

Robb

CRUISE REPORT

R/V H.J.W.FAY - Cruise 4 - Seismic Refraction

75025

Dates: 20-26 October 1975

Ports: Woods Hole to Woods Hole

Ships Officers: Captain: Lawrence Buell  
First Mate: John Ostensen  
Third Mate: James Biller

Scientific Party:

<u>Name</u>	<u>Organization</u>	<u>Responsibilities</u>
John Grow	U.S.G.S.	Chief Scientist
Lyle McGinnis	U.S.G.S.	Geophysicist
Perry Parks	U.S.G.S.	Gravity Technician
Bruce Ambuter	U.S.G.S.	Electrical Engineer/Refraction
Bill Jaworski	U.S.G.S.	Geophysicist/Deck Systems
Chuck Meeder	U.S.G.S.	Refraction Technician
Felicity Oram	U.S.G.S.	Watch Stander
Doug Peeler	U.S.G.S.	Watch Stander
Sally Wood	U.S.G.S.	Watch Stander
Scott Heald	U.S.G.S.	Resident Technician (R/V FAY)
Stan Locker	U.S.G.S.	Watch Stander
Gary Yerman	Bolt Inc.	2000 in <sup>3</sup> Airgun Specialist
Paul Passmore	Refraction Tech. Inc.	Consultant

FAY 004

## Cruise Objectives

Leg 4 of the R/V *FAY* was set up to obtain approximately ~~three~~ reversed refraction lines on Georges Bank and to collect two to four long geophysical profiles over the continental slope and rise.

The seismic refraction velocities were obtained with both expendable and a new recoverable sonobuoy (with an internal digital recorder) in order to confirm velocity models for Georges Bank which had been developed on the basis of earlier reconnaissance refraction studies in the 1950's, and on the basis of interval velocities obtained from multichannel seismic systems.

The gravity profiles into deep water were designed to supplement the gravity measurements over the shallow water portion of Georges Bank, which were collected on *FAY* 3 and to cover several U.S.G.S. multichannel seismic lines where no or poor gravity data was available.

## Instrumentation

The underway geophysical systems employed during Leg 4 were gravity, magnetic gradiometer, and the towed 3.5 kilohertz echosounder (only worked in water less than 500 m).

The expendable sonobuoys included Select International Inc. long range buoys (Model #SLF-73) with a 73 mhz FM transmitter and a double suspension system to isolate the hydrophone. The source was a 2000 cubic inch airgun leased from Bolt Associates Inc. and fired at a repetition rate of 30 seconds.

A large recording buoy was also tested on several stations. The buoy is being developed with a digital magnetic tape recorder for long-range refraction with very high dynamic range. The initial tests were plagued by hydrophone problems, but a good run was finally achieved on the last day.

Cruise Log

The R/V FAY departed Woods Hole at 2000 GMT/20 October 1975. Testing of the 2000 cubic inch airgun commenced at 2130 GMT in Vineyard Sound and were successfully completed at 2300 GMT. The R/V FAY then headed southwest around Martha's Vineyard and off towards Georges Bank.

The FAY arrived at Station 1A (Figure 1) about 2000 GMT/21 Oct. The large recording buoy was deployed but low hydrophone sensitivity required its immediate recovery. Moderate seas (3 to 6 feet) and reluctance by the First Mate to use the hydraulic crane, resulted in delays and some damage to the buoy antenna during recovery. Fortunately, three spare antennae were aboard. An expendable buoy was launched at 0115 GMT/22 Oct. (buoy FAY 4-1A) on a course of 051°. The line was reversed and buoy FAY 4-1B was deployed at 0408 GMT on a course of 220°. High velocity refracted arrivals (5-1/2 to 6 km/sec) were observed at a depth of about 4 km.

At 0600 GMT/22 Oct. the seas were building and many of the scientific crew were seasick. Therefore, the ship was headed out into deep water to pick up gravity and magnetic data along U.S.G.S. multichannel seismic line No. 1 (Figure 1). This survey continued until 1200 GMT/23 Oct.

Beginning about 1445 GMT/23 Oct., three expendable buoys were launched on a course of 230° (FAY 4-2A, B, C). Buoy FAY 4-2C was launched at 1717 GMT and was the best of these buoys. A compressor failure caused some interruptions in the line, but it was completed at 2000 GMT. The large buoy (FAY 4-2D)

was deployed at 2100 GMT but again had hydrophone problems and had to be recovered. An expendable buoy (FAY 4-2E) was launched at 0129 GMT/24 Oct. on a course of 050° and a good run was completed at 0400 GMT. A local magnetic and gravity survey was accomplished during the night and the R/V FAY arrived at Station FAY 4-3 about 1200 GMT/24 Oct. The large buoy was launched at 1421 GMT (Sonobuoy FAY 4-3A) and the ship commenced a course of 052°. An expendable buoy was launched at 1526Z (FAY 4-3B) and was somewhat quieter than the big buoy. The course was reversed at 1749 GMT to 231° and expendable buoys (FAY 4-3C and D) were launched at 1758 GMT. An airgun misfiring problem developed at 1850 GMT which ruined the ends of 4-3C, D. The big buoy was recovered at 2030 GMT. At 2330 GMT on 24 Oct. the FAY headed on a course of 070° to get in position to reshoot 4-3C, D. The new buoy (4-3E) was launched at 0001 GMT/25 Oct. on a course of 230° and was successfully completed at 0420 GMT.

The ship then headed north and at morning launched the big buoy again at 1234 GMT at position (4-4A in Figure 1). This time the buoy worked well and the run was commenced on a course of 050°. At 1437 GMT the ship slowed and maneuvered to attempt some "stacked" signals (i.e. repeated airgun blasts at the same location to improve signal-to-noise enhancement). At 1715 GMT on 25 Oct the ship reversed course to 221° and launched buoys 4-4B and 4-4C. Buoy 4-4B was the best and is labelled on Figure 1. The large buoy was recovered after some searching at 2100 GMT.

At 2111 GMT/25 Oct. all refraction buoy work had been completed and time remained to make another pair of gravity and magnetic profiles into deep water. Therefore, the ship headed south. By about 0230 GMT/26 Oct. the seas had built significantly. The ship was pitching severely into 8 to 12 foot seas and had to slow to 6 knots. At that slow speed, the ship

could not complete the deep water lines and report back into Woods Hole by the required time of 1200 GMT/27 Oct. Since everybody was seasick, including the Chief Scientist, the ship turned west and headed for Woods Hole, in order to assure an early arrival. The seas to the west and over the shelf calmed considerably in the next 6 hours and the *FAY* completed Leg 4, arriving in Woods Hole at 2100 GMT/26 Oct. 1975.

Results

Although only three reversed refraction lines were planned for this leg <sup>and it</sup> was shorter than originally scheduled, four lines were run (Fig. 1). These refraction lines all were near U.S.G.S. multichannel seismic reflection Line #1 (Figs. 1 and 2). The interval velocity data from U.S.G.S. Line #1 showed very high velocity sediments 5.6-5.9 km/sec between 4 to 8 km depth beneath Georges Bank and a 5.2 km/sec layer at a depth of 2 km at the outermost edge of the shelf.

Earlier refraction data is shown at the bottom of Figure 2, which was generally consistent with the interval velocities but left a large gap in the middle shelf. The new clay from *FAY* 4-1 to 4-4 has only had preliminary analysis but is penciled in on the refraction section of the figure. It is clear that the correlation with interval velocities is remarkably good. The high velocity sedimentary rock layer (5.6-5.9 km/sec) was confirmed and probably represents early Cretaceous or Jurassic limestones and dolomites. The 5.0 to 5.4 km/sec material beneath the outer edge of the shelf and upper continental slope probably also represents a carbonate bank or reef which existed at the shelf edge in the early or Middle Cretaceous period.

Cruise Statistics

Gravity Data	1640 km
Bathymetry Data	500 km
Magnetics	600 km
Refraction Station	4 reversed profiles

*3.5 kHz*

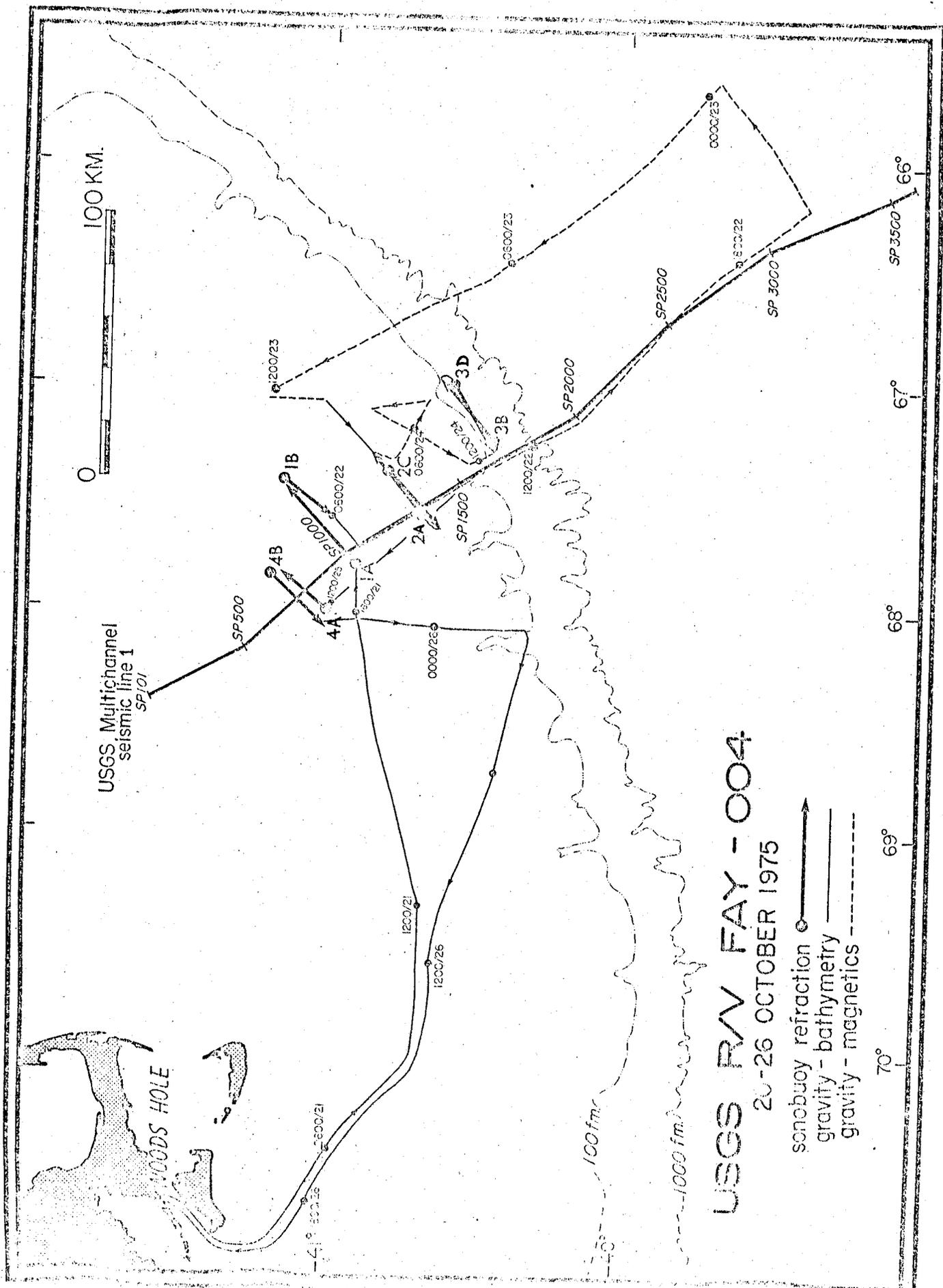


fig. 1

# U.S.G.S. MULTICHANNEL LINE 1 - OFF GEORGES BANK

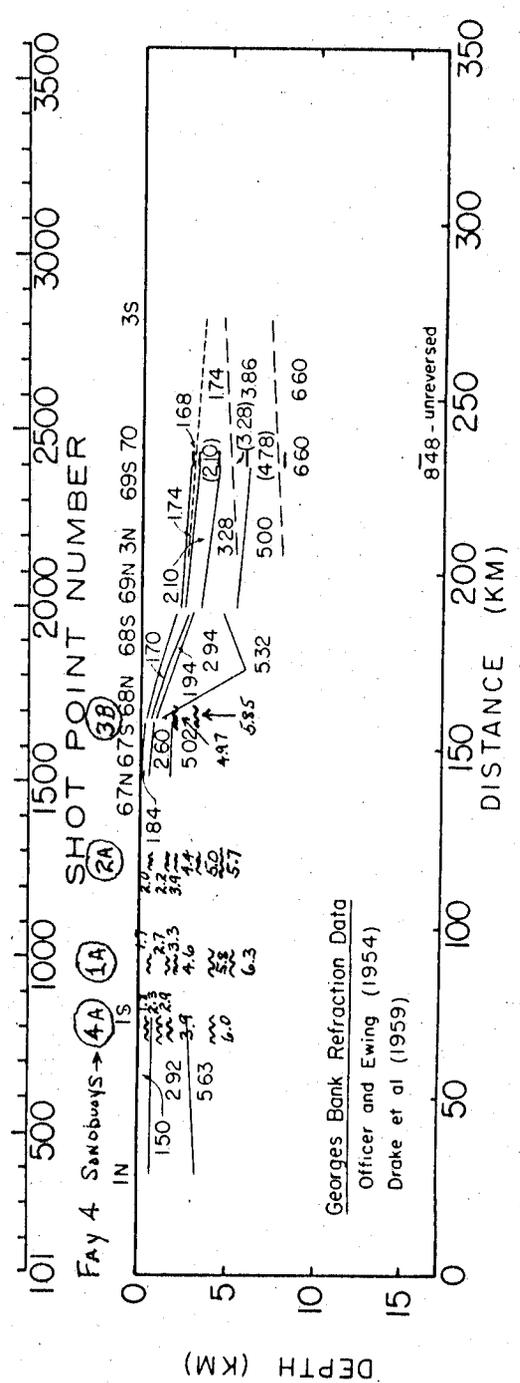
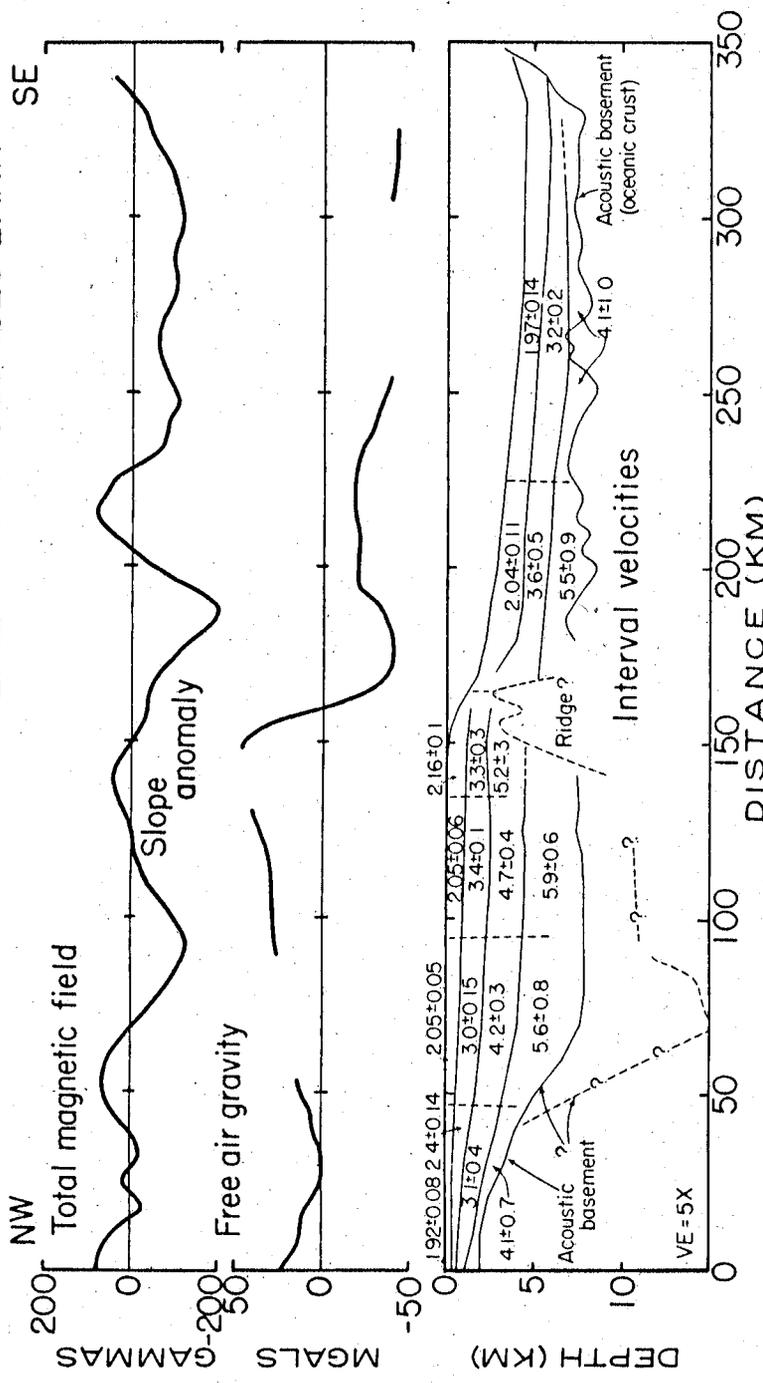


fig. 2