U.S. GEOLOGICAL SURVEY R/V FAY CRUISE 20 & 21

J Grow

Cruise Report

#76030 #76033

FAY 20	FAY 21
Cruise Dates: 10 Aug. - 24 Aug. 1976	28 Aug. - 7 Sept. 1976
PORTS: Norfolk to Woods Hole	Woods Hole to Woods Hole
Scientific Party:	
Chief Scientist - Kim Klitgord	Kim Klitgord
Nav/Grav Engineer - Perry Parks	Don Moller
Seismic Engineer - Frank Jennings	Frank Jennings
Western Rep. - Paul Bereznak	Paul Bereznak
Mechanical Techs - Jerry McCarthy, Rob Pexton, Phil Shea	Jerry McCarthy, Dave Kinney, Wes Lombard
Navigation Watch - Dave Egelson, Claire Reimers, Scott Heald	Dave Egelson, Claire Reimers
Seismic Watch - Hans Schouten (WHOI), Lin Morse, Chris Schoen, Stan Locker, Kevin King	Hans Schouten, Lin Morse, Chris Schoen, Sandy Conley, Nick Lefteriou, Dave Twichell (URI)
Ship's Officers	
Captain - Peter Olander	Peter Olander

CRUISE OBJECTIVES:

The primary objectives of both cruises were to look for geophysical evidence for the continuation of fracture zones from the Mesozoic sea-floor spreading anomalies into the continental margin, investigate the source of lineated magnetic anomalies in the Jurassic Quiet Zone, and to obtain additional seismic data on the continental rise and slope. Seismic reflection profiling was the main data source with supplemental information from the magnetic and gravity systems to carry out these objectives. The cruise tracks (Fig. 1) consisted of 6 long lines and 3 short lines perpendicular to the margin and 4 long lines parallel to the margin. The distribution of the tracks was designed to look at structures parallel to and structures perpendicular to the margin as well as providing tie lines to the ends of the U.S.G.S. CDP lines 1, 3, 5 and 10, DSDP Hole #388 and the ends of lines run on the cruise FAY 19. We were also trying to fill in gaps in the existing network of gravity data and to obtain magnetic gradiometer data in the Jurassic quiet zone. It was hoped that with the seismic reflection data collected on the cruises FAY 19, FAY 20 and FAY 21 that we would have a fairly complete coverage of deep water sediment layers to allow us to map the various seismic horizons such as A, A*, and B. This network includes tie lines to DSDP holes #105, 106 and 388 and the multichannel lines U.S.G.S. CDP #1, 3, 5, 6, 10 and BT1 and the U.S.G.S/IPOD line.

As part of a program to look at environmental problems on the continental shelf, slope and rise, a minisparker system was used to look at deformation in the upper 1/2 sec. of sediment, including features such as slump structures. A one-day side scan survey was carried out at the mouth of the Wilmington Canyon to look at sand waves which form in that area.

Instrumentation

(1) Airgun System - Single channel seismic reflection profiles were collected using a Seismic Engineering Inc. streamer with 40 acceleration cancelling multidyne (MDS) hydrophone transducers in a single active element of 300 foot length. The streamer has a 100 foot stretch section with up to 400 feet of faired lead-in cable. Normally, between 200-300 feet of lead-in cable were deployed. A depth transducer at the head of the active section allows the streamer depth to be measured; normally, it was towed at a depth of 35 to 40 feet.

Four airguns of variable chamber capacity were available (2 each PAR600B with 20 or 40 in^3 chambers and 2 each PAR1900C with 80 or 160 in^3 chambers). During FAY 20 & 21, one 40 in^3 gun was usually used on the shelf, while the 80 or 160 in^3 guns were used in deeper water.

Filter settings for deep water work were usually between 16-60 Hz with 3 to 4 seconds of penetration frequently being obtained. The recorders were on a 5 second sweep on most occasions with up to a 5 second delay in deep water. Firing rates varied between 10 and 11 seconds.

The four compressors leased from Price Compressor, Inc. allowed continuous operation without any loss time due to compressor failures.

Generally speaking, the single channel reflection profiles for FAY 20 & 21 were outstanding with excellent resolution of basement and the deeper Mesozoic horizons througout the Western Atlantic.

Two types of airgun records were obtained during the cruise. The primary record was made on a Raytheon Recorder (called Ray #2) with AGC (automatic gain control), which allowed deeper horizons to be resolved. The normal 3.5 kHz recorder, also a Raytheon (called Ray #1) was used to produce a record without AGC and to act as a spare recorder. On Fay 21 the system was modified again to take the seismic information off of the read head on the tape recorder which was recording all of the seismic information. This was played out on the secondary Raytheon recorder (Ray #1). In this manner we were able to check what was going on to magnetic tape. At one point spurious noise was going onto the airgun trigger channel because of improper grounding of the minisparker system.

(2) Minisparker - A new Teledyne 600 joule minisparker system was installed aboard the R/V FAY for FAY 019. Generally, this system was operated on the EPC Curley recorders on 1/2 second sweep with a 1 second repetition rate. These were generally filtered between 280-1060 Hz and beautiful records were obtained, even in water depths up to 5 km. Penetrations of 200-300 msec was common and in a few cases the sweep had to be lengthened to 1 sec because more than 500 msec of penetration was obtained. This system was an outstanding success which will provide valuable new high resolution control on the upper 500 meters of the sediment column.

(3) 3.5 kHz Echosounder - This system was in an O.R.E. fish and was towed off the port side at a depth of about 5 meters. A Raytheon CESP II pulse correlation system and automatic digital tracking system were employed. In general, this system failed to obtain any subbottom reflections (even on the continental shelf) and was of no value even as an achosounder in deep water. This system was turned off after about 6 hours of operation and its recorder used to obtain a second airgun record.

(4) Geometrics Magnetic Gradiometer - The Geometrics Gradiometer tows two proton precession magnetometers on a single cable at 1000 and 1500 feet behind the ship. The total magnetic field of the aft bottle and their difference were recorded on a Hewlett Packard chart recorder and on digital magnetic tape (parts of the Integrated Navigation System).

The noise level on the two sensors was generally between ± 2 to 3 gammas, which was quite a bit higher than expected. In spite of all efforts to tune and adjust the system, this noise level persisted. Attempts to improve the system were unsuccessful. The depressors were set at maximum depth but the lead weights were not used. The aft bottle was replaced for FAY 21 after a fire on deck, while in port, damaged the original aft bottle. Tests indicated that the problem was either in the towing of the bottles or in extra large permanent magnetization for the ship. Further tests are planned on future cruises and Geometrics have been informed of our problems.

(5) Gravity - The R/V FAY was equipped with a gravity van containing a vibrating string gravity meter mounted on a Mark 19 Sperry gyrostabilized platform, on loan from Carl O. Bowin at Woods Hole Oceanographic Institution (on an Office of Naval Research grant). This system operated flawlessly during all of FAY 019.

(6) Analog Seismic Recording System - During FAY 20 and 21, the minisparker was generally recorded on the EPC Curley 19-inch dry paper recorders. The 2 types of airgun records were two Raytheon 19-inch dry paper recorders. The signal with AGC was displayed on Raytheon #2 and the signal off the tape and without AGC was displayed on Raytheon #1.

Magnetic tapes of airgun, minisparker, and 3.5 kHz systems were also recorded on 3600 ft analog tapes on a seven track Honeywell system.

(7) Integrated Navigation System (INS) - A new Integrated Navigation System was installed aboard the R/V FAY during February. This system was contracted through Western Geophysical Inc. and contains the following major sybsystems:

a. Satellite Receiver
b. Teledyne Range-Range LORAN C unit
c. Rubidium Frequency Standard
d. Doppler Sonar - not installed
e. Mark 29 gyrocompass
f. Hewlett Packard 21 MX computer system
g. Two 9-track digital tape transports
h. Calcomp 30 inch plotter
i. Keyboard and line printers

This system encountered intermittent problems during the FAY 20 and 21 cruises, but in general the system worked fairly well. Whenever possible the INS was used to fire the airgun at a set distance interval but usually this was not very satisfactory and the computer was used to fire the guns at a 10 or 11 sec rep. rate.

Chronological Log - FAY 20

The FAY's departure from Norfolk was delayed for 2 days while Hurricane Belle passed by just off of the coast. When we finally departed at 0800L (1200Z) on August 10th we had good weather and calm seas. The underway geophysical gear (airgun, magnetometer, mini-sparker and 3.5 kHz) were deployed at about 1900 Z near the edge of the continental shelf. The 3.5 kHz system proved to be almost worthless in deep water, so after a few hours the system was turned off and the recorder used as a spare for the airgun system. The other systems ran smoothly for the entire cruise with only brief shut downs of the airgun system to fix the guns and of the minisparker system to carry out regular maintenance. Heading into port on August 24th, we pulled in the airgun and magnetometer at the 50 fathom contour but left out the minisparker as we crossed part of Nantucket Shoals.

Our cruise track was laid out in an attempt to avoid sailing against the Gulf Stream. Two of our long profiles were run northward with the Gulf Stream and the third profile was far enough to the east so that we were unaffected by the Gulf Stream. As a result we were able to average over 7 knots over the ground for a sizeable portion of the trip and thus to make up some of the time lost in Norfolk. In general, we kept our speed at between 5 and 6-1/2 knots. We only had 2 days of bad weather (August 18th and 19th), which were caused by Hurricane Candice. We passed about 45 miles to the west of the center of the hurricane on the morning of August 19th.

The only major problem on the trip was the high noise level on the Geometric's Gradiometer. The scatter in the field readings at each bottle ($\pm$2 gammas) made it impossible to see the small grandients in the magnetic quiet zone. The bottles were examined several times and the depressors adjusted to deeper depths, but the problem remained. The pulling in of the bottles, while steaming on several different courses, suggested that the ship has a rather large permanent magnetic field. In addition, we had a problem with out LORAN-C reception which eventually was fixed by replacing a corroded terminal box.

Chronological Log FAY 21

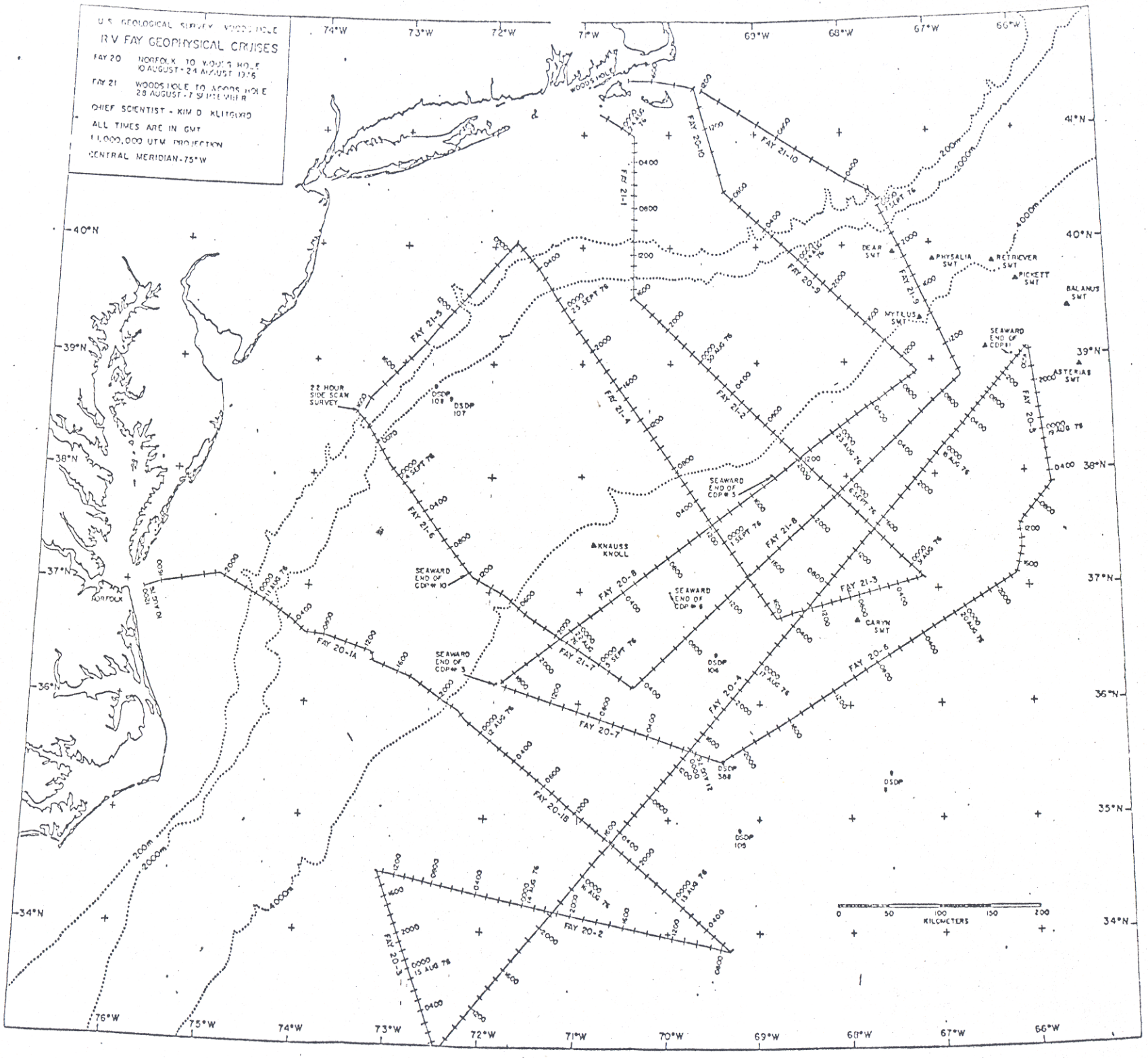
The FAY's departure from Woods Hole was delayed for 2-1/2 days while waiting for new crew members. We finally left on the afternoon of August 28th. We steamed around the west end of Marth's Vineyard and deployed the airgun, magnetometer and minisparker at a point south of the channel between Martha's Vineyard and Nantucket. Most of the tracks on this leg were run perpendicular to the continental margin to get better coverage of the continental slope/rise area. At the end of line FAY 21-4, we pulled in the airgun system and magnetometer and steamed at full speed along the edge of the continental shelf (Line FAY 21-5) to the mouth of the Wilmington Canyon. A one-day side scan sonar survey was conducted by Dave Twichell, looking at the sand waves near the mouth of the canyon. The ORE side scan system owned by U.S.G.S.

was used, and it worked remarkably well from the very beginning. Unfortunately, we had extremely bad LORAN-C navigation and the final navigation was based primarily on the LORAN-A navigation kept by the bridge.

Departing from the Wilmington Canyon, we headed back into deep water for one final traverse parallel to the continental margin. We were contacted by U.S.G.S.-Woods Hole at this point to see if we could conduct a side-scan survey on the edge of George's Bank, where the drill ship GLOMAR CONCEPTION had lost the on-floor drill assembly. Although the water depth was too deep for the amount of cable which we had on the side scan, we did go to the site and attempted to use the side scan. We could only get about 50 fm from the bottom and did not see anything. We did find that it was very difficult to conduct a slow speed survey in that area because of the fast currents. We steamed back to Woods Hole, with only the minisparker deployed and arrived in Woods Hole at about noon on September 7, 1976.

Data Collected

Data Type	FAY 20 (km)	FAY 21 (km)
Gravity	3950	2885
Airgun	3700	2150
Magnetics	3700	2150
Minisparker	3700	2750
3.5 kHz	60	140
Side Scan	0	140


U.S. GEOLOGICAL SURVEY WOODS HOLE
R/V FAY GEOPHYSICAL CRUISES
FAY 20 NORFOLK TO WOODS HOLE
10 AUGUST - 24 AUGUST 1976
FAY 21 WOODS HOLE TO AZORES HOLE
28 AUGUST - 7 SEPTEMBER
CHIEF SCIENTIST - KIM D KLITGORD
ALL TIMES ARE IN GMT
1:1,000,000 UTM PROJECTION
CENTRAL MERIDIAN-75°W
WOODS HOLE
NORFOLK
22 HOUR SIDE SCAN SURVEY
SEAWARD END OF CDP# 10
SEAWARD END OF CDP# 5
SEAWARD END OF CDP# 3
SEAWARD END OF CDP# 1
KNAUSS KNOLL
DEAR SMT
PHYSALIA SMT
RETRIEVER SMT
PICKETT SMT
BALANUS SMT
MYTILUS SMT
ASTERIAS SMT
CARYN SMT
DSDP 107
DSDP 108
DSDP 106
DSDP 388
DSDP 105
FAY 20-1A
FAY 20-1B
FAY 20-2
FAY 20-3
FAY 20-4
FAY 20-5
FAY 20-6
FAY 20-7
FAY 20-8
FAY 20-9
FAY 20-10
FAY 21-1
FAY 21-2
FAY 21-3
FAY 21-4
FAY 21-5
FAY 21-6
FAY 21-7
FAY 21-8
FAY 21-9
FAY 21-10
200m
2000m
4000m
0 50 100 150 200
KILOMETERS