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Cruise Report

R/V ATLANTIC TWIN 76-1

DSRV NEKTON GAMMA

1-7 July 1976

Roscop 5 Oct 76

D.W. Folger, U.S.G.S.
Woods Hole, MA 02543

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Vessel: R/V ATLANTIC TWIN, Master - Van Horn

DSRV NEKTON GAMMA: Pilots - Slater, Parsons and Czahara

Cruise No: R/V ATLANTIC TWIN - 76-1; DSRV NEKTON GAMMA

Area: North Atlantic (Georges Bank Area), U.S.G.S.
Mooring 107, Station 4502, Station 4503
Mooring 108, Mooring 110

Ports: Woods Hole-Woods Hole, MA

Date: 1-7 July 1976

Personnel:

U.S.G.S.	Folger, D. - Chief Scientist
	Bothner, M.
	Fabro, R.
Consultants	Eliason, A.
	Vine, N.
VIMS	Kraeuter, J.

Scientific and Navigation Equipment: Loran A,C; ATNAV System; Montedoro-Whitney Corp. Nephelometer-Transmissometer; Filtration Equipment; 35 mm cameras.

Narrative (Chief Scientist's Log)

1 July 76

2330 depart Woods Hole in dense fog

2 July 76

1030 arrive Boston approach buoy (Mooring 107) Checked ATNAV on moored current meter - able to interrogate for a distance of 2 miles. Diving not possible due to dense fog and heavy swell.

1653 launched sub (Dive 683; Folger & Czahara) to survey current meter array. Due to the high currents and turbidity, we were unable to make the search.

1824 positioned ship once more and launched again (Dive 684; Folger & Parsons). Current velocity too high to navigate the sub on the bottom and the dive was terminated.

2130 Nephelometer lowering

3 July 76

0730 steamed to station 4502. Set buoy on Loran bearings.

1000 conducted search for pinger with the ship - no signal received. Visibility 1/4 mile due to fog - no diving possible. Sea calm with large swells.

1100 commence search for pinger with the whaler. No signal received.

1314 Dive 685 (Kraeuter & Slater) current 1-1/2 knots could not hold sub to make search - sub recovered.

1430 commence nephelometer-transmissometer measurements.

1530 main crane winch blew hydraulic line

1700 Hydrocast and suspended matter sampling 4 nephelometer lowerings.

1809 launched sub (Dive 686) at site 4502 (Folger & Parsons). Current once again too strong to maneuver. Flat bottom no ripples.

4 July 76

0600 on Station 4503 (Mooring 108)

0800 search for and located pinger north of the northern buoy.

0900 set ATNAV transponders - commence survey of area.

1320 launched sub (Dive 687; Bothner & Czahara), 100 m north of the northern buoy. Located pinger, could not find wheel or pipe. Surfaced at 1450.

1531 launch Dive 688; Folger & Slater - found railroad wheel, unburied, essentially the same as when it was surveyed in Sept., 1975. Sub forced to surface due to approaching fog at 1603.

2000-2300 conducted transmissometer-nephelometer, temperature lowerings; collected 3 suspended matter samples.

2300-2400 calibrated ATNAV System.

5 July 76 - on Station 4503

0700 heavy fog, sea calm.

1300 commence nephelometer experiments, hydrocasts, suspended matter.

1530 start recovery of ATNAV transponders

1930 completed recovery, visibility still less than a 100 m.

1945 lower the nephelometer - 3 casts.

2050 complete nephelometer lowerings

2100 commence steaming to Station 111
No dives possible during the day due to extremely dense fog.

6 July 76

0900 arrive on Mooring 110 - fog moderately heavy. Survey the area with ATNAV transponder.

1000 fog cleared

1055 launched sub (Dive 690; Folger & Parsons) to survey bottom and search for lost current meter. At 1143 fog closed in, the dive terminated before the survey or search completed. Recovered sub; fog closed in; visibility less than 50 m.

1404 commence nephelometer lowerings, 1 hydrocast.

1530 secured nephelometer lowerings.

1540 commence steaming to Woods Hole - visibility less than 10 m.

Daily Log — R/V ATLANTIC TWIN

Date: 2 JULY 76 | Day | Position – Area of Activities: Woods Hole. Georges Bank, Mass.

Charter Party G.O. (USGS) 9

Crew W. VAN HORN - J. Ratkowitz . T. Silker . L Redling

Activities Nekton Gamma support - Sampling

Weather Am - fog Temp. 68° Baro. 30.01 ↓ Tide Wind SW 10

Time	
	enroute Woods hole - Georges bank HEAVY fog
0045	Off Cape Poge - Marthas' Vineyard - 114° c
0108	Changed Course 098° c Reduced speed 1000
0436	" " 125° c Heavy Fog. Vis 200yd
0645	" " 155°
0710	" " 175 Vessel on stbd bow 1.5 mi
0740	" " 145
0910	Vis. 3 mi. Resumed speed
1015	On station - Swells 5' SW. 1H7 2844 3H5 1067
1654	Sub away 40° 48.5' N 69° 00 W
1800	Sub on Hip -
1820	Sub away 40° 48.6' N 69° W
1855	Sub back. loaded on deck
	Worked on STD + Sample equipment
2200	Relocated Vessel out of Shipping lanes. Set night watch for drift - N.L.C lights lit

Break | Lunch | Dinner | Hours Operated

Daily Log

R/V ATLANTIC TWIN

Date: 3 JULY 76 | Day: SAT | Position – Area of Activities: Great South Channel, Georges Bank

Charter Party: GC (USGS) G

Crew: WVH - TS - LR JR

Activities: Nekton Gamma sampled

Weather | Temp. 64° | Baro. 30.15 ↑ | Tide | Wind SW

Time	
	hove to + drifting .5 mi W of PN Buoy
00 1	1 Target in sight - trawler 3 mi East
0630	chck
0640	Best Accuracy - 345 - 143 - Underway
0735	Hove To: Approximate Dive Site -
0735	Buoy Over 143 - 3576 345 1106 143 - 2877
1155	launched Whale for Search
1316	Sub Away 143 3577 345 1105 143 - 2877
	Winds calm - SW swell 1-2 Haze - Vis
1425	TDC Array 143 - 3577 345 1107 Deployed
1450	" " 143 3572 345 1106 Retrieved
1545	" " 143 - 3577 345 1106 Deployed
1716	" " 143 3565 345 1101 Retrieved
1720	" " 143 3577 345 1107 Deployed
1731	143 3561 345 1096 Retrieved
1800	Sub Away 143 3569 345 1100
1150	Sub on ship 3568 345 1100
2010	Buoy picked up - Underway #108 100°C

Break | Lunch | Dinner | Hours Operated

Daily Log — R/V ATLANTIC TWIN

Date	Day	Position – Area of Activities
4 JULY 76	SUN	GEORGES BANK

Charter Party G.O. (USGS) 9

Crew VanHuen - Silker - Redling - Ratkowitz

Activities NEKTON GAMMA SUPPORT

Weather CLR. Temp. 64 Baro. 30.15 Tide DATUM OF 19 Wind S 5-10

HAPPY 200TH BIRTHDAY AMERICA

Time	
	ENROUTE SITE # 108 - STEERING 100°C
0340	CHANGED COURSE 108°C - REDUCED SPEED IN FOG - 1200
0415	NOTED SERIOUS ERROR IN 3H4 BEARING - CHANGED COURSE TO 060°C
0620	ON SITE. EASTERN BUOY 1147:2521 1143:2860 3H5:1039
	THICK FOG - VIS 150'
0700	WINDS INCREASED TO 20 30 K. WNW. VIS. 5 MI
0814	PINGER OVER ~~CENTER OF BUOY TRIANGLE~~ E OF E BUOY
0845	2ND PINGER OVER BRG 132° - 312° M FROM EASTERN BUOY
0934	3RD " " " 210° - 030° M FROM CENTER OF AREA
1315	LAUNCH 100 YDS NORTH OF NORTH BUOY
1445	SUB UP - ON HIP.
1530	SUB AWAY - SAME AS PREVIOUS DIVE LOCATION - RR WHEEL 400 YDS NORTH OF NORTH BUOY IN LINE WITH N/S BU
1608	SUB ON HIP - 600 YDS NNE " " "
	SHUTDOWN DUE TO FOG VIS 3/4 MI.
1849	SUB AWAY - 100 YDS NNW OF NORTH BUOY
2002	PICKED UP SUB 3/4 MI E OF NORTH BUOY
2025	SUB ABOARD
	RAN WATER (STD) SAMPLES + NAV. TRAVERSES
2350	ANCHORED 1/2 MI N.W OF SITE - 38 FATH

Break 13 Lunch 13 Dinner 13 Hours Operated 24

Daily Log

R/V ATLANTIC TWIN

Date 5 JULY 76 Day MON | Position – Area of Activities Georges Bank

Charter Party G.O. (USGS) 9

Crew WVH TS LR JP

Activities NEKTON Gamma support

Weather CLR - Temp. 64° Baro. 30.15S Tide based on 1230 -MF Wind V 10

Time	
	Anchored 1/2 mi N.W of Test Site 41°51.2 N 67°24 W
0600	HEAVY FOG Laying To on anchor
	worked with sampling equiptment off A frame
1525	Weighed anchor - moving back to buoys
1540	Began Search for Drifting Pinger.
1705	Recovered pinger #1 - Began Retrieval of 2+3
1830	P.U. No. 2
1930	P.U. No 3 - visabilit 100 yds
2055	143 2847 147 2523 41°50 N 67 23.2 W
	END of Sampling (START AT BUOY AREA)
2100	Underway Steering 020°m
2115	Changed To 012°m
	Break 13 Lunch 13 Dinner 13 Hours Operated 24

Daily Log

R/V ATLANTIC TWIN

Date Day	Position – Area of Activities
6 July 76	Georges Bank

Charter Party U.S.G.S (G.O.) 9

Crew WVH TS JR LR

Activities NEKTON GAMMN SUPPORT

Weather patchy fog Temp. 64 Baro. – Tide Wind 12-18 mph Pollock

Time	
	Enroute between sites - frequent Thick fog & numerous boats.
0630	STEERING 320 - crossing shoals
0900	ON STATION - 1H3 : 2651 1H7 : 2160 41°54'N 67°47.7'W
1055	Sub away 1H3 : 2652 1H7 : 2160 300 yds W. of 'A' Buoy
1132	Fog closing in - Aborting Dive
1141	Sub on hip - @ buoy
1404	Began STD sampling - AT 17 Buoy
1545	Underway - Reduced speed - 260°M.
	Stopping @ 1/2 hr intervals for Sonic scan
1800	Underway. Woods hole - 262°
	Heavy fog - Reducing Speed in Traffic
	Area

Break 13 Lunch 13 Dinner 13 Hours Operated 24

Daily Log — R/V ATLANTIC TWIN

Date 76 Day 7 JULY WED | Position – Area of Activities WOODS HOLE - OFFSHORE

Charter Party G.O. (USCS) 9

Crew WRH TS LR JR

Activities NEKTON-GOMMA SUPPORT -
ENROUTE WH TO EXCHANGE PERSONNEL

Weather LCO | Temp. | Baro. | Tide | Wind SW 20

Time	
0001	Proceeding Reduced Speed in fog
0300	A Buoy - G.R.S. Channel -
0505	Resumed speed - Visability 2 Mi.
0918	N.M.F.S. Dock Woods Hole
1120	moved to WHOI Dock - Took on fuel - water Grub - Laundry - Changed Oil - Mains & Gen. Scrubbed decks
1530	Secured - Crew released for personal business until 1800
2030	underway
2130	235° C
2200	Running @ 2/3 speed in 5' head seas

Break 13 Lunch 4 Dinner 8 Hours Operated 24

Operationa. Summary
ATLANTIC TWIN - NEKTON GAMMA
1-7 July 1976

Sta./Dive #		Date	Locations Lat.	Long.	Loran (A) (C)	Time Down	Up	ΔT	Water Depth	Observer	Pilot	Notes
Moor. 107	683	July 2	40°48.6 N	69°0.0 W	37541.2 70182.5 (C)	1653	1800	67	77	Folger	Czahara	1-1.5 kts current large sand waves could not locate meters.
"	684	"	"	"	"	1824	1845	23	77	Folger	Parsons	Currents high Could not stem currents.
Sta. 4502	685	July 3	40°38.9 N	69°02.5 W	1105 3577 (A)	1314	1352	38	85	Kraeuter	Slater	Current 1-1.5 kts Conducted biology survey.
"	686	"	"	"	"	1809	1919	70	85	Folger	Parsons	Current 1-1.5 kts Conducted bottom survey.
4503 (Moor. 108)	687	July 4	40°51.2 N	67°24.0 W	16138.0 36801.1 (C)	1320	1450	90	84	Bothner	Czahara	Pipe search and bottom survey.
4503	688	"	"	"	"	1531	1603	32	84	Folger	Slater	Located RR wheel.
4503	689	July 5	"	"	"	1850	1953	61	84	Kraeuter	Slater	Pipe search and biology survey.
Moor. 110	690	July 6	41°59.0 N	67°47.0 W	36484.6 69979.5 (C)	1055	1143	48	85	Folger	Parsons	Current Meter search - bottom survey

Sample Inventory
ATLANTIC TWIN 76-1 - NEKTON GAMMA

Station	Date	Time	Location	Data	Custodian
Mooring 107	2 July 76	2130	40°48.6'N 69°0.0'W	Transmissometer lowering (Tape 1)	Bothner
4502	3 July 76	1430	40°38.9'N 69°02.5'W	Hydrocast -T & Sal., Samples	"
"	"	1700	"	Hydrocast -T, Sal., Suspended Matter 3	"
				4 Transmissometer lowerings (Tape 2)	
4503 (Mooring 108)	4 July 76	2000	40°61.2'N 67°24.0'W	Hydrocast - T, Sal., Suspended Matter 3 Transmissometer 1 Cast	"
"	5 July 76	1300	"	Hydrocast- T, Sal., Suspended Matter 3 Transmissometer 1 Cast	"
		1945	"	Transmissometer 3 Casts	"
		2030	"	Hydrocast - Temp., Sal., Suspended Matter 3	"
Mooring 110	6 July 76	1400	41°59.0'N 67°47.0W	Hydrocast - Temp., Sal., Suspended Matter 3 Nephelometer - 1 Cast	"

Transmissometer 8 casts
Hydrocast 6
Nephelometer 1
Suspended matter samples 5

Discussion

Objectives of this cruise were to evaluate changes in bottom configuration and biology in areas where railroad wheels and pipes were set in 1975, and to search for a lost current meter array.

At Mooring Site 107 currents on the bottom were too strong (75-100 cm/sec) for the submersible to maneuver. Thus the current meter array could not be inspected. A survey of the bottom, however, revealed large sand waves or dunes (several meters in wavelength and 50-100 cm high) moving along a gravel and cobble pavement. Crests of both these large waves and of smaller ripples were being reoriented by the tide indicating that tidal flow in and out of Great South Channel causes significant movement of sand on the bottom.

At nearby Station 4502 few ripples were evident even though current velocities were as high as those observed at the current meter mooring. The layer of gelatinous spherules (tunicates) that covered the bottom in September, 1975 was not present. Why the gravelly, sandy bottom appeared to be stable is not yet obvious.

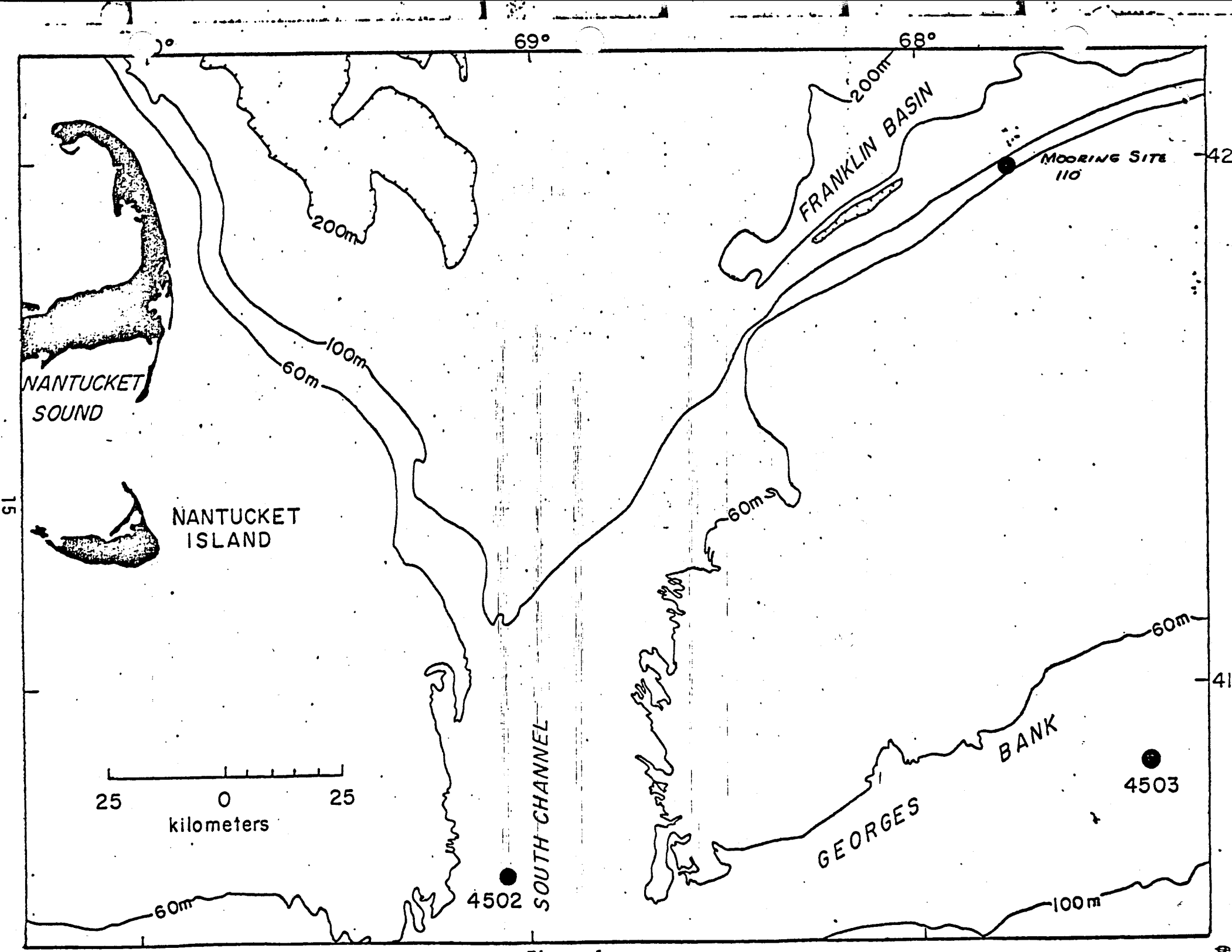
At Station 4503 currents were higher than those experienced in 1975; these hampered the search for the pipe and wheel. However, the wheel was located and photographed extensively. Little change in the bottom was apparent in the area suggesting that sediment does not move substantially. An array of ATNAV transponders was deployed at this site to evaluate the system for precision navigation of the submersible. The system was not used to guide the submersible, however, because one transponder failed after locations of all three had been established with the computer. As a feasibility study the deployment was successful.

Mooring Site 110 on the north side of Georges Bank had not been surveyed previously. The main objectives of the dives there were to recover a lost current meter array and to evaluate bottom conditions. The bottom comprised hard sand almost devoid of ripple marks and covered by brittle stars. The 2000 lb. mooring anchor for one buoy had barely sunk into the sand. Currents were slow (<10 cm/sec). Unfortunately no extensive search or survey was conducted because dense fog caused the first dive to be terminated early and precluded further dives.

Diving operations during the whole cruise were severely restricted by heavy fog that shrouded the Bank during part or all of each day. Sea conditions were most often good but visibility commonly was not within operating minimums.

Because of a new safety procedure on the submersible no grab samples were taken as anticipated. However, 15 samples of suspended matter, salinity, and measurements of temperature were recovered and 10 lowerings of the complete transmissometer system were carried out. Time was not available to complete the 30 lowerings as planned. These lowerings were particularly significant because they revealed a persistent nepheloid layer at about 40 m depth and also proved that the transmissometer system with a deck readout is an extremely powerful tool for the study of suspended matter in shelf waters.

The XBT's scheduled to be deployed were saved for a subsequent cruise aboard R/V OCEANUS.


69°
68°
200m
FRANKLIN BASIN
MOORING SITE
110
42
NANTUCKET
SOUND
100m
60m
NANTUCKET
ISLAND
60m
60m
41
25
0
25
kilometers
4502
SOUTH CHANNEL
BANK
GEORGES
4503
60m
100m

July 2, 1976 Dive #683 Station: Mooring Site 107 Observer: Folger Pilot: Czahara

Nekton Dive 683 our initial dive with ATLANTIC TWIN 76-1 and Nekton Gamma. We are at mooring site 107, the Boston approach buoy; we are diving to examine the current meter assembly that lies roughly 300 m at 190° from the buoy. Diving at 1653 - 90 feet - temp. 10.8°; 140' - 10.2°C. Heavy concentration of plankton at 200' - 10°C; depth 240' - 10°C. Bottom in sight.

Visibility is good 15 - 20 feet; it is a sandy bottom with ripples and some broken shells; not much in the way of vegetation. On the bottom at 1657 - heavy plankton (abundant arrow worms); ripple-marked bottom with assymetric ripples. The current ripple orientation is exactly reversed to the present current flow which is flowing at right angles to the axes of the ripples; but the steep sides are up current. Current flow is towards 200° approximately north to south exactly reverse to the flow indicated by the ripple marks. The ripples do appear to be reorientating - I can see the crests backed over.

We have now taken 4 color photos - the flash did not go off on a couple of them. The time is now 1704, we are beginning on a heading to take us towards the current meter mooring. The bottom is ripple-marked with asymmetric ripples. We are going over some very large ripples or dunes several meters in wave length and at least 60 cm high. Nearby is a smaller set of asymmetric ripples of 5-10 cm length and a cm or two high. The bottom here is covered with white shell debris - mostly Arctica, maybe some spiscula - can't really tell because suspended matter is dense. The sand looks to be fine to medium grained - mostly quartz and felspar with some dark minerals (magetite). Pebbles are abundant - up to several cm in diameter - they do not seem to be concentrated in the troughs. Animal life is common - skates, hake, some kind of greenish algae on the bottom and a lot of little pinkish hydroids. (Shooting photos) - Several large sand waves and quite a few giant sea stars. Now going over another sand wave several m long. Some are

large - about 4-5 feet high every 40-50 feet. The sand waves are probably 3-4 m long and they are a meter and a half or so high. They are very steep features and dune-like; some of them have smooth backs others are rippled somewhat. We are now traversing the bottom - it is 1712 - we are looking for the main current meter array - just went over a big boulder - it is the first big boulder I've ever seen here - it is about 60 cm across and covered with anemones; the bottom is covered with these little pink anemones a couple of cm high; gravel is quite variable in size - from 1 cm across up to 10 cm. The current is reversing the lip at the tops of ripples as they begin to reorientate themselves in the opposite direction. Placopecten are about 20 cm across; there are many small, white star fish, common small fiddler crabs and either rays or skates. We are going up and down over large sand waves - it is clear that current velocities at times are higher than they are now - I would say that the current is actually at least a half knot and maybe a little faster. Reference on camera photos - picture of a sand dollar should be good. Photos from lower window of gravel bottom; one boulder looks like granite-well rounded and smooth - there are enormous masses of sand prograding over the shelly bottom - clearly they are in motion. Virtually no shells in or on the big sand waves themselves. More fish in this area than I have seen before - white and reddish sand dollars are common. Because of the very high turbidity in the water it probably will be tough to get good photos - most of the photography will have to be at close range out of the lower port. A number of spotted cod fish down here - first ones I've seen - they are light gray, not very big 10-30 cm. 1725 taking more pictures. 1729 still traversing; pebbles seem to be much more concentrated. The micro ripples are only 10 cm long and 1 cm high. We are now moving into an enormous shell bed mostly placopecten shells - all concave side down with few exceptions; they look quite old. Again the ripple asymmetry seems to be exactly reversed to the current flow. We must be looking at fairly recent tide change from flow into Great South Channel to flow now more or less out of it.

We got blown a long way on the descent - we are now going directly into the current. A big mean looking fish here looks like an eel pout. Small particles are being pulled along the bottom, they are mostly organic. I just saw a small clam literally being rolled along - the current velocity apparently is increasing. I've seen a number of tracks and trails in some areas that completely obliterate the sand wave pattern. Hydrzoans make a very nice indicator of current direction - they are leaning way over with the current. Small transparent shrimp are lying on the bottom. Green algae is present in some areas and totally absent in others. Snapping a sequence of shots here of the hydroids tipped with the current - lot of tiny red caridean shrimp. 1751 we are beginning to surface - unable to reach the current meter mooring because of the high current velocities on the bottom which are now about a knot. Passing 150' - temperature 10° - 110' - temperature still 10° - light increasing. We are at the surface now - almost 1800.

July 2, 1976 Dive #684 Station: Mooring Site 107 Observer; Folger Pilot; Parsons

Going down at same location - we'll try to get up current of the current meter array and run down on it. The time is now 1824 - we are now entering the water. Water temperature at the surface is 15.5° C. Commencing descent at 1825 - temperature decreasing - 14° at 40'; 13.5° - 50'; 13.2° descending rapidly in abundant plankton; 12° at 90'; 11° - 100'; 10° passing 150'; 10° passing 200'; at the bottom - 248' depth - temperature 10.1° - time 1829. Bottom covered by fine and medium sand; ripple marks now reorienting on the edge of one of the big dunes - active winnowing going on on a sharp dune. Sand looks as if it had been moving one way and now it is being transported back the other. We are now running down current - little hydroids are all pointing in the same direction we are going now - no question that they lean with the current. The big dunes have very sharp features and they appear to be a couple of meters long and a meter high. Must be close to the angle of repose on one side. The sand waves apparently reorient completely during each tidal cycle. We're supposed to be about 20 meters from the target but we have been blown down current again and can't make enough headway to go into the current here. We're leaving the bottom at 1845 - water depth of 250 feet - lots of arrow worms in the water here -- blue, small, a few cm long. Very heavy turbidity at 200' - looks like a snow storm. At 150' turbidity is somehwat less - 100' turbidity moderate not particularly heavy. Surface - end of dive at 1845 2nd of July. Concludes dive 684 - an unsuccessful attempt to find the current meter array.

July 3, 1976 Dive #685 Station 4502 Observer: Kraeuter Pilot: Slater

Left surface 1314 and returned 1352. Heading down 20'. 50-70'. A lot of snowflake-like stuff in the water. Very turbid - 100' still very turbid. Still very turbid, looks like snowflakes going by. 150' still the same snowflakes. 200' still much the same. On the bottom. A lot of asteroids and some cerianthid anemones. Looks like two Astropecten - both are Asterias vulgaris. Cerianthid anemones. Current very strong, we can barely move. Bottom flat, smooth, no ripples. A small hermit crab. Looks like little mud tubes sticking up out of the bottom. We're not moving at all. Another small hermit crab. The bottom appears to be a fine to medium sand covered with patches of small tubes. Some hydroids like a Sertularia. The hermit crab is like the red striped ones we've been getting in our samples. Pagurus acadianus, I believe. Dead Arctica. A lot of hydroids and cerianthid anemones. A starfish literally sliding across the bottom moving quite rapidly. There's some kind of a sculpin - sea robin (sea raven), it's not the striped one. There's a large burrowing anemone like the orange one Jack brought back from our last cruise. Lunatia heros. Quite a few of the short stubby orange anemones as on our last cruise except these are white. Great many very samll tubes. Placopecten. Placopecten is way down in a depression. A sponge sliding across the bottom. A flounder here, I'm not sure what kind. There's a starfish off a ways, looks to be a Henricia. Saw another live scallop near the sponge that was sliding across the bottom. A lot of fairly small skates. The fish are all oriented into the current. They appear to be sea robins (longhorn sculpin) and skates. There's a hake, I can just barely see. Placopecten way down in a depression. A lot of small hermit crabs out here. Another small Placopecten way down in a depression. Large Placopecten forms a depression just like a bay scallop.

Siphons of some clam - probably Arctica. There's a white Asterias that may be Asterias tanneri. Also just saw a small shrimp like Dichelopandalus. A bunch sea squirts or something like that. Placopecten, skate egg cases. There's some kind of nudibranch barely holding onto the bottom. Yellow tail flounder. A small Cancer tumbling along the bottom. Cancer borealis. Large sculpin like fish (Sea Raven). Another Buccinum. Fronds of some kind of a holothurion sticking out of the bottom. Skate looks like a little skate. A couple of Merluccius. These hake are just lying in little depressions in the bottom hanging on like everybody else. A lot of the starfish are wrapped around things. It looks like they have just been feeding. Eelpout. Just took a picture of a Placopecten and a Cancer both in the same depression. Cancer borealis. Red hake or white hake. Another large eelpout. There's another nudibranch and a small crab which I can't identify. Also a Dichelopandalus. Another large Cancer borealis.

July 3, 1976 Dive #686 Station 4502 Observer: Folger Pilot: Parsons

About to commence dive 686 at 1809 on station 4502 - we've been unable to locate the pinger in the area of the pipe and railroad wheel; in the water at 1810. Surface water temperature is 17° C - commencing descent at 1812 - 3 July. Suspended matter is not particularly dense so far, in fact it is quite clear. 30' - temperature 16°C; 50' - temperature 14.9°C - thermocline is quite abrupt; 75' - temperature 11.5°C dropping very fast; 100' - temperature 10.8°C. Looks like the temperature is staying right at 10° at 150'. Suspended matter is very heavy down here now - looks mostly like planktonic debris - very coarse and quite concentrated; 200' - temperature 10°C; approaching the bottom - on the bottom at 227'. Bottom temperature at 227' - 10°. The bottom here is quite flat. Some hummocks and depressions made by placopecten. Drift approximately 1/2 to 1 knot - quite a lot of fine material overlying coarse sand and gravel that looks to be mostly organic. Many hydroids. Very strong south drift. No ripple marks here to speak of - that is kind of remarkable at this depth - I can't see any indication of them or of any sand waves. The bottom has a sort of growth on it. This is much different from yesterday at the mooring site (107); entirely different bottom here - no well defined ripples - no large dune like sand waves. Perphaps this organic coating over the bottom holds the sand particles together. Fine particulate matter is moving over the bottom - some shells are concave up - in fact quite a few shells are. Shell debris and star fish are abundant with some small shrimp. There is a nice big flounder. I'll try a few movies - I'll commence a few moving pictures here. Okay, this bottom is still anomalous - it may be that there's a great deal of very coarse material, certainly the gravel is much more abundant than yesterday, but there is no evidence of ripple marks - even though the tide has been flowing very rapidly; the two options are one coarse sediment and the other protection by this organic filamentous layer that seems to be present everywhere. The time is now 1830 - drifting on the bottom just above the bottom. I'll take a little more footage to show these hydroids. I think

that tide has slowed down a lot. These photos will be good photos - initially to show a contrast; later on we'll take more in the sand wave areas and show the difference; certainly should be ripple marks forming here, but there aren't, last year the area was covered by gelatinous tunicates and we assumed that was the reason for the absence of ripples. Thus far, we have seen no boulders whatsoever, just pea gravel and fine to medium to coarse sand; it's still covered with this debris; lightish gray to tan, it covers the bottom with about a 1/2 cm layer or less. The main perturbing influence on the bottom here is the scallops - they make large depressions, I imagine to get out of the current; the rest of the bottom is quite featureless. A little more movie coverage - including a skate and two red hake - again, some angular pebbles, a lot of pea gravel well rounded up to 2-3 cm and some cobbles but very few. Just took a photo of a large white placopecten shell - concave up - location for this series of shots - a series of no flash photos in here will give some identification. I have gotten a good skate shot in here, I am shooting most of these at X and F8 and I'm going to shift to F6 now. The scallop depressions seem to be covered with gravel - obviously the scallop winnows away the fine material - maybe that's why it is concentrated, but on the other hand there may be a layer of gravel just below the surface. There is one of those big depressions - all gravel lined - the focus is pretty good - shot of it. That ended that film, ran out of tape and ran out of film; we've been down about half an hour. Starting a new roll of film, I'll take a couple of shots inside to get us oriented. Note the red light to start the second roll of dive 686 - 3 July 1976. Okay, I'll take a few still shots now of the same location just to watch particles moving by-these ought to be

pretty good - and then a little movie footage of the same hydroids to give you an idea of the current velocity. I think we are about finished - we'll conclude then with still photos of the current moving the hydroids and the material along the bottom, and I'll snap two black and whites of the light inside. Preparing to conclude the dive at 1913. I think I'll take a little movie film on the way up to show the change in the concentration - leave the lights on - okay, that will be good. 1914, I'm taking a little movie film as we go up - okay, commencing ascent, we're just off the bottom now, depth is now 222', taking some movies of the suspended matter. I'll take a few shots at say every 25'. We had some suspended matter from the bottom up to about 20', we'll take some more around 200' - 200' photographing - this is about 190' to 200' - marker line is now in view. You can see the white line moving back and forth - our buoy line - depth 175' - ascending more quickly - 150' and ascending - no line visible any more - 100' ascending - for this next burst (50') sequence will begin to get a little lighter with less particulate matter showing. I just used up the film - up to the surface and the film is now gone - on the surface at 1919.

July 4, 1976 Dive #687 Station 4503 Observer: Bothner Pilot: Czahara

Nekton Gamma is in the water at 1320. We're on our way down at 1322. Temperature of surface about 15°C; depth 80' - temperature 11°; depth 100' - good deal of suspended matter in the water - lot of large particles in addition to many fine ones - dominantly finer particles - larger clots look like they're about as big as a head of a pin - just passed through into clearer water now - depth 130' - between 100' - 130' is a phenomenal change in the particulate matter - temperature 10°C; depth 190' temperature 9°C - particulate matter has changed from a combination of large and small to predominantly large particles - still the same size as the larger ones above - looks like 1/2 the size of a hat pin head. Depth 245' - temperature holding steady at 9°C. Particulate matter hasn't changed much - water seems a lot bluer than it did in the upper 100'. We're on the bottom at 1326 - 275' depth - visibility is great - bottom looks like silt - have a little fish down here - here's a hermit crab that looks like he's just barely got a shell on him - not much of a shell - lot of little worm tubes pretruding from the bottom. Fast current - moving what looks like worm tubes. Current estimated to be about 1/2 knot - bottom is not entirely smooth - somewhat irregular on a scale of 1/2 inch. Depressions couple of inches of wave length maybe but no regular smooth ripple marks as such. Snapping a few pictures in a second here - see some sand dollars out there - lot of hermit crabs - just lifting off the bottom now - have some worm tubes sticking right out there - some of them are kind of red; clam shells are full of sand; a few star fish - and a lot of shells - these are all tipped up and full of sand - I'm going to take a picture of them. Picture #2 looks like a bunch of seaweed waving in the breezes. Bottom has a lot of little pot marks - appears to be just eroded out. It's now 1330 temperature of about 8 1/2°C. The bottom is fairly featureless - doesn't have characteristic marks.

Water is pretty clear - saw one hake go by something with big white feelers on the front, I guess that is a hake. Heading north with the current; quite a lot of fish out here - not very big ones yet - some look like jacks. I've seen skate - a lot of clam shells on the top; some fish buried right in the mud. It looks like some conch shells here - there's my first crab coming up - looks like a duengeness to me. Got interested in a couple of scallops that came up off the bottom - they stir up quite a bit of mud as they move - we're coming up on a moon snail now. This current is about 1/2 knot and does not seem to be picking any sediment up off the bottom; the little plants or worm tubes, whatever they are, seem to roll along a little bit and seem to wave in the breezes, but there's no active sediment pick-up that I can see. Shells that are turned with a cup shape up definitely have sand in them. Nice big cod now coming in front of the sub. See if I can get a picture of that one - quite a few cod right around the sub at the moment. It is now 1340 - temperature still just a little under 9°C - and we are cruising around at a depth of 278'. We're heading due south right into the current - heading for the railroad wheel - pinger has a very weak signal. We're sitting pretty quiet on the bottom right now trying to find out what directions to head towards the pinger. Trying to focus on a hermit crab sitting right here on the bottom. Sediment really looks like fine sand, been pretty uniform for the whole trip so far. A lot of these big scallops have apparently dug holes sitting right in the middle of them. There's a skate. Major topography here looks like its generated by the benthic organisms - some dug out holes, otherwise its pretty flat - no appearance of well defined ripple marks or ripple marks of any kind. It's now 1355 and we're still heading about 120° to track down the pinger. About the only place where we can see a lot of debris that is in these big holes - sort of like impact craters is what they look like to me; as far as biology goes it impresses me that there are more crabs than anything else - there are also lots

of hake - - - but crabs seem to predominate. Visibility is still pretty good - 20-30'. There's some eel pout in there - a lot of - looks like a ling cod. We are at the pinger at 1404 - there are some eel pout sitting all around the anchor. One of them has its tail chopped off. I'll try to get a picture of that. There's a lot of debris right around this particular anchor - all kinds of shell fragments than we've noticed before; hermit crabs galore - and of course a big fish is sitting right there; also all around it is a collection of seaweed that reminds me of tumbleweed. There is a large piece of carpet draped around the chain. It's 1406. We have left the pinger and now are trying to find the railroad wheel. Everytime a fish takes off swimming real close to the bottom sediments get stirred up - and there's a good path of cloudy water right behind them to either side. I smell a little smoke in here. The pinger anchor looked like it was pretty well current swept; all the way around it were shells - that suggests some erosion around because of the extra turbulence. Looks to me as though the lineation on the bottom is with the current parallel to our course. Plant life down here that's rooted in the bottom is usually stirred up and torn out when a fish takes off so it's not very firmly rooted. It isn't very rugged stuff - a good current would move this stuff right off. We are now traveling with the current - heading due north - it's 1432. This sediment really isn't all sand - when we hit this bottom and it just flies up all over the place and stays in suspension. Just took a picture of the suspended matter just outside the port window. Okay, we are at the pinger again at 1435. A little evidence of sediment turnover down here - I can see some small holes in the bottom with a lot of grayer colored sediment around them - they are like ant hills - quite a few of them. We got a transponder line. I can see it in the sub now so I'm going to

use it as some sort of indicator for the turbidity. I see a little skylight at this point - there seems to be less suspended matter in the water column now. At about 100' there's a phenomenal change in both the color and the nature of the particulate matter. We've got in addition to some of the big particles a lot of fine particles; plankton has picked up a whole lot too - just saw a couple of jelly fish; 50' it's getting clear - bright I mean, we are on the top at 1450.

July 4, 1976 Dive #688 Station 4503 Observer: Folger Pilot: Slater

Dive 688 preparing for launch at 1523 on the 4th of July - Nekton Gamma dive 688 ATLANTIC TWIN - 76-1 - Folger observer Slater pilot. Snapped 4 or 5 photos - numbers about 15-20 on this roll that are going to be blank or red. Commencing dive at 1531 - temperature 16°C at the surface. 40' - temperature 15°C; 50' - temperature 14.1°; 60' - temperature 18.2°; 75' - temperature 12.8°; 120' - temperature 11.5°; suspended matter increasing - 140' - temperature 10°- the water is colder here. 160' - temperature 9.2° - turbidity about the same - 180' - temperature 9.0°; 200' - temperature 9°; 220' - temperature 8.9° - turbidity seems to be less; 240' - temperature 8.8°; 255' - temperature 8.7°; bottom in sight - on bottom at 1534 - temperature 8.8° depth 275'. The bottom here is relatively featureless - some small hummocks - some fairly large depressions that are probably made by scallops - no obvious ripple marks nor a lot of tufted organic debris. The ripple mark pattern that was obvious here last year is definitely not present now - turbidity is not too bad - visibility must be 6 m - number of concave up shells. First photos will be close ups of the bottom to show the lack of ripple marks; then a few out the upper window. Several hake were in that photograph. Now we'll get a current velocity measurement - 3 seconds to pass the port. It's pretty slow about 5 cm/sec. We're now making a little tour where we've got a good hard echo on the active sonar about 50 yards distance so we are going into the current. The bottom does not seem very variable; there is no sign of ripple marks here, but a lot of tufted material which I didn't see last year.I tried to get a picture of a large depression filled with shells. Material here on the bottom is very fine to fine sand, with abundant tufted material and some scattered shell debris. A lot of the shells are concave up and some are concave down. We have just located the railroad wheel - we are right on top of it. There are two

enormous goose fish here on either side of it; tremendous amount of shell debris around it and a great deal of weed, brown tufted weed all around it. The wheel itself is not buried. The cable to the buoy is wrapped around it. There's quite a bit of corrosion. We'll get a number of shots - there are two tremendous goose fish lying next to it one on each side. I don't see any lobster. Most of the weed is on the west and north side of the wheel. Getting good shots. We're off the bottom at approximately 1558.

Good coverage good shots of the railroad wheel. We have to return to the surface because of an approaching fog bank. We are concluding a few shots on the camera of the aluminum balls down below us. That will conclude the dive 688. Heavy turbidity zone at 110'; high turbidity at 110' - lot of very coarse floccules and sort of a brownish cast to the water; now it's clearing up 75'depth. Time 1601 - approaching the surface.

July 5, 1976 Dive #689 Station 4503 Observer: Kraeuter Pilot: Slater

30' very murky, very greenish brown. Jellyfish just went by. Lot of activity in the water - looks like a lot of copepods and a lot of suspended material at 100'. Stopped here - a lot of copepods bouncing around. Another jellyfish floating by. They didn't see the copepods like this earlier today. Apparently this may be the migration toward the surface. We are starting to go through the thermocline. The water has become clearer, but there are still large numbers of copepods. 150'. Saw several very small squid. Bottom in sight. Some large shells on the bottom - Arctica. Bottom covered with tubes and slender gorgonian corals - red. Depth 275'. Camera shot 1 shows typical masses of tubes growing across the bottom. Very slight current. I see a Dichelopandalus and a Sertularia type hydroid. Pagurus in a Buccinum shell probably P. acadianus, - try to get a picture of it. Some more of the red gorgonians - single stalks sticking out of the bottom - attached to shells and other things. Some large striped gastropods. I don't really know what they are. (Later found them to be Neptunea lyrata decemcostata). There's an Echinarachnius, it looks like it has been chewed up by something. The bottom looks like finer sand than we had last time. A hake is swimming right alongside the sub. It's probably a red hake judging from the ones the cook caught today. Small live Echinarachnius. I've got a picture of those gastropods (Neptunea lyrata decemcostata). Striped. There's a shell right near them - Arctica. Another live Echinarachnius. The bottom is covered with tubes - could be tubes of Corophium or Polydora. There's another hake going into a depression into the bottom. Some cerianthid anemones, not nearly as many as last time. Bottom seems to be covered with patches of these small tubes. There's a large Pagurus, probably Pagurus acadianus. Trying to get a shot of one of the gorgonian corals. There's one of the Neptunea producing an egg case. Over to the side

I see a Merluccius. More broken tests of Echinarachnius. Something has been eating them. Another cerianthid anemone. Some small Epizoanthus type anemones. Very small Placopecten. Large Placopecten. Several Merluccius. Several crater-like depressions in the bottom not associated with the Placopecten. More Neptunea producing egg masses. Eel pout. Another Placopecten. Another hake. Another hake (red). Most are sitting in little depressions in the bottom facing into the current again. There's a large Cancer borealis. The Merluccius are scattered across the bottom. It gives the impression they are all over bottom - not in schools. Dichelopandalus very small here. There's another Echinarachnius broken into bits. The bottom is littered with scattered clumps of shells, mostly Arctica. Another couple of those large snails burrowed partially in the mud. A large holothurion Cucumeria frondosa. Way off I can just barely see a fish.. (Pilot -- it's got a black spot - must be a haddock). It could be a haddock, I can just barely see him myself. Henricia, another Henricia. Starfish are not nearly as numerous as yesterday. There's an Asterias vulgaris. Another large holothurian, Cucumeria-frondosa. Two red hake. Dichelopandalus and passing over an area now with more cerianthid anemones. There's a small skate. Not nearly as many cerianthids as the other day. Something small here darting back into the bottom as we pass over - not cerianthids. More Echinarachnius broken. Something is feeding on them quite extensively at this site. Good many large hermit crabs and a few small ones. There's another Asterias, looks like quite a few of these may be Asterias tanneri. They're in the whiter or lighter phase; I haven't seen any of the dark ones like we get farther south. The bottom is pockmarked with scattered lumps of shell --- Pilot - there's a scallop about 10' off the bottom see him coming down.. OK. The scattered lumps of shell are interspersed with sand often covered with a lighter material.

Skimming along just above the bottom -- There goes a scallop gliding right by our window. OK. There's a bivalve in the bottom I can't make it out. It must be Arctica judging from the shells. General impression is one of extreme patchiness. There's a Dichelopandalus sitting in the open valves of Arctica shell - right outside is and Epizoanthus type thing again. One of those with the hermit crab inside. Several more scallops. Are we still looking for that pipe -- Pilot - Surface says do a biological survey, but I'm still trying to get up there. The current is picking up. I just saw one of those things that keeps winking in and out of the bottom. It appears to be some sort of a polychaete. 4 spot flounder. Another scallop swimming by. The sub seems to frighten them off the bottom. More Sertularia type of hydroid. One of the large Neptunea shells with a hermit crab in it. The bottom gives the impression of being very flat bottom with a lot of little pockmarks in it. The pocks are about the size of a half dollar or a bit larger. These are interspersed between the tubes and larger depressions made by the scallops and fish. There are some small shrimp lying in the bottom, probably Crangon. Some of the mud tubes growing over the shells. Same ones that appear to make the small mats on the bottom here. Again either a Polydora or a Corophium. There's a Dichelopandalus sitting on top of a scallop -- either a Polydora or a Corophium (on the shell). The current is picking up a bit. There goes a sponge cart-wheeling across the bottom. Again I'm surprised by the number of Echinarachnius that have been eaten or at least chewed up. These octocorals seem to have only one polyp. It is located at the part distal to the bottom. A large Cancer borealis just passed by. The octocorals often have a white eggmass or something hanging on their stalks. Another C. borealis passed by. Two Henricia and what looks to be an Asterias tanneri. Most of the asteroids here appear to be A. tanneri as opposed to A. vulgaris. More large scallops than small ones in this location. There's another silver hake sitting on the bottom. He's sitting in a

depression. Off in the distance you can see the eyes of Dichelopandalus shining in the lights. Silver hake. Couple of anemones on top of the shell. It's been quite a while since I've seen the Neptunea ...Another red hake. We seemed to be in quite a bunch of the gastropods when we first landed since then there have been very few. A large eel pout. A Pagurus climbing over a large Arctica shell. Large orange Buccinum shell of some type. Dichelopandalus seem to be associated either with the small depressions or the shells rather than being out in the open if they can help it. Several scallops in this area again. The red gorgonian. A red hake with a sore on his side. Looks like something took a nip out of him. Small scallop. Dichelopandalus eyes right behind shells. Cancer borealis - two close together. Very large nudibranch crawling across the bottom. Several more crawling up the stalks of the gorgonians. C. borealis again. Red hake right in a bunch of shells. Shells have Dichelopandalus and a lot of small hermit crabs around them. Another eel pout sitting down in a hole. Cancer borealis dug in down in a deep burrow. There a sculpin looks like the sea raven we saw yesterday. Several scallops right together. Haven't been recording. ... There's another of the large holothurians (Cucumaria frondosa) down in a depression. I haven't been recording all the Echinarachnius I have seen out here that are chewed up. Very few live individuals. Something is very actively preying on them. All the carcasses look fresh. Quite a few Henricia in this area also. Another Neptunea sitting over there. Now looking out of the bottom part trying to get a closer view of the smaller things. Again there are quite a few of Henricia inside of shells. There's a lot of the little mud tubes scattered in clumps across the bottom.

A Dichelopandalus hiding underneath something. A few cerianthid anemones and the Eupomatus type polychaetes without calcareous tubes. You can just barely see the fans as they wink into the bottom. They are very quick. There's an Asterias vulgaris. Another Henricia. Several more dead Echinarachnius. Occasionally there appear to be siphons of Arctica in the bottom. There's a large red hake. When they swim, they swim into the current. Large scallops sitting in depressions in the bottom. All around them in the depressions are Dichelopandalus. Cancer borealis, Asterias vulgaris, big eel pout. Another large nudibranch. Silver hake, a large sponge associated with a shell. Some more anemones. Again most of the Dichelopandalus appear to be hiding around shells or stalks of the octocorals and things like that. Very few out in the open. Henricia again. Another Cancer borealis fairly large - dug in. Several off in the distance look like they are feeding on the bottom. Pilot. We've given up trying to get to those targets. Too much current. It's increasing all the time. There was a sculpin of some king - long horned - like we saw yesterday. Looks like the dominant asteroid now is Asterias tanneri followed by Henricia and A. vulgaris. A comment was just made by the pilot that many of the motile organisms seem to be reacting to us today - like fish moving off. Scallops lifting off the bottom, etc. We were wondering if this is typical behavior as you approach dusk. More predation. The pilot says this activity is somewhat unusual. Large Lunatia probably L. heros crawling across the bottom out here. It looks similar to what I have described before and I'm just trying to take pictures and see if there is anything unusual. There's a very very large Asterias vulgaris and a sponge like I took a picture of yesterday. We are getting into an area where there are more Neptunea again. Several large C. borealis. We are going to try to get pictures of some of these animals. Pilot - Did the strobe flash? I think it went. I just saw a Cancer borealis chewing on a shell with some octocorals attached. He's moving off slowly now, we seem to

have frightened him a little. I tried to get a picture, but we're not sure the strobe went off. I think it did. F stop on that was 5.6. I've been shooting most on 5.6. The strobe apparently wasn't working on the last couple of shots. Tried a scallop and a couple of other things. We are going to juggle the connections and see how it is going. That worked. It went off this last time. Took the head shot of a hake. Then a head-on shot of a small skate buried in the sand on the bottom. They may be another cause of some of the pockets. He just got up and moved, awful lazy though. Shot hake - F 4. Gone back to 5.6 now. There's a live scallop with barnacles on it. I'd like to get a picture of that. One was a barnacle. The other was a Crucibulum, an Aporrhais occidentalis although dead. Moon snail sand dollar. Another hake. The hake seem to be swimming toward us rather than away. The pilot says they are feeding on our trail on the bottom. Just put in a new roll of film. Just tried to shoot a Eupomatus type polychaete. We are going into the current now very slowly. I'm going to try to get some of the small things. Just missed one of the Cucumaria holothurians. The current is cutting down our maneuverability. I've tried several times to get the Isozoanthus on the small hermit crabs. I'm going to shoot some at F 4 now. Large Cancer with large barnacles on the carapace. A fairly typical disturbance area with Cancer feeding in a hole. We just disturbed him and a hake came up and poked his nose in the hole also. There's a large Loligo type squid sitting off to our left. Propped upon bottom on his tentacles and tail. Sort of like a tripod. Raised upon the head end. Tried a couple of shots of one large holothurian. He's stuck to some shell material and there are some hydroids wrapped around the area. The very first Cyclocardia borealis I've seen partly exposed out of the bottom. Some stringy hydroid lying right by a clam shell. There's a yellow tail flounder. A sculpin maybe a sea raven, I don't know, he was quite a ways off but had the fleshy appendages. The small Dichelopandalus around here (quite a few) they do not seem to be as

closely associated with shell as some of the others. They may be near the clumps of small tubes or partly buried in the sediment. Just took a picture of a clump of anemones on a shell. A small Dichelopandalus by the shell. Took a picture of a small Strongylocentratus. It was tumbling over the bottom very gently. He did a few turns when I was taking a picture. There are several eel pouts around here and they always seem to have their tails coiled around them. Another yellow tail flounder. A shell here covered with a bunch of very small tubes. Those tubes are also covered with a gray fuzz. The tubes are from a polychaete I presume. OK. That large holothurion I've commented on was Cucumaria frondosa. We just passed up into the brownish layer again. Very sharp. Must be at a thermocline or something. A bunch of squid ink around us. There must be quite a few squid out now. Very noticeable change now at 100', many particles in the water. Many more than were down below the area of rapid change although there was a lot of the white snowflaky stuff down there. Squid just went zooming by the window. There's another. It's beginning to look a little green as we look up. I guess it's still light up above. 50'. A very long siphonophore or something just drifted by as we go up. A chaetognath and a lot of copepods flitting about. We've slowed up considerably. There's a lot of stuff I can't identify that looks like needles - probably Rhizosolenia type diatoms. A little jellyfish of some kind. Now we are starting up again. End of dive at 1953 hrs. Down for a little over 1 hour.

July 6, 1976 Dive #690 Station - Buoy Mooring 110 Observer: Folger
Pilot: Parsons

Dive 690 taking place on 6 July 76 ATLANTIC TWIN 76-1 NEKTON GAMMA Dive 690 on the northside of Georges Bank mooring station 110. We will begin a new roll of film - two initial shots are inside the sub. We are launching at 1055. In the water commencing dive 690 surface water temperature is now equilibrating - looks like 16.9° fluctuating. Commencing descent at 1055. We are just below the surface - temperature 15.9; depth 20' - surface water temperature decreasing very fast - it's now 14.2°; 30'-temperature 13.9°; turbidity very heavy fine particulate matter; 50'-temperature exactly 13°C; 90' - temperature 12.0°; descending rapidly - suspended matter became very coarse at that point; just passed an enormous jelly fish - very coarse debris; 140' - temperature 10.2°C; 150' - 10.0°C - very coarse abundant suspended matter. 190' - temperature 8.1°C; 200' - temperature 7.9° - descent slowing - suspended matter still very coarse and abundant;- 230' - 7.0°C - it's probably pretty deep here - 240' - 6.6° - jelly fish are very common down here; 260' - 6.4°C; 280' - 6.4°C - there comes the bottom - sediment is very coarse. A lot of little brittle stars cover the bottom. I'll have to take a picture. Depth 310' - temperature 6.3°C on the bottom. The bottom is absolutely featureless - current much less than 1/2 knot - 0-1/4 knot. Microtopography is very flat. It looks as if the bottom is covered by very fine sand - looks almost silty - worm tubes are common. No perceptible ripple orientation at this locality, very subdued mounds and little depressions. Brittle stars literally cover the bottom entirely and these are covered in turn by an abundant population of shrimp somewhat larger than what we have seen before. There are occasional star fish and occasional hermit crabs, but it's a remarkably unmarked tranquil looking bottom. The current here is probably less than 10 cm per second and maybe less. It takes 5-6 seconds for particles to pass the port -

~5 cm/sec current speed. There's an eel, first eel I've seen; this is a much different population of organisms than is on the south side of the bank. I'll take a few pictures. We will start our first few 35 mm color shots here on the bottom. No flash - flashed up a storm last time - got to go to time exposures. I'll be shooting all pictures on slow exposures, so these will be the only pictures we get down here close to the bottom out of the lower port. Commencing traverse to Butman's western buoy - no difference here on the bottom - absolutely covered with brittle stars - they're just about arm to arm, the size of them is 10 cm across I guess from tip to tip. This is an amazingly inactive bottom in relation to what we have been seeing. There is one big sea robin, a few big hermit crabs, one eel, one flounder. Population in brittle stars is absolutely amazing. Visibility is excellent must be 6-7 m. There's a small hake and a small skate. Small red hake there - very inactive in comparison to the ones we've seen before. A lot of these big eels off in the distance or sculpins; I guess they are sculpins, big ones - first large scallop and he is large - will have to bring the sampler down to get some samples of the bottom here. There's another little flounder; scallops are enormous. Very fine sand, absolutely filled with worm tubes or some kind of tubes - some of them actually extend above the surface. A few scallops very large - 15-20 cm across. We see a series of little troughs - this might be a trawler crack - could be the chain dragging down here - I think he's got 1 current meter on this too. Here's the chain; you are right on the chain, let's just sit on it so we can take a picture. It's in perfect shape. The bottom here is sort of corrugated and it looks like it's all due to the chain; two pictures of the chain should be good. I imagine most of the wear is going to be up close to the surface. See the chain bouncing up and down on the bottom there, might be a current meter up along it. This chain gives a perfect ripple

mark pattern down here. The material on the bottom is reflecting - now we are going to take a look at the anchor; the chain is in perfect shape; there it is, might get a lobster underneath it if there are any around; there are some pretty big fish around it. The anchor is upside down, it's lying on its top instead of flat. We are now sitting right next to the Stimpson anchor looking right into a great big eel populace that has apparently taken refuge right underneath it; should be a great place for lobster, but I don't see any. We'll take a few still shots right here. Okay, we'll take a few pictures of the corner of the Stimpson anchor if we can. There is no sediments to speak of on top of the anchor - a little bit - everything appears to be in tact. Turn her a little bit to the left, I think will be good - a little more - if she'll hold there it'll be good - buoy probably pulling us right back around again. Picture taking - hope these come out - we can actually see where the chain is on to the Stimpson anchor here. Brittle stars appear to be buried in the area right around the anchor itself; we are going to try a traverse between the two buoys to see if we can pick up the current meter and the transponder. The time is now 1127, commencing the traverse. We have a faint radar target, guess we'll go and take a look at that just to see if the target might be just a part of the mooring - it lies 150' from the western buoy the direction we want to go is ultimately 070° or 075°. Try stirring up the bottom down here and see how fine this stuff is. We'll have to surface because of fog - leaving the bottom at 1133. Will have some temperature measurements on the way up - left the bottom at 310' temperature is now 6.4 depth 300'; turbidity is still quite fine - visibility good near the bottom. We are actually flying up - depth 260' - temperature 6.4° - depth was 280' 270' now, is still 6.4°; 250' - temperature still 6.4°; ascending - visibility is still pretty good here at this depth - there's a nice long salp. 240' - temperature

still 6.4° - ascending; 220' - temperature still 6.4°. Just beginning to start coming up now, the depth is now 200' temperature 6.7° - beginning to come up faster now. 190' - 7.0°C; 170' - 7.1°C; 150' - 8°C - coming up very fast now - 140' - 10.9°C; 90' - 10.3°; 80' - 11.8°C; 60' - 12°C; even these are rough, going up too fast to get a good reading - coming up to the surface on the surface at 1143. That concludes dive 690, surfaced in the fog. Took a couple of pictures up in air to end that dive.