UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Mid-range sidescan-sonar data and high-resolution seismic-profile data from the U.S. Atlantic Continental Slope and Rise off New England, between long 67°15'W. to 70°55'W.

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS or BLM.

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Sidescan-sonar and high-resolution seismic-reflection data were acquired by the U.S. Geological Survey during R.V. GYRE cruise 81-G-12 from July 27 to August 17, 1981. The sonar survey covered an area of about 1,190 km^2 on the Continental Slope south of Martha's Vineyard, Massachusetts, bounded by 40°00'N., 39°35'N. and 70°10'W., 70°55'W. (fig. 1) in water depths between 250 and 2,200 m. A total of 375 km of data were acquired. The objective of the survey was to document submarine landforms interpreted to exist in this area on the basis of previous seismic surveys (Bailey and Aaron, 1982a,b).

Five tracks separated by about 5.5 km were run parallel to the slope. Each track represents the axis of an image swath 5 km wide. A track was run up Atlantis Canyon, and two tracks, spaced to provide about 2.5 km overlap, were run along Alvin Canyon.

The sonar system used was the International Submarine Technology, Ltd. (IST), Sea MARC (Mapping And Remote Characterization) I, owned and operated by Lamont-Doherty Geological Observatory. The Sea MARC fish, a neutrally bouyant vehicle tethered to a one-ton depressor, is towed approximately 300 m off the bottom at all times, producing a "draped" survey. A 4.5-kHz echo sounder was mounted on the fish to provide continuous bottom-profile record and ship-to-fish range. Ship speed was maintained at about 2 kn.

Sea MARC emits 1.7° horizontal beams at frequencies of 27 kHz and 30 kHz with a bandwidth of 5 kHz. The beam-depression angle is relatively large, so a back-scatter component from surface roughness has a strong influence on image gray tone patterns. Dark tones represent acoustic reflections; light tones represent acoustic shadow or forward scatter. Sea MARC has a dynamic range of 160 db, but because the electrostatic paper recorders used for analog display have only a 16-db range, signal returns were automatically classified according to 16 equal-interval density classes.

A slant-range correction to horizontal range was automatically performed. Each array of 1,024 pixels per side was collected during each 4-s sweep, then printed according to machine-calibrated range correction. Images were made nearly isometric by keeping range and azimuth distances nearly equal on the images during recording. This was accomplished by manually adjusting recorder chart speed to ship speed.

Navigation was maintained by 5-minute Loran-C fixes supplemented with satellite fixes. All annotated and recorded times were in Greenwich Mean Time (GMT).

The data include:

1. Processed sidescan images: recorded at a 4-s sweep. Data include port and starboard look directions, each with 2.5-km range, slant-range corrected, and nearly isometric along track. Grid lines parallel to track on the images represent 250-m spacing; grid lines perpendicular to track represent 15-minute time marks. Tracklines are numbered at beginning and end of each line. Time and date annotated every hour.

2. 4.5-kHz subbottom records: recorded at a 1-s sweep; grid lines parallel to track represent 10-m spacing; grid lines perpendicular to track represent 15-minute marks. Time and date annotated each hour. Reference

depth (depth below sea level) labeled frequently and at every scale change.

3. Ship's 3.5-kHz bottom profile: recorded at a 4-s sweep; grid lines perpendicular to track represent 15-minute marks: Time and date annotated each hour.

4. Ship's 3.5-kHz/sonar 4.5-kHz bottom profiles. Each profile recorded simultaneously on 2-channel recorder. 3.5-kHz profile recorded at a 1-s sweep; record marked in 150 m depth intervals; 4.5-kHz profile recorded transcribed at a 2-s sweep. Grid lines perpendicular to track represent 15-minute marks. Time and date annotated each hour.

5. Processed subbottom (4.5-kHz bottom profile)/processed sidescan images: Image and profile data recorded simultaneously on 2-channel recorder. Same annotations and characteristics as described in items 1 and 2.

Seismic-profile data were collected from August 9-14, 1981, seaward of Georges Bank on the upper Continental Rise between Lydonia and Oceanographer Canyons (fig. 2) in water depths greater than 2,100 m. The objectives of the survey were to extend existing geophysical coverage of the Continental Slope (Bailey and Aaron, 1982a,b; O'Leary, 1982) onto the upper rise in order to provide detailed geologic and geophysical data on the possible origin and evolution of submarine canyons and on sediment transport and other processes within the canyon domain. The survey area includes Bear Seamount, which allows the deposition pattern around the seamount to be evaluated.

Approximately 1,230 km of data were collected at a ship speed of approximately 6 knots (11 km/hr). Tracklines oriented parallel to the trend of the slope and rise were approximately 2 km apart; crossing dip lines were spaced between 4 and 10 km apart (fig. 2). All times given on the data and navigational plots are in GMT or Z.

Equipment included a 40-in^3 (655 x 10^{-6} m^3) airgun, 800-joule minisparker, and 3.5-kHz profiler. The seismic-reflection profiles collected using a 40-in^3 (655 x 10^{-6} m^3) airgun sound source and a 200-element hydrophone were recorded on strip charts at both 2-s and 4-s sweep rates. The 4-s sweep data were filtered at 30 to 200 Hz; the 2-s data were filtered at 60 to 200 Hz. Data from the 800-joule minisparker were filtered at 300 to 1,300 Hz and were recorded on a strip chart using a 1-s sweep. The profiles from a 3.5-kHz shallow-penetration seismic-reflection system with a hull-mounted transducer were also recorded on a strip chart with a 1-s sweep. The three types of profile data provide resolution of reflectors from the sea floor to a penetration of approximately 0.6 seconds.

The quality of the records is generally good, reflecting the favorable wind and sea conditions during the survey.

Original seismic and sidescan-sonar records may be viewed at the U.S. Geological Survey, Woods Hole, MA 02543. Microfilms or paper copies of the data and 1:50,000 scale track charts can be purchased only from the National Geophysical Data Center, NOAA/EDIS/NGDC, Code E64, 325 Broadway, Boulder, Colorado, 80303.

References Cited

Bailey, N. G., and Aaron, J. M., 1982a, High-resolution seismic reflection profiles from R/V Columbus Iselin CI7-78-2, over the Continental Shelf and Slope in the Georges Bank area: U.S. Geological Survey Open-File Report 82-607, 2 p.

_____ 1982b, High-resolution seismic reflection profiles from R/V James M. Gilliss Cruise GS-7903-3, over the Atlantic Continental Slope and Rise off New England: U.S. Geological Survey Open-File Report 82-718, 2 p.

O'Leary, D. W., 1982, Mid-range sidescan-sonar data from the Continental Slope off Georges Bank, between Lydonia and Oceanographer Canyons: U.S. Geological Survey Open-File Report 82-600, 3 p.

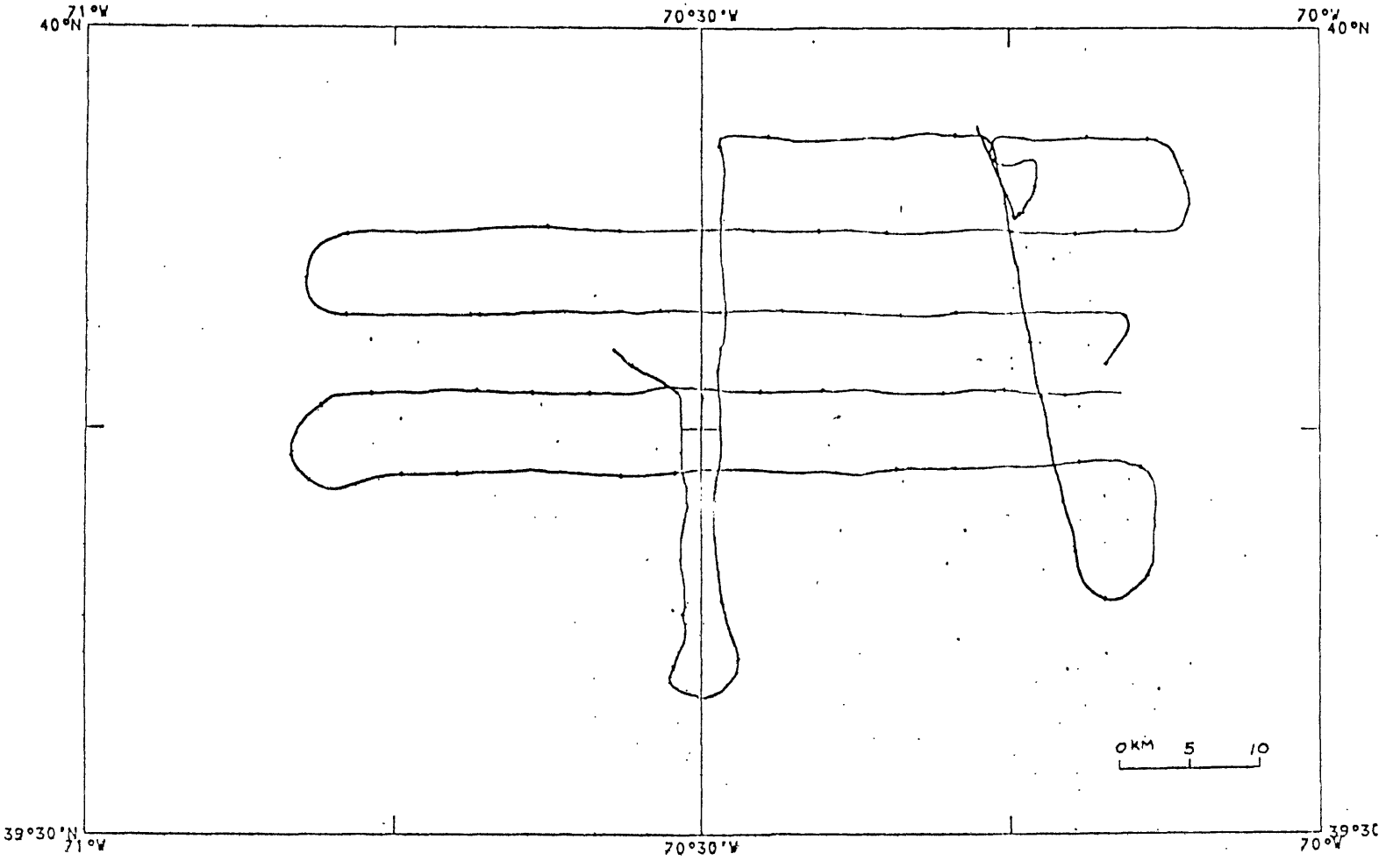

Figure 1. Trackline map of sidescan-sonar survey. Figures at hourly tick marks indicate year, month, day, hour, minute, second. First three figures recorded at 24-hour intervals.

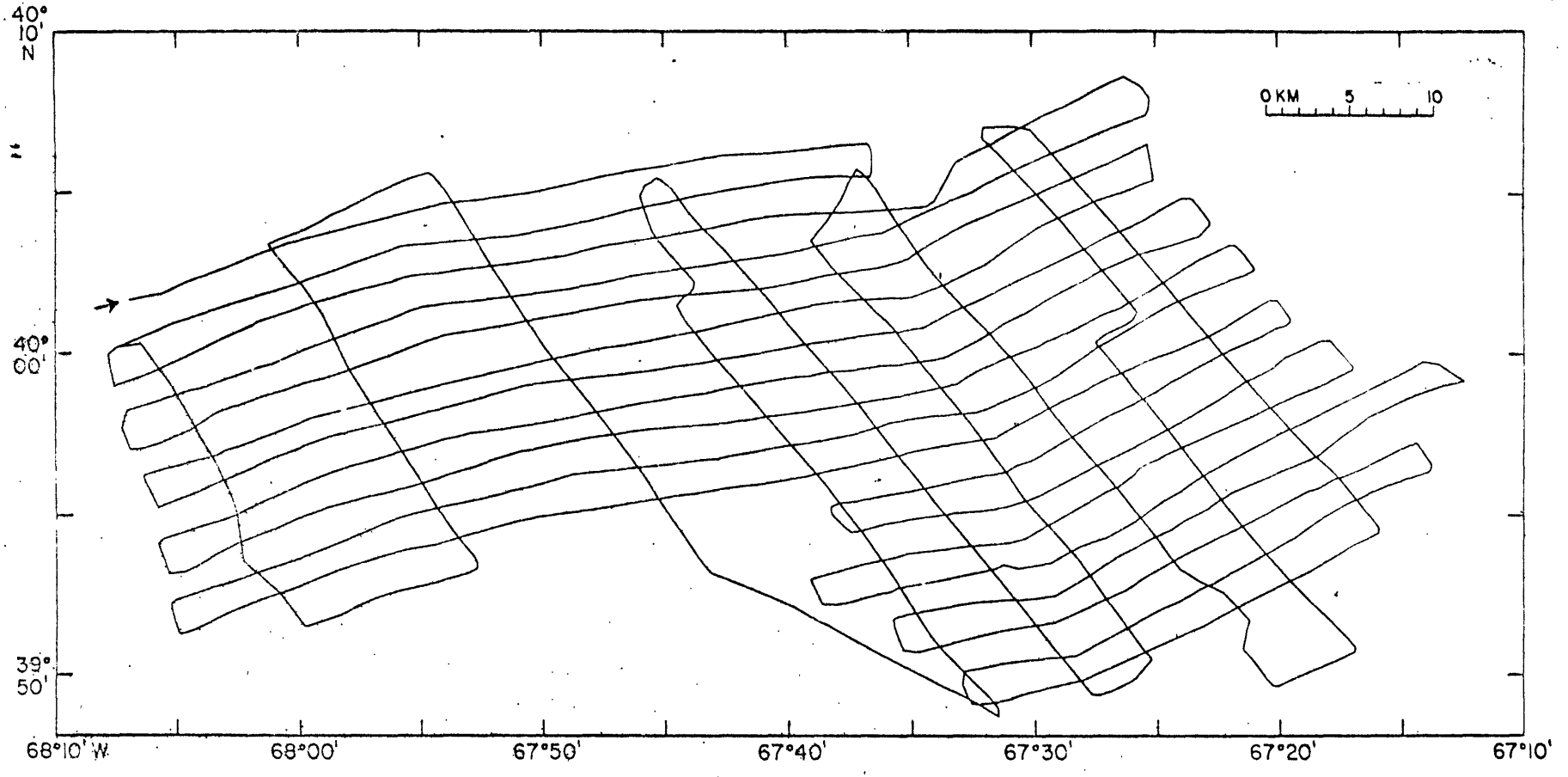

Figure 2. Trackline map of seismic-profile survey; arrow indicates start of line 1.