DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

REPORT FOR EXPLOSION DATA ACQUIRED IN THE 1994 LOS ANGELES REGION SEISMIC EXPERIMENT (LARSE 94), LOS ANGELES, CALIFORNIA

BY

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INTRODUCTION

In the fall of 1994, the U.S. Geological Survey (USGS), the Southern California Earthquake Center (SCEC), the Geological Survey of Canada (GSC), and the Incorporated Research Institutes for Seismology (Program for Array Seismic Studies of the Crust And Lithosphere; IRIS/PASSCAL) jointly conducted an active-source seismic-imaging survey in Southern California, known as the Los Angeles Region Seismic Experiment, 1994 (LARSE94). This was the first active-source survey of a multi-year experiment that is intended to characterize the crust in this region of significant earthquake hazard. In 1993, a passive experiment (LARSE93) had been conducted along Line 1 (Kohler and others, 1996). The goal of LARSE94 was to: (1) produce, high-resolution images of the crust and upper mantle of the offshore region, the San Gabriel Mountains, and the northern part of the San Gabriel Valley, and (2) produce lower-resolution, reconnaissance images of the crust and upper mantle under the Los Angeles basin and Mojave Desert combining refraction and reflection techniques from both air-guns offshore and explosions on land. During the first phase of LARSE94 (Fuis and others, 1996), air-gun sources were fired along multiple traverses of the offshore segments of three lines (Fig. 1). The air-guns were recorded by a 4-km-long streamer, 10 ocean-bottom seismographs, and 172 land-based seismographs (Fig. 1, TABLE 1). In the second phase of the experiment, explosions were detonated along the onshore segment of Line 1, from Seal Beach, CA, to a point northwest of Barstow, CA. The explosions were recorded by a stationary array of 649 seismographs assembled from numerous institutions in North America (Fig. 2, TABLE 1). In this report, we will present the onshore explosive-source data from Line 1.

During the second phase of LARSE94, 62 shots were recorded over a three-night period at a 649 separate recording sites. Three quarry explosions were recorded at a smaller number of sites. More than one third of the recording sites were occupied by three-component seismographs. The seismographs included 228 three-component IRIS/PASSCAL, University of Texas at El Paso (UTEP), and SCEC RefTeks, 187 vertical-component Stanford University Seismic Group Recorders (SGR's), 183 GSC vertical-component Portable Refraction Seismographs (PRS1's), 33 Geological Survey of Canada (GSC) three-component Portable Refraction Seismographs (PRS4's), and 18 U.S. Geological Survey three-component General Earthquake Observation Systems (GEOS) (TABLE 1). (See below for a detailed description of these seismic recorders.)

The U.S. Geological Survey and the Southern California Earthquake Center jointly led the planning (since 1992) and the execution (1994) of the experiment. Persons from numerous individual institutions participated in the field (Table 2). Data recovery was about 95 percent.

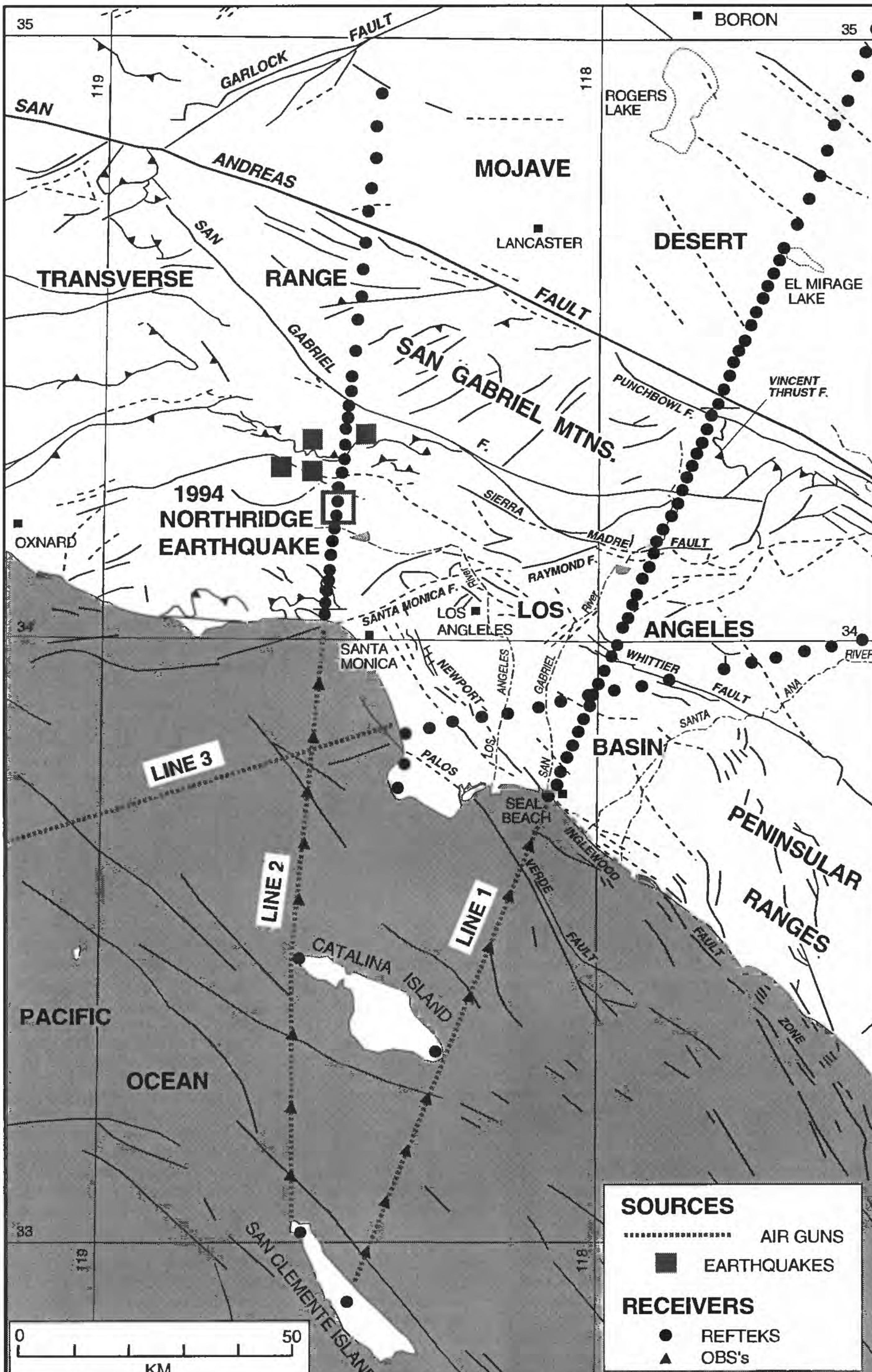

Figure 1. Fault map of the Los Angeles region showing 1) the airgun sources and receivers for LARSE94, and 2) the location of the 1994 Northridge earthquake and four large aftershocks. Faults taken from Jennings (1975).

TABLE 1. Summary of LARSE94 Sources and Receivers

		AIR-GUN SURVEY	EXPLOSION SURVEY
Sources			
	Type	**Air-guns**	**Explosions**
	Provider	LDEO[7]	USGS, SCEC
	Size	20-element, totaling 137.7 l (8370 in ^{3})	20-2000 kg
	Number	25,000	62
Receivers			
	Type	**Streamer**	**Refteks**
	Provider	LDEO	IRIS-PASSCAL, UTEP, SCEC, LANL
	Size or No.	160-channel, 4.2 km long	228, 3-component
	Type	**OBS's**	**SGR's**
	Provider	USGS, GSC	Stanford Univ., IRIS-PASSCAL
	No.	10	187, 1-component
	Type	**Refteks**	**PRS1's/PRS4's**
	Provider	IRIS-PASSCAL	GSC
	No.	170, 1-component	183, 1-component/ 33, 3-component
	Type		**GEOS**
	Provider		USGS
	No.		18, 3-component

7 Abbreviations for institutions are: LDEO--Lamont-Doherty Earth Observatory, USGS--U.S. Geological Survey, SCEC--Southern California Earthquake Center, IRIS-PASSCAL--Incorporated Research Institutes in Seismology/Program for Array Seismic Studies of the Continental Lithoshpere, UTEP--University of Texas at El Paso, LANL--Los Alamos National Laboratory, and GSC--Geological Survey of Canada.

Abbreviations for seismographs are: OBS's--ocean-bottom seismographs (generic), SGR's--Seismic Group Recorders III, Refteks--Refraction Technology seismographs, PRS1's/4's--Portable Refraction Systems, GEOS--Geological Earth Observation Systems. See Borcherdt et al. (1985), Murphy et al. (1993), and Brocher et al. (1995) for a description of these seismographs.

TABLE 2

Personnel of the LARSE94 Explosion Survey

Institution	Number of persons
USGS (Including 7 European volunteers from Karlsruhe University, Germany, GeoForschungZentrum, Potsdam, Germany, Milan University, Milan, Italy, and University of Durham, UK)	37
SCEC:	
University of Southern California	9
California Institute of Technology	12
University of California at Los Angeles	14
University of California at Santa Barbara	3
University of Texas at El Paso	10
IRIS/PASSCAL	4
Geological Survey of Canada	3
University of California at Riverside	1
Orange Community College	9
California State University at Long Beach	5
University of Nevada at Reno	1
Other volunteers	8
Total	116

Signal-to-noise ratios were moderate to excellent in the San Gabriel Mountains and Mojave Desert and moderate to poor in the Los Angeles basin. The data have been archived at the IRIS Data Management Center (DMC) in Seattle, Washington, and are available at:

IRIS DMC
1408 NE 45th Street
Seattle, WA 98105
Telephone: (206) 547-0393

A description of the tape format and headers is given below in the Data Processing section.

GEOLOGIC SETTING

Southern California is a geologically complex region. Line 1 was chosen to minimize the effects of 3-D structure of the crust. Line 1 traverses three markedly different regions, including the Los Angeles basin, the central Transverse Ranges (San Gabriel Mountains), and the Mojave Desert (Figs. 1, 2).

The Los Angeles basin occupies a region at the eastern boundary of the (offshore) Continental Borderland, the southern boundary of the Transverse Ranges and the northwestern boundary of the Peninsular ranges. The Los Angeles basin is fault bounded by the Palos Verde, the Santa Monica, Hollywood, Raymond, and Sierra Madre faults, and is juxtaposed the structurally complex northwestern boundary of the Peninsular Ranges. The present day Los Angeles basin began its evolving in late Miocene by subsidence between the right-oblique Whittier and Palos Verde fault zones and the left-oblique Santa Monica fault system (Wright, 1991). Since the mid-Pliocene, deformation has involved southward shortening of the crust and propagation of blind thrusts beneath the basin.

The Newport-Inglewood fault zone, a major internal structure of the basin, was the location of a Magnitude 6.3 earthquake in 1933. Other large earthquakes near Line 1 include the 1987 M5.9 Whittier Narrows earthquake (Hauksson, and others, 1988) and the 1991 M5.8 Sierra Madre earthquake (Hauksson, 1994). The San Gabriel Valley is a sub-basin of the Los Angeles basin and is bounded on the southeast by the Puente Hills and on the north by the San Gabriel Mountains.

The Transverse Ranges are late Cenozoic, east-west trending ranges that resulted from compression across the left-stepping bend in the San Andreas fault and block rotations. Mesozoic plutonic rocks and Precambrian gneissic rocks form the upper-plate in the San Gabriel mountains. The Vincent thrust fault separates these upper-plate rocks

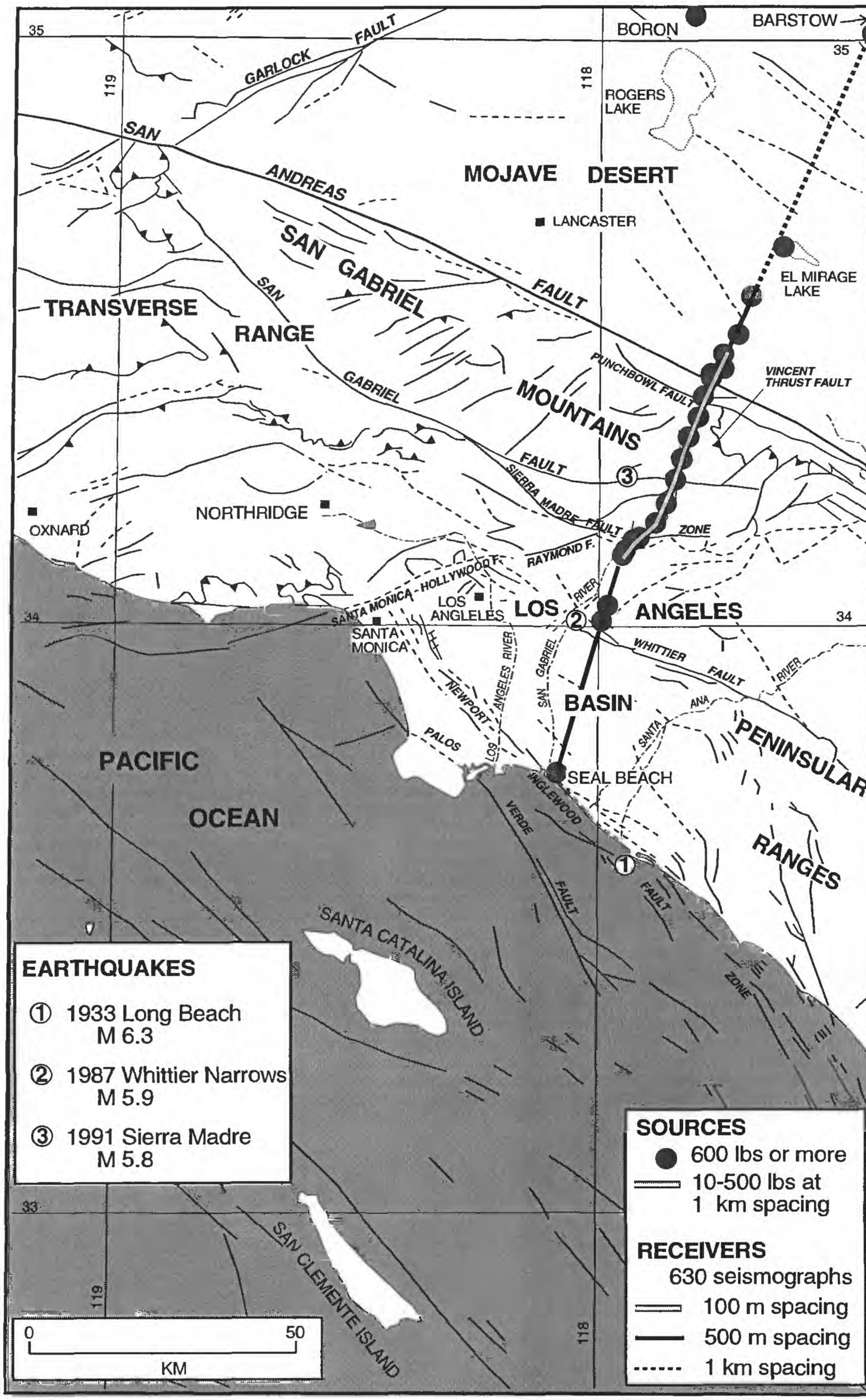

Figure 2. Fault map of the Los Angeles region showing 1) the explosive sources and receivers for LARSE94, and 2) the location of three recent moderate-sized earthquakes. Faults taken from Jennings (1975).

from the lower-plate Pelona schist (Fig. 3D; Jennings, 1977). Catalina greenschists from the Continental Borderland are similar to the Pelona schist (Wright, 1991). However, if and how they are related is not clear.

In the San Gabriel Mountains, north-south shortening is being accommodated by reverse faulting along the southern boundary and broad arching across the interior and northern margin (Ehlig, 1981). The San Gabriel fault, a major internal structural feature and a formerly active strand of the San Andreas fault, experienced 60 kilometers of right-lateral slip during late Miocene and Pliocene (Crowell, 1952). The Punchbowl fault, also an older strand of the San Andreas fault, and the modern trace of the San Andreas fault (which developed to the northeast of the San Gabriel fault, near the northeastern margin of the San Gabriel Mountains (Fig. 3D)), have subsequently offset the North American and Pacific plates by more than 200 km (Powell, 1993).

The Mojave Desert is underlain by topographically low mountains of Mesozoic plutonic and volcanic rocks with minor Paleozoic rocks, separated by basins filled with Tertiary and Quaternary sediments. Rocks in the Mojave Desert are offset by northwest-trending strike-slip faults that have been active in the Quaternary (Fig. 3E).

The main imaging targets of the LARSE94 investigation are the San Andreas fault, the Transverse range frontal fault system (Sierra Madre fault), and blind thrust faults in the Los Angeles basin. Although the San Andreas fault poses the threat of a rare, great earthquake, moderate-sized events that can cause considerable damage have occurred and will occur more frequently in the highly populated areas of metropolitan Los Angeles. In many cases, these moderate-sized earthquakes occur on blind thrusts faults--i.e., thrust faults that are not exposed at the surface (past examples: the 1971 M_L 6.4 San Fernando, the 1987 M5.9 Whittier Narrows, and the 1994 M6.7 Northridge earthquakes). Active-source seismic surveys, such as LARSE94, are one of the best ways to identify blind thrust faults prior to rupture during an earthquake. Unfortunately, as designed, LARSE94 will obtain only a reconnaissance image of the upper crust of most of the Los Angeles basin. Follow-on surveys are required for more detailed imaging.

EXPERIMENT PLANNING AND DESIGN

The 1994 Los Angeles Region Seismic Experiment (LARSE) was conceived by scientists at the USGS in 1991. A internal proposal was submitted to the National Earthquake Hazards Reduction Program (NEHRP) for fiscal year 1992 and seed money was authorized for planning. In 1992, the participation of the Southern California Earthquake Center (SCEC) was assured.

After examining several possible routes, a route extending 160 km from Seal Beach northeastward to a point in the Mojave Desert northwest of Barstow was chosen for Line 1 (Fig. 2). This route had the following scientific and logistical advantages: (1) It traversed a region of Los Angeles that has experienced 3 moderate earthquakes in the past 75 years, the 1933 M6.3 Long Beach earthquake, which ruptured deep parts of the Newport-Inglewood fault zone (Fig. 3B; Richter, 1958), the 1987 M5.9 Whittier Narrows earthquake, which ruptured a part of a blind thrust fault located beneath the Puente Hills and the area to the northwest (Fig. 3B; Hauksson and others, 1988; Davis and others, 1989), and the 1991 M5.8 Sierra Madre earthquake, which ruptured a deep part of the Sierra Madre fault system (Clamshell-Sawpit Canyon fault, Fig. 3D; Hauksson, 1994). (2) Line 1 crossed the region roughly perpendicular to the strikes of most mapped fault (Figs. 2, 3). (3) Line 1 crossed the Los Angeles basin along the San Gabriel river and other waterways that provided access for seismograph locations (Fig. 2). (4) Line 1 crossed areas of the Los Angeles basin that contained enough open space for shotpoints and relatively quiet seismograph locations, including the U.S. Naval Weapons Station at Seal Beach (SP 9450, Fig. 3B), the Puente Hills (SP9160-SP9170, Fig. 3B), and a flood control basin in the northern San Gabriel Valley (SP9000-SP9040, Fig. 3C). (5) Line 1 crossed the San Gabriel Mountains along one of the very few routes accessible by roads.

Obtaining permits for Line 1 was an expensive and lengthy process. In the San Gabriel Mountains, under the jurisdiction of the U.S. Forest Service, each shot point required an environmental assessment, including an archeological and biological study. In the Mojave Desert, under the jurisdiction of the U.S. Bureau of Land Management, each shotpoint, recording site, and the access to these sites required a similar environmental assessment. All persons working in the Mojave Desert were required to attend training sessions on the desert tortoise. In the Los Angeles basin, jurisdictions included numerous local, state, and federal government agencies and private businesses, and a variety of requirements had to be met in permitting shot point and seismograph locations. The permitting process in the Los Angeles basin included addressing city councils and other government bodies, extensive radio, television, and newspaper interviews, and correspondence with numerous individuals and private groups.

The land-based explosion survey of LARSE94 was designed as a combined reflection and refraction imaging experiment, with the reflection part in the center, covering the San Gabriel Valley and the San Gabriel Mountains. Shot points were spaced every kilometer from the flood control basin in the San Gabriel Valley through the San Gabriel Mountains (Figure 3C). In the Mojave Desert and Los Angeles basin, shotpoint spacing was greater, from 5 to 50 kilometers apart (figures 3B and 3E). Seismograph spacing was 100 m through the region of dense shots, from the San Gabriel Valley through the San Gabriel Mountains (shotpoints 9040-8040, Figs. 3C, 3D). In the southern Los Angeles basin and the southern Mojave Desert, seismograph spacing was 500 meters

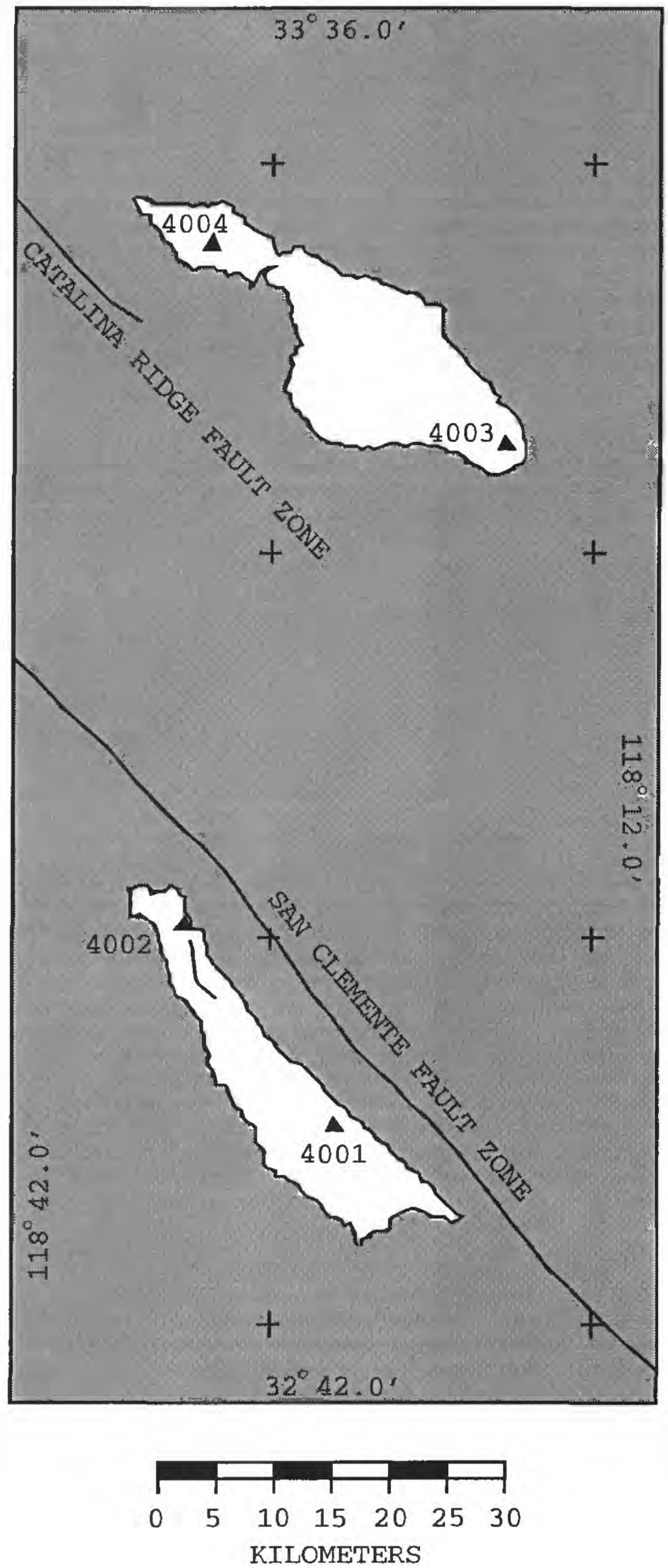

Figure 3A. Fault map showing seismograph sites on San Clemente Island and Santa Catalina Island.

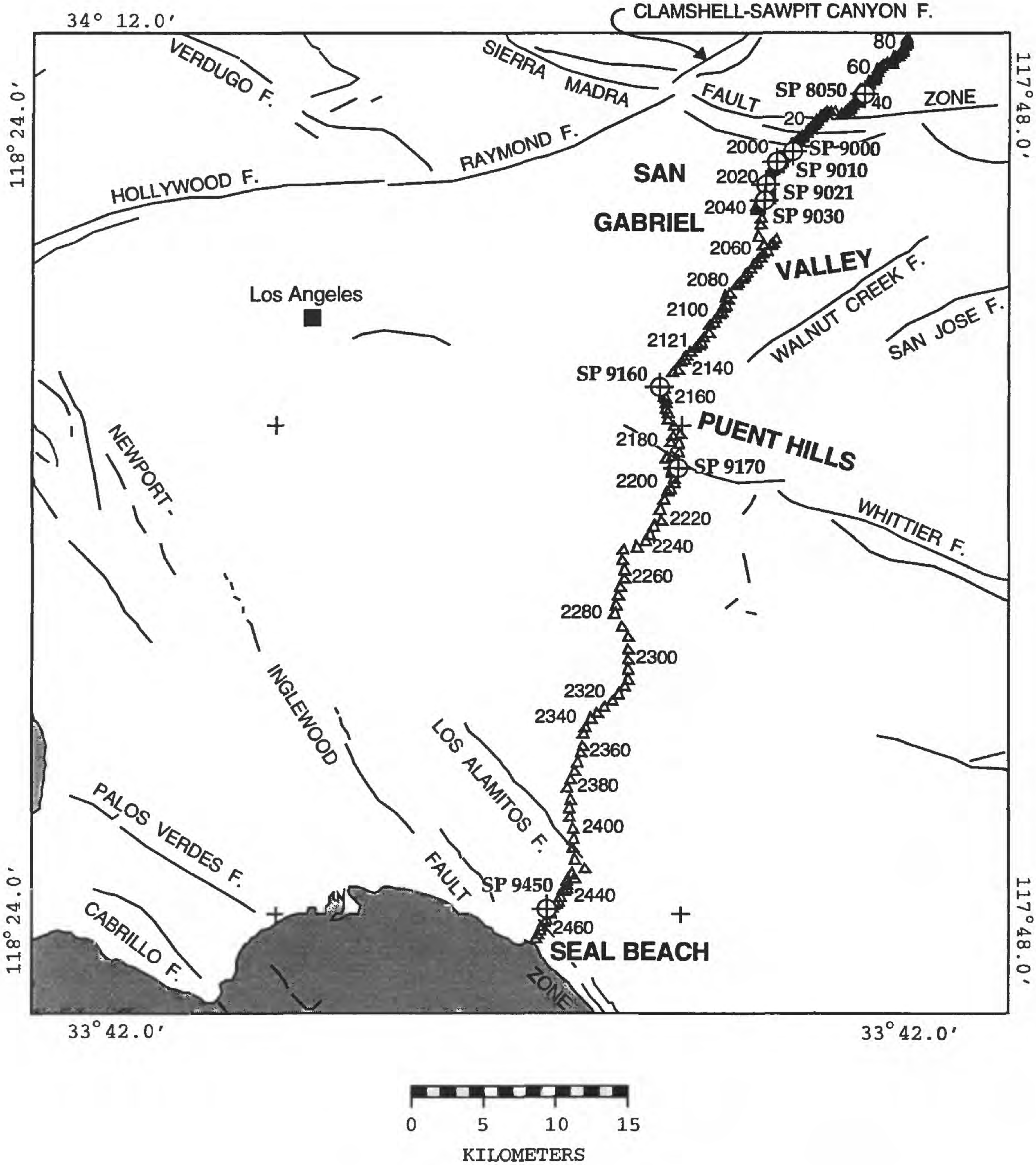

Figure 3B. Fault map showing seismograph sites in the Los Angles basin. Shot points that had more than ~225 kg (500 lbs.) of explosives are shown with crossed circles.

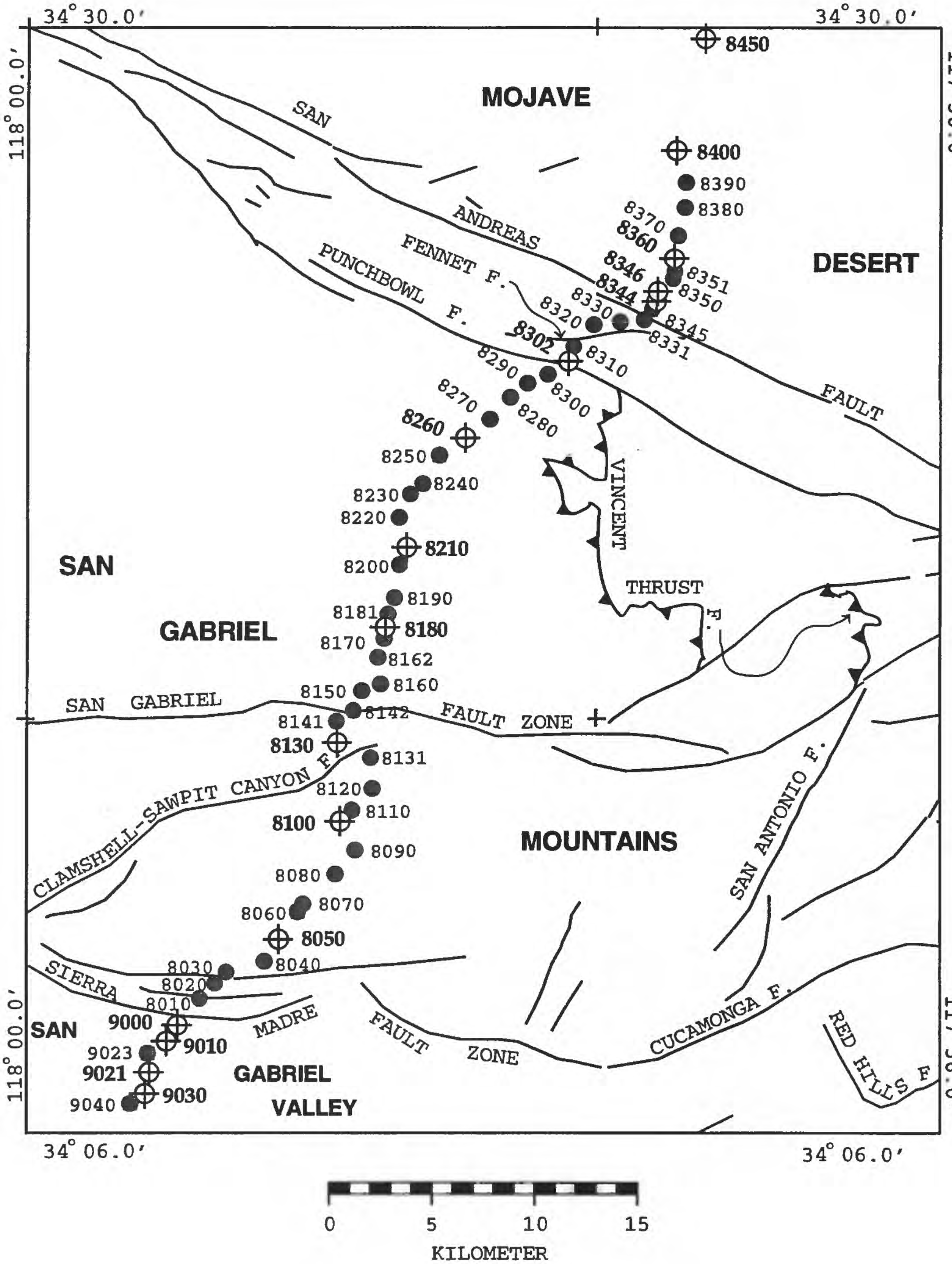

Figure 3C. Fault map showing shot points in the San Gabriel Mountains. Shot points that had more than ~225 kg (500 lbs.) of explosives are shown with crossed circles. Low-yield shots are shown with grey circles.

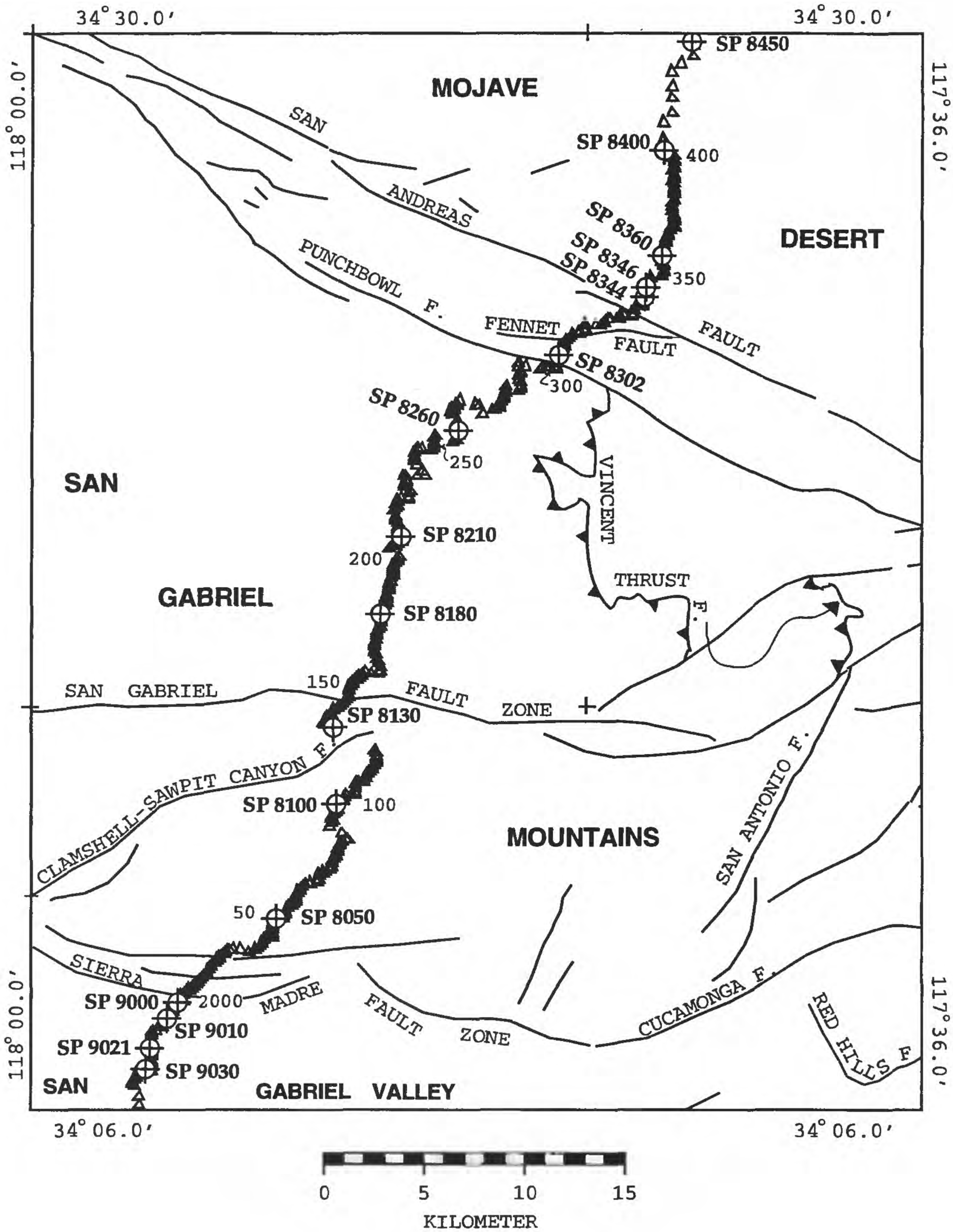

Figure 3D. Fault map showing seismograph sites in the San Gabriel Mountains. Shot points that had more than ~225 kg (500 lbs.) of explosives are shown with crossed circles.

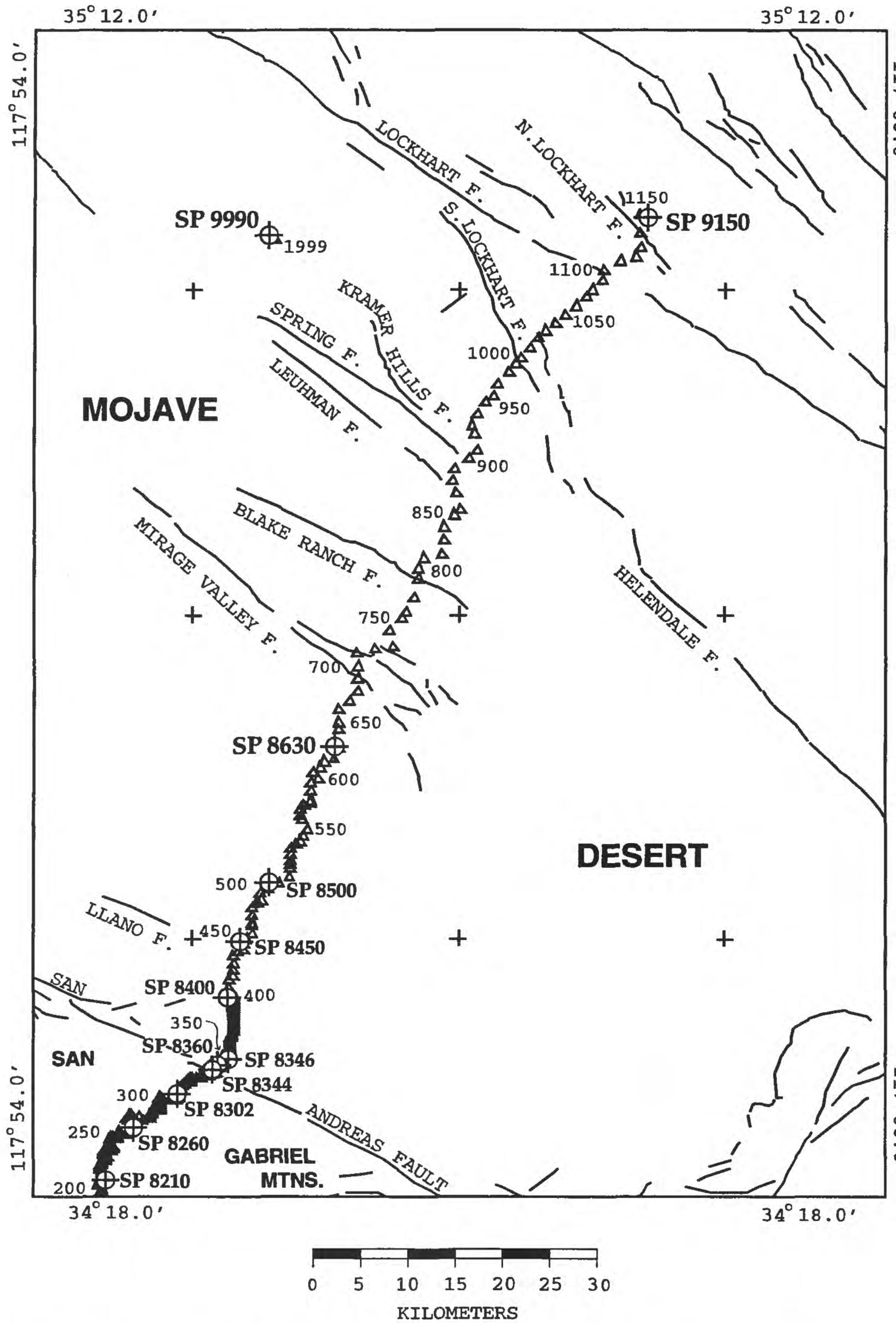

Figure 3E. Fault map showing seismograph sites in the Mojave Desert. Shot points that had more than ~225 kg (500 lbs.) of explosives are shown with crossed circles.

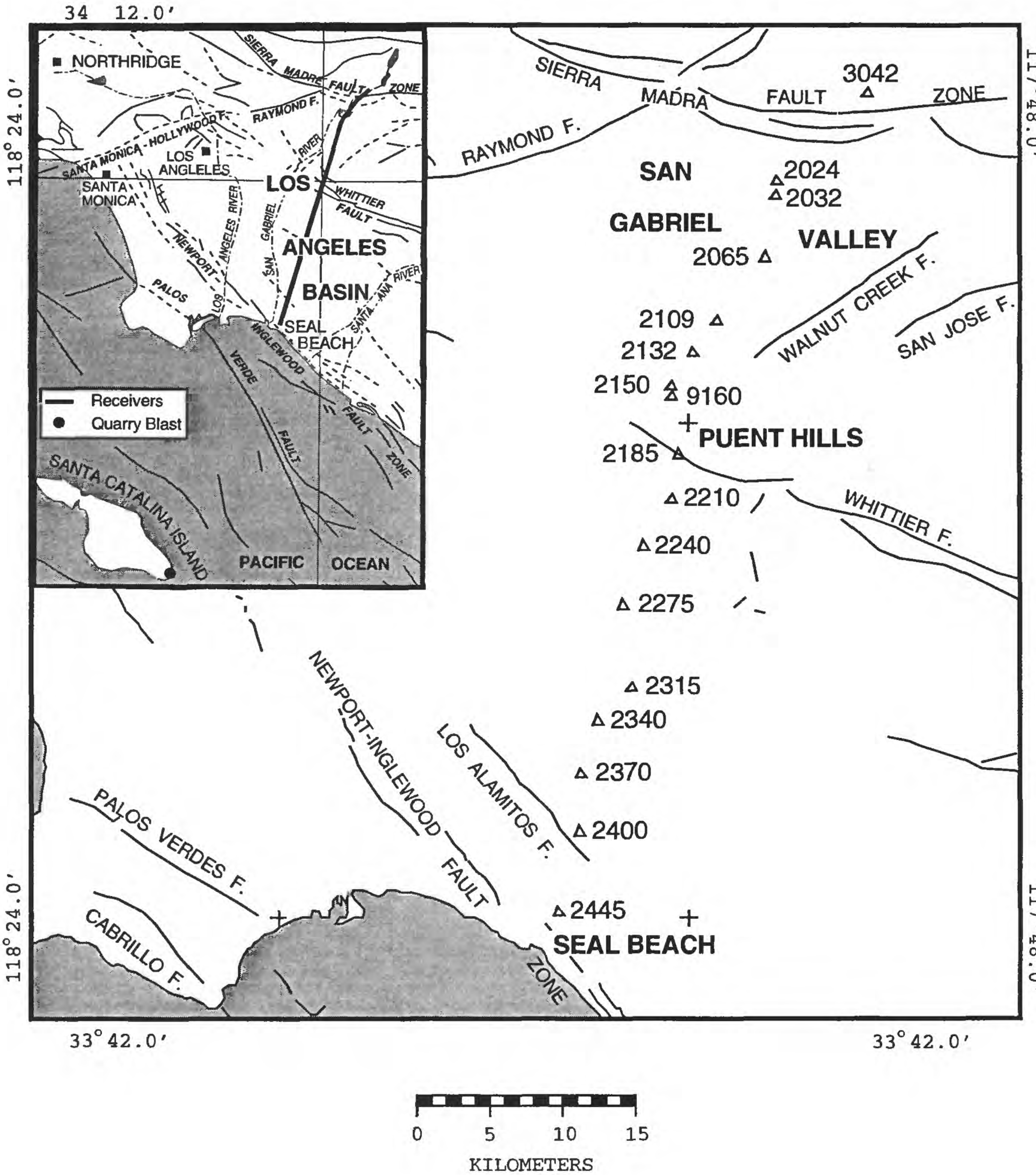

Figure 3F. Fault map showing seismograph sites in the Los Angles basin that recorded the Catilina quarry blast. The inset shows the location of of the blast with respect to the receiver sites.

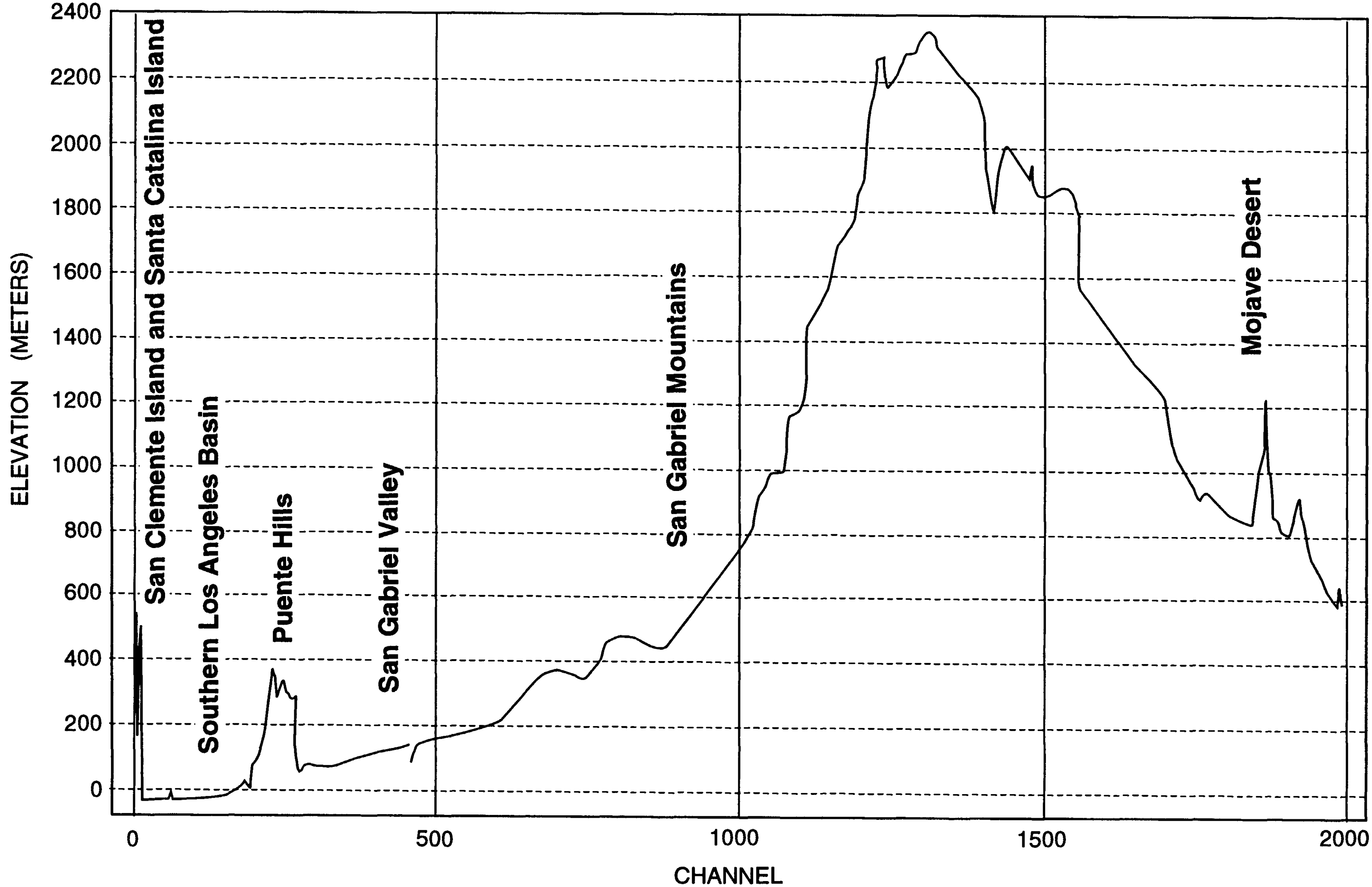

Figure 4. Plot of recording site elevations. Site is given as a channel number. Each seismograph location was assigned 3 channel numbers, which increase northeastward along line 1 from San Clemente Island through the Mojave Desert.

(Fig. 3B). Seismograph spacing was 250m in the northern Los Angeles basin (shotpoints 9170-9040; Fig. 3B) and 1 kilometer in the northern Mojave Desert (north of SP8063; Fig. 3C).

To enhance recording reflections in the central part of the experiment, seismographs with high-frequency response (Refteks, SGR's) were deployed through the northern San Gabriel Valley and San Gabriel Mountains (shotpoints 9170 to 8040, Figs. 3B, 3C). Seismographs in the southern Los Angeles basin and Mojave Desert generally had a lower-frequency response (PRS1's, PRS4's, GEOS) and were more suitable for recording refractions and wide-angle reflections. Thus, of the 160-km profile length (excluding the 4 stations on Santa Catalina and San Clemente Islands, Fig. 3A), a 57-km-length segment was recorded by higher-frequency instruments and is suitable for producing a low-fold, common-midpoint (CMP) stacked section.

In designing the experiment, we used curves relating particle velocity to shot size and distance to determine the maximum amount of explosive that could be detonated at each shot point without damage, perceived or real, at nearby structures (see Kohler and Fuis, 1989, 1992). By using a combination of small and large shots (5-2700 kg), we hoped to obtain both high-frequency vertical-incidence reflections and energy at long offsets for refraction/wide-angle-reflection analysis.

To locate suitable seismograph sites, we conducted noise tests along Line 1. Background noise levels in the Los Angeles basin range from 24dB (relatively quiet) to 42 dB (unacceptably noisy, usually near freeways or major throughfares), with an average around 36dB. For comparison, quiet sites in the San Gabriel Mountains and Mojave Desert had noises levels around 6dB.

Recording sites were selected along the edge of fenced drainage canals, highways, and other roads, where possible. In some areas, home owners and private companies granted permission to record on their property. In many cases, security for the seismographs required complete burial of the recorder and batteries.

Locations for the recording sites and shot points were obtained using a Global Positioning Satellite navigation system (GPS; the Trimble Navigation Pathfinder). These locations (Apendix B) are estimated to be accurate to within ±5 meters horizontally and ±10 meters vertically. The GPS coordinates given in longitude and latitude were converted to Universal Transverse Mercator (UTM) coordinates (zone 11) using an algorithm by Okaya and others (1996a).

Drill-hole shotpoints consisted of a 20-cm-diameter drill hole filled with an ammonium-nitrate-based blasting agent, boosters, and detonating cord. The amount of explosive and the depth to the top of the charge for each shot point are listed in TABLE 3, as well as the depth to any standing water in the holes. Shot crews used signals from a master clocks and shooting systems designed by the USGS to fire an electric blasting cap, which in turn detonated the cord, boosters, and blasting agent. The shot times reported in TABLE 3 are generally master-clock trigger times; delays for the caps, detonation cord, boosters, and blasting agent, which explode at ~5.5-6.0 km/s, are ignored. Master clocks generally drift less than 1 millisecond per week. However, during this experiment some master clocks had larger errors, and, in a few cases, quit or failed to generate a proper trigger, necessitating a manual firing sequence. In some manual firing sequences, where the clock was still running, shot times could be inferred from a strip-chart record displaying simultaneously the master-clock time code and the cap break. In other cases, where the clock quit, shot time had to be inferred from the "uphole time" or arrival time at the nearest seismograph corrected for shot-receiver distance using a known or assumed velocity (see "Comments" column, TABLE 3). The quarry blasts at Boron mine and on Santa Catalina Island were timed using the arrival time recorded at an onsite seismograph, corrected for shot-receiver distance using a known or assumed velocity. Differences between "nominal shot times and actual shot times were written to the headers of all seismograms (see Data Processing section below).

EXPERIMENT SCHEDULE

The LARSE field experiment began in August, 1994. One field crew supervised shot hole drilling and loading and several survey parties staked, flagged, and logged recording sites. Personnel and instruments were assembled from numerous institutions in early October, and instrumentation was tested. The air-gun survey (Fig. 1) was conducted from October 13-20. Eight scientists from the USGS and SCEC supervised the marine part of the air-gun survey aboard the *R/V Ewing* (see Brocher et al., 1995). Two USGS scientists deployed ocean bottom seismographs from the deck ofthe *Yellowfin* (see tenBrink et al., 1996), and a number of scientists, technicians, and students from the USGS, SCEC, and other institutions (TABLE 2) deployed and maintained 170 continuously recording Reftek seismographs on land (Lines 1, 2, and 3, Fig. 1; Okaya et al., 1996a, 1996b).

The land-based explosion survey (Fig. 2) was conducted during the period of October 25-28, when approximately 110 scientists, technicians, and students from a number of institutions (TABLE 2) deployed and maintained 640 seismographs along Line 1 (TABLE 1) and detonated 62 shots during the 3-night period (TABLE 3). In addition, for two days during the land-based survey, 228 Reftek seismographs, dispersed throughout Line 1 in the San Gabriel Mountains and San Gabriel Valley, recorded quarry blasts at Boron Mine, in the Mojave Desert. Following the explosion survey, a cleanup crew returned shotpoint sites to their former conditions.

TABLE 3. SHOT LIST

SHOT POINT ORDER	ORIGINAL SHOT POINT NUMBER	NEW SHOT POINT NUMBER	LATITUDE		LONGITUDE		ALTI TUDE	SHOT TIME ORDER	NOMINAL SHOT TIME jjj:hh:mm:ss	ACTUAL SHOT TIME (CAP BREAK) jjj:hh:mm:ss	COMMENTS	TEAM	TOTAL DEPTH (FT)	SIZE OF EXPLOSIVE (KG)	DEPTH TO TOP OF EXPLOSIVE (FT)	SITE GEOLOGY AND WATER SATURATION (DURING DRILLING/LOADING)	DEPTH TO TOP OF WATER (DURING DRILLING/ LOADING)
1	245	9450	33	45.17076	-118	4.85232	-31	60	301:10:10	301:10:10:02.725	range. Estimated error ±0.025 s.	Criley /Kaderabek	113	408	97	Alluvium (wet)	60/15
2	217	9170	33	58.73382	-118	0.33006	142	59	301:10:08	301:10:08:00.000	Oil at 50 ft in hole	Benz /Bursiaga	74	272	64	ne (dry of water but oil at 50 ft)	
3	216	9160	34	0.78552	-118	0.6738	283	63	301:10:16	301:10:16	No strip chart with time code	Luetgert /Keller	100	399	85	Siltstone/sandstone (dry?)	?
4	204	9040	34	6.62112	-117	57.32346	109	53	301:08:42	301:08:42:00.000	clock; cap break agrees with shooting clock minute mark	Croker /Underwood	79	86	76	Alluvium (dry)	
5	203B	9030	34	6.85044	-117	56.95218	109	61	301:10:12	301:10:12:00.000		Croker /Underwood	140	680	114	Alluvium (dry)	
6	202A	9021	34	7.30662	-117	56.835	118	58	301:10:06	301:10:06:00.000		Laird /Rutledge	100	340	87	Alluvium (dry)	
7	202C	9023	34	7.71492	-117	56.85426	131	52	301:08:36	301:08:36:00.000		Laird /Rutledge	79	181	72	Alluvium (dry)	
8	201	9010	34	7.99074	-117	56.35758	86	57	301:10:04	301:10:04:00.000	Shooting clock frozen; master clock used; ok	Burdette /Benz	100	454	83	Alluvium (dry)	
9	200	9000	34	8.3352	-117	56.10216	145	51	301:08:34	301:08:34:00.000		Burdette /Benz	74	408	58	Alluvium (dry)	
10	1	8010	34	8.925	-117	55.50384	167	64	301:11:32	301:11:32:00.000		McCleam /Farrell	71	23	70	Alluvium (wet)	63
11	2	8020	34	9.25344	-117	55.12392	180	56	301:10:02	301:10:02:00.000		McCleam /Farrell	69	227	60	Alluvium (dry)	
12	3	8030	34	9.49698	-117	54.80346	198	50	301:08:32	301:08:32:00.000		McCleam /Farrell	59	9	59	Alluvium (wet)	48
13	4	8040	34	9.73872	-117	53.81976	218	55	301:10:00	301:10:00:00.000		Reneau /Meyer	71	7	71	Hard rock (wet)	55
14	5	8050	34	10.20012	-117	53.43066	234	49	301:08:30	301:08:30:00.000		Reneau /Meyer	104	544	83	Hard rock (wet)	20
15	6	8060	34	10.7991	-117	52.91472	362	54	301:08:44	301:08:44:00.000		Jenson /Fisher	76	5	76	Hard rock (wet)	45
16	7	8070	34	10.9767	-117	52.7829	351	62	301:10:14	301:10:14:00.000		/Fisher	76	5	76	Hard rock (dry)	
17	8	8080	34	11.62332	-117	51.93972	350	47	300:11:46	300:11:46	No strip chart with time code	Jenson . /Fisher	75	113	71	Hard rock (wet)	45
18	9	8090	34	12.13578	-117	51.41604	330	38	300:10:16	300:10:16	No strip chart with time code	Jenson /Fisher	85	227	76	Hard rock (wet)	45/30
19	10	8100	34	12.75924	-117	51.82848	472	29	300:08:46	300:08:46	No strip chart with time code	Jenson /Fisher	112	454	95	Hard rock (dry/wet)	. . ./98
20	11	8110	34	13.01652	-117	51.49932	481	46	300:11:44	300:11:44:00.000	Cut off time slip	McCleam /Farrell	65	113	61	Hard rock (wet)	45
21	12	8120	34	13.48434	-117	50.93814	431	37	300:10:14	300:10:14:00.000		McCleam /Farrell	61	113	57	Alluvium (dry); well cemented	
22	13A	8131	34	14.13804	-117	51.0315	427	28	300:08:44	300:08:44:00.000		McCleam /Farrell	85	227	76	Hard rock (wet)	75

TABLE 3. SHOT LIST

SHOT POINT ORDER	ORIGINAL SHOT POINT NUMBER	NEW SHOT POINT NUMBER	LATITUDE		LONGITUDE		ALTITUDE	SHOT TIME ORDER	NOMINAL SHOT TIME jjj:hh:mm:ss	ACTUAL SHOT TIME (CAP BREAK) jjj:hh:mm:ss	COMMENTS	TEAM	TOTAL DEPTH (FT)	SIZE OF EXPLOSIVE (KG)	DEPTH TO TOP OF EXPLOSIVE (FT)	SITE GEOLOGY AND WATER SATURATION (DURING DRILLING/LOADING)	DEPTH TO TOP OF WATER (DURING DRILLING/ LOADING)
23	13	8130	34	14.4603	-117	51.89436	463	45	300:11:42	300:11:42	No strip chart with time code	Mooney /Ren	104	454	87	Hard rock (wet)	76
24	14A	8141	34	14.93592	-117	51.93192	498	36	300:10:12	300:10:12	No strip chart with time code	Mooney /Ren	75	113	71	Hard rock (dry?)	?
25	14B	8142	34	15.15954	-117	51.48654	529	27	300:08:42	300:08:42	No strip chart with time code	Mooney /Ren	60	9	60	Alluvium (wet)	35
26	15	8150	34	15.60564	-117	51.23838	594	44	300:11:40	300:11:40	No strip chart with time code	Croker /Underwood	71	113	67	Hard rock (dry)	
27	16	8160	34	15.75942	-117	50.75592	673	35	300:10:10	300:10:10	No strip chart with time code	Croker /Underwood	59	113	55	Debri flow; well cemented (dry)	
28	16B	8162	34	16.30554	-117	50.83422	726	26	300:08:40	300:08:40	No strip chart with time code	Croker /Underwood	65	113	61	Alluvium (wet)	51
29	17	8170	34	16.7379	-117	50.66298	791	43	300:11:38	300:11:38	master clock that was 2 ms off next day	Burdette /Benz	80	227	71	Alluvium (wet)	40
30	18	8180	34	16.99014	-117	50.63874	921	34	300:10:08	300:10:08	master clock that was 2 ms off next day	Burdette /Benz	109	454	92	Hard rock? (dry)	
31	18A	8181	34	17.25564	-117	50.54304	975	25	300:08:38	300:08:38:00.000		Burdette /Benz	60	113	56	Hard rock (dry)	
32	19D	8190	34	17.61522	-117	50.403	992	42	300:11:36	300:11:36:00.000		Luetgert /Dres	80	91	77	Hard rock (wet)	33
33	20C	8200	34	18.32568	-117	50.26704	1319	33	300:10:06	300:10:06:00.000		Luetgert /Dres	61	23	60	Hard rock (dry)	
34	21B	8210	34	18.7152	-117	50.0661	1496	24	300:08:36	300:08:36:00.000		Luetgert /Dres	73 + 81	454	53 + 61	Hard rock (wet)	ave 42
35	22	8220	34	19.35354	-117	50.28078	1685	41	300:11:34	300:11:34:00.000		Laird /Rutledge	83	113	73	soft matrix; (dry/wet)	. ./79
36	23A	8230	34	19.86852	-117	49.97178	1824	32	300:10:04	300:10:04:00.000		Laird /Rutledge	77	181	70	Hard rock (wet)	50
37	24A	8240	34	20.07888	-117	49.63164	1986	23	300:08:34	300:08:34:00.000		Laird /Rutledge	84	113	80	Hard rock (dry/wet)	. . /73
38	25	8250	34	20.70534	-117	49.21008	2202	40	300:11:32	300:11:32:00.125	Manual fire	Reneau /Meyer	74	113	70	Hard rock (wet)	43
39	26	8260	34	21.07152	-117	48.53166	2285	31	300:10:02	300:10:02:00.000		Reneau /Meyer	113	318	101	Hard rock (wet)	59
40	27	8270	34	21.48402	-117	47.91048	2323	22	300:08:32	300:08:32:00.000		Reneau /Meyer	74	113	70	Hard rock (dry)	
41	28A	8280	34	21.939	-117	47.34834	2248	39	300:11:30	300:11:30:00.015	interpolated to be 15.4 ms late at shot	VanSchaack /Criley	76	113	72	Hard rock (dry)	
42	29A	8290	34	22.28898	-117	46.91208	2184	30	300:10:00	300:10:00:02.893	Manual fire. Fired off master clock interpolated to be 14.6 ms late at shot	VanSchaack /Criley	75	113	71	Hard rock (dry)	
43	30	8300	34	22.48194	-117	46.36596	2101	21	300:08:30	300:08:30:00.014	interpolated to be 13.8 ms late at shot	VanSchaack /Criley	76	113	72	Hard rock (dry)	
44	30B	8302	34	22.74786	-117	45.84048	1803	15	299:10:14	299:10:14:00.000		Croker /Underwood	145	907	110	Alluvium (dry/wet)	. ./90

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SHOT POINT ORDER	ORIGINAL SHOT POINT NUMBER	NEW SHOT POINT NUMBER	LATITUDE		LONGITUDE		ALTITUDE	SHOT TIME ORDER	NOMINAL SHOT TIME jjj:hh:mm:ss	ACTUAL SHOT TIME (CAP BREAK) jjj:hh:mm:ss	COMMENTS	TEAM	TOTAL DEPTH (FT)	SIZE OF EXPLOSIVE (KG)	DEPTH TO TOP OF EXPLOSIVE (FT)	SITE GEOLOGY AND WATER SATURATION (DURING DRILLING/LOADING)	DEPTH TO TOP OF WATER (DURING DRILLING/LOADING)
45	31	8310	34	23.07954	-117	45.67752	2000	7	299:08:44	299:08:44	No strip chart with time code	Croker /Underwood	76	113	72	Hard rock (wet/dry)	70/. .
46	32	8320	34	23.54394	-117	45.12408	1917	19	299:11:42	299:11:41:59.932	Manual fire	VanSchaack /Criley	76	113	72	Hard rock (wet/dry)	55/. .
47	33	8330	34	23.6172	-117	44.46486	1862	14	299:10:12	299:10:11:59.313	Manual fire;10:42 written on strip chart; master clock 3	VanSchaack /Criley	70	113	66	Hard rock (wet)	38/22
48	33A	8331	34	23.66202	-117	43.81578	1855	6	299:08:42	299:08:42:00.018	Manual fire; master clock 3 (type 1)	VanSchaack /Criley	75	113	71	Hard rock (wet)	40
49	34E	8345	34	23.90256	-117	43.59102	1857	18	299:11:40	299:11:40:00.000		Kaderabek /Cartwright	68	23	67	Hard rock (wet)	48
50	34D	8344	34	24.06168	-117	43.4862	1866	13	299:10:10	299:10:10:00.000		Kaderabek /Cartwright	90	408	74	Hard rock (wet)	80
51	34F	8346	34	24.2832	-117	43.50174	1853	5	299:08:40	299:08:40:00.000		Kaderabek /Cartwright	145	998	107	Alluvium?;well cemented; (wet)	90
52	35	8350	34	24.54984	-117	43.05498	1587	17	299:11:38	299:11:38:00.000		McCleam /Farrell	76	227	67	Hard rock (wet)	52
53	35A	8351	34	24.70026	-117	43.04034	1548	12	299:10:08	299:10:08:00.000		McCleam /Farrell	75	227	66	Hard rock (wet)	38
54	36	8360	34	24.96918	-117	43.02246	1511	4	299:08:38	299:08:38:00.000		McCleam /Farrell	101	454	84	Hard rock (wet)	34
55	37	8370	34	25.46838	-117	42.92724	1458	16	299:11:36	299:11:36:00.000		Reneau /Meyer	78	7	78	Hard rock (dry)	
56	38A	8380	34	26.0937	-117	42.76062	1369	11	299:10:06	299:10:06	chart record ok at 299:09:10	Reneau /Meyer	74	113	70	Sandstone (dry)	
57	39	8390	34	26.63202	-117	42.71988	1286	3	299:08:36	299:08:36	No strip chart; test strip chart record ok at 299:07:52	Reneau /Meyer	76; belled	68	75	Sandstone (dry)	
58	40	8400	34	27.3129	-117	42.98766	1221	10	299:10:04	299:10:04:00.000		Laird /Rutledge	136	680	110	Sandstone (dry)	
59	45	8450	34	29.7567	-117	42.23832	1013	2	299:08:34	299:08:34:00.000		Laird /Rutledge	150	680	124	Hard rock? (dry)	
60	50	8500	34	32.52456	-117	40.85724	916	9	299:10:02	299:10:02:00.000		Burdette /Benz	150	907	115	Hard rock? (dry)	
61	63	8630	34	38.76114	-117	36.83808	827	1	299:08:32	299:08:32:00.000		Burdette /Benz	156	907	121	Playa mudstone? (dry)	
62	115	9150	35	3.42408	-117	19.85736	590	8	299:10:00	299:10:00	Tamp sank 20-30 feet in one hole after loading; third hole drilled to compensate	Criley /Whitelaw	132 + 149 + 143	2,722	52 + 89 + 63	Playa mudstone (dry)	

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63	Boron	9990	35	2.41584	-117	40.50384	639	20	299:22:00	299:22:03:59.263	±0.005, calculated assuming 40 m to explosive pattern & 3 km/s local velocity. 40 holes with 600 lbs each; arranged into 5 lines;100 ms delay between each line	Koperwhats		10,886		Evaporite (borate) (dry)	
64	Boron	9991	35	2.41584	-117	40.50384	639	48	300:22:00	300:22:01:43.514	±0.005, calculated assuming 25 m to explosive pattern & 3 km/s local velocity	Koperwhats		10,886		Evaporite (borate)(dry)	
65	Santa Catalina Island	9992	33	18.76052	-117	18.36345	40	65	143:19:00	143:19:00:3.88	±0.06, time checked with RefTeks approximately 300 meters from blast pattern	Michnick		85,195		Catalina schist	

In addition to data acquisition in October 1994, a blast at the south end of Santa Catalina Island was recorded by 19 Refteks on May 23, 1995. Two Refteks at the quarry site were used to infer the origin time and, using internal GPS receivers, the location of the blast. 85,195 kg of ammonium nitrate/diesel-fuel mix was detonated simultaneously in an adit, producing a seismic event with a local magnitude of $M_L 2.97$. Receivers were only deployed in the Los Angeles basin and San Gabreil Valley to record the blast. Unfortunately the blast occurred at noon, a noisy time in the Los Angeles basin. Nevertheless, some signal can be discerned from recorders in the Los Angeles basin.

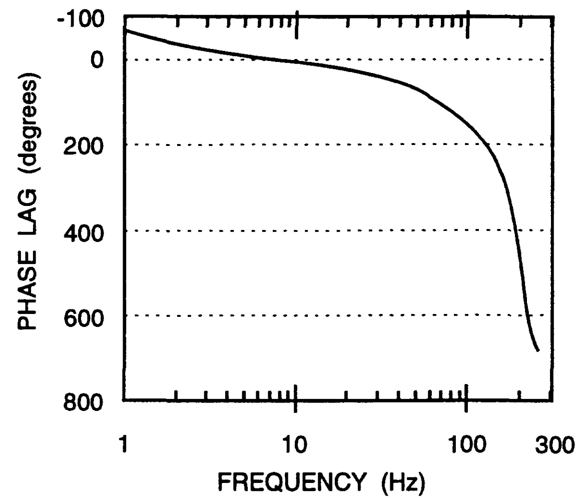
SEISMIC ACQUISITION SYSTEMS

Four different types of seismographs were used to acquire seismic data during LARSE94: GSC PRS's, Stanford SGR III's, RefTeks from IRIS/PASSCAL and other sources, and USGS GEOS (Table 1). A general description of each is given here, but for more detailed descriptions see Asudeh and others (1992) for the GSC PRSs, the SGR II seismic group recorder field system technical manual, by Globe Universal Sciences, Inc., and L-10 geophone specifications, by Mark Products, for the Stanford SGR III's, and Borcherdt and others (1985) for the GEOS.

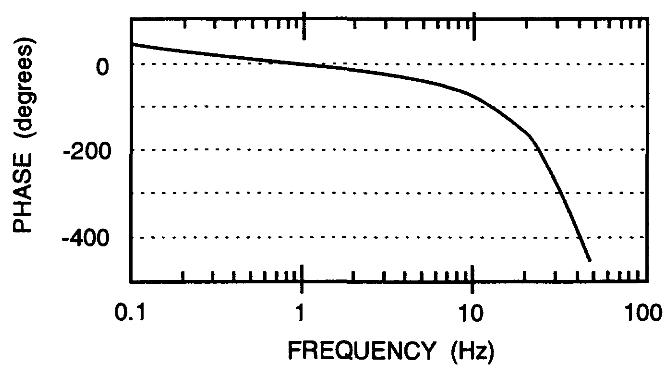
Two models of PRS's were used, the single-channel PRS1 and the three-channel PRS4. Both instruments are designed similarly. Mark Products L4C, 2-Hz vertical component geophones were used with the PRS1 and 3-component L4C, 2-Hz geophones were used with the PRS4. Automatic gain-ranging from 1 to 1024 in binary steps allows a total dynamic range for these instruments of 132 dB. Seismic data are sampled at 120 samples per second (8.33 ms) by a 12-bit A/D converter and stored in memory (DRAM) until the data are transferred ("uploaded") to a PC. Phase and amplitude response curves for the overall system are shown in Figures 5C and 6B, respectively. The amplitude response peaks between 5 and 6 Hz. For each unit, timing is provided by a temperature-compensated oscillator (TCXO) that is synchronized to satellite time during the programming ("downloading") process. After retrieval of the recorders, the clock drift is measured and a clock correction is made assuming a linear drift rate. Most clocks drift less than 20 milliseconds during a 24-hour period. The PRS instruments were designed by the Geological Survey of Canada and built by EDA Instruments Ltd.

The SGR III is a single-channel, digital seismic recorder with a theoretical dynamic range of 156 dB. Data are sampled at 500 samples per second (2 ms) by a 12 bit A/D converter with gain ranging from 0-90 dB in 6 dB steps. The SGR's have been modified to turn on at preset

A



B



C

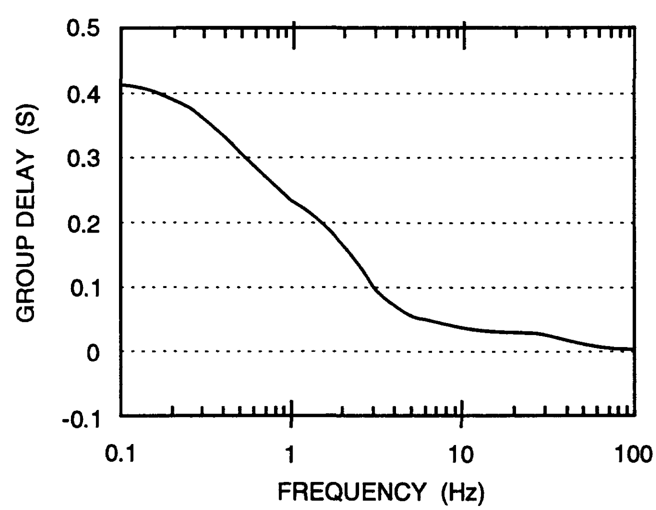
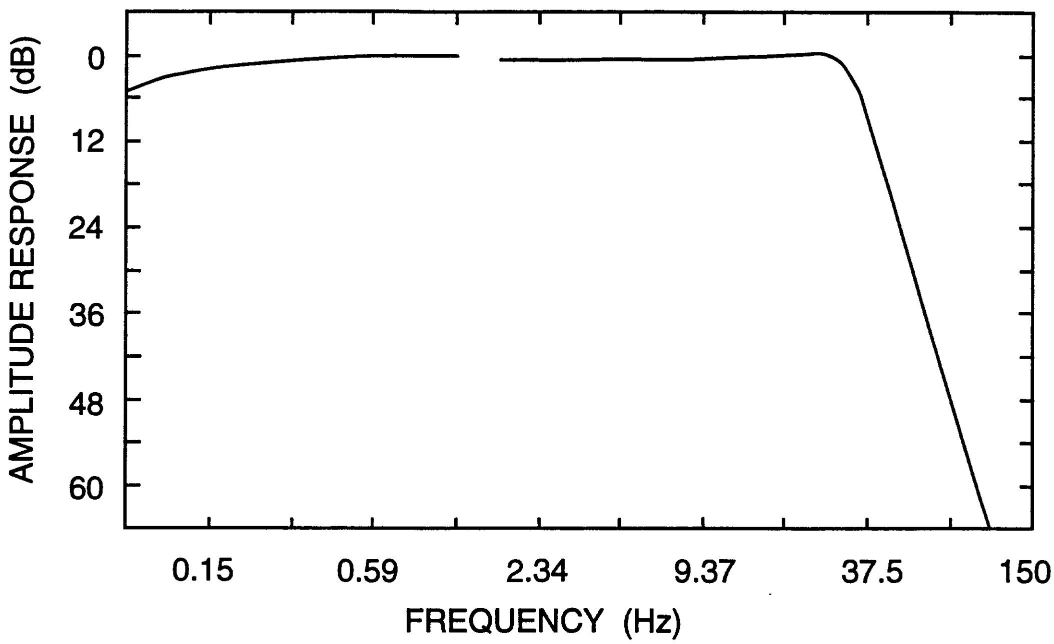
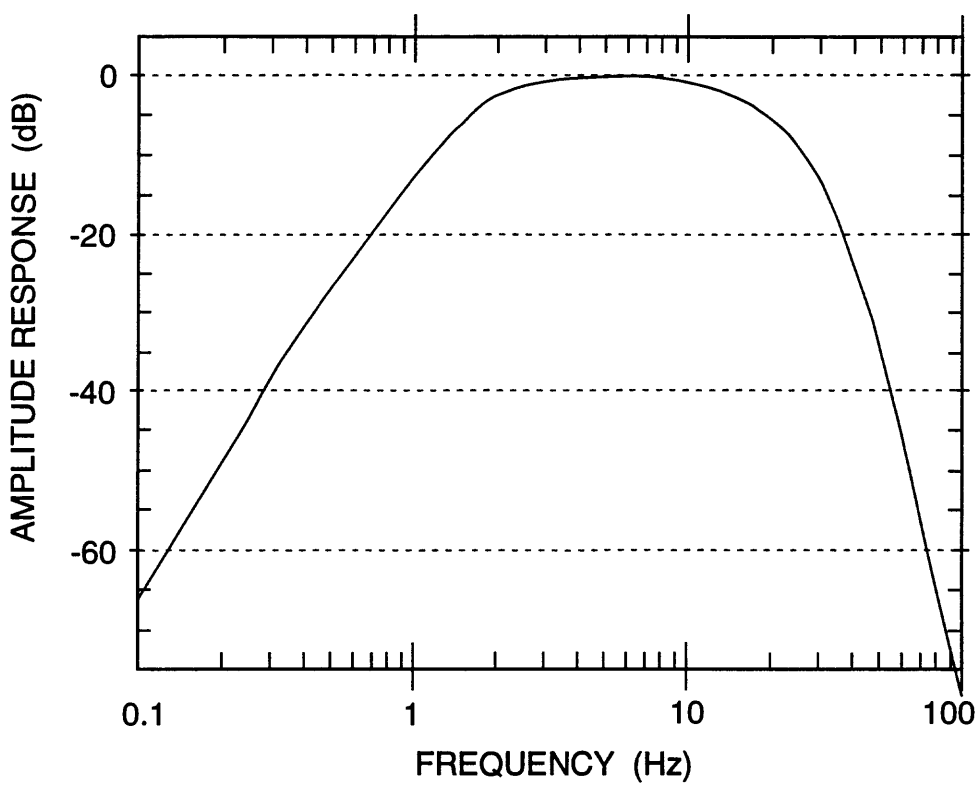


Figure 5. The phase characteristics of A.) SGR B.) GEOS C.) PRS1 with the filters as described in the text.



A



B

Figure 6. Amplitude response curves for A.) GEOS without geophone, B.) PRS1 with a Mark Products L4-C 2-Hz geophone, and C.) SGR with Mark Products L10-B 8-Hz geophone.

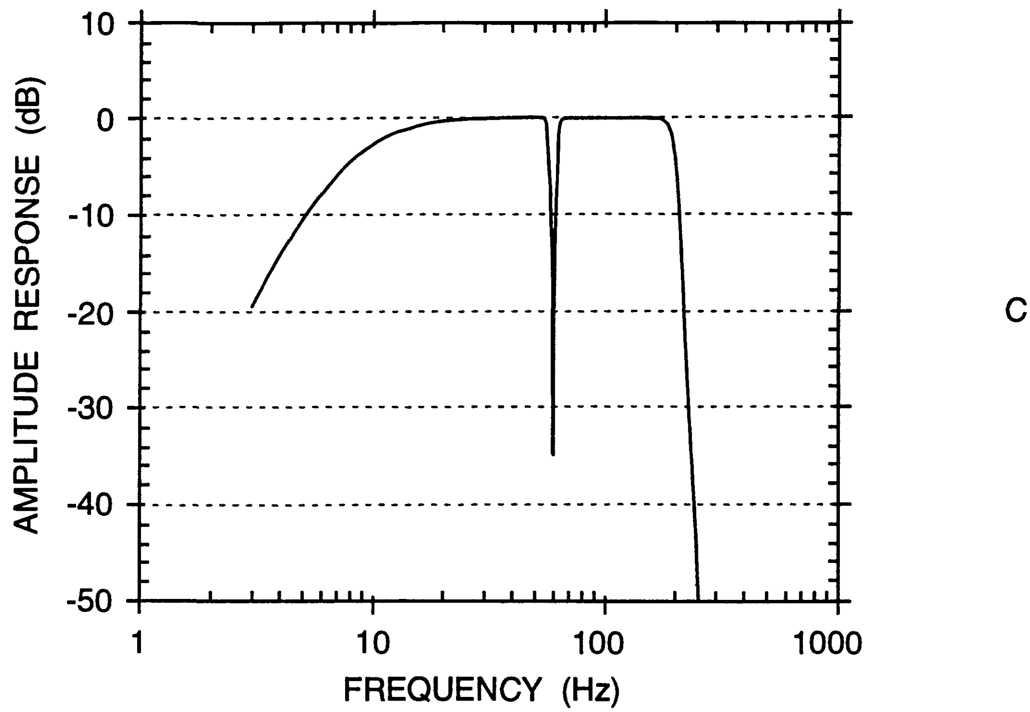


Figure 6C. Amplitude response curve for SGR with Mark Products L10-B 8-Hz geophone.

times instead of using the standard radio turn on. Timing is provided by a TXCO that is synchronized to a USGS master clock prior to deployment. Like the GSC PRS's, most SGR clocks drift less than 20 milliseconds during a 24-hour period. The USGS master clocks drift approximately one millisecond per week and are checked periodically against satellite clocks. The digital data and the clock drift at the time of instrument retrieval are recorded on cartridge tape. The drift rate (assumed linear) is used to calculate a chronometer correction at shot time. For this experiment, the SGR III pre-amplifier was set to 50 mV, the low-cut filter was "out", and the 60-Hz notch filter was "in". Figure 5A shows the phase characteristics of the system associated with these filter settings. Each SGR III was connected to a single string of 6 modified Marks Products L-10B vertical-component geophones (8 Hz) connected in series. The total system response is shown in Figure 6C. The SGR III recorders were designed by Amoco Production Company, built by Globe Universal Sciences, Inc., and modified by the USGS.

The RefTek 72A-06 and Ref-Tek 72A-07 instruments are a digital seismic data acquisition system (DAS) with three-input-channels and a 235 mB data-storage disk. The RefTek 72A-02 and Ref-Tek 72A-08 are DAS's designed similar to the Ref-Tek 72A-06 and Ref-Tek 72A-07 instruments but have 6 input channels. During this experiment, only three of the six channels were used to record data. Timing for all models of RefTeks is provided by an internal voltage controlled oscillator (VCXO). Each instrument was synchronized with a GPS clock when it was deployed and when it was retrieved. Some of the sites had external GPS clocks permanently attached to the instrument while they recorded data. RefTeks are programmable for a range of different sample rates. During this experiment, data were recorded at 250 samples per second (4 ms). The RefTek 72A-06 has 16-bit resolution and produces data at two gains per channel (six-channel output), a fixed low-gain (18 dB) and a variable high-gain (programmable for 0, 18, 30, 42, 54, 66, or 78 dB). The variable-high-gain preamplifier was set to 78 dB during this experiment. The RefTek 72A-07 has 24-bit resolution and outputs data at one of two gains, 1 or 32. During this experiment, the gain of the RefTek 72A-07's was set to 32. The RefTek 72A-02 and RefTek 72A-08 are 6 channel equivalents to the RefTek 72A-06 and RefTek 72A-07, respectively. All RefTeks are amplitude compatible, so that a given ground motion is recorded with the same amplitude on all systems. Ground motion was sensed by Mark Products L-28 4.5-Hz three-component geophones and by Marks Products L-22D 2-Hz three-component geophones. The geophone type was written to the headers of each trace. RefTeks filtered data digitally with a series of digital finite impulse response (FIR) filters before the data were decimated. These filters are zero phase and non-causal.

The General Earthquake Observation System (GEOS) is a six-channel seismic recording system with a dynamic range of 96 dB. The low-pass, anti-aliasing filter is software selectable for corner frequencies of 17, 33, 50, and 100 Hz. During this experiment, only three of the input channels were used, and ground motions were sensed by Marks Products L-22D 2-Hz, three-component geophones. Seismic data were filtered by an anti-aliasing filter with a corner frequency of 33 Hz. Because of low storage capacity, data were sampled at 100 samples per second (10 ms) by a 16-bit A/D converter, and the digital data were written to cartridge tapes. Phase- and amplitude-response curves for the system are shown in Figures 5B and 6A, respectively. The amplitude response curve shown, is for the GEOS recorder only and does not include the geophone. However, since the geophone response is flat at high frequencies and the amplitude of the low frequencies is primarily determined by the corner frequency of the geophone (2-Hz in this case), the response for frequencies below 2-Hz drops off rapidly. Timing is provided for each unit by a TCXO that was synchronized every three hours to WWVB.

DATA PROCESSING

The mix of instruments posed several unique recording problems. The PRS1's and PRS4's have an instrument response designed for lower-frequency refraction/wide-angle reflection recording (2-30 Hz), whereas the SGR and RefTek recorders are designed for higher-frequency reflection recording. Because of the limited data storage of the GEOS, they were programmed to record data at lower frequencies and were more suited to recording refraction/wide-angle reflection data. Although all of the playback systems produce SEG-Y data tapes, the header files and sample rates are different for each system. Merging the data required extensive processing (Fig. 7).

Processing of the data was undertaken at the U.S. Geological Survey on a SUN SPARC 2 computer using the Advance Products ProMAX processing system. Locations for shot points and recording sites were entered into the database. The geoid used for latitude, longitude, and elevation was WGS84 and coordinates were transformed to UTM coordinates (zone 11). Two sites were chosen to collocate different instrument types. The collocated data and the quarry blast on Santa Catalina Island were processed separately from the shot-gather data (see below). Processing of the shot gathers proceeded in 3 stages (Figure 7). In the first stage, major trace-header variables were established for each recorder type (including shot and receiver parameters), timing corrections (due to recorder clock drift in the field) were determined, and the data were resampled to 250 samples per second (4-ms sampling rate). In the second stage, data from all of the recorder types were merged and sorted into shot order. For the collocation sites, only data from one recorder type was retained. Additional trace-header variables were assigned, and all shots were plotted. Using these plots as a reference, additional timing corrections were made, and corrections were made for polarity problems and errors resulting from incorrect field notes (e.g. wrong location). Finally, in stage III, all header parameters were written to the database, and the shot-ordered data were written in SEG-Y format to tape.

The Santa Catalina Island quarry blast, shot 65, was recorded 7 months after the main experiment and is treated as a separate deployment. Data were sampled at 125 samples per second (8-ms sampling rate) for 80 seconds and in stage II, a new set of geographically ordered site numbers, SITE INDEX (1-19, south to north) and CHANNEL numbers (3 per station, 1-57, south to north) were assigned.

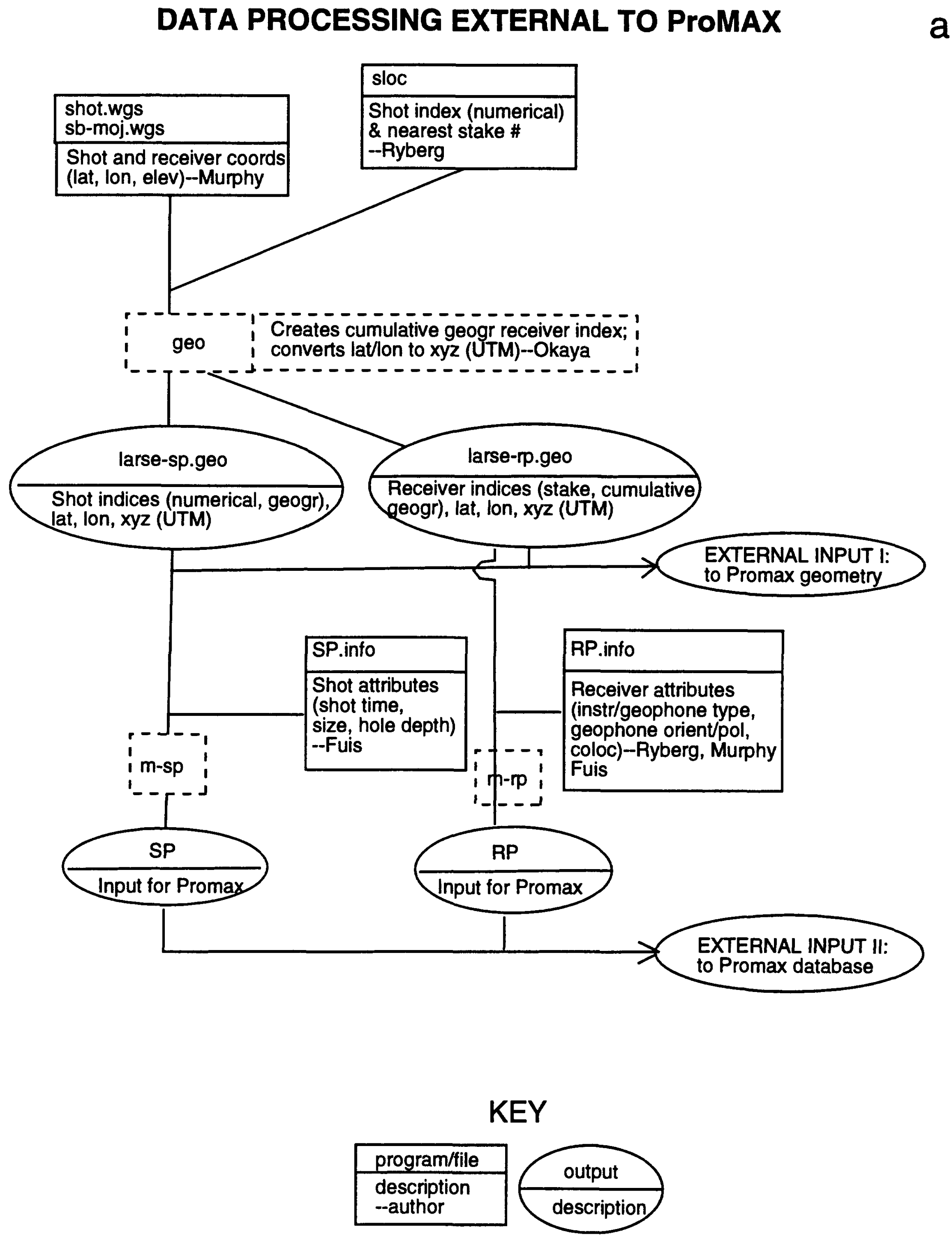
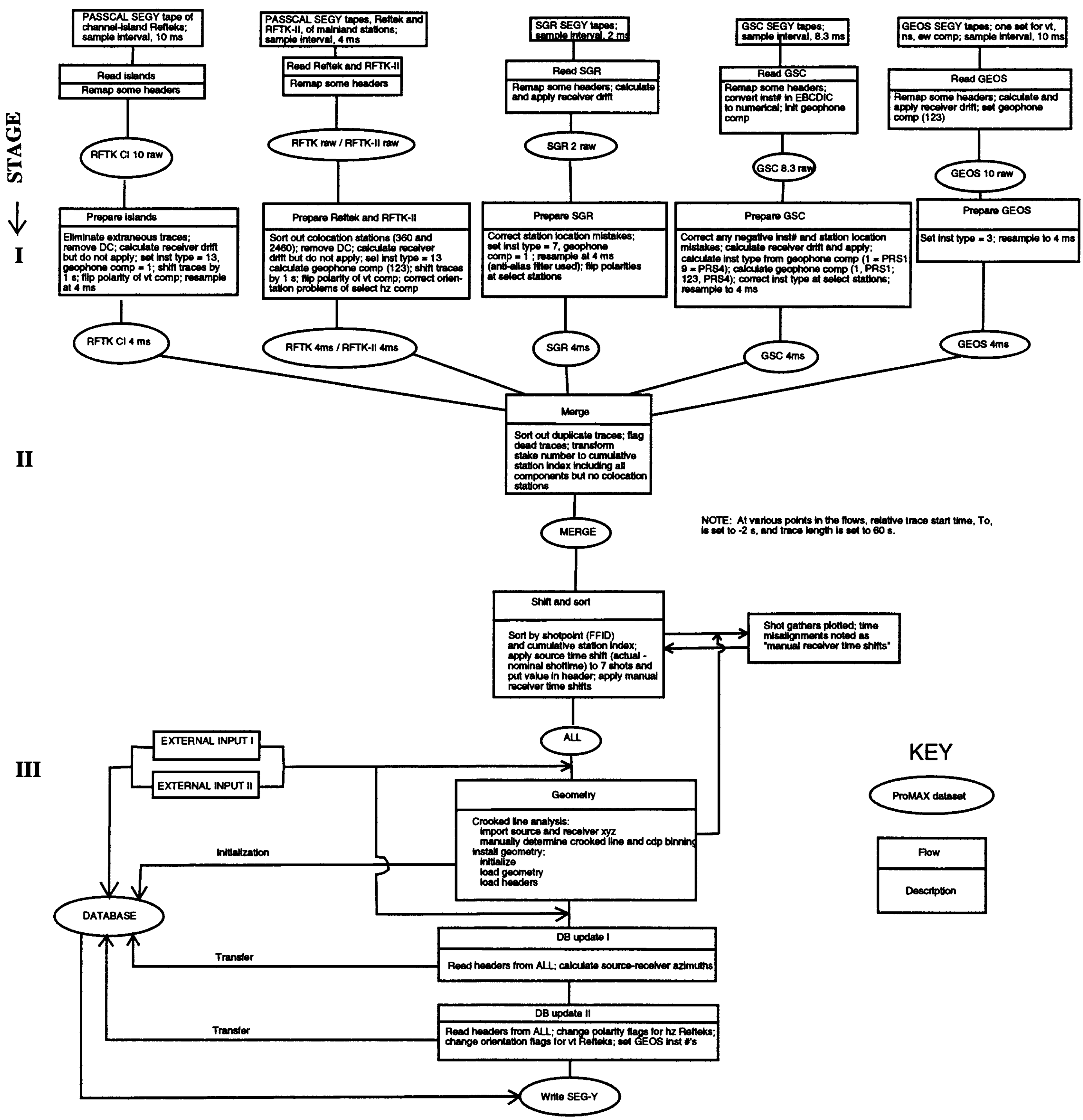
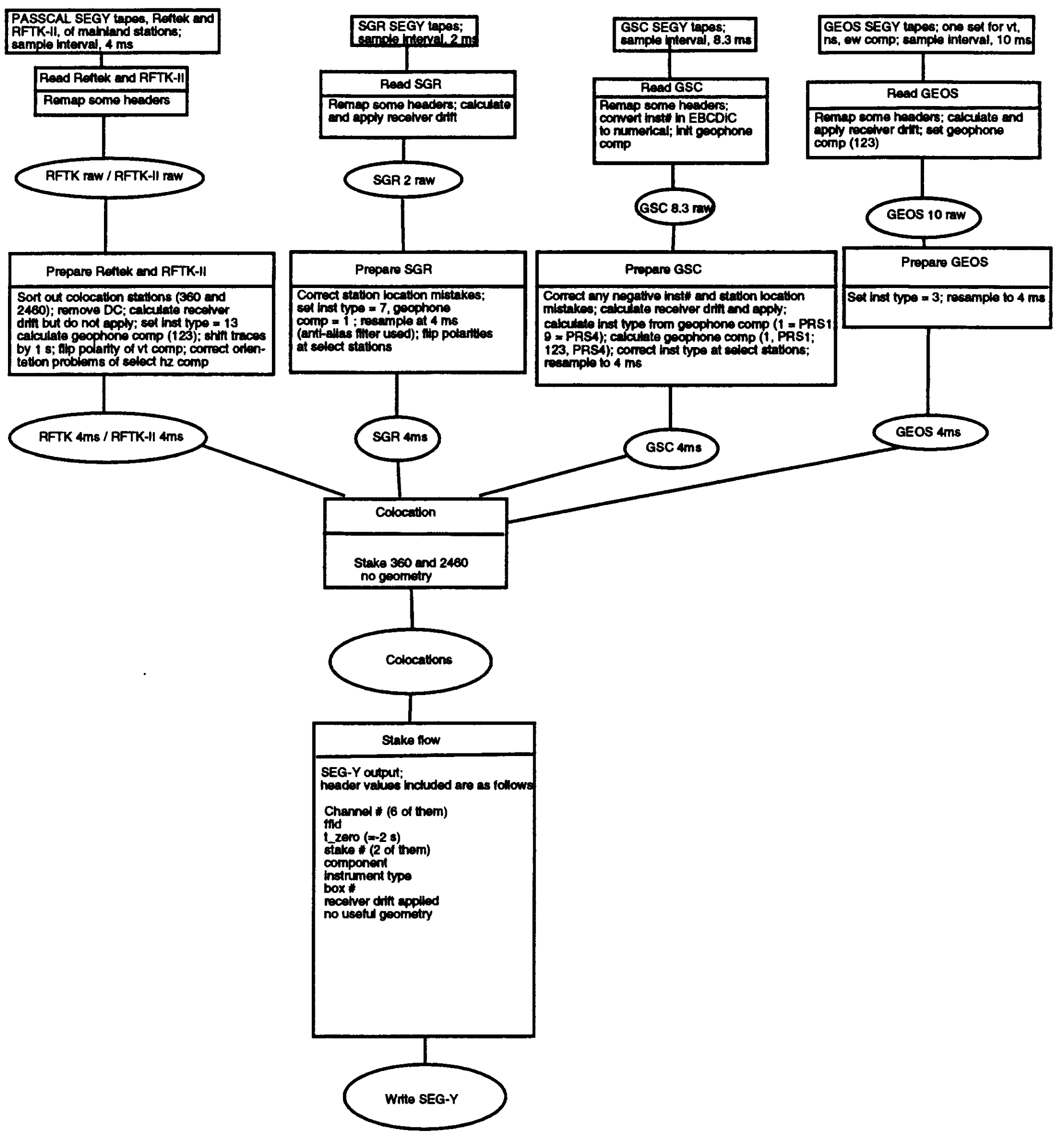


Figure 7. Flow diagrams for LARSE94 data processing. (a) Processing external to Promax; (b) ProMAX processing--main data set; (c) ProMAX processing--colocation sites

ProMAX DATA PROCESSING FLOWS--MAIN DATA SET b



ProMAX DATA PROCESSING FLOWS--COLOCATION SITES C



Stage I

Each of the different instrument systems produced raw SEG-Y tapes with different predefined trace headers. Certain key variables, including shotpoint index, the shotpoint name or number, the station name or number, and geophone component number, were used to define a consistent set of major trace headers: SHOT (shot-gather index, from 1-64, assigned by geographic order, south to north; bytes 9-12), SP (shotpoint name or field number; bytes 17-20), STAKE (station name or number--field stake number), and COMPONENT (north-south, etc.; bytes 179-180) (see TABLE 5). In addition, INSTRUMENT TYPE (bytes 215-216) and GEOPHONE TYPE trace header (bytes 221-222) were defined (TABLE 5).

Stage II

During the second stage, the reformatted data from each instrument system were merged and sorted into shot gathers. At this stage, geometry, timing information, and other miscellaneous information were loaded into the headers. A geographically ordered site number was defined, SITE INDEX (1-664, south to north; bytes 169-170), as well as a cumulative station-trace index, CHANNEL (3 per station, 1-1992, south to north; bytes 13-16). For CHANNEL, sites that had vertical-component instruments only, have two unused channels associated with them. Receiver timing corrections were applied and shot gathers were plotted. Each shot gather was carefully examined for apparent timing problems. In general, only timing problems exceeding 50 ms were noted for correction. The RefTek data contributed the great majority of timing problems. Nearly 20 percent of the Reftek seismograms showed misalignment when compared with seismograms from neighboring recorders (generally, SGR's). The amount of misalignment was measured and these receiver time drifts were subtracted and recorded in the headers. (The origin of the RefTek problem is a faulty program for logging GPS time information and calculating drift). In stage II, TRACEID (bytes 29-30) was set to 1 (seismic data), as is required by SEG-Y format and MST (bytes 181-184) was set to 0. A complete description of the header values is given in Table 5. They are compatible with the IASPEI SEG-Y format.

Stage III

In the third and final stage of processing, the final header parameters were written to the database, and the shot-ordered data were written in SEG-Y format to six 8-mm tapes. Each tape has an EBCDIC reel header. The data collected in 1994 were written and plotted as shot gathers in geographic order from south to north with a sample rate of 4 msec and a trace length of 60 seconds. The Santa Catalina Island quarry blast data, collected in 1995, were written as a shot gather, also in geographic order from south to north, but with a sample rate of 8 msec and a trace length of 80 seconds. Tape 1 contains shot indices 1-22, tape 2 contains shots indices 23-44, tape 3 contains shot indices 45-64, tape 4 contains shot index 65, a quarry blast on Santa Catalina Island, and tapes 5 and 6 contain the collocation shot gathers discussed below.

Collocation sites

The collocation sites and the type of instrument LOCATED at these sites are listed in TABLE 4. These data were processed and sorted into shot gathers for each of the two sites. The data were corrected for shot drifts but no other error checking was done. Traces have header values consistent with the rest of the 1994 data set. For each shot, a separate channel was assigned for every trace at a site.

TABLE 4

COLLOCATION SEISMOGRAPHS

Collocation Site	Seismograph types present	Tape
Stake 2460	3,7,9	5
Stake 360	1,13	6

Seismograph types
1=PRS1
3=GEOS
7=SGR
9=PRS4
13=RefTek

TABLE 5

ARCHIVE DATA TAPE FORMAT

Archive data tapes are written in standard SEG-Y 32-bit IBM floating point format (Barry et al., 1975). 8 mm tapes have been used for distribution; each tape has the standard SEG-Y EBCDIC reel header. Minor modifications to the trace headers have been made to allow the archived data to be adequately described. A list of the header fields used for these data is shown below.

Trace Identification Header (total of 240 bytes)

---

size	bytes	LARSE-Explosion
long	1- 4	*L0: Sequence number within line*
long	5- 8	*L0: Sequence number within reel*
long	9- 12	**L1: Shot gather index number: [1-64; geographic order; S to N]**
long	13- 16	**L1: Shot gather trace number: [1-1992; 3 traces/stake (or site): vertical component plus 2 horizontal components or 2 zero traces; cumulative from S to N; no colocation sites]**
long	17- 20	L1: SP name (e.g., 8170)
long	21- 24	CDP number (empty)
long	25- 28	CDP trace number (empty)
short	29- 30	L0: Trace ID code (SET = 1)
short	31- 32	No. vertically summed traces (empty)
short	33- 34	No. horz summed traces (empty)
short	35- 36	1 = production, 2 = test (SET = 1)
long	37- 40	L1: Source-receiver offset (signed)
long	41- 44	L1: Receiver elevation
long	45- 48	L1: Source elevation
long	49- 52	L1: Source depth: (center of explosive source)
long	53- 56	Datum elevation at receiver (empty)
long	57- 60	Datum elevation at source (empty)
long	61- 64	Water depth at source (empty)
long	65- 68	Water depth at receiver (empty)
short	69- 70	L0: should be (SET = 1)
short	71- 72	L0: (SET = -10)
long	73- 76	L1: Source long deci-sec of arc (/36000.)
long	77- 80	L1: Source lat deci-sec of arc (/36000.)

long	81- 84	L1: Receiver long deci-sec of arc (/36000.)
long	85- 88	L1: Receiver lat deci-sec of arc (/36000.)
short	89- 90	L1: Coordinate units (SET = 2 = DEGREES)
short	91- 92	Weathering velocity (empty)
short	93- 94	Sub-weathering vel. (empty)
short	95- 96	L2: Polarity flag: 0--data has NOT been modified; the convention indicated in 111 applies 1--data has NOT been modified; the convention indicated in 111 does not apply -1--data HAS been modified; the convention indicated in 111 applies
short	97- 98	L2: Orientation flag: (same description as for polarity flag)
short	99-100	L1: Source static (msec) (NOT USED)
short	101-102	L1: Receiver static (msec) (NOT USED)
short	103-104	L1: Total static applied (msec) (NOT USED)
short	105-106	L2: Manual time shift applied ("hand static")
short	107-108	L2: Actual - nominal shot time (msec)
short	109-110	L1: Relative time of first sample (msec): T_O = -2000)
short	111-112	L2: Polarity convention (SET = 1): The convention used is POSITIVE DEFLECTION = GROUND UP, NORTH, OR EAST
short	113-114	L2: Orientation convention: Channel 1 (vertical component) (SET = 0) Channels 2 and 3 (horizontal components): 0--North arrow on geophone points North 1--North arrow on geophone points West 2--North arrow on geophone points East In the last two cases, changes to the data include interchange of channels and appropriate polarity changes. In the case where the North arrow on the geophone points South, a polarity change is made and indicated under the polarity flag. 99--unknown orientation
short	115-116	L1: number Samples if <2^15; else=32767 (see 229-232)
short	117-118	L1: Sampling interval in microsec
short	119-120	Gain type (empty)
short	121-122	L1: Instrument gain constant (NOT USED)
short	123-124	instrument inital gain in dB (empty)
long	125-128	M4: UTM source X
long	129-132	M4: UTM source Y
long	133-136	M4: UTM receiver X

long	137-140	M4: UTM receiver Y
short	141-142	L2: Colocation site (0=N; 1=Y) (See tape 2 for data from all colocated intruments. Only data from one instrument is shown in tape 1)
short	143-144	alias filter slope (empty)
short	145-146	notch filter frequency (empty)
short	147-148	notch filter slope (empty)
short	149-150	low-cutoff frequency (empty)
short	151-152	L2: Deployment number (shot night: 1,2,3)
short	153-154	Source line (empty)
short	155-156	L1: Instrument channel number (NOT USED)
short	157-158	L1: Time of first sample year
short	159-160	L1: Time of first sample day
short	161-162	L1: Time of first sample hour
short	163-164	L1: Time of first sample minute
short	165-166	L1: Time of first sample sec
short	167-168	L1: Time code [GMT=2]
short	169-170	L2: Site index (1-664; S to N)
short	171-172	L2: Site index w/ colocated inst. (NOT USED)
short	173-174	M0: PASSCAL: Field stake (or site) number
short	175-176	[empty]
short	177-178	[empty]
short	179-180	L2: Component (Z=1, N-S=2, E-W=3)
long	181-184	I: Microsec trace start time
short	185-186	I: Charge size (kg) or airgun size (cu in)
short	187-188	I: Shot/trigger time - year
short	189-190	I: Shot/trigger time- Julian day
short	191-192	I: Shot/trigger time - hour
short	193-194	I: Shot/trigger time - minute
short	195-196	I: Shot/trigger time - second
long	197-200	I: Shot/trigger time - microsec
long	201-204	I: Override for sample interval (SET = 0)
short	205-206	I: Azimuth of sensor orient axis (NOT USED)
short	207-208	I: Geophone inclination (NOT USED)
long	209-212	I: LMO static (x/v) (ms) (NOT USED)
short	213-214	I: LMO flag: (0=Y, 1=N) (SET = 1)
short	215-216	I: Instrument type: 1--PRS1 3--GEOS 7--SGR 9--PRS4 13--Reftek (all types included)
short	217-218	I: correction to be applied: (SET=0)
short	219-220	I: Azimuth of source-receiver (min of arc)

short 221-222 Geophone type:

1--L28 (PASSCAL)(4.5 Hz)
2--L22 (2 Hz)
3--L10B (8 Hz)
4--L4 1 Hz
5--L4 2 Hz
6--FBA
7--TDC-10 (4.5 Hz)
8--L28 (GSC)
9--LRS1033 (4.5 HZ)
99--unknown

short 223-224 Geophone number (NOT USED)
short 225-226 Inst. ID number
short 227-228 (MUST BE EMPTY)
long 229-232 Number of samples if > 2^15 (see 115-116)
long 233-236 M2: Reftek amplitude bias removed (NOT USED)
short 237-238 M1: Receiver clock drift removed (Negative means the trace was shifted (i.e., moved) to earlier time)
short 239-240 blank

L0: needed for SEGY format
L1: experiment description
L2: overrides definition

Italicized type = SEGY standard def. that is USED
Bold type = OVERWRITE of SEGY standard def.
Regular type = SEGY standard def. that is NOT USED

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APPENDIX A

RECORD SECTIONS

The shot gathers presented below were plotted as follows. Reducing velocity is 6 km/s. Not all traces are represented; we have decimated the traces through the San Gabriel Mountains. Trace wiggles are plotted and positive swings are filled. Traces are plotted from southwest (left) to northeast (right).

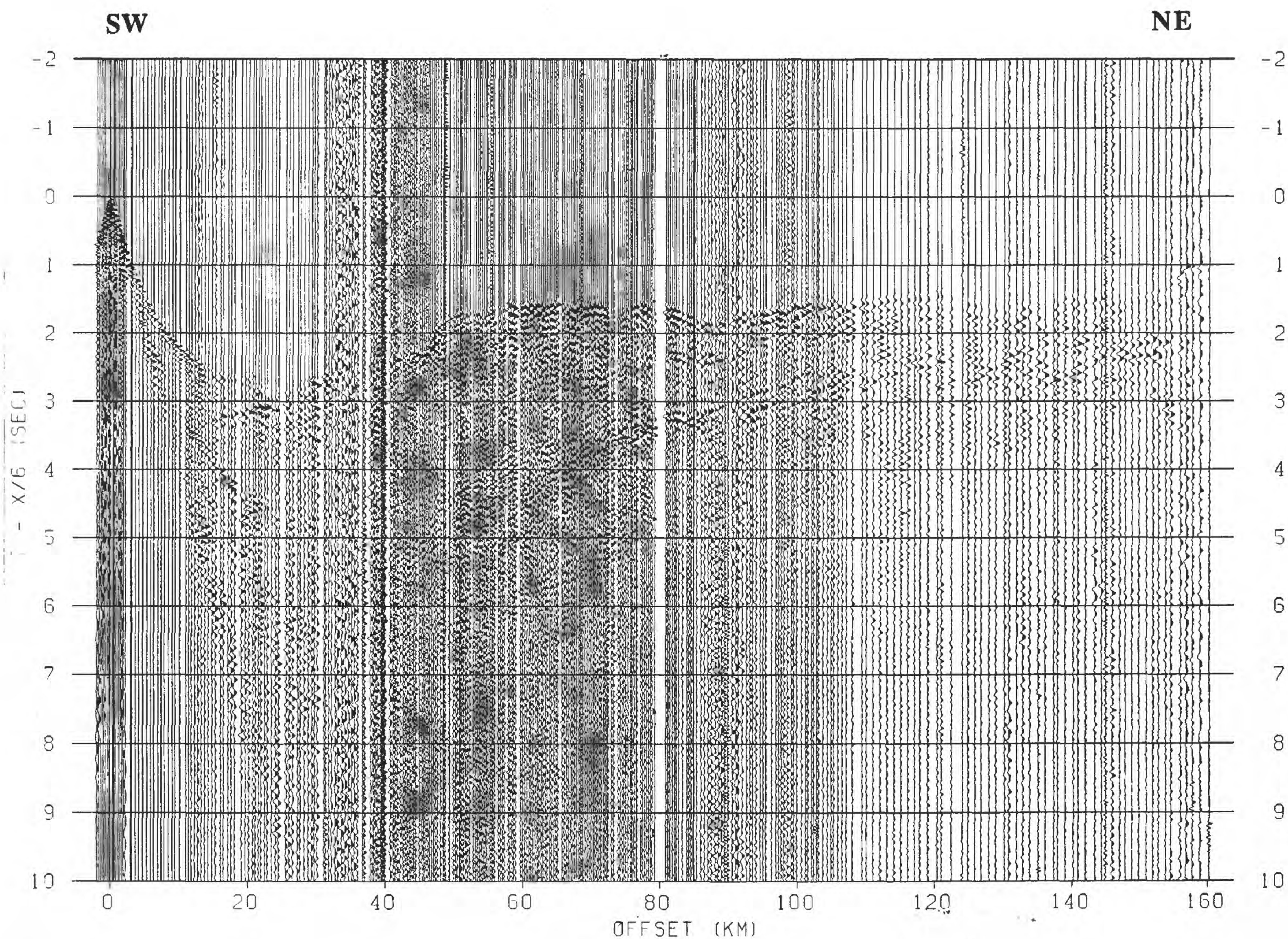

Figure 8. Shot 1 Shotpoint 9450

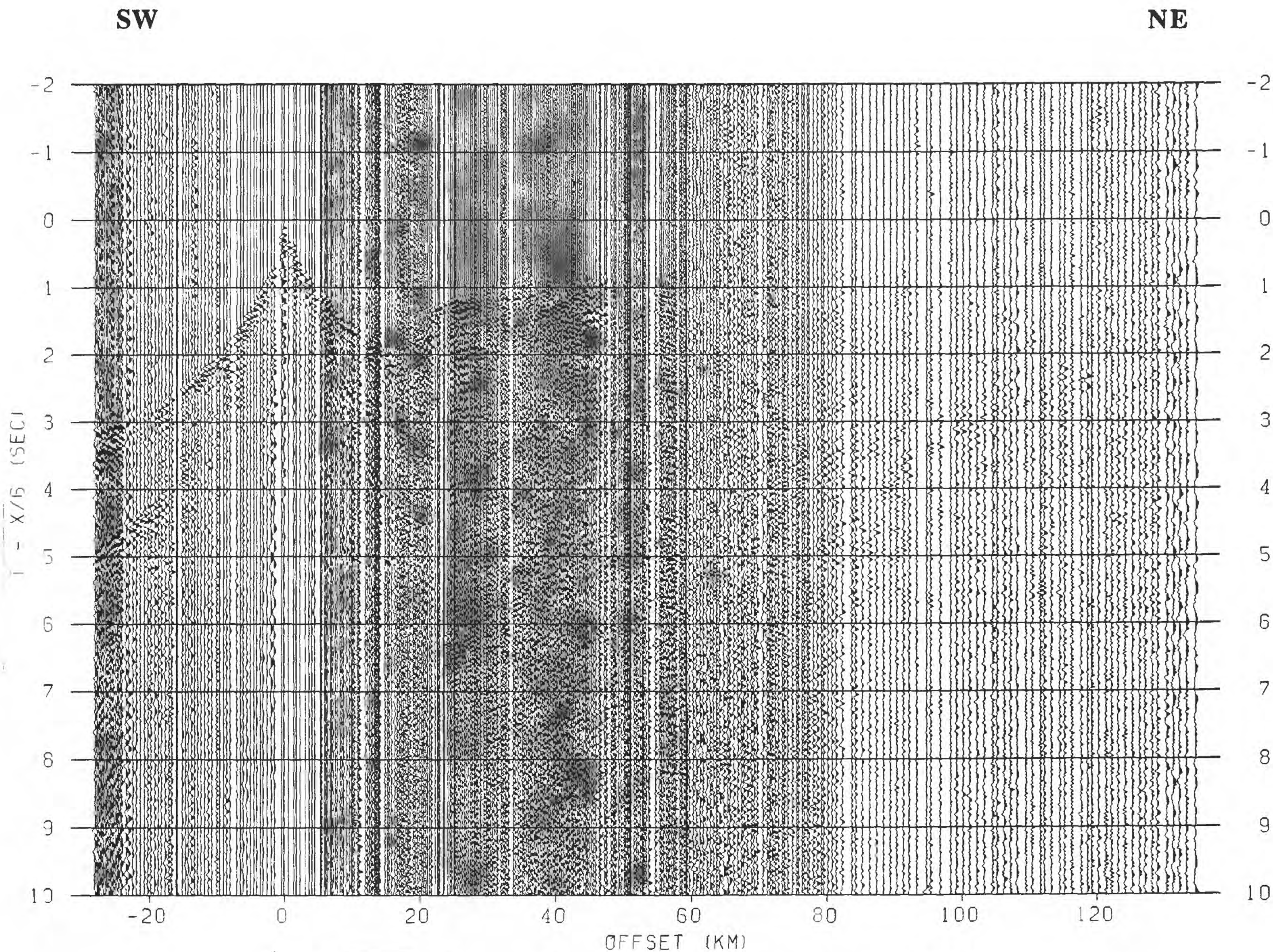

Figure 9. Shot 2 Shotpoint 9170

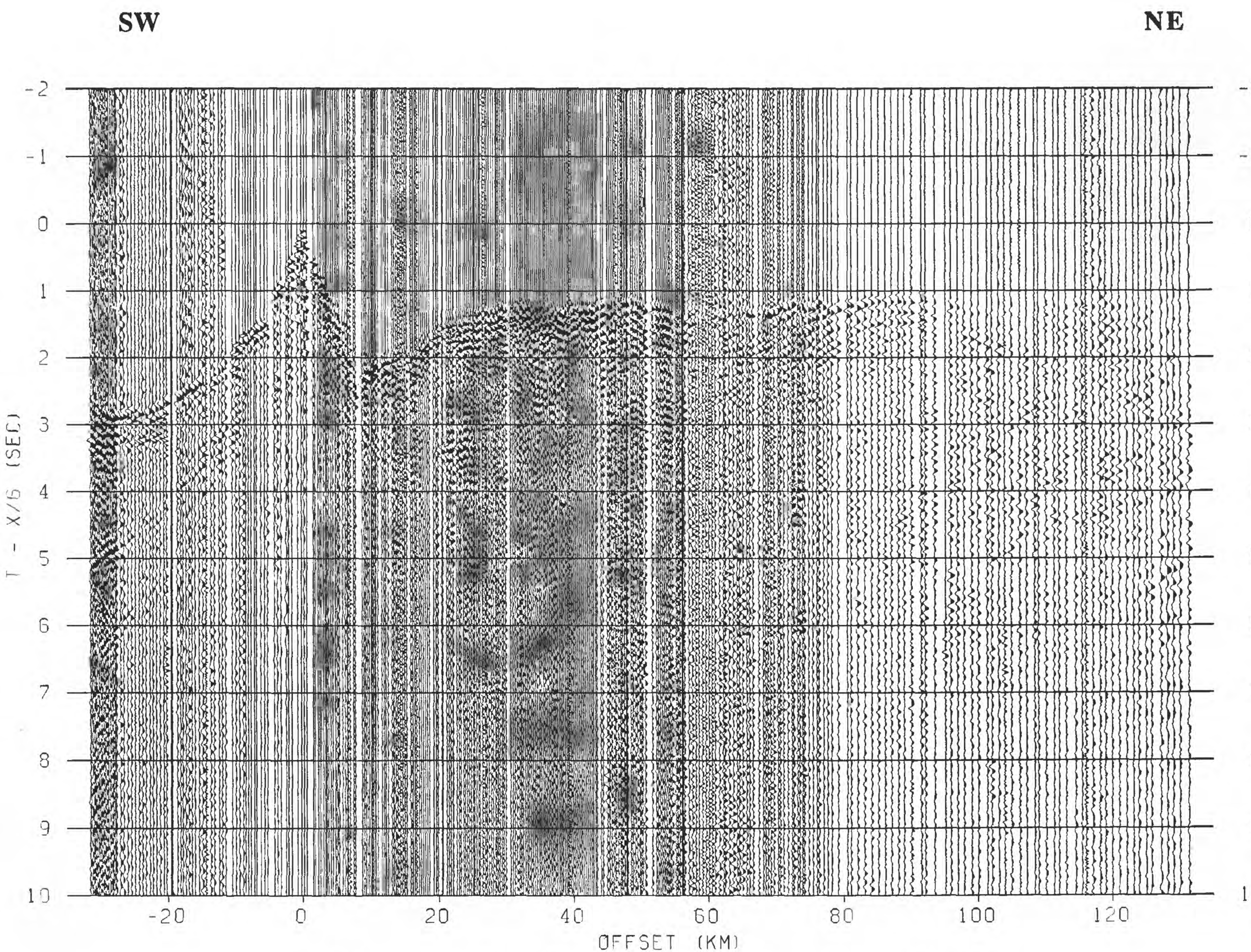

Figure 10. Shot 3 Shotpoint 9160

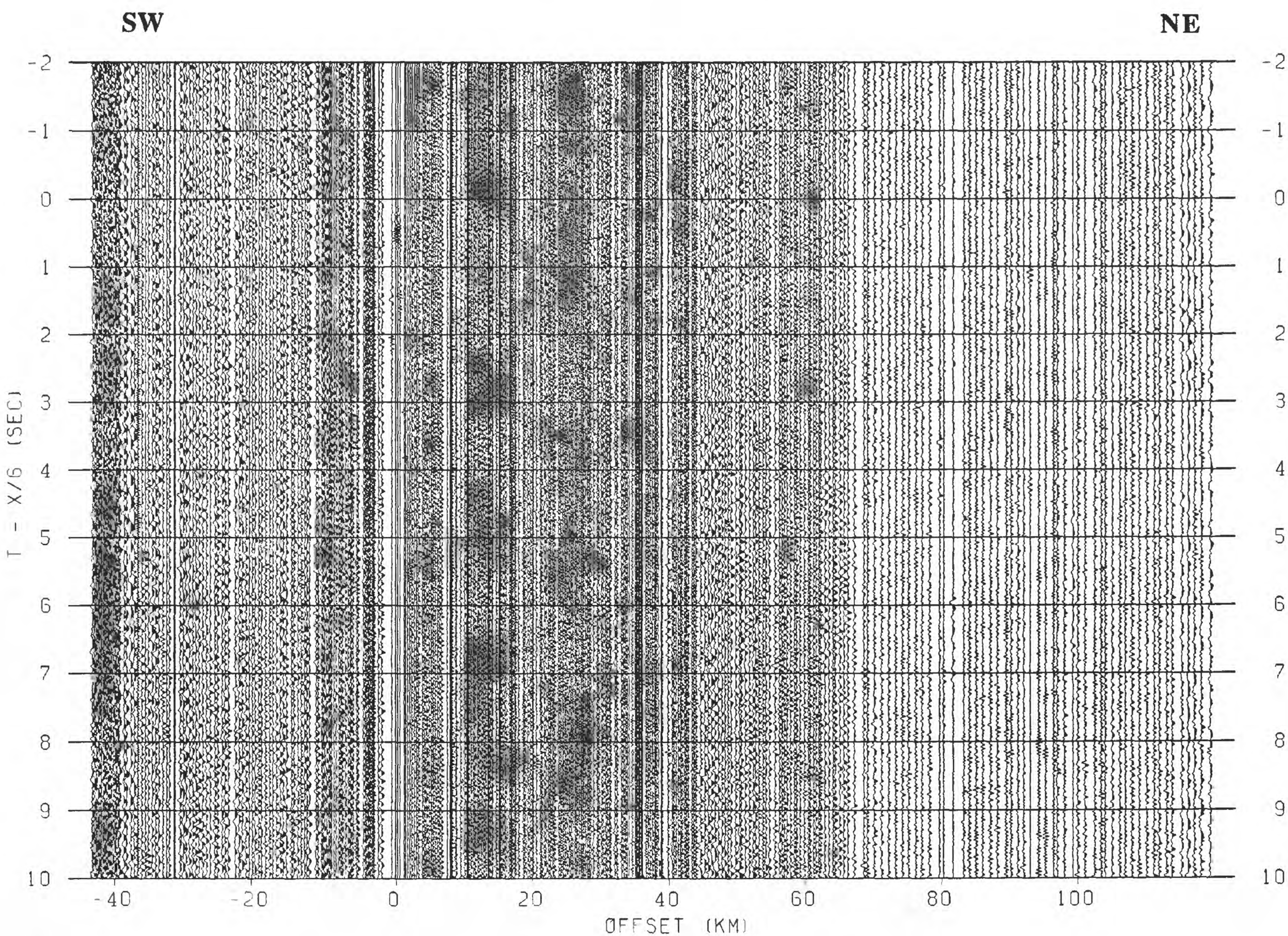

Figure 11. Shot 4 Shotpoint 9040

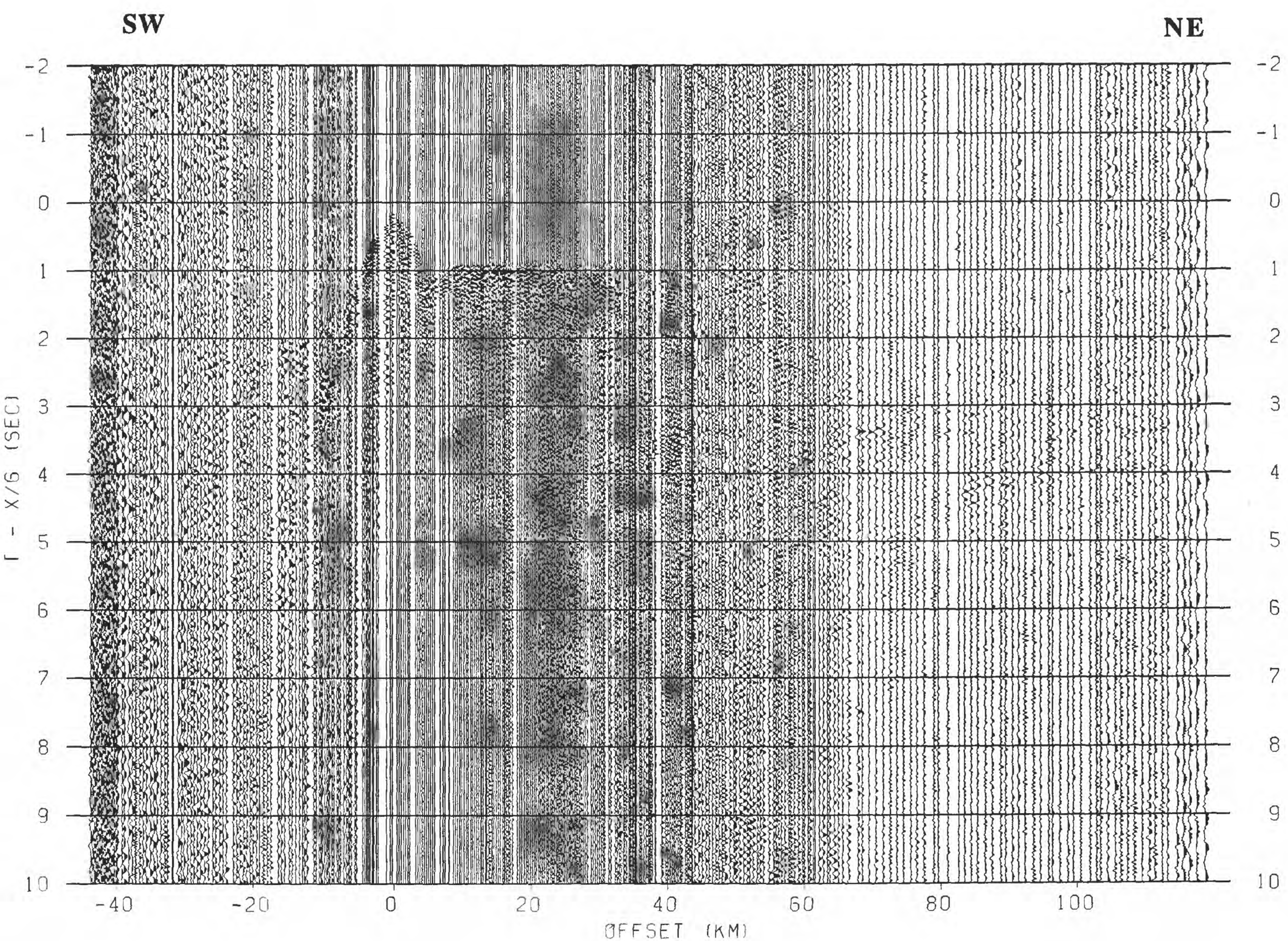

Figure 12. Shot 5 Shotpoint 9030

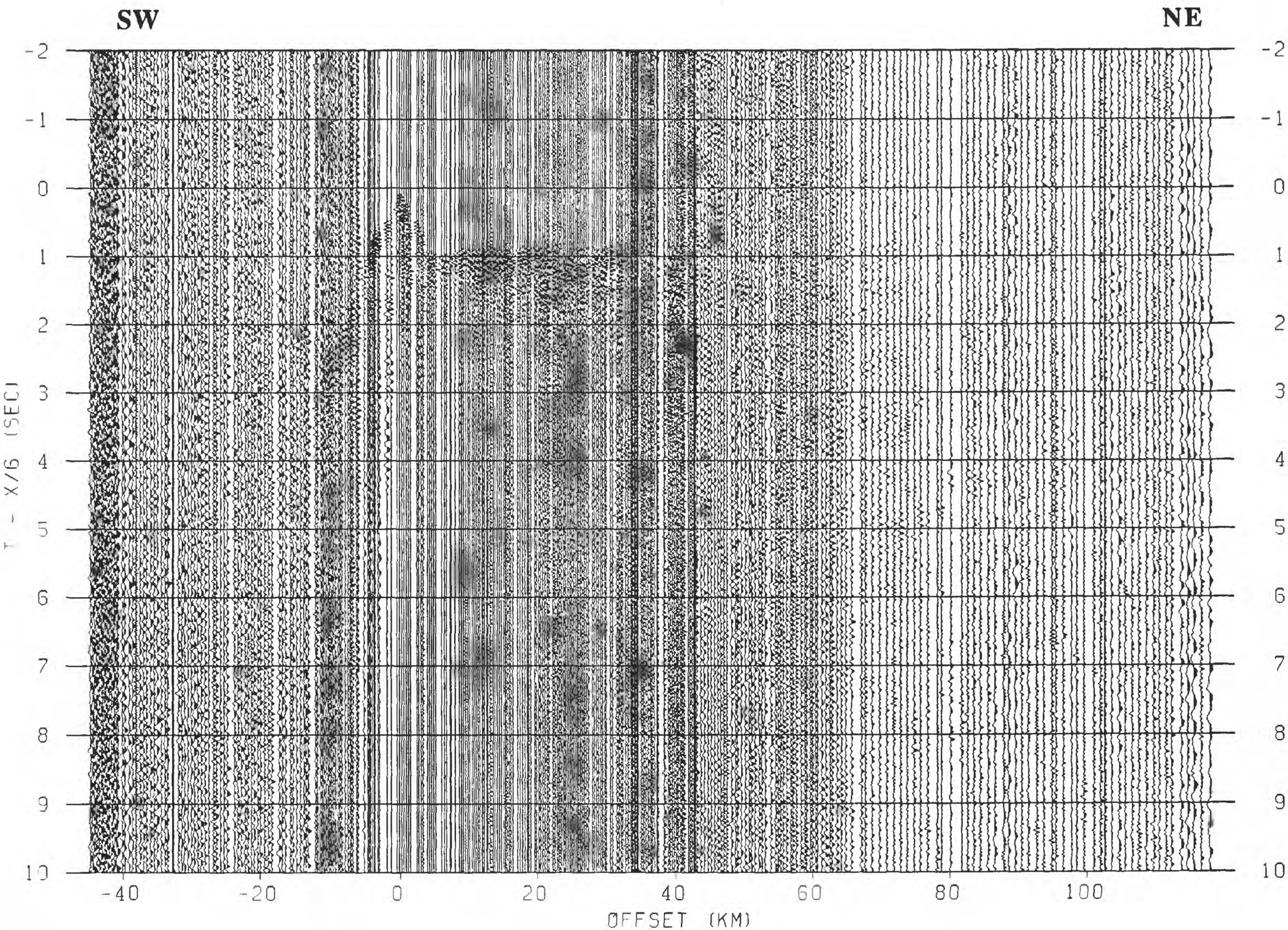

Figure 13. Shot 6 Shotpoint 9021

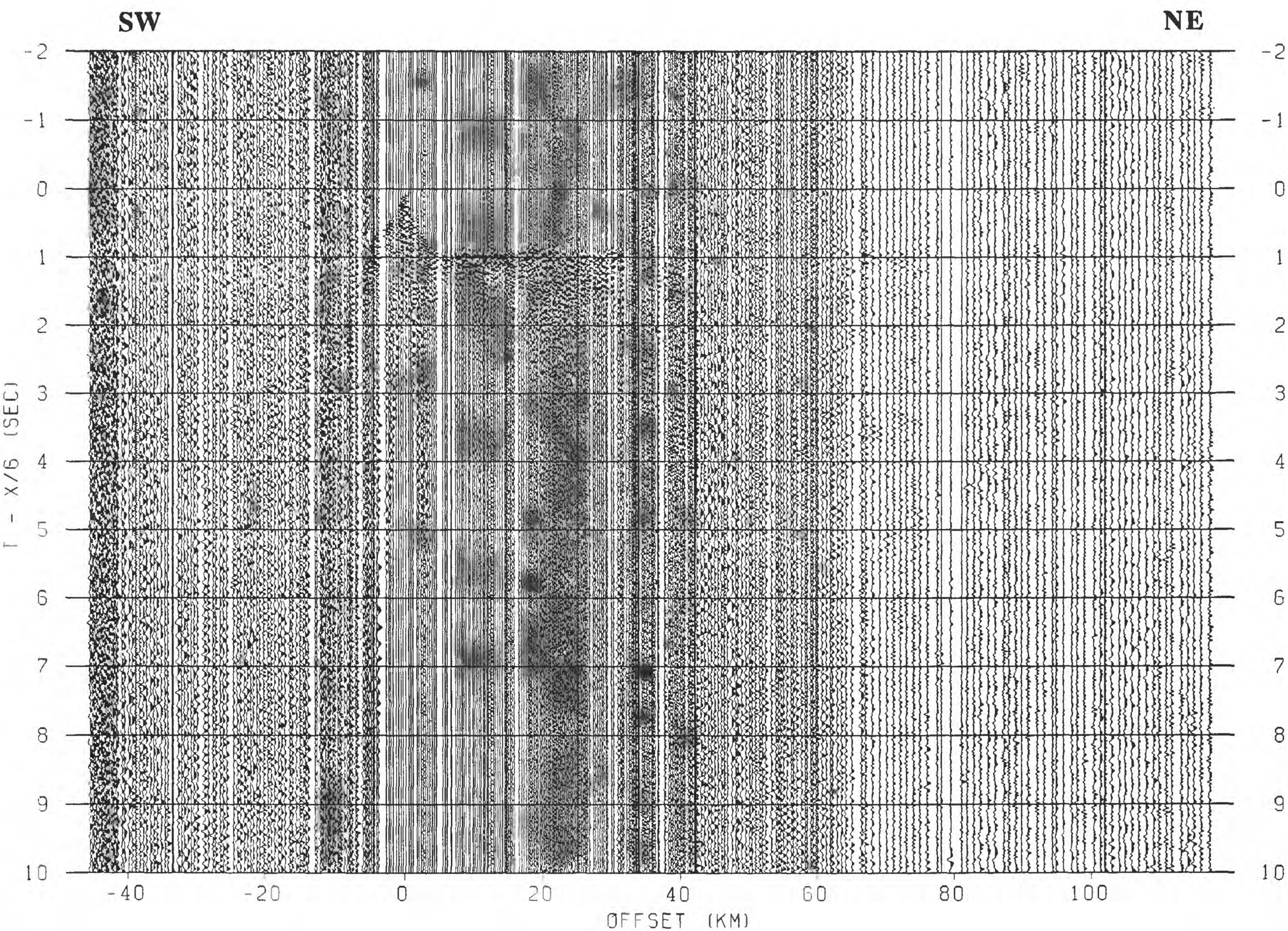

Figure 14. Shot 7 Shotpoint 9023

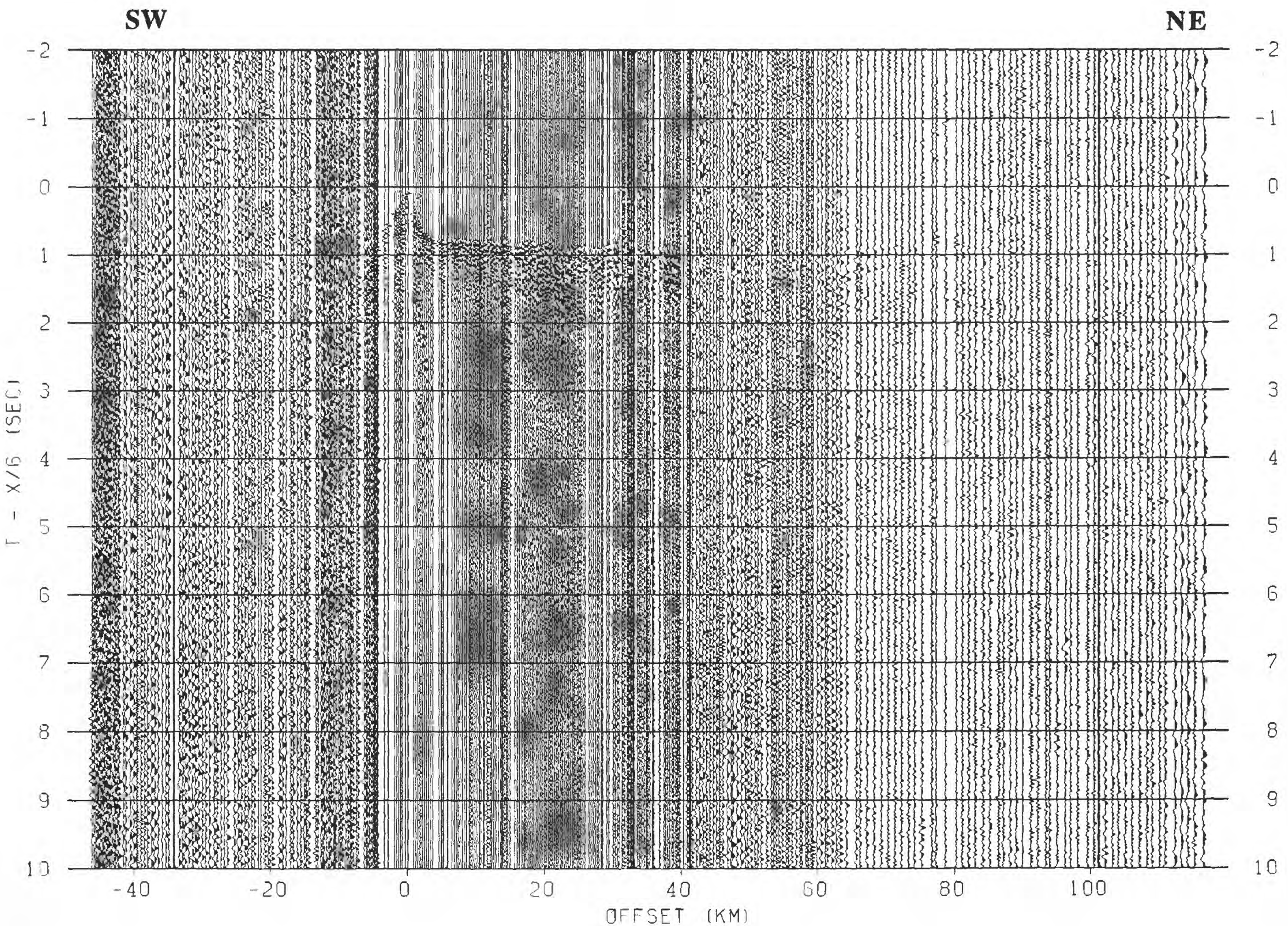

Figure 15. Shot 8 Shotpoint 9010

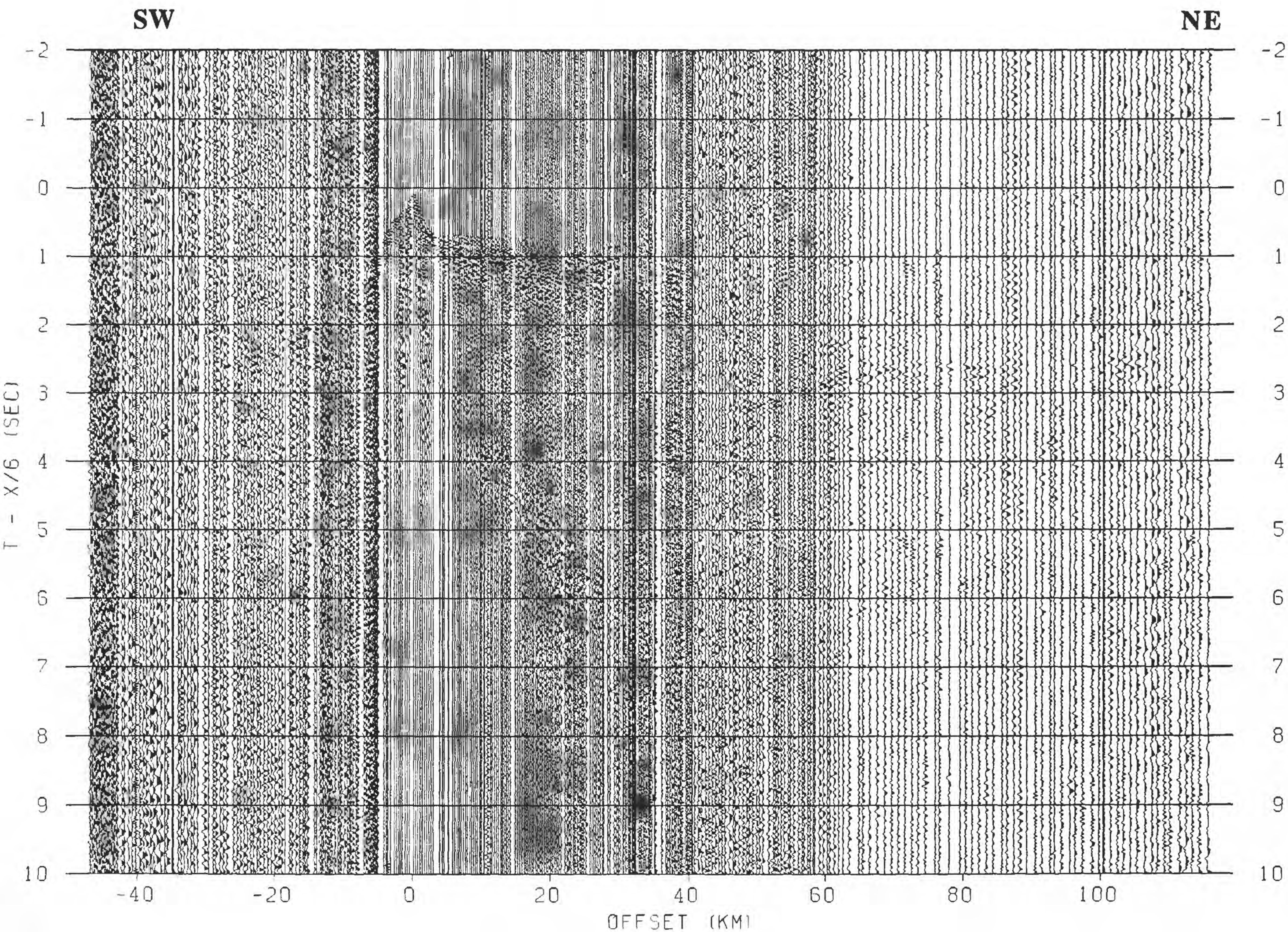

Figure 16. Shot 9 Shotpoint 9000

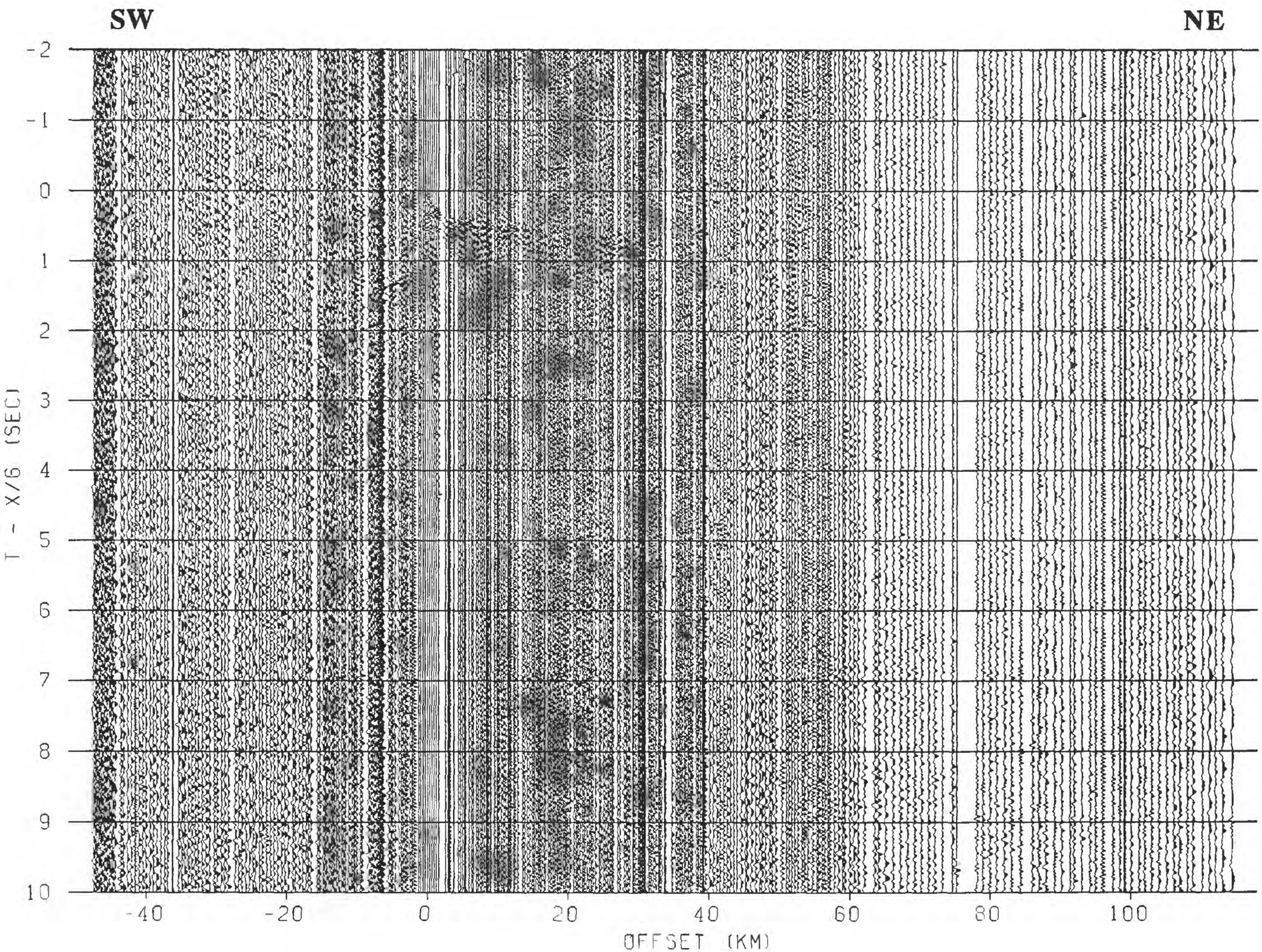

Figure 17. Shot 10 Shotpoint 8010

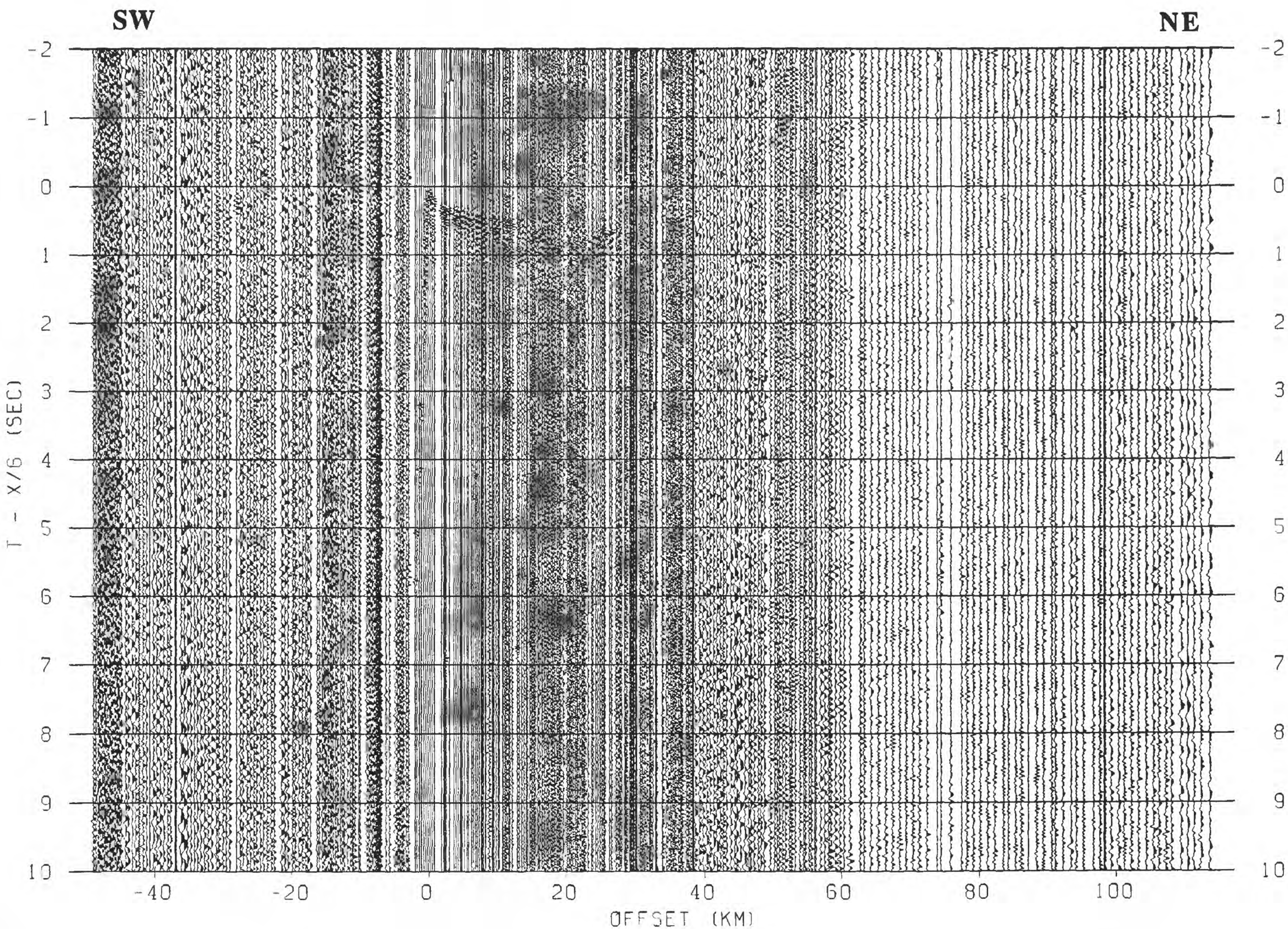

Figure 18. Shot 11 Shotpoint 8020

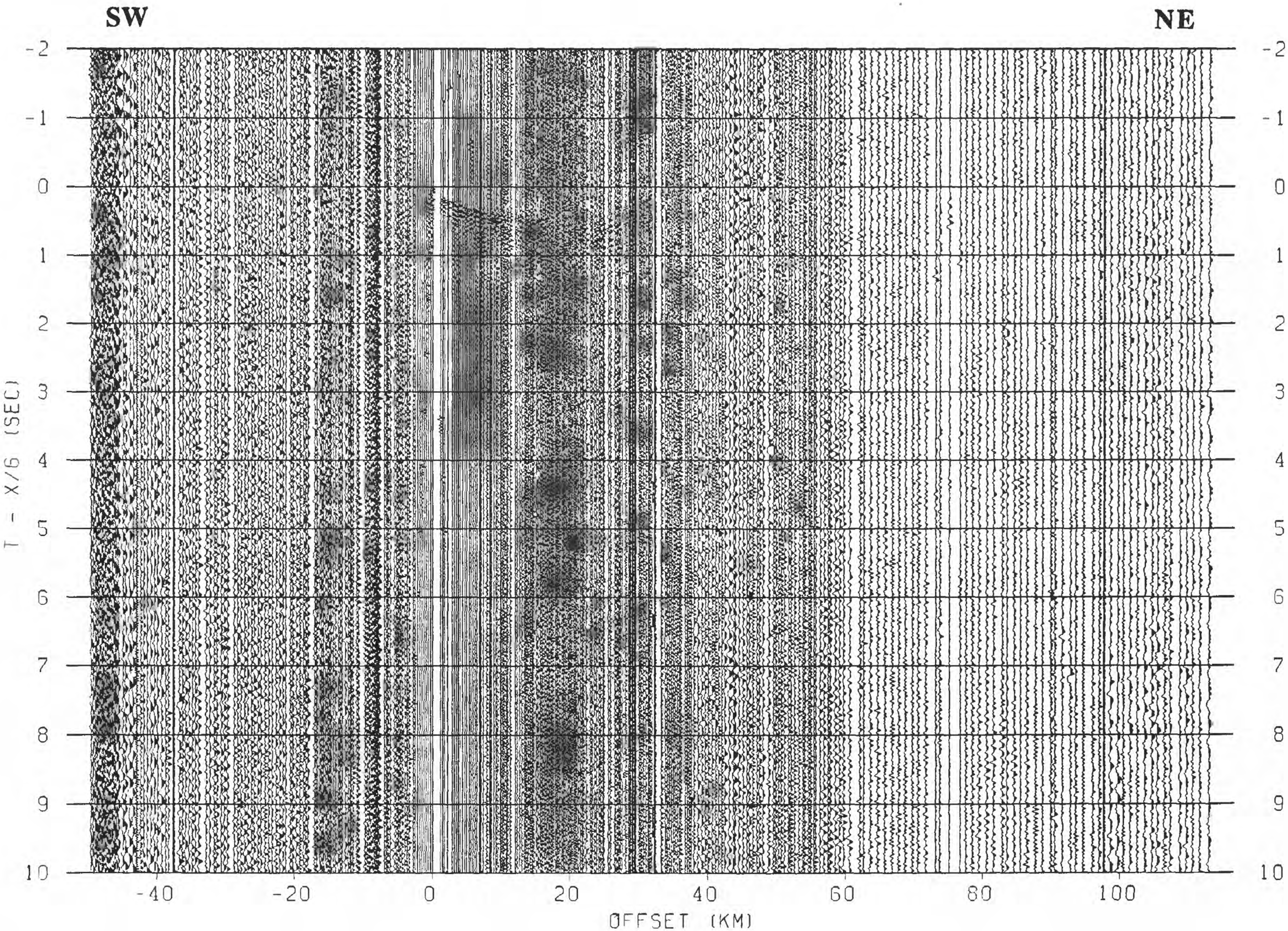

Figure 19. Shot 12 Shotpoint 8030

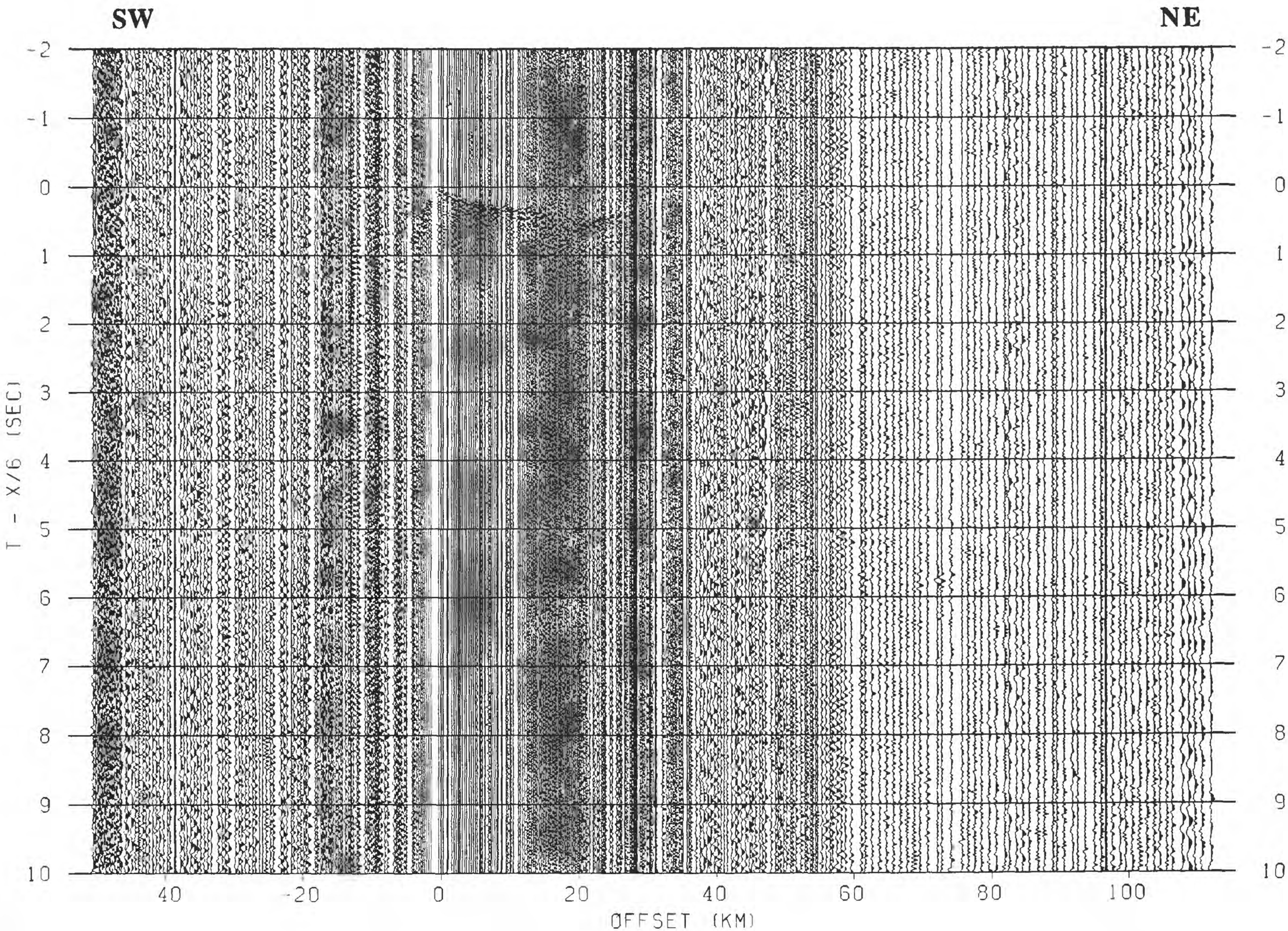

Figure 20. Shot 13 Shotpoint 8040

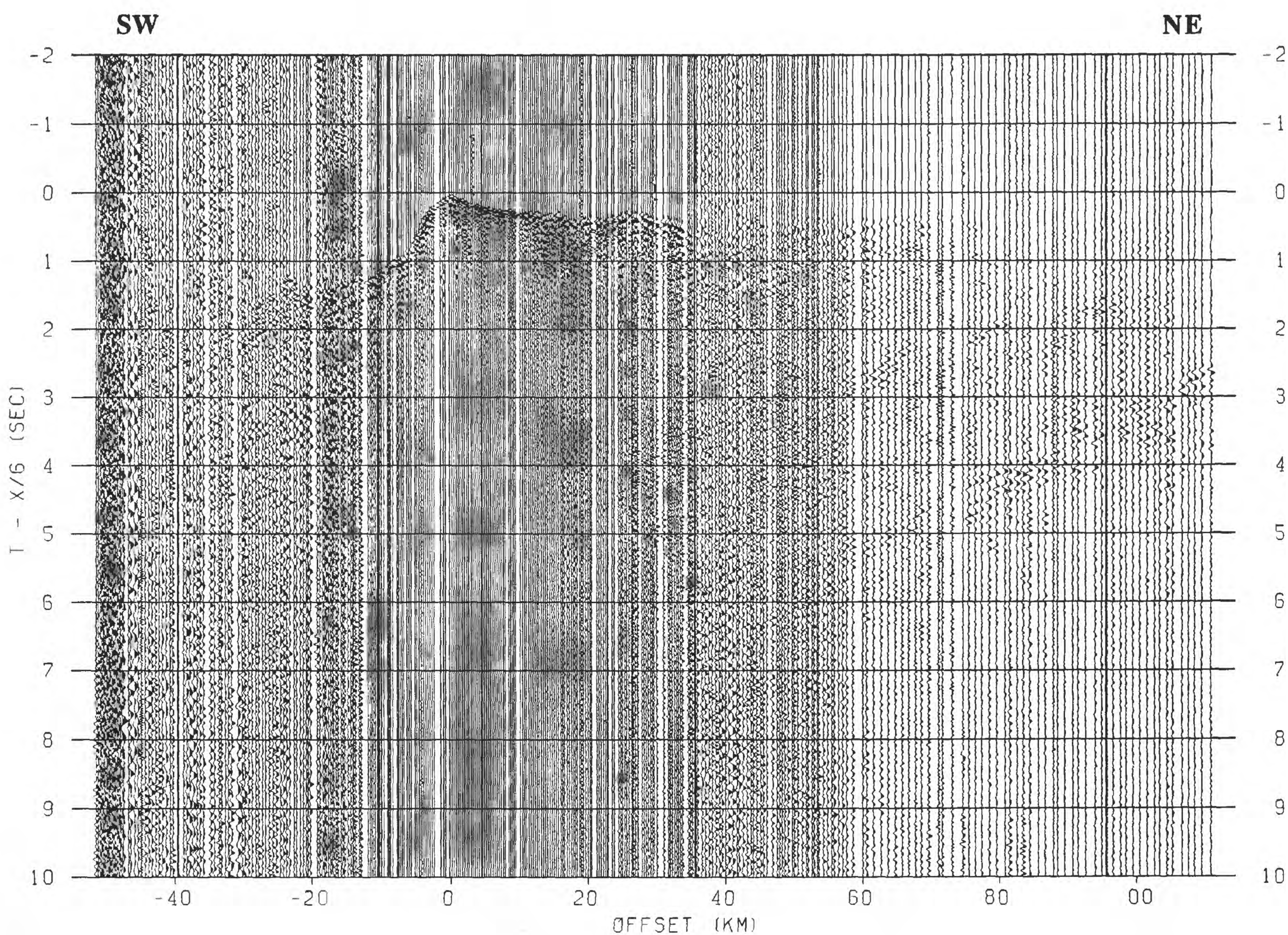

Figure 21. Shot 14 Shotpoint 8050

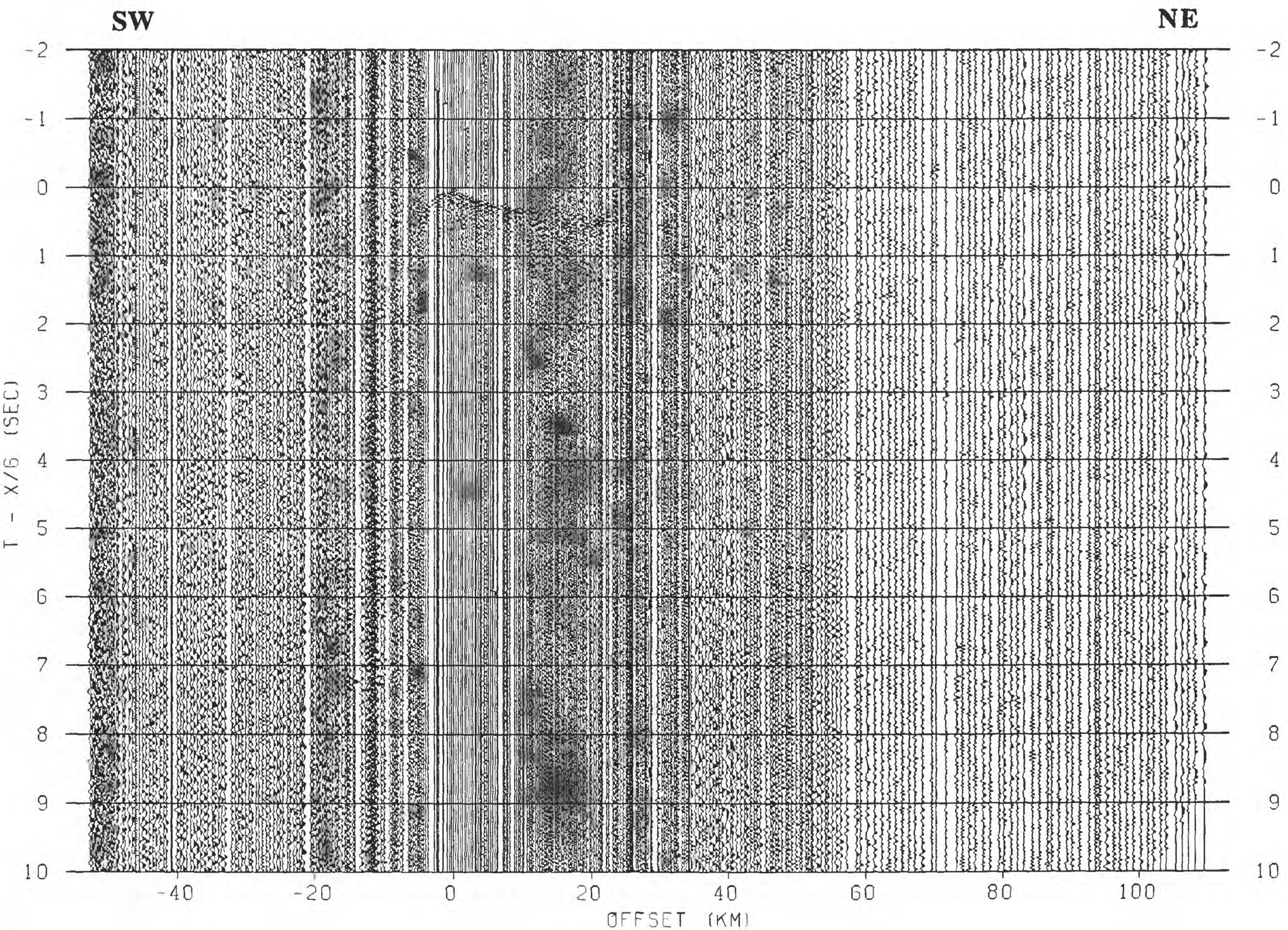

Figure 22. Shot 15 Shotpoint 8060

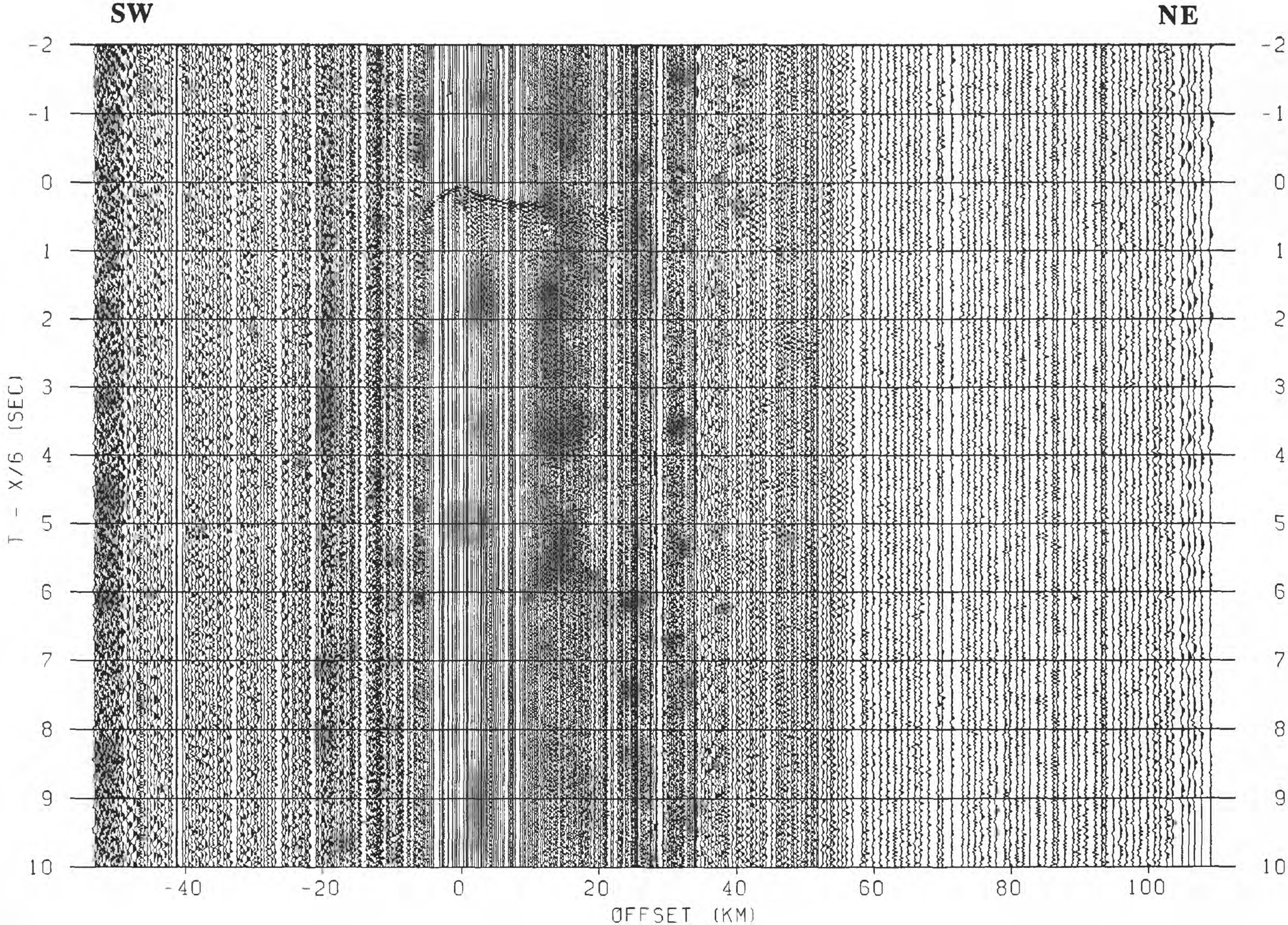

Figure 23. Shot 16 Shotpoint 8070

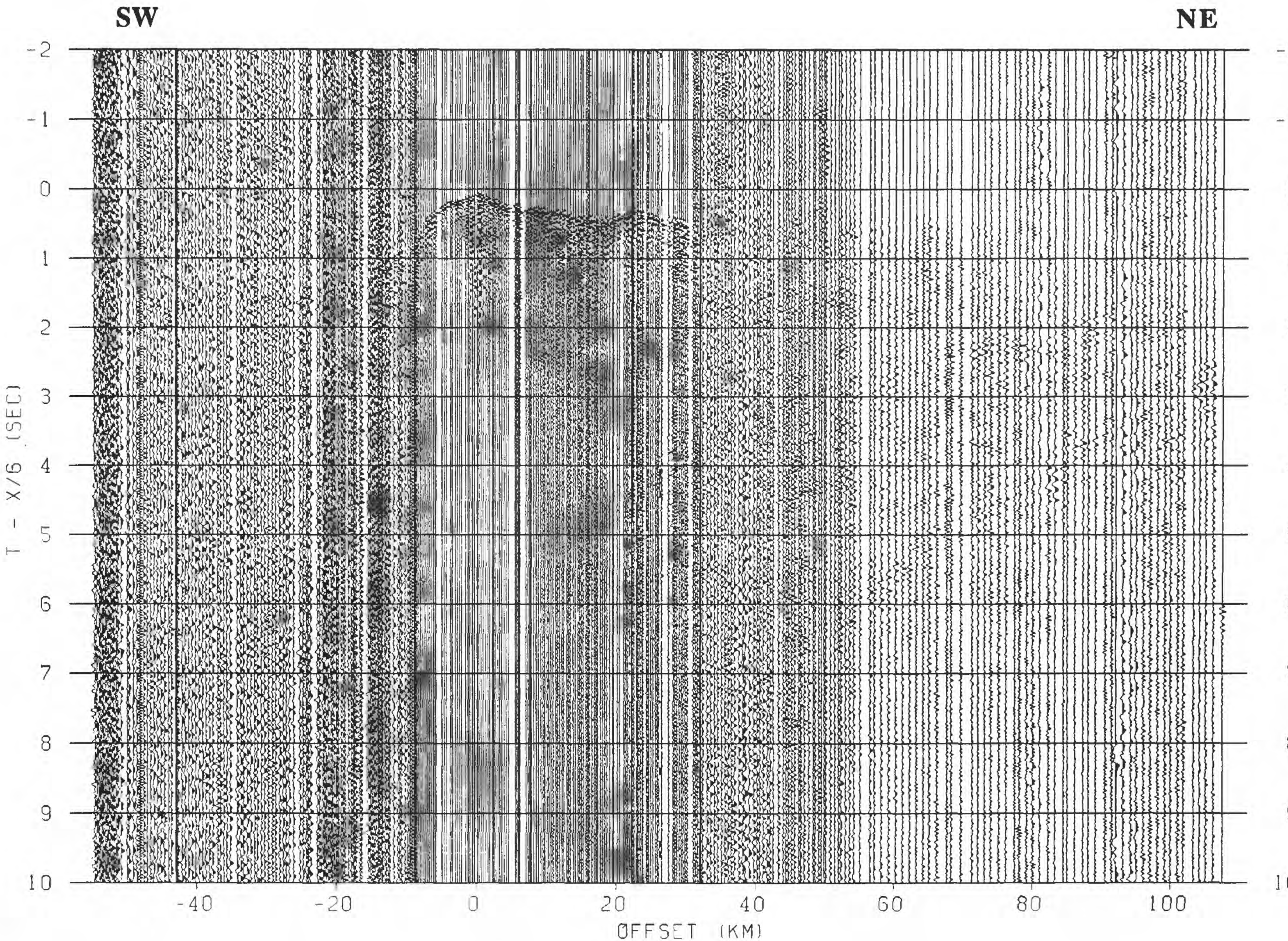

Figure 24. Shot 17 Shotpoint 8080

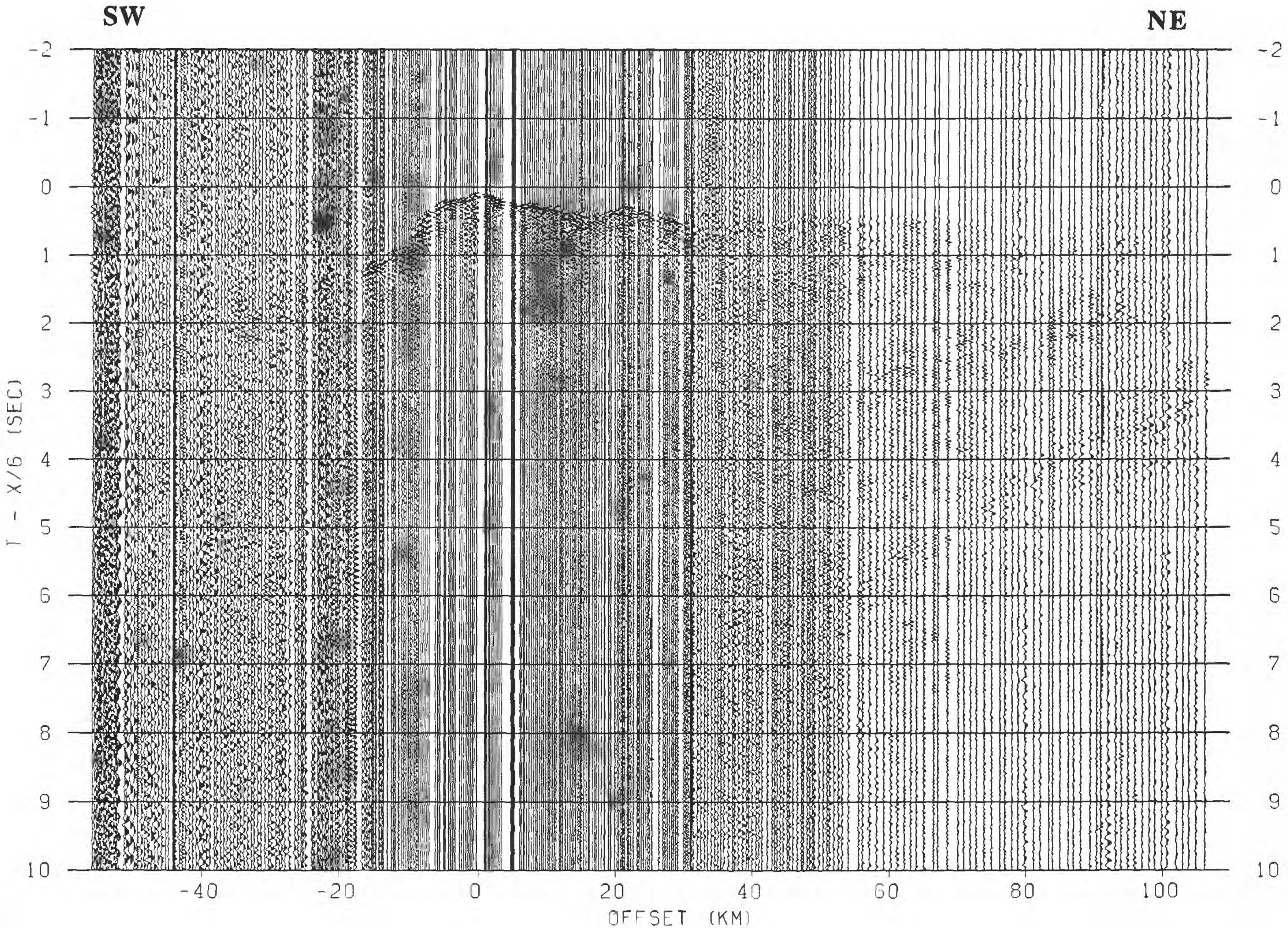

Figure 25. Shot 18 Shotpoint 8090

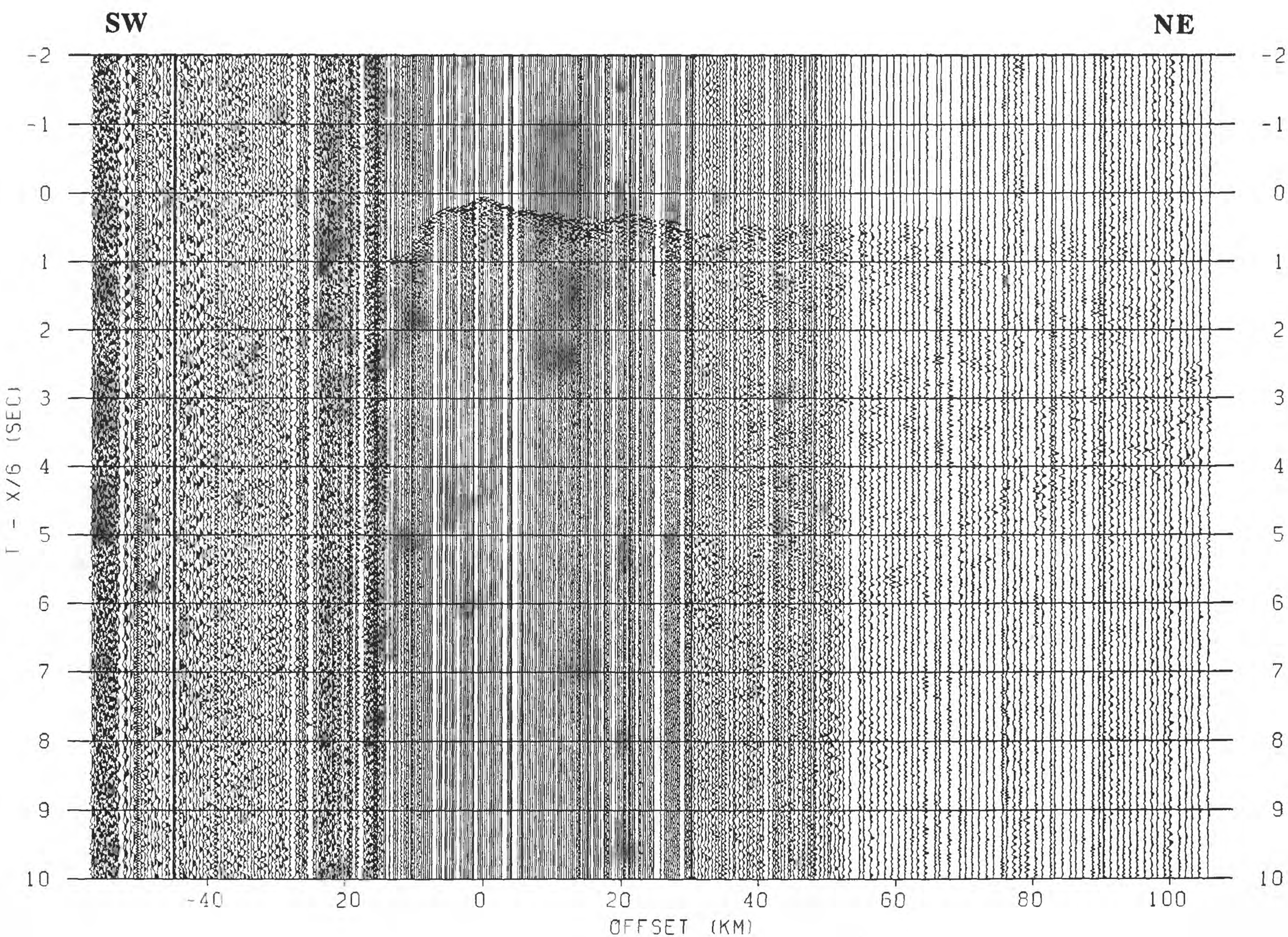

Figure 26. Shot 19 Shotpoint 8100

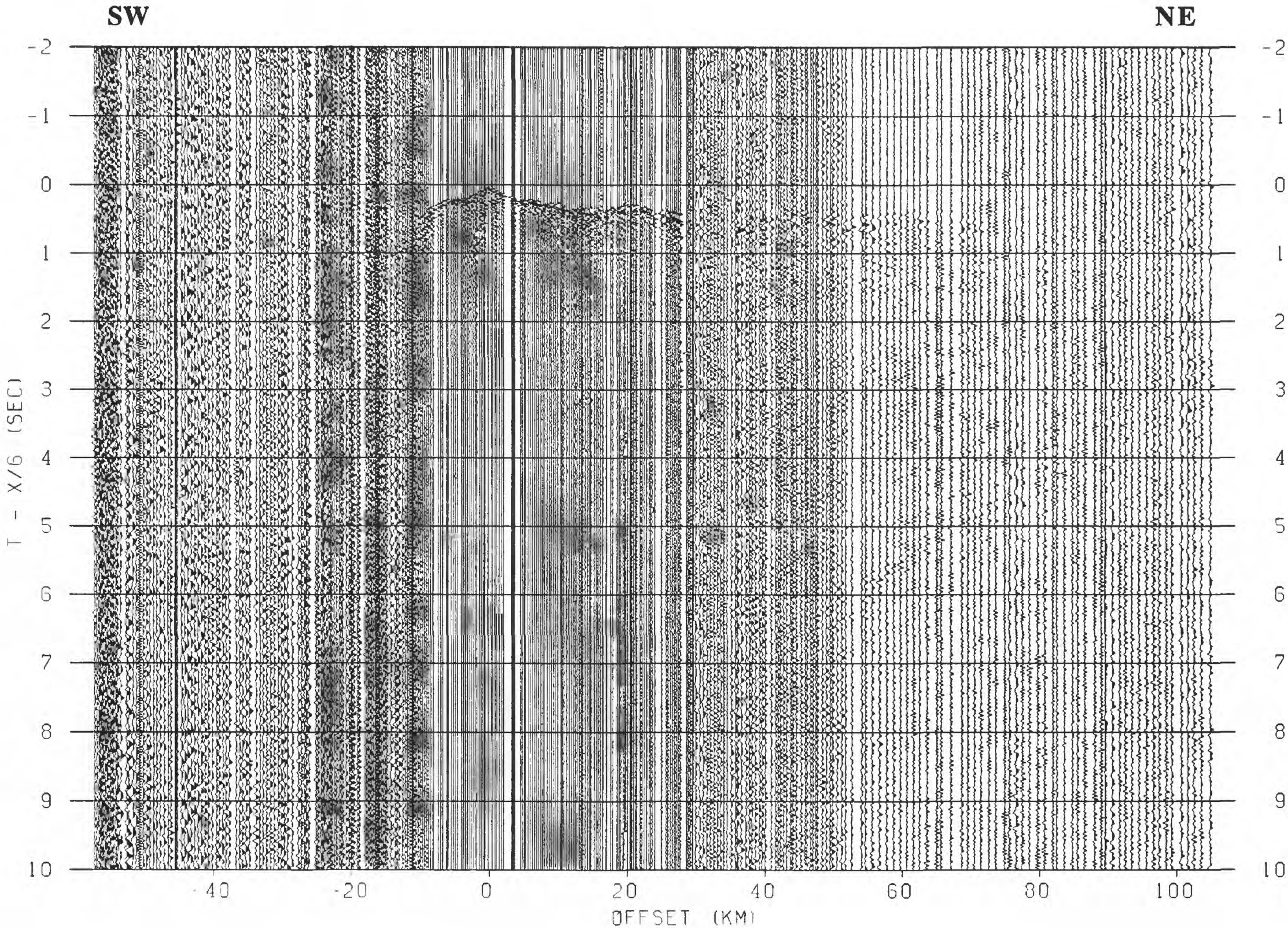

Figure 27. Shot 20 Shotpoint 8110

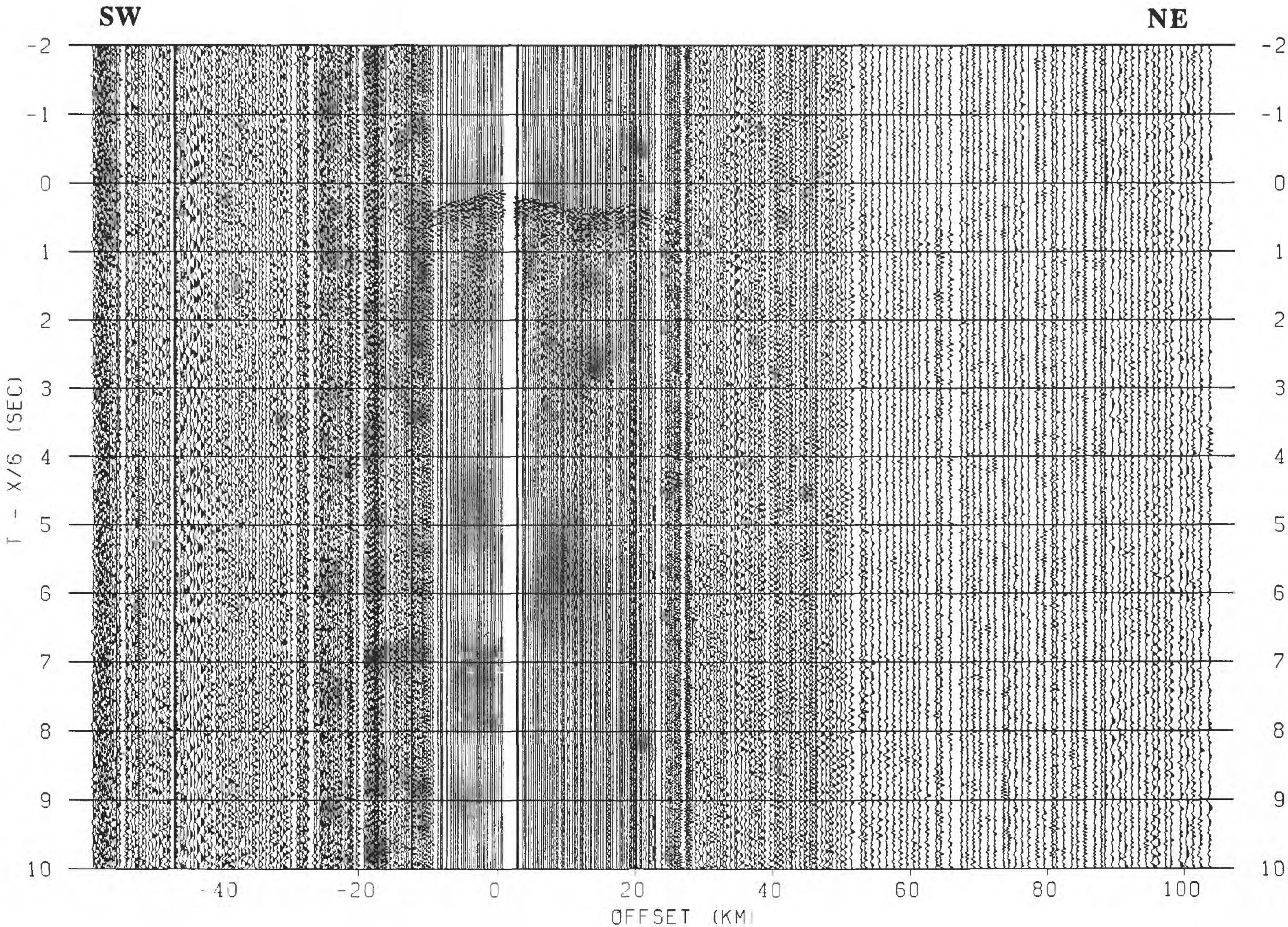

Figure 28. Shot 21 Shotpoint 8120

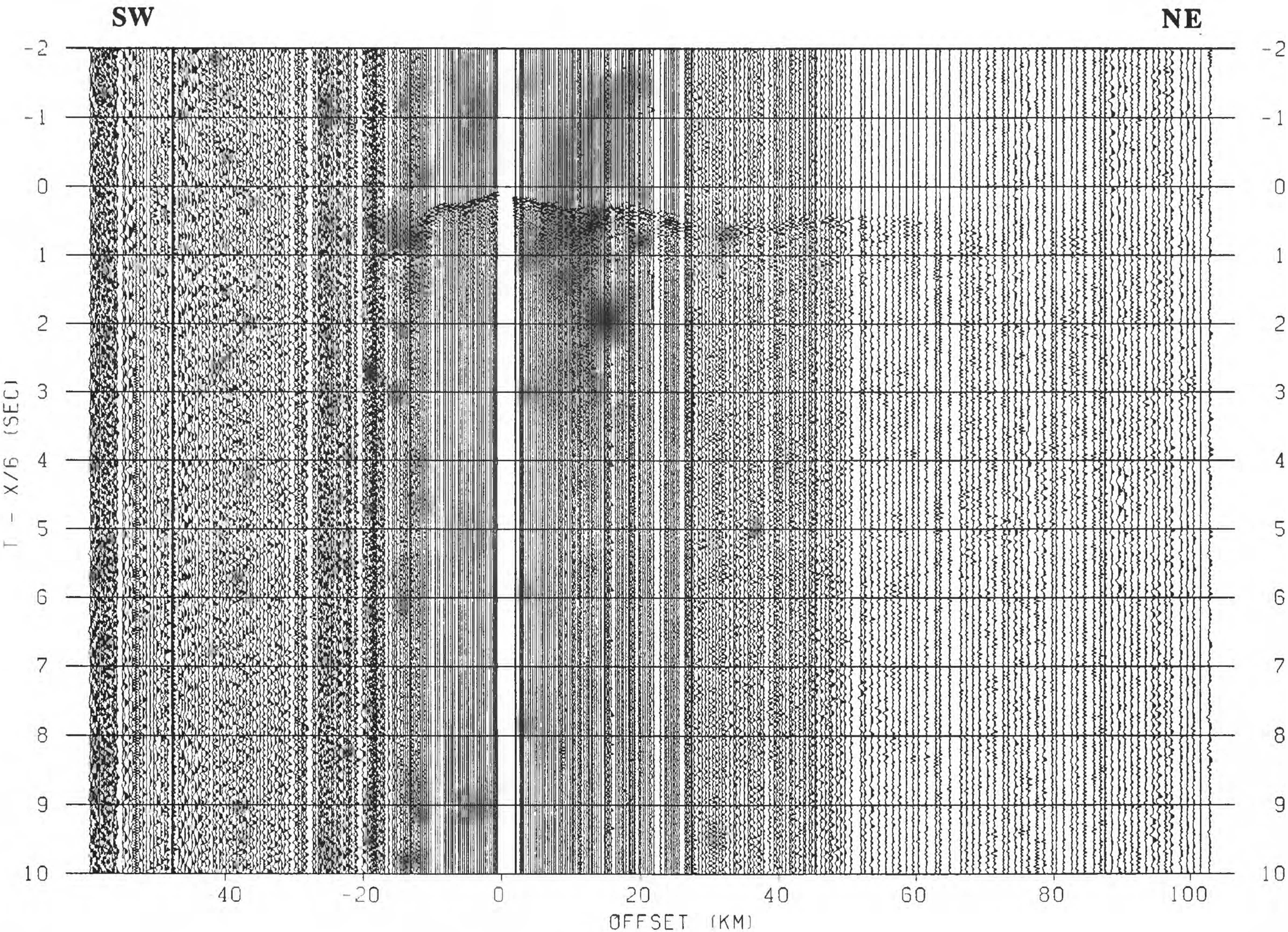

Figure 29. Shot 22 Shotpoint 8131

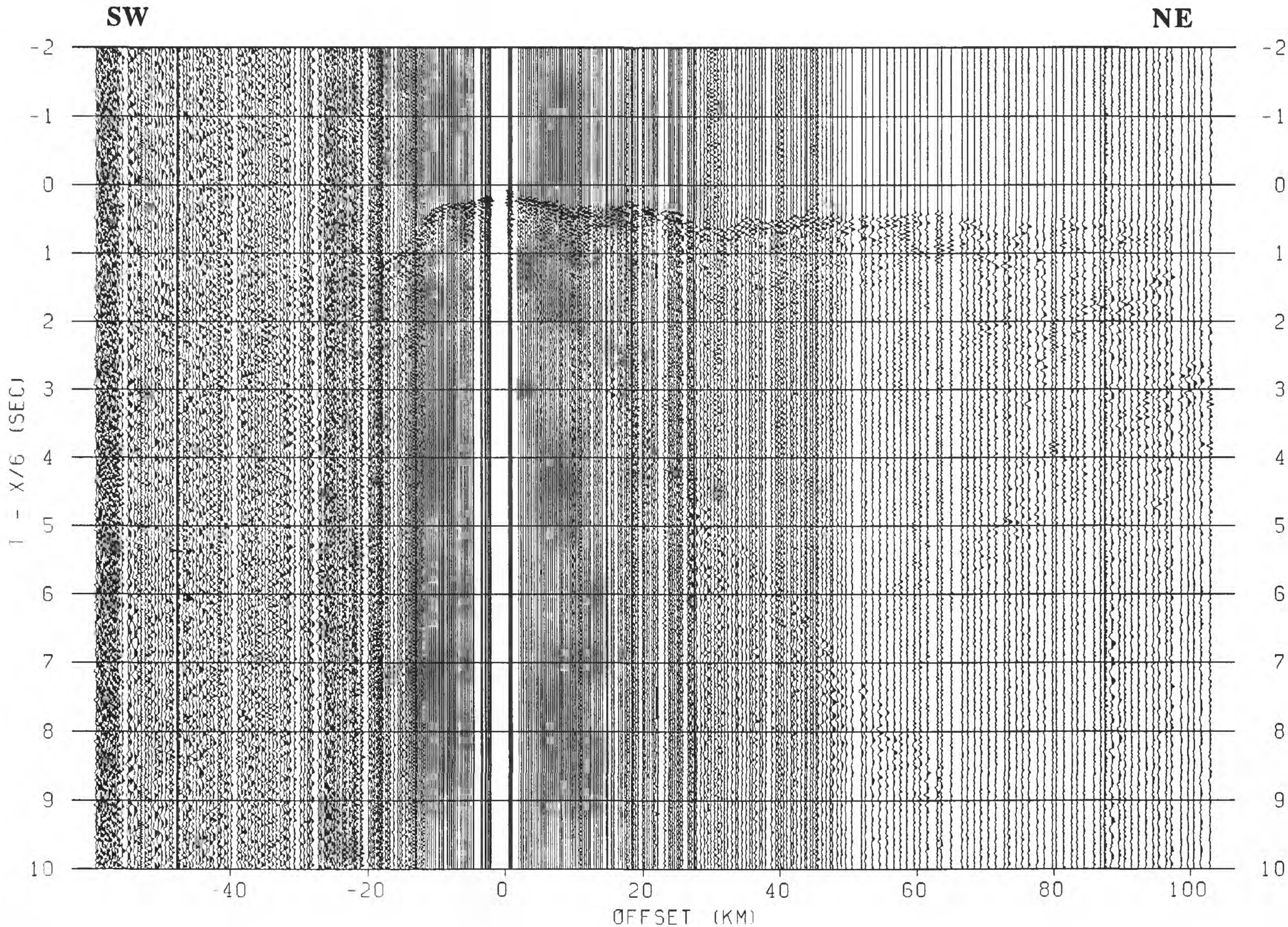

Figure 30. Shot 23 Shotpoint 8130

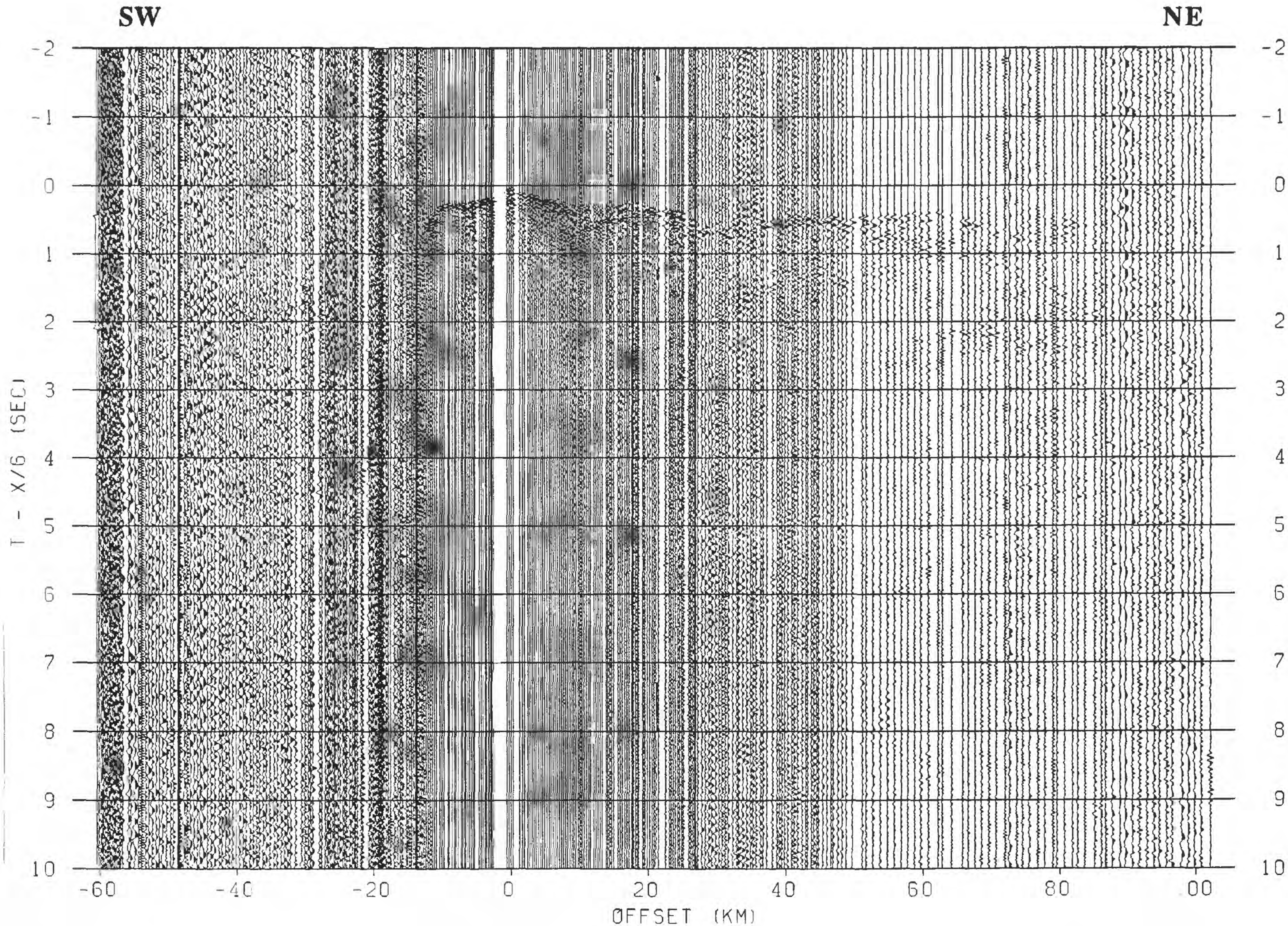

Figure 31. Shot 24 Shotpoint 8141

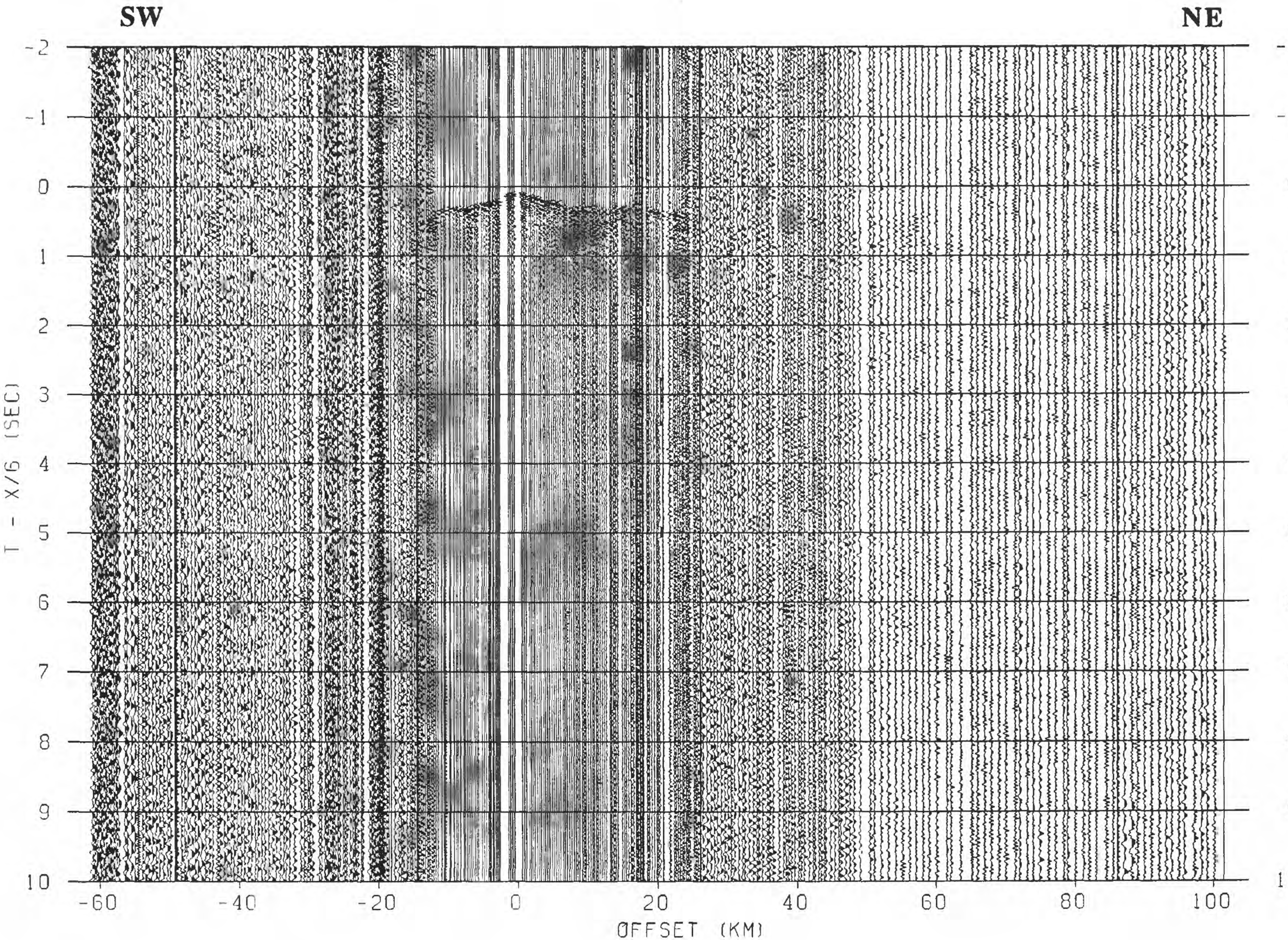

Figure 32. Shot 25 Shotpoint 8142

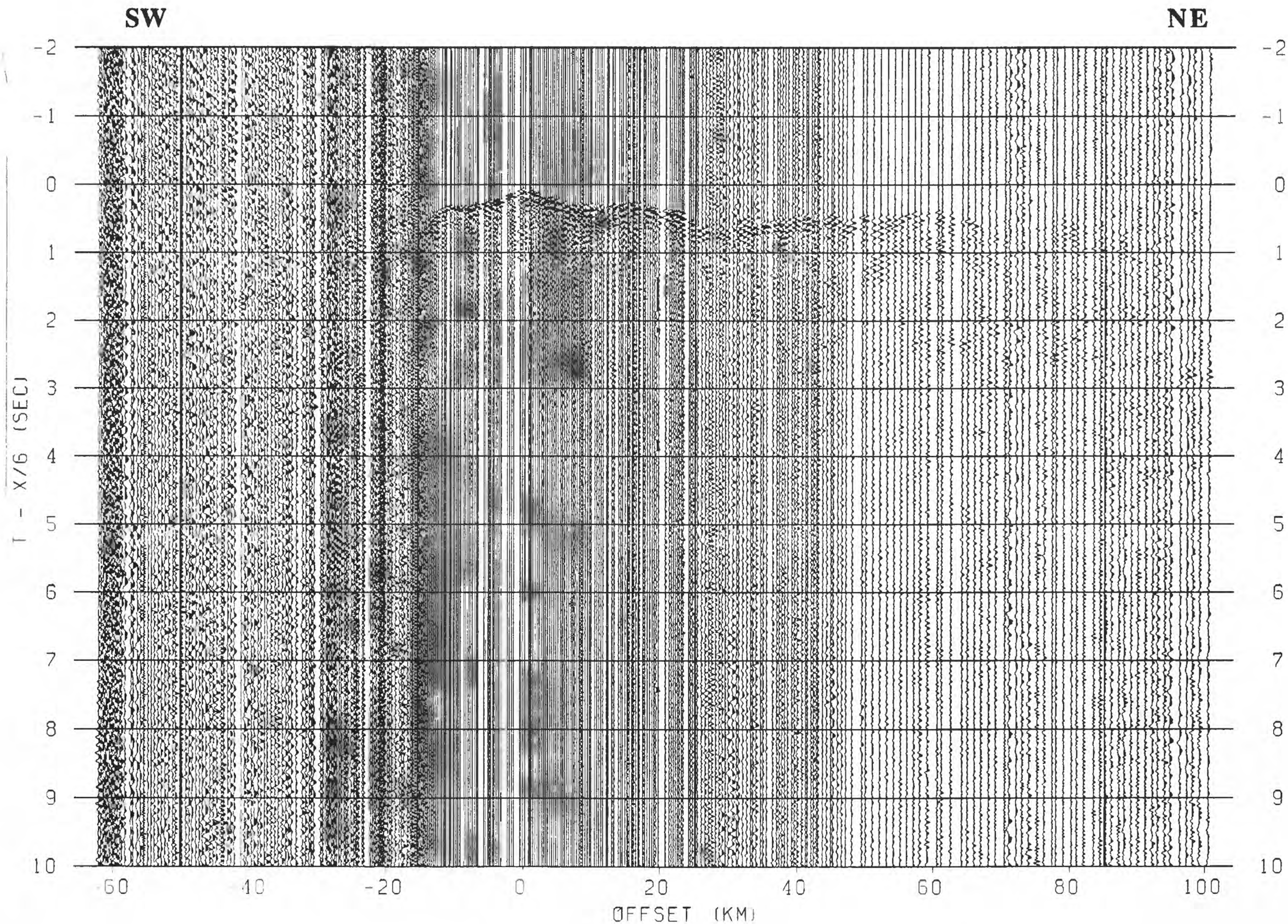

Figure 33. Shot 26 Shotpoint 8150

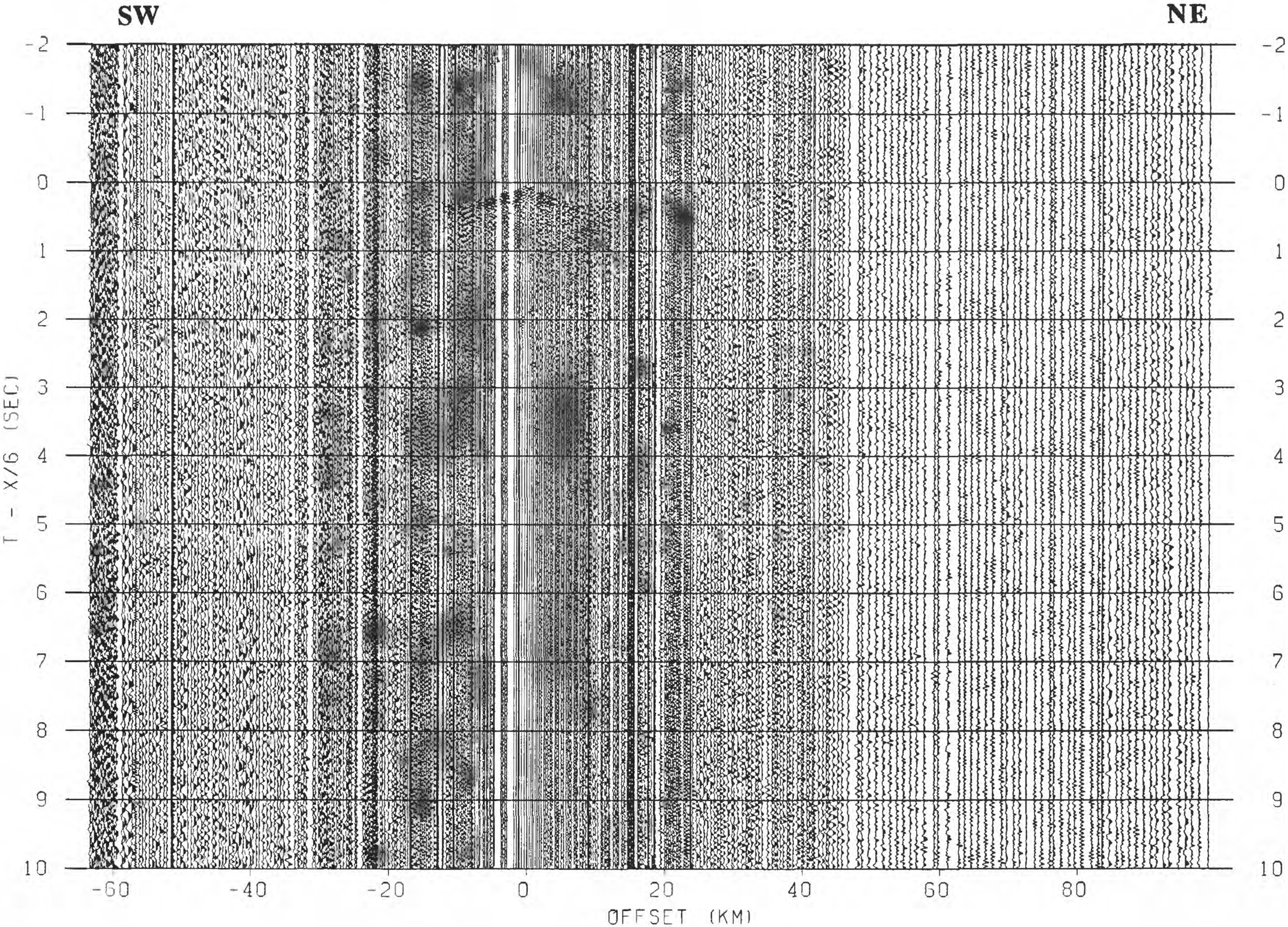

Figure 35. Shot 28 Shotpoint 8162

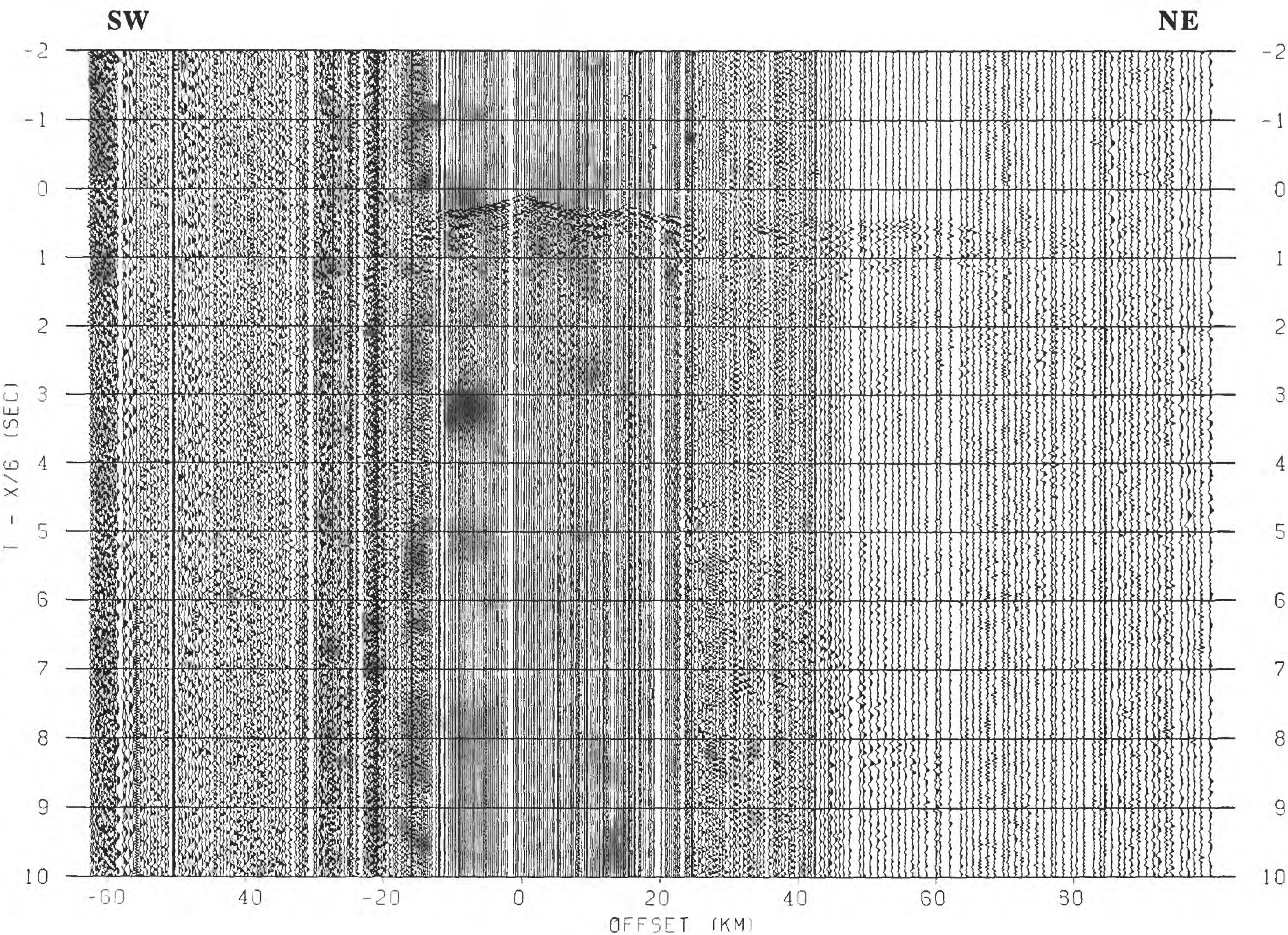

Figure 34. Shot 27 Shotpoint 8160

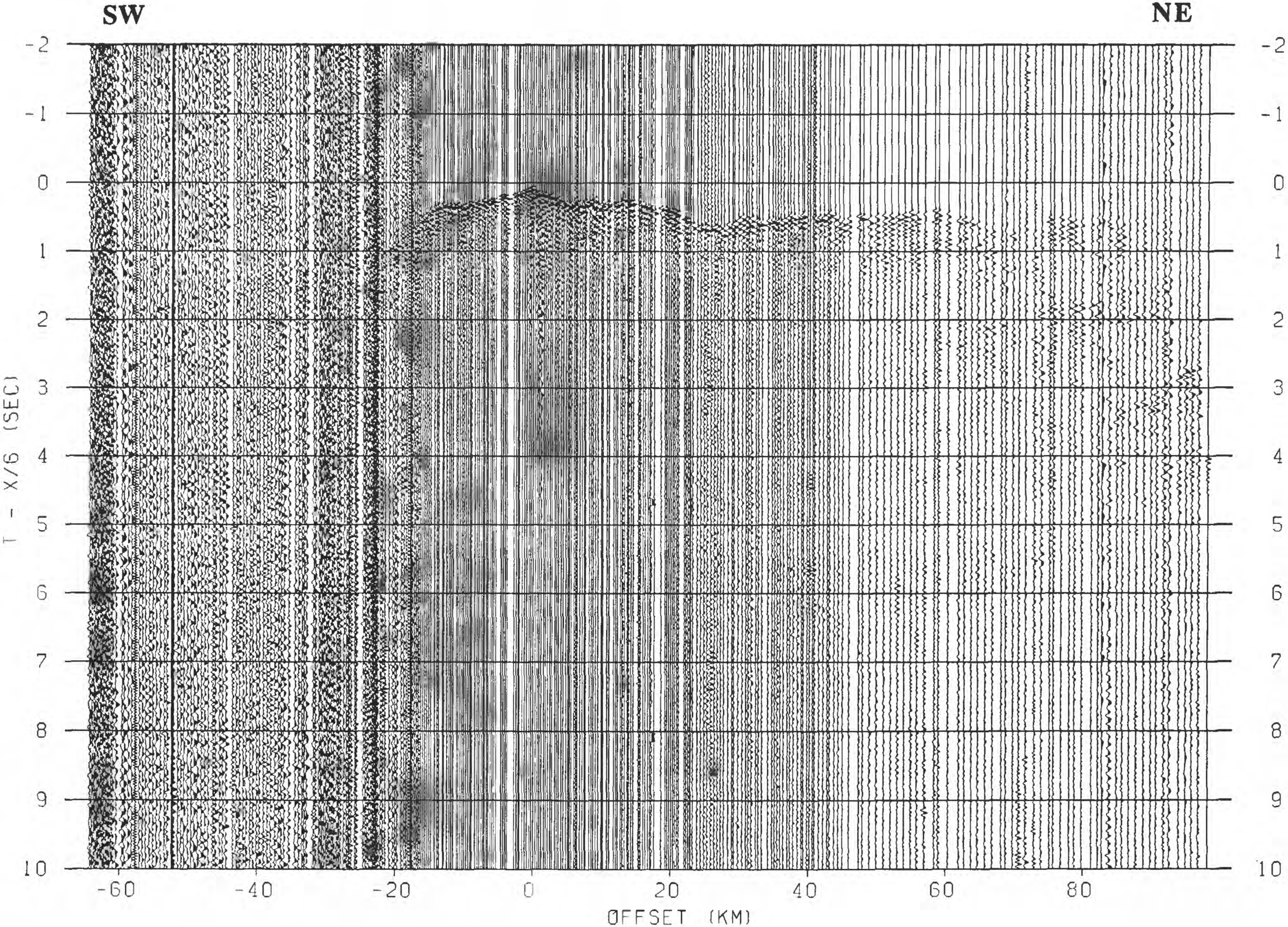

Figure 36. Shot 29 Shotpoint 8170

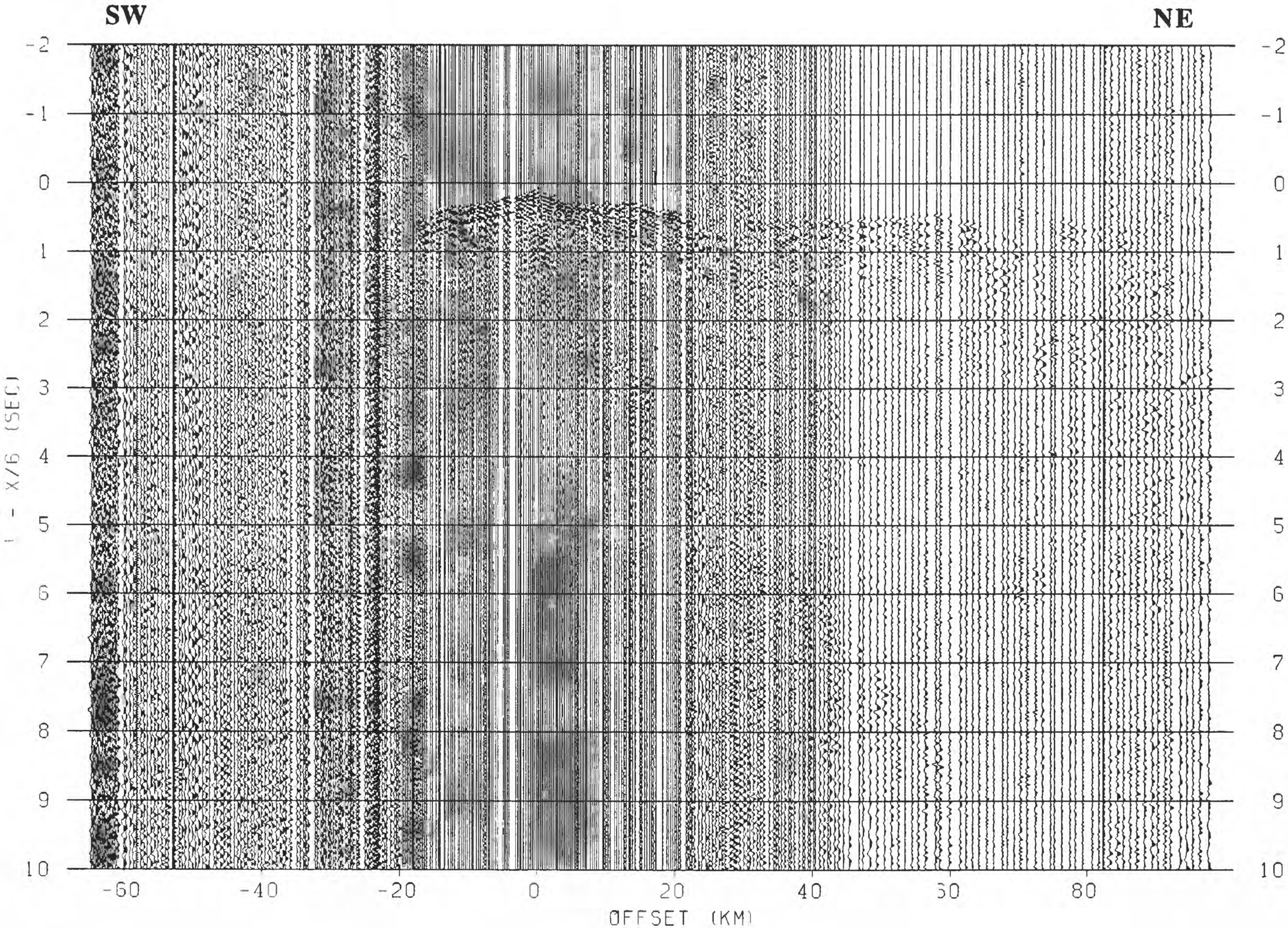

Figure 37. Shot 30 Shotpoint 8180

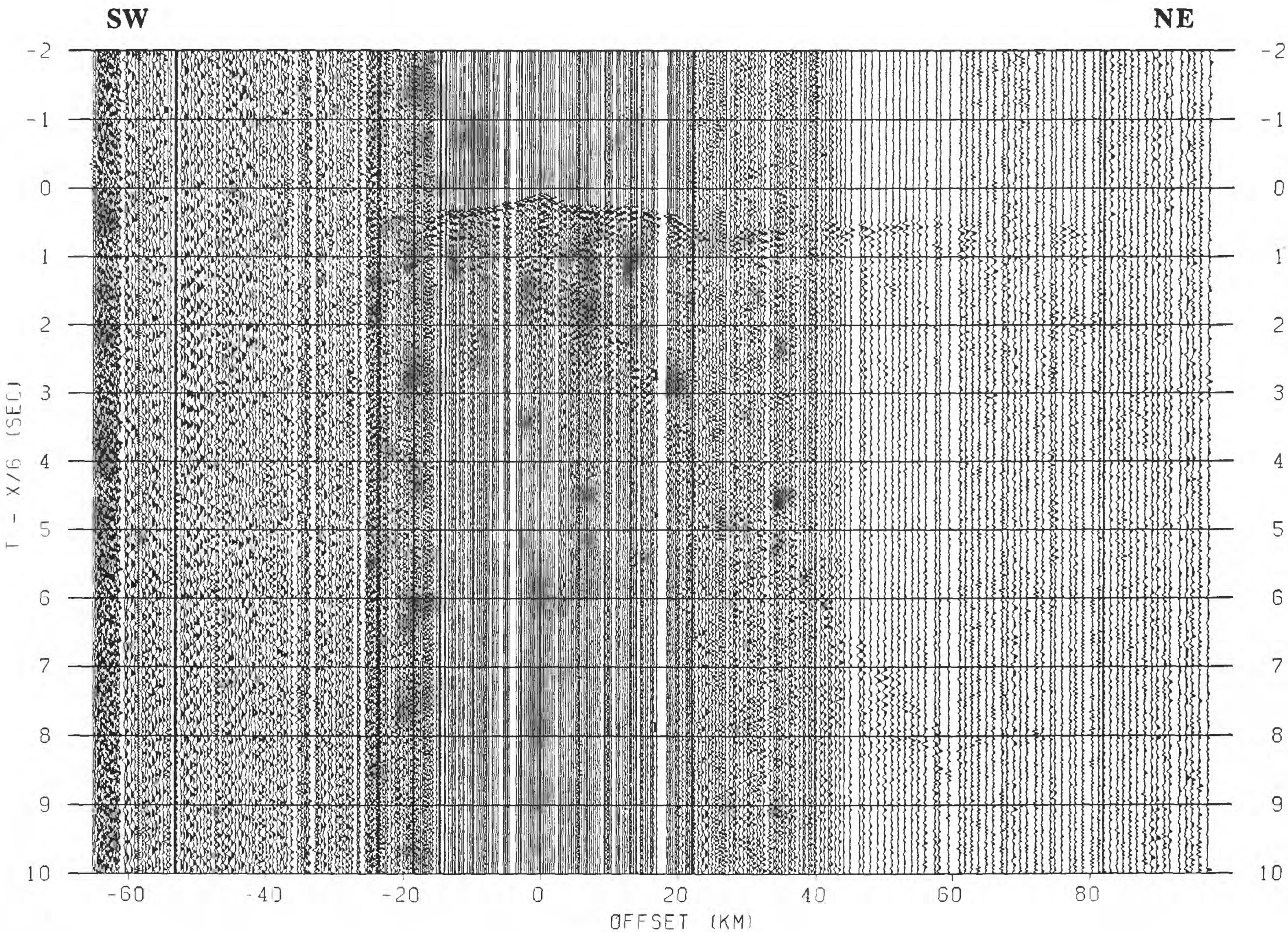

Figure 38. Shot 31 Shotpoint 8181

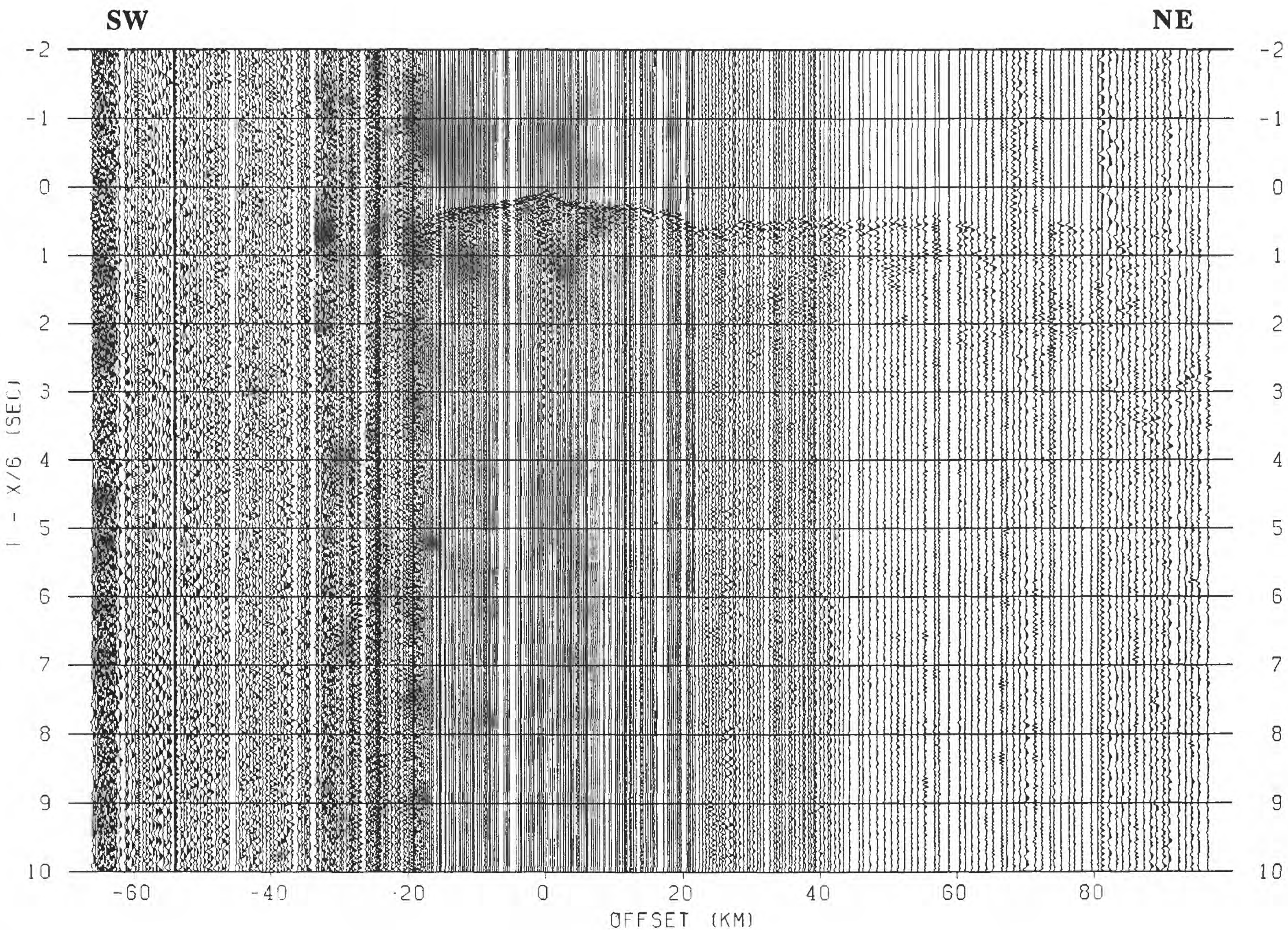

Figure 39. Shot 32 Shotpoint 8190

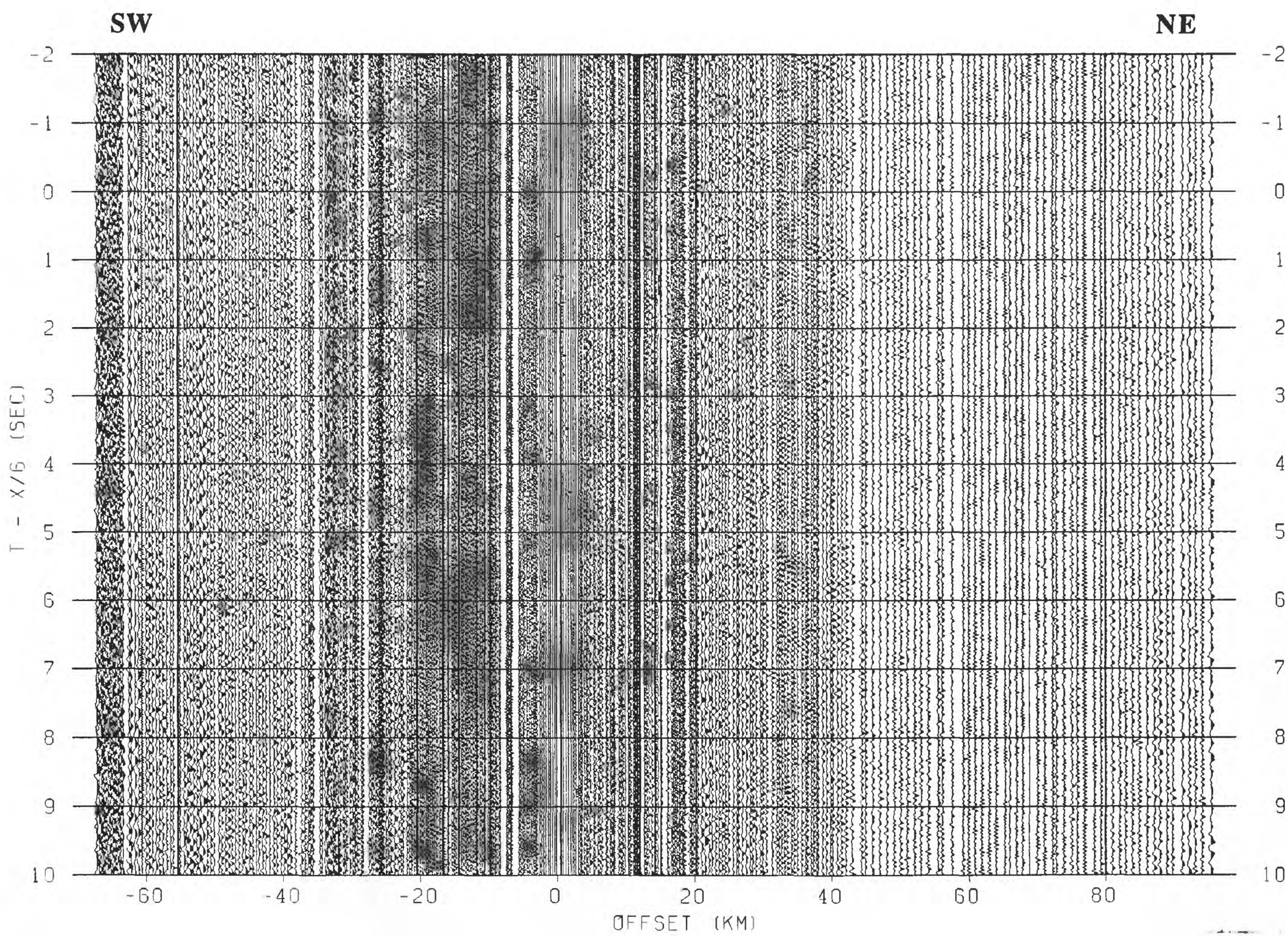

Figure 40. Shot 33 Shotpoint 8200

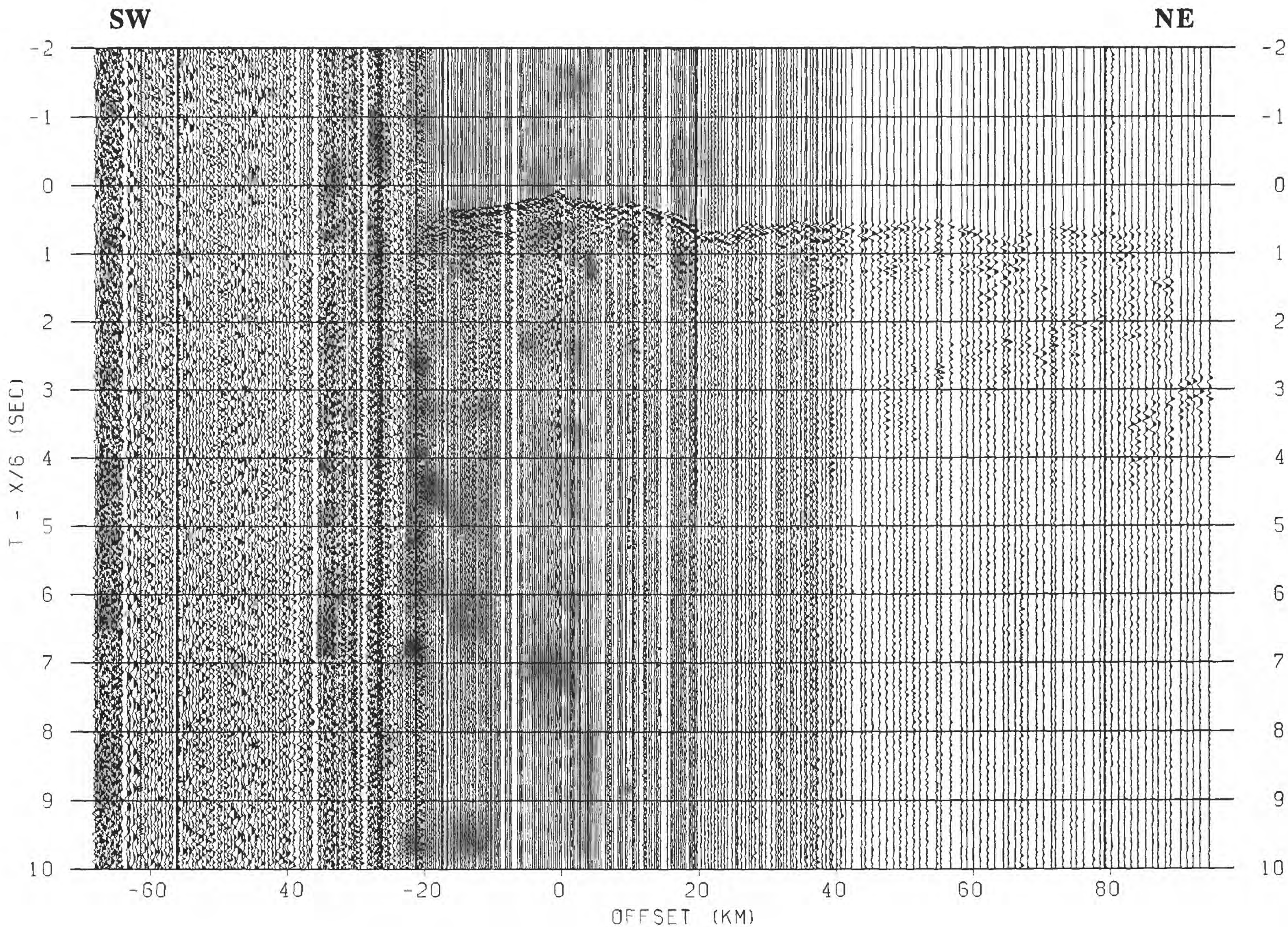

Figure 41. Shot 34 Shotpoint 8210

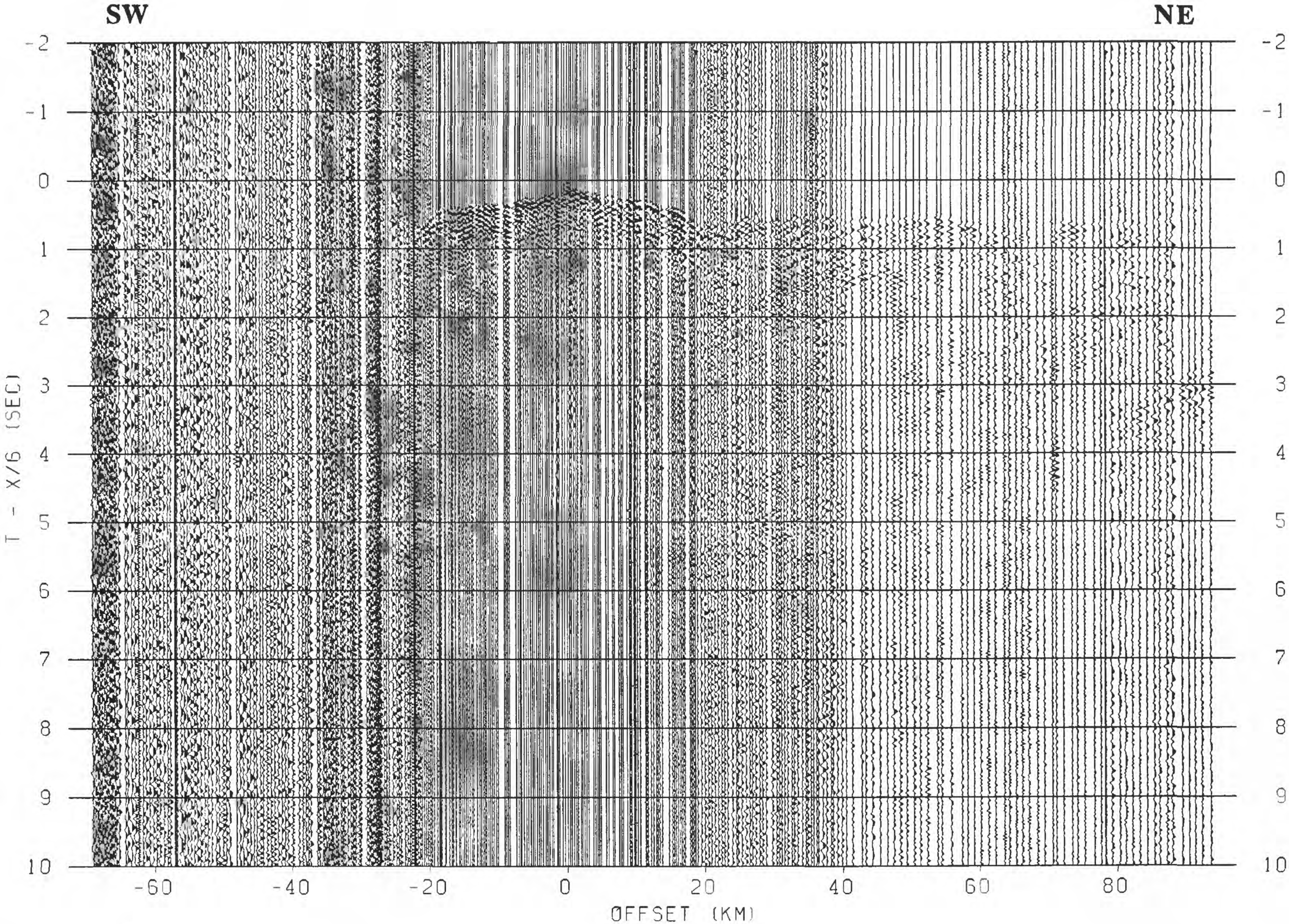

Figure 42. Shot 35 Shotpoint 8220

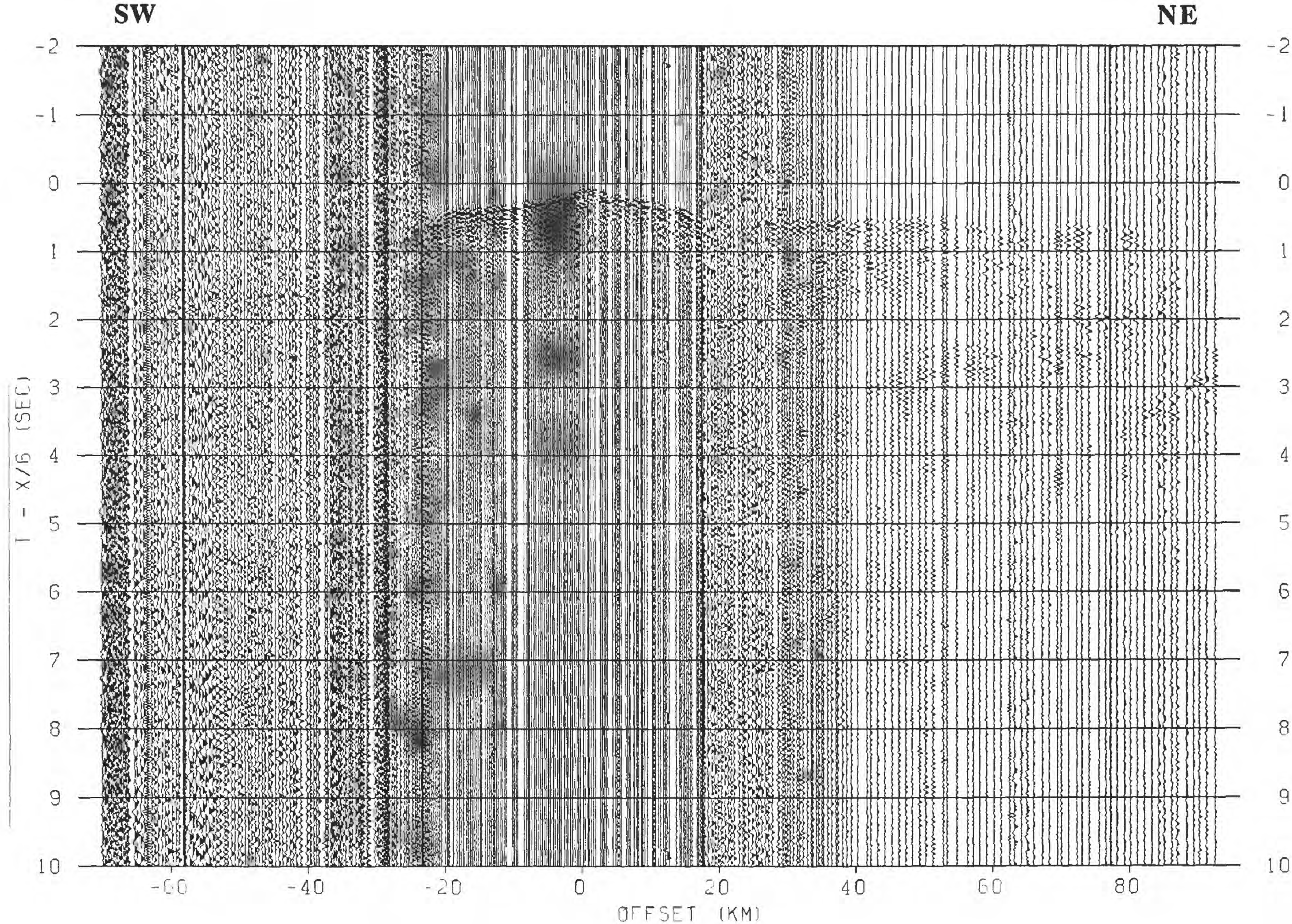

Figure 43. Shot 36 Shotpoint 8230

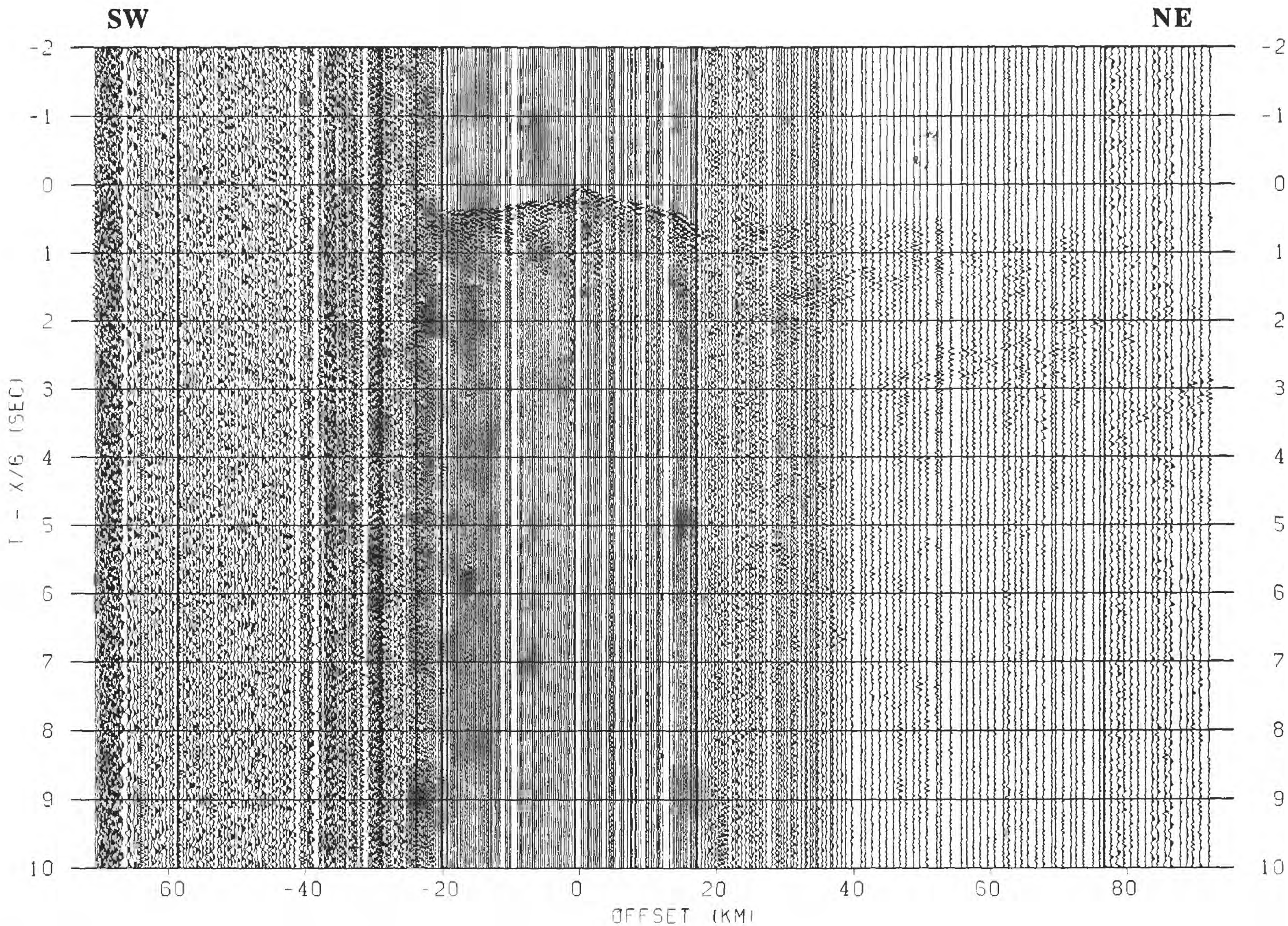

Figure 44. Shot 37 Shotpoint 8240

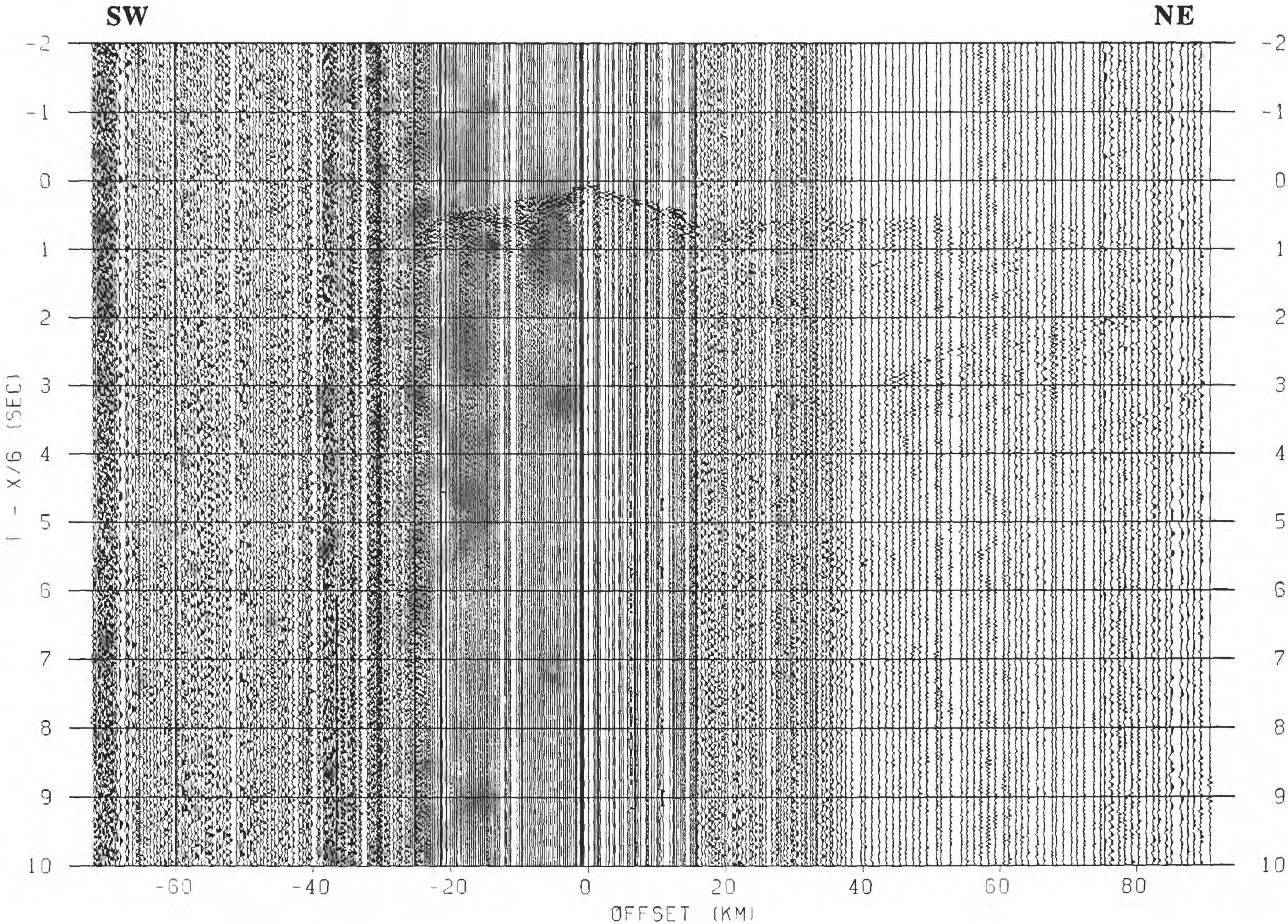

Figure 45. Shot 38 Shotpoint 8250

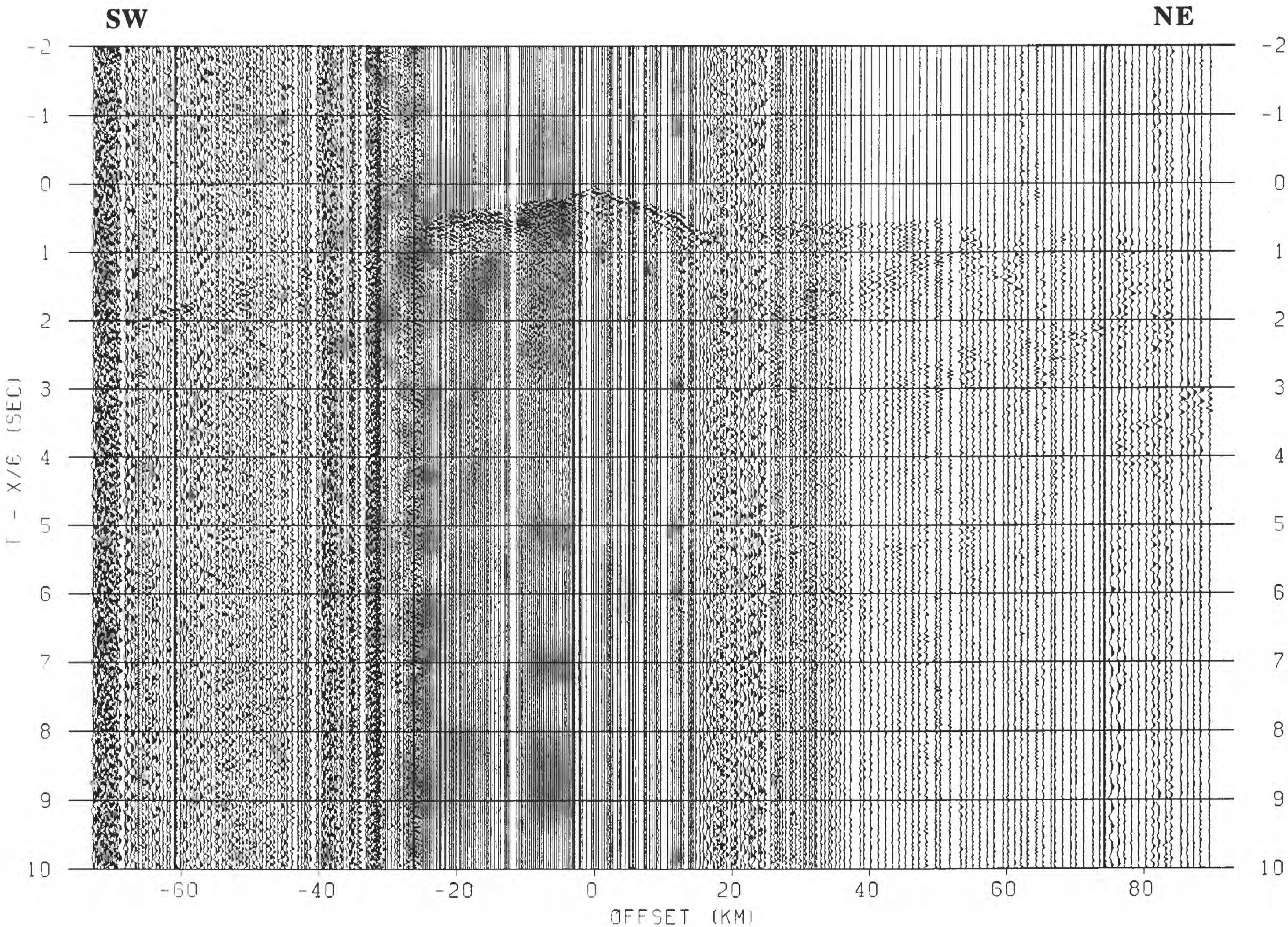

Figure 46. Shot 39 Shotpoint 8260

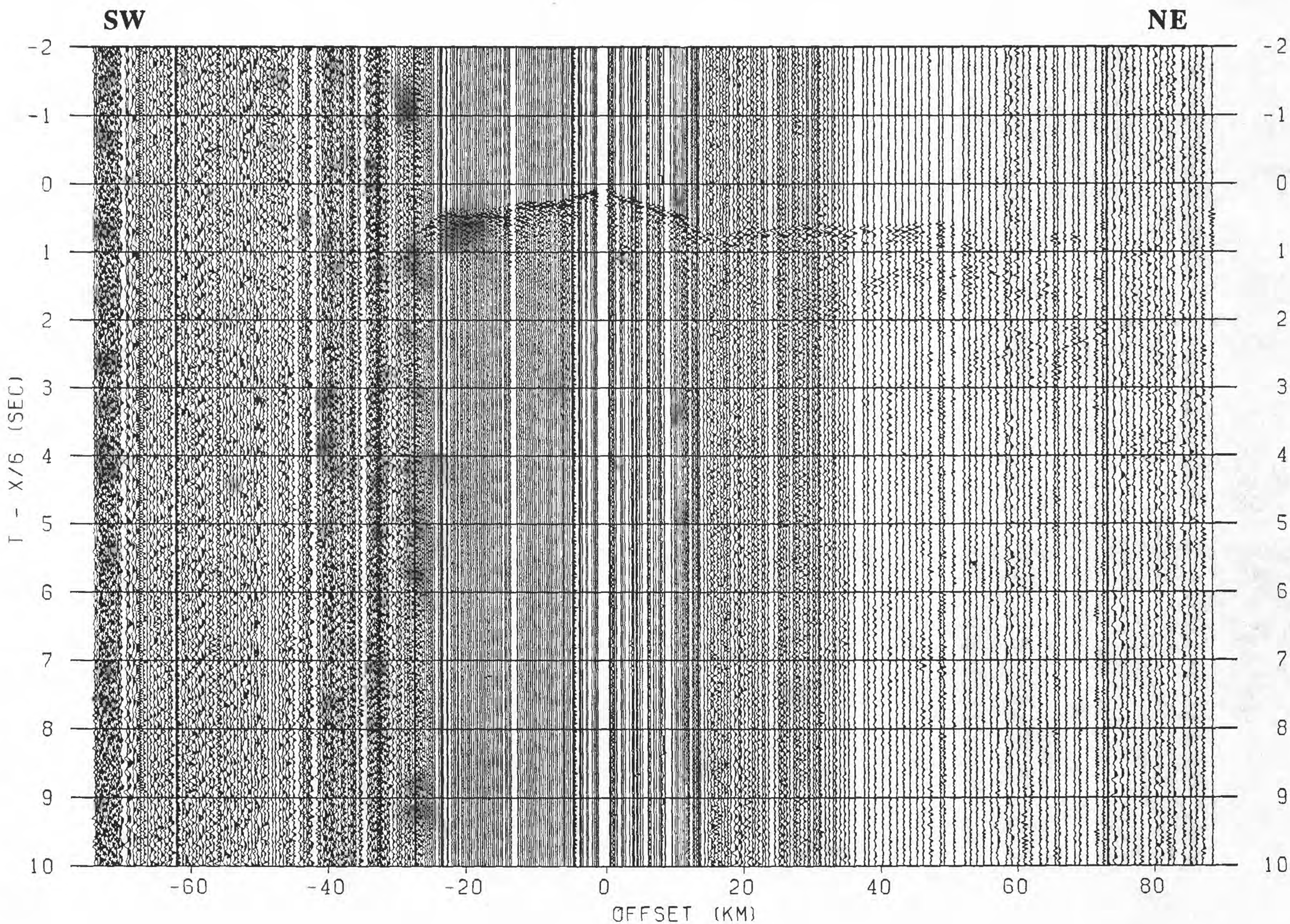

Figure 47. Shot 40 Shotpoint 8270

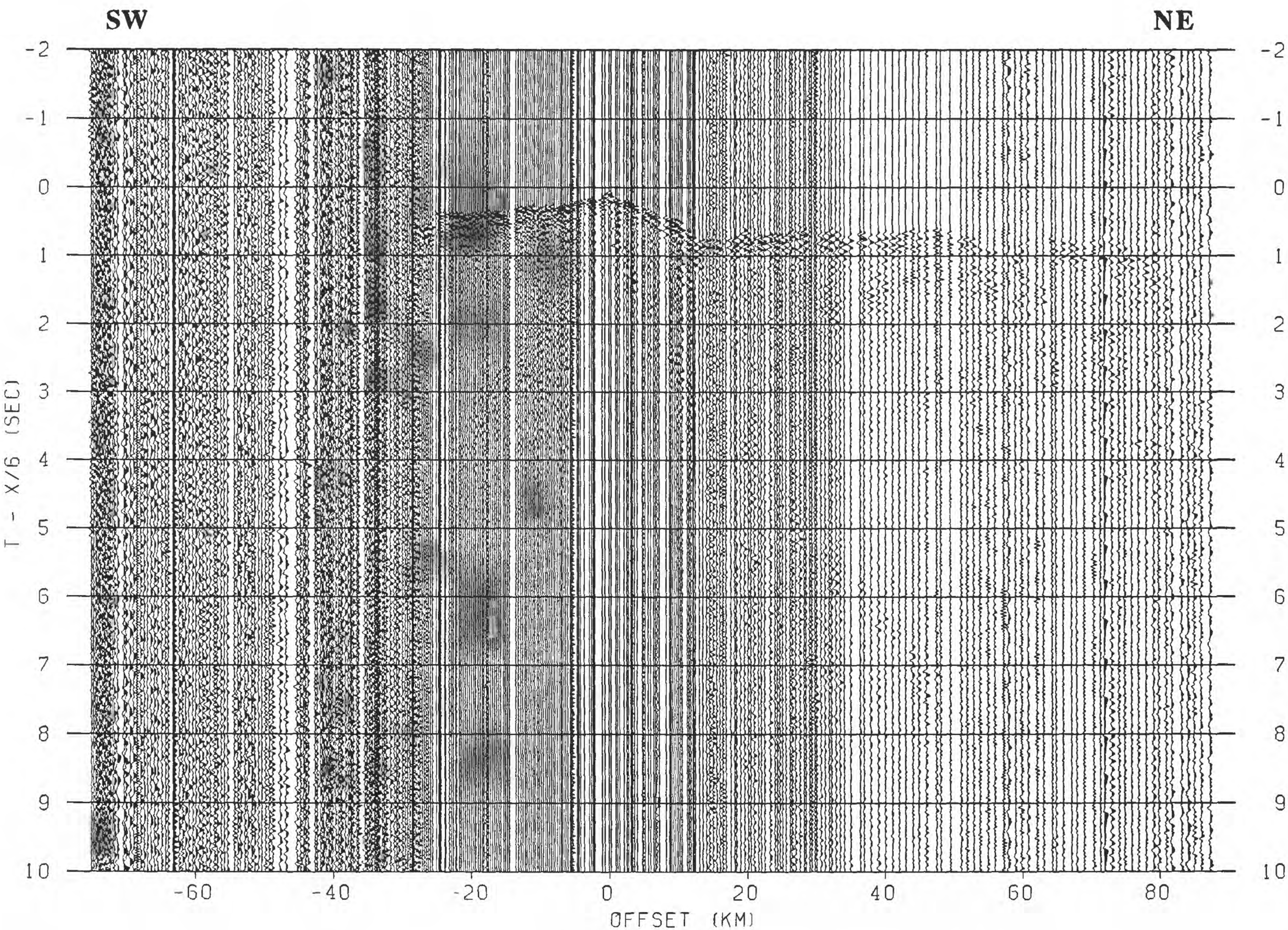

Figure 48. Shot 41 Shotpoint 8280

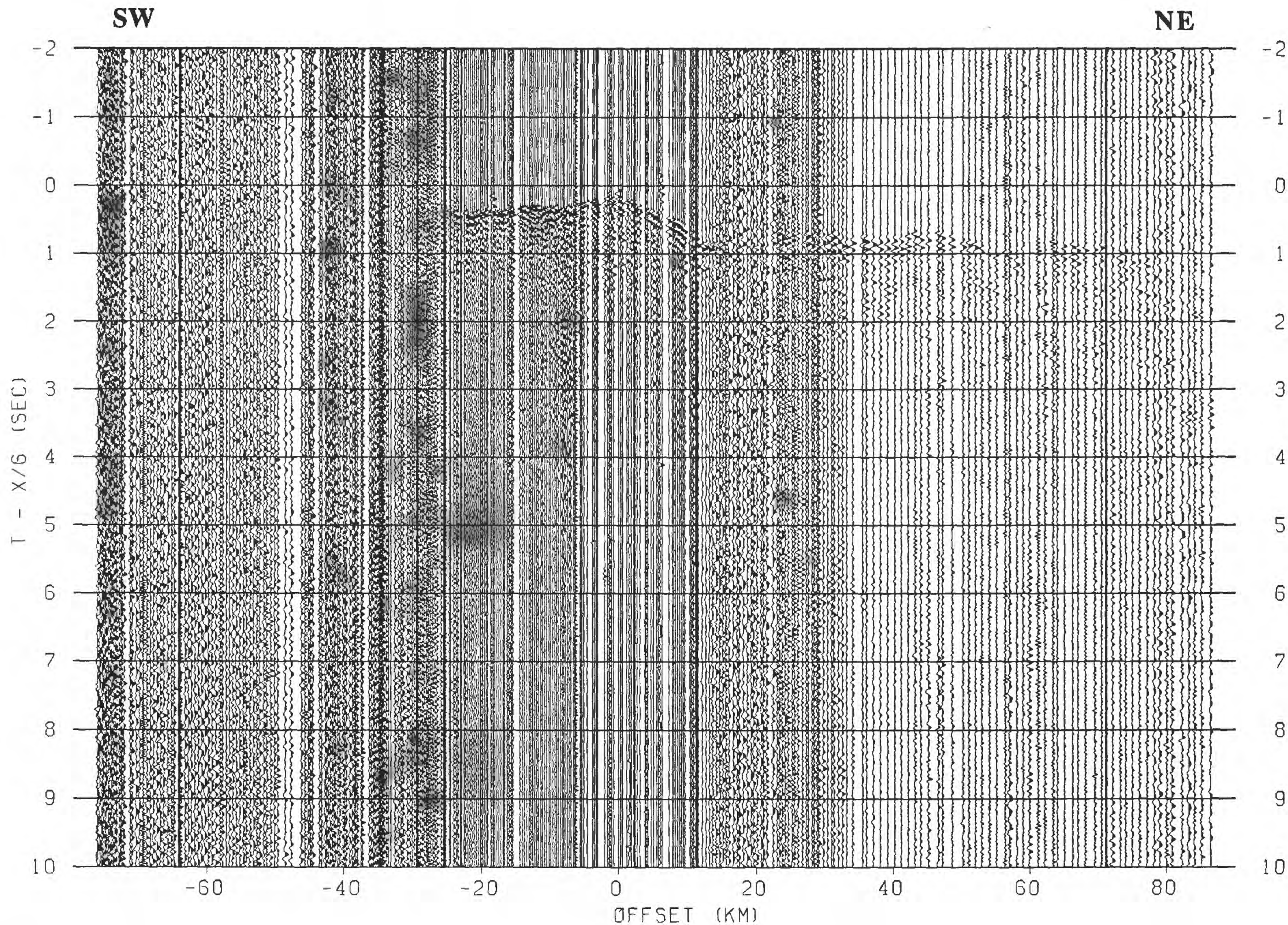

Figure 49. Shot 42 Shotpoint 8290

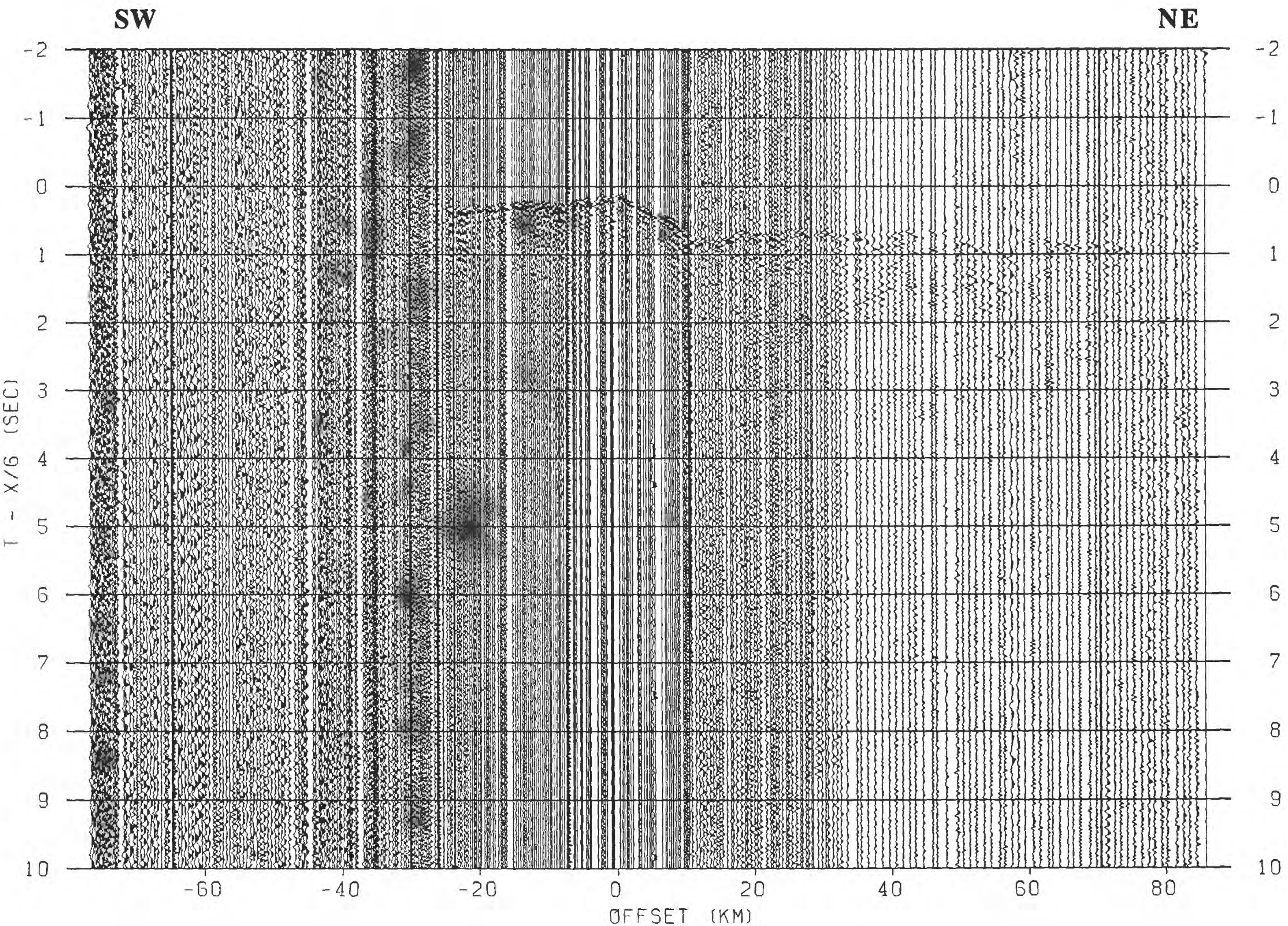

Figure 50. Shot 43 Shotpoint 8300

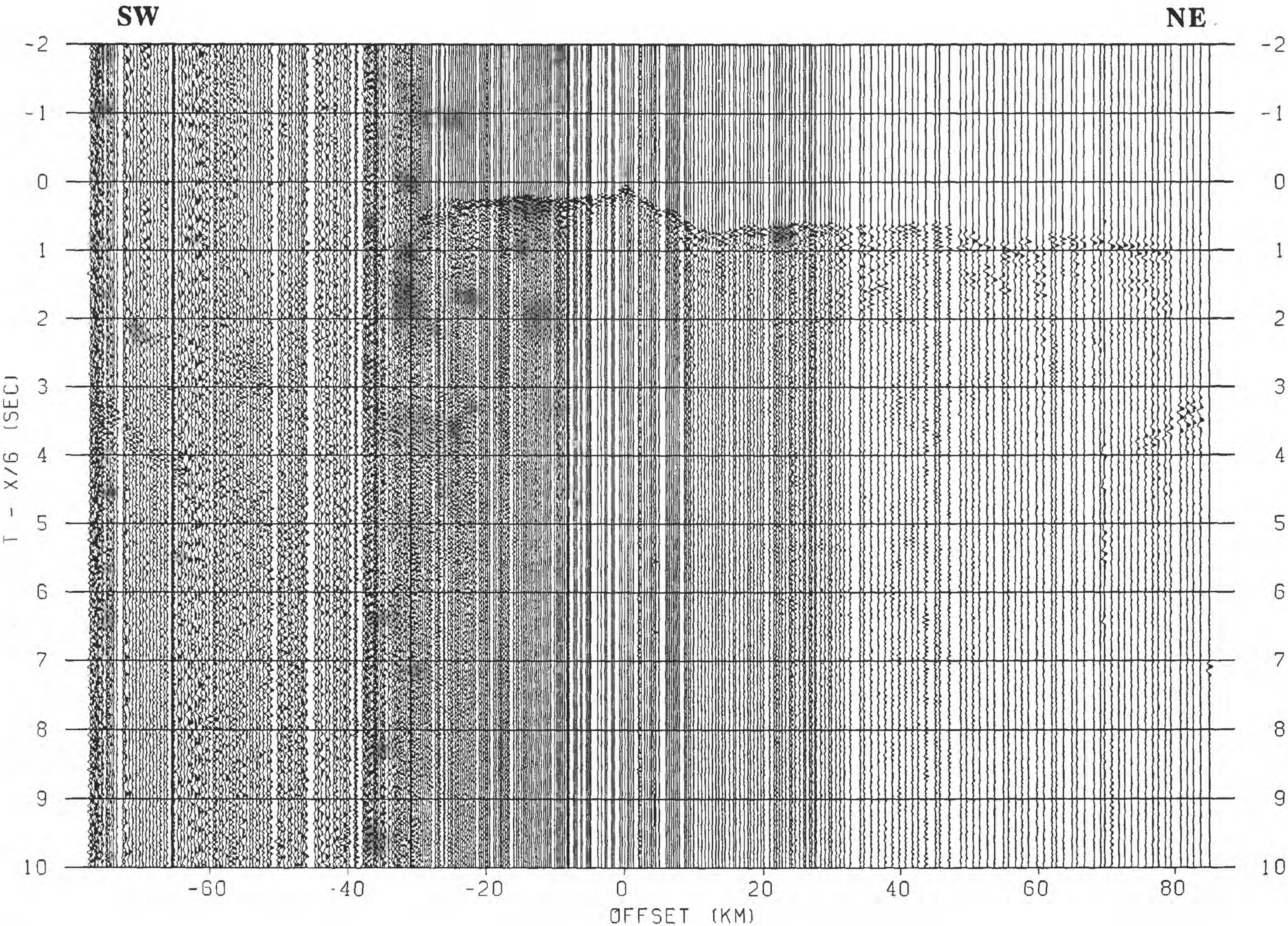

Figure 51. Shot 44 Shotpoint 8302

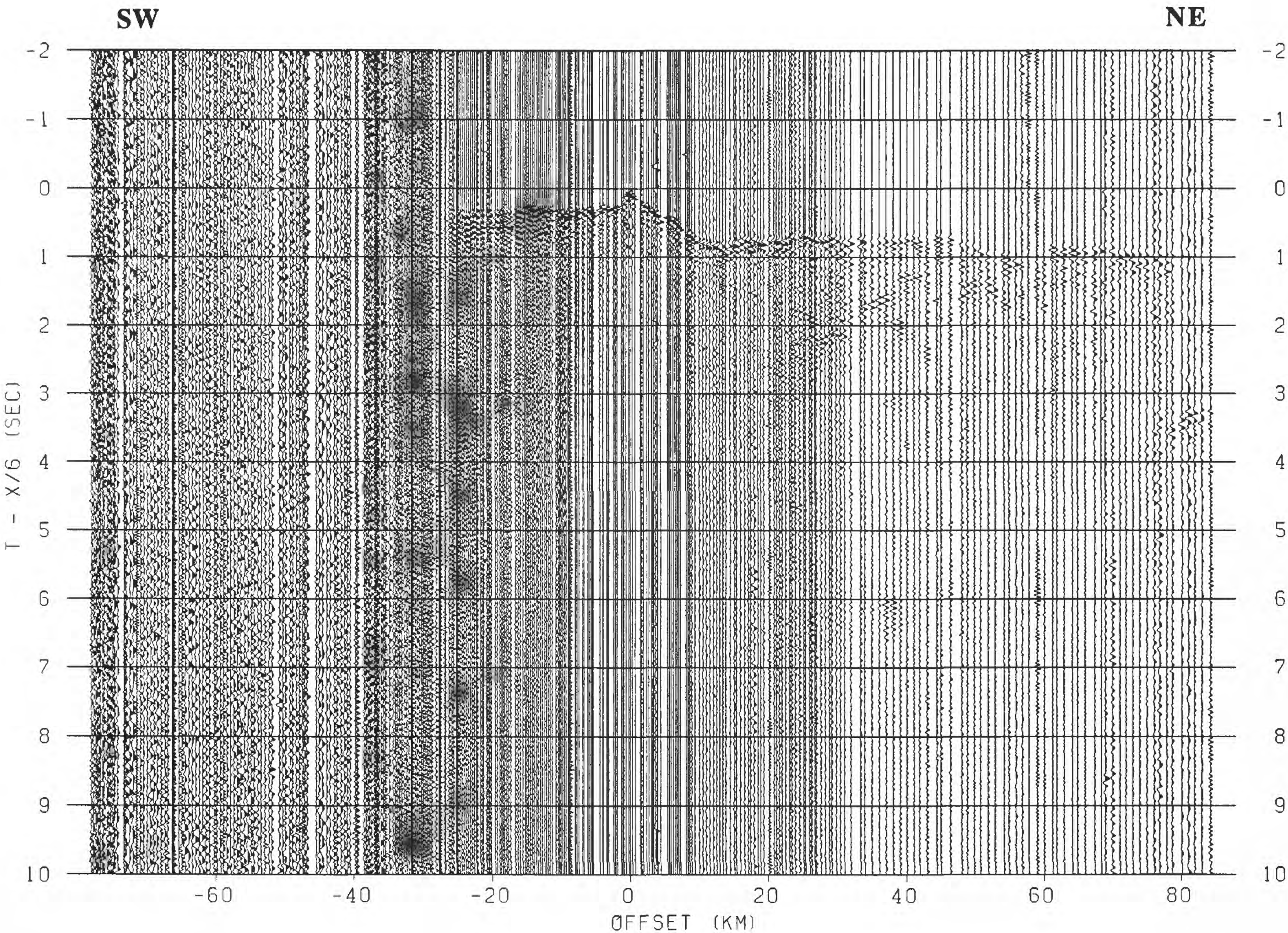

Figure 52. Shot 45 Shotpoint 8310

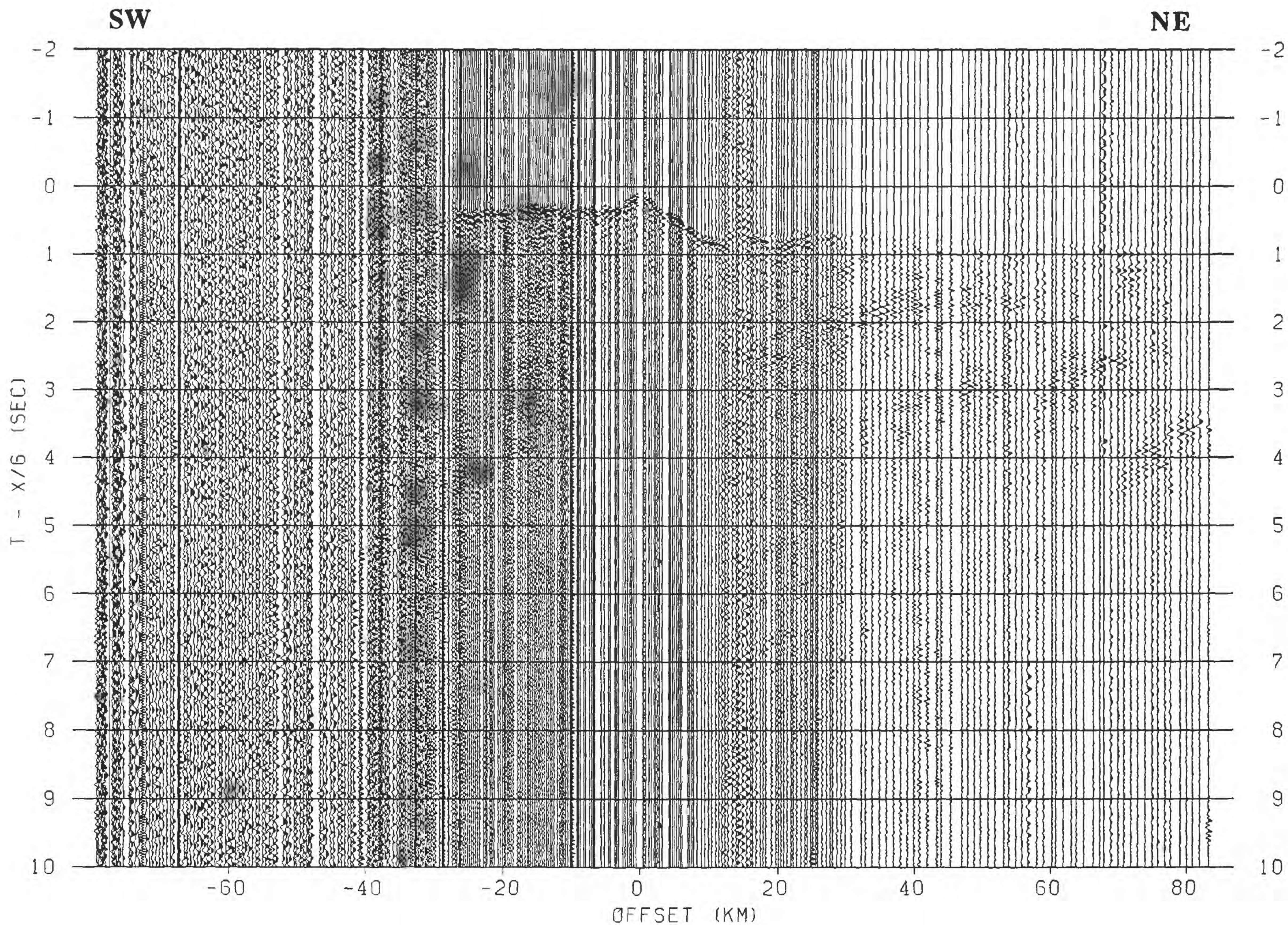

Figure 53. Shot 46 Shotpoint 8320

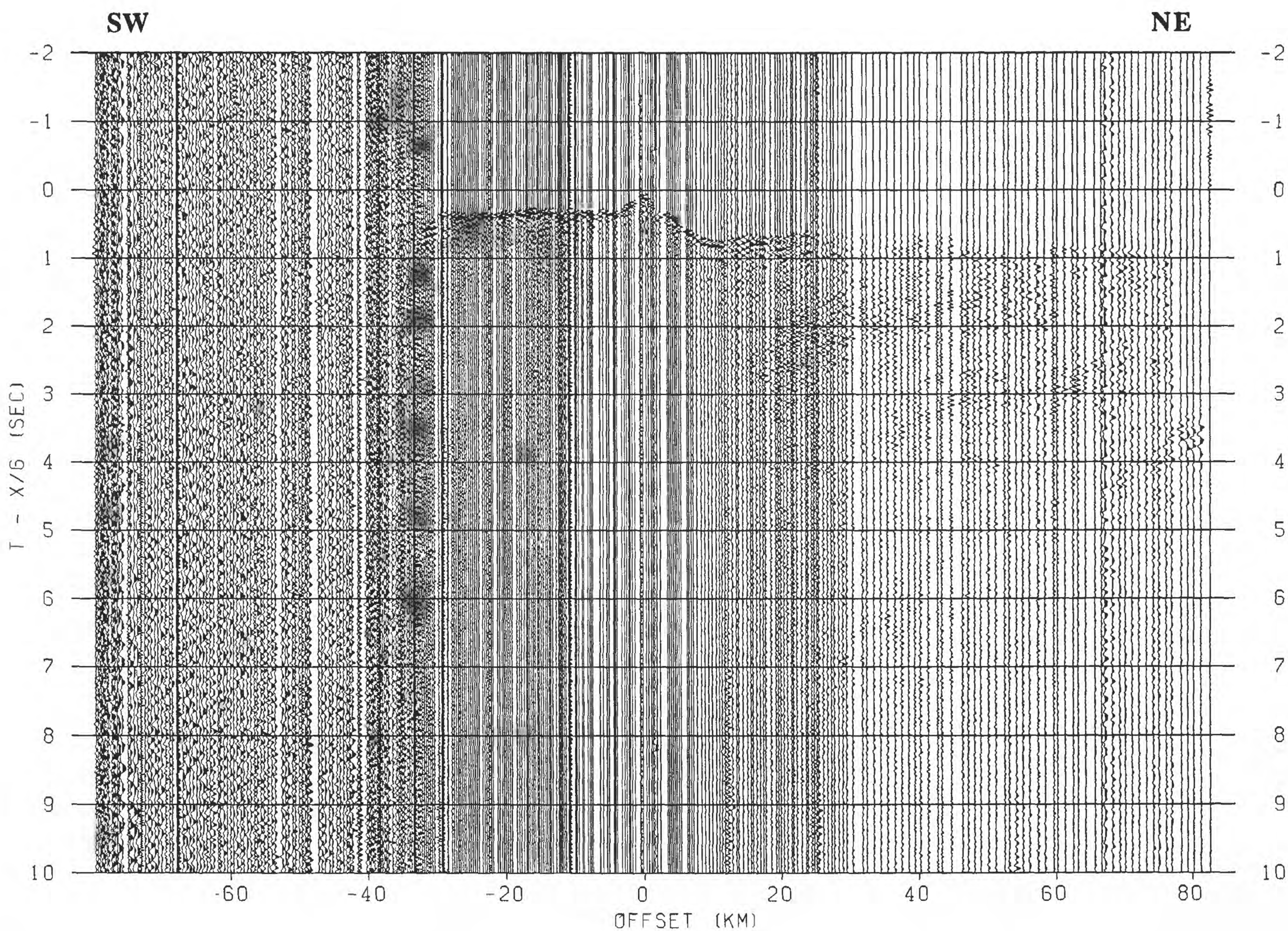

Figure 54. Shot 47 Shotpoint 8330

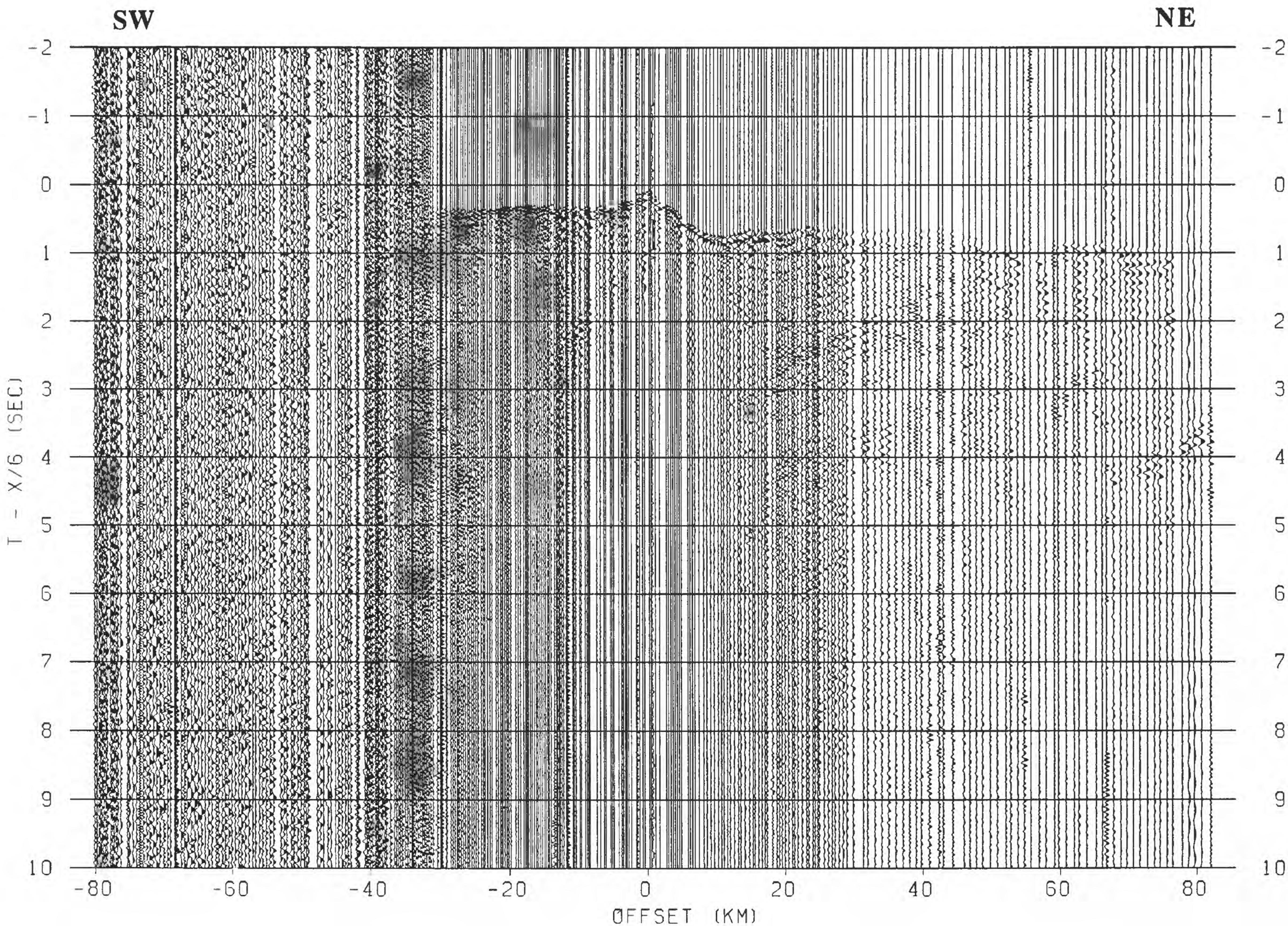

Figure 55. Shot 48 Shotpoint 8331

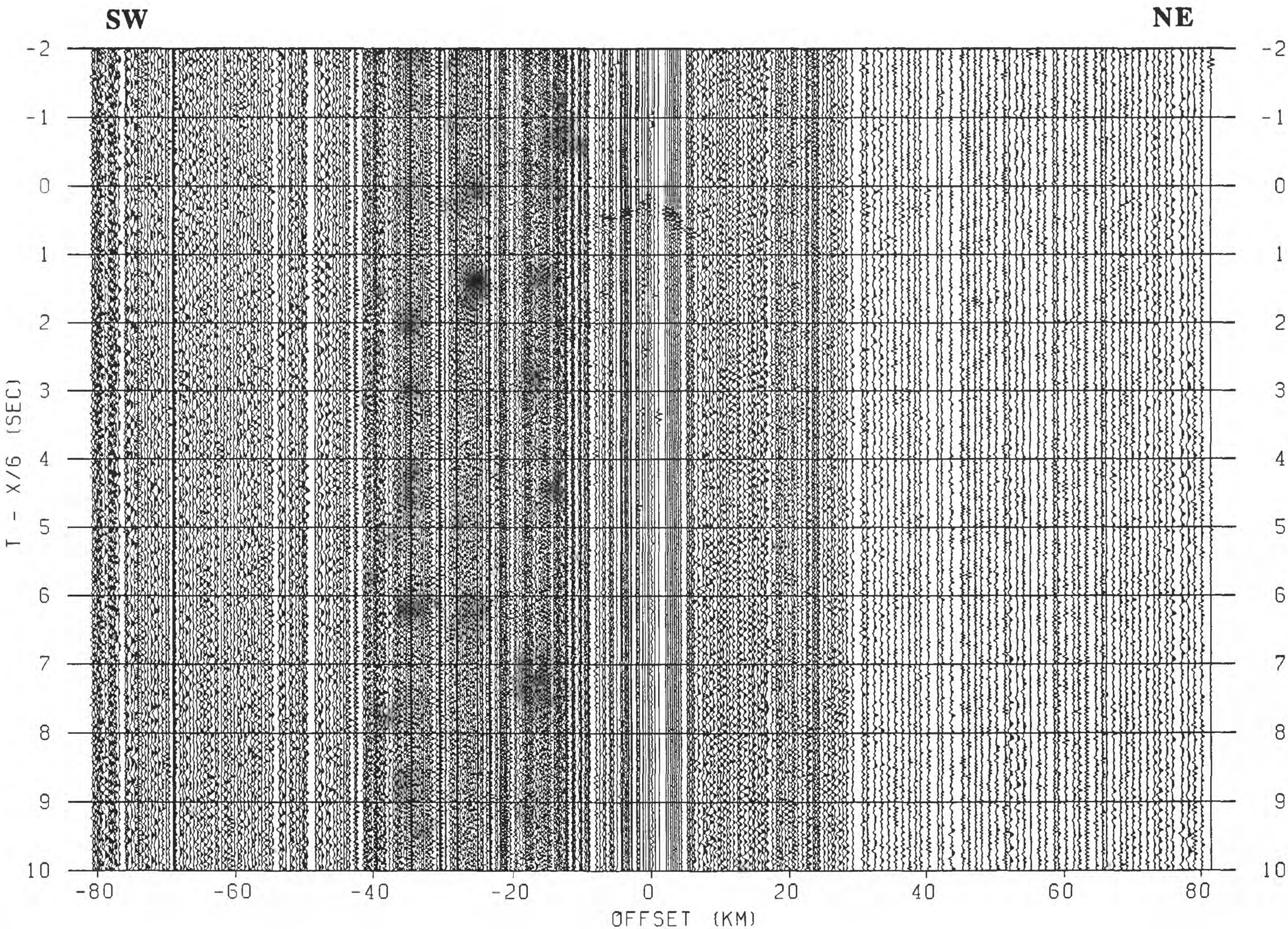

Figure 56. Shot 49 Shotpoint 8345

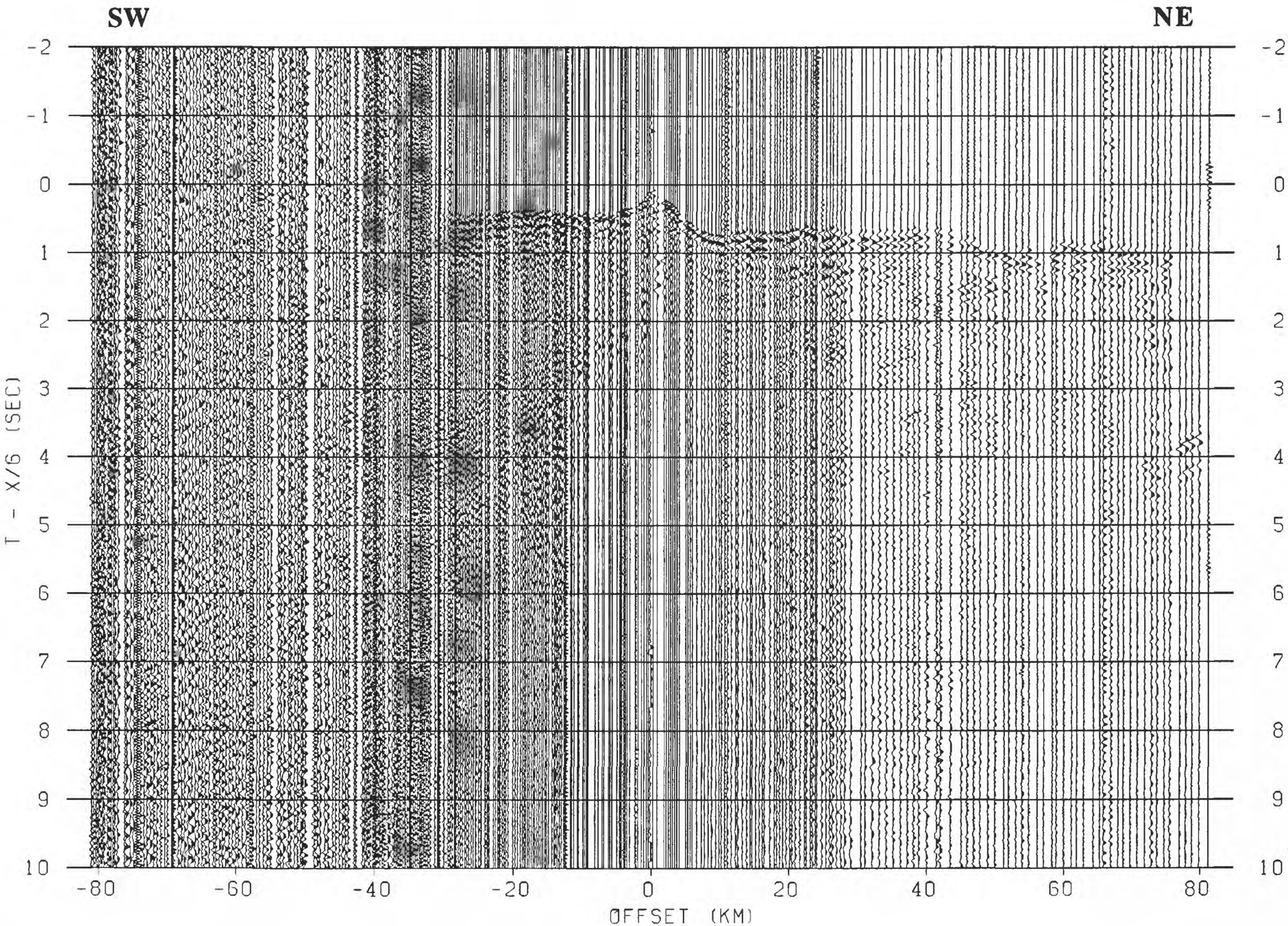

Figure 57. Shot 50 Shotpoint 8344

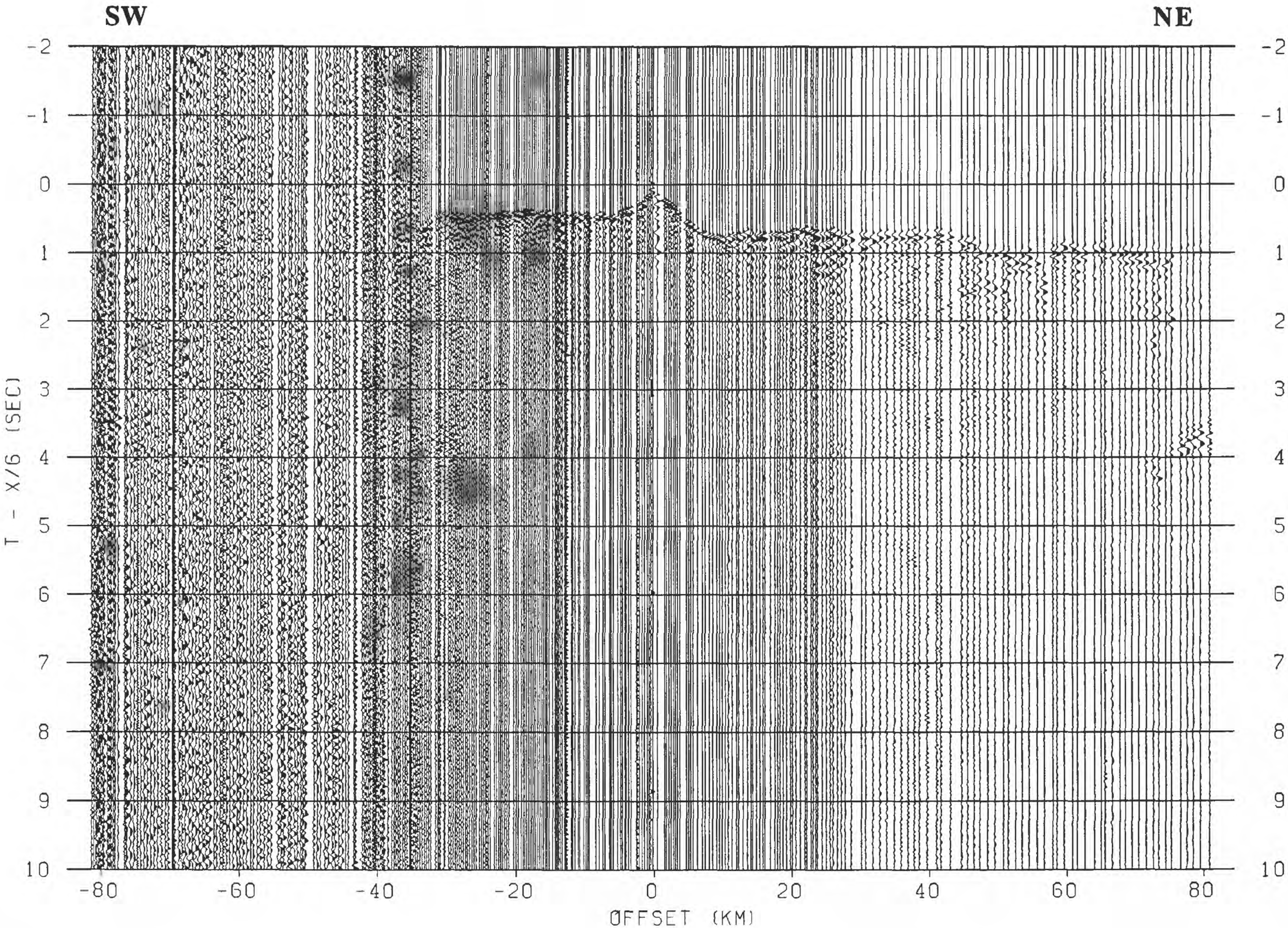

Figure 58. Shot 51 Shotpoint 8346

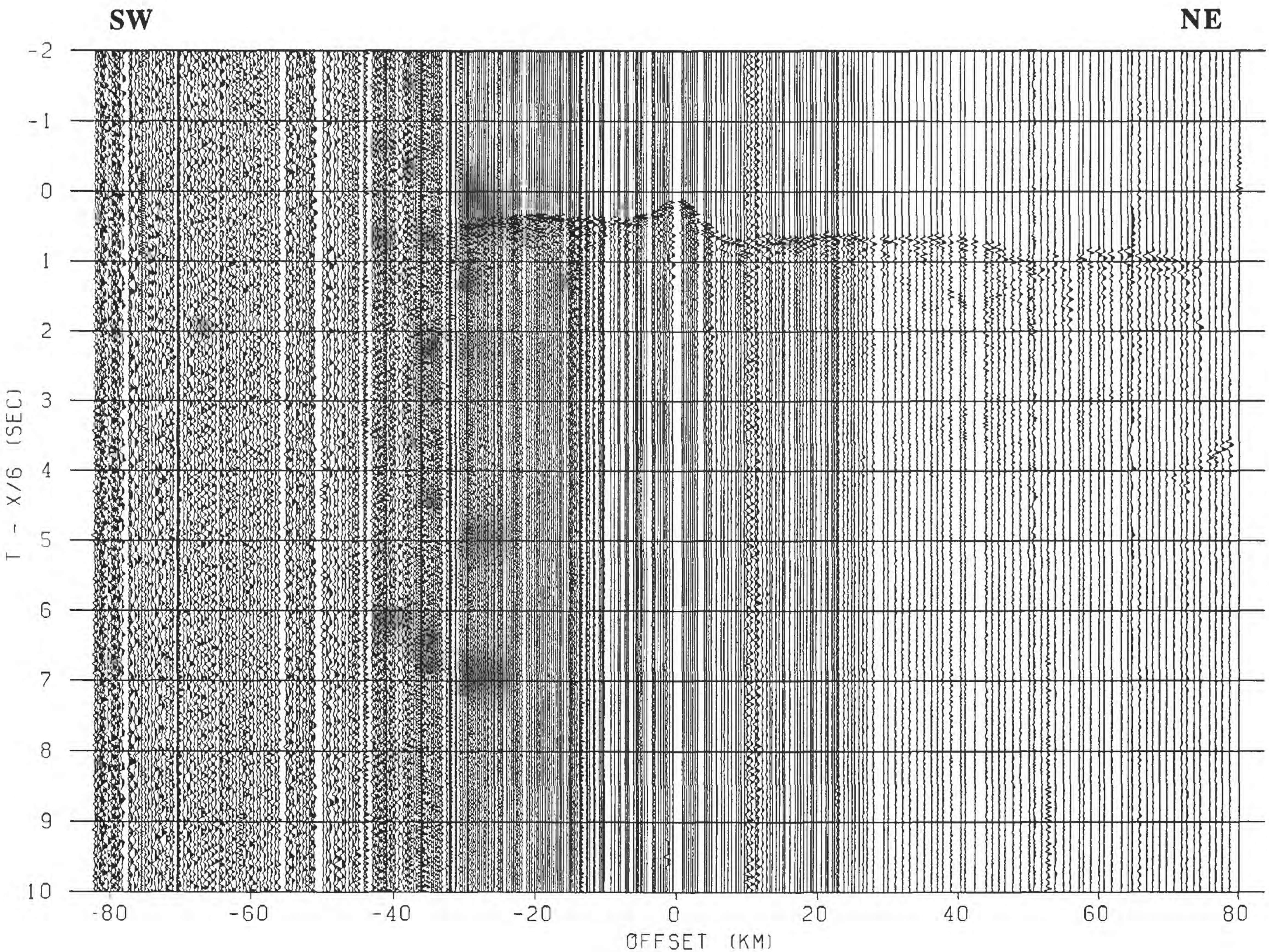

Figure 59. Shot 52 Shotpoint 8350

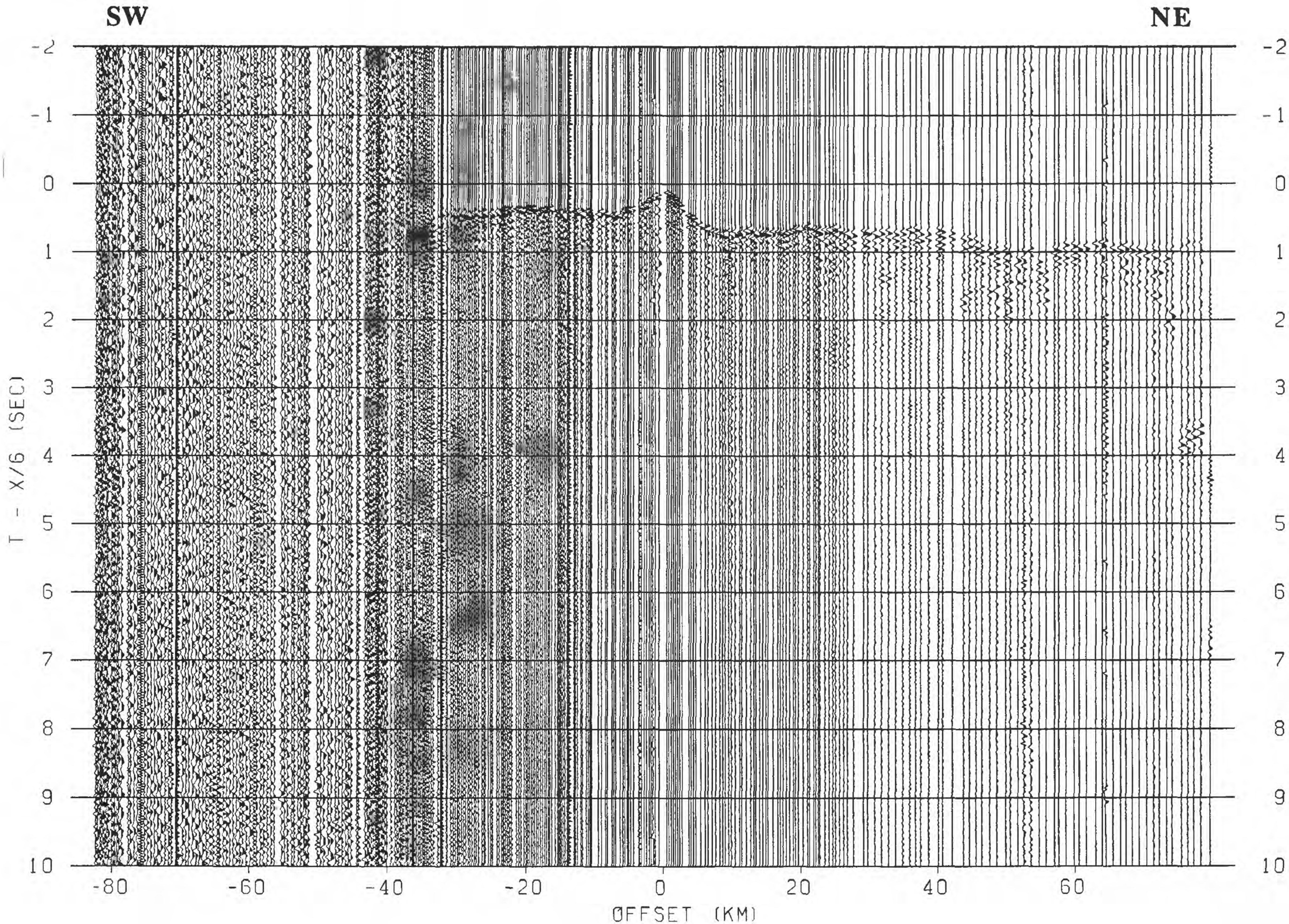

Figure 60. Shot 53 Shotpoint 8351

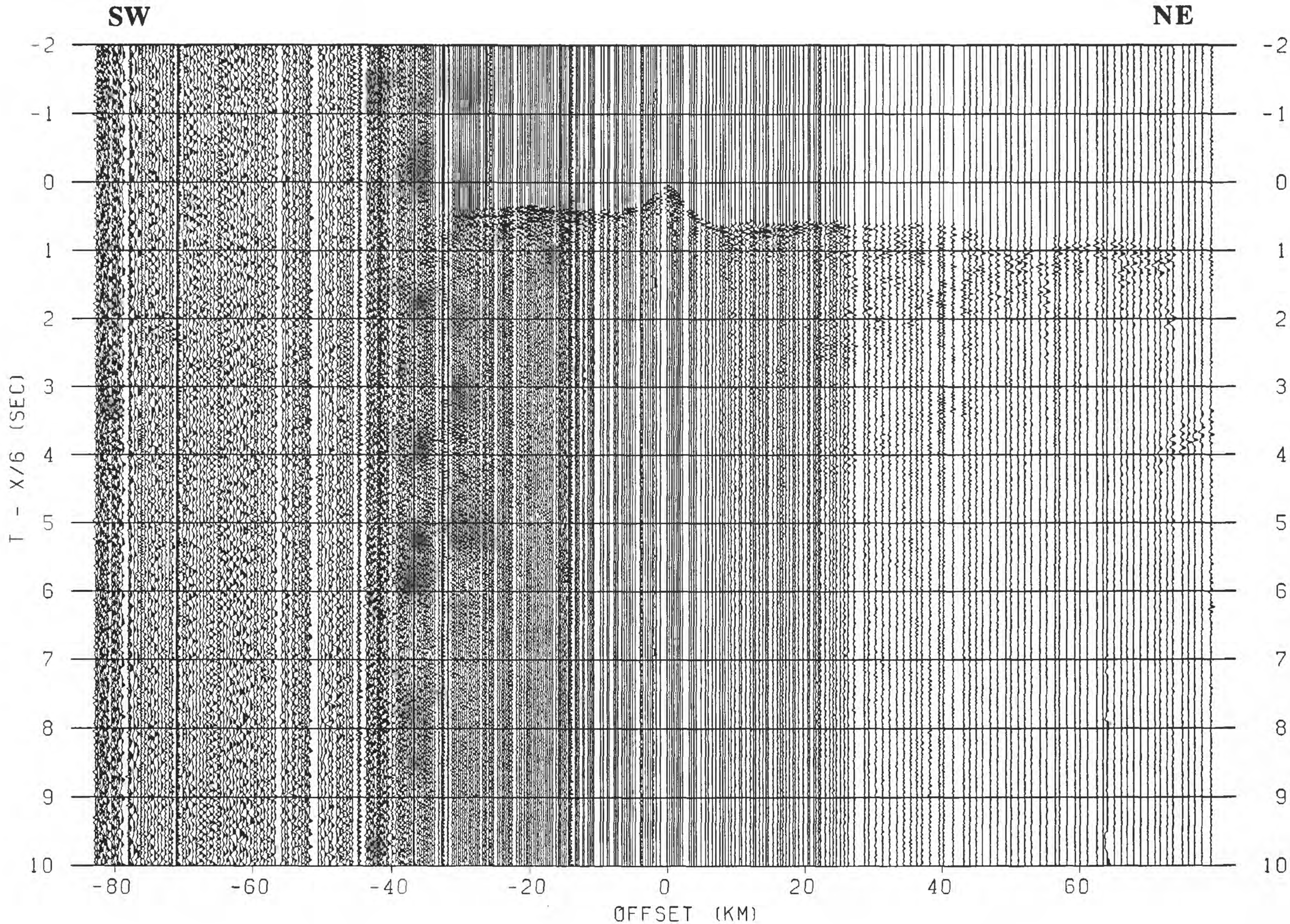

Figure 61. Shot 54 Shotpoint 8360

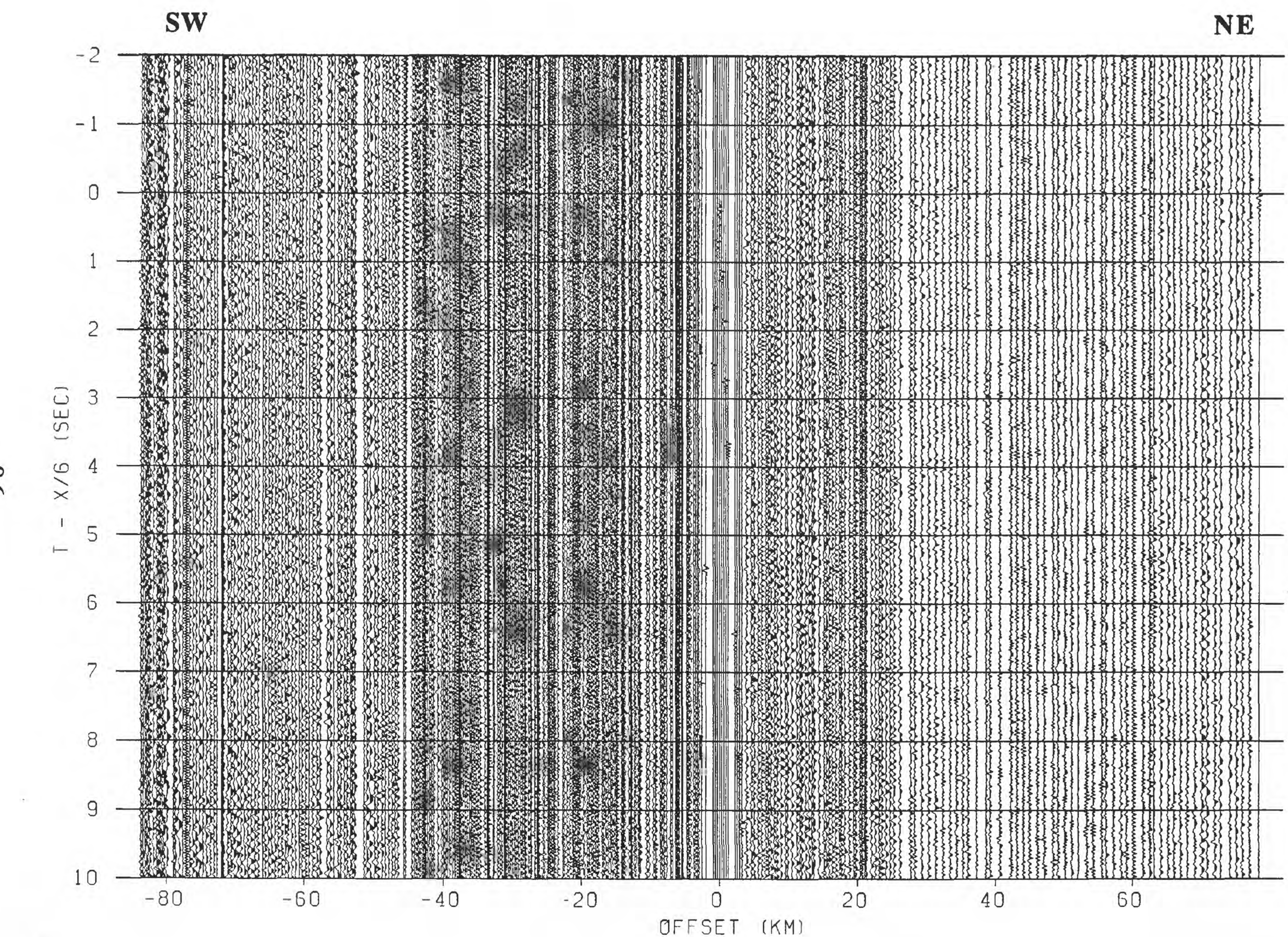

Figure 62. Shot 55 Shotpoint 8370

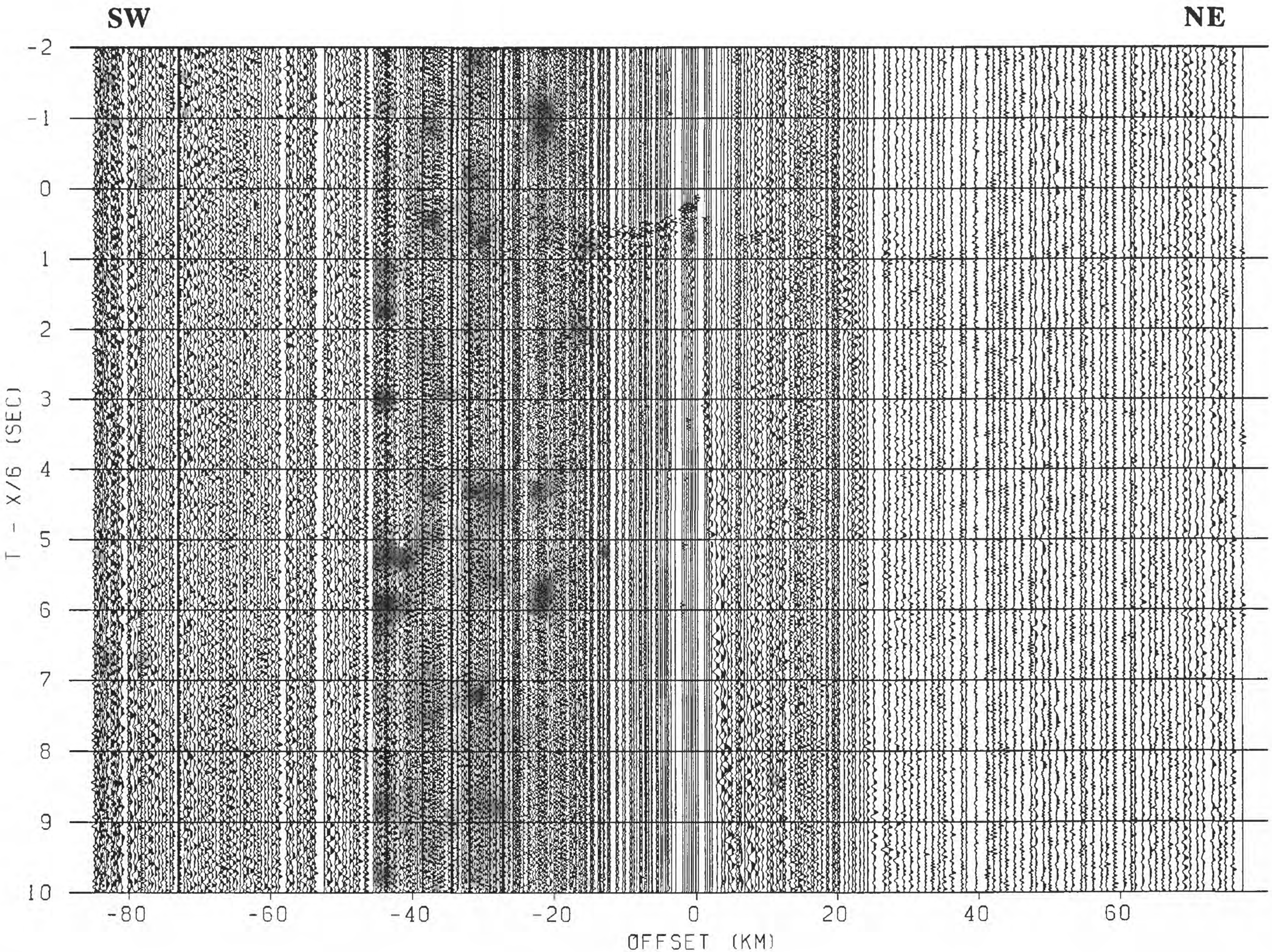

Figure 63. Shot 56 Shotpoint 8380

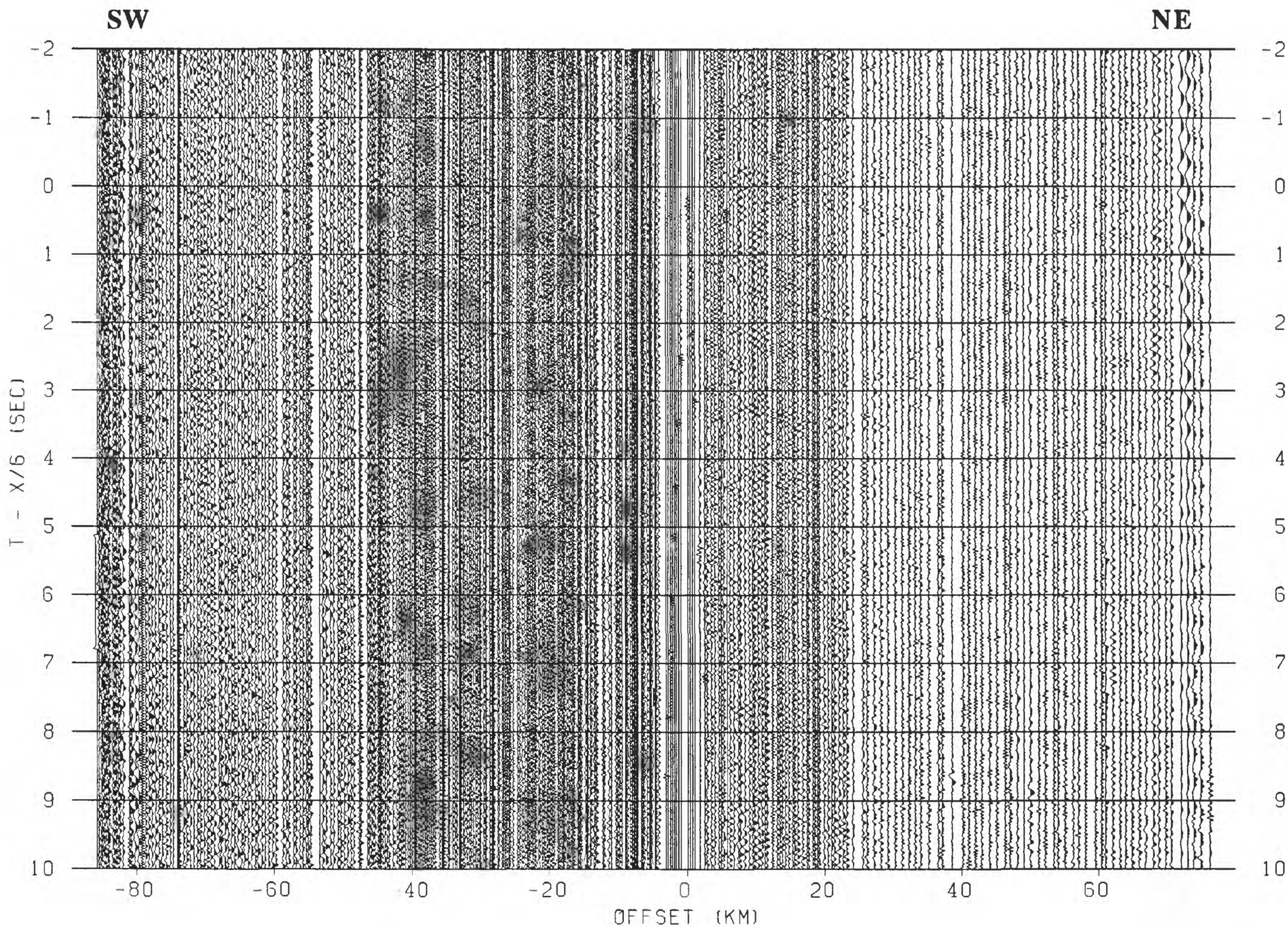

Figure 64. Shot 57 Shotpoint 8390

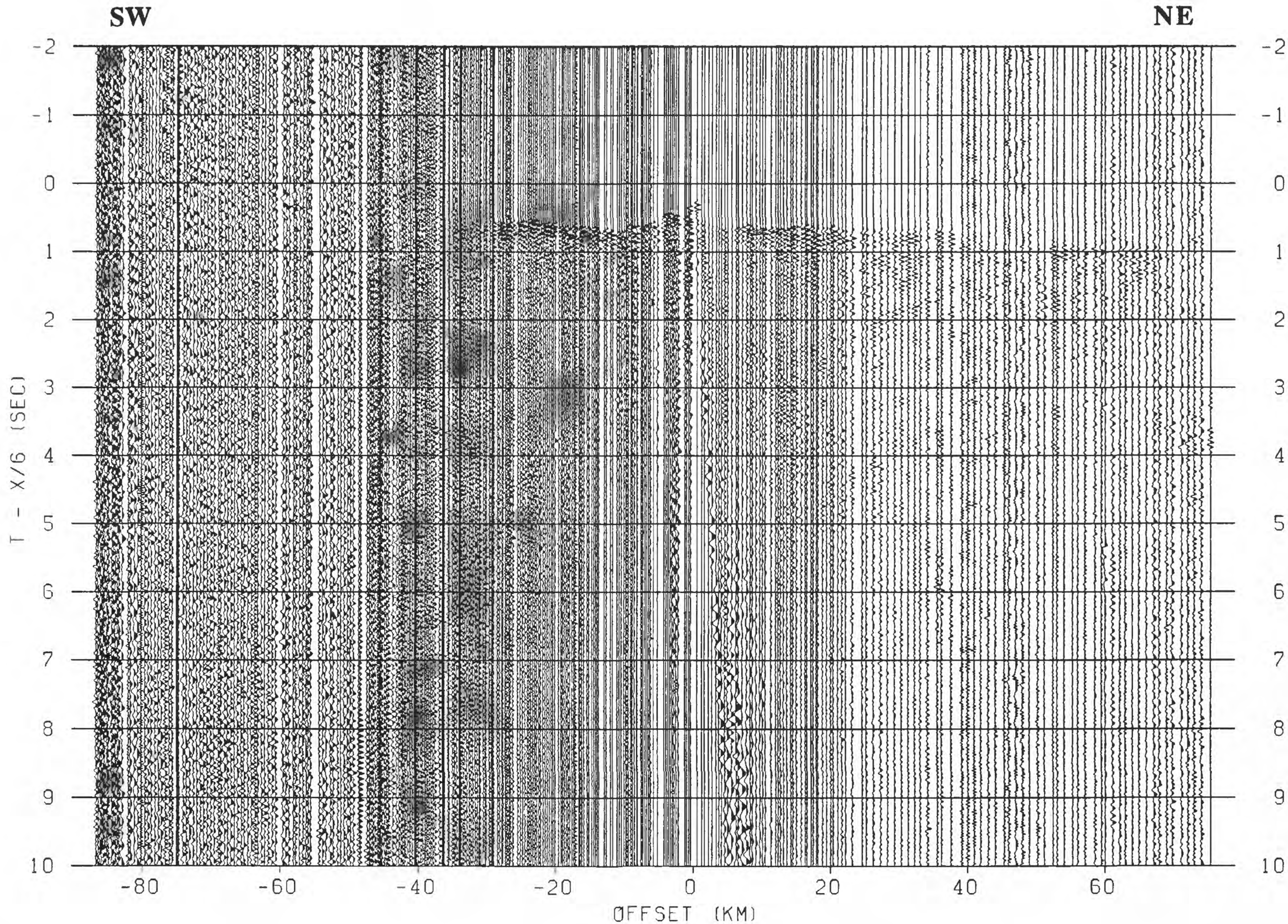

Figure 65. Shot 58 Shotpoint 8400

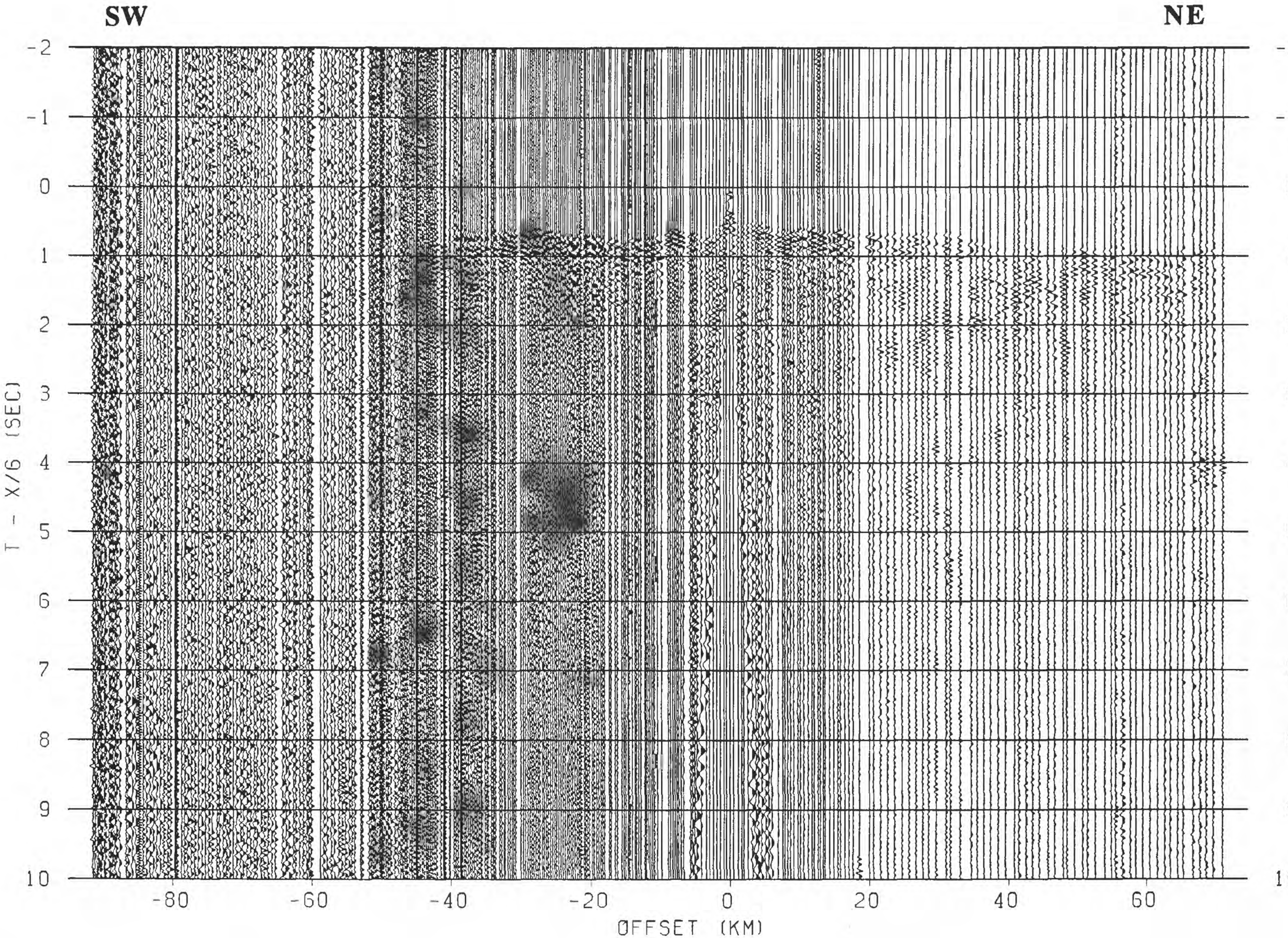

Figure 66. Shot 59 Shotpoint 8450

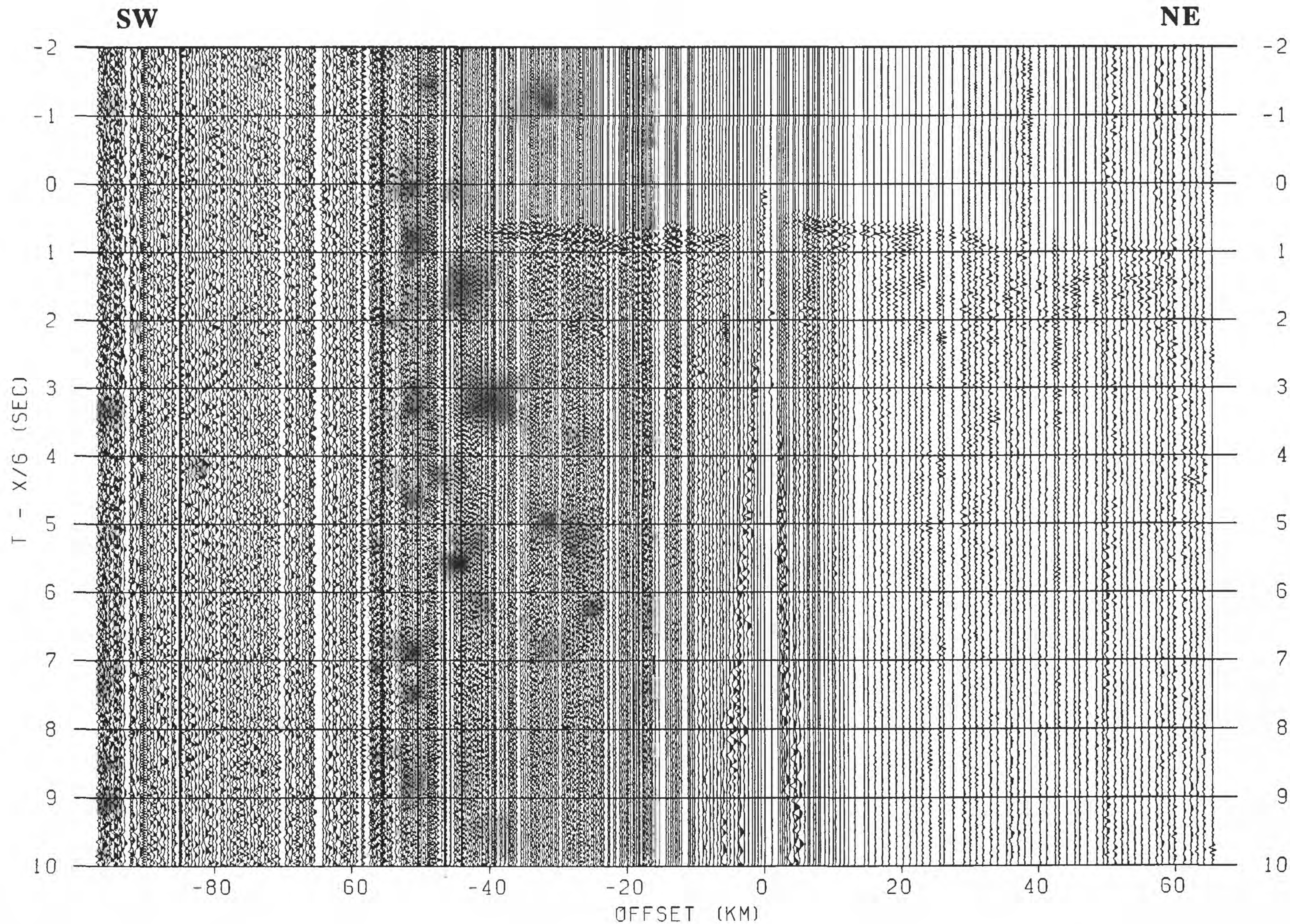

Figure 67. Shot 60 Shotpoint 8500

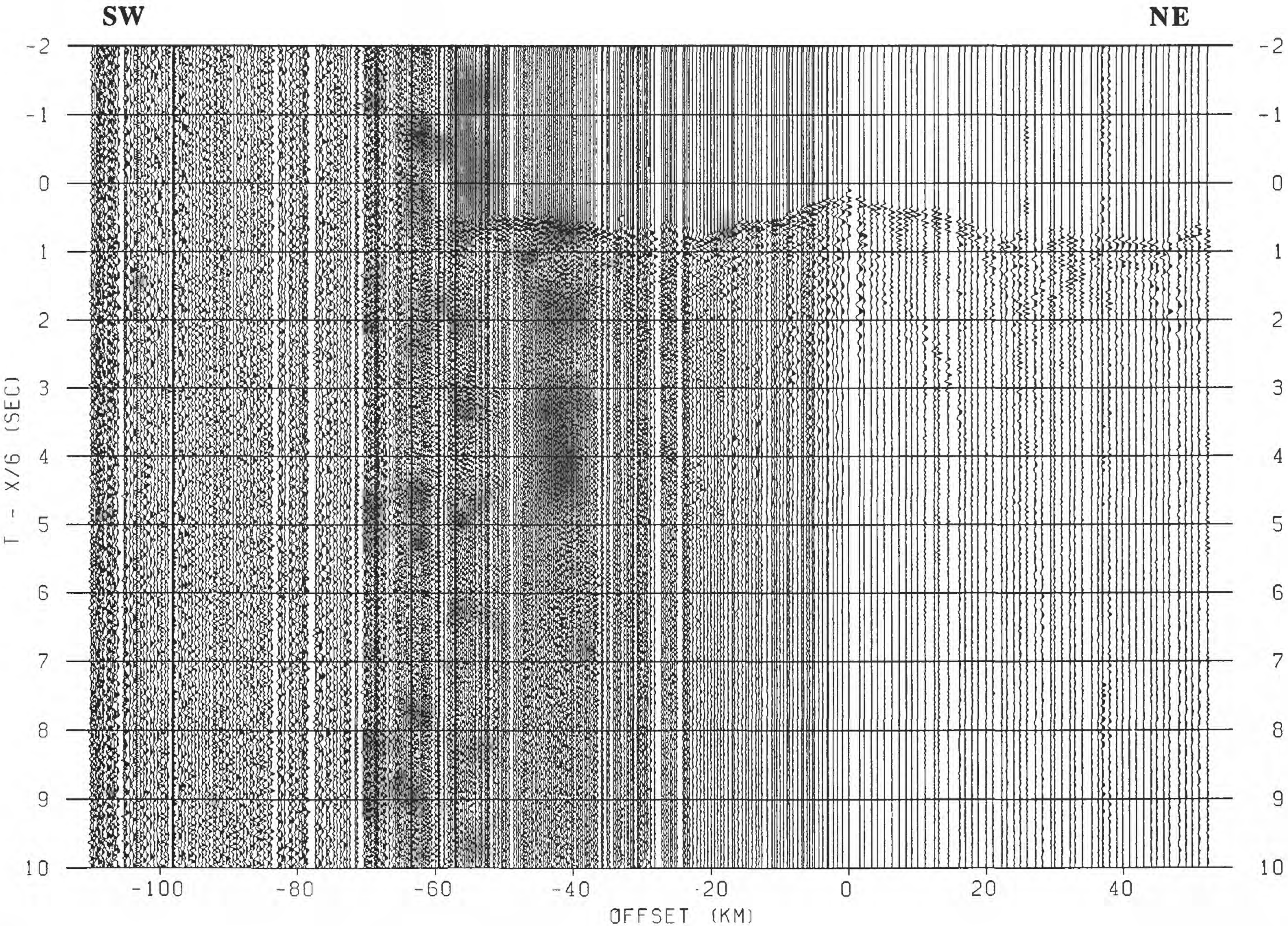

Figure 68. Shot 61 Shotpoint 8630

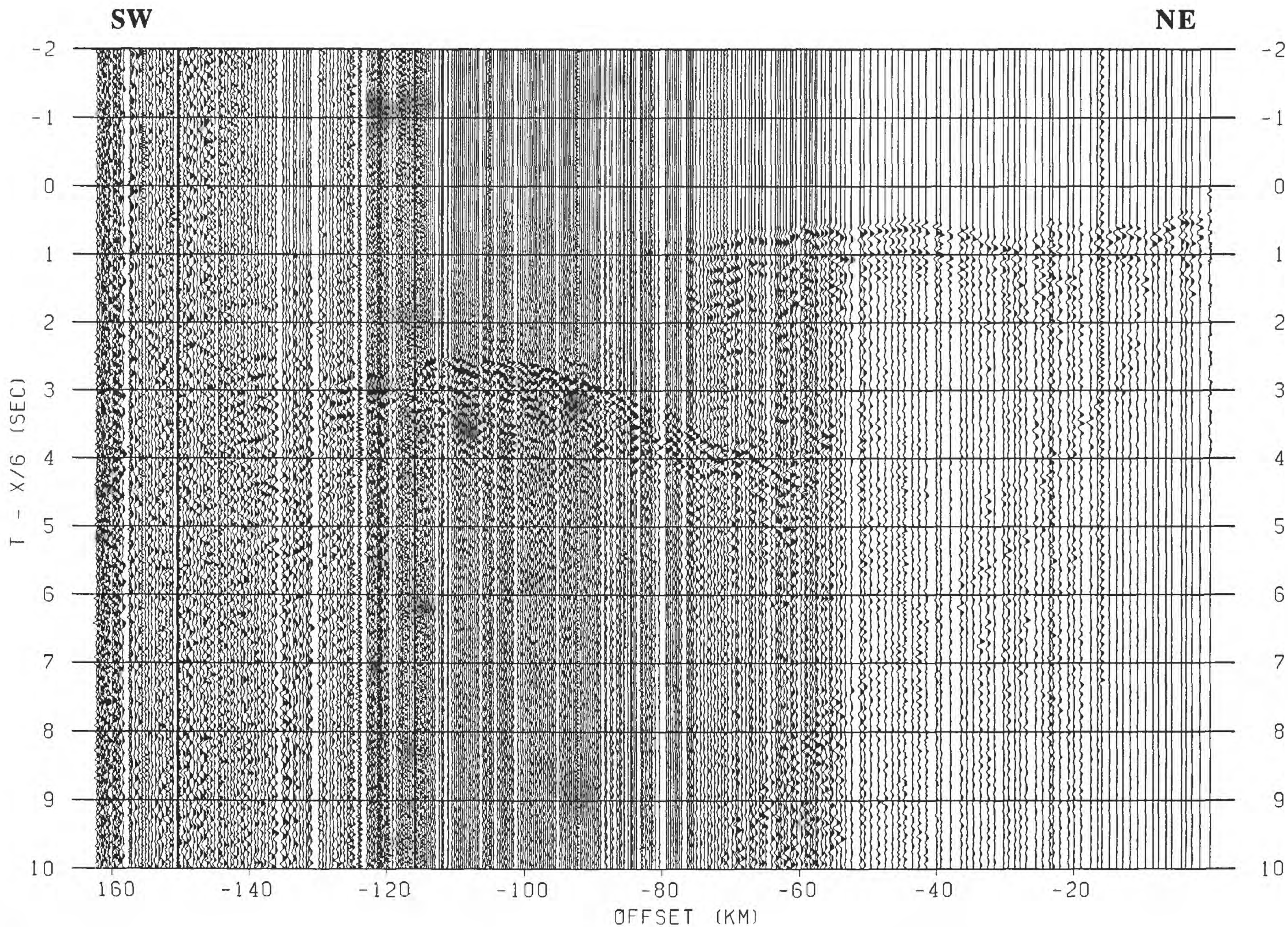

Figure 69. Shot 62 Shotpoint 9150

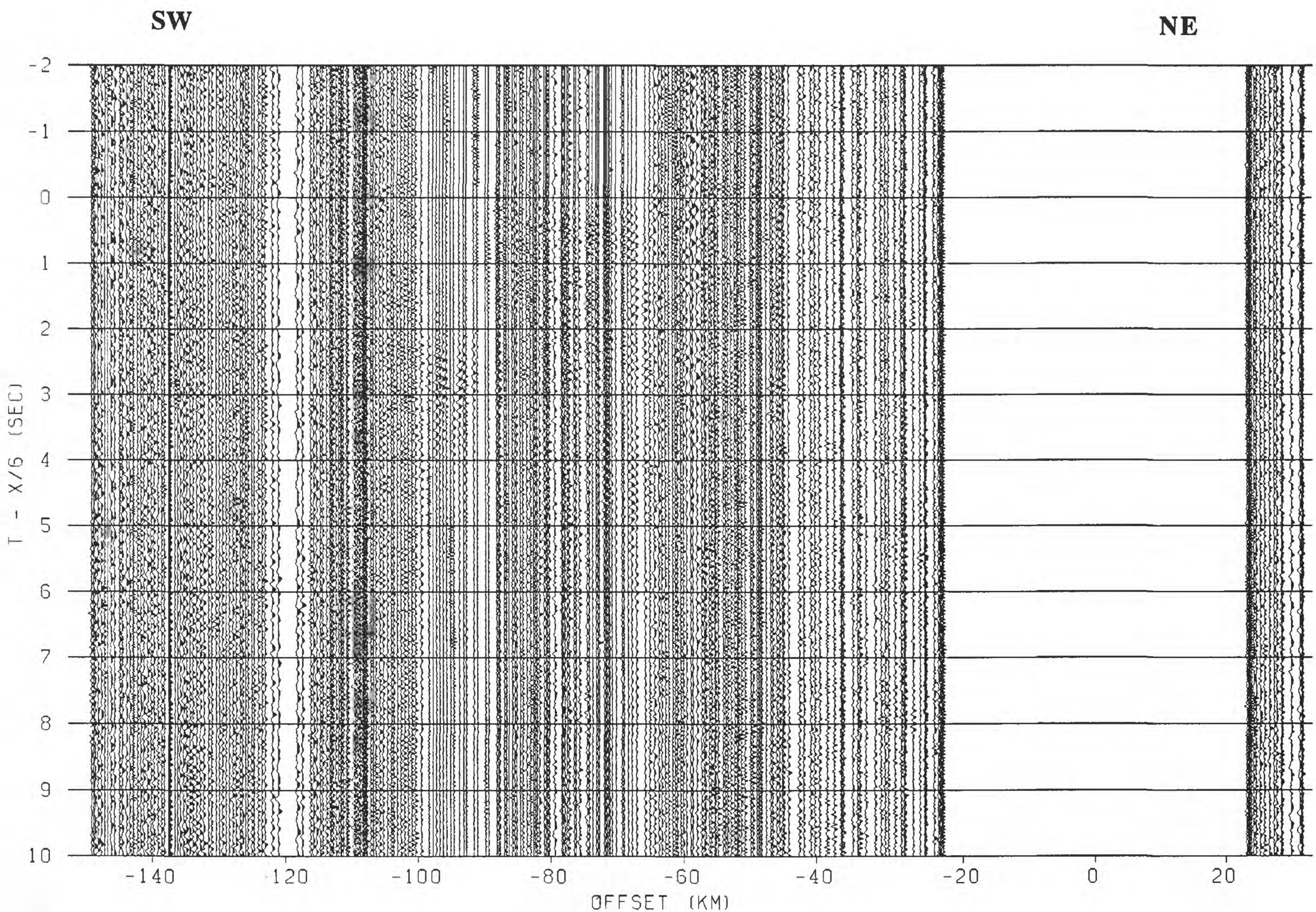

Figure 70. Shot 63 Shotpoint 9990

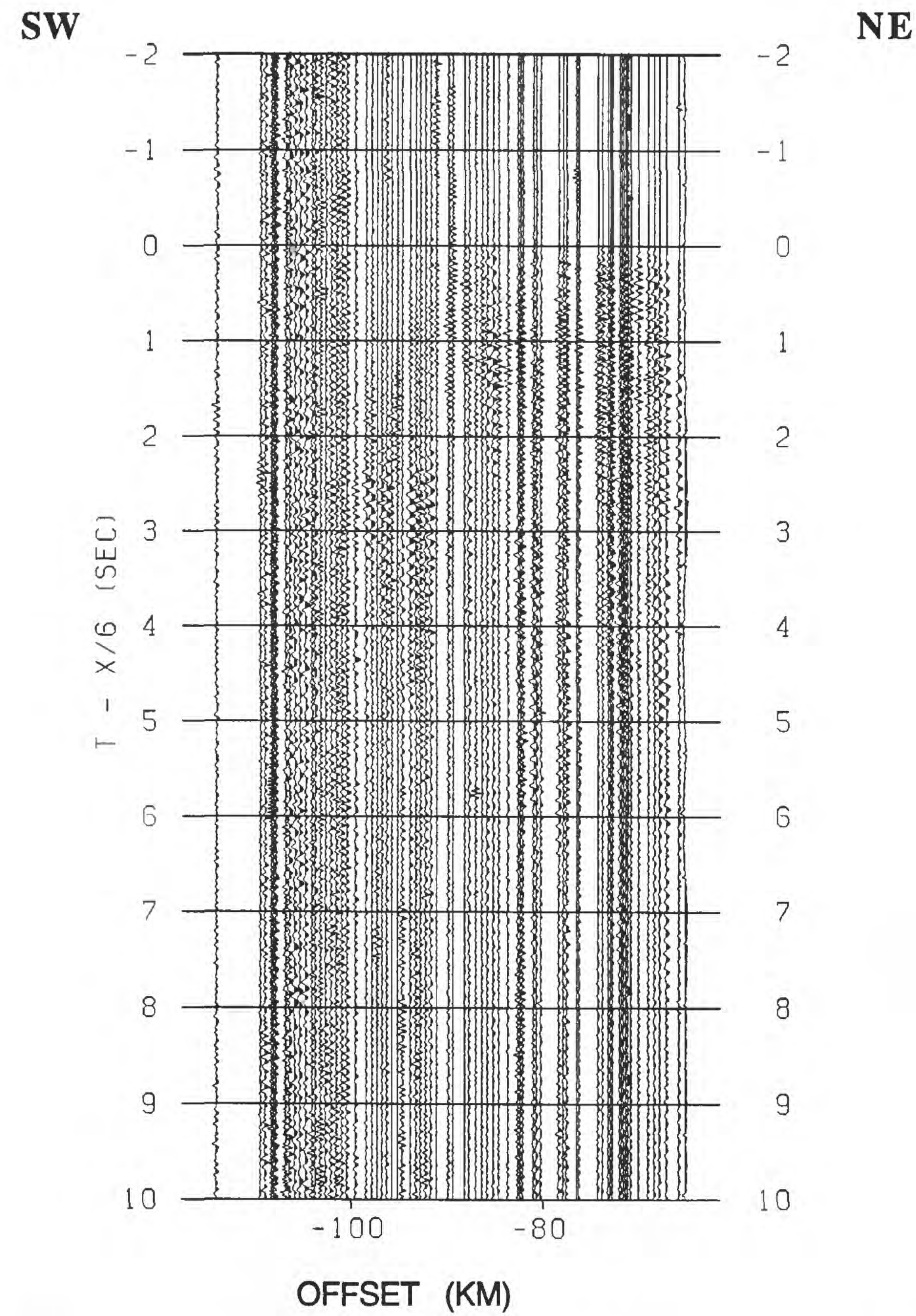

Figure 71. Shot 64 Shotpoint 9991

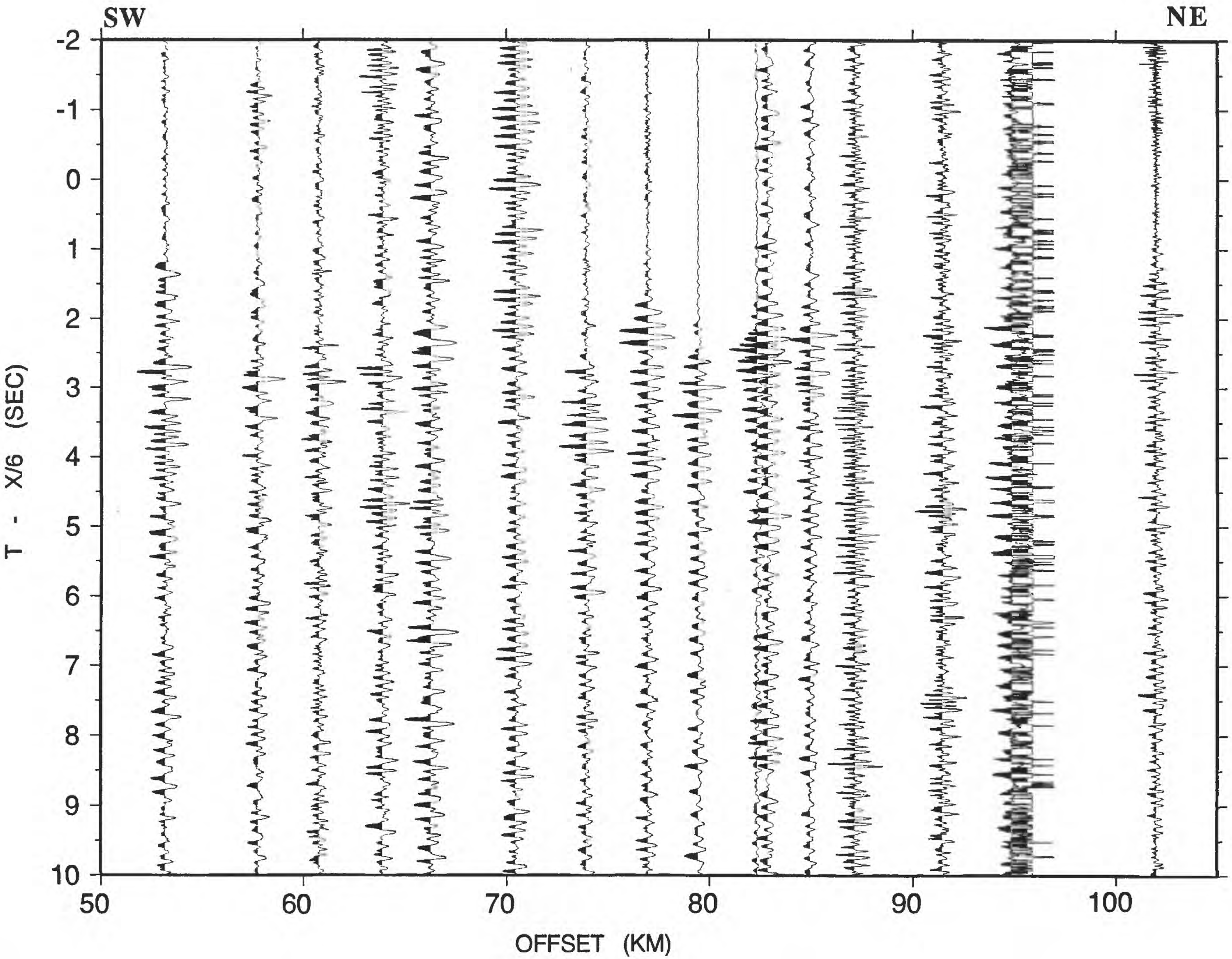

Figure 72. Shot 65 Shotpoint 9992

APPENDIX B

RECEIVER AND SHOTPOINT LOCATIONS

For each stake (receiver site or shotpoint), the WGS-84 latitude, longitude and altitude above (or below) the ellipsoid is listed in the following table. In addition, the UTM zone and X and Y coordinates are listed.

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
1	34.140739	-117.932533	158	11	414023.4	3778153.8
2	34.142212	-117.933846	159	11	413903.9	3778318.2
3	34.142803	-117.932846	163	11	413996.7	3778382.8
4	34.143433	-117.931824	162	11	414091.6	3778451.8
5	34.144043	-117.930817	165	11	414185.1	3778518.8
6	34.144562	-117.929764	167	11	414282.7	3778575.2
7	34.145241	-117.928787	168	11	414373.4	3778649.8
8	34.145901	-117.927887	168	11	414457.0	3778722.2
9	34.146599	-117.927032	165	11	414536.5	3778798.8
10	34.147324	-117.926201	170	11	414613.9	3778878.5
11	34.148033	-117.925346	171	11	414693.4	3778956.5
12	34.148659	-117.924614	172	11	414761.6	3779025.2
13	34.149338	-117.923828	174	11	414834.7	3779100.0
14	34.150043	-117.923096	173	11	414902.9	3779177.5
15	34.150749	-117.922394	181	11	414968.3	3779255.2
16	34.151516	-117.921715	179	11	415031.7	3779339.8
17	34.152267	-117.921036	179	11	415095.0	3779422.5
18	34.152931	-117.920334	181	11	415160.4	3779495.5
19	34.153629	-117.919609	186	11	415227.9	3779572.2
20	34.154316	-117.918907	183	11	415293.3	3779647.8
21	34.155029	-117.918182	182	11	415360.8	3779726.2
22	34.155727	-117.917419	187	11	415431.9	3779803.0
23	34.156391	-117.916664	175	11	415502.2	3779876.0
24	34.156956	-117.915810	188	11	415581.5	3779938.0
25	34.157532	-117.914894	197	11	415666.5	3780001.0
26	34.158234	-117.914032	191	11	415746.6	3780078.2
27	34.158783	-117.913063	199	11	415836.5	3780138.2
28	34.159340	-117.911728	197	11	415960.1	3780199.0
29	34.159687	-117.910263	201	11	416095.5	3780236.2
30	34.159760	-117.907219	202	11	416376.2	3780241.8
31	34.158520	-117.903076	208	11	416756.8	3780101.0
32	34.159161	-117.900963	212	11	416952.2	3780170.2
33	34.159668	-117.900444	211	11	417000.6	3780226.0
34	34.160172	-117.899033	216	11	417131.2	3780280.8
35	34.161041	-117.898094	214	11	417218.5	3780376.5
36	34.161945	-117.897430	222	11	417280.6	3780476.2
37	34.162758	-117.896790	221	11	417340.5	3780565.8
38	34.163509	-117.896225	219	11	417393.2	3780648.8
39	34.163998	-117.895264	224	11	417482.3	3780702.0
40	34.164150	-117.892235	238	11	417761.7	3780716.5
41	34.165138	-117.892036	241	11	417780.9	3780825.8
42	34.166080	-117.892281	256	11	417759.3	3780930.5
3042	34.164517	-117.891732	223	11	417808.3	3780756.7
43	34.167007	-117.892174	256	11	417770.0	3781033.2
44	34.167885	-117.892387	260	11	417751.2	3781130.8
45	34.168793	-117.892166	277	11	417772.5	3781231.2
46	34.169998	-117.892418	285	11	417750.4	3781365.0
47	34.170925	-117.892029	279	11	417787.2	3781467.5
48	34.171291	-117.891235	288	11	417860.7	3781507.5
49	34.171383	-117.887756	310	11	418181.4	3781515.0
50	34.172298	-117.887314	309	11	418223.1	3781616.0
51	34.173046	-117.886902	317	11	418261.8	3781698.5
52	34.173904	-117.886566	320	11	418293.5	3781793.5
53	34.174892	-117.886299	331	11	418319.1	3781902.8
54	34.175694	-117.885216	336	11	418419.7	3781990.8
55	34.175877	-117.884224	342	11	418511.3	3782010.2
56	34.176445	-117.883018	347	11	418622.9	3782072.5
57	34.177280	-117.882370	354	11	418683.5	3782164.5
58	34.178207	-117.882240	358	11	418696.3	3782267.2
59	34.179001	-117.882080	361	11	418711.9	3782355.0
60	34.180172	-117.881676	358	11	418750.3	3782484.5
61	34.181057	-117.881317	358	11	418784.2	3782582.5

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
62	34.181561	-117.880569	358	11	418853.6	3782637.8
63	34.182362	-117.879677	355	11	418936.6	3782725.8
64	34.183090	-117.878784	353	11	419019.5	3782806.0
65	34.183727	-117.877907	361	11	419101.0	3782875.8
66	34.183804	-117.876259	366	11	419252.9	3782883.0
67	34.184250	-117.875809	368	11	419294.8	3782932.2
68	34.184422	-117.872787	370	11	419573.4	3782948.8
69	34.184971	-117.872086	367	11	419638.6	3783009.2
70	34.185871	-117.871864	364	11	419659.8	3783108.8
71	34.186890	-117.871986	359	11	419649.6	3783221.8
72	34.187683	-117.871620	359	11	419684.1	3783309.5
73	34.188225	-117.869766	360	11	419855.4	3783368.0
74	34.188675	-117.868385	356	11	419983.1	3783417.0
75	34.189217	-117.867195	354	11	420093.3	3783476.0
76	34.189976	-117.866425	344	11	420165.0	3783559.8
77	34.190361	-117.865700	350	11	420232.2	3783601.8
78	34.191578	-117.866096	341	11	420196.8	3783737.0
79	34.192543	-117.865654	346	11	420238.4	3783843.8
80	34.193356	-117.865204	339	11	420280.7	3783933.5
81	34.193794	-117.864120	345	11	420380.9	3783981.2
82	34.194706	-117.863564	351	11	420433.1	3784082.0
83	34.195778	-117.863441	351	11	420445.3	3784200.8
84	34.196495	-117.862885	359	11	420497.3	3784279.8
85	34.197300	-117.862968	365	11	420490.3	3784369.0
86	34.198273	-117.862503	372	11	420534.1	3784476.5
87	34.199059	-117.861885	377	11	420591.8	3784563.2
88	34.199833	-117.861099	381	11	420664.9	3784648.5
89	34.200157	-117.859711	387	11	420793.2	3784683.5
90	34.200542	-117.858543	396	11	420901.1	3784725.2
91	34.202553	-117.861465	414	11	420633.8	3784950.5
92	34.205570	-117.866684	449	11	420155.8	3785289.0
93	34.206497	-117.865875	450	11	420231.2	3785391.2
94	34.207340	-117.865181	458	11	420295.9	3785484.2
95	34.208248	-117.865623	468	11	420256.0	3785585.2
96	34.209332	-117.865639	468	11	420255.6	3785705.2
97	34.210224	-117.865181	470	11	420298.7	3785804.0
98	34.210869	-117.864464	472	11	420365.3	3785875.0
99	34.211502	-117.863441	471	11	420460.1	3785944.2
100	34.212566	-117.863831	468	11	420425.2	3786062.5
101	34.213703	-117.864227	469	11	420389.8	3786189.0
102	34.214825	-117.864426	468	11	420372.6	3786313.5
103	34.214729	-117.861366	477	11	420654.3	3786300.5
104	34.215538	-117.860794	476	11	420707.8	3786389.8
105	34.216156	-117.860214	477	11	420761.8	3786457.8
106	34.216858	-117.859291	477	11	420847.4	3786535.0
107	34.216785	-117.856476	481	11	421106.7	3786524.8
108	34.217361	-117.855286	483	11	421216.9	3786587.8
109	34.218033	-117.855164	480	11	421228.8	3786662.0
110	34.219414	-117.855408	470	11	421207.6	3786815.2
111	34.220100	-117.854973	462	11	421248.2	3786891.2
112	34.221272	-117.855179	464	11	421230.4	3787021.2
113	34.221958	-117.854454	452	11	421297.8	3787096.8
114	34.221775	-117.851852	448	11	421537.2	3787074.5
115	34.222530	-117.851471	447	11	421573.1	3787158.0
116	34.223454	-117.851112	445	11	421607.0	3787260.0
117	34.224453	-117.850677	444	11	421647.9	3787370.5
118	34.224812	-117.849625	436	11	421745.2	3787409.5
119	34.225742	-117.848900	439	11	421812.9	3787512.0
120	34.226528	-117.847946	442	11	421901.4	3787598.5
121	34.227432	-117.847534	438	11	421940.2	3787698.5
122	34.228115	-117.846817	443	11	422006.9	3787773.5

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
123	34.229038	-117.846100	444	11	422073.8	3787875.5
124	34.230049	-117.845543	441	11	422126.0	3787987.0
125	34.230785	-117.845757	439	11	422107.0	3788069.0
126	34.231598	-117.845657	446	11	422116.9	3788159.0
127	34.232597	-117.846245	440	11	422063.7	3788270.2
128	34.233582	-117.846596	442	11	422032.3	3788379.5
129	34.244312	-117.869438	465	11	419938.7	3789587.2
130	34.245018	-117.869080	457	11	419972.4	3789665.2
131	34.245728	-117.868271	468	11	420047.6	3789743.2
132	34.246159	-117.867409	479	11	420127.3	3789790.2
133	34.246754	-117.866577	482	11	420204.5	3789855.8
134	34.247478	-117.866089	490	11	420250.1	3789935.8
135	34.248314	-117.865501	493	11	420305.0	3790027.8
136	34.248978	-117.865265	503	11	420327.4	3790101.2
137	34.249287	-117.863792	512	11	420463.3	3790134.5
138	34.249821	-117.862846	518	11	420550.9	3790192.8
139	34.250340	-117.861893	524	11	420639.2	3790249.8
140	34.250790	-117.861031	533	11	420719.0	3790299.0
141	34.251534	-117.860176	539	11	420798.4	3790380.8
142	34.252785	-117.859360	547	11	420874.8	3790518.8
143	34.253441	-117.858765	552	11	420930.2	3790591.0
144	34.254292	-117.858551	554	11	420950.6	3790685.2
145	34.255749	-117.858559	568	11	420951.3	3790846.8
146	34.256943	-117.858574	579	11	420951.0	3790979.2
147	34.257656	-117.857597	583	11	421041.6	3791057.8
148	34.258511	-117.856850	591	11	421111.2	3791151.8
149	34.259197	-117.855934	595	11	421196.2	3791227.2
150	34.259930	-117.854622	602	11	421317.7	3791307.5
151	34.260811	-117.853813	614	11	421392.9	3791404.5
152	34.261189	-117.852737	618	11	421492.3	3791445.5
153	34.261993	-117.852119	625	11	421550.0	3791534.2
154	34.262604	-117.850960	644	11	421657.3	3791601.2
155	34.261982	-117.848366	655	11	421895.5	3791530.2
156	34.262386	-117.844810	675	11	422223.2	3791572.2
157	34.263142	-117.844437	672	11	422258.3	3791655.8
158	34.264267	-117.844231	674	11	422278.3	3791780.5
159	34.265766	-117.844849	669	11	422222.8	3791947.0
160	34.266514	-117.845184	678	11	422192.6	3792030.2
161	34.267654	-117.845695	697	11	422146.6	3792157.2
162	34.269028	-117.846283	703	11	422093.8	3792309.8
163	34.270046	-117.846725	707	11	422054.0	3792423.2
164	34.271084	-117.847076	735	11	422022.7	3792538.5
165	34.272026	-117.846840	737	11	422045.3	3792642.8
166	34.273121	-117.846855	738	11	422044.9	3792764.2
167	34.274109	-117.846718	752	11	422058.4	3792873.8
168	34.275040	-117.846397	765	11	422088.8	3792976.5
169	34.275894	-117.846176	767	11	422110.0	3793071.2
170	34.276897	-117.846085	772	11	422119.3	3793182.5
171	34.277748	-117.845833	781	11	422143.3	3793276.5
172	34.278416	-117.844826	793	11	422236.6	3793349.8
173	34.279160	-117.845024	806	11	422219.0	3793432.5
174	34.279774	-117.844406	824	11	422276.5	3793500.0
175	34.280785	-117.844475	881	11	422271.1	3793612.2
176	34.281948	-117.844452	891	11	422274.2	3793741.2
177	34.282993	-117.843987	916	11	422318.1	3793856.8
178	34.283821	-117.844460	932	11	422275.3	3793949.0
179	34.284939	-117.844444	940	11	422277.7	3794072.8
180	34.285587	-117.843971	935	11	422321.8	3794144.2
181	34.286556	-117.843208	960	11	422393.0	3794251.2
182	34.287292	-117.843025	969	11	422410.5	3794332.8
183	34.287685	-117.841682	971	11	422534.4	3794375.2

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
184	34.288494	-117.840843	974	11	422612.4	3794464.2
185	34.289555	-117.840744	981	11	422622.5	3794581.8
186	34.290421	-117.840759	973	11	422621.9	3794677.8
187	34.290936	-117.841591	980	11	422545.8	3794735.5
188	34.292538	-117.840141	985	11	422680.7	3794912.2
189	34.293713	-117.840126	999	11	422683.2	3795042.5
190	34.294617	-117.840141	998	11	422682.6	3795142.8
191	34.295582	-117.840385	1056	11	422661.0	3795250.0
192	34.295925	-117.838821	1065	11	422805.3	3795286.8
193	34.297344	-117.838821	1164	11	422806.6	3795444.2
194	34.298134	-117.838348	1173	11	422850.8	3795531.2
195	34.298851	-117.838295	1166	11	422856.4	3795610.8
196	34.299892	-117.838066	1158	11	422878.4	3795726.2
197	34.300671	-117.837944	1156	11	422890.4	3795812.2
198	34.301777	-117.838509	1172	11	422839.4	3795935.5
199	34.302563	-117.837952	1184	11	422891.4	3796022.2
200	34.303173	-117.837082	1200	11	422972.0	3796089.2
201	34.303959	-117.836891	1219	11	422990.3	3796176.2
202	34.304550	-117.836540	1232	11	423023.1	3796241.5
203	34.305473	-117.835808	1272	11	423091.3	3796343.2
204	34.308598	-117.840187	1439	11	422691.2	3796693.0
205	34.309036	-117.838448	1455	11	422851.7	3796740.2
206	34.309681	-117.837639	1465	11	422926.7	3796811.2
207	34.310242	-117.836891	1468	11	422996.0	3796872.8
208	34.310802	-117.835869	1482	11	423090.6	3796934.2
209	34.311356	-117.834694	1484	11	423199.2	3796994.8
210	34.312168	-117.834251	1499	11	423240.7	3797084.5
211	34.313091	-117.833939	1506	11	423270.3	3797186.5
212	34.314407	-117.834831	1514	11	423189.3	3797333.2
213	34.316128	-117.836464	1540	11	423040.7	3797525.2
214	34.316917	-117.836349	1547	11	423051.9	3797612.8
215	34.318039	-117.836693	1575	11	423021.4	3797737.2
216	34.319145	-117.837051	1608	11	422989.4	3797860.2
217	34.320061	-117.837288	1622	11	422968.5	3797962.0
218	34.320610	-117.837585	1617	11	422941.6	3798023.0
219	34.322784	-117.837967	1689	11	422908.5	3798264.5
220	34.323673	-117.837349	1693	11	422966.2	3798362.5
221	34.324158	-117.836807	1704	11	423016.4	3798416.0
222	34.325283	-117.837051	1697	11	422995.0	3798540.8
223	34.326096	-117.836861	1713	11	423013.3	3798630.8
224	34.326714	-117.836563	1714	11	423041.2	3798699.2
225	34.327099	-117.835129	1739	11	423173.5	3798740.8
226	34.327003	-117.831963	1755	11	423464.7	3798727.8
227	34.327942	-117.831787	1760	11	423481.7	3798831.8
228	34.328922	-117.831779	1766	11	423483.3	3798940.5
229	34.329704	-117.830750	1781	11	423578.8	3799026.5
230	34.331448	-117.833595	1816	11	423318.6	3799221.8
231	34.332668	-117.833626	1863	11	423316.9	3799357.2
232	34.333401	-117.832672	1862	11	423405.2	3799437.8
233	34.334270	-117.832954	1896	11	423380.1	3799534.5
234	34.335148	-117.833748	1900	11	423307.9	3799632.2
235	34.335583	-117.832695	1922	11	423405.2	3799679.8
236	34.335258	-117.827660	1987	11	423868.0	3799640.0
237	34.335262	-117.824196	2101	11	424186.7	3799637.8
238	34.335720	-117.824112	2096	11	424194.8	3799688.5
239	34.337345	-117.825233	2107	11	424093.1	3799869.5
240	34.339561	-117.828056	2167	11	423835.4	3800117.5
241	34.340939	-117.829010	2189	11	423749.0	3800270.8
242	34.341946	-117.829124	2199	11	423739.3	3800382.5
243	34.342865	-117.828674	2248	11	423781.6	3800484.2
244	34.343845	-117.828926	2259	11	423759.3	3800593.0

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
245	34.344311	-117.828400	2220	11	423808.2	3800644.2
246	34.345310	-117.827049	2181	11	423933.2	3800754.0
247	34.345634	-117.825539	2186	11	424072.5	3800789.0
248	34.344688	-117.820900	2202	11	424498.3	3800680.5
249	34.345612	-117.820259	2203	11	424558.1	3800782.5
250	34.346577	-117.820511	2207	11	424535.8	3800889.8
251	34.347481	-117.820137	2219	11	424571.0	3800989.8
252	34.348408	-117.820107	2221	11	424574.6	3801092.5
253	34.349365	-117.819962	2220	11	424588.8	3801198.5
254	34.350159	-117.819496	2223	11	424632.3	3801286.0
255	34.347984	-117.811394	2254	11	425375.6	3801039.0
256	34.348568	-117.810097	2262	11	425495.4	3801102.8
257	34.349567	-117.810326	2256	11	425475.2	3801213.8
258	34.350399	-117.809914	2281	11	425513.8	3801305.8
259	34.350834	-117.808929	2278	11	425604.7	3801353.2
260	34.352161	-117.809311	2287	11	425570.8	3801500.8
261	34.352947	-117.809044	2274	11	425596.1	3801587.8
262	34.353764	-117.808563	2288	11	425641.0	3801677.8
263	34.354992	-117.809242	2291	11	425579.6	3801814.5
264	34.356068	-117.809532	2297	11	425553.9	3801934.0
265	34.358093	-117.811378	2313	11	425385.9	3802160.0
266	34.359383	-117.812744	2321	11	425261.5	3802304.0
267	34.360119	-117.812088	2331	11	425322.5	3802385.0
268	34.360279	-117.810295	2332	11	425487.5	3802401.5
269	34.361099	-117.809799	2339	11	425533.8	3802492.2
270	34.362057	-117.810013	2343	11	425515.0	3802598.5
271	34.361637	-117.801277	2343	11	426318.0	3802545.5
3271	34.363255	-117.808510	2356	11	425654.3	3802730.2
272	34.361538	-117.800117	2336	11	426424.5	3802533.8
273	34.358109	-117.798027	2314	11	426613.8	3802152.0
274	34.359756	-117.793770	2284	11	427006.7	3802331.5
275	34.360153	-117.792465	2279	11	427127.0	3802374.8
276	34.360748	-117.790955	2273	11	427266.4	3802439.5
277	34.361584	-117.790649	2272	11	427295.2	3802532.0
278	34.362514	-117.790733	2265	11	427288.3	3802635.2
279	34.363388	-117.790146	2256	11	427343.1	3802731.8
280	34.363842	-117.789162	2253	11	427434.0	3802781.2
281	34.364750	-117.789108	2249	11	427439.7	3802882.0
282	34.365650	-117.788689	2239	11	427479.0	3802981.5
283	34.366199	-117.787491	2231	11	427589.7	3803041.5
284	34.367168	-117.787636	2229	11	427577.2	3803149.0
285	34.368263	-117.787491	2227	11	427591.4	3803270.5
286	34.367222	-117.781960	2198	11	428099.1	3803151.0
287	34.368004	-117.781288	2198	11	428161.5	3803237.2
288	34.368908	-117.781036	2188	11	428185.5	3803337.2
289	34.369804	-117.780937	2183	11	428195.3	3803436.8
290	34.371250	-117.781761	2185	11	428120.8	3803597.5
291	34.372551	-117.782120	2184	11	428089.0	3803742.0
292	34.373287	-117.781273	2179	11	428167.5	3803823.0
293	34.374203	-117.781357	2172	11	428160.5	3803924.8
294	34.375816	-117.782623	2159	11	428045.5	3804104.5
295	34.376862	-117.781868	2157	11	428115.8	3804219.8
296	34.376049	-117.779243	2139	11	428356.4	3804128.0
297	34.374855	-117.772469	2094	11	428978.3	3803990.8
298	34.375572	-117.771576	2094	11	429061.0	3804069.8
299	34.375751	-117.769844	2084	11	429220.3	3804088.2
300	34.375595	-117.768181	2079	11	429373.1	3804069.8
301	34.374687	-117.765373	1924	11	429630.5	3803967.2
302	34.376045	-117.764915	1885	11	429673.8	3804117.5
303	34.377514	-117.764725	1844	11	429692.5	3804280.2
304	34.378532	-117.764046	1812	11	429755.8	3804392.8
305	34.379585	-117.764381	1800	11	429725.8	3804509.8

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
306	34.380672	-117.763588	1894	11	429799.7	3804629.8
307	34.382069	-117.762985	1929	11	429856.2	3804784.0
308	34.382664	-117.762337	1976	11	429916.3	3804849.5
309	34.383038	-117.761826	1959	11	429963.7	3804890.8
310	34.383495	-117.761185	1970	11	430023.0	3804941.0
311	34.384392	-117.761215	2007	11	430020.9	3805040.5
312	34.385323	-117.761200	1994	11	430023.1	3805143.8
313	34.385929	-117.760185	1980	11	430116.9	3805210.2
314	34.386486	-117.758957	1975	11	430230.2	3805271.0
315	34.387447	-117.758240	1968	11	430297.0	3805377.2
316	34.388233	-117.757912	1960	11	430327.8	3805464.2
317	34.388023	-117.755020	1948	11	430593.4	3805439.0
318	34.389210	-117.754913	1940	11	430604.2	3805570.5
319	34.388744	-117.752197	1930	11	430853.5	3805517.0
320	34.390194	-117.752060	1923	11	430867.3	3805677.5
321	34.391098	-117.752609	1918	11	430817.6	3805778.2
322	34.391708	-117.752190	1920	11	430856.7	3805845.5
323	34.391521	-117.747467	1904	11	431290.6	3805821.8
324	34.391293	-117.744690	1883	11	431545.7	3805794.5
325	34.391853	-117.743980	1893	11	431611.4	3805856.0
326	34.392406	-117.743088	1942	11	431693.9	3805916.8
327	34.393490	-117.741478	1875	11	431842.8	3806036.0
328	34.393669	-117.740715	1849	11	431913.0	3806055.2
329	34.393494	-117.737953	1859	11	432166.8	3806034.0
330	34.393890	-117.736282	1851	11	432320.7	3806076.8
331	34.394951	-117.736137	1836	11	432334.9	3806194.2
332	34.395184	-117.734749	1842	11	432462.7	3806219.2
333	34.394810	-117.730736	1858	11	432831.3	3806175.0
334	34.395611	-117.730972	1837	11	432810.2	3806264.0
335	34.396809	-117.730598	1834	11	432845.5	3806396.8
336	34.397110	-117.729614	1845	11	432936.2	3806429.5
337	34.398144	-117.729324	1849	11	432963.7	3806543.8
338	34.398895	-117.728790	1846	11	433013.4	3806626.8
339	34.398895	-117.726250	1858	11	433246.9	3806625.2
340	34.399628	-117.725677	1856	11	433300.1	3806706.0
341	34.400600	-117.725525	1863	11	433314.8	3806813.8
342	34.401089	-117.724449	1879	11	433414.1	3806867.2
343	34.402264	-117.724342	1864	11	433424.9	3806997.5
344	34.403156	-117.724792	1862	11	433384.2	3807096.8
345	34.404430	-117.725212	1856	11	433346.7	3807238.2
346	34.405087	-117.724960	1858	11	433370.3	3807310.8
347	34.405640	-117.725304	1853	11	433339.2	3807372.5
348	34.406139	-117.724380	1846	11	433424.4	3807427.2
349	34.407402	-117.723450	1829	11	433511.0	3807566.5
350	34.408344	-117.722862	1803	11	433565.7	3807670.8
351	34.409054	-117.722397	1798	11	433609.1	3807749.0
353	34.409283	-117.717690	1579	11	434041.8	3807771.5
354	34.410213	-117.717545	1564	11	434055.9	3807874.5
355	34.411160	-117.717010	1554	11	434105.8	3807979.0
356	34.411949	-117.716667	1551	11	434137.9	3808066.5
357	34.413204	-117.716499	1542	11	434154.3	3808205.5
358	34.414265	-117.716873	1541	11	434120.8	3808323.2
359	34.415440	-117.717148	1514	11	434096.5	3808453.8
360	34.416557	-117.717125	1501	11	434099.4	3808577.8
361	34.417252	-117.716888	1498	11	434121.7	3808654.5
362	34.418163	-117.716667	1496	11	434142.8	3808755.5
363	34.419174	-117.716606	1483	11	434149.2	3808867.5
364	34.420094	-117.716156	1478	11	434191.2	3808969.2
365	34.421108	-117.716362	1469	11	434173.1	3809081.8
366	34.422146	-117.716064	1465	11	434201.3	3809196.8

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
367	34.423073	-117.715645	1461	11	434240.6	3809299.2
368	34.423958	-117.715378	1455	11	434265.8	3809397.2
369	34.424683	-117.714684	1444	11	434330.2	3809477.0
370	34.425514	-117.714272	1438	11	434368.7	3809569.0
371	34.426498	-117.713707	1428	11	434421.3	3809677.8
372	34.427452	-117.713333	1422	11	434456.4	3809783.2
373	34.427784	-117.712212	1414	11	434559.7	3809819.5
374	34.428699	-117.712311	1406	11	434551.3	3809921.0
375	34.429699	-117.712303	1398	11	434552.8	3810031.8
376	34.430775	-117.712234	1387	11	434559.9	3810151.0
377	34.431675	-117.712311	1402	11	434553.7	3810251.0
378	34.432770	-117.712334	1378	11	434552.4	3810372.5
379	34.433880	-117.712410	1367	11	434546.2	3810495.5
380	34.434921	-117.712349	1360	11	434552.7	3810611.0
381	34.435875	-117.712410	1350	11	434547.8	3810716.8
382	34.436779	-117.712395	1344	11	434549.9	3810817.0
383	34.437664	-117.712059	1335	11	434581.4	3810915.0
384	34.438282	-117.711761	1333	11	434609.2	3810983.2
385	34.439976	-117.712196	1327	11	434570.6	3811171.2
386	34.440994	-117.712173	1314	11	434573.5	3811284.2
387	34.442097	-117.712013	1302	11	434589.1	3811406.5
388	34.442924	-117.712143	1301	11	434577.8	3811498.2
389	34.443958	-117.712334	1297	11	434561.1	3811613.0
390	34.444912	-117.712425	1283	11	434553.4	3811718.8
391	34.445496	-117.712280	1281	11	434567.2	3811783.5
392	34.446564	-117.711876	1273	11	434605.2	3811901.8
393	34.447620	-117.712334	1264	11	434564.0	3812019.2
394	34.448589	-117.712364	1259	11	434561.9	3812126.5
395	34.449638	-117.712143	1252	11	434583.1	3812242.8
396	34.450703	-117.712234	1242	11	434575.5	3812361.0
397	34.451706	-117.712128	1236	11	434586.1	3812472.0
398	34.452728	-117.712326	1231	11	434568.7	3812585.5
399	34.453884	-117.712799	1217	11	434526.1	3812714.0
400	34.454540	-117.712349	1223	11	434568.0	3812786.5
405	34.460358	-117.717087	1182	11	434137.3	3813434.8
410	34.466583	-117.716911	1136	11	434158.3	3814125.0
415	34.470112	-117.713142	1116	11	434507.2	3814513.8
420	34.475338	-117.712845	1091	11	434538.7	3815093.0
425	34.479900	-117.712563	1066	11	434568.1	3815598.8
430	34.485432	-117.712883	1044	11	434543.0	3816212.5
435	34.488670	-117.708710	1035	11	434928.8	3816568.8
440	34.491184	-117.703735	1026	11	435387.4	3816844.5
445	34.495735	-117.703735	1012	11	435390.9	3817349.0
450	34.499138	-117.701027	1002	11	435642.2	3817724.8
455	34.503307	-117.695023	994	11	436196.6	3818183.2
460	34.509212	-117.695358	978	11	436170.3	3818838.2
465	34.512112	-117.695343	979	11	436173.9	3819159.8
470	34.517956	-117.695404	960	11	436172.8	3819807.8
475	34.524086	-117.695457	948	11	436172.6	3820487.8
480	34.527596	-117.690514	941	11	436628.9	3820873.8
485	34.529480	-117.686783	939	11	436972.8	3821080.2
490	34.534653	-117.687149	924	11	436943.1	3821654.2
495	34.537601	-117.679604	925	11	437637.7	3821976.5
500	34.542076	-117.680954	916	11	437517.1	3822473.5
505	34.542366	-117.669930	925	11	438528.9	3822499.0
510	34.546902	-117.660362	919	11	439410.1	3822996.0
515	34.553421	-117.660255	913	11	439424.6	3823719.0
520	34.556602	-117.659393	914	11	439506.0	3824071.2
525	34.560013	-117.658600	905	11	439581.3	3824449.0
530	34.564251	-117.658562	903	11	439587.8	3824918.8
535	34.569096	-117.658783	893	11	439571.1	3825456.2

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
540	34.573025	-117.653709	888	11	440039.2	3825889.0
545	34.574612	-117.650002	894	11	440380.5	3826062.8
550	34.578579	-117.647453	882	11	440617.1	3826501.0
555	34.583988	-117.644150	879	11	440923.9	3827099.0
560	34.591717	-117.648529	865	11	440527.8	3827958.5
565	34.594666	-117.649490	874	11	440441.7	3828286.2
570	34.599998	-117.649025	860	11	440488.2	3828877.2
575	34.602264	-117.646355	858	11	440734.7	3829127.0
580	34.604538	-117.641045	856	11	441223.2	3829376.0
585	34.606472	-117.640190	852	11	441302.8	3829590.0
590	34.613129	-117.639641	851	11	441357.9	3830327.8
595	34.619255	-117.640190	847	11	441311.8	3831007.5
600	34.622448	-117.633469	864	11	441930.2	3831357.8
605	34.627697	-117.638245	840	11	441496.1	3831942.5
610	34.631660	-117.631454	838	11	442121.3	3832378.0
615	34.636078	-117.627151	834	11	442518.8	3832865.5
620	34.638672	-117.618530	832	11	443310.7	3833148.2
630	34.645878	-117.613899	829	11	443740.0	3833944.8
640	34.660446	-117.614258	830	11	443717.0	3835560.5
650	34.666142	-117.614487	833	11	443699.9	3836192.2
660	34.675926	-117.614014	842	11	443749.8	3837277.0
670	34.682705	-117.604218	864	11	444651.8	3838023.2
680	34.690086	-117.596642	899	11	445350.7	3838837.8
690	34.700359	-117.596626	937	11	445358.8	3839976.8
700	34.710060	-117.596535	987	11	445373.6	3841052.5
710	34.719704	-117.597099	1017	11	445328.2	3842122.2
720	34.723450	-117.580437	1036	11	446856.3	3842528.8
730	34.724915	-117.562691	1067	11	448482.0	3842682.0
740	34.737335	-117.566032	1224	11	448183.8	3844061.0
750	34.746994	-117.554115	1008	11	449280.6	3845126.0
760	34.751396	-117.550362	974	11	449626.9	3845612.2
770	34.762627	-117.542976	914	11	450309.6	3846854.0
790	34.777245	-117.539093	862	11	450673.7	3848473.2
800	34.785530	-117.539207	838	11	450668.1	3849392.0
810	34.793346	-117.534721	846	11	451083.2	3850256.5
820	34.795670	-117.516922	826	11	452712.8	3850505.8
830	34.806572	-117.515770	817	11	452824.4	3851714.2
840	34.816582	-117.515373	806	11	452866.4	3852824.0
850	34.825867	-117.506073	799	11	453722.2	3853849.2
860	34.830509	-117.500526	800	11	454231.9	3854361.5
870	34.842167	-117.503761	804	11	453942.7	3855656.0
880	34.852234	-117.506516	812	11	453696.5	3856773.5
890	34.861179	-117.504868	816	11	453852.1	3857764.8
900	34.868717	-117.491783	840	11	455052.2	3858594.8
910	34.875378	-117.483727	872	11	455792.2	3859329.8
920	34.888798	-117.486946	894	11	455505.2	3860819.5
930	34.895313	-117.489250	918	11	455298.1	3861543.0
940	34.904015	-117.484093	865	11	455774.0	3862505.8
950	34.912945	-117.476021	834	11	456516.2	3863492.5
960	34.917679	-117.469208	810	11	457141.0	3864014.5
970	34.926666	-117.464745	782	11	457553.3	3865009.2
980	34.936821	-117.454430	748	11	458500.5	3866131.0
990	34.943558	-117.447540	724	11	459133.0	3866875.2
1000	34.947758	-117.443253	717	11	459526.6	3867339.2
1010	34.955189	-117.434937	716	11	460289.6	3868160.0
1020	34.962749	-117.426971	699	11	461020.4	3868995.2
1030	34.968422	-117.420433	697	11	461619.9	3869622.0
1040	34.974575	-117.411064	681	11	462478.0	3870300.8
1050	34.980869	-117.401451	673	11	463358.3	3870995.2
1060	34.987656	-117.391075	667	11	464308.3	3871744.0
1070	34.994396	-117.381599	650	11	465176.0	3872488.2

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
1080	34.999985	-117.375893	607	11	465699.1	3873106.0
1090	35.006672	-117.366226	629	11	466583.9	3873844.2
1100	35.014565	-117.365601	624	11	466644.2	3874719.2
1110	35.021797	-117.348610	603	11	468197.1	3875515.8
1120	35.025204	-117.334358	593	11	469498.6	3875889.2
1130	35.032520	-117.330322	592	11	469869.4	3876699.2
1140	35.043327	-117.330612	585	11	469846.9	3877897.8
1150	35.057190	-117.331055	586	11	469811.7	3879435.2
1999	35.039120	-117.675301	645	11	438406.6	3877589.8
2000	34.140049	-117.933418	157	11	413941.2	3778078.0
2001	34.139694	-117.934555	153	11	413836.0	3778039.5
2002	34.138977	-117.935326	164	11	413764.2	3777960.8
2003	34.138279	-117.936043	154	11	413697.4	3777884.0
2004	34.137558	-117.936729	149	11	413633.3	3777804.5
2005	34.136833	-117.937431	152	11	413567.9	3777724.8
2006	34.136124	-117.938156	158	11	413500.3	3777646.8
2007	34.135399	-117.938866	151	11	413434.2	3777567.0
2008	34.134464	-117.939682	143	11	413357.9	3777464.0
2009	34.133659	-117.939987	132	11	413329.0	3777375.0
2010	34.132866	-117.940422	111	11	413288.1	3777287.2
2011	34.132053	-117.940987	102	11	413235.2	3777197.8
2012	34.131378	-117.941643	90	11	413174.0	3777123.5
2013	34.130730	-117.941917	84	11	413148.0	3777051.8
2015	34.129593	-117.944557	134	11	412903.4	3776928.0
2016	34.129433	-117.946358	133	11	412737.2	3776911.8
2017	34.128586	-117.946907	132	11	412685.7	3776818.2
2018	34.127590	-117.946999	131	11	412676.2	3776708.0
2019	34.126587	-117.947014	128	11	412673.8	3776596.8
2020	34.125584	-117.947052	130	11	412669.2	3776485.5
2021	34.124615	-117.946899	127	11	412682.3	3776378.0
2022	34.123577	-117.946899	127	11	412681.2	3776263.0
2023	34.122578	-117.946899	127	11	412680.2	3776152.0
2024	34.121563	-117.947159	123	11	412655.2	3776039.8
2025	34.120594	-117.947014	130	11	412667.6	3775932.2
2026	34.119579	-117.946922	121	11	412675.0	3775819.5
2027	34.118557	-117.946770	117	11	412688.0	3775706.0
2028	34.117538	-117.946770	117	11	412687.0	3775593.2
2029	34.116512	-117.946762	113	11	412686.6	3775479.5
2030	34.115547	-117.946671	114	11	412694.1	3775372.2
2031	34.114403	-117.946556	116	11	412703.5	3775245.2
2032	34.114204	-117.947762	115	11	412592.1	3775224.2
2033	34.114136	-117.950607	113	11	412329.6	3775219.2
2034	34.113964	-117.952118	112	11	412190.1	3775201.5
2035	34.112957	-117.953644	112	11	412048.3	3775091.0
2036	34.111992	-117.953316	111	11	412077.5	3774983.8
2037	34.111183	-117.954254	110	11	411990.2	3774895.0
2038	34.110558	-117.955147	107	11	411907.2	3774826.2
2039	34.109741	-117.954971	105	11	411922.5	3774735.5
2040	34.109058	-117.954742	104	11	411942.9	3774659.8
2043	34.104710	-117.952103	99	11	412181.9	3774175.2
2046	34.101490	-117.952324	95	11	412158.2	3773818.5
2050	34.093964	-117.943214	94	11	412990.8	3772976.0
2052	34.095966	-117.953499	104	11	412044.1	3773207.0
2053	34.092213	-117.944603	92	11	412860.8	3772783.0
2055	34.090748	-117.946144	96	11	412717.2	3772622.0
2056	34.091042	-117.950661	94	11	412300.8	3772658.5
2058	34.088581	-117.948357	85	11	412510.8	3772383.5
2060	34.086590	-117.950485	87	11	412312.4	3772164.5
2063	34.084915	-117.952278	90	11	412145.2	3771980.5
2065	34.083107	-117.954239	83	11	411962.5	3771781.8
2068	34.081299	-117.956108	85	11	411788.2	3771582.8

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
2070	34.079163	-117.958382	79	11	411576.2	3771347.8
2073	34.077160	-117.960518	75	11	411377.0	3771127.5
2075	34.075951	-117.961823	77	11	411255.3	3770994.8
2078	34.074551	-117.963272	76	11	411120.1	3770840.8
2080	34.072441	-117.965576	72	11	410905.3	3770608.8
2082	34.070881	-117.967285	74	11	410746.0	3770437.2
2088	34.067051	-117.971230	72	11	410378.0	3770016.0
2090	34.065380	-117.974258	69	11	410096.7	3769833.5
2093	34.063469	-117.972527	71	11	410254.5	3769620.0
2095	34.060791	-117.973450	66	11	410166.5	3769323.8
2098	34.059433	-117.975136	67	11	410009.5	3769174.8
2100	34.057999	-117.976631	66	11	409869.9	3769017.0
2102	34.055984	-117.978035	69	11	409738.2	3768795.0
2105	34.054211	-117.979546	60	11	409596.9	3768599.5
2107	34.052479	-117.981209	60	11	409441.6	3768409.0
2109	34.050835	-117.983597	66	11	409219.4	3768228.8
2114	34.046684	-117.984222	61	11	409157.2	3767769.0
2117	34.044868	-117.987282	60	11	408872.9	3767570.5
2121	34.042061	-117.988716	61	11	408737.5	3767260.5
2123	34.040546	-117.990501	62	11	408571.1	3767094.0
2124	34.039253	-117.992538	66	11	408381.7	3766952.5
2128	34.037502	-117.995743	72	11	408084.0	3766761.2
2130	34.035294	-117.998131	86	11	407861.2	3766518.5
2133	34.033726	-117.999519	75	11	407731.3	3766346.0
2132	34.034526	-117.998917	81	11	407787.8	3766434.1
2135	34.032032	-118.001198	54	11	407574.5	3766159.5
2140	34.028069	-118.003197	82	11	407385.7	3765722.0
2145	34.026581	-118.006592	148	11	407070.6	3765560.0
2150	34.018196	-118.011269	284	11	406629.6	3764634.5
2155	34.014542	-118.011223	278	11	406629.8	3764229.2
2157	34.013641	-118.010864	280	11	406662.0	3764129.0
2160	34.011150	-118.010544	297	11	406688.8	3763852.5
2163	34.008347	-118.010536	298	11	406686.5	3763541.8
2165	34.006004	-118.009804	306	11	406751.6	3763281.2
2167	34.002377	-118.009590	319	11	406767.3	3762878.8
2170	33.999325	-118.005539	331	11	407138.1	3762536.8
2173	33.995041	-118.001694	321	11	407488.6	3762058.2
2175	33.994118	-118.006538	281	11	407040.2	3761960.2
2177	33.990376	-118.002327	351	11	407425.1	3761541.5
2180	33.990910	-118.007507	378	11	406947.2	3761605.5
2183	33.985550	-118.002464	311	11	407407.1	3761006.5
2185	33.983917	-118.006844	276	11	407000.8	3760829.5
2187	33.983002	-118.010422	249	11	406669.3	3760731.2
2190	33.979412	-118.006584	181	11	407019.9	3760329.8
2193	33.976742	-118.006859	137	11	406991.6	3760034.0
2195	33.975266	-118.007050	136	11	406972.4	3759870.2
2197	33.971924	-118.005997	123	11	407066.0	3759499.0
2200	33.969501	-118.004784	127	11	407175.5	3759229.2
2203	33.967075	-118.007492	96	11	406922.6	3758962.5
2205	33.965424	-118.009537	90	11	406731.9	3758781.2
2210	33.961391	-118.011391	71	11	406556.2	3758336.0
2215	33.956692	-118.013901	9	11	406319.1	3757817.0
2220	33.950794	-118.013062	44	11	406390.2	3757162.2
2225	33.948208	-118.017578	33	11	405970.0	3756879.8
2230	33.943806	-118.020500	19	11	405695.1	3756394.2
2235	33.940643	-118.022682	16	11	405490.0	3756045.5
2240	33.937656	-118.028503	14	11	404948.7	3755719.8
2245	33.936138	-118.037010	5	11	404160.8	3755559.2
2250	33.930859	-118.037613	0	11	404099.1	3754974.5
2255	33.926018	-118.036125	2	11	404231.2	3754436.2
2260	33.920979	-118.036362	4	11	404203.7	3753877.8

STA	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
2265	33.916668	-118.038628	-2	11	403989.4	3753402.0
2270	33.912415	-118.039970	-6	11	403860.5	3752931.5
2275	33.908077	-118.041367	-4	11	403726.6	3752452.0
2280	33.903816	-118.041809	-7	11	403680.9	3751980.0
2285	33.896709	-118.037537	-8	11	404067.9	3751187.8
2290	33.891621	-118.033363	-15	11	404448.1	3750619.8
2295	33.884998	-118.033394	-15	11	404437.9	3749885.5
2300	33.880016	-118.033363	-18	11	404435.2	3749333.0
2305	33.875008	-118.033363	-16	11	404429.6	3748777.5
2310	33.869965	-118.033363	-15	11	404424.0	3748218.5
2315	33.865917	-118.035660	-16	11	404207.1	3747771.8
2320	33.862442	-118.039078	-20	11	403887.0	3747389.8
2325	33.858917	-118.043152	-18	11	403506.2	3747002.5
2330	33.855541	-118.048180	-17	11	403037.3	3746633.0
2335	33.852634	-118.052483	-18	11	402635.9	3746314.8
2340	33.849625	-118.056496	-19	11	402261.2	3745984.8
2345	33.844807	-118.059822	-22	11	401948.0	3745453.8
2350	33.841656	-118.060623	-16	11	401870.2	3745105.2
2355	33.835819	-118.061478	-19	11	401784.5	3744458.8
2360	33.832344	-118.062668	-20	11	401670.4	3744074.5
2365	33.827469	-118.064377	-21	11	401506.7	3743535.8
2370	33.822506	-118.066330	-22	11	401320.2	3742987.2
2375	33.818642	-118.068848	-23	11	401082.8	3742561.2
2380	33.814571	-118.070976	-23	11	400881.1	3742112.0
2385	33.808662	-118.069244	-23	11	401034.6	3741455.0
2390	33.804352	-118.069817	-22	11	400976.6	3740977.5
2395	33.799599	-118.069458	-24	11	401004.3	3740450.2
2400	33.793579	-118.067513	-25	11	401177.5	3739781.0
2405	33.788464	-118.067207	-25	11	401199.9	3739213.5
2410	33.783859	-118.067589	-26	11	401159.3	3738703.2
2415	33.777794	-118.066597	-27	11	401244.2	3738029.8
2422	33.772823	-118.060051	-27	11	401844.6	3737472.2
2423	33.770401	-118.068733	-32	11	401037.8	3737212.0
2425	33.768330	-118.066765	-29	11	401217.8	3736980.5
2427	33.767353	-118.070930	-14	11	400830.9	3736876.2
2430	33.764622	-118.070702	-29	11	400848.9	3736573.2
2433	33.762821	-118.070908	-31	11	400827.8	3736373.8
2435	33.761093	-118.073067	-31	11	400625.8	3736184.2
2437	33.758804	-118.075241	-31	11	400421.8	3735932.5
2440	33.756752	-118.076515	-29	11	400301.4	3735706.2
2443	33.755219	-118.077934	-30	11	400168.2	3735537.5
2445	33.753277	-118.080452	-31	11	399932.8	3735324.5
2446	33.753296	-118.080452	-30	11	399932.8	3735326.8
2447	33.751190	-118.080894	-30	11	399889.4	3735093.8
2450	33.749420	-118.081940	-31	11	399790.5	3734898.5
2453	33.747120	-118.083847	-30	11	399611.2	3734645.2
2455	33.745205	-118.085091	-31	11	399493.7	3734434.0
2457	33.743397	-118.086617	-30	11	399350.3	3734235.0
2460	33.741684	-118.087570	-26	11	399259.9	3734046.0
2463	33.739422	-118.089516	-30	11	399077.1	3733797.2
2465	33.737152	-118.090912	-32	11	398945.1	3733547.0
4001	32.877666	-118.450600	528	11	364298.3	3638657.8
4002	33.008678	-118.567444	159	11	353582.8	3653340.2
4003	33.318378	-118.319695	432	11	377160.0	3687360.5
4004	33.448174	-118.547508	498	11	356166.6	3702044.0
4005	33.315128	-118.307956	116	11	378248.2	3686986.4
4006	33.314425	-118.308516	122	11	378195.1	3686909.0

SP	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
8010	34.148750	-117.925064	167	11	414720.2	3779035.8
8020	34.154224	-117.918732	180	11	415309.4	3779637.5
8030	34.158283	-117.913391	197	11	415805.8	3780083.2
8040	34.162312	-117.896996	217	11	417321.0	3780516.5
8050	34.170002	-117.890511	233	11	417926.2	3781364.0
8060	34.179985	-117.881912	361	11	418728.3	3782464.0
8070	34.182945	-117.879715	351	11	418933.6	3782790.5
8080	34.193722	-117.865662	350	11	420238.8	3783974.5
8090	34.202263	-117.856934	329	11	421051.0	3784914.8
8100	34.212654	-117.863808	472	11	420427.4	3786072.2
8110	34.216942	-117.858322	480	11	420936.8	3786543.5
8120	34.224739	-117.848969	430	11	421805.6	3787401.0
8130	34.241005	-117.864906	463	11	420352.9	3789217.0
8131	34.235634	-117.850525	426	11	421672.3	3788610.2
8141	34.248932	-117.865532	498	11	420302.8	3790096.5
8142	34.252659	-117.858109	528	11	420989.8	3790504.0
8150	34.260094	-117.853973	593	11	421377.5	3791325.0
8160	34.262657	-117.845932	673	11	422120.2	3791603.2
8162	34.271759	-117.847237	726	11	422008.5	3792613.5
8170	34.278965	-117.844383	790	11	422277.8	3793410.2
8180	34.283169	-117.843979	921	11	422318.9	3793876.2
8181	34.287594	-117.842384	975	11	422469.8	3794365.8
8190	34.293587	-117.840050	991	11	422690.1	3795028.5
8200	34.305428	-117.837784	1319	11	422909.5	3796339.8
8210	34.311920	-117.834435	1495	11	423223.6	3797057.0
8220	34.322559	-117.838013	1684	11	422904.1	3798239.5
8230	34.331142	-117.832863	1823	11	423385.7	3799187.5
8240	34.334648	-117.827194	1986	11	423910.3	3799572.0
8250	34.345089	-117.820168	2201	11	424566.0	3800724.5
8260	34.351192	-117.808861	2284	11	425611.3	3801393.0
8270	34.358067	-117.798508	2323	11	426569.5	3802147.8
8280	34.365650	-117.789139	2248	11	427437.6	3802981.8
8290	34.371483	-117.781868	2184	11	428111.2	3803623.5
8300	34.374699	-117.772766	2101	11	428950.8	3803973.5
8302	34.379131	-117.764008	1803	11	429759.8	3804459.0
8310	34.384659	-117.761292	2000	11	430014.1	3805070.0
8320	34.392399	-117.752068	1916	11	430868.4	3805922.0
8330	34.393620	-117.741081	1862	11	431879.3	3806050.0
8331	34.394367	-117.730263	1854	11	432874.4	3806125.8
8344	34.401028	-117.724770	1866	11	433384.6	3806860.8
8345	34.398376	-117.726517	1857	11	433221.9	3806567.8
8346	34.404720	-117.725029	1853	11	433363.7	3807270.2
8350	34.409164	-117.717583	1586	11	434051.6	3807758.2
8351	34.411671	-117.717339	1548	11	434076.0	3808036.0
8360	34.416153	-117.717041	1511	11	434106.8	3808532.8
8370	34.424473	-117.715454	1457	11	434259.2	3809454.2
8380	34.434895	-117.712677	1368	11	434522.5	3810608.2
8390	34.443867	-117.711998	1286	11	434591.9	3811602.8
8400	34.455215	-117.716461	1220	11	434190.8	3812864.0
8450	34.495945	-117.703972	1012	11	435369.4	3817372.5
8500	34.542076	-117.680954	916	11	437517.1	3822473.5
8630	34.646019	-117.613968	827	11	443733.8	3833960.5
9000	34.138920	-117.935036	145	11	413790.9	3777954.0
9010	34.133179	-117.939293	85	11	413392.5	3777321.0
9021	34.121777	-117.947250	117	11	412647.0	3776063.5
9023	34.128582	-117.947571	131	11	412624.5	3776818.5
9030	34.114174	-117.949203	108	11	412459.1	3775222.2
9040	34.110352	-117.955391	108	11	411884.4	3774803.8
9160	34.013092	-118.011230	283	11	406627.6	3764068.5
9170	33.978897	-118.005501	142	11	407119.4	3760271.8
9450	33.752846	-118.080872	-30	11	399893.4	3735277.2
9150	35.057068	-117.330956	589	11	469820.7	3879421.8

SP	LATITUDE	LONGITUDE	ALT	ZONE	X-UTM	Y-UTM
9990	35.040264	-117.675064	638	11	438429.0	3877716.5
9991	35.040264	-117.675064	638	11	438429.0	3877716.5
9992	33.312675	-118.306058	40	11	378421.4	3686712.1