HLY05-01 Cruise Report (June 13-26, 2005; Barrow-Barrow)

Chief Scientist, Dennis A. Darby (Old Dominion University), Principal Investigators: Leonid Polyak (Ohio State University), Margo Edwards (University of Hawaii), Greg Cutter (Old Dominion University), Jens Bischof (Old Dominion University), Glenn Berger (University of Nevada, Reno).

Introduction and Acknowledgements

The primary objective of this cruise was to obtain expanded sections of Holocene and older sediment from the North American continental slope between Barrow and the Northwind Ridge. These sections are important to the development of a pan-Arctic stratigraphy because this is the only area from which previous cores were obtained with higher sedimentation rates than a few cm/kyr that were beyond the shelf. Key to this effort was the use of multibeam and 3.5 kHz seismic profiles to locate cores in drift deposits or other scenarios that would provide the necessary sedimentation rates and hopefully preserve fossil biota. Despite the unfavorable ice conditions at this time of year that prohibited towing acoustical survey gear, the cruise was an outstanding success. The onboard acoustic system on USCGC Healy gave adequate sub-bottom data, especially when the ship was drifting in the packice, to locate several cores that should meet the objectives of high resolution. In addition to the coring objectives, plankton tows and CTD casts were made to determine needed oceanographic data to support the stratigraphic and paleoclimate goals ultimately driving this research.

Despite being beset for four days in a patch of multiyear ice, the Coast Guard crew on the USCGC Healy performed in a very professional and enthusiastic manner to accomplish the science mission. They were quick to learn from the tough ice conditions encountered, especially in the first week. Captain Dan Oliver, the officers and crew of the USCGC Healy are acknowledged for their facilitation of the cruise goals and for their expertise in accomplishing all tasks that the science required. In particular, we express our appreciation to Captain Dan Oliver, Executive Officer Jeffery Jackson, Operations Officer James Dalitsch, Engineering Officer John Reeves, Senior Chief Navigator Timothy Sullivan, and all of the helmsmen that negotiated some rather difficult ice conditions. A special thanks goes to the marine science technician (MST) crew lead by Chief Don Snider and consisting of Dan Gaona, Rob Olmstead, Erick Rocklage, Josh Robinson, Chad Klinestekaer, and Travis Corbet. LtJG Jessica Noel was instrumental in overseeing the MST crew and science operations and we are indebted to her for making the science operations a success. The aviation department led by Lt. Andrea Sacchetti played a key role in ice reconnaissance and the collection of dirty ice samples, as well as the transfer of personnel and equipment to and from the ship at Barrow.

The core tech, Pete Kalk and the logistic support from the University of Oregon (Nick Pisias and company) provided excellent support and the result was the recovery of quality piston core material totaling over 100 meters, plus multicores for the upper half meter and trigger cores. The science crew worked very hard to make up for the initial setback of four days lost at the outset due to being beset in multiyear ice. A total of eight jumbo piston cores (JPC) and six multicores (MC) were collected. This is more than the planned three each but without the towed seismic system and it's better resolution, we were forced to improvise and take cores without optimal imagery of the sub-bottom. In addition to the coring, a total of five plankton hauls in the upper 200 meters were successfully completed and several dirty ice sites were located by reconnaissance helicopter flights and a total of 15 ice samples containing entrained sediment were collected.

The Office of Polar Programs, Arctic Division at NSF and the USCG supported the research. We are particularly grateful for the logistic support added to the project by Simon Stephensen at OPP (NSF).

Cruise Participants

Name	Institution	Position
Dennis Darby	Old Dominion University	Chief Scientist
Leonid Polyak	Ohio State University	Scientist
Margo Edwards	University of Hawaii	Scientist
Glenn Berger	Desert Research Institute	Scientist
Jens Bischof	Old Dominion University	Scientist
Greg Cutter	Old Dominion University	Scientist
Joseph Ortiz	Kent State University	Scientist
Guillaume St-Onge	Universite de Quebec	Scientist
Christine Theriault	GEOTOP, Universite de Quebec	Grad Student
Brian Meeks	Kent State University	Grad Student
Pete Kalk	Oregon State University	Coring Technician
Steven Marshall	Kings Fork High School, Suffolk, VA	TREC teacher
Mark Rognstad	University of Hawaii	Engineer
Steven Tottori	University of Hawaii	Engineer
Bob Anderson	SAIC	Engineer
Louis Whitcomb	Johns Hopkins University	Engineer
Paul Johnson	University of Hawaii	Scientist
Stefanie A. Brachfeld	Montclair State University	Scientist
Lyanne Yurco	Kent State University	Undergrad Student
Val Schmidt	Lamont-Doherty Earth Observatory	system engineer
Steve Roberts	Univ. Center for Atmos. Res.	comp system admin

HLY05-01 Cruise Track

The cruise track was originally designed to take advantage of the towed acoustical system from the University of Hawaii, the IMI system. This original track involved a zigzag transect across the continental slope off northern Alaska starting near the core site occupied in 2002 by the Keigwin cruise. The two cores taken at this site contained about 17 m of Holocene and the multibeam data was studied from this location to gain insight into the geologic context for this expanded Holocene section. From the available acoustic data, we determined that this site was located on the western flank of a small canyon system that either contained drift deposits from the west or overflow deposits from down-canyon flows.

This core site (HLY02-JPC16) was covered be heavy ice and ridging at the beginning of our cruise (HLY05-01) so targets farther to the west were a better option. Thus similar areas were located from the available multibeam bottom topography were located and surveyed by the Healy's onboard acoustic system. The revised cruise track (Fig. 1) traversed several small canyon systems to the west of Barrow Canyon.

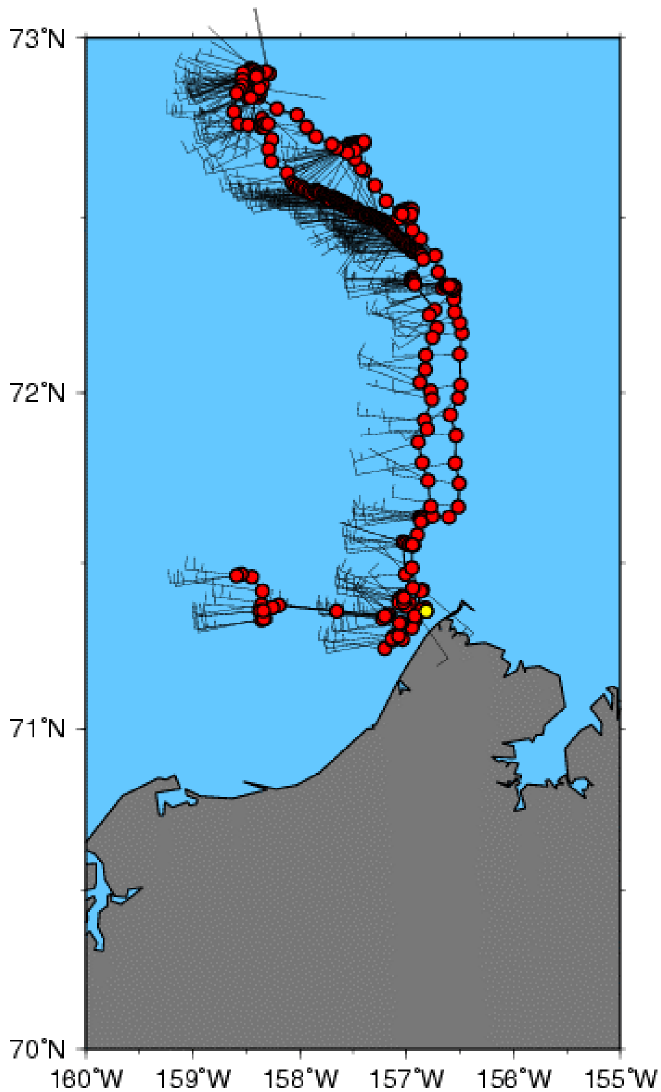


Figure 1. Cruise track for HLY0501 June 13-June 25, 2005. Track away from Barrow, Alaska is slightly offset to west from return track and the track essentially parallels the shelf margin. Red circles indicate ship position every six hours starting at yellow circle (start/end). Wind direction and strength was very constant from the east throughout. (Cruise track and wind plot provided by www.icefloe.net).

Seismic Stratigraphy

Digital recordings of 3.5 kHz Knudsen sub-bottom profiler were recovered during most of the HLY05-01 track. The quality of the records on the transits was low because of numerous disturbances related to the ship's motion in heavy ice; a much better quality was obtained during intervals when the Healy was just drifting with the packice. Side echo artifacts in the areas with uneven seafloor topography (hummocks and channels) complicate the records; this effect was more pronounced with increasing water depth because of the wider footprint of the acoustic signal, i.e., the signal cone intersected a larger seafloor area in deeper water. Despite these complications, many records provide helpful information for understanding the geological and stratigraphic context for the upper ~20-30 m of sediment. This understanding, together with multibeam bathymetry data was critical for identifying coring locations and will be essential for further interpretation of recovered sediment cores.

At two locations the IMI acoustic system (Univ. Hawaii) including a chirp profiler was deployed. Although limited, the sub-bottom IMI records provide some additional information to the 3.5 kHz data.

HLY0501 Stations

Although the primary objective of the HLY0501 cruise is to collect high-resolution sediment cores, several other research objectives were accomplished as well. These include sampling dirty sea ice, plankton tows, CTD hydrocasts, and multibeam and 3.5kHz data processing (Table 1).

Table 1. Summary of all tasks performed during HLY05-01. (Event log compiled by USCG supported MATE intern Ray Savicke)

HLY0501 Event Log
Chief Scientist: Dennis Darby
June 13 - June 26, 2005

Event	Begin Date and Time local (+8hours GMT)	Cast Max Depth Time local (+8hours GMT)	End Date and Time local (+8hours GMT)	Operation	Lat**	Long**	Lat Long Code*	Depth (m)	
								Water	Cast
1	6/13/05 10:08	n/a	6/13/05 17:32	Helicopter PAX	71.275	-157.0933	A/B	~400	n/a
2	6/14/05 14:41	n/a	6/14/05 15:39	Helicopter Ice Recon	72.314399	-156.933053	A	200	n/a
3	6/14/05 20:30	n/a	6/18/05 18:50	Beset	72.392083	-156.868026	A	300	n/a
4	6/16/05 9:54	n/a	6/16/05 10:37	Helicopter Sci. Recon	72.487088	-157.243292	A	n/d	n/a
5	6/16/05 10:50	n/a	6/16/05 12:05	Helicopter Sci Recon	72.60833	-157.805	B	n/d	n/a
6	6/18/05 9:11	n/a	6/18/05 10:10	Helicopter Sci Recon	72.72763	-157.68328	B	n/d	n/a
7	6/18/05 10:26	n/a	6/18/05 11:30	Helicopter Sci Recon	72.95333	-156.87167	B	n/d	n/a
8	6/19/05 9:51	n/a	6/19/05 11:26	Helicopter Sci Recon	72.854204	-158.572572	A	290	n/a
9	6/19/05 16:50	17:23	6/19/05 18:16	JPC1A	72.905244	-158.42049	B	1163	1163
10	6/20/05 8:32	9:29	6/20/05 10:05	MultiCore1	72.902348	-158.429415	B	1140	1140
11	6/20/05 14:26	15:32	6/20/05 17:15	JPC2	72.893923	-158.286967	B	1422	1422
12	6/20/05 21:19	n/a	6/20/05 21:42	VPT	72.894987	-158.310994	A	1325	100
13	6/20/05 22:47	23:00	6/20/05 23:14	CTD	72.895	-158.316667	B	1282	270
14	6/20/05 23:51	0:23	6/21/05 1:28	CTD	72.894242	-158.323586	B	1234	1218
15	6/21/05 13:55	14:27	6/21/05 15:00	JPC3	72.85973	-158.422828	B	546	546
16	6/21/05 15:47	16:07	6/21/05 16:31	MultiCore3	72.86511	-158.447276	B	763	763
17	6/21/05 20:19	n/a	6/21/05 20:41	VPT	72.84319	-158.387264	A	505	100
18	6/22/05 11:07	11:21	6/22/05 12:35	JPC4	72.697876	-157.41761	B	538	538
19	6/22/05 13:16	n/a	6/22/05 18:00	Helicopter Emer.	72.698136	-157.439255	A	489	n/a
20	6/22/05 13:55	14:12	6/22/05 14:31	MultiCore4	72.698152	-157.453368	B	462	462
21	6/22/05 19:08	19:15	6/22/05 20:08	JPC5	72.694201	-157.517716	B	415	415
22	6/22/05 20:15	n/a	6/23/05 0:13	VPT	72.693923	-157.530932	A	435	250
23	6/23/05 0:52	n/d	6/23/05 1:53	CTD	72.687131	-157.5507	A	384	384
24	6/23/05 18:22	19:04	6/23/05 20:07	JPC6	72.511287	-157.032905	B	673	673
25	6/23/05 19:29	n/a	6/23/05 20:29	Small Boat Sci	72.513273	-156.941495	A	674	n/a
26	6/23/05 20:39	20:56	6/23/05 21:20	MultiCore6	72.510369	-157.053378	B	607	607
27	6/24/05 5:54	n/a	6/24/05 8:35	VPT	72.296815	-156.556875	A	352	250
28	6/24/05 9:30	9:49	6/24/05 10:40	CTD	72.297954	-156.585923	B	340	320
29	6/24/05 11:16	surface	6/24/05 12:45	EIMI	72.298177	-156.596804	A	347	2
30	6/24/05 13:43	14:10	6/24/05 14:27	Helicopter Sci Recon	72.38833	-156.365	B	347	n/a
31	6/24/05 14:15	14:36	6/24/05 15:11	JPC7	72.299326	-156.627917	B	321	321
32	6/24/05 15:45	15:54	6/24/05 16:09	MultiCore7	72.300246	-156.642828	B	348	305
33	6/25/05 10:14	10:20	6/25/05 10:29	MultiCore8	71.626781	-156.842053	B	87	87

34	6/25/05 11:46	11:50	6/25/05 12:43	JPC8	71.628034	-156.859142	B	90	90
35	6/25/05 14:19	n/a	6/25/05 15:25	VPT	71.543955	-156.927999	A	XXX	100?
36	6/25/2005 16:07		6/25/05 0:00	CTD					

* Lat/Long Code:	**Lat/Long from SCS/Aft p-code
A = Begin Time Location	
B = Sample/Cast Depth Max Location	
C = End Time Location	

Table 1 continued.

Event	Notes
1	25 PAX embarking,
2	Ops and AG1 Ice Recon
3	[158.068367 72.599874] Lat/Long of breakout
4	No landings or ice samples collected
5	4 Helicopter landings for ice sampling, Guilliam St. Onge
6	Ice sample collected, Joe Ortiz
7	Ice sample collected, Glenn Berger
8	No landings or ice samples collected
9	JPC Coupler Failure, (13.7m core length)
10	Lat/Long from SCS/Aft p-code
11	JPC bent at 30 feet (rigged at 70') sediment core (8.6m core length)
12	64 micron mesh, sampling forams, 1 m ring nut vertical tow
13	CTD aborted due to wire abrasion on bolts
14	CTD stopped data transmit at ~1100m depth, only bottom 2 bottles tripped (blown deck unit fuse)
15	Core length 13.4m, mud on JPC weight stand
16	7 tubes, 2 Niskin bottles, added 300lbs to weight stand, bottle 8 no trigger
17	64 micron mesh, sampling forams, 1 m ring nut vertical tow
18	14.8m core length recovered
19	Helicopter transfer of crew member to Barrow, death in family
20	8A no good, 4A did not trigger
21	16.64m core length recovered, sec 1 fell off holders
22	64 micron mesh, sampling forams, 1 m ring nut vertical tow
23	CTD
24	15.9m core length recovered,
25	Ice walk, Dirty Ice sampling, 5 samples collected, Jens Bischof
26	MulitCore 8 not deployed
27	64 micron mesh, sampling forams, 1 m ring nut vertical tow
28	CTD
29	EIMI test, surface reading only
30	1 dirty ice sample collected
31	**small core: 4.72m core length**

32	Average 59cm core lengths
33	**Tubes half full: 30cm avg.**
34	**15.19m core length**
35	64 micron mesh, sampling forams, 1 m ring nut vertical tow

Cruise Log of Daily Science Activities

Monday, June 13,2005
Helicopter transfers from Barrow to the Healy for the Science Crew and some of the Healy crew that were rotating off the ship began around 10 am and by 5:30 pm everyone was onboard. There was a meeting to discuss ice conditions and due to relatively heavy ice in the area of our initial coring station northeast of Barrow, we decided to head northwest toward some potential interesting features along the slope that could yield high sedimentation rates. The primary objective of this cruise is to obtain sediment cores from such areas in order to develop detailed paleoclimate records for the last several tens of thousands of years. Initial preparations for our first station began with moving science gear from the hold to the science labs.

Tuesday, June 14, 2005
Work continued with preparing Healy for coring and other science operations. The giant piston corer had to be rigged and the multicorer readied. Core liners for this multicorer are used to extrude the 50-70 cm long cores into. These plastic tubes are cut to length and then sliced in two lengthwise. The two halves are then taped back together so that after the sediment from one the eight permanent multicorer tubes are pushed up into one of these precut liners, it can be easily opened by cutting the tape and running a wire through the sediment. The plankton nets and porewater sampling devices had to be setup and this was mostly completed by dinner time when we became lodged in a floe of multiyear ice that compressed behind us preventing the Healy from backing to ram it's way through. This was precipitated by an unfortunate wind direction that pushed the ice perpendicular to the cut being made by Healy.

Wednesday, June 15, 2005
The wind continues from the east-southeast and there is little relief from our predicament. There are some bright spots as the multibeam is working great with the lack of ice noise from Healy. This changes suddenly around 3 pm when ice is pushed against the starboard side and Healy lists 3.5° to port. While not much this is certainly noticeable. At this point ice must have lodged beneath the ship blocking the transponders because all acoustic data ceases.
Even flight operations normally scheduled for reconnaissance has to be cancelled because of the wind strength and direction, not permitting safe launching of a helicopter. This also scrubbed the scheduled flight for Dr. Greg Cutter who had the first flight looking for dirty sea ice so that the sediment could be sampled to determine where this ice originated. This is done later by analyzing the Fe oxide grains in the sediment trapped in the ice when it

formed. The chemical composition of these grains is used like a fingerprint to match each grain to previously analyzed grains from around the margins of the Arctic Ocean.

Thursday, June 16, 2005

Our situation remains unchanged despite a reprieve in the wind from the southeast. This wind has pushed ice against the starboard side. The helicopter recon flights went off today and Dr. Greg Cutter was on the first flight looking for dirty ice to the northeast of our position. While he didn't find any, Dr. Guillaume St-Onge was lucky enough during the second flight to the northwest and brought back several bags of ice with sediment. This sediment will later be analyzed to determine where this ice formed. We revved the Healy's engines to maximum this afternoon to see if we could affect the ice ahead of us because we no longer can backup. While the gush of seawater behind the ship was spectacular, causing a river of flow over the icepack, the ice didn't budge.

Dr. Margo Edwards gave the first science talk for the ship's crew tonight entitled: "Voyage to the bottom of the sea". She presented work that she did in the equatorial waters with Alvin dives on the mid-ocean ridge there and spectacular shots of deep-sea smokers.

Friday, June 17, 2005

Melt ponds are rapidly developing everywhere and new cracks are appearing so we have high hopes of breaking out of "Ice Camp Healy". Winds are predicted to increase from 10 to 25 kts overnight and that too may cause some shifting of the pack that has us pinned-in. Everyone is anxious to get under way and collect some core. Morale is still high and everyone has found something to keep busy. There have already been two science talks, one by Dr Margo Edwards on the Alvin dives to mid-ocean ridge smokers (hydrothermal vents) in the equatorial Pacific and one by Chief Scientist, Dr. Dennis Darby on "Arctic Ice Drift, Past and Present: Implications for Climate Change". Captain Oliver has assigned a detail to man two fire hoses on the stern to melt a large ice block that dives at an angle under the stern and is apparently pressing against both rudders. After about six hours, they are having an impact because not only is the pressure relaxing but our 3.5° list to port is half that since they started. Healy depends on speed to ram thick floes by backing and ramming. If we can't backup, we have little hope to breaking the multiyear floe in our path. When large slabs of this ice broke and slid in behind us on Tuesday evening, we lost that backup ability. The dirty sea ice samples collected yesterday have melted and we will be ready to decant the meltwater tomorrow when the sediment settles-out completely. There appears to be lots of sediment in these initial samples of dirty ice.

Saturday, June 18, 2005

The big news is that "Ice Station Healy" is on the move. We broke out around 17:00 hr. after nearly a day of spraying fire hoses on the large ice block that was wedged under our stern. By melting the top, it shifted up, out of the water and allowed us to backup a little. After several hours of back and forth we finally started making headway in this multiyear floe that had us imprisoned. We then set a heading north, northwest to some potential coring targets on the continental slope near 72.9° N and 158.43° W, about 23 miles away and expect to reach this sometime around noon Sunday.

Flight operations again were successful in spotting and sampling dirty ice about 20 miles north of where we were beset. During our record setting "ice camp" of 4 days, we did drift west, northwest over 13 miles. Unfortunately, most of the time the ice trapped under the ship blocked the acoustic signals from the multibeam and we did not collect much data about the bottom bathymetry nor sub-bottom.

Monday, June 20, 2005

Our position: Lat. 72.54° N, Long. 158.26° W

Weather: Wind: SE 8 knots, Air Temp 2.7°C 37°F

The recovery from the first core taken on Sunday the 19th was nearly 13.5 meters, which was remarkable considering that a coupling gave way, probably upon entry into the bottom and completely separated when we began to haul the piston core out of the water. The core immediately bent where the PVC core liner was exposed and eventually broke at this location. Since the core (JPC1) was only rigged for 15 meters, losing a mere 1.5 m was remarkable and a tribute to the core tech, Pete Kalk and the MST crew from Healy. The MST crew is the Coast Guard techs assigned to work the winches and do everything needed on the deck to assist the science mission. Today we rigged for 22 m because the seismic data indicated a thick sequence of relatively soft sediment, but the ice drift carried us into deeper water by the time the core reached the bottom and into sediment much harder than the seismic data indicated farther up slope. The core (JPC2) bent about 30° after penetrating about 11m and impacting a very stiff clay layer. Amazingly, the core was able to penetrate a muddy sand and gravel layer near the surface and then through nearly 11 m of stiff clay before hitting the extremely stiff clay and stopping. This core will help to understand the origin of these valleys on the continental slope and how the sediments were deposited in them.

After the piston core was secured onboard, no easy task with a 70 ft core whose lower 30 ft is bent, the hard work of pulling PVC pipe out of the steel core barrel began and took nearly 4 hours of coaxing with come-alongs and crew muscle. We recovered more than 11 meters.

Immediately after the piston core was secured on deck, a plankton net was deployed as we drifted. A good sample was obtained by raising the net several times before closing it. A hydrocast in 1400 m water depth was not successful when the trigger failed to trip the niskin bottles properly to close them with water samples from various depths.

Surveying commenced at about 2 am ship time and continued until 10 in the morning.

Tuesday, June 21, 2005

Our position: Lat. 72.50° N, Long. 158.22° W

Weather: Wind ENE 9 kts, Air Temp 1°C, 34°F

We collected our third jumbo piston core today (JPC3). We rigged for 15 m and got full penetration in about 540 meters water depth and excellent recovery. There was a 2 hour delay before the multicorer could be deployed following the piston core and during that time we drifted into much deeper water and steeper bottom slope. This resulted in poor recovery of the multicore with only about 20 cm in one side and zero in the tube opposite. This was followed by another successful vertical plankton haul, primarily for the upper

100 m water depth. We surveyed all night along the continental slope toward Barrow Canyon to the southeast.

After three glorious days of sunny weather in the mid 30°'s, the high pressure to our north has brought slightly cooler air into the area and with the abundant open leads here, evaporation is rapid, resulting in fog. Still the Arctic is fascinating with the broken ice up to 1.5 meters thick and patches of open water, with or without the foggy conditions that add a touch of surrealism to our view.

Wednesday, June 22, 2005

Today was a full day of coring. We collected a Jumbo Piston Core (JPC4) along the slope of a small canyon in about 540 meters of water followed by a multicore to sample the upper 50-70 cm at the sediment water interface. Then we drifted southwest with the pack ice into slightly shallower water and retrieved a second piston core (JPC5). Both piston cores were rigged for 18 m and we recovered about 13.5 m in the first and nearly 16.5 m in the second. Both cores had full penetration but contained water pockets in the lower 1 to 2 meters due to water being pulled into the core liner by the speed of the core barrel entering the sediment and water being sucked into the barrel faster than the sediment by the piston. Together with the multicore between them these two piston cores will hopefully provide a long record with relatively high resolution. The sub-bottom profiles suggest that the two cores can be correlated and probably overlap for a continuous long record. We can only determine this after opening these cores and determining the age of the sediment layers in each core. Pore water and sediment parameters were collected from the multicore. While the coring crews worked a 16-18 hour day, several others had to wait until the cores were retrieved to begin a CTD hydrocast to collect water samples, including temperature and conductivity (salinity) with depth. A vertical plankton haul was also made to depth intervals of up to 250 m. The folks doing these measurements did not finish until after 2 am. The bottom acoustic surveys including sub-bottom profiles were collected overnight as we broke ice to the southeast. We will position ourselves for a survey of another canyon and then the head of Barrow Canyon before heading to Barrow on Saturday.

Thursday, June 23, 2005

We located another expanded section of possible Holocene (last 10,000 yrs.) sediment from the sub-bottom profiler in 700 meters water depth at 72° 30.7' N and 157° 1.5'W along the continental slope north-northwest of Barrow, Alaska. We rigged for 18 meters (60 ft.) and recovered about 16 m of sediment (JPC6), including a nearly full 10 ft gravity trigger core. A multicore with 7 tubes and 1 Niskin bottle was deployed soon thereafter and nearly 70 cm of the upper sediment column was recovered. The science crew and the Coast Guard Techs were up late with a plankton haul and CTD hydrocast that was completed before 1 am Barrow time. Both were successful. Thus far we have recovered 6 piston cores and a total of 85 meters of core not including multicores and trigger weight cores.

Today was another beautiful sunny Arctic summer day for the most part with occasions of fog and temperatures just below freezing. Between 3 and 5 pm there was ice liberty for all of the crew and all except essential watches enjoyed some Frisbee, soccer, football and refreshments on the ice. This was also a great photo opportunity and just by chance, we were setup on an open lead in the ice and someone noticed some dirty ice across the lead from the ship so Dr. Bischof was transported by launch to collect some samples. It turned out to be one of the most concentrated sediment in ice seen thus far.

Friday, June 24, 2005
After surveying all night along the continental shelf margin, we positioned for another piston core in 400 + meters (JPC7). Unfortunately, we missed our target due to some delays as we drifted faster than expected into shallower water. Instead of coring several meters of Holocene mud and then several glacial deposits, we hit over compacted glacial till immediately below only a couple meters of Holocene mud. This till was apparently over-compacted by former ice bergs that grounded in this area. The stiff mud resulted in some tense moments in the winch control room when pull-out strain reached nearly 20,000 lbs. Normally pull-out for this depth and core (rigged for 15m) would be about half this. Another multicore, CTD hydrocast (water sampling), and plankton haul were successfully completed as well. We will move closer to Barrow tonight and survey the head of Barrow Canyon for a good core site to sample a thick sequence of Holocene sediments.

Saturday, June 25, 2005
Today was the last working day of the cruise and a very busy day indeed. We took the eight and last jumbo piston core in the early afternoon near the head of the Barrow Canyon in 88 meters water depth. The target was an expanded Holocene section of up to 20 meters thickness. We recovered a little more than 15 m of sediment (JPC8), probably all Holocene with a small amount of pre-Holocene sediment, potentially pre-Quaternary sediment at the bottom of the core. The trigger weight core recovered a little over 2 meters of sediment and the multicore taken immediately after the JPC recovered 30 cm of the surface sediment from the bottom. No plankton haul was made because the last one was adequate for characterizing this area. After the JPC, TW core, and multicore were curated and stowed in the refrigerator onboard Healy, general clean up began. Everyone pitched in to clean the labs, stow gear in the ship hold, and clean berths in preparation for our departing the ship on Sunday and the arrival of the next science crew for leg HLY05-02. In retrospect, our slow start precipitated by being stuck for four days was more than made-up by everyone's hard work during the remainder of the cruise. We collected over 115 meters of JPC and this far exceeded expectations. Hopefully there is a great sediment record to be worked on for the future. We will not know exactly what was recovered as far as a paleoclimate record for perhaps several more years when we have a chance to thoroughly examine the sediment recovered.

Sunday, June 26, 2005
The science crew and some of the Coast Guard crew departed Healy today via helicopter to Barrow. Most of the science crew flew out of Barrow the next day with hopefully fond memories and lots of data.

Coring

In order to save wire time on station, a JPC was taken first and then a multicore. This allowed time to re-rig the JPC if needed for a second core while the multicore was deployed via the aft A-frame. The sites chosen for coring (Table 2) were as similar as possible to the site in 2002 where L. Keigwin recovered two cores with approximately 17 m of Holocene. Based on the available multibeam bottom topography maps of this site, it appears to be located on the west side of one of the many small canyon systems feeding into the Canada Basin. Our best speculation at this time is that the rapid accumulation at these sites resulted from either overflow suspension flows down the canyon or eastward flowing contour currents depositing fine sediment on the lee of the canyon sides. Thus we cored several sites in similar settings to the west whenever the Knutson 3.5 kHz showed 10 or more meters of transparent sediment at the surface (Holocene?).

Table 2. Summary of Cores (JPC and MC).

		Core	**Lowering**		**Core Hit**	**Bottom**		
CORE No.	**DATE**	**TIME (UT)**	**DEPTH (m)**	**TIME (UT)**	**Latitude (deg.)**	**Longitude (deg.)**	**Water Depth (m)***	**Site Physiography**
JPC1	2001-06-19	00:48	1193	01:23	72.90567	158.42243	**1163**	Canyons
JPC2	2001-06-19	22:48	1397	23:32	72.89438	158.28497	**1422**	Canyons
JPC3	2001-06-20	22:11	546	22:27	72.86030	158.42132	**546**	Mid-slope
JPC4	2001-06-21	19:03	548	19:21	72.69815	157.41995	**538**	Upper mid-slope
JPC5	2001-06-22	03:04	410	03:15	72.69463	157.52007	**415**	Shoals
JPC6	2001-06-23	02:45	682	03:04	72.51182	157.03472	**673**	Lower mid-slope
JPC7	2001-06-23	22:15	322	22:36	72.30000	156.62883	**322**	Upper Slope
JPC8	2001-06-24	19:46	89	18:20	71.6298	156.882	**90**	Barrow Canyon
MC1	2001-06-19	16:30	1136	17:29	72.90277	158.42735	**?**	Canyons
MC3	2001-06-20	23:45	685	0:07	72.86567	158.44530	**763**	Mid-slope
MC4	2001-06-21	21:57	462	22:12	72.69890	157.45367	**462**	Upper mid-slope
MC6	2001-06-23	4:38	625	4:56	72.51092	157.05512	**607**	Lower mid-slope
MC7	2001-06-23	23:45	305	23:54	72.30095	156.64358	**305**	Upper Slope
MC8	2001-06-24	18:15	90	18:20	71.62743	156.84302	**87**	Barrow Canyon

Table 2 continued. (*discrepancy with core lowering depth due to drift during lowering). UT=Greenwich time or local Barrow time plus 8 hours.

CORE No.	Length of Core Pipe (m)	Core Diam. (cm)	Pull out (lbs)	Estimated Core Length (m)	Trigger core Length (cm)
JPC1	15	10	11000	13.72	202.5
JPC2	22	10	16010	8.58	110
JPC3	15	10	10800	13.39	237
JPC4	18	10	11080	14.60	228.5
JPC5	18	10	10300	16.73	259
JPC6	18	10	10890	15.78	269.5
JPC7	15	10	19500	4.72	225
JPC8	22	10	16130	15.19	306
MC1	71 cm	10	2200	50 cm	
MC3	71 cm	10	?	10 cm	
MC4	71 cm	10	2200	60 cm	
MC6	71 cm	10	1920	65 cm	
MC7	71 cm	10	2060	58 cm	
MC8	71 cm	10	1620	30 cm	

The cores were cut into 1.5 m segments numbered initially with Roman Numerals (I, II, etc.) from the core bottom as they were extruded and later renumbered during logging from the top with Arabic numerals (1, 2, etc.), sealed and stored until logging and splitting (Table 3). Measurements of each core segment are based on the core liner length but plastic foam rods inserted into the ends are noted where they occur (Table 3). There were problems with the first two cores (JPC 1 & 2). The core barrel separated, probably on pullout due to stress elongation of the coupling holes in the barrel allowing the segments to separate. Only about 1.5 meter of sediment core washed into the ocean from between segments 8 and 9 when the PVC core liner bent and then broke as it was hauled out of water. Also segment 2 of this core (JPC-1) contained only water due to the piston core dragging sediment up the core on pullout. The second core, JPC2, hit a very hard surface of largely sand with stiff clay beneath. While the core penetrated about 6-7 m, the stiff clay containing rather large IRD clasts stopped the core and caused the core barrel to bend at sections 3 and 4. No sediment was lost due to this bending, although extrusion from the core barrel required considerable pounding on the core liner.

Table 3. Details of JPC sections.

HLY05-01 JPC1

JPC_ section	length_cm	Depth below sea floor (cm)	Cum. Length _cm	Comments
1	150	0	150	
2	150.5	150	300.5	
3	151.5	300.5	452	Core barrel separated &
4	54.5	452	506.5	PVC broke with loss of ~1.5m (sec3-4)
5	149.5	506.5	656	
6	131.5	656	787.5	
7	150.5	787.5	938	
8	151	938	1089	
9	50	1089	1139	
10	81	1139	1220	no sediment, only water
11	152.5	1220	1372.5	
Total Length cm:	1372.5			

TC1_ section	length_cm	Top_ cm	Cum. Length _cm
1	101.5	0	101.5
2	101	101.5	202.5

HYL05-01 JPC2

JPC_ section	length_cm	Top_ cm	Cum. Length _cm	
1	94	0	94	
2	94	94	188	Sand & gravel in bottom of section
sediment between sections	10	188	198	Sediment recovered and bagged.
3	53	198	251	Mud in clam shells, disarticulated
4	132	251	383	Core bent at coupling with section 5

5	150	383	533	
6	94	533	627	
sediment between sections	8.5	627	635.5	Sediment recovered and bagged.
7	127	635.5	762.5	
8	95	762.5	857.5	
TOTAL LENGTH cm:	857.5			

TC_ section	length_cm	Top_ cm	Cum. Length _cm
1	110	0	110

HLY05-01 JPC3

JPC_section	length_cm	Top_ cm	Cum. Length _cm
1	135.5	0	135.5
2	150.5	135.5	286
3	150.5	286	436.5
4	150.5	436.5	587
5	150	587	737
6	151	737	888
7	150	888	1038
8	151	1038	1189
9	150	1189	1339
TOTAL_cm	1339		

TC_sec.	length_cm	Top_ cm	Cum. Length _cm
1	121	0	121
2	116	121	237

HLY05-01 JPC4

JPC_sec	length_cm	Top_ cm	Cum. Length _cm
1	99	0	99
2	148.5	99	247.5
3	149.5	247.5	397
4	150	397	547
5	151.5	547	698.5
6	150	698.5	848.5

7	150.5	848.5	999
8	150	999	1149
9	69.5	1149	1218.5
sediment between sections			
10	92		
11	150		
Total_length_cm:	1460.5		

Trigger	
1	77.5
2	151
	228.5

HLY05-01 JPC5

JPC_sec	length_cm	Top_cm	Cum. Length_cm
1	105.5	0	105.5
2	150.5	105.5	256
3	151	256	407
4	149.5	407	556.5
5	154.5	556.5	711
6	150.5	711	861.5
7	150.5	861.5	1012
8	150.5	1012	1162.5
9	125	1162.5	1287.5
10	151	1287.5	1438.5
Bagged separately	6.5	1438.5	1445
11	141	1445	1586
12	66	1586	1652
Cutter_	20.5	1652	1672.5
Total length_cm:	1672.5		

Trigger Core	
2	150
1	109
	259

HLY05-01 JPC6

JPC_section	length_ cm	Top_ cm	Cum. Length _cm
1	99	0	99
2	151	99	250
3	151	250	401
4	149.5	401	550.5
5	152	550.5	702.5
6	150	702.5	852.5
7	150.5	852.5	1003
8	150	1003	1153
9	123.5	1153	1276.5
10	150	1276.5	1426.5
11	151	1426.5	1577.5
Total_length_cm:	1577.5		
Trigger Core			
1	119		
2	150.5		
Total TC cm	269.5		

HLY05-01 JPC7

JPC_section	length_ cm	Top_ cm	Cum. Length _cm
1	151	0	151
sediment between sections	8	151	159
2	83.5	159	242.5
sediment between sections			
3	78.5	242.5	321
4	150.5	321	471.5
Total_length_cm:	471.5		
Trigger			

Core		
1	73.5	has packing rod on both ends
2	151.5	

Cutter sed. in a ziploc bag

HLY05-01 JPC8

JPC_section	length_ cm	Top_ cm	Cum. Length _cm
1	52	0	52
2	150.5	52	202.5
3	151	202.5	353.5
4	151	353.5	504.5
5	151	504.5	655.5
6	150.5	655.5	806
7	150.5	806	956.5
8	151.5	956.5	1108
9	73	1108	1181
10	150	1181	1331
11	34	1331	1365
12	151	1365	1516

Total_length_cm:	1516

Trigger Core	Length	
1	58	tube length = 62 cm, but foam insert on top. Mud length is 58.
2	148	tube length = 152, but foam insert on bottom. Mud length is 148.

Table 4A. Details of multicore tubes. The slot for tube 7 was used for a water bottle and thus the 8 slot tube became number 7 in all multicores.

Core/Tube	**Length before Extrusion (cm)**	**Length after Extrusion (cm)**	**Comments**
MC-1			
1	**50.0**	**49**	
2	**49.0**	**44.5**	**Lost 2cm from bottom**

3	**blackened**	**G. Berger**	**Luminescence dating**
4	**blackened**	**G. Berger**	**Luminescence dating**
5	**50.0**	**G. Cutter**	**Used for porewater**
6	**50.3**	**G. Cutter**	**Used for porewater**
7	**49.5**	**50**	
MC3			
1	**10.6**		
2	**10.1**		
3	**blackened**	**G. Berger**	**Luminescence dating**
4	**blackened**	**G. Berger**	**Luminescence dating**
5	**13.1**		
6	**18.5**		
7	**Did not trigger**		
MC4			
1	**60.0**		
2	**58.0**		
3	**blackened**	**G. Berger**	**Luminescence dating**
4	**blackened**	**G. Berger**	**Luminescence dating**
5	**61.5**		
6	**61.5**		
7	**Bottom paddle**	**No core**	

	did no seat		
MC6			
1	**64.0**		
2	**62.0**		
3	**blackened**	**G. Berger**	**Luminescence dating**
4	**blackened**	**G. Berger**	**Luminescence dating**
5	**62.5**		
6	**61.5**		
7	**65, top 2cm spilled out**	**during extrusion**	
MC7			
1	**58.7**		
2	**57.3**		
3	**blackened**	**G. Berger**	**Luminescence dating**
4	**blackened**	**G. Berger**	**Luminescence dating**
5	**59.2**		
6	**60.0**		
7	**59.5**		
MC8			
1	**26.5**		
2	**26.0**		
3	**blackened**	**G. Berger**	**Luminescence dating**
4	**blackened**	**G. Berger**	**Luminescence**

			dating
5	**30.0**		
6	**26.5**		
7	**28.0**		

Table 4B. Location, times, water depths, and average length of multicores.

Cruise HLY05-01 Multicore Data

All coordinates are for core on the bottom (i.e. triggered)
NOTE: Seabeam not working. All lat/long from GPS on bow. Water depths from Knudsen 3.5 kHz system unless otherwise indicated.
NOTE: All times are local, Barrow AK time. No GMT or UTC display in Aft Control.
All coordinates are for core on the bottom (i.e. triggered)
Wire Out = meters of wire paid out of winch #2 when MC triggered. Winch operator paid out an extra 5-6 meters of cable after triggering.

Station/Core#	Date_local	Julian_Day	Time_on_bottom_local
1	20-Jun-05	171	9:29
3	21-Jun-05	172	16:07
4	22-Jun-05	173	14:12
6	23-Jun-05	175	20:56
7	24-Jun-05	176	15:54
8	25-Jun-05	177	18:20

Water_depth _m	Depth_recorder	*WireOut_m	Pullout_tension_lbs	**Average_core _length_cm
?	none active	1120	2200	50
763	3.5 kHz	721	?	10
462	3.5 kHz	446	2200	60
607	Seabeam	594	1920	65
305	Seabeam	295	2060	59
87	Seabeam	85	1620	30

INDIVIDUAL PROJECT PROGRESS REPORTS

Geochemical Studies on HOTRAX Leg 1

The goals of the biogeochemical studies on Leg 1 of HOTRAX were to acquire high resolution (high sedimentation rate) cores (multi- and piston corers), process the multicorer samples in the field to preserve (via freezing) iron sulfides and carbonates, and take porewater samples for trace metals and nutrients. During Leg 1, a total of 4 (out of 6) multicores were obtained for biogeochemical studies (core lengths ranging from 30 to 65 cm). The Multicores sampled for porewaters were: MC1, MC4, MC6, and MC8.

From the seven multicore tubes at each of these four core sites, one tube was selected for porewater extraction. It was held in a sectioning table under a nitrogen atmosphere, the upper 5 cm were sectioned at 1 cm intervals and at 2 cm below this. All samples were immediately frozen at –70 °C after removal from the nitrogen glove bag. A whole core squeezer (e.g., Zhang et al., Mar. Chem., 61, 127-142, 1998) was used to obtain porewaters (0.4 µm filtered) from another multicorer tube at ca. 1 mm intervals in the upper 1 cm (interval depths to be determined after sediment porosity is measured). These porewater samples were also immediately frozen at –70 °C. The sediment and porewater samples were returned frozen to the ODU laboratory. In addition to the piston core samples (Table 3), the multicorer samples will be used for the following determinations if funding can be obtained: porosity; dry sediment density; organic carbon, nitrogen, and sulfur; inorganic (carbonate) carbon; mackinawite (FeS), griegite, and pyrite; biogenic silica; bulk trace elements (Al, Ti, Mo, Fe, Mn, Cd, Zn); and Cd/Ca in benthic and planktonic forams. Porewater samples will be analyzed for nutrients (nitrate, phosphate, silicate), trace elements (Cd, Fe, Mn), and chlorinity.

Reflectance Studies and Plankton Tows

Joseph D. Ortiz, Kent State University, 7-12-2005

Introduction-

The Kent State University Department of Geology participants in the HOTRAX Leg 1 Cruise (June 2005) included: Associate Professor Joseph Ortiz, and his two students, Lyanne Yurko, and Brian Meeks. Primary responsibilities of the KSU team included measurement of diffuse spectral reflectance on the Multicore-collected sediment recovered during the cruise, and operation of the Vertical Plankton Tow system (VPT). In addition, the KSU science party members assisted in all aspects of the science operations including: jumbo piston coring, underway watches, and helicopter ice recon and sediment recovery from “dirty ice”.

Diffuse Spectral Reflectance Measurements-

During the cruise, sediment color was quantified through measurement of diffuse spectral reflectance (DSR) using a Minolta CM-2600d spectrophotometer. Measurements were conducted on a 3mm spot-size with the instrument set to exclude the specular reflectance component. Two separate measurement protocols were followed depending on the pre-processing of the multicore tube to be studied (Table 5). Multicores that were split and exposed to air, were scraped lightly to create a smooth surface and were then covered with a single layer of a commercial plastic wrap (Gladwrap™ was used for consistency with ODP DSR reflectance measurements). The split cores were measured at 0.5 cm intervals along the core surface, taking care to avoid disturbed areas and sediment burrows. Multicore tubes that were sectioned by G. Cutter in a glovebag under a nitrogen atmosphere and then stored in Ziplock bags were measured directly through the plastic bag to preserve the nitrogen atmosphere and prevent exposure to air.

A total of 101 DSR measurements were generated from the glovebag samples, while 689 measurements were obtained from the surfaces of the split cores, yielding a total of 799 DSR measurements generated during the cruise. Replicate measurements of homogenized sediment scraped from the split surface of MC1-7 indicate the reproducibility of the raw reflectance values ranged from 0.028 to 0.054 % (n=10) with no significant wavelength-dependant trends. Shipboard analysis of the reflectance data focused on study of the CIELab colorspace parameters L* (lightness), a* (red-green contrast), and b* (blue-yellow contrast).

Values of L* for the glovebag samples ranged from approximately 20 to 60, with L* trends or oscillations that decreased in amplitude down-core (Figure 2). The measurements from the split cores showed similar variability (Figure 3). Cores grouped into samples with L* that increased in value down-core (e.g. MC-1, MC-4 and MC-6), and those with brighter core-tops and which demonstrated no trend, or large amplitude fluctuations throughout the core. This separation of cores into two groups was also apparent in the a* (Figure 4 and 5) and b* (Figure 6 and 7) parameters. Values of a* and b* tended to decrease down-core, with a series of reversals in b* which appear to define specific layers that may be of use as stratigraphic markers.

To test this, we aligned the b* records from MC 1.6 and MC 3.6 by stretching the depth record from core MC 3.6 by a factor of 1.85. This simple stratigraphic adjustment which implies sedimentation rates varied by a factor of 2 between the two sites produces a good fit in terms of both a* and b* values (Figure 8). Comparison of glovebag and splitcore surface measurements from Core MC-4 provides a potential means of quantifying yearly diagenesis within the cores in responses to oxidation of the split core surface (Figure 9). In most cases, split core measurements were completed as soon after core splitting as possible. In the case of core MC 4.5, however, measurements could not be completed until several hours later due to a conflict with the operation of the VPT. These measurements indicate that DSR provides a potentially useful stratigraphic tool in Arctic settings, and that measurements should be completed as soon after core splitting as possible.

Table 5. Reflectance Sample Log for Cruise

Multicore	Measurement	Number of Samples	Comments
MC 1-	Glovebag [1]	24	
MC 1-	Split Core [2]	0	
MC 3-	Split Core	39	
MC 4-	Split Core	121	
MC 4-	Glovebag	31	
MC 6-	Split Core	130	Measurements of 2nd half of MC 6-tube1 occurred several hours after sampling
MC 6-	Split Core	129	
MC 6-	Glovebag	31	
MC 7-	Split Core	123	
MC 8-	Split Core	53	
MC 8-	Glovebag	15	
	Subtotal Glovebag	101	
	Subtotal Split Core	595	
	Total	**696**	

Measurement
1. Split core surface @ 0.5 cm resolution
2. Glovebag subsamples under nitrogen atmosphere

Vertical Plankton Tow Stations-

Plankton samples were collected from various depths at a total of five stations during HOTRAX I using a vertical plankton tow system consisting of a 63 µm mesh plankton net attached to a 1-m diameter ring. The net was constructed with a 5:1 length to mouth-area towing ratio, and closed using a messenger and quick release as needed. The volume of water filtered was measured using a mechanical flow meter mounted in the throat of the net. Preliminary estimates indicate that the net filtered between 6 and 38 m^3 of water per net tow depending on the depth interval sampled and number of times the net was towed through the interval. This yielded estimated bio-volume concentrations that ranged between 3 and 63 ml/m^3. These numbers are preliminary as some of the bio-volume estimates are yet to be completed.

Table 6. Vertical Plankton Tow Summary

HLY0501 VPT	Depth Range (m)	Flowmeter Haul Volume (m^3)	Plankton Biovolume[1] (ml/m^3)
Tow 1 Net 1	0-50	38	11
Tow 1 Net 2	0-100	67	3
Tow 2 Net 1	0-50	9	63
Tow 2 Net 2	0-100	38	12
Tow 3 Net 1	0-50	12	19
Tow 3 Net 2	50-100	22	n/a
Tow 3 Net 3	100-150	38	n/a
Tow 3 Net 4	150-250	32	5
Tow 4 Net 1	0-50	8	38
Tow 4 Net 2	50-100	26	n/a
Tow 4 Net 3	100-150	36	4
Tow 4 Net 4	150-250	29	7
Tow 5 Net 1	0-50	17	n/a
Tow 5 Net 2	50-100	6	n/a
Tow 5 Net 3	75-100	9	n/a

Note: 1. Samples marked n/a have yet to have their biovolume estimated.

Figure 2 HYL05-01 L* for MC glovebag measurements

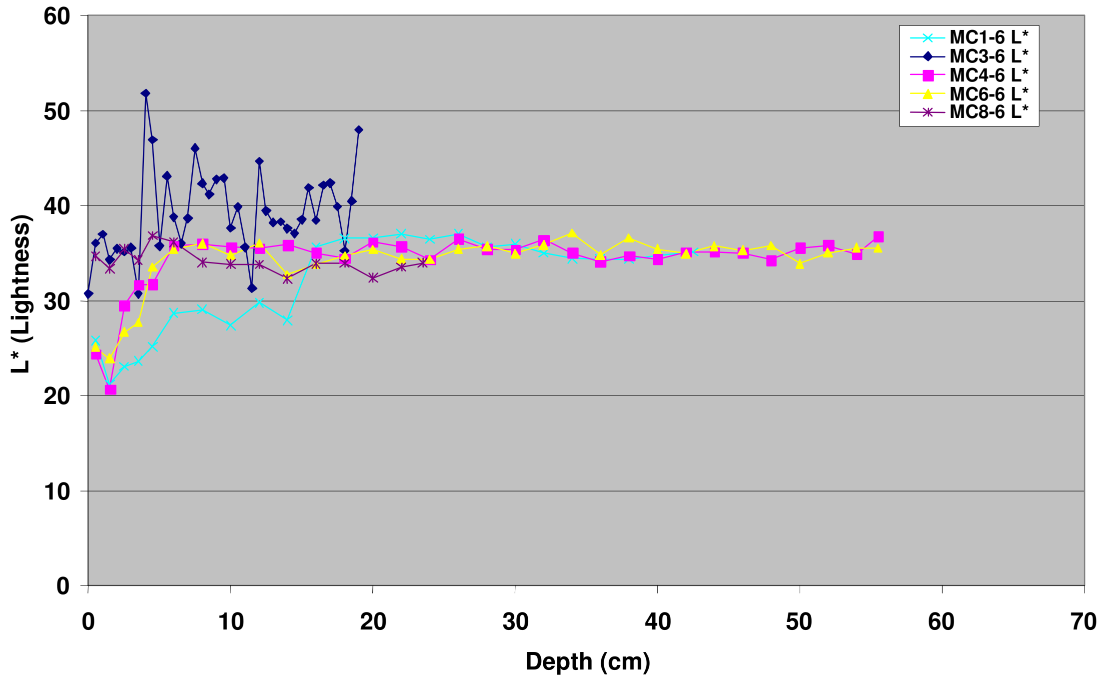


Figure 3 HYL05-01 L* for MC splitcore measurements

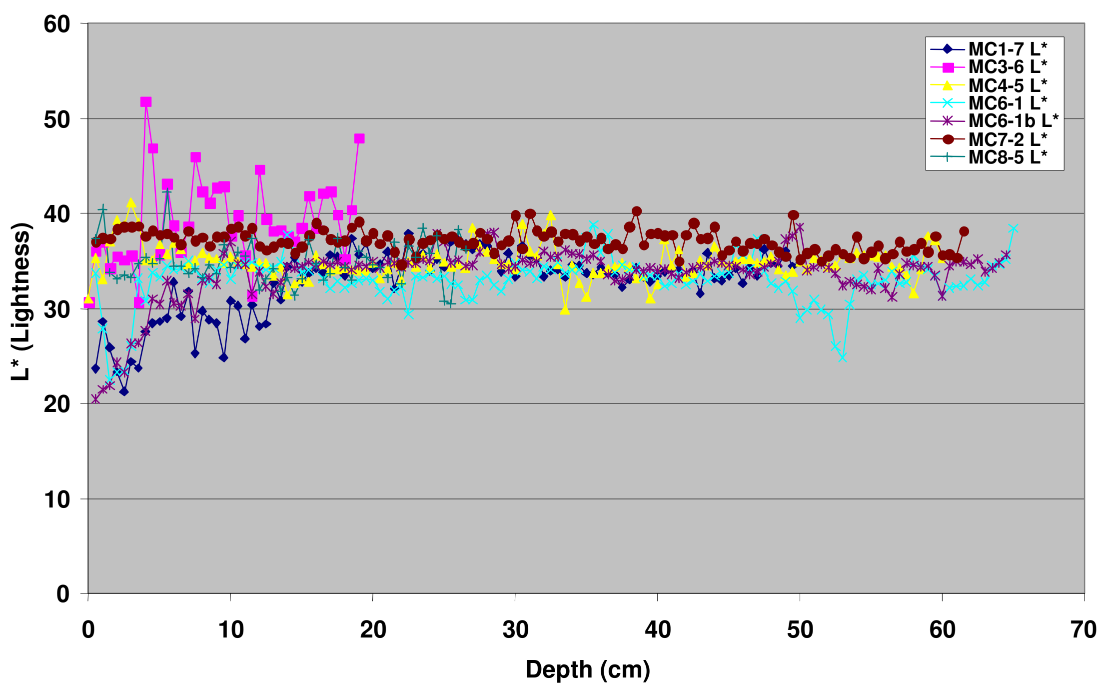


Figure 4. HYL05-01 a* for MC glovebag measurements

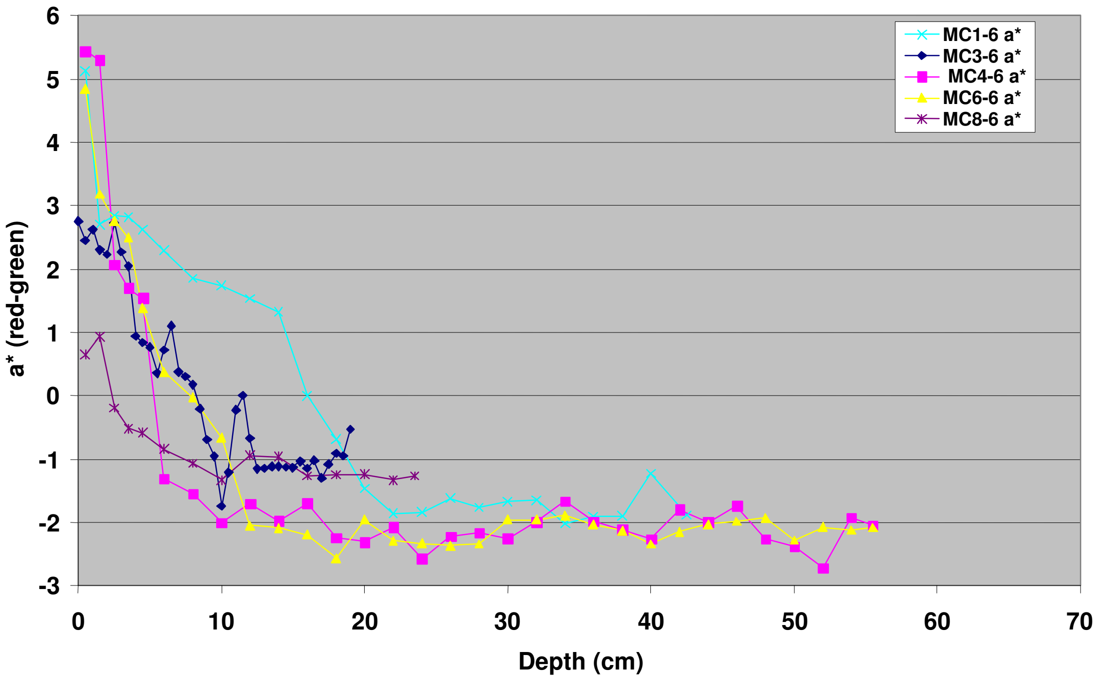


Figure 5. HYL05-01 a* for MC splitcore measurements

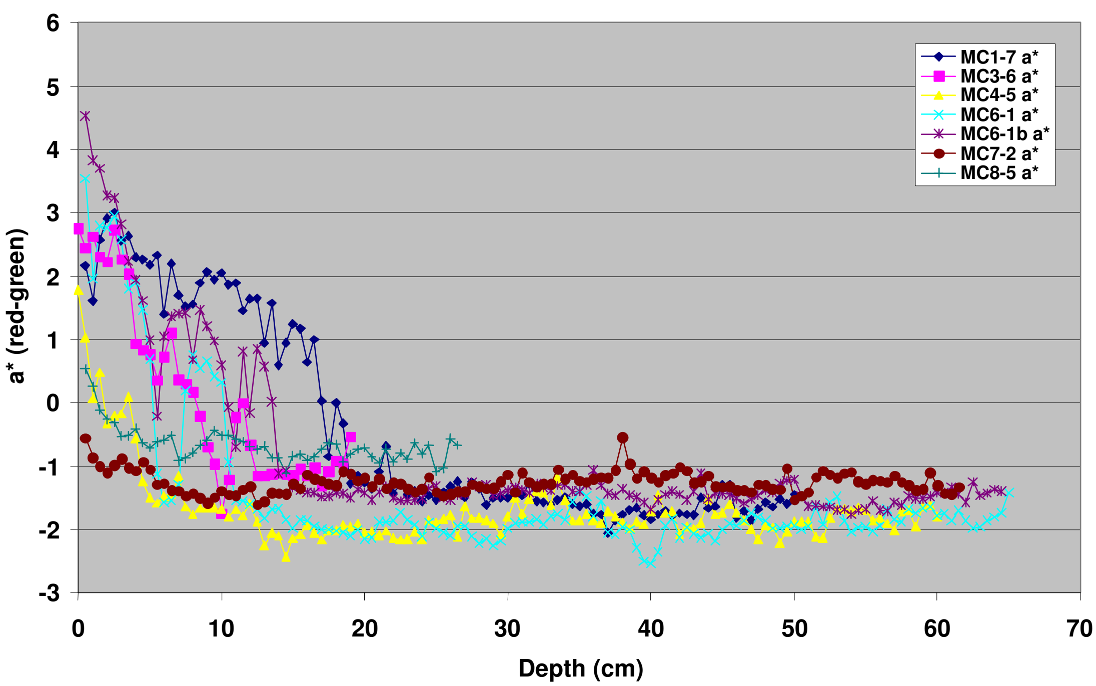


Figure 6. HYL05-01 b* for MC glovebag measurements

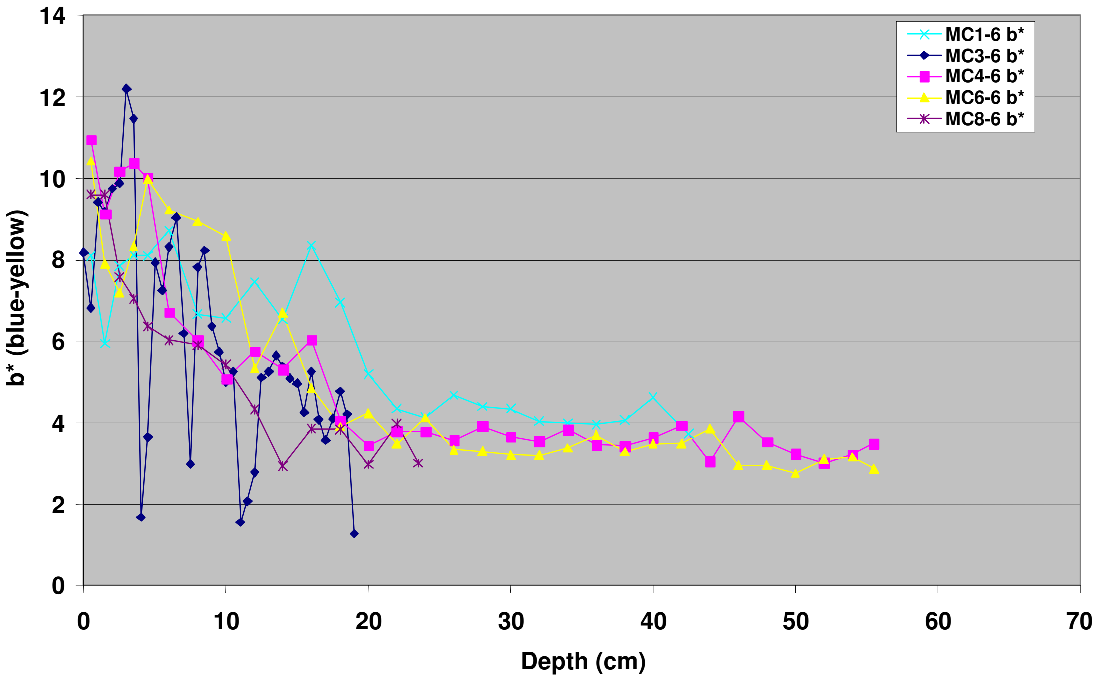


Figure 7. HYL05-01 b* for MC splitcore measurements

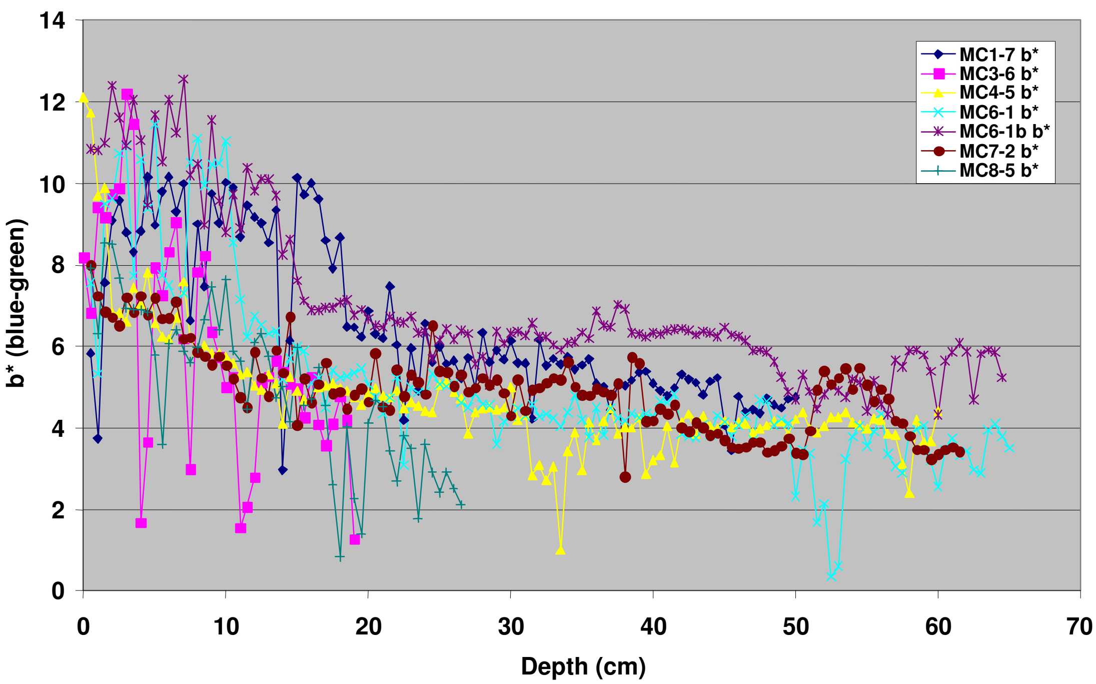


Figure 8. HLY-05-01 MC1.7 and MC 3.6 (on depth = 1.85*z)

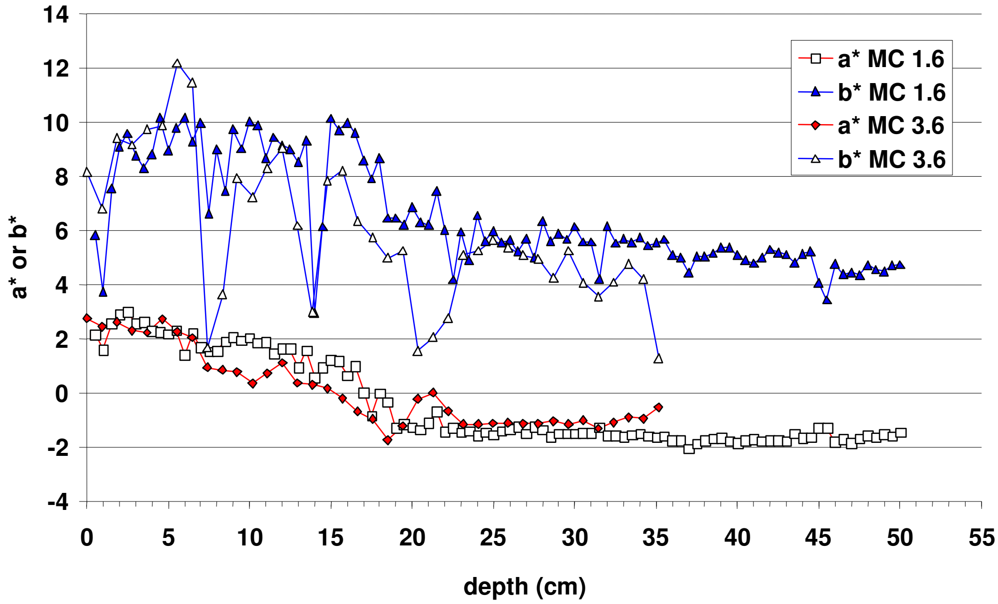
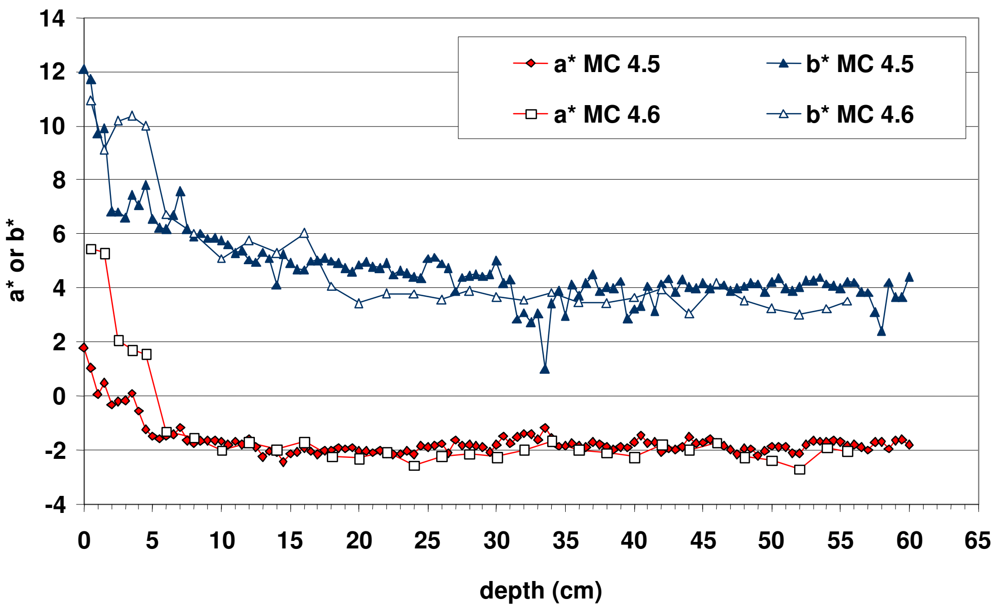


Figure 9. HLY-05-01 MC 4.5 and MC 4.6 (sectioned)



Core and water processing for radioisotopes and isotope analysis of foraminifera in multicore tube samples (upper 50+ cm of sediment column).

Guillaume St-Onge (University of Quebec at Rimouski and GEOTOP)
Guillaume St-Onge (UQAR and GEOTOP), Claude Hillaire-Marcel and Anne de Vernal (UQAM and GEOTOP) and Stefanie Brachfeld (MSU)

The following on board processing and/or measurements were done on the following multicores and water masses. Unless otherwise noted, all the below sediments and water samples will be shipped back, further processed and curated at GEOTOP (Montreal, Canada).

HLY05-01-MC1

Multicore Tube 2: 44.5 cm after extrusion and 49 cm before extrusion from the multicore tube into presplit plastic liners for storage. Approximately 2 cm was lost at the base, compaction: 2.5 cm

1) Eh measurements (1 cm intervals)
2) 5-cm thick slices were sub-sampled for radium analysis of the pore waters

Multicore Tube 7: 49.5 cm after extrusion and 50.5 cm before extrusion. Compaction and/or loss: 1 cm

1) Splitting, core photography and description of one half
2) Spectrophotometer (J. Ortiz) of the described half
3) Sub-sampling of both halves at 0.5 cm intervals for: -Forams and dinocysts;
   -Radiogenic isotopes
4) Sub-sampling at 1 cm intervals of the described half for rock-magnetism analysis (will be processed and curated by S. Brachfeld at MSU)

HLY05-01-MC3

Multicore Tube 8: 14 cm, bottom flap on this tube was open during recovery, length before extrusion not measured.

1) Eh measurements (1 cm intervals)
2) 5-cm thick slice were sub-sampled for radium analysis of the pore waters

Multicore Tube 6: 19 cm after extrusion, before extrusion: 18.5 cm, 0.5 cm expansion

1) Splitting, core photography and description of one half
2) Spectrophotometer of the described half (both Minolta and X-rite Colortron II, G. St-Onge and J. Ortiz)
3) Sub-sampling of both halves at 0.5 cm intervals for: -Forams and dinocysts

-Radiogenic isotopes
4) Sub-sampling at 1 cm intervals of the described half for rock-magnetism analysis (will be processed and curated by S. Brachfeld at MSU)

HLY05-01-MC4

Multicore Tube 1: 56 cm after extrusion, 60 cm before extrusion, compaction and/or lost: 4 cm

1) Eh measurements (1 cm intervals)
2) 5-cm thick slices were sub-sampled for radium analysis of the pore waters

Multicore Tube 5: 62 cm after extrusion, 61.5 cm before extrusion; 0.5 cm expansion

1) Splitting, core photography and description of one half
2) Spectrophotometer (J. Ortiz) of the described half
3) Sub-sampling of both halves at 0.5 cm intervals for: -Forams and dinocysts
-Radiogenic isotopes
4) Sieving between 10 and 106 μm of about 5-6 cc of the upper first 2.5 cm at 0.5 cm intervals (to prevent foram dissolution)
5) Sub-sampling at 1 cm intervals of the described half for rock-magnetism analysis (will be processed and curated by S. Brachfeld at MSU)

HLY05-01-MC6

Multicore Tube 5: 59 cm after extrusion, 62.5 cm before extrusion, compaction and/or lost: 3.5 cm

1) Eh measurements (1 cm intervals)
2) 5-cm thick slices were sub-sampled for radium analysis of the pore waters

Multicore Tube 1: 64.5 cm after extrusion, 64 cm before extrusion; 0.5 cm expansion

Note: while splitting the core, one half was disturbed (labeled MC6-disturbed). This half was not sub-sampled.

1) Splitting, core photography and description of the undisturbed half
2) Spectrophotometer (J. Ortiz) of the undisturbed half
3) Sub-sampling of the undisturbed half at 0.5 cm intervals for: -Forams
-Radiogenic isotopes
4) Sub-sampling at 1 cm intervals of the undisturbed half for rock-magnetism analysis (will be processed and curated by S. Brachfeld at MSU)

Multicore Tube 4: This core was secured and will be processed at GEOTOP for forams, dinocysts and radiogenic isotopes

.

HLY05-01-MC7

Multicore Tube 2: 56 cm after extrusion, 57.3 cm before extrusion; compaction and/or lost: 1.3 cm

1) Eh measurements (1 cm intervals)
2) 5-cm thick slices were sub-sampled for radium analysis of the pore waters

Multicore Tube 1: 61.5 cm after extrusion, 59 cm before extrusion. 2.5 cm expansion

1) Splitting, core photography and description of one half
2) Spectrophotometer of the described half (J. Ortiz)
3) Sub-sampling of both halves at 0.5 cm intervals for: -Forams and dinocysts
-Radiogenic isotopes
4) Sub-sampling at 1 cm intervals of the undisturbed half for rock-magnetism analysis (will be processed and curated by S. Brachfeld at MSU)

HLY05-01-MC8

Multicore Tube 8: 26 cm before extrusion, 28 cm, compaction and/or loss: 2 cm

1) Eh measurements (1 cm intervals)
2) 5-cm thick slices were sub-sampled for radium analysis of the pore waters

Multicore Tube 5: 28 cm after extrusion, 30 cm before extrusion. Compaction and/or loss: 2 cm

1) Splitting, core photography and description of one half
2) Spectrophotometer of the described half (J. Ortiz)
3) Sub-sampling of both halves at 0.5 cm intervals for: -Forams and dinocysts
-Radiogenic isotopes
4) Sub-sampling at 1 cm intervals of the undisturbed half for rock-magnetism analysis (will be processed and curated by S. Brachfeld at MSU)

Multicorer bottom water sampling

4.5 L of water (2 x 250 ml and 1 x 4 l) were taken from a Niskin bottle attached to the multicorer at every multicorer sampling location (MC1, MC3, MC4, MC6, MC7, MC8)

Water column sampling (CTD Casts)

Water column sampling was done at the following stations:

Station 2 CTD1: A fuse was blown and data were only collected going down. Only the bottom water could be collected and no water samples were taken on assent (8.5L: 2 x 250 ml and 2 x 4 l) at 1219 m

Station 5 CTD2: 8.5 L was collected at 384m, 156m, 100m, 36m and the surface (2 m)

Sea Ice Sampling for Entrained Sediment

The two legs of HOTRAX '05 provide a unique opportunity to resample the Beaufort Shelf and Slope as well as the central Arctic for dirty seaice. The Arctic Ocean Section (AOS94), was the first crossing of the central Arctic Ocean by two surface vessels, the USCGC Polar Sea and the Canadian Louis St. Laurent, in 1994. Several dirty seaice samples were collected by this historic expedition and now the HOTRAX '05 provided the opportunity to replicate these samples 11 years later. The HLY0501 cruise provided sea ice sediment samples from five different sites near Alaska that will provide an important reference point for comparison with samples that were collected during the HLY0503 crossing of the central Arctic Ocean (Table 8).

All but one of these dirty seaice samples were taken during helicopter reconnaissance flights extending as much as 20 miles from the ship. One of the sample sites was reached by small boat during a coring station. The objective for collecting these samples of dirty ice is to determine the source area for the sediment using Fe oxide chemical fingerprint matches of these seaice sample to the Circum-Arctic Fe oxide mineral chemical composition database (Darby, 2004). This source matching provides the net drift of the sea ice from the shallow source area to where they were sampled. Such data reveals new insights into the entrainment process and the transport of sediment into the Arctic by this important process.

Table 7. Summary of sea ice samples collected during HLY0501 for sourcing the entrained sediment.

Ice Sample No.	Latitude	Longitude	Date	Time (Alaska Time)	Collected Using	Notes:
1 (HLY0501-ICE1A)	72° 36.5'	157° 48.3'	6/16/05	10:50-12:05:00 PM	Helicopter	pressure ridge ice, few melt ponds; sample collected by Guilluame St-Onge

2 (HLY0501-ICE1B)	72° 37.7’	157° 43.8’	6/16/05	10:50-12:05:00 PM	Helicopter	~100 m distance from #1; sample collected by Guilluame St-Onge
3 (HLY0501-ICE1C)	72° 37.7’	157° 43.3’	6/16/05	10:50-12:05:00 PM	Helicopter	~100 m distance from #2; sample collected by Guilluame St-Onge
4 (HLY0501-ICE1D)	72° 37.5’	157° 39.0’	6/16/05	10:50-12:05:00 PM	Helicopter	~300+ m distance from #3 Fairly good recovery of sediment. sample collected by Guilluame St-Onge
5 (HLY0501-ICE2A)	72° 43.8’ N	157° 41’W	6/18/2005	9:11-10:10	Helicopter	Opaque bag sample by Joe Ortiz. Lat & Long listed incorrectly as decimal degree on bags
6 (HLY0501-ICE2B)	72° 43.8’N	157° 41’W	6/18/2005	9:11-10:10	Helicopter	Collected by Joe Ortiz.
7 (HLY0501-ICE2C)	72° 43.8’N	157° 41’W	6/18/2005	9:11-10:10	Helicopter	Collected by Joe Ortiz.
8 (HLY0501-ICE3A)	72° 57.2’N	156° 52.3’ W	6/19/2005	10:26-11:30	Helicopter	Collected by Glenn Berger (Samples in black container for luminescence)
9 (HLY0501-ICE3B)	72° 57.2’ N	156° 52.3W	6/19/2005	10:26-11:30	Helicopter	Collected by Glenn Berger (Samples in black container for luminescence)
10 (HLY0501-ICE4A)	72° 30.662’N	157° 3.033’W	6/23/2005	19:35	Small Boat	Collected by Jens Bischof
11 (HLY0501-ICE4B)	72° 30.662’N	157° 3.033’W	6/23/2005	19:41	Small Boat	Collected by Jens Bischof
12 (HLY0501-ICE4C)	72° 30.662’N	157° 3.033’W	6/23/2005	19:47	Small Boat	Collected by Jens Bischof
13 (HLY0501-ICE4D)	72° 30.662’N	157° 3.033’W	6/23/2005	19:55	Small Boat	Collected by Jens Bischof
14 (HLY0501-ICE5A)	72° 23.3’N	156° 21.9’W	6/24/2005	13:43-14:27	Helicopter	Collected by C. Therault
15 (HLY0501-ICE5B)	72° 23.3’N	156° 21.9’W	6/24/2005	13:43-14:27	Helicopter	Collected by C. Therault
15B (HLY0501-ICE5C)	72° 23.3’N	156° 21.9’W	6/24/2005	14:10	Helicopter	Collected by C. Therault

Flight Operations

The aviation wing onboard USCGC Healy consisted of two HH65 helicopters, four pilots and four helicopter mechanics. The helicopters were equipped with wheels and skis for landing in shallow snow. The purpose of the helicopters was to fly ice reconnaissance, assistance in the science mission (landing people on the ice for observations and sampling), and for emergencies. During this cruise they performed all three and most of the dirty ice sampling was done from the helicopters. One emergency flight was to transport a crew member into Barrow due to a death in the family.

Summary of Flights

Science: Sorties=6, Hours=7.2

Ice Recon: Sorties=1, Hours=1.0

Logistics (flight in/out of Barrow that were Science related): Sorties=12, Hours=19

Recommendations

All recommendations for changes will be made in the HLY0503 Cruise Report so as to avoid redundancy.

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