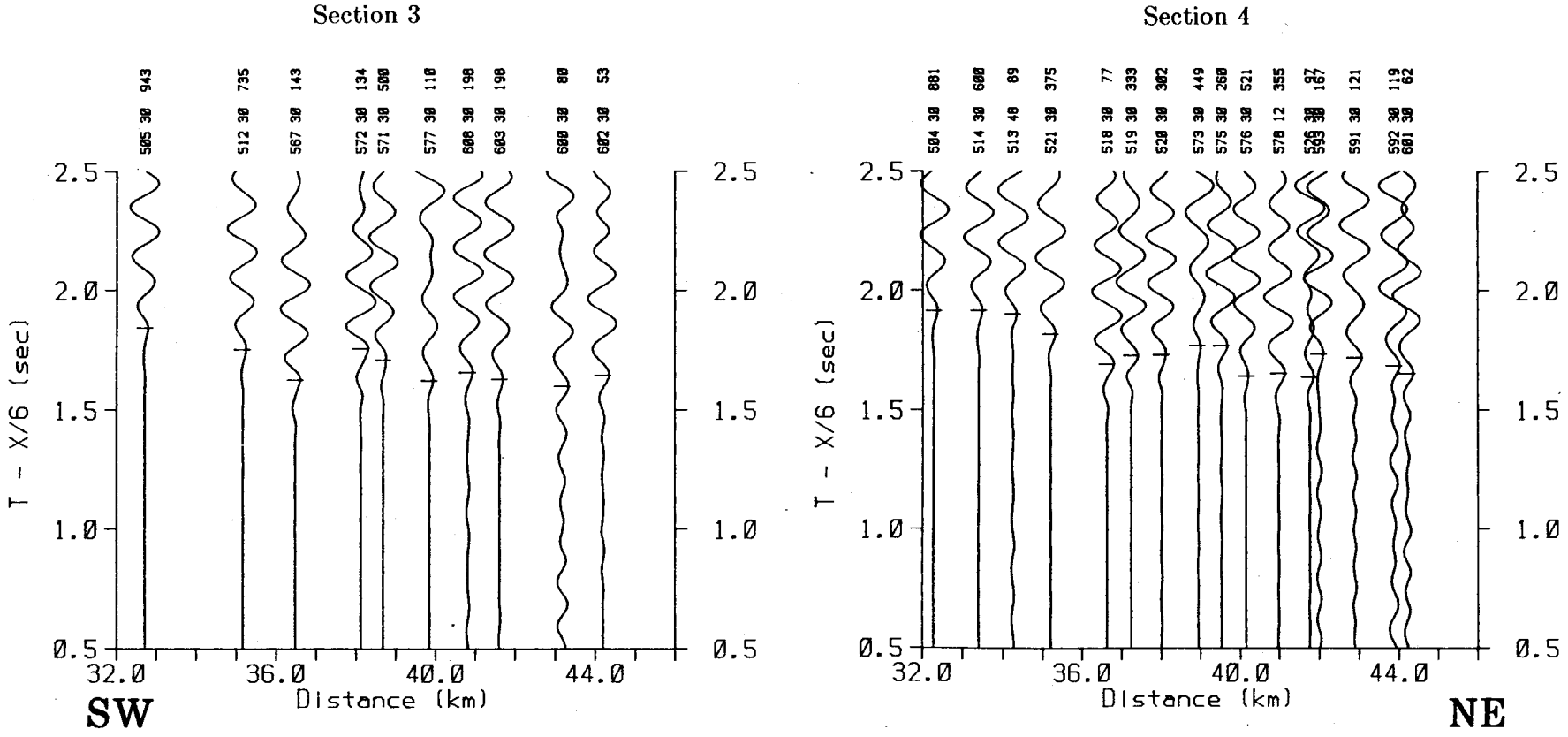

Plate 67. Shot Point 13, Shot 21, Sections 3 and 4.
Filtered seismograms with picked arrivals.

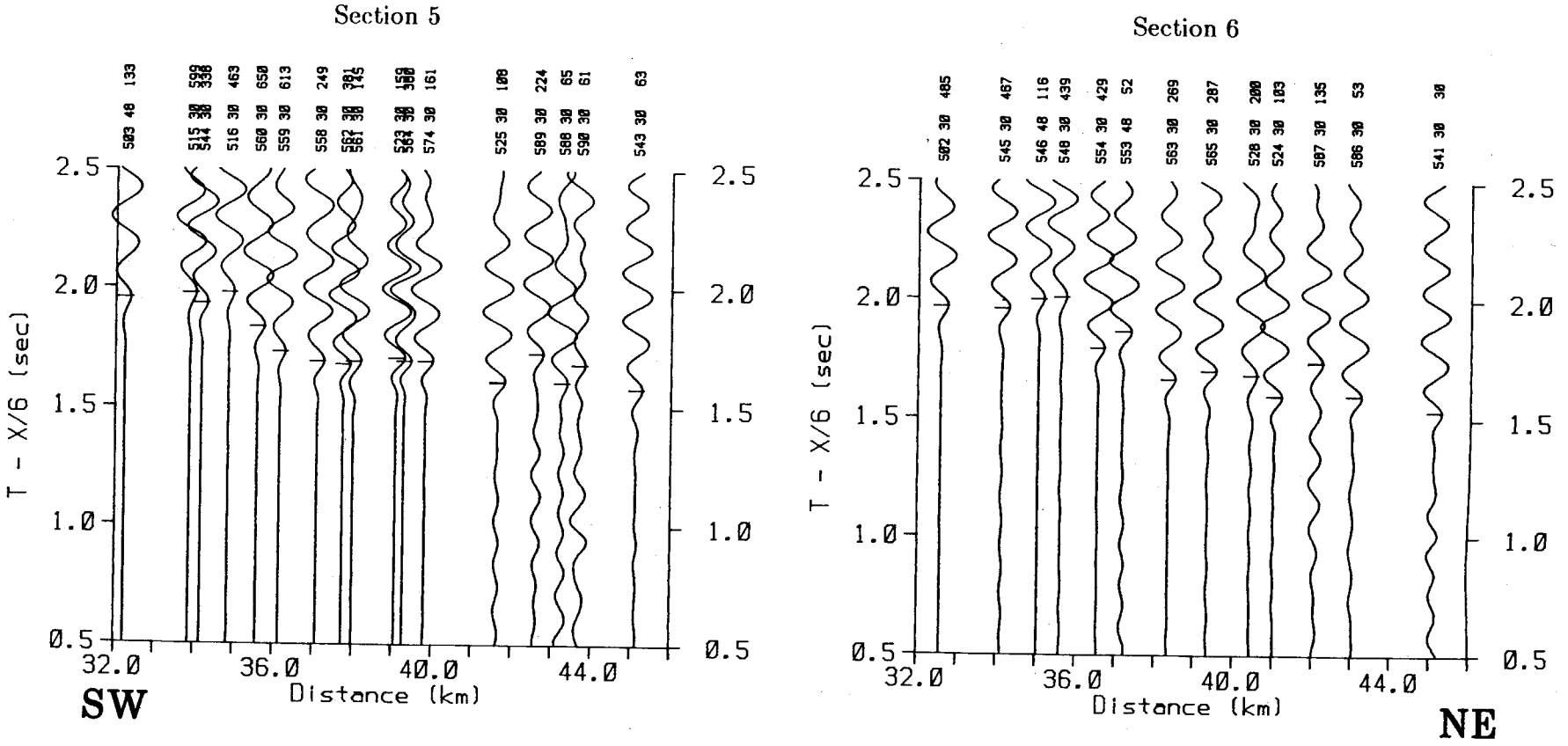

Plate 68. Shot Point 13, Shot 21, Sections 5 and 6.
Filtered seismograms with picked arrivals.

Made from best available copy

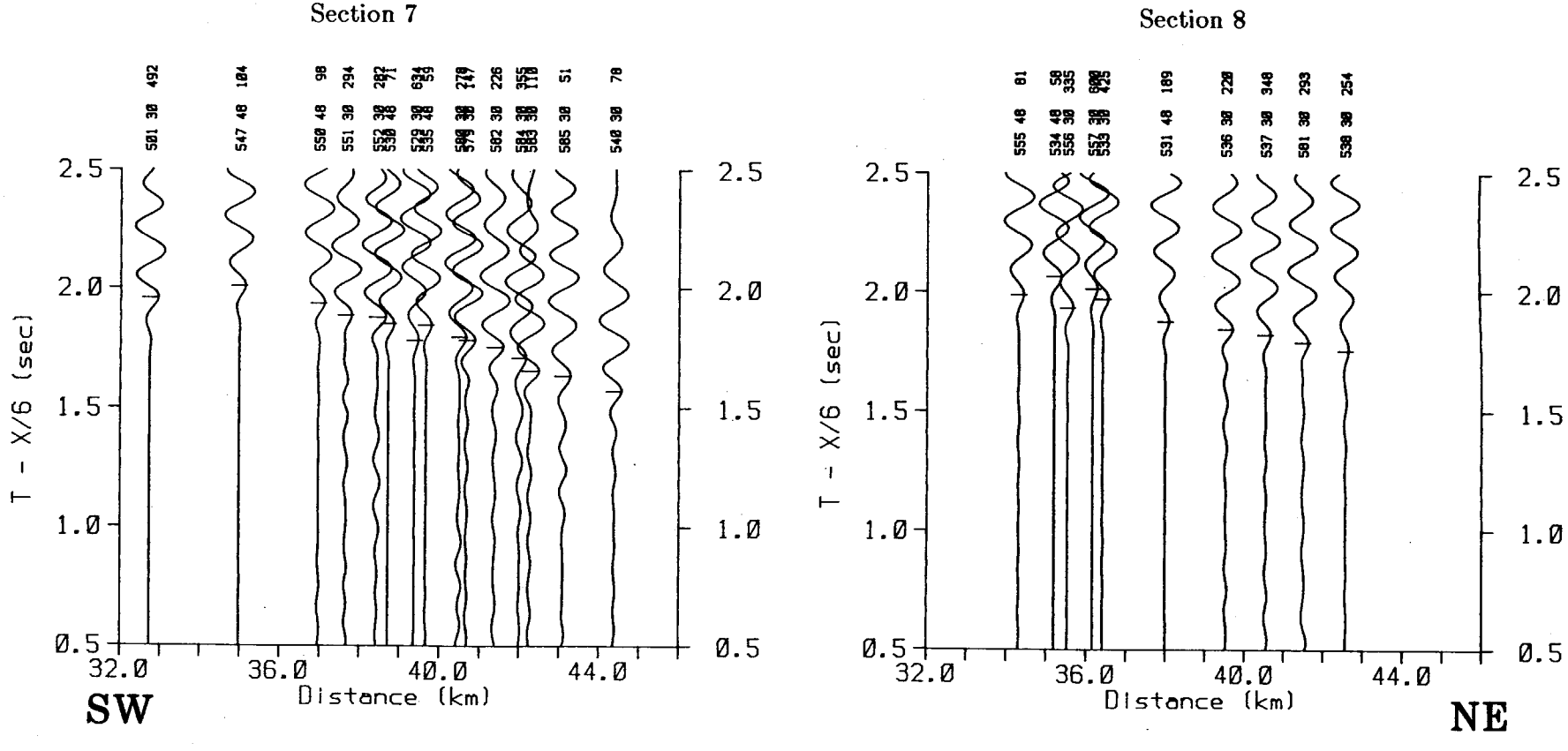

Plate 69. Shot Point 13, Shot 21, Sections 7 and 8.
Filtered seismograms with picked arrivals.

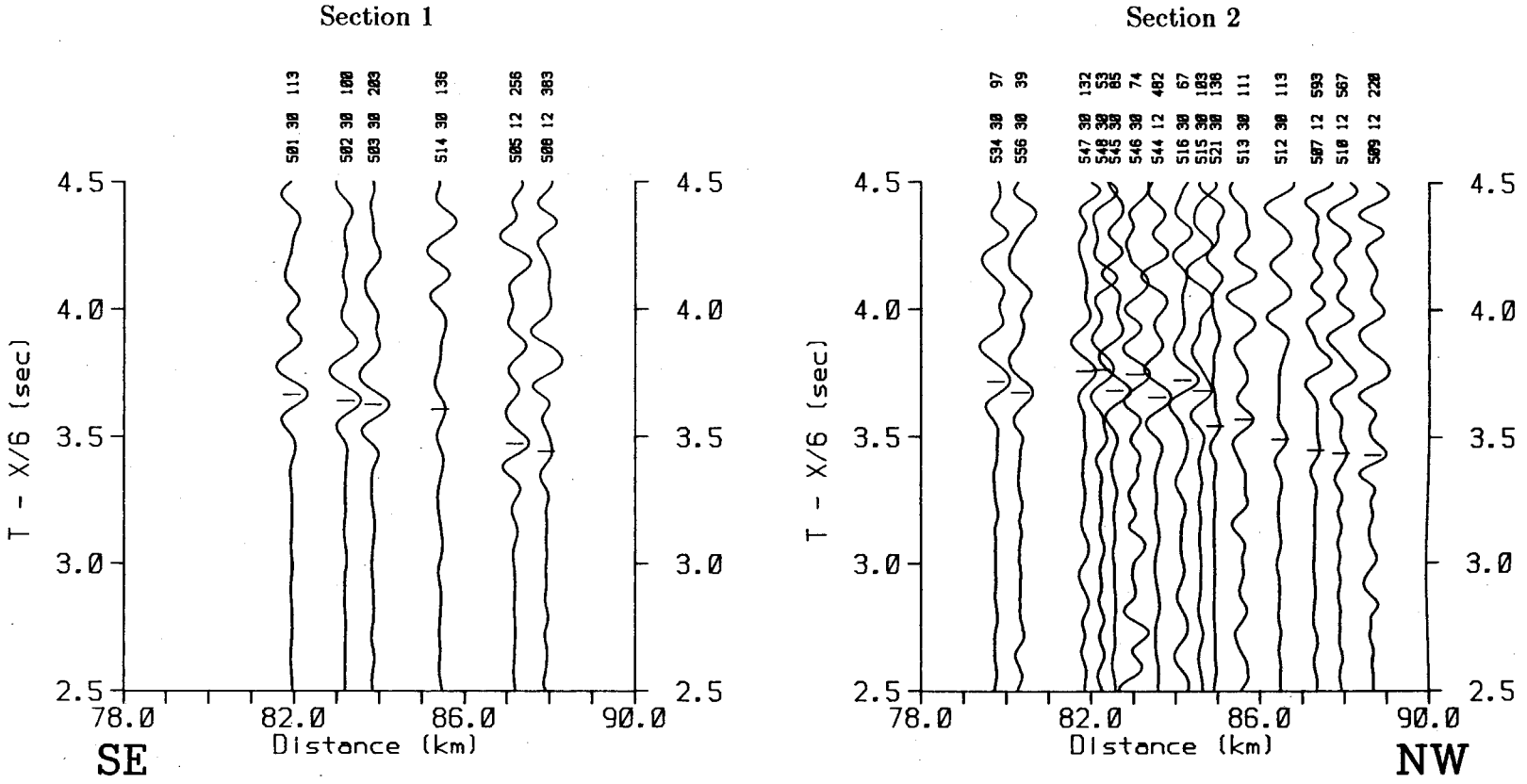

Plate 70. Shot Point 15, Shot 18, Sections 1 and 2.
Filtered seismograms with picked arrivals.

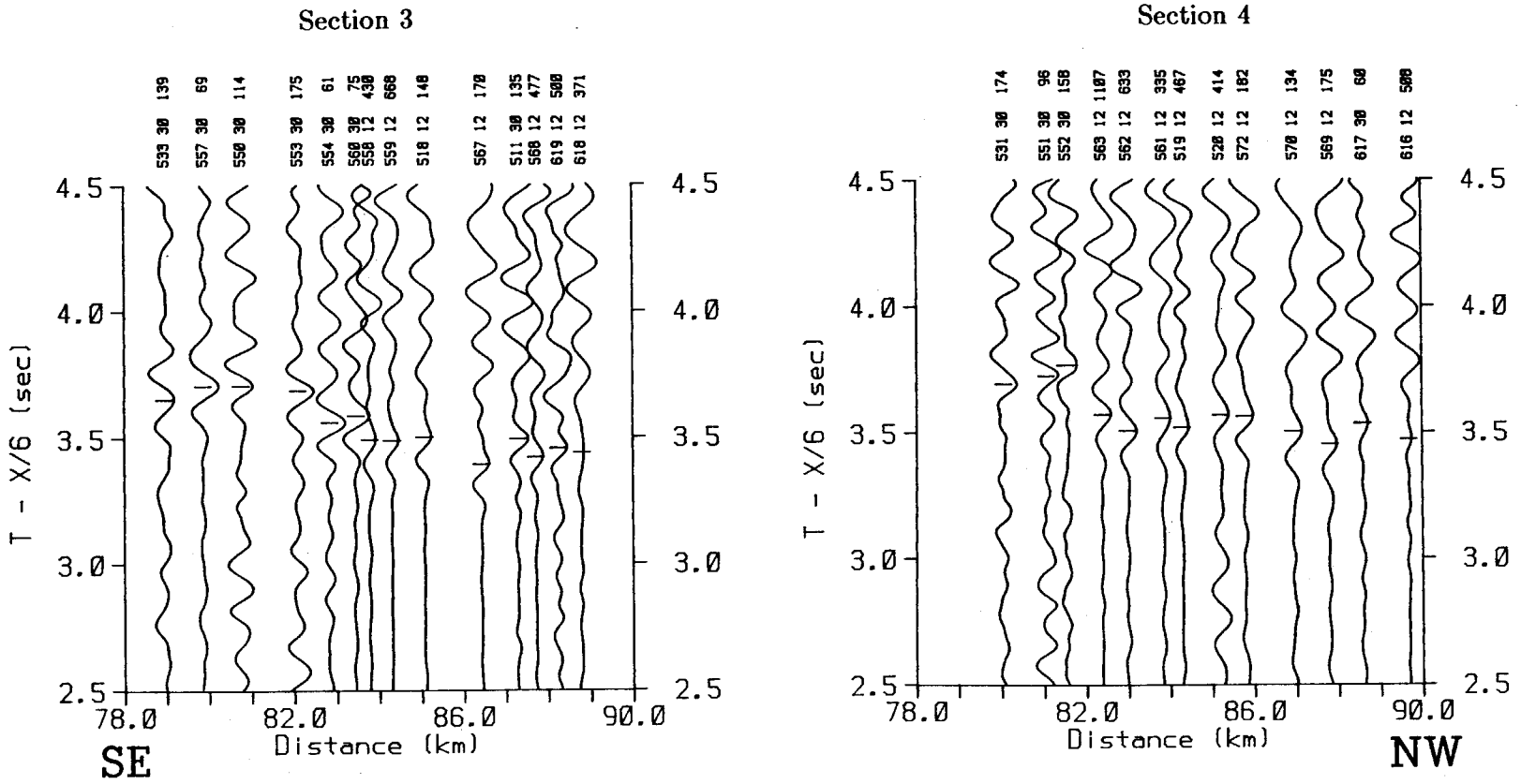

Plate 71. Shot Point 15, Shot 18, Sections 3 and 4.
Filtered seismograms with picked arrivals.

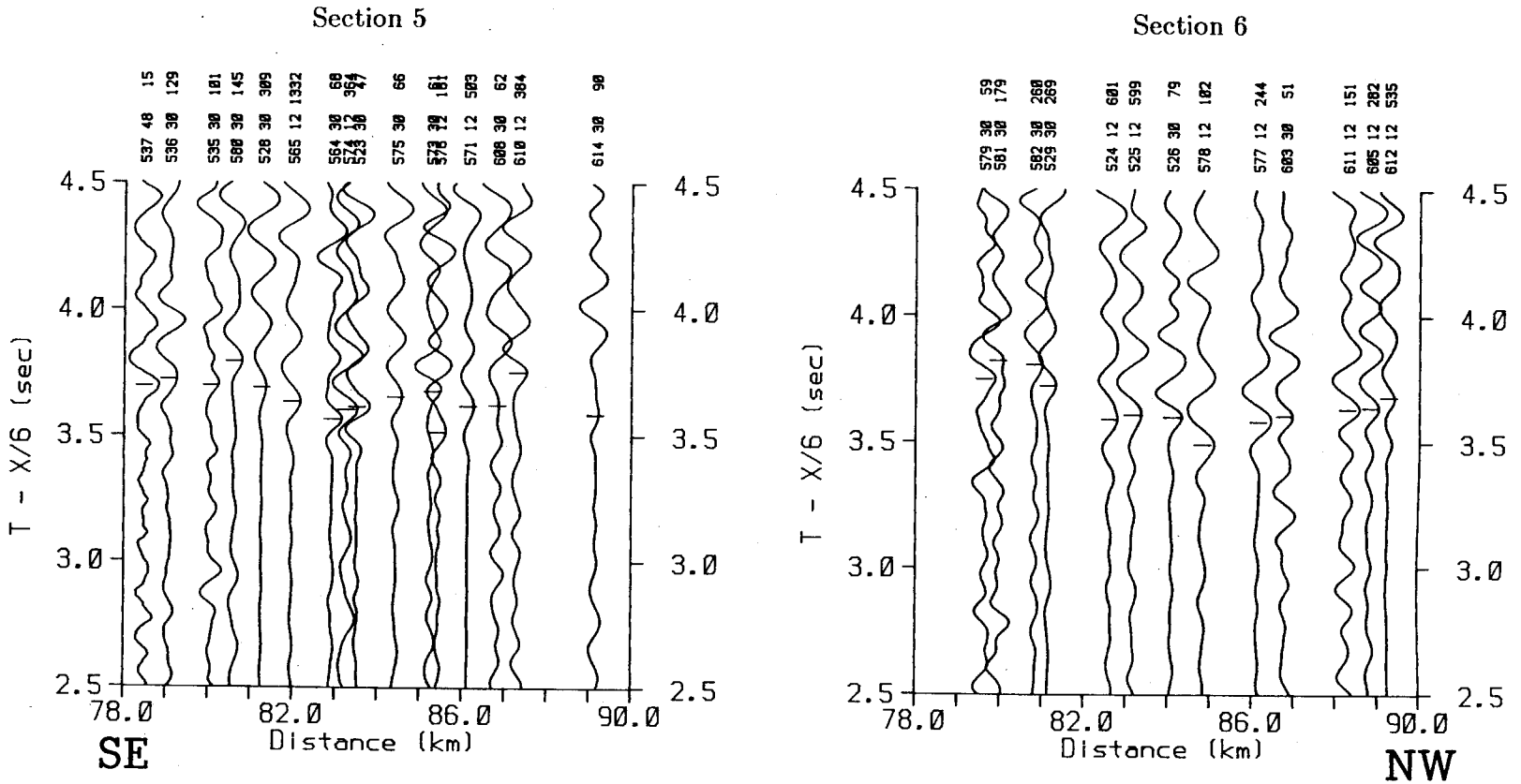

Plate 72. Shot Point 15, Shot 18, Sections 5 and 6.
Filtered seismograms with picked arrivals.

Made from best available copy

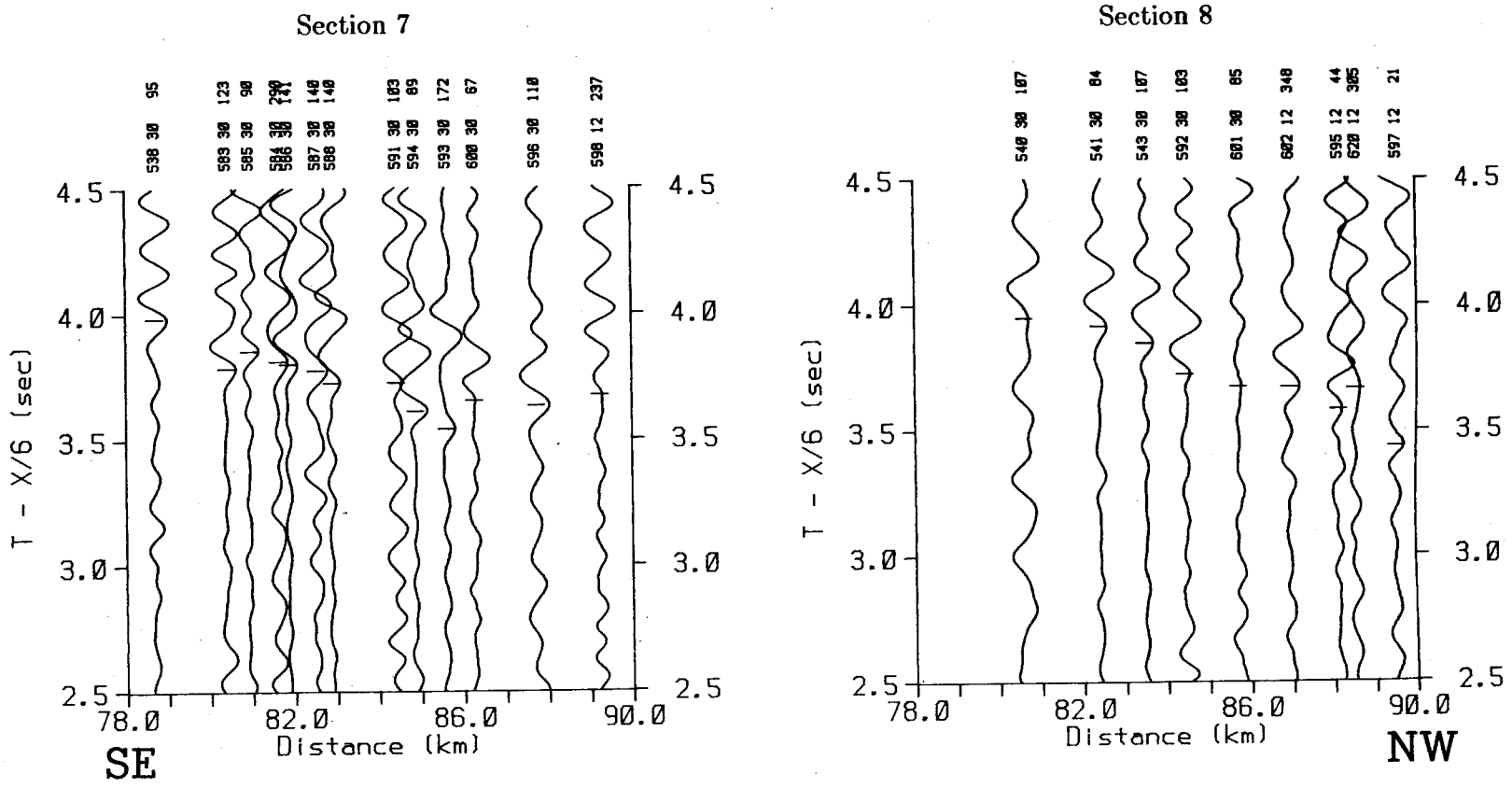

Plate 73. Shot Point 15, Shot 18, Sections 7 and 8.
Filtered seismograms with picked arrivals.

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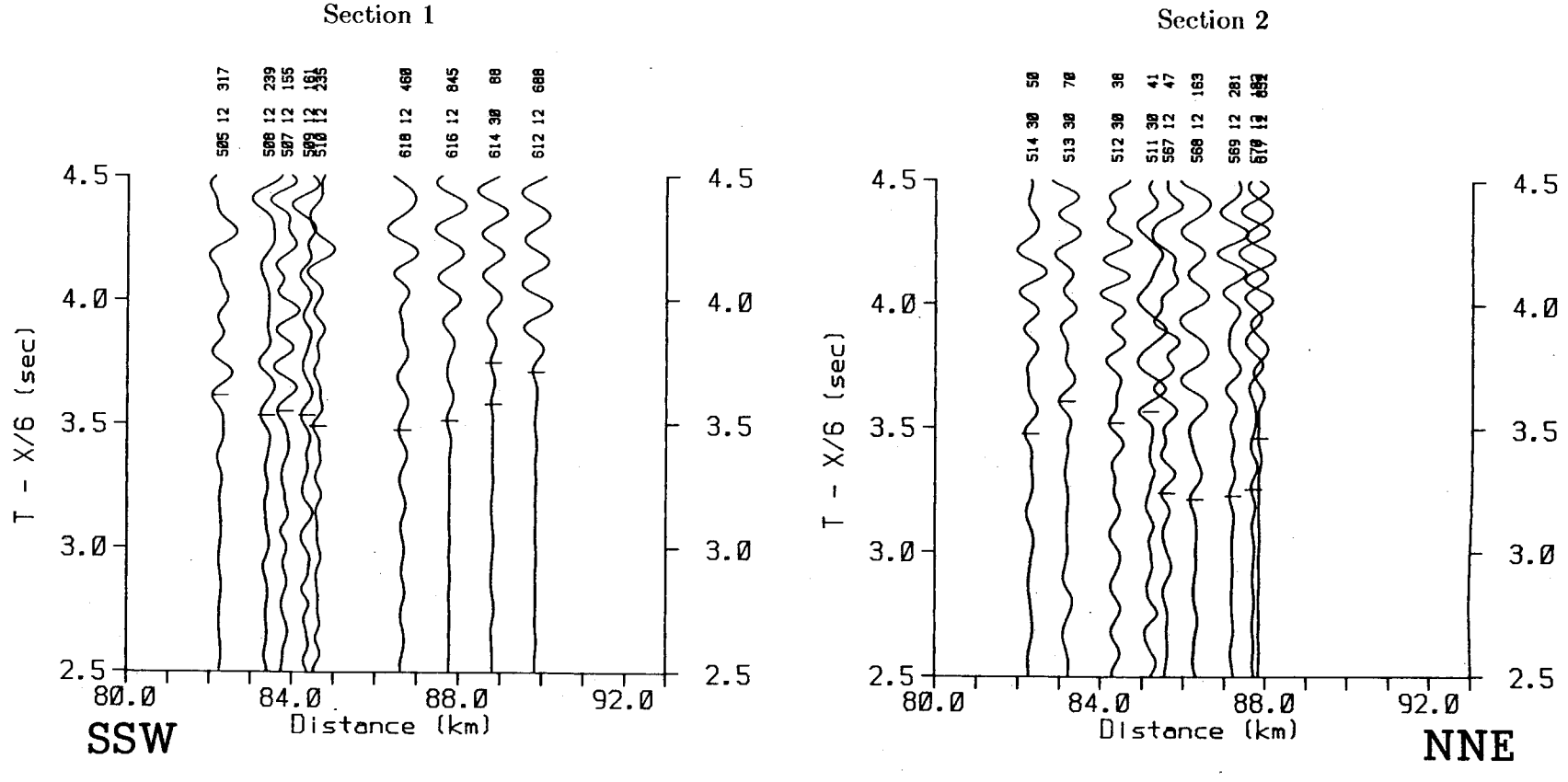

Plate 74. Shot Point 16, Shot 12, Sections 1 and 2.
Filtered seismograms with picked arrivals.

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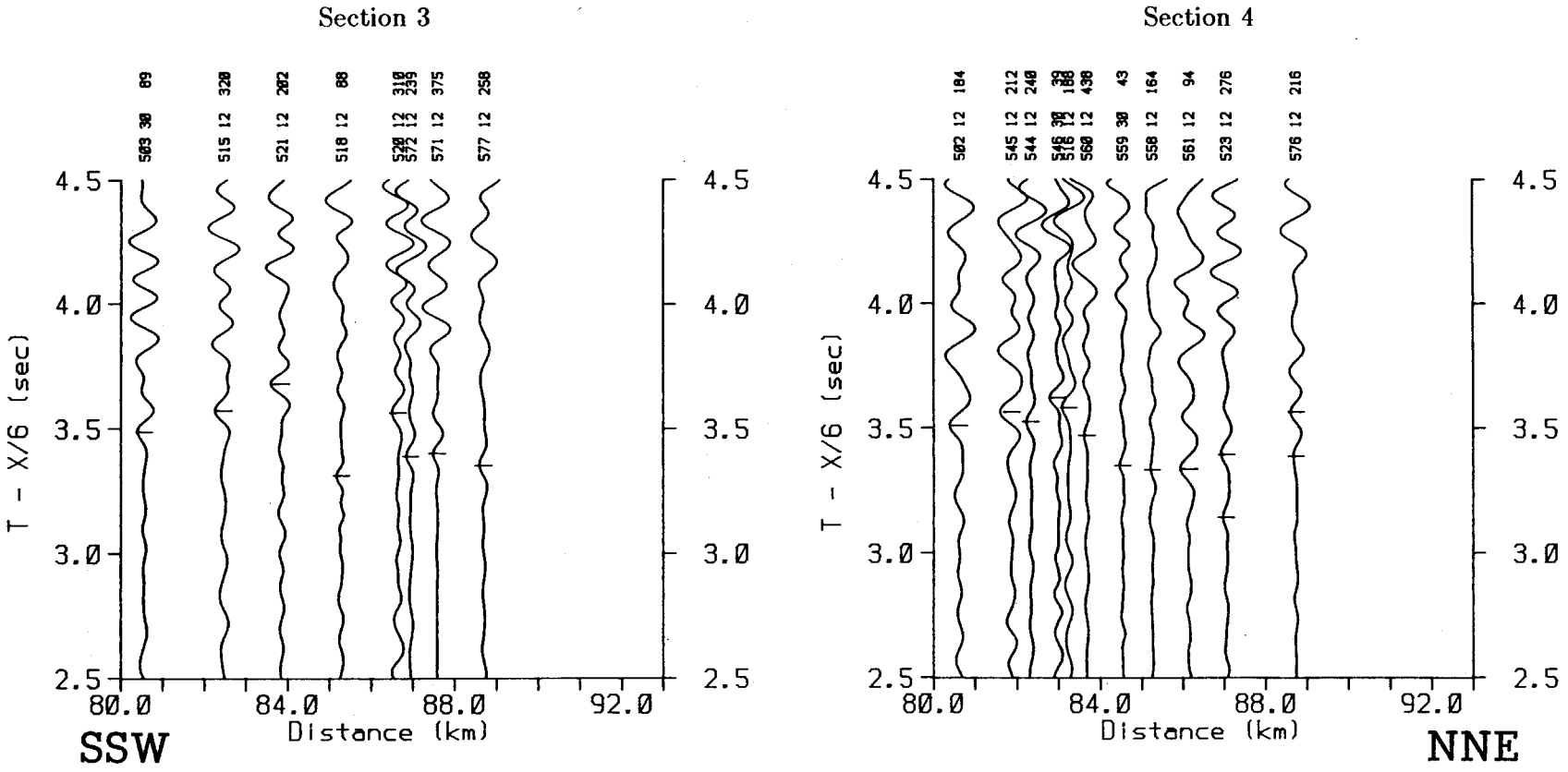

Plate 75. Shot Point 16, Shot 12, Sections 3 and 4.
Filtered seismograms with picked arrivals.

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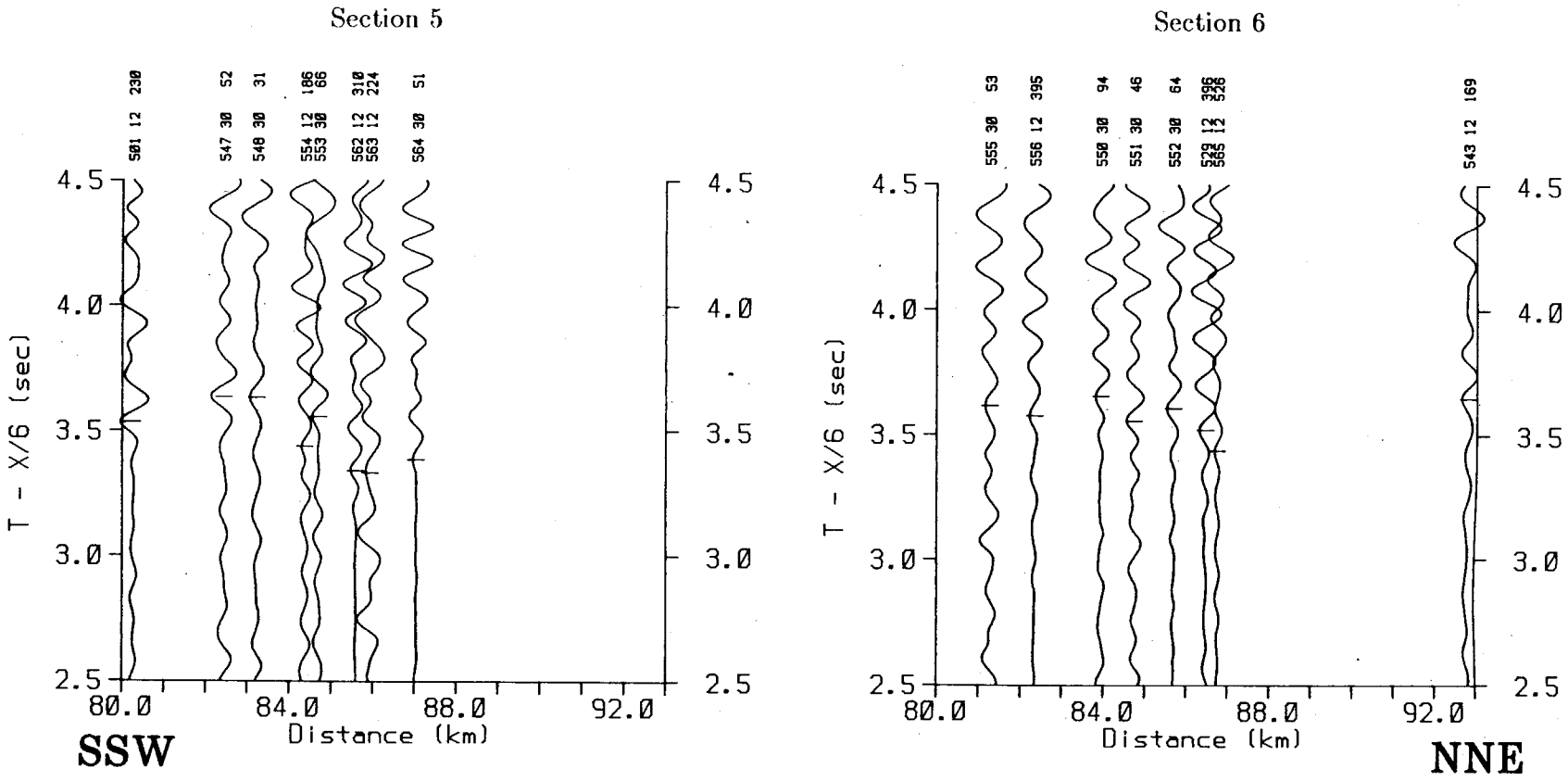

Plate 76. Shot Point 16, Shot 12, Sections 5 and 6.
Filtered seismograms with picked arrivals.

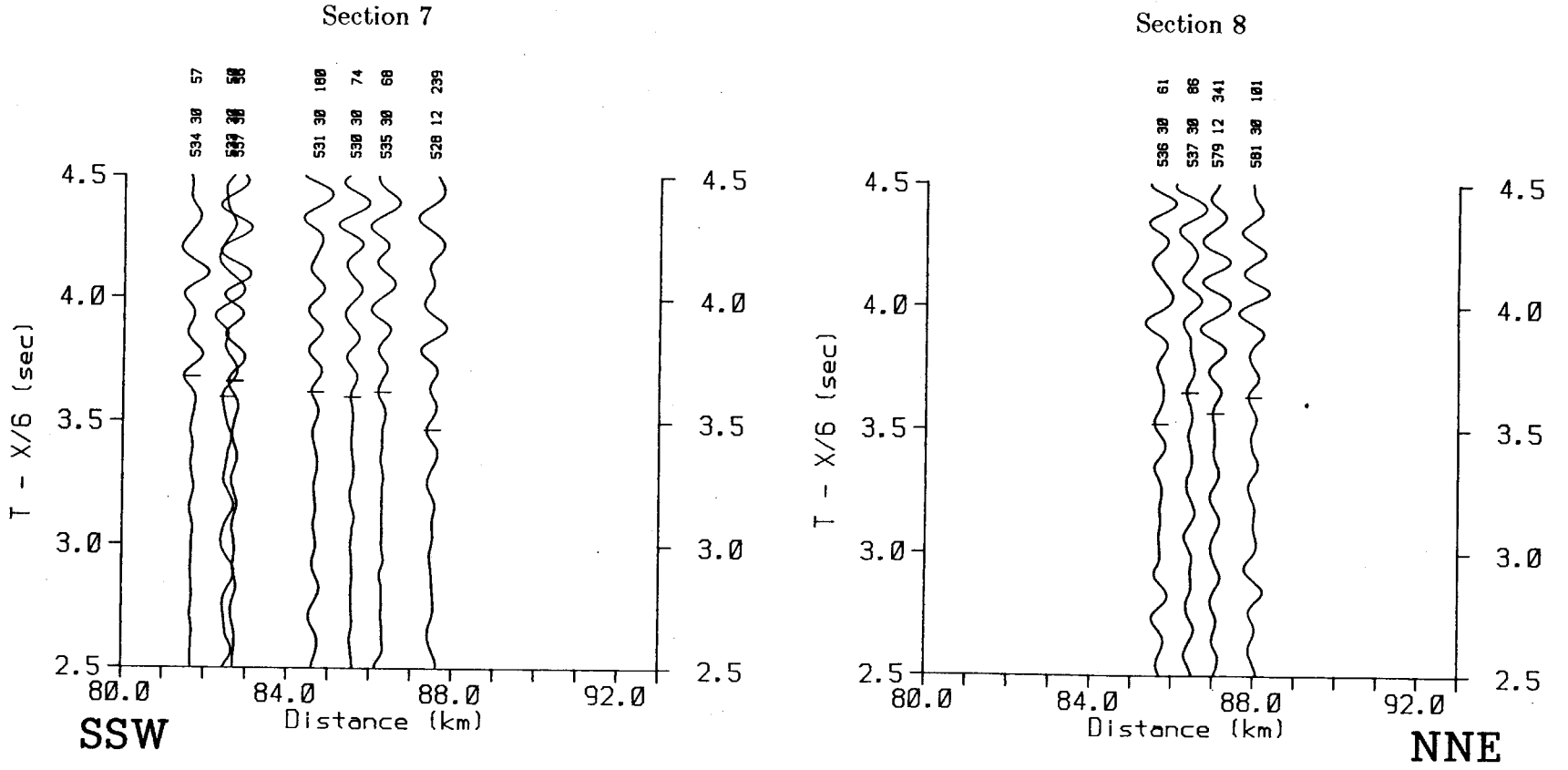

Plate 77. Shot Point 16, Shot 12, Sections 7 and 8.
Filtered seismograms with picked arrivals.

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PLATE 1