Cruise Report for GYRE 81-G-13

by

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A multichannel seismic reflection survey of the outer continental shelf, slope, and rise of Georges Bank and the Long Island shelf, west of Nantucket Shoals, was carried out from 22 August 1981 to 13 September 1981 by the Atlantic - Gulf of Mexico Branch, Office of Marine Geology, U.S. Geological Survey (USGS) aboard the R.V. GYRE of Texas A & M University. The survey was part of the framework studies for the Resource Assessment Program of the Office of Marine Geology. The R.V.GYRE, under the command of Captain James Ilse, left the Woods Hole Oceanographic Institution (WHOI) Marine facilities at 1730z (1330h local) 22 August 1981 to survey the buried paleoshelf edge alone the south side of Georges Bank between 72°W and 67°W. It returned to Woods Hole at 2325z (1925h local) 3 September 1981 to replace the USGS multichannel streamer which had been lost as a result of bad weather from Tropical Storm Emily. The ship departed Woods Hole again at 1245z (0845h local) 8 September 1981 with the WHOI multichannel seismic streamer to survey buried grabens just south of Marthas Vineyard and Long Island, returning to Woods Hole at 1600z (1200h local) 13 September 1981.

Scientific Personnel

The scientific party aboard the R.V. GYRE was composed entirely of U.S. Geological Survey personnel, with Kim D. Klitgord as Chief Scientist and John S. Schlee as co-Chief Scientist.

SCIENTIFIC PERSONNEL - GYRE 81-G-13

1.	Kim D. Klitgord	Chief Scientist	U.S.G.S. - OMG - Woods Hole
2.	John S. Schlee	Geologist	U.S.G.S. - OMG - Woods Hole
3.	David W. Folger	Geologist	U.S.G.S. - OMG - Woods Hole
4.	Robin Bell	Geologist	U.S.G.S. - OMG - Woods Hole
5.	Ann Swift	Geologist	U.S.G.S. - OMG - Woods Hole
6.	Betsy Coward	Geologist	U.S.G.S. - OMG - Woods Hole
7.	Nick Zihlman*	Geologist	U.S.G.S. - OER - Reston
8.	Deborah Hutchinson**	Geologist	U.S.G.S. - OMG - Woods Hole
9.	David Nichols	Seismic Tech.	U.S.G.S. - OMG - Woods Hole
10.	Gregg Miller	Seismic Tech.	U.S.G.S. - OMG - Woods Hole
11.	Jack Connell	Seismic Tech.	U.S.G.S. - OMG - Woods Hole
12.	David Mason	Airgun Tech.	U.S.G.S. - OMG - Woods Hole
13.	Paul Bowker	Airgun Tech.	U.S.G.S. - OMG - Woods Hole
14.	Jim Dodd	Navigation Tech.	U.S.G.S. - OMG - Woods Hole
15.	Robert Douthart*	Navigation Tech.	U.S.G.S. - OMG - Woods Hole
16.	Barry Irwin**	Navigation Tech.	U.S.G.S. - OMG - Woods Hole

OMG - Office of Marine Geology - Atlantic-Gulf of Mexico Branch

OER - Office of Energy Resource - Oil and Gas Branch

* - Left the ship September 3, 1981

** - Joined the ship Septmeber 8, 1981

Cruise Objectives

The primary purpose of the cruise was to survey the bruied paleoshelf edge along the south side of Georges Bank. The shelf edge during the Jurassic and Early Cretaceous was buried by younger sedimentary rock and has been considered one of the regions of significant hydrocarbon potential [Uchupi et al., 1977; Grow et al., 1979; Schlee et al., 1979; Mattick et al., 1981]. The multichannel seismic-reflection profiles collected on GYRE 81-G-13 were spaced between existing multichannel lines (Figure 1) to enhance our ability to locate the paleoshelf edge (Figure 2) and to trace deep-sea stratigraphic units [Klitgord and Grow, 1980] landward to the paleoshelf edge. A short survey was made of a buried ridge that parallels Hudson Canyon along its northeast side (Figure 3) and may control the location of the Canyon.

The second objective of the cruise was to survey the buried grabens along the north side of Georges Bank and south of Marthas Vineyard and Long Island [Klitgord and Behrendt, 1979; Klitgord et al., 1982]. These grabens are located along the landward edge of the main sedimentary basins and are thought to be Late Traissic or Early Jurassic in age. The sediment cover is thin (less than 4 km thick) and the grabens have a northeast orientation (040°) parallel to the landward edge of the marginal basins. Because of the loss of the seismic streamer, the Georges Bank part of this survey was not carried out. There is a large graben (Figure 4), which passes between Marthas Vineyard and Nantucket, that was crossed four times on the cruise. Two long profiles were acquired south of Long Island, crossing several buried grabens, including one, at the western end of the survey, which may be the seaward extension of the Connecticut Valley Late Triassic - Early Jurrasic Graben.

Magnetic anomaly and Gravity anomaly data were acquired on all profiles to aid in interpreting basement structures. The grabens are often bordered by

magnetic and gravity highs, with magnetic lows over the basement lows [Klitgord et al., 1982]. A small magnetic high is located over the basement ridge along the northeast side of Hudson Canyon, suggesting a weekly magnetized body.

Navigation and Data Logging

A Western Geophysical Integrated Navigation-Gravity System (WINGS), provided the primary navigation for the cruise. The navigational information from a Northstar 6000 LORAN-C (Rho-Rho and Hyperbolic) receiver, a Magnovox satellite receiver, and a Sperry SRD301 speed log and Sperry Mark 29 gyro were recorded on 7-track tape along with the magnetic and gravity data. This same system was used to fire the airguns, as well as logging shotpoint numbers, time, and position on magnetic tape.

Scientific Equipment

Seismic reflection data was acquired using a 540 cu. in. airgun with wave shaper, a SEI 12-channel receiver, and a DFS-V recording system. The airgun was fired every 50m, a repetition rate of about 20 seconds. The 12-channel receiver was a 1200m streamer with 12 - 50m active sections alternated with 12 - 50m inactive sections, starting with a 50m stretch section. There was 500′ (152m) of lead-in cable, the 50m stretch section and a 50m inactive section before the first active section. With the airgun 50′ (15m) behind the ship, the offset (to the middle of the first active receiver) was ~262m (152m - 15m + 50m +50m +25m). When the WHOI, SEI multichannel streamer was used, there were only 10 active sections and 10 dead sections, with no stretch section. A 460′ (140m) lead in cable and 50′ (15m) airgun cable were used for a 200m offset to the middle of the first receiver section. The seismic data were recorded in digital form on 7-track tape in SEG-Y format at a 2 millisecond sample rate using a DFS-V recording system. A 5-second and later a 6-second

length was recorded, using a variable delay to avoid recording travel time through the water column.

A hull-mounted, 3.5 kHz seismic system was used in addition to the multichannel seismic system. Variable quality subbottom penetration was acquired with this system.

A Geometrics magnetometer was towed for the entire cruise. The data quality was very poor during the first two days, with a high noise level from the cable. A better signal-to-noise ratio was achieved after cleaning and taping all the connectors in the cable between the sensor bottle and the recording unit, but there still remained a 1 or 2 nT noise level.

Two gravity systems were used on the GYRE: a Bell Model XI pendulous accelerometer Gravity System on a Sperry Mark-29 Gyroscope platform, and a LaCoste-Romberg two-component gravity system on loan from the U.S. Navy.

Cruise Narrative

The GYRE left Woods Hole at 1730z, 22 August 1981 heading southwest to start the first multichannel line on cruise 81-G-13 (Figure 5) across the western end of the Georges Bank shelf edge. Poor weather was enountered as soon as we passed south of Marthas Vineyard, and it did not improve for about 2 days. Multichannel seismic (MCS) Line #1 started at 39° 56'N, 71° 51'W on a heading of 150°. Because of rough seas, the line had to be abandoned after only 6 hours and we turned east to pick up the southern part of MCS Line #2, which we completed to its southern end. We ran a short survey (Line 1B) with three passes across Hudson Canyon to map the buried ridge located along the northeast side of the canyon. On the second crossing of the ridge, basement reached a depth that was shallower than the base of the adjacent seafloor canyon. The southern part of Line #1 was then shot, not quite reaching as far

north as the point at which we had stopped previously; we then headed east to pick up the northern half of Line #2. Lines 3 through 7 were run without any problems and with improved weather. During Line #5 the magnetometer was fixed, with a significant reduction in noise after cleaning and taping all cable connections. Data quality was dubious prior to this point for the magnetometer.

By Line #8 we had moved eastward as far as the main fishing area and lost over 3 hours avoiding fishing boats before being able to begin Line #8. We had to do some maneuvering on Line #9 to avoid buoys. On Line #10 the recording length on the DFS-V was increased from 5 seconds to 6 seconds to ensure recording basement. On line #12 we made a dog-leg to cross two buried basement highs. On Line #13 we crossed Bear Seamount. On Line #16 we crossed a buried basement high. As we started running Line #17, which crossed Oceanographer and Lydonia Canyons, we became surrounded by Japanese long-line fishing boats and had to do considerable maneuvering to avoid a maze of buoys and ships. Line #17 had several dog-legs along the landward side of the Georges Bank shelf edge and we had to avoid other seismic crews as well as the fishing boats. We had to bring the seismic steamer back on board at the end of Line #17 because several acoustic channels were working poorly. One of the inactive sections was badly sliced, probably as a result of our tangle with a Japanese long line, and it had to be replaced.

Line #18 headed south towards the New England Seamounts as Tropical Storm Emily headed north towards us. Weather was expected to get worse so we planned to complete Line #18 and turn north across Geroges Bank into the Gulf of Maine until Emily passed to the east. Unfortunately the streamer was lost after 11 hours on Line #18. The next 12 hours were spent searching for the lost streamer, but we finally had to depart the area because Emily was closing

on us rapidly and it was getting too rough to search further. Examination of the clean break on the streamer suggested it might have been caused by a shark bite. It is also possible that our encounter with the Japanese long lines had also sliced more than the one section, and the weakened section had failed as the seas increased. The GYRE returned to port at 2300z 3 September 1981 to pick up the WHOI multichannel receiver.

The GYRE left Woods Hole again at 1245z 8 September 1981 with a ten-channel streamer, borrowed from WHOI to start a survey of the buried grabens south of Marthas Vineyard and Long Island. Line #19 was just south of Marthas Vineyard and it ended short of Nantucket Shoals to avoid a field of lobster pots. Line #20 also terminated early to avoid lobster pots, and the seismic gear was pulled onboard as we steamed south to Line #21. Line #21 was terminated early to avoid the main ship traffic lane and 5 hours were lost trying to get onto line #22 while avoiding the main traffic lane. Line #22 was the southern most line across the Nantucket grabens. Line #23 was uneventful, running along the length of the shelf south of Long Island and crossing at its western end the main New York north-south ship traffic lane. Line #24 was parallel to Line #23, and Line #25 ran north to the eastern end of Long Island where the survey was terminated. The GYRE returned to Woods Hole at 1600z 13 September 1981 for the end of GYRE 81-G-13.

The GYRE was at sea for about 18 days. During that time we collected 3100km of gravity data, and 2350 km of magnetic, bathymetric, 3.5 kHz seismic reflection, and multichannel seismic reflection data.

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Acknowledgements

The success of the cruise was due, in a large part, to the able cooperation of the ship's crew and expertise of the technical ataff in the scientific party. The acquisition of multichannel seismic reflection profiles was possible because of a smoothly operating airgun system, under the supervision of D. Mason, and seismic acquisition system under the supervision of D. Nichols. Long hours were spent on the system by them and the rest of the technical staff, at sea and ashore. The efforts of the navigation staff and the seismic watch standers were also outstanding and greatly appreciated. The generous loan of the WHOI multichannel seismic streamer and the assistance of T. O'Brien are gratefully acknowledge.

Figure Captions

Figure 1: Tectonic map of the Long Island shelf - Georges Bank region showing buried structures crossed by GYRE 81-G-13. Existing multichannel seismic lines and GYRE 81-G-13 lines are indicated.

Figure 2: Seismic record from CDP Line #5 across the paleoshelf edge south of Nantucket. See figure 1 for location.

Figure 3: Seismic record from Line 1b across buried basement ridge that is located along the northeast side of Hudson Canyon. See Figure 1 for location.

Figure 4: Seismic record from CDP Line #5 across buried graben that trends to the northeast between Marthas Vineyard and Nantucket. See Figure 1 for location.

Figure 5: Track chart for GYRE 81-G-13 with hour tics and anotations every 12 hours. The line numbers are indicated within circles.

GYRE 81-G-13 AUG.-SEPT. 1981

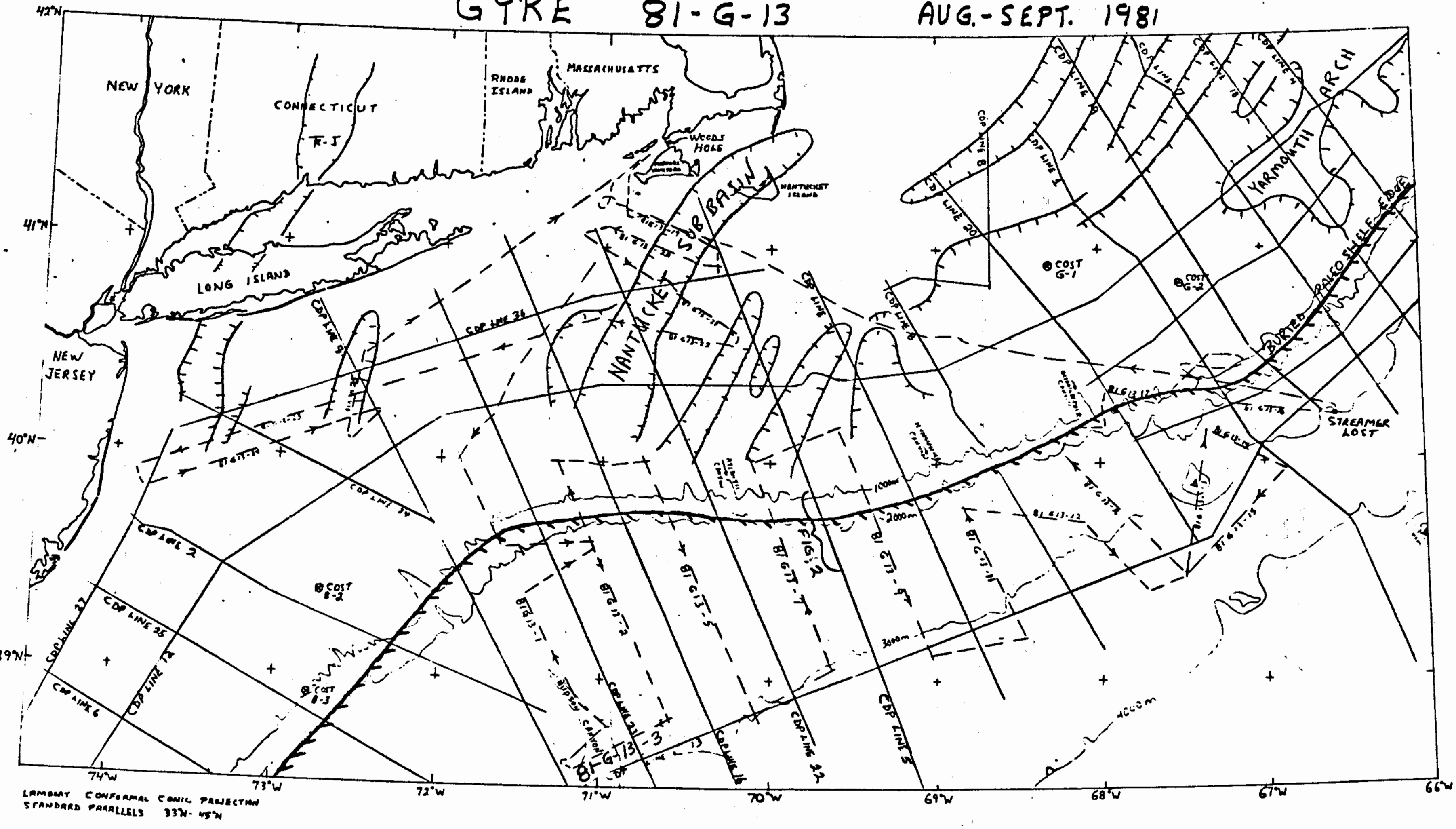


FIGURE 1

CDP SEISMIC LINE 5

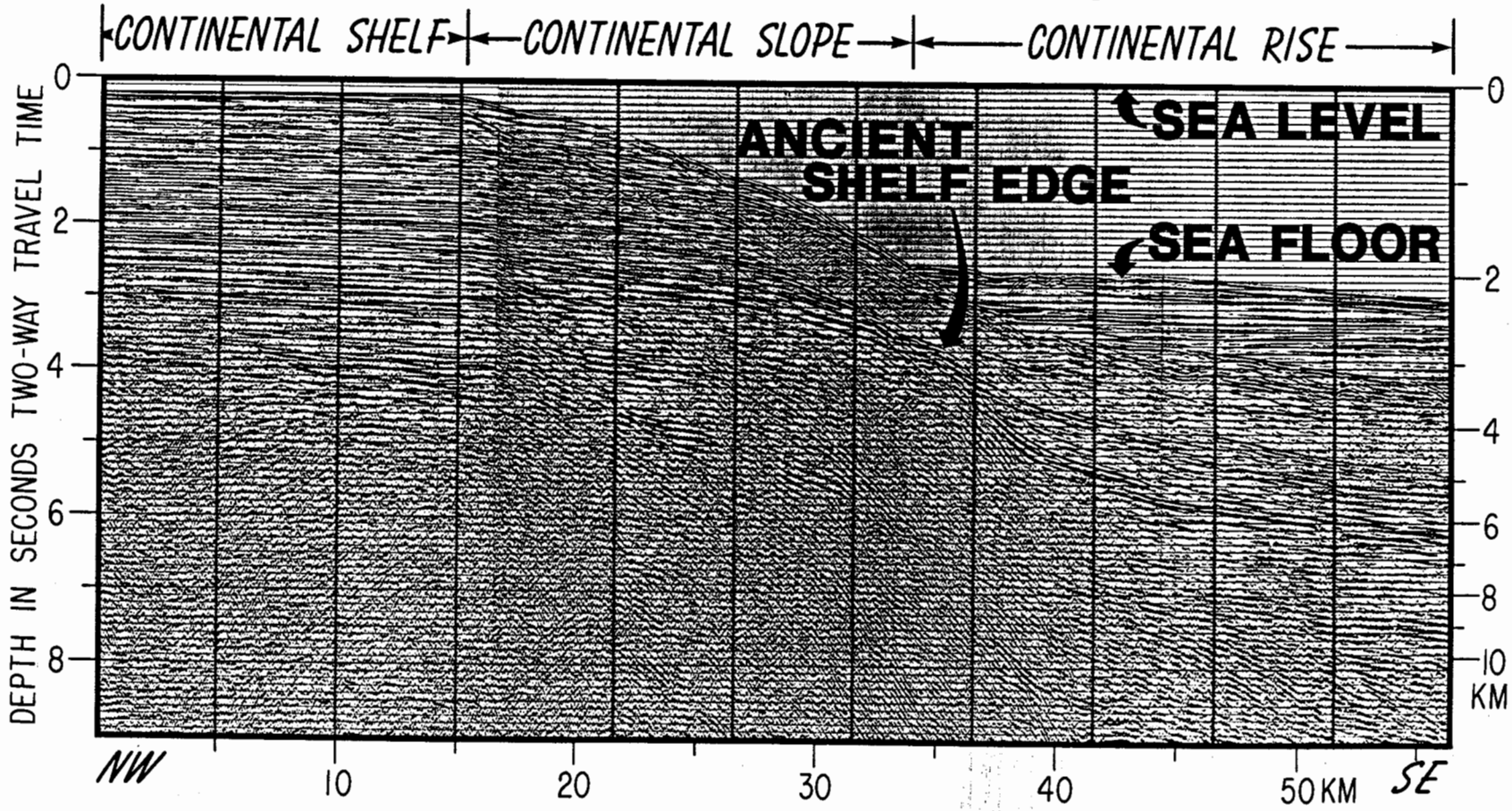


FIGURE 2

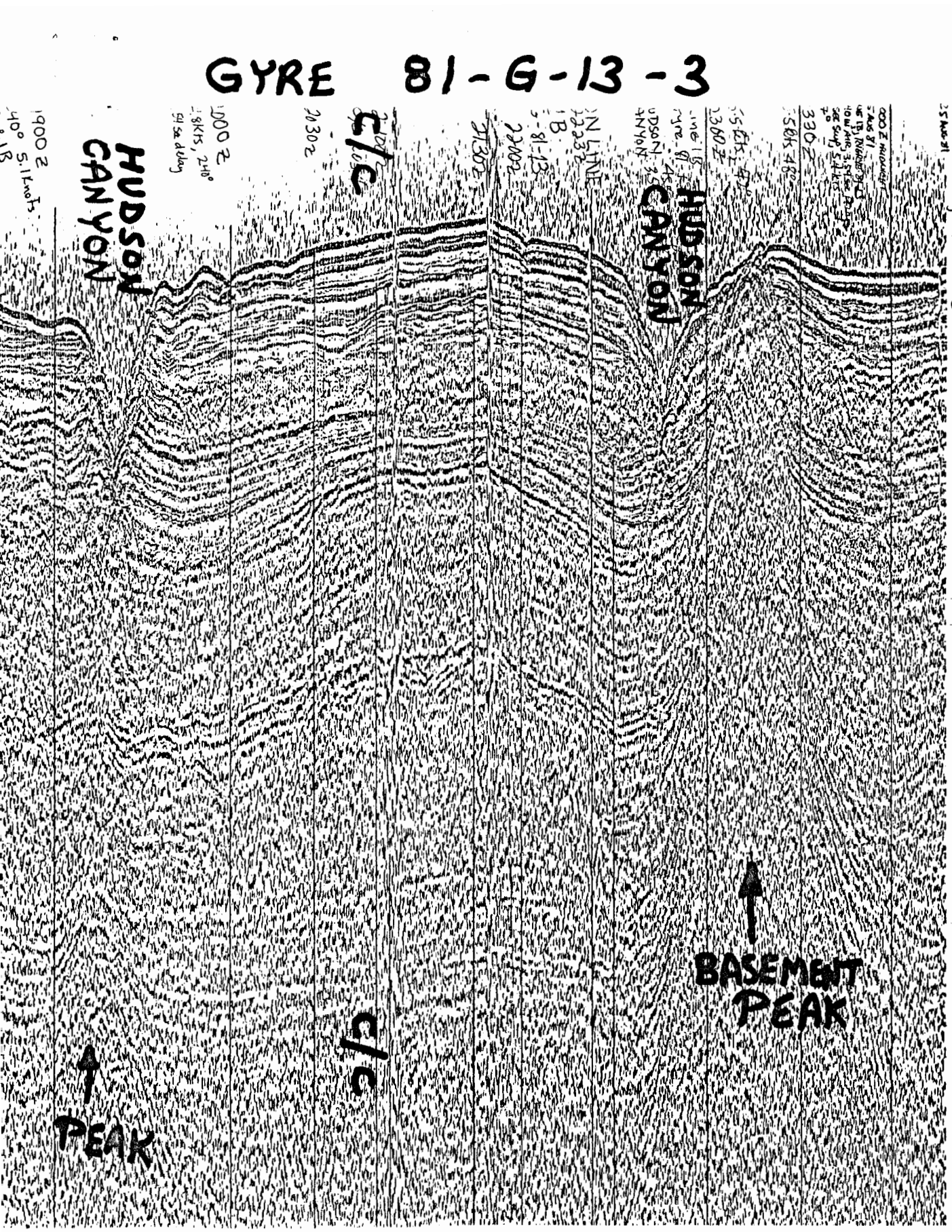

GYRE 81-G-13-3
SECONDS TWO-WAY TRAVEL TIME
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
HUDSON CANYON
HUDSON CANYON
BASEMENT PEAK
C/C
C/C
PEAK

FIGURE 3

CDP LINE #5

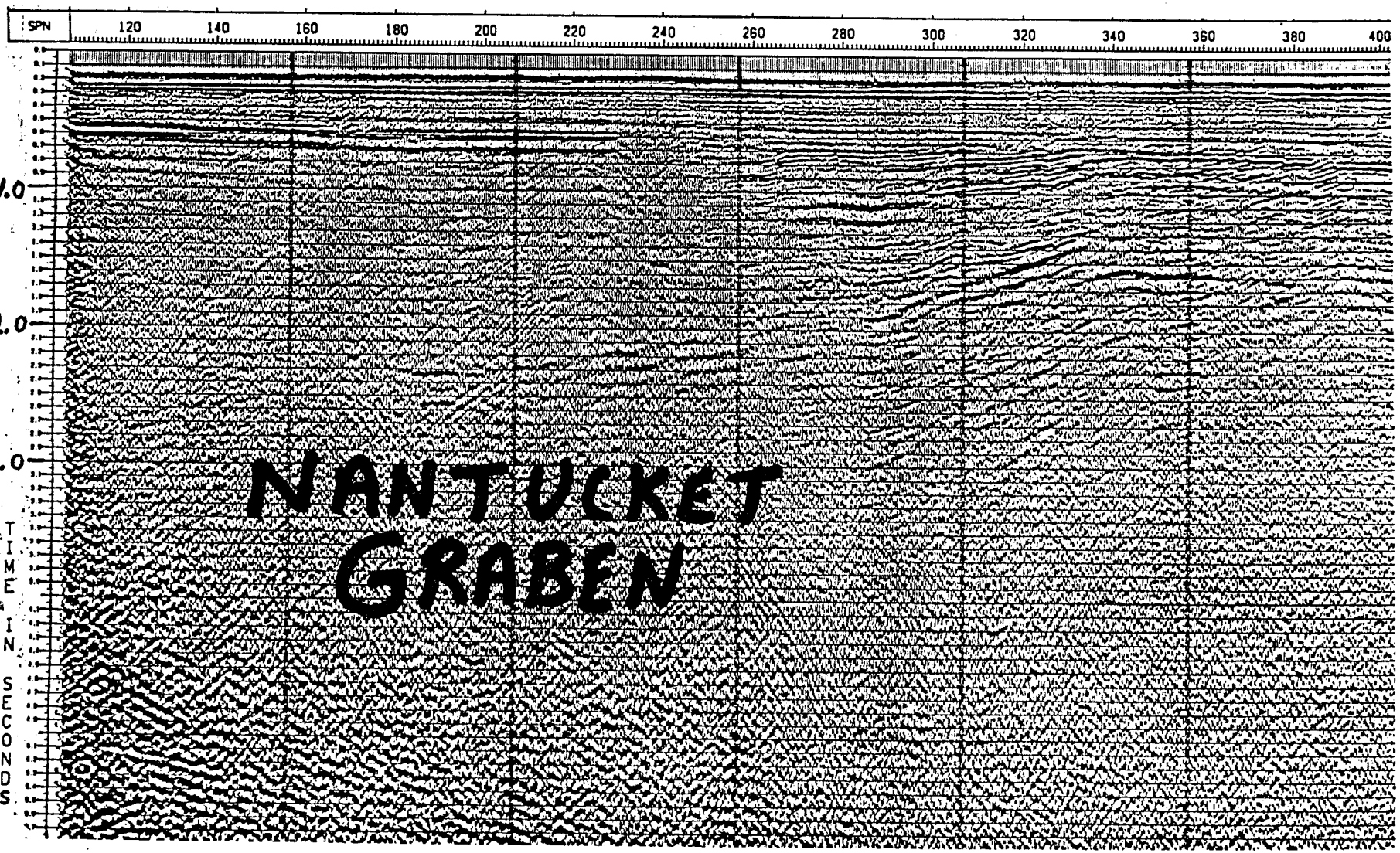
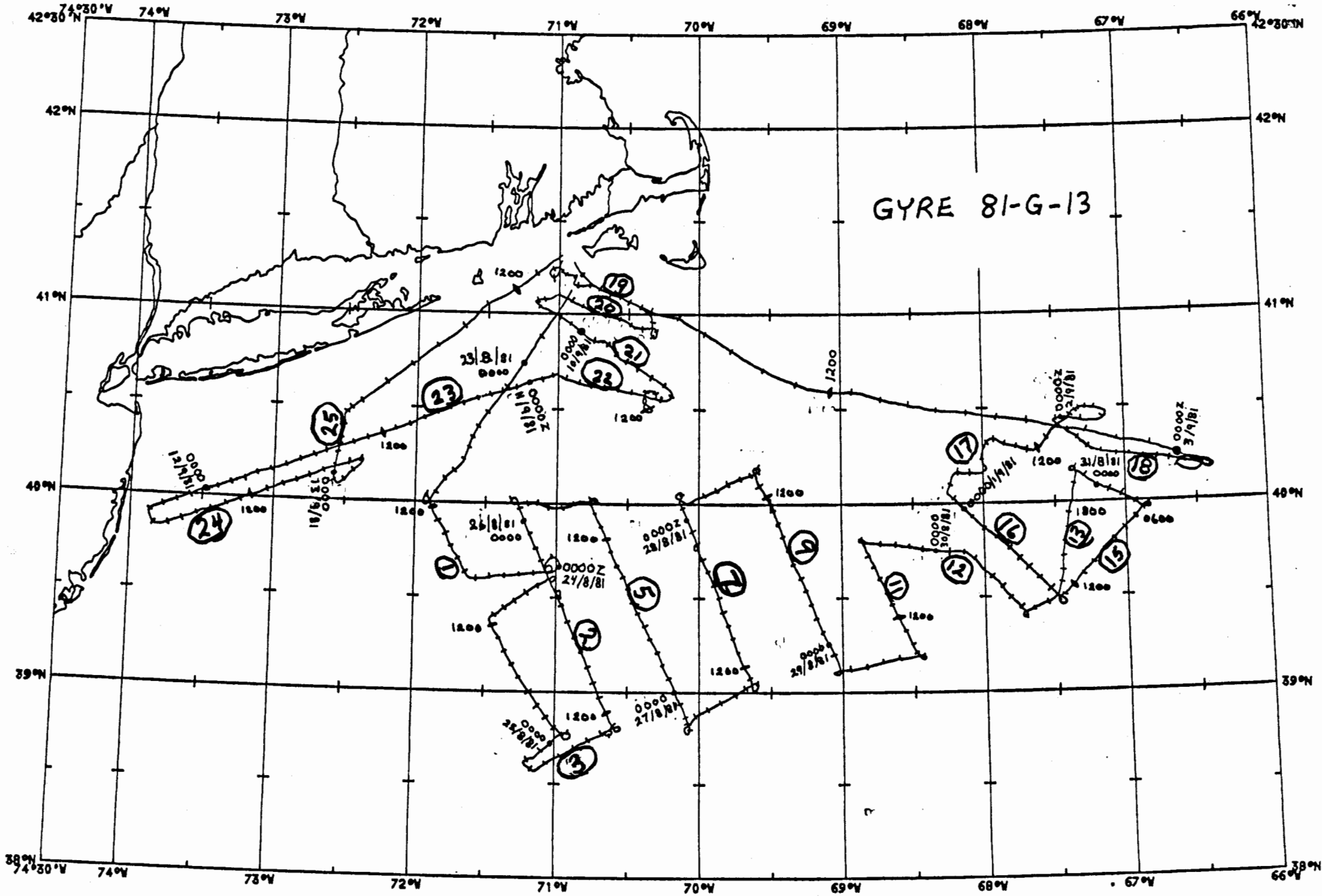


FIGURE 4


GYRE 81-G-13
74°30'W
74°W
73°W
72°W
71°W
70°W
69°W
68°W
67°W
66°W
42°30'N
42°N
41°N
40°N
39°N
38°N
1200
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0600
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23/8/81
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24/8/81
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FIGURE 5