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# 3. UNDERWAY GEOPHYSICS[1]

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## Introduction

During Ocean Drilling Program (ODP) Leg 143, six sites (865–870) were drilled on or near Cretaceous reef-bearing guyots in the Mid-Pacific Mountains and Marshall Islands regions. The *JOIDES Resolution* departed Honolulu, Hawaii, at 0100 hr UTC, 23 March 1992, to begin Leg 143 and arrived at the first site, Site 865 on Allison Guyot, at 1920 UTC, 27 March 1992, having traveled approximately 2318 km (1251 nmi) between the port of Honolulu and Site 865. The ship departed Site 865 at 0115 UTC, 5 April, and arrived at Site 866 on Resolution (originally "Huevo") Guyot at 2030 UTC, 6 April, a distance of 716 km (387 nmi). Transit to Site 867 on Resolution Guyot involved offsetting the ship a distance of 2.2 km using both the main engine and after thrusters, with the Site 866 acoustic beacon as reference; Site 867 was occupied from 24 to 27 April 1992. Similarly, the Site 867 acoustic beacon was used as a reference point to offset the ship about 400 m to Site 868. The *JOIDES Resolution* departed Site 868 at 2205 UTC, 28 April, and arrived at Site 869 near Wodejebato (originally Sylvania) Guyot at 1755 UTC, 2 May, a transit of approximately 1646 km (888 nmi). The ship departed Site 869 at 0700 UTC, 15 May, and steamed 274 km (148 nmi) to Site 870 at Anewetak Atoll, arriving at 2200 UTC, 15 May. The ship departed Anewetak Atoll at 1900 UTC, 16 May, to begin a two-day transit to Majuro, Marshall Islands, ending Leg 143 at 2100 UTC, 18 May 1992. The ship was under way for a total of 12 of the 57 days at sea.

Site 865 (proposed Site All-A) is located halfway between the summit and south edge of the summit platform, atop Allison Guyot in the central Mid-Pacific Mountains. Site 866 (proposed Site Hue-A) is a multiple reentry site at the northern edge of the lagoon on Resolution Guyot in the western Mid-Pacific Mountains. Sites 867/868 (proposed Site Hue-B) are located on the perimeter mound of Resolution Guyot. Site 869 (proposed Site Syl-3) is a basinal fan site located southwest of Wodejebato Guyot and Pikinni (Bikini) Atoll in the central Marshall Islands, 1500 km (809 nmi) southwest of Resolution Guyot. Site 870 (proposed Site Ane-1) is an engineering test site located in the lagoon of Anewetak Atoll. The locations of Sites 865 through 868 were based on single-channel seismic profiles collected in 1988 by the *Thomas Washington* during cruise RNDB10WT. The location of Site 869 was based on seismic profiles obtained by the *Moana Wave* during cruise MW8805 in 1988 and by the *Thomas Washington* during cruise TUNE08WT in January 1992.

Positioning of the drill ship during transit and drilling was achieved mainly by using global positioning system (GPS) navigation and dead reckoning in GPS gaps. Drill sites were chosen partly using GPS navigation and also by examining single-channel seismic reflection and 3.5-kHz echo-sounder records for topographic landmarks.

Geophysical data were collected by the *JOIDES Resolution* during Leg 143 while the ship was in transit to and from ports and between drill sites. Magnetic and bathymetry (using the precision depth recorder [PDR]) data were collected on approach to Sites 865, 866 and 869. Short seismic reflection surveys were conducted upon departure from Sites 865 and 866. Sonobuoy refraction/wide-angle reflection lines were shot upon approaching Sites 865, 866 and 869 and upon departing from Sites 865 and 866.

A chart of the Pacific Ocean region traversed during Leg 143 with the ship's track is shown in Figure 1. This plot was generated from GPS transit satellite, course- and speed-change data, and on- and off-site information compiled from the bridge log, the underway geophysical log, and the HIGHRES (shipboard seismic data acquisition and processing software) tape headers. The final site positions are an average of the GPS positions collected while on site.

## Navigation Data

GPS data were used to reconstruct the ship's track around each drill site. GPS data are preferred over Loran-C and dead-reckoning positions because of their greater accuracy. Navigation data were collected both in the Underway Geophysics Laboratory, using a Magnavox MX1107 transit satellite receiver, and on the bridge, using a Magnavox MX4400 satellite-navigation system. The satellite receiver systems receive positions from the GPS satellites at 60-s intervals.

GPS fixes were printed to hard copy at a variable rate. The sampling density depended on the nature of the survey; it was generally 1 fix/15–30 min while in transit and increased to 1 fix/min when approaching or surveying the site. The ship's track was assumed to proceed from point to point unless otherwise indicated from course-change information listed in the HIGHRES headers. The density of points illustrated is less than the actual amount of data collected, but is sufficient to ensure an accurate reconstruction of the ship's track.

## Data Acquisition

Shipboard geophysical instrumentation included two precision echo sounders (3.5 and 12 kHz), a magnetometer, seismic reflection profilers, sonobuoy receiver, and satellite navigation systems. The instruments were maintained and operated by ODP marine technicians in cooperation with the Shipboard Scientific Party and the officers and crew of SEDCO-FOREX, Inc. Table 1 summarizes the amounts and types of geophysical data collected. Bathymetry and magnetics were recorded continuously along transits, and the data in MGD77 format are available upon request from the ODP Database Librarian. Only bathymetry in profile is presented here; the 3.5- and 12-kHz data are not presented because of the volume of data involved.

The seismic sources available on board the *Resolution* during Leg 143 consisted of two synchronized 80-in.$^3$ Seismic Systems, Inc. water guns that operated at approximately 2000 psi, and two Hamco 200-in.$^3$ water guns that operated at approximately 2000 psi. These were operated either individually or in various combinations, as specified in Table 2. A Teledyne streamer possesses a 100-m active section that contains 60 hydrophones that can be combined to produce a single signal. This streamer was deployed from the fantail and towed about 500 m behind the vessel at a depth of about 10 m.

Four single-channel reflection seismic lines were recorded during Leg 143, covering approximately 2463.6 nmi (Table 1). Single-channel seismics were amplified, filtered, and displayed in real-time analog format on two Raytheon line-scan dry-paper recorders. Seis-

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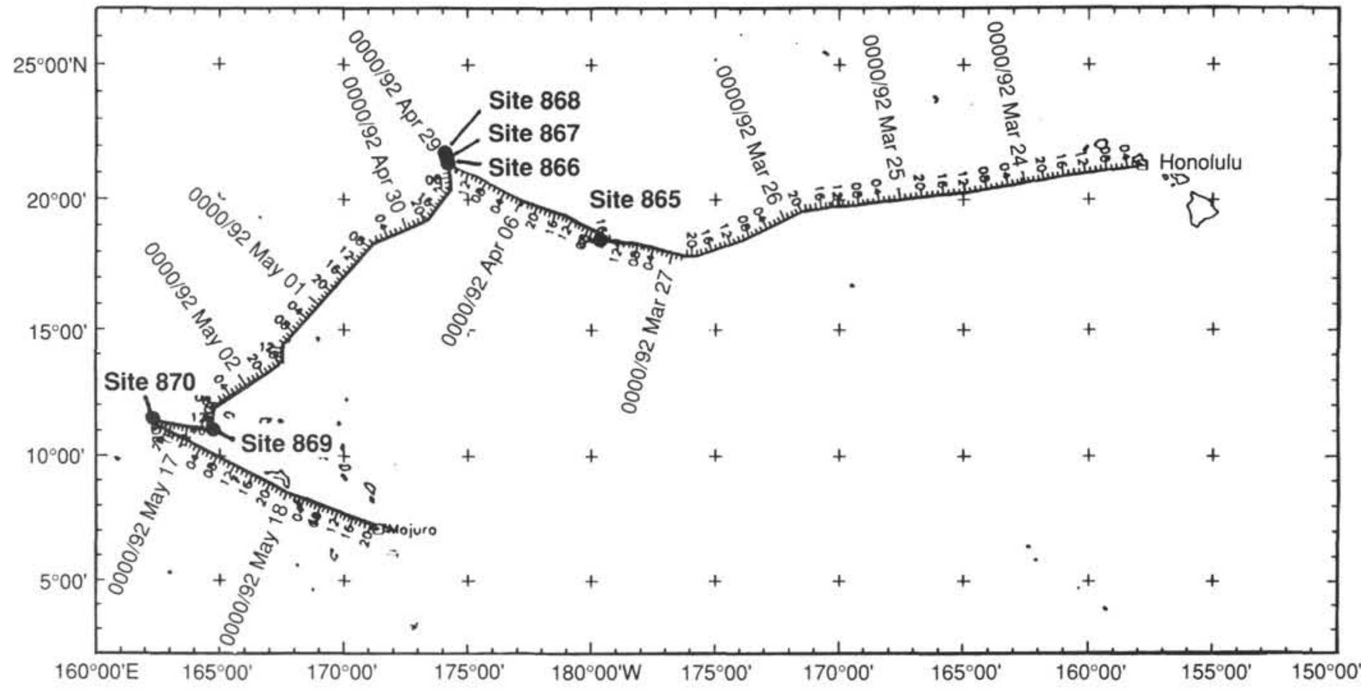


Figure 1. Plot of general navigation and site location for Leg 143, generated from GPS, course-, and speed-change data given in the Appendix (this chapter). Detailed navigation plots for seismic lines and site approaches are shown in Figures 3, 5, and 7.

mic data were also recorded on magnetic tape by a Masscomp 561 computer (Table 2), which functions as the central unit to record, process, and display the data. Five seconds of data were recorded at a 1-ms sample rate in SEG-Y format at 1600 bpi. Data were processed and displayed real-time on a 15-in. Printronix high-resolution graphics printer (160 dots/in.) according to the parameters listed in Table 3. Raw data were recorded on magnetic tapes in SEG-Y format with a density of 1600 bpi. Portions of seismic lines recorded by the Masscomp were reprocessed for shipboard reference using SIOSEIS software. The reprocessed data were displayed on a 22-in.-wide Versatec plotter (200 dots/in.). The digital seismics displayed in this chapter were reprocessed at the University of Hawaii using the SSC software; but despite reprocessing, some of the high-speed transit data were of very poor quality. Copies of all seismic data can be obtained from the ODP Database Librarian.

## Magnetic and Bathymetric Data

A Geometrics 801 proton precession magnetometer, towed approximately 300 m astern, was used during transits and site surveys. Measurements were performed at 3-s intervals with 1 nT sensitivity. Total intensity, magnetic field data were recorded in analog format on a strip-chart recorder, in digital format within the HIGHRES headers (one reading per shot), and manually every 5 min in the underway geophysics log. The magnetic field values were reduced to anomaly values by subtracting the 1985 International Geophysical Reference Field. Figure 2 shows bathymetry, magnetic anomaly, course, and speed data, plotted in profile as functions of time and distance.

## Single-channel Seismic-reflection Data

Single-channel seismic-reflection data were collected during transit and across the drill sites. The seismic sections with their corresponding ship's track segments are shown in Figures 3 through 10. Spurious offsets in the delay time occurred while using the starboard 200-in.$^3$ water gun, and these are visible in the records as short, obviously erroneous changes in delay time. The problem seemed to be related to the blast phone; when the acquisition system was run on "simulate," rather than "blast phone," no offsets occurred. Traces were band-pass filtered (25–60 Hz or 25–100 Hz, as specified in Table 3); a three-trace, equally weighted, running-slant mix and automatic gain control were applied to all traces. Signal losses caused by water-gun malfunctions are identified on the records.

## Seismic Line 1, Honolulu to Allison Guyot

Seismic Line 1 (1548 UTC, 25 March [JD 85], shot point 1, to 1610 UTC 27 March [JD 87], shot point 13281) was recorded en route to Site 865 along the track segment shown in Figure 3. The processed digital seismic profile is shown in Figure 4. Line 1 begins near the eastern end of the Mid-Pacific Mountains. The course was altered slightly from a great-circle track to Allison Guyot to pass over some previously unsurveyed guyots shown on the regional bathymetric chart (Mammerickx and Smith, 1985).

Four of these unnamed guyots (herein termed Guyots 1 through 4) are seen on the profile between 1800 UTC, 25 March, and 2310 UTC, 26 March [JD 86]. Guyot 1 (1800–2120 UTC; about 19°35′N, 171°25′W) shows an acoustically transparent cap of variable thickness (0.1–0.2 s two-way traveltime [twtt]) overlying a strong, discontinuous reflector with moderate relief. Dredging and drilling experience elsewhere in this region suggests that this reflector is the subaerially eroded surface of a Cretaceous shallow-water platform (van Waasbergen and Winterer, in press). This reflector forms a distinct platform atop a somewhat stronger, more continuous reflector that could be interpreted as a wave-cut bench. Although somewhat obscured, the eastern edge of the guyot is very steep, but covered completely by a talus(?) pile that slopes gently into a shallow basin. The western edge of Guyot 1 drops sharply into a deeper (5.2 s twtt), sediment-filled basin.

A small seamount is located between Guyots 1 and 2, from 2210–2320 UTC, 25 March. The top is difficult to discern because of the poor quality of the record, but its surface appears highly irregular, and no internal structure is revealed. Very little sediment is present in the western half of the small basin between the seamount and Guyot 2, and the western edge of the basin appears to be fault-bounded.

**Table 1. Geophysical data coverage.**

| Port: Honolulu<br>Line number | Line 1 | Line 2 | Line 3 | Line 4 | Line 5 |
|---|---|---|---|---|---|
| Navigation and bathymetric (PDR) data: | | | | | |
| Start time (UTC) | 0120 3/23/92 | 0115 4/5/92 | 2207 4/28/92 | 0630 5/15/92 | 1600 5/16/92 |
| Latitude | 21°15.764′N | 18°25.966′N | 21°16.753′N | 11°03.462′N | 11°19.559′N |
| Longitude | 157°58.306′W | 179°32.838′W | 174°17.792′E | 164°15.917′E | 162°15.976′E |
| End time (UTC) | 1955 3/27/92 | 2030 4/6/92 | 1627 5/2/92 | 2120 5/15/92 | 1821 5/18/92 |
| Latitude | 18°26.310′N | 21°19.852′N | 10°59.527′N | 11°24.907′N | 7°24.936′N |
| Longitude | 179°33.402′W | 174°19.036′E | 164°44.980′E | 162°22.189′E | 170°40.519′E |
| Distance (nmi) | 1249 | 418 | 945 | 141 | 585 |
| Total: 3338 nmi | | | | | |
| Magnetic data: | | | | | |
| Distance (nmi) | 1229.9 | 410.5 | 940 | 141 | 585 |
| Total: 3306.4 nmi | | | | | |
| Seismic reflection data: | | | | | |
| Distance (nmi) | 1017 | 412 | 904.6 | 130 | 0 |
| Total: 2463.6 nmi | | | | | |

**Table 2. Seismic data, real-time recording parameters.**

| Line number | Line 1 | Line 2 | Line 3 | Line 4 |
|---|---|---|---|---|
| Start at (latitude) | 19°42.398′N | 18°26.386′N | 21°19.793′N | 11°00.093′N |
| Start at (longitude) | 170°40.869′W | 179°32.991′W | 174°17.826′E | 164°45.019′E |
| End at (latitude) | 18°26.390′N | 21°21.164′N | 10°55.288′N | 11°14.383′N |
| End at (longitude) | 179°33.346′W | 174°17.921′E | 164°44.806′E | 163°21.781′E |
| Source: | | | | |
| Air/water guns | Water | Water | Water | Water |
| Size (in.$^3$) | 2 × 80 | 1 × 200 | 1 × 200 | 1 × 200 |
| Port or starboard | Port and starboard | Starboard | Starboard | Starboard |
| Streamer: | | | | |
| Port or starboard | Port | Port | Port | Port |
| Analog 1: | | | | |
| Low-cut filter (Hz) | 30 | 100 | 100 | 100 |
| High-cut filter (Hz) | 150 | 250 | 250 | 250 |
| Analog 2: | | | | |
| Low-cut filter (Hz) | 30 | 100 | 100 | 100 |
| High-cut filter (Hz) | 150 | 250 | 250 | 250 |

Guyot 2 (0340–0535 UTC, 26 March; about 18°52′N, 172°00′W) is a steep-sided, apparently simple structure; the summit is just under 2.3 s twtt. About 0.1 s of pelagic cap covers the flat top of the guyot. Guyot 2 is situated atop a platform at 4.4 s; the platform forms the bottom of the basin to the west of Guyot 2. This basin shows about 0.25 s of sediment covering a low-relief basement. The reflector defining the basement terminates abruptly at 0520 UTC, 26 March, where the seafloor begins to slope more steeply up to Guyot 3.

Guyot 3 (0606–0700 UTC, 26 March; about 18°41′N, 173°26′W; data loss 0700–0722 UTC) shows irregular relief. A pelagic cap of variable thickness covers a carbonate platform up to 0.8 s thick; the platform overlies a highly irregular, deeper reflector. Basement west of Guyot 3 is highly irregular until 1340 UTC, 26 March; at that point, the basement character changes to a gently undulating profile. The highs are sediment covered (about 0.1 s); the basins, which deepen to the west, show up to three major reflector sequences. The basement appears to be faulted in places. This undulating terrain terminates at a broad, sediment-capped platform seen at 1850 to 2022 UTC, 26 March. The western edge of this platform slopes steeply to a small basin.

Guyot 4 (2130–2310 UTC, 26 March; about 17°56′N, 176°25′W) is covered by about 0.1 s of transparent pelagic cap sediments. A strong reflector occurs about 0.3 to 0.35 s below that, and discontinuous, medium-amplitude reflectors are seen down to 0.8 s below the guyot's surface. The wide, deep (>5.0 s) basin west of Guyot 4 contains up to 1.1 s of sediment overlying a nearly flat basement. A continuous, medium-amplitude reflector (5.8 s) can be traced across the basin; erosion has cut through the upper sediments in the central part of this basin, down to this reflector.

Between the basin and the eastern end of Allison Guyot, the basement relief is very irregular, and no guyot summits are seen.

The east end of Allison Guyot, starting at about 1300 UTC, 27 March, has rugged relief consisting of many small, conical features that appear on multibeam bathymetric maps made during the *Thomas Washington* site-survey cruise. These give way westward to the thick, carbonate-platform sediments of late Albian age that were drilled at Site 865. The sediments appear to lap against the small volcanic cones, indicating that the cones are older than the sediments.

## Seismic Line 2, Allison Guyot to Resolution Guyot

Seismic Line 2 (0125 UTC, 5 April [JD 96], shot point 1, to 1937 UTC, 6 April [JD 97], shot point 11229) was recorded en route to Site 866 along the track segment shown in Figure 5. The processed digital seismic profile is shown in Figure 6. Line 2 first passes directly over Site 865 and then across the northwestern part of the guyot. The northwestern edge of Allison slopes steeply down to relatively flat seafloor with up to 0.3 s of flat-lying sediments. Hamilton Guyot is seen at 2300 to 0020 UTC, 5 to 6 April; about 0.1 s of pelagic sediments covers a virtually featureless summit region; small structureless mounds at the eastern edge of the summit bound the interior of the guyot, which shows up to 0.5 s of continuous and discontinuous reflectors having variable amplitudes.

Most of the seismic-reflection data gathered at high ship speeds (>11 kt) are of poor quality; the seafloor is visible, but little sub-bottom structure is revealed. A sediment wedge from 0516 to 0800 UTC, 6 April, steps down to a flat-bottomed basin having about 0.45 to 0.6 s of sediment fill.

At about 1200 UTC, 6 April, the seafloor shallows in a single step, from 5.2 to 3.4 s, to the platform on which Resolution Guyot is constructed. At 1425 UTC, 6 April, the ship slowed to begin its site survey, crossing Resolution Guyot from east to west. The thickness of the pelagic cap is obscured by the character of the bottom reflector; a medium-amplitude, broken reflector at 2.2 s twtt and a strong, continuous reflector at 2.7 s define internal diagenetic boundaries (as revealed by drilling); neither of these reflectors is "basement." Deeper, discontinuous reflectors (e.g., 2.95 s twtt) may represent basement.

## Seismic Line 3, Resolution Guyot to Wodejebato (Sylvania) Guyot

Seismic Line 3 (2207 UTC, 28 April [JD 119], shot point 1, to 1627 UTC, 2 May [JD 123], shot point 18141) was recorded en route to Site 869 along the track segment shown in Figure 7. The processed digital seismic profile is shown in Figure 8. Upon departing Resolution Guyot, the ship steamed westward across the summit edge to survey the western side of the guyot. A zig-zag pattern across the northwestern edge of the guyot reveals the sediment wedges proximal to the guyot. A profile was shot across the guyot from north to south, over Sites 866 and 867. Coherent reflectors are noted to a depth of 2.9 s twtt, a full second below the summit's surface. To the south, basement topography is rugged and sediment thickness is highly variable. Once again, at high ship speeds (>11 kt), the deep seafloor and sub-bottom structure are barely discernable.

Slight deviations of the ship's track to Site 869 permitted transects of three guyots and a small seamount within the Mid-Pacific Mountains. Part of the record from the first guyot (1040–1200 UTC, 29 April [JD 120]) was lost owing to an improper delay setting. Nevertheless, the remainder shows a summit platform at 2.65 s with at least 0.07 s of pelagic sediment cover. The second guyot (1900–2030 UTC, 29 April) is broader than the first, has some pelagic cover, and shows a summit platform at 1.9 s that includes a sediment-filled hole at 2007 UTC. The seamount (2140–2200 UTC, 29 April) rises approximately 1.6 s above the basin seafloor and shows a rounded summit, probably because the ship passed over its flank. The third guyot (0512–0930 UTC, 30 April [JD 121]) is the massive edifice, Sio Guyot, at the western limit of the Mid-Pacific Mountains. The record of the approach to this guyot was lost in a data gap from 0138 to 0512 UTC. Sio Guyot shows few reflections beneath its summit, implying a thin pelagic cover. On the western flank of the edifice, a rugged and variably thick sediment apron can be seen.

## Seismic Line 4, Site 869 to Site 870

Seismic Line 4 (0630–2120 UTC, 15 May [JD 136], shot points 1 to 3277) shows the deep basin between Site 869 and Anewetak Atoll, where Site 870 was drilled. Owing to the fast ship's speed used in transit, little sub-bottom seismic stratification can be seen along the line. A topographic high (1020–1400 UTC, 15 May) appears to be an erosional remanent, rather than a volcanic construct. This is more obvious from 3.5-kHz records, in which outcropping reflectors can be seen within the remanent. On approach to Anewetak, a sub-bottom reflector is seen at approximately 0.35 s below seafloor. At about 1630 UTC, 15 May, the archipelagic apron of Anewetak can be seen, and the flanks of the atoll begin to rise by 1735 UTC, 15 May.

Woden-Kopakut (Ratak) Guyot (1315–1515 UTC, 1 May [JD 122]) rises from the seafloor in a series of distinct steps. The southern edge drops off more steeply than the northern edge. Acoustically transparent pelagic sediments (0.1–0.15 s twtt) cap an irregular, almost undulatory summit surface. No internal structure can be discerned.

Crossing Wodejebato Guyot from northeast to southwest, the profile over its top (0647–1040 UTC, 2 May) shows the pelagic (about 0.1 s) and carbonate caps, as well as deeper layering to 0.4 s twtt beneath the summit. The surface of the carbonate cap is very irregular. Discontinuous patches of high-amplitude reflectors probably indicate horizontal facies (diagenetic) changes.

On approach to Site 869, the seafloor is very smooth; seismic horizons are generally laterally discontinuous. A prominent, continuous, high-amplitude reflector occurs at a depth of 6.65 to 6.70 s twtt; packets of semi-continuous, variable-amplitude reflectors occur at 6.9, 7.1, and 7.3 s. Discontinuous, low-amplitude reflectors are visible to about 7.5 s twtt.

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van Waasbergen, R.J., and Winterer, E.L., in press. Summit geomorphology of western Pacific guyots. *In* Pringle, M.S., Sager, W.W., Sliter, W.V., and Stein, S. (Eds.), *The Mesozoic Pacific*, Geophys. Monogr. Ser.: Washington, D.C. (Am. Geophys. Union).

* Abbreviations for names of organizations and publication titles in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

**Ms 143IR-104**

**Table 3. Seismic data processing parameters.**

| | Line 1 | Line 2 | Line 3 |
|---|---|---|---|
| Data window (ms): | 5000 | 5000 | 5000 |
| Time (UTC): | | | |
| From | 1548 | 0125 | 2207 |
| | 25 Mar | 5 Apr | 28 Apr |
| To | 1610 | 1937 | 1627 |
| | 27 Mar | 6 Apr | 2 May |
| Shotpoints: | | | |
| From | 1 | 1 | 1 |
| To | 13281 | 11229 | 18141 |
| AGC: | | | |
| Window (ms) | 500 | 500 | 500 |
| Zero-phase band-pass filter: | | | |
| High cut (Hz) | 60 | 100 | 100 |
| Taper width | 64 | 64 | 64 |
| Low cut (Hz) | 25 | 25 | 25 |
| Taper width | 64 | 64 | 64 |

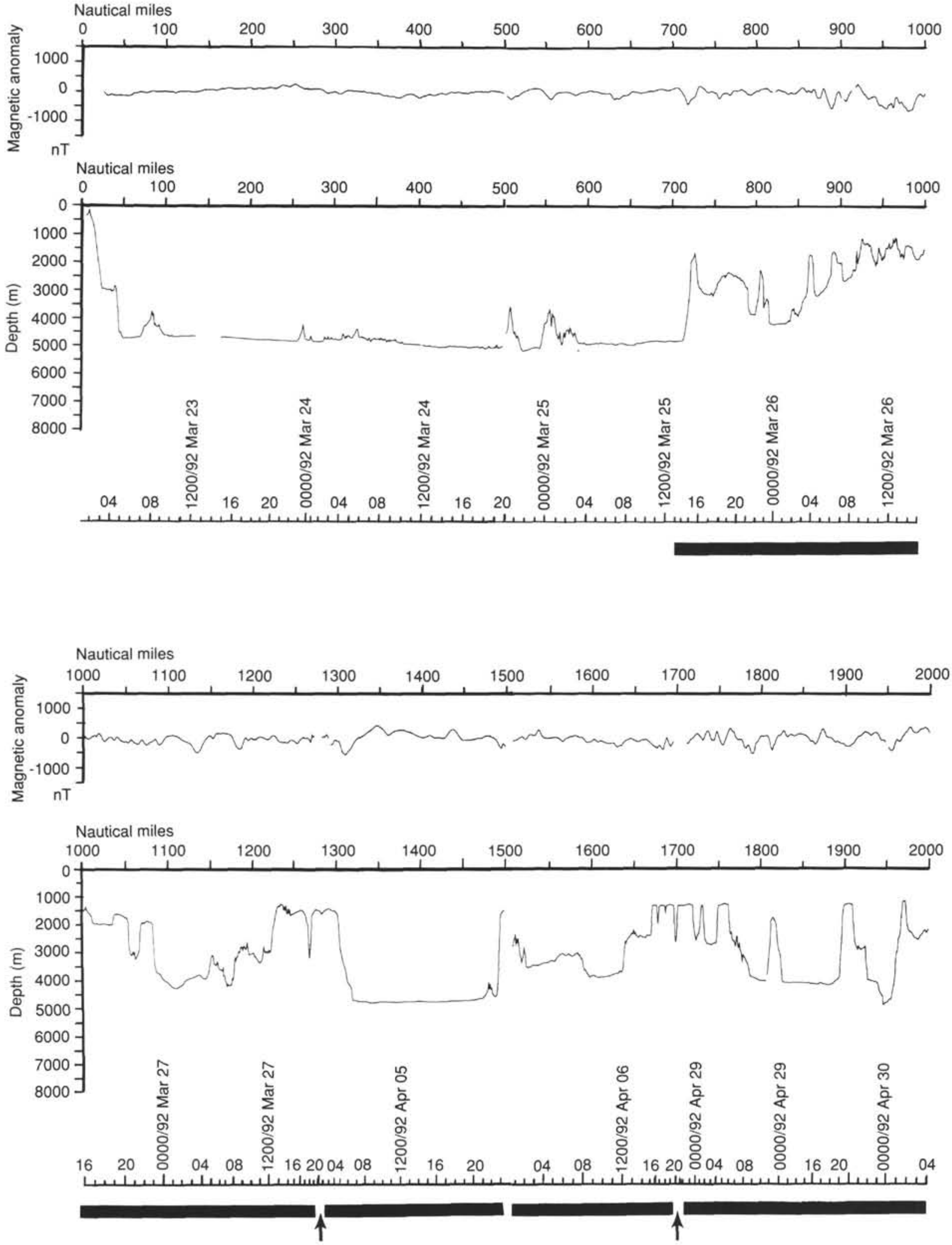
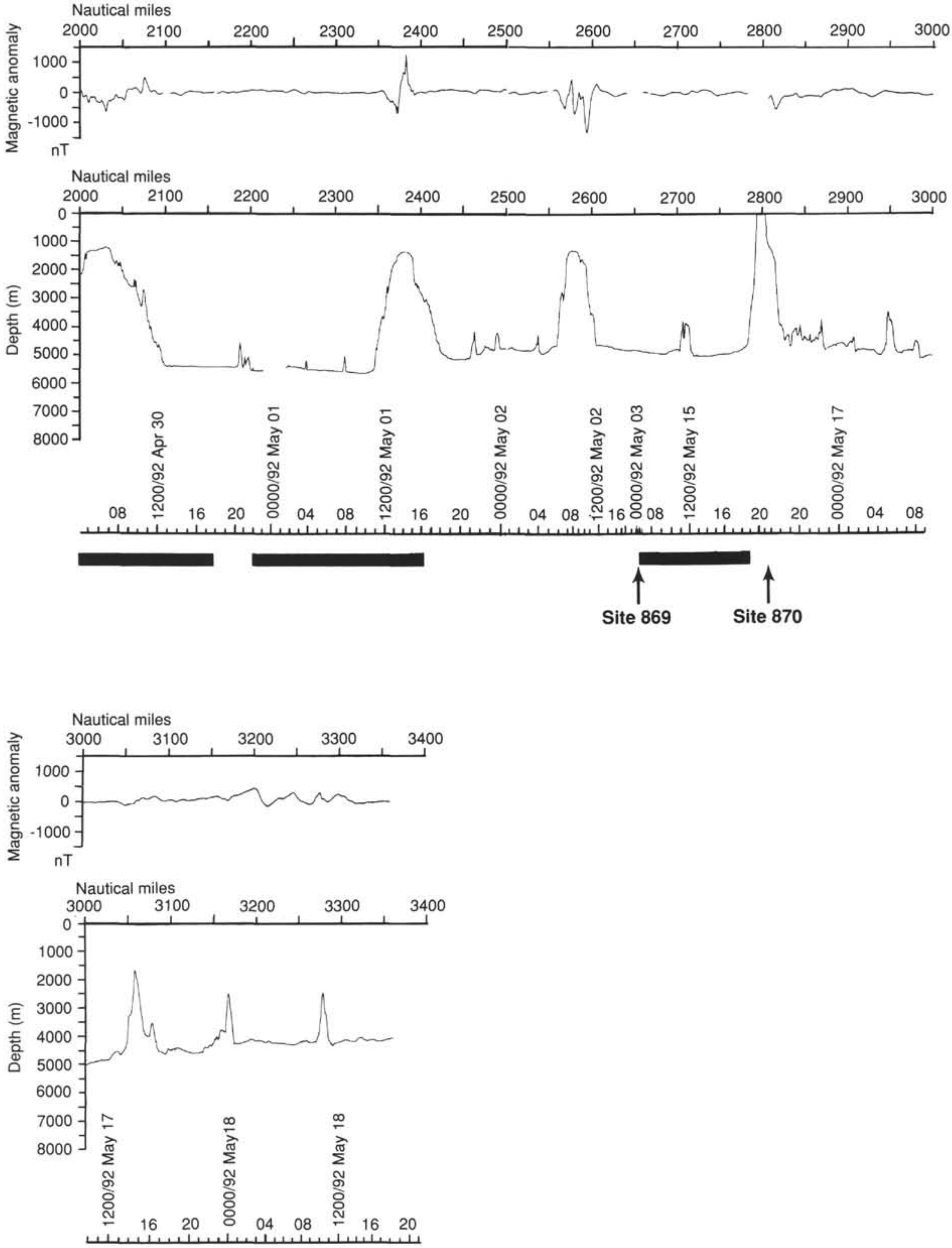



Figure 2. Records of magnetic and bathymetric profiles obtained during Leg 143. Solid bars indicate seismic-reflection coverage. Bottom horizontal scale displays time in hours (UTC) and date.

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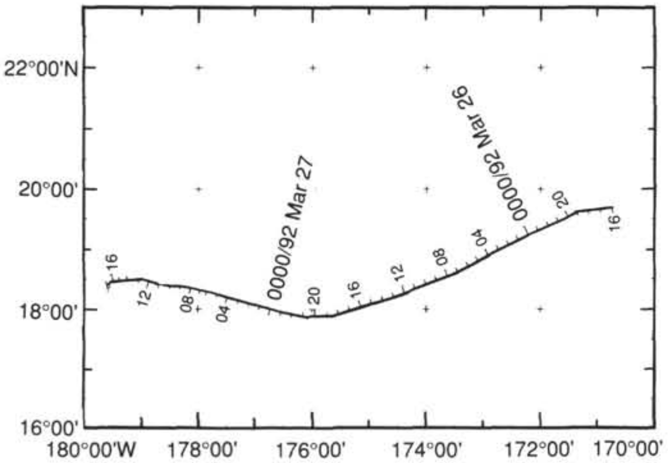



Figure 3. Detailed navigation plot of Line 1, en route to Site 865, generated from GPS and navigation data. Positions of the ship are shown as tick marks and are identified by UTC. The processed digital seismic record is shown in Figure 4.

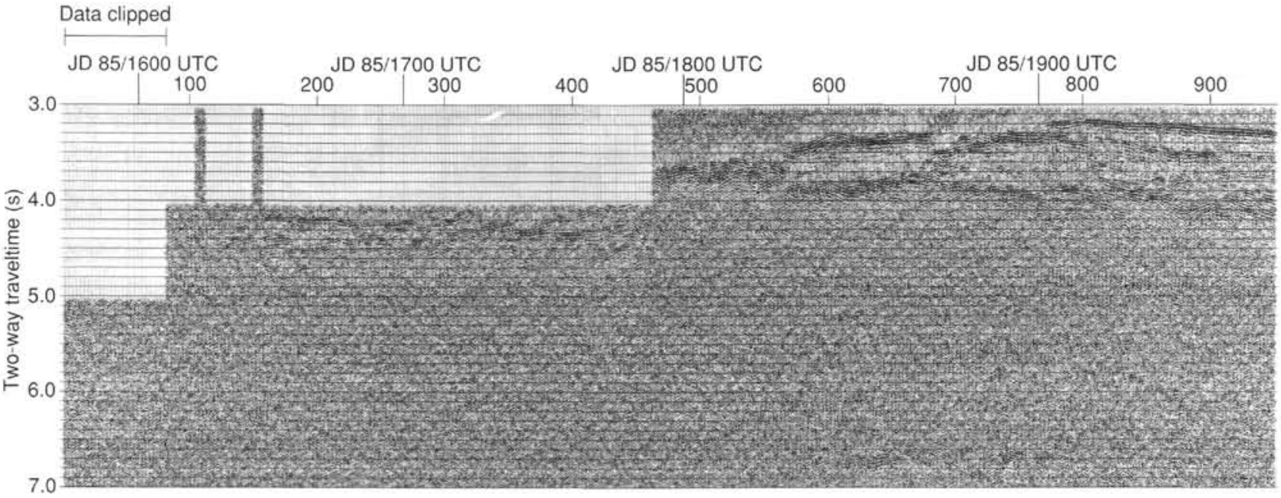
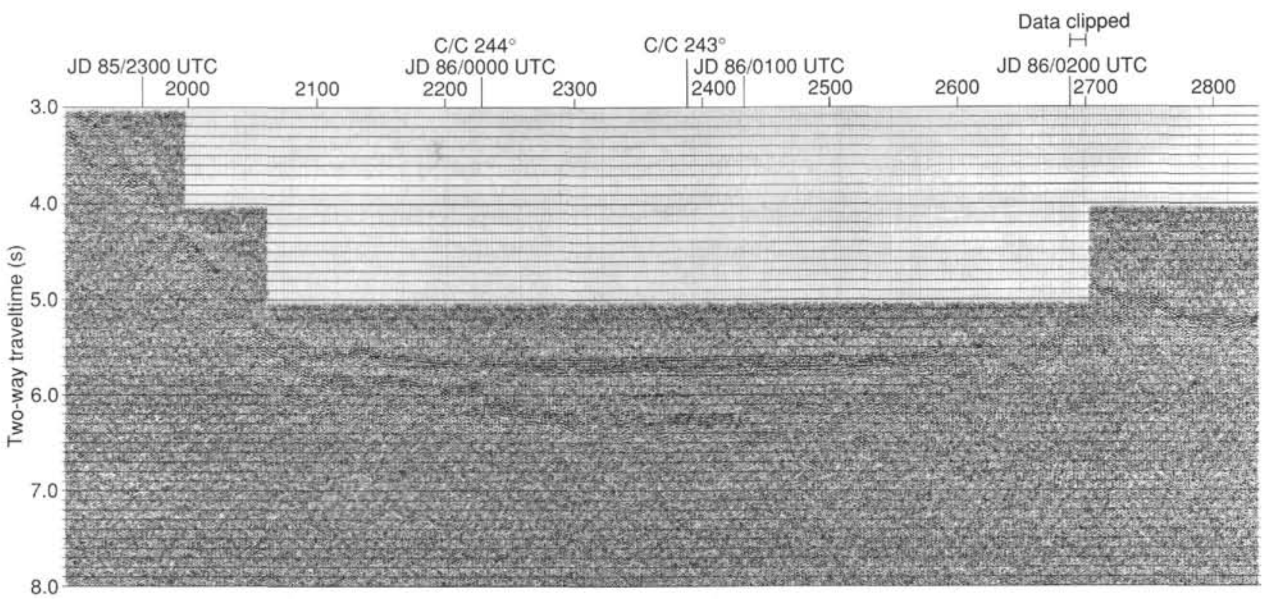



Figure 4. Processed digital seismic profile of Line 1, en route to Site 865. Processing parameters are given in Table 3, and the ship's track is shown in Figure 3.

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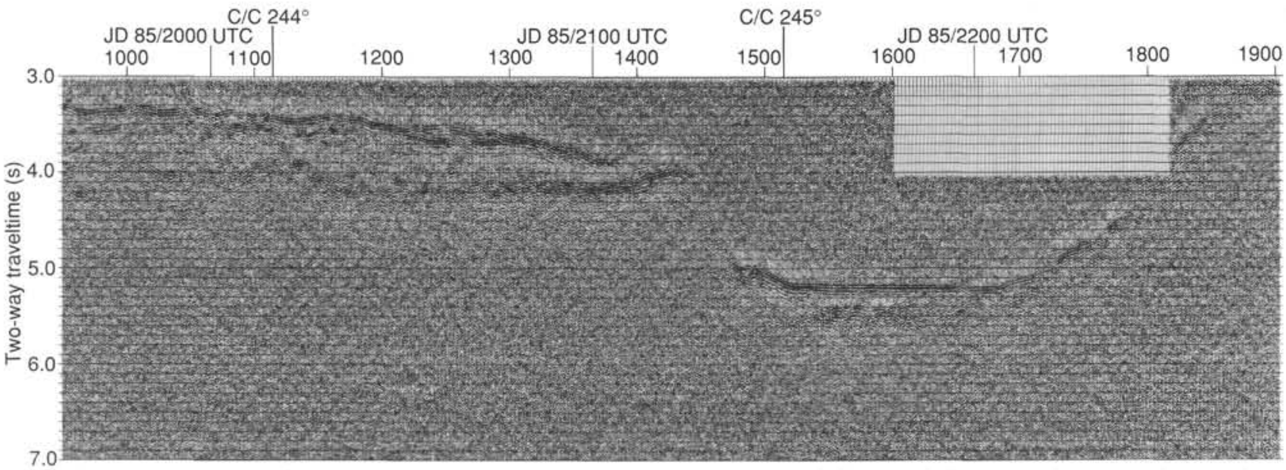


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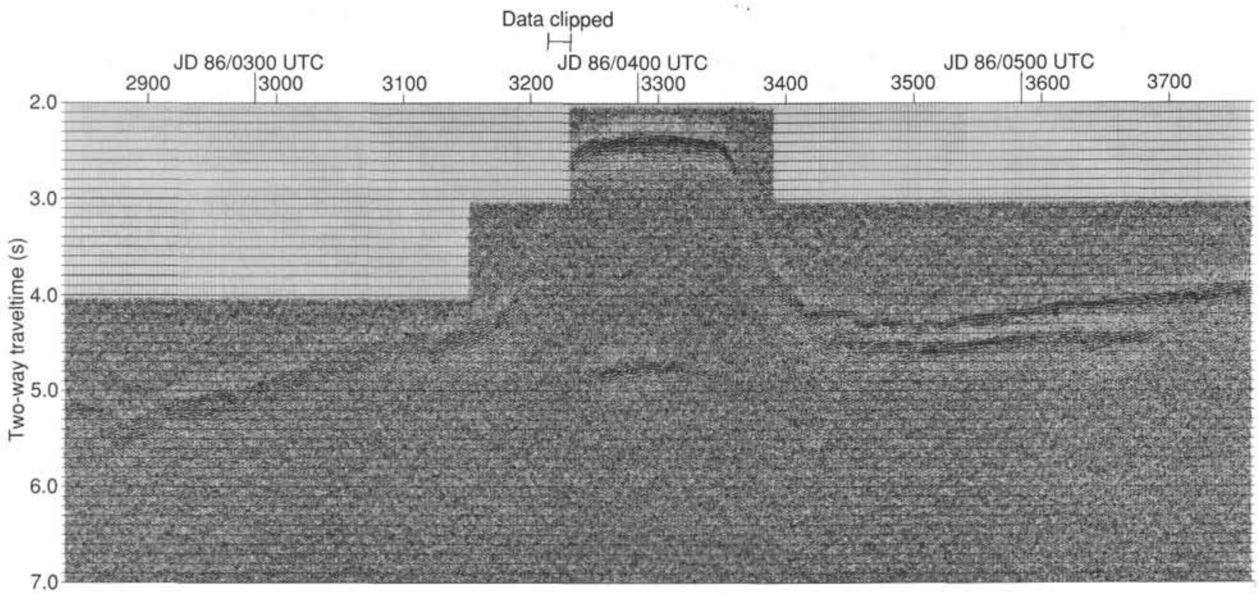


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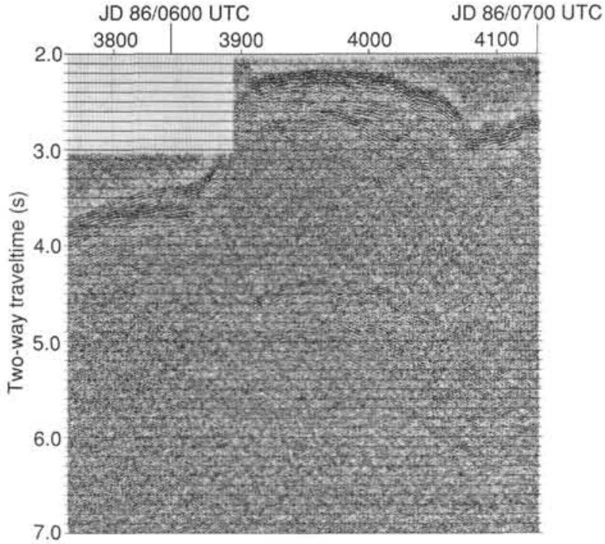


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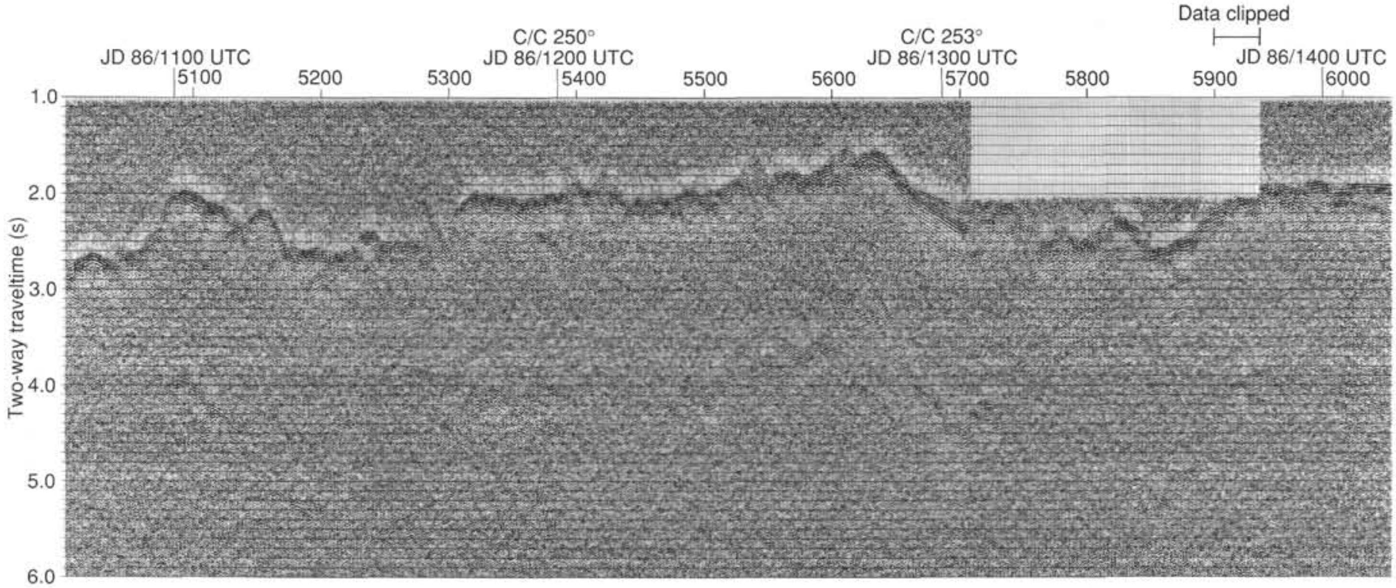


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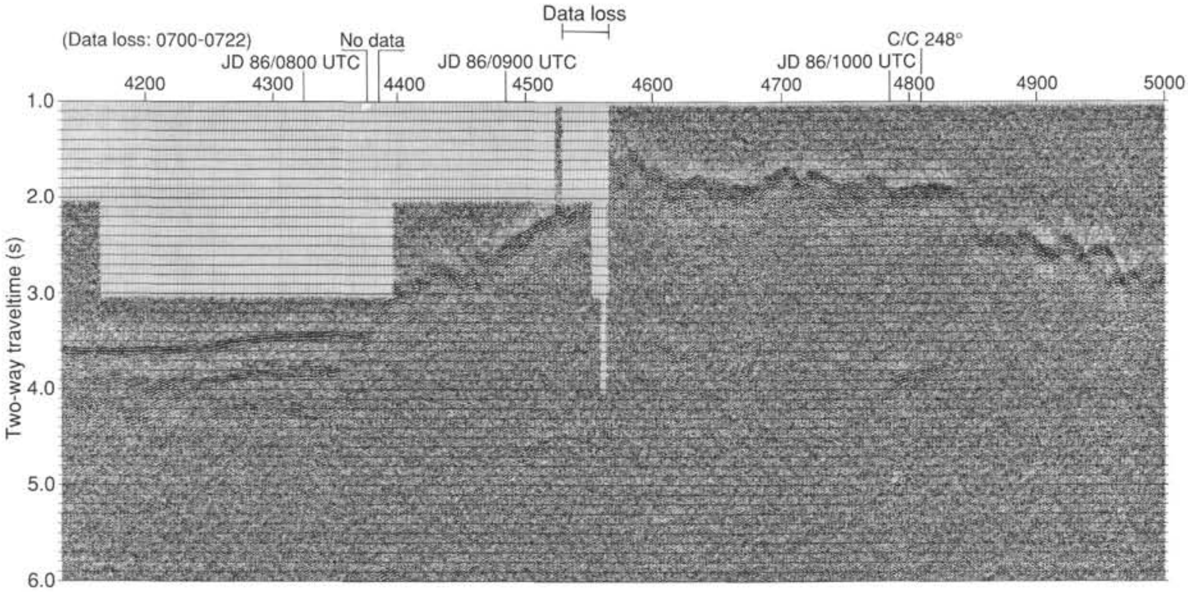


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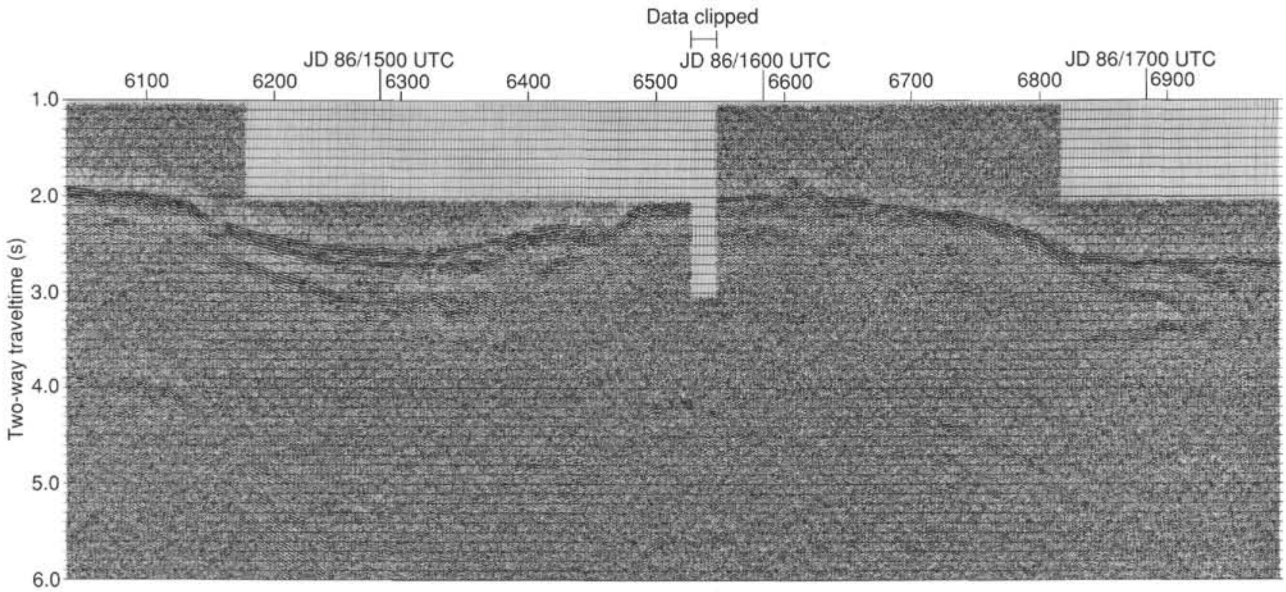


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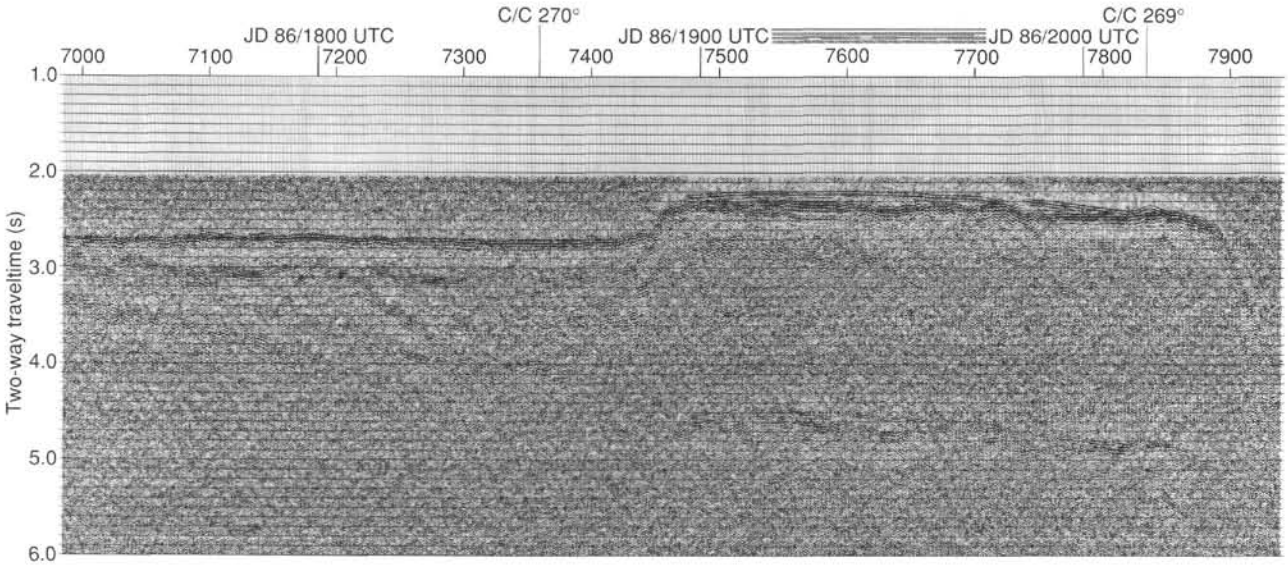


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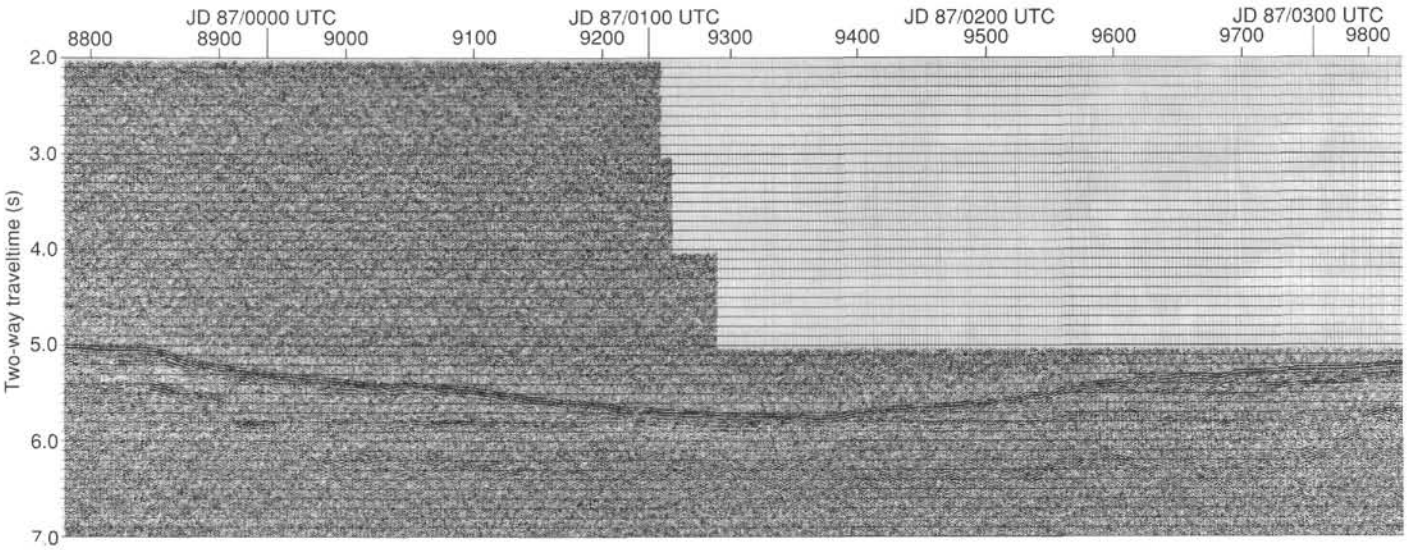


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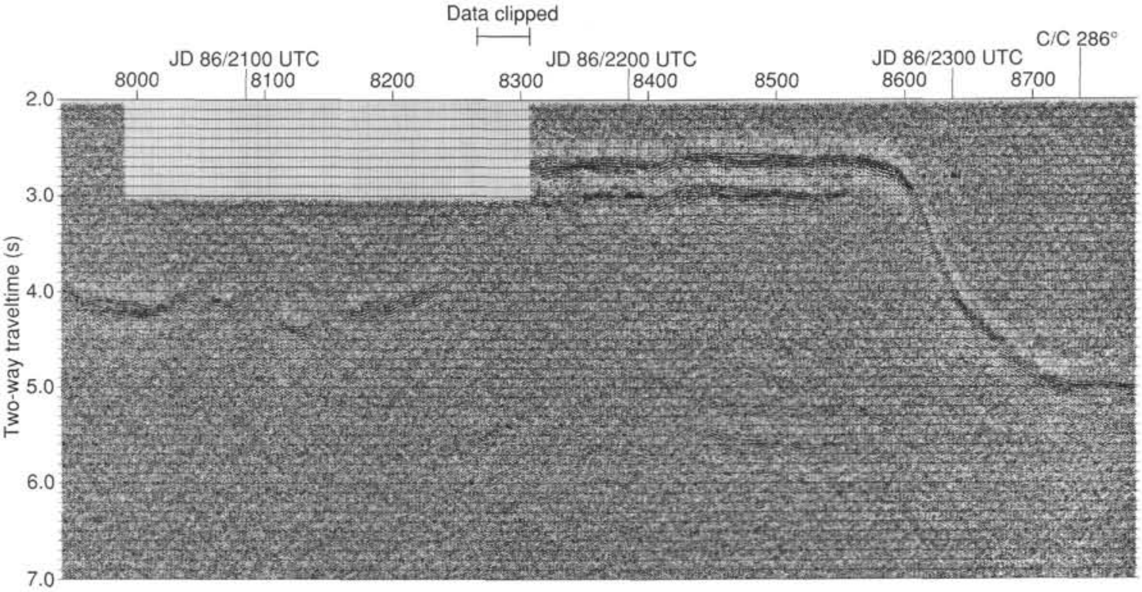



Figure 4 (continued).

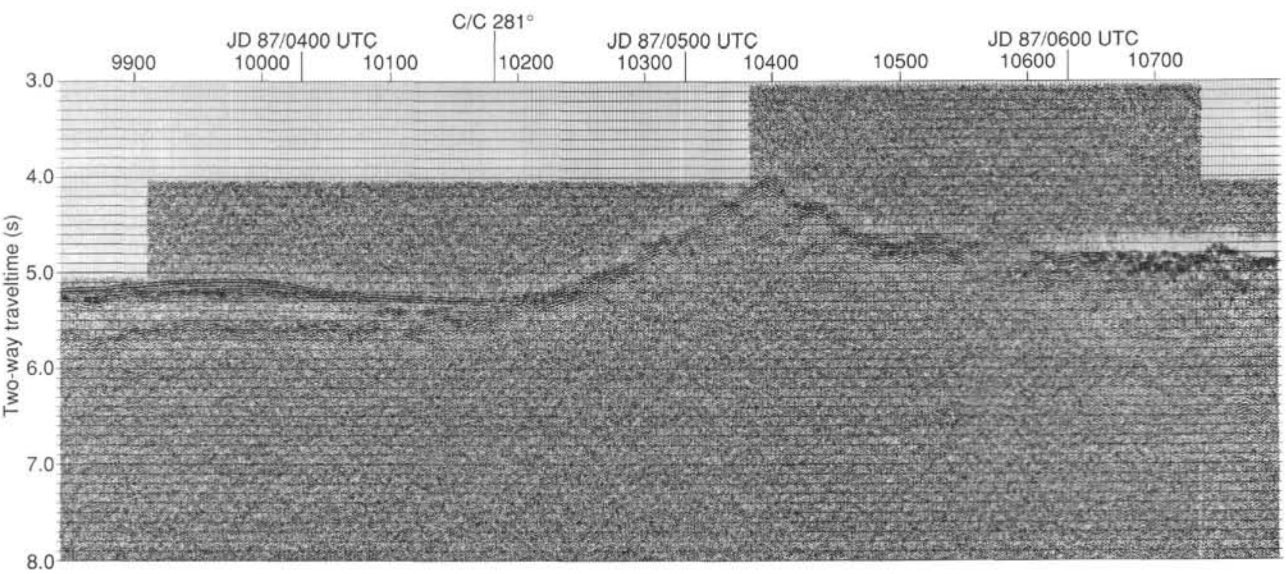



Figure 4 (continued).

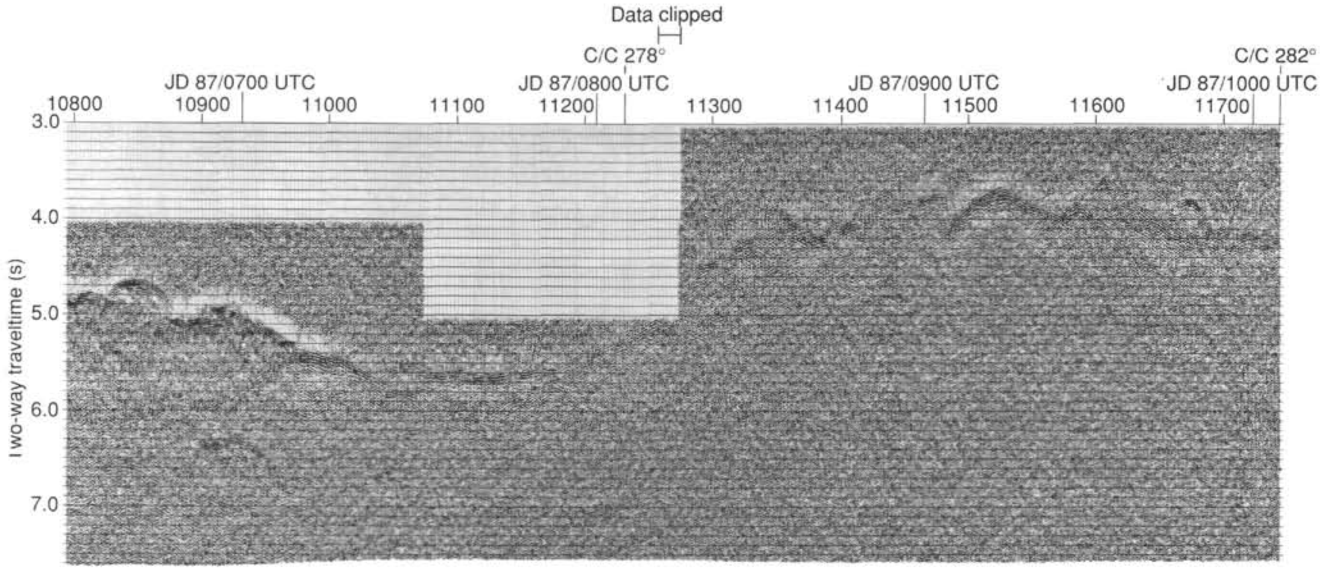
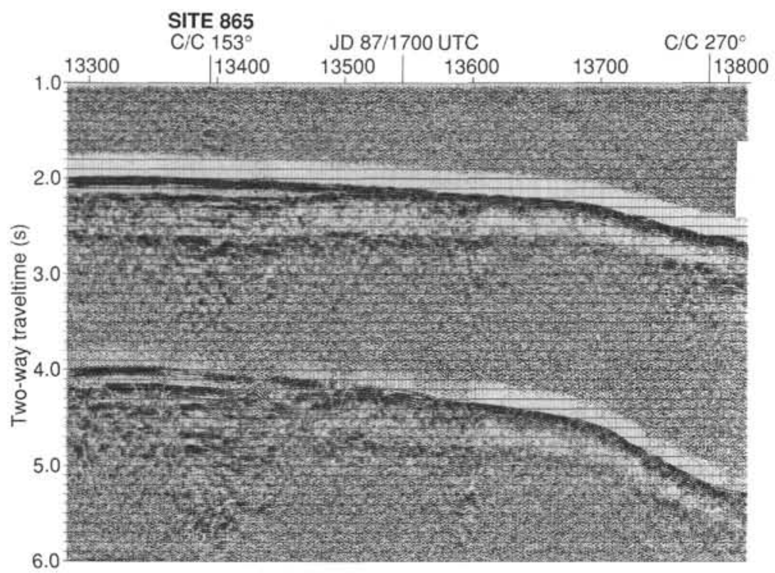



Figure 4 (continued).

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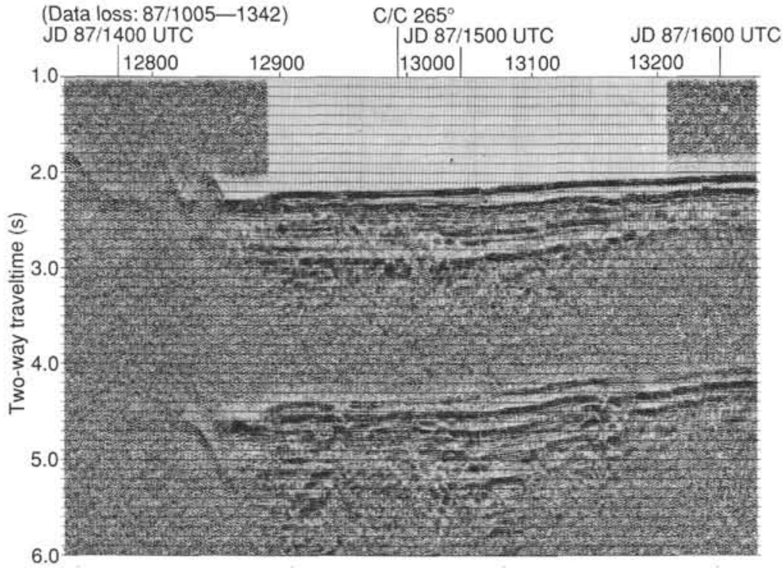


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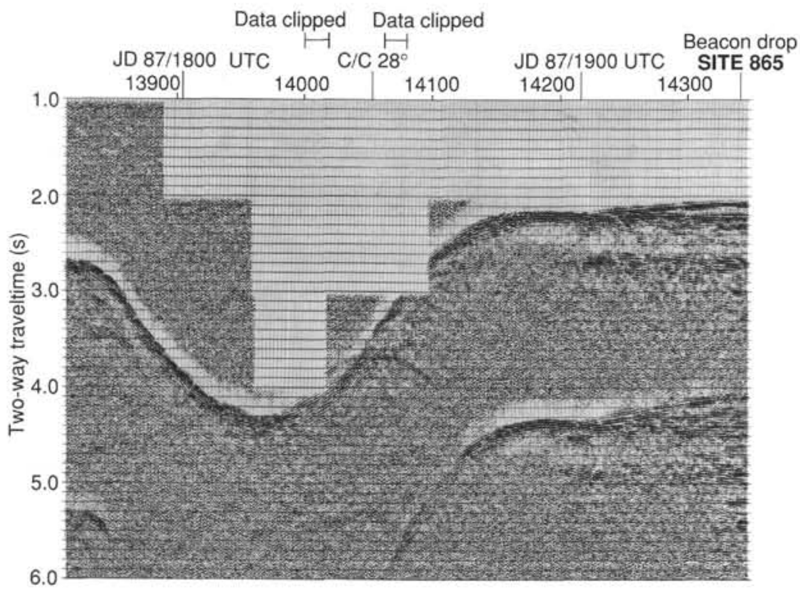



Figure 4 (continued).

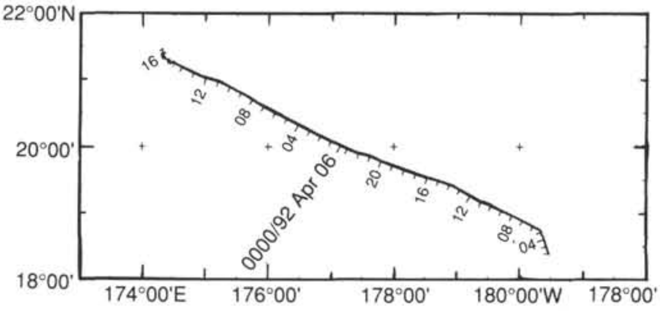



Figure 5. Detailed navigation plot of Line 2, en route to Site 866, generated from GPS and navigation data. Ship positions are shown as tick marks and are identified by UTC. Extrapolated positions are shown as tick marks. The processed digital seismic record is shown in Figure 6.

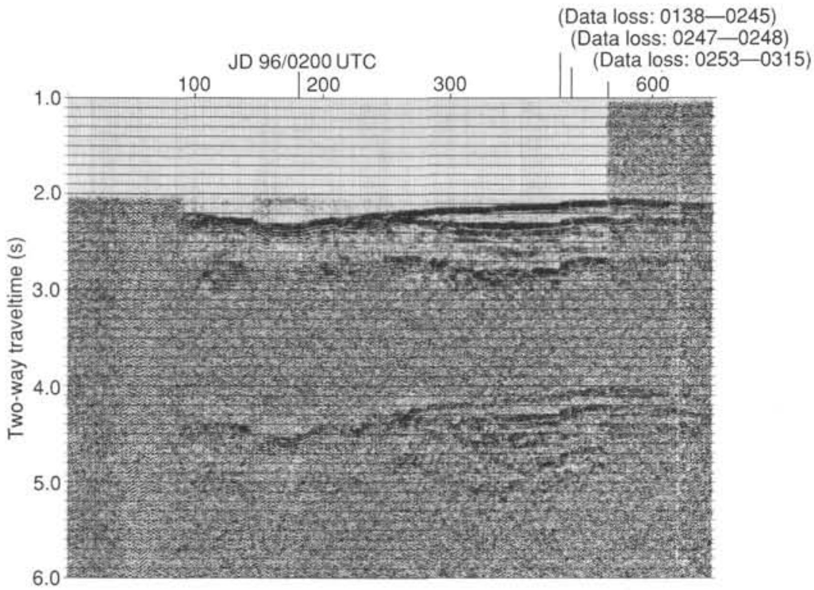



Figure 6. Processed digital seismic profile of Line 2, en route to Site 866. Processing parameters are given in Table 3, and the ship's track is shown in Figure 5.

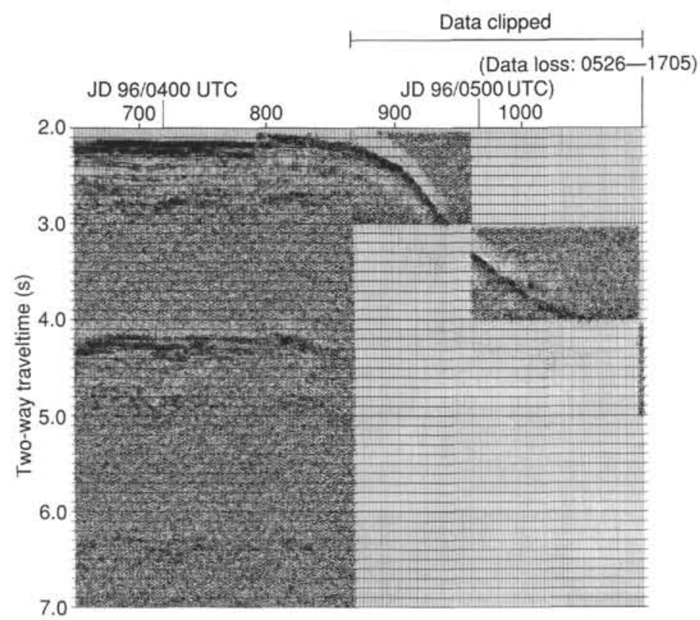



Figure 6 (continued).

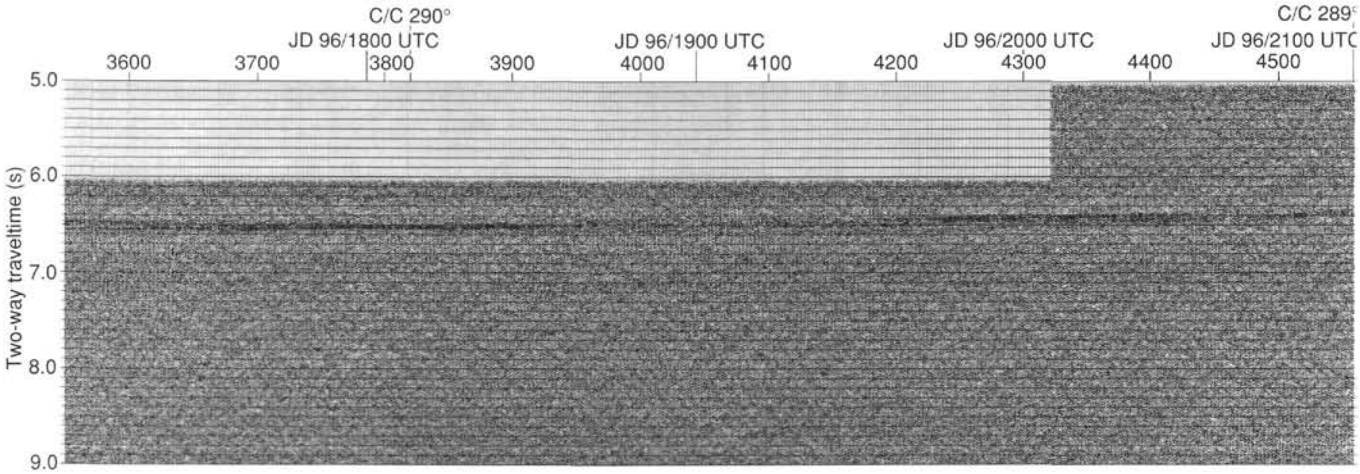
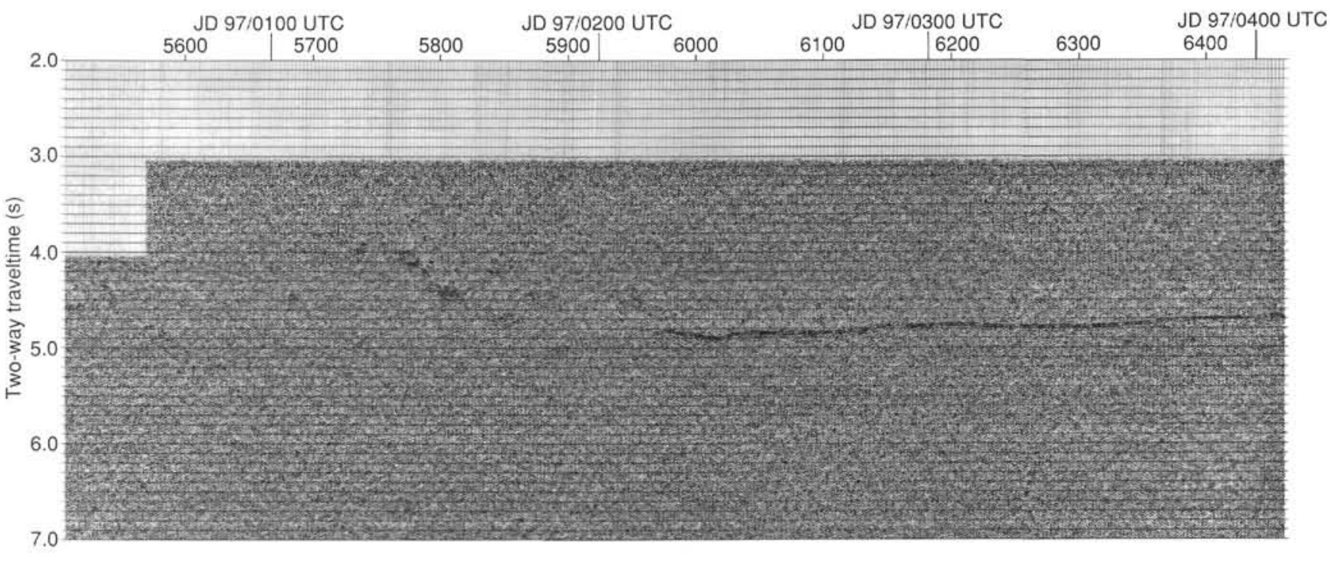



Figure 6 (continued).

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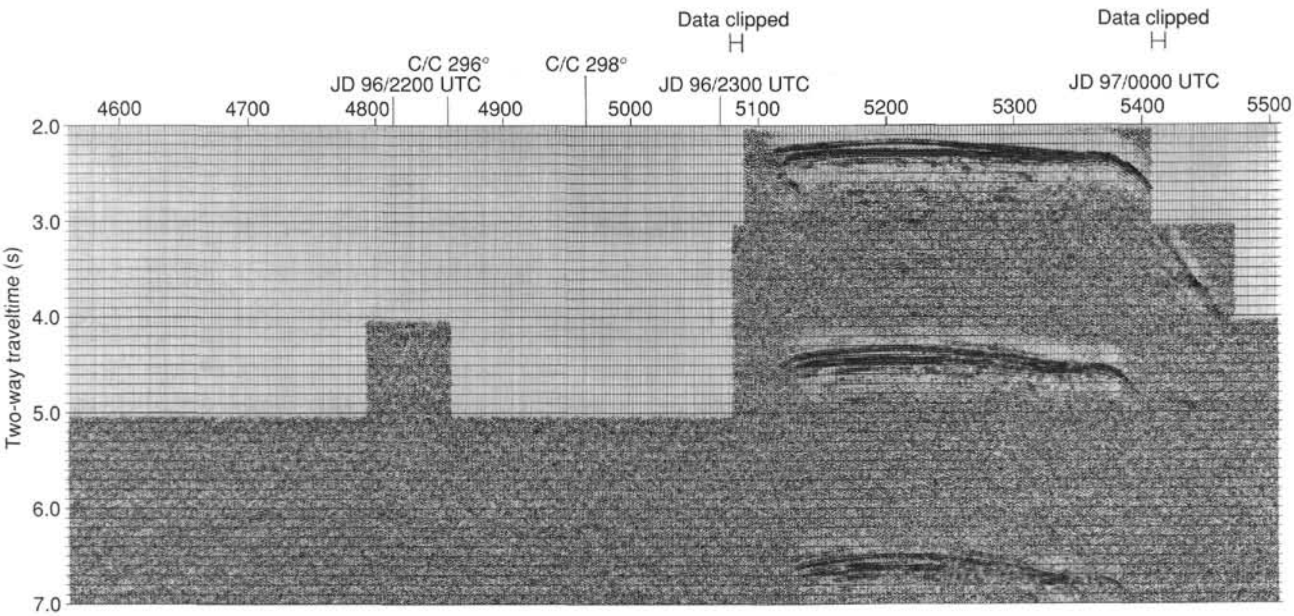


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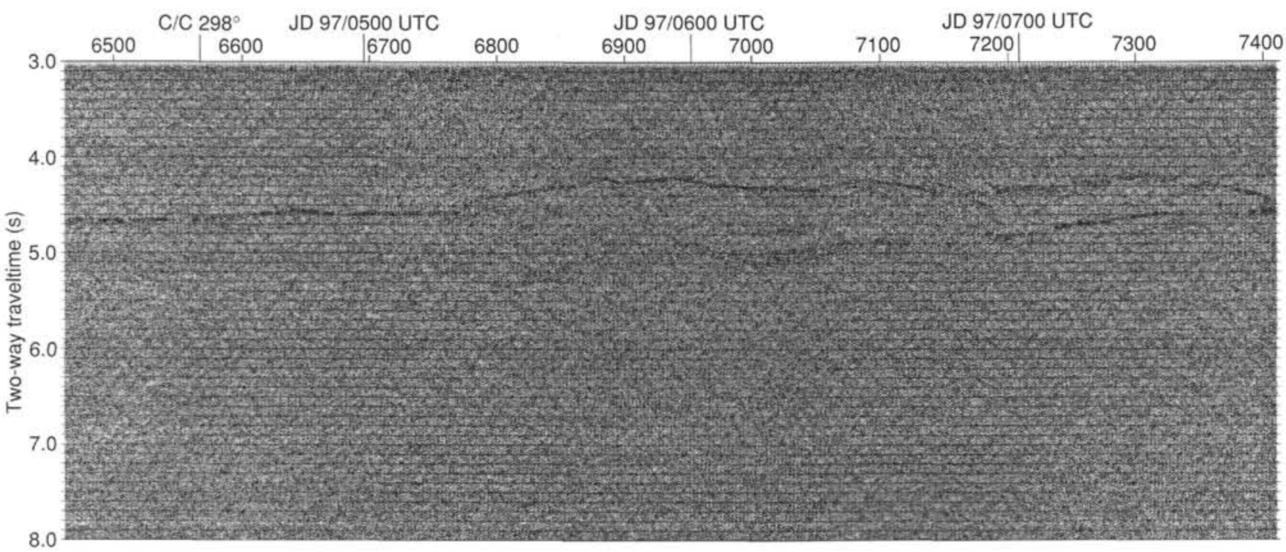


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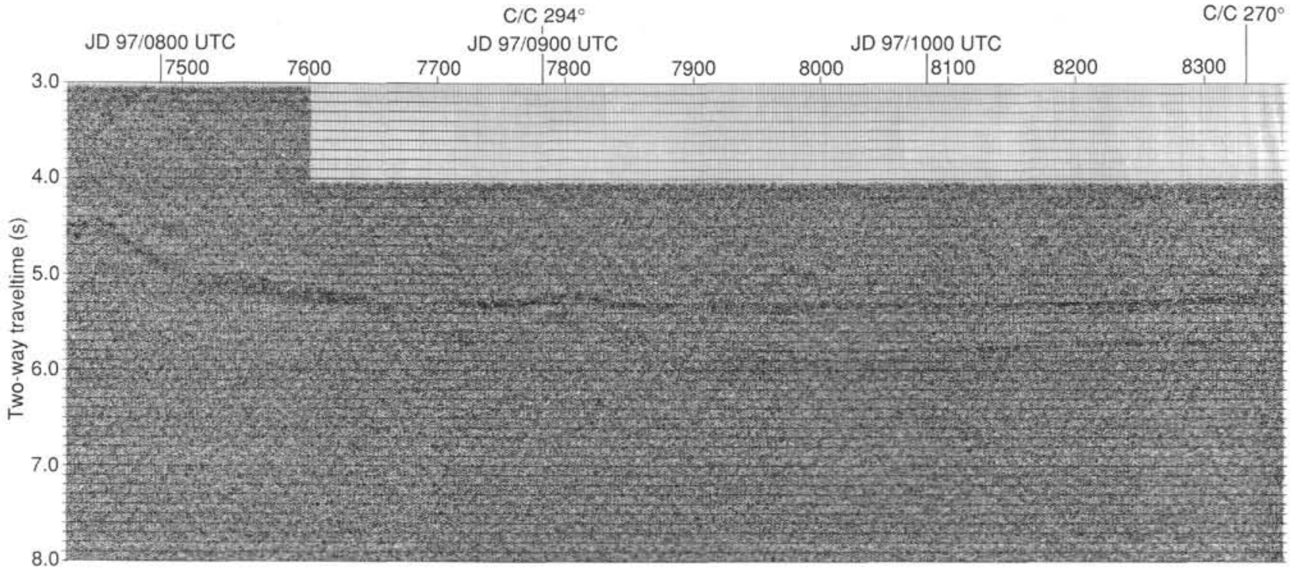


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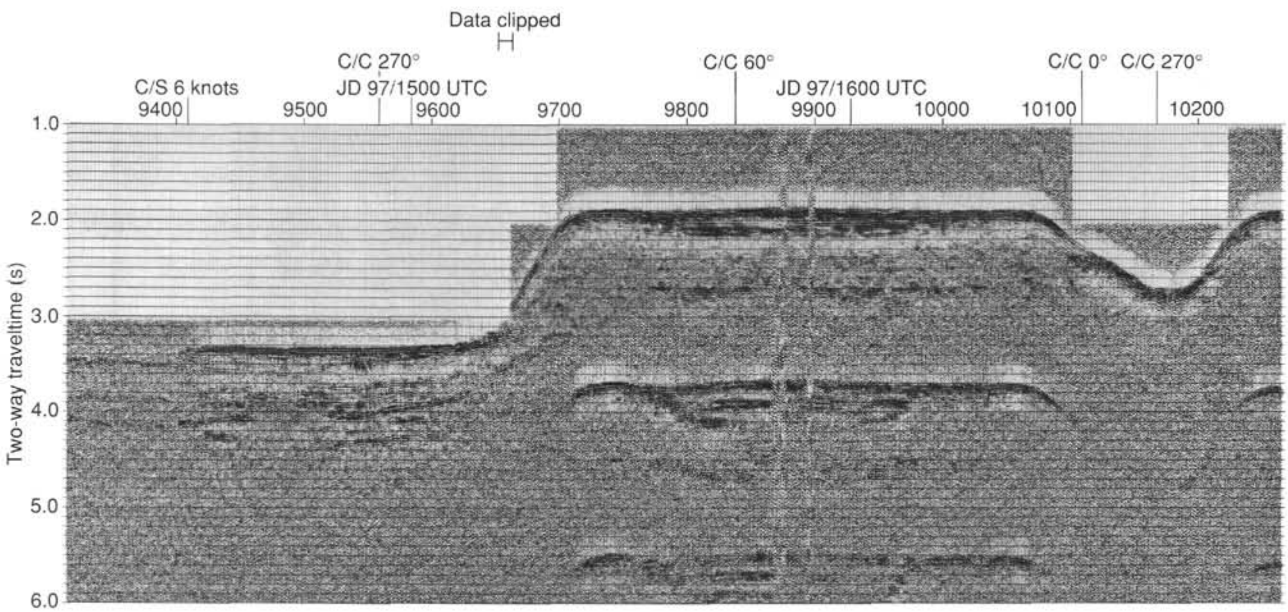


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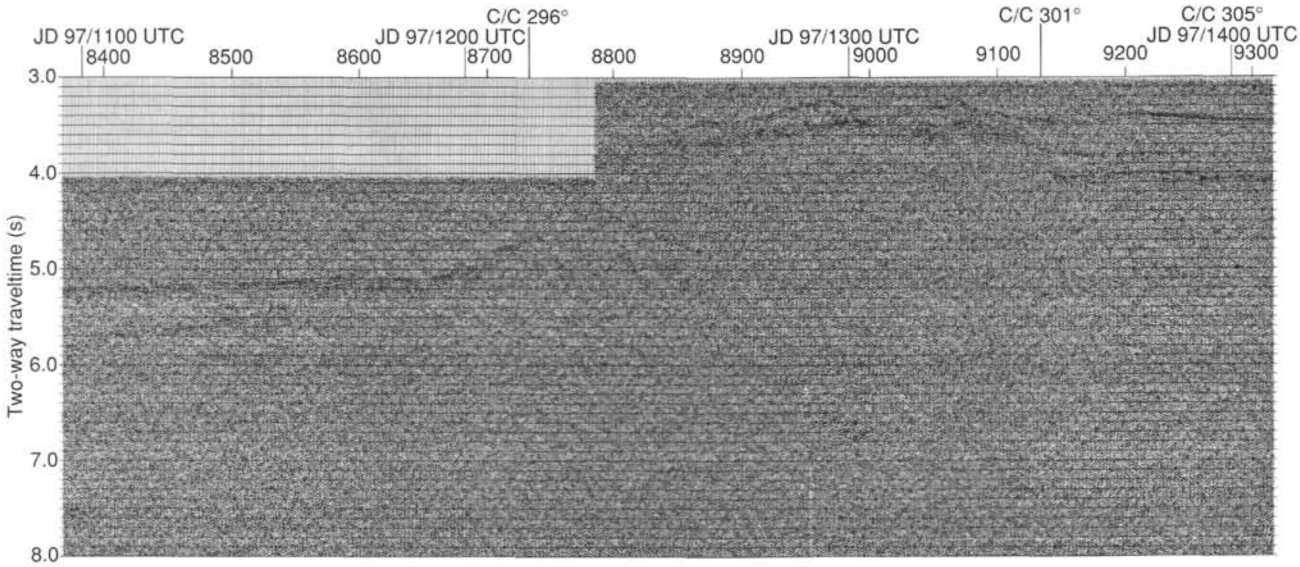



Figure 6 (continued).

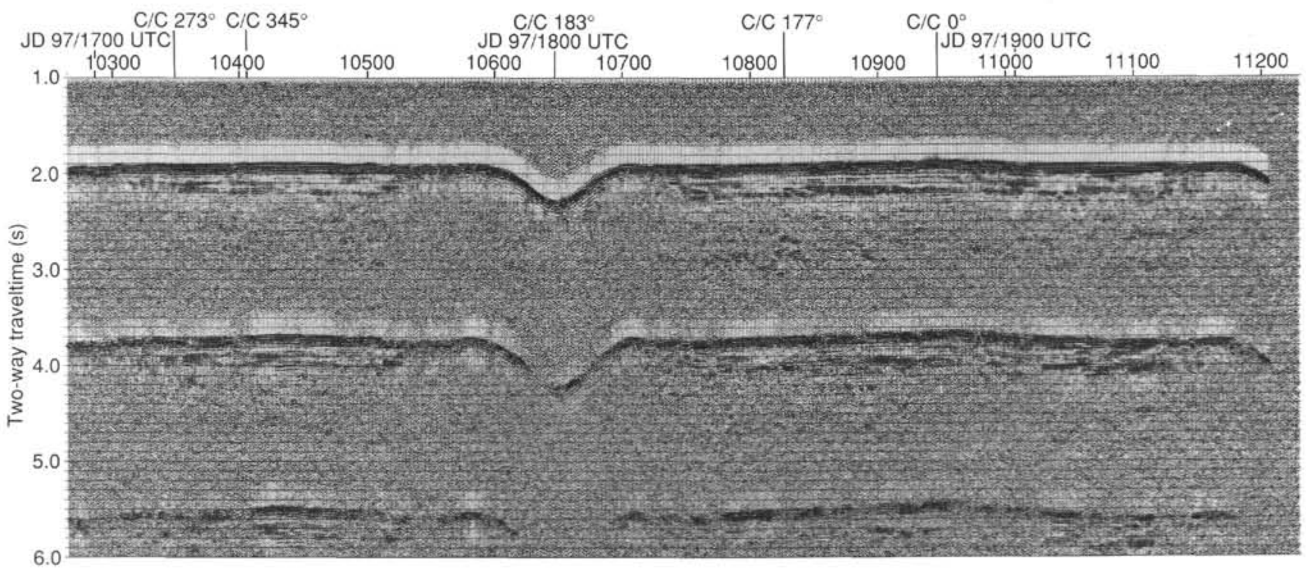



Figure 6 (continued).

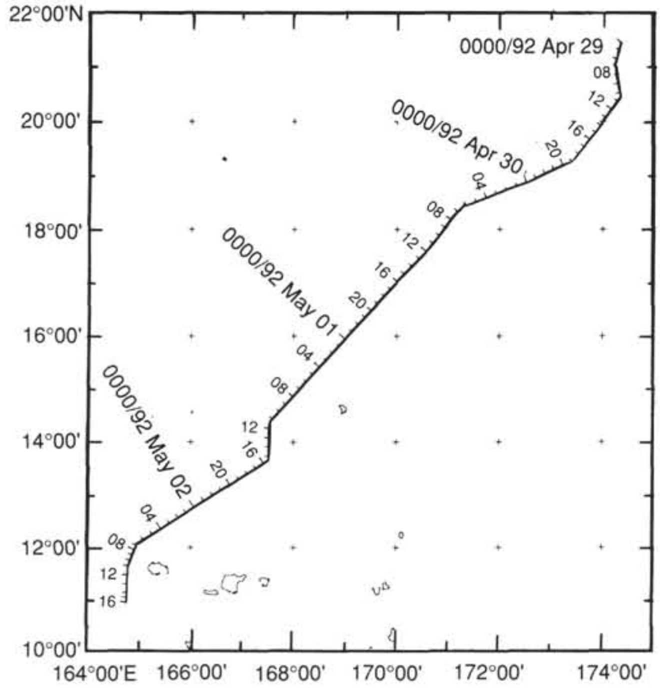



Figure 7. Detailed navigation plot of Line 3, en route to Site 869, generated from GPS and navigation data. Ship positions are shown as tick marks and are identified by UTC. Extrapolated positions are shown as tick marks. The processed digital seismic record is shown in Figure 8.

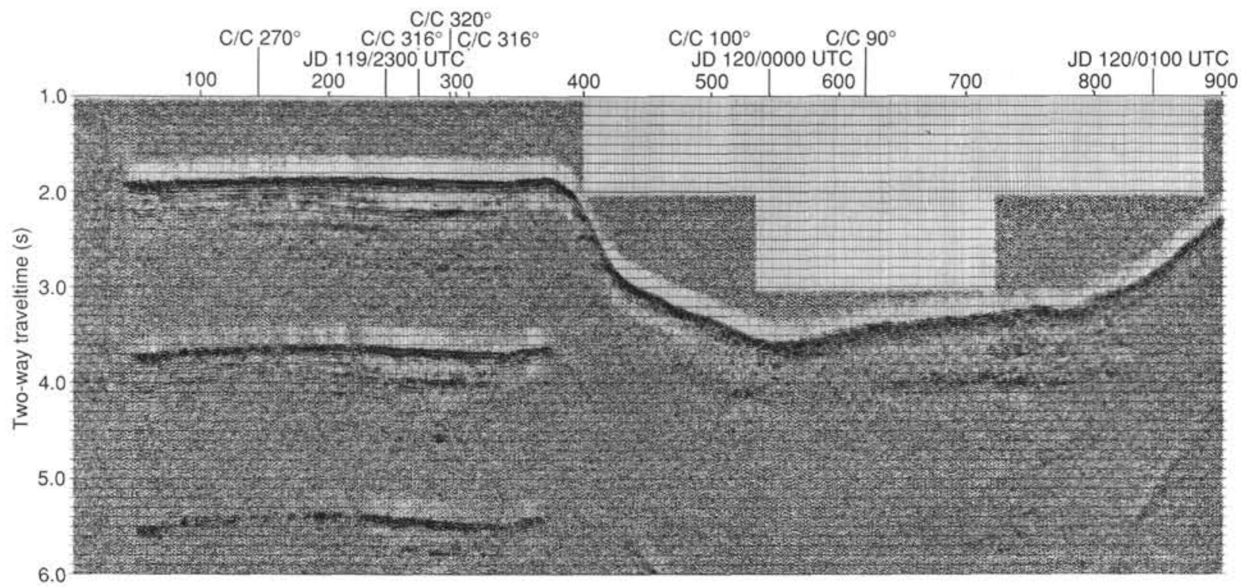



Figure 8. Processed digital seismic profile of Line 3, en route to Site 869. Processing parameters are given in Table 3, and the ship's track is shown in Figure 7. Sonobuoy traveltime plots are shown and paired with section of corresponding seismic line. Between shot points 1800 and 2250, and between shot points 24700 and 25000, Part A shows the seismic-reflection record and Part B shows the seismic-refraction (sonobuoy) record. Between shot points 22500 and 22900, Part A shows the seismic-refraction (sonobuoy) record and Part B shows the seismic-reflection record.

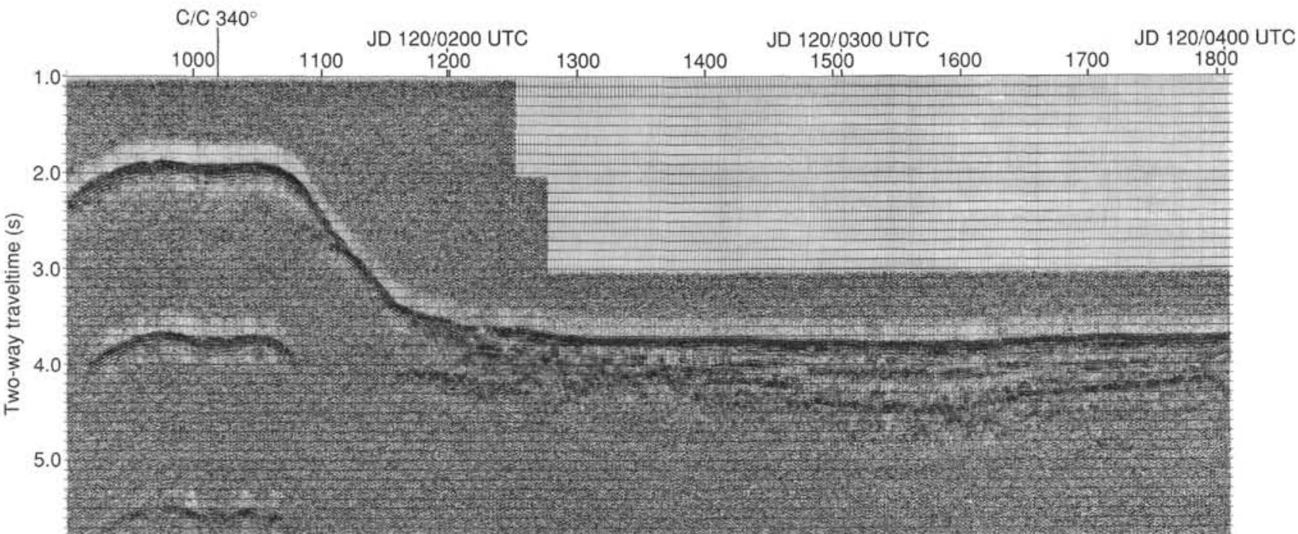



Figure 8 (continued).

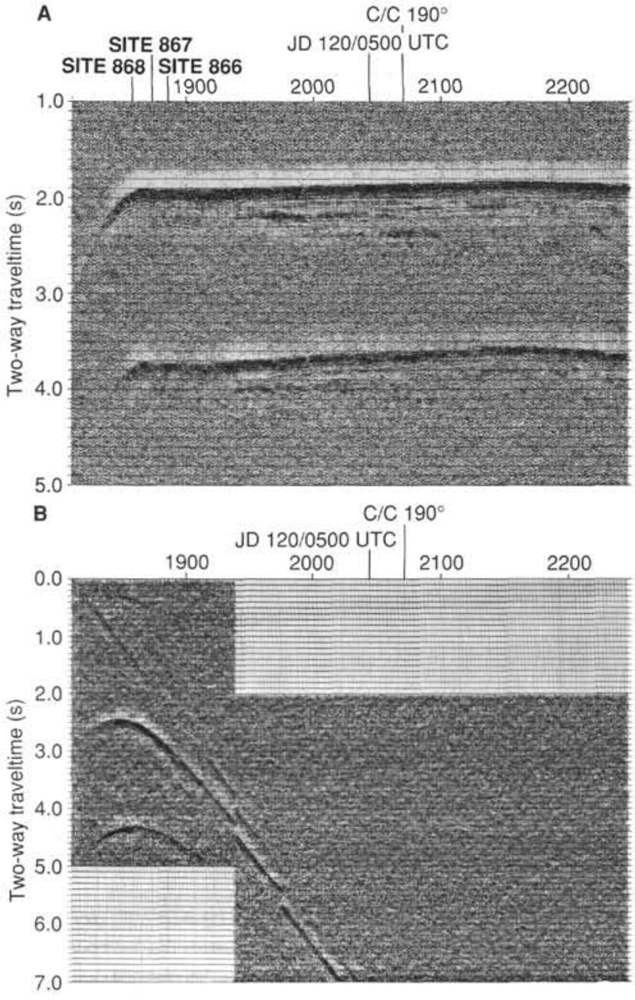



Figure 8 (continued).

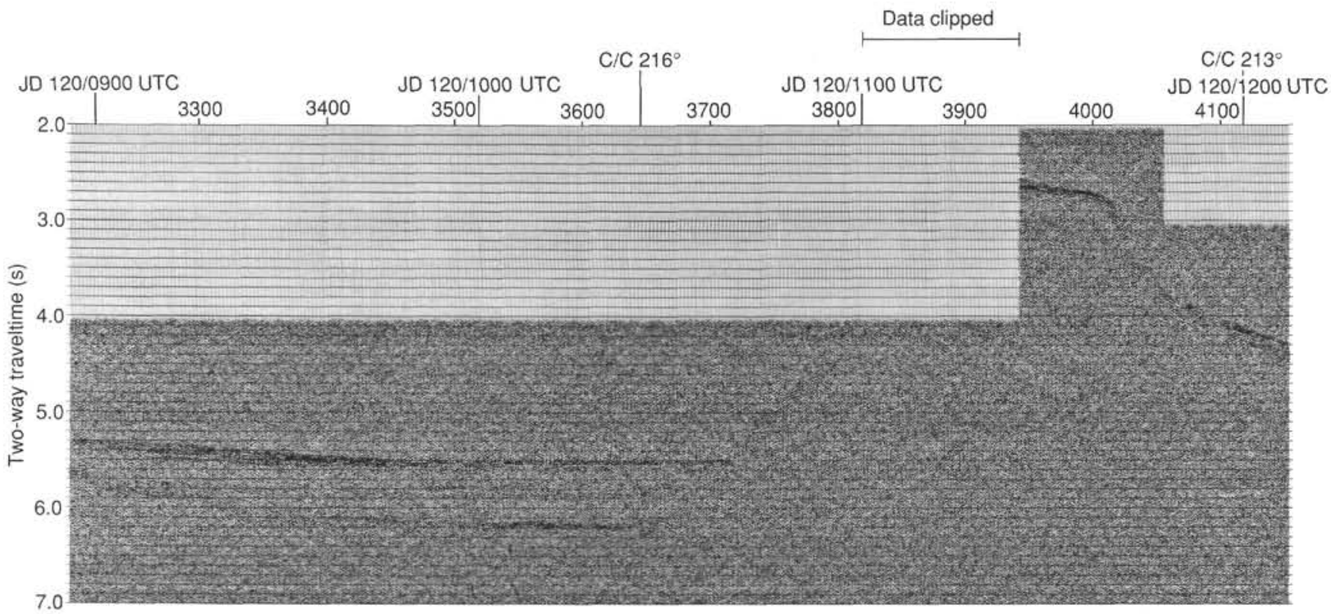
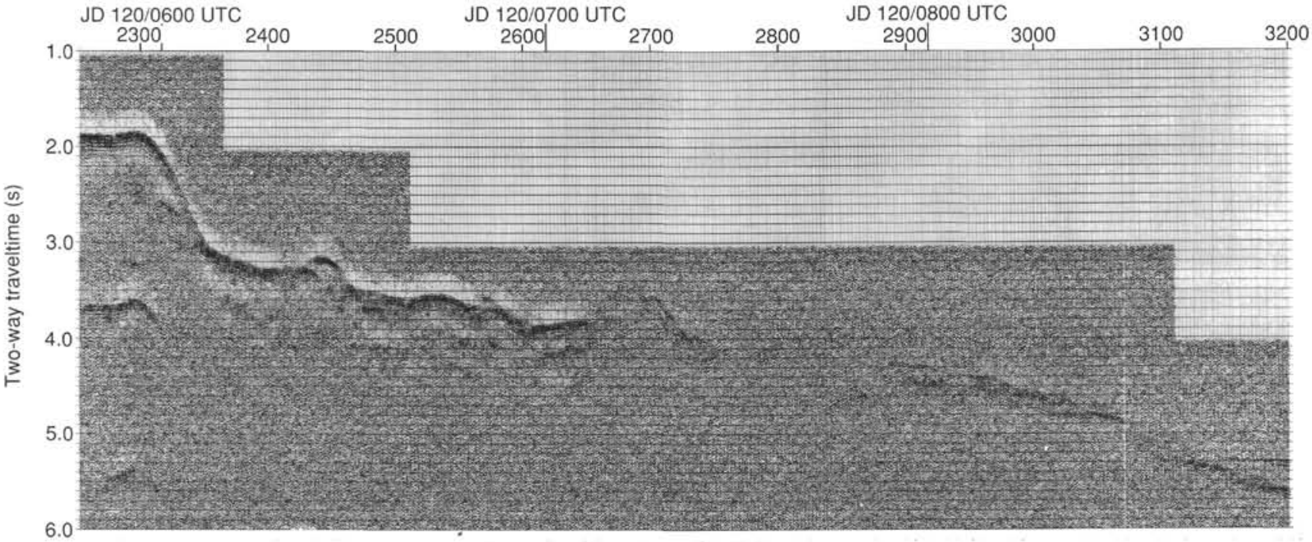



Figure 8 (continued).

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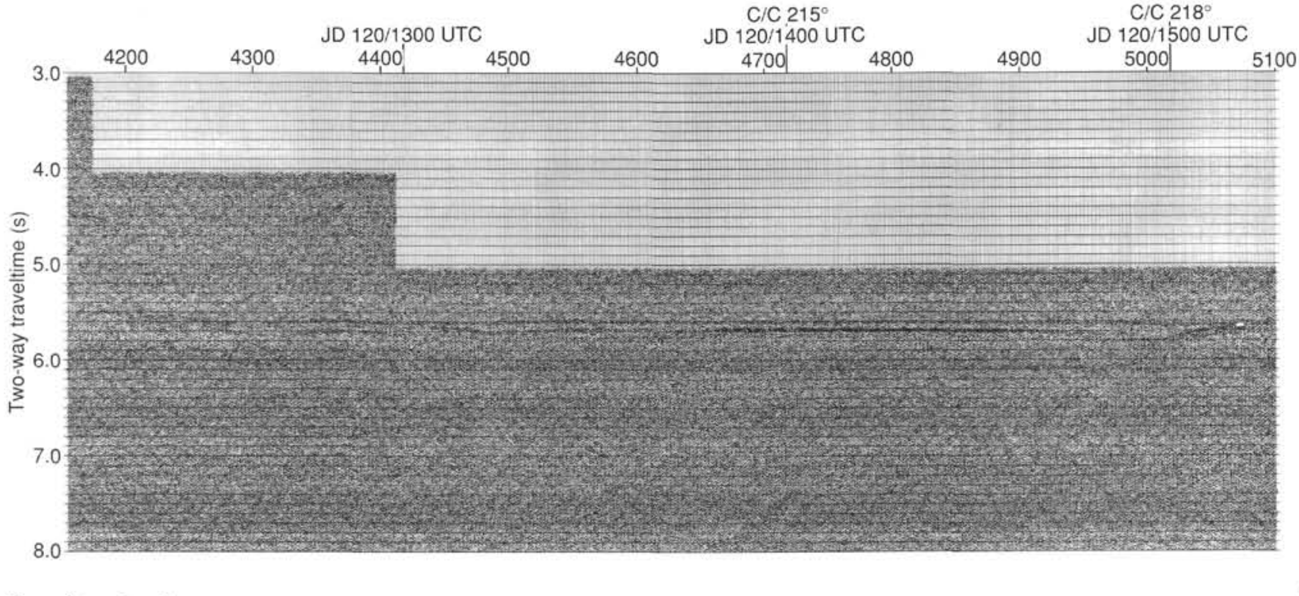


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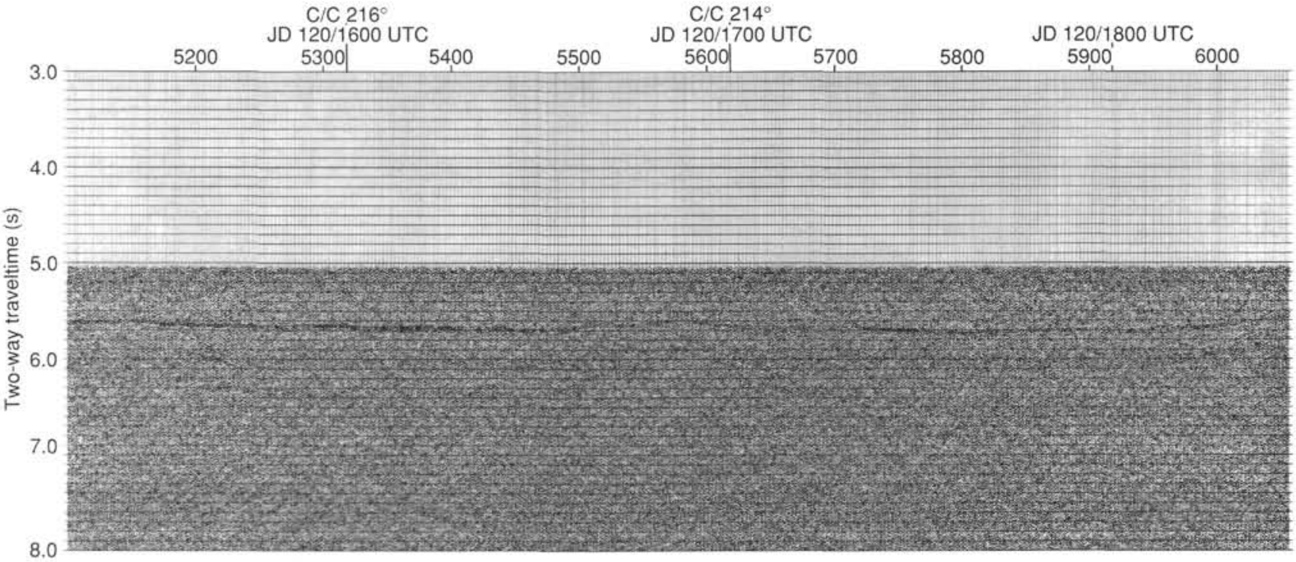


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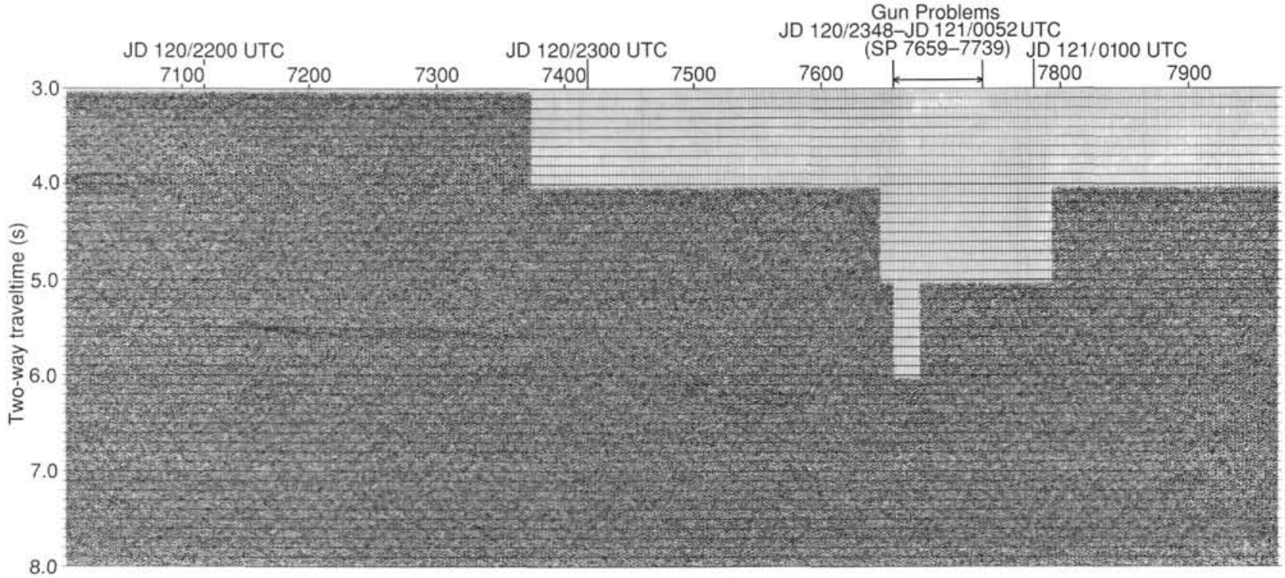


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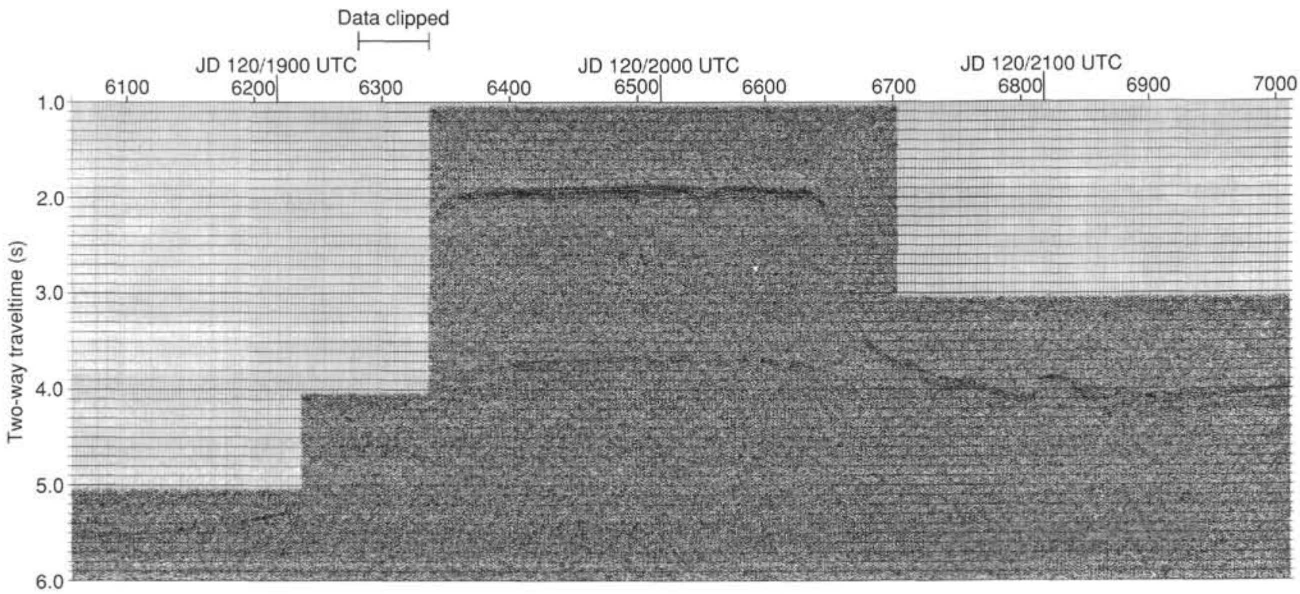


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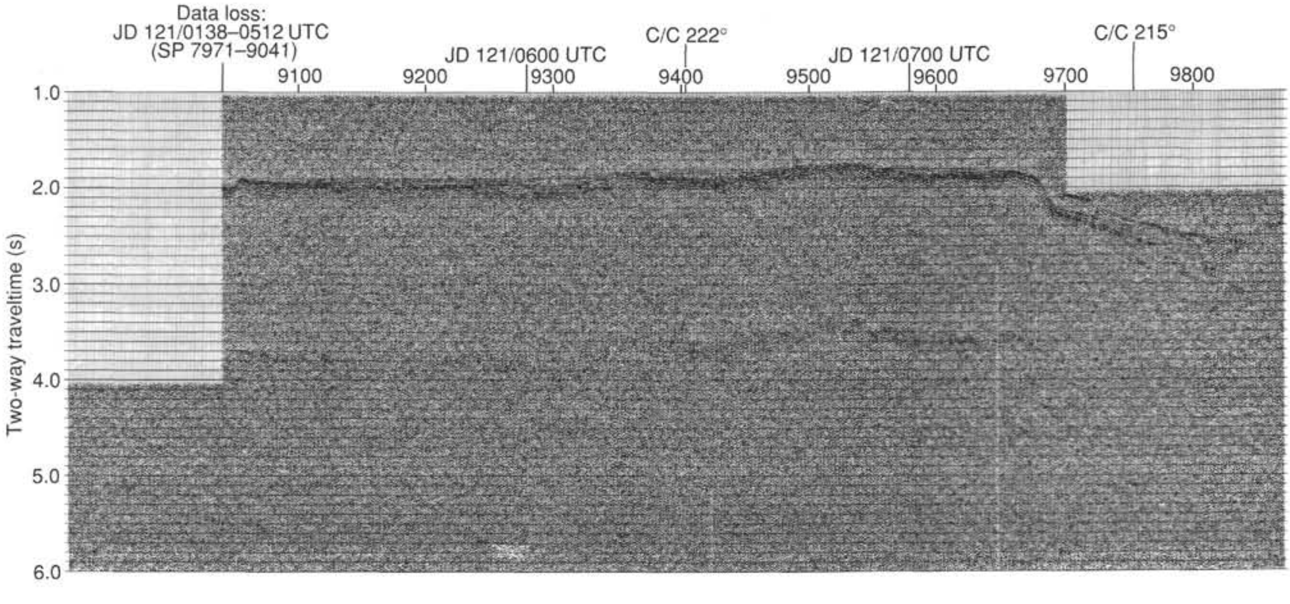


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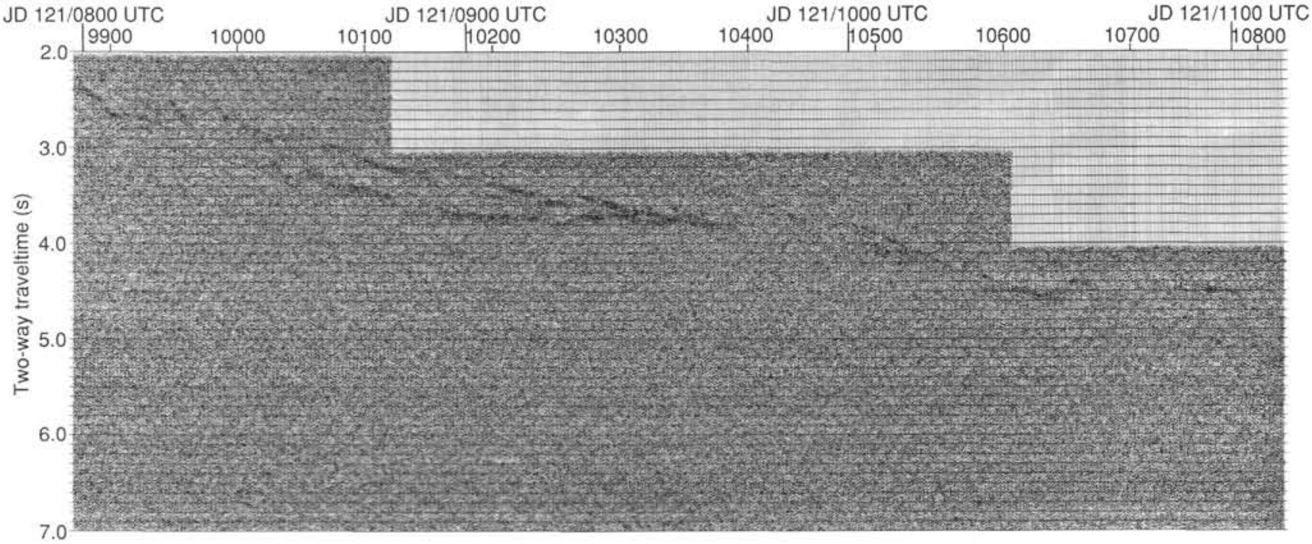


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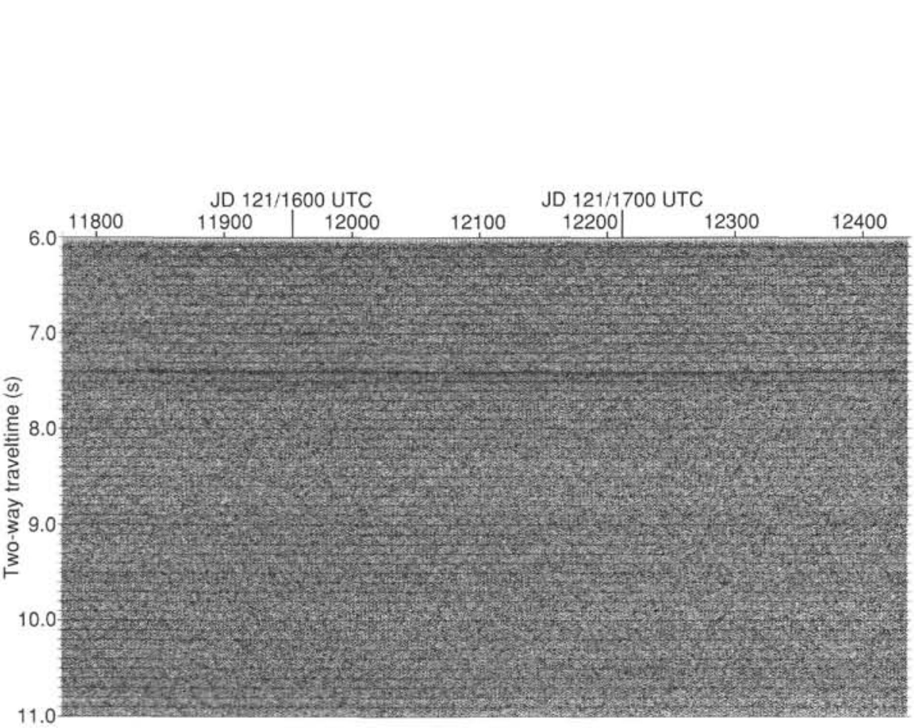


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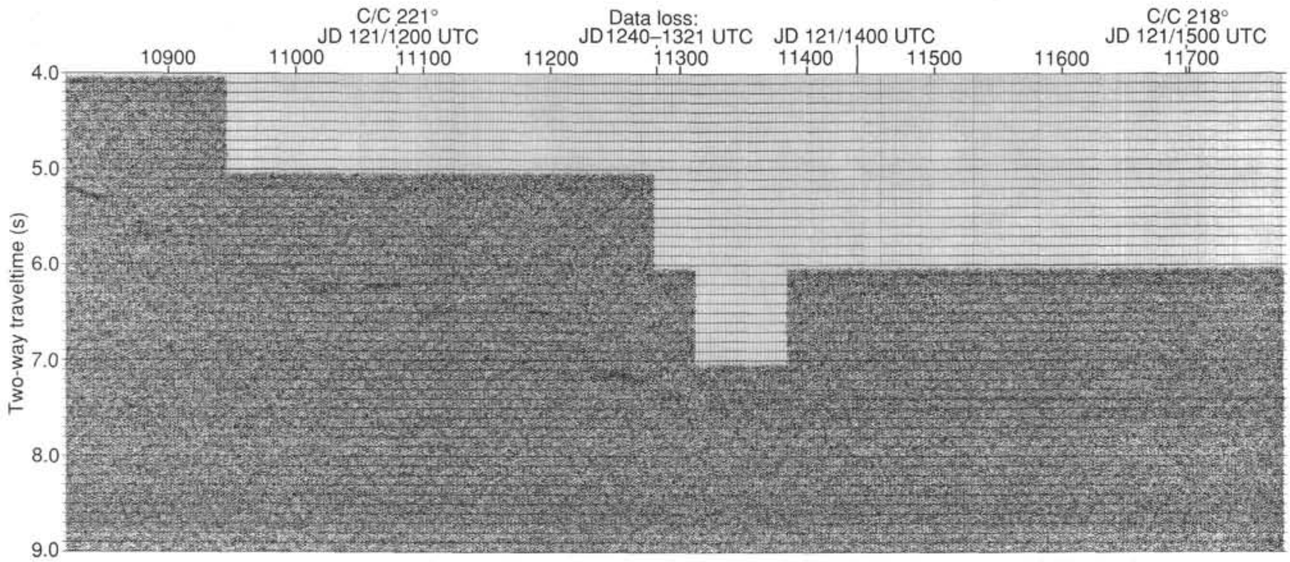


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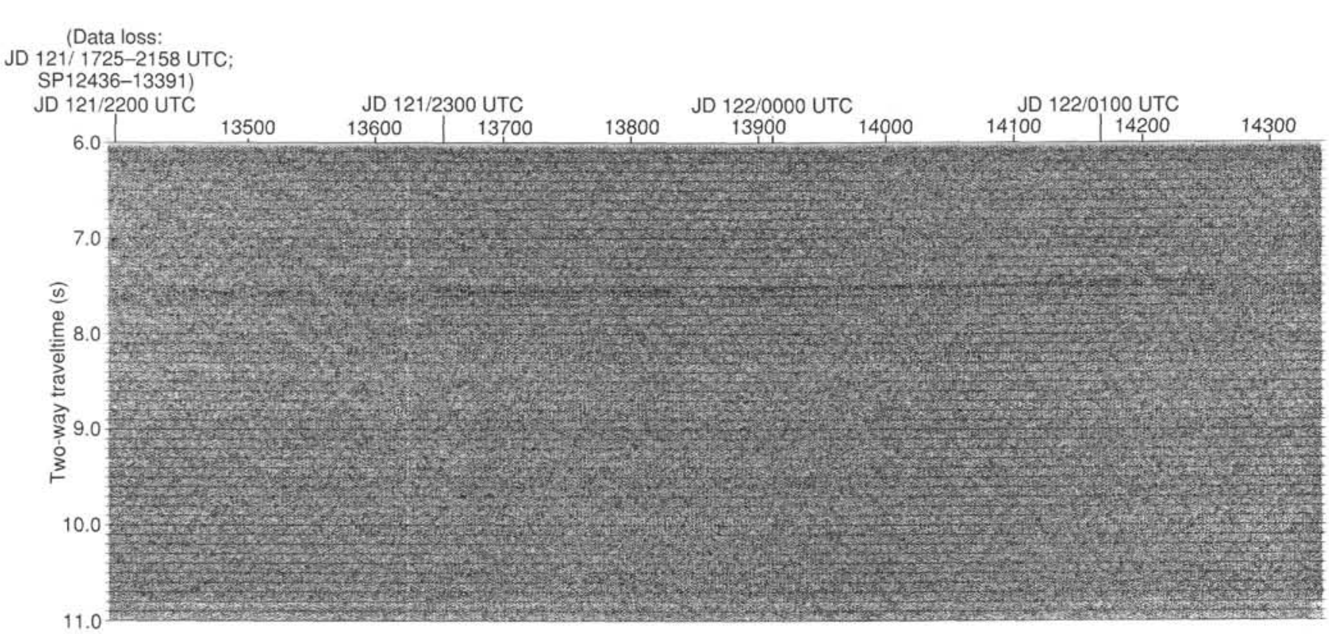


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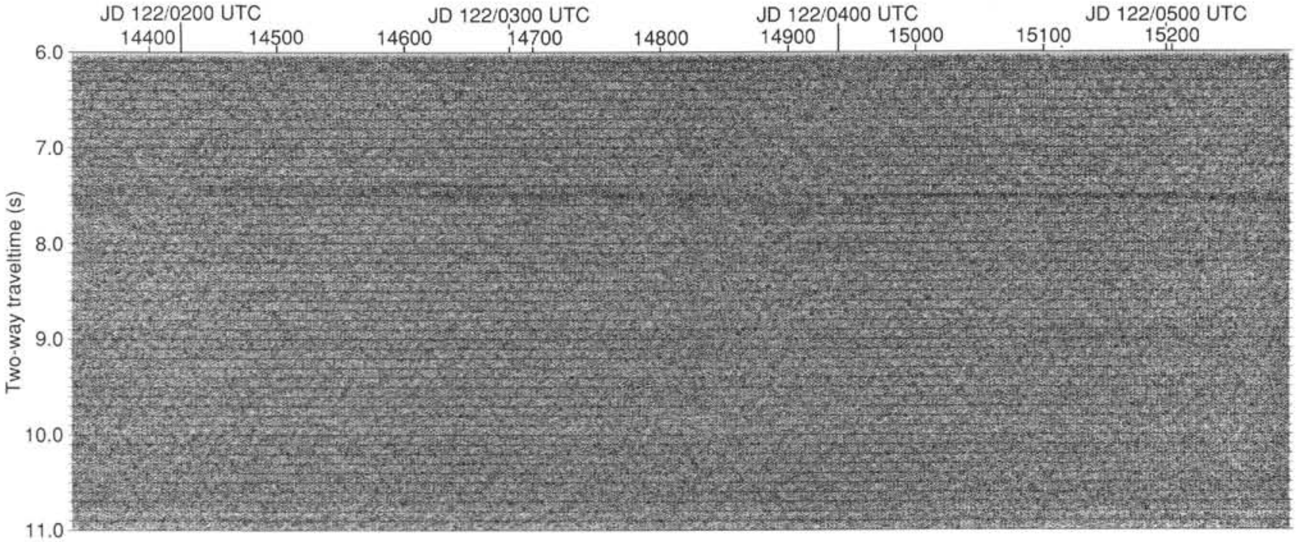


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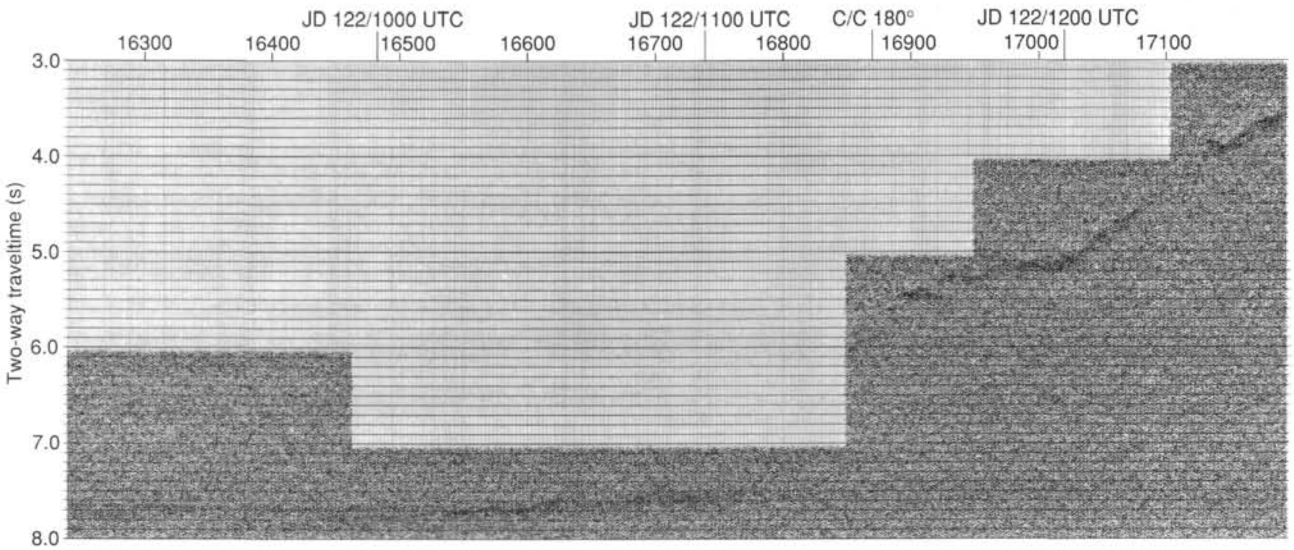


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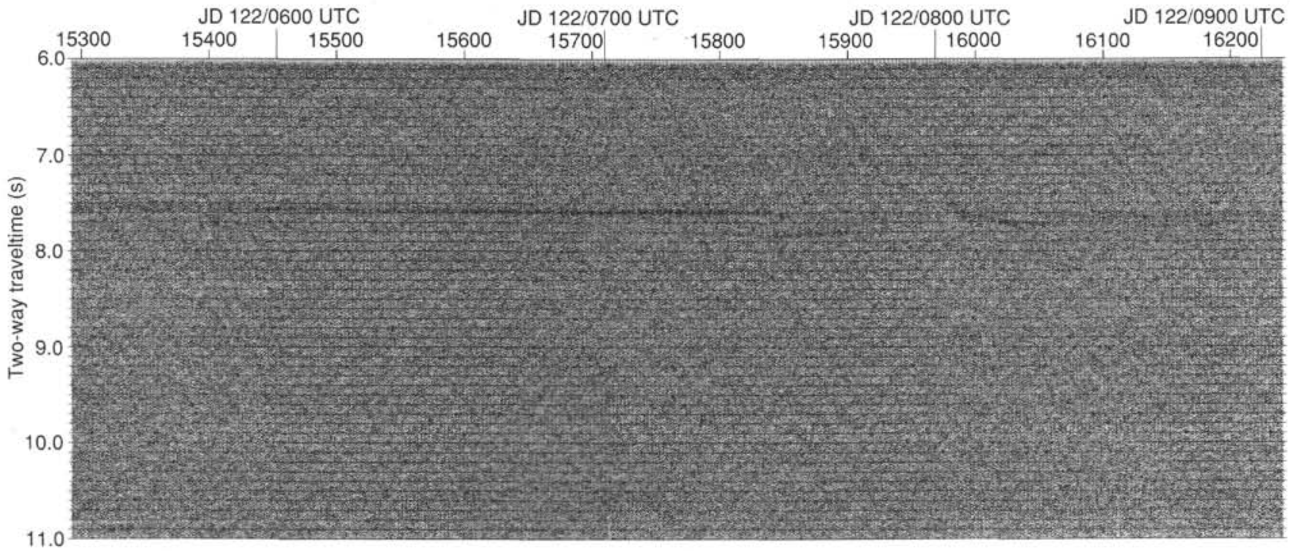


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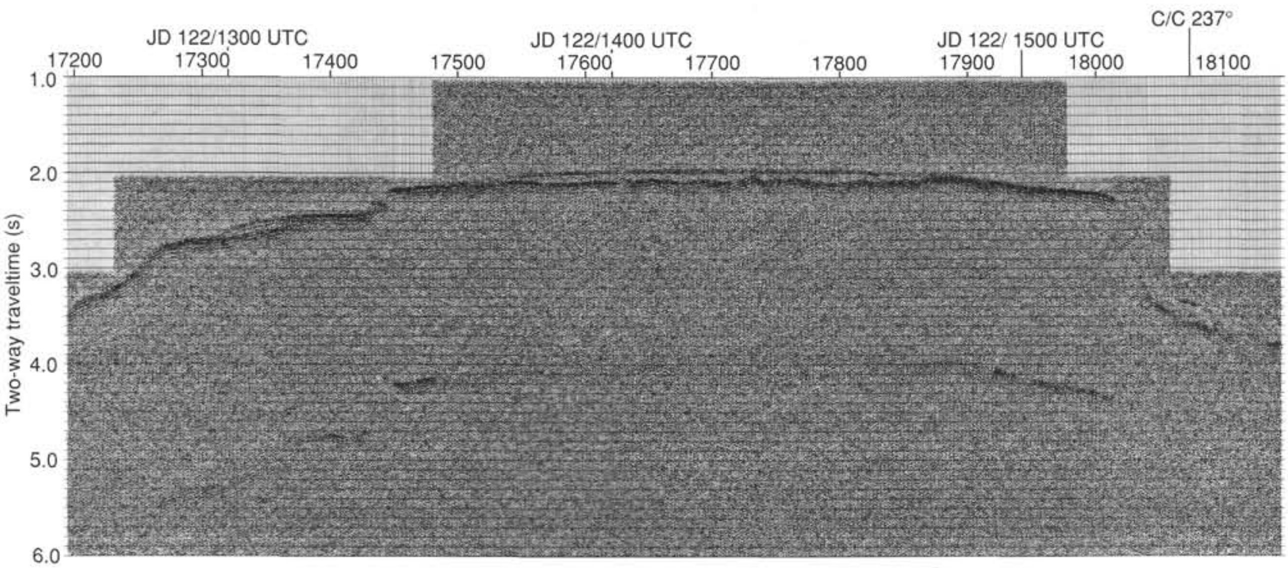


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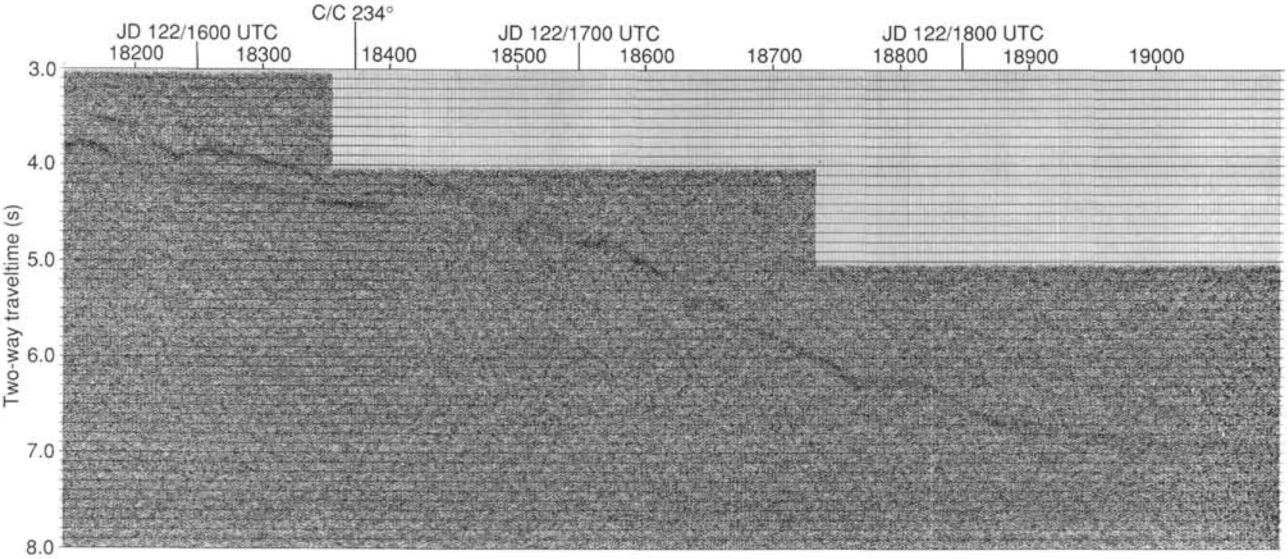


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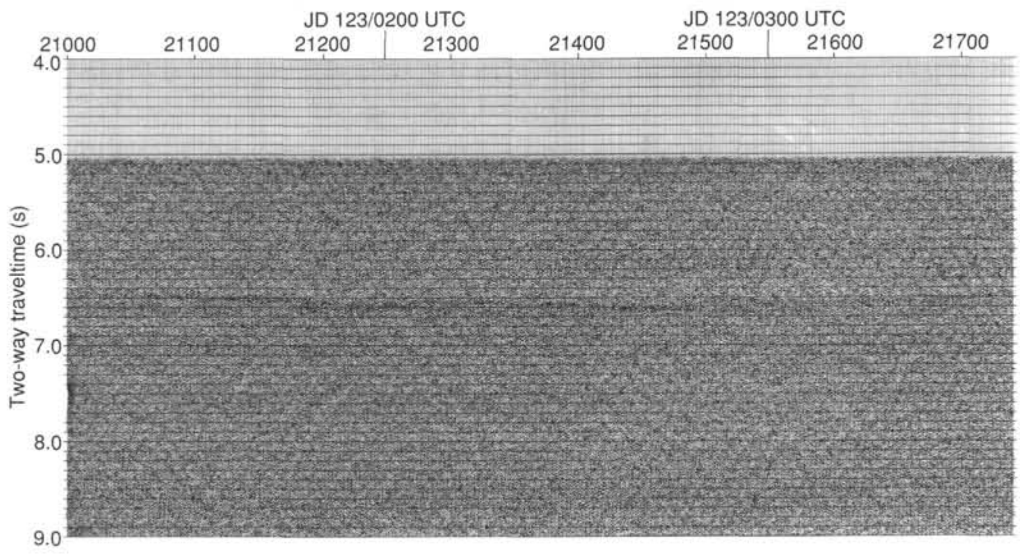


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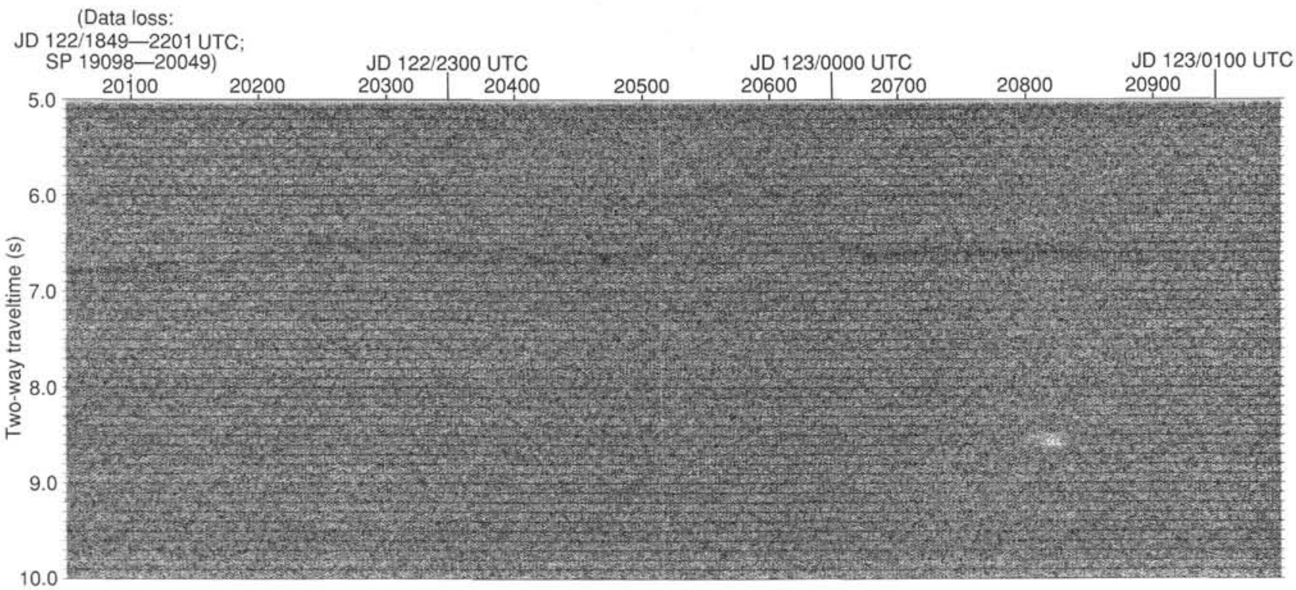


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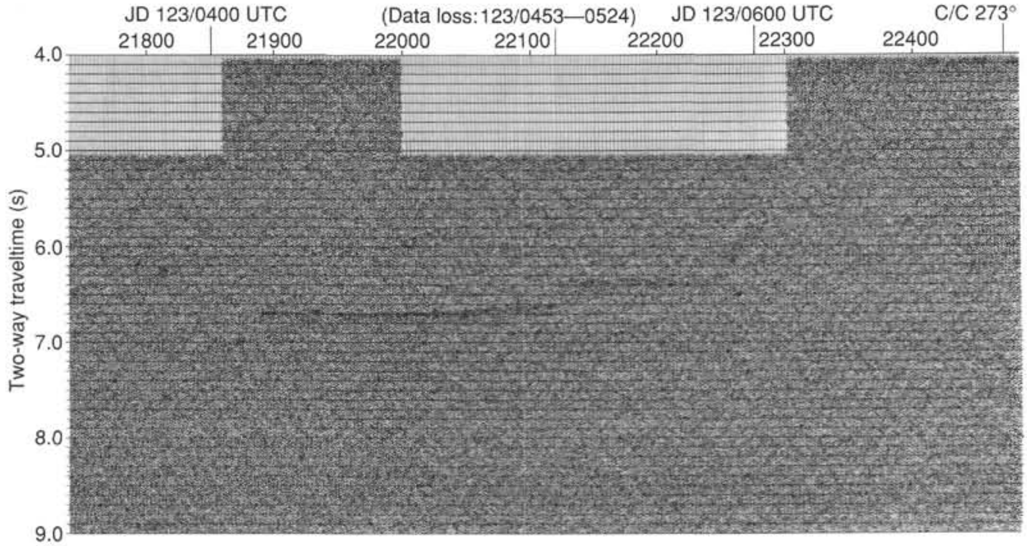


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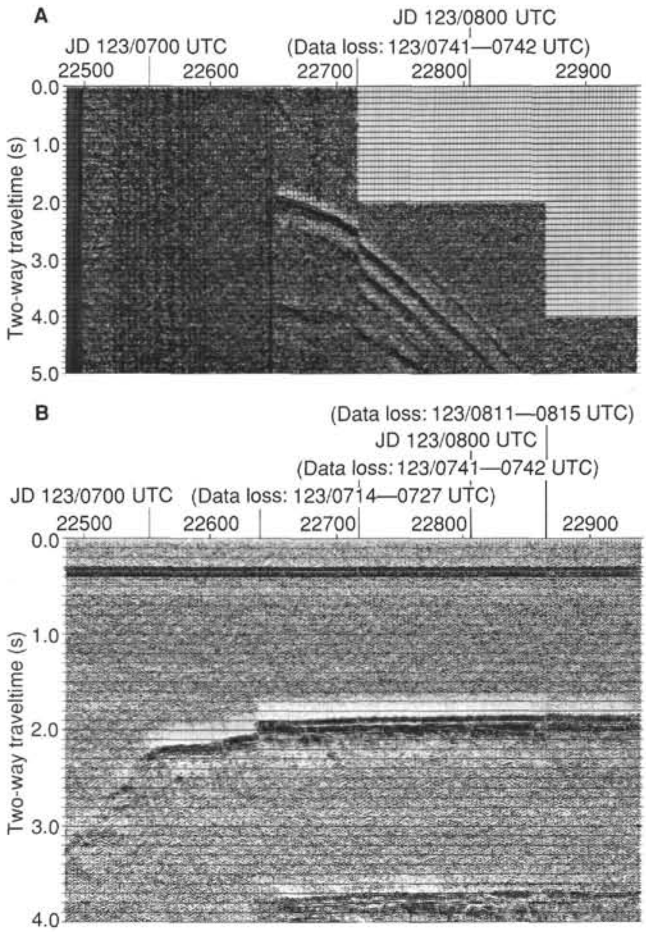


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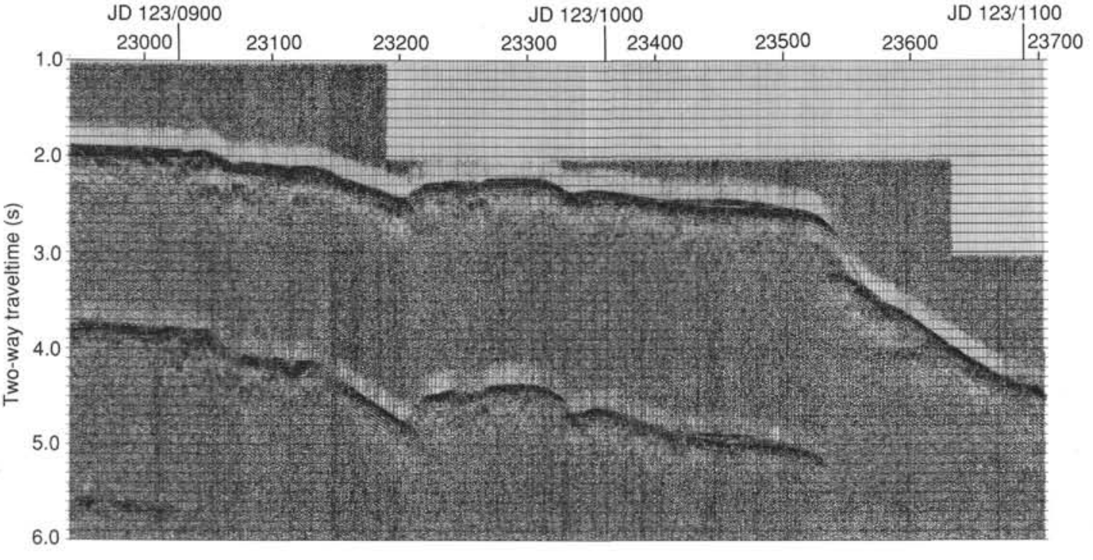


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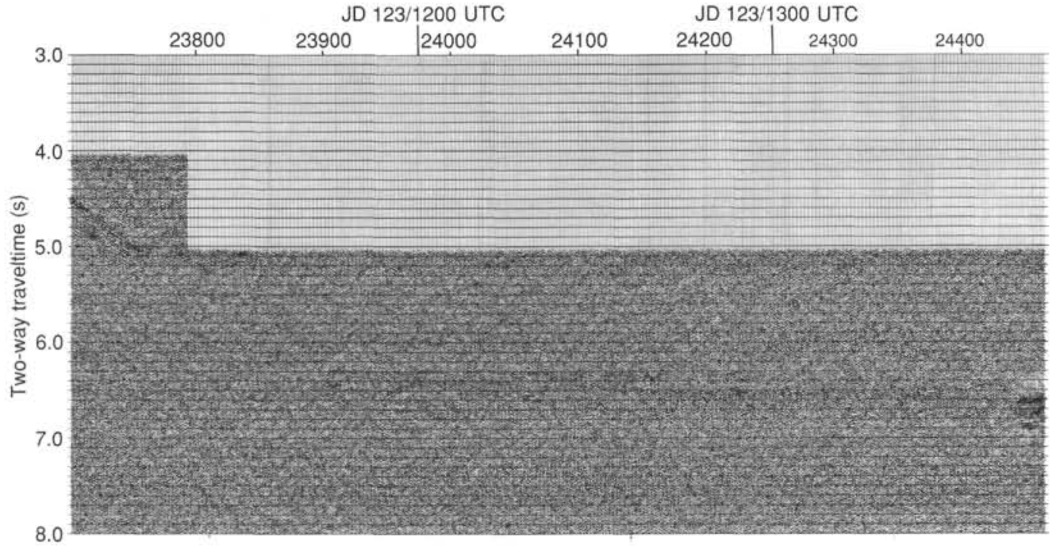

JD 123/1200 UTC
JD 123/1300 UTC
23800
23900
24000
24100
24200
24300
24400
3.0
4.0
5.0
6.0
7.0
8.0
Two-way traveltime (s)

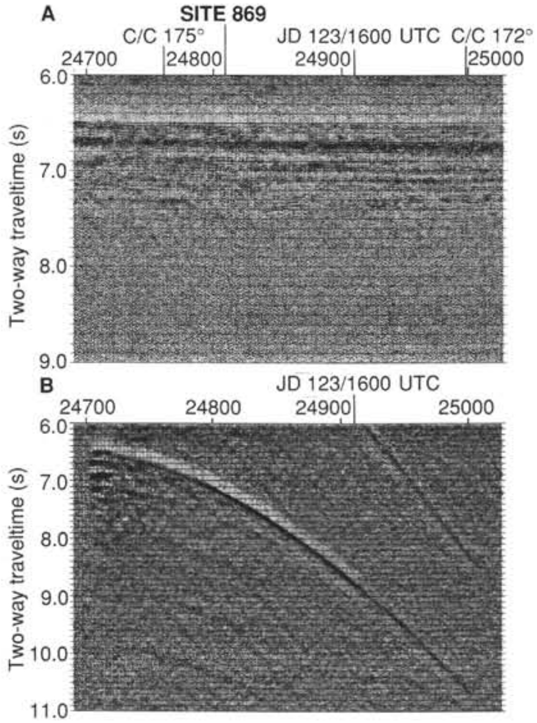



Figure 8 (continued).

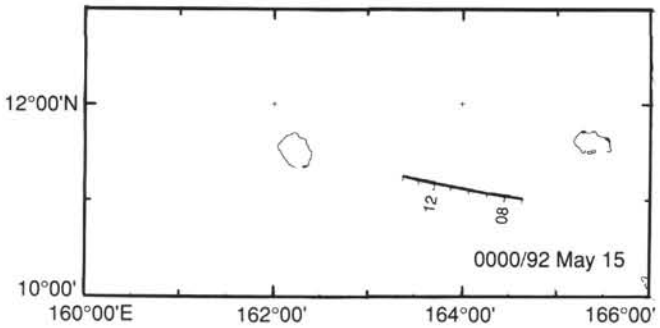



Figure 9. Detailed navigation plot of Line 4, en route to Site 870, generated from GPS and navigation data. Ship positions are shown as tick marks and are identified by UTC. The processed digital seismic record is shown in Figure 10.

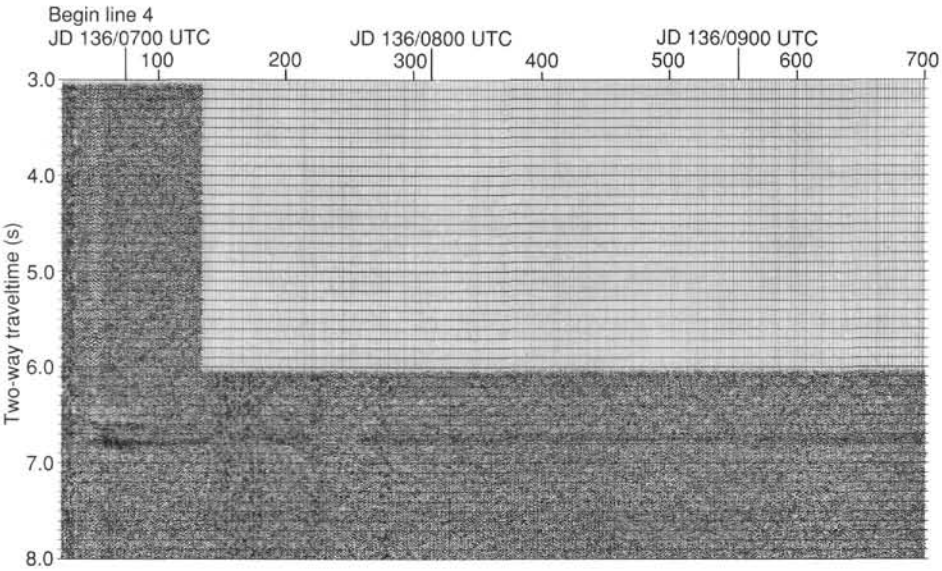



Figure 10. Processed digital seismic profile of Line 4, en route to Site 870. Processing parameters are given in Table 3, and the ship's track is shown in Figure 9.

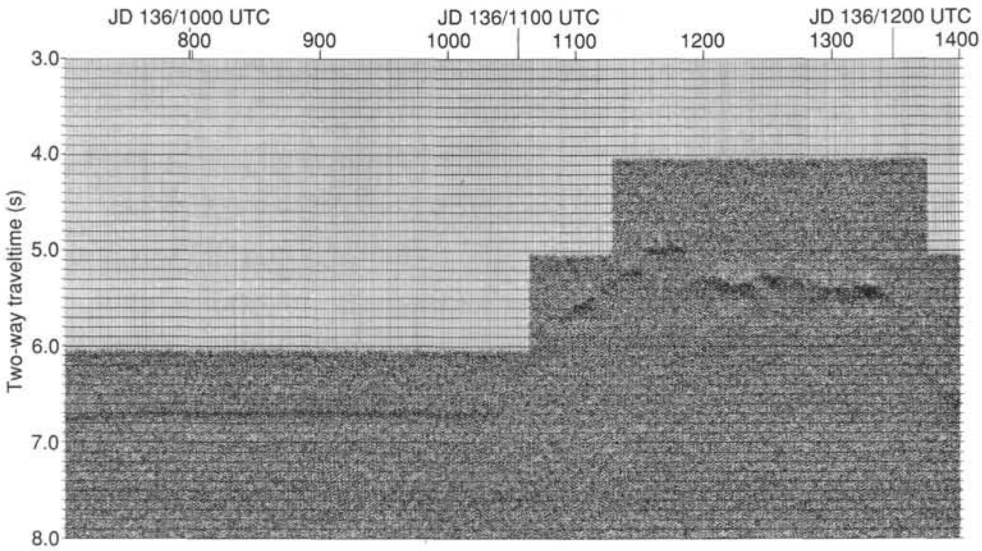



Figure 10 (continued).

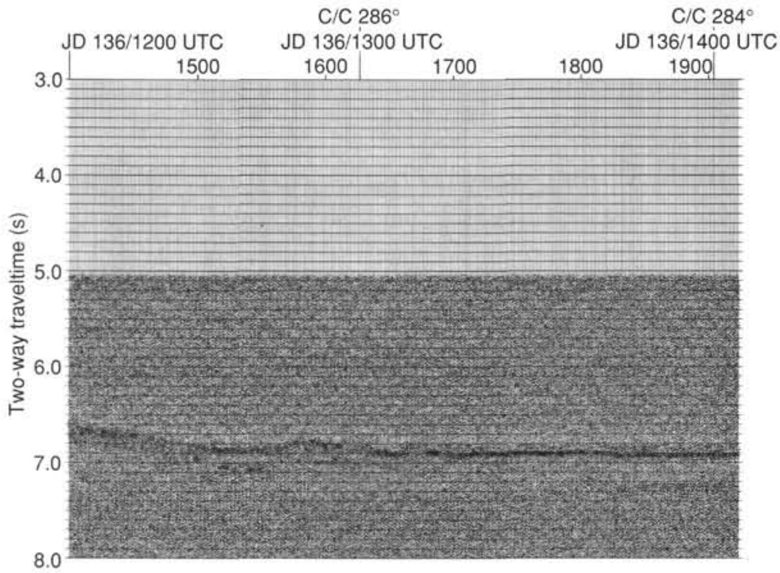
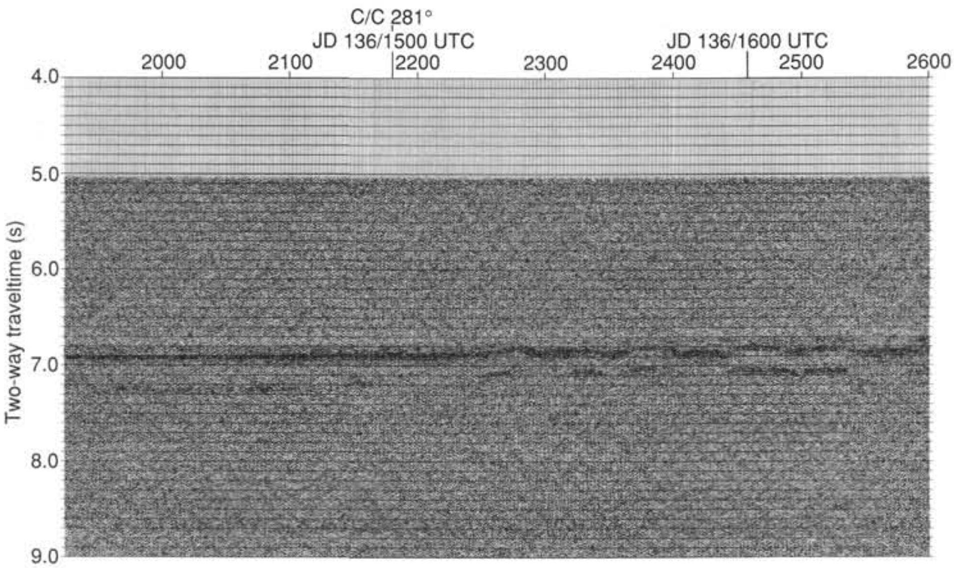



Figure 10 (continued).

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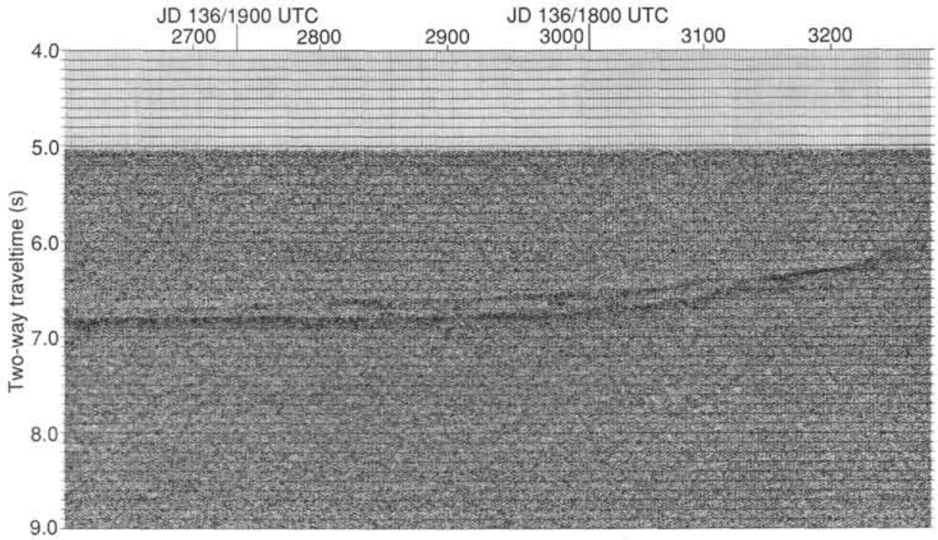


Figure 10 (continued).