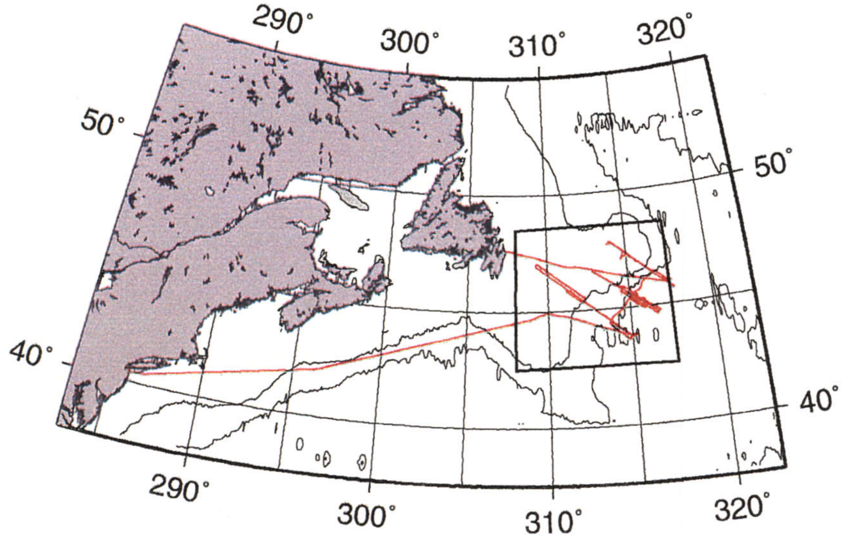
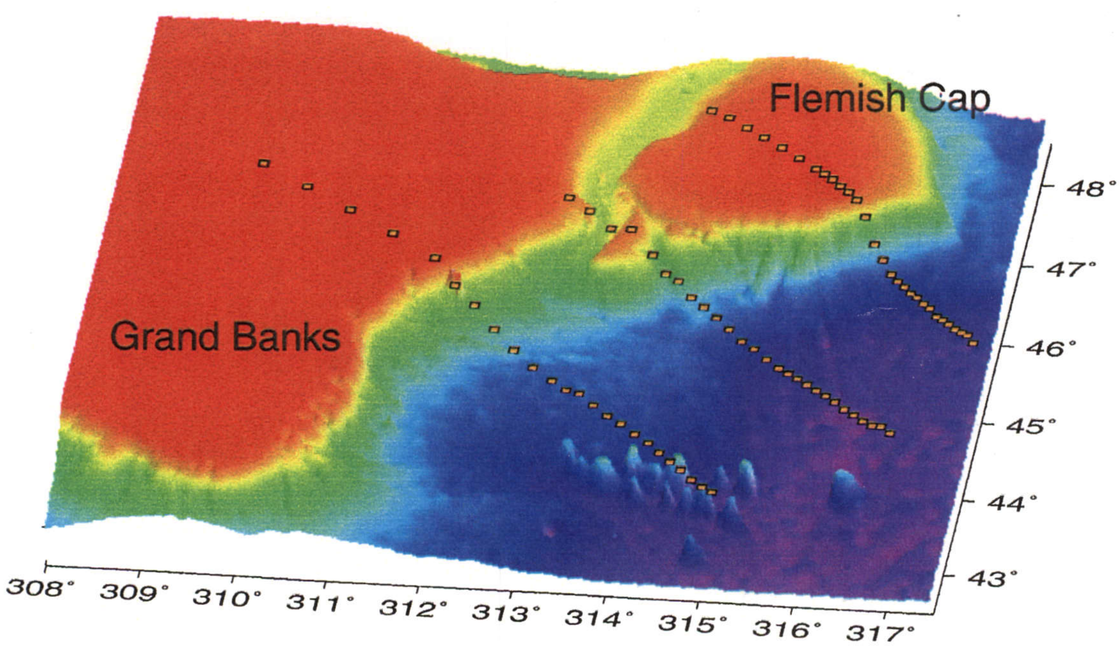
Cruise Report EW-0007
Newfoundland Basin

SCREECH: Study of Continental Rifting and Extension on the Eastern Canadian sHelf

R/V Maurice Ewing
15 July - 17 August 2000
St. John's to Newark





SCREECH: Study of Continental Rifting and Extension on the Eastern Canadian sHelf

Newfoundland Basin, Flemish Cap, and Grand Banks

Cruise Report
EW-0007
R/V *Maurice Ewing*
St. John's, NF, to Newark, NJ
15 July – 17 Aug 2000

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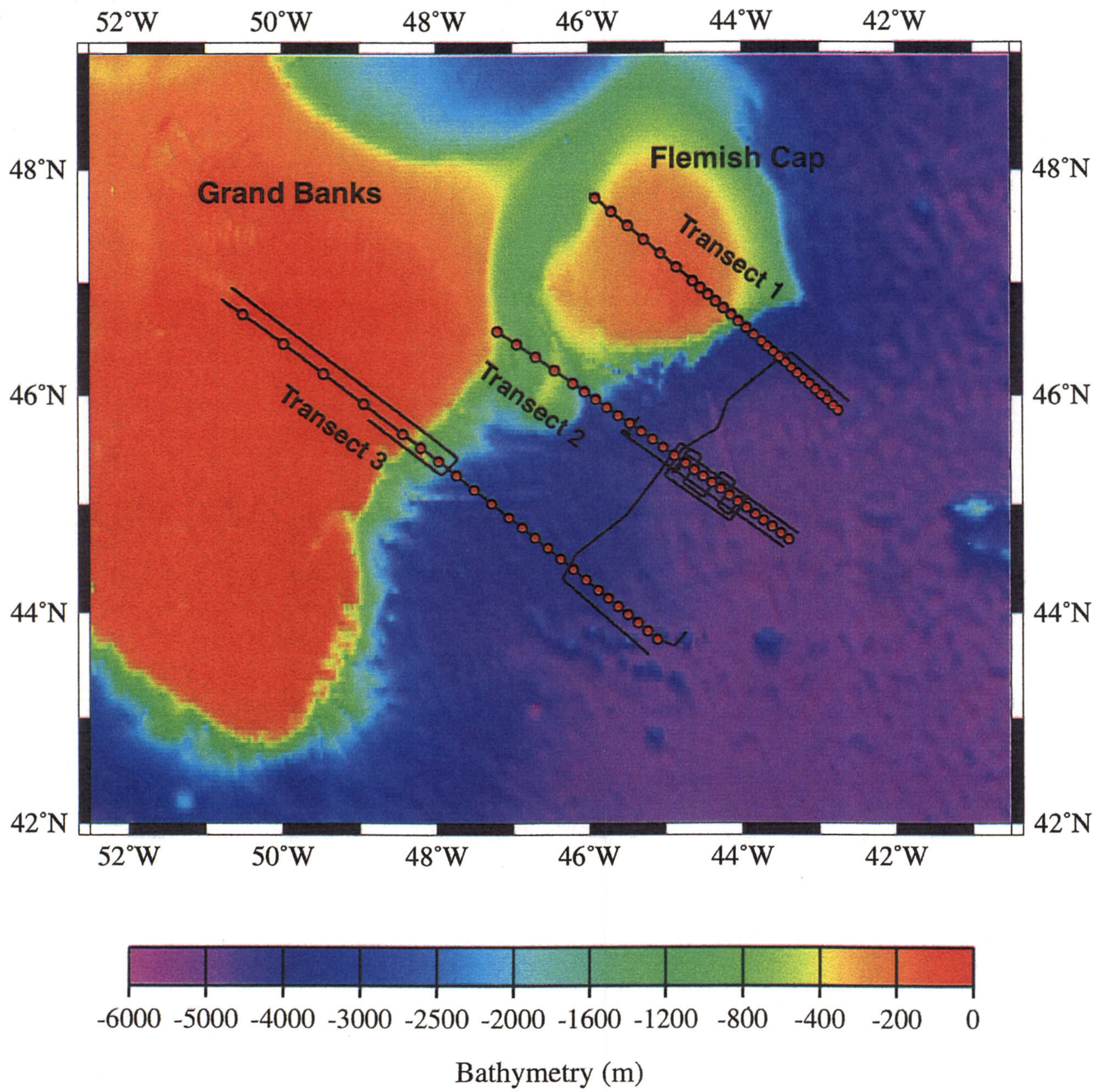
SCREECH Survey Location



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BACKGROUND AND SCIENTIFIC OBJECTIVES

Deformation and magmatism during continental rifting and eventual breakup are fundamental yet poorly understood processes. To advance our understanding of these processes significantly, we must characterize with unprecedented detail and accuracy the structure and composition of conjugate rifted margins across the full width of the transition from undeformed continental crust to normal oceanic crust. The Newfoundland - Iberia conjugate margins are an excellent natural laboratory for such a study. Their geological characteristics are favorable to address the fundamental scientific questions, logistically the areas are readily accessible, and a large ODP and geophysical database (currently strongly skewed toward the Iberia margin) already exists to focus inquiries on essential scientific questions.

Our field program is on the Newfoundland side of the Newfoundland - Iberia rift, and our results will be integrated with complementary data on the Iberia margin to give an unequaled overview of a complete, mature rift system. The critical characteristics of the Newfoundland margin that need to be understood are tectonic structure, composition, and thickness of crust in four zones: 1) full-thickness, unrifted continental crust beneath the Grand Banks, 2) rifted and thinned crust of known continental origin, generally beneath the continental slope and rise, 3) transitional crust of disputed origin in the deep Newfoundland Basin, and 4) known oceanic crust seaward of the transitional crust. We are studying these zones with state-of-the-art reflection/refraction seismic experiments, using dense arrays of ocean-bottom seismic instruments together with R/V Ewing's large, tuned airgun array and new, 6-km-long hydrophone streamer. Our focus is on three transects that extend from known continental crust on the shelf seaward to known oceanic crust; these transects completely traverse a wide region of thin, transitional crust of enigmatic origin in the deep Newfoundland Basin. Each of these transects is optimally located with respect to detailed geophysical and drilling studies on the conjugate Iberia margin. This maximizes the utility of each Newfoundland transect in terms of interpreting results at existing ODP drill sites on the Iberia margin, improving the siting of proposed Newfoundland-margin drill sites and eventually interpreting their results, and interpreting the development of the full rift. Our Newfoundland transects, combined with existing seismic studies on the Iberia margin, constitute the first complete, densely sampled, wide-angle/vertical-incidence transects across conjugate non-volcanic rifted margins.

Our work will distinguish among competing hypotheses for the origin of crust in the Newfoundland Basin, which propose that the basin may be floored by thin continental crust, slow-spreading (or even normal) oceanic crust, or by a wide zone of serpentinized upper mantle. Specific research goals are to: 1) Characterize the transitional crustal structure of the deep Newfoundland Basin as well as the eastern, unextended edge of the adjacent Grand Banks so as to constrain the origin of the crust in the Newfoundland Basin (continental vs. oceanic) and its tectonic evolution; 2) Determine the position and nature of the boundaries between continental and transitional crust, and between transitional and oceanic crust; 3) Evaluate the amount of igneous material accreted on this "non-volcanic" margin to provide constraints on the volcanic/non-volcanic paradigm for rifted margins; and 4) Compare the crustal structure of the Newfoundland margin directly with that of the conjugate Iberian margin to allow well constrained and systematic evaluation of the mechanisms involved in the rifting process.

Our research is a US-Canadian-Danish cooperative effort that includes the Woods Hole Oceanographic Institution (B.E. Tucholke), the University of Wyoming (W.S. Holbrook), the Danish Lithosphere Centre (H.C. Larsen and J.R.Hopper), Dalhousie University (K. Louden) and Memorial University of Newfoundland (J. Hall and C. Hurich), all of whom bring substantial expertise and resources to the project. Our research will also be coordinated with ongoing studies of the conjugate Iberia margin by researchers including R. Whitmarsh (IOS), T. Minshull (Cambridge U.), K. Louden (Dalhousie U.), D. Sawyer (Rice U.) and T. Reston (GEOMAR).

OPERATIONAL OBJECTIVES

Our operational plan was to acquire detailed wide-angle OBS/H and vertical-incidence MCS seismic data along three main transects across the Newfoundland margin, together with auxiliary MCS data (parallel and crossing lines) along and between transects as geological structure dictated and as time permitted. This was a two-ship program, with R/V Oceanus deploying and recovering the OBS/H, and R/V Ewing shooting to the OBS/H and recording MCS data on its 480-channel, 6-km-long streamer. Wide-angle data were recorded on 29 ocean-bottom instruments: 8 WHOI ORBs, 7 WHOI OBH's, 8 Geological Survey of Canada (GSC) OBS's, and 6 Dalhousie OBS's. Shots were fired with R/V Ewing's 20-gun, 8540 cubic inch (131 liter) airgun array. To minimize transit time and maximize survey time, the transects were surveyed from north to south (Transect 1 to Transect 3).

Transect 1 extends from the northern margin of Flemish Cap southeast across thick continental crust of the Cap and seaward across thinned continental crust, "transitional" crust of unknown origin, and about 30 km onto known oceanic crust seaward of magnetic anomaly M0.

Transect 2 extends from continental crust at the western margin of Flemish Pass basin southeast across rifted continental crust, "transitional" crust of unknown origin, and about 60 km onto known oceanic crust seaward of magnetic anomaly M0.

Transect 3 extends from full thickness continental crust on the central Grand Banks southeast across rift basins and rifted continental crust (Jeanne d'Arc basin, Carson-Bonnition basin), "transitional" crust of unknown origin, and about 30 km onto known oceanic crust seaward of magnetic anomaly M0.

R/V Oceanus deployed the OBS/H instruments along each transect prior to R/V Ewing shooting the transect. Instruments were more closely spaced over thinner crust in deep water (typically 9-12 km) and were more widely spaced (20-50 km) over the thick continental crust of Flemish Cap and the Grand Banks. The OBS line on each transect was shot at 200 meter shot spacing in order to minimize previous-shot noise. After Ewing shot each OBS line, Oceanus retrieved the instruments and moved on to the next transect while Ewing returned along the transect shooting the MCS line at 50 meter shot spacing.

R/V Ewing conducted additional MCS surveys along portions of each transect, in part while waiting for Oceanus to redeploy OBS. These surveys concentrated first on acquiring MCS lines parallel to the main transect, and secondly on obtaining crossing lines. The grid-style survey was most extensive on Transect 2, where ODP drill sites will be proposed. Ewing also obtained MCS tie lines between the three transects; these lines tie not only our transects but also numerous seismic lines shot by previous expeditions. At times when Oceanus was waiting for Ewing, it conducted heat-flow surveys on or near the main transects, or did magnetometer surveys if weather did not permit launching the heat-flow instrumentation.

The accompanying table gives the actual operational timetable for both R/V Ewing and R/V Oceanus.

Primary operational goals for R/V Ewing are summarized as follows:

- Fire the Ewing 20-gun array to the OBS/H at 200 m shot spacing and at 50-m shot spacing to the 6-km-streamer on each transect.
- Acquire auxiliary geophysical data (gravity, magnetics, multibeam bathymetry, 3.5 kHz echosounding, XBT profiles) along the ship track.
- Maintain close communications with R/V Oceanus to coordinate operations, and with both Oceanus and our DLC shore-based investigator (H.C. Larsen) to make strategic decisions as necessary during the cruise.
- Produce near-real-time brute stacks of all MCS data.
- Copy all MCS prestack data to DLT or Exabyte tapes for use by participating investigators.
- Produce improved stacking velocities, stacks, and migrations of selected profiles near Transect 2 to facilitate preparation of an Ocean Drilling Program proposal.

PRELIMINARY CRUISE ASSESSMENT

Although we experienced a variety of difficulties during the cruise, and some data sets may be considered less than perfect, we are optimistic that the data will meet or exceed our goals in understanding the crustal structure across the Newfoundland margin, and we judge that our field work has been a notable success. Factors responsible for achieving our goals included: 1) adequate planning to accommodate the vagaries of two-ship operations, and especially inclusion of contingency time to cover unforeseen circumstances, 2) flexibility in survey plans that allowed each of the two ships to accommodate changes or in some cases even to assist one another, 3) generally good weather conditions throughout the cruise, and 4) the highly professional ship's crew and LDEO technical staff on Ewing, who did everything possible to help us achieve our goals and ensure a safe cruise.

Notable successes included the following:

- Complete OBS and MCS lines along all three main transects, plus grid MCS survey and tie lines to address special geological problems of interest and to define ocean drilling objectives.

- High quality of the MCS data. The airgun array produced a very sharp and clean pulse, and the 480-channel streamer produces closely spaced CMPs and high-fold data, contributing to a high-resolution reflection record.

- Near real-time brute stacks of the MCS data. We stacked the entire data set (480 channels, 16 sec records) and copied all prestack data to DLT tapes as data came off the system, and we were easily able to keep up with the data flow rate.

- Efficient recovery of one GSC OBS in heavy fog and with the streamer deployed, and return of the instrument to Oceanus several days later via release from the Ewing fantail and pickup by Oceanus.

Principal operational difficulties included the following:

- Fishing long-lines. Commercial fishermen deploy these along the warm-to-cold-water edge of currents in the Newfoundland Basin. They often extend 10-20 miles or more and cannot be crossed because of the possibility of fouling the Ewing's airgun array or streamer. Long-lines were directly in our path as we began to shoot Line 1-OBS, and we were forced to divert around them, sacrificing 200-meter-spaced shots to OBH/S instruments 27 to 29. Fortunately, we were able to shoot to these instruments at 50-meter shot spacing on the return line (1-MCS) by arranging with Oceanus to delay instrument recovery, although the 50-meter spacing is less than optimal because of previous-shot noise. Farther up Line 1-OBS, we snagged abandoned net-and-float flotsam on the streamer's tailbuoy. This forced us to pull in the full streamer, and we lost the tailbuoy as we attempted to bring it onboard. We decided to shoot the rest of the line without the streamer deployed, so the latter part of Line 1-OBS has no associated multichannel data (this is not a significant problem, since MCS data at 50 m shot spacing were later acquired on that portion of the line). Finally, we encountered long-lines that were about to be deployed when we were shooting Line 104, which ties Transect 1 to Transect 2. We were able to communicate by radio with the commercial fishermen involved and arrange plans that minimally impacted each of us. We had no further problems with fishing gear on Transects 2 or 3.

- OBH/S instrumentation. The OBH/S portion of the project can only be considered a qualified success, due to the relatively high rate of instrument losses and failures. We note the primary difficulties here, although they are covered in more detail in the Oceanus cruise report. The Dalhousie and GSC instruments presented new and unusual problems in ship-to-instrument communication during recovery, whereas in previous use these instruments had always been extremely reliable. Three of the instruments were lost, several were recovered on backup-timer release, one failed to record, and one had poor data quality. The WHOI ORB instruments failed to record in four instances. One WHOI ORB was lost because it could not be tracked on the surface during inclement weather (ORBs have no radio transmitter). One WHOI OBH also was lost; Oceanus was unable to communicate with the instrument when it attempted recovery. In the final analysis, Oceanus obtained 24 OBS/H records in 29 deployments on Line1-OBS (plus one additional, poor-quality record), 24 OBS/H records in 27deployments on Line 2-OBS, and 21 OBS/H records in 24 deployments on Line 3-OBS.

- Weather. We were fortunate to have acceptable to good weather conditions throughout most of the cruise. We normally towed the hydrophone streamer at 7.5 meters depth with little noise from surface waves, but on some occasions deepened it to 10 meters when wave noise increased. On 31 July to 1 August we lost about 24 hours of shooting time. Winds and seas were tangling the airgun array and threatening to damage it, so we pulled in the array until the weather subsided. On 11 August we pulled the airguns and streamer about 12 hours before the planned end of our survey in order to depart the area early and avoid the predicted arrival of hurricane Alberto. We had already completed all of our major objectives, so the early termination did not adversely affect our scientific program.

Preliminary scientific results include:

- Basement character changes markedly across the transects, with four basement types visible from west to east: (1) a relatively smooth, high-amplitude reflector beneath continental shelves, (2) an apparently block-faulted geometry in rifted continental crust, (3) smooth, low-reflection-amplitude basement of uncertain affinity beneath the "U" reflection, and (4) rougher, possibly block-faulted basement seaward of the "U" pinchout, which may be serpentinized mantle or oceanic crust. This general morphological pattern exists on all three transects, but each transect differs in detail.

- At the current stage of processing, there is no evidence in our data that U is an unconformity; rather, it seems to conformably overlie a remarkably flat and layered sequence of possibly high-velocity material. The extent of the "U reflection" is very well defined by seaward pinchouts well landward of Srivastava's M0 picks and by landward limits against large, apparently continental fault blocks.

- The basement surface below "U" shows little impedance contrast with the overlying sub-U material, and it thus is defined more by an absence of reflections than by a distinct, regionally correlatable reflection. The basement surface below "U" tends to be deeper and to show less roughness than basement either landward or seaward of the "U" pinchouts. The cross-isochron width of the "U" zone increases steadily southward from Transect 1 to Transect 3.

- Hummocky basement that has relatively low-amplitude roughness and is characteristic of ocean crust occurs at the seaward ends of Transects 1 and 3. At the seaward end of Transect 2, however, the presumed ocean crust seaward of

MO has very high amplitude roughness, suggesting that it was formed under conditions where tectonic extension dominated over magmatic accretion.

- Coherent intra-basement reflections sporadically appear outside the zone of the "U reflection". In the seaward basement province, these reflections appear to dip landward more frequently than seaward. These may eventually prove to be interpretable as fault surfaces and/or Moho reflections. These reflections are much clearer in reprocessed sections than in the brute stacks. We therefore expect that other intra-basement reflectors may be discovered as more lines are processed beyond the brute stack stage.

- A distinct and widespread set of sedimentary sequences is developed above "U". From the base upward, these sequences include: 1) Flat-lying, weakly laminated sediments capped by a flat-lying and highly reflective sequence, all apparently deposited from turbidity flows. 2) Sculpted, pinch and swell reflections that appear to reflect deposition and local erosion controlled by abyssal currents; the base of this sequence may be equivalent to Horizon Au farther south in the western North Atlantic. 3) A sequence of contorted reflections including apparent channel development and channel fill; this sequence is interpreted as fan deposition. 4) A sequence of flat-lying and highly stratified sediments that lap onto the fan deposits; these are abyssal plain turbidites.

SCREECH PROJECT INVESTIGATORS

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H. van Avendonk - University of Wyoming

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T. Funck - Dalhousie University
J. Hall - Memorial University of Newfoundland
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John G. Byrne	Airgun Technician	LDEO
Ropate Maiwiriwiri	Core Bosun	LDEO
Grant T. Rawson	Airgun Technician	LDEO

R/V Maurice Ewing Crew

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Richard N. Thomas	3rd Mate
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Elizabeth B. Scanland	A/B
Monte M. Arbanas	A/B
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Leslie G. Strickland	Oiler
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WATCH SCHEDULE

MAIN LAB

Time (Local)	Scientist	Watchstander
0300 -0900	Hopper	Volkmer Lau
0900 - 1500	Holbrook	Nunes Lang
1500 - 2100	Tucholke	Hogan Shillington
2100 - 0300	van Avendonk	Puckett Winsor

GUN WATCH

Time (Local)	Watch
12 -4	Maiwiriwiri
4 - 8	Byrne
8 -12	Rawson

BRIDGE

Time (Local)	Watch
12 -4	Jeff Sylvia (Second Mate) Bob Jeffrey (A/B) Craig Kerwick (O/S)
4 - 8	Earl Mayhofer (First Mate) Monte Arbanas (A/B)
8 -12	Rick Thomas (Third Mate) Liz Scanland (A/B) Matt Cole (O/S)

CRUISE NARRATIVE

14 July - R/V Oceanus departed from St. Johns at 1200 local time, headed for the west end of Transect 1. There it will begin deployment of 29 OBS/H instruments toward the southeast along the transect. It is expected that OBS/H deployment will be complete by the time R/V Ewing arrives at the east end of the transect, deploys the seismic streamer and airgun array, and is ready to begin shooting.

15 - 17 July 2000 - R/V Ewing departed the dock in St. John's, Newfoundland at 1000 hrs. local time (1230Z) on 15 July 2000. We arrived at the east end of Transect 1, over which Oceanus had completed deploying 29 OBH/S instruments (#1 at the northwest end, #29 at the southeast end), at about 0400Z on 17 July. The tail buoy for the MCS streamer was deployed and streamer deployment commenced at this time, as we worked toward the southeast. We experienced an easterly current of about 2 knots during the latter part of our steam to the deployment location and during the deployment. Winds and seas were nearly calm. During streamer deployment one digitizing can was replaced, and we observed that the streamer was towing very shallow at birds 3, 4, and 5. We deployed nearly the entire streamer in order to get loose wraps tightened up at the bottom of the reel, then recovered the streamer and found that one of the birds was loose in the shallow-towing section.

18 July - By very early this morning, after an unusually long streamer deployment, we had the streamer well balanced and were heading for the position of OBS #29 at the east end of Transect 1. Unfortunately, we encountered a fisherman's long-line directly in our path and had to divert in a counterclockwise circle to the northeast in order to reach the location of OBS #28 or #27. Late in this diversion we encountered another parallel pair of long-lines and were forced to steer between them toward the north. Finally we were able to turn west and get back onto Transect 1 at the position of OBS #26 at about 1730Z; this is some 18-19 km east of Srivastava's M0 position. Thus we had less than 2/3 of the 30 km of ocean crust coverage we had planned seaward of M0. As we proceeded to shoot Line 1-OBS northwest along Transect 1, the water temperature dropped and it became less likely that we would encounter fishermen; they prefer working on the edge of the warm water. The current opposing us also dropped and we made 4.0 - 4.2 knots over the ground, compared to 2.0-2.5 knots earlier in the day when we were in the warm-water drift. At 2200Z, we were running about 10 hours behind schedule. We talked with Keith Louden on Oceanus in the morning, and we agreed that Oceanus should begin picking up OBS/H's at the southeast end of the transect once we were ca. 150 km northwest along the transect. This would help us to regain some time on the OBS deployment for the next transect. We also considered whether it would be worthwhile to leave one or two OBS/H (e.g., numbers 29, 28, or 27) at the east end of Transect 1 for us to shoot over when we returned southeastward while shooting Line 1MCS.

19 July - We continued shooting Line 1OBS northwest along Transect 1 until about 1900Z. At that time the tension on the streamer cable went from a normal 3500 lbs. up to more than 6000 lbs., and we suspected that the tailbuoy had snagged some flotsam. The

Zodiac rescue boat was sent back to the tail buoy (in heavy fog) to check its condition and they found that the buoy was heavily fouled by nets and floats. We were forced to pull in the streamer, beginning about 2400Z. Earlier in the day, during our morning radio communication with Oceanus, we learned that Oceanus was having difficulty locating one of the OBSs (#28) that they had released for recovery. They verified that it released, but were not able to locate it on the surface in very foggy conditions, with visibility only a few hundred yards. We decided that OBS #29 and #27 should be left in place so that we could shoot to them when we returned southeast along Line 1MCS.

20 July - At about 0800Z, we recovered the streamer up to the tailbuoy. During the attempt to retrieve the tailbuoy and the heavy netting draped over it, the tail buoy broke off. Most of the airguns were still deployed, so we had no maneuverability to attempt tailbuoy recovery. The Science Officer, Joe Stennett, decided to let the buoy go, and we decided to shoot the remainder of Line 1OBS without the seismic streamer deployed. We returned to Line 1OBS and completed shooting it at 1940Z. We turned the ship west and began streamer deployment at 2000Z with a new tailbuoy. Sections were checked during deployment; one was topped off with oil and one was changed out. In our daily radio communication with Oceanus, we learned that they had to give up the search for OBS #28 about 1000Z this morning.

21 July - The streamer was fully deployed and we were on course to begin shooting Line 1-MCS toward the southeast at about 0330Z. At our 1400Z radio communication with Keith Louden, we learned that they had recovered about one-third of the OBS/H instruments up to that time and were working their way onto Flemish Cap. Six ORBs remained at the SE end of the transect, to be recovered when Oceanus returned to the southeast. Because of the streamer balancing difficulties, long-lines, and fishing nets, we were at this time more than a day behind schedule. From discussions that we had with Keith, we decided to limit the "grid" around the seaward end of Transect 1 to one parallel track on the northeast side of the transect. This will follow along the heat-flow profile that Keith made two days ago. From there, our track will turn southwest to make an MCS tie from Transect 1 to Transect 2.

22 July - We completed shooting Line 1MCS toward the southeast without encountering any long-lines or fishing gear. We turned and began shooting a parallel line (Line 101) northeast of 1MCS that follows along the line of Keith's heat-flow measurements. Keith reported via radio that they were having problems recovering Dalhousie OBSs at positions #9 and #13 and may have to revisit those locations to see if the instruments surface when the backup timers release at 2100Z on 23 July.

23 July - We turned southwest across Transect 1, doing a small grid survey (Lines 102-103) over an interesting, possibly rotated fault block on Transect 1; the block is capped by a well developed, horizontal reflection sequence (possibly a reef). We then continued to the southwest, shooting a tie line (Line 104) between Transects 1 and 2. Midway along this tie line, we were forced to divert southward about 8 miles to avoid intersecting long-lines that were about to be set along the warm-water edge of the Gulf Stream. Nonetheless, our tie line appears to have a complete, continuous and excellent

stratigraphic sequence developed over its entire length. This includes what we tentatively interpret as the "U unconformity" just above basement. We were slowed during much of the day by a current opposing our tie-line course of ~232 degrees T. Our speed over the ground was 3.0 - 3.2 knots.

24 July - We began MCS grid survey around the seaward part of planned Transect 2, including long lines parallel to the transect line and spaced about 10 km from it (Lines 105-109). In our morning radio contact, Keith reported that they had recovered 24 OBS/H, that 3 WHOI ORBs remain to be recovered today, and that 2 instruments have been lost (one ORB - #28 noted earlier, and the Dalhousie OBS at position #9). The Dalhousie OBS at position #13 released on its backup timer and was recovered. Keith estimated that OBS/H instruments would be deployed on Transect 2 by late on 26 July. Assuming that this timing holds, we would be running about half a day behind schedule.

25 and 26 July - We continued surveying MCS grid lines around Transect 2,completing three main dip lines parallel to the transect (Lines 105, 107,109); these ranged from about 75 to 130 km long. We turned onto the SE end of Transect 2 and began shooting Line 2OBS toward the northwest at about 1700Z on 26 July. Twenty seven OBS/H were deployed from Oceanus and were scheduled to turn on at 1500Z; their positions were numbered from #1 at the northwest end of Transect 2 to #27 at the southeast end.

27 July - The entire day was spent shooting Line 2OBS toward the northwest along Transect 2. We had a favorable current and made 5 knots or better over the ground.

28 - 29 July - Early on the 28th, we completed Line 2OBS. We then turned and shot Line 2MCS to the southeast along Transect 2 without incident. The smooth, strong reflection that characterizes the "U unconformity" is very clear in the profiles, and it is delimited by pinchouts at the base of Flemish Cap to the west, and on basement to the west of M0 in the east, very close to where we had predicted its termination. There are a number of good locations to drill the horizon where it is as little as 1.6-1.7 seconds below the seafloor. Basement in the brute stacks is not a distinct reflection beneath U; rather reflections in the sub-U section fade out where basement is likely to be. We hope to get a clearer picture of basement with application of more accurate stacking velocities and more complete processing.

30 - 31 July - We completed Line 2MCS, and at 1000Z on 30 July we turned onto Line 201 to conduct a grid survey over the southeastern part of Transect 2, crossing potential drill sites. By the morning of 31 July a gale started to build in the survey area. Our grid survey continued until 2300Z on 31 July, while we were shooting Line 210. At that time, we were forced to turn downwind and retrieve all the airguns, which were becoming tangled and potentially could be damaged. We dropped the streamer down to 10 m depth so that it could better ride out the seas; streamer tension remained acceptably low throughout the gale.

1 August - We stood down from MCS shooting most of the day, holding the streamer at 10 meters depth with 40+ knot gusts and 15-foot seas. Wind dropped mid-day and seas

gradually subsided to less than 10-foot swells. We worked our way slowly to OBS position #8, continuing to tow the streamer. OBS #8 had not responded when Oceanus attempted to retrieve it, and Keith asked us to see if we could recover it when it was to release on its backup timer (1800Z). We were operating in heavy fog, with about 100 meters visibility. At 1910Z we heard the radio signal of the OBS as it surfaced, exactly on time, and the ship was navigated following the radio beacon until the OBS appeared out of the fog on the starboard bow. Attempts to grapple the OBS as it drifted along the starboard waist deck were unsuccessful, but within about 2 minutes the Zodiac rescue boat was launched (it had been standing by and was ready to go) and followed the OBS into the fog astern of Ewing. It recovered the OBS and returned to Ewing within 5 minutes. Overall, this was a remarkable recovery, considering that the streamer was still deployed, the ship only briefly dropped speed to 1.5 knots, and we were operating in heavy fog. As a footnote, the streamer had been taken in a few turns on the drum, so it was ready for immediate retrieval should the ship have had to slow down for a significant period. Seas had dropped significantly by the time of the OBS recovery, so following the recovery we deployed the airguns and resumed our grid survey along Transect 2, beginning with Line 301.

2 - 4 August - We continued our grid survey around Transect 2, completing Lines 302-304 and starting Line 305, which is the tie line extending southwest to Transect 3. On 3 August we crossed the planned line of Transect 3, completed Line 305, and turned onto Line 306 which is parallel to and about 16km southwest of the seaward part of Transect 3. The seismic tie along Line 305 shows a very flat and continuous "U unconformity" immediately above basement over the full length of the line, except for one minor interruption by a small basement peak. On 4 August we turned from Line 306 and at about 1545Z we commenced shooting Line 3OBS northwest along Transect 3. Oceanus has deployed 24 OBS/H along Transect 3, numbered from position #1 in the northwest to #24 in the southeast.

5 August - This morning, Oceanus proceeded southeast down the line of Transect 3 to do heat flow work near the seaward end of the transect. At about 1200Z we deployed from the Ewing fantail the OBS that we had recovered 1 August, and Oceanus retrieved the instrument after it passed aft of the streamer tailbuoy. We continued shooting Line 3OBS toward the northwest.

6 August - At 0710Z we changed the shot spacing from 200 meters to 50 meters over the Grand Banks continental shelf. At this change, the line name was changed from 3OBS to 3MCS1. 50-meter spacing was maintained in the shallow water of the Grand Banks and while shooting the MCS portion of the return leg into deep water along Transect 3.

7 August - We completed Line 3MCS1 and at 1144Z turned onto a parallel line, Line 401, which is offset 15 km to the northeast. We spent the entire day shooting toward the southeast along this line.

8 August - Keith reported from Oceanus concerns about whether the WHOI ORB instruments were recording. ORB #20 and #21 at the east end of the transect did not

record, although #12 and #13 did record. Our concern was that ORBs #5, 6, and 7 on the continental slope might not record in that critical area, so we decided that Oceanus would deploy two additional instruments ("#5.5" and "#6.5") between the three ORBs already deployed there. We finished Line 401 and turned southwest (Line 402) across Line 3OBS to shoot Line 403 headed northwest parallel to 3OBS and 3MCS1. This gave us three good MCS crossings of Carson basin.

9 August - About 1230Z we turned back onto the main transect (3MCS1),headed southeast. We continued to shoot at 50 meter shot spacing (Line 3MCS2), which will complete the entire transect at this spacing. We came onto the main transect about 50 km northwest of OBS #5, so our shooting also provided coverage to OBS "#5.5" and"#6.5", in case ORBs #5, 6, and 7 fail to record.

10-11 August - We continued shooting Line 3MCS toward the southeast and completed the line about 0900Z on 11 August. We then turned more easterly (Line 501) to make a crossing of one of the Newfoundland seamounts (Line 502) before turning northwest to cross an interesting area of apparently seaward-dipping reflections and rotated fault blocks that were observed in the old Conrad MCS data. However, in consulting with the captain at about 1400Z, it became apparent that hurricane Alberto was forecast to pass into our area within the next 24-48 hours. Given that we had accomplished all our primary objectives, we decided to declare victory and beat a hasty retreat. At 1434Z we terminated MCS acquisition near the middle of Line 502 and began to pull in gear. By 1925Z the tailbuoy was aboard, all gear was secured, and we began steaming WNW onto the Grand Banks. During the remainder of the day, we had winds of ca. 35 knots and seas to 12-14 feet. The decision to pull in the gear when we did had been a good one.

12-17 August - Ewing transited from the survey area to port in Newark, New Jersey.

TIME, DATE, AND LOG KEEPING

All science records and logs kept on Ewing Cruise 00-07 were recorded in GMT (Zulu), which was three hours ahead of local, ship time (Atlantic Time) during the survey. Date annotation was in either Calendar Day or Julian Day. The table below gives calendar days and corresponding Julian days.

CD	JD	CD	JD	CD	JD
14 July (Fr)	196	27 July (Th)	209	09 Aug.(We)	222
15 July (Sa)	197	28 July (Fr)	210	10 Aug.(Th)	223
16 July (Su)	198	29 July (Sa)	211	11 Aug.(Fr)	224
17 July (Mo)	199	30 July (Su)	212	12 Aug.(Sa)	225
18 July (Tu)	200	31 July (Mo)	213	13 Aug.(Su)	226
19 July (We)	201	01 Aug. (Tu)	214	14 Aug.(Mo)	227
20 July (Th)	202	02 Aug. (We)	215	15 Aug.(Tu)	228
21 July (Fr)	203	03 Aug. (Th)	216	16 Aug. (We)	229
22 July (Sa)	204	04 Aug. (Fr)	217	17 Aug. (Th)	230
23 July (Su)	205	05 Aug. (Sa)	218		
24 July(Mo)	206	06 Aug. (Su)	219		
25 July (Tu)	207	07 Aug. (Mo)	220		
26 July (We)	208	08 Aug. (Tu)	221		

Several hard-copy cruise logs were maintained in the Main Lab. A Science Watchstander Log (standard LDEO log sheets) was typically annotated every half hour and at every event with position, course, speed, etc. An R/V Maurice Ewing Seismic Recording Log was maintained once the seismic program commenced. A Scientific Lab Logbook also was maintained, containing detailed notes on all events and observations during the cruise. Copies of all logs are in the possession of the Co-Chief Scientists, and copies will be archived at Woods Hole Oceanographic Institution.

Communications

The success of this project depended on reliable, regular communications with the R/V *Oceanus*, which was responsible for OBS deployments on the three main transects. Communication achieved the following aims: (1) Exchanging progress updates and coordinating work schedules between the ships; (2) exchange of crucial data between the ships, such as shot time files and instrument positions; and (3) reaction to unforeseen events, such as the need for Ewing to recover one of the Dalhousie OBSs on its timed backup release. We relied on three means of communicating with the *Oceanus*: radio, email, and Inmarsat telephone. We followed a daily radio schedule on SSB (primary frequency 6224; backup 8192) at 1100 LT (1000 LT at the start of the cruise). This worked well, and on only two or three occasions were we unable to raise the Oceanus on SSB. On rare occasions we were close enough to the Oceanus to communicate via HF radio (channel 69).

Email contact with the *Oceanus* worked acceptably throughout the cruise. *Ewing's* four-times-daily email schedule (0900, 1300, 1600, and 2300 EDT) is excellent, and that schedule meshed well with the Oceanus' email schedule (0800 and 1700 EDT) in fostering ship-to-ship dialog. On some occasions, email contact was delayed due to inauspicious orientation of the satellite antenna, but that is to be expected. Jeff Turmelle was very responsive to our needs by lifting the 64 kb file size limit so that we could send large shot time files to the *Oceanus*, and on several occasions he set up special email connects so that we could send time-critical information to *Oceanus*.

We made rare use of the Inmarsat telephone, due to its great expense, but it did prove vital on two occasions when we needed to communicate with *Oceanus* but could not raise them on SSB.

We also relied on regular email contact with our shore-based investigators, particularly Hans Christian Larsen at DLC, when important decisions needed to be taken.

MCS and Shooting Operations

Acquisition Parameters.

Throughout the cruise we used the 6000 m, 480-channel Syntron streamer. Group spacing was 12.5 m, yielding a CMP spacing of 6.25 m.

We recorded 16.324 s records at a sample rate of 0.004 s (with the exception of the first OBS and MCS line, which recorded 16.380 s). We decided on the 4 ms sample rate over the 2 ms rate, for the following reasons: (1) This would minimize the number of 3490E tapes needed, as well as the number of DLT's and Exabytes for data copying; (2) the lower data acquisition rate would allow us to easily keep up with the real-time stacking and tape copying procedures; and (3) based on previous experience with the airgun array, we expected very little energy above the 4-ms Nyquist frequency of 125 Hz. This latter expectation was borne out by spectral analysis of the data, which show a sharp drop-off above 80 Hz.

Shooting was done on distance, with principal shot intervals of 50 m during MCS shooting (yielding a nominal CMP fold of 60) and 200 m when shooting to the OBS's (yielding a nominal CMP fold of 15), to minimize previous shot noise. There were two exceptions to this rule: (1) On the shelf portion of Transect 3, where water depths were less than 100 m and previous shot noise, we shot both MCS and OBS data simultaneously at 50 m spacing. (2) It was occasionally necessary, in the presence of strong tail currents, to increase the shot spacing in order to maintain air pressure to the guns. In these situations (denoted in the MCS logs), the shot interval was first increased to 62.5 m (yielding 48 fold data), and in rare instances, to 75 m (yielding 40 fold data).

Shooting on distance served two goals: (1) It effectively randomized shot times, to prevent coherent previous shot noise, and (2) it simplified assignment of geometry in MCS processing. The system governing shooting on distance appears to be quite stable, judging by the "status" files Jeff Turmelle generates for each shot time file: shot intervals more than 5 m off the nominal 50 m spacing were very rare. In the example appended below, for instance, only 13 shots out of 4137 were more than 5 m off, and those are generally less than 10 m off.

Acquisition System

The Syntrak 480 acquisition system generally performed well, with one major exception: during shooting of the OBS profiles at 200 m shot spacing, we experienced frequent tape drive errors. These were very worrying for a while, especially since we sailed with no (!) spare 3490e tape drive. Joe postulates that the problem is endemic to the system, which was probably not tested for such a long shot spacing (which would be highly unusual in industry). The problem may reside in software or hardware. LDEO should follow up on Joe's initial contacts with Syntron and the tape drive manufacturer to get to the bottom of this problem, as it will surely recur in future OBS cruises. (Indeed, we understand that this same problem occurred during the recent Costa Rica cruise during OBS shooting.)

A more minor problem, but one deserving of attention, is with the tape label system. The 3490e tape labels printed by the system show file numbers and shot numbers which are incorrect as often as they are correct. Quite frequently, the file and shot numbers at the beginning or (especially) the end of the tape are off by one or two, compared with the files and shot numbers that actually exist on the tape. This is a nuisance and could cause real inconvenience in later processing from 3490's since the tape labels do not reflect what is on tape. The watchstanders were asked to check the copy+stack job screen output to correct the shot numbers on the tape labels, though the file numbers could not be verified this way.

Airgun Array

We used a 20-gun, 8540 cu. in. (140 liter) airgun array throughout the cruise, with gun sizes ranging from 145 cu. in. to 875 cu. in. (see figure). Guns were floated from Norwegian floats at a nominal depth of 7.5 m, though the guns often kited above this depth when our water speed increased. The airguns performed well throughout the cruise, with little maintenance needed, apart from occasional line tangles due to heavy seas. The airgun source is remarkably sharp and stable; deconvolution of the data is hardly necessary.

The gun array was centered 55.6 m aft of the Tasman P-Code navigation satellite, which was used to log the ship's position. This offset should be considered when calculating source-receiver ranges for the OBS data.

Streamer Configuration

The Syntron streamer consisted of 480 channels, 6000 m total of active sections, 40 active cans, and groups spaced at 12.5 m intervals. The offset of the near trace (channel #480) from the center of the gun array is 181.65 m (see setback diagram), and the offset of the far trace (channel #1) is 6169 m. Twenty-three birds (12 with compasses) were attached to the streamer. The streamer was usually towed at 7.5 m depth (to be consistent with the gun depth), but in rough seas they were brought down to 10 m depth.

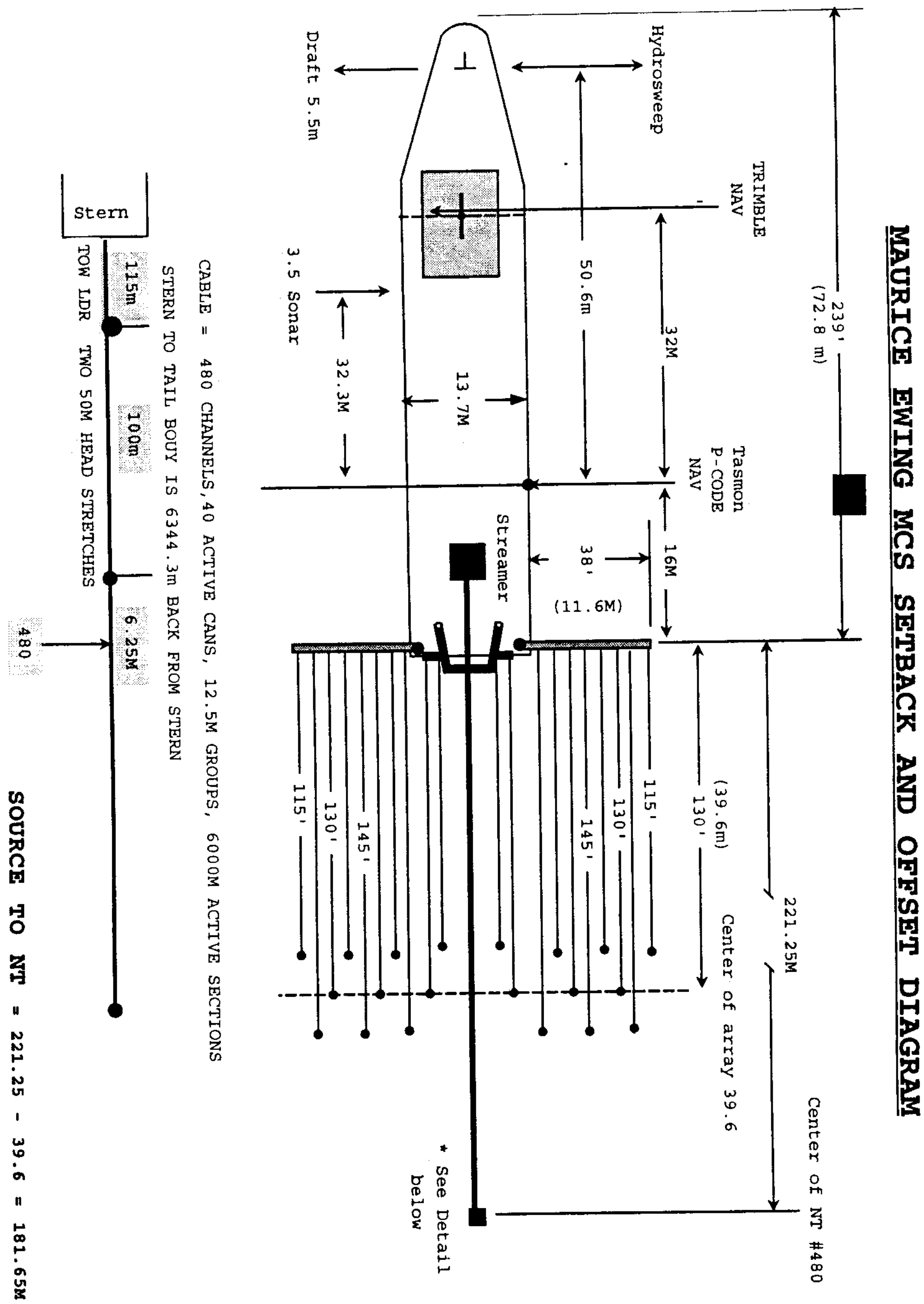
Although we had some early problems with streamer balance, once deployed, the streamer held its assigned depth well, with deviations common only during turns, rough weather, or strong tail currents (which limited our speed through the water). The forward part of the streamer had a definite tendency to sink and should probably be reballasted on deployment during EW0008 (Blake Ridge).

Streamer

MOD	SERIAL #	CAN#	SHIP OFFSET	CHANNELS	BIRD	COMMENTS
TB			6344.3M			TAIL BUOY AT 6345M
STIC	CABLE 25.3M		6319M TO 6344M			
1		2151				POWER MODULE 12151
HS	30120-HS	50M	6269M TO 6319M			
TS	0697-30284TS	50M	6219M TO 6269M			
AT	0498-30024	4M	6215M TO 6219M			
	0398-31433	RED	6140M TO 6215M	1 TO 3	1C	Bird aft on 31433. 6219M
2		3538				
	0298-31388	ORNG	6065M TO 6140M	4 TO 6		
	0298-31407	RED	5990M TO 6065M	7 TO 9		
3		2734			2	Bird at 5994. SRD1
	0198-31319	ORNG	5915M TO 5990M	10 TO 12		
	0198-31333	RED	5840M TO 5915M	13 TO 15		
4		2731				BIRD AT 5844M
	0298-31385	ORNG	5765M TO 5840M	16 TO 18		
	0298-31399	RED	5690M TO 5765M	19 TO 21		
5		3165			3C	COMPASS Bird at 5694M
	0298 31416	ORNG	5615M TO 5690M	22 TO 24		Ch. 2 sections. No telemetry
	0298 31361	RED	5540M TO 5615M	25 TO 27		
6		3607			23	BIRD AT 5544M
	0298-31402	ORNG	5465M TO 5540M	28 TO 30		
	0298-31337	RED	5390M TO 5465M	31 TO 33		
7		3189			4	BIRD at 5394M
	0298-31382	ORNG	5315M TO 5390M	34 TO 36		
	0298-31390	RED	5240M TO 5315M	37 TO 39		
8		3606				
	0298-31346	ORNG	5165M TO 5240M	40 TO 42		
	0298-31381	RED	5090M TO 5165M	43 TO 45		
9		3107			5C	Bird at 5094M
	0298-31391	ORNG	5015M TO 5090M	46 TO 48		
	0298-31336	RED	4940M TO 5015M	49 TO 51		
10		3395				
	0298-31384	ORNG	4865M TO 4940M	52 TO 54		
	0198-31341	RED	4790M TO 4865M	55 TO 57		
11		3599			6	Bird at 4794. SRD2
	0198-31398	ORNG	4715M TO 4790M	58 TO 60		
	0298-31387	RED	4640M TO 4715M	61 TO 63		
12		3597				
	0298-31378	ORNG	4565M TO 4640M	64 TO 66		
	0298-31369	RED	4490M TO 4565M	67 TO 69		
13		3604			7C	Bird at 4494M
	0298-31396	ORNG	4415M TO 4490M	70 TO 72		
	0198-31335	RED	4340M TO 4415M	73 TO 75		

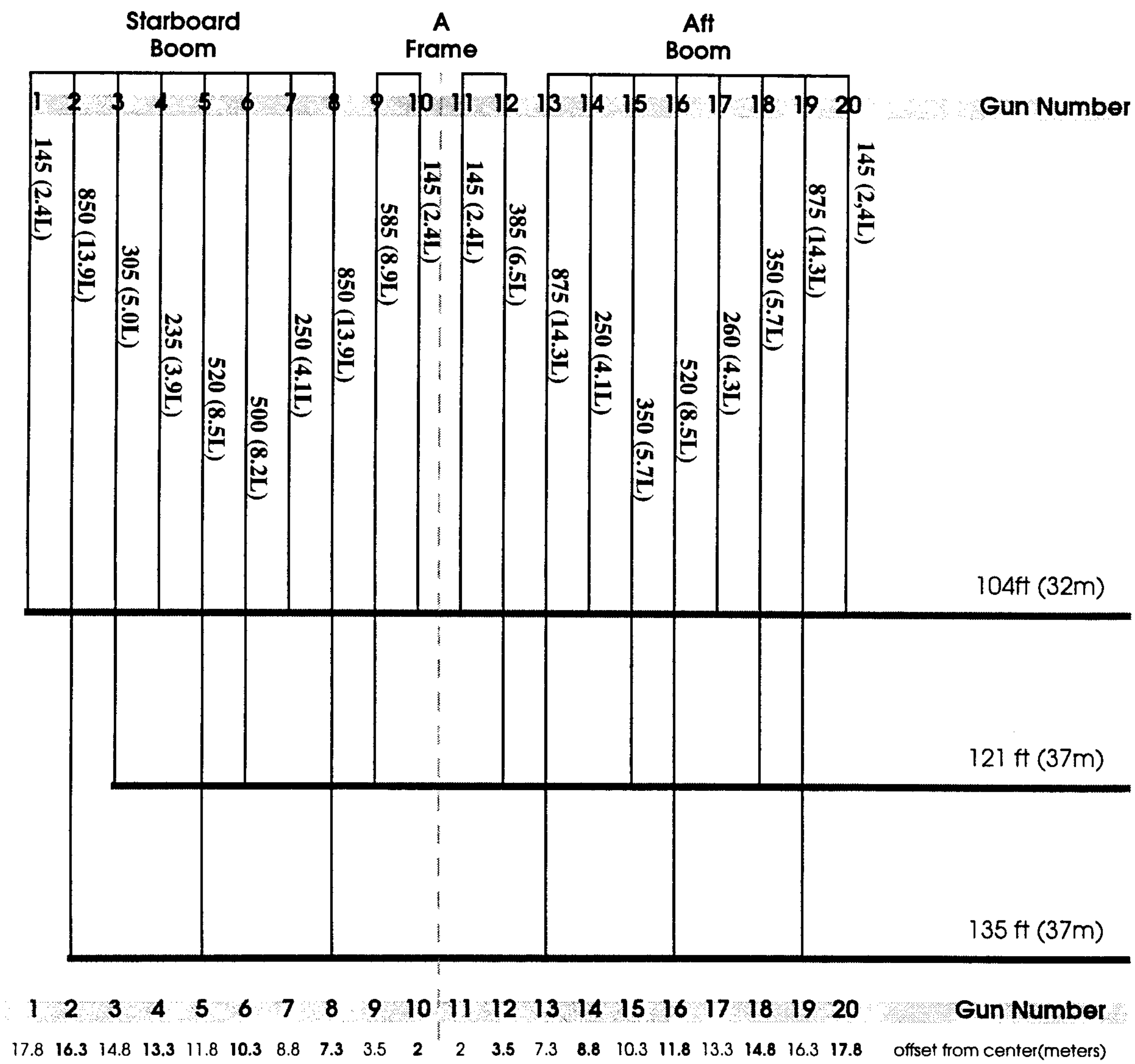
MOD	SERIAL #	CAN#	SHIP OFFSET	CHANNELS	BIRD	COMMENTS
14		2965				
	0198-31362	ORNG	4265M TO 4340M	76 TO 78		
	0298-31373	RED	4190M TO 4265M	79 TO 81		
					8	BIRD at 4194M
15		2714				
	0198-31334	ORNG	4115M TO 4190M	82 TO 84		
	0298-31405	RED	4040M TO 4115M	85 TO 87		
16		2757				
	0198-31348	ORNG	3965M TO 4040M	88 TO 90		
	0397-31119	RED	3890M TO 3965M	91 TO 93		
					9C	Bird at 3894M
17		3031				
	0198-31318	ORNG	3815M TO 3890M	94 TO 96		
	0198-31343	RED	3740M TO 3815M	97 TO 99		
18		3602				
	1296-30312	ORNG	3665M TO 3740M	100 TO 102		
	0996-30302	RED	3590M TO 3665M	103 TO 105		
					10	BIRD at 3594M
19		2940				
	30804	ORNG	3515M TO 3590M	106 TO 108		
	0996-30327	RED	3440M TO 3515M	109 TO 111		
20		2935				
	0197-31058	ORNG	3365M TO 3440M	112 TO 114		
	0298-31389	RED	3290M TO 3365M	115 TO 117		
					11C	Bird at 3294. SRD3
21		3185				
	31329	ORNG	3215M TO 3290M	118 TO 120		ch 2704. No telemetry
	0996-30279	RED	3140M TO 3215M	121 TO 123		
22		2563				
	0297-31082	ORNG	3065M TO 3140M	124 TO 126		
	1096-30330	RED	2990M TO 3065M	127 TO 129		
					12	BIRD at 2994M
23		2507				
	31350	ORNG	2915M TO 2990M	130 TO 132		
	31363	RED	2840M TO 2915M	133 TO 135		
24		2567				
	0996-30300	ORNG	2765M TO 2840M	136 TO 138		
	0696-31347	RED	2690M TO 2765M	139 TO 141		
					13C	Bird at 2694M
25		2717				
	0697-31351	ORNG	2615M TO 2690M	142 TO 144		
	31383	RED	2540M TO 2615M	145 TO 147		
26		2523				
	0996-30304	ORNG	2465M TO 2540M	148 TO 150		
	0996-30283	RED	2390M TO 2465M	151 TO 153		
					14	Bird at 2394. SRD4
27		3163				
	298 31372	ORNG	2315M TO 2390M	154 TO 156		
	0996-30301	RED	2240M TO 2315M	157 TO 159		
28		2511				
	1096-30332	ORNG	2165M TO 2240M	160 TO 162		
	????	RED	2090M TO 2165M	163 TO 165		
					15C	Bird at 2094M
29		2570				
	0597-31248	ORNG	2015M TO 2090M	166 TO 168		
	0597-31269	RED	1940M TO 2015M	169 TO 171		

MOD	SERIAL #	CAN#	SHIP OFFSET	CHANNELS	BIRD	COMMENTS
30		3172				
	0597-31268	ORNG	1865M TO 1940M	172 TO 174		
	0996-30281	RED	1790M TO 1865M	175 TO 177		
31		2505			16	BIRD at 1794M
	???	ORNG	1715M TO 1790M	178 TO 180		
	0996-30303	RED	1640M TO 1715M	181 TO 183		
32		2554				
	1096-30346	ORNG	1565M TO 1640M	184 TO 186		
	30313	RED	1490M TO 1565M	187 TO 189		
33		3182			17C	Bird at 1494M
	0696-10388	ORNG	1415M TO 1490M	190 TO 192		
	0697-31277	RED	1340M TO 1415M	193 TO 195		
34		2506				
	0696-31280	ORNG	1265M TO 1340M	196 TO 198		
	SS1-0696-10057	RED	1190M TO 1265M	199 TO 201		
35		2462			18	Bird at 1194. SRD5
	1096-30320	ORNG	1115M TO 1190M	202 TO 204		
	0996-31349	RED	1040M TO 1115M	205 TO 207		
36		2747				
	0697-31282	ORNG	965M TO 1040M	208 TO 210		
	1096-30337	RED	890M TO 965M	211 TO 213		
37		3192			19C	Bird at 894M
	SS1-0696-0140	ORNG	815M TO 890M	214 TO 216		
	31400	RED	740M TO 815M	217 TO 219		
38		3543				
	0298-31410	ORNG	665M TO 740M	220 TO 222		
	0298-31365	RED	590M TO 665M	223 TO 225		
39		2728			20	Bird at 594M
	31346	ORNG	515M TO 590M	226 TO 228		
	0298-31377	RED	440M TO 515M	229 TO 231		
40		2485			21C	BIRD AT 444
	0198-31321	ORNG	365M TO 440M	232 TO 234		
	???	RED	290M TO 365M	235 TO 237		31357 Leaks
41		2970			22	BIRD AT 294M
	0298-31360	ORNG	215M TO 290M	238 TO 240		
42	30128HS	10284	165M TO 215M	STRETCH		PASSIVE CAN 10284
	30134HS		115M TO 165M	STRETCH		
LDR	0498-30025		STERN TO 115M	LEADER		FIBER OPTIC


MAURICE EWING MCS SETBACK AND OFFSET DIAGRAM
239'
(72.8 m)
Hydrosweep
TRIMBLE
NAV
Draft 5.5m
50.6m
32M
Tasmon
P-CODE
NAV
3.5 Sonar
32.3M
13.7M
Streamer
38'
(11.6M)
16M
130'
(39.6m)
221.25M
115'
130'
145'
145'
130'
115'
Center of array 39.6
Center of NT #480
* See Detail
below
Stern
115m
100m
6.25M
480
TOW LDR TWO 50M HEAD STRETCHES
STERN TO TAIL BOUY IS 6344.3m BACK FROM STERN
CABLE = 480 CHANNELS,40 ACTIVE CANS, 12.5M GROUPS, 6000M ACTIVE SECTIONS
SOURCE TO NT = 221.25 - 39.6 = 181.65M

Airgun Array

Layout of theR/V Ewing 20-gun array
(not to scale)
8540 cubic inches, 140 liters



This file, ts.n222.status, is an example of the shot-time status files produced for each Julian day. A summary of line numbers and shot ranges covered during the day is given, along with unusual shot distances. Note the small number of shots that fall more than 10% outside the nominal 50 m shot spacing.

```
402: 059764 .. 059823: 2000+222:00:00:10.613 .. 2000+222:00:21:38.832

403: 059824 .. 061636: 2000+222:00:22:38.133 .. 2000+222:11:07:32.005

403T: 061637 .. 061873: 2000+222:11:08:03.126 .. 2000+222:12:27:27.970

3MCS2: 061874 .. 063900: 2000+222:12:28:38.137 .. 2000+222:23:59:59.789

      UNUSUAL DISTANCES: (shot distances > 50 +/- 50*0.1)
          403     Shot distance 059823..059824 = 136.718 meters
          403     Shot distance 059891..059892 = 58.094 meters
          403     Shot distance 059903..059904 = 41.639 meters
          403     Shot distance 060786..060787 = 55.104 meters
          403     Shot distance 060848..060849 = 59.767 meters
          403     Shot distance 060850..060851 = 43.578 meters
          403     Shot distance 060862..060863 = 59.623 meters
          403     Shot distance 060875..060876 = 44.549 meters
          403     Shot distance 060891..060892 = 60.334 meters
          403     Shot distance 060936..060937 = 55.160 meters
          403     Shot distance 060983..060984 = 56.934 meters
          403     Shot distance 061322..061323 = 56.030 meters
          403     Shot distance 061389..061390 = 57.282 meters
          403T    Shot distance 061636..061637 = 75.403 meters
          3MCS2   Shot distance 061873..061874 = 169.542 meters
          3MCS2   Shot distance 063594..063595 = 43.904 meters
Total Distance: 206622.520 meters
```

Streamer Navigation

The continuous recordings of magnetic compass headings and the GPS tail buoy location allow for a real-time reconstruction of the streamer cable. Such streamer navigation tools have proved to be indispensable on recent 3-D multi-channel surveys to obtain an even data coverage (e.g., ARAD, Nankai Trough), but they can also be useful during 2-D experiments for two reasons. First, during close encounters with ships and other objects, knowledge of the streamer position can help to avoid damage to the streamer. Second, in processing of 2-D MCS data it is often assumed that the streamer is oriented straight behind the ship on the shot line. In that case, the distance from the guns to the streamer hydrophones can be extracted from the streamer configuration (see preceding table), and source-receiver pairs can be readily binned in common depth points. Feathering of the streamer (i.e., the streamer does not follow the ship track), will not affect the estimated source-receiver offsets as long as the streamer is straight. In that case, the apparent velocities and stacking velocities of reflected waves will remain true in a one-dimensional Earth. However, the bounce points for source-receiver pairs that are stacked in one CMP will not coincide, and lateral variations in the subsurface can cause unusual move-out. If the streamer is curved behind the ship, the true source-receiver offsets are shorter than predicted, and the artifacts in 2-D processed seismic data can be too difficult to overcome. Naturally, this situation occurs at a ship's turn. Streamer navigation can show how long it takes for the streamer to adjust to a turn, and whether ocean currents have a large impact on the streamer position.

We used the streamer navigation program of Alistair Harding for most of the seismic survey. The program, a MATLAB script, fits a spline curve to the compass headings, and it can subsequently accommodate the tail buoy GPS measurement by a rigid rotation of the streamer around the stern of the ship. The program has a very convenient display of the ship and the streamer, which was updated after every air gun shot. The main reason for doing accurate streamer navigation on this experiment was to prepare for a cruise following in September, the 3-D MCS study on the Blake Ridge. Beside fixing problems with the data input and output, we gained some understanding of the behavior of the streamer through turns and in ocean currents.

At the start of the MCS shooting on transect 1, the correct compass locations (preceding table) had not yet been assigned in the program, and other adjustments were necessary to read the real-time navigation logs. Consequently, we were not able to monitor the streamer during the maneuvers that spared the streamer from nearby fishing lines. Later, when the tail buoy was caught in a fishing net, GPS readings from the tail buoy were used directly to determine its position, and the streamer navigation program was not used in the attempt to save the tail buoy. Of course, the hazardous situations that were encountered by the R/V Ewing on the Flemish Cap must be avoided if possible, but streamer navigation might help to keep the streamer at distance from a nearby object in case of an emergency.

Apparently due to the Atlantic Gulf Stream, we experienced ocean currents as strong as 2 knots near the Flemish Cap and the Grand Banks, while currents in the deeper parts of our study area (> 4000 m) were often very weak. Feathering of the streamer was usually worst near the continental slope. In figure Nav.1 we show 3 streamer reconstructions along transect 3. Near the southern edge of the Grand Banks, the orientation of the streamer changed within 6 hours from feathering ~1400 m to the port side (a) to feathering ~1200 m to the starboard side (b). This considerable amount of feathering still only causes very small discrepancies between the true and assumed along-track distances of bounce points, which can cause incorrect binning. However, if the reflectivity of the earth changes significantly over ~1 km, the feathering of the streamer can affect the stacking velocities as mentioned above, which may degrade the image. The currents at the far east end of transect 3 were modest, and did not cause much streamer feathering (c). In figure Nav.2 we show the behavior of the streamer in a turn over 7 hours on August 11. Clearly, currents still play a strong role, as feathering of the streamer was much worse after a small turn at 9:32 than at a near 90° turn at 11:40.

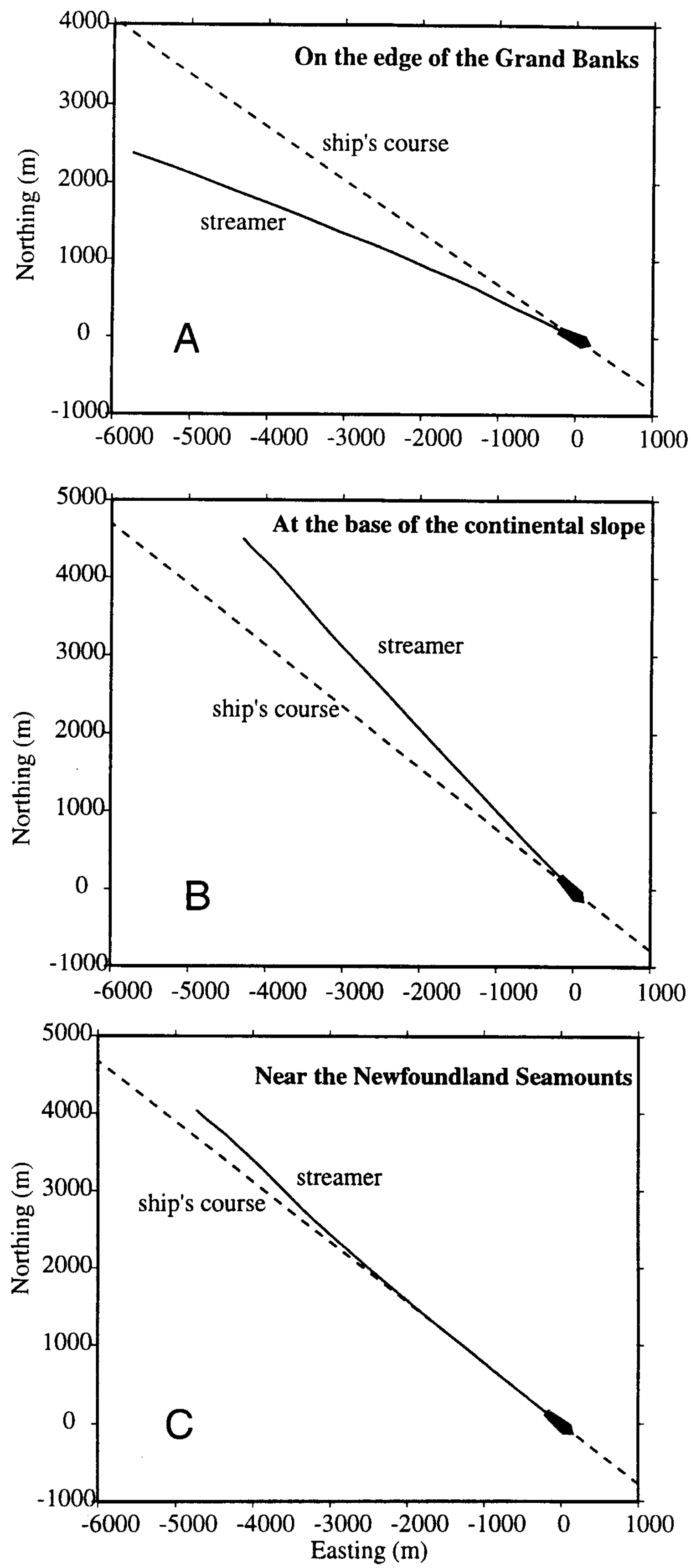

On the edge of the Grand Banks
ship's course
streamer
A
Northing (m)
At the base of the continental slope
streamer
ship's course
B
Near the Newfoundland Seamounts
streamer
ship's course
C
Easting (m)

Fig. Nav.1

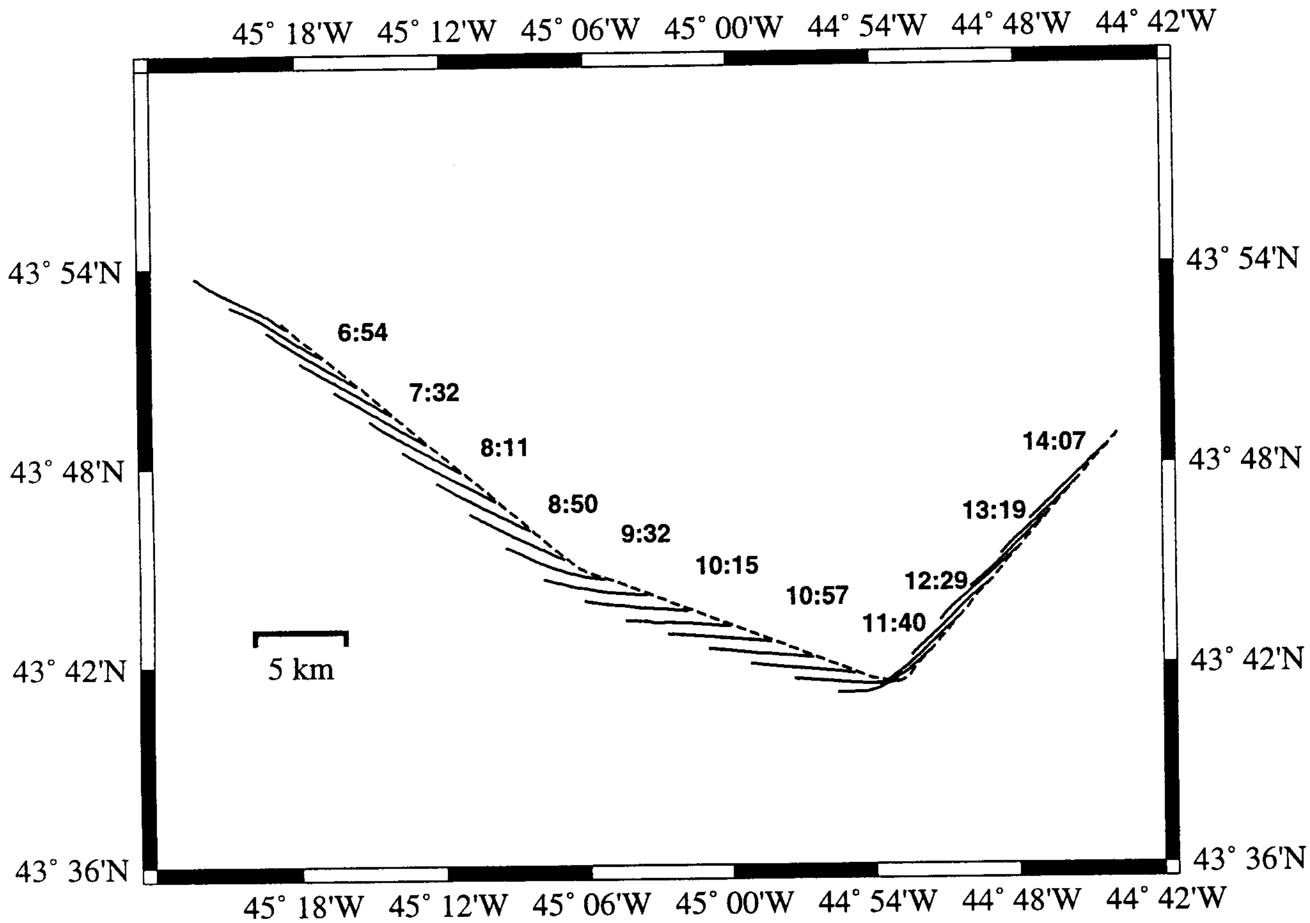


Fig. Nav.2: Ship track (dashed) and streamer positions (solid) through a turn on August 11, between 6:30 and 14:15 GMT.

MCS Data Processing

Real-time Stacking and Copying.

We conducted real-time brute stacking and copying of all data from 3490E to DLT-7 tapes using Sioseis and modified versions of scripts written for previous cruises by Graham Kent, Alistair Harding, and Paul Henkart. The principle change we made to previous procedures was to move the stack+copy task from heezen, an old Sparc10, to grampus, a much more powerful, 4-CPU Sun Enterprise. Jeff Turmelle moved the 3490E and DLT tape drives from heezen to grampus in order to accommodate this change. This enabled us to stack data from the entire 6-km streamer, 16 s of data, and copy to DLT, with time to spare; previous cruises typically processed only the inner half of the streamer.

The copy+stack job (attached) typically took about 10-12 minutes to run on grampus; tapes filled in about 20 minutes, leaving a comfortable buffer. On several occasions, an error in tape copying (e.g., copying 3490s in the wrong order after two tapes ejected nearly simultaneously) led us to re-start the job for a recently started DLT. It was easily feasible to "catch up" with real-time acquisition, even starting 15-20 tapes behind.

The copy+stack job accomplished the following processes: assignment of geometry, insertion of two-way travel time to the seafloor in the headers, CMP gathering, NMO correction, stacking, filtering, and display. Stacking velocities for NMO correction were taken from nearby ERABLE stacks and keyed to water depth. Copies of shot gathers were written to DLT after assignment of geometry. The assigned geometry is not quite correct; our initial estimates of streamer geometry placed the near trace at 183 m offset and the far trace at 6171 m; the near trace should actually be at 181.65 m and the far trace at 6169.15 m. This slight error has no practical effect on the appearance of the brute stacks and can be easily corrected during final processing.

We encountered two problems in the copy+stack procedure, both of which are likely due to SioSeis bugs. First, early on in cruise, the stack job would crash after reading about three 3490 tapes, complaining of " *** ERROR *** NOT ENOUGH AP TO PERFORM FILTER." We tried changing the parameters, changing the order of processes, and tried different combinations of processes with no success, although sometimes the error occurred in NMO rather than FILTER. It seemed that some memory index was being exceeded. After many emails back and forth to Paul Henkart, we finally traced the error to process NMO. Paul discovered the error, emailed a patch to Jeff Turmelle, who recompiled the code. We had no further problems with the stack part of the script. (A minor problem did occur in shallow water: Hydrosweep center beam depths less than 100 m generated error messages, but did not crash the copy+stack job, so we tolerated the inconvenience. We are uncertain as to why previous cruises did not encounter this problem, but it is likely that the fact that we had very long lines and were stacking the entire 480-channel streamer and 16 s of data, contributed to our encountering the problem.

The second problem we encountered was a failure of the copy job to gracefully handle DLT tape changes. We had a script set up to create a file called "out" after DLT tape changes (as per the docs for process OUTPUT), in a manner analogous to the script that creates the file "in" for the input job. The "out" file did prompt the job to continue running; however, upon resuming the job flow, OUTPUT sent numerous error messages to the screen, even while reporting "SHOT XXXX WRITTEN TO TAPE". Checks of the DLT showed that the shots were not properly written to tape. From that point on, we either terminated the copy+stack script when the end of a DLT was encountered, or we changed nearly-full DLTs during line changes, when the copy+stack job was terminated anyway. Since a DLT lasted for a full day of MCS acquisition, this problem was relatively minor and easily worked around during the cruise. We are still uncertain as to the cause of this problem (SioSeis bug or pilot error), but Paul Henkart has been informed of the problem.

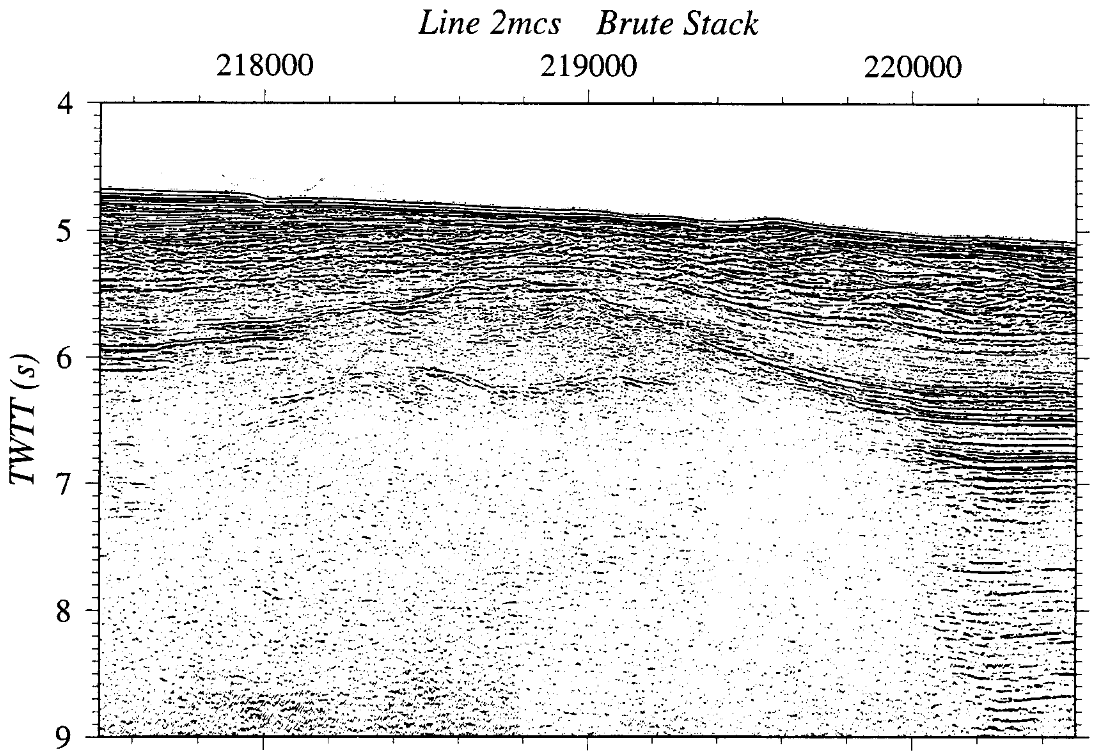
Further details on running the copy+stack procedure, from the watchstander's point of view, can be found in the Watchstander's Guide in this cruise report.

Because of the numerous institutes involved in the project, it was necessary to make several copies of the data. After the initial SEG-D to SEG-Y copy+stack, a second copy of the data was made from the DLT tapes to Mammoth Exabyte tapes for the DLC. This was done on idun using ProMAX and gave us a chance to verify the DLT tapes. The output files from this copy step were used to do a variety of error and consistency checks as described in Appendix 11. The DLT to Exabyte copying took about 8-10 hours per DLT, depending on whether or not data was also written to disk during the copy. The last tape copy was done at the end of the cruise for Dalhousie and Memorial University. Because we only had 10 tapes for this last job, we could not copy the entire data set and prioritized the lines as follows: all the MCS data from the 3 main transects was copied first, the additional MCS around transect 3 was copied second since the Dal/MUN group will be working on this transect, the tieline between transect 2 and transect 3 was copied next, and finally the tieline between transect 1 and transect 2 was copied. The DLT's were then listed on idun using ProMAX so that the tape checking scripts could be run to verify the data copied. It was discovered that two reels from line 3MCS2 were missing from the copy job. These two reels were placed onto a DAT tape.

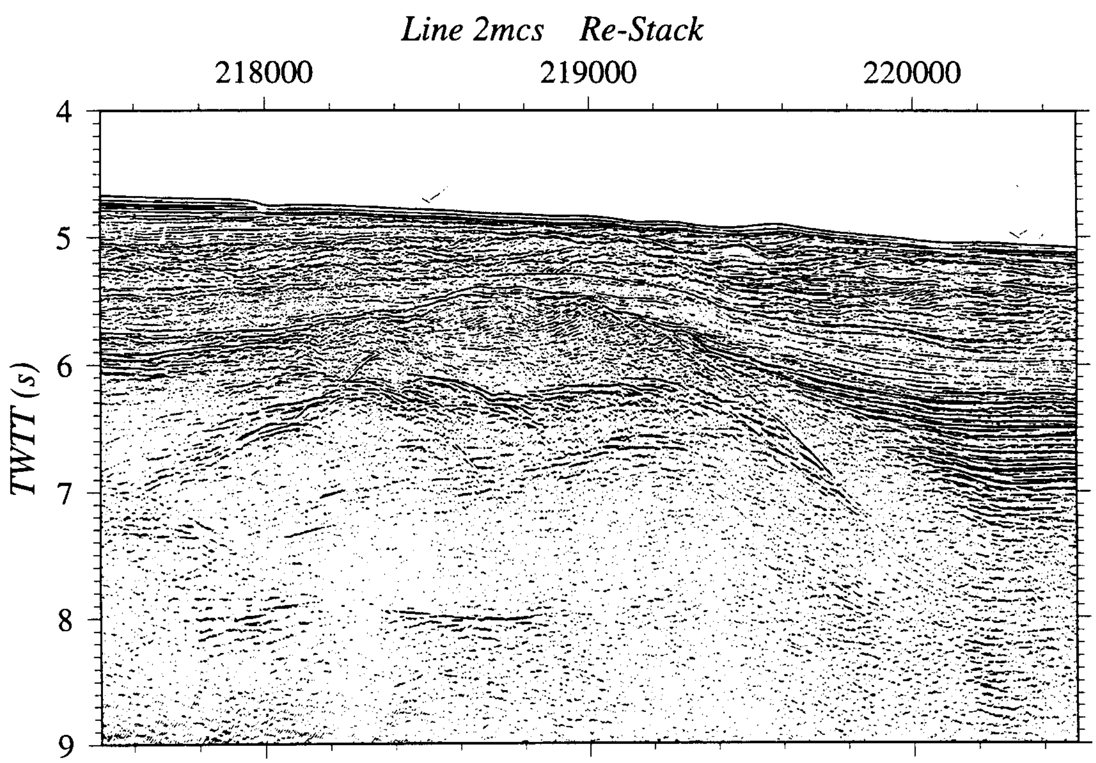
Further Shipboard Processing.

We carried out velocity analysis and re-stacking on several profiles, which were chosen based on their importance for selecting drill sites for the ODP proposal we will submit on October 1. This was done using ProMax on idun (Lines 109, 201, 202, 204, 204b, 206, and 208) and SioSeis on tasman and grampus (Lines 107 and 2mcs; velocities picked every 1250 m). An example of the improvement in stack quality between the brute stack and re-stack is shown below.

Finally, FK-migrations (water velocity) of all brute stacks and re-stacks were conducted. These were plotted for the cruise report (Appendix 8) using Dan Lizarralde's segy2xyz program and GMT.



Line 2mcs Brute Stack
218000
219000
220000
4
5
6
7
8
9
TWTT (s)



Line 2mcs Re-Stack
218000
219000
220000
4
5
6
7
8
9
TWTT (s)

Real-time Stack Script

```
#!/bin/csh -f
if( $#argv != 2 ) then
   echo "Usage: copy+stack.sh  line-number  shot_spacing_meters"
   exit 1
endif
set LINENO = $1
set DX = $2
#mkdir /net/tasman/screech/newfy/Line$LINENO
#chmod a+rw /net/tasman/screech/newfy/Line$LINENO

mkdir /export/home/EW0007/Realtimestack/Line$LINENO
chmod a+rw /export/home/EW0007/Realtimestack/Line$LINENO

sioseis << eof

procs segdin geom header output diskob gather nmo diskoc mute stack diskoe agc filter plot end

segdin
  ffilen 99999 #lfilen 999999999 filinc 99999
  ftr 1 ltr 480 fcset 1 lcset 1
  stime 0 secs 16.324
#   stime 0 secs 16.380
  offline yes  # eject after the rewind after EOT
  newfile yes
  iunit 4 end
end

output
 ontrcs 480
 rewind 0   # leave the tape alone!
# device /dev/rmt/2
 ounit 35 end
end

prout
 fno 0 lno 99999 ftr 479 ltr 479 noinc 10 end
end

geom
 type 2 # increment the shot loaction based on the shot number
 fs 1 ls 999999  # all shot have the same parameters (preset)
 gxp 480 -183   # RESET the closest group only.
 ggx -12.5        # Used to extrapolate gxp!
dfls $DX dbrps 6.25 smear 6.25
 rpadd 1000 end
end

mute
  fno 1 lno 999999
  addwb yes xtp 200 -.1 1500 -.1 3000 1 6200 2 end
end

diskob
# write every 30th shot to a "circular" file
   fno 1 lno 999999 noinc 30 rewind 1
   opath /export/home/EW0007/Realtimestack/latest.shot.segy end
end
diskoc
# write every 30th cmp to a "circular" file
   fno 1 lno 999999 noinc 30 rewind 1
   opath /export/home/EW0007/Realtimestack/latest.cmp.segy end
end
diskod
   fno 1 lno 999999 noinc 30 rewind 1
   opath /export/home/EW0007/Realtimestack/latest.mute.segy end
end
diskoe   # Write out disk file
 opath /export/home/EW0007/Realtimestack/Line$LINENO/stack.line$LINENO end
end

header
  fno 0 lno 9999999 ftr 1 ltr 9999
  r50 r54 / 750.  # convert water depth to water time
  bhdr 28 1
  end
end

gather
#   maxtrs 90 maxrps 500 end
  maxtrs 60 maxrps 500 end
end

#filter
#    pass 5 80 ftype 0 dbdrop 48 end
#end
filter
   fno 1 lno 999999 addwb yes  sets 0 1 1.2 3 3.5 16
   pass 10 80 10 50 10 30 ftype 99 dbdrop 48 end
end

agc
 winlen 1 pctagc 100 end
end

plot
# scalar 1.e-07
 tlines 0.5 1 nibs 7224 ann shotno anninc 10
 def 0.012 trpin 80 wiggle 0
 stime 0 nsecs 12 vscale 1.5
# srpath raster.stack
```

```
 opath /export/home/EW0007/Realtimestack/Line$LINENO/siopltfil.line$LINENO end
# opath /net/tasman/screech/newfy/Line$LINENO/siopltfil.line$LINENO end
end


nmo
# real time nmo, replace interpolation by RP to WB depth in Meters.
# If water depth changes by > 500 m, use previous value. Water-depth
# velocity functions derived from ESP5, interpolation by iso-velocity layering
 vtrkwb 500 stretc 0.50
# SPN 5290
 fno 500 lno 500
 vtp 1479 0.667
   1616 1.081
   1747 1.611
   1888 2.058
   2020 2.472
   2217 2.889
   2741 3.407
   3191 4.171
   3524 5.139
   3741 6.135
   3882 7.075
   4456 8.522
   4624 10.000
   4769 10.500
   4895 11.000
   5105 12.000
   5270 13.000
    end
# SPN 5110
 fno 1000 lno 1000
 vtp 1479 1.333
   1531 1.485
   1650 1.919
   1765 2.276
   1910 2.750
   2001 2.964
   2190 3.369
   2696 3.956
   3167 4.909
   3514 5.900
   3785 7.125
   4355 8.503
   4547 10.000
   4699 10.500
   4830 11.000
   5048 12.000
   5220 13.000 end
# SPN 4810
 fno 1500 lno 1500
 vtp 1479 2.000
   1551 2.336
   1622 2.617
   1727 3.032
   1779 3.335
   1854 3.773
   1941 4.145
   2367 4.728
   2743 5.543
   3383 6.522
   3795 7.530
   4232 8.661
   4391 10.000
   4556 10.500
   4699 11.000
   4933 12.000
   5119 13.000 end
# SPN 4150
 fno 2000 lno 2000
 vtp 1479 2.667
   1542 3.203
   1619 3.713
   1704 4.178
   1741 4.552
   1783 4.933
   1863 5.531
   2267 6.302
   2478 6.880
   2838 7.289
   3320 8.028
   3761 8.991
   3923 10.000
   4130 10.500
   4308 11.000
   4597 12.000
   4823 13.000 end
# SPN 3670
 fno 2500 lno 2500
 vtp 1479 3.333
   1511 4.029
   1565 4.482
   1641 4.984
   1678 5.365
   1746 5.658
   1848 5.999
   1997 6.420
   2151 6.970
   2410 7.476
   2603 7.949
   3321 8.997
   3616 10.000
```

```
   3855 10.500
   4059 11.000
   4387 12.000
   4640 13.000 end
# SPN 3550
fno 3000 lno 3000
vtp 1479 4.000
   1510 4.219
   1580 4.681
   1645 5.082
   1671 5.515
   1720 6.002
   1802 6.234
   1936 6.607
   2103 7.189
   2266 7.923
   2433 8.308
   2985 9.031
   3350 10.000
   3622 10.504
   3847 11.000
   4210 12.000
   4487 13.000 end
# re-picked by wsh - from Line 2mcs (assume same as 4000 m)
fno 3500 lno 3500
vtp 1495 5.500
   1495 5.750
   1520 6.100
   1580 6.600
   1780 7.200
   1820 7.500
   1850 8.102
   1850 8.555
   2200 9.009
   2843 9.500
   3004 10.000
   3328 10.514
   3580 11.000
   3989 12.000
   4299 13.000 end

# re-picked by wsh - from Line 2mcs
fno 4000 lno 4000
vtp 1495 5.500
   1495 5.750
   1520 6.100
   1580 6.600
   1780 7.200
   1820 7.500
   1850 8.102
   1850 8.555
   2200 9.009
   2843 9.500
   3004 10.000
   3328 10.514
   3580 11.000
   3989 12.000
   4299 13.000 end

# re-picked by wsh - from Line 2mcs
fno 4500 lno 4500
vtp 1495 5.700
   1495 6.000
   1530 6.300
   1610 6.800
   1680 7.300
   1900 7.600
   2100 8.555
   2200 9.009
   2843 9.500
   3004 10.000
   3328 10.514
   3580 11.000
   3989 12.000
   4299 13.000 end

# re-picked by wsh - from Line 2mcs
fno 4725 lno 4725
vtp 1500 6.300
   1510 6.500
   1510 6.700
   1580 7.000
   1610 7.300
   1710 7.500
   1770 8.000
   2100 8.500
   2500 9.000
   2800 9.500
   3004 10.000
   3328 10.514
   4299 13.000 end


end


end
eof
```

File "**go.in**:"

```
#!/bin/csh -f
echo "4" > in
chmod 777 in
```

File "**stopp**:"

```
#!/bin/csh -f
echo "-1" > in
chmod 777 in
```

Computers and Networking

All computer operations for this experiment were conducted in the main lab space of the *R/V Ewing*. Having all computer systems in one area simplified the installation of the systems and their connection to the ships 10/100 Base T network. The science party for this cruise installed three HP workstations, **tasman**, **tekapo**, and **hekla**, as well as two SGI workstations, **idun** and **munin**. To make shipping easier, the SGI workstations were brought without monitors and a spare *Ewing* Sony Trinitron was used instead. This setup was used on the previous cruise by a Landmark Graphics representative who lent the science party monitor adapter cables for this purpose. Additionally, the science party utilized two shipboard SUN systems, **grampus** and **heezen**. The HP workstations were used in seismic processing, streamer navigation, transect planning, and figure production. Additionally, **tasman** served to transfer data from DLT tape to disk. The SGI workstations were used for tape duplication (DLT to Exabyte format), as well as seismic processing. Additionally, all of the aforementioned systems were used as x-terminals. The SUN server **grampus** performed the real time stack process and the real time tape duplication (3490 to DLT format) process. This system was also used for general processing. The SUN workstation **heezen** was used primarily as a x-terminal. A MacIntosh iBook provided by the science party was installed at the watchstander station for the purpose of maintaining the tape (DLT and 3490) logs. A HP 755 plotter, a HP LaserJet 6m, and a HP LaserJet 2100TN filled the science party's printing requirements. All of these printers were located in the main lab and provided by the *R/V Ewing*. All of the computing equipment was networked together using the ship's 10/100 Base T network.

Two network related problems were encountered, one in the setup of the HP workstations on the *Ewing's* network and the other involving slow data transfer rates between systems. Both of these problems are detailed in the Network Problems section of this report.

Network Difficulties

An ongoing network problem caused slow data transfer rates between workstations. The slow data transfer rates were observed between all systems, but transfers between the science party workstations and the shipboard systems were particularly slow. The cause of this problem is believed by Jeff Turmelle, systems analyst, to be a defective 10/100 base T switch that all of the science party systems connect through. Mr. Turmelle intends to replace this piece of equipment during the next port call and test the network for acceptable data transfer rates.

A lesser problem involved the setup of the HP workstations on the ship's network. The workstations would not boot when connected to the network. The solution arrived at was to add the HP systems hostnames to the networks DNS server. At this point, the workstations booted normally. No changes were performed on the workstations.

Equipment: Computers and Peripherals

Name	Type	Function and Resources	
tasman	HP	C200 workstation used primarily for streamer navigation and seismic processing. Also used for the transfer of data from DLT tape to disk.	
		Hardware:	
		/dev/dsk/c0t6 mounted as /home	8 Gbyte disk
		/dev/dsk/c0t3 mounted as /tas0	22 Gbyte disk
		/dev/dsk/c0t2 mounted as /tas0	22 Gbyte disk
		/dev/dsk/c0t1 mounted as /screech	70 Gbyte disk
		/dev/rmt/1m	DLT tape drive
		Principle software:	
		MATLAB 5.1, Sioseis	
tekapo	HP	B132L workstation used primarily used for seismic processing. Also used in figure preparation and as a x – terminal.	
		Hardware:	
		/dev/dsk/c0t6 mounted as /home	4 Gbyte disk
		/dev/dsk/c0t1 mounted as /tek0	22 Gbyte disk
		/dev/dsk/c0t2 mounted as /puk0	22 Gbyte disk
		Principle software:	
		Sioseis, Ghostscript, GMT	
hekla	HP	715/80 workstation used primarily for transect planning. Also used in figure preparation and as a x – terminal.	
		Hardware:	
		/dev/dsk/c0t6 mounted as /home	8 Gbyte disk
		/dev/dsk/c0t3 mounted as /hek1	4 Gbyte disk
		/dev/dsk/c0t5 mounted as /hek2	4 Gbyte disk
		/dev/rmt0m	DAT tape drive
		Principle software:	
		GMT, Ghostscript	
idun	SGI	Indigo 2 workstation used primarily as a tape copy workstation (DLT to Exabyte). Also used for seismic processing.	
		Hardware:	
		/dev/dsk/dks0d1 mounted as /system	2 Gbyte disk
		/dev/dsk/tpsld3	DLT tape drive
		/dev/dsk/tpsld5	Exabyte tape drive
		Principle software:	
		ProMax 2D 1998.1	

munin	SGI	O2 workstation used primarily used as a file server for a large disk. Also used for GMT3.3.4 processing. Hardware: /dev/dsk/dks0d1 mounted as /system 4 Gbyte disk /dev/dsk/dks1d1 mounted as /munin 50 Gbyte disk Principle software: GMT 3.3.4
grampus	SUN	Ultra-Sparc Enterprise 3000 server used primarily for real time stacking and real time tape duplication (3490 to DLT). Also performed seismic processing. Hardware: /dev/dsk/c0t0 mounted as / 9 Gbyte disk /dev/dsk/c0t3 mounted as /users 9 Gbyte disk /dev/dsk/c0t2 mounted as /data 9 Gbyte disk /dev/dsk/c0t1 mounted as /export home 18 Gbyte disk /dev/rst4 3490 tape drive /dev/rst35 DLT tape drive /dev/rmt/1 DAT tape drive Principle software: Sioseis
heezen	SUN	Sparc 10 workstation used primarily as a x – terminal. Hardware: /dev/dsk/c0t3 mounted as / 400 Mbyte disk /dev/dsk/c0t1 mounted as /export 4 Gbyte disk /dev/dsk/c0t0 mounted as /export2 4 Gbyte disk /dev/rst11 Exabyte tape drive
plotter	HP	DesignJet 755CM color plotter
hp_6text	HP	LaserJet 6mv (text files only)
hp_6ps	HP	LaserJet 6mv (PostScript files only)
lj2100	HP	LaserJet 2100TN

Recommendations

In general, the Ewing and her crew met our needs exceptionally well. The ship is very well suited to the acquisition of high-quality multichannel seismic data, and many things have changed for the better since the last time we sailed (1996). The Syntron streamer, with its 6-km offset and 480 channels, provides excellent spatial coverage. The new acquisition system is much more stable than the old Digicon system. Finally, the refurbished guns and float system make for an exceptionally stable, well-tuned source. And the Ewing crew, as usual, excelled in all tasks. Overall, we have few complaints.

As always, though, there were a few snags, and a few procedures that could be improved upon:

- We had some serious concerns with respect to the 3490e tape drives. Only two were available for recording, and a third was useful only for tensioning tapes. If one of the two good drives had failed, we would have lost significant amounts of data during tape changes. LDEO should make sure that at least one fully functional spare, and preferably two, is available on the ship *before* any MCS cruise sails.
- We had consistent tape drive errors with the 3490e drives when we shot at long intervals (200 meters, ca. 70-80 seconds). Joe Stennett contacted the manufacturer and learned that this is a known problem that the manufacturer can repair. These repairs should be done as soon as possible.
- The ship's computer networking leaves much to be desired. The connection between the visitors' computers and ship's computers (grampus, heezen) typically operated around 50-60 kilobytes per second -- the speed of an outdated phone modem. This network is nominally supposed to function at 10-100 Mb/sec. Jeff Turmelle believes that a faulty network hub is to blame. However, even if that hub had been functioning properly, we would not have had 100 Mb/s connectivity throughout the lab. The science lab network should be upgraded to full 100 Mb/s functionality.
- The label printing system for MCS tapes needs to be overhauled to assure that what is printed on the labels agrees with what is actually on tape.
- It would be highly desirable, for purposes of, e.g., waveform inversion, to have a system onboard Ewing for measuring the far-field source signature of the gun array. A simple hydrophone on a long (300-400 m) tether would do the trick. We recommend that Lamont look into providing such a system for routine use on the Ewing.
- It would also be very desirable to have on the ship a GPS receiver that is identical to that on the streamer tailbuoy, such that both accessed the same satellites, and positions from both receivers were recorded. This would assure accurate relative positioning of the front and rear end of the streamer, even if absolute position were in error.
- Black ink cartridges for the HP plotter were in very short supply. An adequate supply of cartridges in all colors should be maintained on the ship.

Actual:

OCEANUS			start date:	14.5	EWING			start date:	15.4
Task	Duration	Elapsed Hours	Elapsed Days	Date	Task	Duration	Elapsed Hours	Elapsed Days	Date
Steam St. John's - W 1	27	27	1.13	15.6	Steam St. John's - E 1	38	38	1.58	17.1
Wireline test of releases	6	33	1.38	15.9	Deploy streamer+guns	20	58	2.42	17.9
Deploy 29 OBH/S, Line I	26	59	2.46	17.0	Shoot Line 1, OBS, depl strmr	74	132	5.50	21.0
Wait/heat flow?	64	123	5.13	19.6	Shoot Line 1, MCS	38	170	7.08	22.6
Recover 29 OBH/S, Line 1	128	251	10.46	25.0	Shoot line 12 + grids	95	265	11.04	26.5
Steam to E 2	9	260	10.83	25.3	Shoot Line 2, OBS	42	307	12.79	28.3
Reprogram instruments	0	260	10.83	25.3	Shoot Line 2, MCS	47	354	14.75	30.3
Deploy 29 OBH/S, Line 2	26	286	11.92	26.4	Shoot grids	37	391	16.29	31.8
Wait/heat flow?	47	333	13.88	28.4	Weather downtime; recover OBS	24	415	17.29	1.8
Recover 29 OBH/S, Line 2	74	407	16.96	31.5	Finish grid; strike line to T3	65	480	20.00	4.5
Wait for timed release, #27	45	452	18.84	2.3	Shoot Line 3, OBS	66	546	22.75	7.3
Steam to E3	7	459	19.13	2.6	Shoot Line 3, MCS	105	651	27.13	11.6
Deploy 29 OBH/S, Line 3	45	504	21.01	4.5	Recover guns + streamer	5	656	27.33	11.8
Wait/heat flow?	70	574	23.92	7.4	Contingency	0	656	27.33	11.83
Recover 29 OBH/S, Line 3	110	684	28.51	12.0	Steam to Newark	116	772	32.17	16.7
Contingency	0	684	28.51	12.0					
Steam to St. John's	9	693	28.90	12.4					

Plan:

OCEANUS			start date:	14.5	EWING			start date:	15.5
Task	Duration	Elapsed Hours	Elapsed Days	Date	Task	Duration	Elapsed Hours	Elapsed Days	Date
Steam St. John's - W 1	31	31	1.27	15.8	Steam St. John's - E 1	46	46	1.94	17.4
Wireline test of releases	6	37	1.52	16.0	Deploy streamer+guns	17	63	2.65	18.1
Deploy 29 OBH/S, Line I	49	86	3.58	18.1	Shoot Line 1, OBS	44	107	4.47	20.0
Wait/heat flow?	46	132	5.49	20.0	Shoot Line 1, MCS	48	155	6.47	22.0
Recover 29 OBH/S, Line 1	69	201	8.38	22.9	Shoot line 12 + grids	107	262	10.93	26.4
Steam to E 2	10	211	8.78	23.3	Shoot Line 2, OBS	46	308	12.82	28.3
Reprogram instruments	24	235	9.78	24.3	Shoot Line 2, MCS	67	375	15.62	31.1
Deploy 29 OBH/S, Line 2	50	285	11.86	26.4	Shoot 23 + grids	80	455	18.95	3.5
Wait/heat flow?	46	331	13.78	28.3	Shoot Line 3, OBS	72	527	21.94	6.4
Recover 29 OBH/S, Line 2	74	405	16.87	31.4	Shoot Line 3, MCS	72	598	24.93	9.4
Steam to E 3	7	412	17.16	31.7	Recover guns + streamer	12	610	25.43	9.9
Reprogram instruments	24	436	18.16	1.7	Contingency	44	654	27.26	11.8
Deploy 29 OBH/S, Line 3	62	498	20.75	4.3	Steam to Newark	138	793	33.02	17.5
Wait/heat flow?	52	550	22.92	6.4					
Recover 29 OBH/S, Line 3	98	648	27.01	10.5					
Contingency	63	711	29.63	13.1					
Steam to St. John's	9	720	30.02	13.5					

APPENDIX 2

Nearest Shot Point and CMP to Location of OBS Deployments

Line 1

Site	OBS	LAT.	LON.	Depth (m)	Shot Point for Intervals 50 m	200 m	CMP
1	DAL-B	47 45.00' N	45 55.00' W	513	2576	2450	21608
2	DAL-C	47 37.73' N	45 42.08' W	300	2998	2345	24984
3	DAL-D	47 30.44' N	45 29.23' W	274	3419	2240	28352
4	OBH-27	47 23.12' N	45 16.44' W	222	3840	2135	31720
5	OBH-20	47 15.78' N	45 03.70' W	183	4261	2029	35088
6	OBH-19	47 08.42' N	44 51.03' W	158	4682	1073	38456
7	GSCA-2	47 01.03' N	44 38.41' W	140	5102	968	41816
8	GSCA-6	46 57.50' N	44 32.42' W	133	5303	917	43424
9	GSCA-7	46 53.97' N	44 26.45' W	163	5503	867	45024
10	OBH-16	46 50.43' N	44 20.48' W	152	5704	817	46632
11	OBH-25	46 46.89' N	44 14.54' W	284	5904	768	48232
12	OBH-23	46 43.35' N	44 08.60' W	498	6104	718	49832
13	DAL-A	46 39.79' N	44 02.68' W	1357	6304	668	51432
14	DAL-E	46 36.24' N	43 56.77' W	2613	6505	618	53040
15	DAL-F	46 32.68' N	43 50.87' W	3228	6705	568	54640
16	OBH-26	46 29.11' N	43 44.99' W	3784	6906	518	56248
17	ORB-7	46 26.25' N	43 40.29' W	3937	7066	478	57528
18	ORB-2	46 23.39' N	43 35.60' W	4020	7226	438	58808
19	GSCA-1	46 20.53' N	43 30.92' W	4109	7386	398	60088
20	GSCA-3	46 17.66' N	43 26.25' W	4201	7547	358	61376
21	GSCA-4	46 14.79' N	43 21.58' W	4289	7707	324	62656
22	ORB-3	46 11.92' N	43 16.93' W	4388	7867	284	63936
23	ORB-8	46 09.04' N	43 12.28' W	4484	8027	244	65216
24	ORB-9	46 06.16' N	43 07.64' W	4550	8188	203	66504
25	GSCA-5	46 03.28' N	43 03.00' W	4615	8348	164	67784
26	GSCA-8	46 00.40' N	42 58.38' W	4637	8493	124	68944
27	ORB-1	45 57.51' N	42 53.76' W	4634	8611	50	69888
28	ORB-5	45 54.62' N	42 49.15' W	4657	8718	*	70744
29	ORB-6	45 52.08' N	42 45.13' W	4658	8811	*	71488

* No shot was fired directly over or reasonably close to the instrument's position.

Nearest Shot Point and CMP to Location of OBS Deployments

Line 2

Site	OBS	LAT.	LON.	Depth (m)	Shot Point for Intervals 50 m	200 m	CMP
1	ORB-8	46 34.50' N	47 11.50' W	502	23887	23522	192096
2	ORB-3	46 27.52' N	46 56.58' W	720	24348	23406	195784
3	GSCA-4	46 20.52' N	46 41.73' W	1152	24810	23291	199480
4	ORB-2	46 13.47' N	46 26.94' W	455	25270	23176	203160
5	ORB-6	46 06.40' N	46 12.22' W	1580	25732	23061	206856
6	GSCA-8	46 02.08' N	46 03.29' W	2148	26012	22990	209096
7	ORB-9	45 57.75' N	45 54.38' W	2371	26293	22920	211344
8	GSCA-6	45 53.41' N	45 45.49' W	3178	26573	22850	213584
9	GSCA-5	45 49.05' N	45 36.63' W	3432	26853	22780	215824
10	OBH-26	45 44.69' N	45 27.79' W	3538	27134	22710	218072
11	OBH-23	45 40.31' N	45 18.97' W	3774	27414	22640	220312
12	OBH-25	45 35.92' N	45 10.18' W	4002	27694	22570	222552
13	GSCA-3	45 31.52' N	45 01.41' W	4242	27974	22500	224792
14	GSCA-2	45 27.11' N	44 52.66' W	4423	28256	22430	227048
15	GSCA-1	45 22.69' N	44 43.93' W	4538	28536	22359	229288
16	OBH-16	45 19.24' N	44 37.16' W	4539	28755	22304	231040
17	ORB-1	45 15.78' N	44 30.39' W	4562	28973	22250	232784
18	OBH-19	45 12.32' N	44 23.64' W	4590	29191	22196	234528
19	DAL-F	45 08.84' N	44 16.91' W	4525	29410	22141	236280
20	DAL-E	45 05.37' N	44 10.19' W	4685	29628	22087	238024
21	DAL-D	45 01.88' N	44 03.48' W	4710	29847	22032	239776
22	OBH-20	44 58.39' N	43 56.78' W	4732	30066	21977	241528
23	ORB-7	44 54.90' N	43 50.10' W	4738	30284	21923	243272
24	OBH-27	44 51.39' N	43 43.43' W	4753	30502	21868	245016
25	DAL-C	44 47.88' N	43 36.78' W	4742	30720	21814	246760
26	DAL-B	44 44.37' N	43 30.14' W	4745	30939	21759	248512
27	DAL-A	44 40.86' N	43.23.51' W	4750	31157	21695	250256

Nearest Shot Point and CMP to Location of OBS Deployments

Line 3

Site	OBS	LAT.	LON.	Depth (m)	Shot Point for Intervals 50 m	200 m	CMP
1	DAL-C	46 43.92' N	50 30.50' W	107	52702	52702	422616
2	DAL-E	46 27.93' N	49 58.88' W	75	51700	51700	414600
3	GSCA-2	46 11.79' N	49 27.57' W	71	50698	50698	406584
4	DAL-D	45 55.51' N	48 56.56' W	72	49696	49696	398568
5	ORB-6	45 39.10' N	48 25.86' W	127	62604	48736	501832
6	ORB-7	45 31.50' N	48 11.83' W	1173	63065	48621	505520
7	ORB-9	45 23.87' N	47 57.87' W	1694	63526	48505	509208
8	OBH-27	45 16.22' N	47 43.98' W	2500	63987	48390	512896
9	DAL-B	45 08.54' N	47 30.14' W	3117	64448	48275	516584
10	GSCA-1	45 00.83' N	47 16.37' W	3568	64909	48160	520272
11	GSCA-8	44 53.09' N	47 02.66' W	3638	65370	48045	523960
12	ORB-3	44 47.35' N	46 52.56' W	3665	65710	47959	526680
13	ORB-1	44 41.60' N	46 42.50' W	3827	66050	47874	529400
14	OBH-20	44 35.84' N	46 32.47' W	3845	66391	47789	532128
15	OBH-19	44 30.06' N	46 22.48' W	3814	66731	47704	534848
16	OBH-16	44 24.26' N	46 12.52' W	3915	67072	47619	537576
17	GSCA-5	44 18.45' N	46 02.59' W	3970	67413	47533	540304
18	GSCA-4	44 12.63' N	45 52.69' W	3945	67753	47448	543024
19	GSCA-3	44 08.03' N	45 44.91' W	4094	68022	47381	545176
20	ORB-2	44 03.42' N	45 37.16' W	4328	68290	47314	547320
21	ORB-8	43 58.80' N	45 29.42' W	4447	68560	47246	549480
22	OBH-25	43 54.18' N	45 21.70' W	4566	68827	47180	551616
23	OBH-23	43 49.54' N	45 14.01' W	4620	69096	47113	553768
24	OBH-26	43 45.00' N	45 06.50' W	4670	69357	47047	555856

Appendix 3: Table of crossing points

format:
line#; CDP#; Nearest shot#; position of CDP (long,lat(deg.))

Cross between line 1MCS and 102				
1MCS	60768	7470	-43.474810	46.317173
102	107690	10668	-43.474794	46.317152
Cross between line 1MCS and 103				
1MCS	59797	7349	-43.533801	46.353407
103	110827	10982	-43.533814	46.353388
Cross between line 1MCS and 104				
1MCS	60367	7420	-43.499200	46.332142
104	113860	11285	-43.499209	46.332171
Cross between line 2MCS and 104				
2MCS	227544	28317	-44.845727	45.435722
104	137687	14254	-44.845714	45.435715
Cross between line 2MCS and 106				
2MCS	240672	29958	-44.001297	45.001850
106	134889	16735	-44.001308	45.001863
Cross between line 2MCS and 108				
2MCS	228893	28486	-44.758361	45.391523
108	149216	18526	-44.758353	45.391490
Cross between line 2MCS and 202				
2MCS	239918	29864	-44.049465	45.026976
202	264764	32969	-44.049414	45.026965
Cross between line 2MCS and 204				
2MCS	237616	29576	-44.196747	45.103498
204	272191	33898	-44.196721	45.103488
Cross between line 2MCS and 206				
2MCS	234827	29227	-44.375664	45.195841
206	286928	35740	-44.375700	45.195825
Cross between line 2MCS and 208				
2MCS	230858	28731	-44.631457	45.326752
208	296218	36843	-44.631467	45.326777
Cross between line 2MCS and 301				
2MCS	218697	27211	-45.422611	45.724894

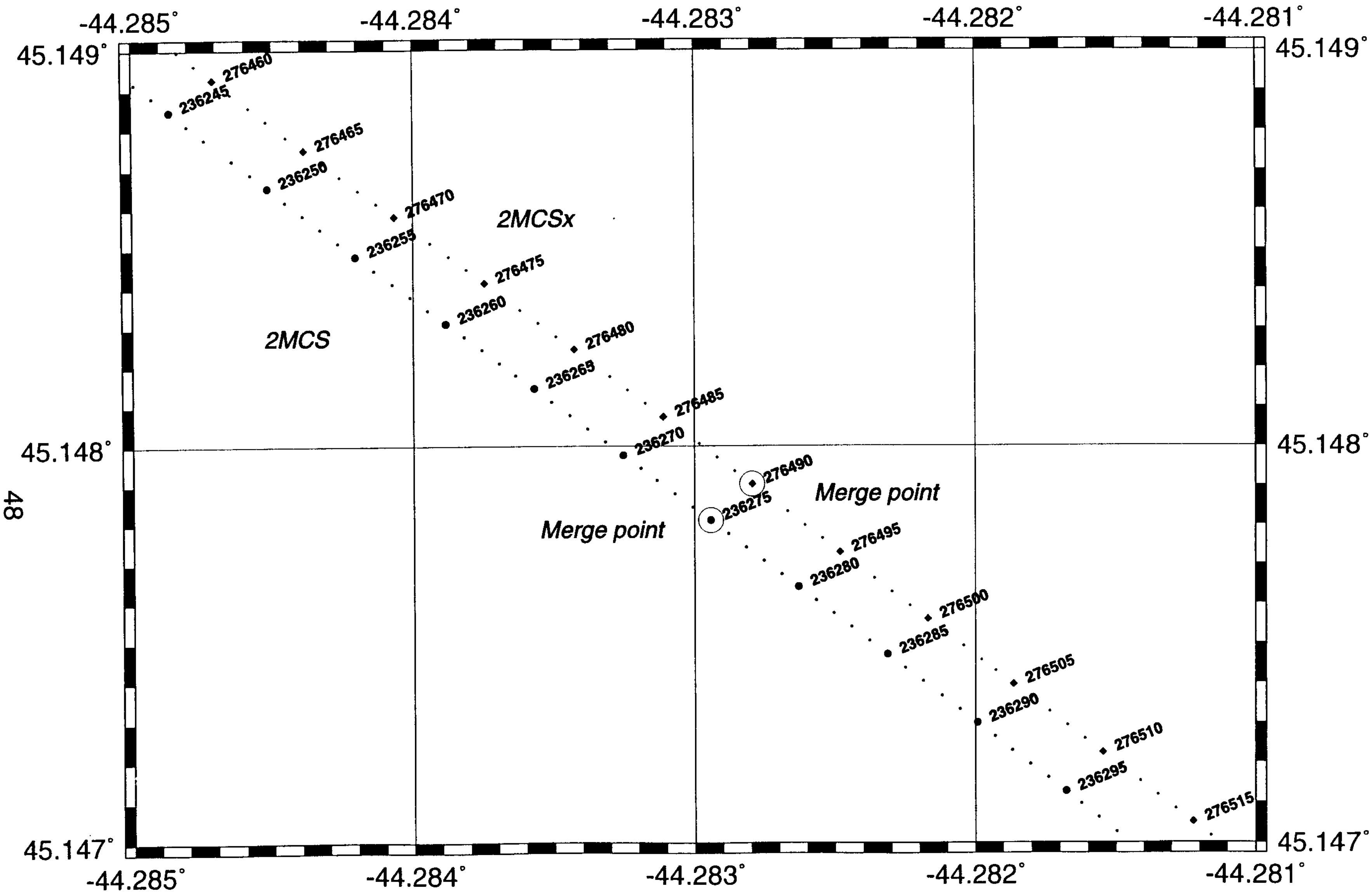
301	302004	37625	-45.422610	45.724872
Cross between line 2MCS and 303				
2MCS	228470	28433	-44.785830	45.405407
303	322504	40137	-44.785834	45.405429
Cross between line 2MCS and 305				
2MCS	226628	28202	-44.905147	45.465852
305	327251	40780	-44.905149	45.465873
Cross between line 107 and 204b				
107	139273	17283	-44.132338	45.165719
204b	281194	35023	-44.132303	45.165716
Cross between line 107 and 206				
107	142041	17629	-44.312310	45.255583
206	285600	35574	-44.312333	45.255552
cross between line 107 and 208				
107	146057	18131	-44.573263	45.386090
208	297501	36972	-44.573246	45.386083
Cross between line 109 and 106				
109	162783	20222	-44.086516	44.918443
106	133060	16507	-44.086508	44.918469
Cross between line 109 and 202				
109	162033	20128	-44.134821	44.942884
202	266612	33201	-44.134851	44.942878
Cross between line 109 and 204				
109	159684	19835	-44.286598	45.019422
204	270313	33663	-44.286606	45.019406
Cross between line 109 and 206				
109	156950	19493	-44.463638	45.108332
206	288835	35978	-44.463672	45.108347
Cross between line 109 and 208				
109	152889	18985	-44.727128	45.240494
208	294268	36658	-44.727106	45.240516
Cross between line 302 and 104				
302	316499	39436	-44.937036	45.341971
104	139707	14506	-44.936989	45.341973
Cross between line 302 and 303				
302	317340	39542	-44.882389	45.314727

303	320481	39934	-44.882378	45.314693
Cross between line 302 and 305				
302	315552	39318	-44.998607	45.372953
305	329282	41034	-44.998577	45.372941
Cross between line 104 and 304				
104	135393	13967	-44.724701	45.529453
304	405082	40408	-44.724727	45.529447
Cross between line 3MCS2 and 305				
3MCS2	536730	66965	-46.260602	44.434621
305	352632	43953	-46.260570	44.434633
Cross between line 3MCS2 and 402				
3MCS2	511179	63771	-47.841155	45.329957
402	477718	59589	-47.841141	45.329946

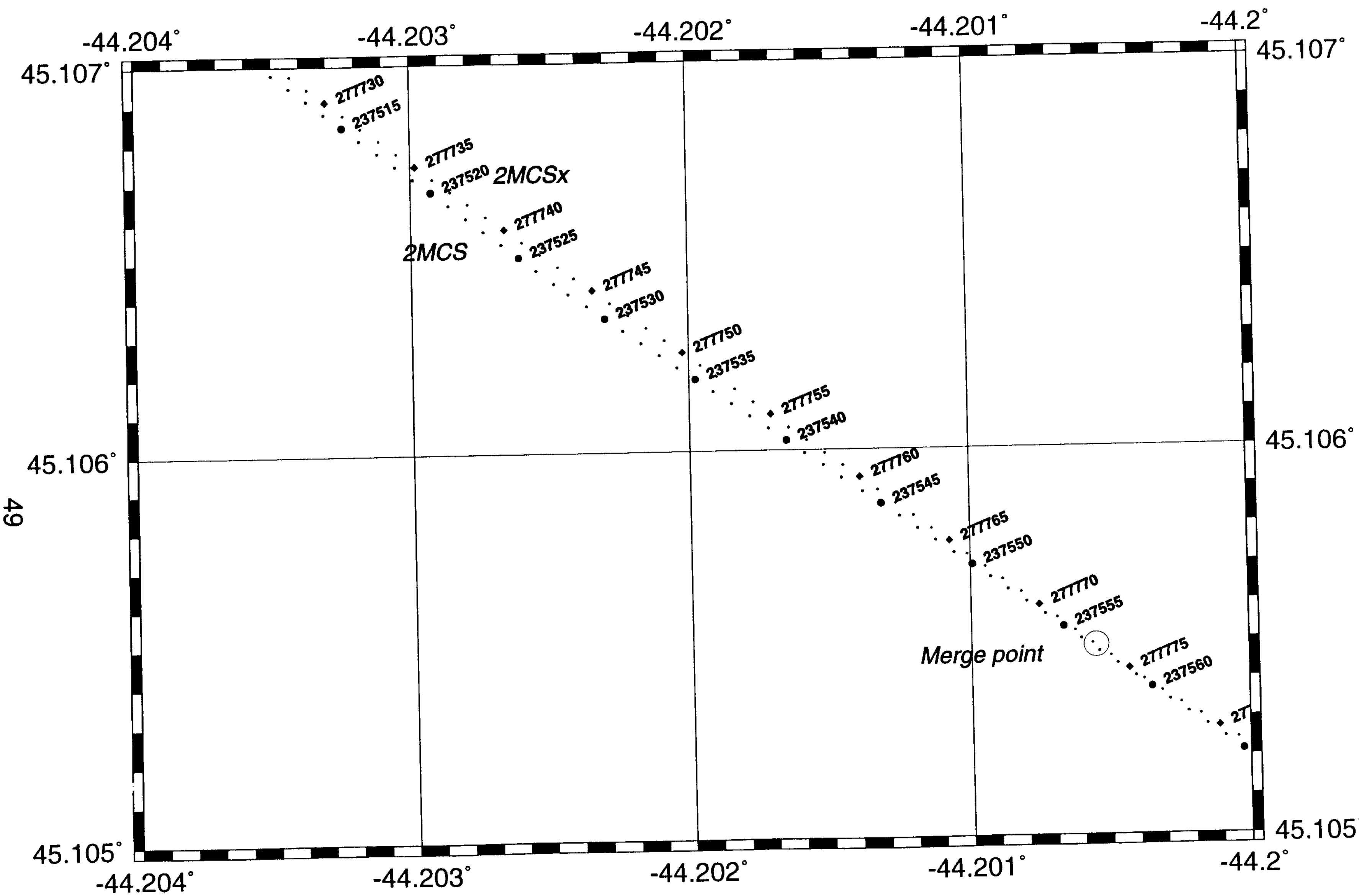
Table of merge points:

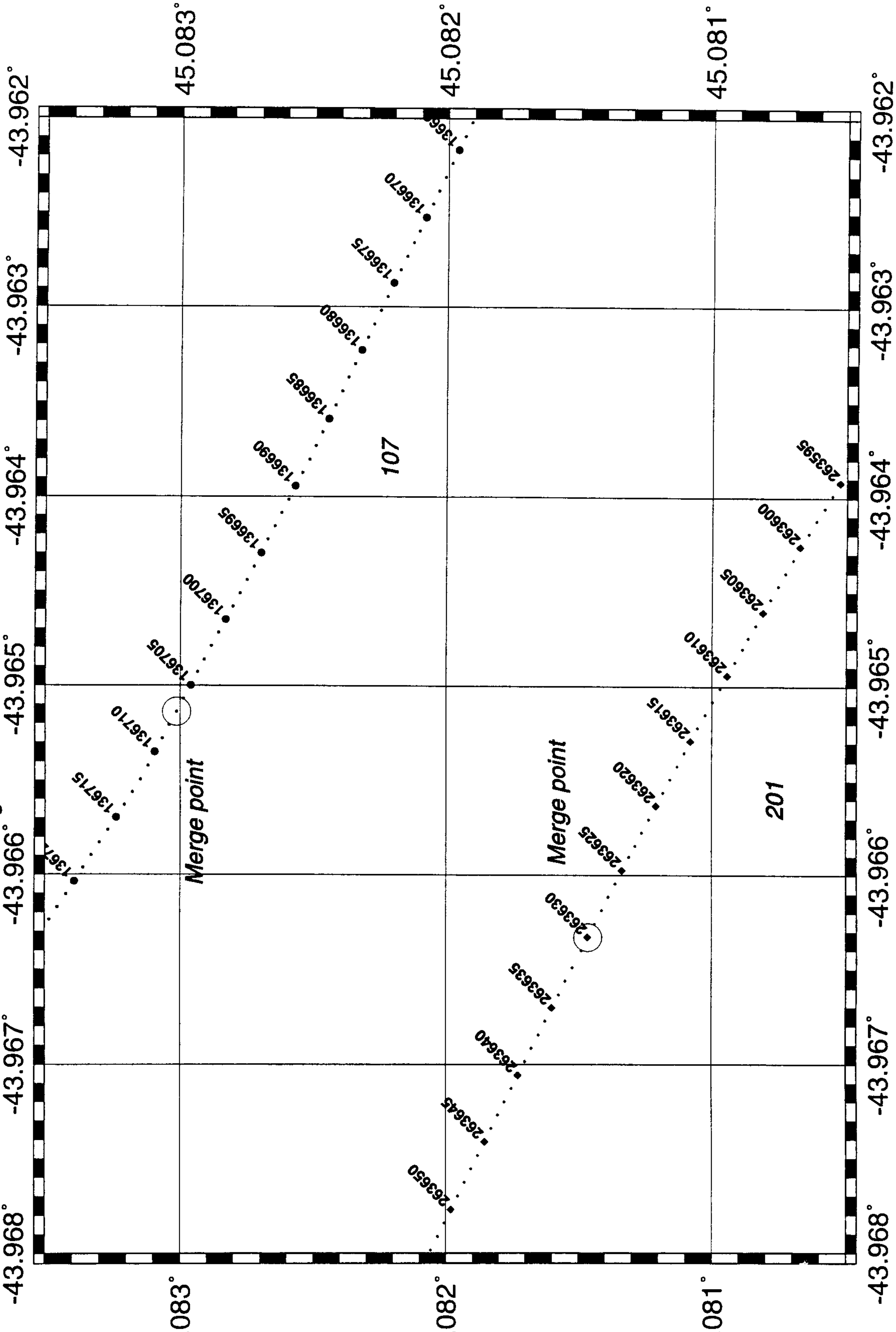
Merge between line 109 and 302				
109	151250	18768	-44.832872	45.294740
302	318045	39360	-44.836687	45.291646
Merge between line 107 and 201				
107	136707	16962	-43.965138	45.083014
201	263630	32828	-43.966328	45.081464
Merge between line 204 and 204b				
204	272357	33919	-44.188904	45.111017
204b	279987	34872	-44.188842	45.110980
Merge between line 210 and 303				
210	374768	37376	-44.721937	45.471712
303	323928	40280	-44.721926	45.471701
Merge between line 3MCS1 and 3MCS2				
3MCS1	396127	49390	-48.786006	45.841587
3MCS2	496280	61909	-48.785973	45.841575
Merge between line 2MCS and 2MCSx, North-Western section				
2MCS	236275	29408	-44.282942	45.147811
2MCSx	276490	34435	-44.282794	45.147903
Merge between line 2MCS and 2MCSx, South-Eastern section				
2MCS	237557	29569	-44.200538	45.105469
2MCSx	277773	34596	-44.200563	45.105490

Merge between line 2MCS and 2MCSx, North West



Merge between line 2MCS and 2MCSx, South East

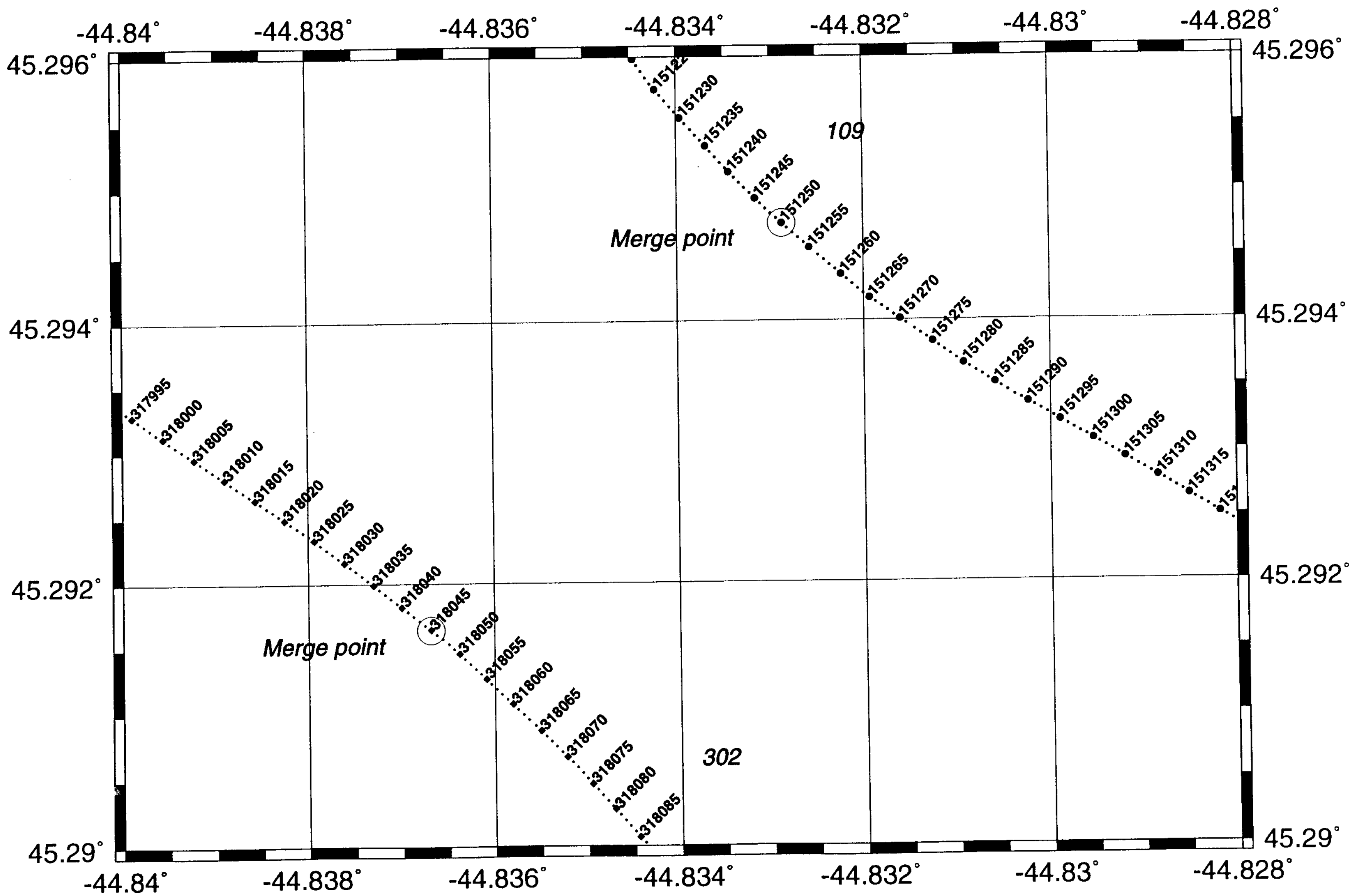




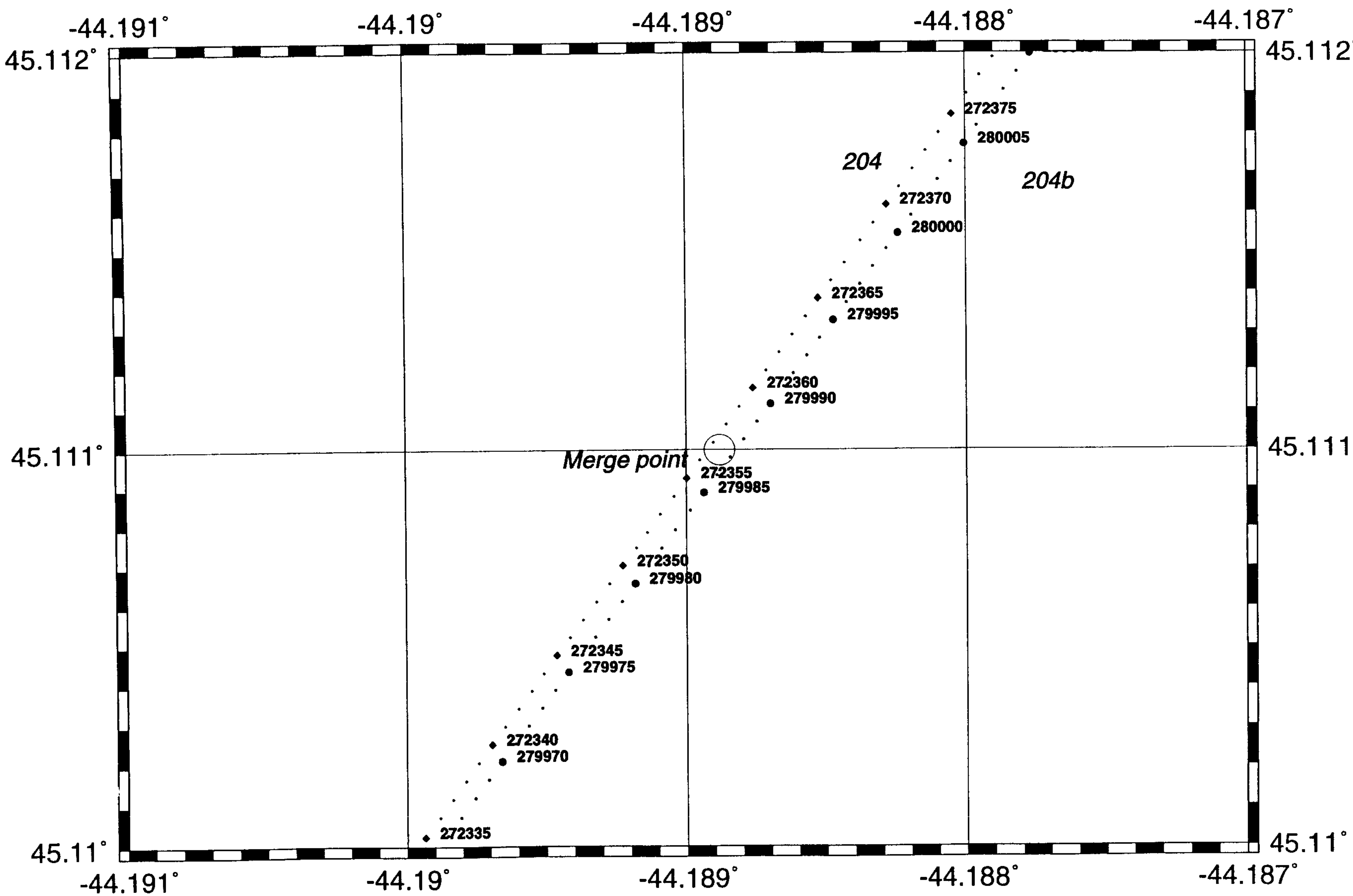
Merge between line 107 and 201

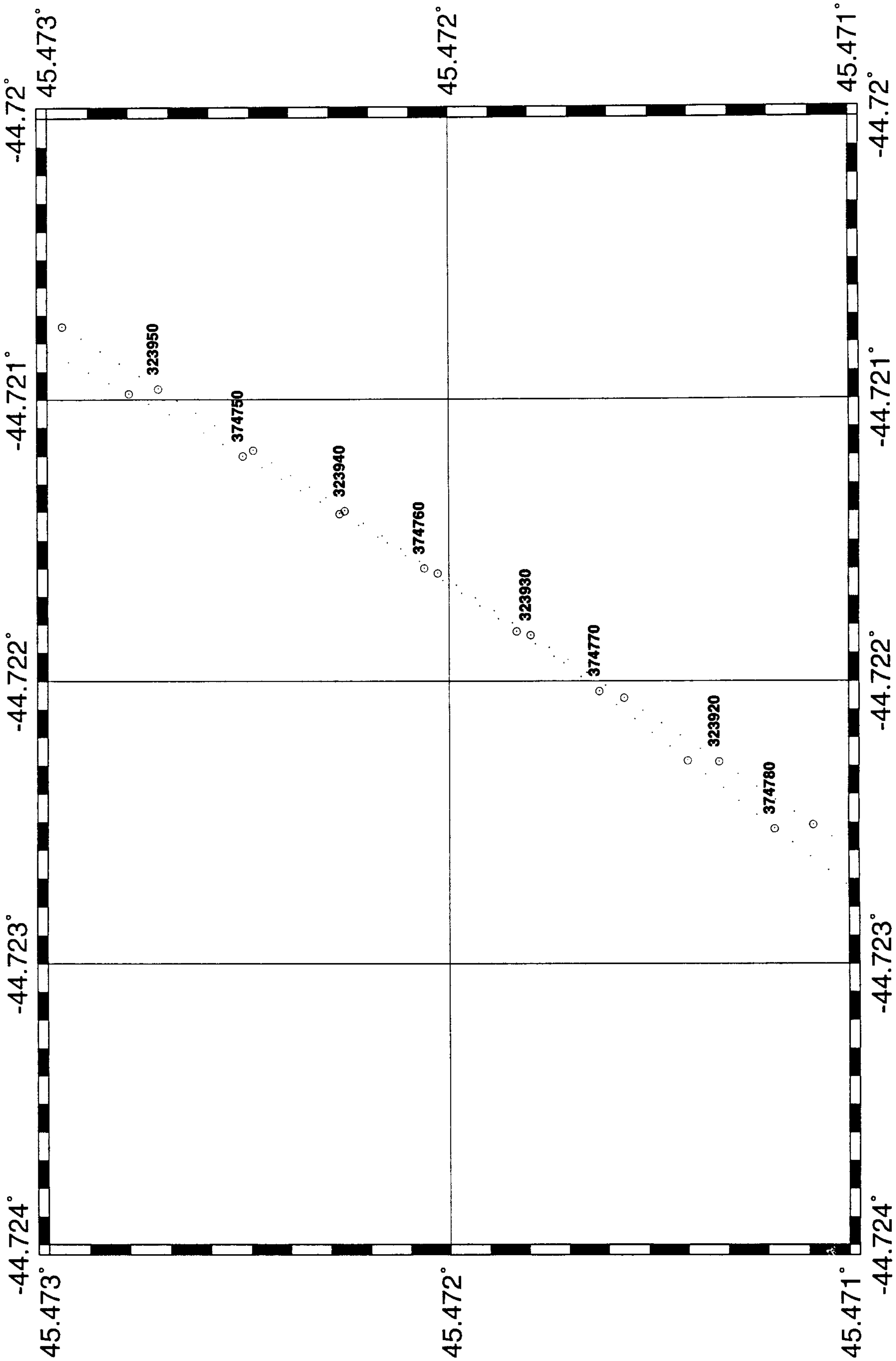
NOTE: Due to a waypoint error, these lines were not properly merged. This is not an error in ship handling.

Merge between line 109 and 302

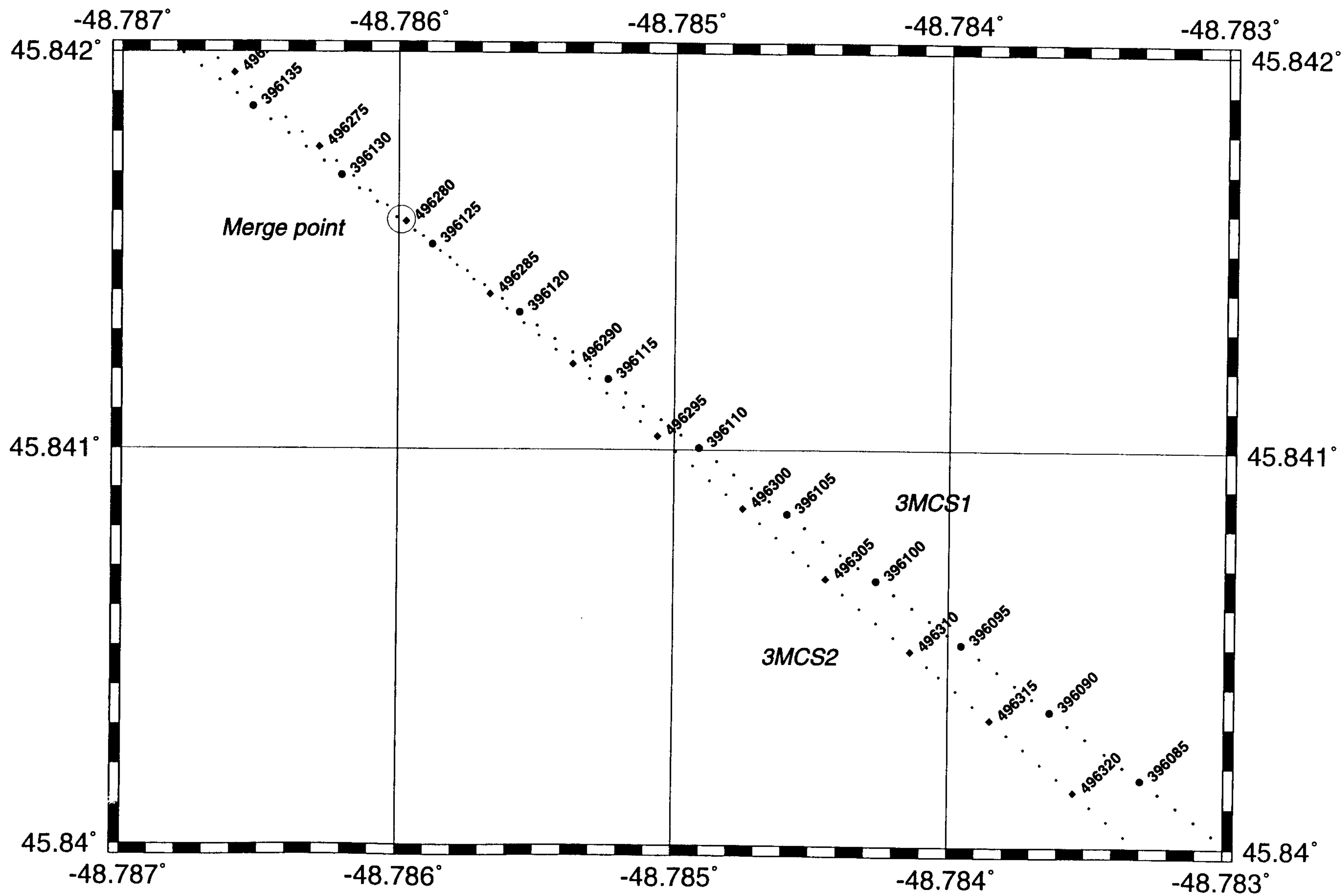


Merge between line 204b and 204




45.473°
45.472°
45.471°
-44.72°
-44.721°
-44.722°
-44.723°
-44.724°
323950
374750
323940
374760
323930
374770
323920
374780

Merge between line 3MCS1 and 3MCS2



Appendix 4: Recovery and Re-Launch of OBS A-6

An unusual occurrence on EW0007 was an unplanned OBS recovery and re-launch. The recovery of OBS A-6 may have been the first time Ewing has conducted an OBS recovery with the full streamer deployed.

During recoveries of Transect 2 OBS's on Oceanus, Keith Louden informed us that four of the Canadian OBS's had failed to release — the instruments at positions L2-8, -19, -21, and -27. Of these four, he believed that one (L2-19) would not be recoverable (its ping indicated that it had released, which is not a good sign in Keith's experience). That left three instruments that all had the same backup release time (1500 LT August 1). Because of the great distance between them (L2-27 and L2-8 were about 230 km apart), it would obviously not be possible for Oceanus to recover all three instruments. Keith believed that it would be possible for him to recover both instruments at L2-21 and -27, near the seaward end of the line, and he asked us to consider options for recovering the instrument at L2-8, on the slope.

We first determined that it would be logistically possible for us to modify our shooting plan so as to put us in a position near L2-8 at its scheduled release time. This required a minor modification but was not too inconvenient, since we already had a planned cross-line in the vicinity of that instrument. The next decision we had to make in considering an OBS deployment was whether to recover the streamer. It would obviously be very difficult to conduct a normal OBS recovery with the streamer out — both our maneuverability and our minimum water speed would be limited. On the other hand, we had no guarantee that the OBS was even on the bottom — Keith had been unable to communicate with it — and even if it were, we had no way of knowing whether it would release. For that reason, we deemed it unwise to spend 12-16 hours recovering and redeploying the streamer, so we discussed alternative strategies to recover the OBS.

In consultation with the captain, we decided on the following plan. We would first attempt to recover the OBS "normally", from the starboard waistdeck. This would be a one-shot deal, as we would be unable to turn around for a second pass at the OBS. However, the captain was confident that, given a sufficient lead-in and the wind on our port side, we could make a reasonable attempt at recovery. As a backup, the captain decided that the rescue boat would be manned and ready to launch if we missed the OBS from the waistdeck. In order to be able to slow the ship for OBS recovery without sinking the streamer, Joe put the tow leader onto the reel and stood ready to begin reeling in the streamer to compensate for a reduced water speed.

At 1610 LT (within a minute of the predicted surface time), we received an RDF signal from the OBS, and we proceeded slowly toward the position. At about 1630 LT the OBS was visible through the fog just off the starboard bow. As the OBS came by the waistdeck, four people attempted to snare it, two with hook-poles (the Chief Mate and Bosun), and two with grappling hooks (Holbrook and Hogan), but all failed. The OBS was just a bit too far off. Michael Hogan produced a valiant toss of the grappling hook (worthy of a Wyoming lasso throw) from the fantail as the OBS passed, but just missed.

The rescue boat, with Jeff Sylvia and Bob Jeffrey aboard, was immediately launched and chased the OBS into the fog. They were able to bring the OBS onto the rescue boat (using a block and tackle rigged for the purpose), and by about 1645 LT, the rescue boat and OBS A-6 were on board the Ewing. We removed the batteries from the flasher and radio and secured the OBS in the container on A-deck.

We later learned that Keith was able to recover the OBS at site L2-21, but there was no sign of the OBS at L2-27. Between the two ships, then, we successfully recovered two of the three instruments we hoped for on the backup timed release.

Because Ewing and Oceanus would not pass near each other until after deployment of OBS on Transect 3, it was impossible for OBS A-6 to be redeployed on that transect. Instead, we transferred the OBS back to Oceanus on August 5, as we passed by them while shooting the OBS transect. We pulled the inner four guns to eliminate the risk of fouling the OBS in their lines, but we continued shooting the other 16 guns. We deployed the instrument through the fantail A-frame without incident; because of the 200 m shot spacing, we were able to continue shooting without even missing a shot. The OBS drifted directly astern, cleared the gun floats, and Oceanus recovered the OBS normally once it cleared our tail buoy.

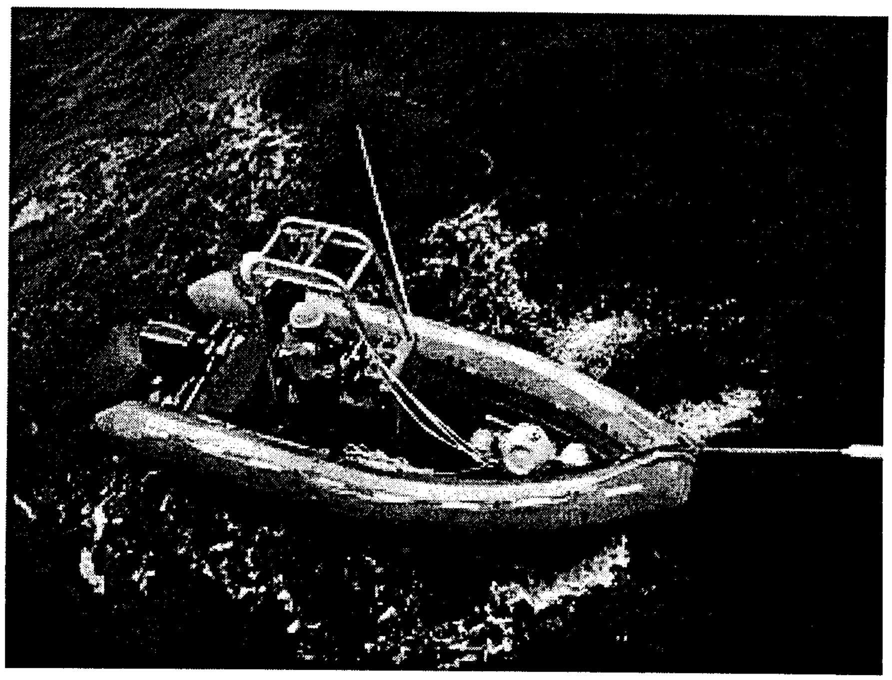
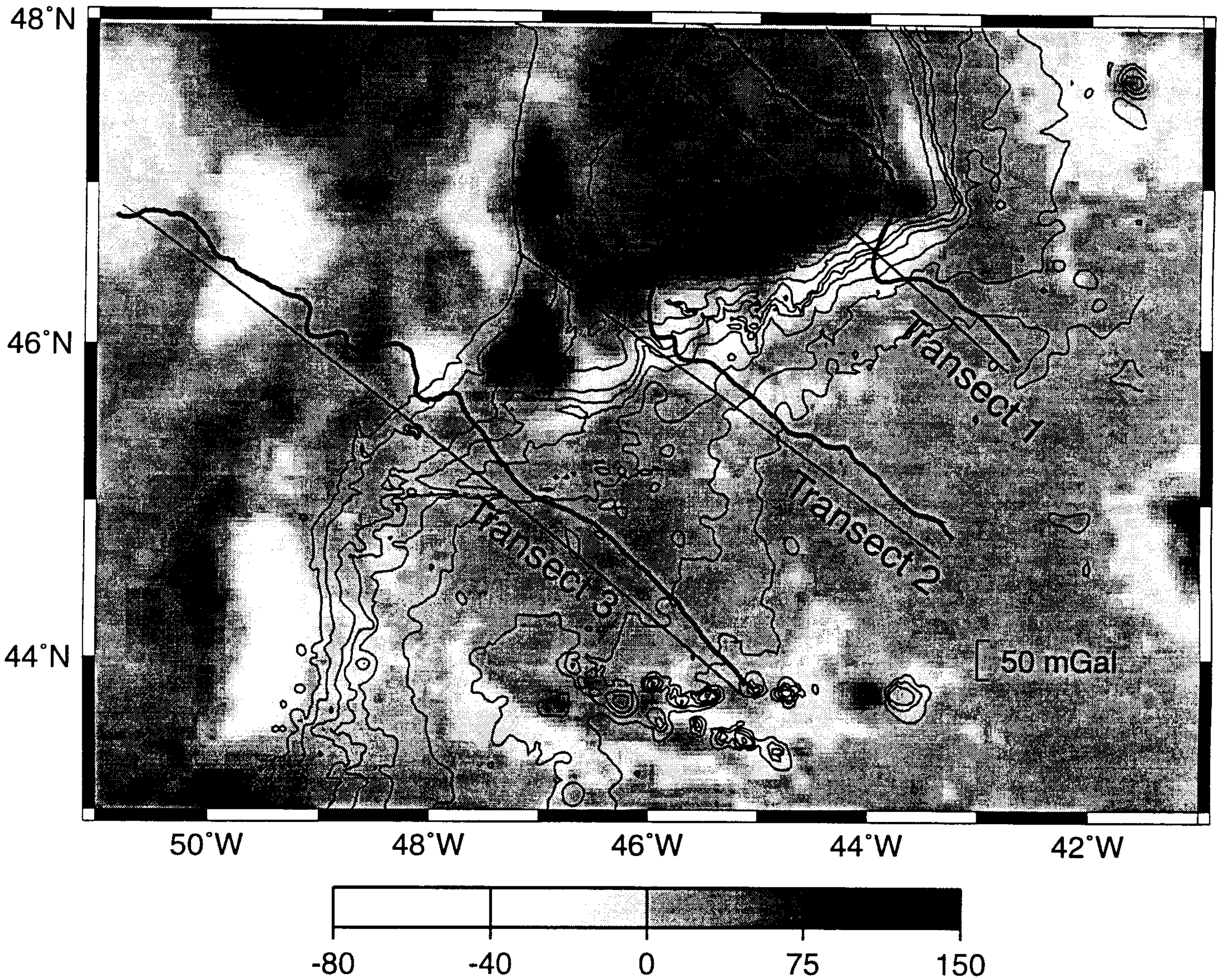


Figure: Jeff Sylvia and Bob Jeffrey return to the Ewing, having just recovered OBS A-6 (in bow of rescue boat).

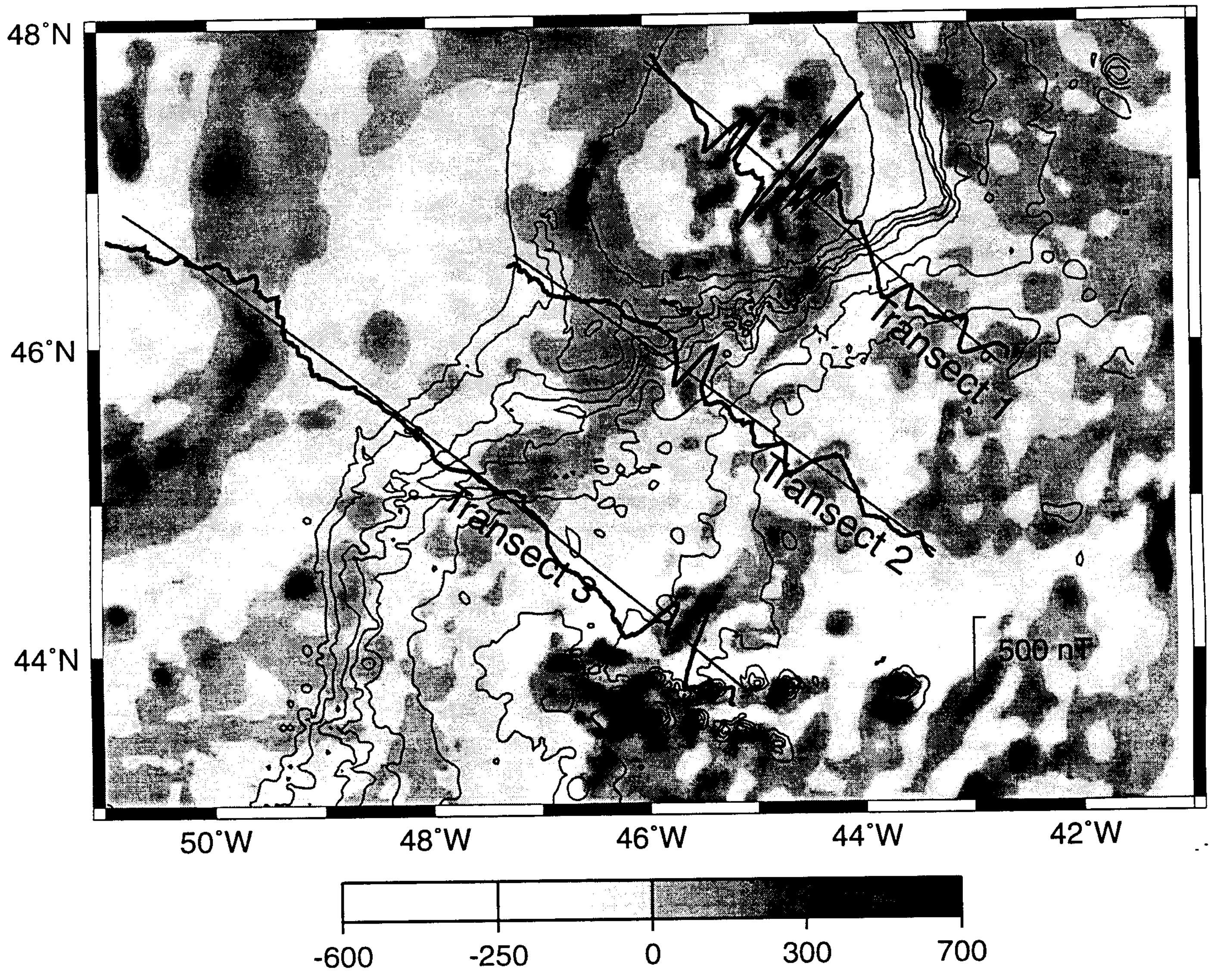
Appendix 5: Plots of Gravity and Magnetic Data

The following pages show plots of out transects on the 2D gravity and magnetic data for the region.

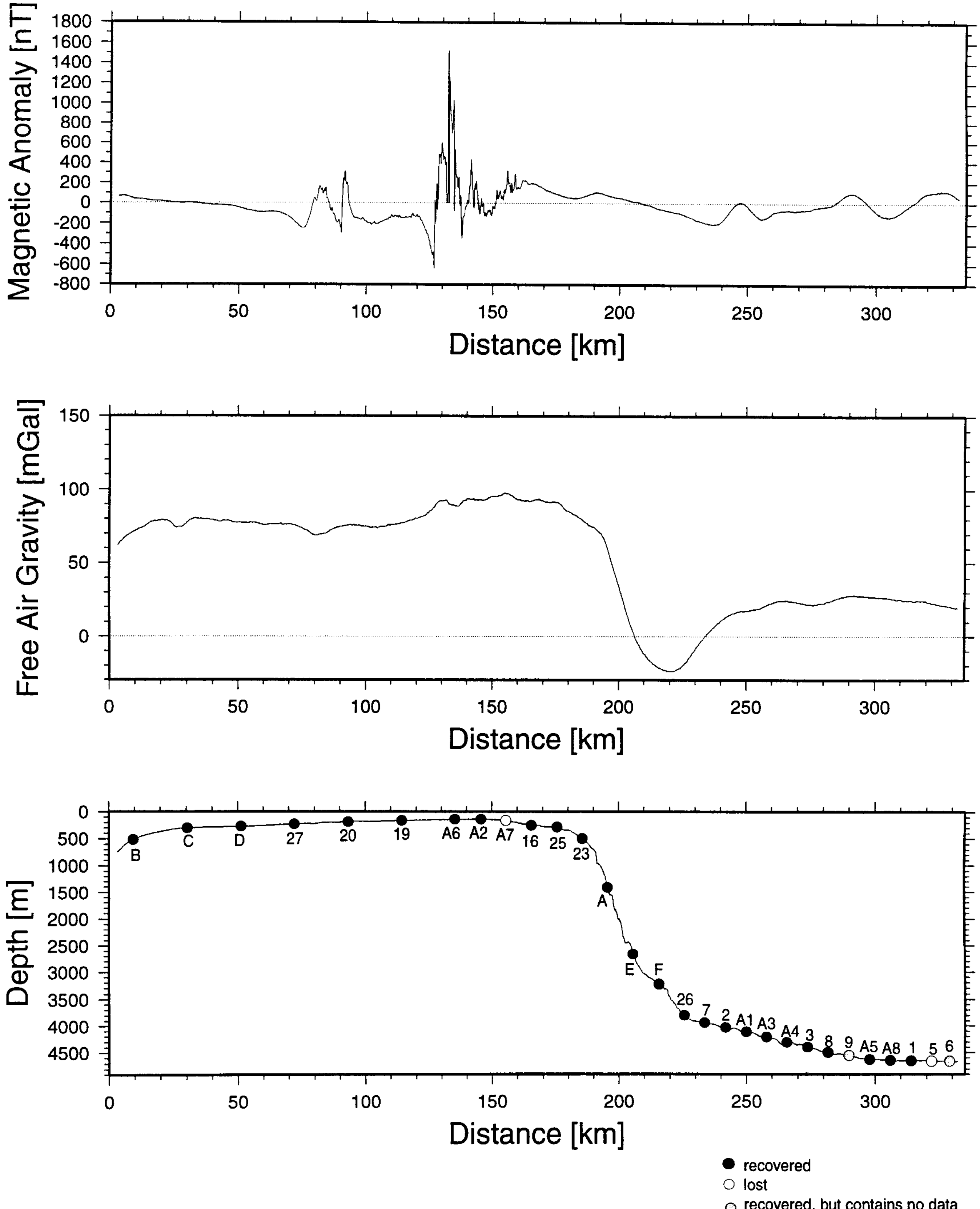
Gravity Anomalies



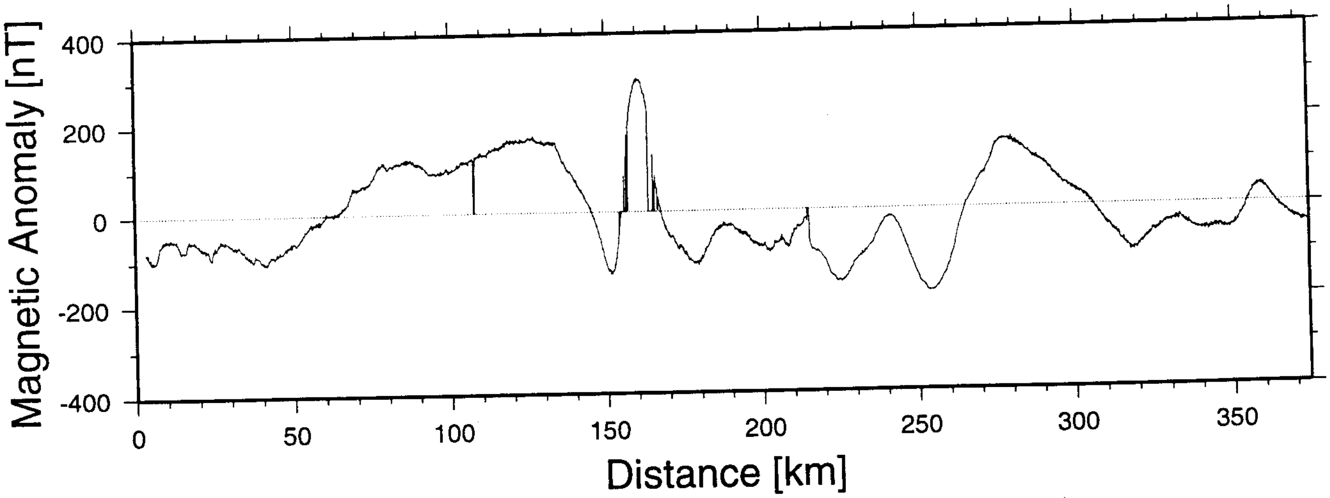
Magnetic Anomalies



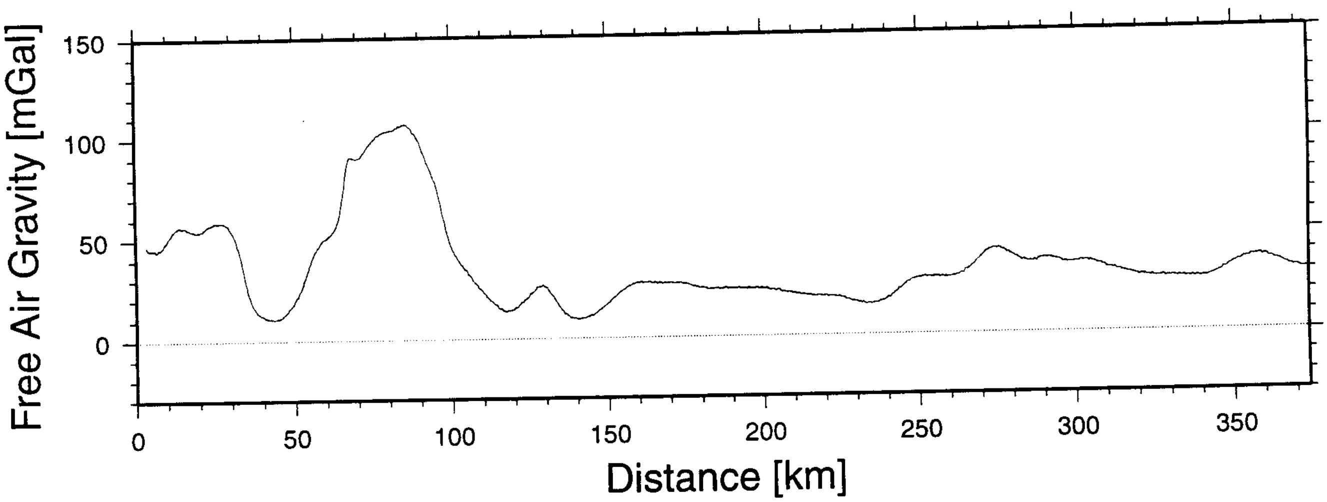
Line 1


Magnetic Anomaly [nT]
Distance [km]
Free Air Gravity [mGal]
Distance [km]
Depth [m]
Distance [km]
B
C
D
27
20
19
A6
A2
A7
16
25
23
A
E
F
26
7
2
A1
A3
A4
3
8
9
A5
A8
1
5
6
recovered
lost
recovered, but contains no data

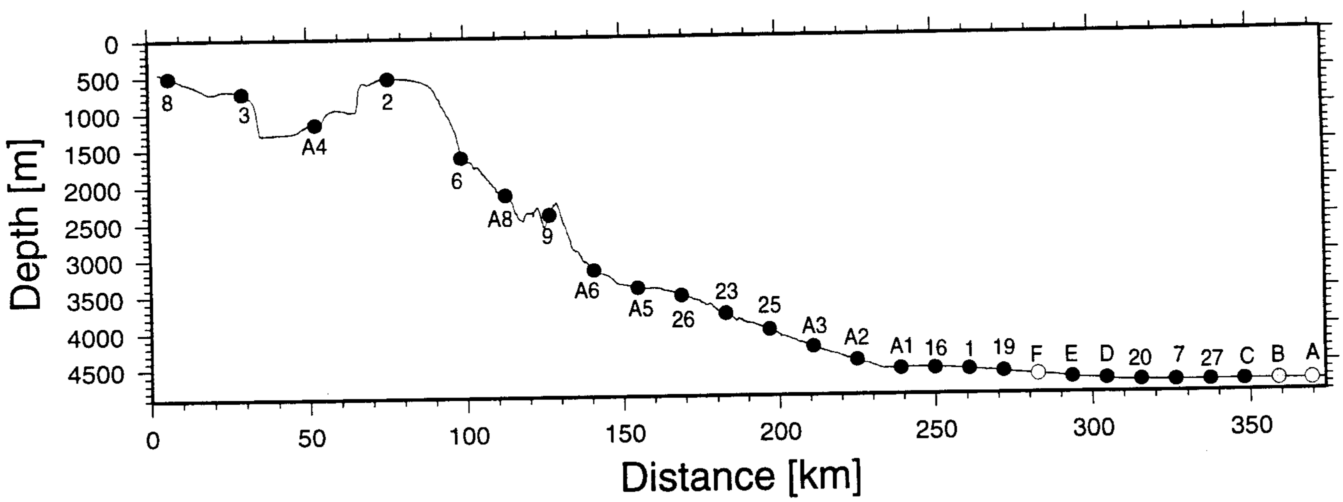
Line 2



Magnetic Anomaly [nT]
400
200
0
-200
-400
0
50
100
150
200
250
300
350
Distance [km]

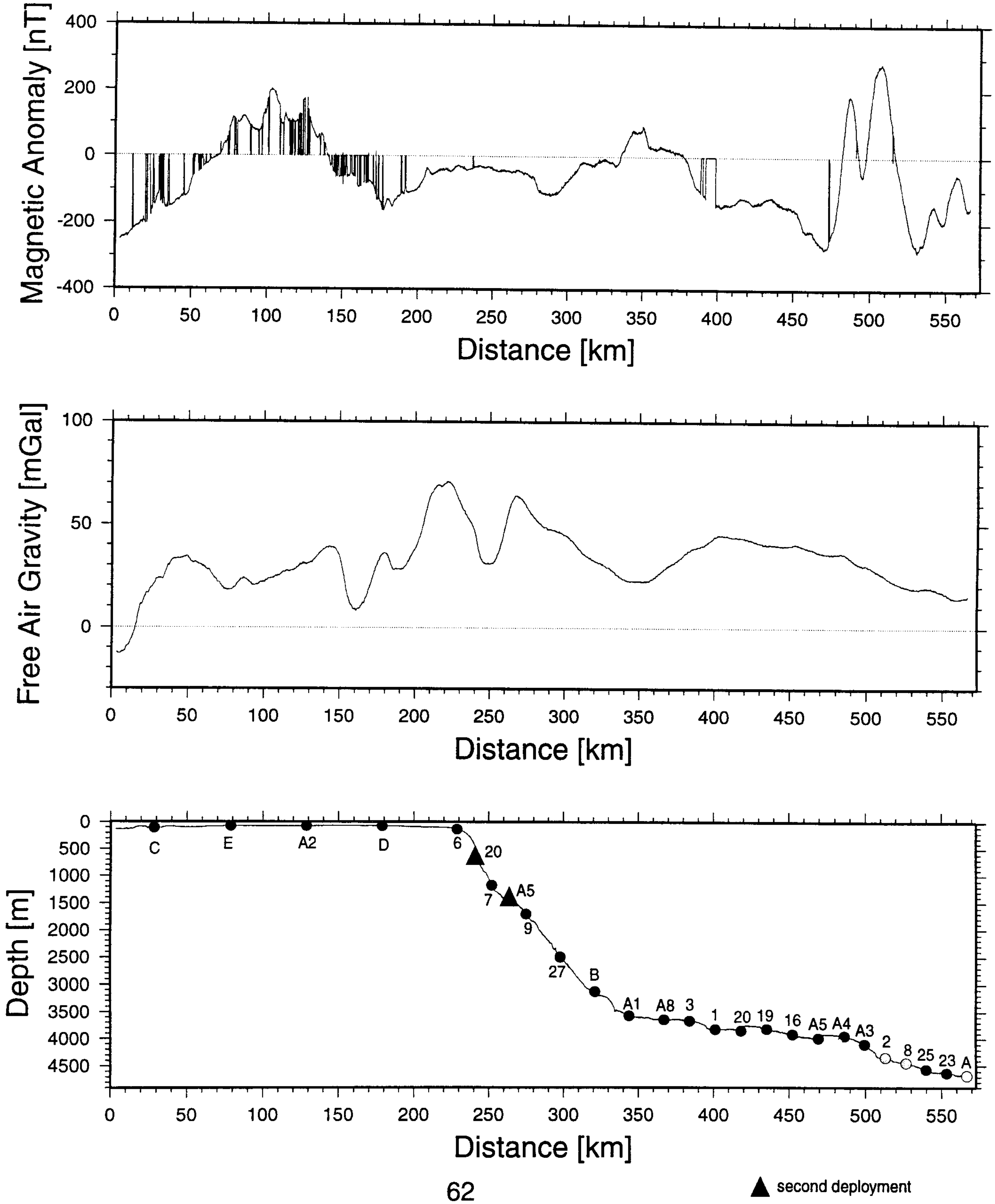


Free Air Gravity [mGal]
150
100
50
0
0
50
100
150
200
250
300
350
Distance [km]



Depth [m]
0
500
1000
1500
2000
2500
3000
3500
4000
4500
8
3
A4
2
6
A8
9
A6
A5
26
23
25
A3
A2
A1
16
1
19
F
E
D
20
7
27
C
B
A
0
50
100
150
200
250
300
350
Distance [km]

Line 3


Magnetic Anomaly [nT]
400
200
0
-200
-400
0 50 100 150 200 250 300 350 400 450 500 550
Distance [km]
Free Air Gravity [mGal]
100
50
0
0 50 100 150 200 250 300 350 400 450 500 550
Distance [km]
Depth [m]
0 500 1000 1500 2000 2500 3000 3500 4000 4500
C E A2 D 6 20 7 A5 9 27 B A1 A8 3 1 20 19 16 A5 A4 A3 2 8 25 23 A
0 50 100 150 200 250 300 350 400 450 500 550
Distance [km]
second deployment

Appendix 6: Data List

Woods Hole:

- Line profiles for transit 2.
- 2 copies of tapes containing all geophysical data (Gravity, Magnetics, XBT, Multibeam, etc…).
- 3.5 kHz profiler.
- Original of written watchstanders' log and main lab. log.
- Copy of seismic recording log.
- Copy of DLT and seismic recording log from the *i Book.*

University of Wyoming:

- 20 DLT's of SEGY data (all prestack MCS data).
- 1 DLT with tar of pre-cruise /tekϕ files.
- 1 DLT with tar of processed UNIX data.
- Original seismic recording log.
- Copies of written main lab. log and watchstanders' log.
- Roll of *Atlantek* plots of all migrated brute stacks.
- Copy of DLT and seismic recording log from the *i Book.*

Memorial University of Newfoundland:

- Copies of written watchstanders' log, seismic recording log, and main lab. log.
- Copy of DLT and seismic recording log from *i Book.*
- 10 DLT's.
- Listing of contents of DLT's.

Danish Lithosphere Center:

- Copies of SEGY files on disc (brute stack, migration stack, etc…).
- Files concerning quality control.
- 59 Exabyte tapes.
- Copies of written watchstanders' log, seismic recording log, and main lab. log.
- Copy of DLT and seismic recording log from the *i Book.*

Dalhousie University:

- 1 4mm tape with tar of plot data and plots.
- Roll of *Atlantek* plots.
- Copies of written watchstanders' log, seismic recording log, and main lab. log.
- Copy of DLT and seismic recording log from the *i Book.*

Appendix 7: Shot point and Common Midpoint Track Maps

The Shot-point plots are based on the processed navigation files that Jeff Turmelle produced at the end of each day (the so-called "TS" files).

The CMP (aka CDP in many circles) track maps are interpolated from the shot point navigation files. A table of CMP numbers and locations is available from JRH. CMP locations were calculated by assigning RP (reflection point) number using the formula used to assign geometry in SioSeis, and then correcting for the offset between the GPS antenna and the source array. Sioseis calculates RP numbers of a source location as INT((SP • Δx)/B) + C, where SP is the shotpoint number , Δx is the shot spacing in meters, B is the CMP bin size in meters, C is an arbitrary integer constant. INT signifies an integer truncation (not rounding...). SP•ΔX is the "x-coordinate" of the shot. Throughout the cruise we used a value of C=1000, B=6.25 meters, and Δx was generally 50 meters for MCS shooting and 200 meters for OBS shooting. On several lines, Δx had to be changed for reasons explained elsewhere. First we describe constant Δx and then variable Δx. The three scripts used are provided below.

On most individual lines, Δx was constant and the geometry assigned should correlate to these maps. For these lines a simple script that uses GMT's project command to interpolate between known locations in the navigation files was used to find latitudes and longitudes of the CMP's. The first step was to find the CMP bin of the ship's GPS antenna. The antenna is 55 meters in front of the center of the source array, and is thus 8 CMP bins ahead of the first shot, whose CMP number is found with the above formula. The CMP files were generated beginning at this point and then calculated up to the antenna position of the last shot. In general, it is believed that the navigation files are accurate to within a few meters, so the bin locations listed here should also be within a few meters. Two additional points: 1. There are data in CMPs before the first one listed here for each line. However, the data in these portions is generally not useful due to lack of fold, or the fact that the beginning of most lines is part of an inside turn. Users who really want to know the precise locations of these bins can always use GMT project to extrapolate, but this seemed unimportant for the present purposes and in the case of an inside turn is a meaningless exercise anyway. 2. The last reflection point is ~145 meters behind the antenna so there are 23 extra points listed in the files where there should be no traces. These extra points make no difference to the track plotting, but users who dislike these points are free to delete them. These two issues are brought up to warn people that these files should not be used to determine the exact first and last CMP's on the line.

On lines with a shot spacing change, things are slightly more complicated. In particular, the copy+stack job was not restarted when this happened, **so the geometry must be re-assigned before processing the data from these lines.** In addition, **the CMP points listed on the brute stacks will not match these maps.** The MCS lines affected by this are 1MCS, 101, 104, and 303. Line 208 also had variable shot spacing, but was restacked on board with the correct geometry, so the stack shown in the cruise report should correlate to the maps here. The maps show the true locations of the CMP bins and take into account the variable shot spacing. This was done by re-calculating the x-coordinates taking into account the change in shot spacing. For a single change in spacing from Δx_1 to Δx_2 that occurred at SP_c, the x-coordinate of all the shots SP after SP_c is found as $x=\Delta x_1(SP_c-1) + \Delta x_2(SP-SP_c + 1)$ and the CMP is found as (x/B) + C as above. In the case of two shot interval changes the formula for x is $x=\Delta x_1(SP_c-1) + \Delta x_2(SP_{c2}-SP_c) + \Delta x_3(SP-SP_{c2} + 1)$ where Δx_2 is the shot interval after the second change and SP_{c2} is the first shot point after the second change.

Script 1: Constant shot spacing per line.

```
#!/bin/csh -f
set LINE=$1

set BINSIZE="6.25"        # CDP bin size in meters
set SHOTINT="50"          # Shot point interval in meters
set TSDIR="./TSfiles"     # Location of the shot time files.  Pre-process with getshotline
set CDPDIR="./CDP"        # The output directory
                          # the getshotline script filters the navigation files and extracts
                          # all the points for a specific line the out is a file called
                          # $LINE.xyn and is used below
# Get the file, calculate an x-position, output a cdp bin number for the antenna position
# of the shot.  The extra 8 in 1008 is the 55 meter offset source-antenna
gawk '{printf("%lf\t%lf\t%d\t%d\n",$1,$2,$3,(($3*shotint)/binsize)+1008)}' \
       shotint=$SHOTINT binsize=$BINSIZE $TSDIR/$LINE.xyn > $CDPDIR/$LINE.ts
set FCDP=`head -1 $CDPDIR/$LINE.ts | gawk '{print $4}'`
set LCDP=`tail -1 $CDPDIR/$LINE.ts | gawk '{print $4}'`
set BINKM=`echo $BINSIZE | gawk '{printf("%lf",$1/1000.)}'`

# Now fill in the spaces in between using project
gawk '(NR > 1) {ncdps = $4-pcdp-1; last = ncdps*binskm ; \
                printf("project -Fxy -C%lf/%lf -E%lf/%lf -Q -G%7.5f \
                        -L0/%7.5f\n",lon,lat,$1,$2,binskm,last)} \
              {lon = $1; lat = $2; pcdp = $4}' binskm=$BINKM $CDPDIR/$LINE.ts \
     | csh -s > pos.tmp.$$
cut -f1,2 pos.tmp.$$ > pos2.tmp.$$
tail -1 $CDPDIR/$LINE.ts | gawk '{printf("%lf\t%lf\n",$1,$2)}' >> pos2.tmp.$
count $FCDP $LCDP > cdp.tmp.$$
#If all went well, the two tmp files are the same length and can be pasted together.
paste pos2.tmp.$$ cdp.tmp.$$ > $CDPDIR/$LINE.cdp
rm *.tmp.$$
exit
```

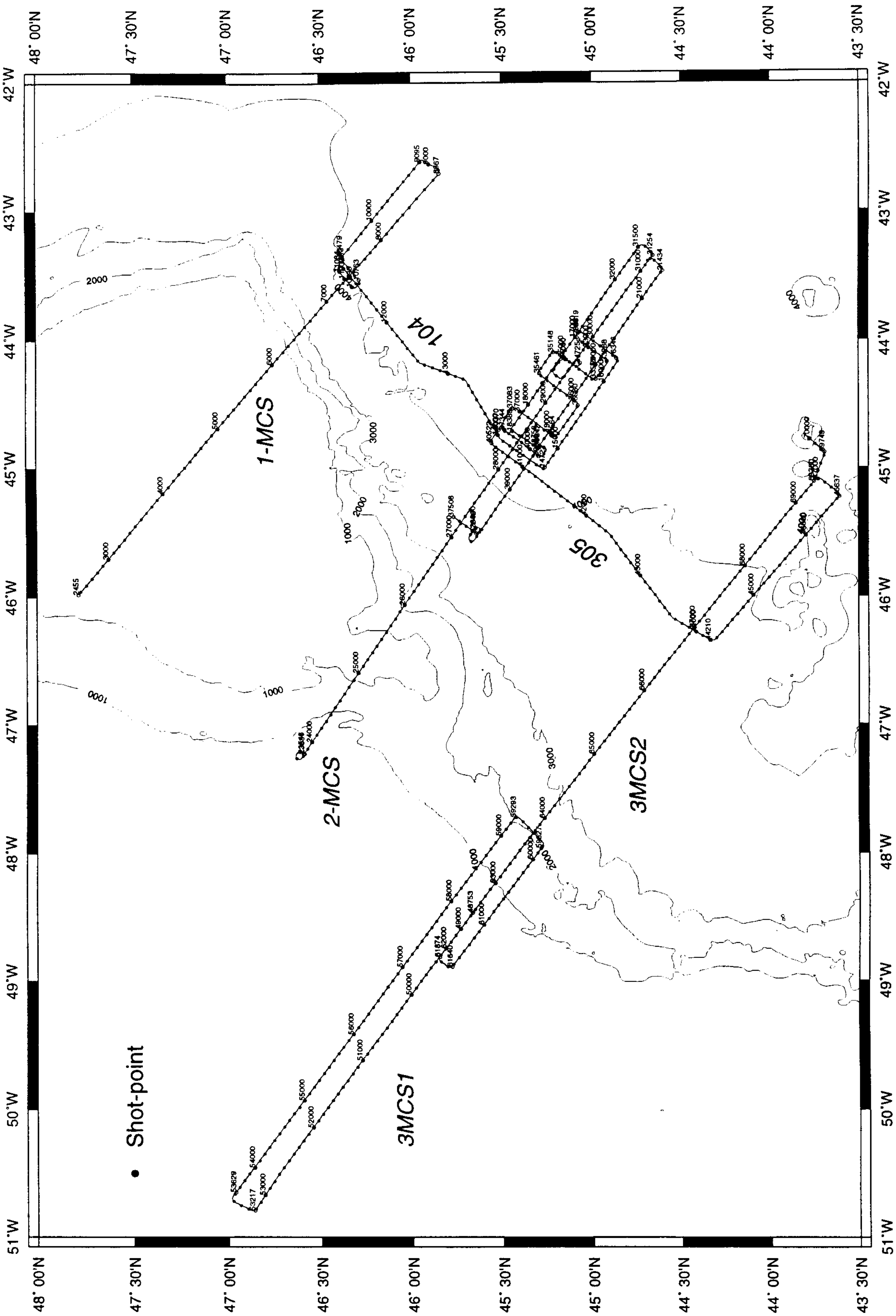
Script 2: Single shot interval change

```
#!/bin/csh -f
set LINE=$1

set BINSIZE="6.25"        # CDP bin size in meters
set SHOTINT="50"          # First Shot point interval in meters
set SHOTINT2="62.5"       # Second shot interval
set CSP="39939"           # First shot at new interval
set TSDIR="./TSfiles"     # Location of the shot time files.  Pre-process with getshotline
set CDPDIR="./CDP"        # The output directory

# Get the file, calculate an x-position, output a cdp bin number for the antenna position
# of the shot.  The extra 8 in 1008 is the 55 meter offset from the source to the antenna
# basically the constant here should be the sioseis constant + 8
gawk '{if ($3 < csp) {printf("%lf\t%lf\t%d\t%d\n",$1,$2,$3,(($3*shotint)/binsize)+1008)} \
       else {printf("%lf\t%lf\t%d\t%d\n",$1,$2,$3, \
                     (((csp-1)*shotint+($3-csp+1)*shotint2)/binsize)+1008)}}' \
       shotint=$SHOTINT shotint2=$SHOTINT2 binsize=$BINSIZE csp=$CSP $TSDIR/$LINE.xyn \
    > $CDPDIR/$LINE.ts
set FCDP=`head -1 $CDPDIR/$LINE.ts | gawk '{print $4}'`
set LCDP=`tail -1 $CDPDIR/$LINE.ts | gawk '{print $4}'`
set BINKM=`echo $BINSIZE | gawk '{printf("%lf",$1/1000.)}'`
```

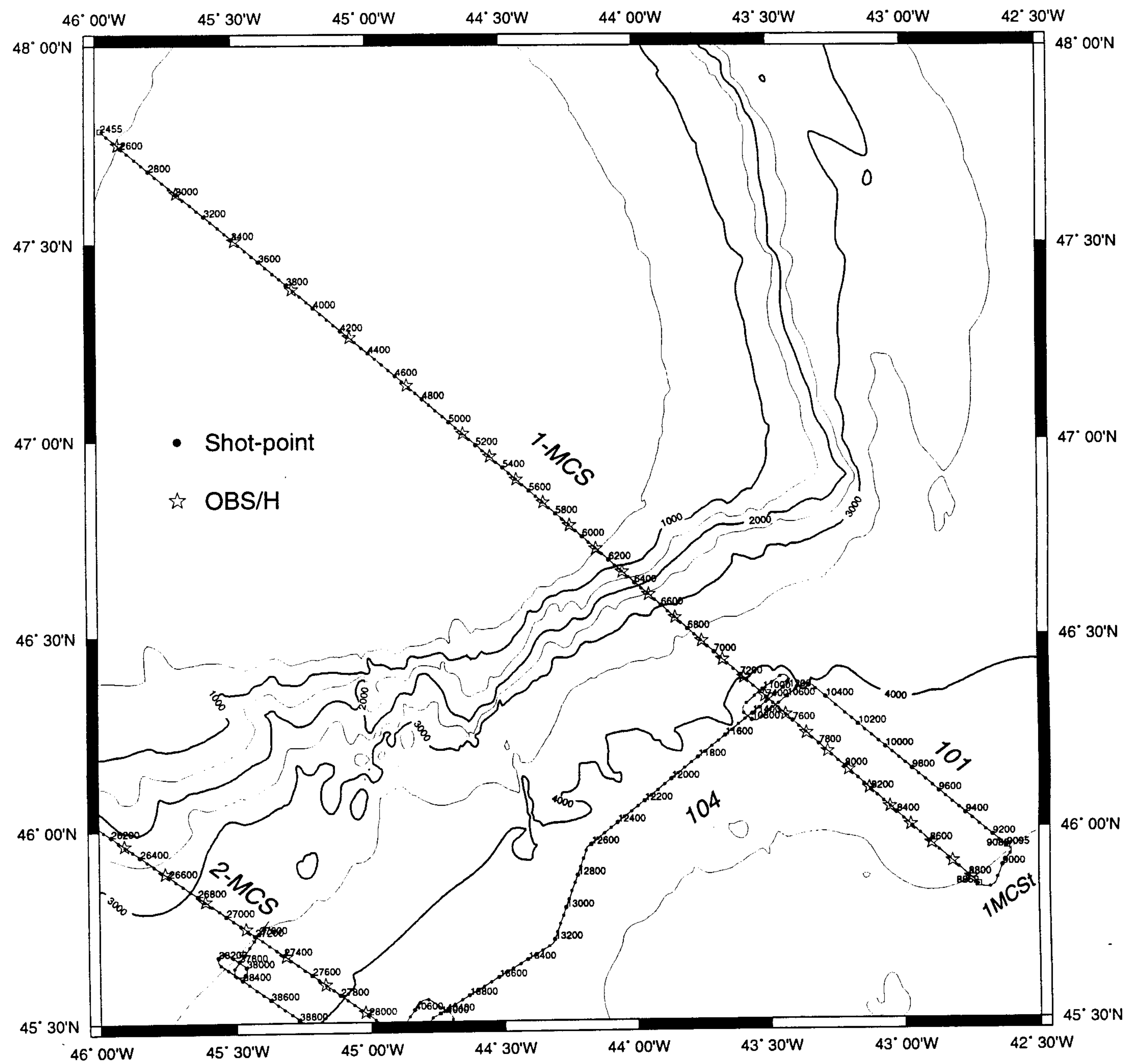
```
# Now fill in the spaces in between
gawk '(NR > 1) {ncdps = $4-pcdp-1; last = ncdps*binskm ; \
              printf("project -Fxy -C%lf/%lf -E%lf/%lf -Q -G%7.5f \
                      -L0/%7.5f\n",lon,lat,$1,$2,binskm,last)} \
              {lon = $1; lat = $2; pcdp = $4}' binskm=$BINKM $CDPDIR/$LINE.ts \
                | csh -s > pos.tmp.$$

cut -f1,2 pos.tmp.$$ > pos2.tmp.$$
tail -1 $CDPDIR/$LINE.ts | gawk '{printf("%lf\t%lf\n",$1,$2)}' >> pos2.tmp.$$
count $FCDP $LCDP > cdp.tmp.$$
paste pos2.tmp.$$ cdp.tmp.$$ > $CDPDIR/$LINE.cdp
rm *.tmp.$$
exit
```

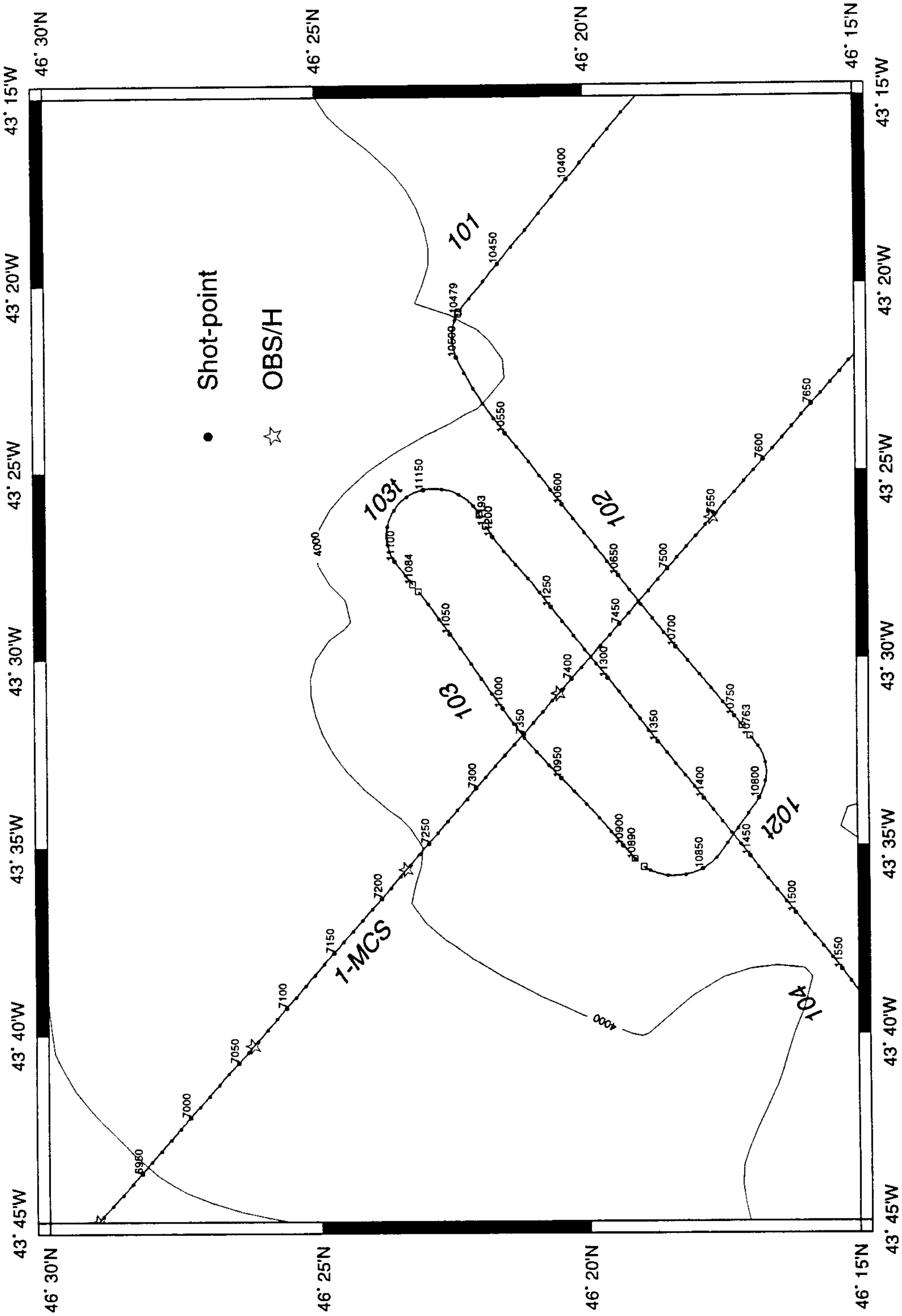
Script 3: Two shot interval changes

```
#!/bin/csh -f
set LINE=$1

set BINSIZE="6.25"         # CDP bin size in meters
set SHOTINT="50"           # First Shot point interval in meters
set SHOTINT2="62.5"        # Second shot interval
set SHOTINT3="75"          # Third shot interval
set CSP="8431"             # First shot at new interval
set CSP3="8565"            # First shot at next new interval
set TSDIR="./TSfiles"      # Location of the shot time files.  Pre-process with getshotline
set CDPDIR="./CDP"         # The output directory

# Get the file, calculate an x-position, output a cdp bin number for the antenna position
# of the shot.  The extra 8 in 1008 is the 55 meter offset from the source to the antenna
# basically the constant here should be the sioseis constant + 8
gawk '{if ($3 < csp) {printf("%lf\t%lf\t%d\t%d\n",$1,$2,$3,(($3*shotint)/binsize)+1008)} \
       else if ($3 < csp3) {printf("%lf\t%lf\t%d\t%d\n",$1,$2,$3,\
           (((csp-1)*shotint+($3-csp+1)*shotint2)/binsize)+1008)} \
       else  {printf("%lf\t%lf\t%d\t%d\n",$1,$2,$3,\
           (((csp-1)*shotint+(csp3-csp)*shotint2+($3-csp3+1)*shotint3)/binsize)+1008)}}' \
       shotint=$SHOTINT shotint2=$SHOTINT2 shotint3=$SHOTINT3 \
       binsize=$BINSIZE csp=$CSP csp3=$CSP3 $TSDIR/$LINE.xyn > $CDPDIR/$LINE.ts
set FCDP=`head -1 $CDPDIR/$LINE.ts | gawk '{print $4}'`
set LCDP=`tail -1 $CDPDIR/$LINE.ts | gawk '{print $4}'`
set BINKM=`echo $BINSIZE | gawk '{printf("%lf",$1/1000.)}'`

# Now fill in the spaces in between

gawk '(NR > 1) {ncdps = $4-pcdp-1; last = ncdps*binskm ; \
              printf("project -Fxy -C%lf/%lf -E%lf/%lf -Q -G%7.5f \
                      -L0/%7.5f\n",lon,lat,$1,$2,binskm,last)} \
              {lon = $1; lat = $2; pcdp = $4}' binskm=$BINKM $CDPDIR/$LINE.ts \
    | csh -s > pos.tmp.$$

cut -f1,2 pos.tmp.$$ > pos2.tmp.$$
tail -1 $CDPDIR/$LINE.ts | gawk '{printf("%lf\t%lf\n",$1,$2)}' >> pos2.tmp.$$
count $FCDP $LCDP > cdp.tmp.$$
paste pos2.tmp.$$ cdp.tmp.$$ > $CDPDIR/$LINE.cdp
rm *.tmp.$$
exit
```

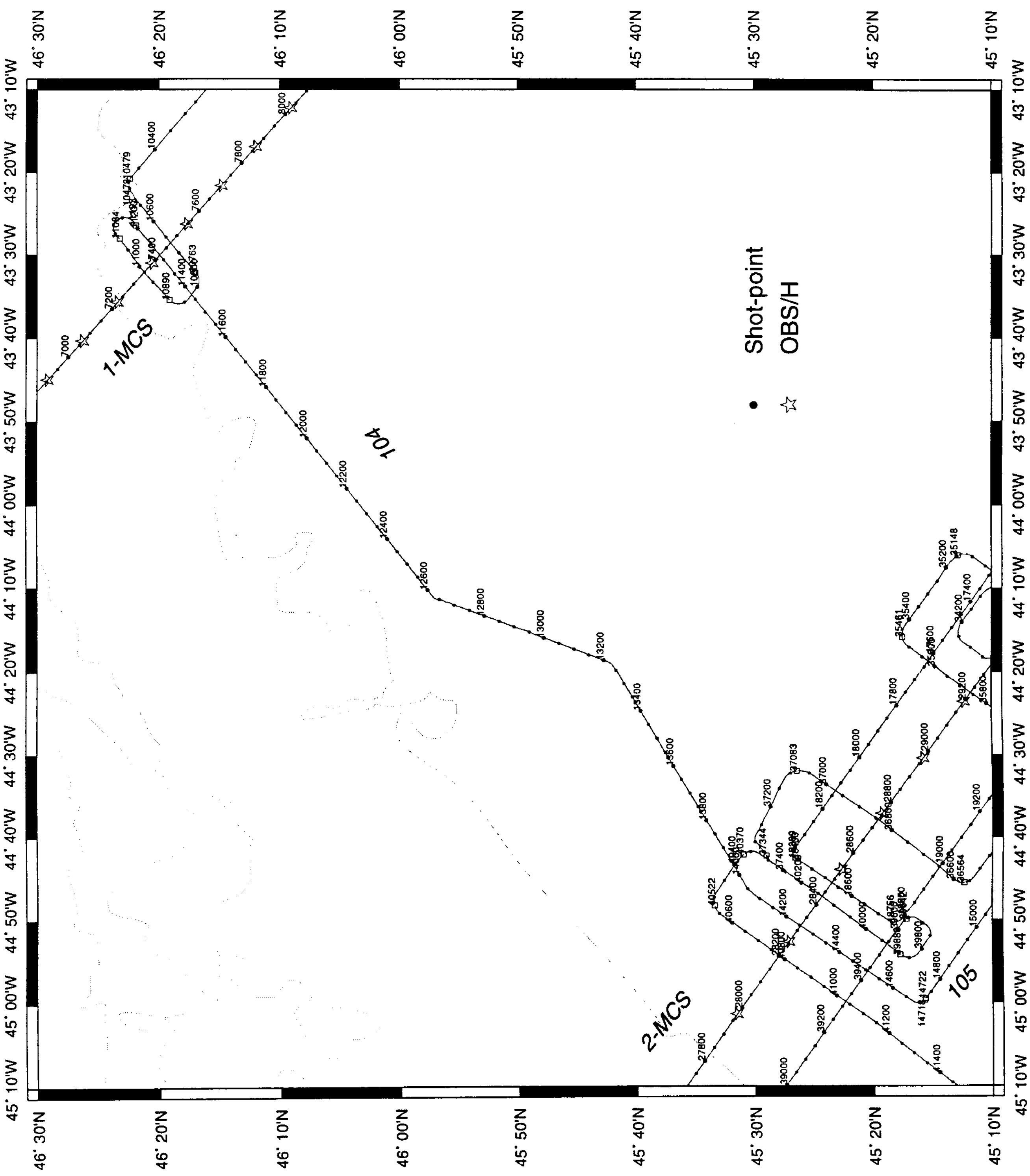


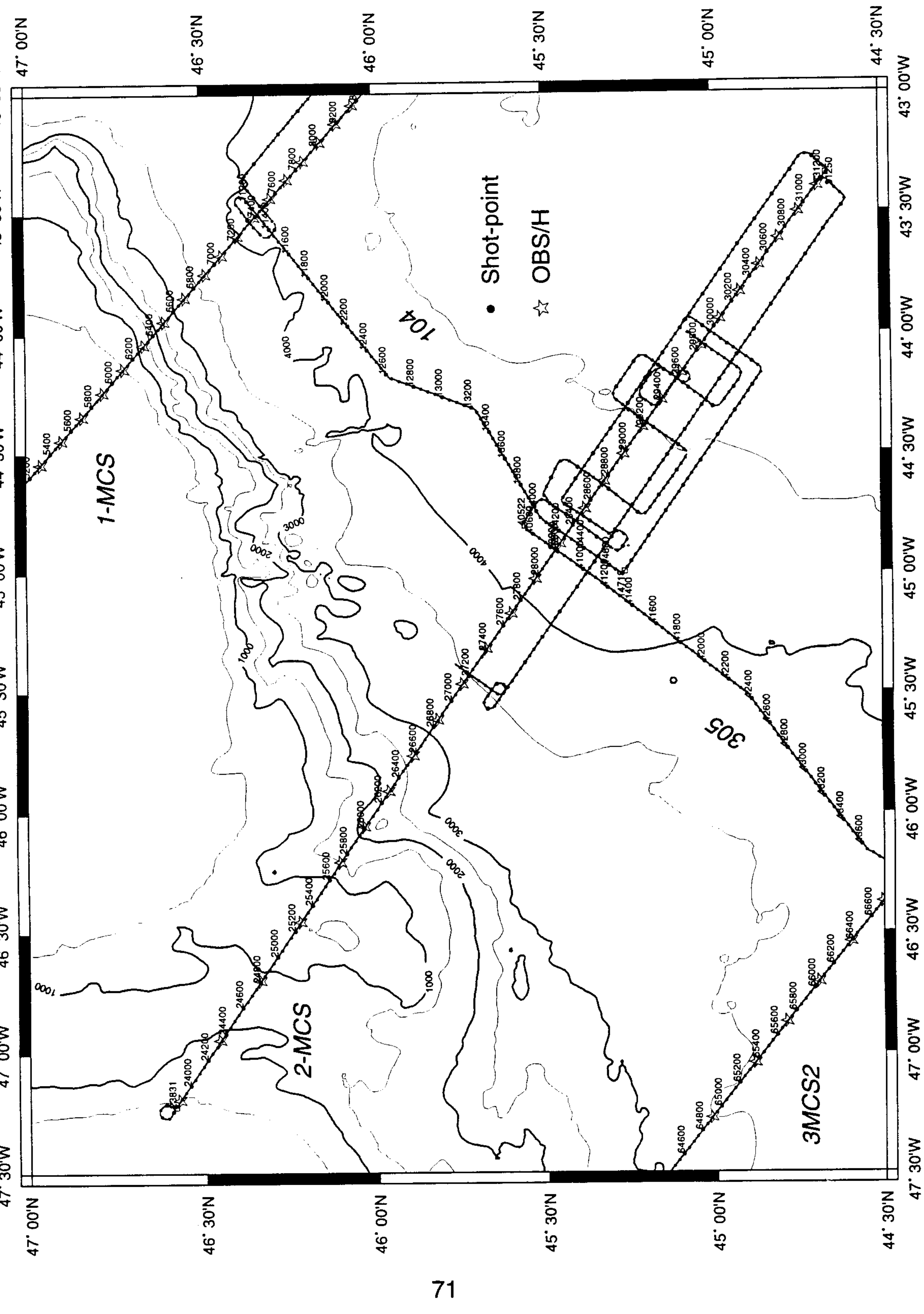
Shot-point
1-MCS
2-MCS
3MCS1
3MCS2
104
305
48° 00'N
47° 30'N
47° 00'N
46° 30'N
46° 00'N
45° 30'N
45° 00'N
44° 30'N
44° 00'N
43° 30'N
42°W
43°W
44°W
45°W
46°W
47°W
48°W
49°W
50°W
51°W


46° 00'W
45° 30'W
45° 00'W
44° 30'W
44° 00'W
43° 30'W
43° 00'W
42° 30'W
48° 00'N
47° 30'N
47° 00'N
46° 30'N
46° 00'N
45° 30'N
Shot-point
OBS/H
1-MCS
2-MCS
1MCSt
101
104
1000
2000
3000
4000

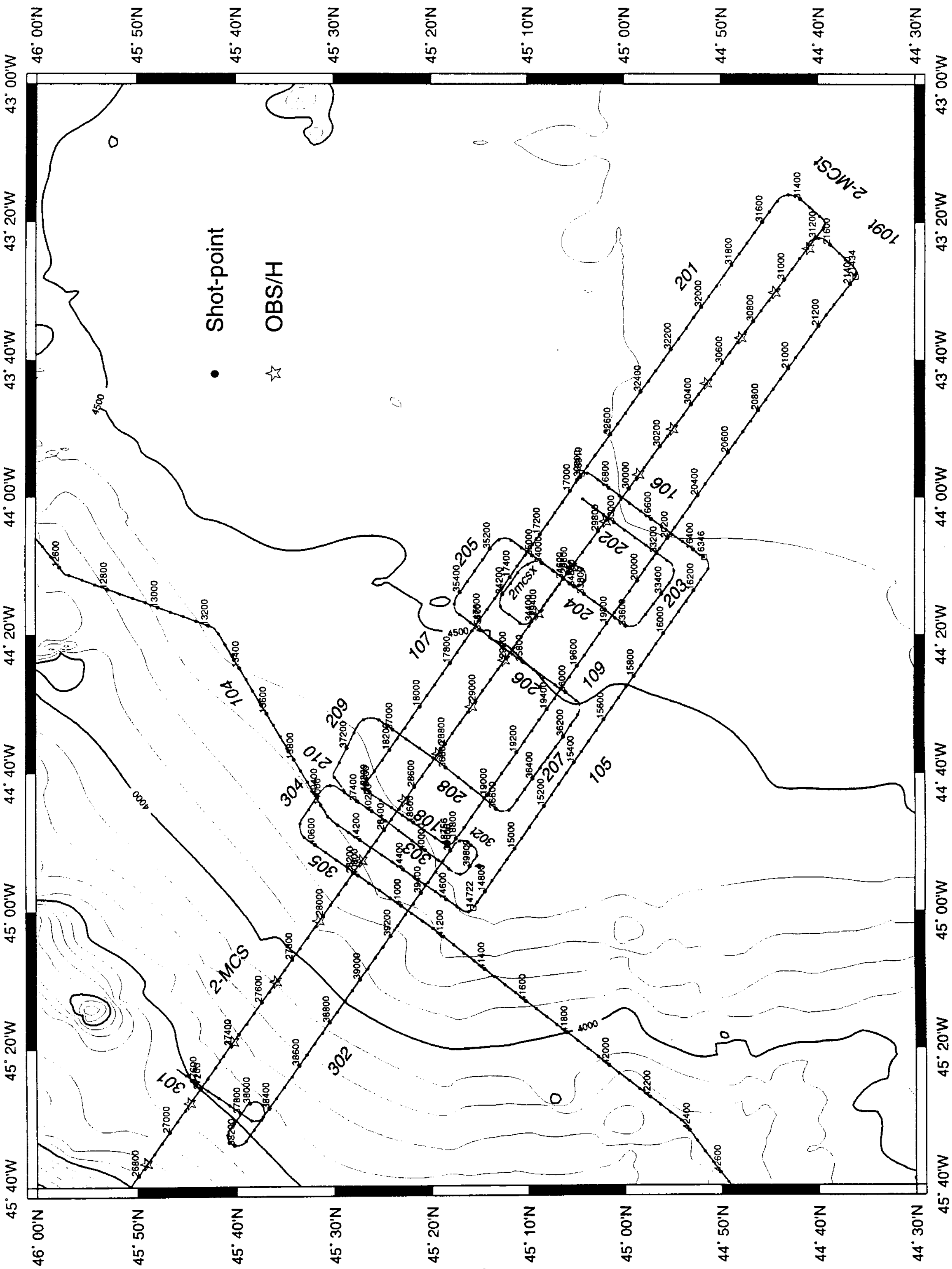


Shot-point
OBS/H
101
102
102t
103
103t
104
1-MCS
4000
46° 30'N
46° 25'N
46° 20'N
46° 15'N
43° 15'W
43° 20'W
43° 25'W
43° 30'W
43° 35'W
43° 40'W
43° 45'W

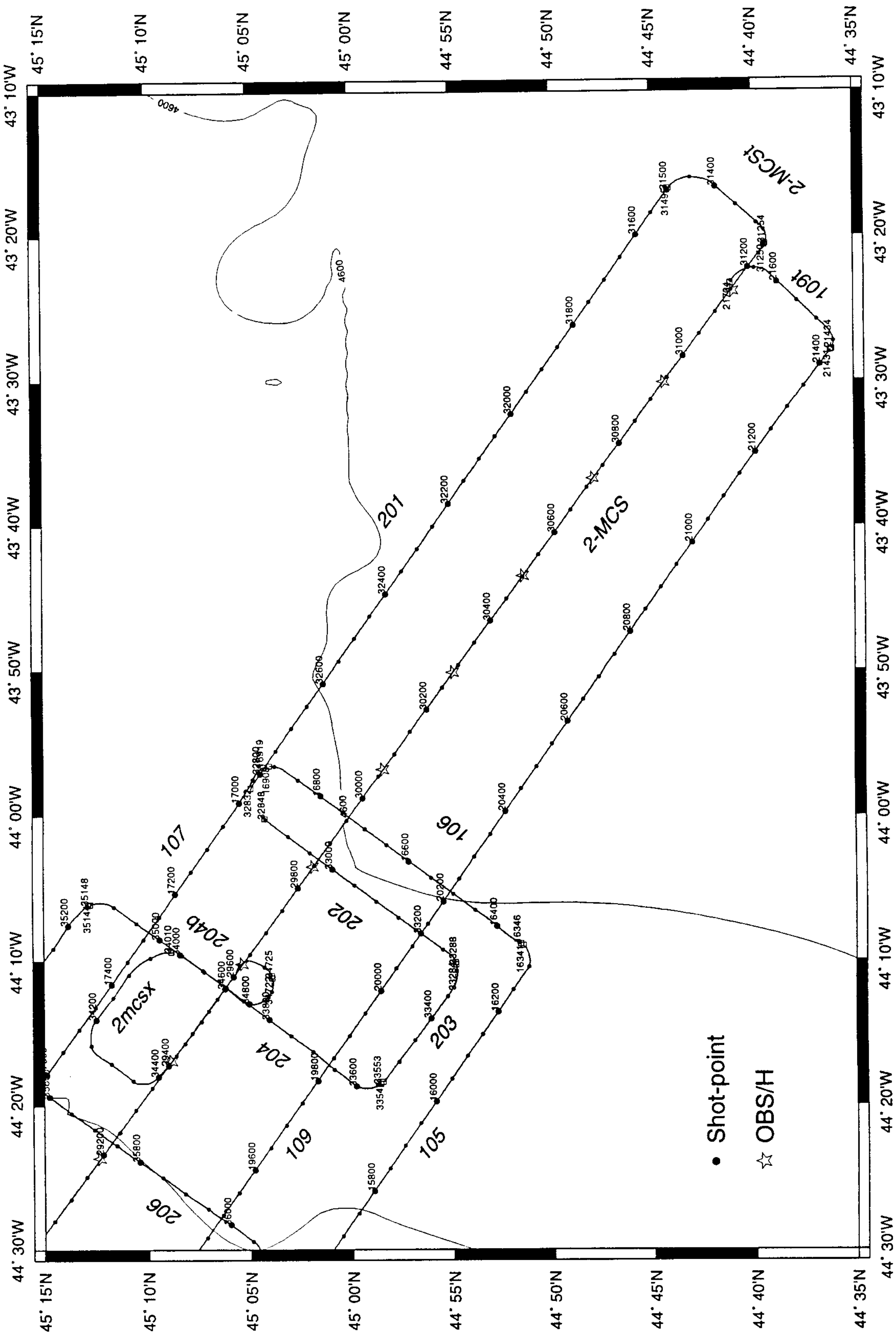

Shot-point
OBS/H
1-MCS
104
2-MCS
105
46° 30'N
46° 20'N
46° 10'N
46° 00'N
45° 50'N
45° 40'N
45° 30'N
45° 20'N
45° 10'N
43° 10'W
43° 20'W
43° 30'W
43° 40'W
43° 50'W
44° 00'W
44° 10'W
44° 20'W
44° 30'W
44° 40'W
44° 50'W
45° 00'W
45° 10'W



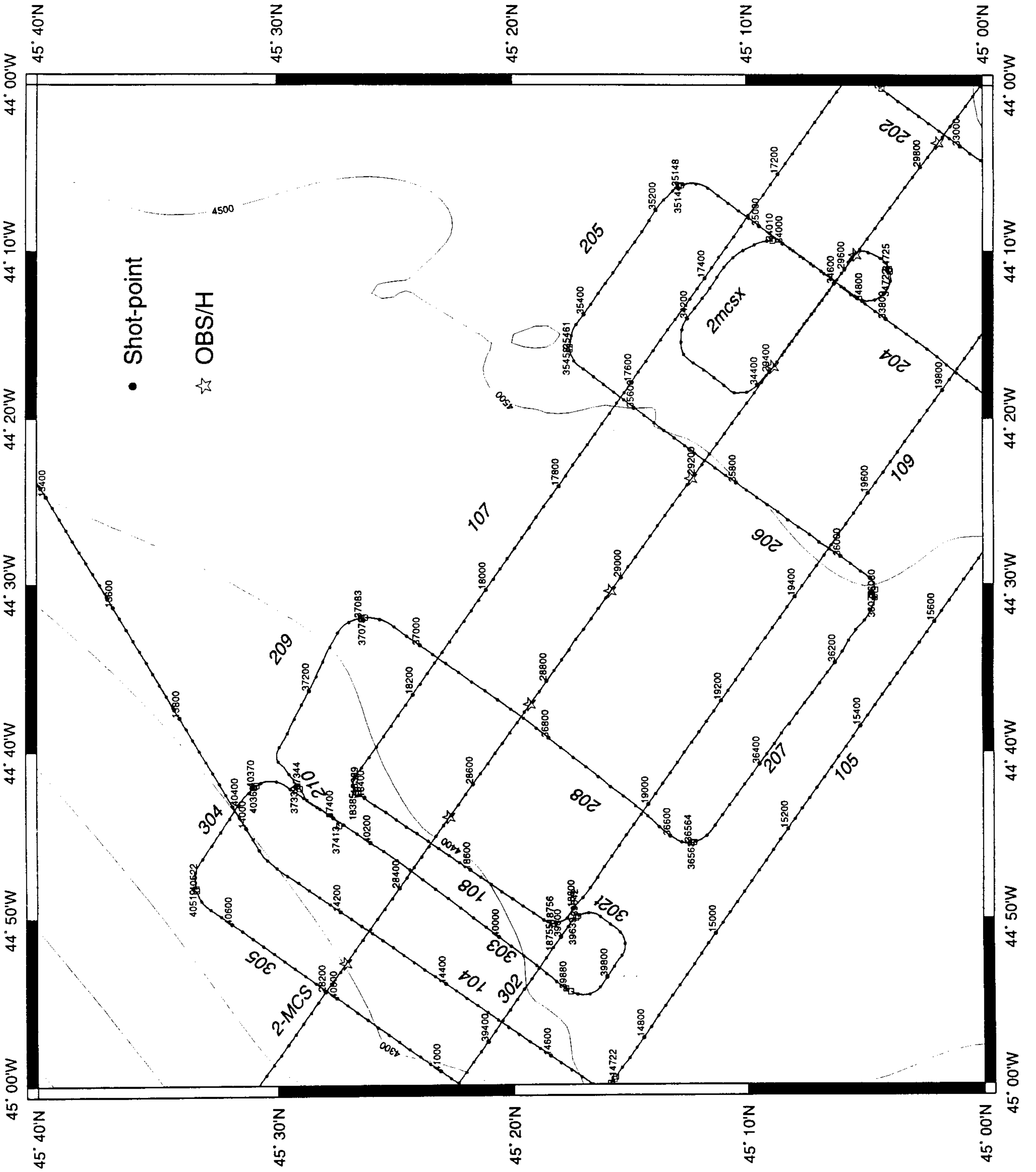
Shot-point
OBS/H
1-MCS
2-MCS
3MCS2
104
305
47° 00'N
46° 30'N
46° 00'N
45° 30'N
45° 00'N
44° 30'N
43° 00'W
43° 30'W
44° 00'W
44° 30'W
45° 00'W
45° 30'W
46° 00'W
46° 30'W
47° 00'W
47° 30'W

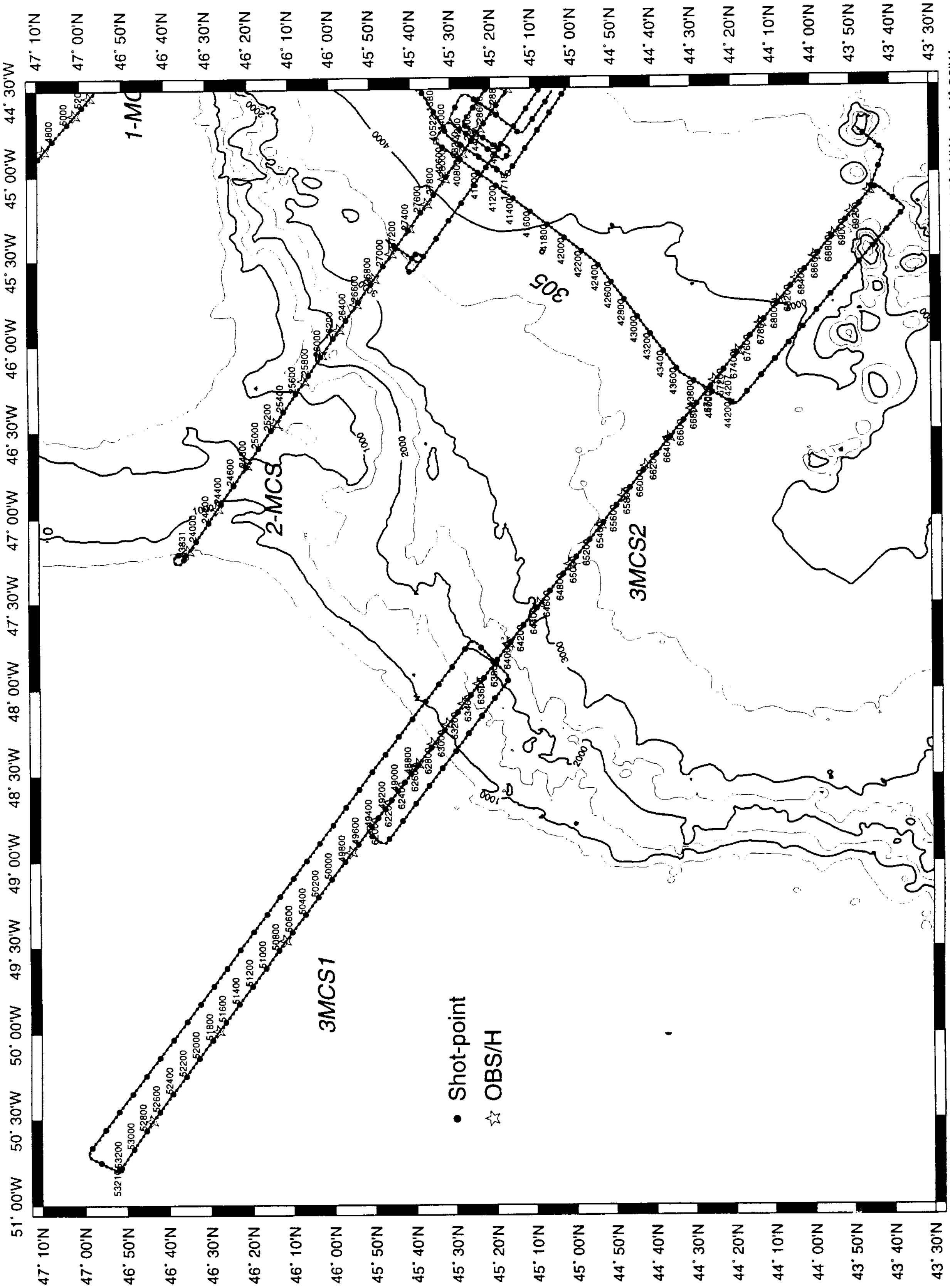


Shot-point
OBS/H
2-MCS
2-MCSt
2mcsx
46° 00'N
45° 50'N
45° 40'N
45° 30'N
45° 20'N
45° 10'N
45° 00'N
44° 50'N
44° 40'N
44° 30'N
43° 00'W
43° 20'W
43° 40'W
44° 00'W
44° 20'W
44° 40'W
45° 00'W
45° 20'W
45° 40'W

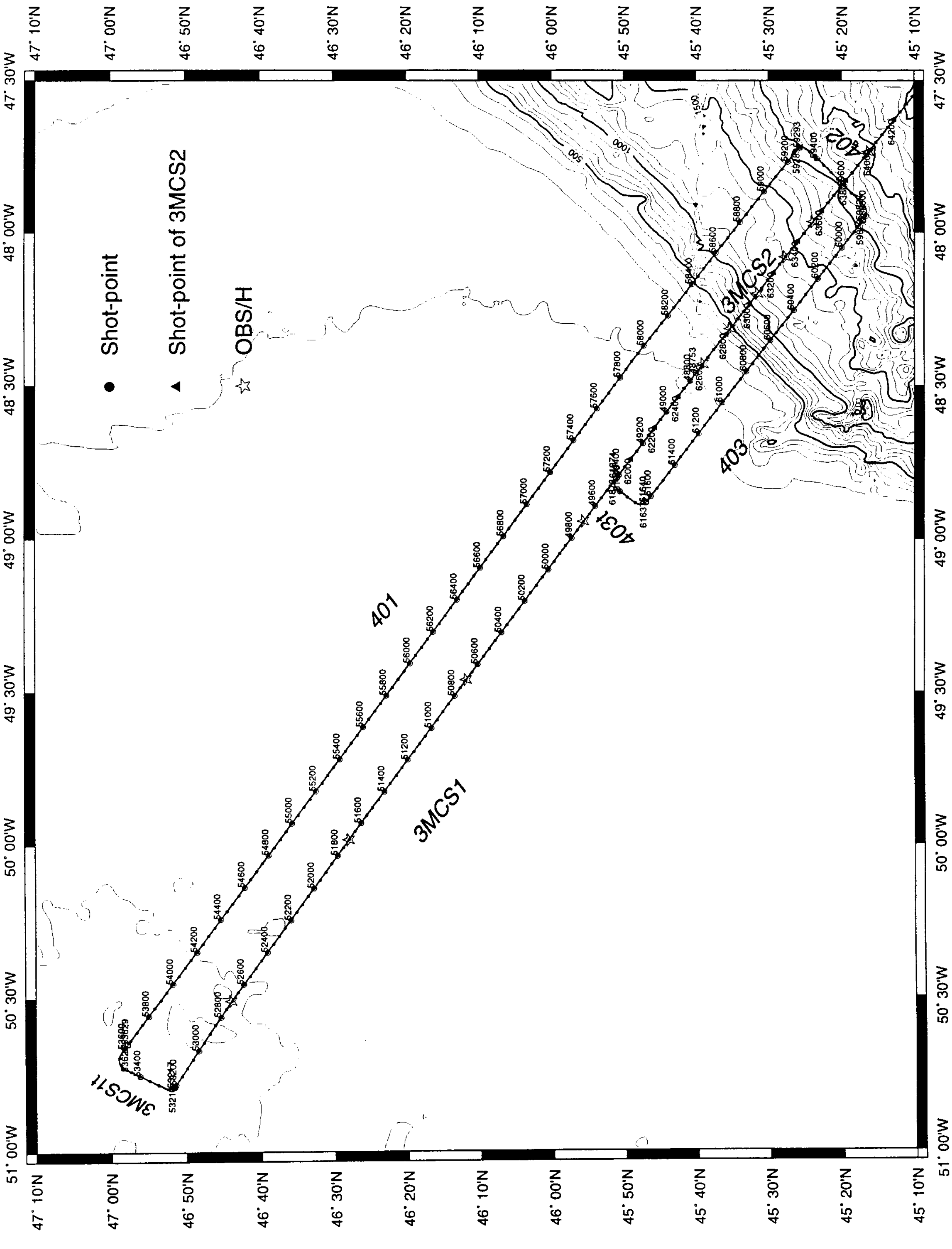


Shot-point
OBS/H
2-MCS
2-MCSt
2mcsx
201
202
203
204
204b
206
105
106
107
109
109t
4600
45° 15'N
45° 10'N
45° 05'N
45° 00'N
44° 55'N
44° 50'N
44° 45'N
44° 40'N
44° 35'N
43° 10'W
43° 20'W
43° 30'W
43° 40'W
43° 50'W
44° 00'W
44° 10'W
44° 20'W
44° 30'W

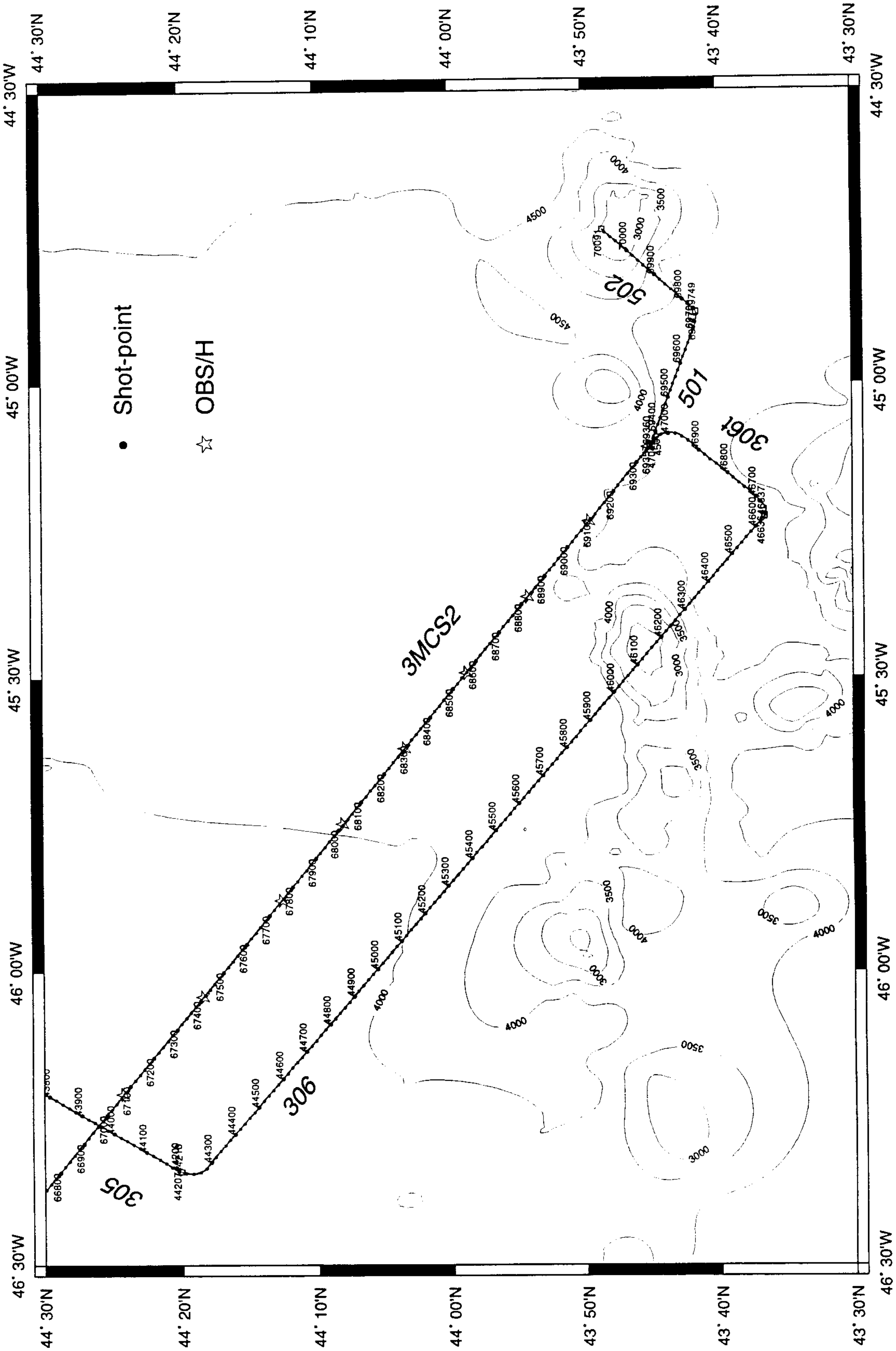

Shot-point
OBS/H
45° 40'N
45° 30'N
45° 20'N
45° 10'N
45° 00'N
44° 00'W
44° 10'W
44° 20'W
44° 30'W
44° 40'W
44° 50'W
45° 00'W
4500
4400
4300
2-MCS
2mcsx
104
105
107
108
109
202
204
205
206
207
208
209
210
302
302t
303
304
305



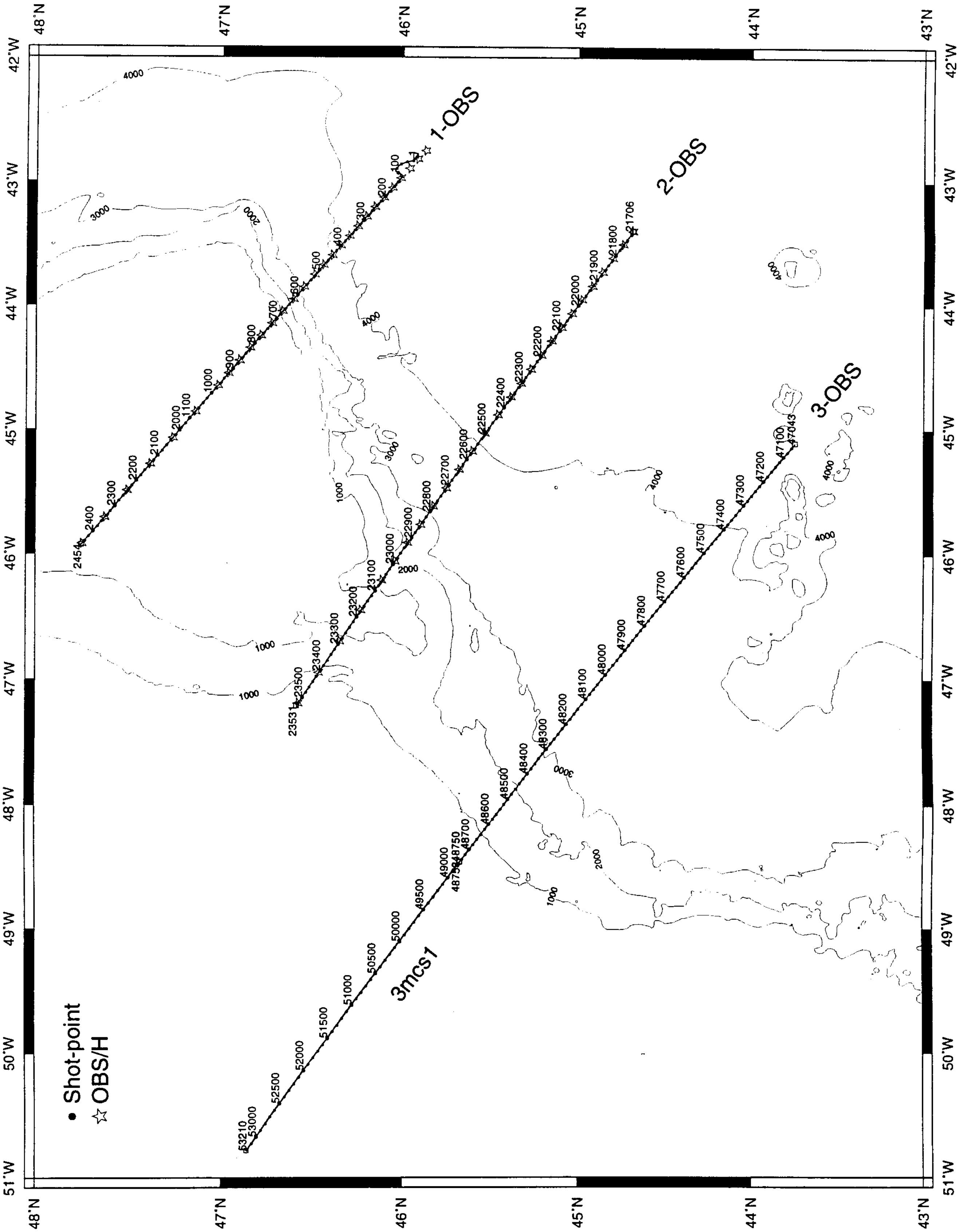
3MCS1
3MCS2
2-MCS
1-MC
305
Shot-point
OBS/H



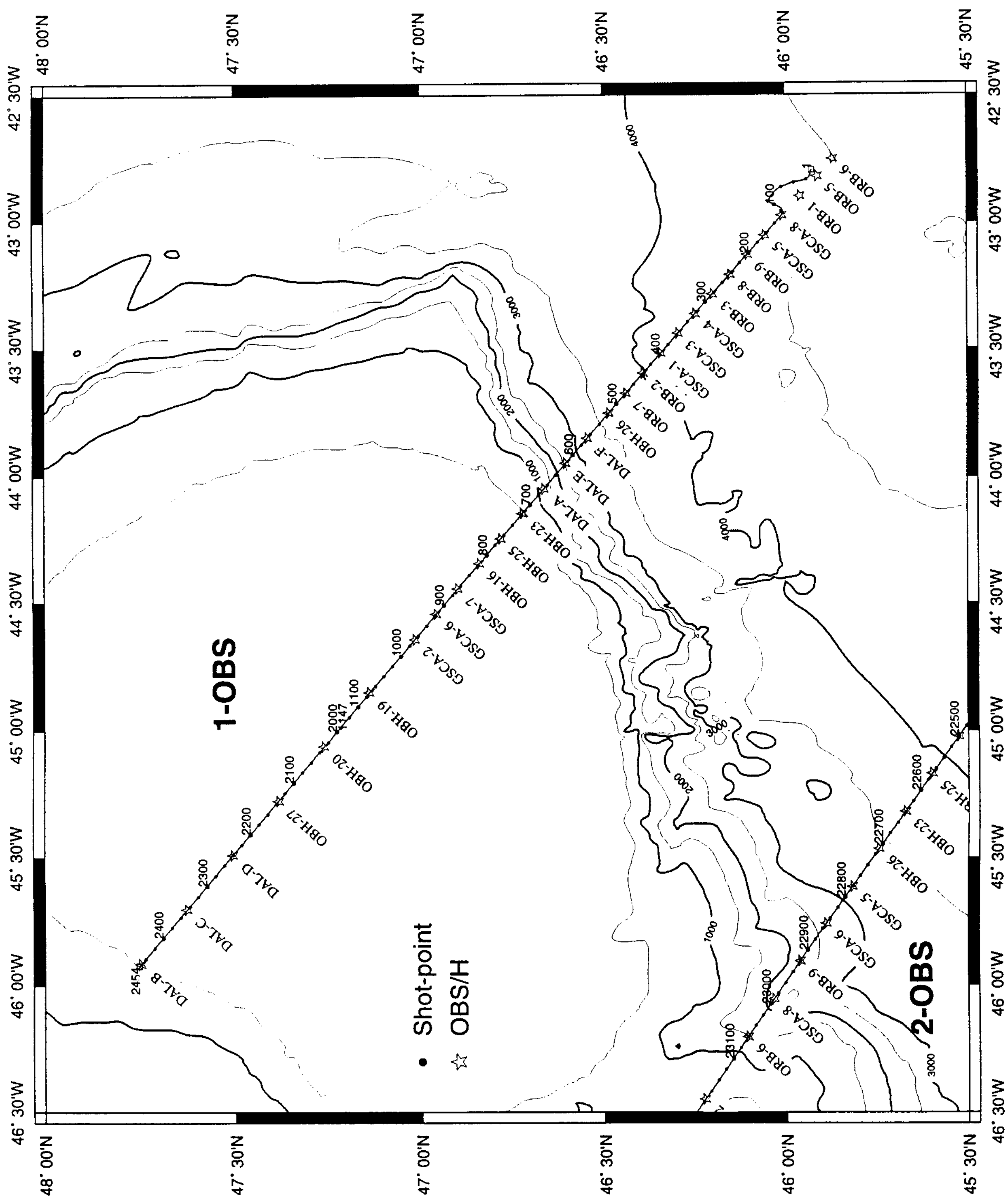
Shot-point
Shot-point of 3MCS2
OBS/H
401
3MCS1
3MCS2
403
402
4031
47° 10'N
47° 00'N
46° 50'N
46° 40'N
46° 30'N
46° 20'N
46° 10'N
46° 00'N
45° 50'N
45° 40'N
45° 30'N
45° 20'N
45° 10'N
47° 30'W
48° 00'W
48° 30'W
49° 00'W
49° 30'W
50° 00'W
50° 30'W
51° 00'W

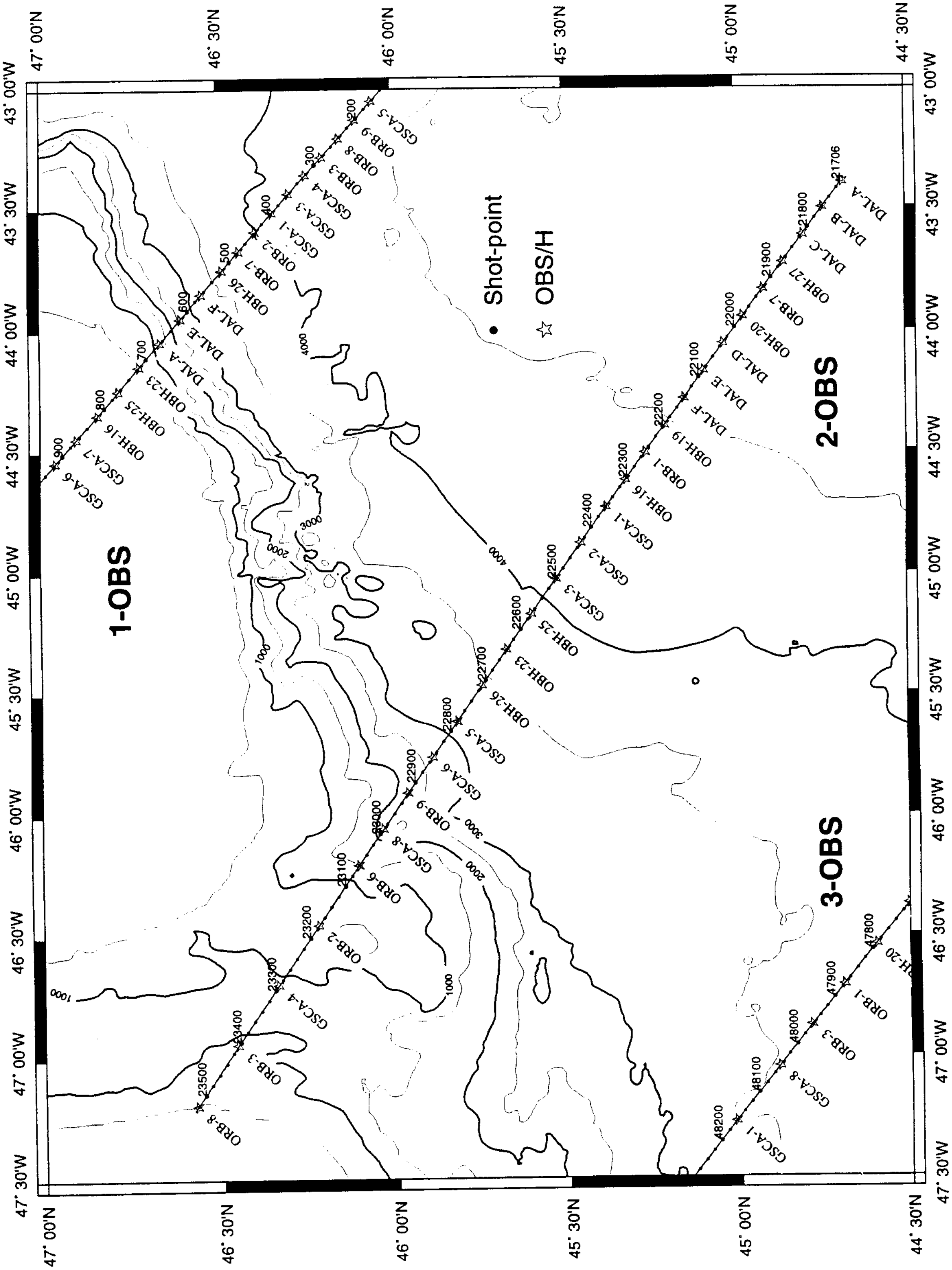


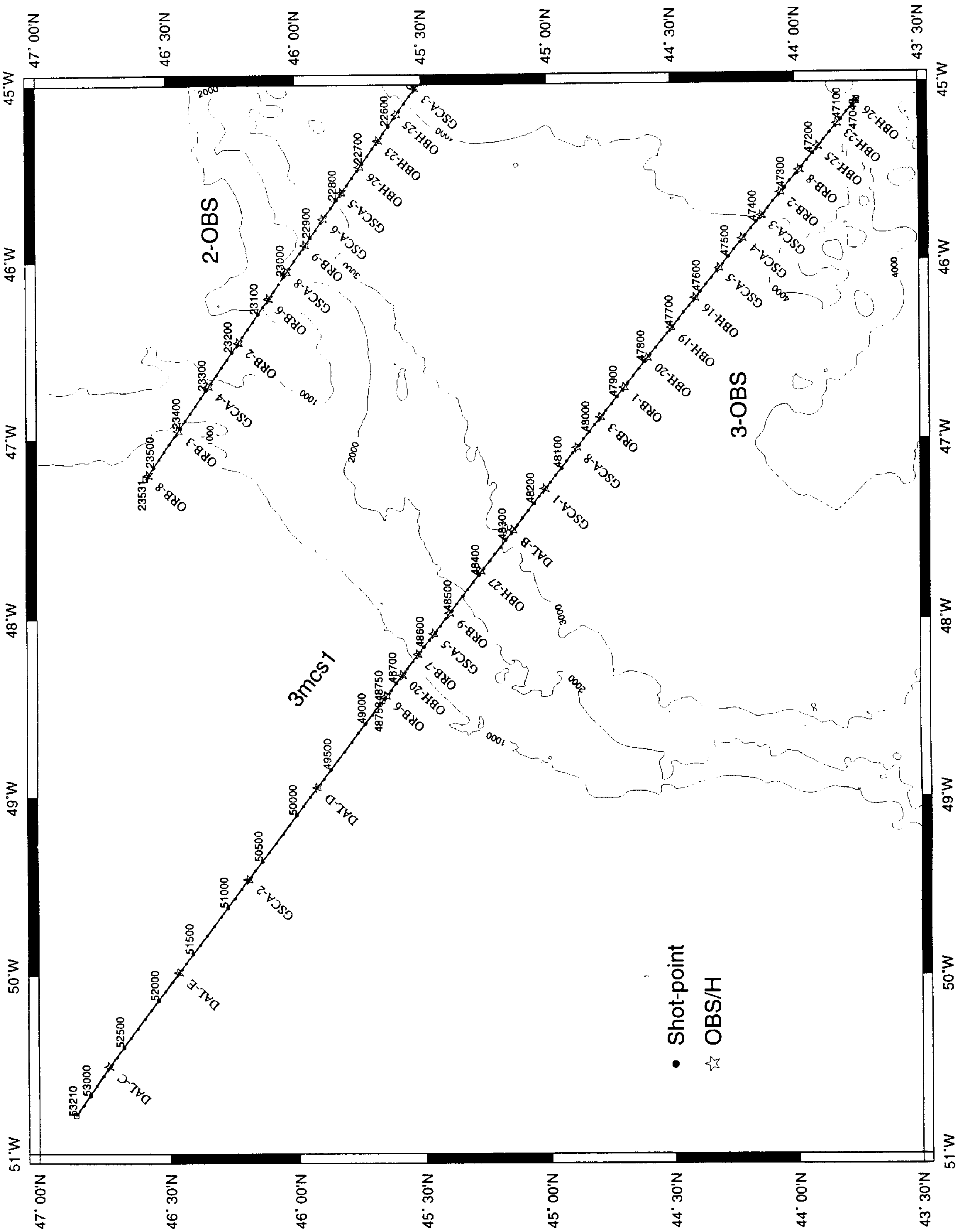
Shot-point
OBS/H
3MCS2
306
305
501
502
44° 30'N
44° 20'N
44° 10'N
44° 00'N
43° 50'N
43° 40'N
43° 30'N
44° 30'W
45° 00'W
45° 30'W
46° 00'W
46° 30'W

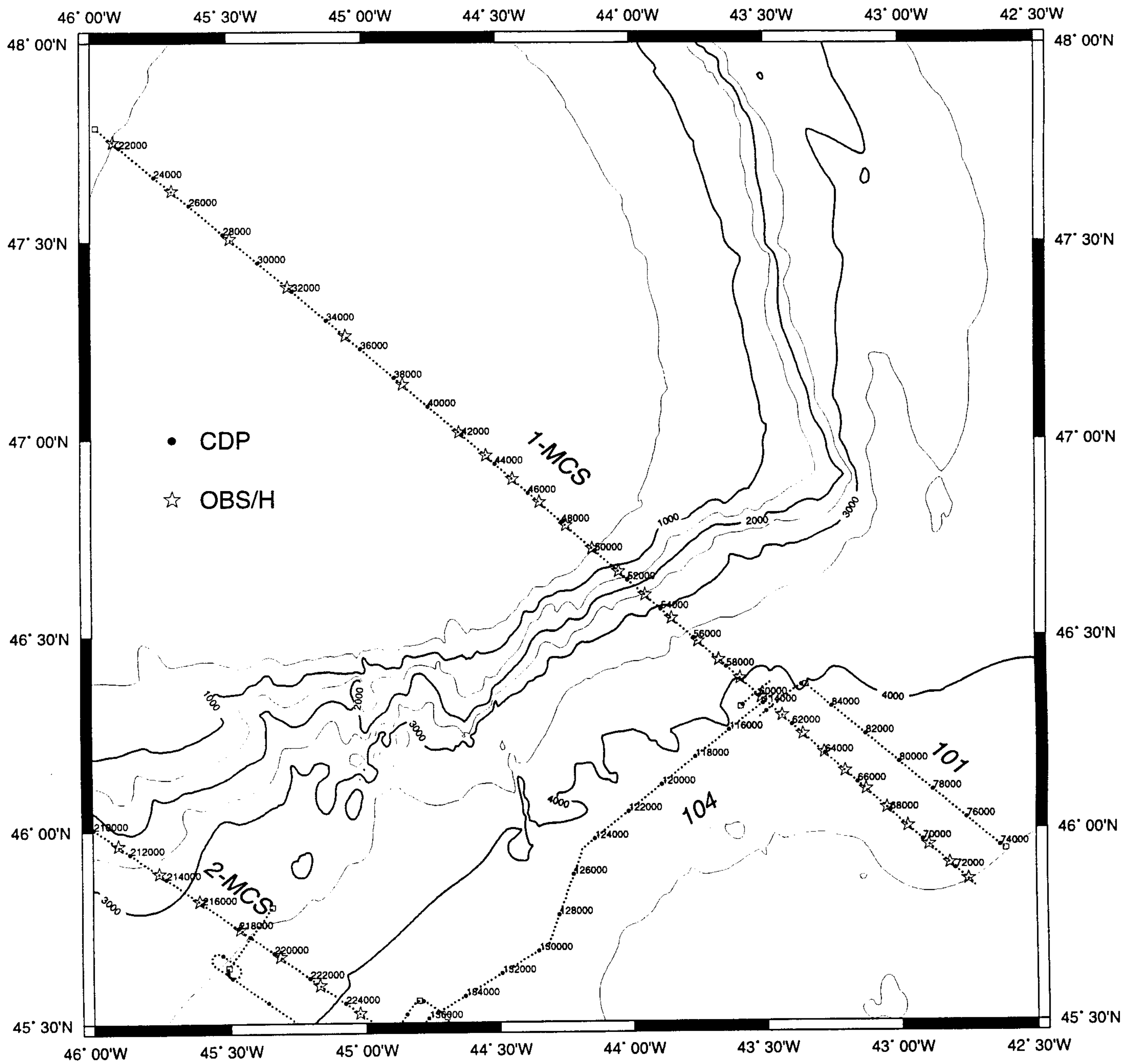


Shot-point
OBS/H
1-OBS
2-OBS
3-OBS
3mcs1
42˚W
43˚W
44˚W
45˚W
46˚W
47˚W
48˚W
49˚W
50˚W
51˚W
43˚N
44˚N
45˚N
46˚N
47˚N
48˚N

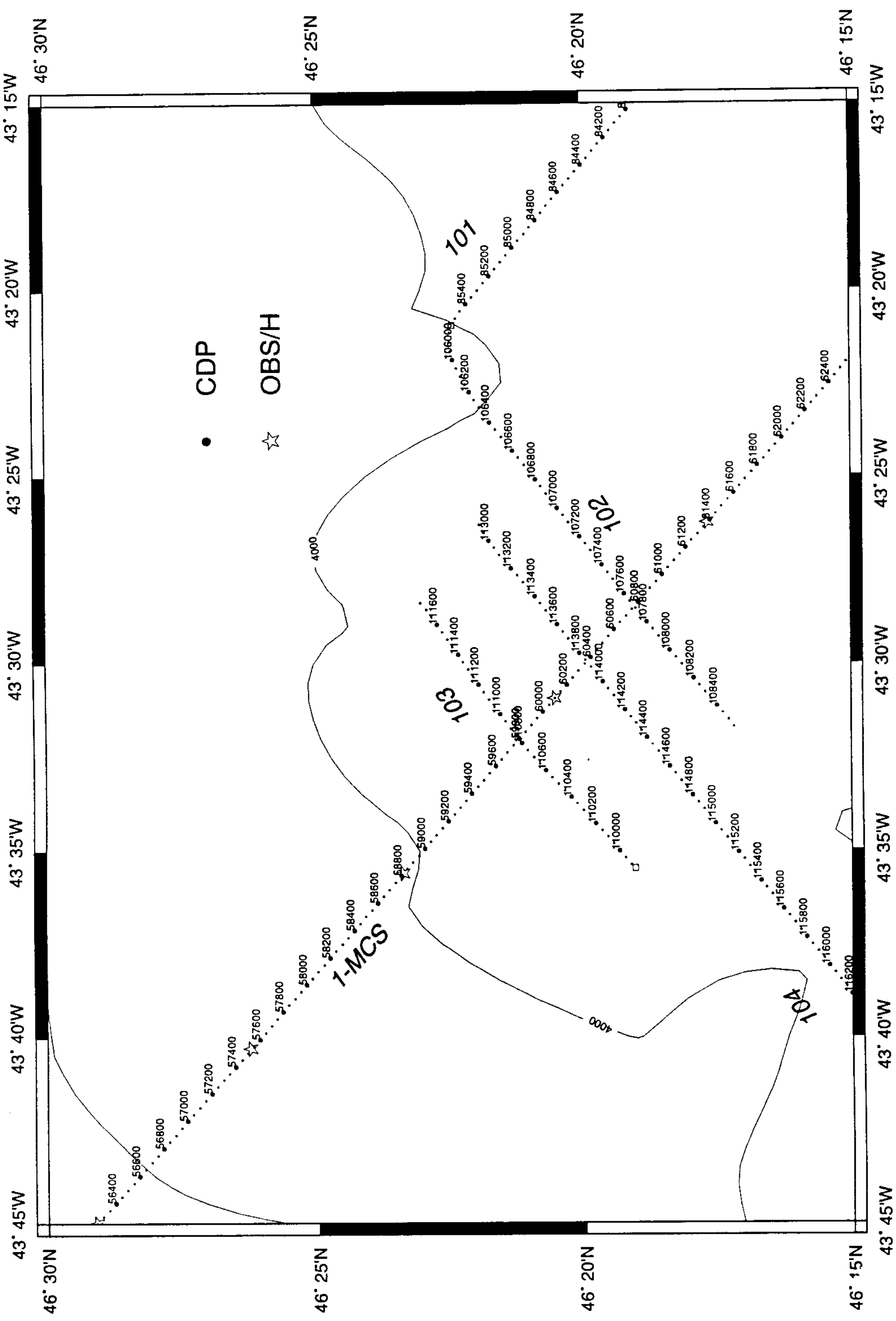

1-OBS
2-OBS
Shot-point
OBS/H
48° 00'N
47° 30'N
47° 00'N
46° 30'N
46° 00'N
45° 30'N
42° 30'W
43° 00'W
43° 30'W
44° 00'W
44° 30'W
45° 00'W
45° 30'W
46° 00'W
46° 30'W
ORB-6
ORB-5
ORB-1
GSCA-8
GSCA-5
ORB-9
ORB-8
ORB-3
GSCA-4
GSCA-3
GSCA-1
ORB-2
ORB-7
OBH-26
DAL-F
DAL-E
DAL-A
OBH-23
OBH-25
OBH-16
GSCA-7
GSCA-6
GSCA-2
OBH-19
OBH-20
OBH-27
DAL-D
DAL-C
DAL-B
GSCA-6
GSCA-5
OBH-26
OBH-23
OBH-25


1-OBS
2-OBS
3-OBS
Shot-point
OBS/H

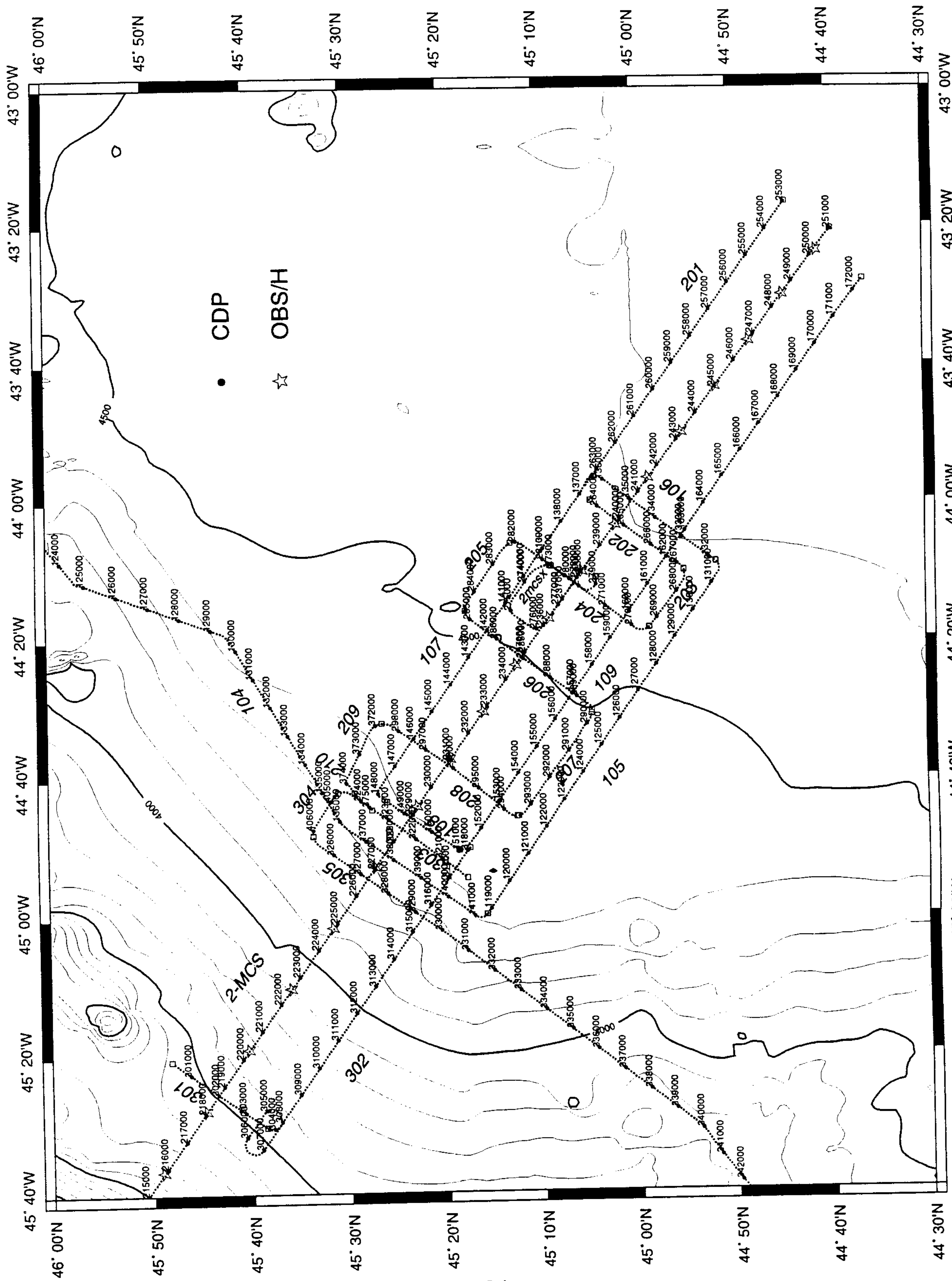

2-OBS
3-OBS
3mcs1
Shot-point
OBS/H

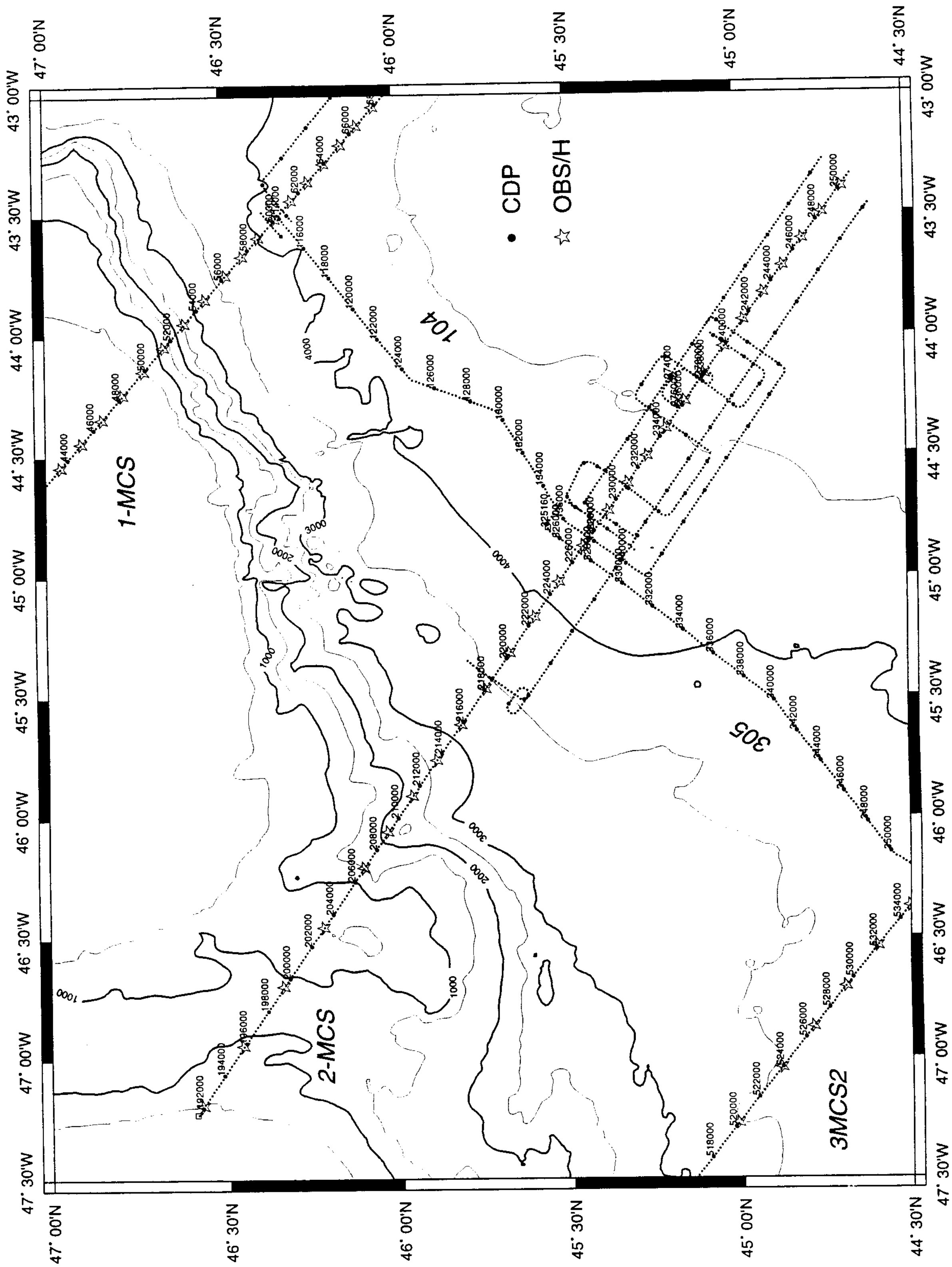


46° 00'W
45° 30'W
45° 00'W
44° 30'W
44° 00'W
43° 30'W
43° 00'W
42° 30'W
48° 00'N
47° 30'N
47° 00'N
46° 30'N
46° 00'N
45° 30'N
• CDP
☆ OBS/H
1-MCS
2-MCS
101
104
1000
2000
3000
4000

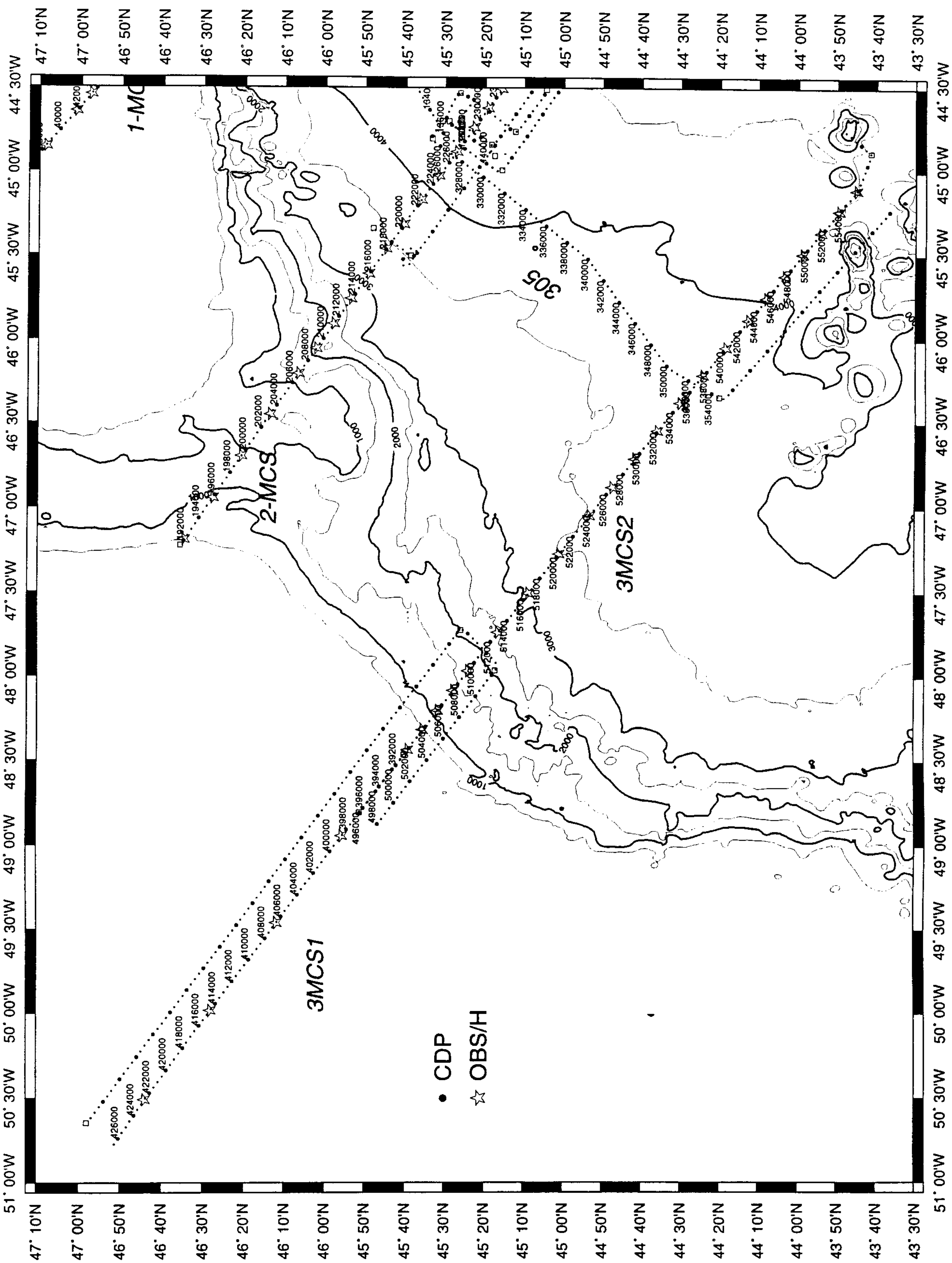


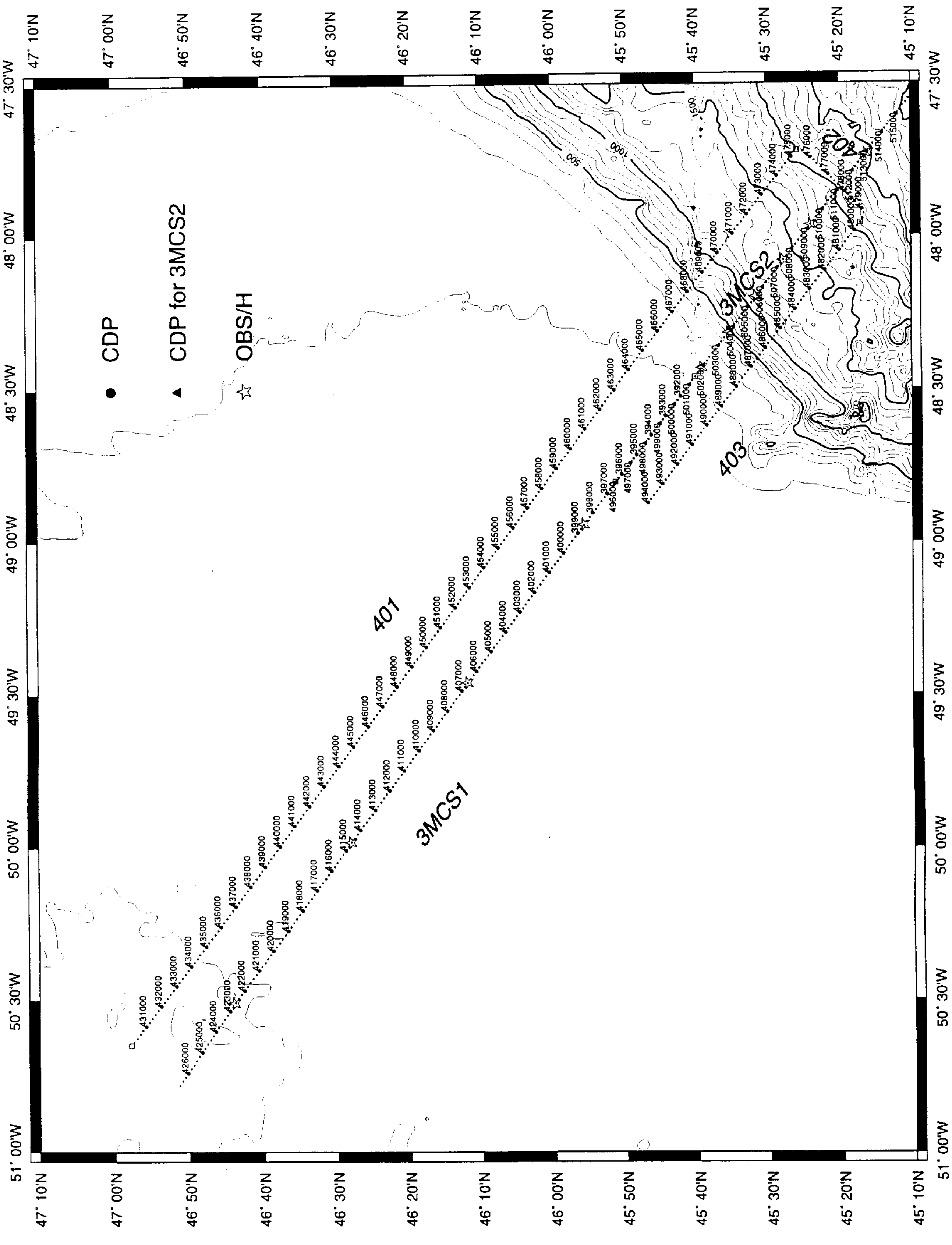
46° 30'N
46° 25'N
46° 20'N
46° 15'N
43° 15'W
43° 20'W
43° 25'W
43° 30'W
43° 35'W
43° 40'W
43° 45'W
CDP
OBS/H
101
102
103
104
1-MCS
4000


CDP
OBS/H
2-MCS

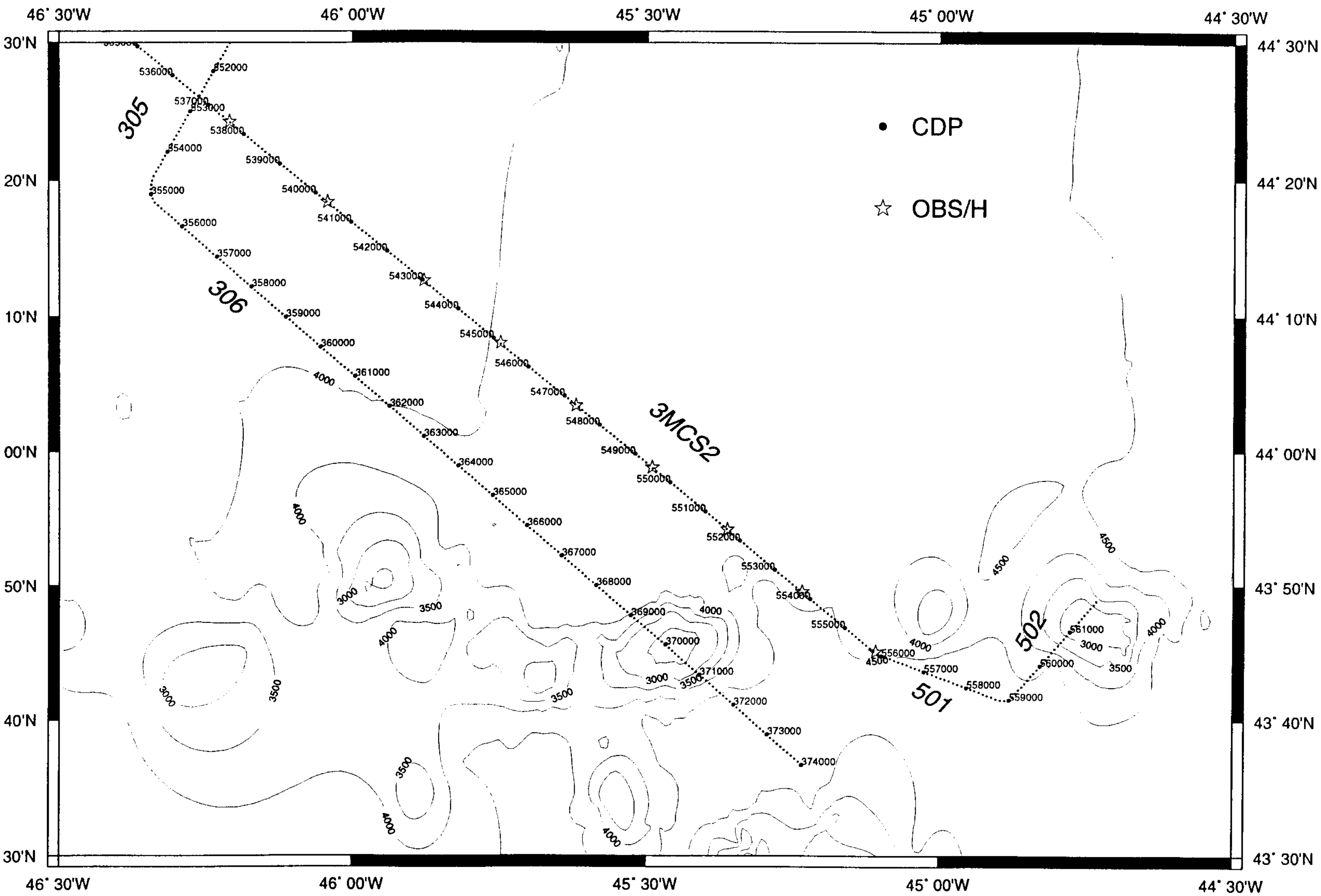


CDP
OBS/H
1-MCS
2-MCS
3MCS2
104
305
47° 00'N
46° 30'N
46° 00'N
45° 30'N
45° 00'N
44° 30'N
43° 00'W
43° 30'W
44° 00'W
44° 30'W
45° 00'W
45° 30'W
46° 00'W
46° 30'W
47° 00'W
47° 30'W
1000
2000
3000
4000


3MCS1
3MCS2
2-MCS
1-MC
305
CDP
OBS/H
51° 00'W
50° 30'W
50° 00'W
49° 30'W
49° 00'W
48° 30'W
48° 00'W
47° 30'W
47° 00'W
46° 30'W
46° 00'W
45° 30'W
45° 00'W
44° 30'W
47° 10'N
47° 00'N
46° 50'N
46° 40'N
46° 30'N
46° 20'N
46° 10'N
46° 00'N
45° 50'N
45° 40'N
45° 30'N
45° 20'N
45° 10'N
45° 00'N
44° 50'N
44° 40'N
44° 30'N
44° 20'N
44° 10'N
44° 00'N
43° 50'N
43° 40'N
43° 30'N

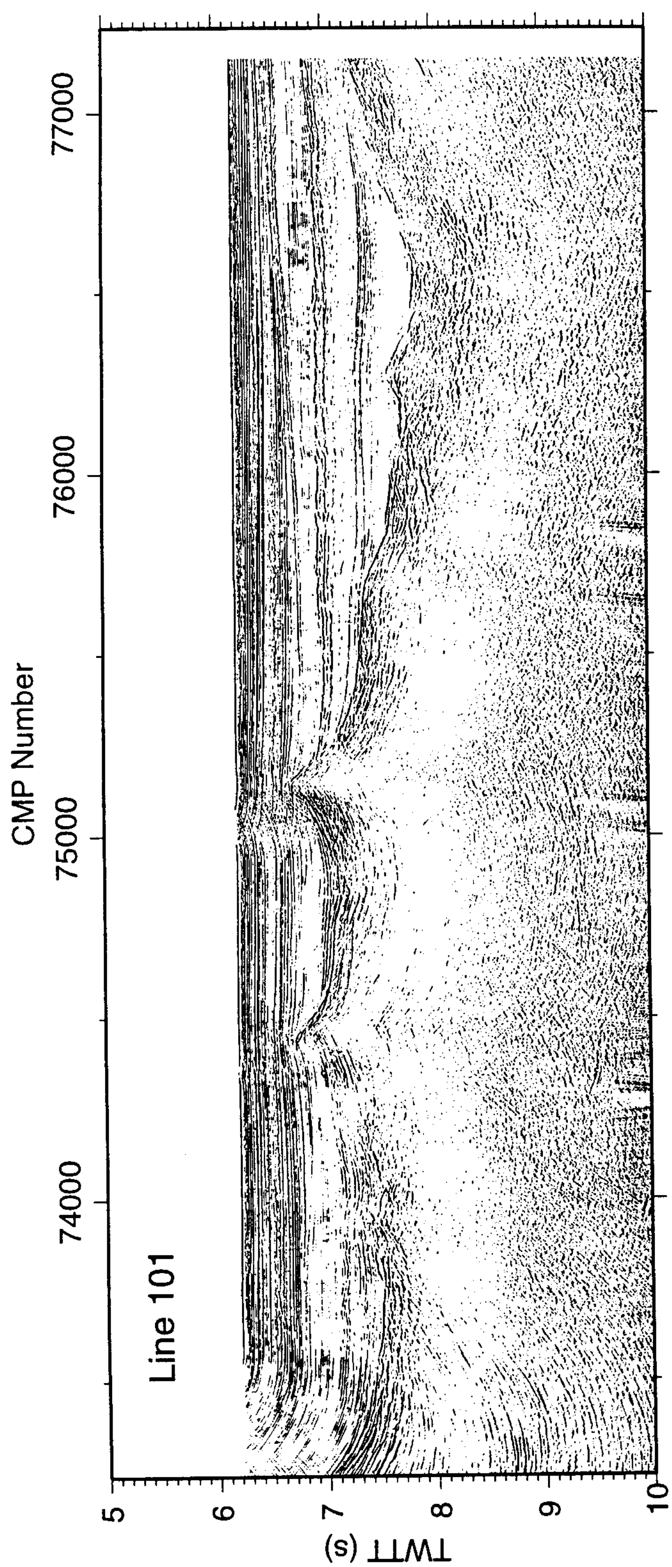


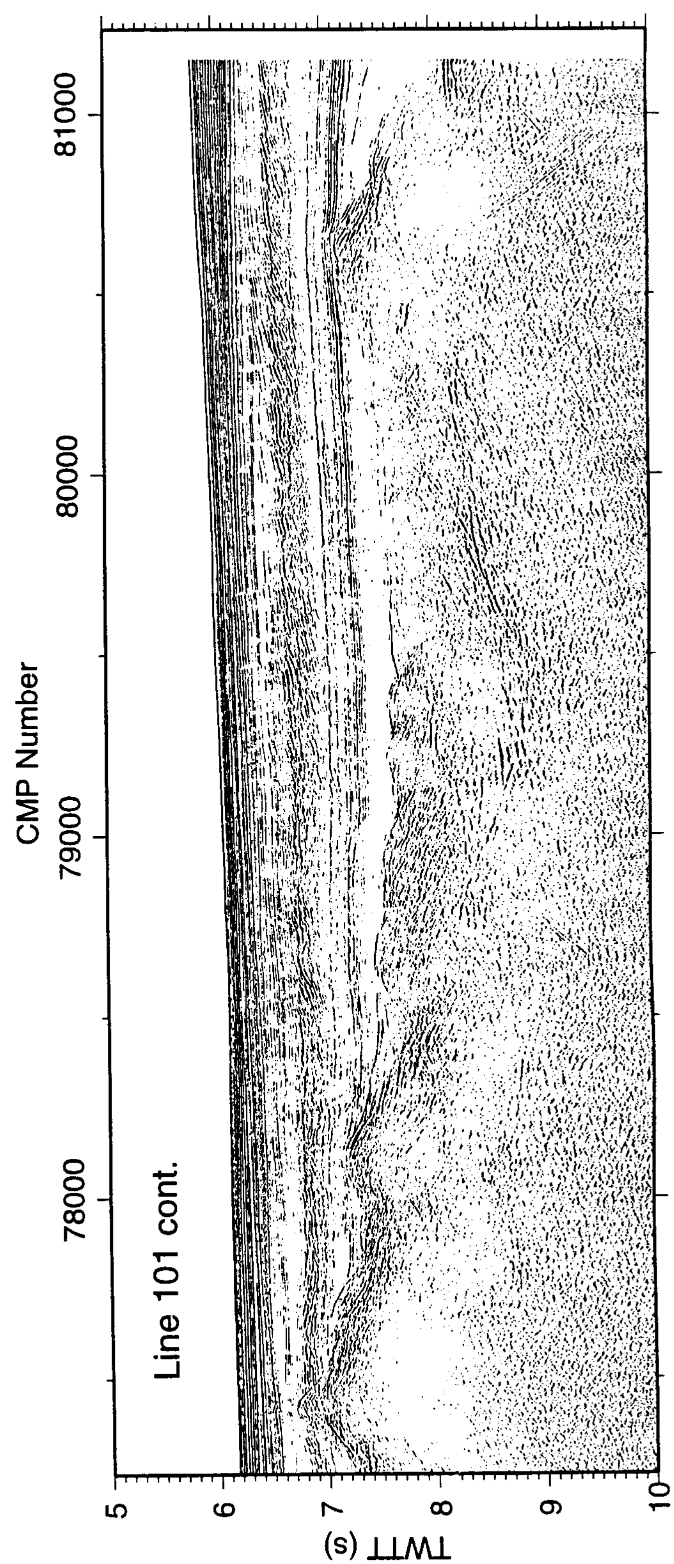
CDP
CDP for 3MCS2
OBS/H
401
402
403
3MCS1
3MCS2
500
1000
1500
47° 30'W
48° 00'W
48° 30'W
49° 00'W
49° 30'W
50° 00'W
50° 30'W
51° 00'W
47° 10'N
47° 00'N
46° 50'N
46° 40'N
46° 30'N
46° 20'N
46° 10'N
46° 00'N
45° 50'N
45° 40'N
45° 30'N
45° 20'N
45° 10'N

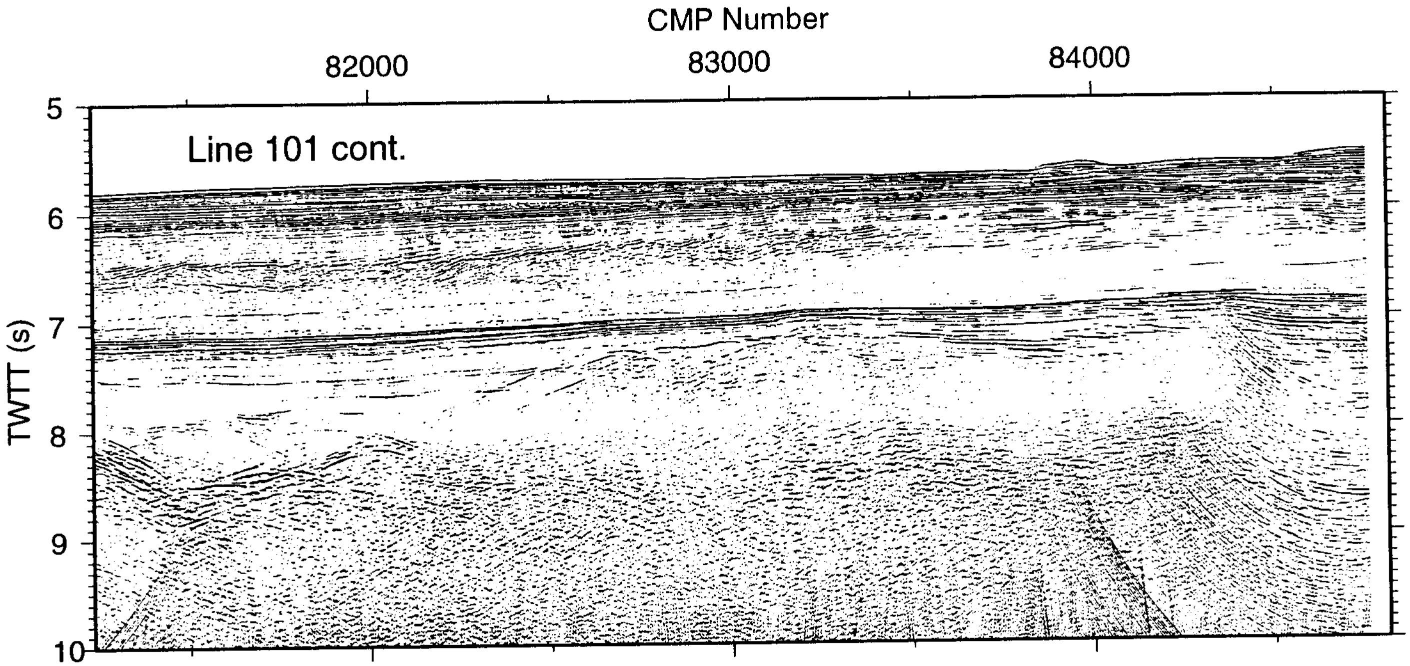

CDP
OBS/H
3MCS2
305
306
501
502
46° 30'W
46° 00'W
45° 30'W
45° 00'W
44° 30'W
44° 30'N
44° 20'N
44° 10'N
44° 00'N
43° 50'N
43° 40'N
43° 30'N

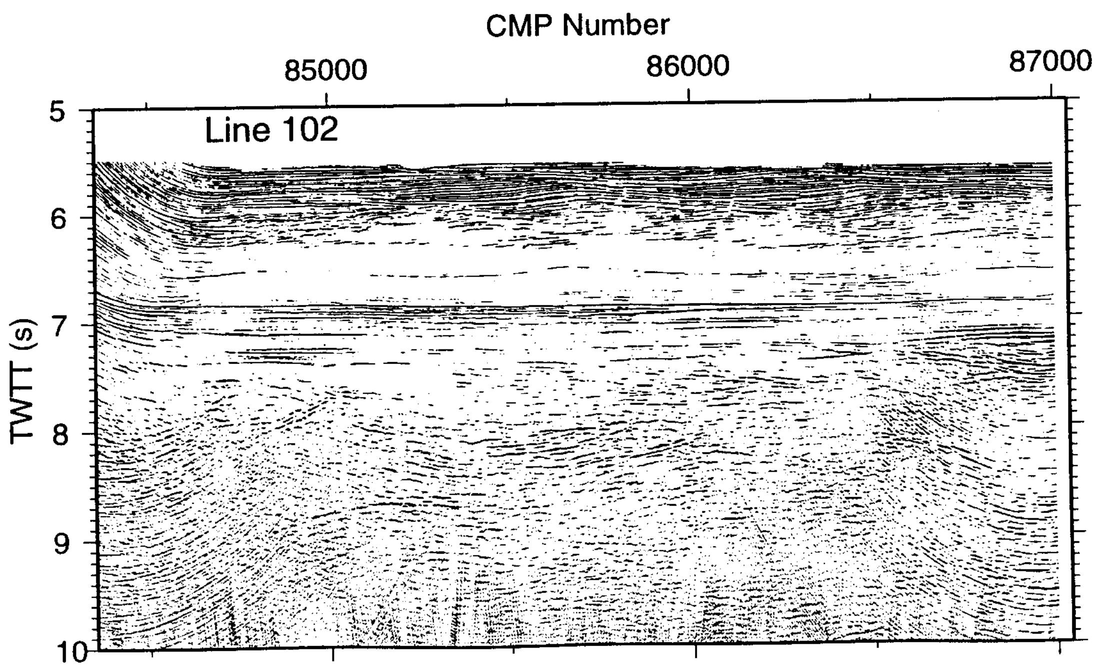
Appendix 8: Stacks of MCS Data

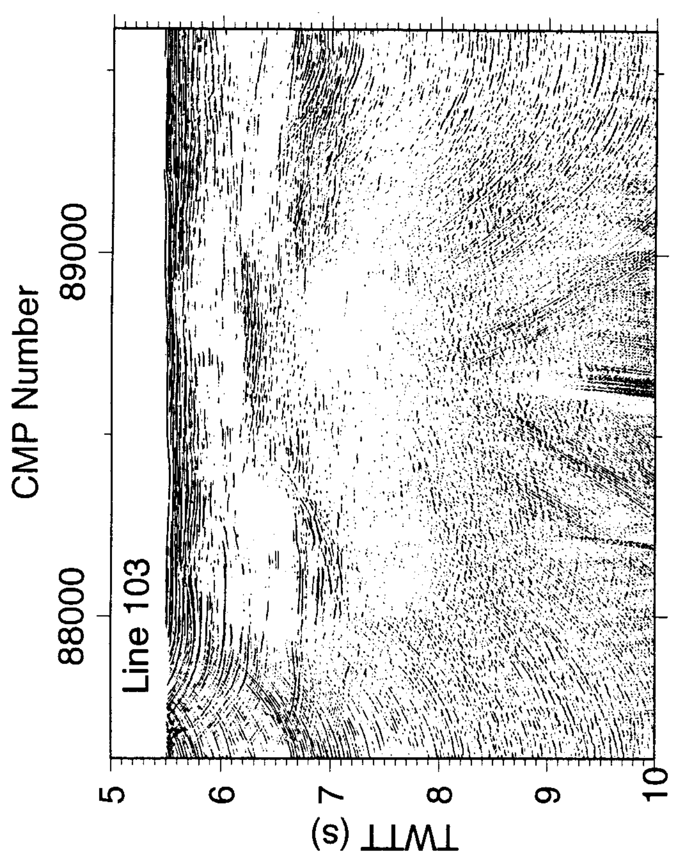
The following pages show plots of migrated stacks of all lines acquired during EW-0007. Stacks are shown in short sections, so as to display details of the stratigraphy and basement character. Most of the lines shown are migrated brute stacks. For lines 107, 109, 201, 202, 204, 204b, 206, 208, and 2mcs, migrated re-stacks (with velocities re-picked at ~1 km intervals) are shown. All migrations are simple FK migrations with water velocity.


Line 101
CMP Number
74000
75000
76000
77000
TWTT (s)
5
6
7
8
9
10

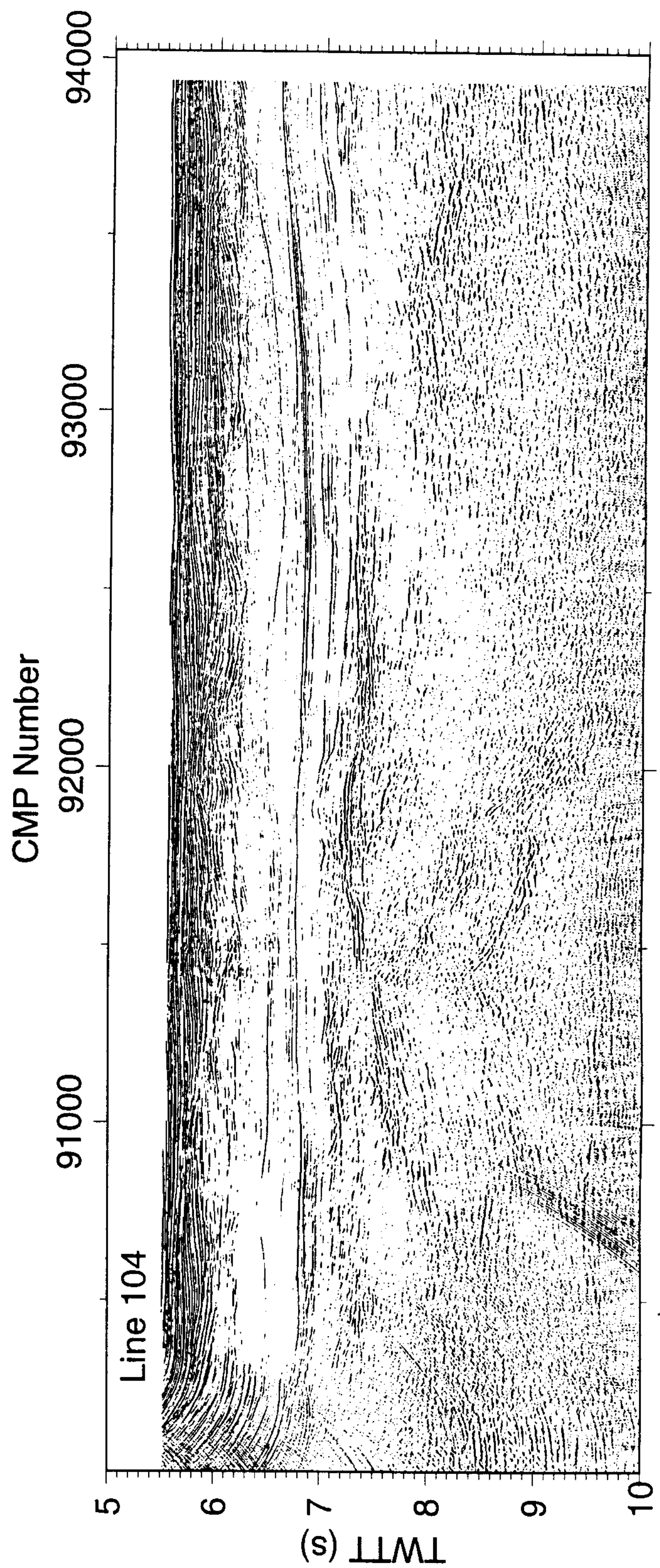

Line 101 cont.
CMP Number
78000
79000
80000
81000
TWTT (s)
5
6
7
8
9
10


CMP Number
82000
83000
84000
TWTT (s)
5
6
7
8
9
10
Line 101 cont.

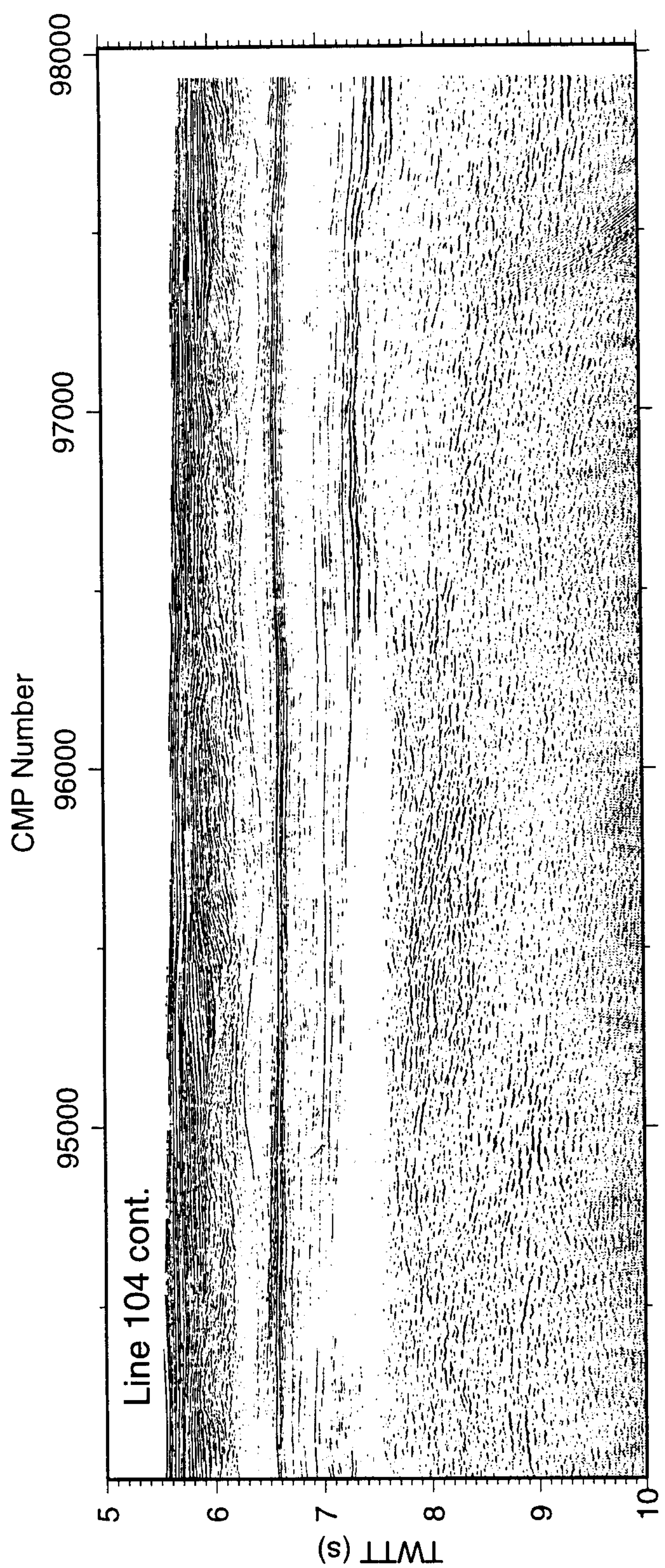

CMP Number
85000
86000
87000
TWTT (s)
5
6
7
8
9
10
Line 102

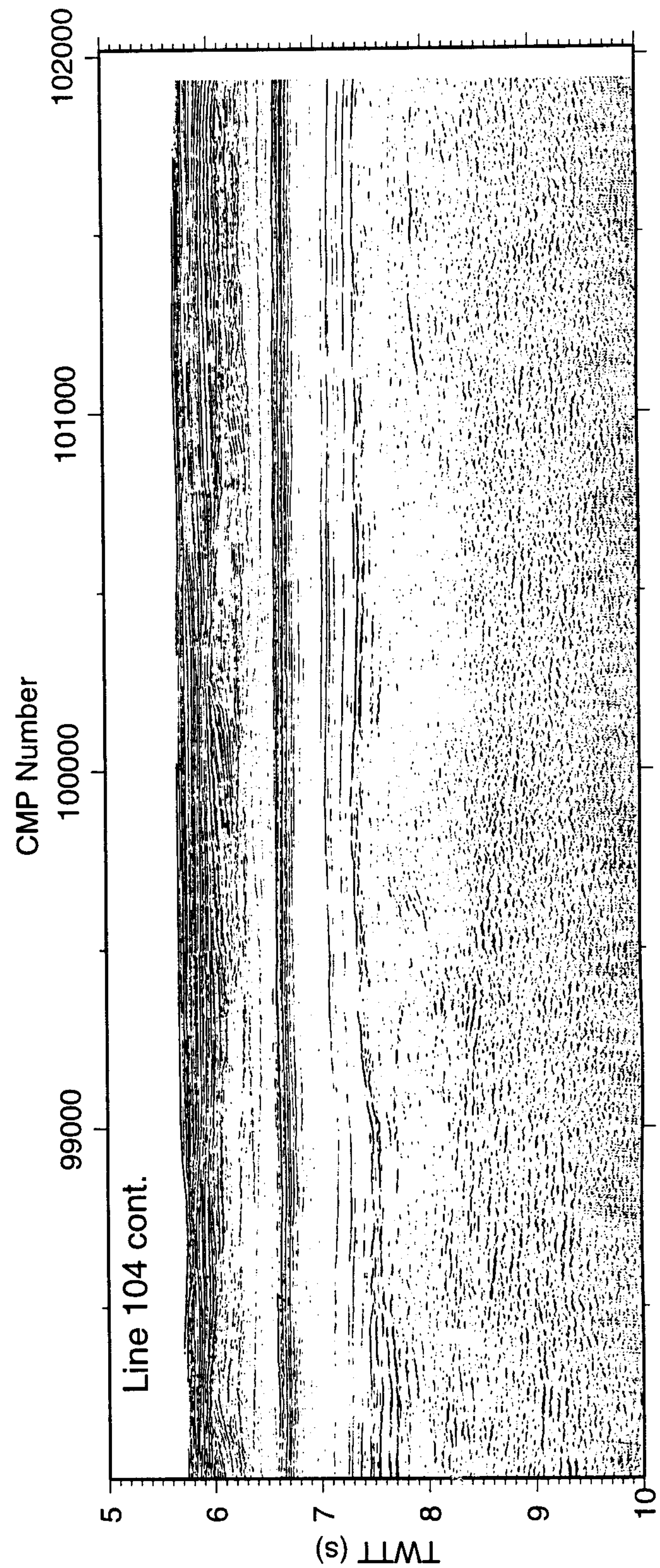


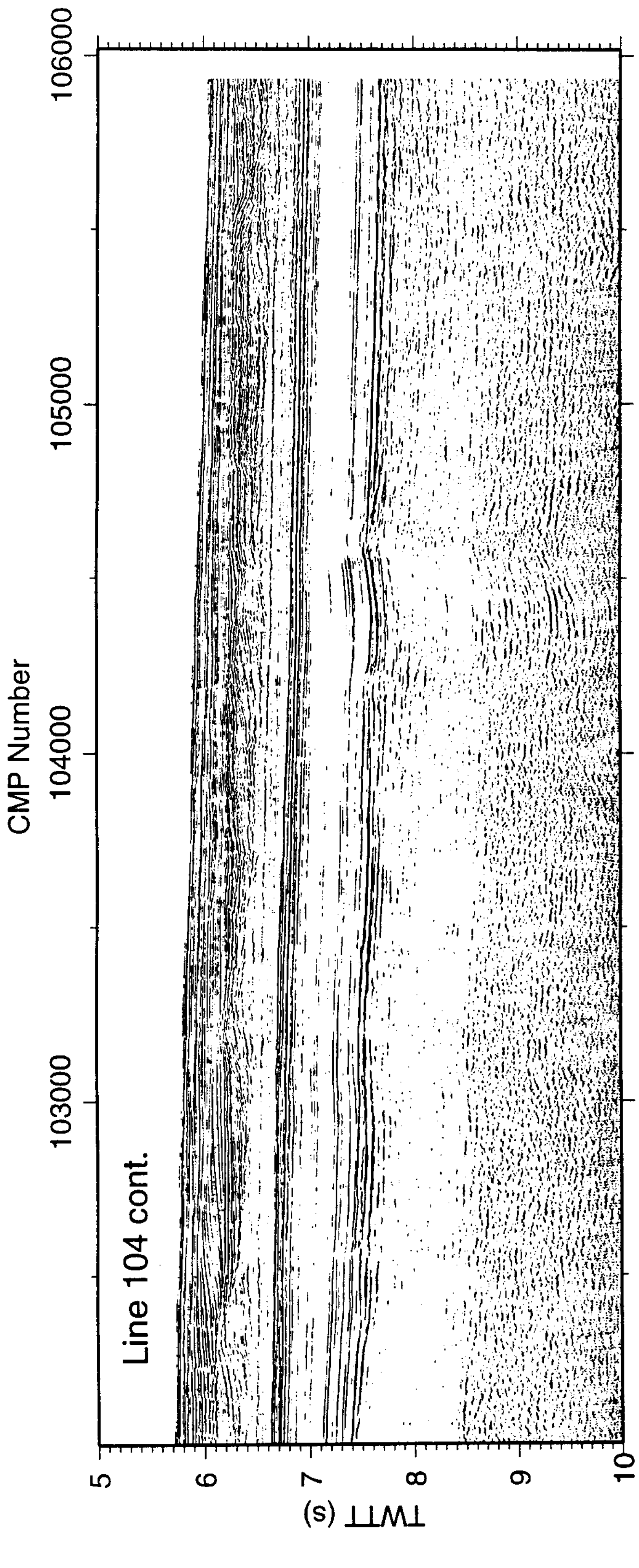
CMP Number
88000
89000
Line 103
TWTT (s)
5
6
7
8
9
10

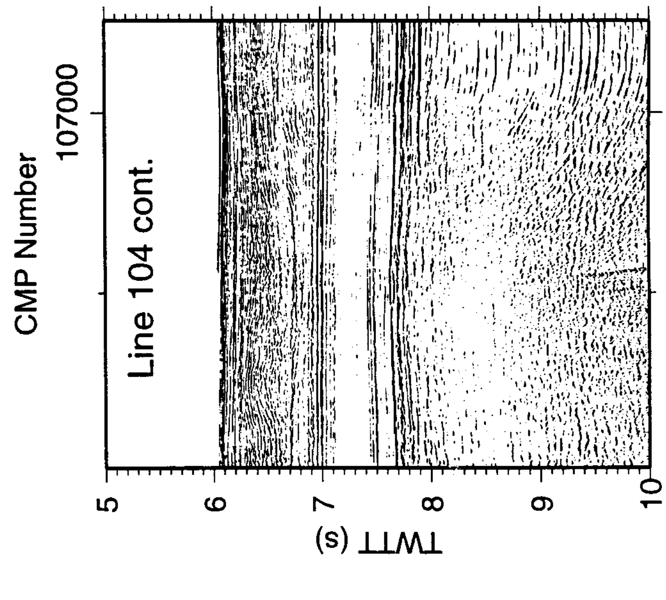


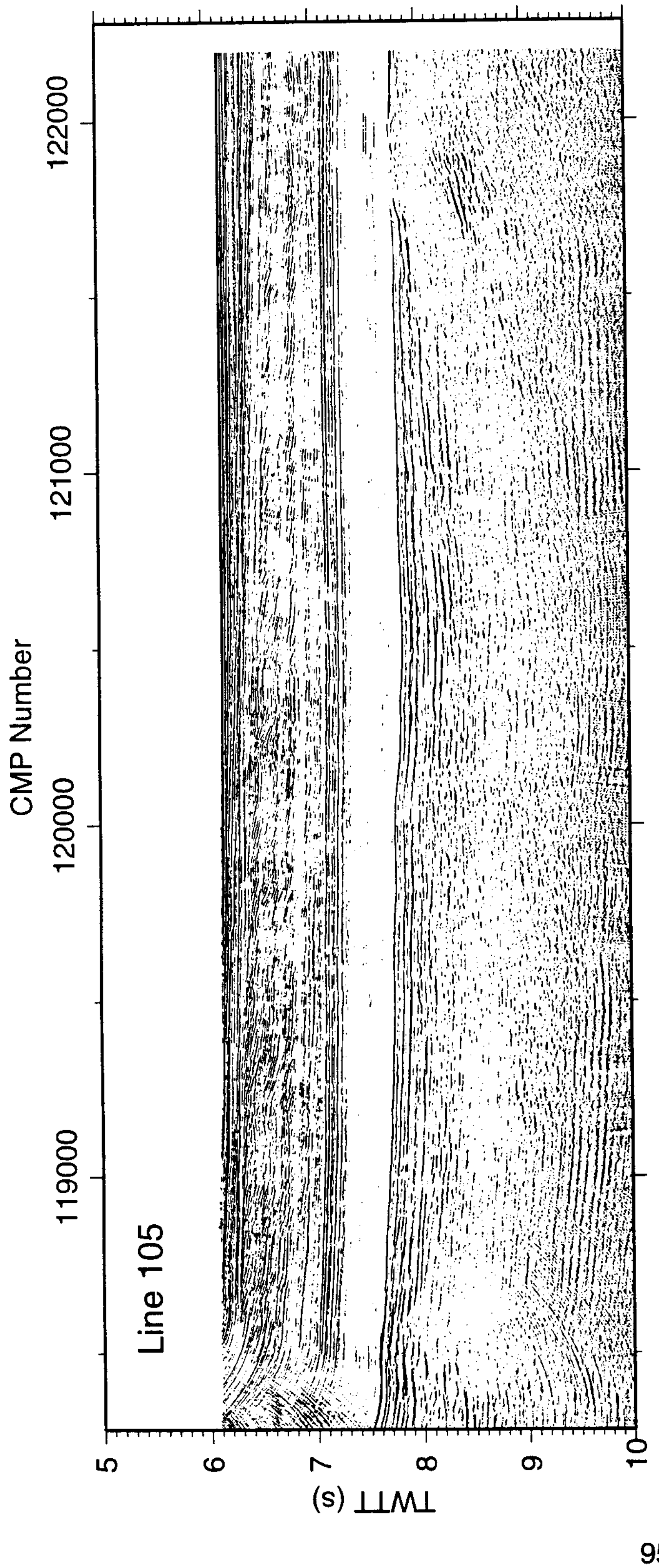
CMP Number
91000
92000
93000
94000
Line 104
TWTT (s)
5
6
7
8
9
10


Line 104 cont.
CMP Number
95000
96000
97000
98000
TWTT (s)
5
6
7
8
9
10

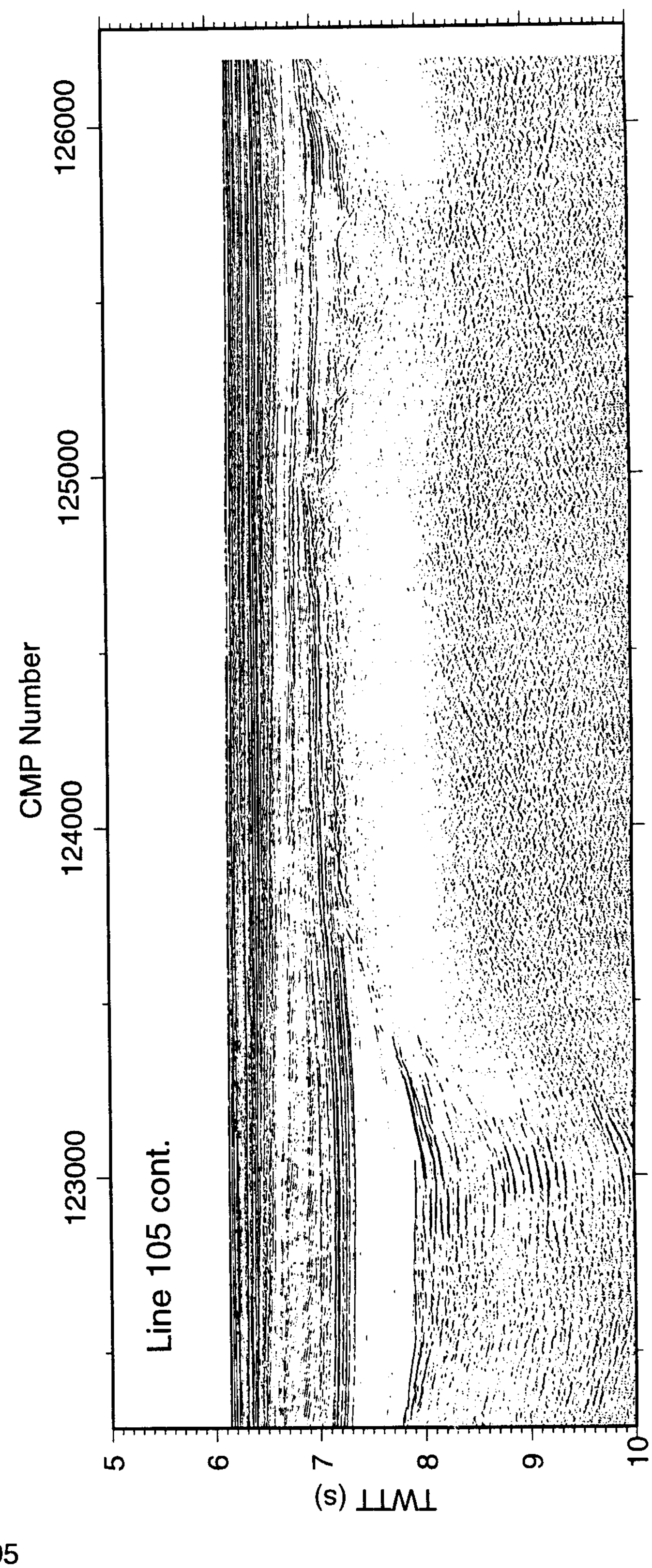

Line 104 cont.
CMP Number
99000
100000
101000
102000
TWTT (s)
5
6
7
8
9
10


Line 104 cont.
CMP Number
103000
104000
105000
106000
TWTT (s)
5
6
7
8
9
10

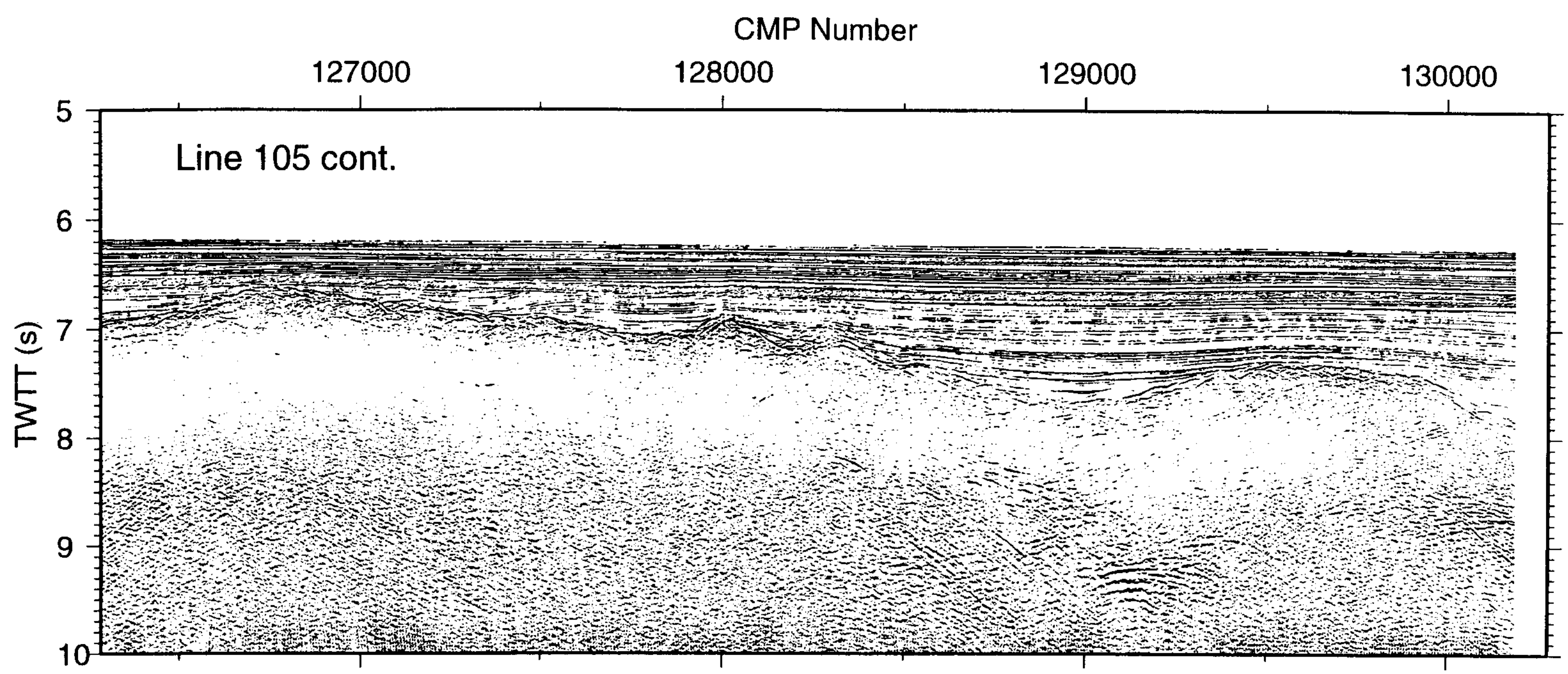

Line 104 cont.
CMP Number
107000
TWTT (s)
5
6
7
8
9
10

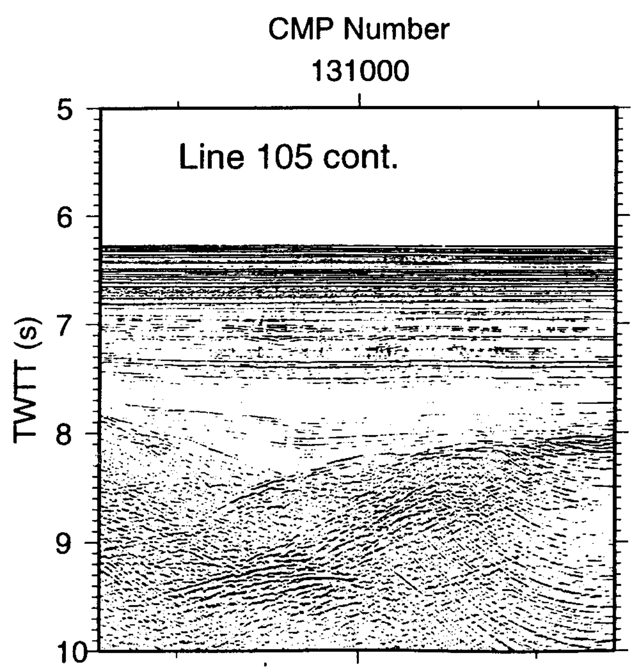


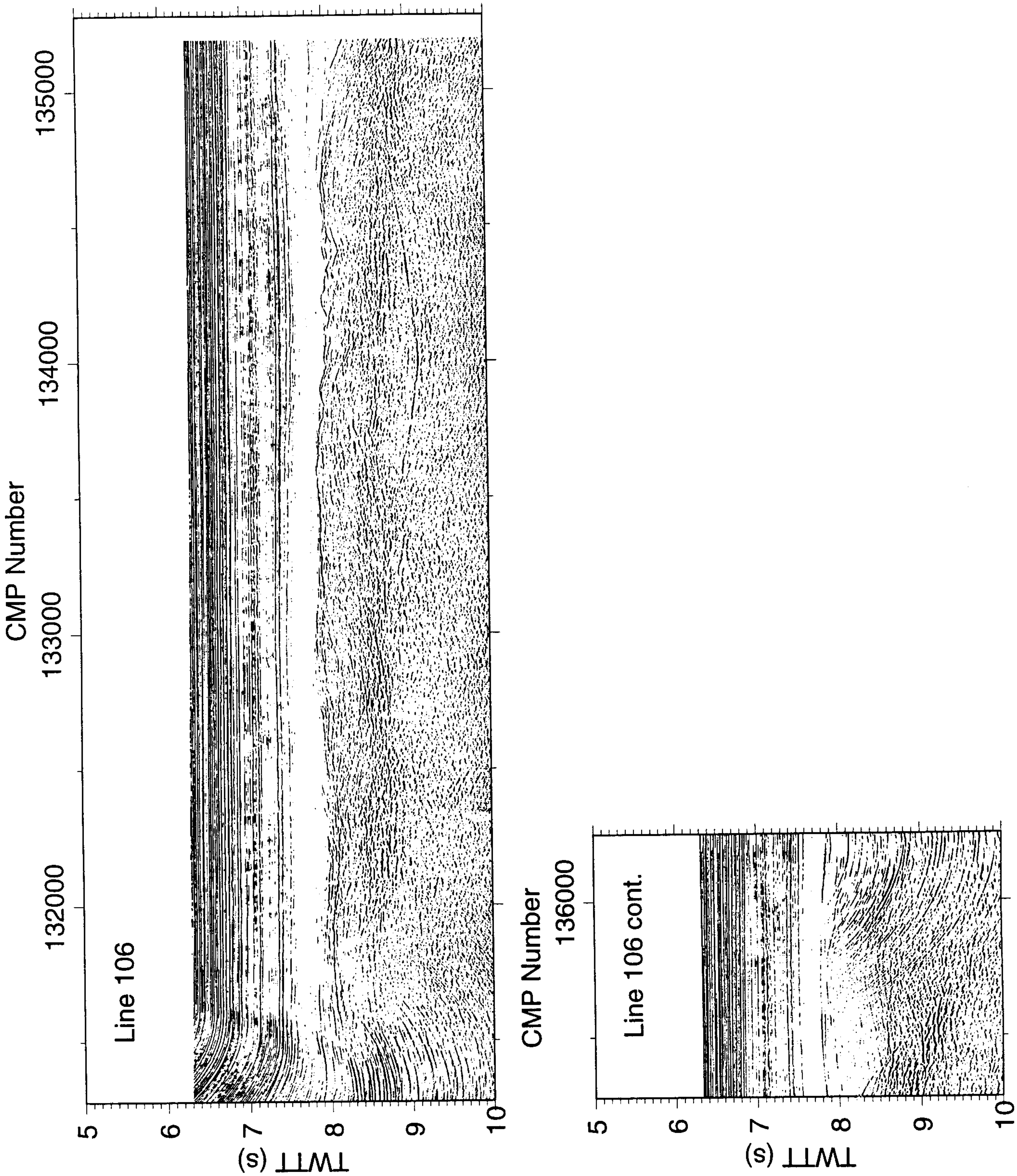
Line 105
CMP Number
119000
120000
121000
122000
TWTT (s)
5
6
7
8
9
10



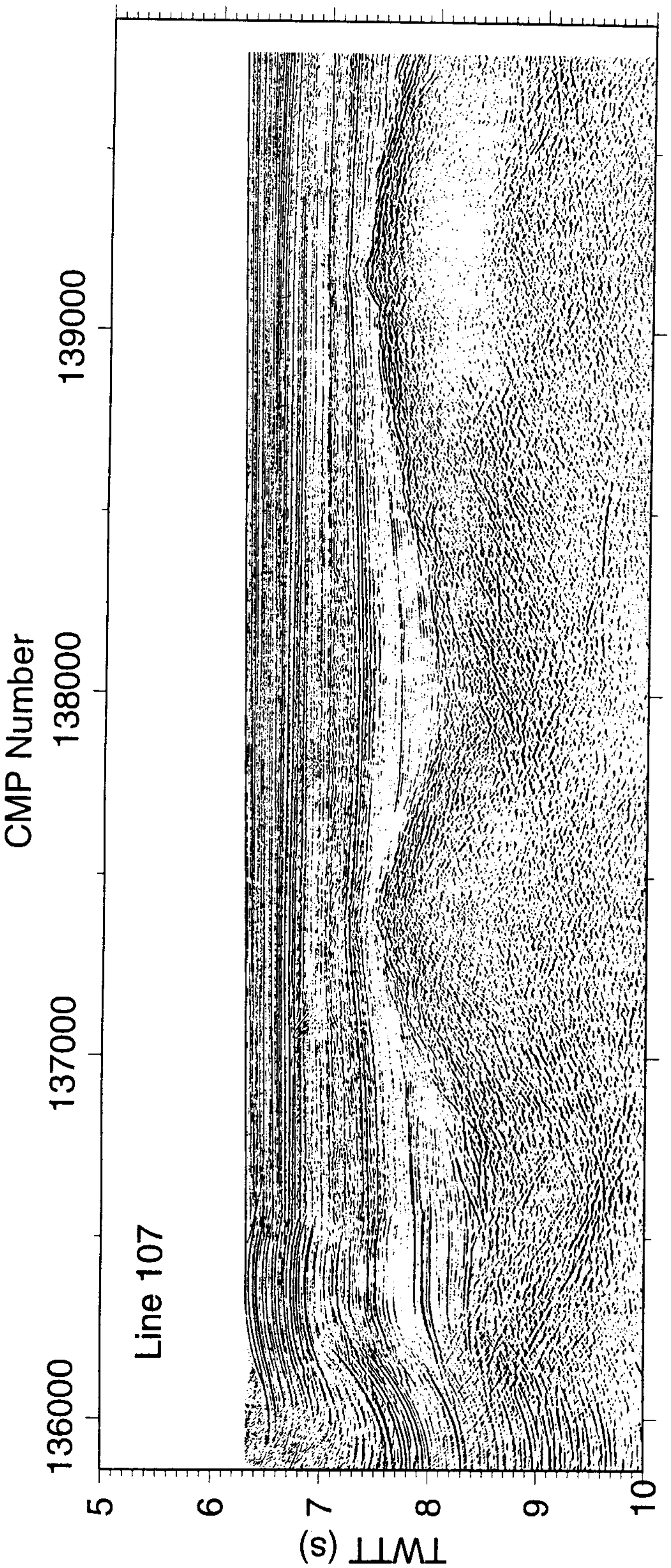
Line 105 cont.
CMP Number
123000
124000
125000
126000
TWTT (s)
5
6
7
8
9
10

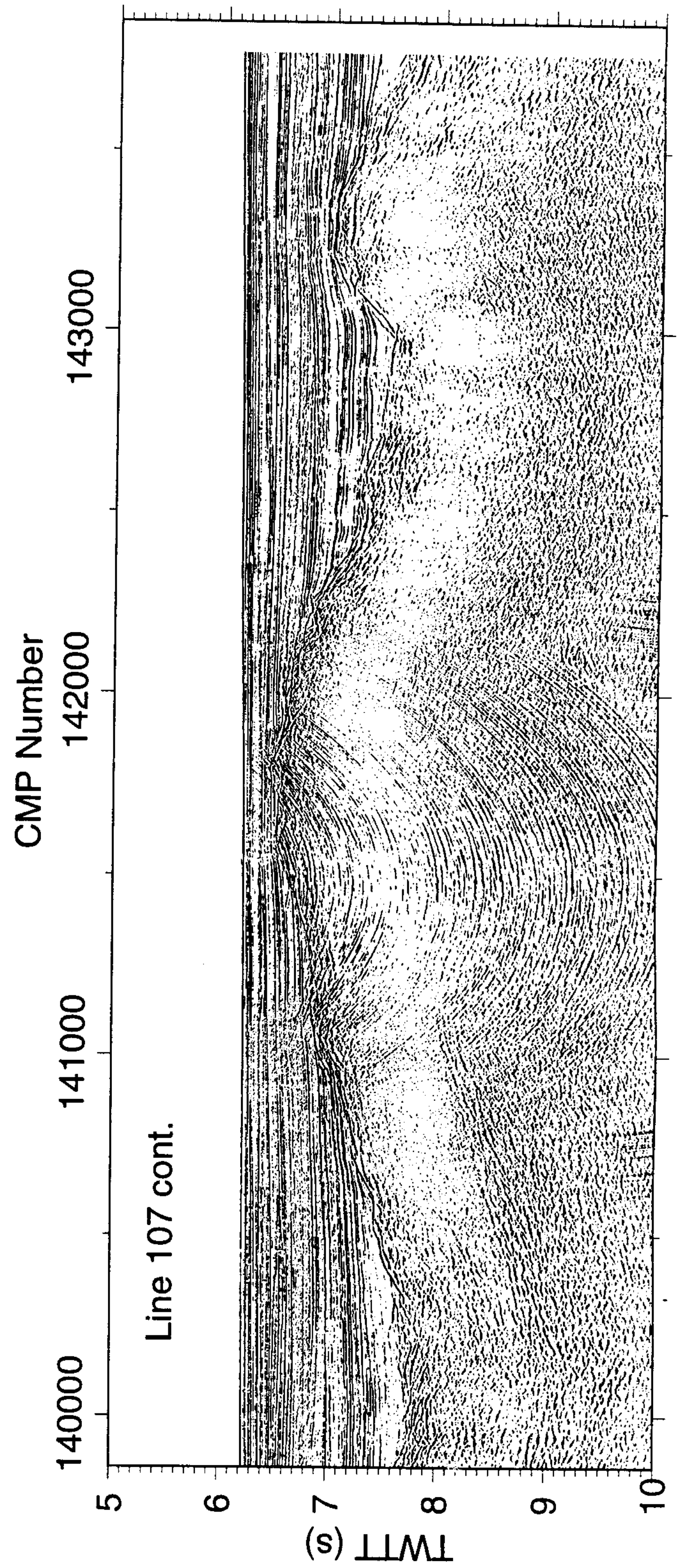

CMP Number
127000
128000
129000
130000
5
6
7
8
9
10
TWTT (s)
Line 105 cont.

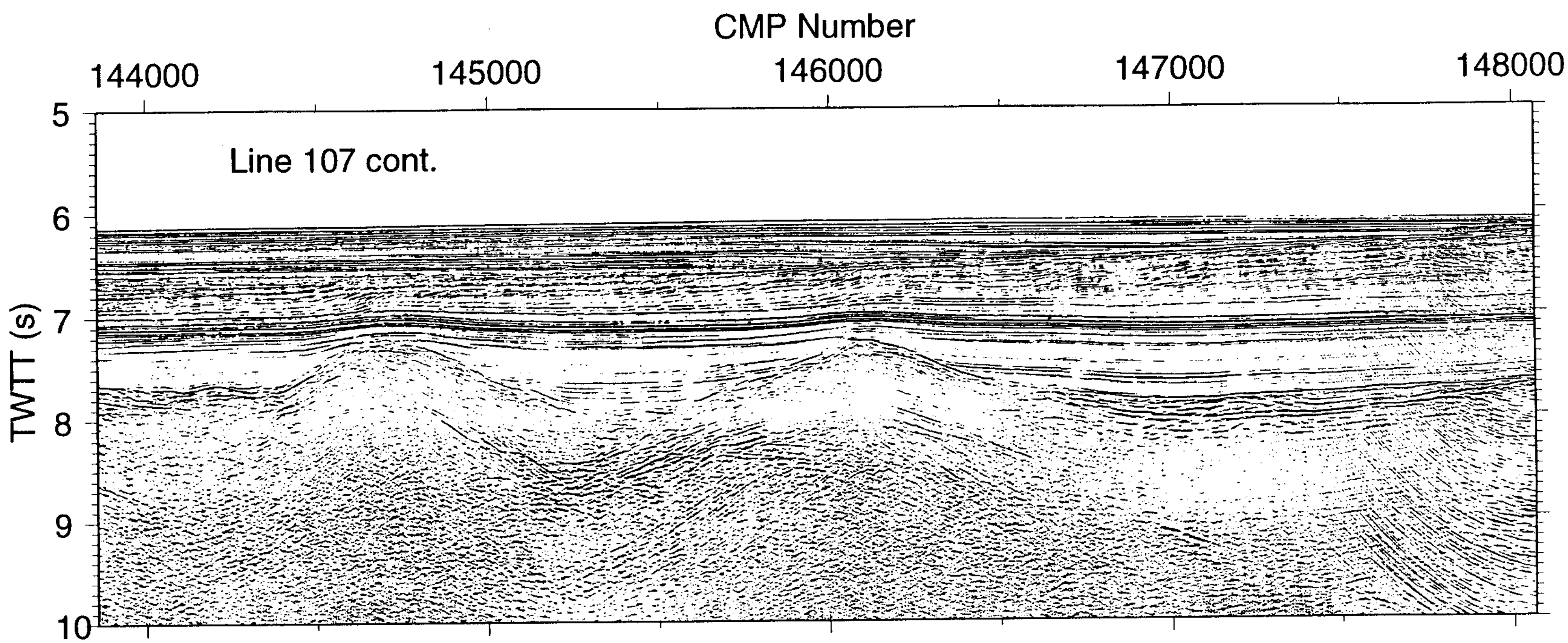

CMP Number
131000
5
6
7
8
9
10
TWTT (s)
Line 105 cont.



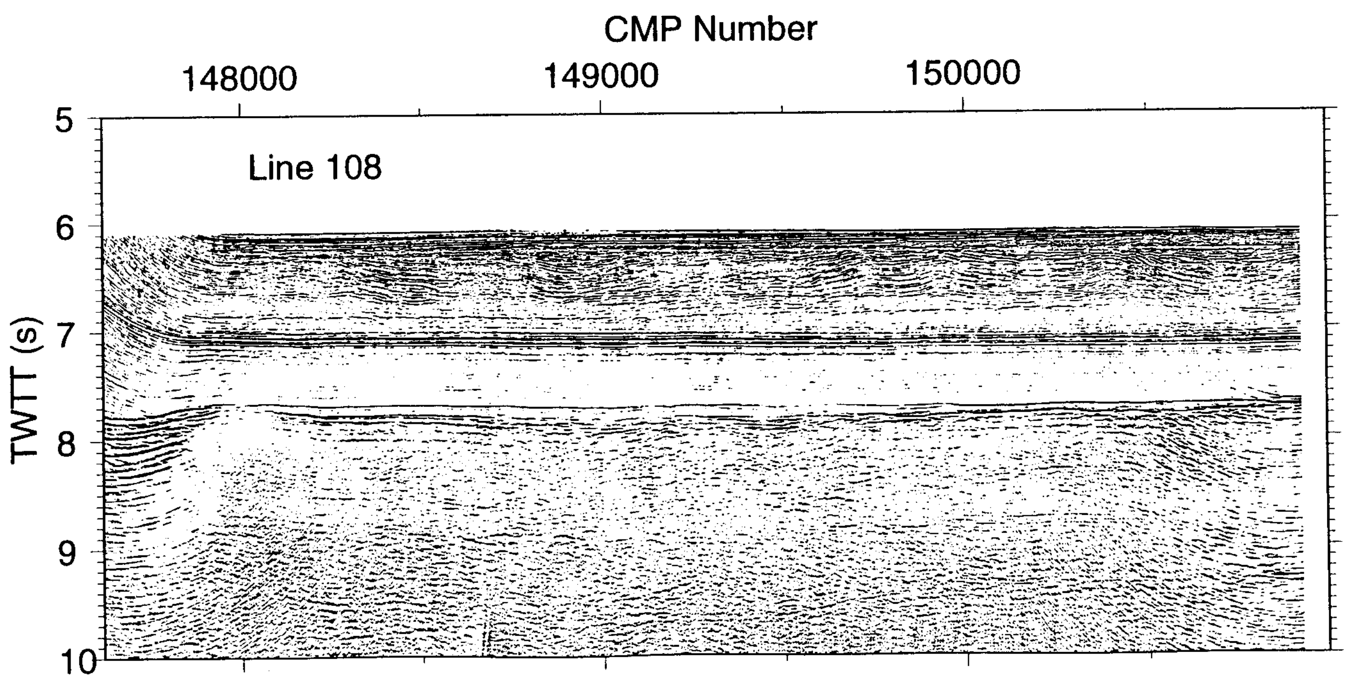
CMP Number
132000
133000
134000
135000
Line 106
TWTT (s)
5
6
7
8
9
10
CMP Number
136000
Line 106 cont.
TWTT (s)
5
6
7
8
9
10


CMP Number
136000
137000
138000
139000
Line 107
TWTT (s)
5
6
7
8
9
10

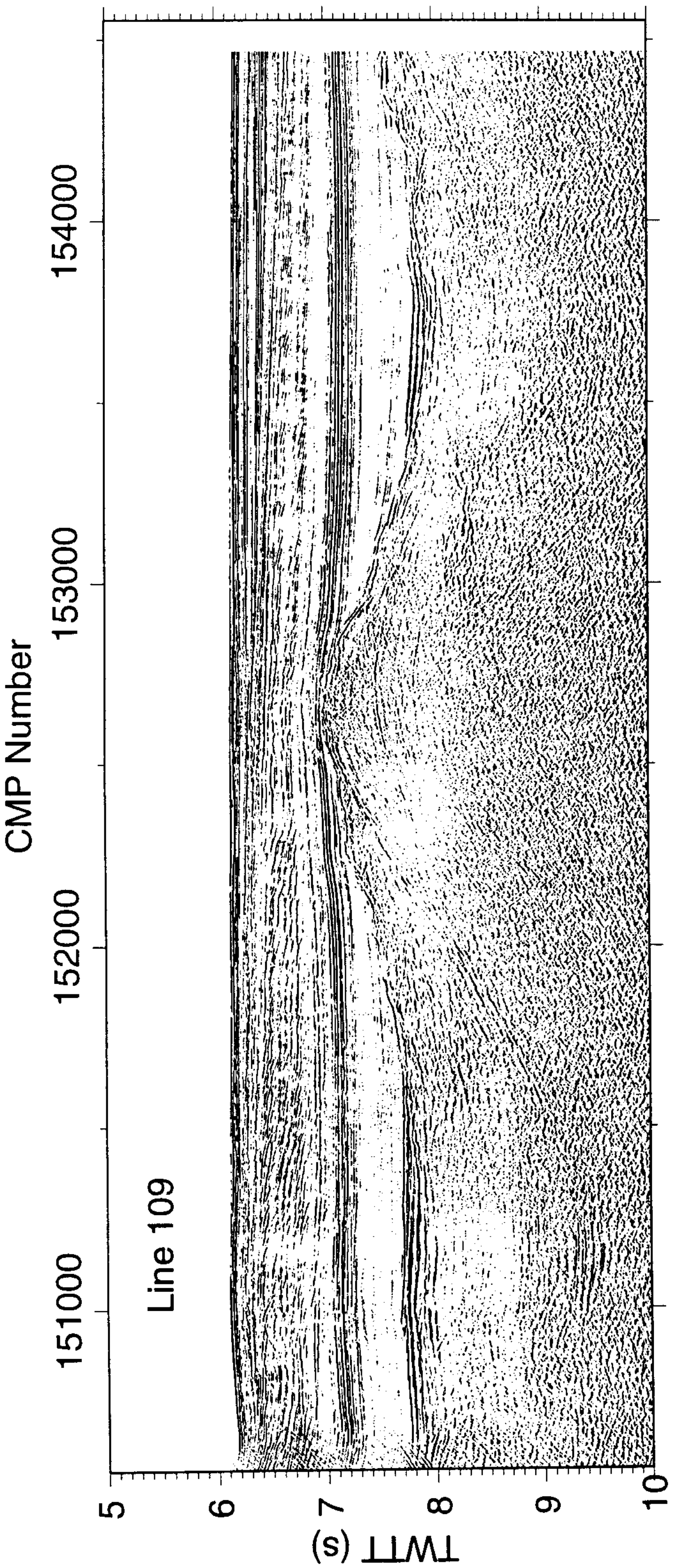

CMP Number
140000
141000
142000
143000
Line 107 cont.
TWTT (s)
5
6
7
8
9
10

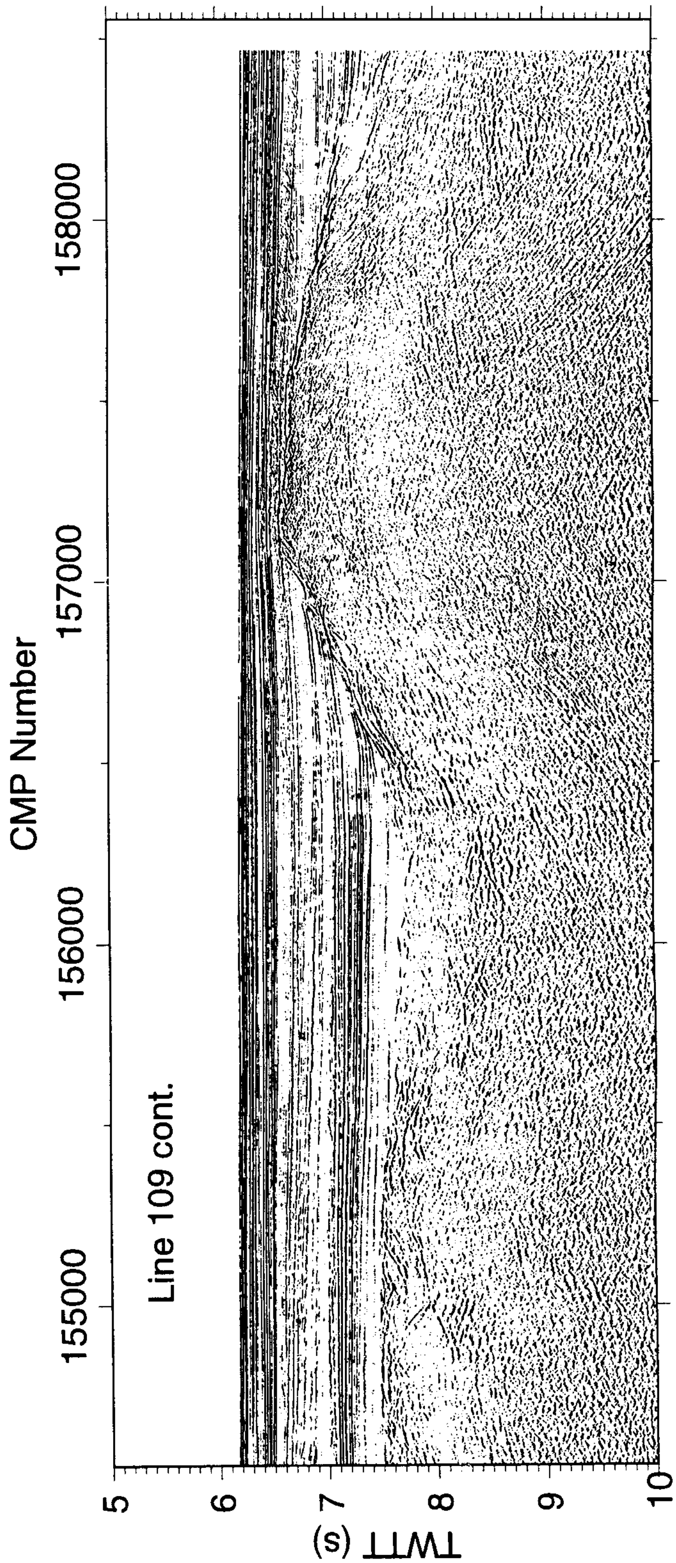


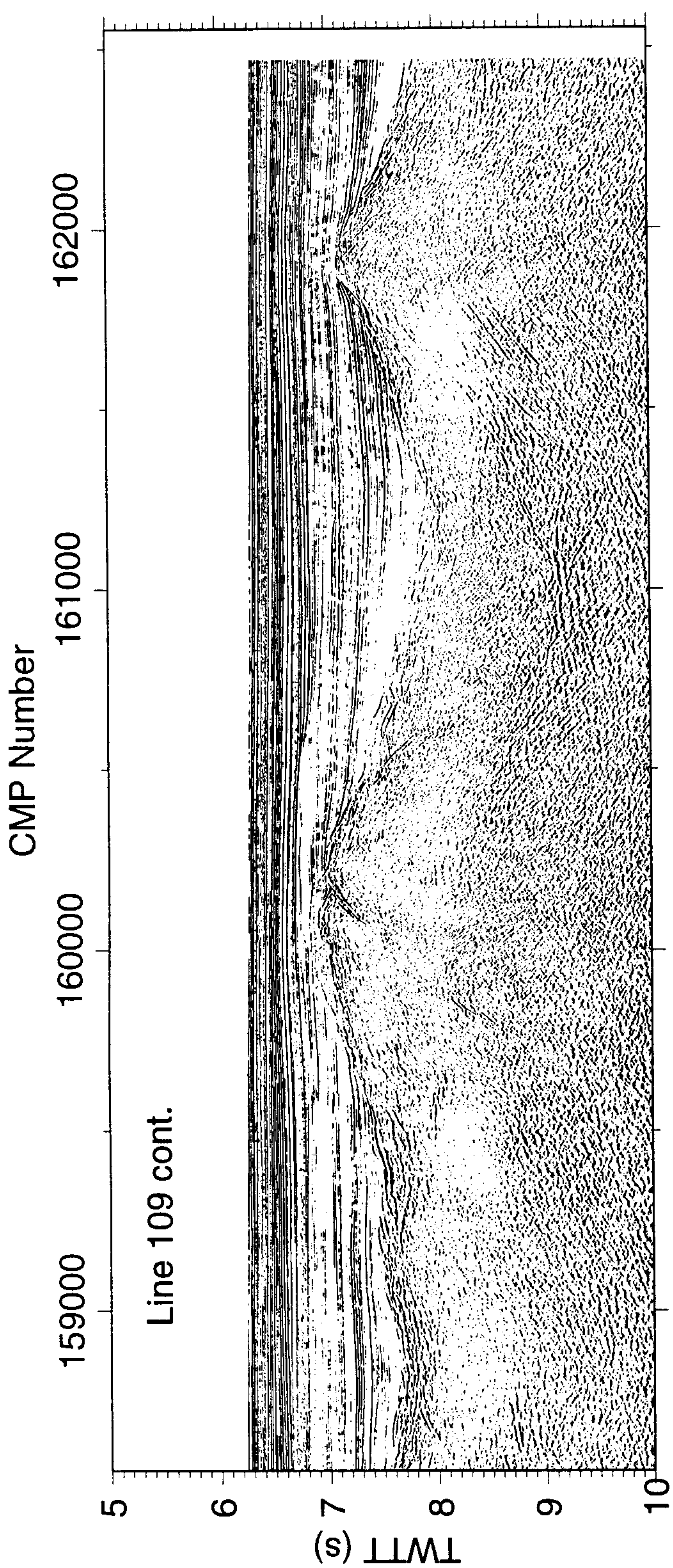
CMP Number
144000
145000
146000
147000
148000
Line 107 cont.
TWTT (s)
5
6
7
8
9
10

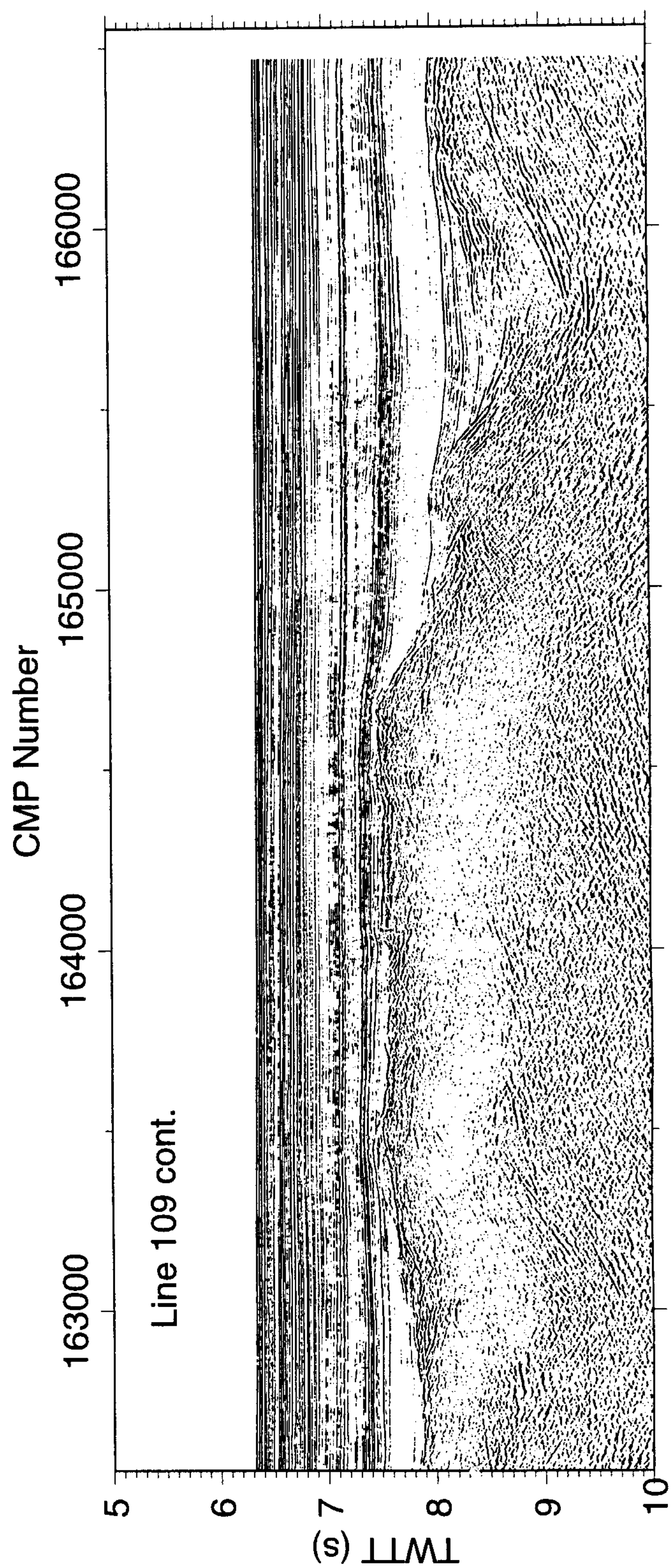


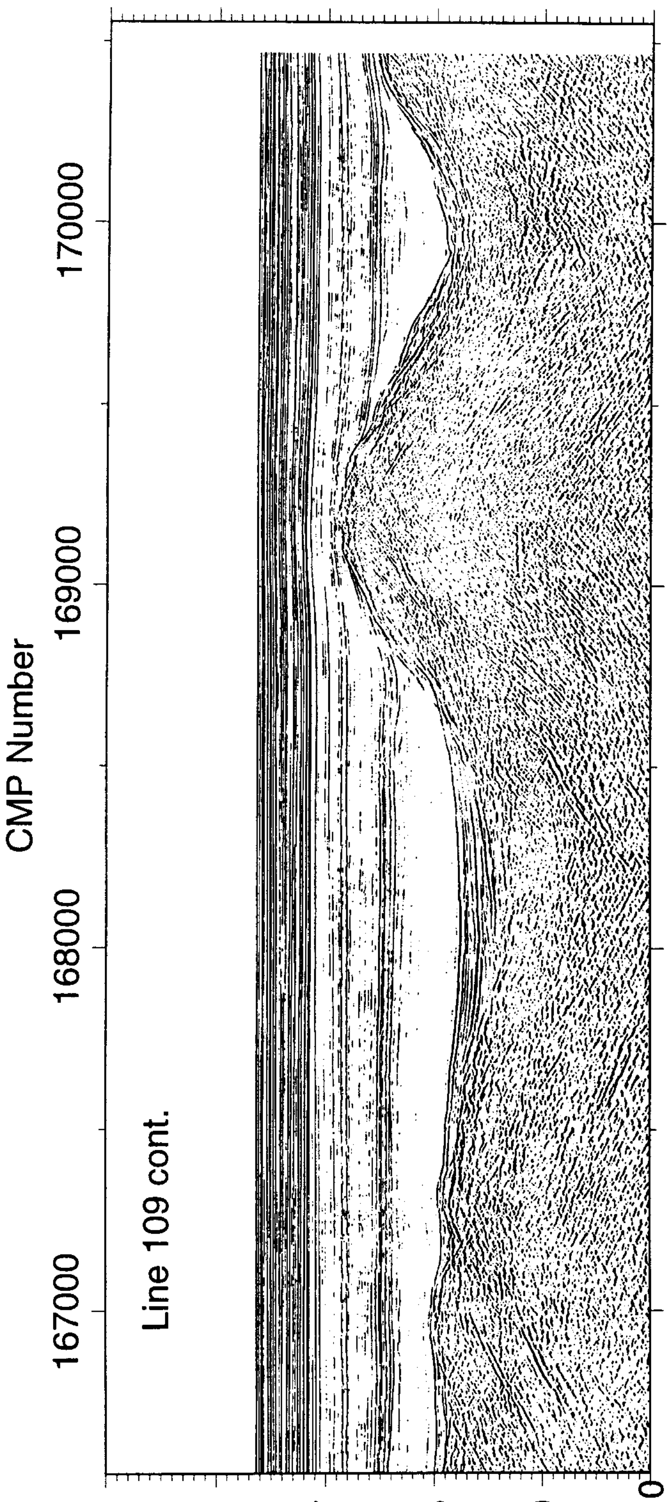
CMP Number
148000
149000
150000
Line 108
TWTT (s)
5
6
7
8
9
10


Line 109
CMP Number
151000
152000
153000
154000
TWTT (s)
5
6
7
8
9
10

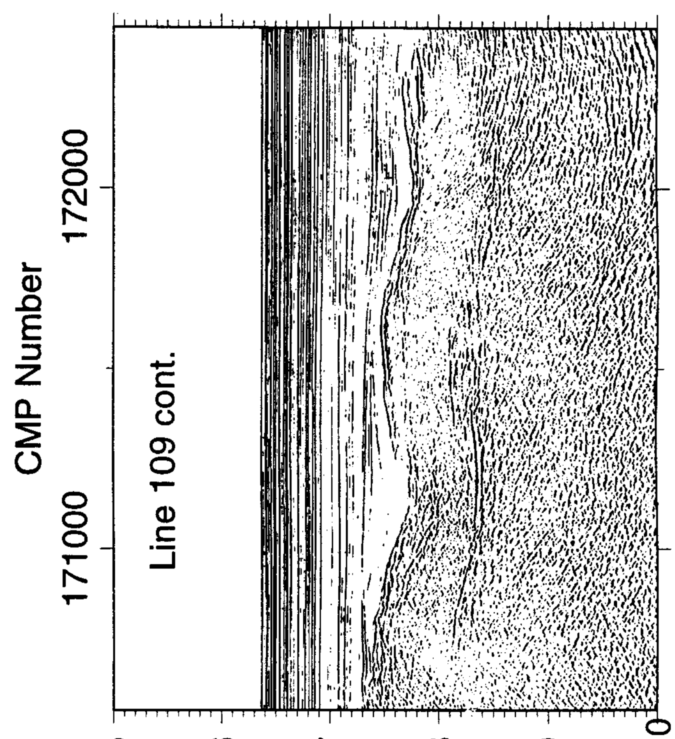

Line 109 cont.
CMP Number
155000
156000
157000
158000
TWTT (s)
5
6
7
8
9
10


CMP Number
Line 109 cont.
159000
160000
161000
162000
TWTT (s)
5
6
7
8
9
10

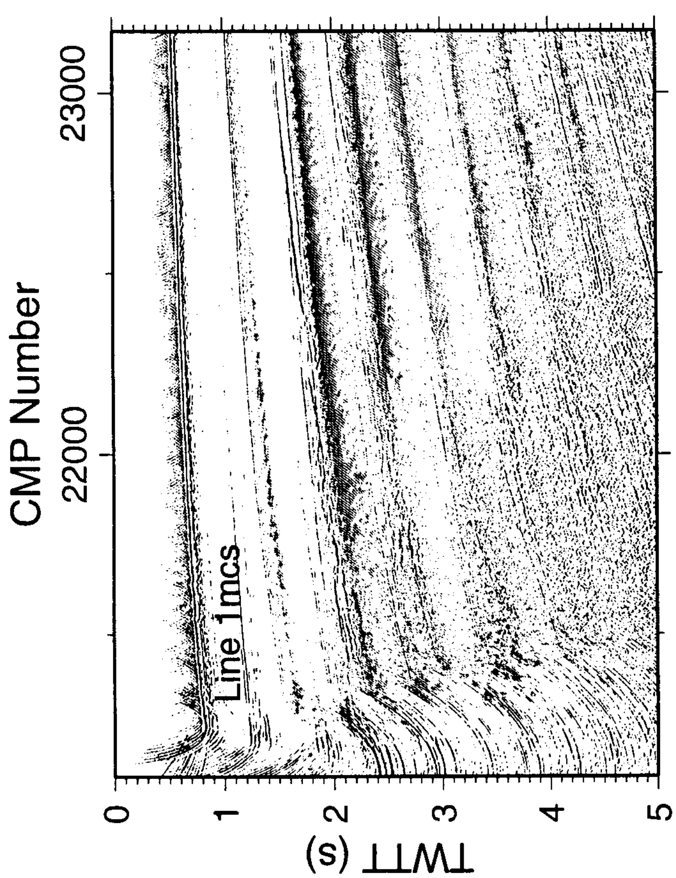

CMP Number
Line 109 cont.
163000
164000
165000
166000
TWTT (s)
5
6
7
8
9
10

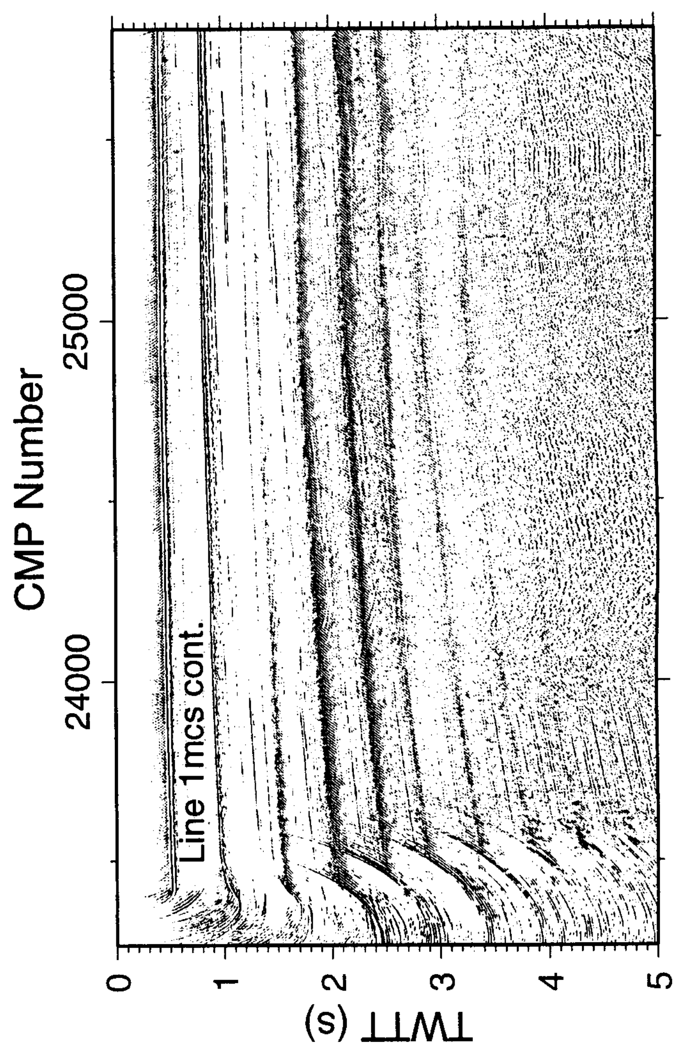


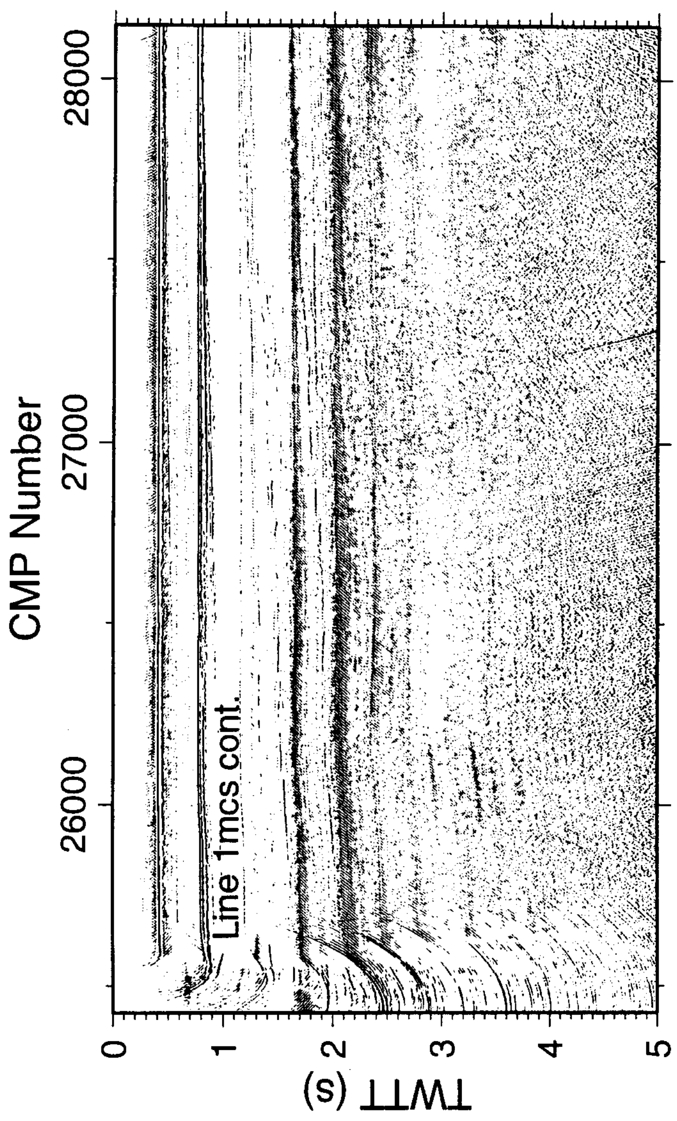
Line 109 cont.
CMP Number
167000
168000
169000
170000
TWTT (s)
5
6
7
8
9
10

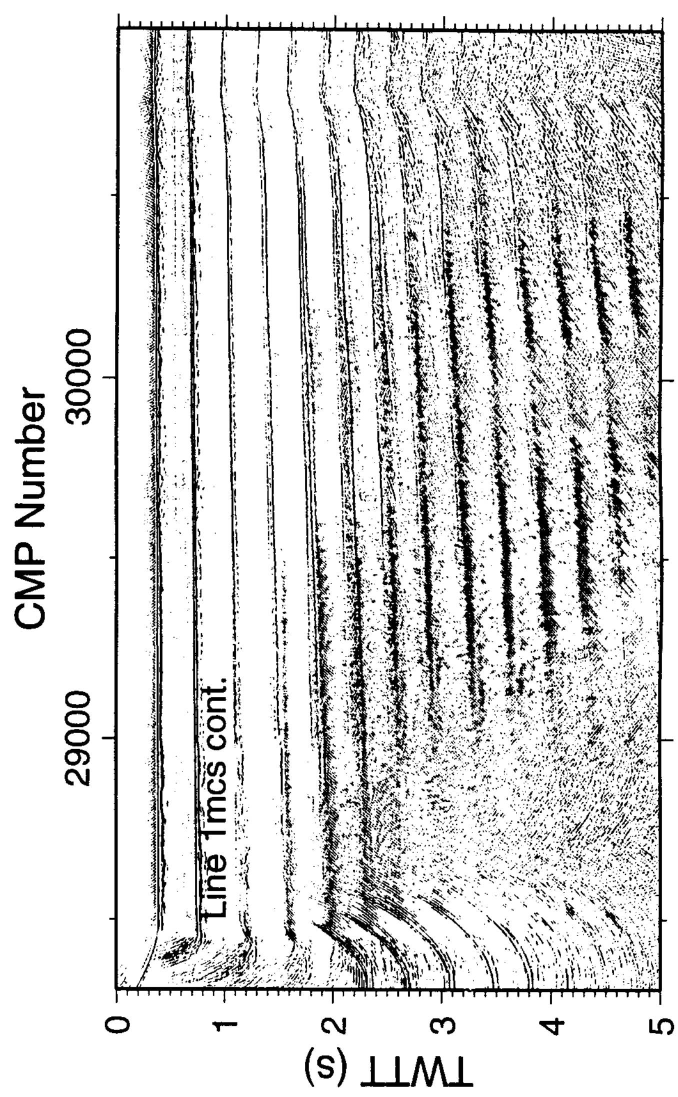


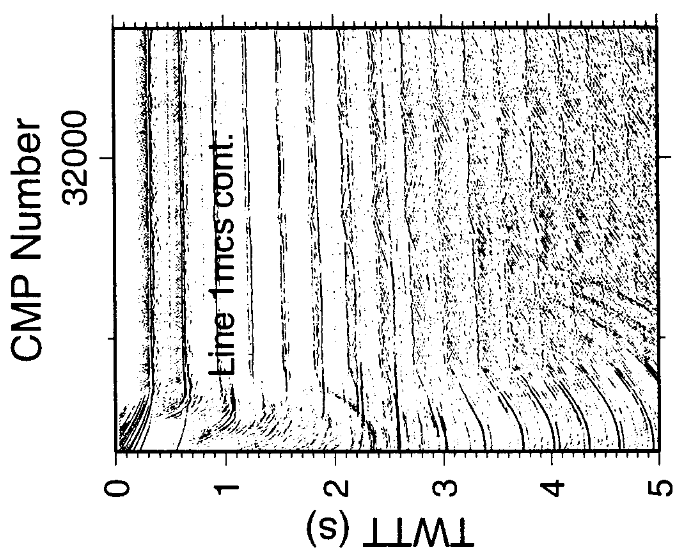
Line 109 cont.
CMP Number
171000
172000
TWTT (s)
5
6
7
8
9
10


CMP Number
22000
23000
Line 1mcs
0
1
2
3
4
5
TWTT (s)


CMP Number
24000
25000
Line 1mcs cont.
0
1
2
3
4
5
TWTT (s)


CMP Number
26000
27000
28000
Line 1mcs cont.
TWTT (s)
0
1
2
3
4
5


CMP Number
29000
30000
Line 1mcs cont.
TWTT (s)
0
1
2
3
4
5


CMP Number
32000
Line 1mcs cont.
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4
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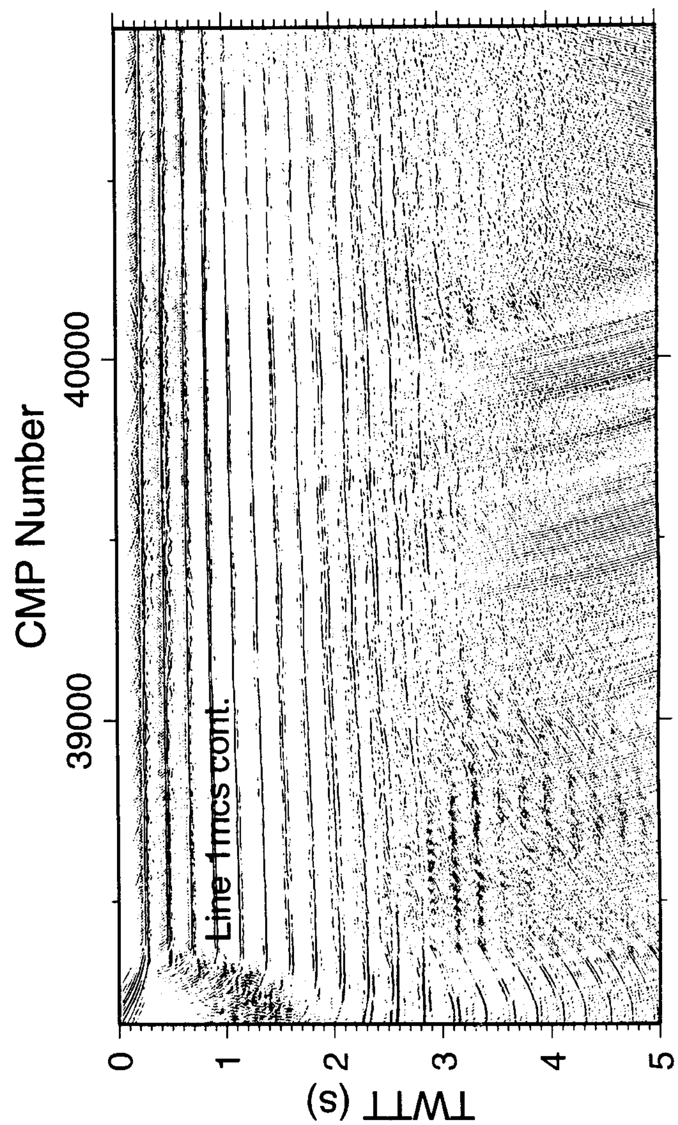
TWTT (s)


CMP Number
39000
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Line 1mcs cont.
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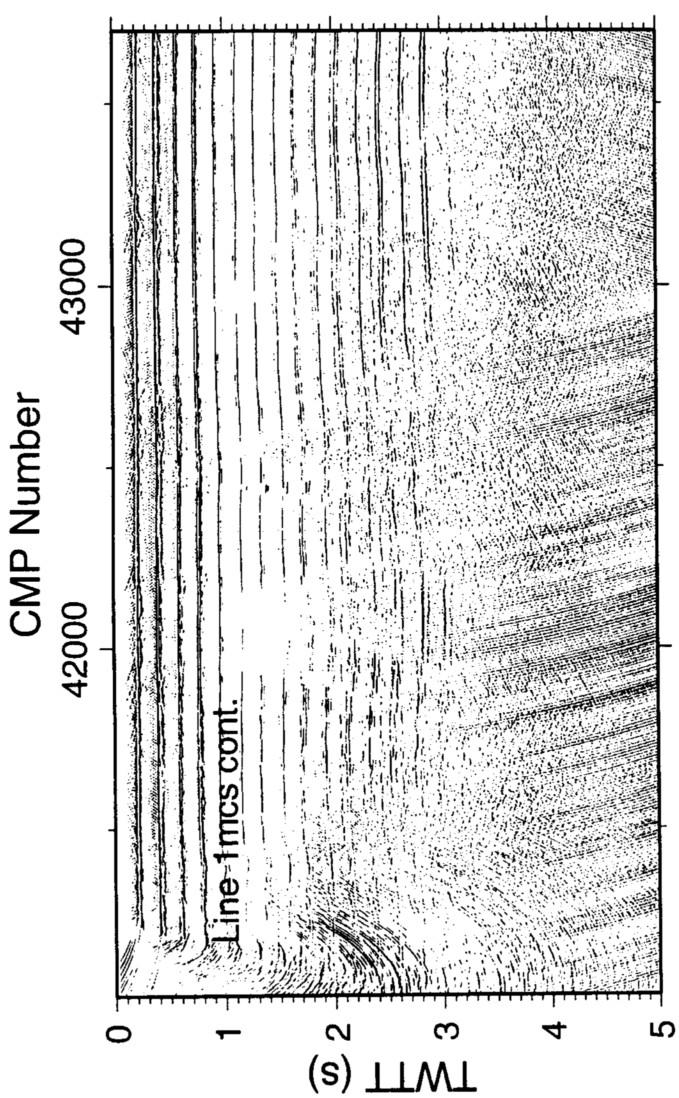
3
4
5
TWTT (s)


CMP Number
42000
43000
Line-1mcs cont.
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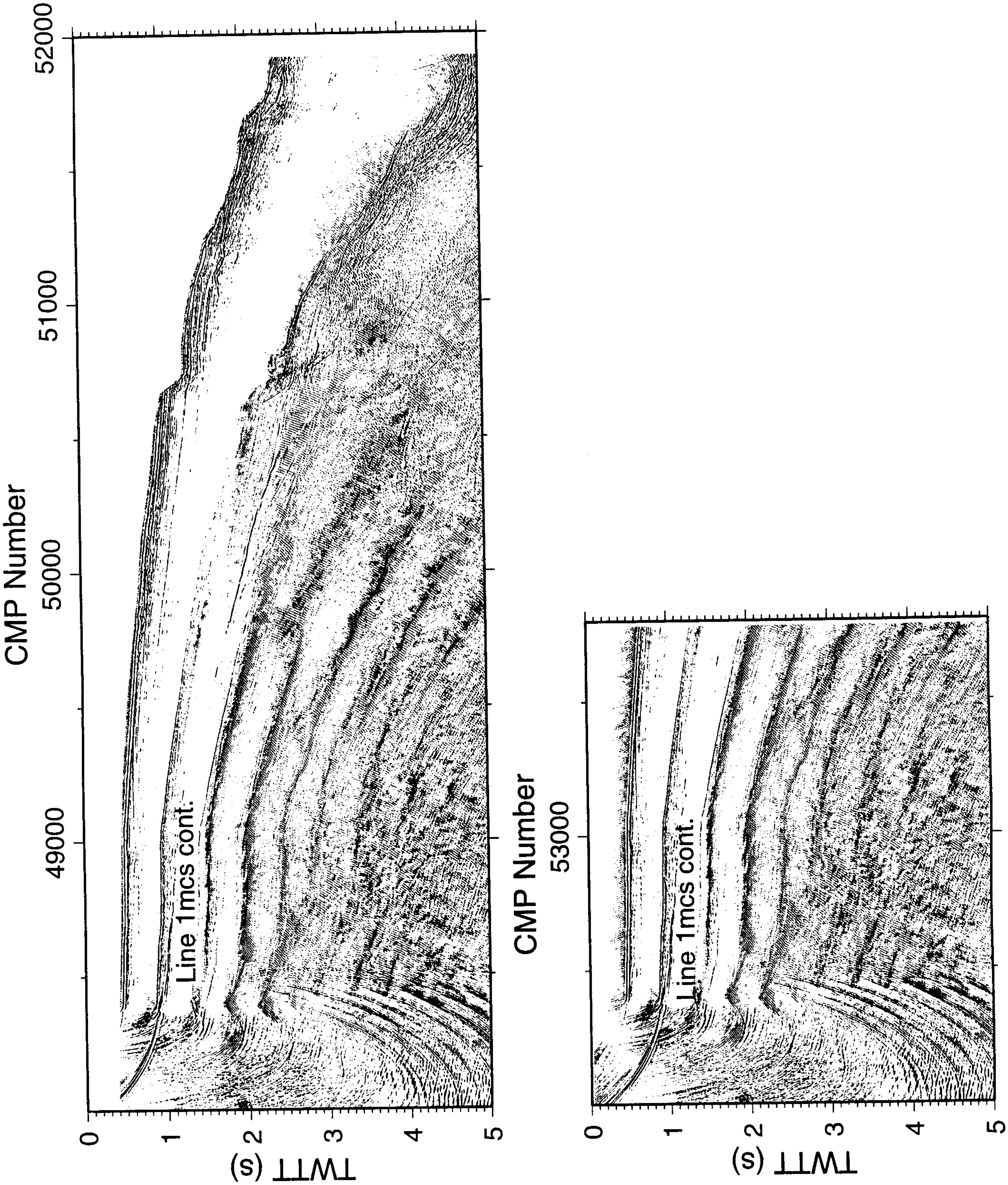
2
3
4
5
TWTT (s)


CMP Number
49000
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51000
52000
Line 1mcs cont.
TWTT (s)
0
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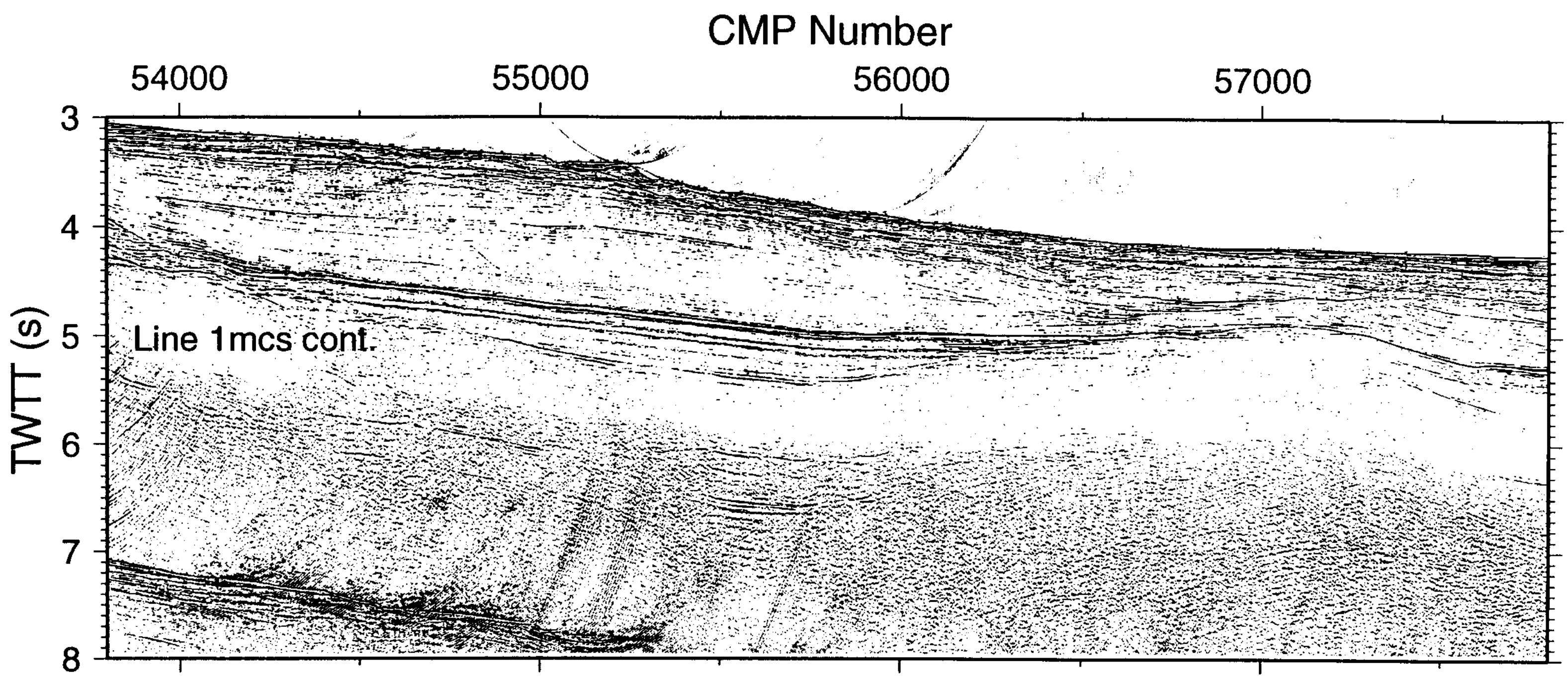
4
5
CMP Number
53000
Line 1mcs cont.
TWTT (s)
0
1
2
3
4
5


CMP Number
54000
55000
56000
57000
TWTT (s)
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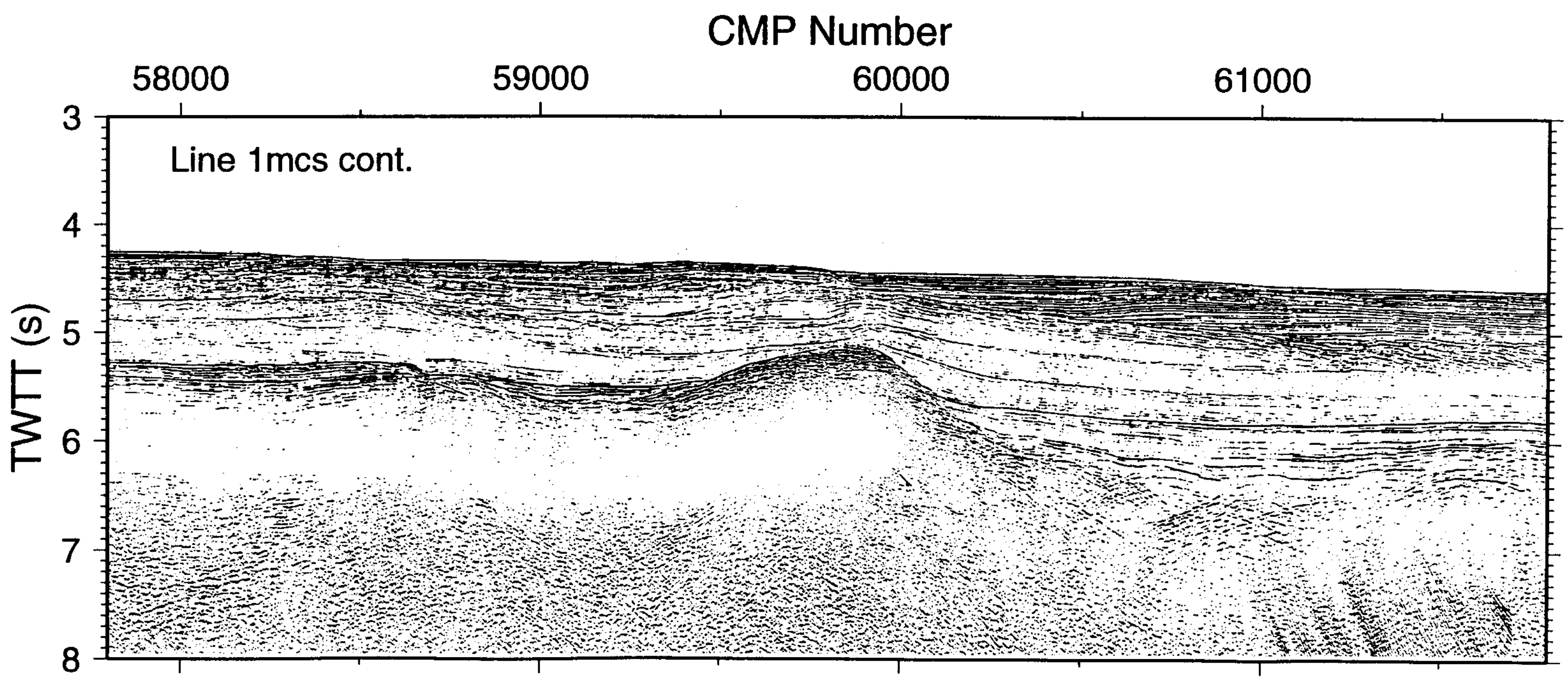
8
Line 1mcs cont.


CMP Number
58000
59000
60000
61000
TWTT (s)
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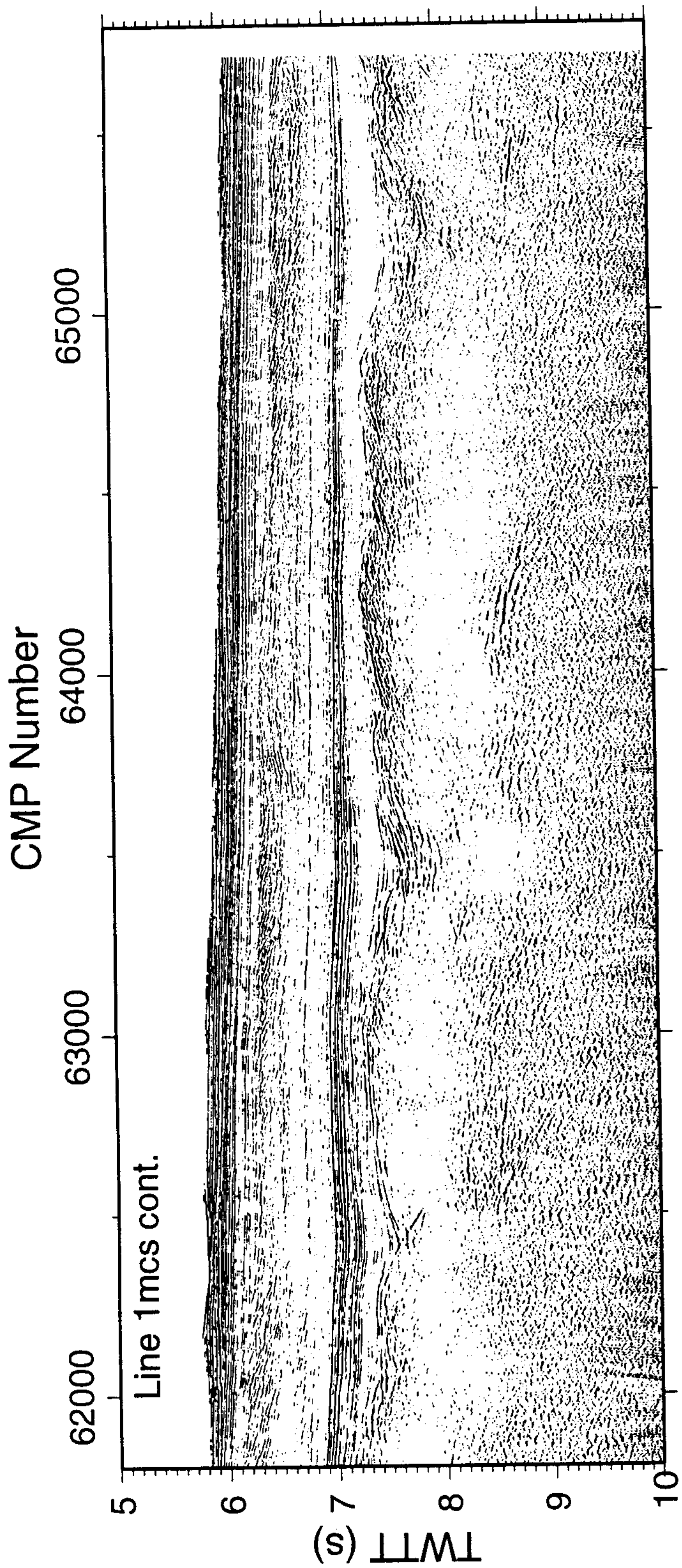
8
Line 1mcs cont.



CMP Number
62000
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65000
TWTT (s)
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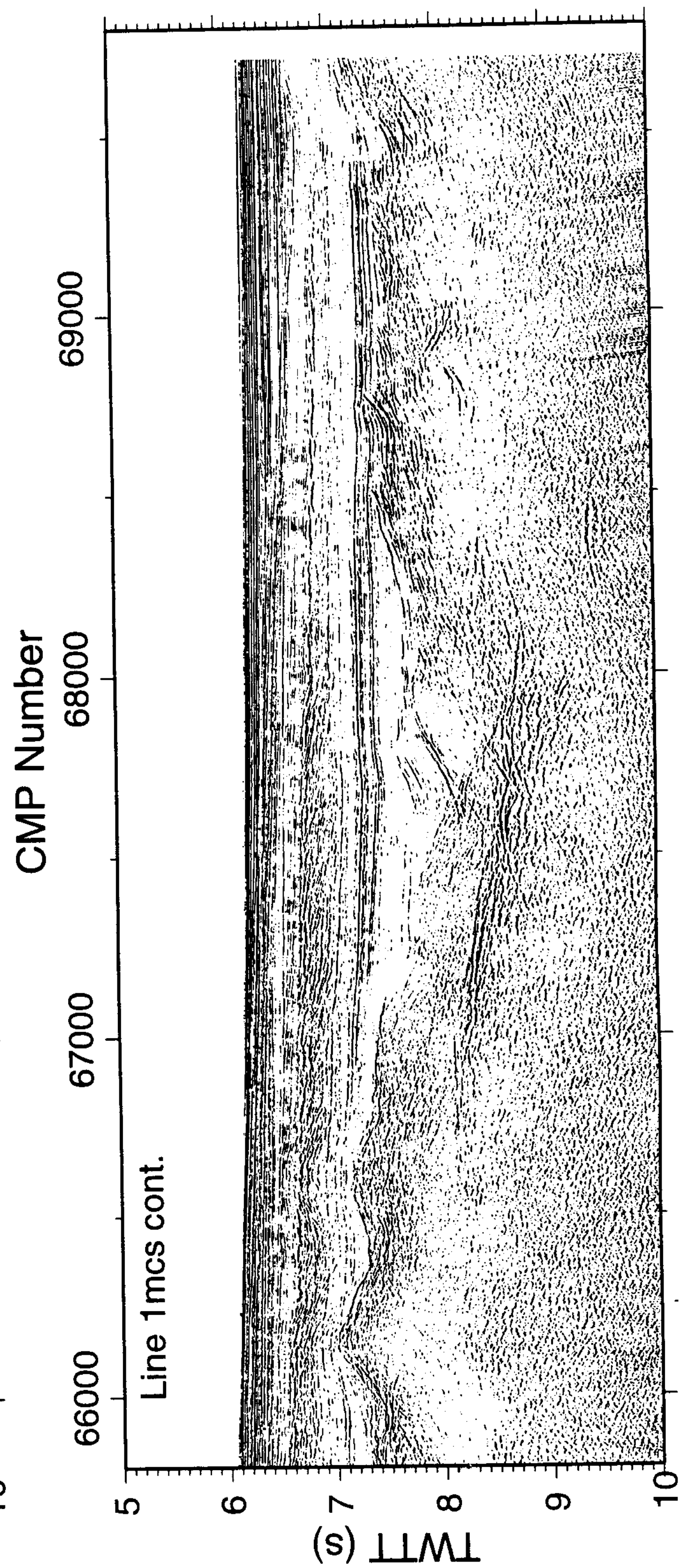
Line 1mcs cont.



CMP Number
66000
67000
68000
69000
TWTT (s)
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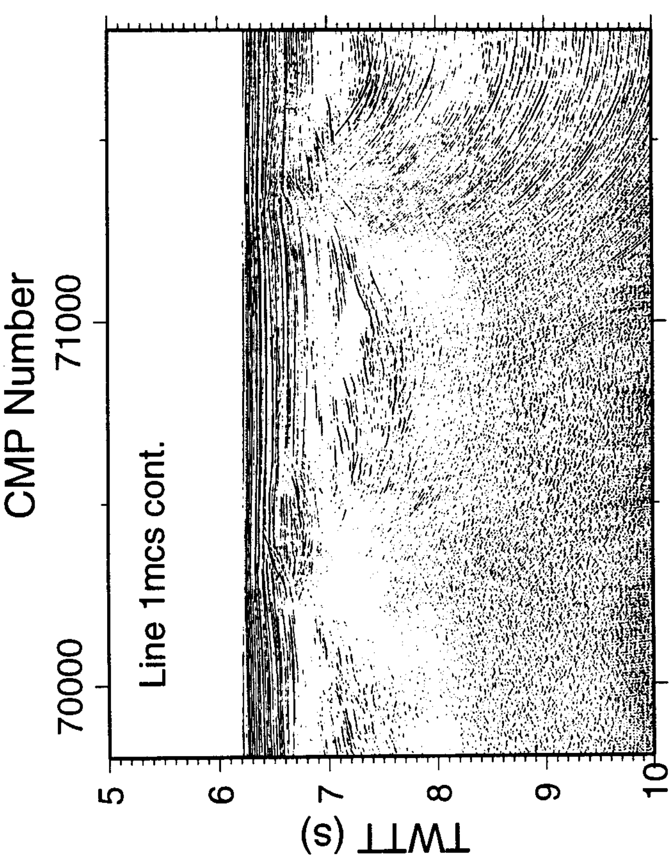
10
Line 1mcs cont.



CMP Number
70000
71000
Line 1mcs cont.
TWTT (s)
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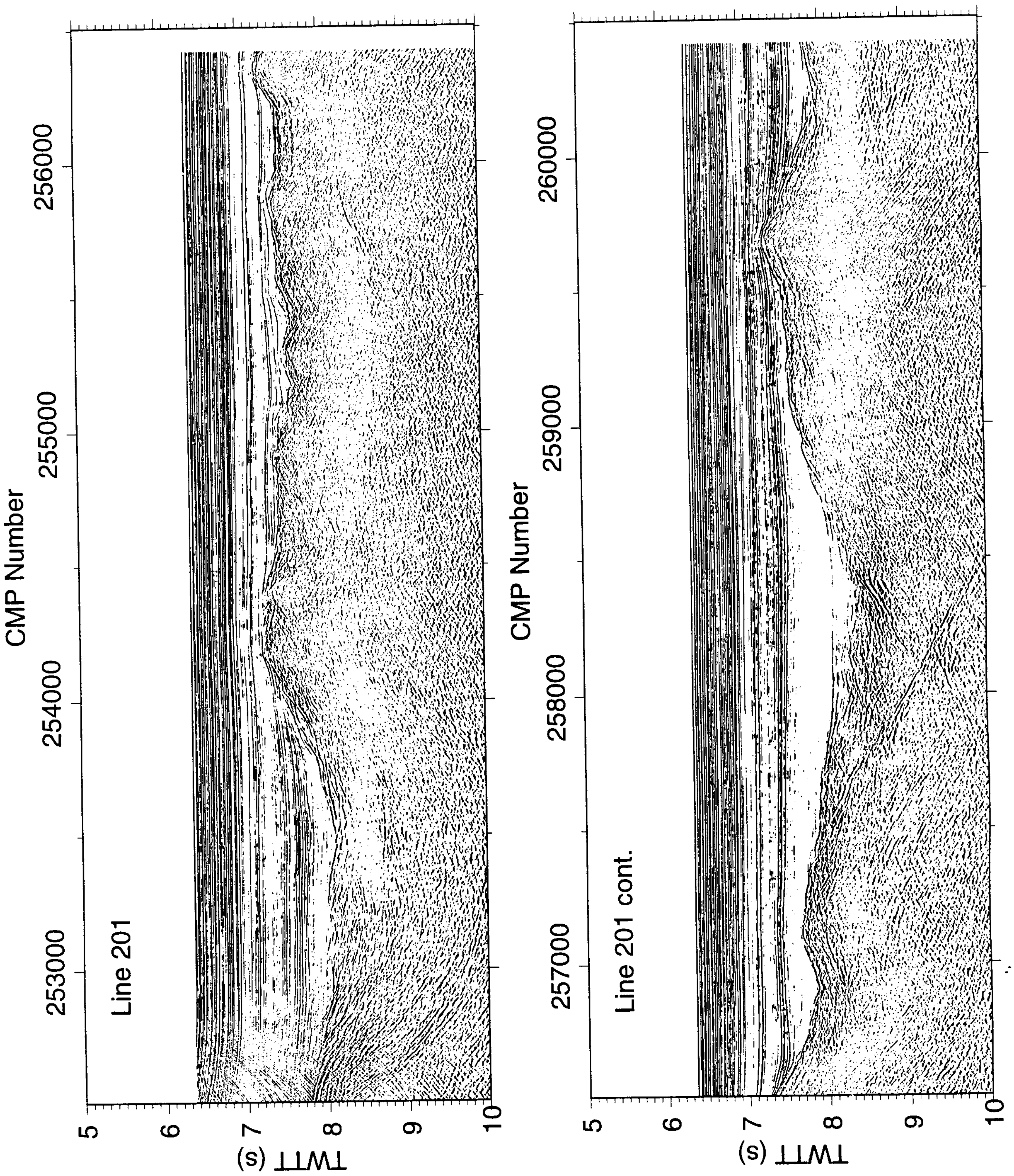
CMP Number
253000
254000
255000
256000
Line 201
TWTT (s)
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6
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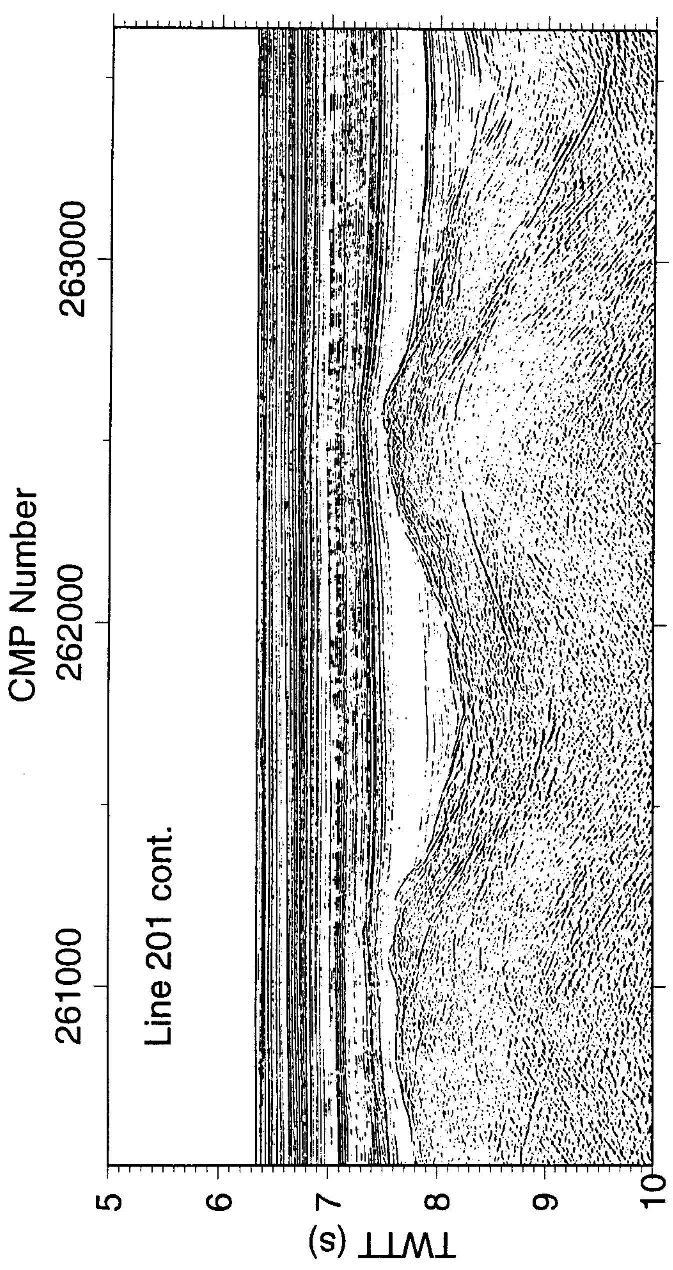
CMP Number
257000
258000
259000
260000
Line 201 cont.
TWTT (s)
5
6
7
8
9
10


CMP Number
261000
262000
263000
Line 201 cont.
TWTT (s)
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6
7
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9
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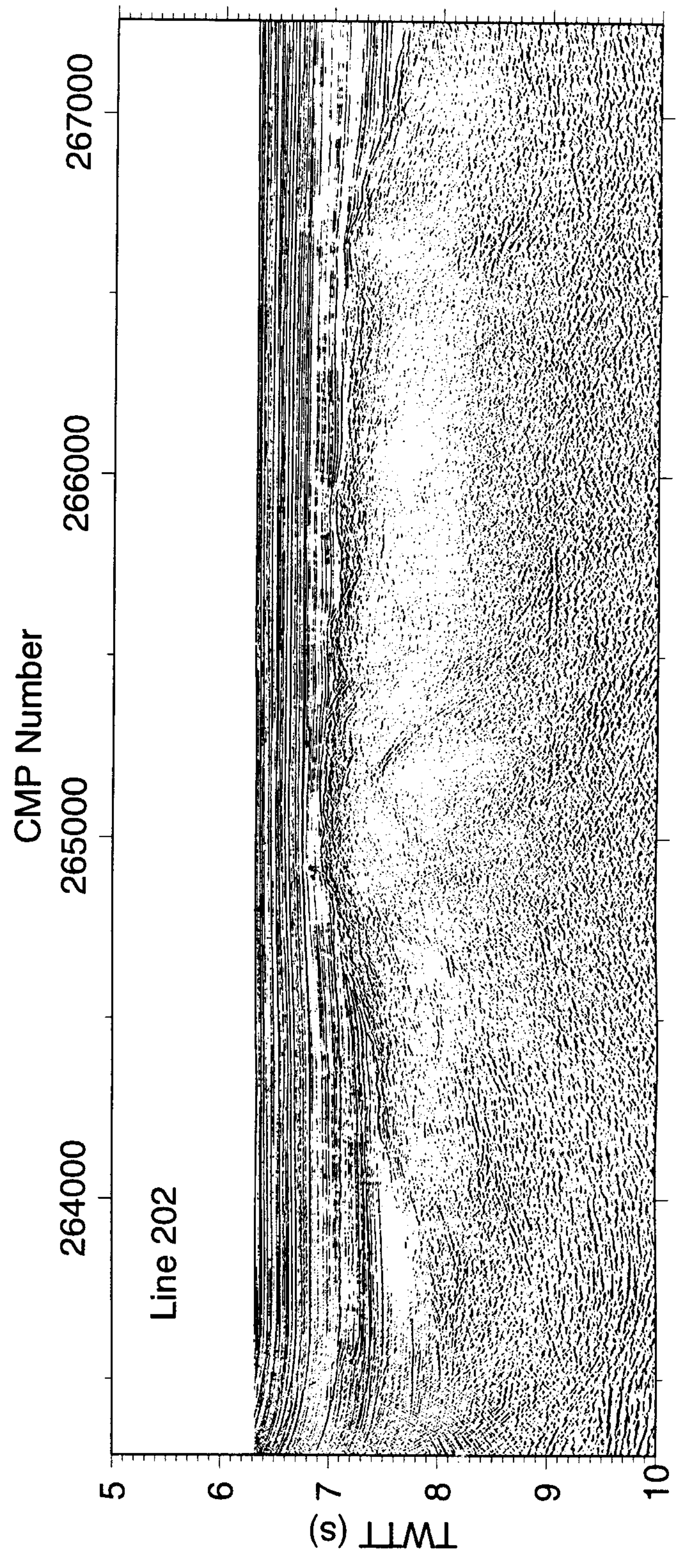
CMP Number
264000
265000
266000
267000
Line 202
TWTT (s)
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9
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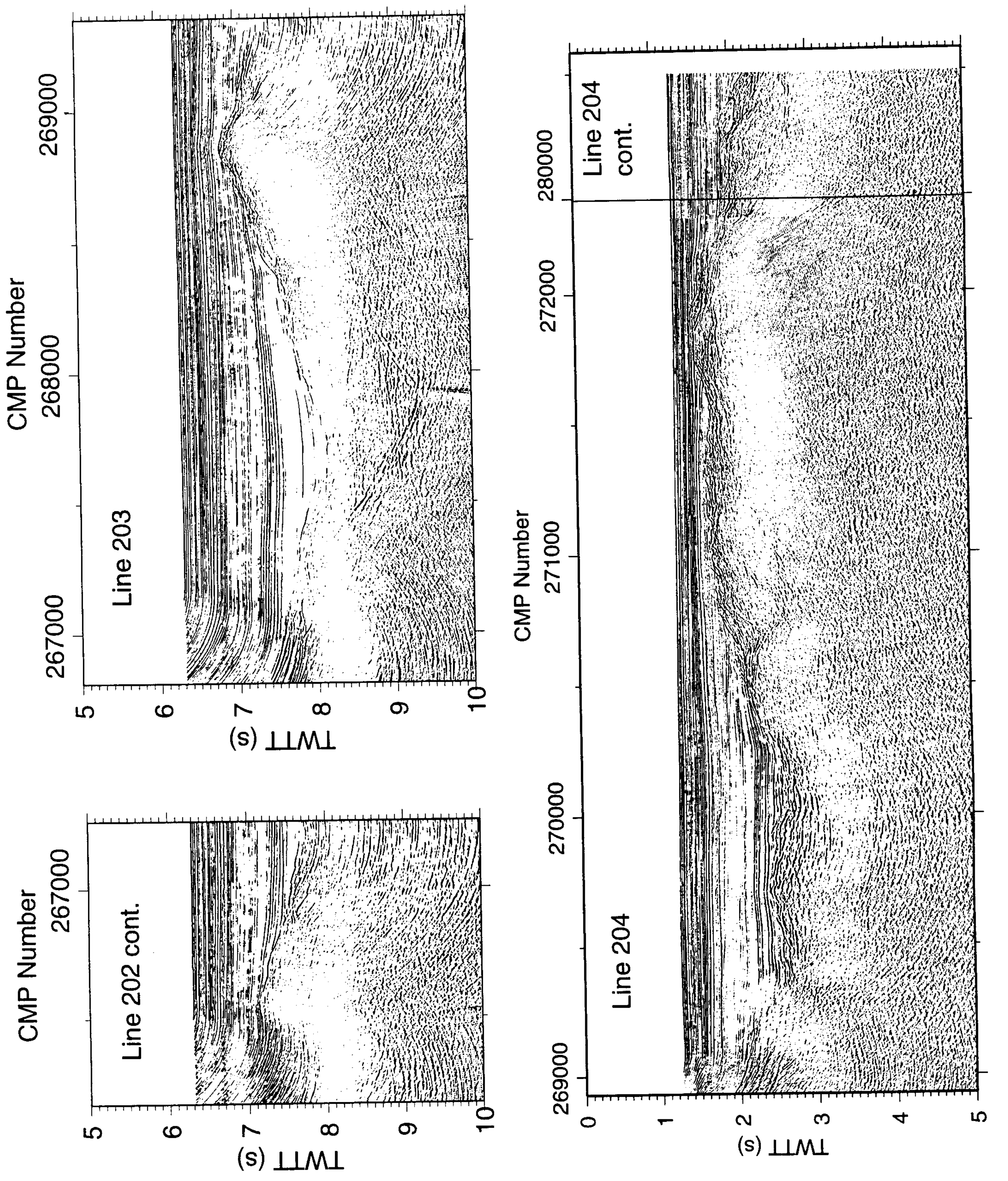

CMP Number
267000
Line 202 cont.
TWTT (s)
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7
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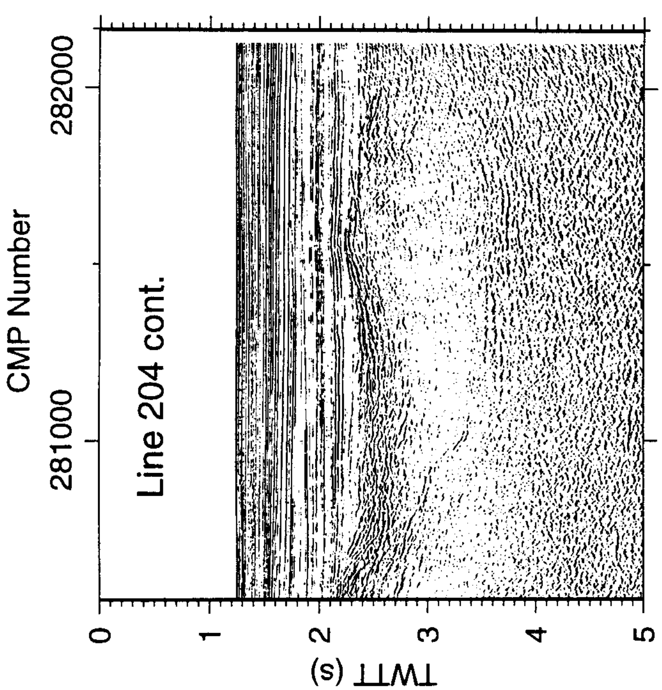
9
10
CMP Number
267000
268000
269000
Line 203
TWTT (s)
5
6
7
8
9
10
CMP Number
269000
270000
271000
272000
280000
Line 204
Line 204 cont.
TWTT (s)
0
1
2
3
4
5


CMP Number
281000
282000
Line 204 cont.
TWTT (s)
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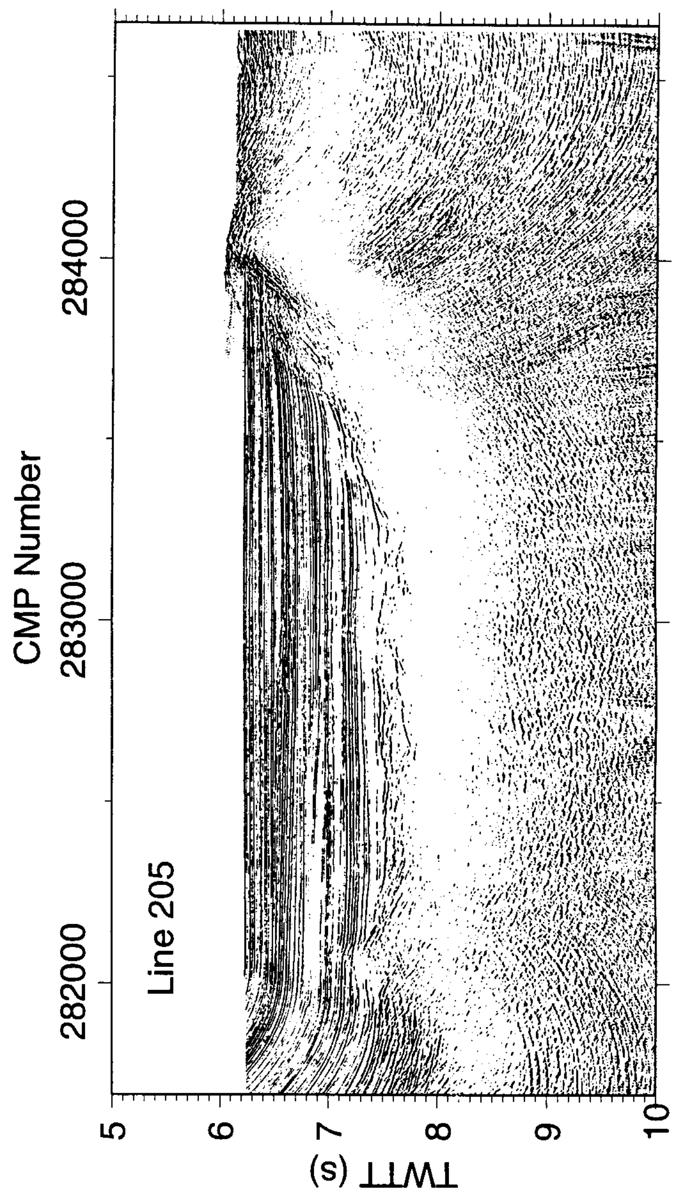
1
2
3
4
5


CMP Number
282000
283000
284000
Line 205
TWTT (s)
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7
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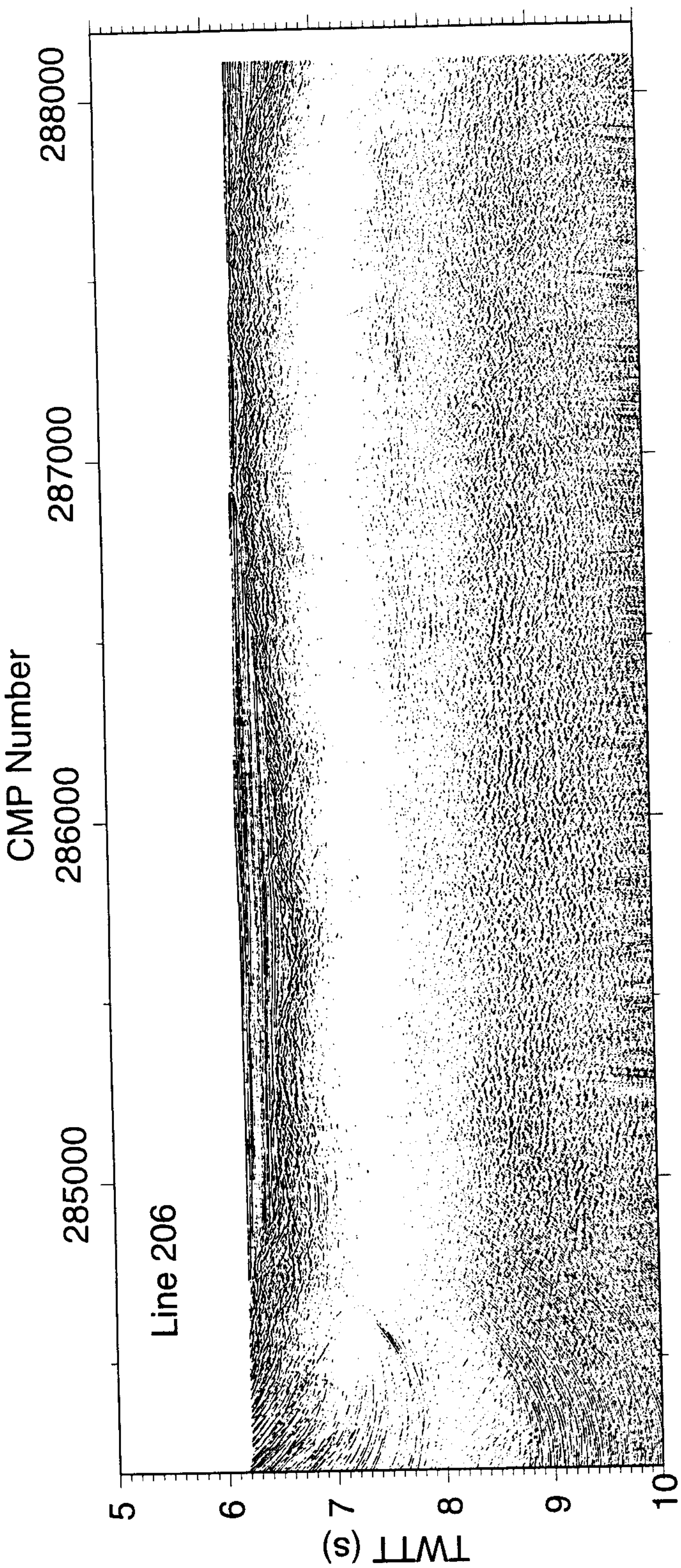

Line 206
CMP Number
285000
286000
287000
288000
TWTT (s)
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7
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9
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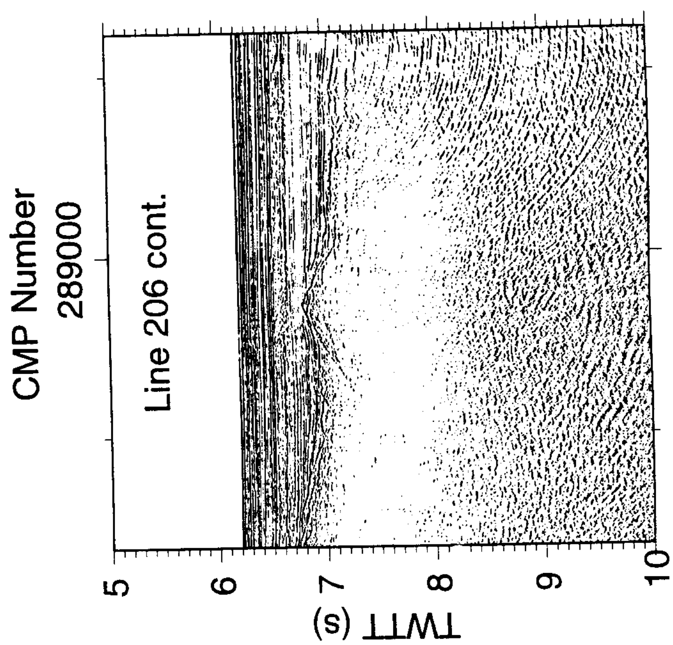

Line 206 cont.
CMP Number
289000
TWTT (s)
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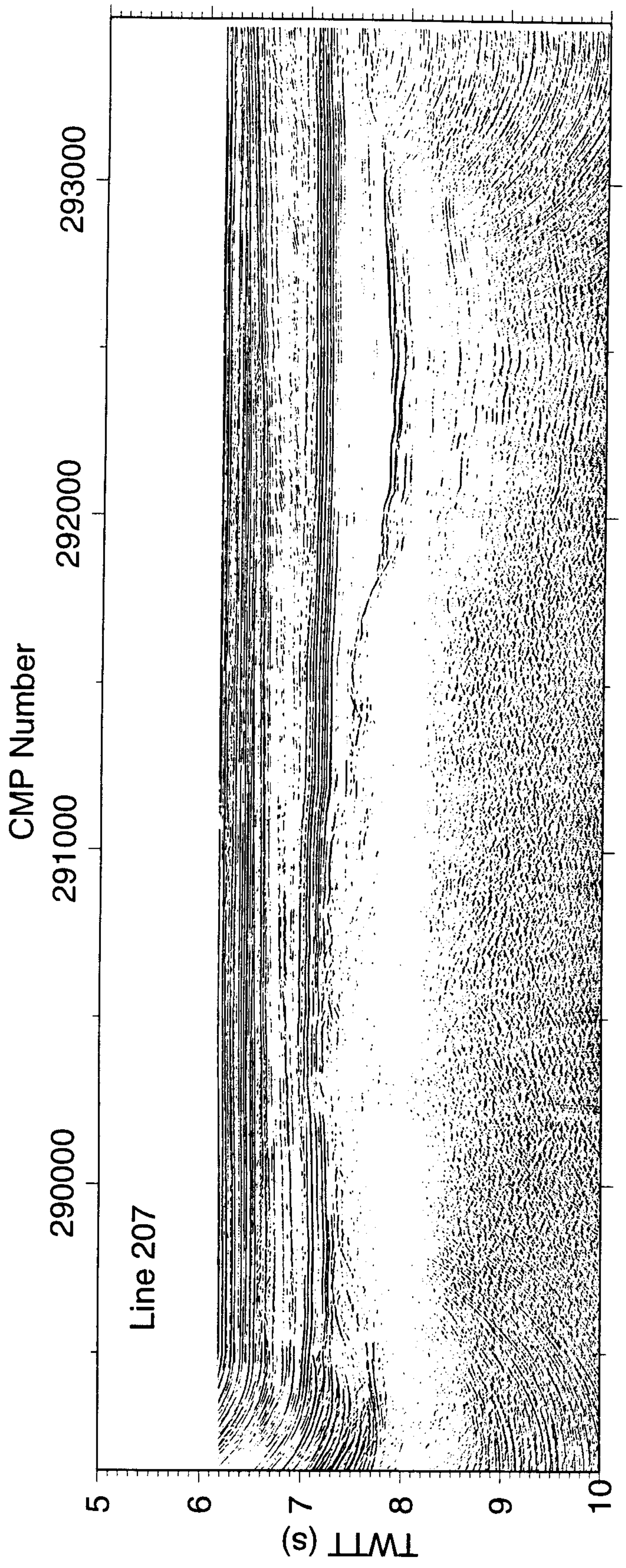
7
8
9
10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290000
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292000
293000
Line 207
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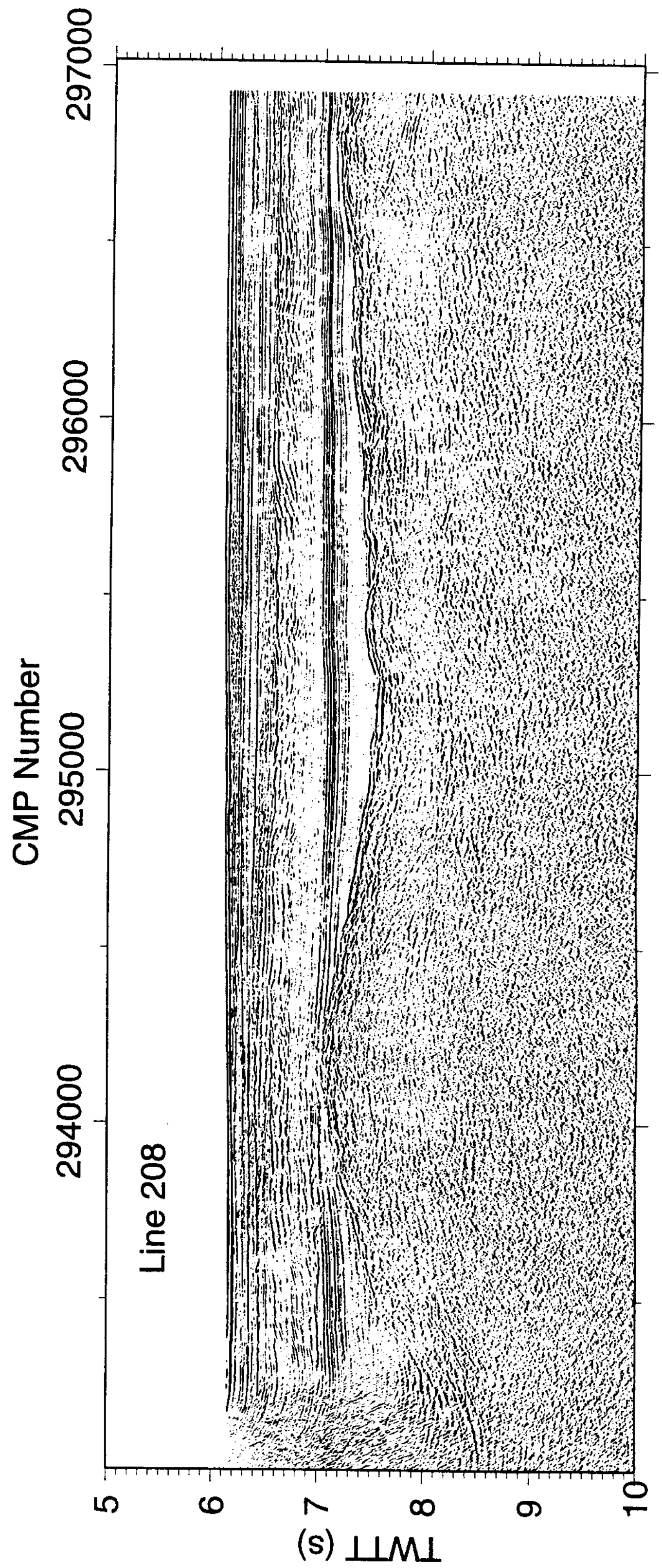
6
7
8
9
10
TWTT (s)


CMP Number
294000
295000
296000
297000
Line 208
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6
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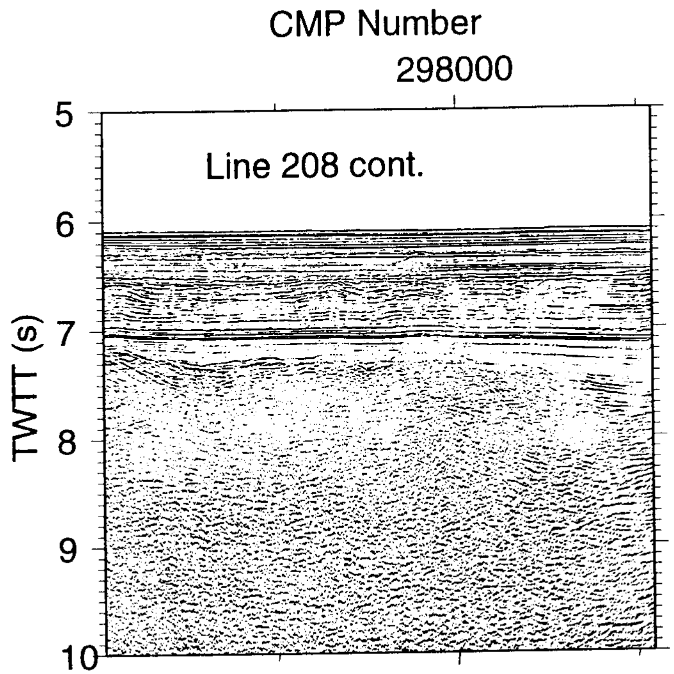
8
9
10
TWTT (s)


CMP Number
298000
Line 208 cont.
TWTT (s)
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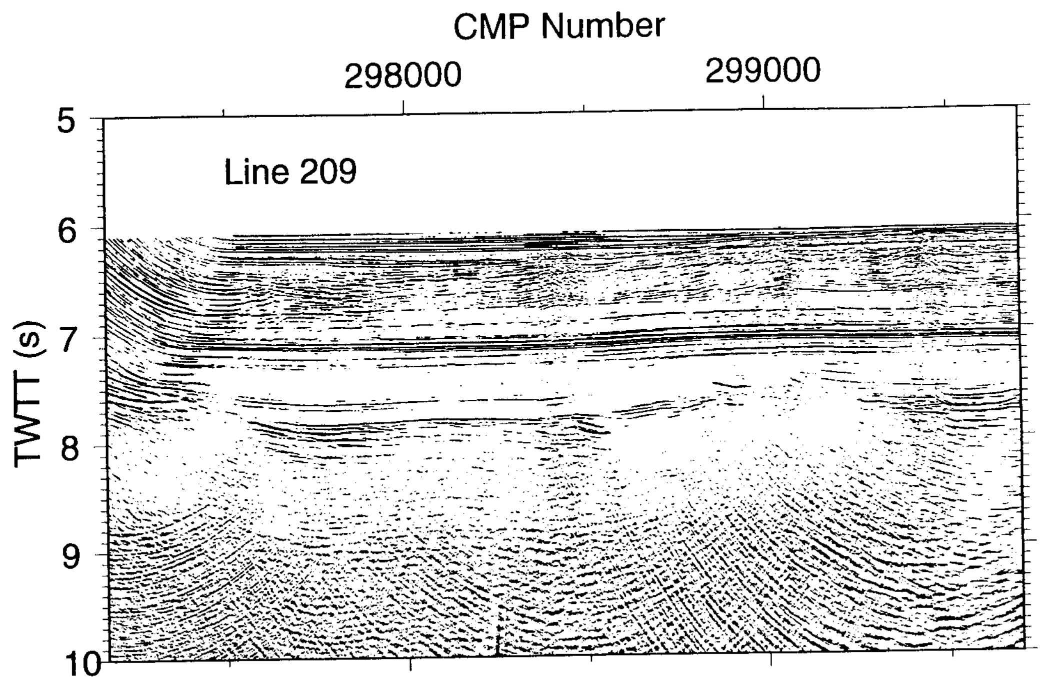
7
8
9
10


CMP Number
298000
299000
Line 209
TWTT (s)
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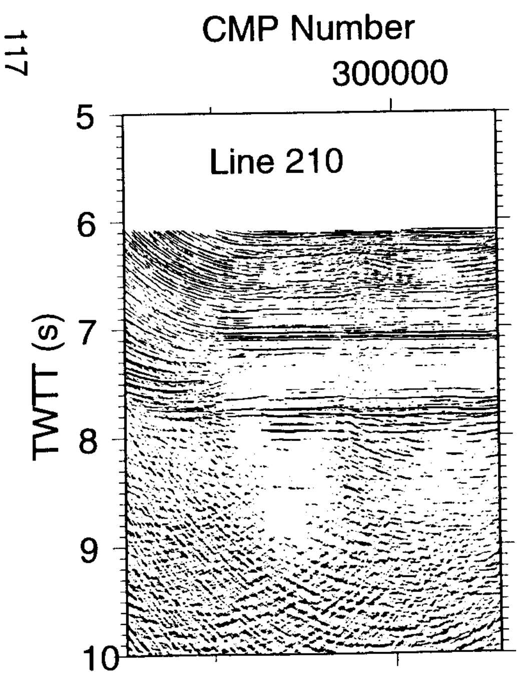
7
8
9
10


CMP Number
300000
Line 210
TWTT (s)
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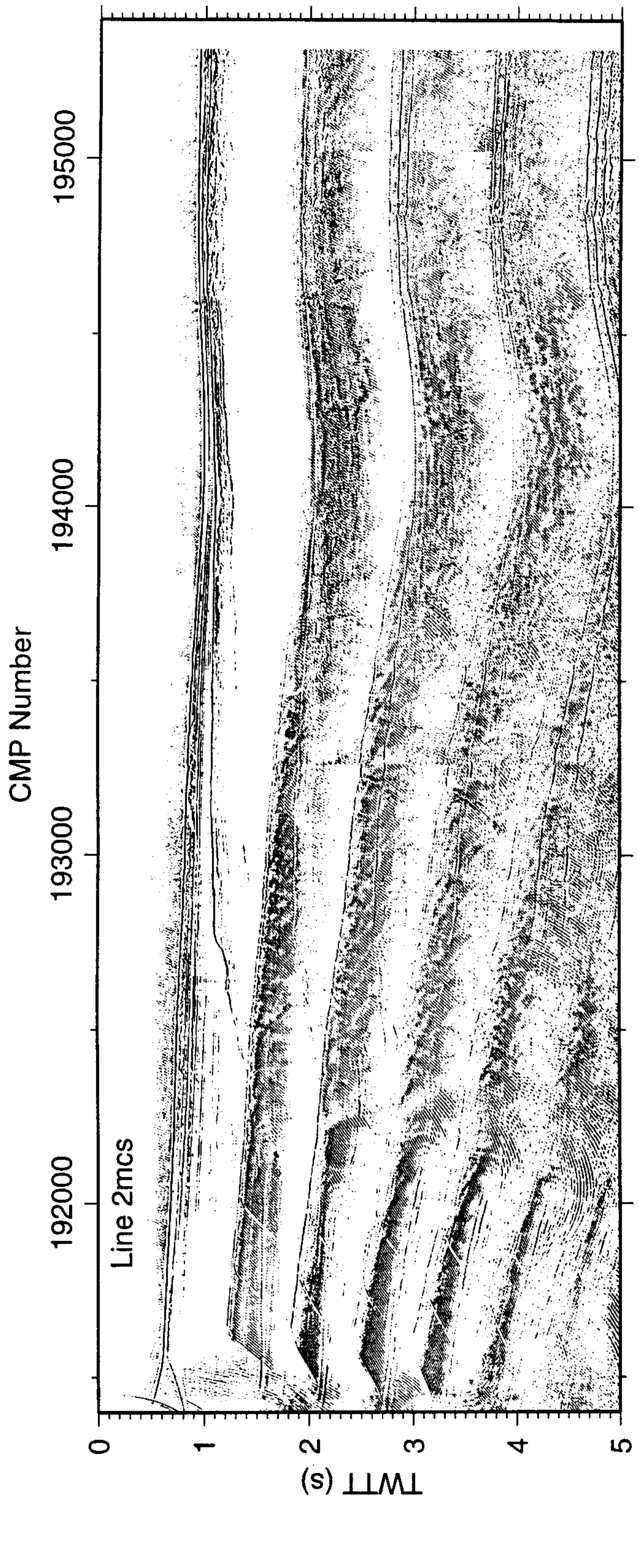
9
10


CMP Number
192000
193000
194000
195000
Line 2mcs
TWTT (s)
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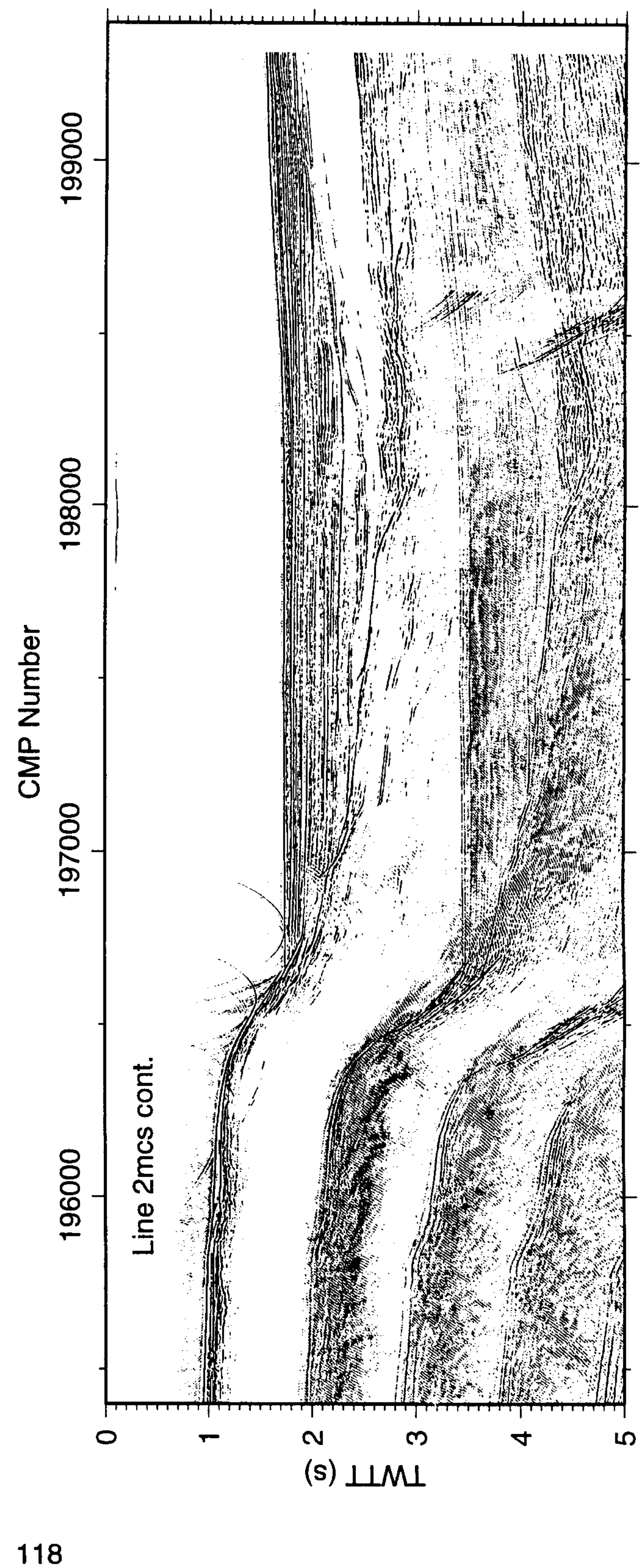
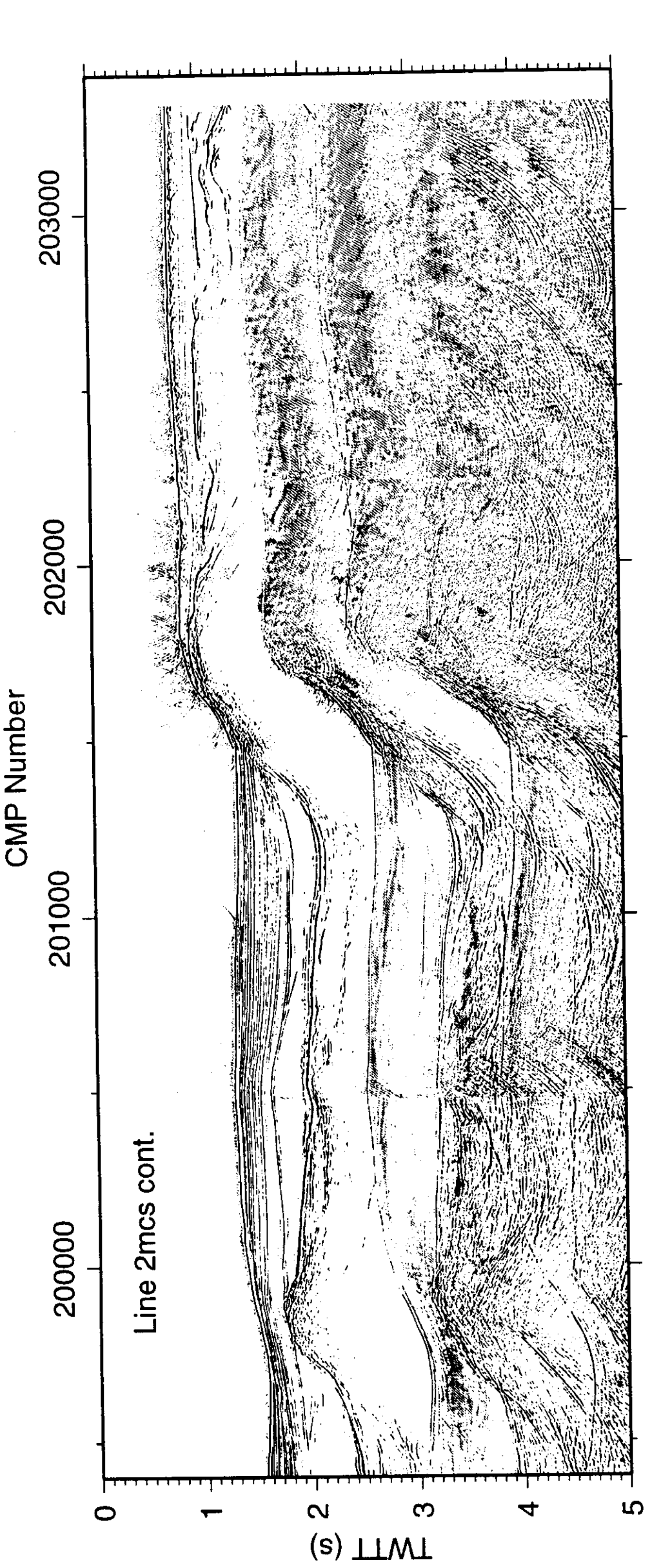
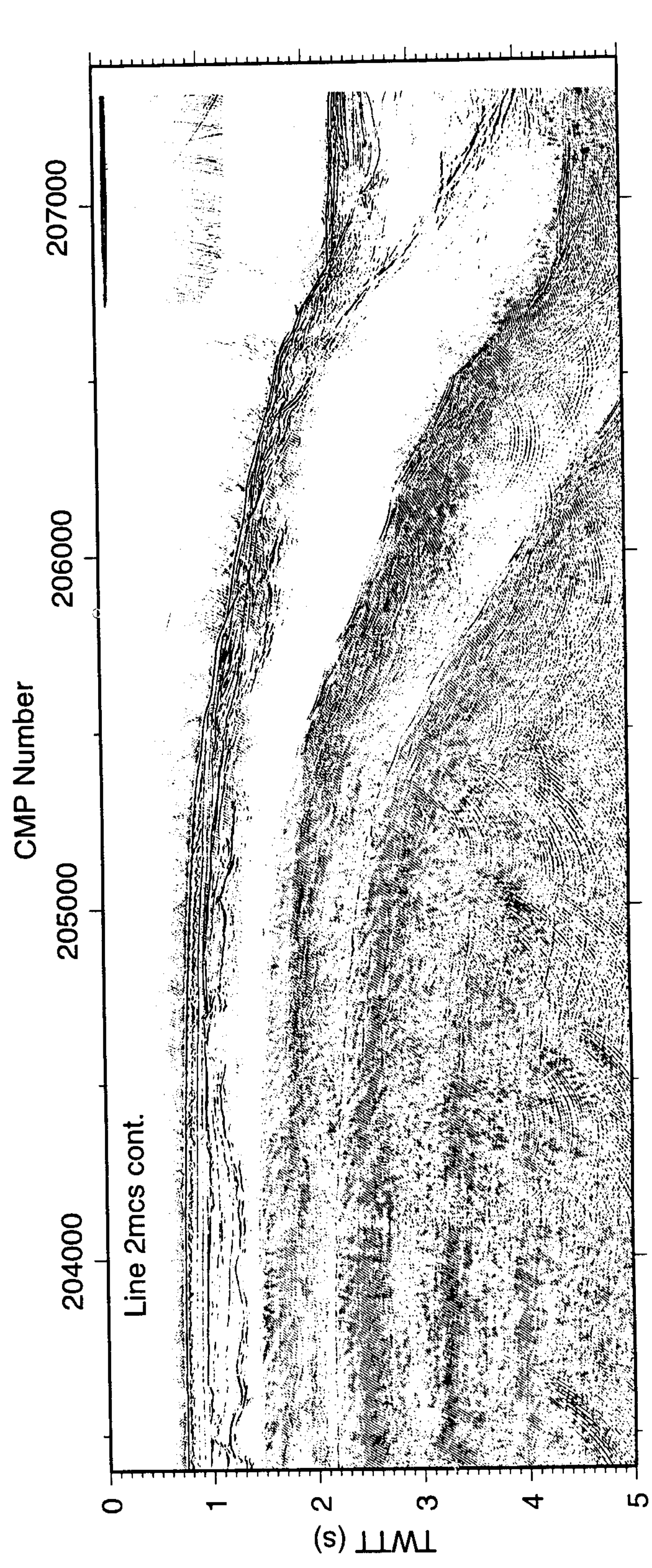
1
2
3
4
5


CMP Number
196000
197000
198000
199000
Line 2mcs cont.
TWTT (s)
0
1
2
3
4
5


CMP Number
200000
201000
202000
203000
Line 2mcs cont.
TWTT (s)
0
1
2
3
4
5


CMP Number
204000
205000
206000
207000
Line 2mcs cont.
TWTT (s)
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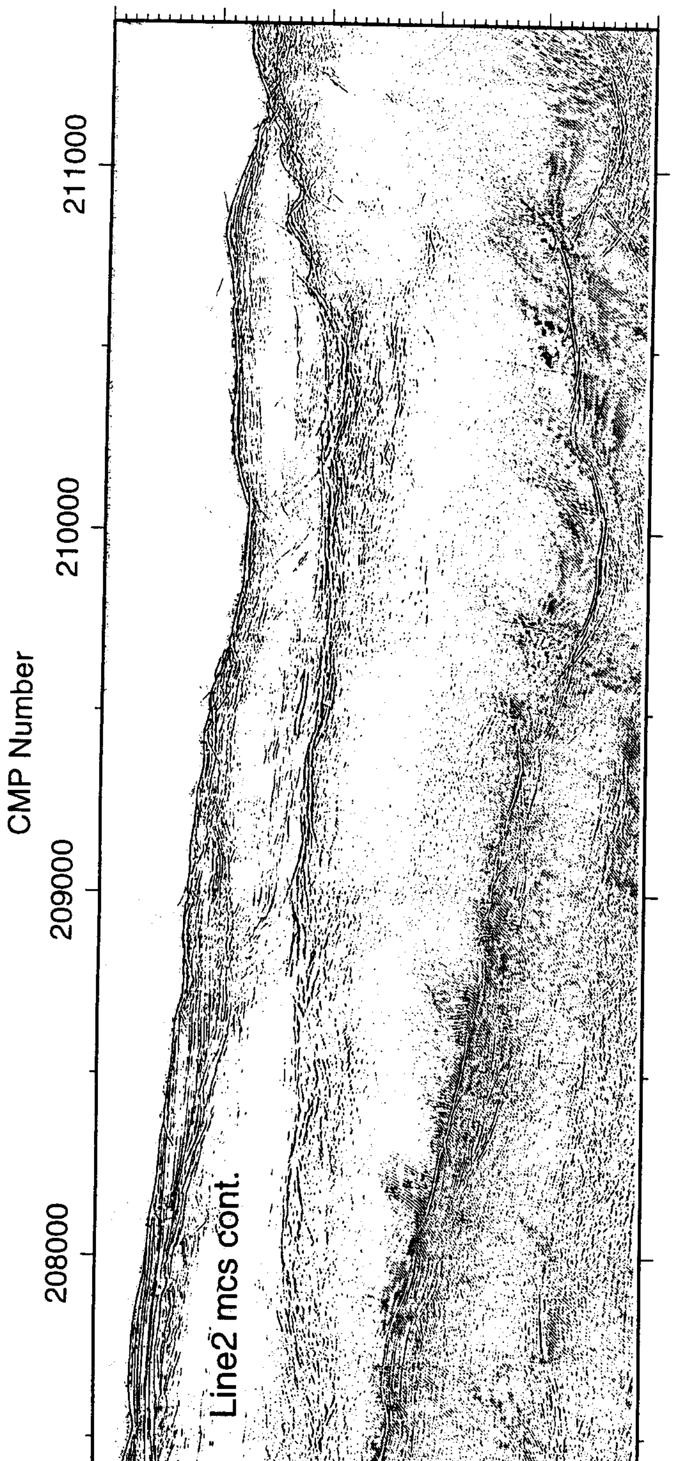
1
2
3
4
5


CMP Number
208000
209000
210000
211000
Line2 mcs cont.
TWTT (s)
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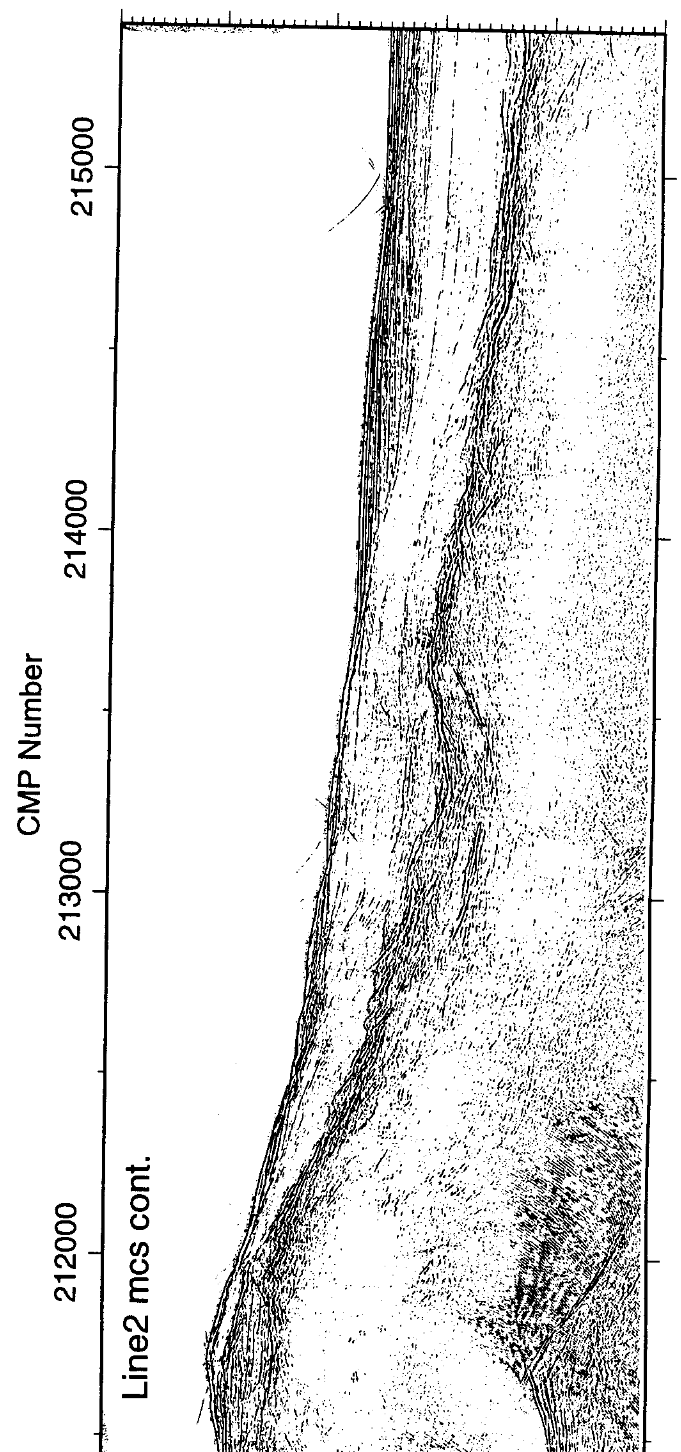
6
7


CMP Number
212000
213000
214000
215000
Line2 mcs cont.
TWTT (s)
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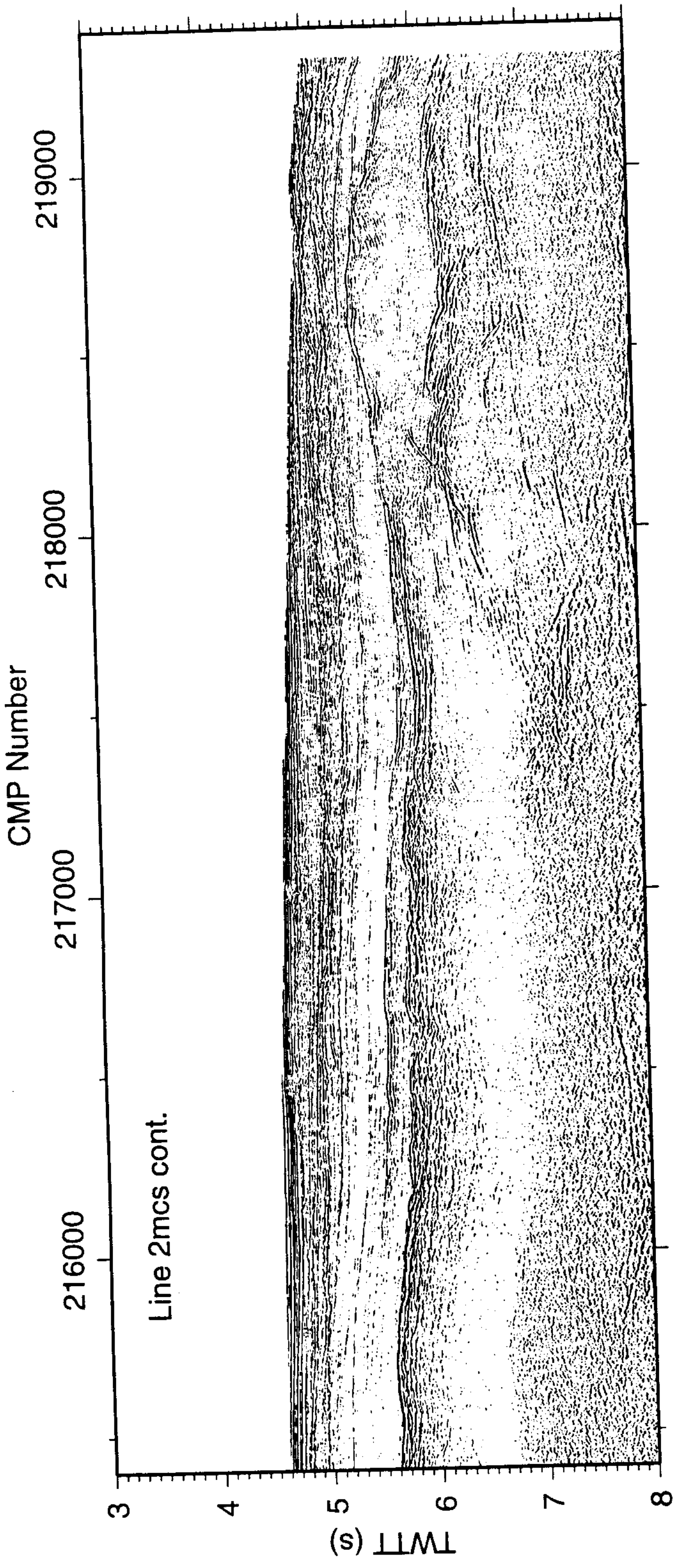
6
7


Line 2mcs cont.
CMP Number
216000
217000
218000
219000
TWTT (s)
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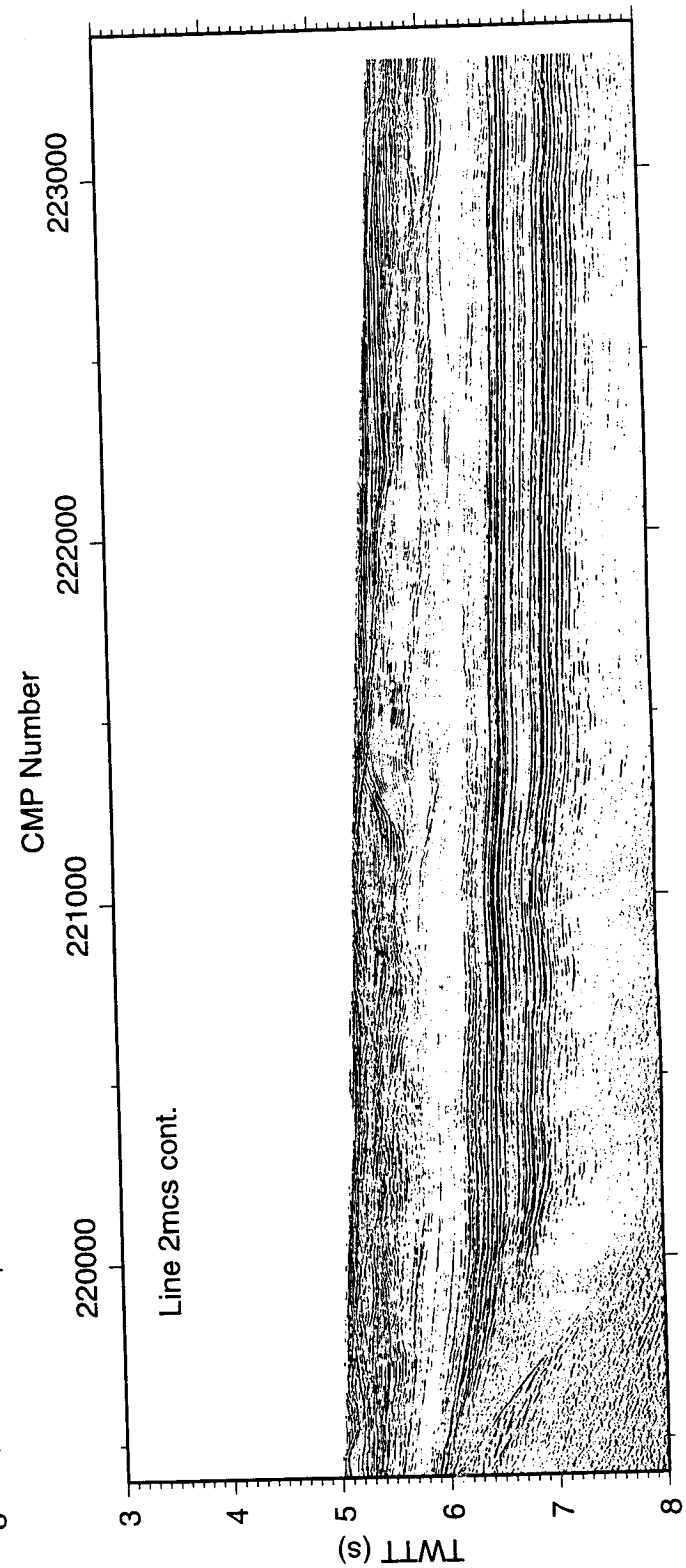
5
6
7
8


Line 2mcs cont.
CMP Number
220000
221000
222000
223000
TWTT (s)
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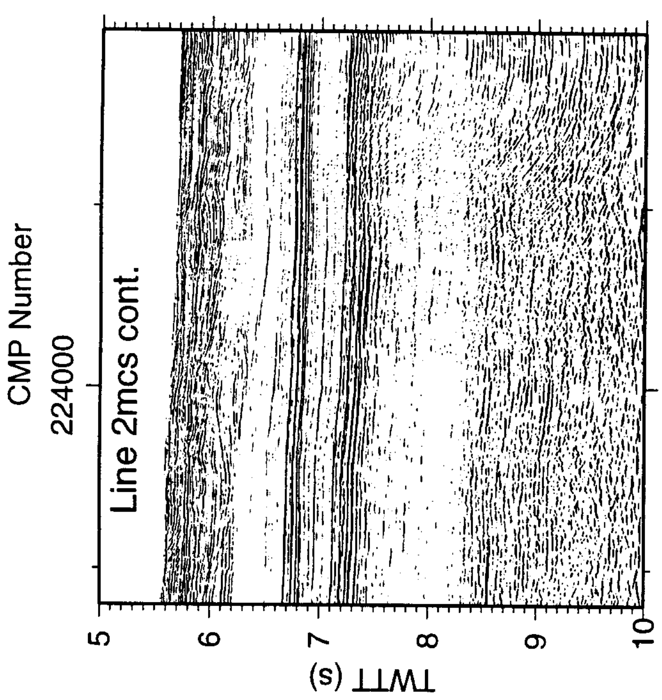
4
5
6
7
8



CMP Number
224000
Line 2mcs cont.
TWTT (s)
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7
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9
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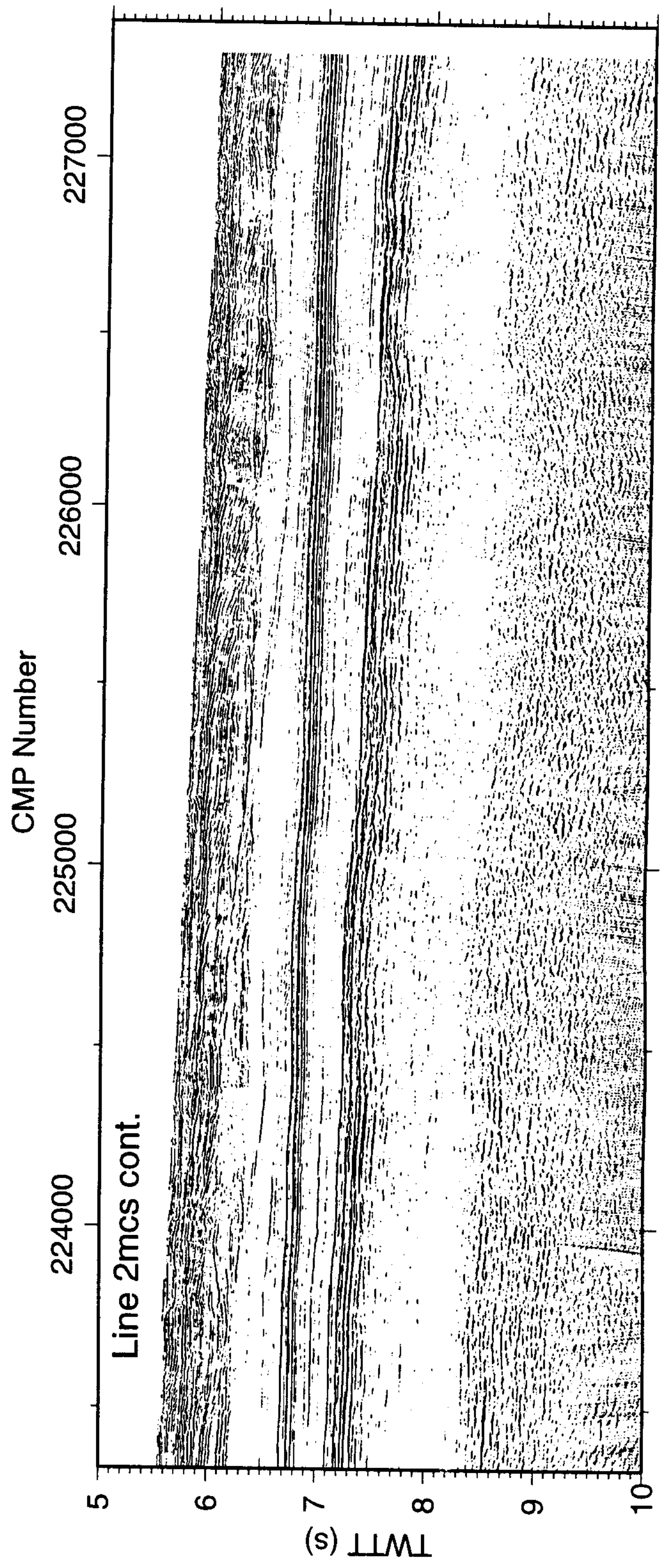

CMP Number
224000
225000
226000
227000
Line 2mcs cont.
TWTT (s)
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9
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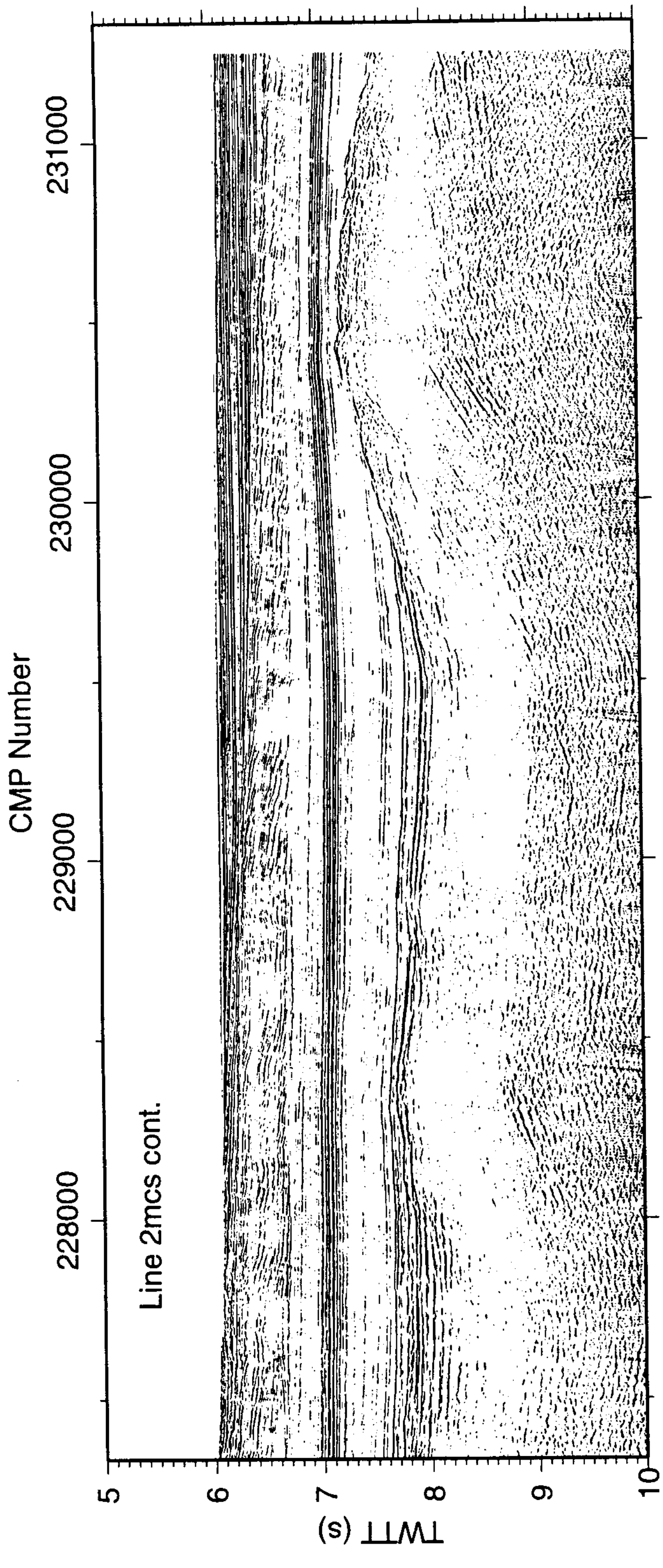
CMP Number
231000
230000
229000
228000
Line 2mcs cont.
TWTT (s)
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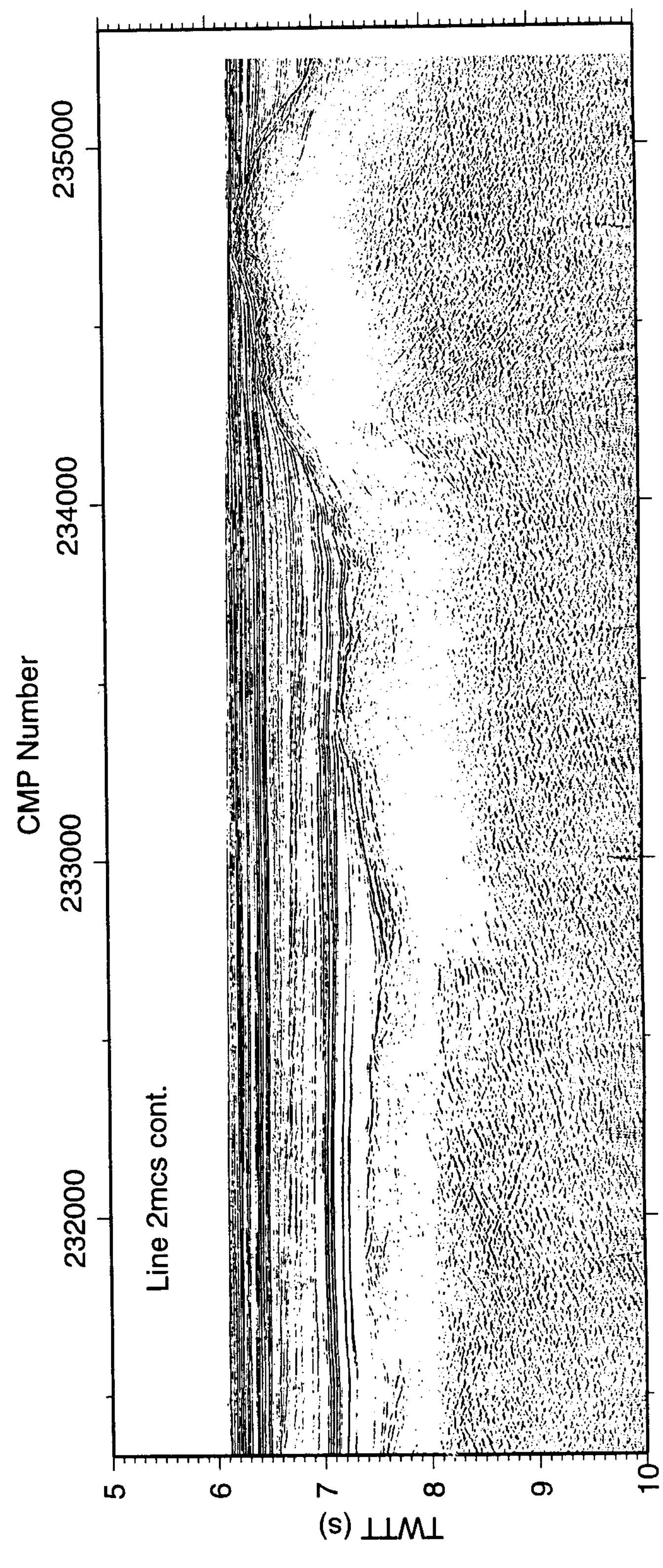
CMP Number
235000
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233000
232000
Line 2mcs cont.
TWTT (s)
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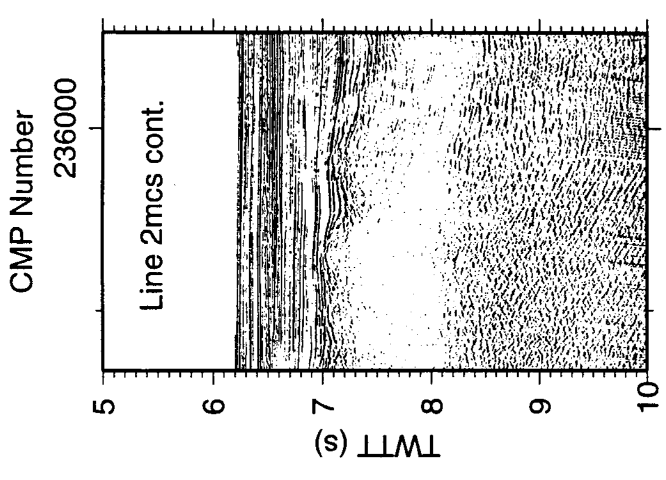
CMP Number
236000
Line 2mcs cont.
TWTT (s)
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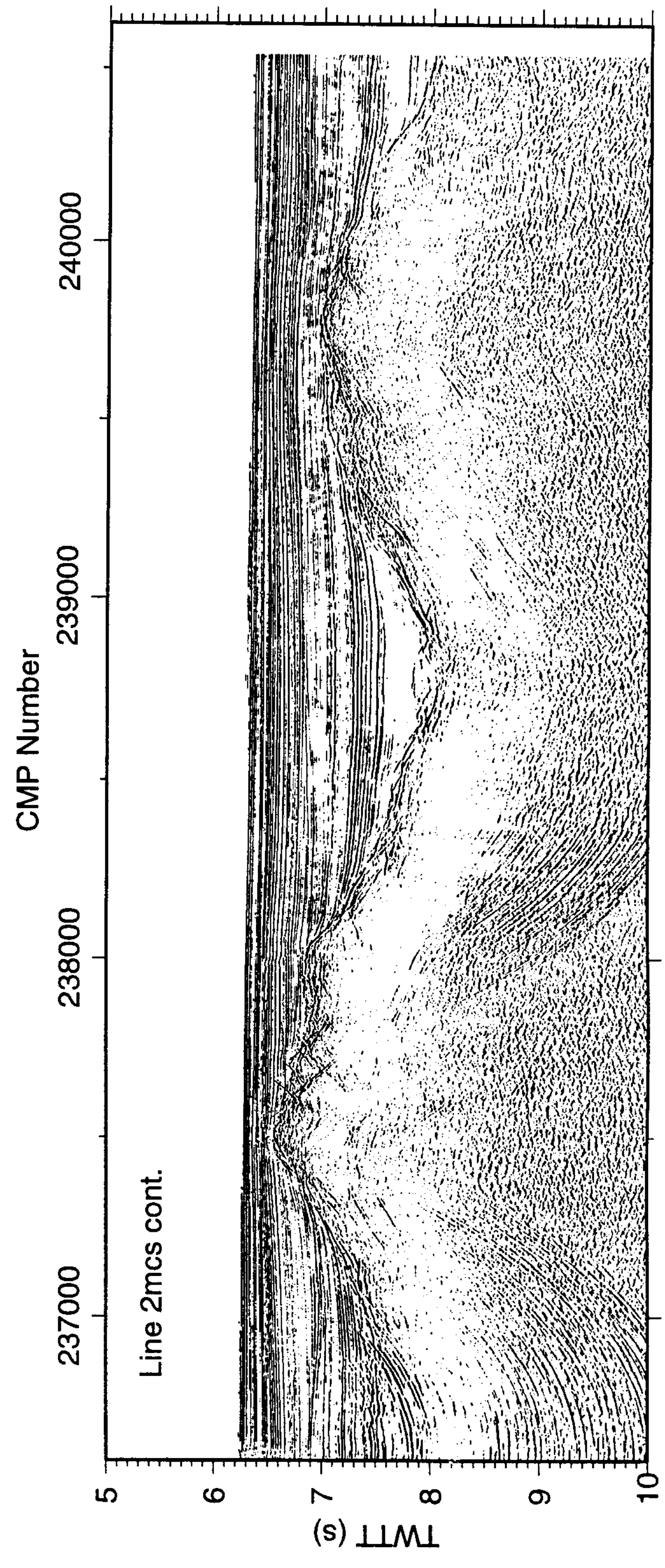
CMP Number
237000
238000
239000
240000
Line 2mcs cont.
TWTT (s)
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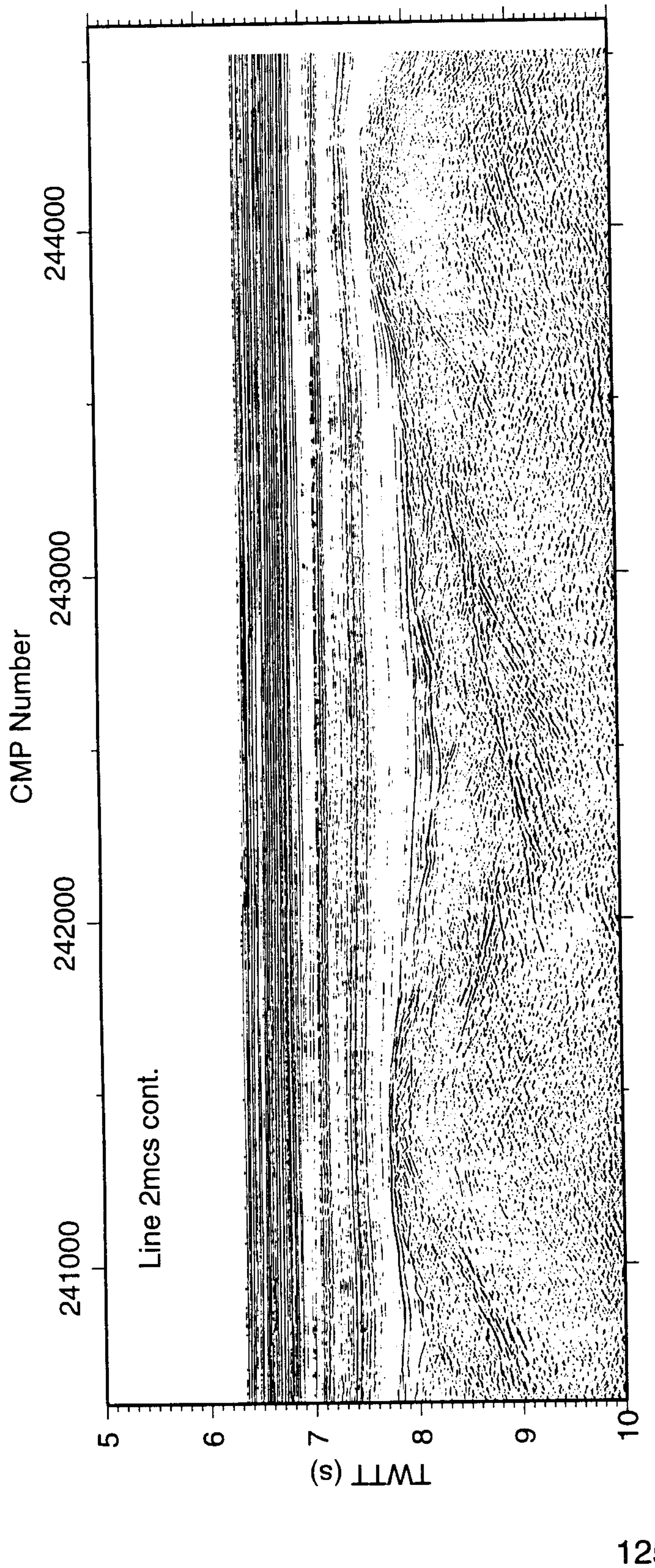

Line 2mcs cont.
CMP Number
241000
242000
243000
244000
TWTT (s)
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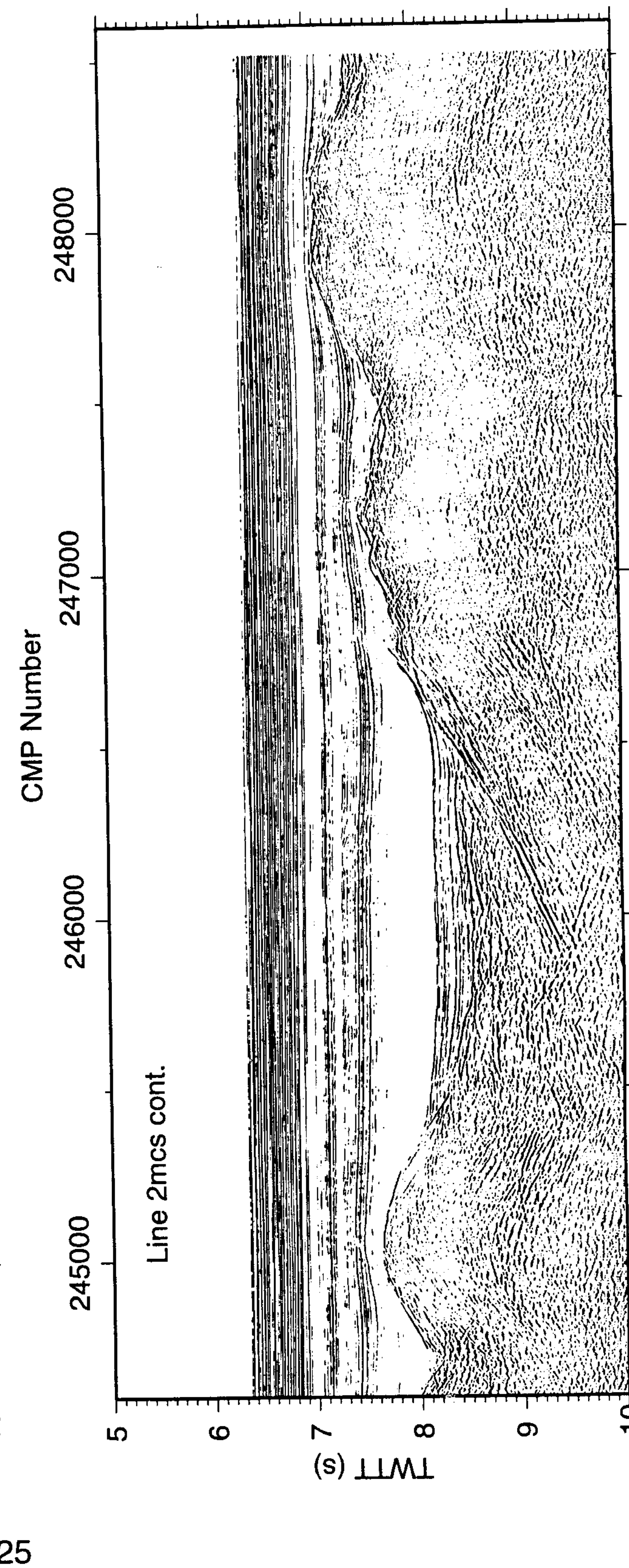

Line 2mcs cont.
CMP Number
245000
246000
247000
248000
TWTT (s)
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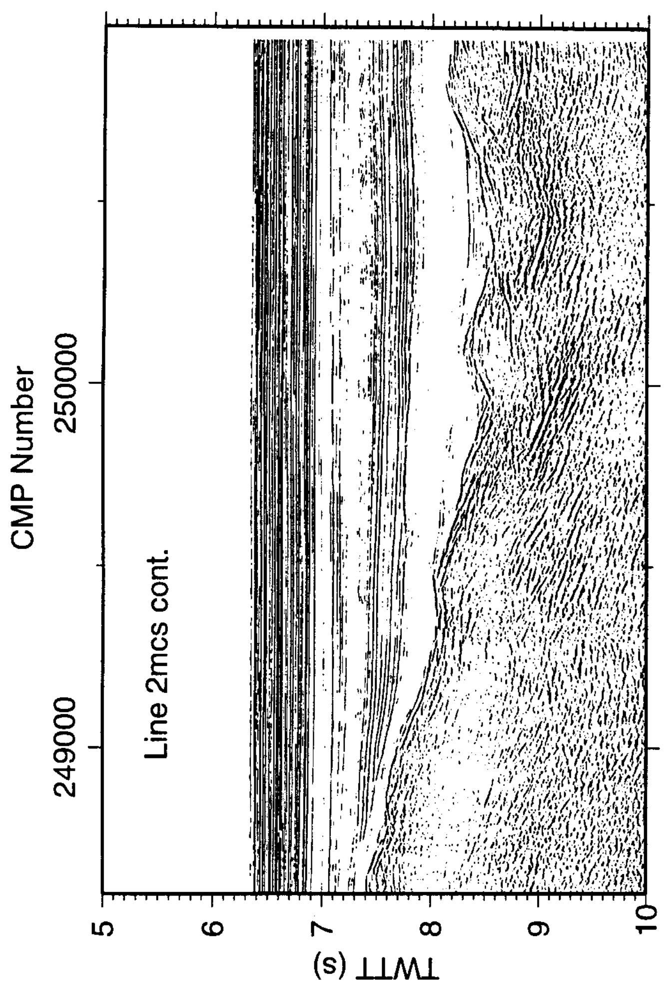
10


CMP Number
249000
250000
Line 2mcs cont.
TWTT (s)
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8
9
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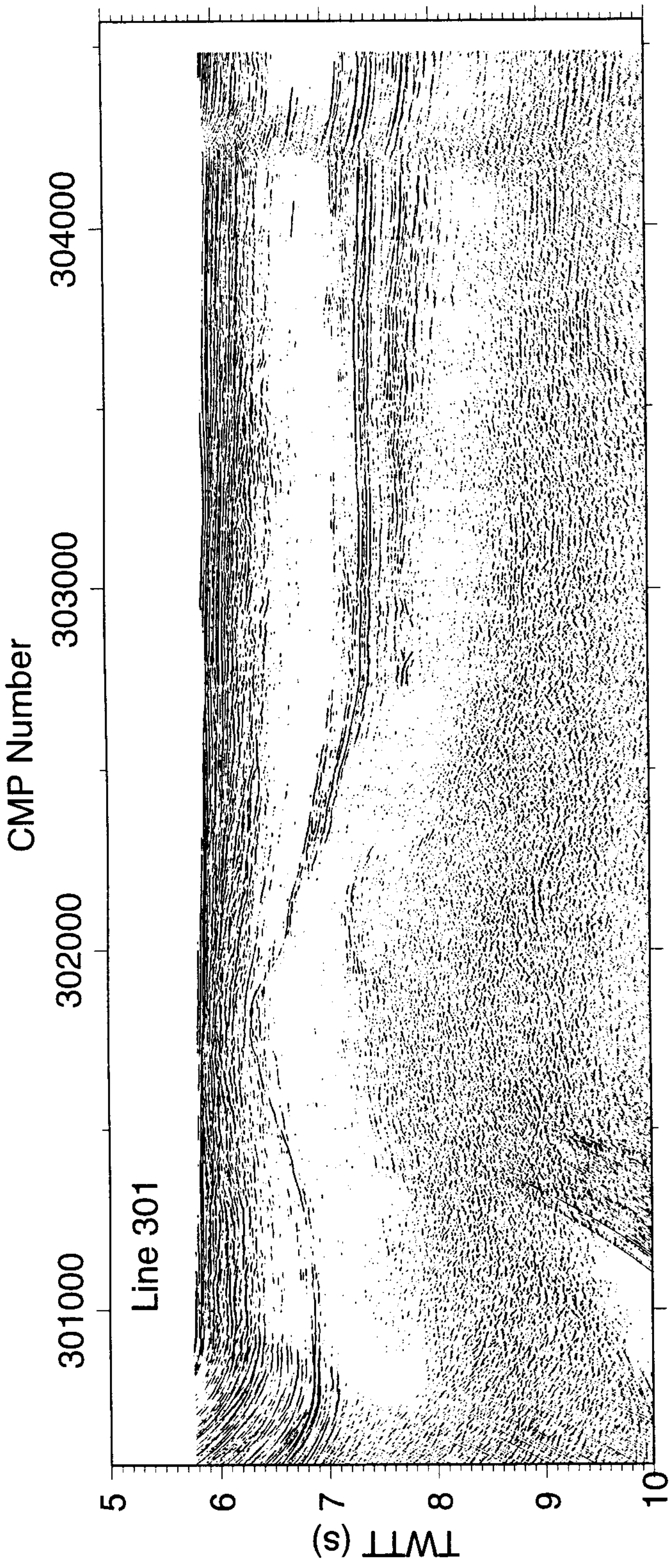
CMP Number
301000
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303000
304000
Line 301
TWTT (s)
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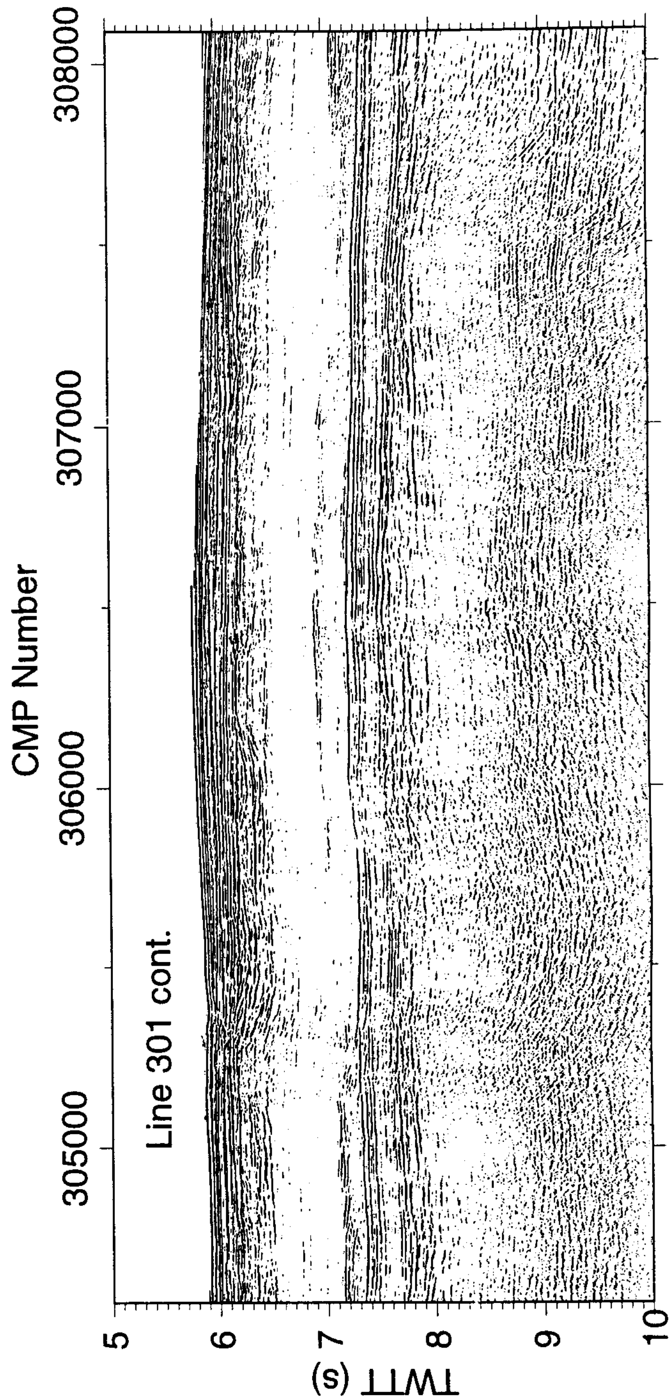
CMP Number
305000
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307000
308000
Line 301 cont.
TWTT (s)
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9
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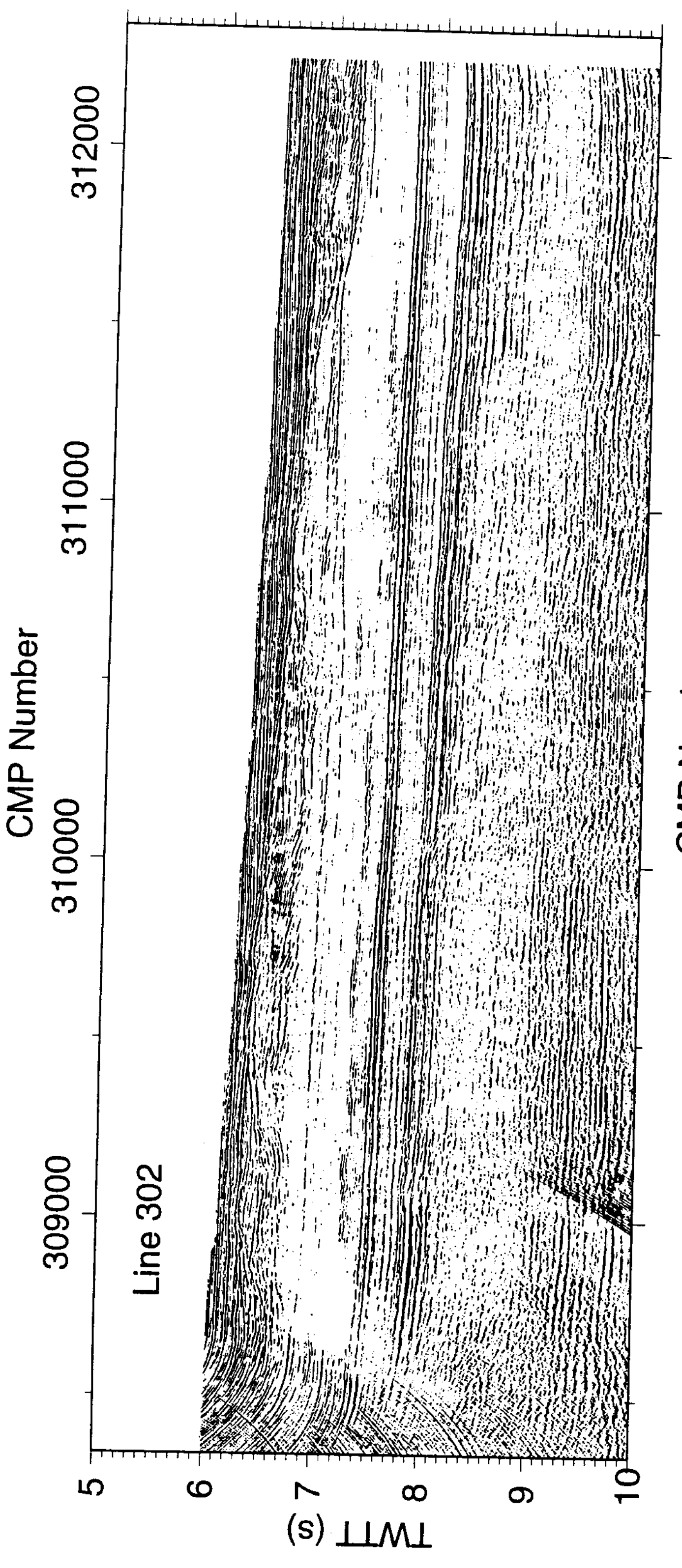
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309000
310000
311000
312000
Line 302
TWTT (s)
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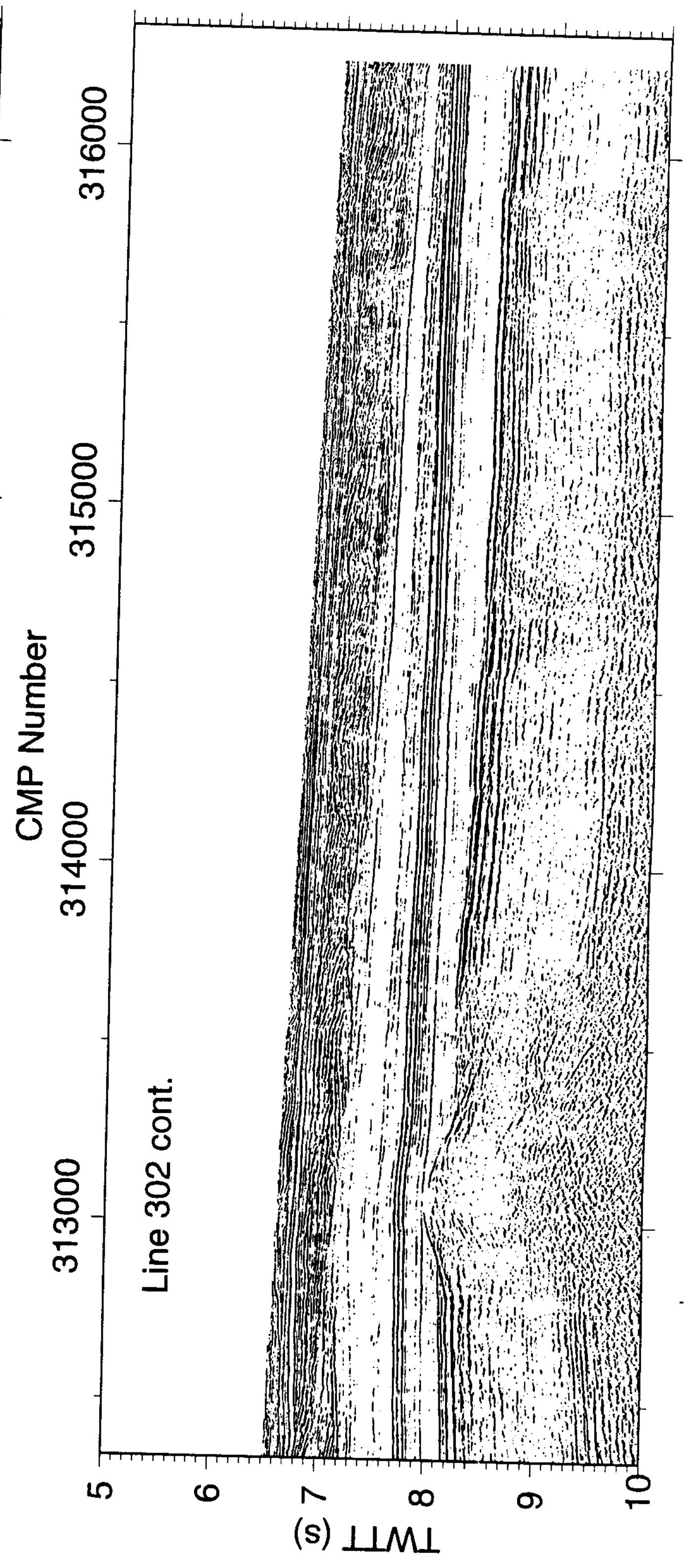
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315000
316000
Line 302 cont.
TWTT (s)
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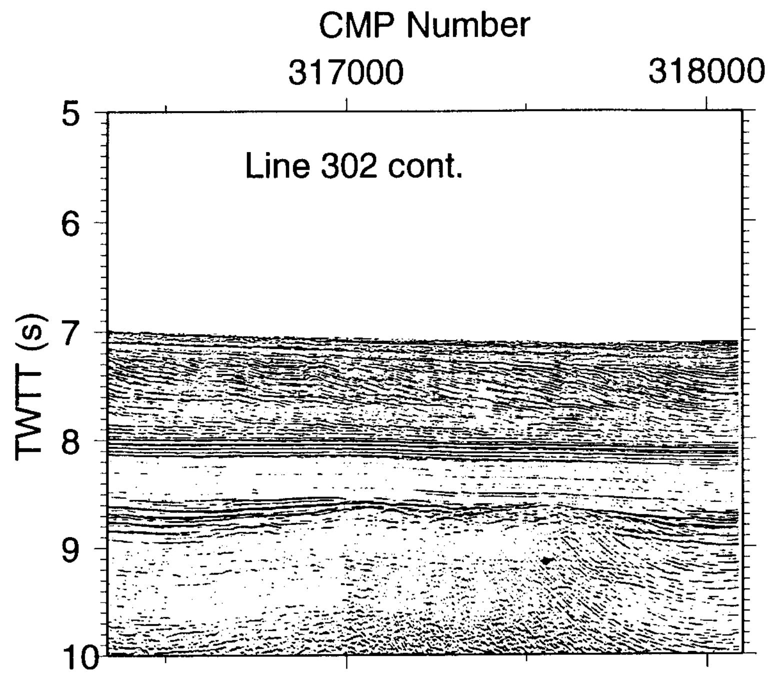
CMP Number
317000
318000
Line 302 cont.
TWTT (s)
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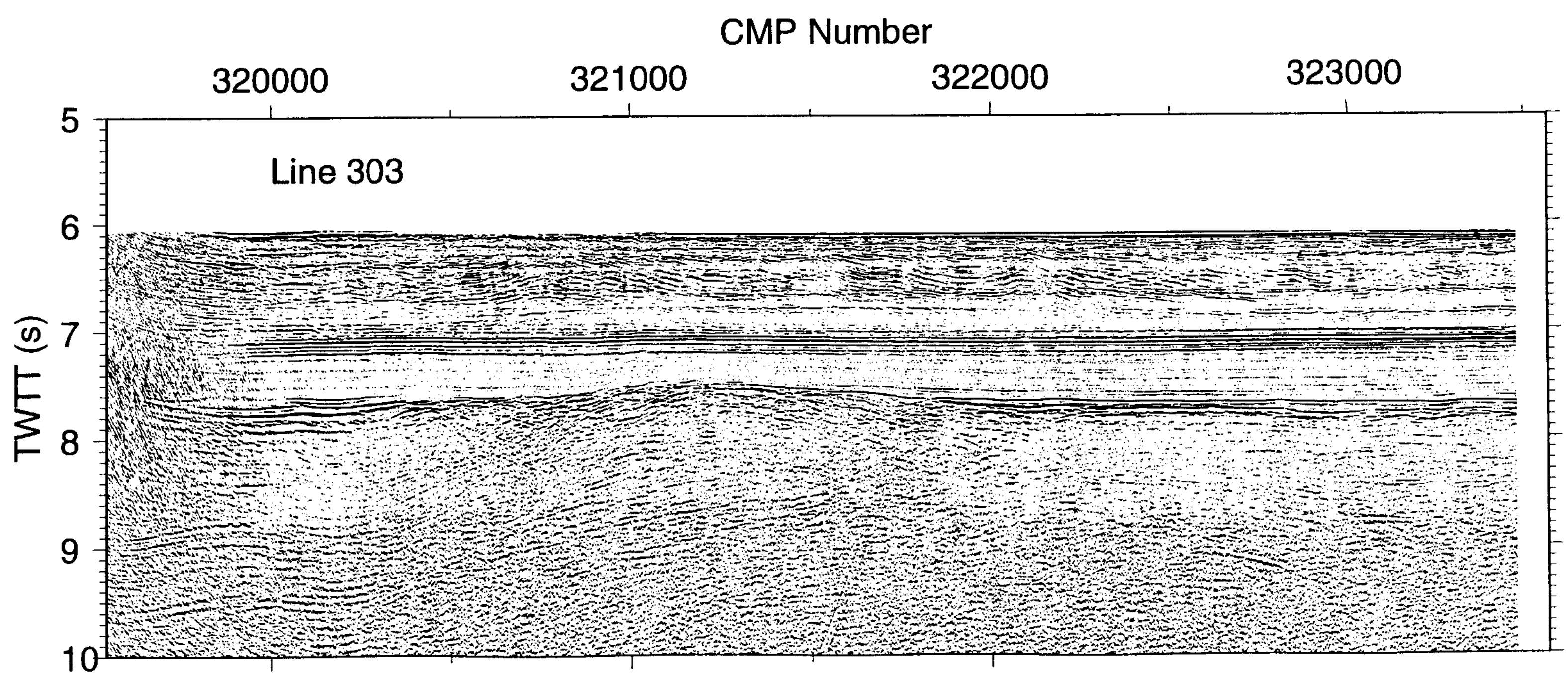
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322000
323000
Line 303
TWTT (s)
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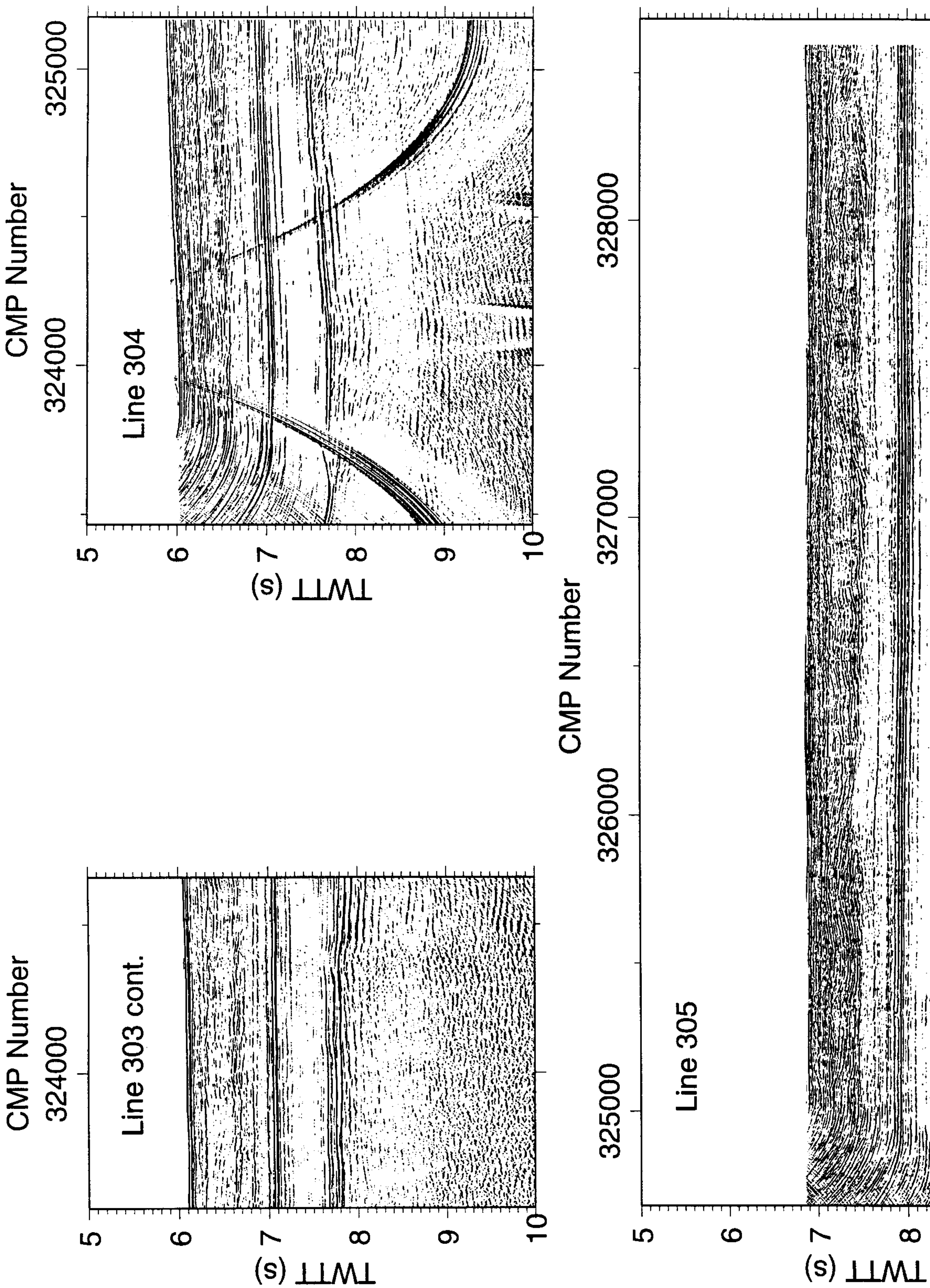
CMP Number
Line 304
324000
325000
TWTT (s)
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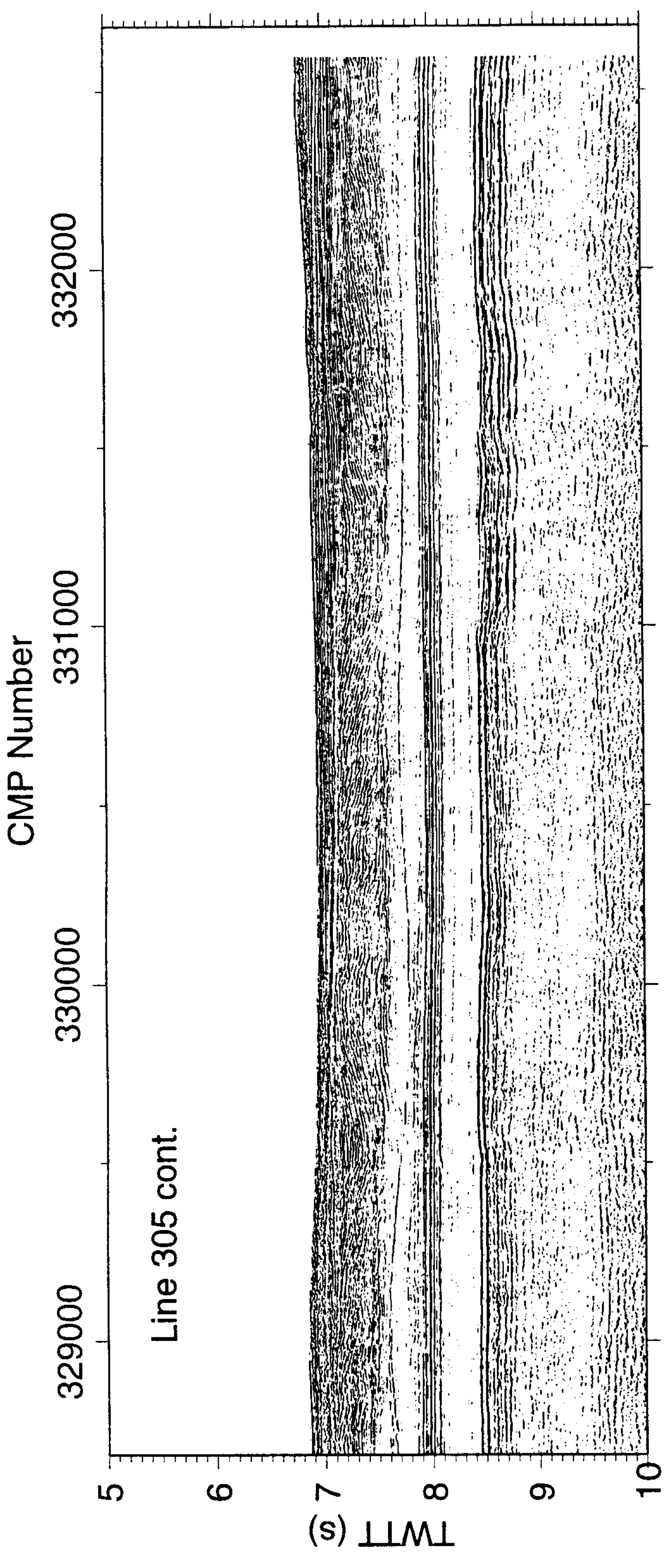
CMP Number
Line 303 cont.
324000
TWTT (s)
CMP Number
Line 305
325000
326000
327000
328000
TWTT (s)


CMP Number
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331000
332000
Line 305 cont.
TWTT (s)
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7
8
9
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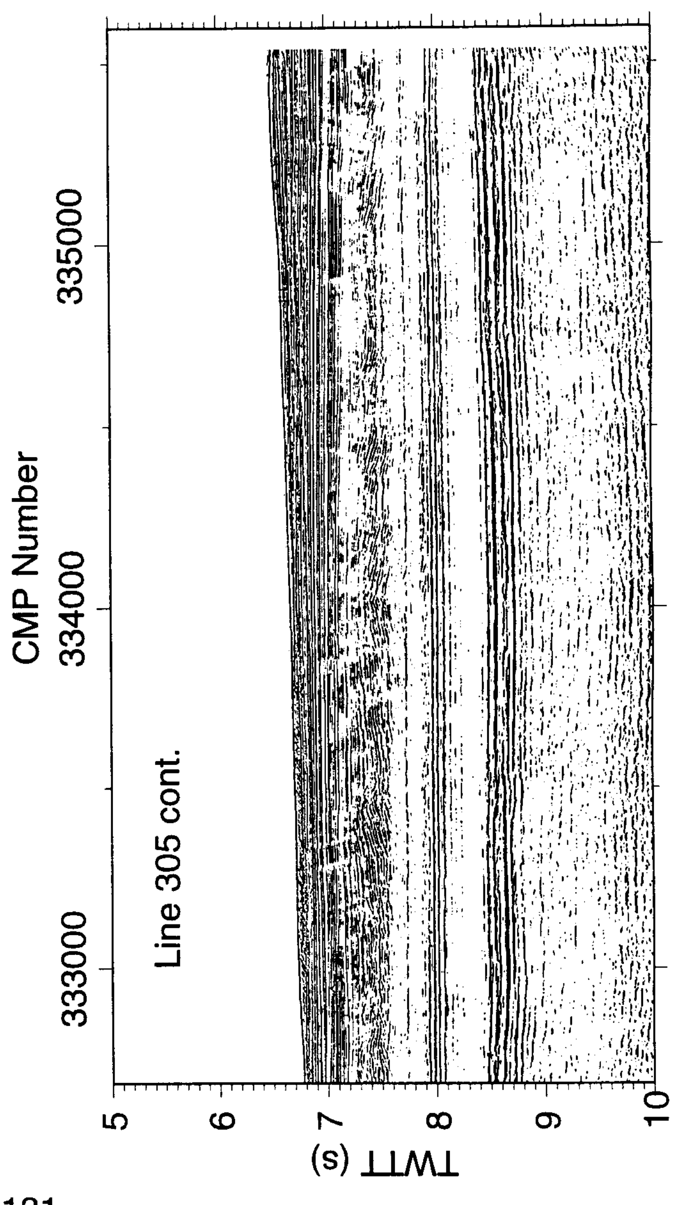
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334000
335000
Line 305 cont.
TWTT (s)
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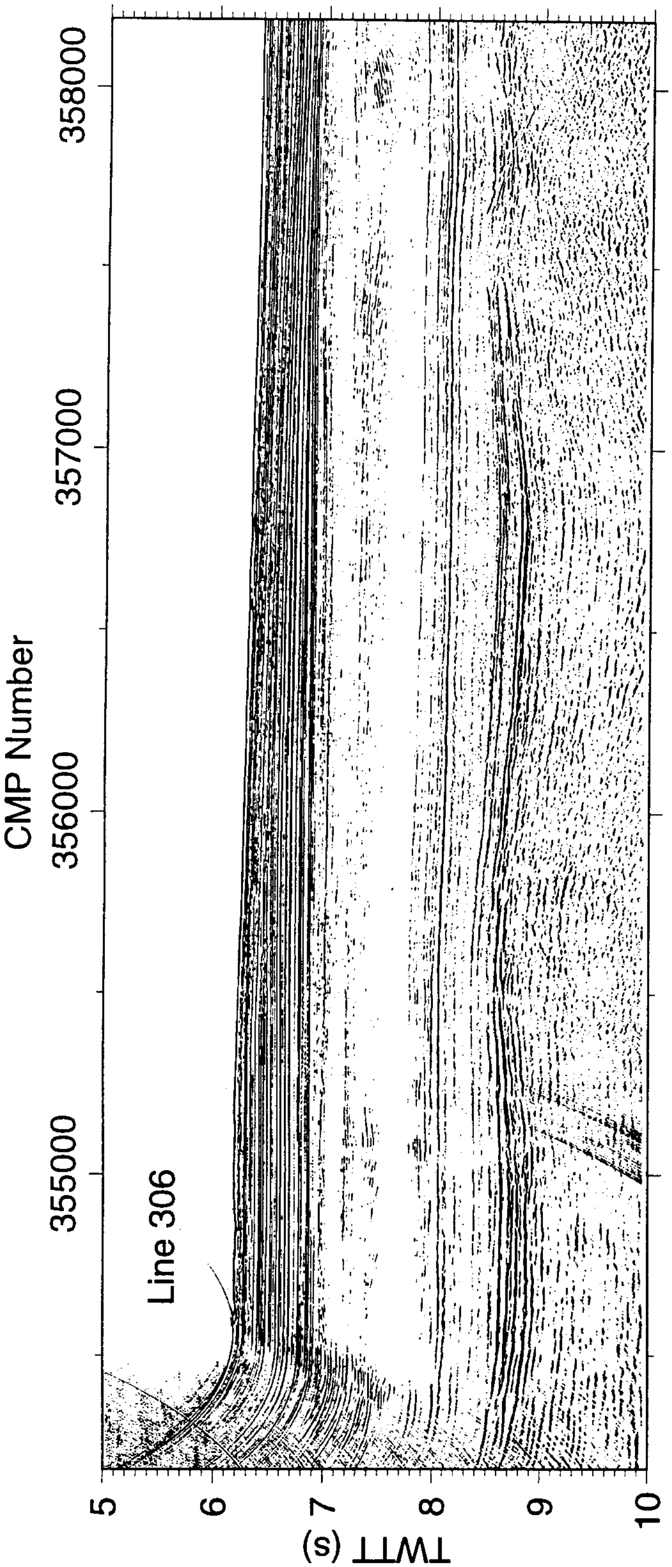

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357000
358000
Line 306
TWTT (s)
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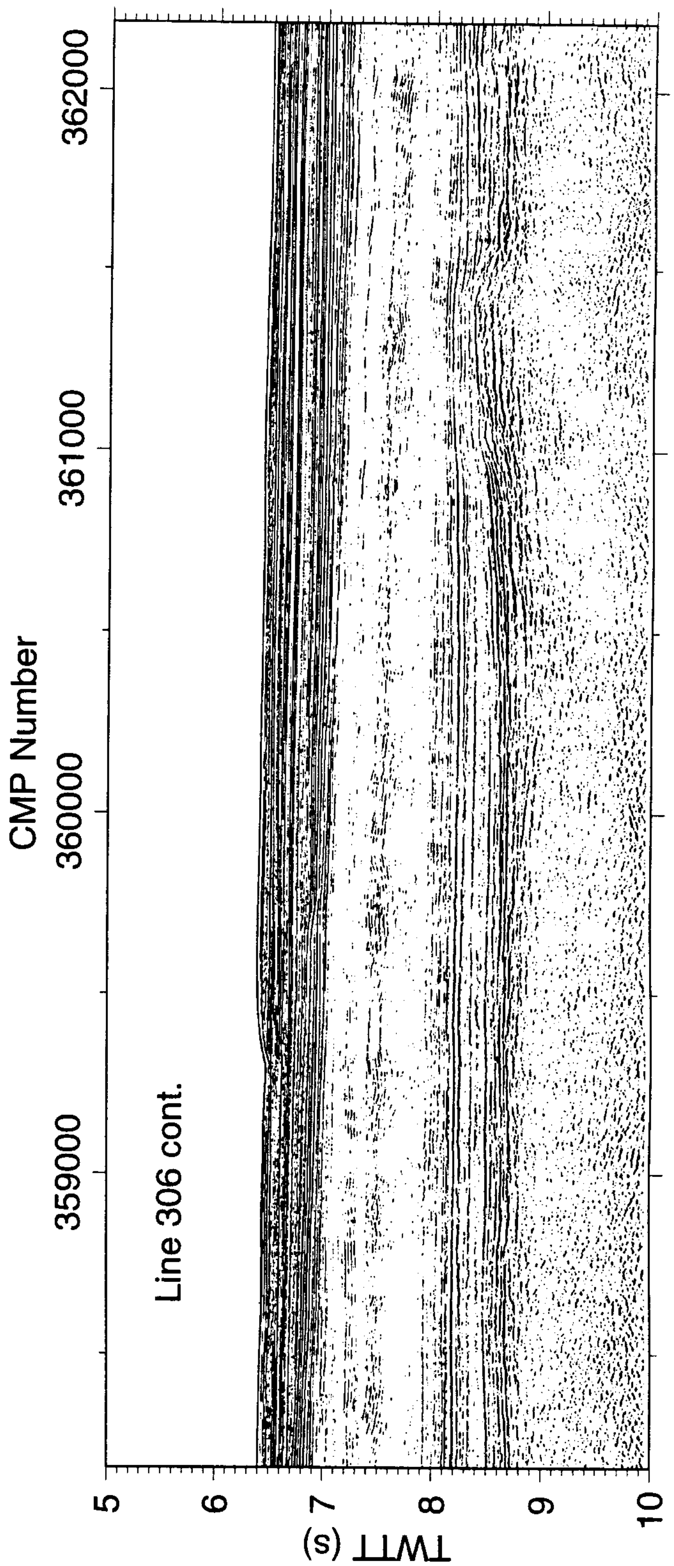

CMP Number
359000
360000
361000
362000
Line 306 cont.
TWTT (s)
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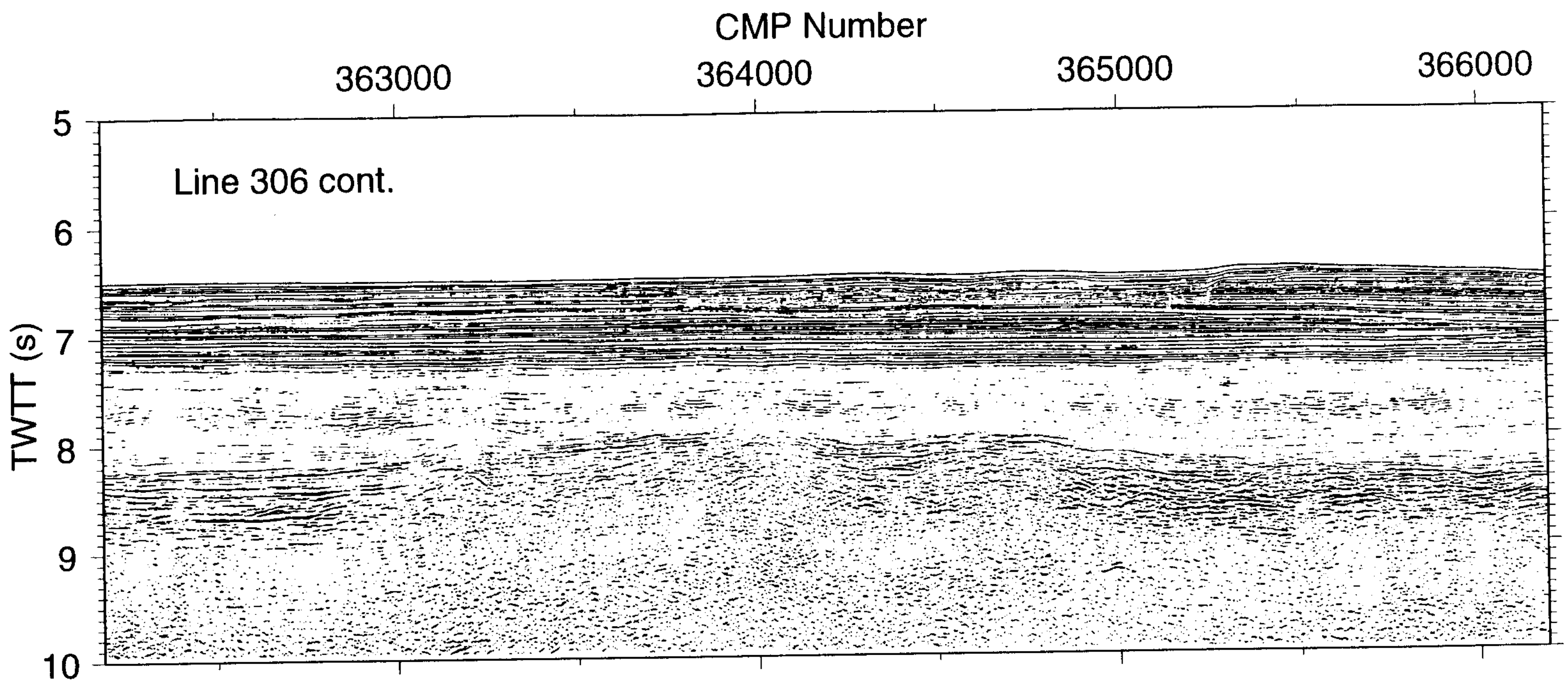
CMP Number
363000
364000
365000
366000
Line 306 cont.
TWTT (s)
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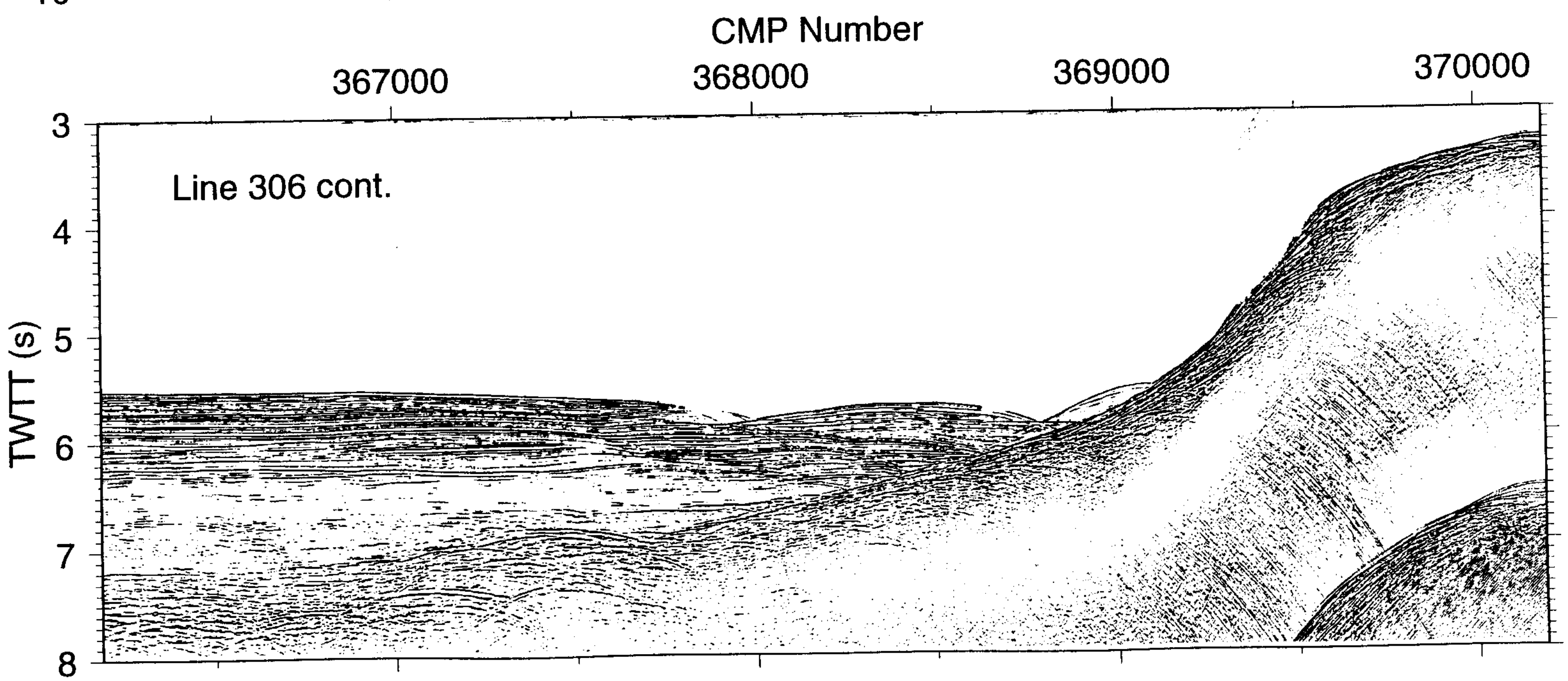
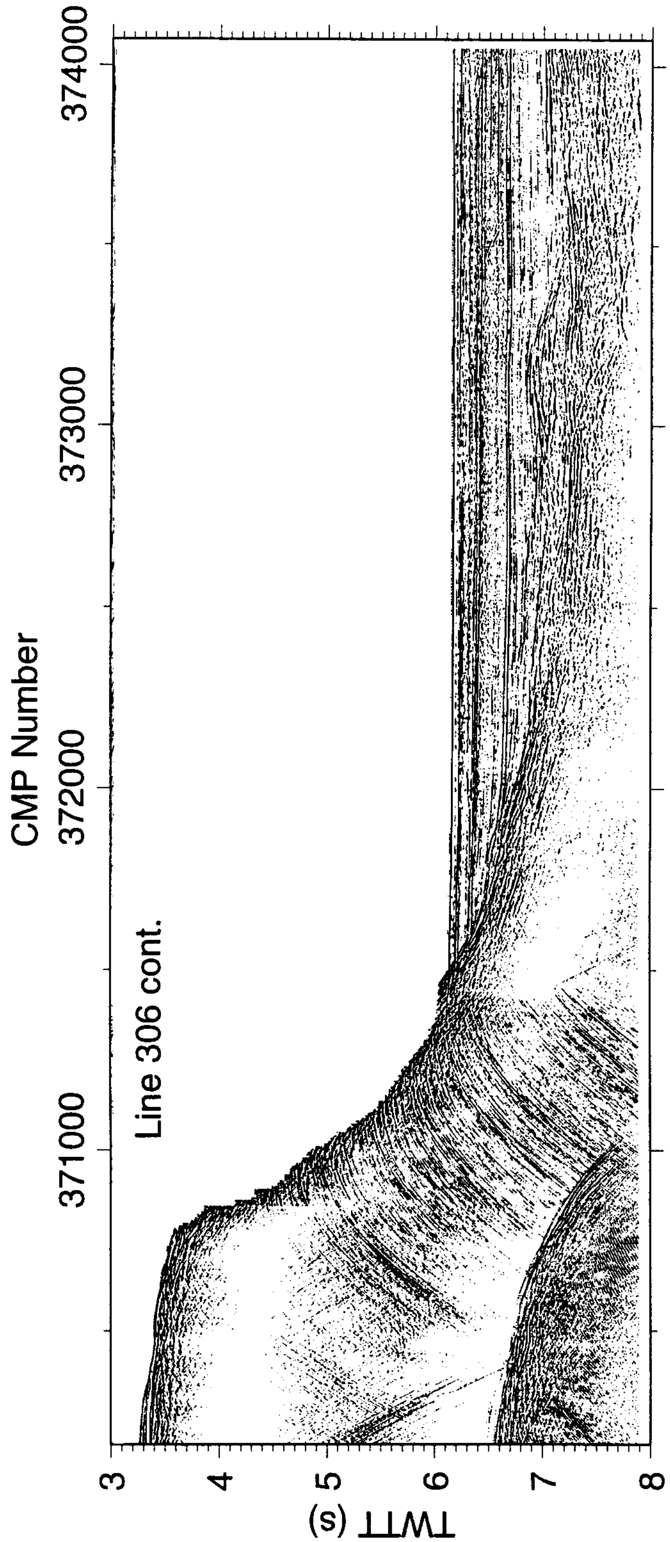
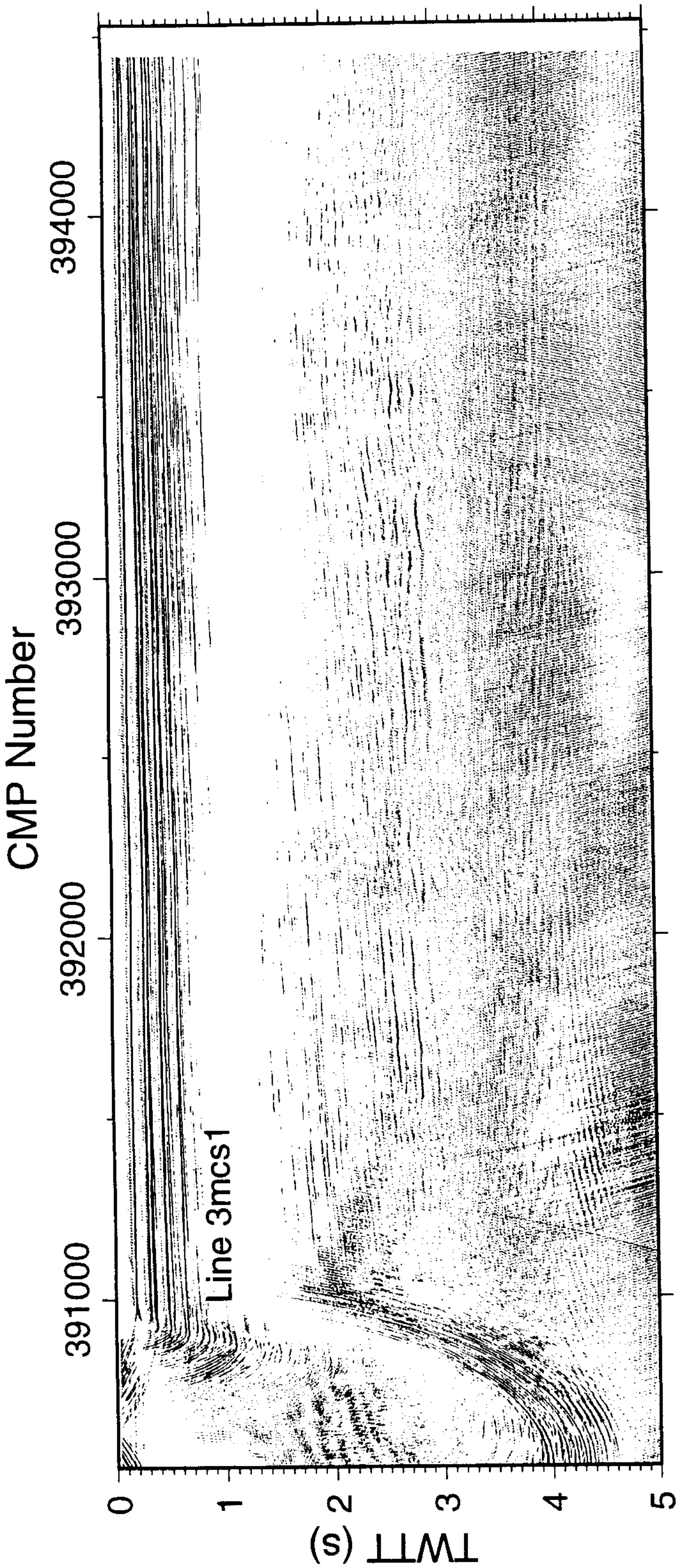
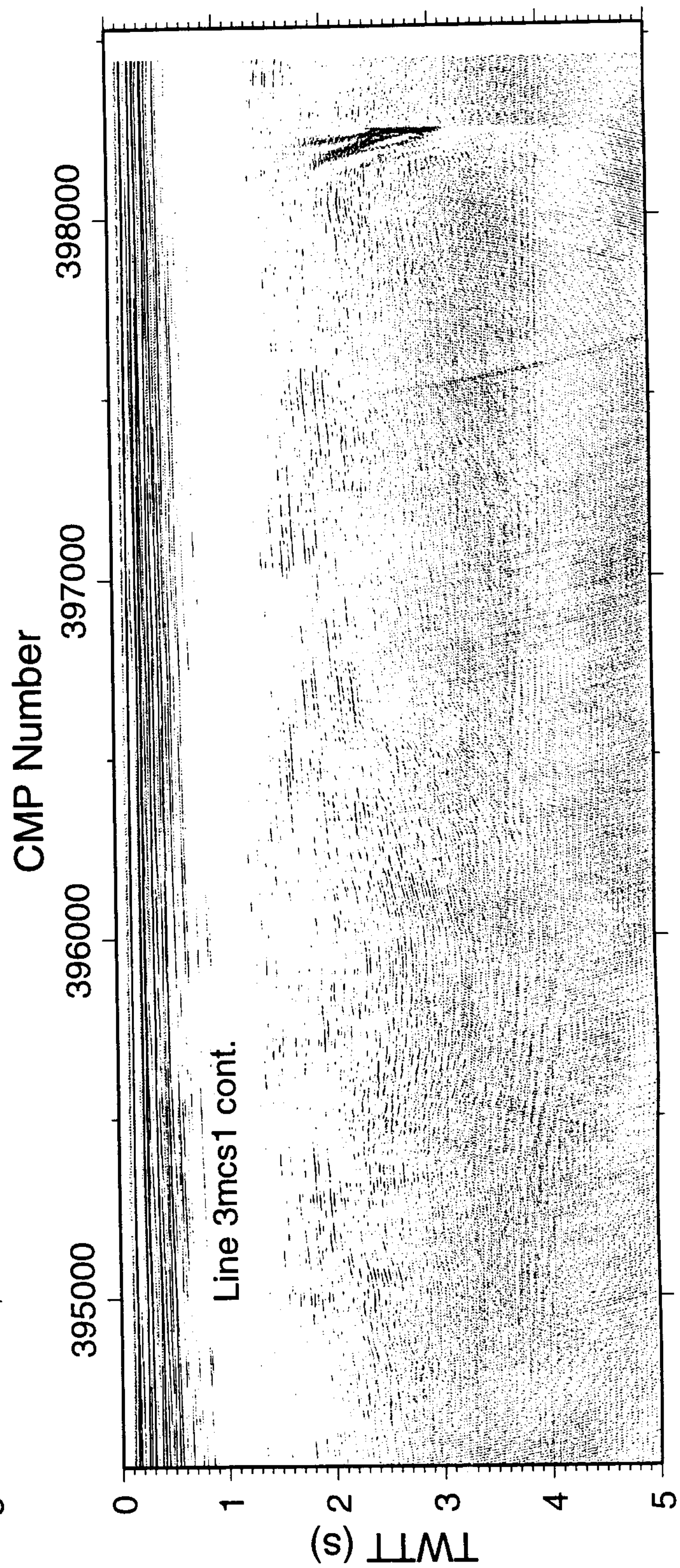

CMP Number
367000
368000
369000
370000
Line 306 cont.
TWTT (s)
3
4
5
6
7
8

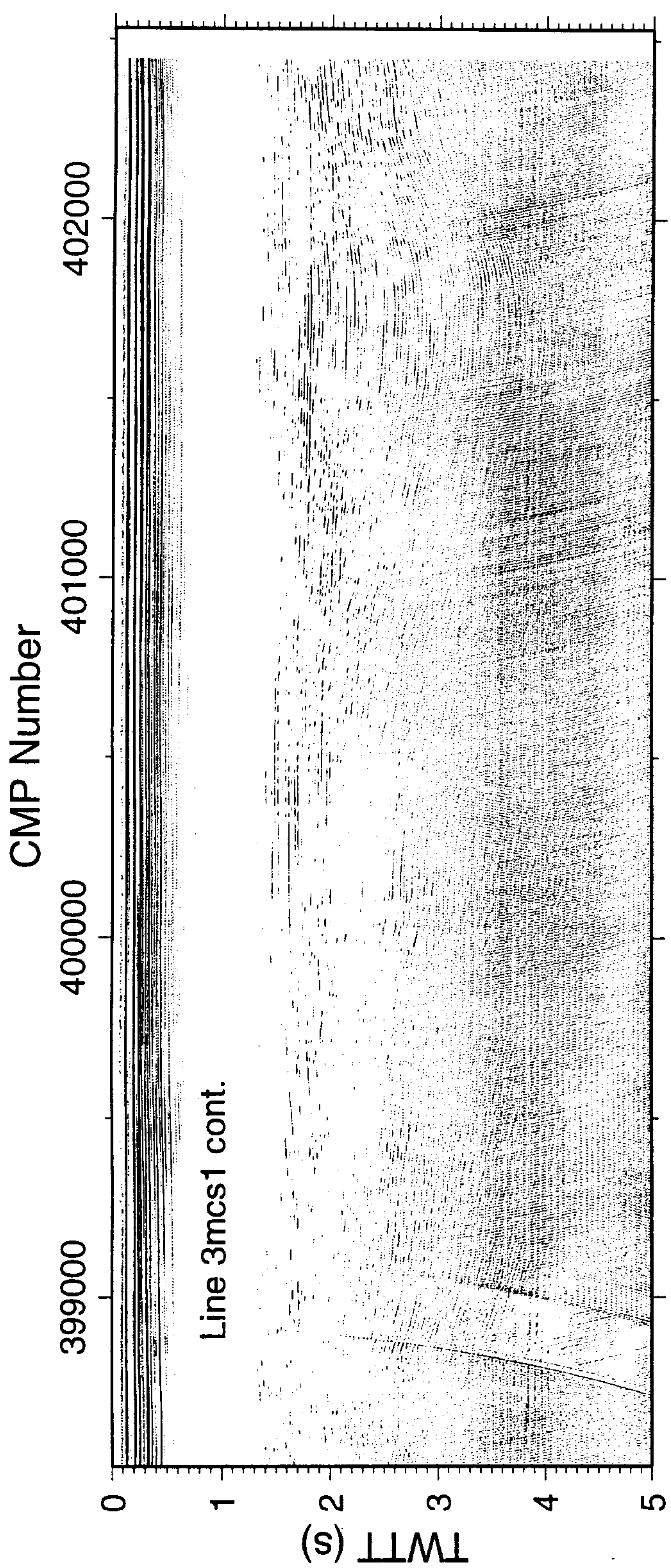

CMP Number
Line 306 cont.
371000
372000
373000
374000
TWTT (s)
3
4
5
6
7
8

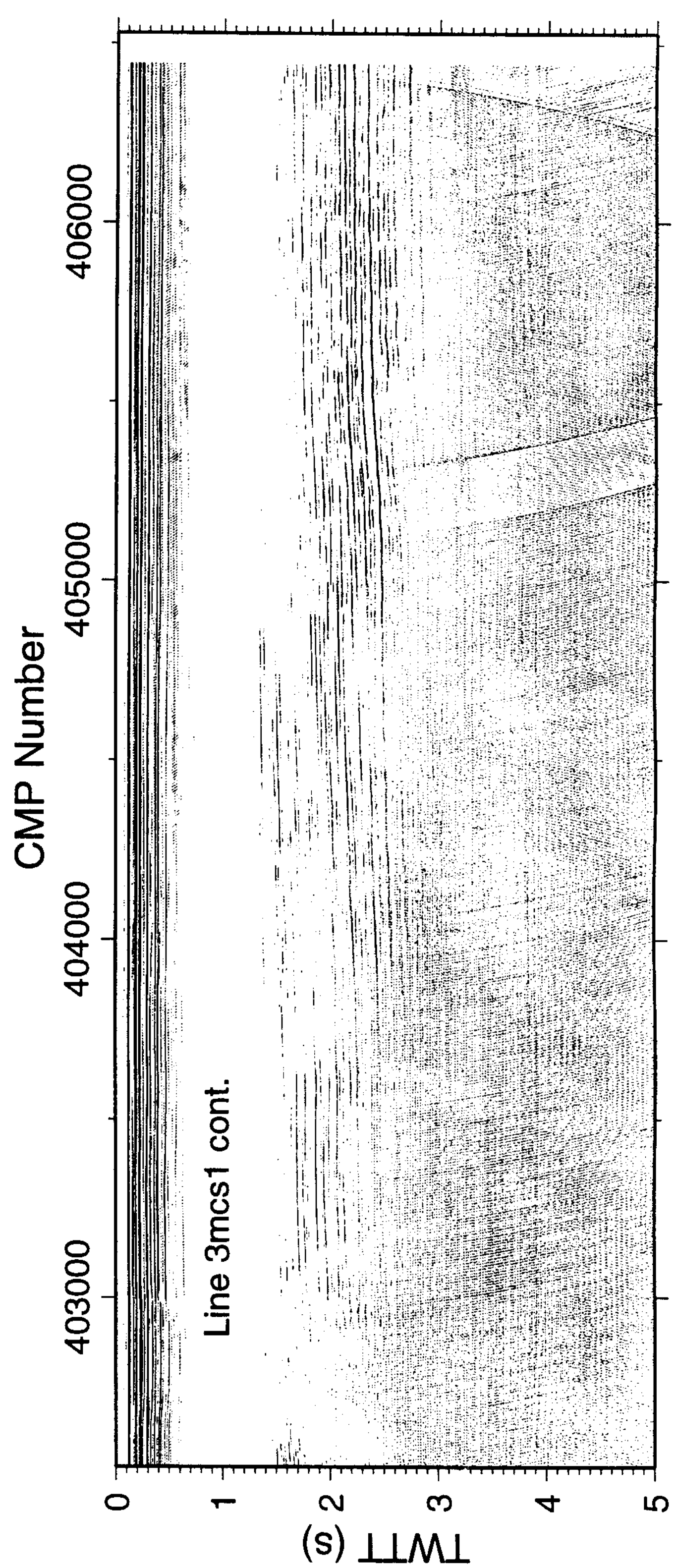


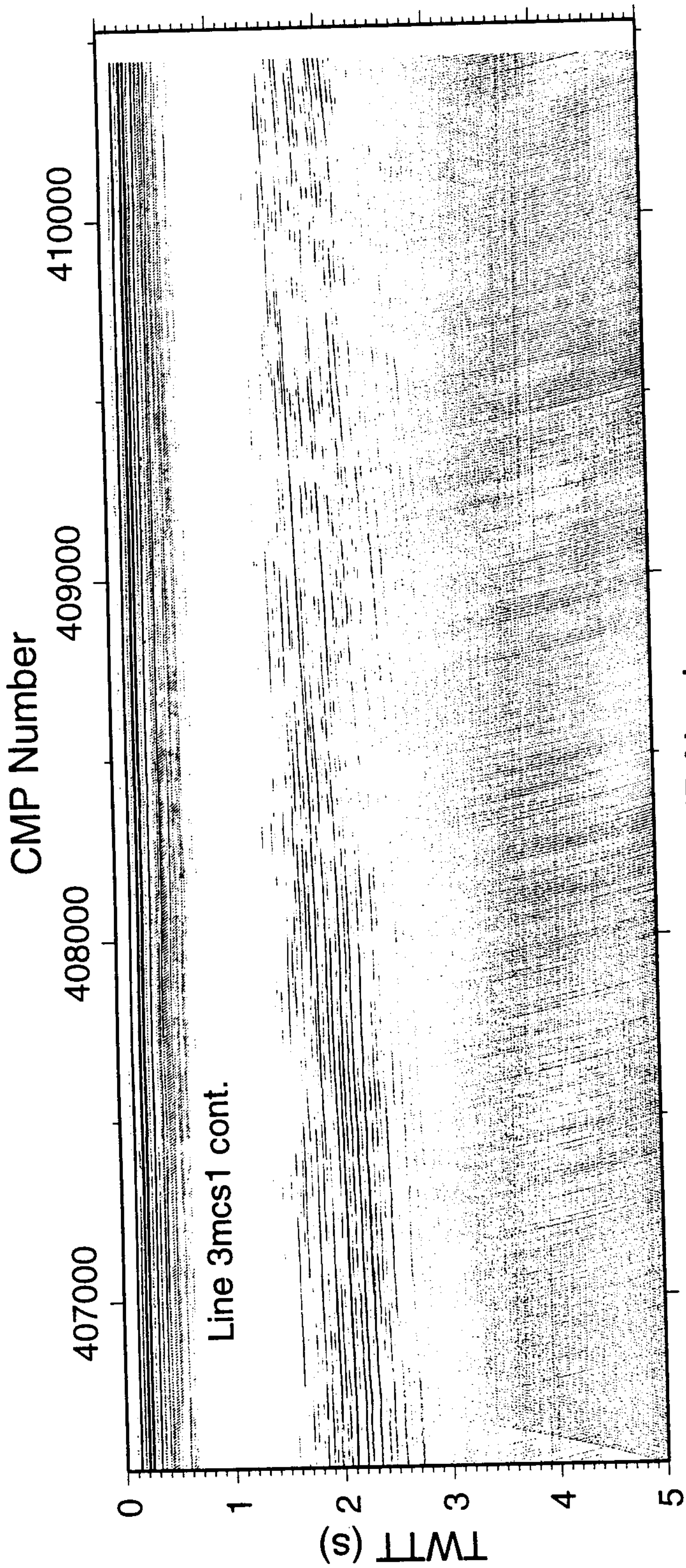
CMP Number
391000
392000
393000
394000
Line 3mcs1
TWTT (s)
0
1
2
3
4
5

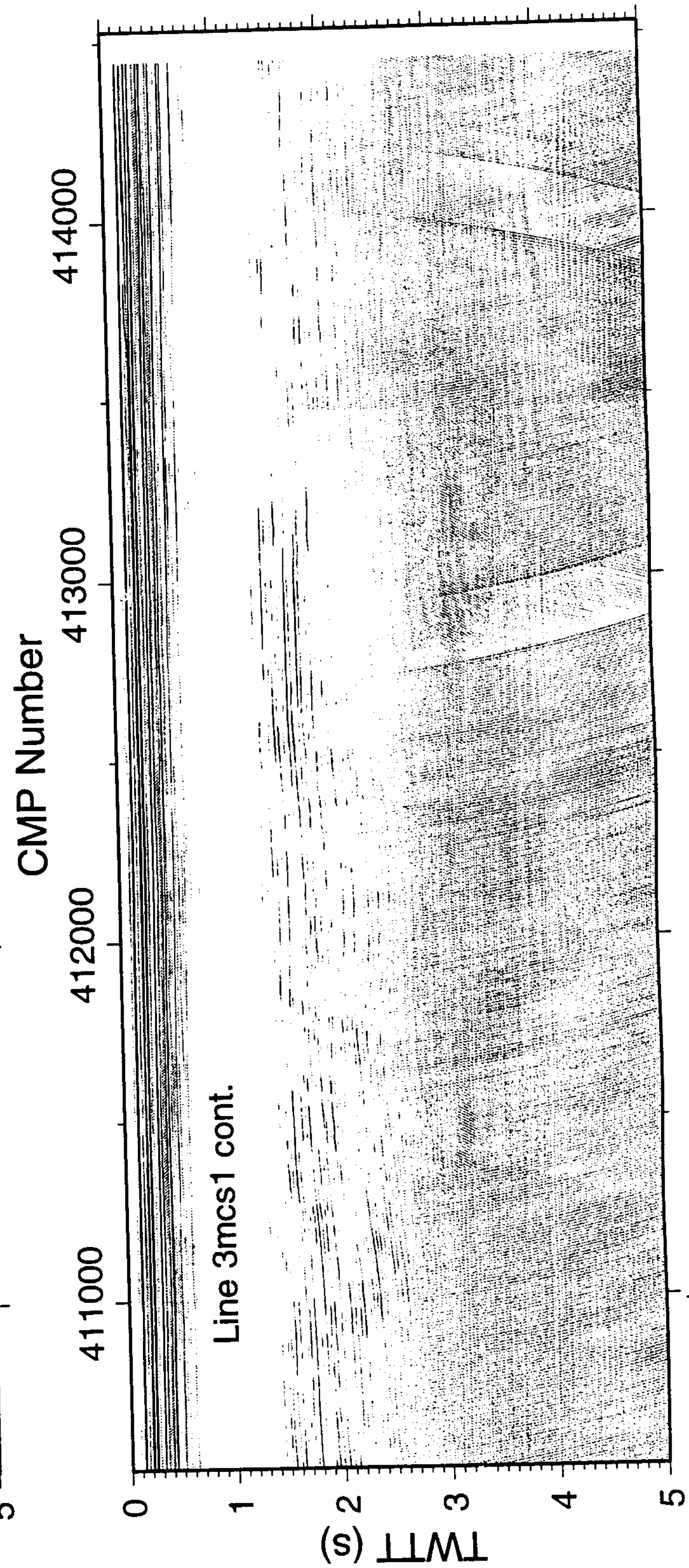


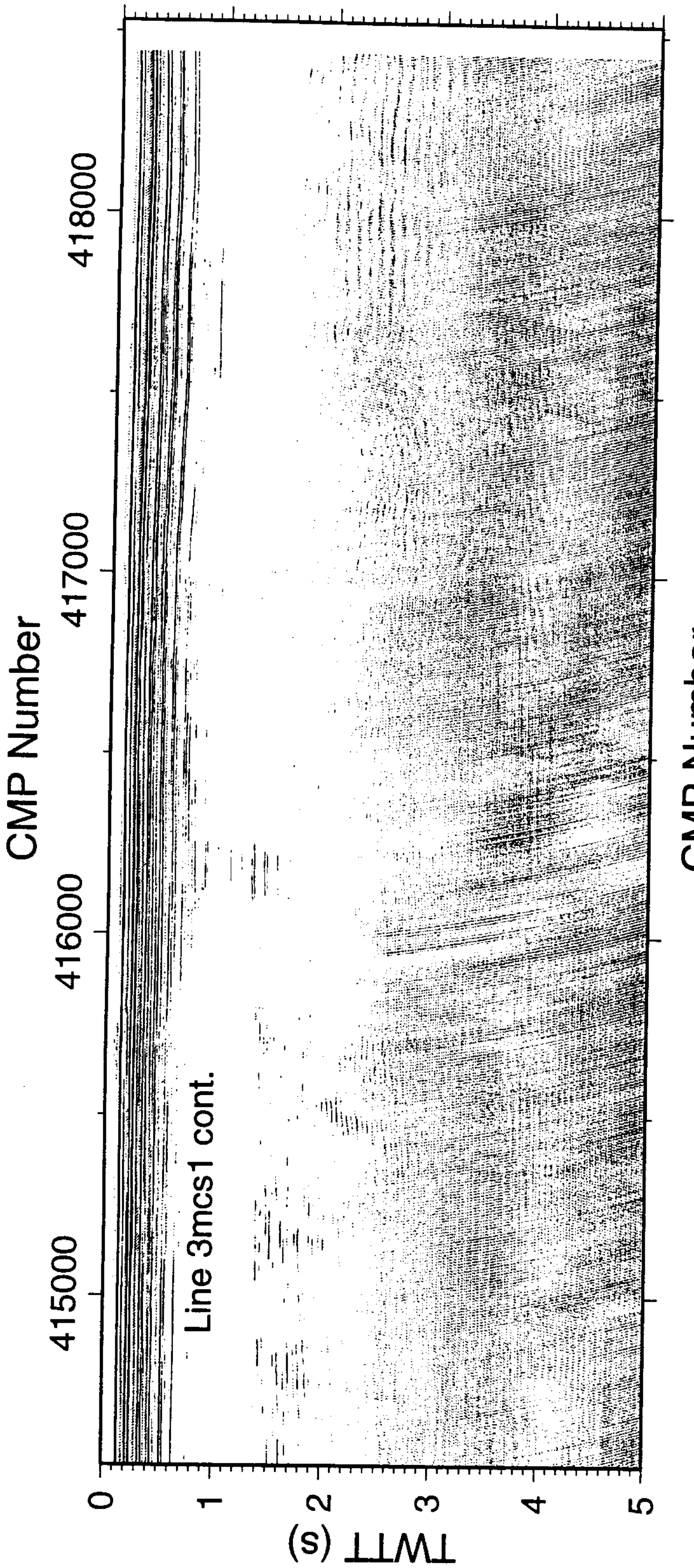
CMP Number
395000
396000
397000
398000
Line 3mcs1 cont.
TWTT (s)
0
1
2
3
4
5

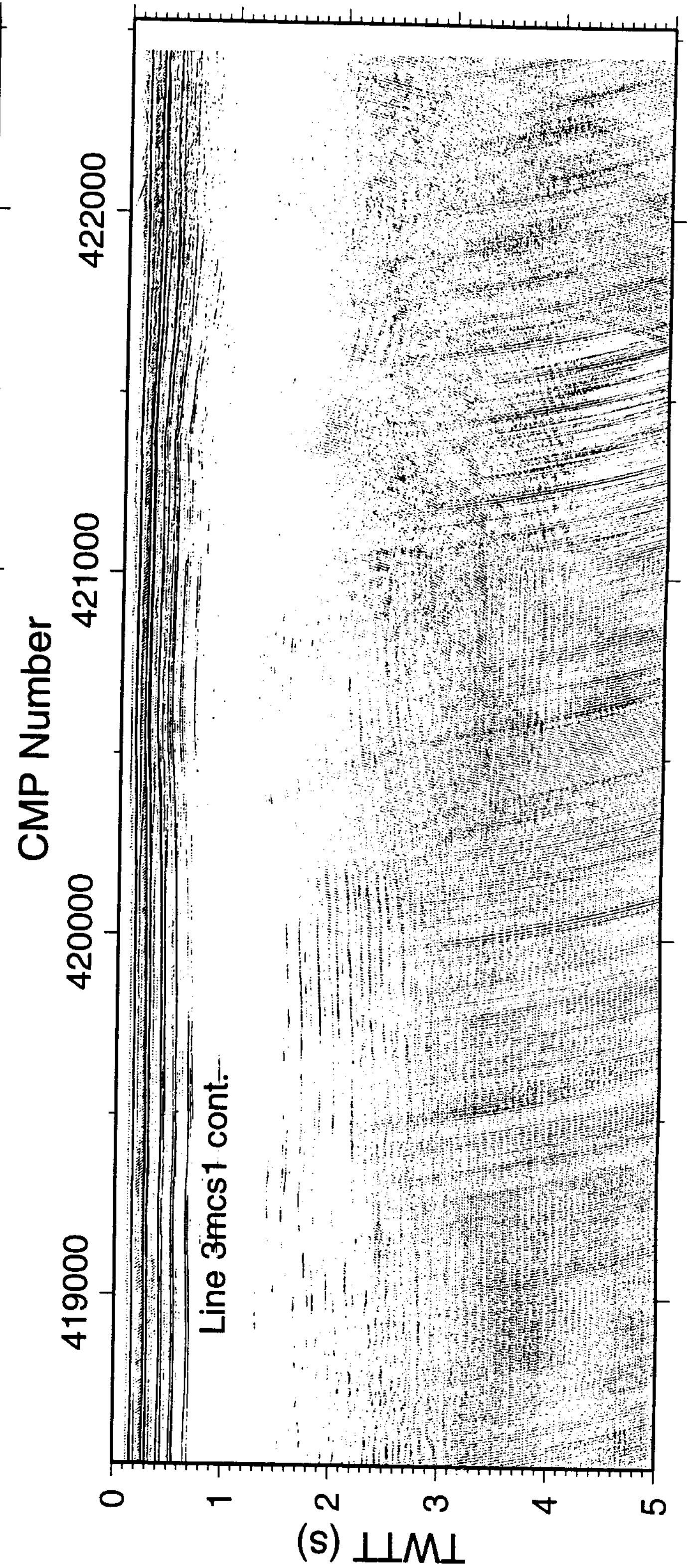

CMP Number
399000
400000
401000
402000
Line 3mcs1 cont.
TWTT (s)
0
1
2
3
4
5

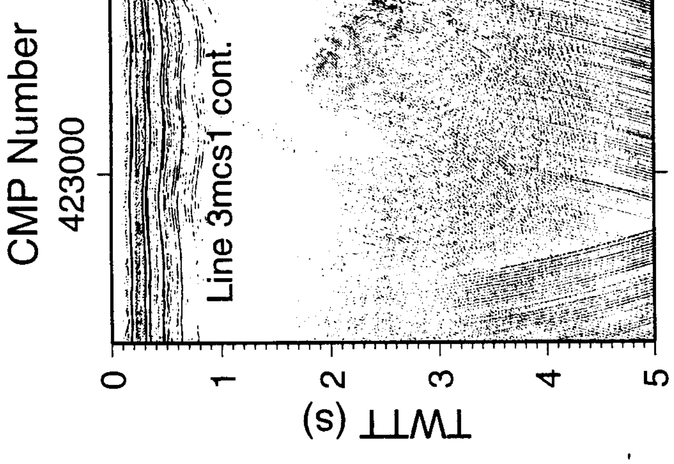

CMP Number
403000
404000
405000
406000
Line 3mcs1 cont.
TWTT (s)
0
1
2
3
4
5

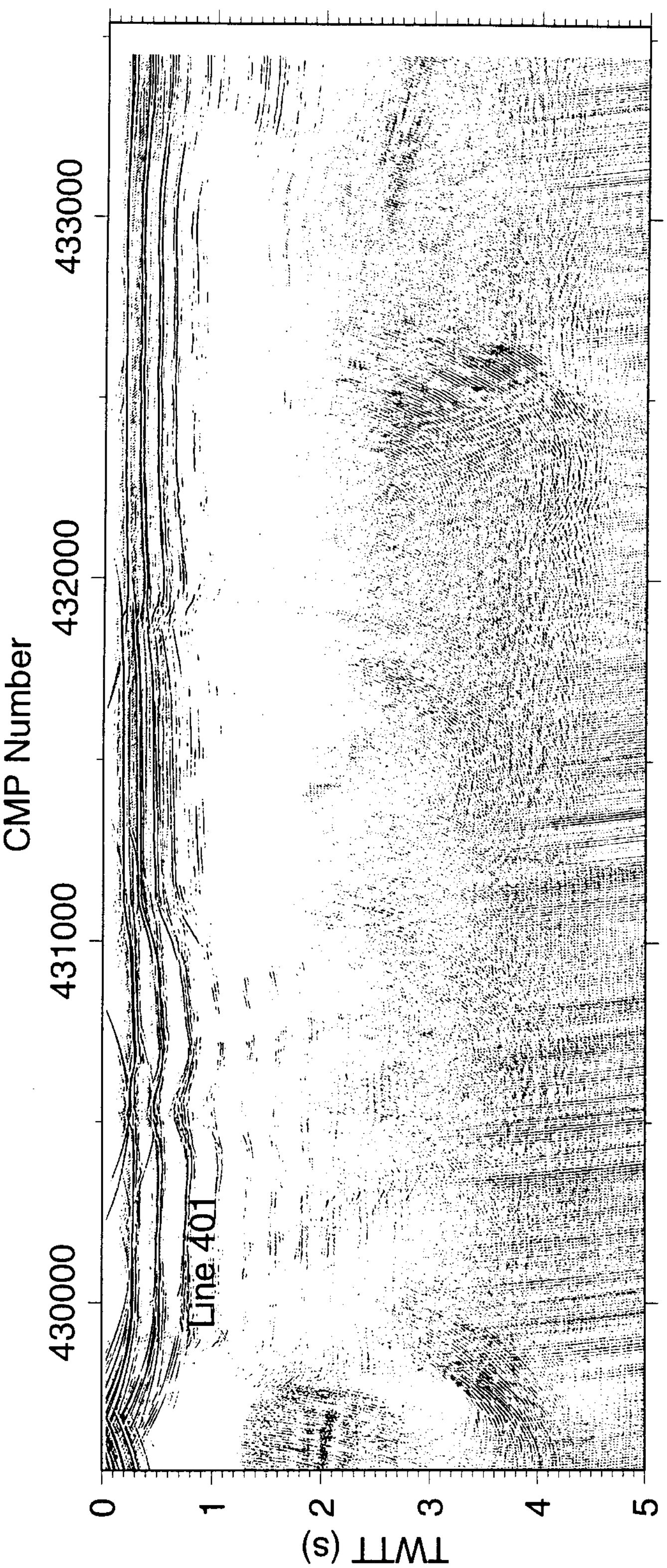

CMP Number
407000
408000
409000
410000
Line 3mcs1 cont.
TWTT (s)
0
1
2
3
4
5

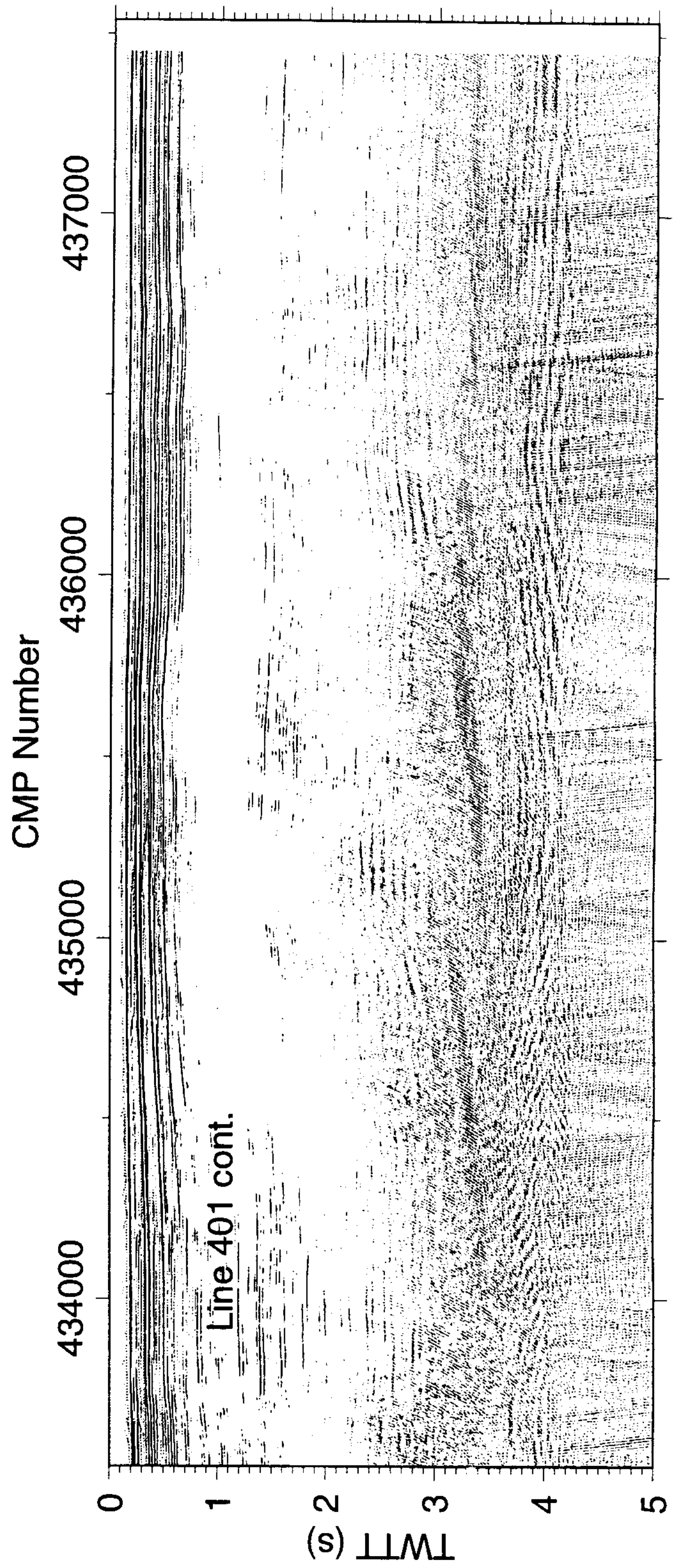

CMP Number
411000
412000
413000
414000
Line 3mcs1 cont.
TWTT (s)
0
1
2
3
4
5

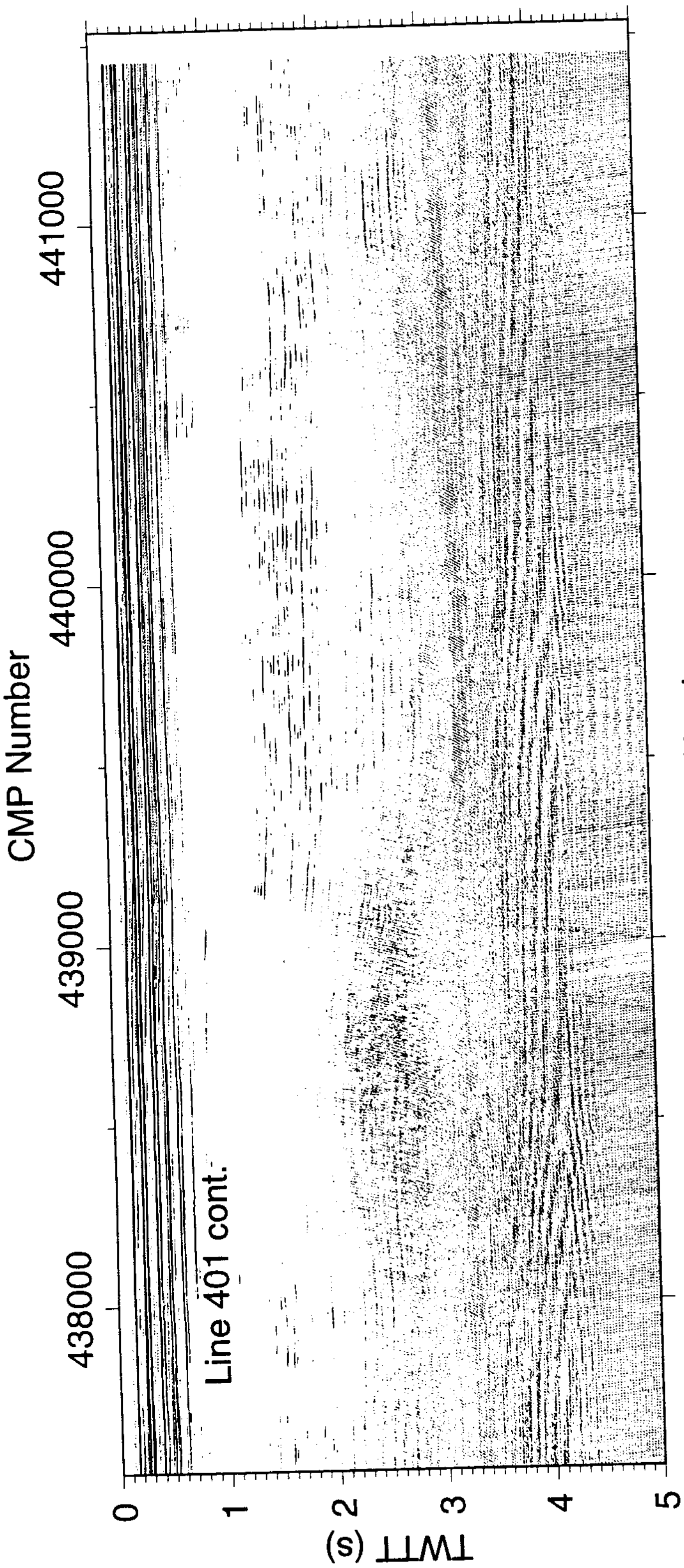

CMP Number
415000
416000
417000
418000
Line 3mcs1 cont.
0
1
2
3
4
5
TWTT (s)

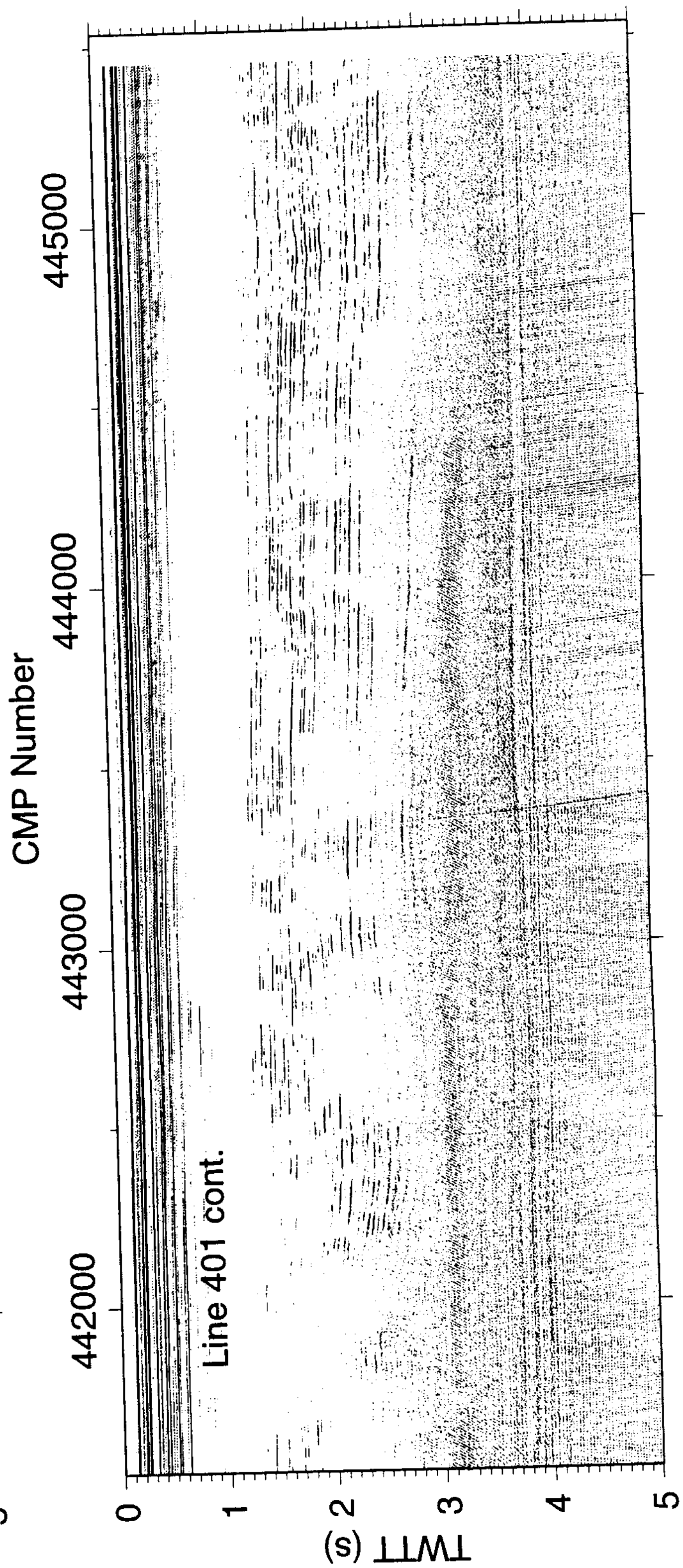

CMP Number
419000
420000
421000
422000
Line 3mcs1 cont.
0
1
2
3
4
5
TWTT (s)

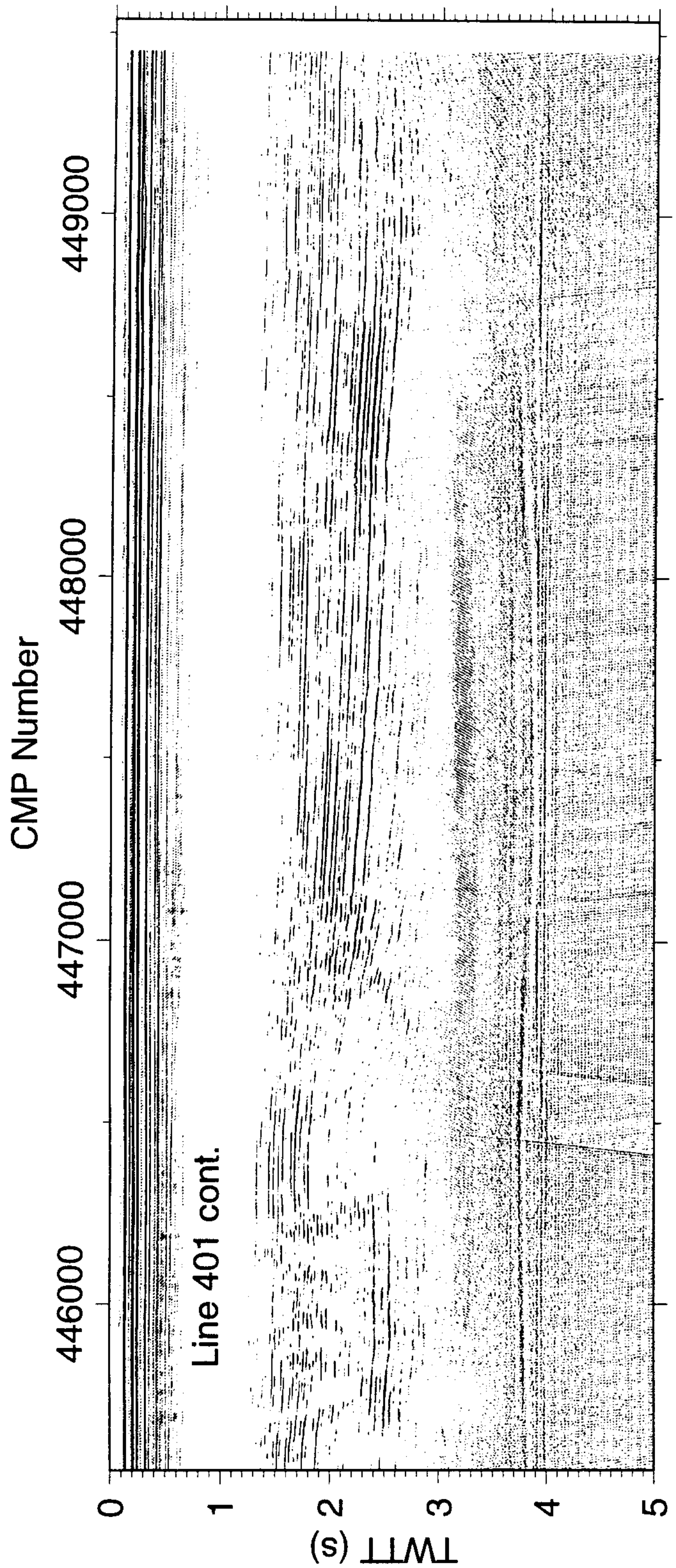

CMP Number
423000
Line 3mcs1 cont.
TWTT (s)
0
1
2
3
4
5

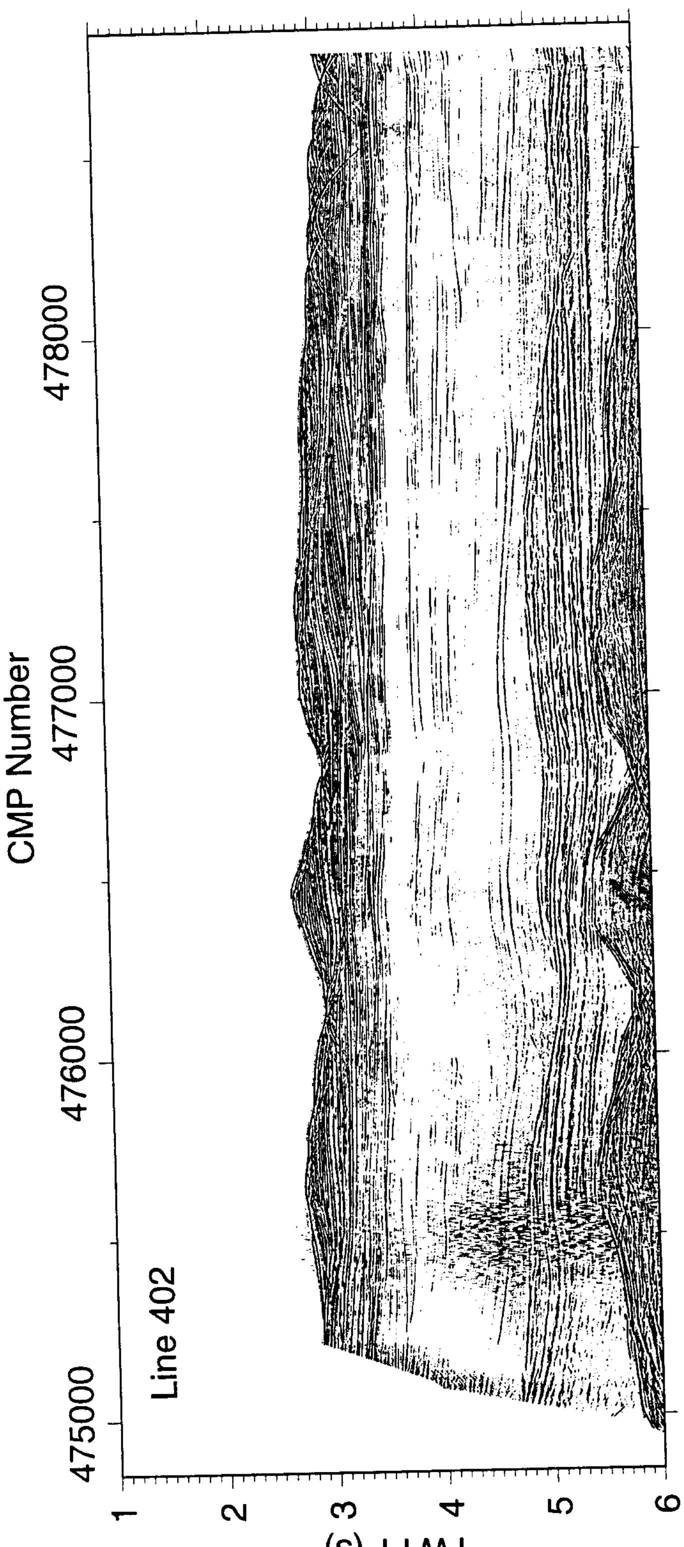

CMP Number
430000
431000
432000
433000
Line 401
TWTT (s)
0
1
2
3
4
5

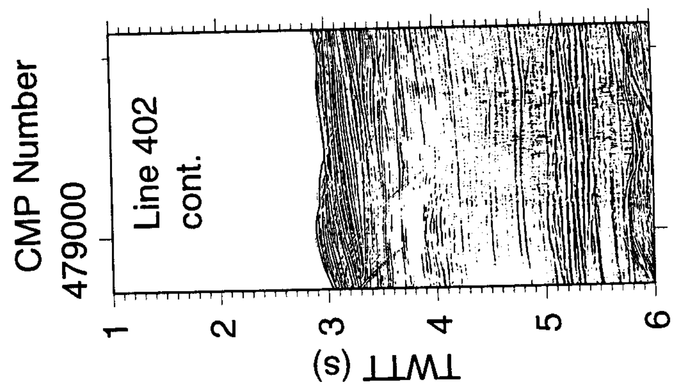

CMP Number
434000
435000
436000
437000
Line 401 cont.
TWTT (s)
0
1
2
3
4
5

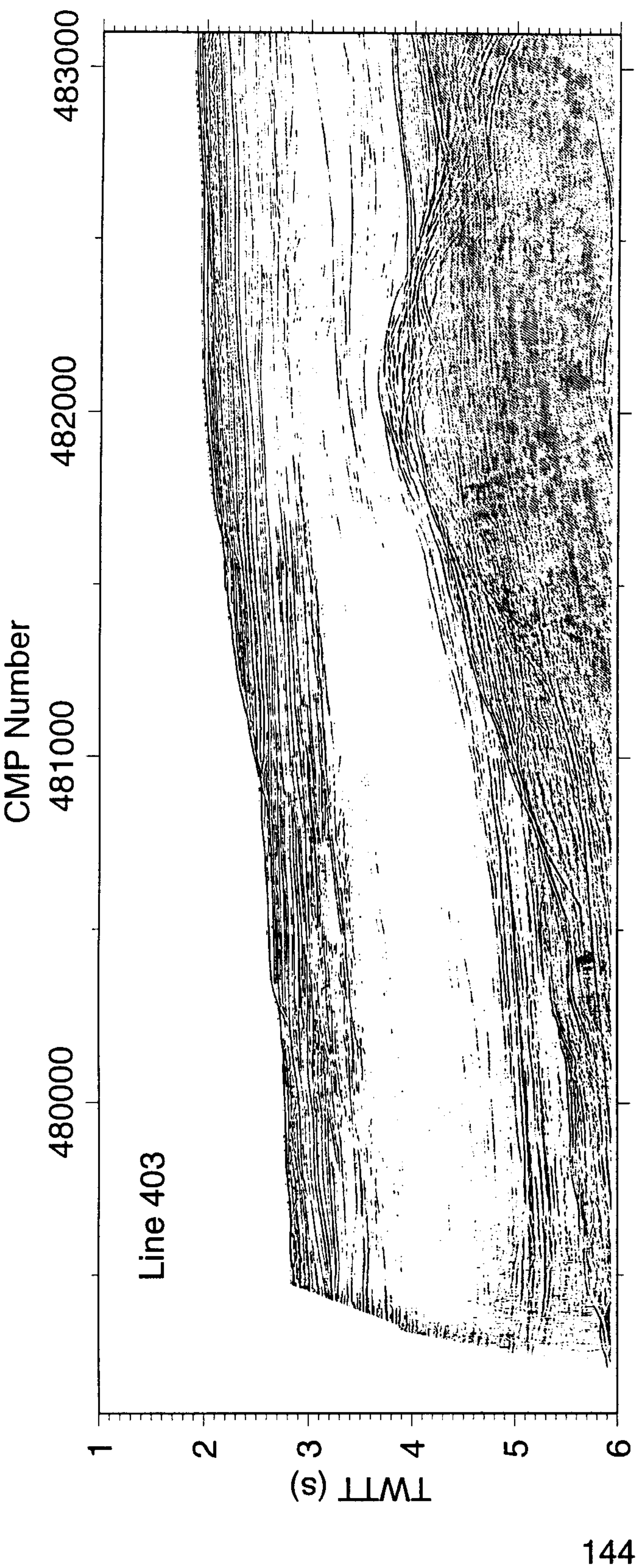

CMP Number
438000
439000
440000
441000
Line 401 cont.
TWTT (s)
0
1
2
3
4
5


CMP Number
442000
443000
444000
445000
Line 401 cont.
TWTT (s)
0
1
2
3
4
5

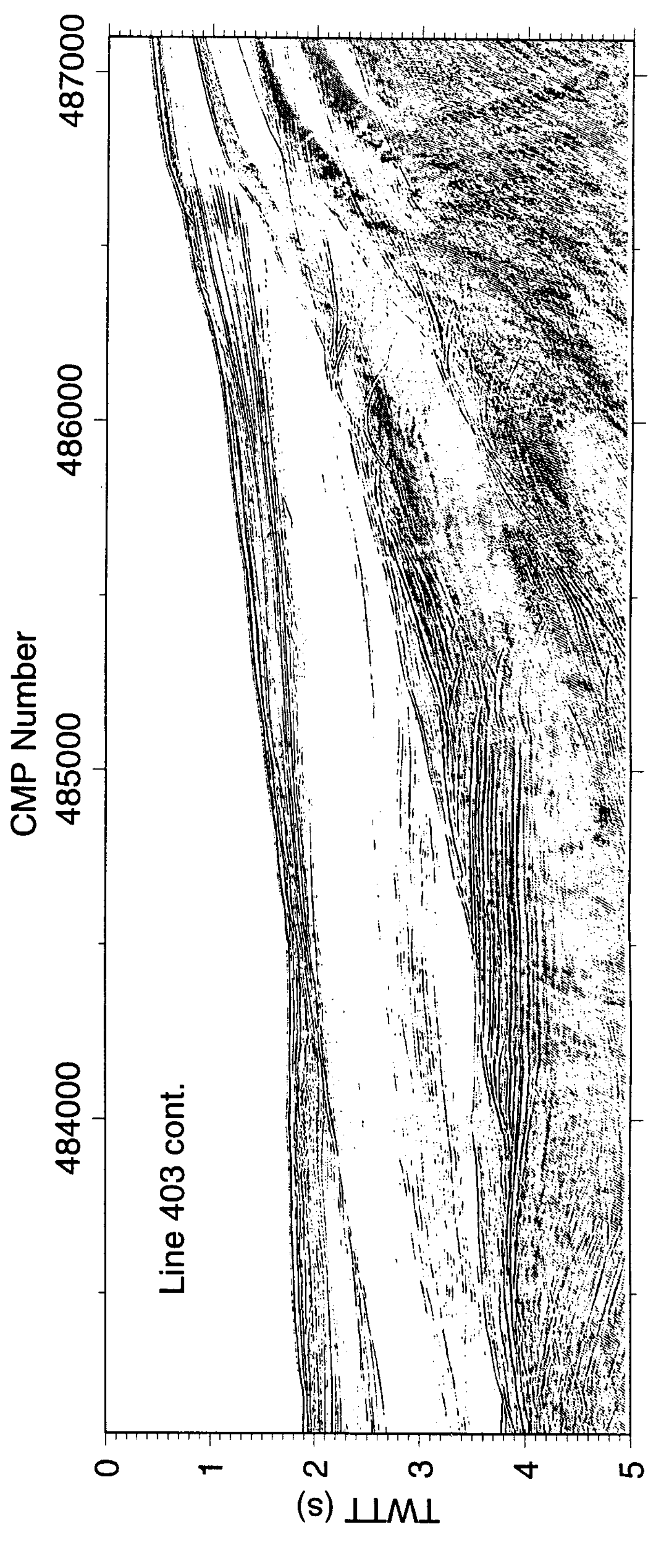

CMP Number
446000
447000
448000
449000
Line 401 cont.
0
1
2
3
4
5
TWTT (s)


Line 402
CMP Number
475000
476000
477000
478000
TWTT (s)
1
2
3
4
5
6

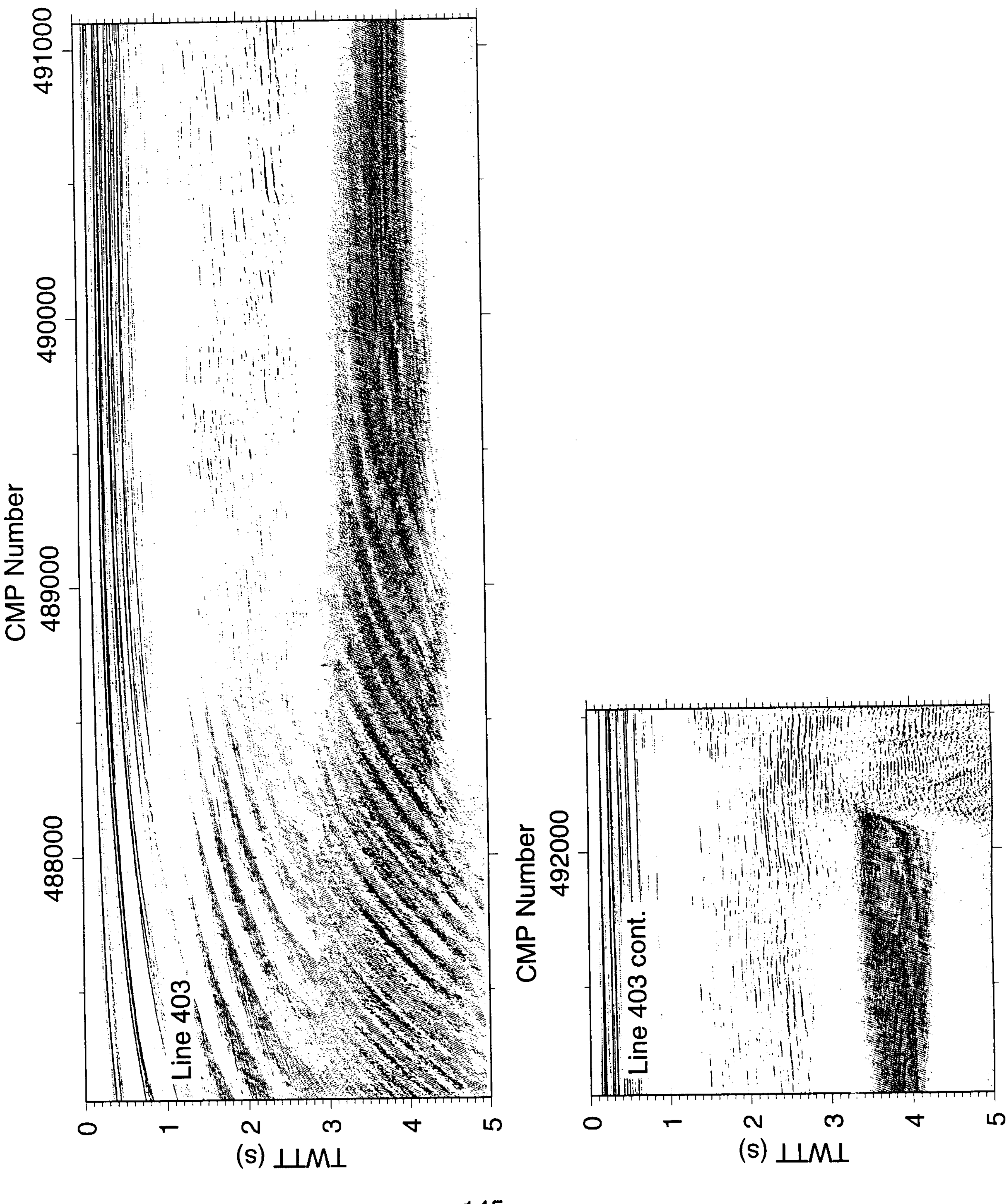

Line 402 cont.
CMP Number
479000
TWTT (s)
1
2
3
4
5
6



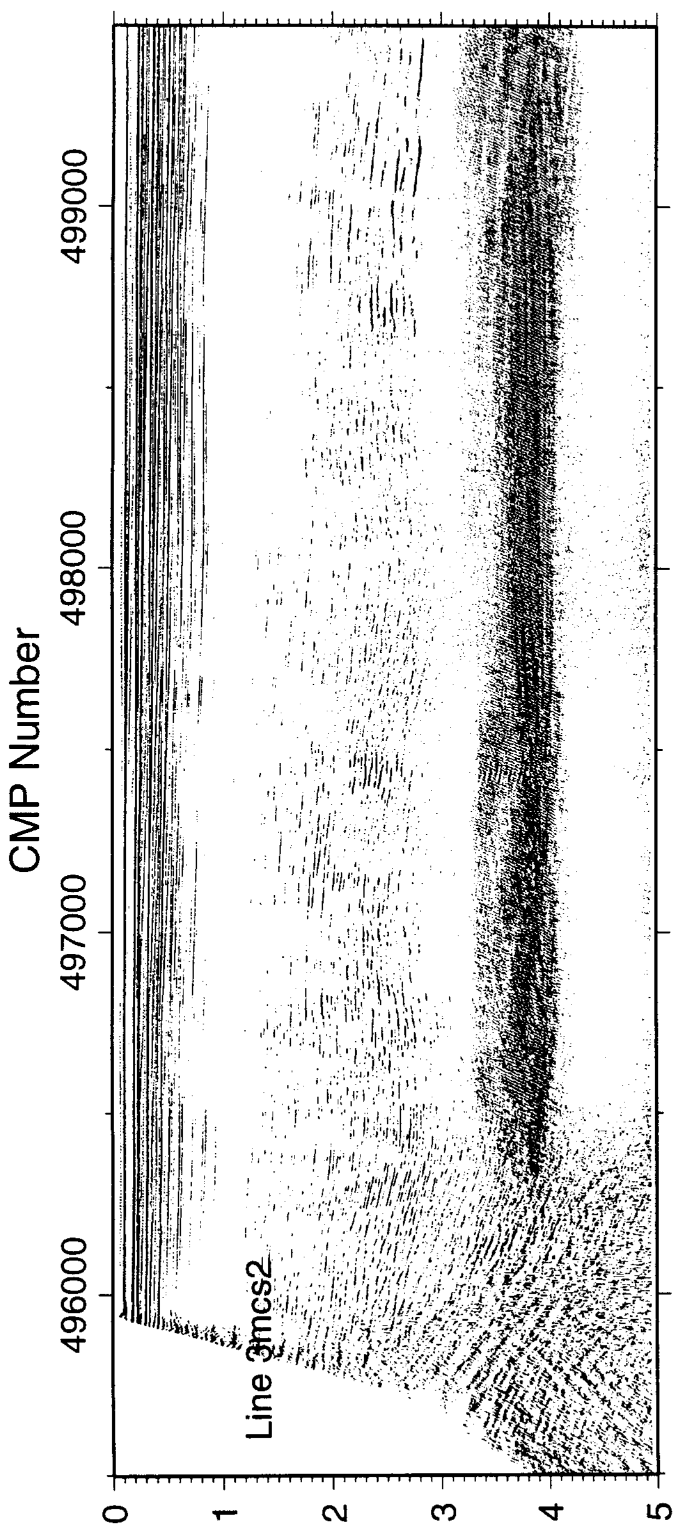
Line 403
CMP Number
480000
481000
482000
483000
TWTT (s)
1
2
3
4
5
6

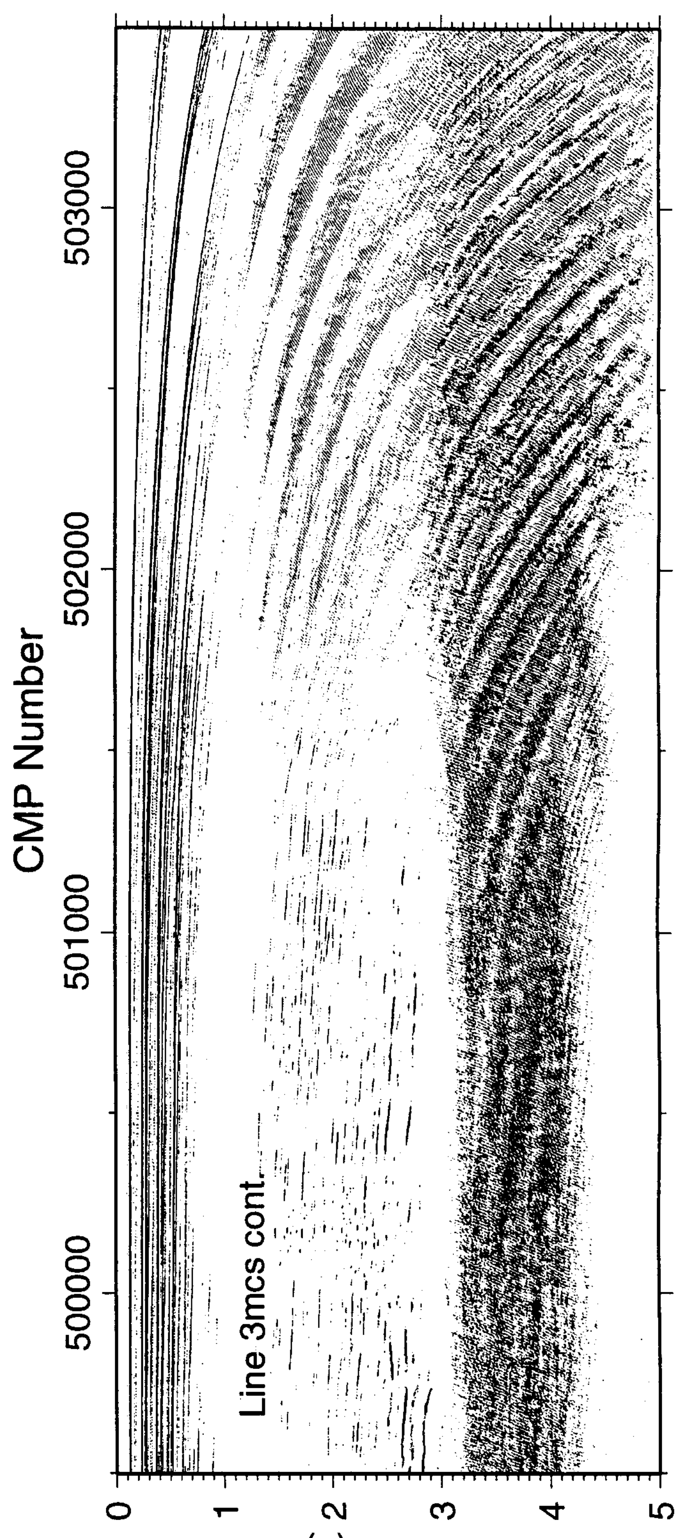


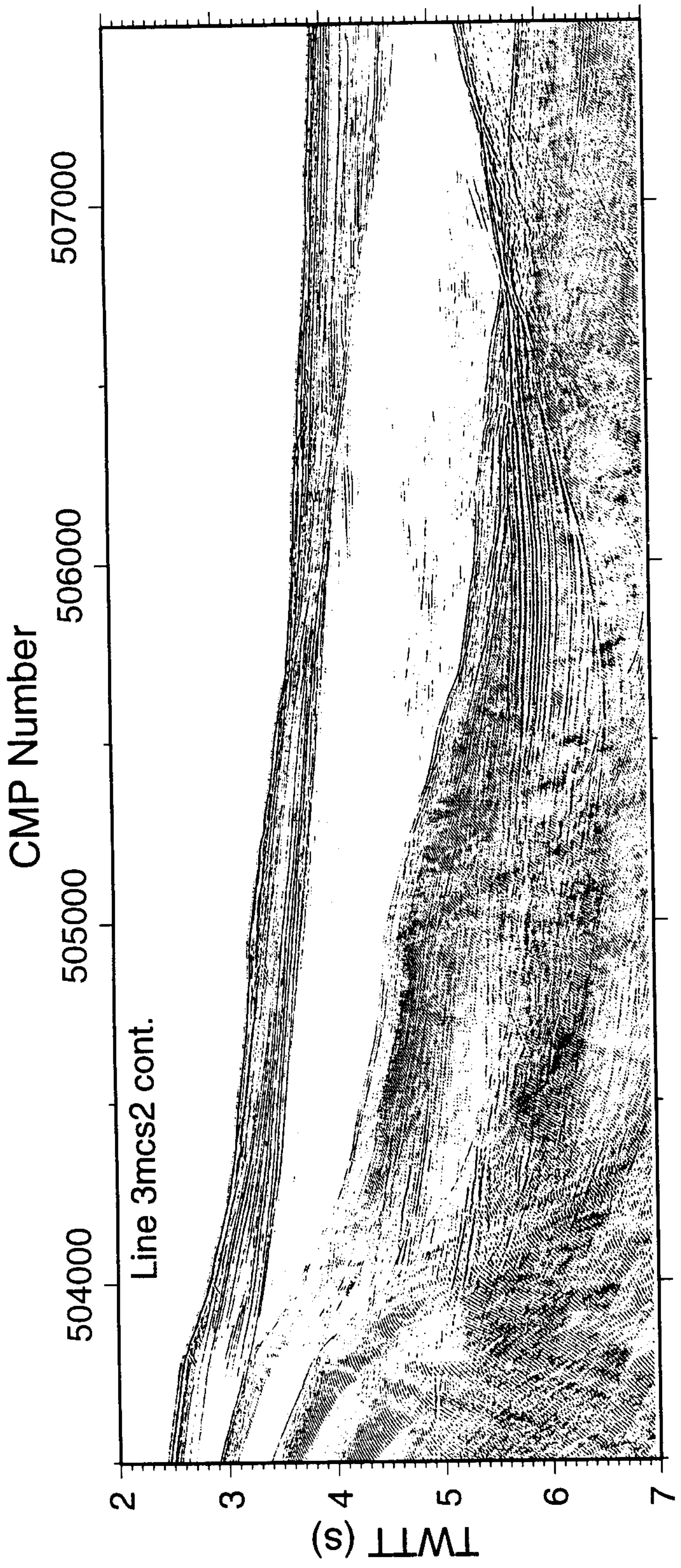
Line 403 cont.
CMP Number
484000
485000
486000
487000
TWTT (s)
0
1
2
3
4
5

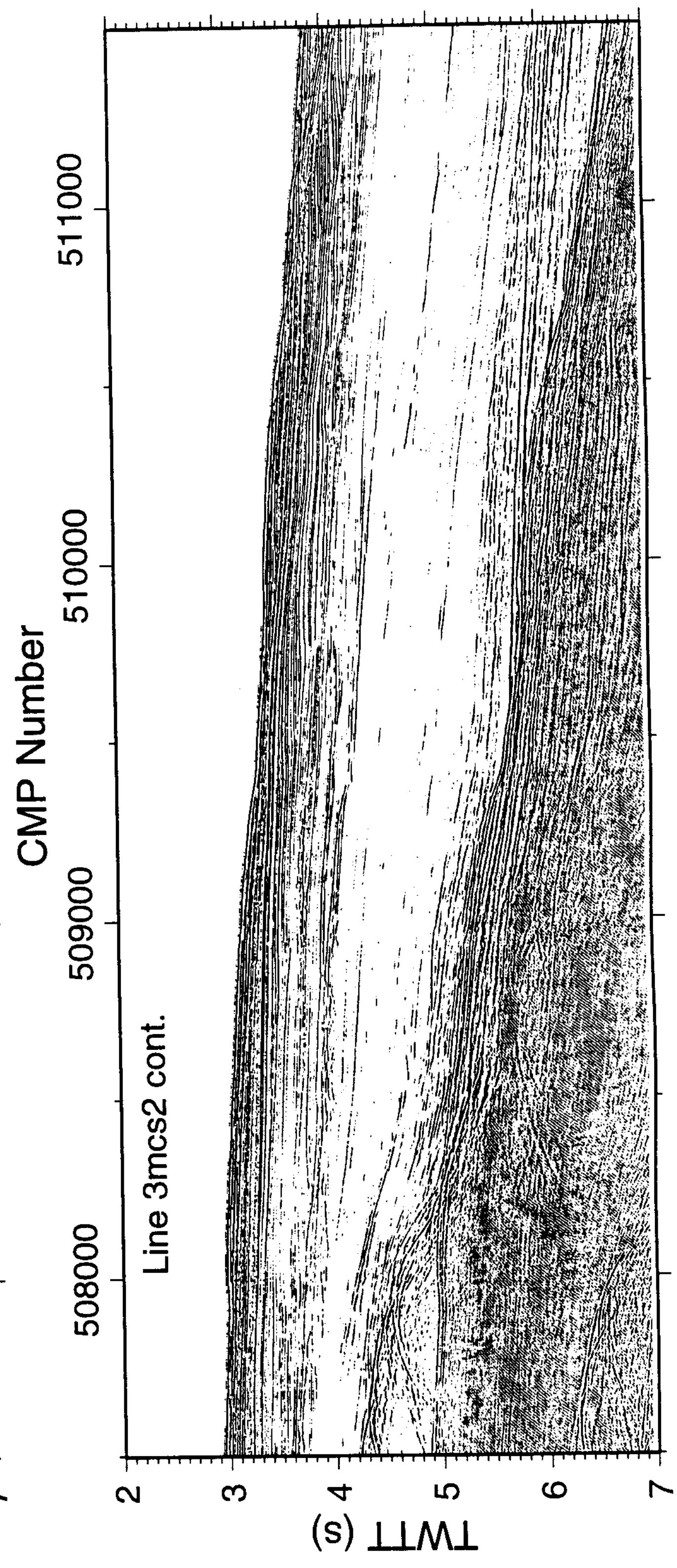


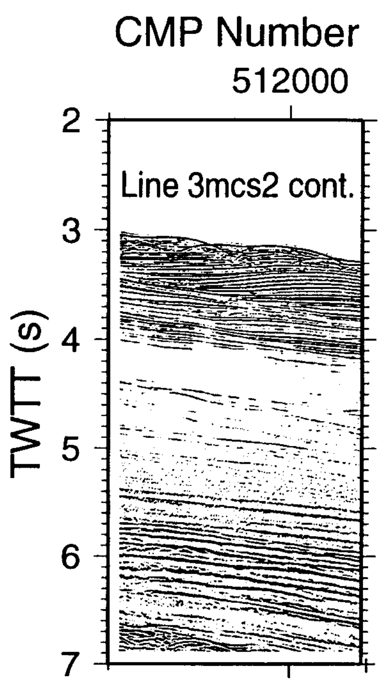
CMP Number
491000
490000
489000
488000
Line 403
TWTT (s)
0
1
2
3
4
5
CMP Number
492000
Line 403 cont.
TWTT (s)
0
1
2
3
4
5

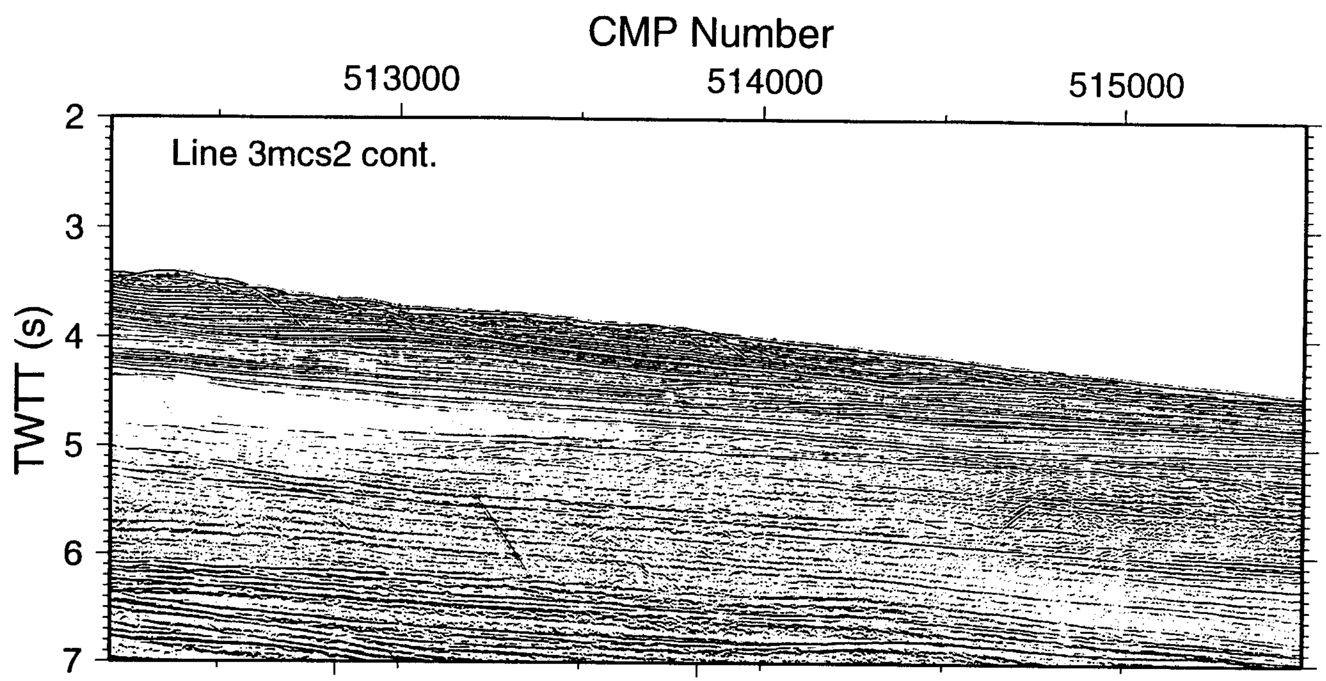

CMP Number
496000
497000
498000
499000
Line 3mcs2
TWTT (s)
0
1
2
3
4
5

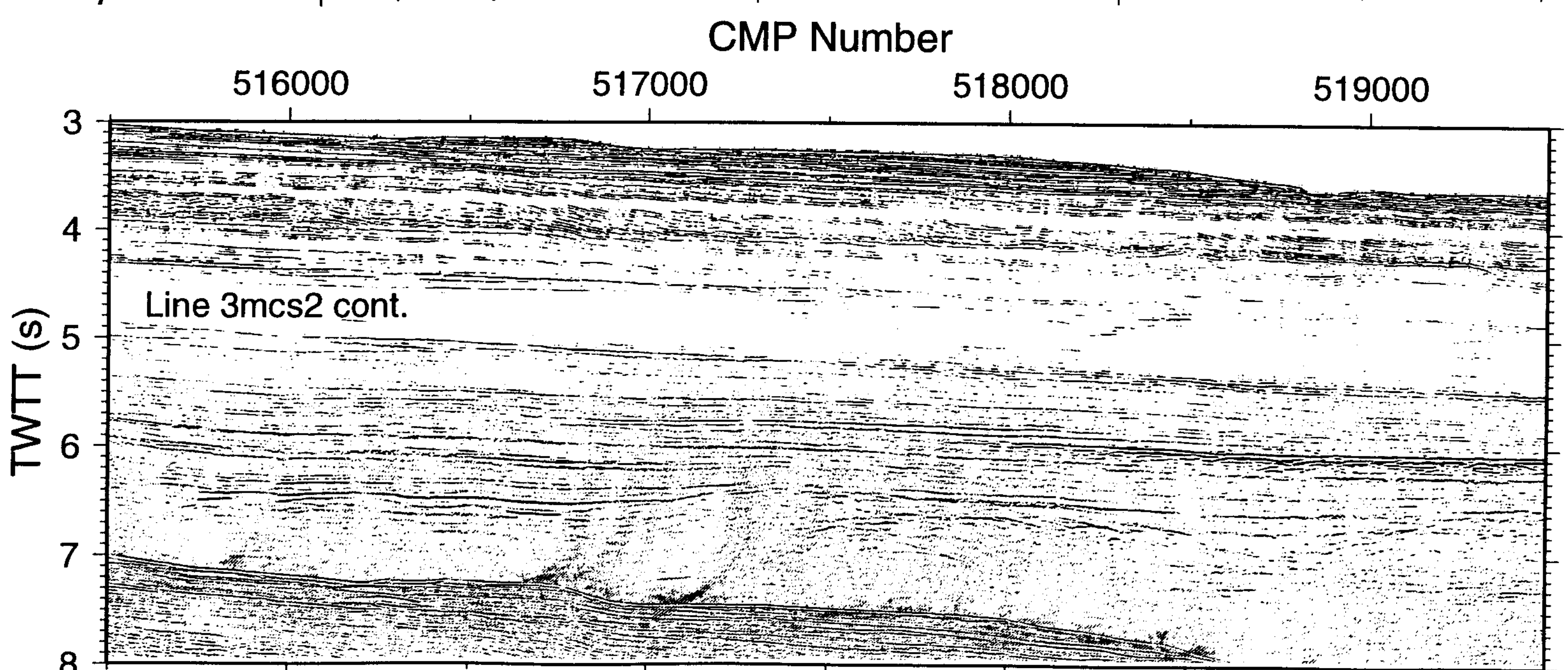

CMP Number
500000
501000
502000
503000
Line 3mcs cont.
TWTT (s)
0
1
2
3
4
5

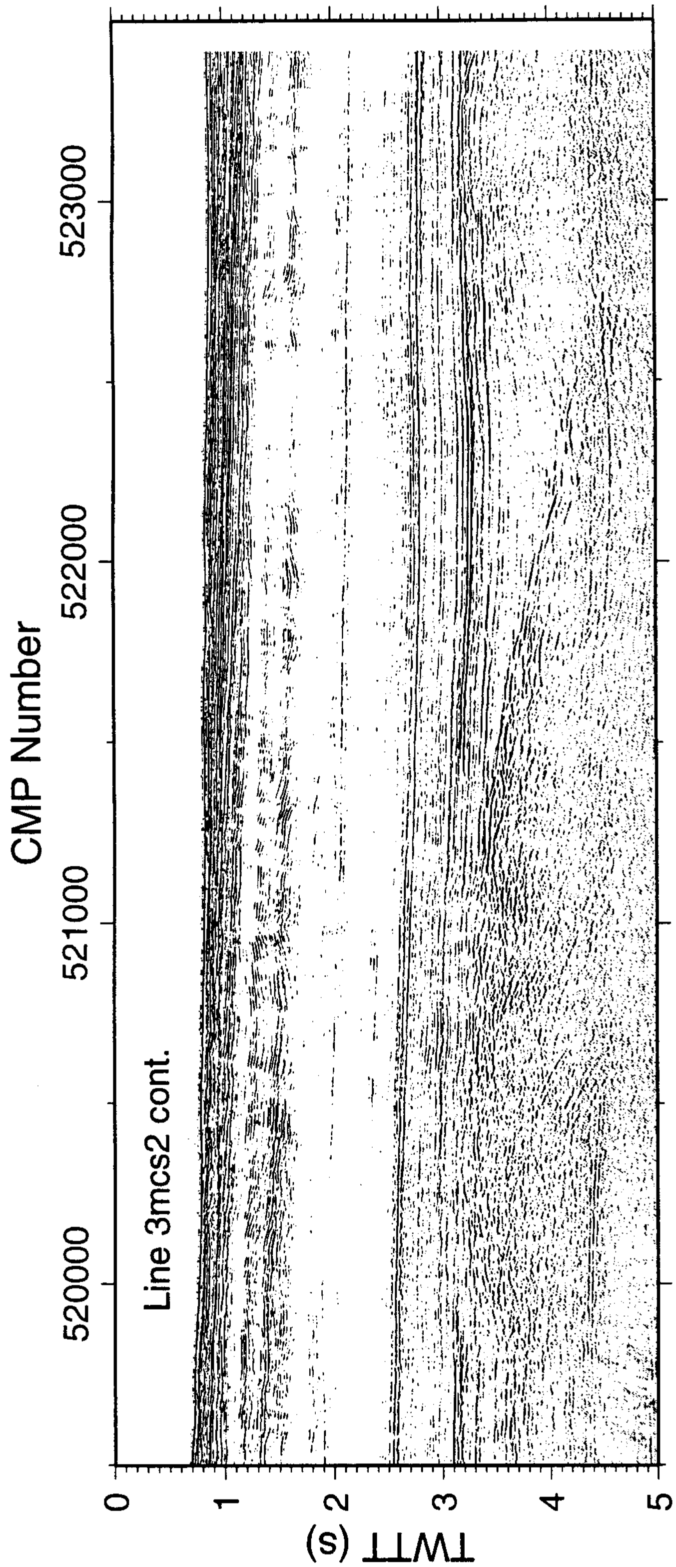

CMP Number
504000
505000
506000
507000
Line 3mcs2 cont.
TWTT (s)
2
3
4
5
6
7

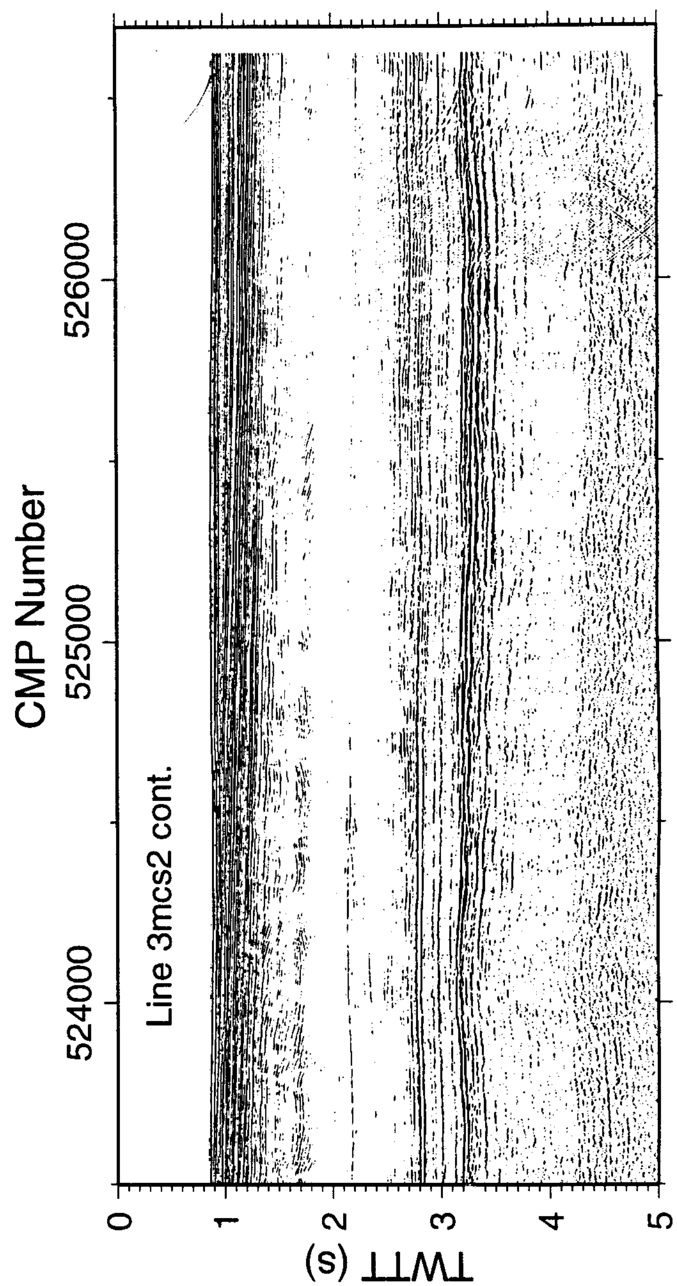

CMP Number
508000
509000
510000
511000
Line 3mcs2 cont.
TWTT (s)
2
3
4
5
6
7

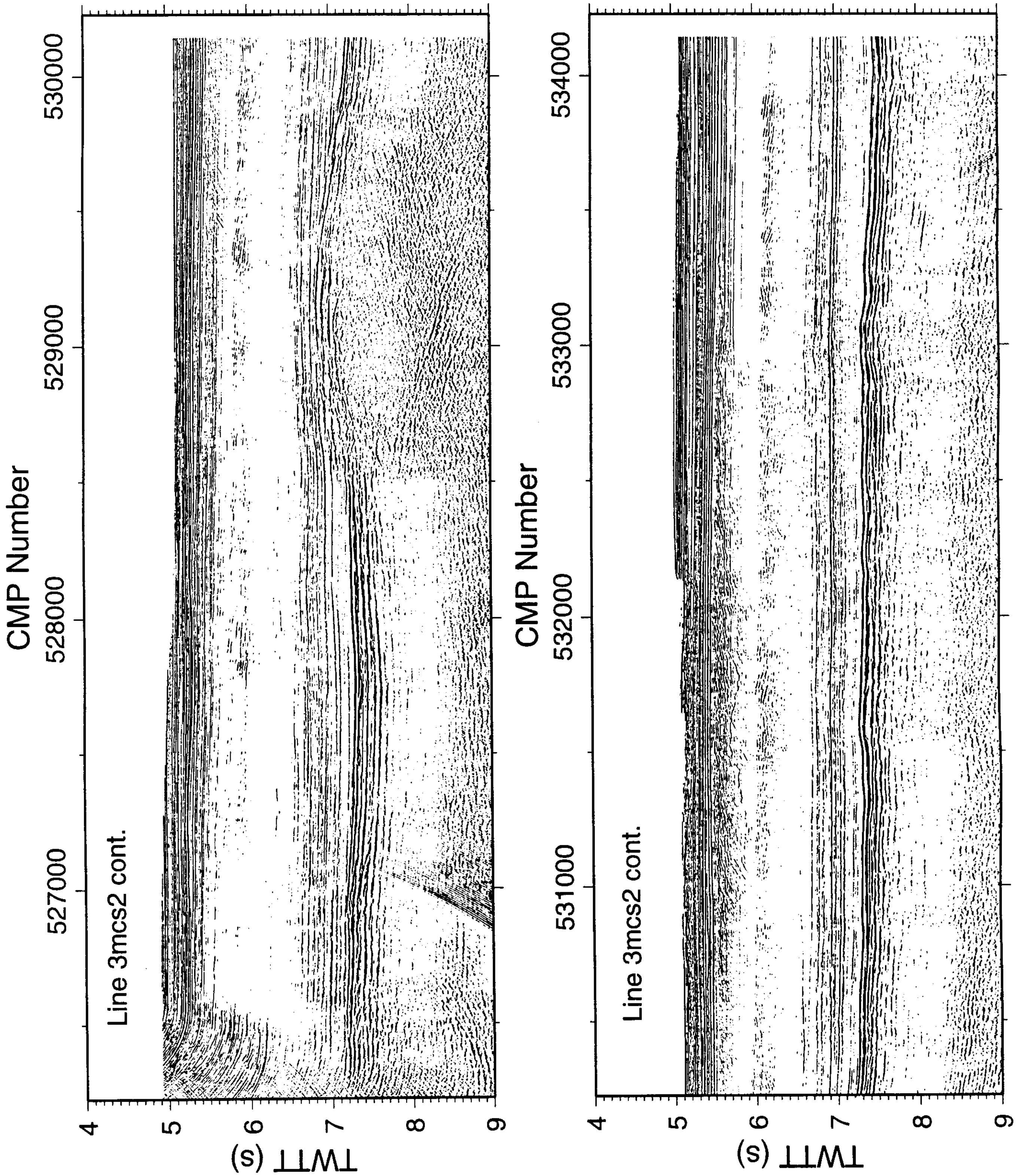

CMP Number
512000
TWTT (s)
2
3
4
5
6
7
Line 3mcs2 cont.

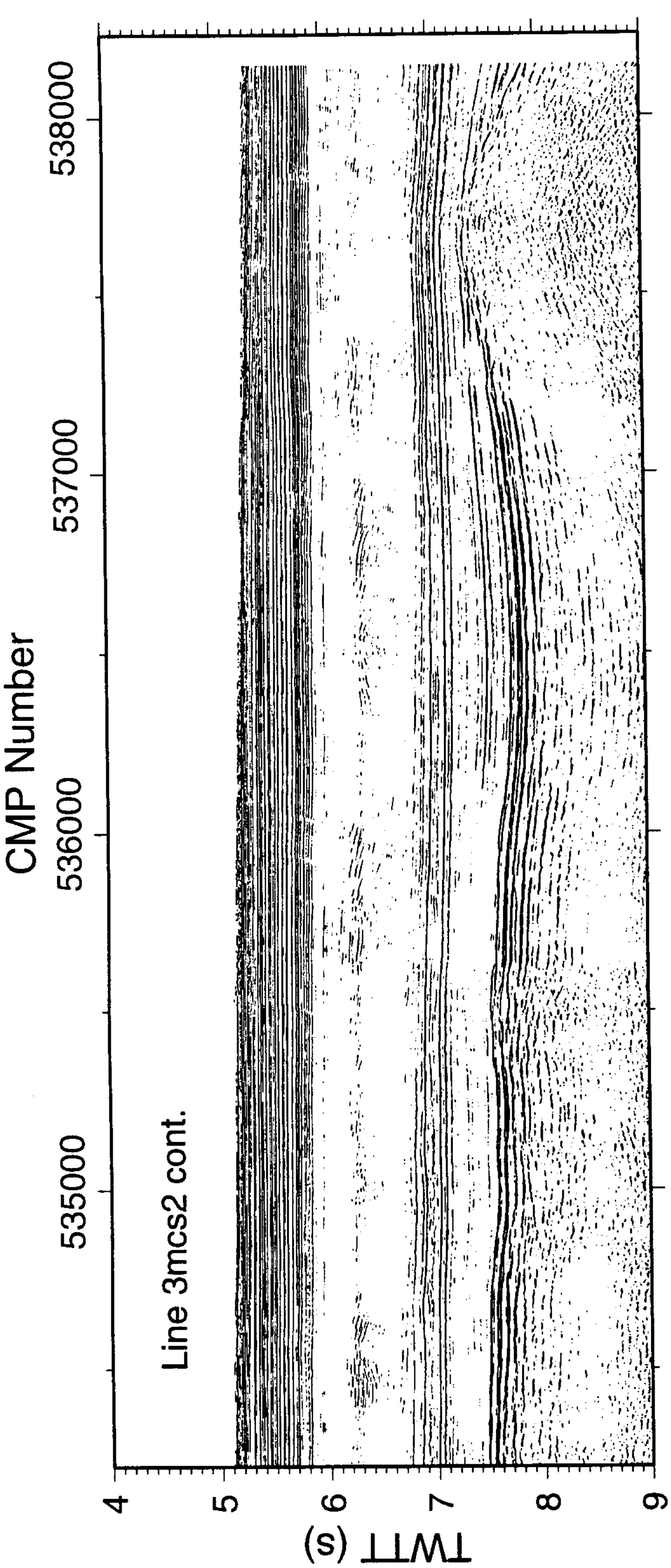

CMP Number
513000
514000
515000
TWTT (s)
2
3
4
5
6
7
Line 3mcs2 cont.

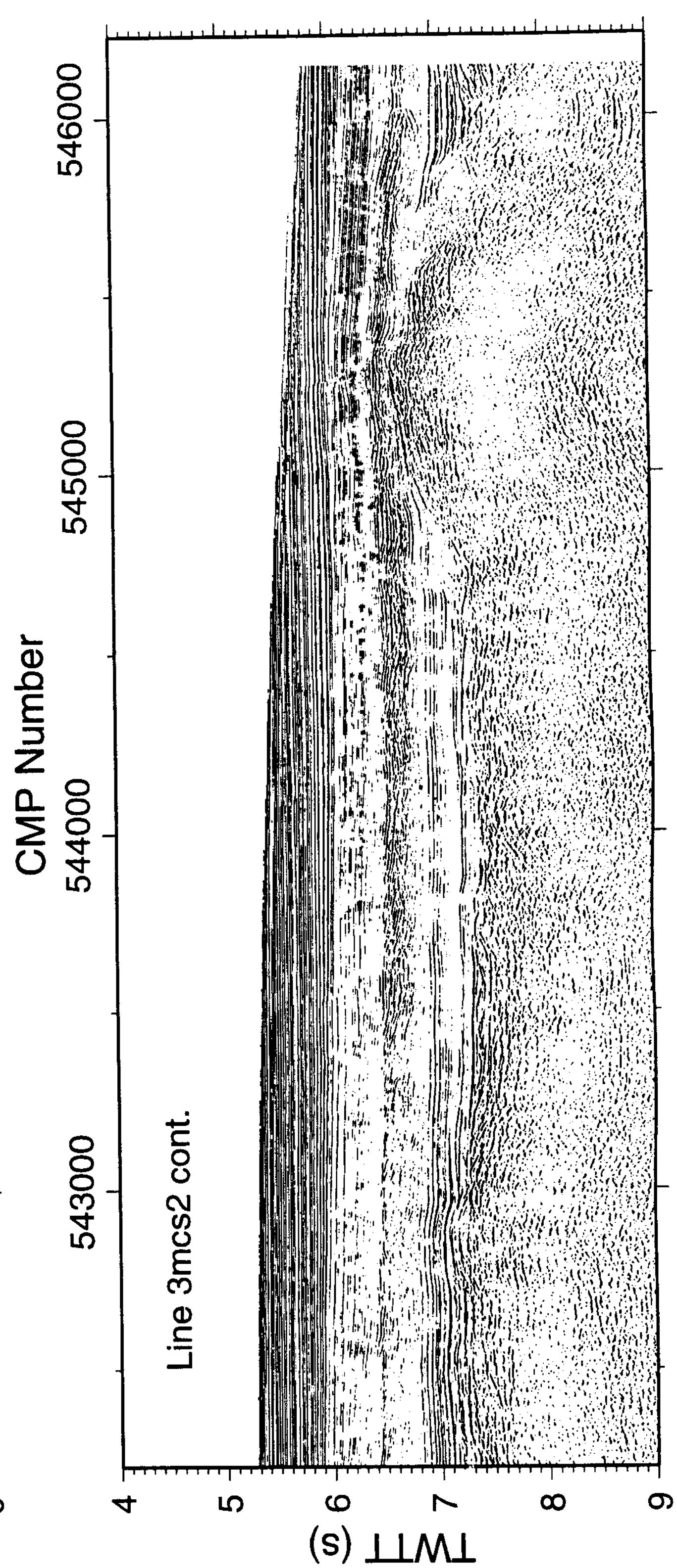

CMP Number
516000
517000
518000
519000
TWTT (s)
3
4
5
6
7
8
Line 3mcs2 cont.

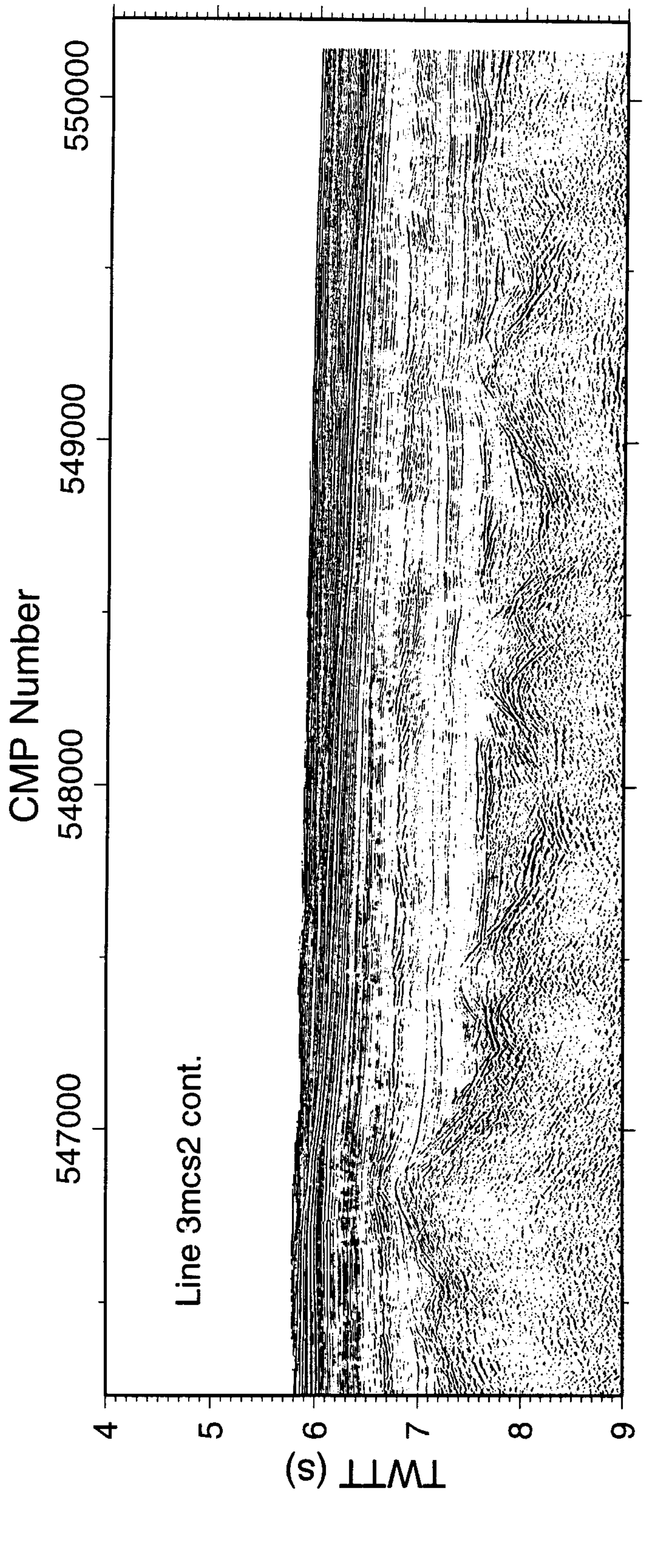

CMP Number
520000
521000
522000
523000
Line 3mcs2 cont.
TWTT (s)
0
1
2
3
4
5

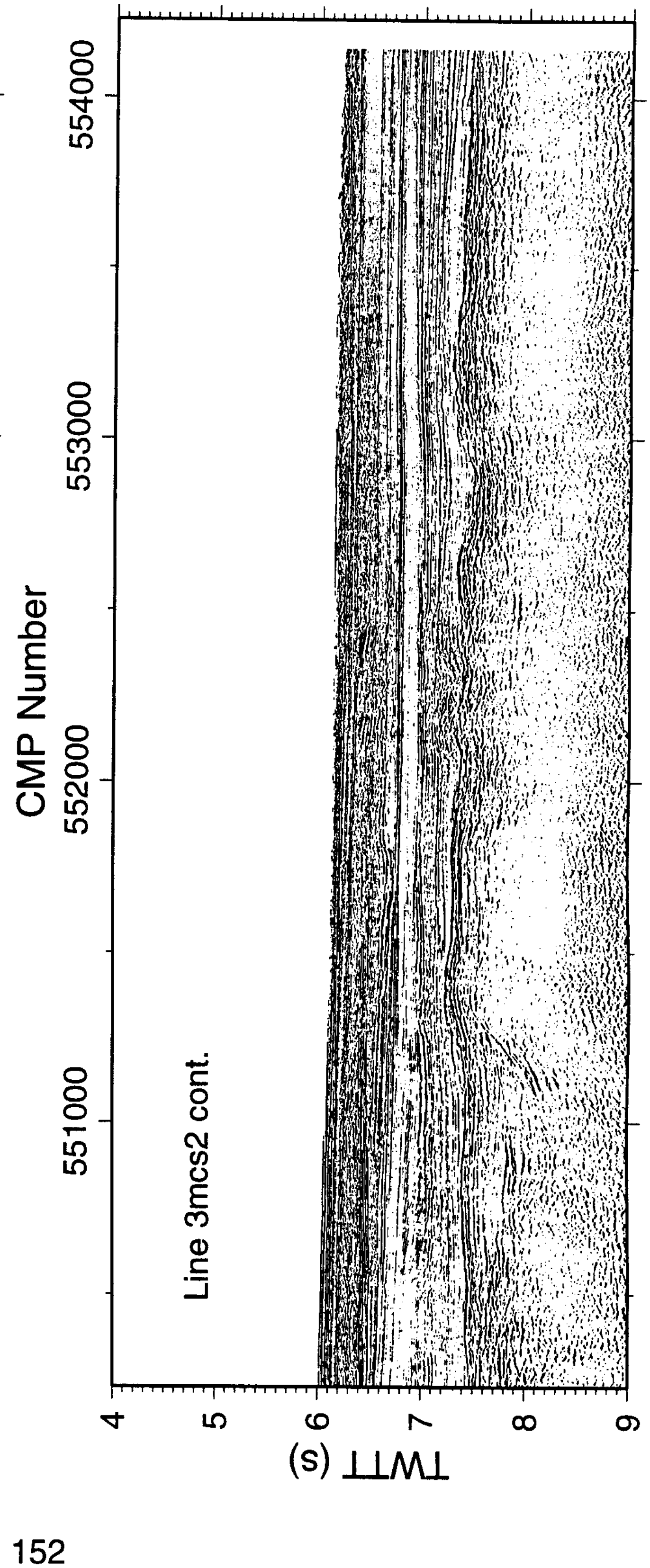

CMP Number
524000
525000
526000
Line 3mcs2 cont.
TWTT (s)
0
1
2
3
4
5

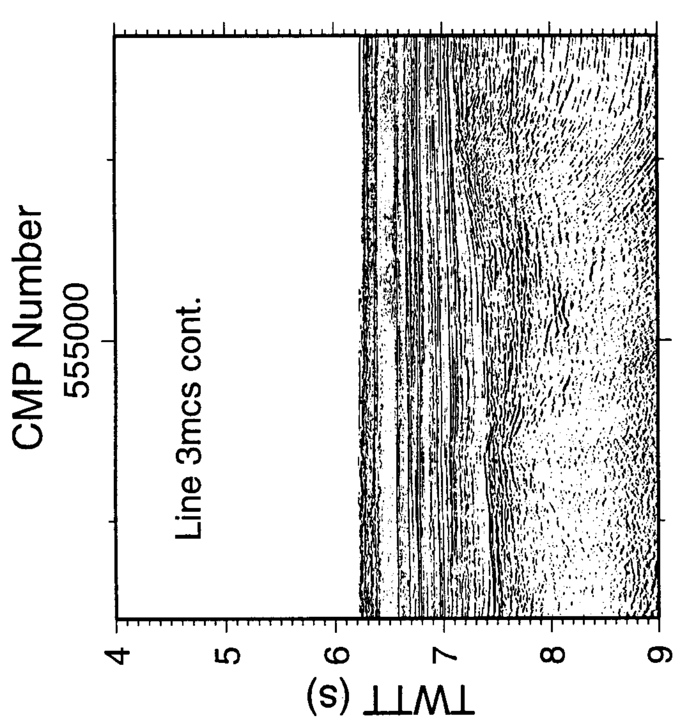

CMP Number
527000
528000
529000
530000
Line 3mcs2 cont.
4
5
6
7
8
9
TWTT (s)
CMP Number
531000
532000
533000
534000
Line 3mcs2 cont.
4
5
6
7
8
9
TWTT (s)

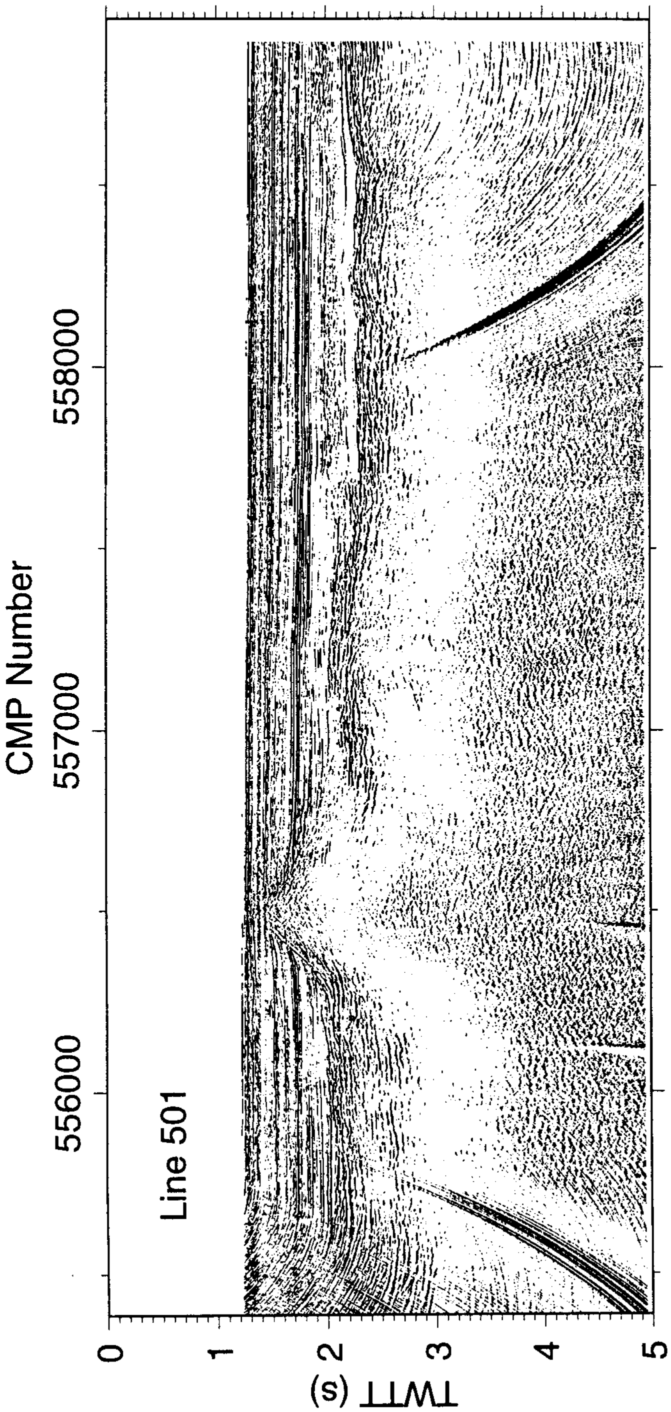

CMP Number
535000
536000
537000
538000
Line 3mcs2 cont.
TWTT (s)
4
5
6
7
8
9

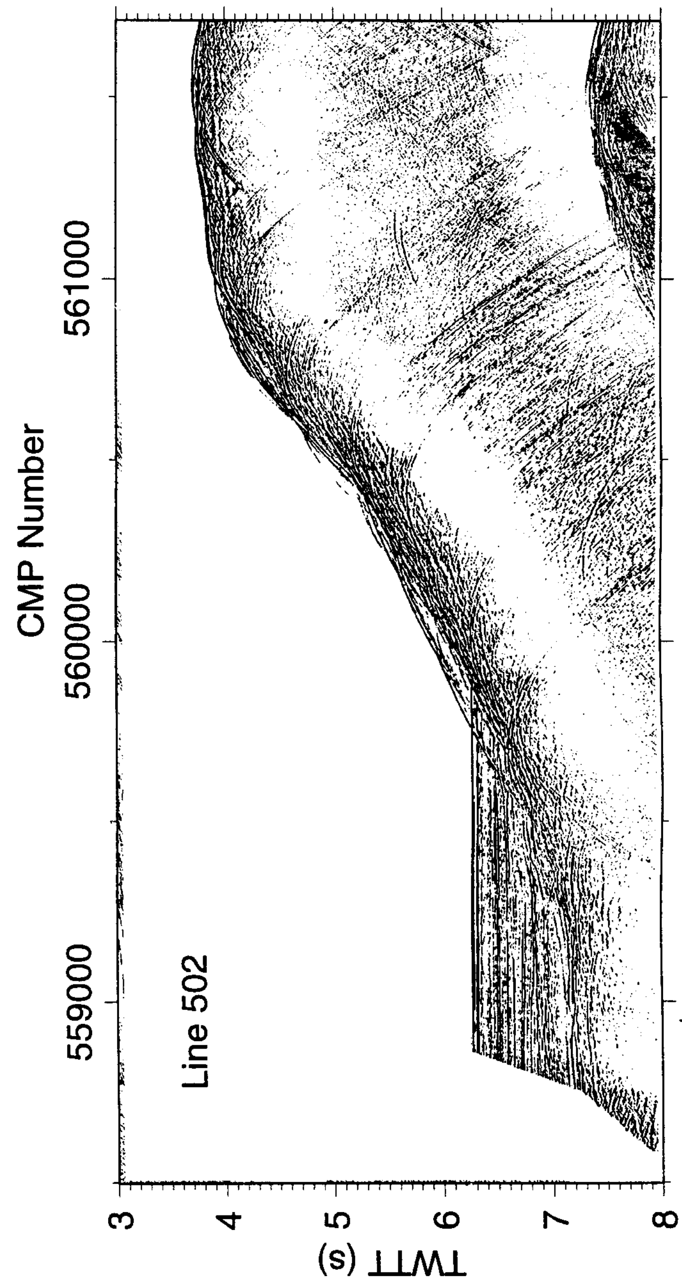

CMP Number
543000
544000
545000
546000
Line 3mcs2 cont.
TWTT (s)
4
5
6
7
8
9


CMP Number
550000
549000
548000
547000
Line 3mcs2 cont.
4
5
6
7
8
9
TWTT (s)


CMP Number
554000
553000
552000
551000
Line 3mcs2 cont.
4
5
6
7
8
9
TWTT (s)


CMP Number
555000
Line 3mcs cont.
4
5
6
7
8
9
TWTT (s)


Line 501
CMP Number
556000
557000
558000
TWTT (s)
0
1
2
3
4
5


Line 502
CMP Number
559000
560000
561000
TWTT (s)
3
4
5
6
7
8

Appendix 9: Data Logs

This appendix contains logs of (1) MCS lines acquired during EW-0007 and (2) data tapes created during tape copies of SEGY data. These logs were created using Filemaker Pro. An additional seismic recording log, which contains a detailed list of all 851 field tapes (3490E), but this log was not included here due to its length.

MCS Line Log: EW 0007

Group Interval 12.5meters Dist Near Ch. -183 meters Channels 480 Samp. Rate 4000 usec
(This was the value assigned at sea. Should be -181.65)

Line	Julian Day	Time	Latitude	Longitude	Reel	Shot	File	Wyo DLTs	DLC 8mm	Dal/ MUN DLTs	Rec. Length sec	Shot Intervals in meters			
1OBS	200	13:00	45 55.574 N	042 47.801 W	1	1	1	01	01		16.380	all	200		
	201	18:51	46 02.256 N	042 55.484 W	18	1151	1143								
	Missing/Problem Shots:	10, 17, 349, 455, 654, 745 - 748, 925, 1016 - 1018. Shot 368 incomplete (322 traces). Reel 18 not copied (shots 1109 to end, see seismic recording log).													
1MCS	203	03:31	47 47.099 N	045 58.727 W	20	2455	1	02	02	01	16.380	2455-8430	50	8565-8852	75
	204	17:38	45 50.915 N	042 43.309 W	91	8852	6395	04	05	02		8431-8564	62.5		
	Missing/Problem Shots:	4574, 6187, 6191. Shot 4045 incomplete (204 traces)													
1MCSt	204	17:44	45 50.602 N	042 42.547 W	92	8867	1	05	06		16.380	all	75		
	204	19:28	45 56.756 N	042 36.709 W	95	9080	214								
	Missing/Problem Shots:	9079													
101	204	19:37	45 57.043 N	042 37.292 W	96	9091	1	05	06		16.380	9091 - 10310	50	10317-10478	75
	205	05:43	46 22.460 N	043 21.440 W	115	10479	1192					10311-10316	62.5		
	Missing/Problem Shots:	9103, 9170-9192, 9251-9287, 9374, 10351, 10387, 10458. Shot 9250 incomplete (287 traces). File numbers reset after Shot 9250 (File 140)													
102	205	05:43	46 22.460 N	43 21.440 W	116	10481	1	05	06		16.380	all	62.5		
	205	07:43	46 17.000 N	043 32.000 W	119	10757	277								
	Missing/Problem Shots:	10480. Extra shot at end of line with bogus source number.													
102t	205	07:43	46 17.000 N	043 32.000 W	120	10762	1	05	06		16.380	all	62.5		
	205	08:35	46 19.002 N	043 35.500 W	121	10885	124								
	Missing/Problem Shots:														
103	205	08:35	46 19.002 N	043 35.500 W	122	10888	1	05	06		16.380	all	62.5		
	205	10:00	46 23.051 N	043 28.286 W	124	11079	192								
	Missing/Problem Shots:														

MCS Line Log: EW 0007

Group Interval 12.5meters Dist Near Ch. -183 meters Channels 480 Samp. Rate 4000 usec
(This was the value assigned at sea. Should be -181.65)

Line	Julian Day	Time	Latitude	Longitude	Reel	Shot	File	Wyo DLTs	DLC 8mm	Dal/ MUN DLTs	Rec. Length sec	Shot Intervals in meters	
103t	205	10:00	46 23.051 N	043 28.286 W	125	11082	1	05	06		16.380	all	62.5
	205	10:46	46 22.307 N	04325.656W	126	11186	105		07				
	Missing/Problem Shots:												
104	205	10:46	46 22.020 N	043 26.049 W	127	11189	1	05	06		16.380	11193 - 11324	62.5
	206	15:00	45 15.728 N	044 59.530 W	169	14718	3523	06	08			11325 - 14718	50
	Missing/Problem Shots:	11220, 11311-11314, 11325, 12384, 13606, 13697-13700, 13775											
105	206	15:00	45 15.501 N	044 59.190 W	170	14722	1	06	08		16.380	all	50
	207	03:12	44 52.017 N	044 ??.??? W	187	16341	1620		09				
	Missing/Problem Shots:												
106	207	03:13	44 52.017 N	044 ??.??? W	189	16346	1	06	09		16.380	all	50
	207	06:33	45 04.283 N	043 56.627 W	195	16908	563						
	Missing/Problem Shots:												
107	207	06:33	45 04.283 N	043 56.627 W	196	16913	1	06	09		16.380	all	50
	207	15:10	45 26.577 N	044 42.547 W	212	18385	1472	07	10				
	Missing/Problem Shots:	18190											
108	207	15:10	45 26.577 N	044 42.547 W	213	18389	1	07	10		16.380	all	50
	207	18:44	45 18.508 N	044 50.262 W	218	18751	360						
	Missing/Problem Shots:	18436, 18527 - 18530, 18577, 18752											
109	207	18:44	45 18.508 N	044 50.262 W	219	18753	1	07	10		16.380	all	50
	208	14:32	44 36.129 N	043 27.978 W	248	21431	2679		11				
	Missing/Problem Shots:	20547, 20817											

MCS Line Log: EW 0007

Group Interval 12.5meters **Dist Near Ch.** -183 meters **Channels** 480 **Samp. Rate** 4000 **usec**
(This was the value assigned at sea. Should be -181.65)

Line	Julian Day	Time	Latitude	Longitude	Reel	Shot	File	Wyo DLTs	DLC 8mm	Dal/ MUN DLTs	Rec. Length sec	Shot Intervals in meters	
109t	208	14:32	44 36.129 N	043 27.978 W	249	21434	1	07	11		16.380	all	50
	208	16:08	44 41.008 N	043 23.229 W	252	21704	250						
	Missing/Problem Shots:	**21641, 21660, 21662, 21664, 21666, 21671, 21674, 21676, 21678, 21680, 21682, 21684, 21686, 21688, 21690, 21692, 21694, 21696, 21698, 21700, 21703**											
2OBS	208	16:08	44 41.008 N	043 23.229 W	253	21706	1	08	12		16.380	all	200
	210	09:20	46 35.262 N	047 13.012 W	304	23532	444						
	Missing/Problem Shots:	*21719, 21734 - 21735, 21743, 21758, 21773, 21792, 21807 - 21808, 21816, 21831, 21844*, **21862 - 21878**, *21893, 21920, 21942*, **21963 - 21971**, *21985, 22008, 22026, 22039, 22053 - 22054, 22062*, **22153 - 22155**, *22169, 22191, 22205, 22216, 22229, 22248, 22516, 22536 - 22538, 22617, 22727, 22771, 22986*, **23077 - 23088. File numbers reset at shots 21879, 21962, and 23089. Reel 282 copied twice onto UWyo DLT 08 (shots 22206-22215)**											
2OBSt	210	09:20	46 35.626 N	047 13.162 W	305	23543	1	08	12		16.380	all	50
	210	11:00	46 35.346 N	047 13.408 W	307	23819	266						
	Missing/Problem Shots:	**23704, 23707, 23726, 23728, 23730, 23732, 23747, 23749, 23751, 23753, 23814**											
2MCS	210	11:00	46 35.346 N	047 13.408 W	308	23825	1	08	12	?	16.380	all	50
	212	08:50	44 39.361 N	043 20.726 W	390	31250	7419	10	16				
	Missing/Problem Shots:	**23835, 23883, 24136, 24612, 26455, 27909,** *29411 - 29500*, **30212**											
2MCSt	212	08:50	44 39.361 N	043 20.726 W	391	31254	1	10	16		16.380	all	50
	212	10:13	44 44.023 N	043 16.720 W	393	31495	241						
	Missing/Problem Shots:	**31476**											
201	212	10:13	44 44.023 N	043 16.723 W	394	31500	1	10	16		16.380	all	50
	212	17:51	45 05.069 N	043 58.659 W	408	32832	1332		17				
	Missing/Problem Shots:	**31690**											
202	212	17:51	45 05.069 N	043 58.659 W	409	32848	1	10	17		16.380	all	50
	212	21:11	44 54.813 N	044 10.358 W	413	33284	437						
	Missing/Problem Shots:												

MCS Line Log: EW 0007

Group Interval 12.5meters **Dist Near Ch.** -183 meters **Channels** 480 **Samp. Rate** 4000 **usec**
(This was the value assigned at sea. Should be -181.65)

Line	Julian Day	Time	Latitude	Longitude	Reel	Shot	File	Wyo DLTs	DLC 8mm	Dal/ MUN DLTs	Rec. Length sec	Shot Intervals in meters	
203	212	21:11	44 54.813 N	044 10.358 W	414	33288	1	10	17		16.380	all	50
	212	22:37	44 58.569 N	044 18.494 W	416	33547	259						
	Missing/Problem Shots:	**33546**											
204	212	22:37	44 58.569 N	044 18.494 W	417	33553	1	10	17		16.380	all	50
	213	01:04	45 08.841 N	044 09.362 W	422	34004	451	11	18				
	Missing/Problem Shots:	**33877**											
2MCSx	213	01:04	45 08.841 N	044 09.362 W	423	34007	1	11	18		16.380	all	50
	213	05:43	45 03.918 N	044 11.152 W	430	34722	712						
	Missing/Problem Shots:	**34023, 34025, 34029, 34062**											
204b	213	05:43	45 03.918 N	044 11.152 W	431	34725	1	11	18		16.380	all	50
	213	8:00	45 12.712 N	044 06.034 W	435	35144	419						
	Missing/Problem Shots:	**34788**											
205	213	8:00	45 12.712 N	044 06.034 W	436	35148	1	11	18		16.380	all	50
	213	9:46	45 17.502 N	044 15.749 W	439	35458	311						
	Missing/Problem Shots:	**Shot 36411 incomplete (259 traces)**											
206	213	9:46	45 17.502 N	044 15.749 W	440	35461	1	11	18		16.380	all	50
	213	14:30	45 04.553 N	044 30.237 W	446	36079	619						
	Missing/Problem Shots:												
207	213	14:30	45 04.553 N	044 30.237 W	447	36080	1	11	18		16.380	all	50
	213	17:10	45 12.270 N	044 45.478 W	452	36563	477						
	Missing/Problem Shots:	**36130, 36132, 36547, 36555, 36557, 36559, 36562**											

MCS Line Log: EW 0007

Group Interval 12.5meters **Dist Near Ch.** -183 meters **Channels** 480 **Samp. Rate** 4000 **usec**
(This was the value assigned at sea. Should be -181.65)

Line	Julian Day	Time	Latitude	Longitude	Reel	Shot	File	Wyo DLTs	DLC 8mm	Dal/ MUN DLTs	Rec. Length sec	Shot Intervals in meters	
208	213	17:10	45 12.270 N	044 45.478 W	453	36564	1	11	18		16.380	36564-36612	50
	213	20:04	45 26.412 N	044 32.044 W	458	37078	504		19			36613-EOL	62.5
	Missing/Problem Shots:	36567, 36569, 36571, 36578, 36596, 36598, 36600, 36602, 36605, 36608, 36611											
209	213	20:04	45 26.412 N	044 32.044 W	459	37083	1	11	19		16.380	all	62.5
	213	22:09	45 29.132 N	044 42.050 W	462	37339	257						
	Missing/Problem Shots:	*37331*											
210	213	22:09	45 29.132 N	044 42.050 W	463	37344	1	11	19		16.380	all	62.5
	213	23:01	45 27.368 N	044 44.562 W	464	37413	70						
	Missing/Problem Shots:	*37369*											
301	215	00:50	45 45.88 N	044 22.89 W	465	37508	1	12	20		16.380	all	50
	215	02:40	45 38.52 N	45 30.34 W	468	37843	336						
	Missing/Problem Shots:												
302	215	02:40	45 38.520 N	045 30.340 W	469	37848	1	12	20		16.380	all	50
	215	13:41	45 17.269 N	044 49.918 W	488	39639	1791						
	Missing/Problem Shots:	38015											
302t	215	13:41	45 17.269 N	044 49.918 W	489	39642	1	12	20		16.380	all	50
	215	15:05	45 17.835 N	044 54.143 W	491	39874	232						
	Missing/Problem Shots:	39846											
303	215	15:05	45 17.835 N	044 54.143 W	492	39880	1	12	20		16.380	39880-39938	50
	215	18:15	45 30.909 N	044 42.534 W	497	40366	486		21			39939-40366	62.5
	Missing/Problem Shots:	39939											

MCS Line Log: EW 0007

Group Interval 12.5meters **Dist Near Ch.** -183 meters **Channels** 480 **Samp. Rate** 4000 **usec**
(This was the value assigned at sea. Should be -181.65)

Line	Julian Day	Time	Latitude	Longitude	Reel	Shot	File	Wyo DLTs	DLC 8mm	Dal/ MUN DLTs	Rec. Length sec	Shot Intervals in meters	
304	215	18:15	45 30.909 N	044 42.534 W	498	40370	1	12	21		16.380	all	62.5
	215	19:21	45 33.355 N	044 48.344 W	499	40519	150						
	Missing/Problem Shots:												
305	215	19:21	45 33.355 N	044 48.344 W	500	40522	1	12	21		16.380	all	50
	216	19:42	44 20.000 N	046 20.500 W	540	44207	3686	13	22				
	Missing/Problem Shots:												
306	216	19:42	44 20.000 N	046 20.500 W	541	44210	1	14	23		16.380	all	50
	217	13:02	43 36.519 N	045 13.674 W	568	46636	2420						
	Missing/Problem Shots:	*45288*, 45292-45299											
306t	217	13:02	43 36.519 N	045 13.674 W	569	46637	1	14	?		16.380	all	50
	217	15:47	43 44.760 N	045 06.206 W	573	47042	405						
	Missing/Problem Shots:	*46721*, 47032 Extra shot at end of line with bogus source number.											
3OBS	217	15:47	43 44.760 N	045 06.206 W	574	47043	1	14	24		16.380	all	200
	219	07:10	45 39.991 N	048 27.549 W	610	48750	1705	15	25				
	Missing/Problem Shots:	*47059, 47085, 47101 - 47103, 47126, 47142, 47154, 47169 - 47170, 47178, 47263, 47280, 47299 - 47300, 47409, 47436, 47489 - 47492, 47516, 48355*											
3MCS1	219	07:10	45 39.991 N	048 27.549 W	611	48753	1	15	25		16.380	all	50
	220	09:24	46 51.545 N	050 46.995 W	660	53210	4458	16	27				
	Missing/Problem Shots:												
3MCS1t	220	09:24	46 51.545 N	050 46.995 W	661	53217	1	16	27		16.380	all	50
	220	11:44	46 57.859 N	050 38.942 W	665	53626	410						
	Missing/Problem Shots:												

MCS Line Log: EW 0007

Group Interval 12.5meters Dist Near Ch. -183 meters Channels 480 Samp. Rate 4000 usec
(This was the value assigned at sea. Should be -181.65)

Line	Julian Day	Time	Latitude	Longitude	Reel	Shot	File	Wyo DLTs	DLC 8mm	Dal/ MUN DLTs	Rec. Length sec	Shot Intervals in meters	
401	220	11:44	46 57.859 N	050 38.942 W	666	53629	1	16	27		16.380	all	50
	221	21:11	45 25.600 N	047 43.180 W	728	59289	5661	17	29				
	Missing/Problem Shots:												
402	221	21:11	45 25.600 N	047 43.180 W	729	59293	1	17	29		16.380	all	50
	222	00:23	45 17.096 N	047 57.635 W	734	59823	531		30				
	Missing/Problem Shots:												
403	222	00:23	45 17.096 N	047 57.635 W	735	59824	1	17	30		16.380	all	50
	222	11:07	45 46.849 N	048 52.747 W	755	61637	1814	18	31				
	Missing/Problem Shots:												
403t	222	11:07	45 46.849 N	048 52.747 W	756	61640	1	18	31		16.380	all	50
	222	12:29	45 51.054 N	048 48.125 W	758	61873	234						
	Missing/Problem Shots:												
3MCS2	222	12:29	45 51.054 N	048 48.125 W	759	61874	1	18	31		16.380	all	50
	224	09:00	43 45.045 N	045 06.530 W	842	69357	7483	19	34				
	Missing/Problem Shots:	**64986. Shot 66405 incomplete (196 traces).**											
501	224	09:00	43 45.045 N	045 06.530 W	843	69360	1	19	34		16.380	all	50
	224	11:47	43 41.512 N	044 52.893 W	847	69747	388						
	Missing/Problem Shots:	*69734*											
502	224	11:47	43 41.512 N	044 52.893 W	848	69749	1	20	35		16.380	all	50
	224	14:34	43 48.487 N	044 44.322 W	851	70091	343						
	Missing/Problem Shots:												

DLT Tape Log: EW0007

Copied from 3490 E field tapes for University of Wyoming

DLT Tape #	Reels	Shots	Dates Copied	Lines	Notes
01	1 17	1 1108	07/20/2000 07/21/2000	1OBS	There are probably lots of errors on this tape due to problems with the seismic recording system and confusion about which shots went onto which tapes. See 3490E logs for more information.
02	20 37	2455 4045	07/21/2000 07/22/2000	1MCS	SCSI bus reset occurred while copying tape 37. Subsequent copy job could not read past shot 4044, where the previous job crashed. Either there is a problem with the tape, or the crash damaged the data on tape at this location. Shot 4045 has 204 traces, so half the shot was lost. A new DLT was started.
03	38 58 **	4046 5936 **	07/22/2000 07/22/2000	1MCS	DLT write error occured during copy of reel 52. Subsequent DLT to exabyte copy showed that all data after this reel was either or garbage or contained incomplete shots. **Last good shot on tape is the end of reel 52, SP 5396.** Reels 53-58 recopied onto next DLT.
04	53 91	5397 8852	07/22/2000 07/22/2000	1MCS	See comments for DLT#03. Reels 53-58 are OK. Error at end of tape during copy to Exabyte and had to be force killed -- DLT may have bad EOT marker.
05	92 150	8867 13194	07/22/2000 07/24/2000	1MCSt 101, 102 102t, 103 103t, 104	Note that the end of each line contains an end of file mark that requires special handling when reading tapes into sioseis. See the NFILES input parameter in the documentation. Reel 119 had an abnormal termination during tape copy -- data copied past the last shot had lots of header errors and bogus shot information. The tape was checked and there is a bad shot after 10757 with Shot number 278. Subsequent reels were successfully appended to tape and then checked with sioseis to verify that the bad shot did not interfere with reading the tape. Error at end of tape during copy to Exabyte and had to be force killed -- DLT may have bad EOT marker.
6	151 203	13195 17568	07/24/2000 07/25/2000	104 105 106 107	Reel 155 ended early w/drive error DLT ended in middle of reel 203. Stopped at shot 17568.
7	203 252	17568 21704	07/25/2000 07/25/2000	107 108 109 109t	Reel 203 continued from DLT 6. Shot 17568 copied on both DLT 6 and 7. Reel 238 ended early w/drive error

DLT Tape Log: EW0007

Copied from 3490 E field tapes for University of Wyoming

DLT Tape #	Reels	Shots	Dates Copied	Lines	Notes
8	253 325	21706 25401	07/26/2000 07/28/2000	2OBS 2OBSt 2MCS	Reel 282 is copied twice onto this tape (shots 22206-22215). DLT ended due to disk drive error with Screech. Stopped stack job in the middle of reel 325 when error messages showed problem. Last shot incomplete, but OK on next DLT.
9	325 374	25359 29812	07/28/2000 07/29/2000	2MCS	Reel 325 recopied because of previous problems with screech. Reel 370 was not copied and included in stack originally. Copy/stack job and plot job stopped. Two Mount new input tape messages on screen...reel 370 might be blank. Ejecting DLT 9 and starting DLT 10 at reel 370. Reel 374 stopped copying at shot #29812. No error messages, but the reel did not automatically eject from the tape drive.
10	371 419	29501 33822	07/29/2000 07/30/2000	2MCS 2MCSt 201, 202 203, 204	No data reel 370. Copy started at 271.
11	420 464	33823 37413	07/30/2000 07/31/2000	204, 2MCSx 204b, 205 206, 207 208, 209 210, 301	Ran out of space on DLT #10 while reel 420 was copying to it. This along with a line change and two tapes ejecting at the same time has caused some confusion. Starting with reel #431, the line newfile yes was added to the segdin process of our copy/stack script. The script was restarted at the convenience of the start of line, and will now copy each reel to the DLT as a separate file on the DLT.
12	465 515	37508 41887	08/01/2000 08/03/2000	301, 302 302t, 303 304, 305	Copy stopped in the middle of reel 515, which was recopied onto the next DLT.
13	515 540	41872 44207	08/03/2000 08/03/2000	305	Copy restarted at the beginning of reel 515. Reel 521: label correction due to label program crash.
14	541 608	44210 48589	03/08/2000 08/06/2000	306 306t 3OBS	Tapes 583, 588, 593, and 606 are empty. Copy stopped in the middle of reel 608.

DLT Tape Log: EW0007

Copied from 3490 E field tapes for University of Wyoming

DLT Tape #	Reels	Shots	Dates Copied	Lines	Notes
15	608	48539	08/06/2000	3OBS1	Restarted copy job at the beginning of reel 608.
				3MCS1	sioseis errors in hydrosweep header blocks beyond shot 48817, due to water depth less than 100m
	656	52892	08/07/2000		
16	657	52893	08/07/2000	3MCS1	
				3MCS1T	
	705	57228	08/08/2000	401	
17	706	57229	08/08/2000	401	Error at end of tape during copy to Exabyte and had to be force killed -- DLT may have bad EOT marker.
				402	
	752	61443	08/09/2000	403	
18	753	61444	08/09/2000	403	
				403t	
	801	65714	08/10/2000	3MCS2	
19	802	65715	08/11/2000	3MCS2	
				501	
	847	69747	08/11/2000		
20	848	69749	08/11/2000	502	Last DLT of cruise.
					End of tape has last shot copied on it several times. DLT to Exabyte copy job had to be force killed.
	851	70091	08/11/2000		

Exabyte Tape Log: EW 0007

Copied from UWyo DLT tapes for the Danish Lithosphere Center

Tape #	DLT	Shots First	Shots Last	Date Copied	Lines	Notes
01	1	1	1109	07/20/2000	1OBS	
02	02	2455	4045	07/22/2000	1MCS	204 channels from shot 4045 appeared to have survived the crash and were copied from tape.
03	3	4046	5396	07/22/2000	1MCS	
4	4	5397	7830	07/23/2000	1MCS	Last shot may be split onto next tape.
5	4	7830	8852	07/23/2000	1MCS	
6	5	8867	11390	07/25/2000	1MCSt, 101, 102, 102t, 103, 103t, 104	Last shot may be split onto next tape.
7	5	11390	13194	07/25/2000	104	
8	6	13195	15645	07/25/2000	104, 105	Last shot may be split onto next tape.
9	6	15646	17569	07/25/2000	105, 106, 107	
10	7	17568	20021	07/26/2000	107, 108, 109	Last shot may be split onto next tape. Note duplicate shots from previous tape.
11	7	20022	21704	07/26/2000	109, 109t	
12	8	21706	24238	07/29/2000	2OBS, 2OBSt, 2MCS	Last shot may be split onto next tape.
13	8	24239	25401	07/29/2000	2MCS	
14	9	25359	27801	07/30/2000	2MCS	Last shot may be split onto next tape.
15	9	27803	29812	07/30/2000	2MCS	
16	10	29501	31957	07/31/2000	2MCS, 2MCSt, 201	Last shot may be split onto next tape.
17	10	31957	33880	07/31/2000	201, 202, 203, 204	
18	11	33823	36279	08/01/2000	204, 2MCSx, 204b, 205, 206, 207	Last shot may be split onto next tape.

Exabyte Tape Log: EW 0007

Copied from UWyo DLT tapes for the Danish Lithosphere Center

Tape #	DLT	Shots First	Shots Last	Date Copied	Lines	Notes
19	11	36279	37413	08/01/2000	207, 208, 209, 210	
20	12	37508	39957	08/03/2000	301, 302, 302t, 303	Last shot may be split onto next tape.
21	12	39958	41887	08/03/2000	303, 304, 305	
22	13	41872	44207	08/04/2000	305	
23	14	44210	46655	08/06/2000	306, 306t	Last shot may be split onto next tape.
24	14	46655	48589	08/06/2000	306t, 3OBS	
25	15	48538	50872	08/07/2000	3OBS, 3MCS1	Last shot may be split onto next tape.
26	15	50873	52894	08/07/2000	3MCS1	
27	16	52893	55339	08/08/2000	3MCS1, 3MCS1t, 401	Last shot may be split onto next tape.
28	16	55340	57228	08/08/2000	401	
29	17	57229	59666	08/09/2000	401, 402	Last shot may be split onto next tape.
30	17	59667	61443	08/09/2000	402, 403	
31	18	61444	63888	08/10/2000	403, 403t, 3MCS2	Last shot may be split onto next tape.
32	18	63889	65714	08/10/2000	3MCS2	
33	19	65715	68160	08/11/2000	3MCS2	Last shot may be split onto next tape.
34	19	68161	69747	08/11/2000	3MCS2, 501	
35	20	69749	70091	08/11/2000	502	End-o-cruise.

DLT Tape Log: EW0007 *Copied from 3490 E field tapes for Dalhousie University and Memorial University*

DLT Tape #	Reels	Shots	Date Copied	Lines	Notes
01	20-69	2455-6840	08/11/2000	1MCS	
02	69-91 308-334	6839-8852 23825-26186	08/11/2000	1MCS 2MCS	
03	334-383	26169-30663	08/12/2000	2MCS	Note missing reel 370, shots 29411-29500. Reshot as Line 2MCSx.
04	383-390 611-660	30582-31250 48753-53182	08/12/2000	2MCS 3MCS1	
05	660 761-808	53163-53210	08/13/2000	3MCS1 3MCS2	Missed first two reels of 3MCS2. These are copied separately onto a DAT (see tape 11 below).
6	808-851 666-672	66255-70091 53629-54208	08/13/2000	3MCS2 501, 502 401	
7	602-720	54169-58572	08/13/2000	401	
8	720-755 500-513	58489-61637 40522-41760	08/14/2000	401, 402 402, 305	
9	513-566	41692-46469	08/14/2000	305 306	
10	567,568 127-169	46470-46636 11189-14718	07/29/2000	306 104	
11	759-760	61874-62053	08/14/2000	3MCS2	Not a DLTII DDS-1 DAT donated by Steve Holbrook. After discovering that these reels were inadvertantly missed during the DLT copying. Data was streamed to each DLT until they filled up and we were uncertain how much space is left on the last tape, but it is nearly full. Therefore. we copied extra data to DAT.
12	427-430	34371-34722	08/14/2000	2MCSx	Ditto tape 11, except this DAT is aDDS-2 donated by Jeff Turmelle of the Ewing.

Error checking scripts and output

All of the files associated with this error checking are available from JRH.

Four key steps were involved in the error checking, described below. All of these checks used the job.output file that ProMAX generated when copying the UWyo DLT tapes to DLC Exabyte tapes. Steps 1 and 3 are potentially of interest to MCS processors when they read in and begin working on the data. The output from these steps are provided below for reference.

Step 1. The job output file lists all the shots found on tape and includes the file number, the source number, and the number of traces found per shot. SIOSEIS stores a bunch of information in a fake "trace 0" on the SEG-Y tape when copying from SEG-D. Thus each shot should have 481 traces (480 channels + the extra). An awk script was run on this output file to find missing shots and incomplete shots. If more than 90 shots were missing, the script includes a warning to check if a field tape was missed during the field tape copy. Note to ProMAX users: be sure to skip the extra trace when reading data into a ProMAX data set -- a simple check that the channel number is between 1 and 480 is sufficient.

Step 2. This was a check on the correspondence between the file number and shot numbers in the seismic recording log and what was found on tape. For each reel, the first shot and file numbers were exported into a two column file from the Filemaker Pro database, and then a simple awk script sorted through the ProMAX job.output files to verify the correspondence. Mismatches were flagged and the seismic recording log was checked for errors and fixed. The process was repeated for the last shot and last file recorded for each reel. This was also a useful way to find typos and other errors in the seismic recording log.

Step 3. Step 3 was a check on missing files to verify that missing files corresponded to missing shots or other known errors. This list will be important for ProMAX users since ProMAX uses the file number to initialize the geometry database.

Step 4: This was a quick check to verify the first and last shot on each line matched the MCS line log. The data was extracted by checking when the file number was reset to 1. In addition to the line changes, this step caught several instances where the file numbers were reset during a line. The watch-stander logs show that these resets occurred during acquisition system reboots. These resets are noted in the MCS line logs.

STEP 1. Check for missing shots

```
#!/bin/csh -f

set TAPE=$1  # the argument should be the ProMAX job.output file

             # extract the relevant lines first, flip the file and shot numbers
gawk '($1 == "FFID=") {printf("%d\t%d\t%d\n",$4,$2,$8)}' $TAPE > $TAPE.list

             # get the first and last shot information
set FSHOT=`head -1 $TAPE.list | gawk '{print $2}'`
set FFFID=`head -1 $TAPE.list | gawk '{print $1}'`
set FNOTR=`head -1 $TAPE.list | gawk '{print $3}'`

set LSHOT=`tail -1 $TAPE.list | gawk '{print $2}'`
set LFFID=`tail -1 $TAPE.list | gawk '{print $1}'`
set LNOTR=`tail -1 $TAPE.list | gawk '{print $3}'`

echo "First Shot on tape: $FSHOT" > $TAPE.qc
echo "   First FFID: $FFFID   No. of traces: $FNOTR" >> $TAPE.qc
echo " " >> $TAPE.qc
echo "Last Shot on tape:  $LSHOT" >> $TAPE.qc
echo "   Last FFID:  $LFFID   No. of traces: $LNOTR" >> $TAPE.qc
echo " " >> $TAPE.qc

             # now check for missing shots
gawk '(NR > 1) {printf("%d\t%d\t%d\n",$2-pshot,pshot,$2)} {pshot = $2}' $TAPE.list | \
  gawk '($1 == 2) {printf("Missing shot:  %d\n",$2+1)} \
        ($1 >  2) {printf("Missing shots: %d - %d\n",$2+1,$3-1)} \
        ($1 > 90) {printf("    More than 90, check reel copy jobs...\n")}' >> $TAPE.qc
echo " " >> $TAPE.qc
echo " " >> $TAPE.qc
             # now check for incomplete shots
echo "Shots missing 481 traces (480 channels + 1 auxiliary)" >> $TAPE.qc
echo "Some of these may be shots split between tapes.  Check" >> $TAPE.qc
echo "the other logs before concluding there is a problem shot." >> $TAPE.qc
gawk '($3 != 481) {printf("  %d\n",$2)}' $TAPE.list >> $TAPE.qc

rm $TAPE.list
exit
```

This generated the following output, listed here for each copy job.output file, which was renamed to reflect the tape numbers involved in the copy : (format slightly modified)

DLT01 to Ex01.qc

```
First Shot on tape:    1      First FFID:   1       No. of traces:     481
Last Shot on tape:     1108   Last FFID:    1100    No. of traces:     481

Missing shot:  10
Missing shot:  17
Missing shot:  349
Missing shot:  455
Missing shot:  654
Missing shots: 745 - 748
Missing shot:  925
Missing shots: 1016 - 1018
```

```
Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes.  Check
the other logs before concluding there is a problem shot.
  368
```

DLT02_to_Ex02.qc

```
First Shot on tape:    2455    First FFID:   1       No. of traces:     481
Last Shot on tape:     4045    Last FFID:    1591    No. of traces:     204

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes.  Check
the other logs before concluding there is a problem shot.
  4045
```

DLT03_to_Ex03.qc

```
First Shot on tape:    4046    First FFID:   1592    No. of traces:     481
Last Shot on tape:     5936    Last FFID:    3481    No. of traces:     102

Missing shot:  4574
Missing shots: 5397 - 5403
Missing shots: 5577 - 5666       More than 90, check reel copy jobs...

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes.  Check
the other logs before concluding there is a problem shot.
  5396
  5404-5936
```

DLT04_to_Ex04_Ex05.qc

```
First Shot on tape:    5397    First FFID:   2942    No. of traces:     481
Last Shot on tape:     8852    Last FFID:    6395    No. of traces:     481

Missing shot:  6187
Missing shot:  6191

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes.  Check
the other logs before concluding there is a problem shot.
```

DLT05_to_Ex06_Ex07.qc

```
First Shot on tape:    8867    First FFID:   1       No. of traces:     481
Last Shot on tape:     13194   Last FFID:    2002    No. of traces:     481

Missing shot:  9079
Missing shots: 9081 - 9090
Missing shot:  9103
Missing shots: 9170 - 9192
Missing shots: 9251 - 9287
Missing shot:  9374
Missing shot:  10351
```

Missing shot: 10387
Missing shot: 10458
Missing shot: 10480
Missing shots: 279 - 10761 More than 90, check reel copy jobs...
Missing shots: 10886 - 10887
Missing shots: 11080 - 11081
Missing shots: 11187 - 11188
Missing shot: 11220
Missing shots: 11311 - 11314
Missing shot: 11325
Missing shot: 12384

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.
9250

DLT06_to_Ex08_Ex09.qc

First Shot on tape:	13195	First FFID:	2003	No. of traces:	481
Last Shot on tape:	17569	Last FFID:	657	No. of traces:	424

Missing shot: 13606
Missing shots: 13697 - 13700
Missing shot: 13775
Missing shots: 14719 - 14721
Missing shots: 16342 - 16345
Missing shots: 16909 - 16912

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.
17569

DLT07_to_Ex10_Ex11.qc

First Shot on tape:	17568	First FFID:	656	No. of traces:	481
Last Shot on tape:	21704	Last FFID:	250	No. of traces:	481

Missing shot: 18190
Missing shots: 18386 - 18388
Missing shot: 18436
Missing shots: 18527 - 18530
Missing shot: 18577
Missing shot: 18752
Missing shot: 20547
Missing shot: 20817
Missing shots: 21432 - 21433
Missing shot: 21641
Missing shot: 21660
Missing shot: 21662
Missing shot: 21664
Missing shot: 21666
Missing shot: 21671
Missing shot: 21674

Missing shot: 21676
Missing shot: 21678
Missing shot: 21680
Missing shot: 21682
Missing shot: 21684
Missing shot: 21686
Missing shot: 21688
Missing shot: 21690
Missing shot: 21692
Missing shot: 21694
Missing shot: 21696
Missing shot: 21698
Missing shot: 21700
Missing shot: 21703

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT08 to Ex12_Ex13.qc

First Shot on tape:	21706	First FFID:	1	No. of traces:	481
Last Shot on tape:	25401	Last FFID:	1573	No. of traces:	438

Missing shot: 21719
Missing shots: 21734 - 21735
Missing shot: 21743
Missing shot: 21758
Missing shot: 21773
Missing shot: 21792
Missing shots: 21807 - 21808
Missing shot: 21816
Missing shot: 21831
Missing shot: 21844
Missing shots: 21862 - 21878
Missing shot: 21893
Missing shot: 21920
Missing shot: 21942
Missing shots: 21963 - 21971
Missing shot: 21985
Missing shot: 22008
Missing shot: 22026
Missing shot: 22039
Missing shots: 22053 - 22054
Missing shot: 22062
Missing shots: 22153 - 22155
Missing shot: 22169
Missing shot: 22191
Missing shot: 22205
Missing shot: 22216
Missing shot: 22229
Missing shot: 22248
Missing shot: 22516
Missing shots: 22536 - 22538
Missing shot: 22617
Missing shot: 22727

Missing shot: 22771
Missing shot: 22986
Missing shots: 23077 - 23088
Missing shots: 23533 - 23542
Missing shot: 23704
Missing shot: 23707
Missing shot: 23726
Missing shot: 23728
Missing shot: 23730
Missing shot: 23732
Missing shot: 23747
Missing shot: 23749
Missing shot: 23751
Missing shot: 23753
Missing shot: 23814
Missing shots: 23820 - 23824
Missing shot: 23835
Missing shot: 23883
Missing shot: 24136
Missing shot: 24612

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.
25401

DLT09_to_Ex14_Ex15.qc

First Shot on tape:	25359	First FFID:	1531	No. of traces:	481
Last Shot on tape:	29812	Last FFID:	5982	No. of traces:	481

Missing shot: 26455
Missing shot: 27909
Missing shots: 29411 - 29500 More than 90, check reel copy jobs...

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.
29800

DLT10_to_Ex16_Ex17.qc

First Shot on tape:	29501	First FFID:	5671	No. of traces:	481
Last Shot on tape:	33880	Last FFID:	327	No. of traces:	481

Missing shot: 30212
Missing shots: 31251 - 31253
Missing shot: 31476
Missing shots: 31496 - 31499
Missing shot: 31690
Missing shots: 32833 - 32847
Missing shots: 33285 - 33287
Missing shot: 33546
Missing shots: 400 - 33552 More than 90, check reel copy jobs...
Missing shot: 33877

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT11_to_Ex18_Ex19.qc

First Shot on tape:	33823	First FFID:	271	No. of traces:	481
Last Shot on tape:	37413	Last FFID:	70	No. of traces:	481

Missing shot: 33877
Missing shots: 34005 - 34006
Missing shot: 34023
Missing shot: 34025
Missing shot: 34029
Missing shot: 34062
Missing shots: 34723 - 34724
Missing shot: 34788
Missing shots: 35145 - 35147
Missing shots: 35459 - 35460
Missing shot: 36130
Missing shot: 36132
Missing shot: 36547
Missing shot: 36555
Missing shot: 36557
Missing shot: 36559
Missing shot: 36562
Missing shot: 36567
Missing shot: 36569
Missing shot: 36571
Missing shot: 36578
Missing shot: 36596
Missing shot: 36598
Missing shot: 36600
Missing shot: 36602
Missing shot: 36605
Missing shot: 36608
Missing shot: 36611
Missing shots: 37079 - 37082
Missing shot: 37331
Missing shots: 37340 - 37343
Missing shot: 37369

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.
36411

DLT12_to_Ex20_Ex21.qc

First Shot on tape:	37508	First FFID:	1	No. of traces:	481
Last Shot on tape:	41887	Last FFID:	1366	No. of traces:	481

Missing shots: 37844 - 37847
Missing shot: 38015

Missing shots: 39640 - 39641
Missing shot: 39846
Missing shots: 39875 - 39879
Missing shot: 39939
Missing shots: 40367 - 40369
Missing shots: 40520 - 40521

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT13_to_Ex22.qc

First Shot on tape:	41872	First FFID:	1351	No. of traces:	481
Last Shot on tape:	44207	Last FFID:	3686	No. of traces:	481

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT14_to_Ex23_Ex24.qc

First Shot on tape:	44210	First FFID:	1	No. of traces:	481
Last Shot on tape:	48589	Last FFID:	1544	No. of traces:	481

Missing shot: 45288
Missing shots: 45292 - 45299
Missing shot: 46721
Missing shot: 47032
Missing shots: 407 - 47042 More than 90, check reel copy jobs...
Missing shot: 47059
Missing shot: 47085
Missing shots: 47101 - 47103
Missing shot: 47126
Missing shot: 47142
Missing shot: 47154
Missing shots: 47169 - 47170
Missing shot: 47178
Missing shot: 47263
Missing shot: 47280
Missing shots: 47299 - 47300
Missing shot: 47409
Missing shot: 47436
Missing shots: 47489 - 47492
Missing shot: 47516
Missing shot: 48355
Missing shots: 48446 - 48447

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT15_to_Ex25_Ex26.qc

First Shot on tape:	48538	First FFID:	1493	No. of traces:	481
Last Shot on tape:	52894	Last FFID:	4142	No. of traces:	481

Missing shots: 48751 - 48752

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT16_to_Ex27_Ex28.qc

First Shot on tape:	52893	First FFID:	4141	No. of traces:	481
Last Shot on tape:	57228	Last FFID:	3600	No. of traces:	481

Missing shots: 53211 - 53216
Missing shots: 53627 - 53628

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT17_to_Ex29_Ex30.qc

First Shot on tape:	57229	First FFID:	3601	No. of traces:	481
Last Shot on tape:	61443	Last FFID:	1620	No. of traces:	481

Missing shots: 59290 - 59292

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT18_to_Ex31_Ex32.qc

First Shot on tape:	61444	First FFID:	1621	No. of traces:	481
Last Shot on tape:	65714	Last FFID:	3840	No. of traces:	481

Missing shots: 61638 - 61639
Missing shot: 64986

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes. Check
the other logs before concluding there is a problem shot.

DLT19_to_Ex33_Ex34.qc

First Shot on tape:	65715	First FFID:	3841	No. of traces:	481
Last Shot on tape:	69747	Last FFID:	388	No. of traces:	481

Missing shots: 69358 - 69359
Missing shot: 69734

Shots missing 481 traces (480 channels + 1 auxiliary)

```
Some of these may be shots split between tapes.  Check
the other logs before concluding there is a problem shot.
  66405
```

DLT20_to_Ex35.qc

```
First Shot on tape:    69749   First FFID:   1       No. of traces:      481
Last Shot on tape:     70091   Last FFID:    343     No. of traces:      481

Shots missing 481 traces (480 channels + 1 auxiliary)
Some of these may be shots split between tapes.  Check
the other logs before concluding there is a problem shot.
```

STEP 3. Check for missing files

An awk script similar to that above generated the following:

```
Missing File: 452               Corresponding missing shot: 455
Missing File: 651               Corresponding missing shot: 654
Missing File: 919               Corresponding missing shot: 925
Missing Files: 3122 - 3211      Corresponding missing shots: 5577 - 5666
Missing File: 213               Corresponding missing shot: 9079
Missing File: 13                Corresponding missing shot: 9103
Missing Files: 80 - 82          Corresponding missing shots: 9170 - 9192
Missing File: 87                Corresponding missing shot: 9374
Missing File: 1064              Corresponding missing shot: 10351
Missing File: 1100              Corresponding missing shot: 10387
Missing File: 1171              Corresponding missing shot: 10458
Missing File: 32                Corresponding missing shot: 11220
Missing File: 1192              Corresponding missing shot: 12384
Missing File: 2414              Corresponding missing shot: 13606
Missing File: 2580              Corresponding missing shot: 13775
Missing File: 48                Corresponding missing shot: 18436
Missing File: 186               Corresponding missing shot: 18577
Missing File: 1795              Corresponding missing shot: 20547
Missing File: 2065              Corresponding missing shot: 20817
Missing File: 14                Corresponding missing shot: 21719
Missing Files: 29 - 30          Corresponding missing shots: 21734 - 21735
Missing File: 38                Corresponding missing shot: 21743
Missing File: 53                Corresponding missing shot: 21758
Missing File: 68                Corresponding missing shot: 21773
Missing File: 87                Corresponding missing shot: 21792
Missing Files: 102 - 103        Corresponding missing shots: 21807 - 21808
Missing File: 111               Corresponding missing shot: 21816
Missing File: 126               Corresponding missing shot: 21831
Missing File: 139               Corresponding missing shot: 21844
Missing File: 15                Corresponding missing shot: 21893
Missing File: 42                Corresponding missing shot: 21920
Missing File: 64                Corresponding missing shot: 21942
Missing File: 14                Corresponding missing shot: 21985
Missing File: 37                Corresponding missing shot: 22008
Missing File: 55                Corresponding missing shot: 22026
Missing File: 68                Corresponding missing shot: 22039
Missing Files: 82 - 83          Corresponding missing shots: 22053 - 22054
```

Missing File: 91	Corresponding missing shot: 22062
Missing File: 196	Corresponding missing shot: 22169
Missing File: 218	Corresponding missing shot: 22191
Missing File: 232	Corresponding missing shot: 22205
Missing File: 243	Corresponding missing shot: 22216
Missing File: 256	Corresponding missing shot: 22229
Missing File: 275	Corresponding missing shot: 22248
Missing File: 543	Corresponding missing shot: 22516
Missing Files: 563 - 565	Corresponding missing shots: 22536 - 22538
Missing File: 644	Corresponding missing shot: 22617
Missing File: 754	Corresponding missing shot: 22727
Missing File: 798	Corresponding missing shot: 22771
Missing File: 1013	Corresponding missing shot: 22986
Missing Files: 5581 - 5670	Corresponding missing shots: 29411 - 29500
Missing File: 249	Corresponding missing shot: 37331
Missing File: 26	Corresponding missing shot: 37369
Missing File: 1079	Corresponding missing shot: 45288
Missing File: 85	Corresponding missing shot: 46721
Missing File: 17	Corresponding missing shot: 47059
Missing File: 43	Corresponding missing shot: 47085
Missing Files: 59 - 61	Corresponding missing shots: 47101 - 47103
Missing File: 84	Corresponding missing shot: 47126
Missing File: 100	Corresponding missing shot: 47142
Missing File: 112	Corresponding missing shot: 47154
Missing Files: 127 - 128	Corresponding missing shots: 47169 - 47170
Missing File: 136	Corresponding missing shot: 47178
Missing File: 221	Corresponding missing shot: 47263
Missing File: 238	Corresponding missing shot: 47280
Missing Files: 257 - 258	Corresponding missing shots: 47299 - 47300
Missing File: 367	Corresponding missing shot: 47409
Missing File: 394	Corresponding missing shot: 47436
Missing Files: 447 - 448	Corresponding missing shots: 47489 - 47492
Missing File: 472	Corresponding missing shot: 47516
Missing File: 1311	Corresponding missing shot: 48355
Missing File: 375	Corresponding missing shot: 69734

Appendix 10: Watchstanders' Guide

THE WATCHSTANDERS POST

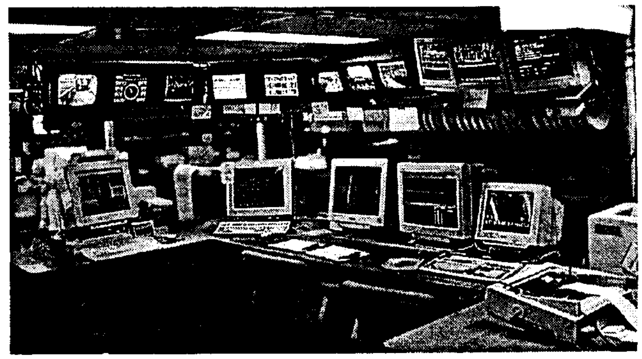
The following manual covers the equipment and activities used most often for the watchstanding position. Coverage of all of the possible activities of the watchstander's position would be outside the scope of this manual. Each Cruise aboard the R.V. Ewing will, inevitably, be different from any other cruise. Data collection will be customized to specific needs of each visiting science party. New errors will occur and new solutions to errors will be found. Equipment, procedures, and personnel will change for each cruise aboard the R.V. Ewing. Although the procedures used by the watchstander may change, the responsibilities will not. All of the watchstander's duties can be placed into two categories: error identification, and ensuring the continuation of data recording.

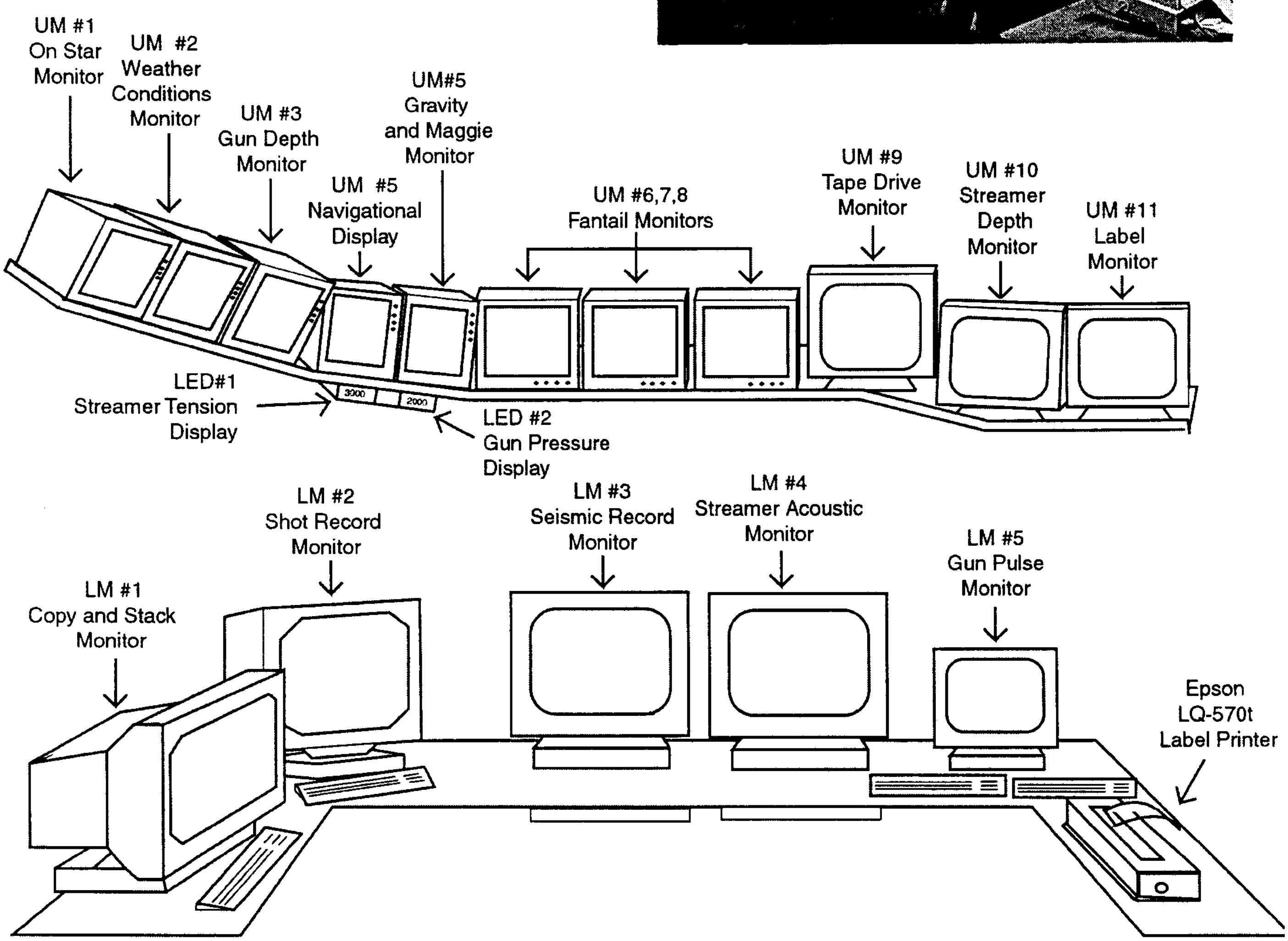
Because of the changing nature of the watchstander's position, it is important that all watchstanders develop open communication with other members of the science party and, most importantly, with the science officer. I t is the science officer who will be able to address all errors. This officer will be up to date on all changes in the watchstander's position. The science officer is also the communication liaison between the visiting science party and the ship's crew. Watchstanders should feel comfortable calling the science officer at any time, day or night. The watchstander is, essentially, watching for errors to report to the science officer.

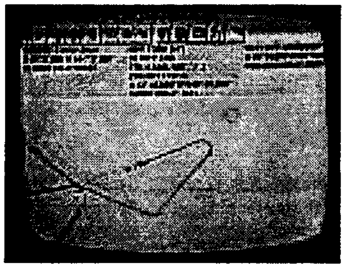
The most important duty of the watchstander is paying attention. Make sure you are aware of the equipment. Listen to what the science officer and members of the science party have to tell you. If you avoid distraction and remain attentive you will help ensure that your cruise is a success.
Good luck.

Michael Hogan
Aug. 15, 2000
EW-0007
Tucholke/Holbrook

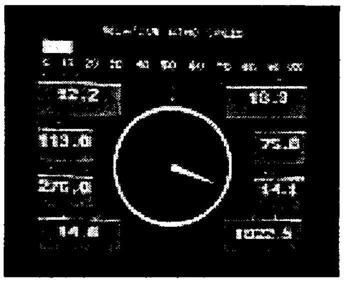
To the right is a photograph of the watchstander's post. Below is an illustration containing the moniters used in the watchstander's regular activities. The letters UM stand for upper moniter and the following number correspond to the position in the array from left to right. LM stands for lower moniter and LED refers the two LED displays used by the watch stander. These abbreviations are used throughout the screens manual and regular activites manual.



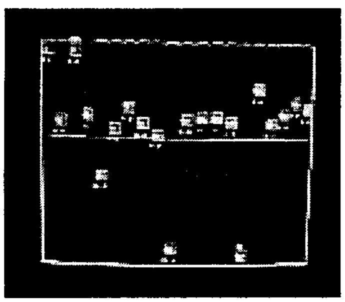




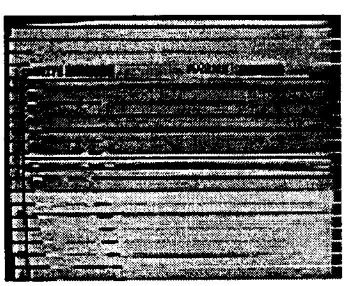
UM #1 On Star Monitor
This screen is used to monitor the ship's navigational system "InStar". From here it is possible to estimate our arrival at different way points. You can also monitor the ship's progress through turns, which is helpful when making line changes. This may also be used as a video monitor of the starboard port deck leading to the fantail .



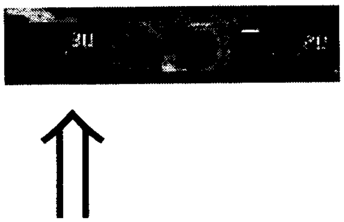
UM #2 Weather Conditions Monitor
Weather conditions are displayed here such as; relative and true wind direction, wind speed, air temperature, humidity, maximum wind gusts, and barometric pressure are displayed on this screen. You may want to include some of these fields in the logs, especially if extreme weather conditions warrant a change in data acquisition.



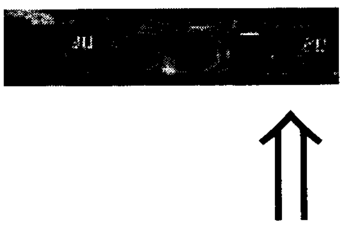
UM #3 Gun Depth Monitor
The depths of the air guns, which are used as a seismic source, are displayed here. Each small block on the screen represents a gun and its relative position. The number located underneath each block is its reported depth. The line running horizontally in the screens center is the optimum depth of the guns as determined by the science officer. Gun depth is monitored closely by the gunners and Science Officer, but should also be monitored by the watchstanders during turns, turbulent weather and while the ship's speed is changing. Occasionally guns will be pulled out of the water by the gunner for maintenance or repair. When this is done the gunners will inform the lab. Guns pulled from the water should be noted in the watchstander's log as well as the data record log.



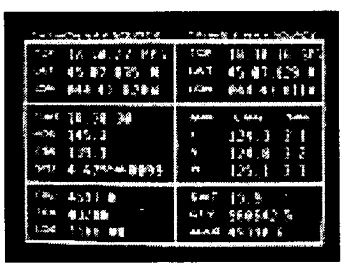
UM #4 Gravity and Maggie Monitor
The bottum graph on this monitor shows gravity data, the top graph shows magnetic data. The gravity meter displays its measurements in the left upper corner and the lower graph in units of milligals. The magnetometer's readings are in the upper right hand corner and upper graph in units of nanotesla As these meters pass over the ground the magnetic and gravity signatures should vary at least slightly. If there is no variations in the data displayed the science officer should be notified as this may indicate instrument failure.



LED #1 Streamer Tension Display
Streamer tension is displayed on the left LED display. Depending on the speed of the ship this measurement, which is in pounds, should remain between 1000 and 4500. The pull of the streamer will vary over short periods of time (minutes) by approximately 300 lbs. If there are any jumps of over 600 lbs. without a corresponding change in speed or if the tension becomes greater then 6000 lbs., the science officer should be notified. This may indicate a foreign object is entangled in the streamer cable. Early recognition of jumps in streamer tension may prevent the loss of part or all of the streamer.



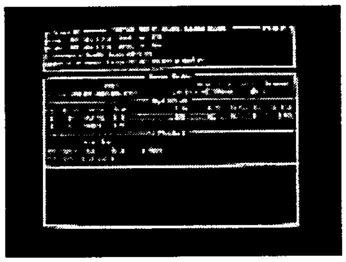
LED #2 Gun Pressure Display
Air pressure to the air guns in p.s.i. is displayed to the right of the streamer tension. When the guns fire, air is expelled into the water. Compressors return air pressure before another shot is fired. The pressure at which the guns are fired should remain close to 2000 lbs. If the peak pressure falls below 1800 lbs. the gunner on duty or the science officer should be notified. If the pressure becomes too low the guns may fill with water. In order to increase pressure the compressor output may be increased or the speed of the ship may be decreased to increase the time interval between shots.



UM # 5 Navigational Monitor
Navigational data is posted from 2 separate sources here, Tasmon and Trimble navigational sources. For purposes of the watchstanders log Tasmon fields are used for latitude and longitude. Greenwich mean time (**TIME**), heading (**HDG**), course(**CSE**), speed through the water(**SPD**), and the propellers rotation per minute (**RPM**), are found in the left center block. Course made good (**CMG**) and speed made good (**SMG**), are found to the right for **1**, **5**, and **15** minute intervals. **SMG** and **CMG** are measurements of the speed and course over the ground, whereas **SPD** is a reading of our speed through the water. The center beam depth (**CBD**) is the seafloor depth as measured from the bow of the boat using the hydrosweep device. **TEN** is the tension of the streamer cable over short time intervals, but actual streamer tension should be monitored from the led display below this monitor. **LOG** is the total miles traveled since the beginning of the cruise. **SWT** is the surface water temperature. Gravity (**GTY**) and magnetometer data (**MAG**) are displayed here as well but should be monitored using the gravity-magnetometer screen.

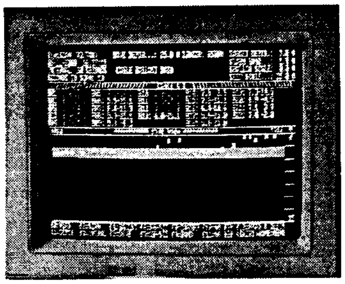
UM # 6,7,8 Fantail Monitors

The three monitors that occupy the center of the upper monitor array are used to watch activity on the fantail (rear deck). From these monitors it is possible to view the deployment of the streamers and guns. During heavy weather, the watchstander should keep track of any activity on the fantail so that action may be taken if an accident should occur.

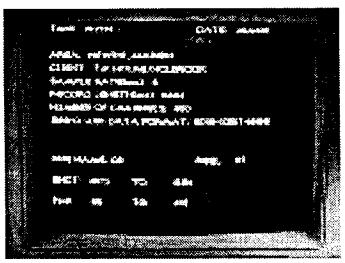


UM # 9 Tape Drive Monitor

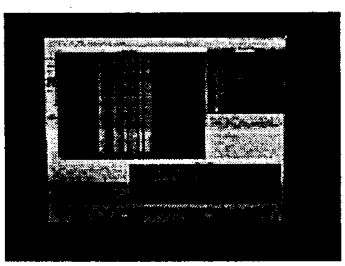
Status of the recording devices is posted here. The tape drives, located just forward of the watchstanders post, are labeled 1 for the drive on the right and 0 for the drive on the left in the **Drive** column. The drive currently in use will be highlighted in light blue. The **Status** column will post the current status of the drives; **ACTIVE** for recording, **READY** for standby, and **UNLOAD** when a tape is full. Error messages will also post on the drive's LED display (where the photo shows ready). The **Reel** number, located on the drive monitoring screen, is identical to the tape number. **File** numbers are equivalent to shot numbers except that file numbers return to zero after each line change. **Shot** numbers are continuous and unique. **Left** is the number of shots that can be recorded before the tape is filled. **Retry** and **ECC** will register the number of errors on a tape that the device has tried to correct. If these fields read more than three or are registering frequently then the chief scientist should be notified. **Wr. Time** is the amount of time it took in seconds to write the last shot to the 3490e tape. If this field registers more than 10 seconds or is erratic, then errors may occur in writing to the tape. The science officer should be notified and notation of the event should be made in the seismic recording log.



UM # 10 Streamer Depth Monitor
Streamer depth is posted here. In the lower half of the screen a green bar simulates the acceptable depth of the streamer set by the science officers. The small yellow characters are the individual birds. The birds are winged devices attached to the streamer that control the depth of the cable. If the bird characters appear above or below the green line the streamer needs to be repositioned. In the top half of the screen the individual depths of the birds are posted along with the angle of the birds' wings. Blue highlighted depths indicate that the bird is outside of the programmed depth. The depth of the birds and the streamer will be disrupted during turns, turbulent seas, and changes in speed. If the streamer is above or below the set depth by over 5 meters, for an extended period of time, or if it reaches the surface, notify the chief scientist. A change in the speed of the ship will usually correct the depths of the birds and the streamer.



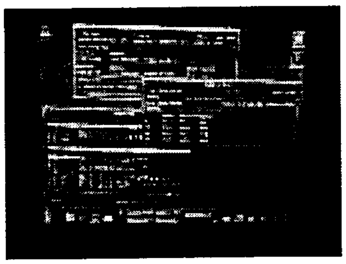
UM # 11 Label Monitor
The label screen displays information which will be printed on the Epson LQ-570t label printer on the right side of the post. This label from here is then attached to the corresponding 3490e tape. Information on the top portion of the screen will usually remain the same throughout the period of data collection and will be set by a science officer. The **SHOT**, **FILE**, and **REEL** (tape) number fields on the lower portion of the screen change automatically. The **LINE NAME** field is changed manually as you change lines. It should be noted that there is a slight delay as the system updates the data on the label screen. Frequently there will be errors on the labels, so it is necessary to verify the record of shots as they are stacked and copied to DLT tape. If necessary, changes to the label should be made so that it matches the record on the Copy and Stack Monitor.



LM #1 Copy and Stack Monitor
This screen monitors the copying of data from 3490e tapes onto DLT tapes as well as the stacking of data into brute stacks that are printed out on the large Atlantek printer on the starboard bulkhead the watchstanders station. The screen **Copy_Stack** should be opened. The **Stack Window**, **Stack I/O Window**, **Atlantek Plotting Window**, should be arranged so that all are visible. As data is read and then copied, the shots are listed in the **Stack**

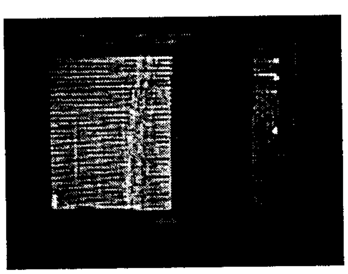
Window. This is also where the stack and copy job is started. The shot numbers here should be checked against the labels on each 3490e tape, the recording log and tape database. All of these should be changed to correspond to the shots listed in the screen output of the copy and stack job. Commands to continue or stop the copy and stacking process are typed in the **Stack *I/O* Window**. The plotting job is monitored, stopped, and started in **Atlantek Plotting Window**.

LM #2 Shot Record Monitor



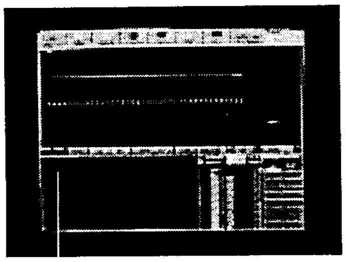
Two screens are used here primarily, the **Seismic** and **Watchdata** screens. The **Seismic** screen should be open during the watch. Two windows are of importance here **Seismic Output** and **Seismic Recorder.** The **Seismic Output** window provides information concerning each shot as it is registered into the system. Shot number, distance and time between shots, and other information about each shot are listed. You should acquaint yourself with the location of this information. There are several times when you may need to record this data, and the screen advances rather quickly. You will need to use the **Seismic Controller** screen to change the line name field as well as the shot interval. Occasionally alarms will sound from this terminal. Alarms controls are found in the **Watchdata** screen. If information is not received from the listed instruments within a period of time a steady beep will sound until data is received or the alarm is silenced. Active alarms can be identified as the last data registered is highlighted in white. If a particular instrument is being worked on and the alarm is sounding you may silence it by clicking on the corresponding orange button. All alarms should be brought to the attention of the science officer and should be noted in the log.

LM #3 Seismic Record



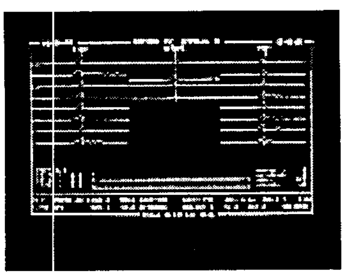
This screen displays the data received from each channel on the streamer for one shot at a time. The channels are listed vertically and time is registered horizontally. As data is received by this monitor it is displayed for every fourth channel. Every eighth channel is labeled. After each shot the next consecutive series of every fourth shot is displayed. By the fourth shot all channels have been displayed. From this screen it is possible to identify all bad channels, which should be brought to the science officer's attention and be noted in the logs. You can also identify periods of noisy data, when channels register noise from ship turns, turbulent seas, etc.. These periods should also be noted in the logs, and the scientist on watch should be notified.

LM #4 Streamer Acoustic Monitor



From this screen you are able to observe the signal received by the streamer. The green line in the upper section of the screen represents the signal received by the streamer. The white numbers underneath it list every tenth channel and are an indication of their relative location. As surface waves, reflections, and refractions, are received by each channel, you are able to watch as the signal progresses down the streamer. It is also possible to observe periods of noisy data collection here. This is recognized by the random scattering of the signal. This noisy data can be caused by turbulent seas, turning of the ship, or surfacing of the streamer. Any noisy periods should be brought to the attention of the scientist on watch and noted in the logs.

LM # 5 Gun Pulse Display



This screen displays data concerning the air guns. The horizontal lines in the upper portion of the screen are indications of the guns' activity. When the guns fire, the pulse emitted by each gun is shown on the screen. The largest pulse is displayed as a large peak in the line. Under ideal conditions the largest pulse from each gun should line up on the screen at the light blue vertical line, In the lower section of the screen information concerning individual gun's performance is displayed. As a large X wanders to different green lines in the upper section the corresponding gun's firing history is displayed in the lower section of the monitor. The graph in the lower center of the screen displays the gun's timing over a series of several shots. A gun firing late or prematurely will have several wide green bars extending above or below the horizontal green line. If a gun is off by more than two milliseconds the length of the delay will appear in the upper screen next to the pulse of the misfiring gun. If a gun is off by more then two milliseconds and is displaying digits in the upper screen a scientist on watch should be notified and this should be noted in the logs.

Regular Activities

LOGS

It is important to understand that you cannot record too much information into the logs. Even events that may at the time seem trivial may prove useful when the data is processed and interpreted in the future. It is hard if not impossible to recall events after the data collection is through. All communication, with the crew or other members of the science party, any errors, any changes in the equipment, course, or collection techniques, should be written down in at least one log. Sample logs are included in the final pages of this manual.

Science Watch Standers Log:

This log should be filled out every half hour. A short alarm sounds every 30 minutes behind the watch standers station as a reminder. Entries should also be made at; way points, beginning and ending of turns, any change with relation to the air guns, and anything else that could contribute to the interpretation of the data after the cruise is over.

J-DAY = Julian date. Located on the LED display above the tape drives.
TIME =Greenwich Mean Time. Located on the LED display above the tape drives.
PIT LOG = The total distance traveled since at port. Located on the Navigational screen under **LOG**.
CSE = Course. Located on the **Navigational Monitor** (UM #5) under **CSE.**
SPD = Speed through the water. Located on the **Navigational Monitor** (UM #5) under **SPD.**
DEPTH = Depth. Located on the **Navigational Monitor** (UM #5) under **CBD.**
LAT = Latitude. Located on the **Navigational Monitor** (UM#5) under **TASMON. NAV SOURCE** column beside **LAT.**
LON = Longitude. Located on the **Navigational Monitor** (UM #5) under **TASMON. NAV SOURCE** column beside **LON.**

Seismic Recording Log

This log is primarily used to document the process of recording data to tape. There are a few fields similar to the Watch Standers log. Tape # Shot # and File # are all properties of the recording process. An entry should be made for both the beginning and ending of each tape. Most of the fields in these entries will be similar, but occasionally file # and shot # are not consecutive and should be noted. Entries should also be made for any changes in data acquisition such as guns brought on-line or off-line, changes in streamer depth, noisy data etc,.

DATE (calendar day), J. DAY, GMT (Time) LATITUDE, LONGITUDE = See Watch Standers log equivalent.
Tape # = Is also listed as reel #. Located on the **Tape Drive Monitor** (UM #9) under **Reel**
Shot # = Located on the **Shot Record Monitor** (LM#2), in the **Seismic** Screen, in the **Seismic Output** Window listed as **Shot Number** between horizontal lines
File # Located on the **Tape Drive Monitor**(UM #9) under **File**

Retensioning Tapes

In order to optimize the recording of data to the 3490e tapes each cassette must be retensioned. This is done in the TD 3610 tape drive found directly behind the watch standers station. This drive is exactly like the tape drives used to record the 3490e tapes.

Steps for Retensioning.

1.........Turn on the drive by pressing the square button located in the lower left corner.

2........When display reads "**Not Ready**" hold ready button and press rewind.

3.........Display will read "**Self Test**". Press unload button.

4.........Display will read **"SCRATCH TAPE"**. Insert untensioned 3490e cartridge.

5.........When tape is ejected display will read "**Diag OK**". Hold ready button and press rewind.

6..........To retension other tapes repeat from step 2

Changing 3490e Tapes

Depending on the ship's speed and the shot interval, the length of time it takes a 3490e tape to fill will vary. You can monitor the recording of shots in the **Tape Drive Monitor** (UM#9). The number of shots remaining before a tape is full is displayed under the **"Left"** column. When this number reaches zero the display will read "**Unloading**" in the status column and a tape will rewind and be ejected. The recording process will switch to the opposite drive and the operation is repeated. At any time during the recording process an error may occur. Errors will first be displayed on the tape drive's LED display. In the case of an error, you will often need to manually unload the tape from the drive. This is done by holding the **"READY"** button and pressing "**UNLOAD**" on the tape drive. Regardless of how many shots are in the "**left**" column. The status will read unload after the next shot is processed and the tape will eject.

Steps For Changing Tapes

1.........In the **Tape Drive Monitor** (UM #9) As the number in the "**Left**" column approaches zero, fill out the fields in the recording logs.

2.........When the "**Left**" column reaches zero you should be positioned near the drive with a replacement tape in hand.

3.........When the tape is ejected, replace it with a blank retensioned 3490e tape.

4..........Immediately write-protect ejected tape. This is done by rolling a switch in the upper right corner to expose 🔒 (padlock) symbol.

5..........A label will be printed from the Epson LQ-570t printer. Attach printed label to the ejected tape.

6..........Begin the Copy and Stacking process.

Copying and Stacking

Data from the entire six kilometer streamer can be stacked and copied in near-real time using grampus (a 4-cpu Sun Enterprise) and Sioseis scripts (see Real-Time Stacking section of EW 0007 cruise report). Note: Some of the script names (e.g., "go.in") are specific the EW 0007 cruise. Your mileage may vary.

Due to the expense of 3490e tape drives visiting science parties may wish to copy these tapes to a different medium. An external 3490e tape drive and a DLT tape drive exist in the forward section of the main lab (around the large electronic cabinet, forward of the watchstander's post) and may be used for this reason. Stacking is a process which surpresses noise and produces a clearer image of the earth. The stacked image can be printed on the Atlantek printer located on the starboard bulkhead of the watchstander's post. Both copying and stacking are done simultaneously using the external 3490e tape drive, the DLT tape drive, and the Copy Stack terminal . Copying and stacking jobs that have been suspended at the end of the previous tape can be restarted by typing the command "***go.in***" in the Stack I/O window on the Copy Stack Terminal

Steps for copying and Stacking Data.

1........Place 3490e tape in the tape drive located in the forward section of the main lab.

2.........When drive's display reads **READY** type "**go.in**" onto the Stack I/O window on the **Copy and Stack Monitor** (LM #1)

3.........Note the shot numbers listed in the Stack In window. These should be checked against the data on the 3490e labels, recording log, and tape log database. All of these should be changed to match the Stack I/O record.

Tape Log Database

Each visiting science party will most likely have a database created so that information about each 3490e and DLT tape can be easily accessed. This is usually done on a simple spreadsheet program but will be customized for individual cruises. Typically the fields that will be entered by the watchstander for each 3490e reel will be: the starting and ending time, the starting and ending latitude and longitude, the first and last file number, the first and last shot number, and any remarks about each tape such as errors encountered, waypoints, and/or seafloor instruments crossed. The DLT database will also contain the numbers of the reels contained on each tape. It is beneficial to have this program contained on a laptop computer and kept beside the **Copy and Stack Monitor**. This way the shot numbers can be easily recorded from the **Stack Window**. While the stacking and copying are taking place shot numbers are read off the 3490e tape, making it the most accurate record of the shots contained on each tape.

Changing Lines

The changing of a line will usually coincide with a turn. What sort of turn is made to move on to the next line will determine when one line ends and another begins (see diagram 1-A at the end of this manual) In the case of a 90 degree turn or less the watch stander has some lee way in where to begin the turn. In these circumstances the final tape of the previous line should be used until there is only 10-15 shot in the "**Left**" column of the tape drive monitor or the turn is nearly complete. As soon as the line is changed the 3490e tape will eject. Waiting for the final 15 shot on a tape will save tape space and allow enough time so that the change is complete by the time the boat is on the next line. In the case of a 180 degree turn the turn itself becomes its own line. In this case the change of the line should start immediately when the ship begins turning and change again as soon as the turn is complete.

Steps for Changing Lines.

1 In the **Shot Record Monitor** (LM #2)

- A. In the **Seismic** screen, in the **Seismic Controller** Window make necessary changes in the line name field.
- B At the top left corner of the **Seismic Controller** Window pull down the "**File**" menu by clicking on it with the mouse
- C Click on the "**Stop Shooting**" button
- D Click on the "**Start Now**" button when the Gun pressure reaches an acceptable firing pressure

3 In the **Streamer Acoustic Monitor** (LM #4)

- A click **"Stop Cycle"** in the top portion of the screen and click **"Yes"** when asked "**Stop External Cycle?**"
- B click **"Start Line"** in the top portion of the screen
- C In the pop up window click on the **Line Name** field and make the necessary changes in the line name field. Then click on the **"Accept"** button
- D At the top of the screen click on the **"Cycle"** button and then click the **"Start External Cycle"** button.
- E The current drive will register "**UNLOAD**" in the **Tape Drive Monitor** and a tape will soon be ejected

5 In the **Gun Pulse Display** (LM #5)

- A Using the **Gun Pulse keyboard** strike the ***F1*** key
- B Hold the ***Shift*** key and strike the ***Tab*** key until you reach the line field.
- C Type in the new line number and hit enter.
- D Strike the ***esc*** key to return to the usual screen.

4 In the **Label Monitor** (UM #11)

- A Wait for a label to be printed for the ejected tape
- B using the **Label keyboard** hit the ***esc*** key
- C At the prompt type "***edit label.cfg***"
- D Scroll down to the line name using the keyboards arrow keys and make the necessary changes to the **"Line"** field.
- E Select the **"File"** menu by holding the ***alt*** key and pressing ***F***. Scroll down using the *arrow keys* and hit *enter*.
- E Select the **"File"** menu again and select **"Exit"**

Changing Lines for the Copy and Stack Process

When changing a line it is necessary to change the file into which data is copied and stacked, which is in turn plotted. A change of line in the **Copy and Stack Monitor** (LM # 1)will coincide with the above changing line process. There is however, a period of time between the two in which the final tape of the pervious line is copied and stacked.

Steps For Changing Lines in the Copy and Stack Process

1........After the final 3490e tape from the previous line has been recorded type *"**stopp**"* on the **Copy and Stack Monitor** (LM #1) in the **Stack I/O** window.

2.........Place the first 3490e tape from the new line in the tape recorder. Wait for the drives display to read "**READY**".

3.........In the **Stack I/O** window type ***"copy+stack..sh*** **(the number of the new line)(the spacing of shots)."** This will begin the stacking and copying process.

4..........After the first tape from the new line is finished copying and stacking, place the cursor in the **Atlantek Plotting** window, holds the ***control button*** and press ***c***.

5..........In the **Atlantek Plotting** window type ***"cd"*** to move into a higher directory.

6......... In the **Atlantek Plotting** window type ***"cd"*** **(the name of the new directory).**

7...........Type ***"atlantek siopltfil.line*(the number of the new line)**

8...........There should be a small gap in the printing of the brute stacks from the Atlantek printer.

Changing DLT Tapes

After approximately 46 of the 3490e tapes (4200 shots) have been copied to the DLT medium it will become necessary to change the DLT tape. A message reading "**Mount New Output Tape**" will appear in the **Stack Window** of the **Copy and Stack Monitor**. The DLT drive is located in the forward section of the main lab on the forward side of the large electronic cabinet.

Steps to Change DLT Tape

1.........Place the mouse icon in the **Stack Window** of the **Copy and Stack Monitor**. Hold the ***"control key"*** and press ***"c"***.

2..........Wait for the screen to read "**End of sioseis run**". Place the mouse in the **Atlantek Plotting Window** hold the "control key" and press "c".

3..........Move to the DLT drive. Press the "UNLOAD" button in the lower right hand corner.

4..........Lift the door located underneath the mounted DLT tape. This will eject the DLT tape.

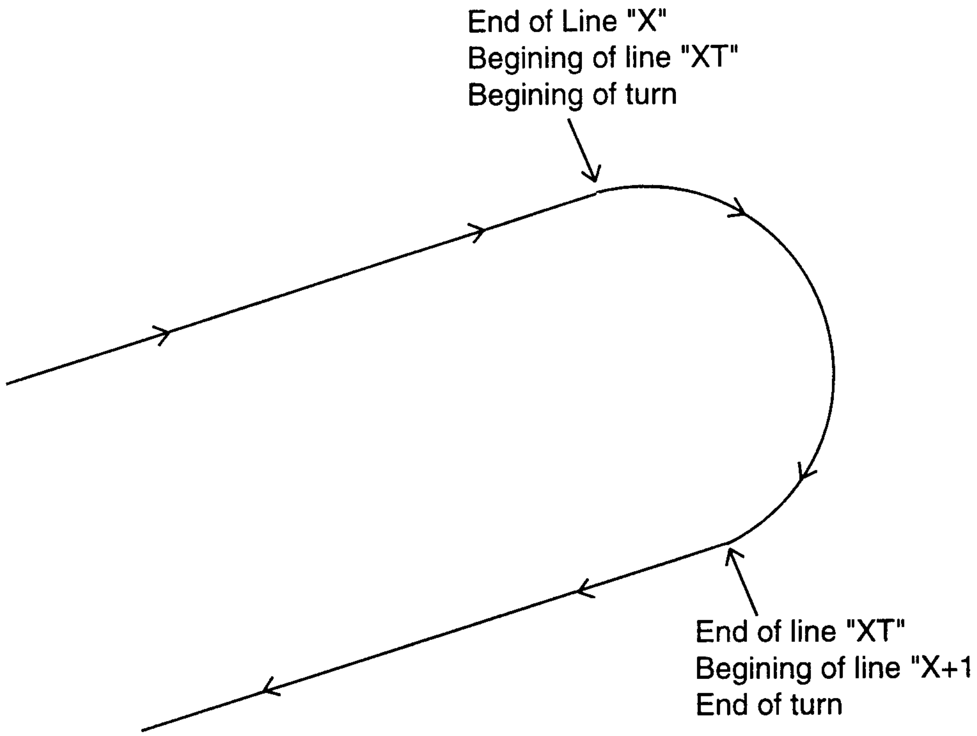
5..........Immediately write protect the DLT tape by sliding the write protect switch to the left so that the orange indicator can be seen. The write protect switch is located to the left of the label.

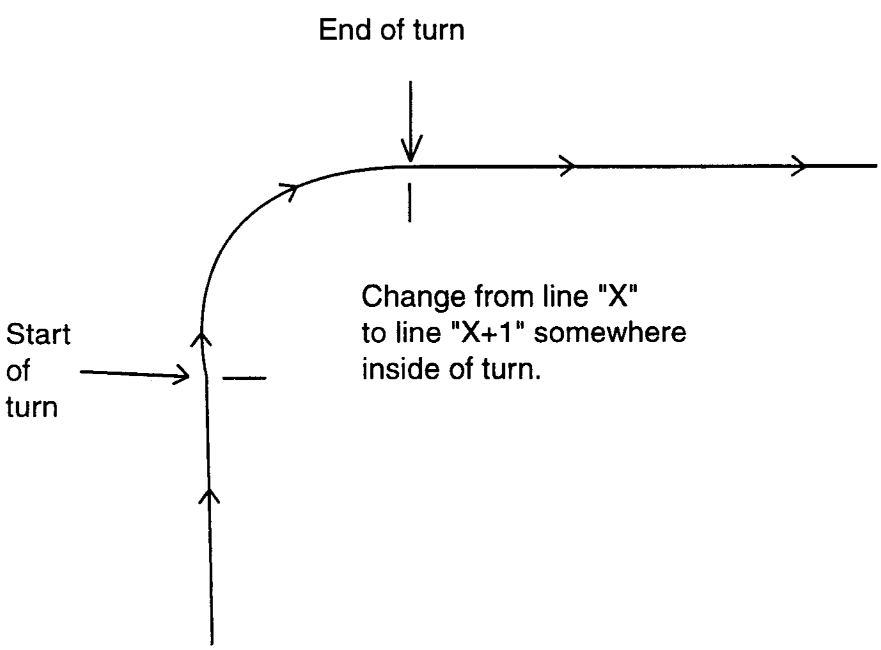
6..........Create a new label for the next DLT tape and insert the tape.

7..........Press the "**select**" button on the right of the DLT drive until the green indicator button on the right side lights up the columns "**35**" and "**Compress**".

8..........Resume the copy and stacking process by typing ***"copy+stack..sh*** **(the number of the new line)(the spacing of shots)."** In the **Stack Window**.

Turning Diagram
1-A





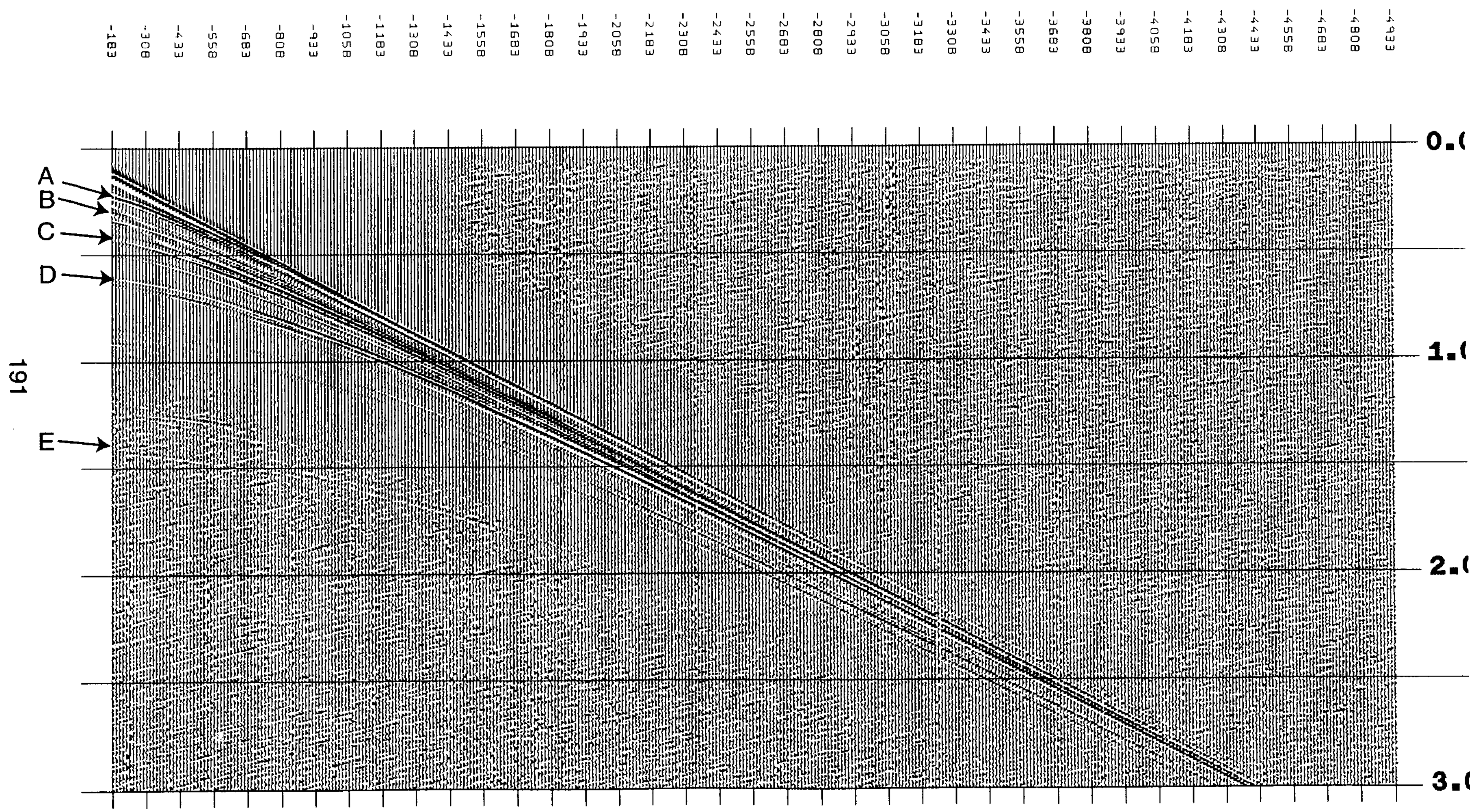
Appendix 11: Water-Column Reflections

In examining shot and CMP gathers from our survey, we made an unusual (in our experience) observation: mid-water reflections. Figure 11.1 shows the inner 5 km of the streamer for SP 69958; the seafloor reflection is off the bottom of the page at about 4.3 s. Several water-column reflections, particularly in the upper 1 s, are clearly visible. This shotpoint was near one of the XBTs we acquired; the sea-water temperature profile returned by that XBT (Figure 11.2) shows several strong excursions that correspond reasonably well (at the back-of-the-envelope level) to reflections in the shot gather. The table below gives approximate zero-offset two-way travel times and depths to reflectors, assuming a uniform water velocity of 1500 m/s.

Reflection	Two-way time (s)	Depth (@ 1500 m/s)
A	0.18	135 m
B	0.27	202 m
C	0.36	270 m
D	0.58	435 m
E	1.40	1050 m

The observation of these reflections raises the possibility of applying seismological analysis techniques (e.g., traveltime modeling, waveform inversion, stacking, etc.) for physical oceanographic purposes. A "snapshot" of water masses might be achievable (assuming that changes in the water masses occur on a significantly longer time scale than it takes the Ewing to survey a given area) by, say, stacking water-column reflections. It would be especially interesting to know if seismic inversion techniques could successfully predict the water-temperature structure measured by the XBT.

Shotpoint 69958, Line 502: Mid-water column reflections



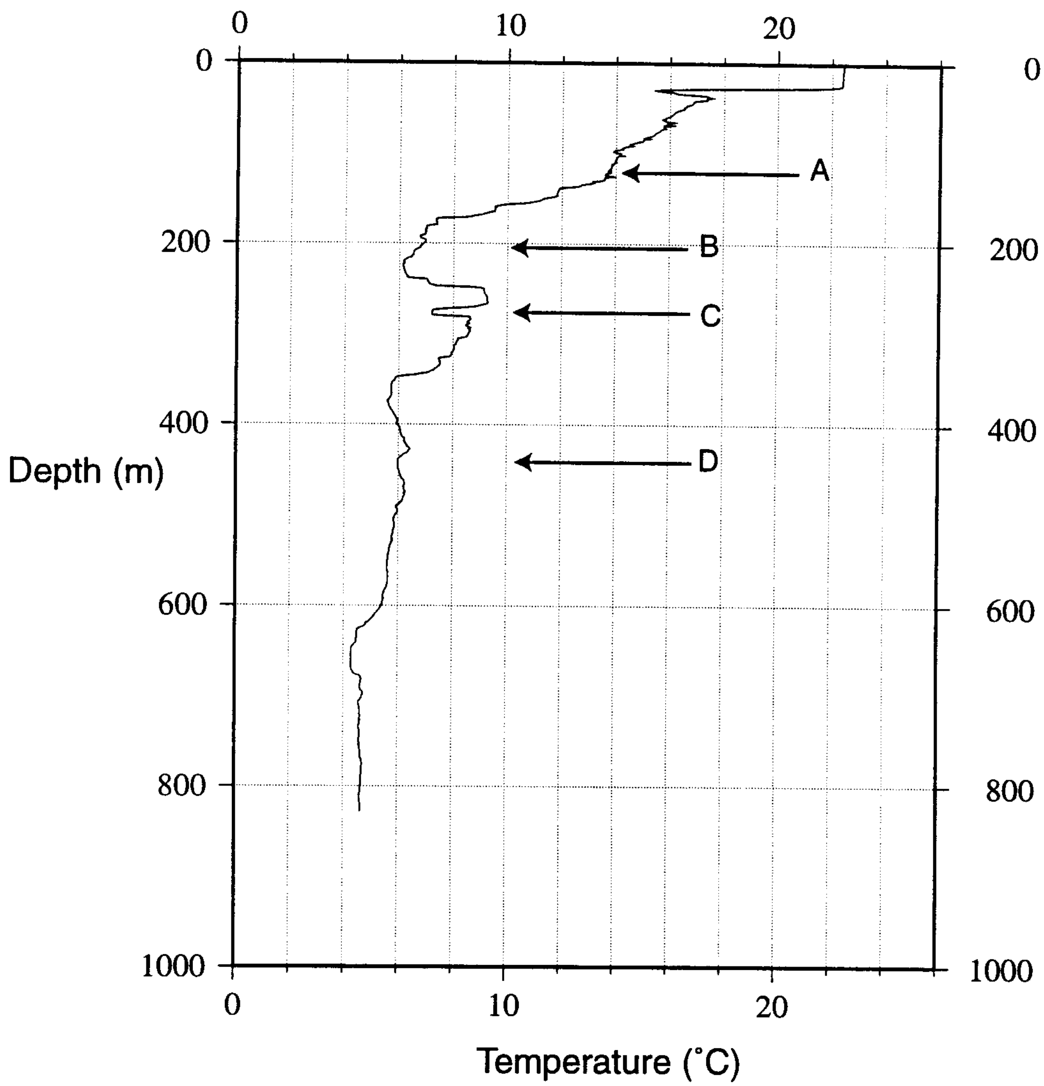


Fig. 11.2 Expendable bathythermograph (XBT) measured near SP 69958 on Line 502. Note strong excursions in water temperature; labeled arrows show predicted depths of reflections observed in Figure 11.1, assuming constant water velocity of 1500 m/s. (XBT 200707.XT7; 11 Aug 2000, 13:31 GMT)

Appendix 12: Industry Seismic Noise

We knew before sailing that up to four industry or contract seismic vessels would be working in the Grand Banks/Flemish Cap area: the GECO Triton, the Viking Veritas, the Polar Duke, and the Akademik Shatskiy. The possibility of seismic interference from these vessels was thus a concern for us. At several points during the cruise, we saw apparently water-borne noise from one or more seismic vessels on our shot gathers. The example in Fig. 12.1, from Flemish Pass Basin, shows two separate, coherent, high-frequency wavetrains with opposite moveout, arriving ahead of the direct water wave. The only plausible explanation for these arrivals is industry seismic shots. In this example, the likely culprits are the GECO Triton and Viking Veritas, both of which were working in or around the Flemish Pass Basin. At one point during the cruise we had direct radio contact with the Triton, who said they could definitely see our shots on their records as well. They asked us if we could halt our shooting for a short time (less than 1 hour) while they finished a line. Their request was cordial and professional, but no hint of reciprocity was offered -- i.e., it is doubtful that they would have agreed to a similar request from us. Since the timing of their request coincided with a turn for us, we agreed to stop shooting during the turn.

The industry shot noise is generally relatively low-amplitude and shows up only through the effect of AGC. The noise would not be expected to stack coherently, and there is indeed no indication in the brute stacks that it does. We expect, however, that this noise might be a considerably greater problem on the OBS records.

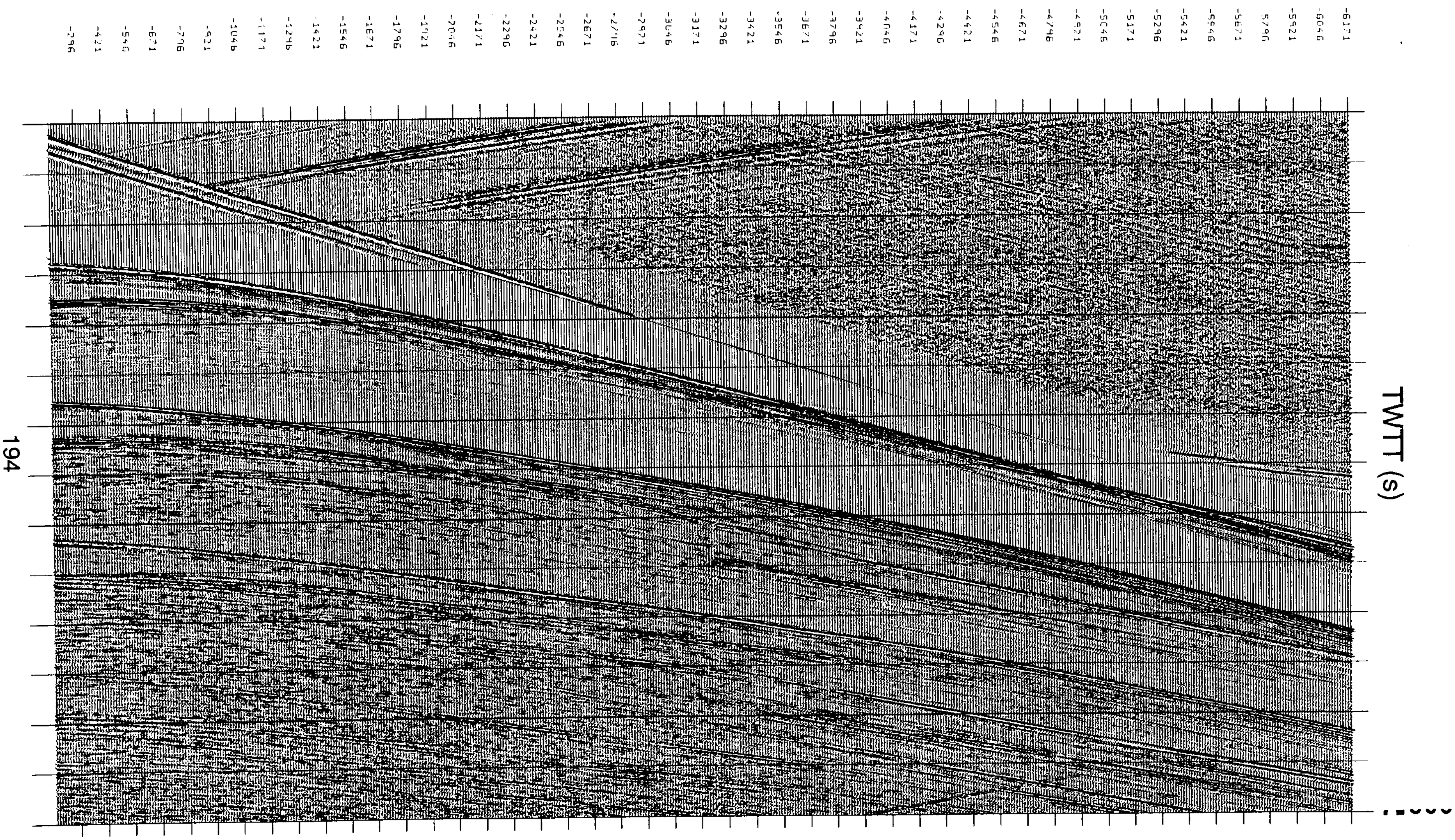


Fig. 12.1: Shotpoint 24871, Line 2mcs (Flemish Pass): Interference from industry seismic vessels. Two wavetrains arriving prior to the water wave are visible, with opposite moveouts. This is water-borne noise from industry seismic vessels shooting in the vicinity (the GECO Triton and either the Viking Veritas or the Polar Duke).