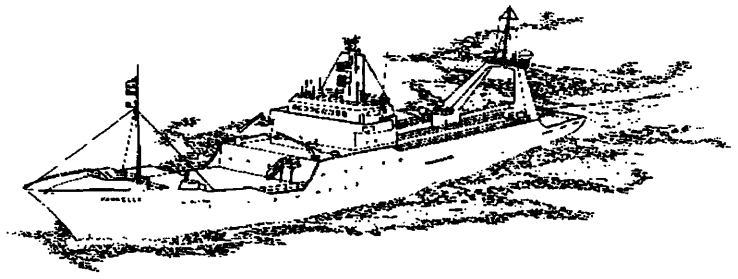
U.S. Department of the Interior

Geological Survey



Magnetic and bathymetric data from R/V FARNELLA cruises FRNL87-1, 87-2, 87-3, 87-4, and 87-5 in the U.S. Atlantic Margin EEZ, Southern Blake Escarpment, and Nova Scotia Continental Rise

David Lubinski [1]
John Hughes-Clarke [2]
William Dillon [1]
Dennis O'Leary [1]
Peter Popenoe [1]
James Robb [1]
Eric Schmuck [1]

Open-File Report 90-254

---

1. U.S Geological Survey, Branch of Atlantic Marine Geology, Woods Hole, MA 02543 USA.

2. Presently with: Department of Geology, James Cook University, Townsville, Queensland, Q4811 Australia.

1990

Magnetic and bathymetric data from R/V FARNELLA cruises FRNL87-1, 87-2, 87-3, 87-4, and 87-5 in the U.S. Atlantic Margin EEZ, Southern Blake Escarpment, and Nova Scotia Continental Rise

by
David Lubinski
John Hughes-Clarke
William Dillon
Dennis O'Leary
Peter Popenoe
James Robb
Eric Schmuck

During the winter and spring of 1987, the U.S. Geological Survey, in cooperation with the Institute of Oceanographic Sciences of the United Kingdom, collected approximately 31,350 line kilometers (km) of magnetic data and approximately 32,280 line km of bathymetric data in the U.S. Atlantic Margin Exclusive Economic Zone (EEZ), Southern Blake Escarpment, and Nova Scotia Rise (Fig. 1). Collected simultaneously with the magnetic and bathymetric data was a suite of geophysical data. These geophysical datasets will be released at a later date and include GLORIA (Geological LOng-Range Inclined Asdic) sidescan-sonar digital image data, 3.5 kilohertz (kHz) high-resolution sub-bottom profiler records, 10 kHz bottom profiler records from which bathymetric data were derived, and two channel seismic-reflection profiles. Survey line spacing was about 25 km in water depths exceeding 3,000 meters (m) and gradually decreased to less than 5 km in 200 m water depths. No areas were surveyed with depths shallower than 200 m. Orientation of the tracklines varies with respect to the trend of the bathymetric contours for each of the five legs (Fig.1).

Five cruises were conducted aboard R/V FARNELLA during 113 days at sea between 2 February and 28 May 1987. Leg 1 (2 February-27 February) covered the northern Blake Plateau, continental slope, and upper rise, acquiring 6,482 line km of bathymetric data and 5,556 line km of magnetic data (Fig. 2). Effort switched to the continental slope and upper rise between Cape Hatteras and Hudson Canyon for leg 2 (1 March-26 March) where 6,100 line km of both bathymetric and magnetic data were collected (Fig. 3). The third leg (28 March-25 April) surveyed the New England continental slope and rise and, in conjunction with the Geological Survey of Canada (John Hughes-Clarke, co-chief scientist) and the Canadian Hydrographic Service, covered a portion of the Nova Scotia continental rise, accumulating 10,042 line km of bathymetric and magnetic data (Fig. 4). Leg 4 (27 April-8 May) visited the continental rise off Cape Hatteras, acquiring 3,240 line km of bathymetric and magnetic data (Fig. 5). An additional 6,419 line km of bathymetric and magnetic data were collected over the Blake Plateau, Blake Escarpment, and Northeast Providence Channel during leg 5 (9 May-28 May) (Fig.6).

Primary navigation for legs 1, 2, 4, and 5 used a combination of Loran-C and satellite fixes, while leg 3 navigation exclusively utilized Loran-C fixes .

The magnetic data were collected using a proton-precession magnetometer towed approximately 150 m astern of the ship. The total magnetic field values were recorded in nanoteslas at two-minute intervals. The residual magnetic anomalies were later calculated using 1987 values of the International Geomagnetic Reference Field (IAGA, division I, working group 1, 1986).

A towed 10-kHz bottom profiler and a paper display were used to record bathymetric information. Conversion of echo travel time to uncorrected depth was made assuming a sound velocity in water of 1,500 m/s. Uncorrected depth was entered into a computer file at six-minute intervals, interpolated to two-minute values, and later merged with navigation data values. Depths were subsequently corrected using the Carter table/Carter area method (Carter, 1980).

A summary of the study areas, kilometers of data collected, cruise dates, ports, equipment, and methods used can be found in Tables 1 and 2. The magnetic tape data format is explained in Tables 3 and 4. The original data may be examined at the U.S. Geological Survey, Woods Hole, MA 02543. Magnetic tapes of the navigation, magnetic data, and digitized bathymetry can be purchased only from the **National Geophysical Data Center, 325 Broadway, Boulder, CO 80303, telephone (303) 497-6542**. Plots of residual magnetic anomaly/bathymetry along track, sidescan sonar imagery sheets, and reductions of seismic reflection airgun profiles for all five 1987 R/V FARNELLA cruises will be published in atlas form (EEZ-Scan '87 Scientific Group).

REFERENCES CITED

Carter, D.J.T., 1980, *Echo Sounding Correction Tables*: Hyrographic Department, Tauton, U.K. 150 p.

EEZ-Scan '87 Scientific Group, in press, *Atlas of the U.S. Atlantic Margin*: U.S. Geological Survey Misc. Investigation Series Atlas, I-2054.

IAGA Division I, Working Group 1, 1986, *International Geomagnetic Reference Field revision, 1985*: EOS, Transactions American Geophysical Union, v.67, no. 24.

TABLE 1

	FRNL87-1	FRNL87-2	FRNL87-3	FRNL87-4	FRNL87-5
Chief Scientist	Peter Popenoe David Twichell	James Robb John Schlee	Dennis O'Leary John Hughes-Clark (GSC[¤])	James Robb Peter Popenoe	William Dillon Kathryn Scanlon
Study Area	Northern Blake plateau, continental slope, and upper rise	Cape Hatteras to Hudson Canyon, continental slope, and upper rise	New England continental slope and rise, Nova Scotia rise	Offshore Cape Hatteras, continental rise	Blake Plateau, Blake Escarpment
Bathymetry (line km)	6,482	6,100	10,042 *	3,240	6,419
Magnetics (line km)	5,556	6,100	10,042 *	3,240	6,419
Departure Date	02/02/87	03/01/87	03/28/87	04/27/87	05/09/87
Departure Port	Jacksonville, FL	Norfolk, VA	Woods Hole, MA	Woods Hole, MA	Norfolk, VA
Arrival Date	02/27/87	03/26/87	04/25/87	05/08/87	05/28/87
Arrival Port	Norfolk, VA	Woods Hole, MA	Woods Hole, MA	Norfolk, VA	Nassau, Bahamas
Days at Sea[§]	26	26	29	12	20
Primary Navigation	Loran-C and satellite	Loran-C and satellite	Loran-C	Loran-C and satellite	Loran-C and satellite

* LEG 3 line kilometers: 6882 in U.S. EEZ , 3160 offshore Canada .
[¤] GSC= Geological Survey of Canada
[§] 113 total days at sea

TABLE 2

	BATHYMETRIC DATA (all five cruises)	MAGNETIC DATA (all five cruises)
Equipment	10 kHz bottom profiler bow-towed	proton precession magnetometer towed 150 m astern
Original Data	digitized from paper records	digital data
Correction Method	Carter Area	1987 IGRF anomalies
Total line km	32,283	31,357

TABLES 1 AND 2

A detailed summary of study areas, kilometers of data collected, cruise dates, ports, equipment, and methods used for R/V FARNELLA cruises FRNL87-1, 87-2, 87-3, 87-4, and 87-5 in the U.S. Atlantic Margin EEZ, Southern Blake Escarpment, and Nova Scotia Continental Rise.

TABLE 3

Sample Data:

```
         10        20        30        40        50        60        70
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345
-------------------------------------------------------------------------------------------------
FRNL87-2    870302 0710 36.7153  -74.6442              395  393 1053317  102
FRNL87-2    870302 0712 36.7196  -74.6427              395  393 1053319  100
FRNL87-2    870302 0714 36.7239  -74.6411              395  393 1053321   98
FRNL87-2    870302 0716 36.7282  -74.6396              395  393 1053323   95
FRNL87-2    870302 0718 36.7324  -74.6831              395  463 1053325   94
```

TABLE 4

Field Location	Field Description
1-11	Ship and Cruise Identification
15-16	Year
17-18	Month
19-20	Day
22-23	Hour (Greenwich Mean Time)
24-25	Minutes
27-33	Latitude (decimal degrees: xx.xxxx) north latitude is positive
35-42	Longitude (decimal degrees: -xx.xxxx) west longitude is negative
53-57	Uncorrected Depth (meters)
58-62	Corrected Depth (meters)
63-65	Carter Area
66-70	Total Magnetic Intensity (nanoteslas)
71-75	Residual Magnetic Intensity (nanoteslas)

TABLES 3 AND 4 Data format on magnetic tape for R/V FARNELLA cruises FRNL87-1, 87-2, 87-3, 87-4, and 87-5 in the U.S. Atlantic Margin EEZ, Southern Blake Escarpment, and Nova Scotia continental rise (USGS Branch of Atlantic Marine Geology MERGED-MERGED3 format).

Numbers are character spaces for each data field in a single record. Space between fields is occupied by whitespace or dashes and is not consistent throughout file.

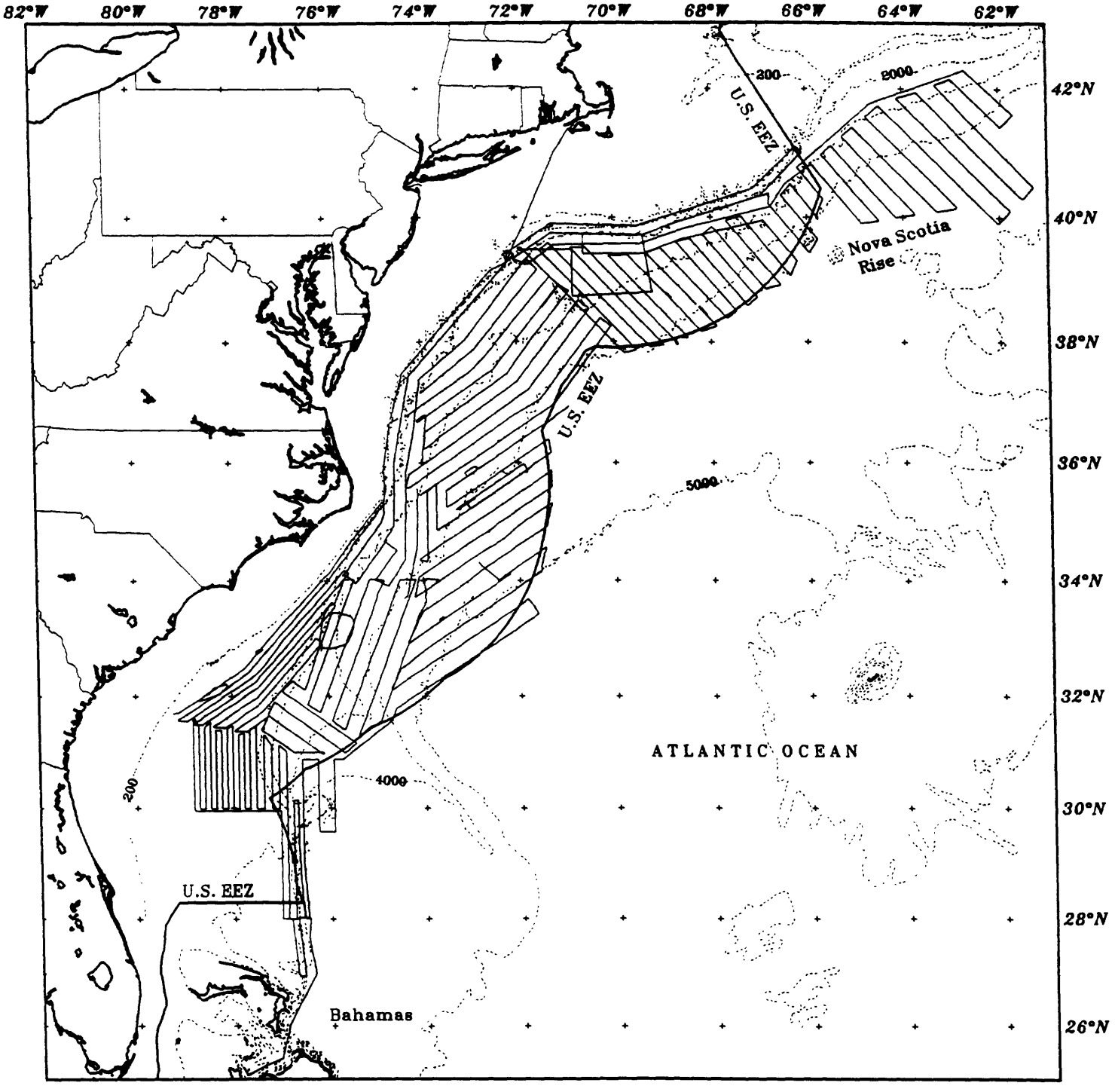


FIGURE 1 Trackline map for R/V Farnella cruises FRNL87-1, 87-2, 87-3, 87-4, and 87-5 in the U.S. Atlantic Margin EEZ, Southern Blake Escarpment, and Nova Scotia Continental Rise. Thin solid lines represent the ship's track along which magnetic and bathymetric data were collected. Thick solid line represents the U.S. Exclusive Economic Zone boundary. Dashed lines are bathymetric contours in meters (200, 1000, 2000, 3000, 4000, and 5000 meters).

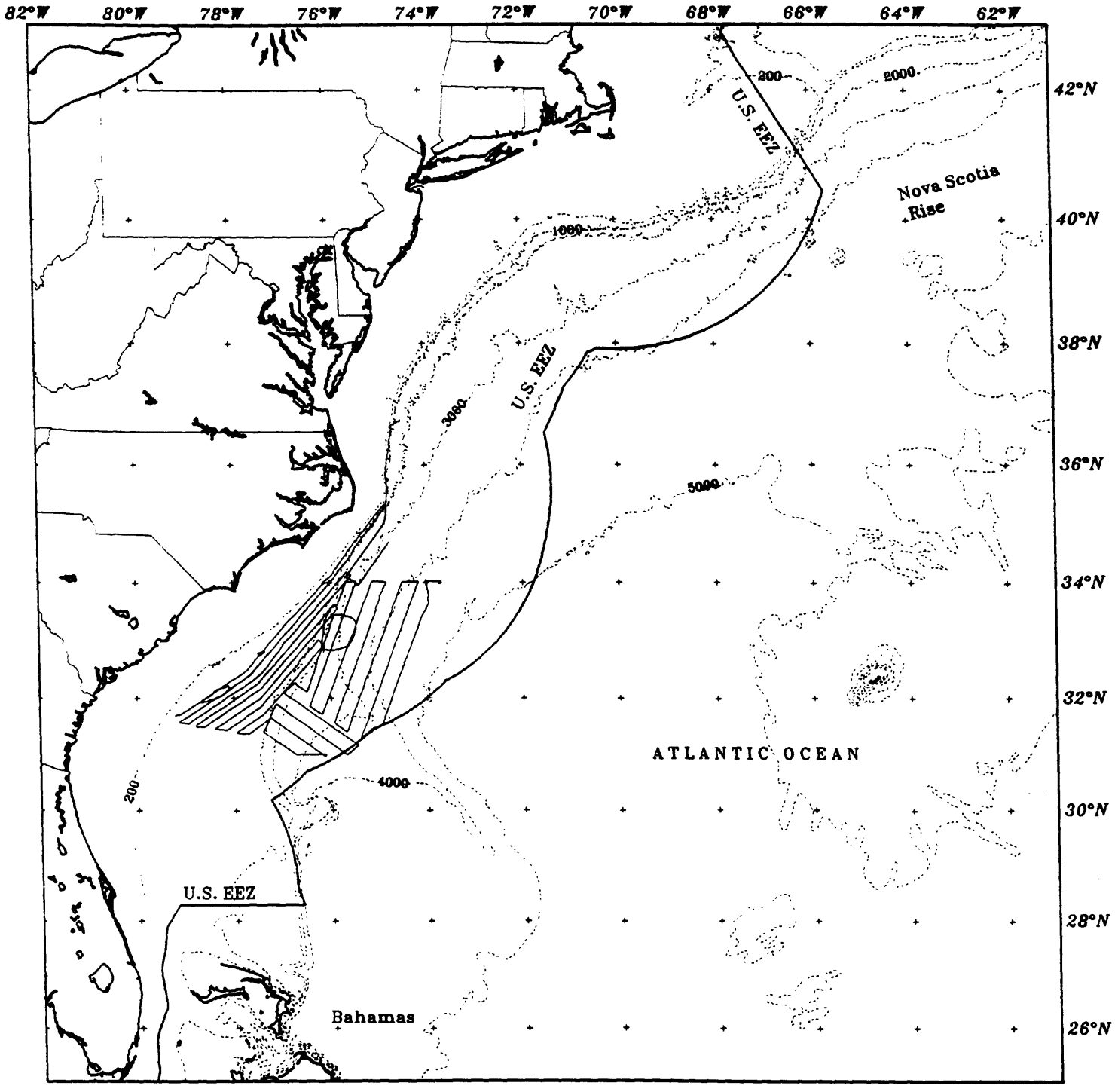


FIGURE 2 Trackline map for R/V Farnella cruise FRNL87-1 in the U.S. Atlantic Margin EEZ. Thin solid lines represent the ship's track along which magnetic and bathymetric data were collected. Thick solid line represents the U.S. Exclusive Economic Zone boundary. Dashed lines are bathymetric contours in meters (200, 1000, 2000, 3000, 4000, and 5000 meters).

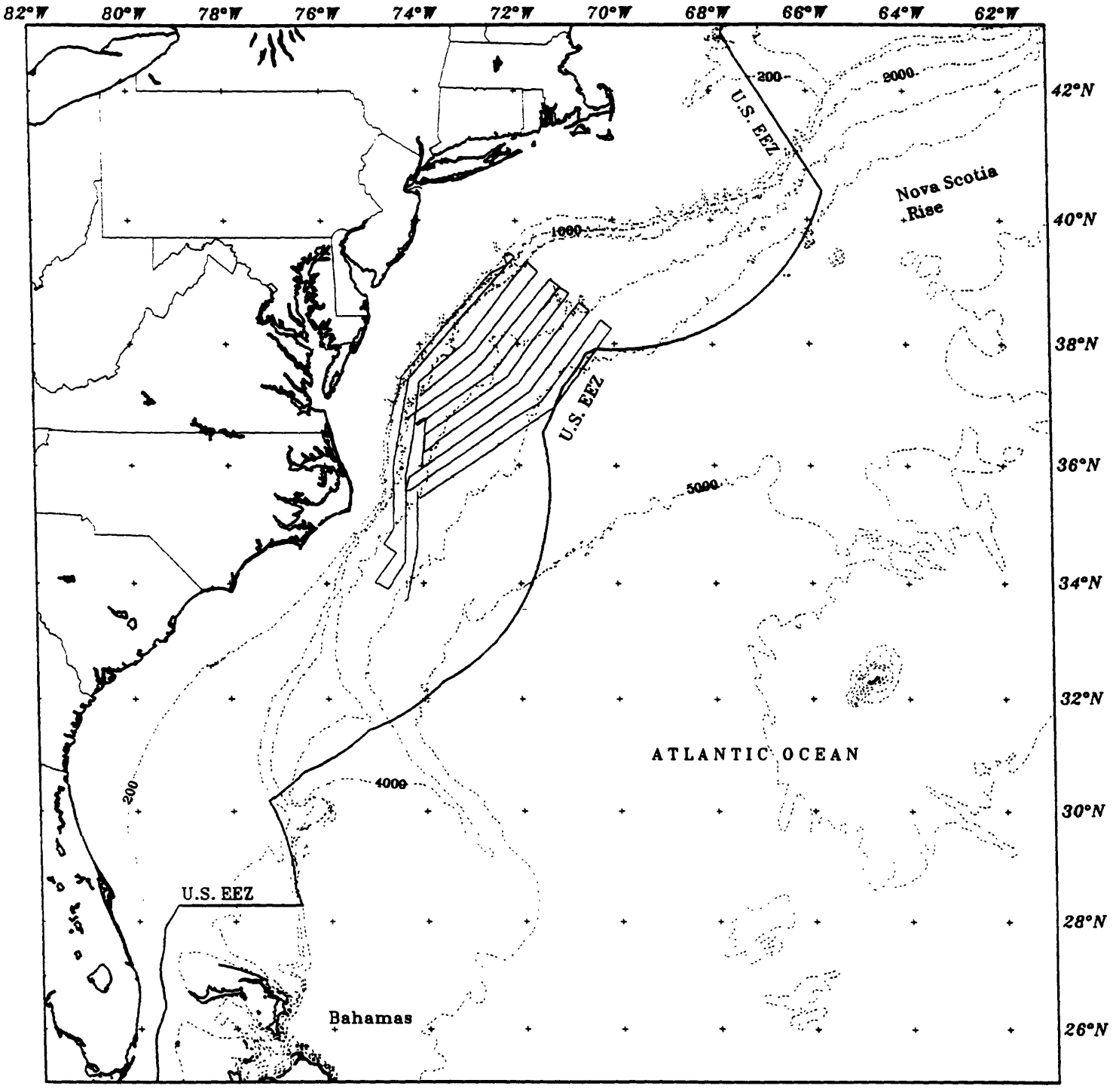


FIGURE 3 Trackline map for R/V Farnella cruise FRNL87-2 in the U.S. Atlantic Margin EEZ. Thin solid lines represent the ship's track along which magnetic and bathymetric data were collected. Thick solid line represents the U.S. Exclusive Economic Zone boundary. Dashed lines are bathymetric contours in meters (200, 1000, 2000, 3000, 4000, and 5000 meters).

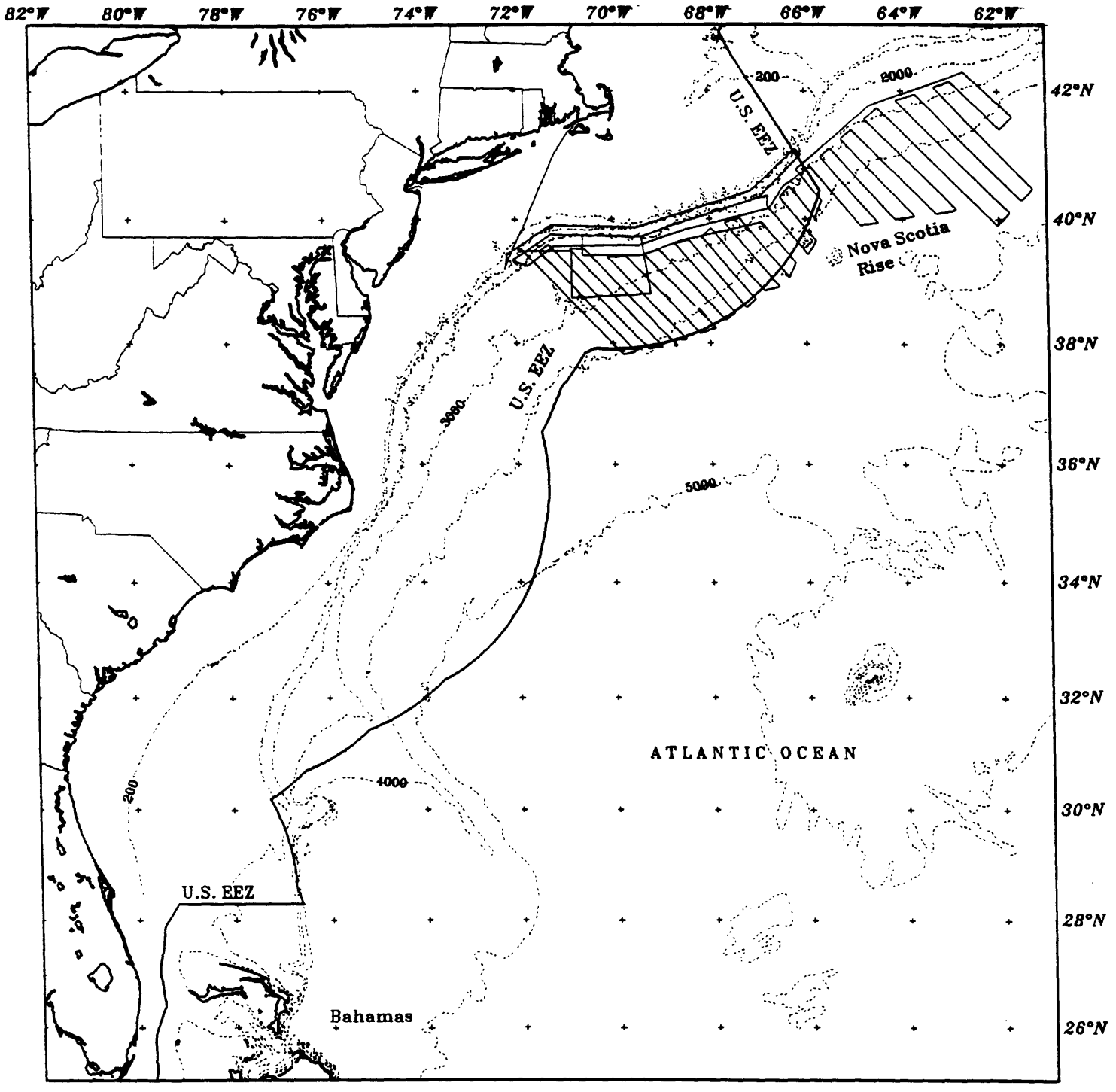


FIGURE 4 Trackline map for R/V Farnella cruise FRNL87-3 in the U.S. Atlantic Margin EEZ and Nova Scotia Continental Rise. Thin solid lines represent the ship's track along which magnetic and bathymetric data were collected. Thick solid line represents the U.S. Exclusive Economic Zone boundary. Dashed lines are bathymetric contours in meters (200, 1000, 2000, 3000, 4000, and 5000 meters).

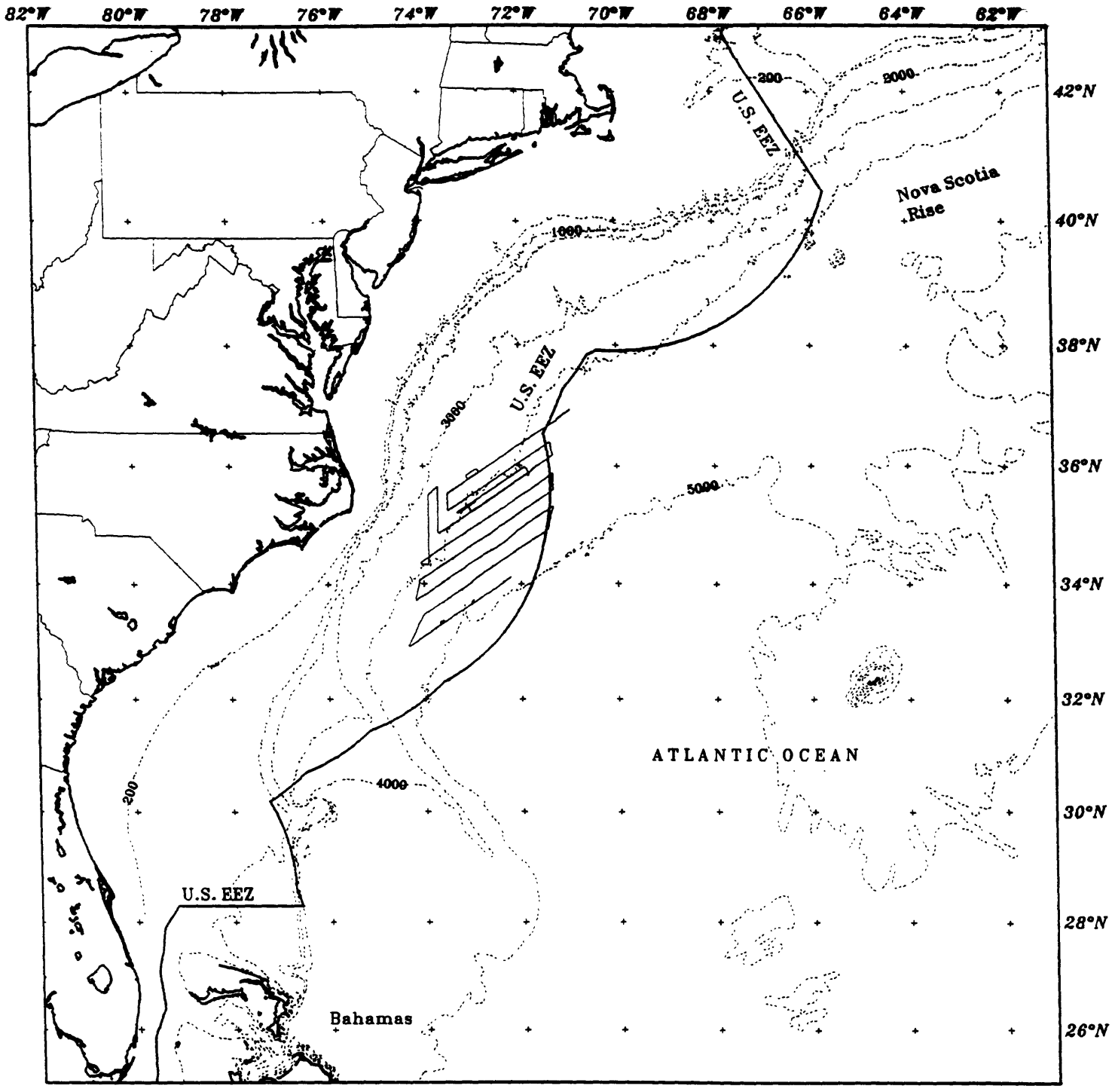


FIGURE 5 Trackline map for R/V Farnella cruise FRNL87-4 in the U.S. Atlantic Margin EEZ. Thin solid lines represent the ship's track along which magnetic and bathymetric data were collected. Thick solid line represents the U.S. Exclusive Economic Zone Boundary. Dashed lines are bathymetric contours in meters (200, 1000, 2000, 3000, 4000, and 5000 meters).

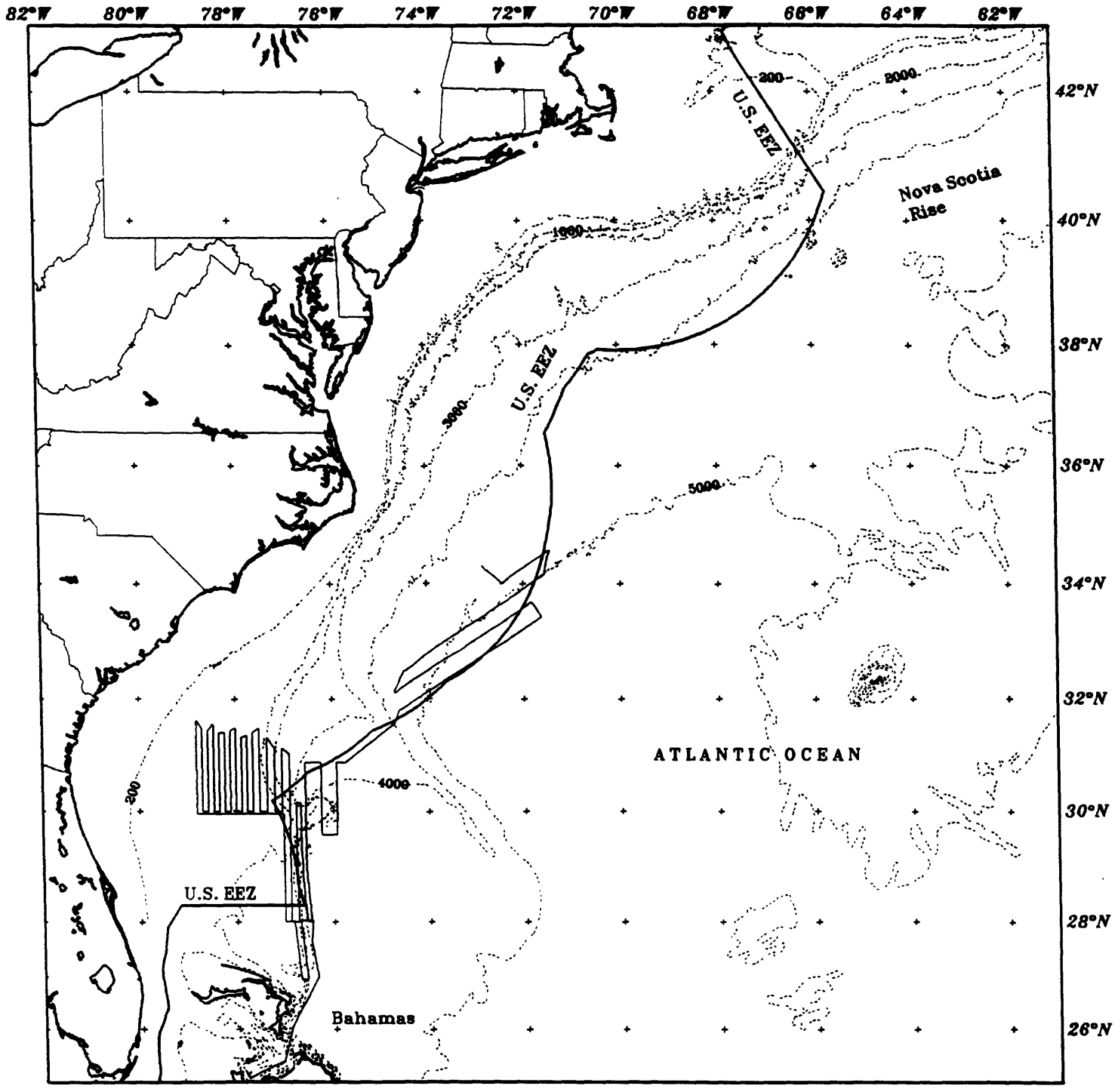


FIGURE 6 Trackline map for R/V Farnella cruise FRNL87-5 in the U.S. Atlantic Margin EEZ and Southern Blake Escarpment. Thin solid lines represent the ship's track along which magnetic and bathymetric data were collected. Thick solid line represents the U.S. Exclusive Economic Zone boundary. Dashed lines are bathymetric contours in meters (200, 1000, 2000, 3000, 4000, and 5000 meters).