3. UNDERWAY GEOPHYSICS[1]

Shipboard Scientific Party[2]

INTRODUCTION

Geophysical data were collected during Leg 127 of the Ocean Drilling Program (ODP). *JOIDES Resolution* was under way for 8 days of the 60 days at sea, traveling approximately 1931 nautical miles (nmi) between Port Tokyo, Japan, and Pusan, Korea (Fig. 1).

Shipboard geophysical instrumentation included two precision echo-sounders, a magnetometer, a single-channel seismic reflection system with digital recording, and a satellite navigation system (Table 1). These instruments were maintained and operated by Ocean Drilling Program marine technicians, in cooperation with the scientific party and the officers and crew of SEDCO-FOREX, Inc.

NAVIGATION DATA

Navigation data were collected in the Underway Geophysics Laboratory by a Magnavox 1107 GPS (Global Positioning System) Transit Satellite Receiver, which was used as the primary positioning system. Loran C (Micrologic COMMANDER) was used as the secondary positioning system. Continuous GPS coverage was available for approximately 14 hr per day during the cruise. Course and navigation speed data were collected by HIGHRES, the shipboard seismic data acquisition and processing software package. The GPS data are preferred over transit satellite and dead-reckoning positions because of the continually updated, higher-quality data available during a GPS "window." Plots of the navigation in the vicinity of the Leg 127 sites are shown in the site chapters of this volume. These plots were generated from GPS transit satellite positions, course- and speed-change data, and on- and off-site information compiled from the bridge log, the underway geophysical log, and the HIGHRES tape headers. The Ocean Research Institute, University of Tokyo produced the navigation compilation. The final site locations are an average of all positions collected while on site.

It is not possible to carry out all site approach surveys during GPS windows; therefore, the information used to reconstruct the ship's track around each drill site is combined GPS and Loran C data. The GPS fixes are printed to hard copy at a user-specified rate; Loran C fixes are logged from the Underway Geophysical Lab repeater. The sampling density depends on the nature of the survey, generally one fix per 15–30 min in the initial part of the survey, and increasing to one fix per minute when approaching the site. The ship's track is assumed to proceed from point to point unless suggested otherwise by course-change information listed in the HIGHRES tape headers. The density of points illustrated does not necessarily conform with the amount of data collected, but is sufficient to ensure an accurate reconstruction of the ship's tracks.

BATHYMETRIC DATA

Bathymetric data were obtained with both 12-kHz Precise Depth Recorder (PDR, by Raytheon) and 3.5-kHz sub-bottom profiler (also Raytheon). The 3.5-kHz system uses an array of 12 Raytheon TR-109 transducers and a Raytheon PTR-105B Transceiver. A Raytheon CESP-III correlator was used to improve the signal-to-noise ratio (20 dB). The pulse width used was 100 ms. The hull-mounted transducers are situated 6 m below sea level.

MAGNETIC DATA

A Geometrics 801 proton precession magnetometer was used during transits and site surveys, towed approximately 500 m astern (Fig. 2). Total intensity magnetic field data were recorded in analog format on a strip chart recorder, in digital format via the HIGHRES headers (one reading per seismic shot), and manually every 5 min in the underway geophysical log. The magnetic field values were reduced to anomaly values by subtracting the 1985 International Geophysical Reference Field. Figure 3 shows an example of a magnetic anomaly profile along selected Leg 127 track lines.

SEISMIC-REFLECTION DATA

Single-channel seismic reflection profiles were collected over 800 nmi during Leg 127. Selected processed profiles in the vicinity of the Leg 127 sites are shown in the site chapters, and all the unprocessed single-channel records are displayed in Figure 4 (back pocket). Copies of the records are available from the Data Base Supervisor, Ocean Drilling Program. The seismic data acquisition system and parameters are described below.

Source

Two 80-in.^{3} water guns (Seismic System Inc. or SSI) suspended from the fantail were used as the seismic source on the *JOIDES Resolution* during Leg 127. The water guns were synchronized within 1 ms and operated at approximately 1700–2000 psi. The towing depth of the sources was difficult to control and was about 8–12 m (Fig. 2). Shot interval was usually every 12 s.

Receiver

A 100-m-long Teledyne streamer containing 60 active sections was towed approximately 500 m behind the vessel (Fig. 2). A 25-m-long stretch section was put between the lead-in cable and the streamer cable. The towing depth was monitored by pressure sensors, but there was no attempt to control streamer depth except by the ship's speed or by the offset distance from the ship to active hydrophone section.

Seismic Data

Seismic data were displayed in real time in analog form, after amplification and band-pass filtering, on two Raytheon Line Scan Recorders. The summed signals from the hydrophones (60

[1] Tamaki, K., Pisciotto, K., Allan, J., et al., 1990. *Proc ODP, Init. Repts.*, 127: College Station, TX (Ocean Drilling Program).

[2] Shipboard Scientific Party is as given in the list of participants preceding the contents.

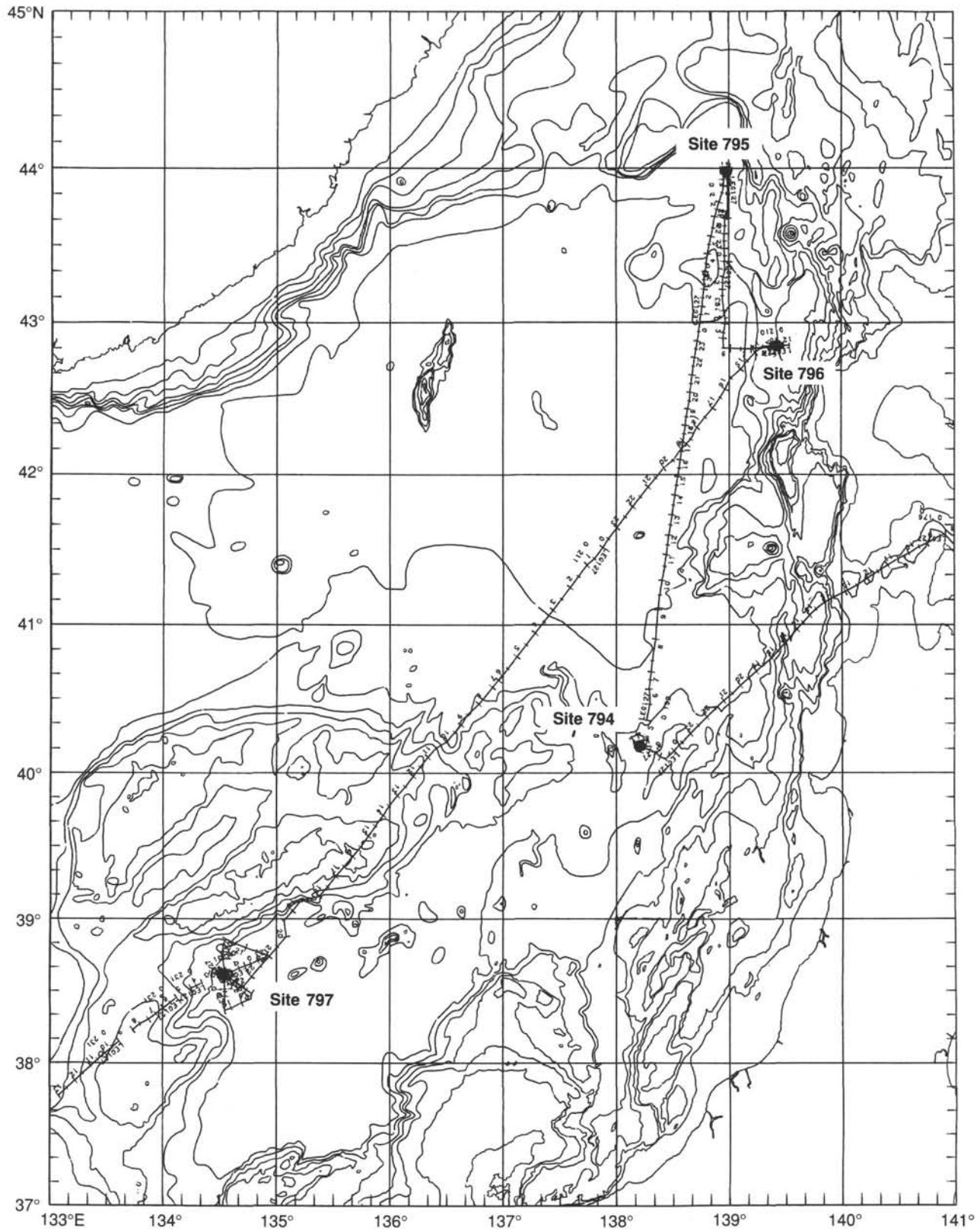

Figure 1A–D. Ship track lines for Leg 127.

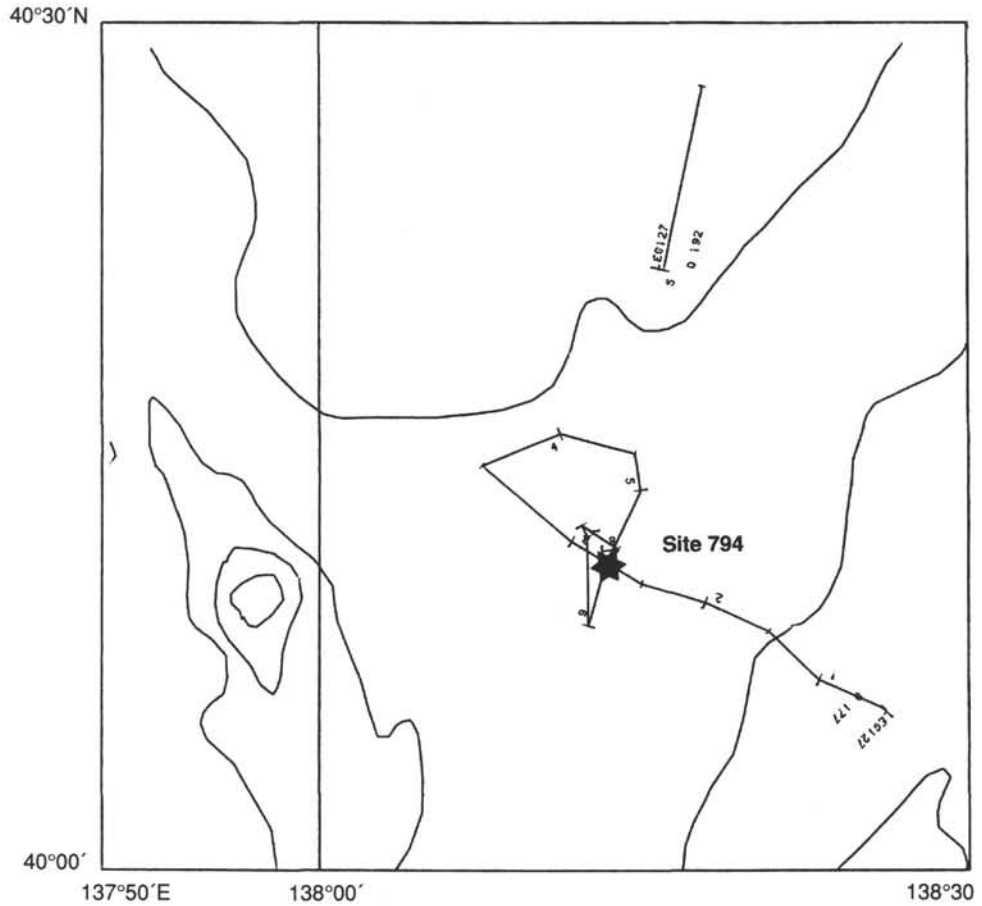

Figure 1 (continued).

active sections) were also recorded using a Masscomp 561 computer, which functions as the central unit to record, process, and display the data. Data were processed and displayed in real time on a 15-in.-wide Printronix high-resolution graphic printer (160 dots/in.). Raw data were filtered (25–250 Hz band-pass filtering) and then recorded on magnetic tape, using a SEG-Y digital tape format and a density of 1600 bits/in. Sampling length was usually 1 ms, and recording length was 5 s.

Processing

Digital seismic data were processed during this leg by SIOSEIS on a Masscomp computer and at the Ocean Research Institute, University of Tokyo, following the cruise. The basic processing sequences are as follows: (1) definition of geometry, (2) deconvolution filtering, (3) band-pass filtering, and (4) automatic gain control (AGC) before display. An example of a processed profile is shown in Figure 5.

SONOBUOY DATA

A Sonobuoy exploration was carried out during the Site 794 site survey. This survey used the same water gun sources (total 160-in.^{3}) as were used during the reflection seismic surveys. Two sonobuoys (Magnavox AN/SSQ-53B, operating at 136.0–173.5 MHz) were dropped on the extension of Line 794-1 (see "Operations" section, "Site 794" chapter, this volume). The depth of these sonobuoys was approximately 25 m. Signals from the sonobuoys were converted to normal FM broadcast band frequencies and then input into a high-frequency Realistic AM/FM stereo receiver. The data were displayed in real time in analog form on a Raytheon Line Scan Recorder.

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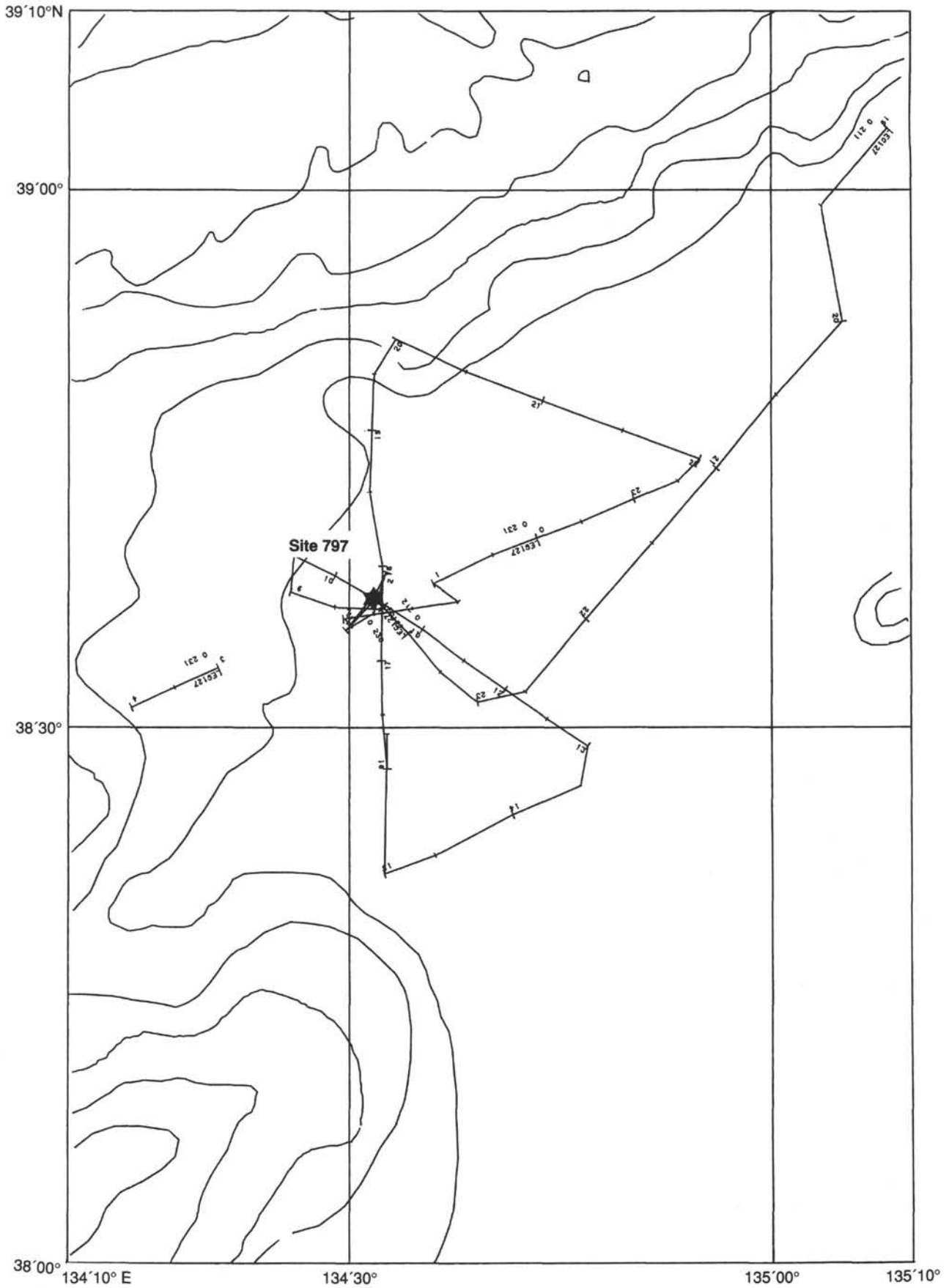

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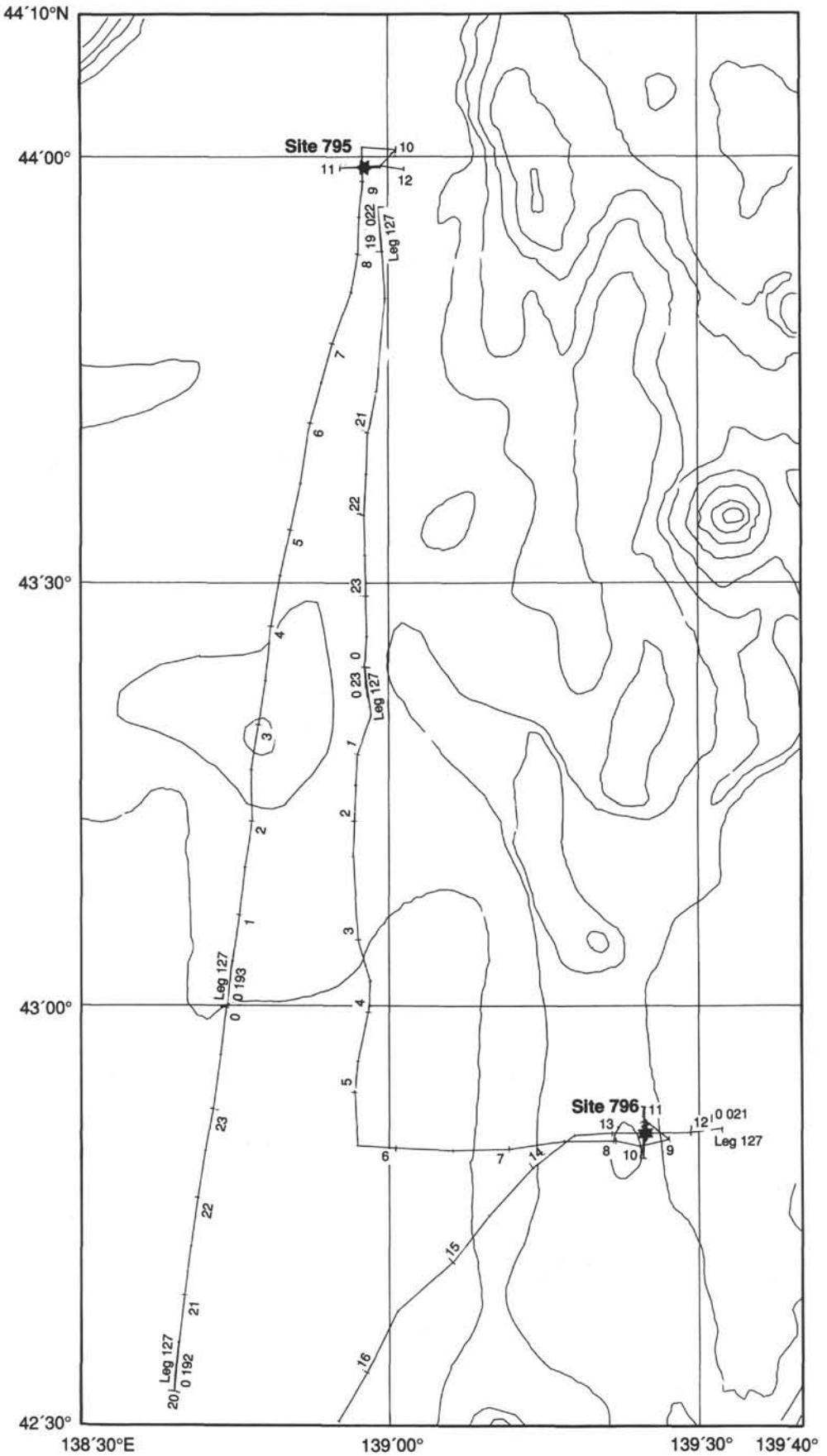

Figure 1 (continued).

Table 1. Summary of geophysical data configuration, *JOIDES Resolution*.

	Instruments		Remarks
Navigation data	GPS	Magnavox/1107 GPS	14 hr/day
	Loran C	Micrologic/COMMANDER	
Bathymetric data	12 kHz	Raytheon/CESP-III	Analog (LSR)
	3.5 kHz	Raytheon/CESP-III	Analog (LSR)
Magnetic data	Proton magnetometer	Geometrics/801	500 m astern
Seismic reflection data	Source	SSI/water gun	80-in.^{3} × 2, 1700–2000 psi
	Receiver	Teledyne exp/streamer	Length: 100 m 60 active sections
	Recorder	Masscomp, Raytheon	Format: SEG-Y
	Processing	SIOSEIS	on MASSCOMP 561
Sonobuoy data	Source	SSI/water gun	80-in.^{3} × 2, 1700–2000 psi
	Sonobuoy	Magnavox/AN/SSQ-53B	Operating frequency = 136.0–173.5 MHz, convert to FM signal

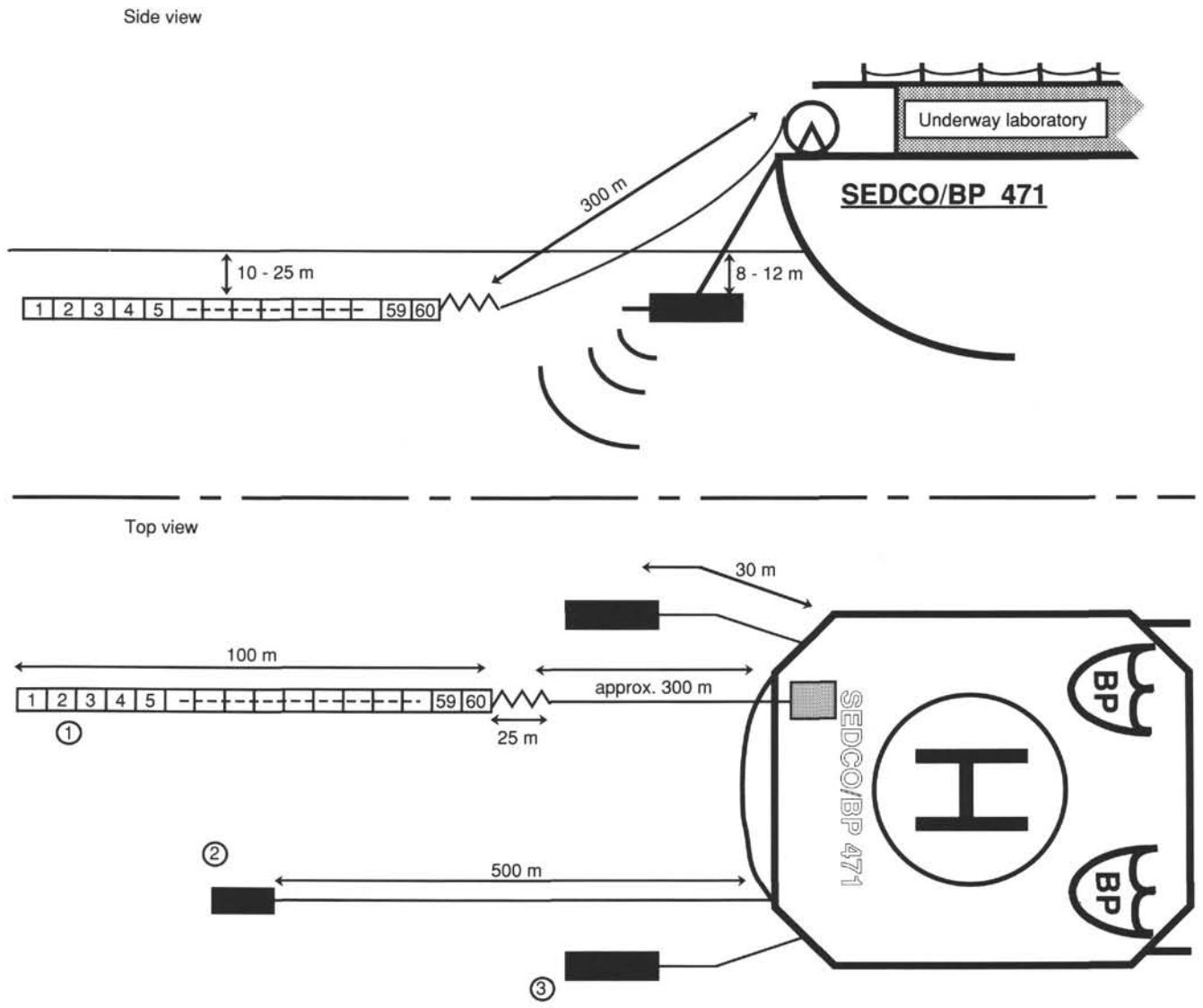

Figure 2. Schematic illustrations of underway geophysical survey by *JOIDES Resolution*. (1) Teledyne streamer cable which includes 60 active sections. (2) Geometrics 801 proton magnetometer. (3) SSI water gun.

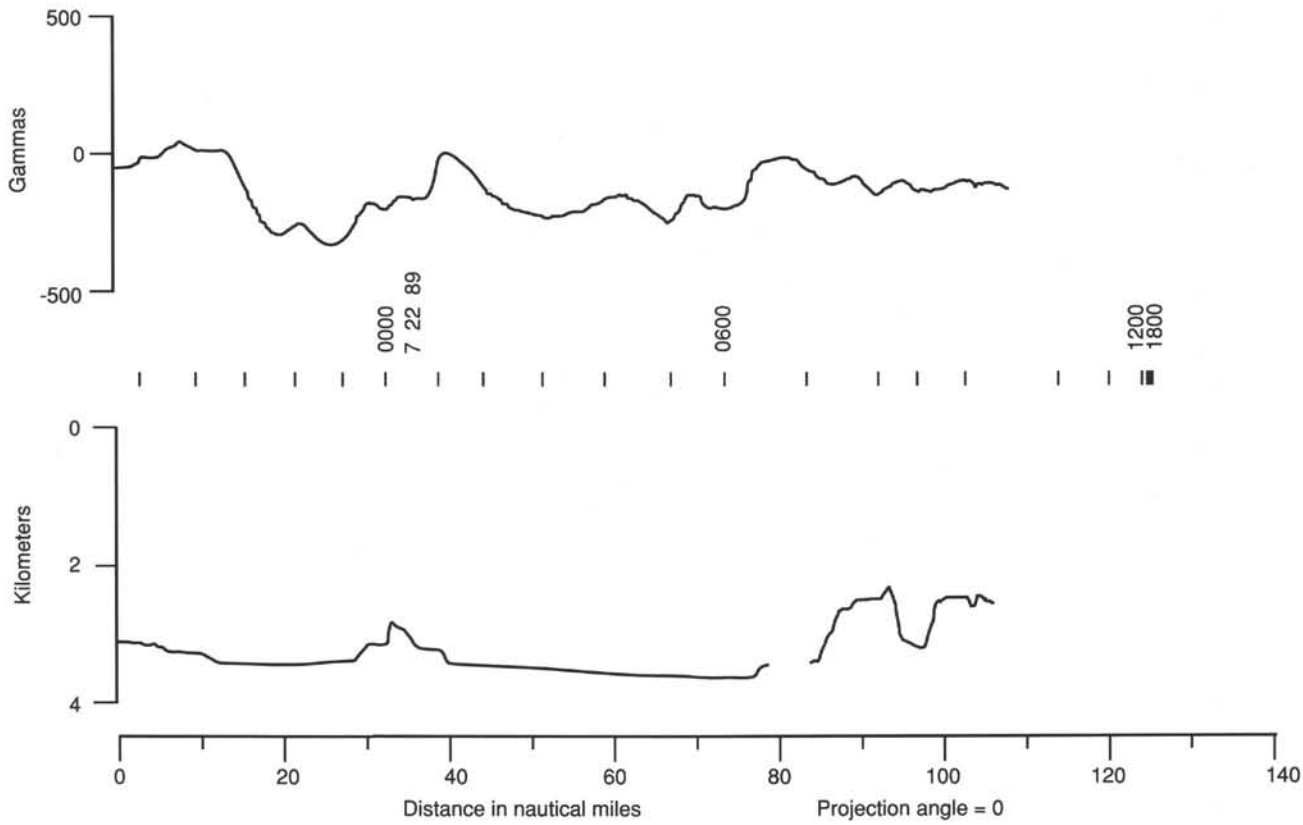

Figure 3. An example of a magnetic anomaly profile from Leg 127.

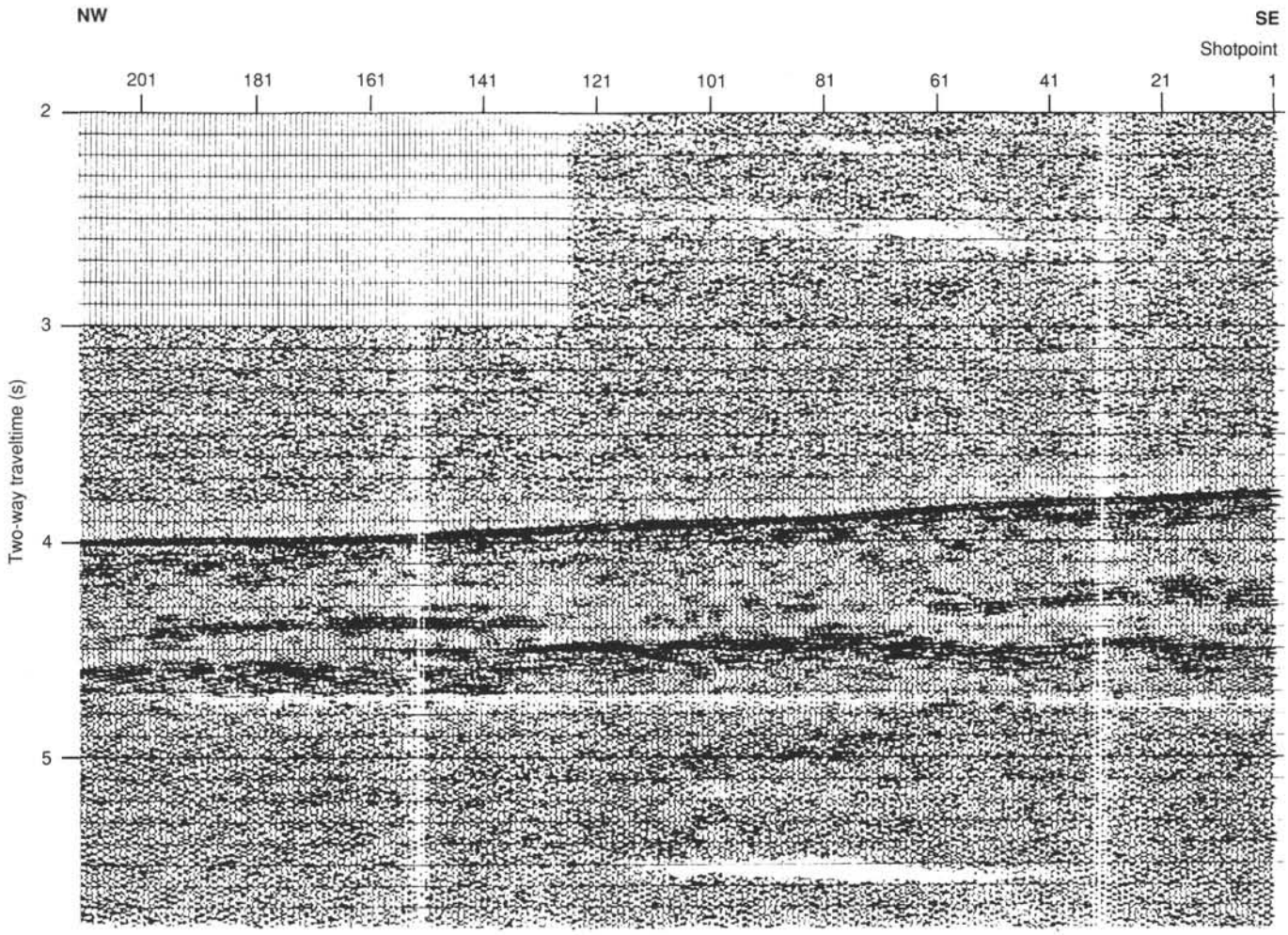

Figure 5. An example of a processed single-channel seismic profile of Line 794-1. This profile was processed by SIOSEIS on a Masscomp 561 computer at the Underway Geophysical Laboratory during Leg 127.