

#79020

CRUISE REPORT

R/V JAMES M. GILLISS, GS 7903-6

AUG. ¹⁰⁻²⁹~~8~~ - 28, 1979

Peter Popenoe
U.S. Geological Survey
Woods Hole, MA 02543

Vessel: R/V James M. GILLISS

Cruise Number: GS 7903-6

Project: Southeastern Atlantic Outer Continental Shelf Environmental Assessment

Areas of Operation;

1. Continental Shelf, Slope and rise, Cape Hatteras to Cape Romain
2. Continental Shelf, 30°N - 32°N offshore N. Florida and Georgia
3. Red Snapper Sink, offshore Crescent Beach, Florida
4. Continental Shelf, Crescent Beach to Cape Canaveral, Florida

Dates: Lv. Charleston, S.C. 18:30 10 Aug. 1979

Ar. Wilmington, N.C. 16:25 13 Aug. 1979 (Ship repairs)

Lv. Wilmington, N.C. 20:00 15 Aug. 1979

Ar. Miami, Florida 09:00 29 Aug. 1979

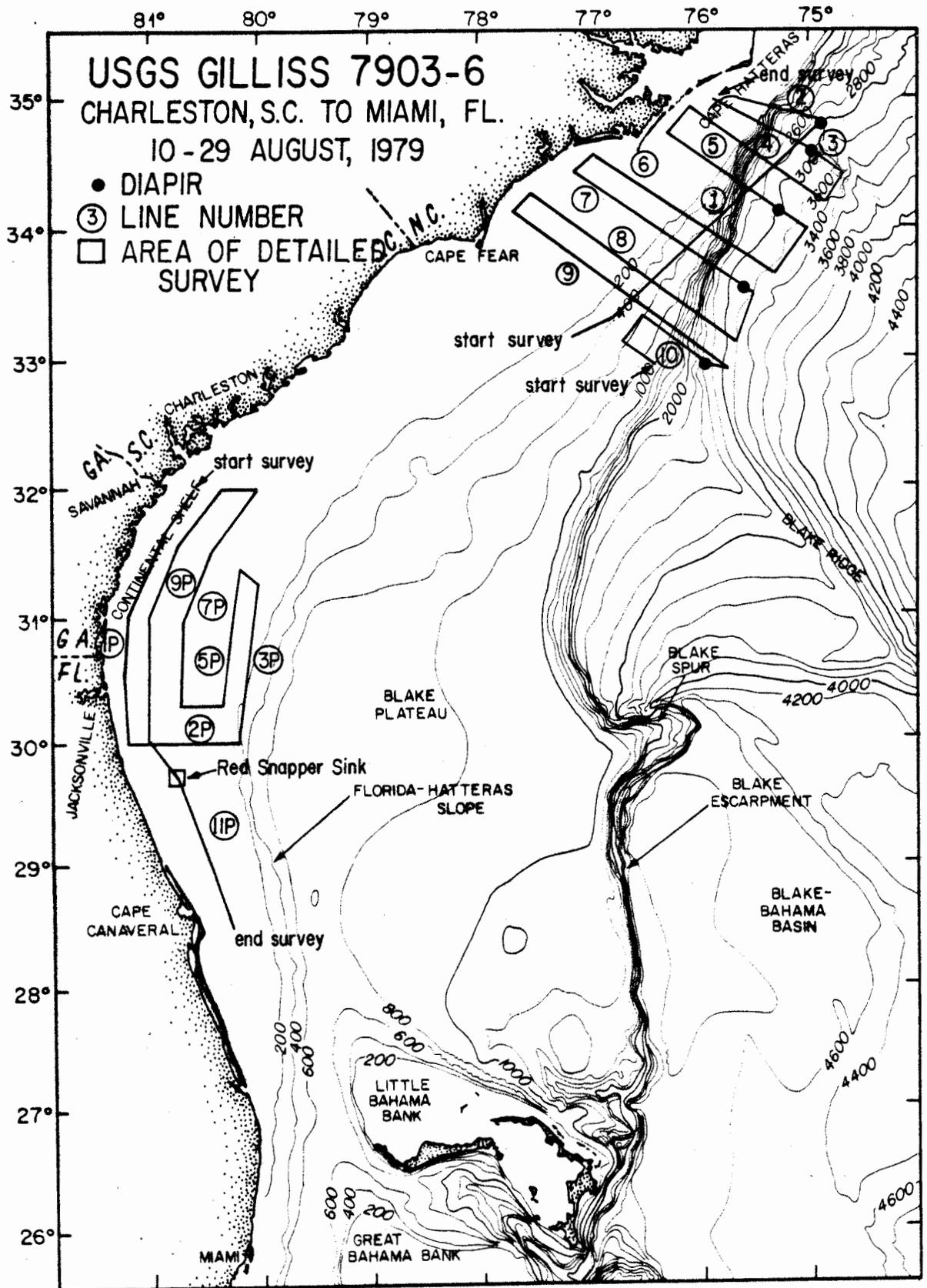
Scientific Party:

Peter Popenoe, Chief Scientist, USGS
Janet Burke, Cruise Curator, Watchstander, USGS
Elizabeth Coward, Watchstander, USGS
James Dodd, INS Navigation, USGS
Robert Dothart, Technician, USGS
David Geever, INS Navigation, USGS (WHOI)
Al Goodman, Technician, USGS
Barry Irwin, INS Navigation, USGS
John Larson, Technician, USGS
Dave Mason, Compressor Technician, USGS (WHOI)
Gerald McCarthy, Technician, USGS
Marshall Otter, Watchstander, USGS
Ken Parowski, Technician, USGS
Steve Schertzer, Watchstander, USGS

Captain: Robert Hagan, Jr.

Purpose of Cruise:

Cape Hatteras area; High resolution seismic profiling of the continental shelf, slope, and rise for a regional assessment of environmental hazards to petroleum exploration and development. Specifically the nature and frequency of slumping, faulting, cut and fill, scour, sand waves, karst topography were examined. Two lines were run to define a growth fault seen on deep CDP data in the area.



Offshore Georgia Continental Shelf: This survey was conducted to assess possible pipeline corridor routes on the Georgia shelf. High-resolution seismic reflection data was used to assess Pleistocene river channels, scour, sand waves, cut and fill, faulting, shallow gas, and reefs and hardground development.

Red Snapper Sink: Detailed high-resolution seismic lines were put across and near the sink to assess the seismic nature of the karst development in this area.

Florida Shelf: A high-resolution seismic reflection profile was run between Red Snapper Sink and Cape Canaveral to trace the subsurface expression of the karst surface.

Navigation Techniques:

1. USGS-Western Geophysical Integrated Navigation System.

- a. Rho-rho Loran C
- b. Hyperbolic Loran C
- c. Gyro Compass
- d. Doppler speed log
- e. Satellite updates

2. Northstar model 6000, hyperbolic Loran C

- a. Two Northstar 6000 units
- b. Digital clock
- c. Magnetic tape recorder
- d. Paper tape printout at 5 minute intervals

Scientific Equipment-Data Acquisition Systems

1. Airgun systems
 - 2-40 cubic inch airguns with wave shaper
 - 5 cubic inch airgun with wave shaper
 - 1 cubic inch airgun
2. 3.5 kHz, hull mounted echo-sounding system
3. EG&G Uniboom system
4. Lacoste-Rhomberg 5-26 gravity meter
5. Bell 5M-203 gravity meter
6. Geometrics marine proton magnetometer

Tabulated Information:

Days at sea: 16 days 5.5 hrs.

Amounts of data acquired:

Airgun (1,5,20 and 40 cu inch airguns were used based on water depth and ringing problems)	3290km	(1775 NM)
3.5 kHz	3290km	(1775 NM)
Uniboom	1352km	(730 NM)
Gravity	4940km	(2665 NM)
Magnetics	1935km	(1045 NM)

Narrative and comments

Cape Hatteras Area: The cruise was delayed six and one half days from its scheduled departure of 0800 Aug. 4 while the R/V GILLISS sought a replacement for the Chief Engineer, who had broken his leg on August 2 while in port. At 15:00 EDT 10 August 1979, a new Chief Engineer, Larry Moore, arrived and at 18:30 EDT we departed Charleston, S.C. towards the Cape Hatteras portion of the survey. We arrived on line at 0730 EDT Aug. 11 and by 0745 EDT equipment was deployed. Seas were 2-4 ft and the weather beautiful except during several thunderstorms in the late evening. Some difficulties were experienced with the airguns during the first day and the 3.5 kHz unit was putting out a double signal, however these problems were corrected during the day.

The Cape Hatteras survey was planned to continue the 30 km dip-line regional coverage north from the R/V FAY 17, 18 and 26 cruises on the Florida-Hatteras shelf and the R/V ISELIN, leg 3 cruise of the Blake Plateau. The area covered is the southern part of the Carolina Trough, a deep Jurassic basin, that had been proposed for petroleum leasing during Lease Sale 56, scheduled for April 1981. Of particular petroleum interest in this area are a number of diapirs that are believed to originate from Jurassic salt at depth. Chief environmental concerns are Gulf Stream scour and slope stability (slumping).

Because of the extremes in water depths (10-3500m) airguns were changed along lines from 2-40 cu in. to 1-40 cu in, 1-5 cu in, and 1 - 1 cu in as the water depth shallowed. For this survey single channel airgun, 3.5 kHz echo-sounder, gravity, and magnetic data were taken. A 5 cu in airgun was run

continuously and recorded, rather than a sparker to minimize cross talk between the reflection systems.

During the second day (Aug. 12) seas went from 4-5' in the morning to 5 to 7 ft off Hatteras in the evening, with winds of 30 knots. Seas were perpendicular to our course on line 2 and caused the GILLISS to roll considerably with resultant discomfort to the crew. At 16:58 EDT we had a power failure which knocked out the computers. These were soon reprogrammed, but because of the heavy seas and problems experienced with the second generator, the Captain suggested we alter course while generator repairs were attempted. At 2100 EDT the Captain and Chief Engineer informed me that the relay box for one generator was burned out and that the other generator was cycling badly. We would have to put into Wilmington, N.C. for repairs. Equipment was pulled and we steamed for Wilmington, N.C., arriving 16:25 EDT, Aug. 13.

Aug. 14 was spent in Wilmington with little progress on repairs. On Aug. 15 at 13:30 Eric Rasmutin, and electrician, arrived from Miami and by 18:00 had fixed both generators. We departed Wilmington at 20:00 to return to the Cape Hatteras area, arriving on line 07:45 EDT, 16 Aug.

With the exception of high seas (7-9') on 16 Aug. the rest of the Cape Hatteras survey went well, with good weather and generally 3-5' seas. This survey was completed at 19:35 EDT on 21 August, 1979. By 19:55 all equipment was in and we began steaming toward the Georgia coast. Data quality for this survey was good to excellent. Interesting features included the following:

line 1: large deep-water reef, subsurface compactional (?) faulting

line 2: slumping on slope

line 4: slumping near base of slope
shale (?) diapirs at base of slope

line 5: large salt(?) diapir
minor slumping on slope
small shelf-edge reef

line 6: shelf-edge reef and trench
compactional (?) deep faulting
spectacular slumping on slope

- line 7: slumps on slope
shelf-edge reef with trench
- line 8: shelf-edge reef with trench
spectacular normal faulting on slope
shale (?) diapir
salt (?) diapir
- line 9: slumps and normal faults on slope
shale (?) diapirs
shelf edge reef with trench
- line 10: Salt (?) diapir
shale (?) diapir
spectacular normal faults on slope
slumping
possible large slump scar
- line 11: Shale (?) diapir
fault

Georgia Coastal Area

Arrived on line and deployed equipment 23:30 EDT, 22 Aug. 1979. Equipment used included 1 cu in, 5 cu in, 20 cu in airguns and Uniboom reflection systems. Gravity data was also taken, but not magnetics.

The survey was uneventful with generally only fair to good seismic records because of shallow depths and ringing problems. Penetration was on the order of 1/2 second. Good weather was experienced during the entire survey and it was completed at 16:30 EDT, 27 Aug.

Interesting features included several areas of channeling on the mid-shelf, and small, shallow channels on the inner-shelf. During much of the survey the 3.5 system was able to define the sand cover thickness of the shelf.

Red Snapper Sink

Red Snapper sink is a 435 ft deep sink hole at the mid-shelf near 29°44'27" N. lat. and 80°44' 52.5" W long. offshore of Crescent Beach, Florida. It is probably developed in Eocene (Ocala group) age carbonates although it may be connected to caverns in the underlying Avon Park, Lake City, and Oldsmar Limestones, which are known to be cavernous onshore. The seismic survey was run to determine criteria for the seismic identification of karst areas of the

offshore subsurface.

We arrived in the vicinity of the sink at 20:35 EDT 27 Aug. and made 4 good passes before leaving at 23:30. The sink appeared to be developed near the crest of a regional high on the Ocala (?) group which brings the limestones to the near surface. Regionally the unit dips north into the Southeast Georgia Embayment and South off the Peninsular Arch. The sink location appears to be controlled by a small depression, perhaps of structural origin, in the limestone.

Red Snapper Sink to Cape Canaveral, Florida

In order to trace the unit in which Red Snapper Sink is developed, the survey was continued to Cape Canaveral, Florida before being terminated at 15:50 EDT 28 Aug. This survey defined a spectacular undulating buried unconformity believed to be the top of the Ocala Group or underlying Avon Park, which became progressively deeper to the south, and was pitted with depressions which appeared identical seismically to Red Snapper Sink, thus they are probably buried sink holes. The buried undulating high relief surface appeared to be folded, as suggested by Meisburger and Field, 1976 as underlying beds seemed to be conformable with, and to pinch out against the surface. A second interpretation is that the apparent bedding beneath the surface represents seismic ringing rather than structure. Further analyses of the data is needed to settle this question. The survey did point up that the karst beds can be traced easily in the subsurface.

At 1600 all equipment was pulled and we proceeded at full speed to Miami where we arrived at the dock at 0900 EDT 29 August, terminating the cruise.

We received excellent and friendly cooperation from Captain Hagan and when initial difficulties with crew and ship were solved, the ship performed well. It was an extremely pleasant cruise.

Meisberger, E.P., and Field, M.E., 1976, Neogene sediments of the Atlantic Inner Continental Shelf off northern Florida; Am. Assoc. Pet. Geol. Bull. v. 60, no. 11, p. 2019-2037.

CHIEF SCIENTIST'S NOTES

- 8/3/79 Arrived on Aug. 3, 1979 at 0815 AM - Cruise departure set for 1100 hrs 8/4/79.
- 8/3/79 0400 - Captain Hagan informed me that the Chief Engineer had a broken leg and that a new Chief Engineer could not be obtained until 8/6/79. New departure time set for 1300 hrs, Aug. 6, 1979.
- 8/5/79 New departure time set for 0800, Aug. 7, 1979 because of arrival time of Chief Engineer.
- 8/6/79 Chief Engineer not able to come because of accident on way to airport - cruise further delayed - no replacement available.
- 8/7/79 New Chief Engineer - Larry Moore to arrive Thursday AM.
(Tues) Cruise extended to 29 Aug. Mahlon's leg (leg 7) to start Sept. 1-14.
- 8/9/79 Chief Engineer to arrive 12:45 P.M. on Friday 8/10/79. Sailing
(Thurs) time set for 15:00, 8/10/79.
- 8/10/79 Chief Engineer arrived appr. 1500, cruise delayed until 18:28 for
(Fri) engine part. Cast off all lines 18:28. Cleared all buoys 19:30.
- 8/11/79 On station - deployed equipment 40 in³ airgun and 5 in³ airgun
(Sat) 07:45. Waves 2-4', weather beautiful except for some storms in late evening. Several airgun failures, 3.5 putting out double signal, 5 in³ airgun record not very good. Most geology was unspectacular - some slumps at base of Blake Escarpment.
- 8/12/79 0815 - Beautiful day, seas 4-5', records greatly improved from
(Sun) 8/11/79. We are now using 2 40 in³ airguns and 5 in³ airgun. Recorded a diapir at 0930z near N. end of line 1. Second possible diapir near start of line 2. Storms throughout the night caused loss of INS and Loran several times.
- 2100z (1700) Seas 5-7' off Cape Hatteras Power failure on ship caused all equipment to go down. Power back on at 2103z but all equipment must be reprogrammed. Seas are sideways to us causing much rolling - many sick. Power outage was caused by engineers switching to alternate generator.
- 1800 - (2200z) Captain and engineer called me for a conference. Engineer says the alternate generator has serious problems, is cyclic and needs to be checked by an expert. We should really go to port for repairs but if we could alter our course for several hours (5) he will again try the generator when it cools down.
- 1815 Changed course for the west end of line 4.

- 2100 - Capt. Hagan informed me that the relay box for the no. 1 generator was burned out - the other generator is acting badly - we should pull all equipment and head to Wilmington N.C. for repairs
- 8/13/79 At dock, Wilmington Shipping Company, Wilmington, N.C. 16:25. No news
(Mon) on parts needed.
- 8/14/79 At dock, Wilmington, N.C. Parts for repair apparently located in
(Tues) Baltimore - will take 24 hrs to leave here.
- 8/15/79 13:30 Eric Rasmuton, an electrician from Miami showed up - began
(Wed) working on problem. Problem was a bent spring and a worn lever arm. fixed by 18:00. Sailing time set for 19:00
- 20:00 - Cast off all lines
- 8/16/79 On line, deploy equipment 07:45. Seas 3-6' wind 30 knots. Good records!
(Thurs) 09:30 Seas 5-8' - rolling badly
11:30 Seas 8-9'
2:00 Seas calming - line 10 is the most interesting yet - many low angle gravity faults and slumps on slope. 2 salt domes
- 8/17/79 Seas 3-5' a beautiful day - good records - on shelf most of day
(Fri)
- 8/18/79 Seas 3-5', line 8 records show more faulting below slope. Some
(Sat) older slumping. Also a possible reef, all equipment functioning well.
- 8/19/79 Seas 3-5' - another day of good records - beautiful shelf edge reef
(Sun) on line 6.
- 8/20/79 Seas 3-4'. All going well. Estimated completion of first survey 12:00
(Mon) Tuesday.
- 8/21/79 Crossed salt dome #2. Good weather, seas 3-5', bucking Gulf Stream
(Tues) on line 3 - speed over bottom down to 2.5 knots. 19:35 - lost 9 hrs due to Gulf Stream. Finished Hatteras Survey. Started bringing in equipment. 19:55 - All equipment in - steaming for Georgia coast.
- 8/22/79 In transit all day to Savannah area. Sea 1-3'. Rebuilt airguns and
(Wed) tested Uniboom and other equipment. ETA 24:00 (0400z) Aug. 23.
- 23:30 Arrive on line for pipeline survey - start deploying equipment-
deployed Uniboom, 1 inch airgun, 5 inch airgun and 3.5 system -
Equipment in water 0000 Aug. 23 (0400z).
- 8/23/79 Seas 1-3', Speed 5 knots, Uniboom riding quite well. Records are
(Thurs) very good considering the shallow water - Uniboom seeing a very strong reflector at about 12 m depth (Pliocene?) 1800 - Seas 2-4' records are all good to excellent.
- 8/24/79 Another hot, beautiful day - seas 2-4', all equipment acting well.
(Fri) Good data on shelf, and slope. Am cutting lines 3P and 5P to put us back on schedule. ETA 12:00 Aug. 29.

8/25/79 Hot - seas 2-4' - good records. ETA 20:00, Aug 27 to finish pipeline
(Sat) survey. Then Red Snapper sink.

8/26/79 Hot again - seas 2-4' - records fair to good. Main trouble seems to be
(Sun) engine noise - good 3.5 records.

8/27/79 Ocean a mill pond - waves 1-2' finished pipeline survey at 16:30 -
(Mon) Arrived Red Snapper Sink at 20:30 - profiled RSS until 23:30 with 4
good passes at sink - unspectacular except for showing that the sink
occurs at a regional depression in the strata. Profiled all night
toward Cape Canaveral.

8/28/79 Waves 2-4'. Spectacular data showing several buried sink holes and
(Tues) undulating buried surface very suggestive of regional tectonism between
Red Snapper Sink and Cape Canaveral - beds are draped onto this rough
surface - beds below surface are folded into broad anticlines and
synclines and top surface appears to be eroded

15:50 - End of survey

16:00 - Proceed full speed to Miami

8/29/79 Dock, Dodge Island, Miami 0900
(Tues)