CRUISE REPORT

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WARMPAST 2007

Marine geological cruise to
East Greenland Margin

R/V "Jan Mayen" September 29 – October 14 2007

Katrine Husum
Department of Geology
University of Tromsø
N-9037 Tromsø, Norway

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Introduction

This cruise was carried out within two IPY (International Polar Year) projects: 1) Arctic Natural Climate and Environmental Changes and Human Adaptation: From Science to Public awareness (SciencePub) IPY-39 funded by the Research Council of Norway, and 2) "Arctic Ocean warming in the Past" (WARMPAST) IPY-786. Both projects are part of the international APEX program (Arctic Paleoclimate and its Extreme).

The overall aim of both projects is to advance our knowledge of climate warming in the Arctic, by studying past climate change. The present climate in the Arctic shows signs of rapid change with decreasing sea ice cover and increasing temperature of the Atlantic Water. The implications of this warming are highly uncertain, as modelling experiments projecting temperatures for the next 100 years show a large scatter at high northern latitudes. Therefore it is crucial to obtain long records of the climate changes in the past to assess the natural limits of Arctic climate. In order to obtain data on temperature, salinity etc in the water masses from the past when it was not possible to get instrumental measurements of these factors; we study fossil micro-flora and micro-fauna in the sediments in addition to their chemical composition. Their composition and abundance depend on climatic factors like temperature and salinity of the sea water, thus showing how the marine environment and water masses were back in time (palaeoclimatic proxy data).

The main objective of this cruise is to improve ocean temperature and sea-ice proxies by achieving high quality modern analogue data on planktonic and benthic foraminifera, coccoliths, diatoms, dinocysts, foraminiferal Mg/Ca-ratios and oxygen and carbon isotopes. Undisturbed sediment samples will be taken by multi corer, and CTD measurements will be obtained along two transects across the east Greenland Margin at 70° and 74° N in order to cover the widest possible oceanographic range in the eastern part of the polar North Atlantic. Water samples will also be obtained and filtered along the 70° N from Tromsø to East Greenland for analyses of coccoliths in the water column. In addition, samples will be analysed with regard to the phytoplankton marker IP_{25} and lipids.

Background and objectives

The last glacial - interglacial period in the Polar North Atlantic region was characterized by high amplitude, millennial scale variations in climate and water masses (Bauch *et al*. 2001; Hald *et al*. 2001; Rasmussen & Thomsen 2004; Spielhagen *et al*. 2004). This variation had a large impact on the growth and decay of the Svalbard Barents and northern Fennoscandian ice sheets (Knies *et al*. 1999; Spielhagen *et al*. 2004). Glacial build-up phases and subsequent deglaciations were associated to influx of "warm" Atlantic Water during e.g. the last glacial maximum and during marine isotope stage, MIS 4. These periods were followed by oceanic cold extremes associated with meltwater, perennial sea-ice cover and inert oceanic circulation (Hald *et al*. 2001; Knies *et al*. 2003). Thus, we aim to quantify sea surface temperatures and salinity during well known glacial - deglacial sequences during MIS 4 and, MIS 2/1 in high-resolution sediment cores from the continental slope off western and northern Svalbard.

We also aim to test climate model predictions that the Arctic warming may be higher than the global mean, and the Arctic sea ice will almost disappear during summer in the end of this century (IPCC 2007). Further, modelling experiments also predict an inverse relationship between influx of Atlantic Water through the North Cape Current (NCC) and the West Spitsbergen Current (WSC) (Laurantin 2004). This influx is linked to large-scale atmospheric circulation (North Atlantic Oscillation and Arctic Oscillation), which has implications for sea-ice distribution, ocean temperatures and precipitation and thus glaciation in the Barents region. These predictions will be tested in paleoclimate-records reflecting the WSC and NC during the late glacial-Holocene.

In order to investigate natural rapid ocean changes on longer time scales it is crucial to obtain reliable quantitative proxy data. Earlier reconstructions of sea surface temperatures (SST) below 5°C are hampered by incomplete training sets, sample quality and unsuitable sample preparation techniques (e.g. Pflaumann *et al.* 2006). We aim to improve modern analogue data on planktonic and benthic foraminifera, coccoliths, diatoms, dinocysts, foraminiferal Mg/Ca-ratios and oxygen and carbon isotopes. Undisturbed sediment samples will be taken by multi corer and CTD measurements in the polar North Atlantic covering the widest possible oceanographic range in the area. The goal is to extend the marine polar data set to include more sites from Arctic seas to improve the transfer functions, to increase the range of environmental variables (e.g. salinity, seasonality, sea-ice cover) in the transfer functions.

Operational framework

The cruise was carried out with R/V "Jan Mayen" together with the biological TUNU III expedition lead by Jørgen Schou Christiansen from the Norwegian College of Fishery Science. Their aim was to investigate the fish faunas in the fjords and coastal areas of East Greenland. Multibeam data from the East Greenland margin will also be made available for Dr. S. Bünz at the Dept. of Geology, University of Tromsø.

Cruise narrative

Saturday (September 29): The participants embarked in Tromsø in the early afternoon. The ship left the harbour as scheduled in the afternoon, and set course for Scoresby Sound, East Greenland. Water sampling began already in the Malangen fjord as the ship was heading out to the coast. At the coast some heavy swells were encountered in the evening, but the ship made good speed anyway.

Sunday (September 30): Transport to Scoresby Sound. The weather was good with calm seas and clear skies. Water sampling was continued.

Monday (October 1): Transport to Scoresby Sound. The weather was still favourable (fresh breeze), and the sea was relatively calm. Water sampling was carried out. The island Jan Mayen was passed during the afternoon. However, it was overcast and foggy, so it was not observed visually. Sub-bottom profiling with the chirp and multibeam was set up, and tested. The lab was also prepared.

Tuesday (October 2): Very early in the morning a seismic survey with the sub-bottom profiler was carried out across the most western sampling site in the 70°N transect, before a final site was chosen (Fig. 1). Here CTD measurements were carried out, in addition to sampling with the multi corer. There were problems with the configuration file of the CTD, so the CTD measurements were wrong and disregarded. The course was set towards Scoresby Sound, while sub-bottom profiling and water sampling were continued. The wind speed was of gale force, and the sea was a little rough. However, the wind speed was reduced, and the first drift ice was encountered at the shelf during the afternoon. The mouth of Scoresby Sound was reached in the evening. The biology sampling began in the Scoresby Sound during the evening (trawling).

Wednesday (October 3): Biology sampling in Scoresby Sound (fish faunas). The conditions were excellent: sunny and calm.

Thursday (October 4): Biology sampling in Scoresby Sound (fish faunas); overcast and calm seas.

Friday (October 5): Because of the drift ice, we waited for the daylight before leaving Scoresby Sound. Sub-bottom profiling was started at 10 AM, when the ship began to head out. Sub-bottom profiling was continued out on the shelf surveying for sampling sites. The first site was identified and sampled in the afternoon ca. 500 m water depth. After the sampling the weather deteriorated to strong gale and the southernmost part of the sediment sampling transect was abandoned. The course was set for a site at 70° 12.19 N and 17° 54.77 W which was identified by the sub-bottom profiling on the way into Scoresby Sound.

Saturday (October 6): During the night the weather had deteriorated to full storm, and when it was clear that the weather would not improve during the day, and that sampling would not be possible the course was set for the sediment sampling transect at 74 N. The ship moved very slowly northwards due to the high winds and waves (up to 6 m).

Sunday (October 7): The weather improved to fresh breeze, and the ship steamed with good speed (10 knots) towards 74° N. Both the multibeam and chirp was started at 9 AM. The innermost position in the 74 N transect was abandoned because of ice, and the second shelf position was reached in the evening (water depth ca. 2300 m). It was sampled with the multi corer, and CTD profile was obtained.

Monday (October 8): Sub-bottom profiling was done along the 74° N sediment sampling transect, and 2 stations were sampled at ca. 2600 and 2700 m water depth during the night and early morning (multi corer and CTD). At the first of the stations additional water sampling from the water column was done. The wind had increased during the night to 12 m/s in the morning. At 11 the wind speed was 18-20 m/s (gale), but sub-bottom profiling was continued along the line to the most eastern station at ca. 3000 water depth. The wind and swells were still too high for sampling and sediment sampling was abandoned. Instead the course was set for the edge of the sea ice, and a sampling station at 1600 m water depth south-west of the 74° N transect. This station was reached

at 7pm in the evening, and it was covered by drift ice, so only gravity coring was possible. A long gravity core of 539 cm was obtained. Afterwards the ship left the drift ice, and at the edge of the sea ice plankton sampling was carried out.

Tuesday (October 9): Biology sampling along the ice edge from 74 – 77° N (looking for seals). The remaining multi sediment cores were subsampled. No seals were found at this water depth, and the course was set for 76° N. A pelagic trawl was done in the late afternoon.

Wednesday (October 10): Biology sampling along and within the ice edge around 77° N (looking for seals). The winds were high up to 20 m/s in the morning, but when the ice was reached, it calmed down to 10 m/s (fresh breeze). At the end of the day when it began to darken the ship went out of the drift ice, and pelagic trawling was carried out. At 23.30 the course was set for a multi corer station. Subbottom profiling was done on the way to the site.

Thursday (October 11): The multi corer station (3000 m water depth) was sampled with the multi corer during the night/early morning. A CTD cast was also done, and water sampling from the water column was done. It was then decided not to go into the drift ice after seals, as the drift ice is too widespread now, and the water depth too deep for the seals. The course was set for Svalbard, and a geology sampling transect was begun. A station at 3000 m in the middle of the Greenland Basin was sampled in the afternoon in very nice weather. Unfortunately the weather changed, and the next station at 77 30' N and 02 E was cancelled due to high winds (11-14 m/s, strong breeze). Subbottom profiling was continued to the next station. The winds were even higher 14-17 m/s (gale) and no sampling were done through the night.

Friday (October 12): The weather had improved slightly to 12-14 m/s, but it was still too high. Additionally, continuously high swells prohibited sampling with the multi corer. Biology sampling with the bottom trawl was carried out in the morning. The wind calmed down and it was attempted to sample with the multi corer, but it was not successful due to high swells. The course was set for the shelf while sub-bottom profiling. A suitable site was found on the shelf and sampling with the multi corer and CTD measurements were carried out. Water samples from the water column were also collected with the CTD. However, the swells were very high, and further sampling was abandoned. Continuous water sampling was carried out as the boat steamed through Isfjorden towards Billefjord.

Saturday (October1 3): Packing and cleaning the lab. Biology sampling in Billefjord (trawling). Arrival in Longyearbyen in the afternoon.

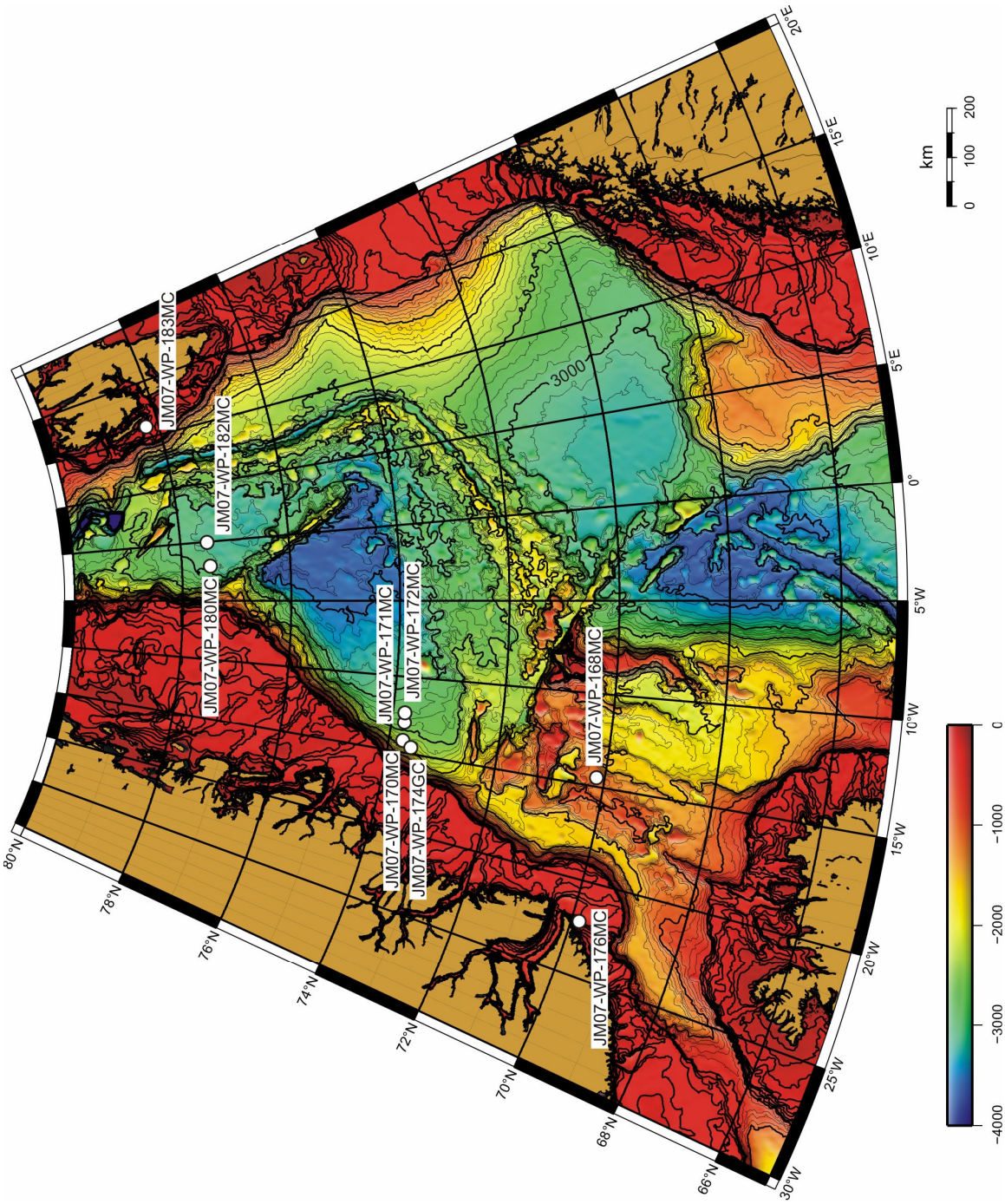

Fig. 1. Location map showing the stations which were sampled during the cruise.

Methods

The positions of the sediment cores were identified with sub-bottom profiler (chirp 3 - 5 kHz) (Appendix 2). The surface samples were sampled with multi corer (6 core liners, outer diameter 110mm, length 0.8m). CTD measurements were obtained in order to measure salinity, temperature, conductivity and turbidity through the water column. CTD measurements are carried out with a Seabird 911 CTD with an attached turbidimeter (Appendix 2).

Water sampling and filtration

Sea water was sampled from the sea water intake of the boat (3-5 l pr sample). The water samples went through a filtration system with a vacuum pump. The filters have a mesh size of 0.8 µm.

Subsampling of multi corer

The multi corer automatically gives 6 cores. Subsampling was carried out as soon as possible to avoid compaction of the unconsolidated surface sediments. Five different subsamples were taken for the proxies; 0-5 cm for the planktonic and benthic foraminifera, 0-15 cm (every cm) for dinocysts/^{210}Pb, and coccoliths/IP_{25}, 0-1 cm diatoms, 0-1 cm foraminiferal Mg/Ca-ratios, and 0-1 cm foraminiferal oxygen and carbon isotopes. One core was subsampled for every cm full length, and the samples were kept as reference samples (frozen). When the multi corer was not full i.e. there was not obtained 6 multi cores the samples were split in halves (except St. JM07 – WP- 180 MC which were split in thirds), and individual samples for isotopes and Mg/Ca were sometimes abandoned. Instead these analyses will be performed on foraminiferal specimens form the foraminiferal samples. The sediment samples were stored at 5° C. The foraminiferal samples from the upper 5 cm were additionally preserved with ethanol and Rosa Bengal stain.

Subsampling of gravity corer and piston corer

The cores were cut into shorter pieces of 1 m, capped, labelled and transported back to Tromsø. The cores are stored at 5° C at the Kræmer Kaia cool storage in Tromsø.

Preliminary results

Surface water samplings were done at 31 stations along the route from Tromsø to East Greenland and from Greenland to Spitsbergen (Appendix 4). Additional water samplings from 3 different depths at in the water column were done at 3 stations (Appendix 4).
A total of 8 stations were sampled for surface sediments with the multi corer, and 1 station was sampled with the gravity corer (Fig. 1, Appendix 5). Sub-bottom profiling (2 - 12 kHz) was done at every station and supplementary survey was carried out in selected areas. CTD measurements were performed at all stations except station JM07-WP-168 MC, where there were problems with the configuration files.

Future work

The gravity cores are stored at the University of Tromsø (Kræmer Kaia Cool storage facility). They will be logged with the Multi Sensor core logger with regard to e.g.

magnetic susceptibility at the Department of Geology, University of Tromsø during 2007/2008.

The samples from the multi sediment cores will be prepared and analysed during 2007/2008 by the different research groups (Table 1). Analyses of the phytoplankton biomarker IP_{25} will be performed on spare material from the coccoliths samples (J. Giraudeau/G. Masse). The filtered water samples will be analyzed with regard to coccoliths (J. Giraudeau). NB the reference samples from the multi sediment cores are kept frozen at the Department of Geology, University of Tromsø.

Analysis	**Responsible**	**Affiliation**
Coccoliths	J. Giraudeau	Université Bordeaux, France
Diatoms	N. Koc	Norwegian Polar Institute, Norway
Dinocysts/ ^{210}Pb dating	A. de Vernal	Université du Québec a Montreal, Canada
Foraminifera (benthic)	D. Klitgaard Kristensen	Norwegian Polar Institute, Norway
Foraminifera (planktonic)	K. Husum/ M. Hald	University of Tromsø, Norway
Foraminiferal oxygen and carbon isotopes	R. Spielhagen	Leibniz Institute of Marine Sciences Kiel, Germany
Foraminiferal Mg/Ca	T. Marchitto	Instaar, USA
Phytoplankton biomarker IP_{25}	G. Masse	University of Plymouth, U.K.

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APPENDICES

1. Participants
2. Equipment
3. Ship log
4. Sample log (water samples)
5. Sample log (sediment samples)
6. Temperature and salinity profiles from the stations
7. Profiles of the penetration echo sounder from the stations

APPENDIX 1

In addition to the crew of RV "Jan Mayen" led by Captain Jon Almestad, the geology participants were:

	Name	Affiliation
1	Katrine Husum	Dept. of Geology, University of Tromsø
2	Dorthe K. Kristensen	Norwegian Polar Institute
3	Patrycja Jernas	Norwegian Polar Institute
4	Jacques Giraudeau	UMR 5805 "EPOC", CNRS/Université Bordeaux
5	Knut Magnus Fossan (Engineer)	Dept. of Geology, University of Tromsø

Shift A:
Katrine Husum
Patrycja Jernas

Shift B:
Dorthe K. Kristensen
Jacques Giradeau

APPENDIX 2

Equipment

Acoustic equipment

- Edgetech Chirp (full range 1.5 - 12 kHz) sub-bottom profiler with XSTAR software. Store formats: CD-rom
- EPC 2086 plotter, 2 channel
- Echo sounder, Simrad EK 500, 38 kHz

Coring equipment

- Multi-corer, KC model 72.000 (6 liners, outer diameter 110 mm, length 0.8m)
- Gravity corer (core length max 6 m, outer diameter of liners 110 mm)

Water properties

- Seabird 911 Plus CTD with compact rosette. Turbidimeter attached to CTD (gain: 1x, 5x, 20x, 100x, light source wavelength: 880nm, sensing distance from window: < 5cm approx.). Store formats: CD.
- Millipore filtration system: stainless steel filtration ramp (3 inlets) and vacuum pump

Appendix 3

Date	Time	Subject	Weather	Area
29/9	13:00	The participants arrived.	calm, sunny	Tromsø
29/9	15:00	Safety instructions and demonstration of emergency exits and survival suits on RV "Jan Mayen"	calm, sunny	Tromsø
29/9	15:55	Departure Tromsø, heading for Scoresby Sound, East Greenland	calm, sunny	Tromsø
30/9	all day	Transport to the Greenland Sea	calm, overcast (heavy swells near the coast)	Norwegian Sea
1/10	12:30	Sub-bottom profiling begun to test equipment and new printer (no recording)	calm, overcast	Norwegian Sea
1/10	15:00	passing the island Jan Mayen	calm, overcast/fog	Norwegian Sea
2/10	16:00	Sub-bottom profiling core site, recording	calm, overcast	Greenland Sea
2/10	03:50	Multi corer sampling (St. 168) and CTD measurement site #414	calm, overcast	Greenland Sea
2/10	05:50	Transport to Scoresby Sound	windy, overcast	Greenland Sea
2/10	20:00	arrival Scoresby Sound. Sub-bottom profiling finished	calm, sunny	Scoresby Sound
2/10	22:00	Bio sampling (trawl)	calm, sunny	Scoresby Sound
3/10	all day	Bio sampling (trawl, fish traps, retrieving seabird logger)	calm, sunny	Scoresby Sound
4/10	all day	Bio sampling (fish traps, plankton sampling)	overcast, calm	Scoresby Sound
5/10	09:00	heading out the fjord	calm, sunny	Scoresby Sound
5/10	09:00	Sub-bottom profiling transect, recording	calm, sunny	Scoresby Sound shelf
5/10	15:00	Multi corer sampling (St. 176) and CTD measurement site #415	sunny, windy	Scoresby Sound shelf
5/10	17:30	Sub-bottom profiling stopped	sunny, very windy	Scoresby Sound shelf
6/10	all day	To much wind to work, heading for 74N	sunny, stormy	Scoresby Sound shelf
7/10	09:00	Sub-bottom profiling recording on route to 74N for Dr. S. Bünz	sunny, calm with swells	East Greenland Shelf
7/10	19:30	Start seismic survey at 74N sediment sampling transect	calm, sunny	East Greenland Shelf
7/10	22:00	Multi corer sampling (ST. 170) and CTD measurement site #416 (finished @ 24)	calm, overcast	East Greenland Margin
8/10	00:30	Continued sub-bottom profiling along the 74N sediment sampling transect	calm, overcast	East Greenland Margin
8/10	00:30	Multi corer sampling (ST. 171) and CTD measurement site #417 (finished @ 03:00)	calm, overcast	East Greenland Margin
8/10	03:00	Continued sub-bottom profiling along the 74N sediment sampling transect	some winds (11m/s)	East Greenland Margin
8/10	06:00	Multi corer sampling (ST. 172) and CTD measurement site #418 (finished @ 8:20)	some winds (11m/s)	East Greenland Margin
8/10	09:35	Continued sub-bottom profiling along the 74N sediment sampling transect	some winds (12 m/s)	East Greenland Margin
8/10	11:20	Sub-bottom profiling along the 74N sediment sampling transect. Station @ 2900 m abandoned because of high winds	high winds (18-20 m/s)	East Greenland Margin
8/10	12:30	End of sub-bottom profiling along the 74N sampling transect. NO stations sampled because of high winds	high winds (18-20 m/s)	East Greenland Margin

Date	Time	Subject	Weather	Area
8/10	12:30	Heading back to the edge of the sea ice and potential gravity corer site	high winds (18-20 m/s)	East Greenland Margin
8/10	20:00	Sampling gravity corer within the sea ice	calm, sunny	East Greenland Margin
8/10	22:00	Heading out of the ice drift	calm, clear	East Greenland Margin
8/10	23:00	Biology sampling (plankton sampling and CTD)	calm, clear	East Greenland Margin
9/10	08:30	Subsampling of multi cores. Biology sampling (looking for seals).	calm, clear	East Greenland Margin
9/10	13:00	Finished subsampling of multi cores. Transport to 76N.	calm, clear	East Greenland Margin
10/10	all day	Biology sampling (looking for seals, plankton sampling and CTD)	windy-calm, clear	East Greenland Margin
10/10	23:30	Sub-bottom profiling towards station @ 77 30' N ca. 3000 m water depth.	some winds, clear	Greenland Basin, western side
11/10	01:35	Multi corer sampling (ST. 180 and CTD measurement site # 421 (coring finished @ 05:13)	some winds, clear	Greenland Basin, western side
11/10	07:00	Biology sampling (plankton sampling) at St. 180	calm, overcast	Greenland Basin, western side
11/10	10:00	Continued sub-bottom profiling along the 77 30' N sediment sampling transect towards Svalbard	calm, overcast-clear	Greenland Basin
11/10	13:05	Multi corer sampling (St. 182 and CTD measurement site # 422 (2 attempts)	calm, clear	Greenland Basin
11/10	20:40	Reached sampling station, but it was cancelled due to high winds.	clear, high winds 11-14 m/s (strong breeze – near gale)	Greenland Basin
12/10	03:00	Reached sampling station @ 2000 m water depth, but it was cancelled due to high winds	overcast, high winds 12-15 m/s (near gale)	Greenland Basin, eastern side
12/10	06:00	Reached sampling station @ 1700 m water depth, but it was cancelled due to high winds	overcast, high winds 12-15 m/s (near gale)	West Spitsbergen Margin
12/10	08:30	Reached sampling station @ 1000 m water depth, but it was postponed due to high winds	overcast, high winds 12-15 m/s (near gale)	West Spitsbergen Margin
12/10	09:30	Biology sampling, bottom trawling	overcast, high winds 11-12 m/s (near gale)	West Spitsbergen Margin
12/10	13:30	Failed multi corer sampling, continued subbottom profiling.	overcast, windy 8-10 m/s, swells	West Spitsbergen Margin
12/10	16:30	Multi corer sampling (St. 183 and CTD measurement site # 424 (2 attempts)	overcast, windy 10 m/s, calm	West Spitsbergen Margin
13/10	08:30	Biology sampling, bottom trawling	overcast, calm	Billefjord, Spitsbergen
13/10	09:00	Packing equipment/samples and cleaning the lab	overcast, calm	Billefjord, Spitsbergen
13/10	11:00	Departure for Longyearbyen	overcast, calm	Billefjord, Spitsbergen
13/10	14:30	Arrival Longyearbyen	overcast, calm	Isfjorden

Appendix 4A

Number	Date	Latitude	Longitude	Volume filtered (l)
Malangen Fjord	29/9			1,1
1	29/9	69 39' N	19 41' E	1,3
2	30/9	69 49' N	13 51' E	3,0
3	30/9	69 54' N	12 26' E	3,5
4	30/9	69 59' N	10 50' E	3,0
5	30/9	70 03' N	9 35' E	3,0
6	30/9	70 08' N	8 10' E	4,0
7	30/9	70 12' N	6 40' E	4,0
8	30/9	70 17' N	5 14' E	3,6
9	30/9	70 22' N	3 30' E	3,5
10	30/9	70 26' N	2 10' E	2,5
11	1/10	70 39' N	1 55' W	5,0
12	1/10	70 44' N	3 34' W	4,0
13	1/10	70 48' N	4 51' W	3,5
14	1/10	70 53' N	6 27' W	4,0
15	1/10	70 58' N	7 47' W	4,0
16	1/10	70 46' N	8 52' W	4,0
17	1/10	70 37' N	10 27' W	5,0
18	2/10	70 15' N	13 36' W	4,3
19	2/10	70 07' N	14 50' W	4,0
20	2/10	70 11' N	17 14' W	3,1
21	2/10	70 12' N	18 41' W	5,5
22	2/10	70 14' N	20 23' W	3,4
23	4/10	70 10' N	23 20' W	1,5
24	7/10	73 14' N	15 40' W	4,0
25	8/10	73 46' N	13 39' W	4,0
26	11/10	77 30' N	1 15' E	4,0
27	12/10	77 49' N	4 19' E	3,4
28	12/10	78 08' N	7 14' E	4,0
29	12/10	78 09' N	9 02' E	4,0
30	12/10	78 13' N	9 29' E	4,0

Appendix 4B

Station Number	Date	Latitude	Longitude	**Sampled water depth (m)**	Volume filtered
JM07 - WP - 171 MC	8/10	73 46.138' N	13 0.603' W	5	4
				40	6
				250	4
JM07 - WP - 180 MC	11/10	77 28.610' N	02 02.540' W	5	4
				100	6
				250	4
JM07 - WP - 183 MC	12/10	78 13.837' N	11 00.570' E	5	4
				80	5
				325	4

Appendix 5A

Station Number	Date	Water depth (m)	Latitude	Longitude	Corer type	Core recovery	Core length	No. of core sections/ multi cores	Area
JM07 - WP - 168 MC	5/10	332	70 09.000' N	14 31.000' W	MC	not full	49	2	Greenland Sea
JM07 - WP - 176 MC	5/10	482	69 51.585' N	22 07.906' W	MC	half full	25	3	Scoresby Sound Shelf
JM07 - WP - 170 MC	7/10	2285	73 44.873' N	14 11.956' W	MC	full	40	5	East Greenland Margin
JM07 - WP - 171 MC	8/10	2570	73 46.138' N	13 0.603' W	MC	half full	10	3	East Greenland Margin
JM07 - WP - 172 MC	8/10	2742	73 47.080' N	12 21.640' W	MC	half full	50	3	East Greenland Margin
JM07 - WP - 174 GC	8/10	2140	73 34.741' N	14 34.093' W	GC	full	539	6	East Greenland Margin
JM07 - WP - 180 MC	11/10	3029	77 28.610' N	02 02.540' W	MC	not full	27	2	Greenland Basin, western side
JM07 - WP - 182 MC	11/10	3100	77 30.540' N	00 02.270' W	MC	not full	60	3	Greenland Basin
no label	12/10	1036	78 09.022' N	09 02.528' E	MC	empty	0	0	West Spitsbergen Margin
JM07 - WP - 183 MC	12/10	340	78 13.837' N	11 00.570' E	MC	not full	30	2	West Spitsbergen Margin

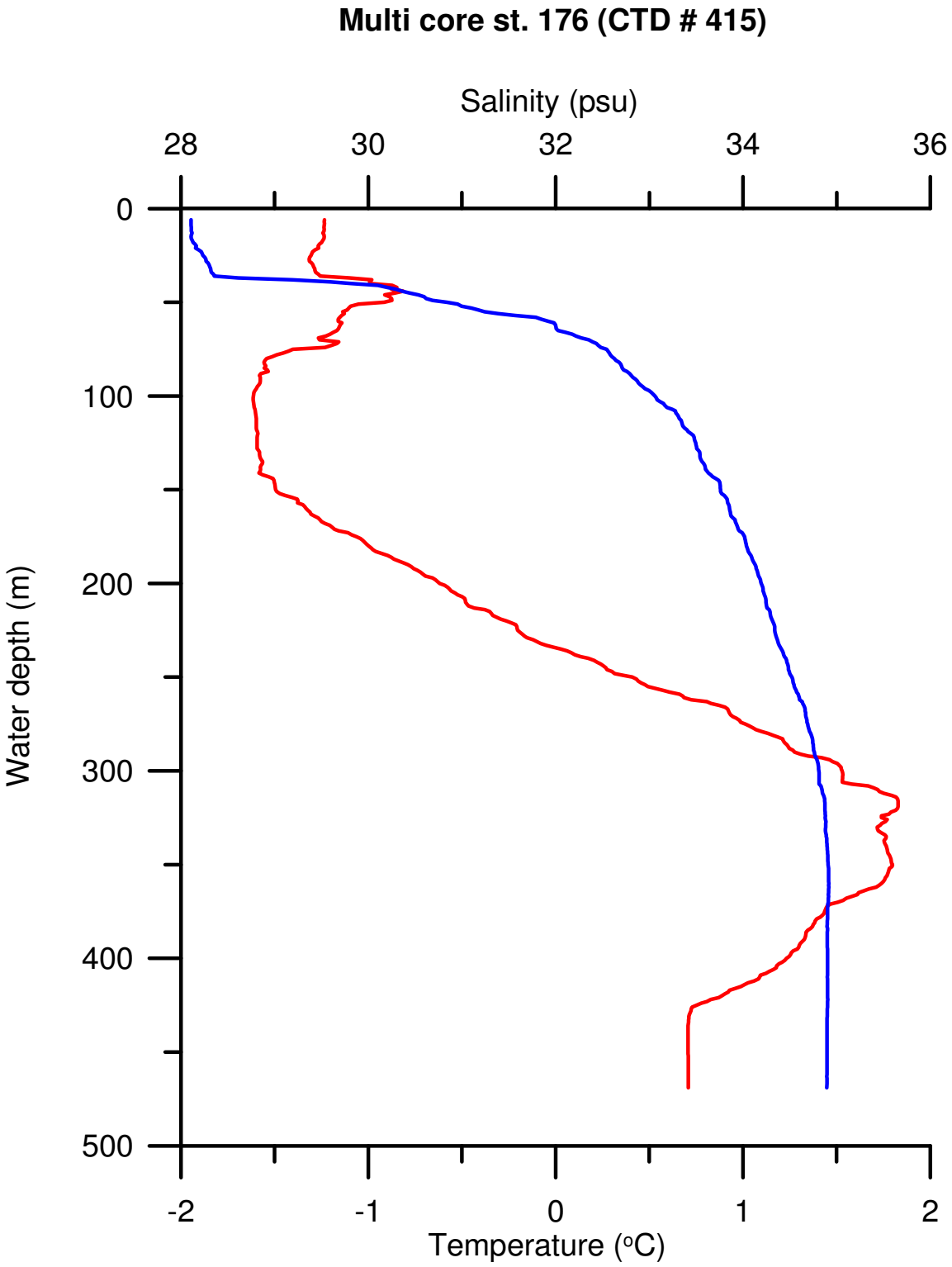
Appendix 5B

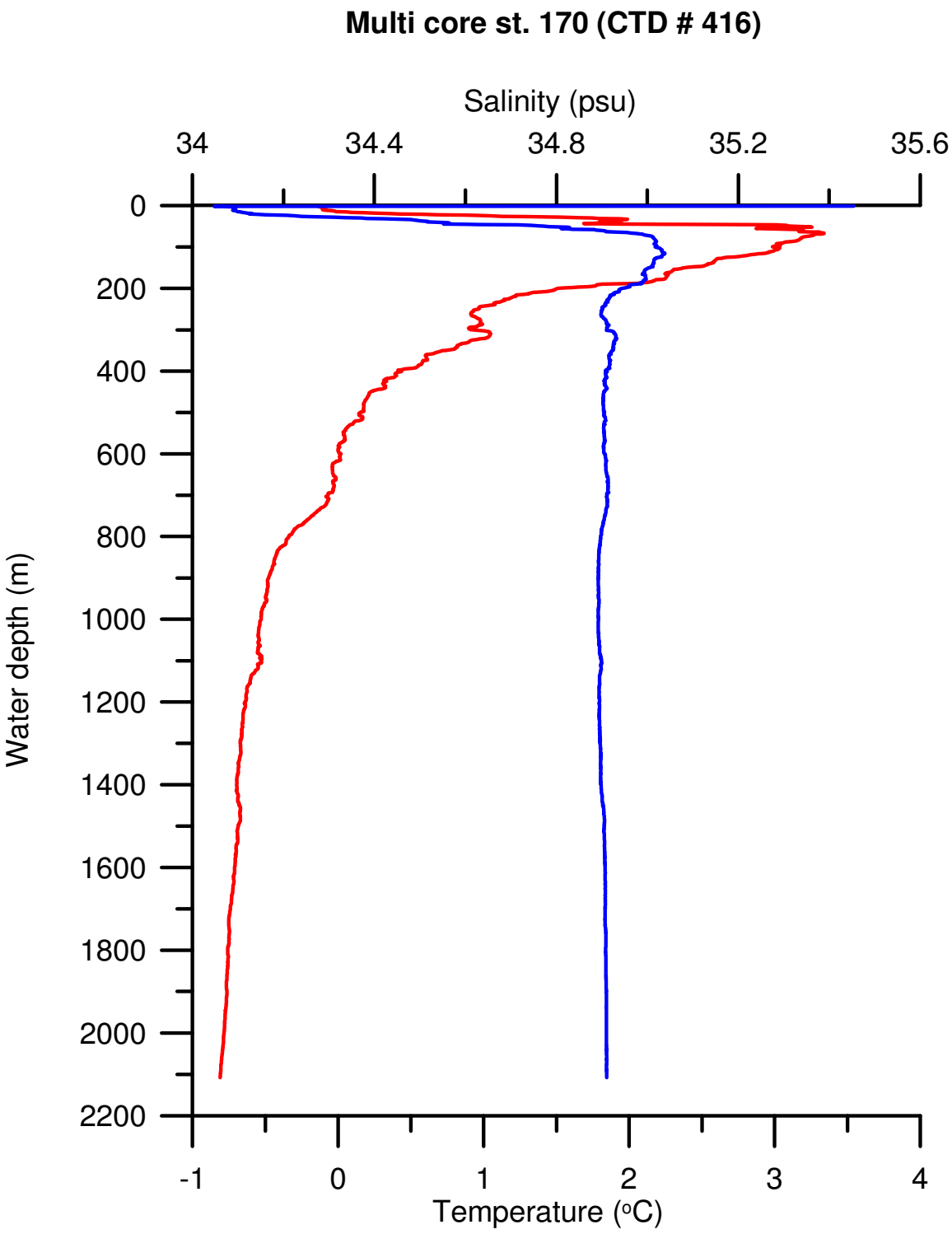
Station Number	Subcoring labelling
JM07 – WP – 168 MC	MC A subsamp. 0-1 cm: 1/2 sample for forams-isotopes-Mg/Ca and 1/2 sample for diatoms, 1 - 10 cm for forams, MC B subsamp. 0-1 cm: 1/2 sample for dinoflagellates-^{210}Pb and 1/2 sample for coccoliths-IP_{25}. #168 on bridge.
JM07 – WP – 176 MC	MC A subsamp. 0-17 cm every cm: forams -Mg/Ca -reference. 0-5 cm preserved in ethanol & Rosa Bengal, MC B subsamp. 0-15 cm every cm: 1/2 sample for dinoflagellates-^{210}Pb and 1/2 sample for coccoliths-IP_{25}, MC C subsamp. 0-1 cm: 1/2 sample for diatoms, 1/2 sample for isotopes.
JM07 – WP – 170 MC	MC A subsamp. 0-5 cm every cm: forams-Mg/Ca, MC B subsamp. 0-15 cm every cm: 1/2 sample for dinoflagellates-^{210}Pb and 1/2 sample for coccoliths-IP_{25} AND 15-42 cm for reference, MC C subsamp. 0-1 cm: 1/2 sample for diatoms, 1/2 sample for lipids, MC D subsamp. 0-1 cm: isotopes, MC E subsamp. 0-17 cm reference.
JM07 – WP – 171 MC	MC A subsamp. 0-5 cm every cm: forams-Mg/Ca AND 5-15 cm: reference, MC B subsamp. 0-7 cm: 1/2 sample dinoflagellates-^{210}Pb and 1/2 sample for coccoliths-IP_{25}, MC C subsamp. 0-1 cm: 1/2 sample for diatoms; 1/2 sample for isotopes NB subsampled immediately as water was lost on deck.
JM07 – WP – 172 MC	MC A subsamp. 0-5 cm every cm: forams-Mg/Ca AND 5-43 cm: reference, MC B subsamp. 0-15 cm every cm: 1/2 sample for dinoflagellates-^{210}Pb and 1/2 sample for coccoliths/IP_{25}, MC C subsamp. 0-1 cm: 1/2 sample for isotopes and 1/2 sample for diatoms.
JM07 – WP – 174 GC	JM07-WP-174 GC: 0-100, 100-200, 200-300, 300-400, 400-500, 500-539 (6 sections). Samples from core catcher, core cutter, and "below core cutter".
JM07 – WP – 180 MC	MC A subsamp. 0-5 cm every cm: forams-Isotopes-Mg/Ca AND 5-27 cm: reference, MC B subsamp. 0-1 cm: 1/3 sample for dinoflagellates-^{210}Pb, 1/3 sample for coccoliths/IP_{25}, 1/3 sample for diatoms AND 1-12 cm every cm dinoflagellates.
JM07 – WP – 182 MC	MC A subsamp. 0-5 cm every cm: forams-Mg/Ca AND 5-62 cm: reference, MC B subsamp. 0-53 cm every cm: 1/2 sample for dinoflagellates-^{210}Pb and 1/2 sample for coccoliths/IP_{25}, MC C subsamp. 0-1 cm: 1/2 sample for isotopes and 1/2 sample for diatoms.
JM07 – WP – 183 MC	MC A subsamp. 0-5 cm every cm: forams-isotopes-Mg/Ca AND 5-27 cm: reference, MC B subsamp. 0-1 cm: 1/3 sample for dinoflagellates-^{210}Pb, 1/3 sample for coccoliths/IP_{25}, 1/3 sample for diatoms AND 1-15 cm every cm: 1/2 sample for coccoliths/IP25 and 1/2 sample for dinoflagellates.

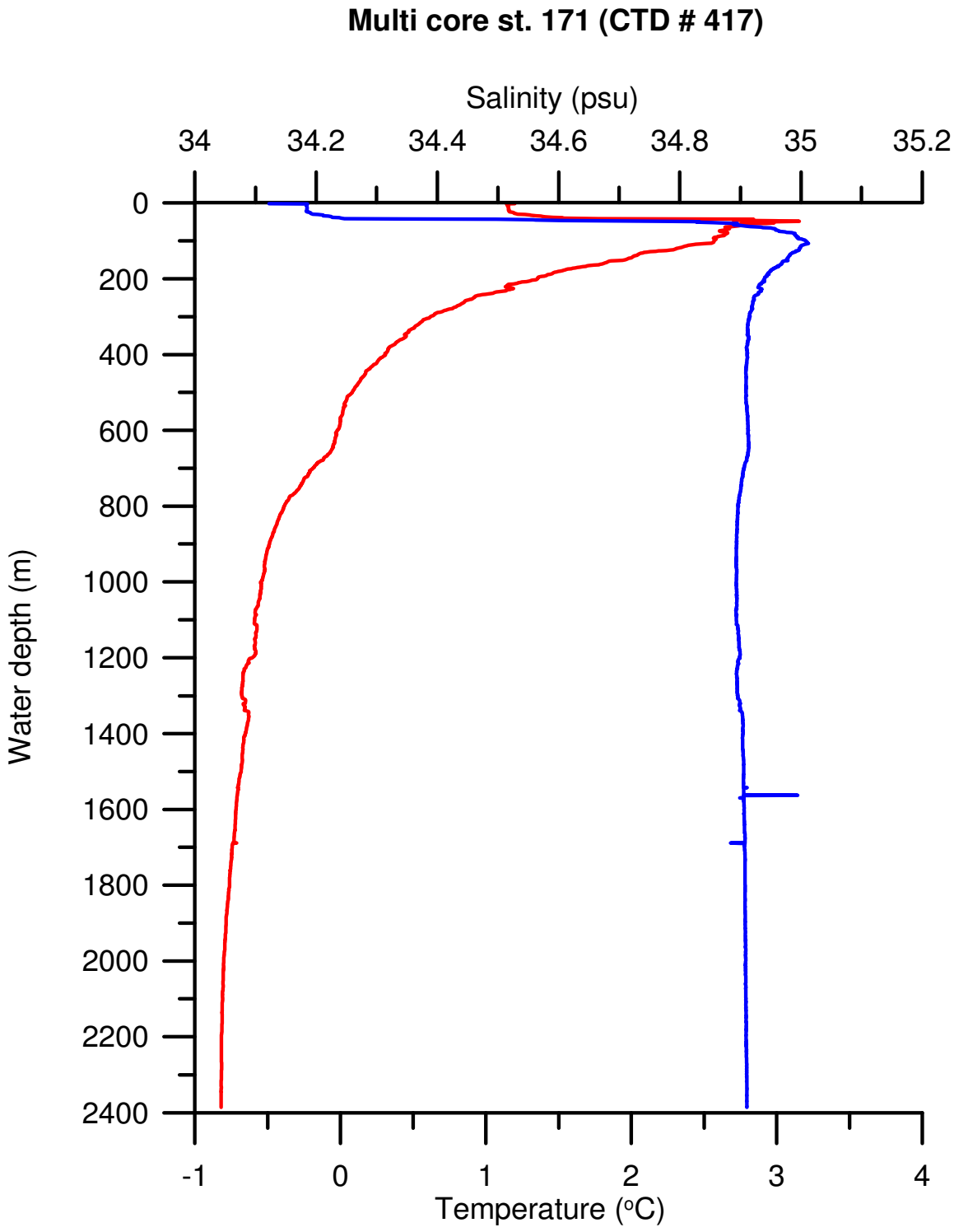
Appendix 5C

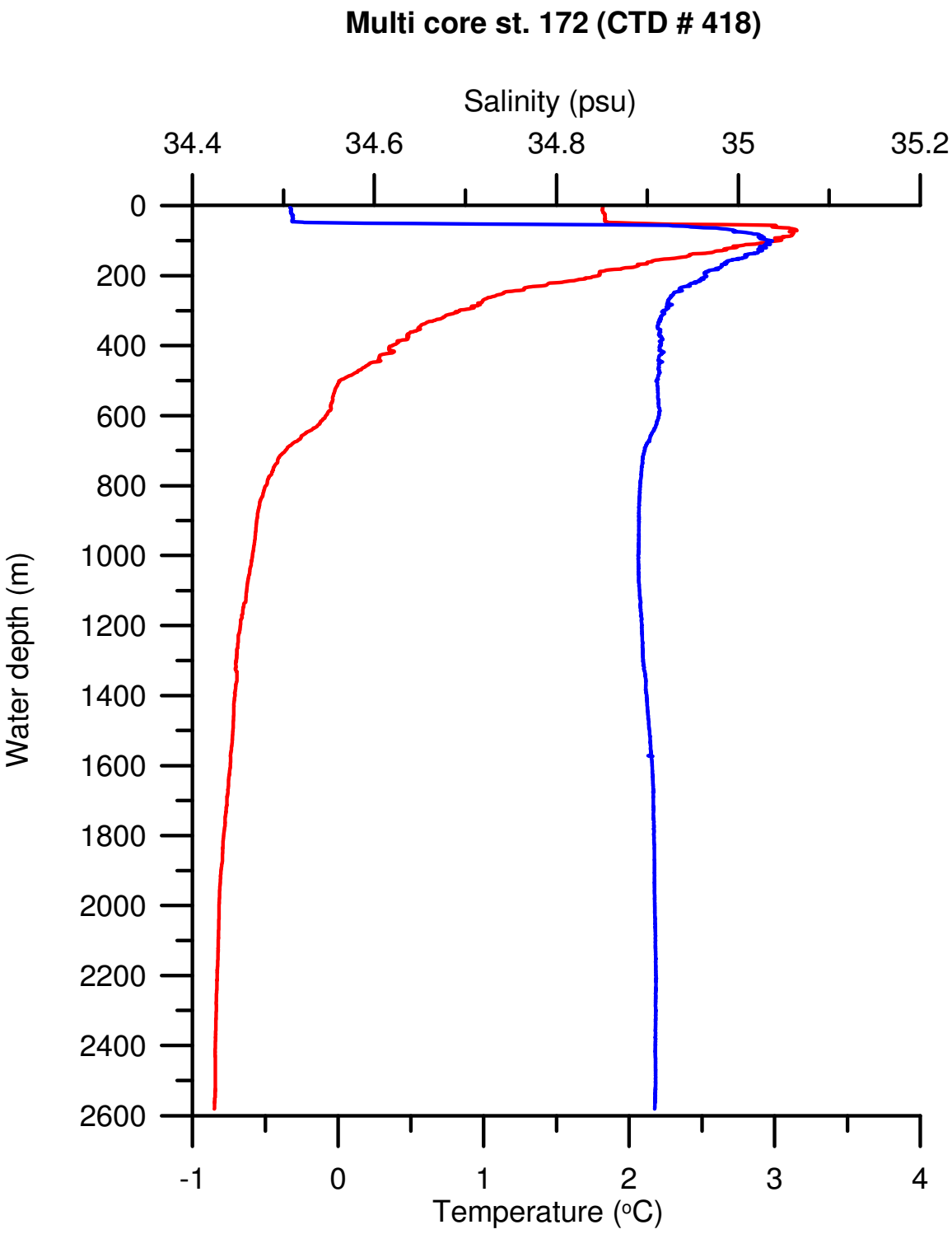
Station Number	Comments
JM07 – WP – 168 MC	3 tubes broken, 1 empty, 2 cores filled. CTD measurements deleted, because the wrong configuration file was applied.
JM07 – WP – 176 MC	3 tubes, 2 empty, 1 with sediment but without water above surface. Subsampling was carried out 7/10 because the sea was too rough to work in until then. The water had run out of the tubes then. CTD # 415.
JM07 – WP – 170 MC	Only 5 tubes were loaded. All full. CTD # 416.
JM07 – WP – 171 MC	Six tubes loaded, three retrieved with little sediment (up to 10 cm thick). CTD # 417. Water samples from 3 different depths for filtration (5, 40, 250 m).
JM07 – WP – 172 MC	Six tubes loaded, three retrieved. CTD # 418.
JM07 – WP – 174 GC	Penetration: > 6m
JM07 – WP – 180 MC	Only 2 tubes with sediments. One shovel did not release. One shovel very bended! CTD # 421. Water samples from 3 different depths for filtration (5, 100, 250 m).
JM07 – WP – 182 MC	First attempt failed, it was not left long enough on the seafloor (30 seconds). Second attempt (60 seconds on sea floor) success: 3 good cores. CTD # 422.
No label	The bended shovel removed, only 5 tubes loaded. No cores retrieved. Penetration was 10 cm. Too high swells
JM07 – WP – 183 MC	The bended shovel removed, only 5 tubes loaded. First attempt failed, but penetration was 30 cm. Some parts of multi corer were lose and hampered release, so every part were tightened, and a second attempt was done. 2 tubes were destroyed, 1 empty and 2 had sediments. CTD # 424. Water samples from 3 different depths for filtration (5, 80, 325 m).

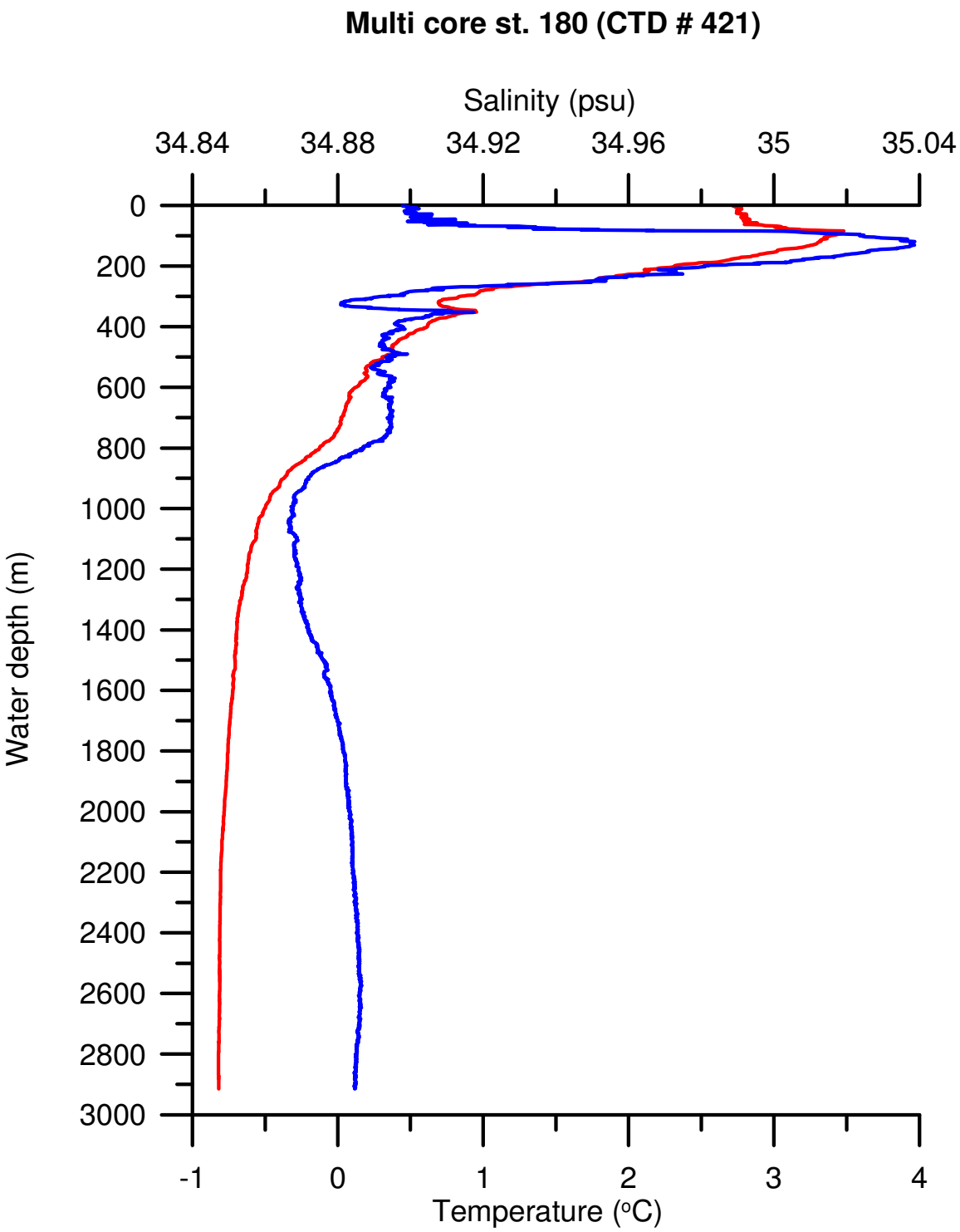
Appendix 6

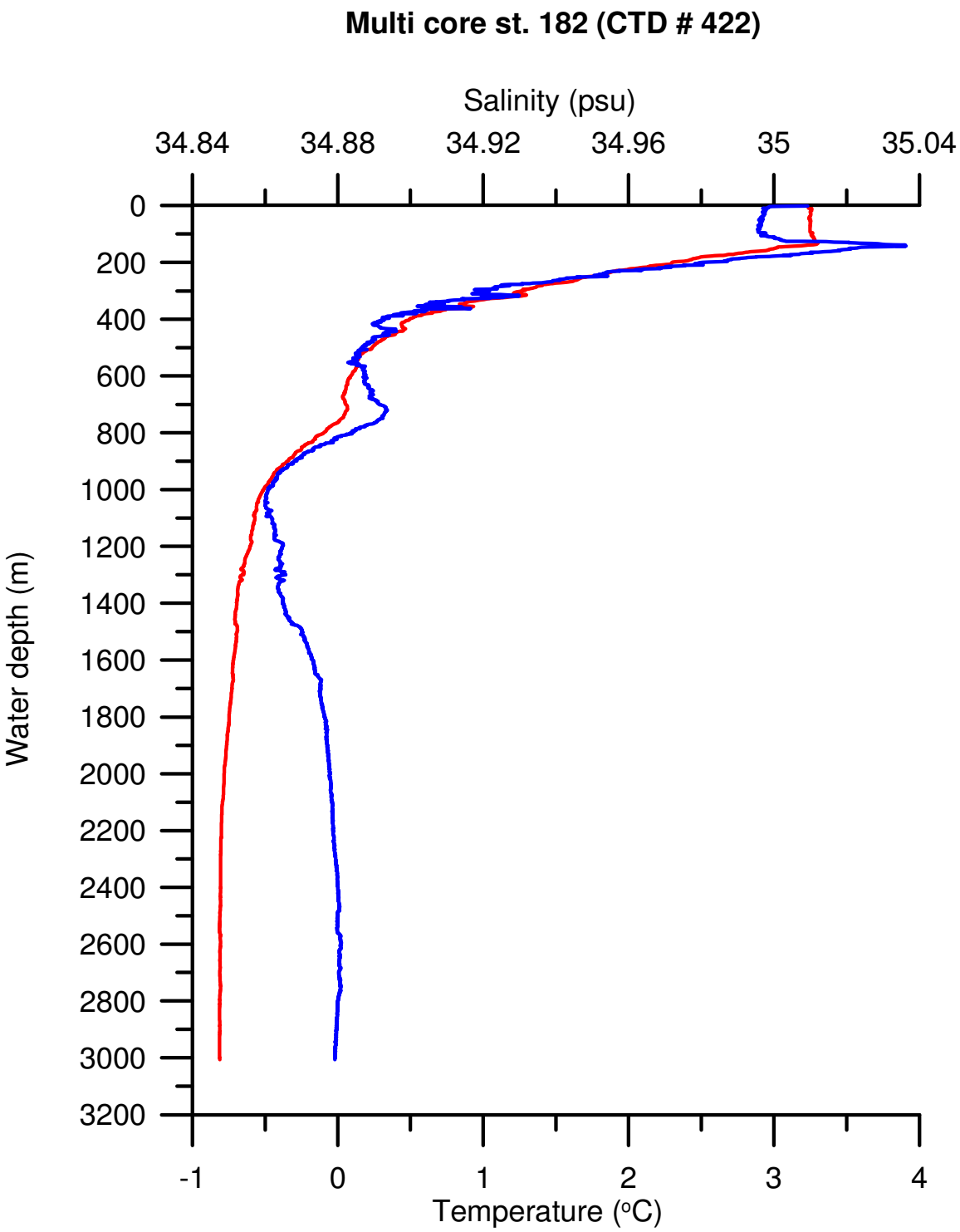

Multi core st. 176 (CTD # 415)
Salinity (psu)
28
30
32
34
36
0
100
200
300
400
500
Water depth (m)
-2
-1
0
1
2
Temperature (°C)

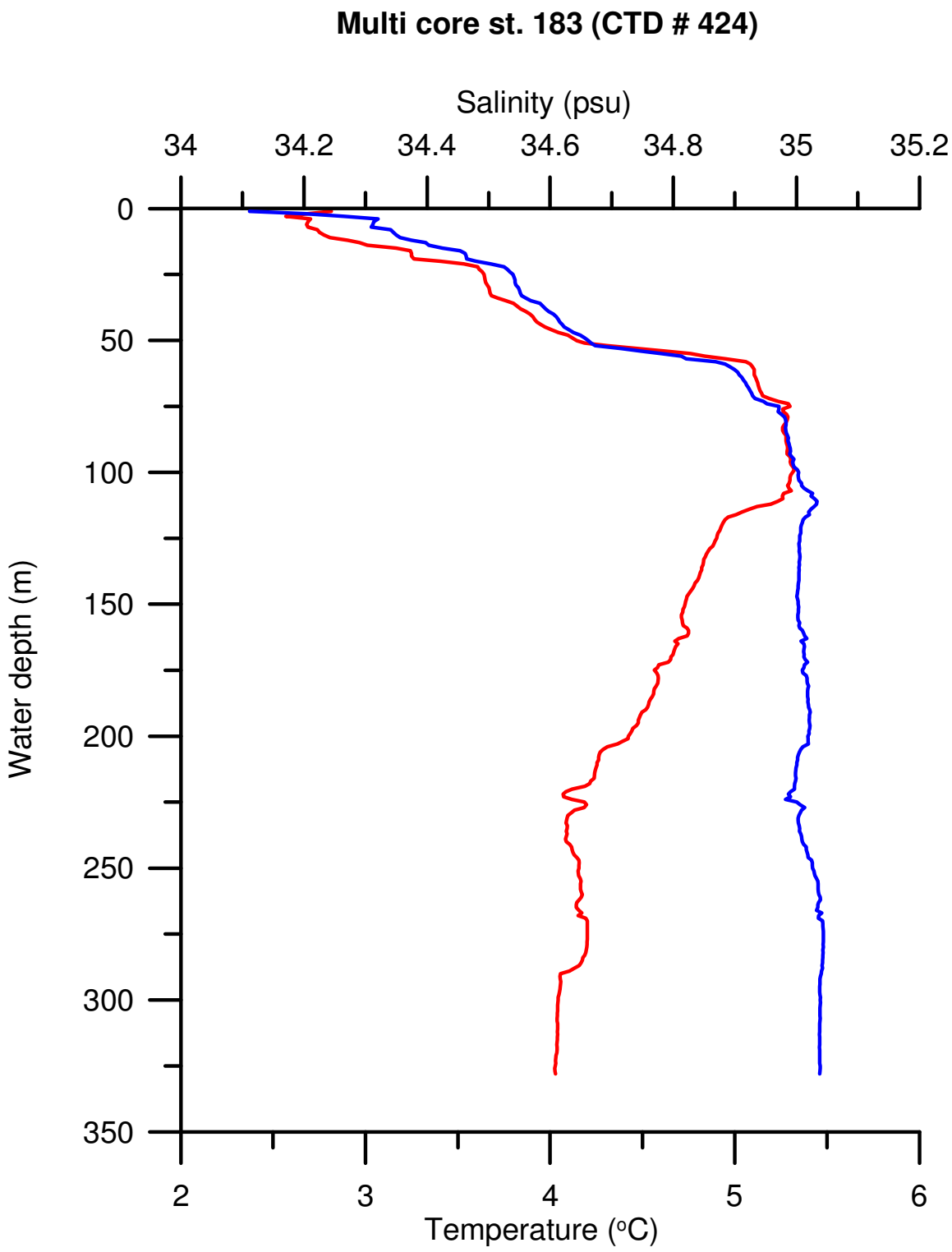

Multi core st. 170 (CTD # 416)
Salinity (psu)
34
34.4
34.8
35.2
35.6
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
Water depth (m)
-1
0
1
2
3
4
Temperature (°C)


Multi core st. 171 (CTD # 417)
Salinity (psu)
34
34.2
34.4
34.6
34.8
35
35.2
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Water depth (m)
-1
0
1
2
3
4
Temperature (°C)


Multi core st. 172 (CTD # 418)
Salinity (psu)
34.4
34.6
34.8
35
35.2
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Water depth (m)
-1
0
1
2
3
4
Temperature (°C)

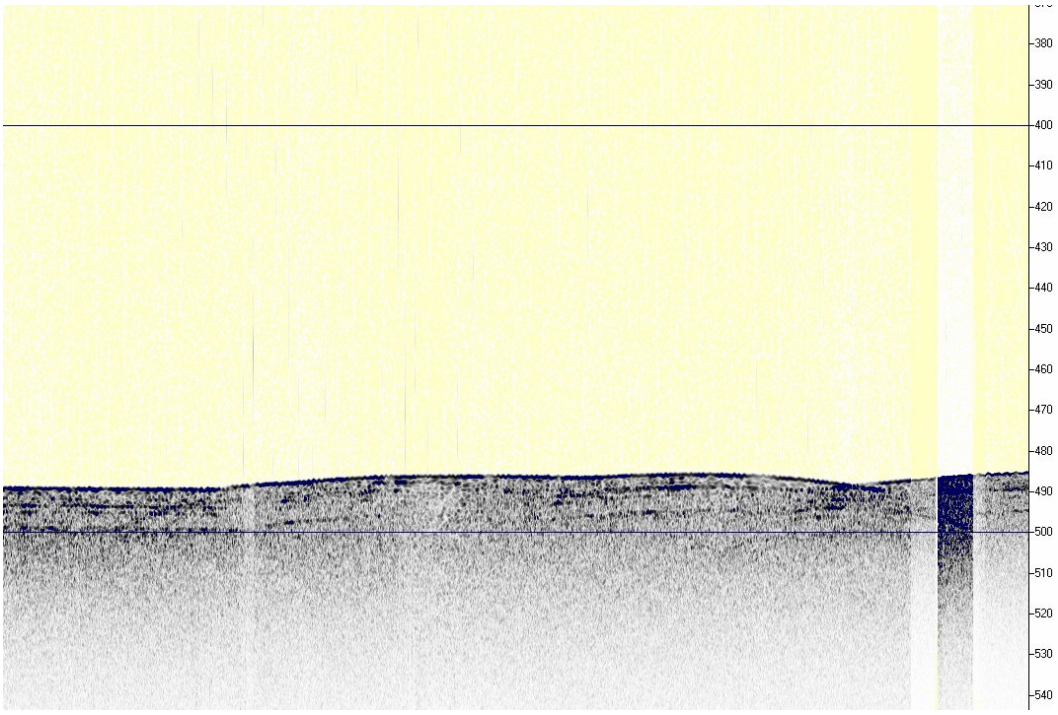

Multi core st. 180 (CTD # 421)
Salinity (psu)
34.84
34.88
34.92
34.96
35
35.04
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
Water depth (m)
-1
0
1
2
3
4
Temperature (°C)


Multi core st. 182 (CTD # 422)
Salinity (psu)
34.84
34.88
34.92
34.96
35
35.04
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
Water depth (m)
-1
0
1
2
3
4
Temperature (°C)

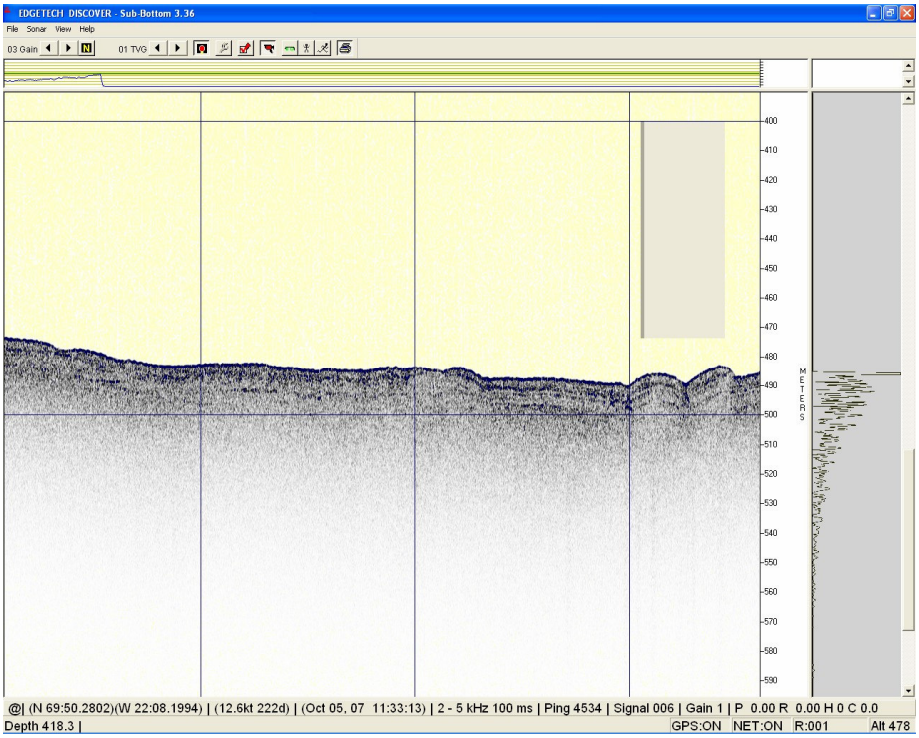

Multi core st. 183 (CTD # 424)
Salinity (psu)
34
34.2
34.4
34.6
34.8
35
35.2
0
50
100
150
200
250
300
350
Water depth (m)
2
3
4
5
6
Temperature (°C)

Appendix 7

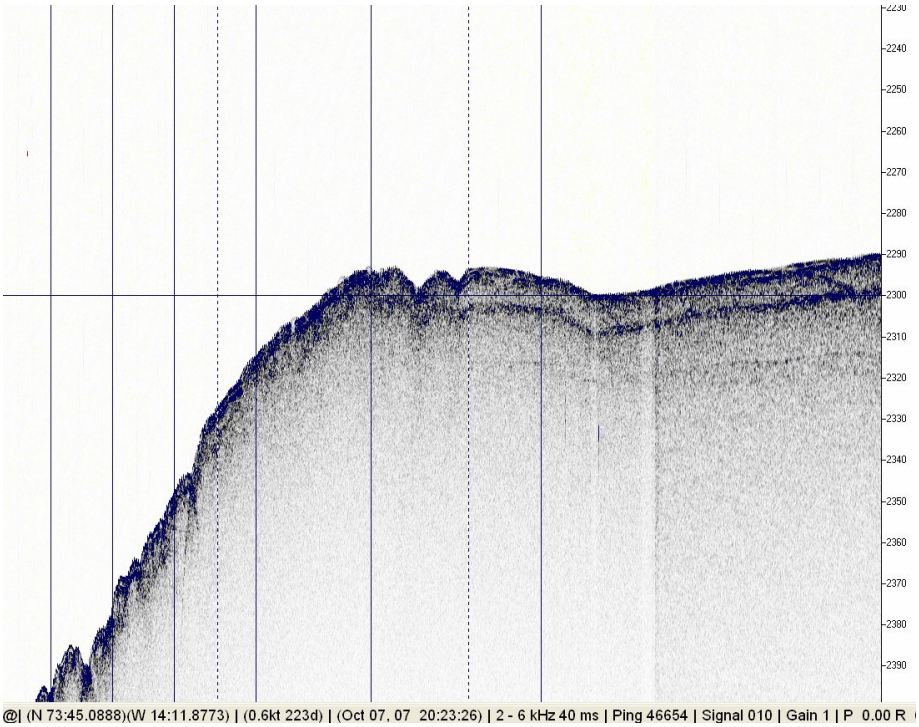
St. JM07 – WP – 168 MC



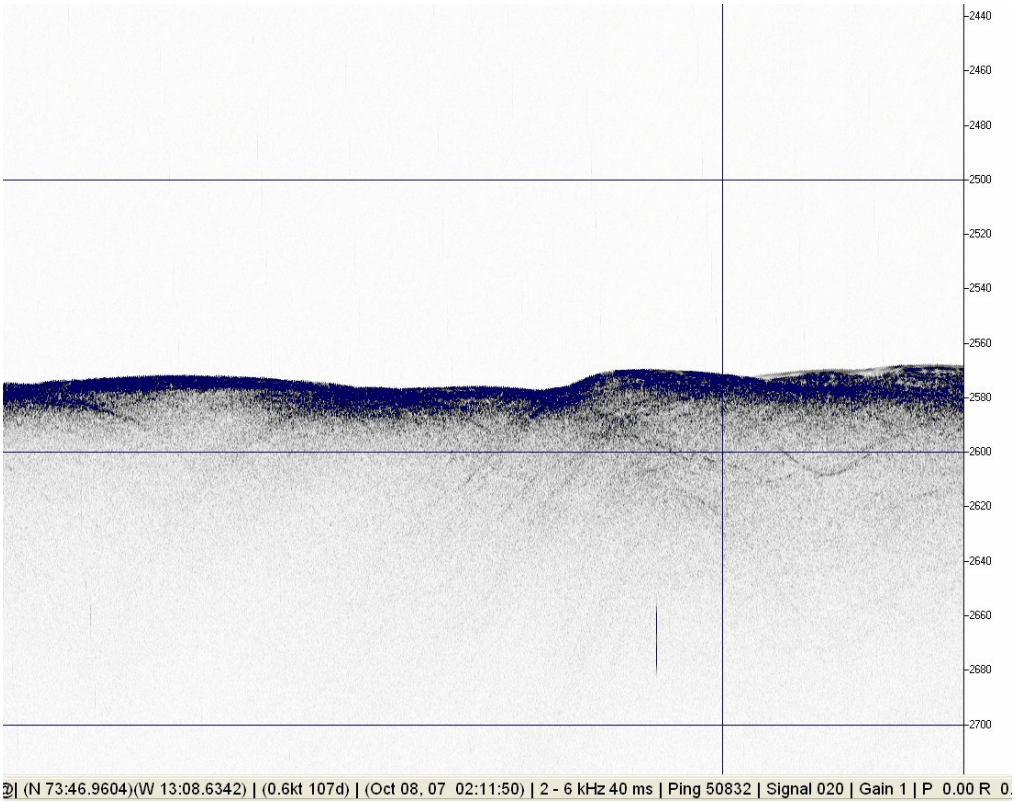
St. JM07 – WP – 176 MC



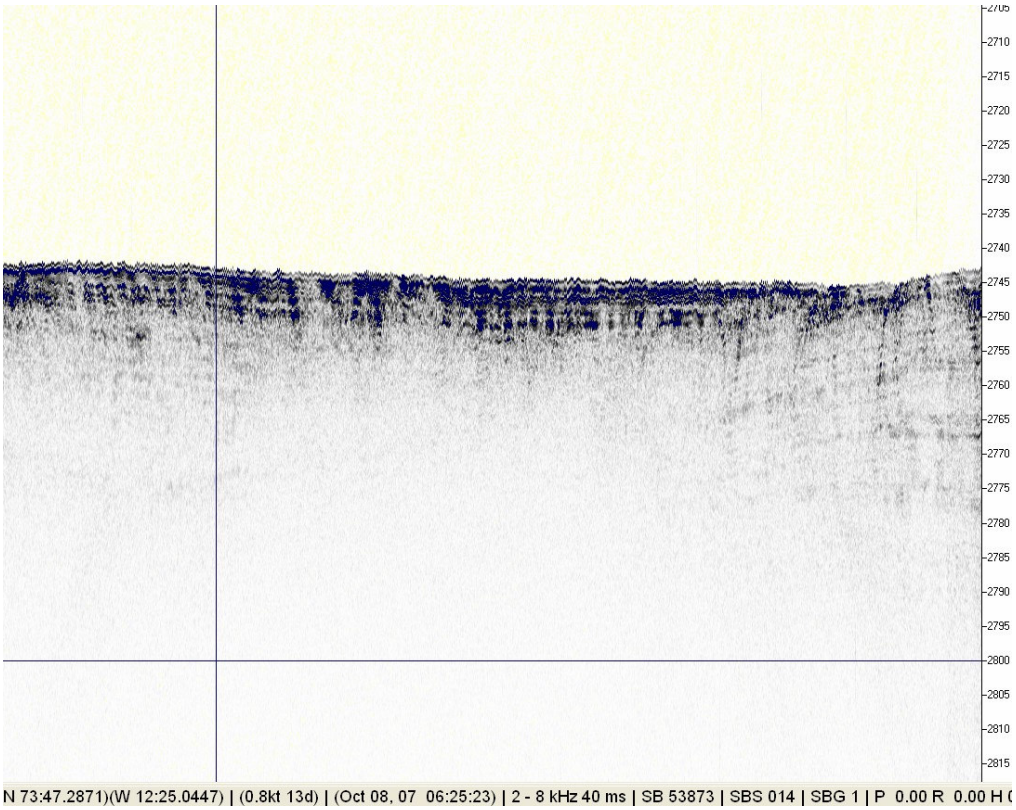
St. JM07 – WP – 170 MC



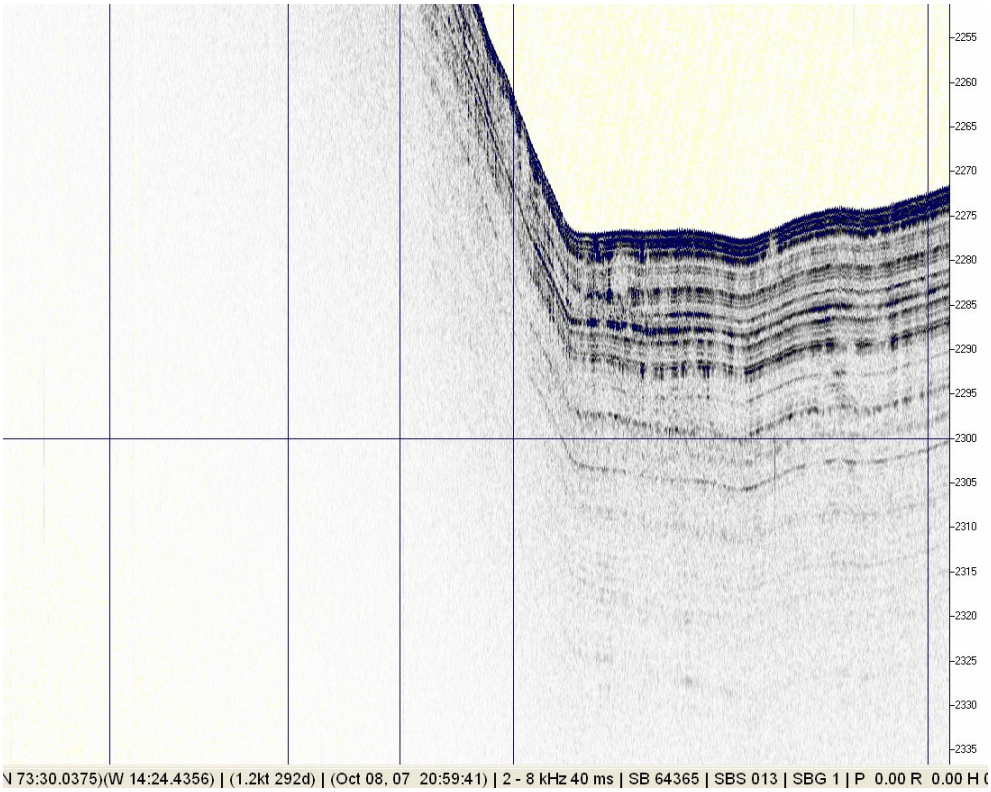
St. JM07 – WP – 171 MC



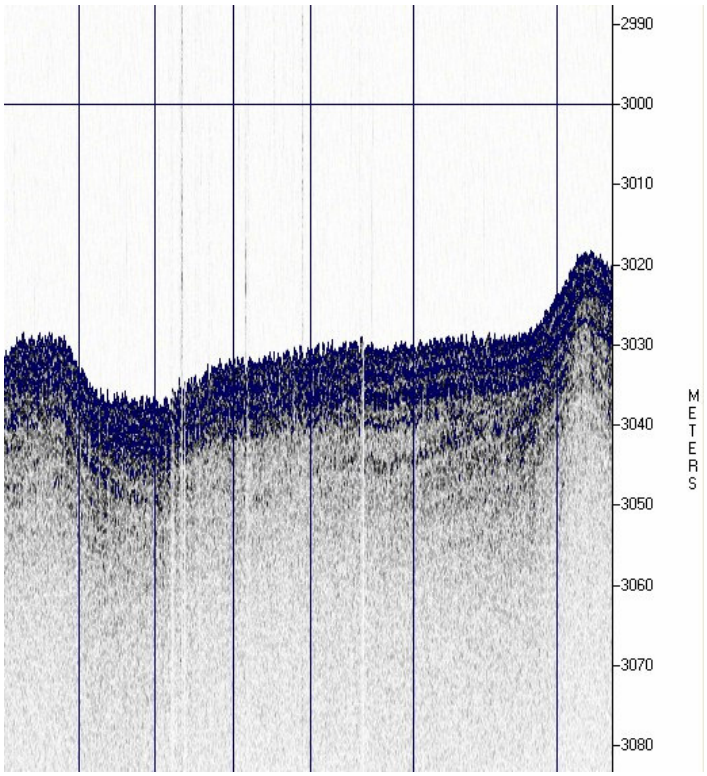
St. JM07 – WP – 172 MC



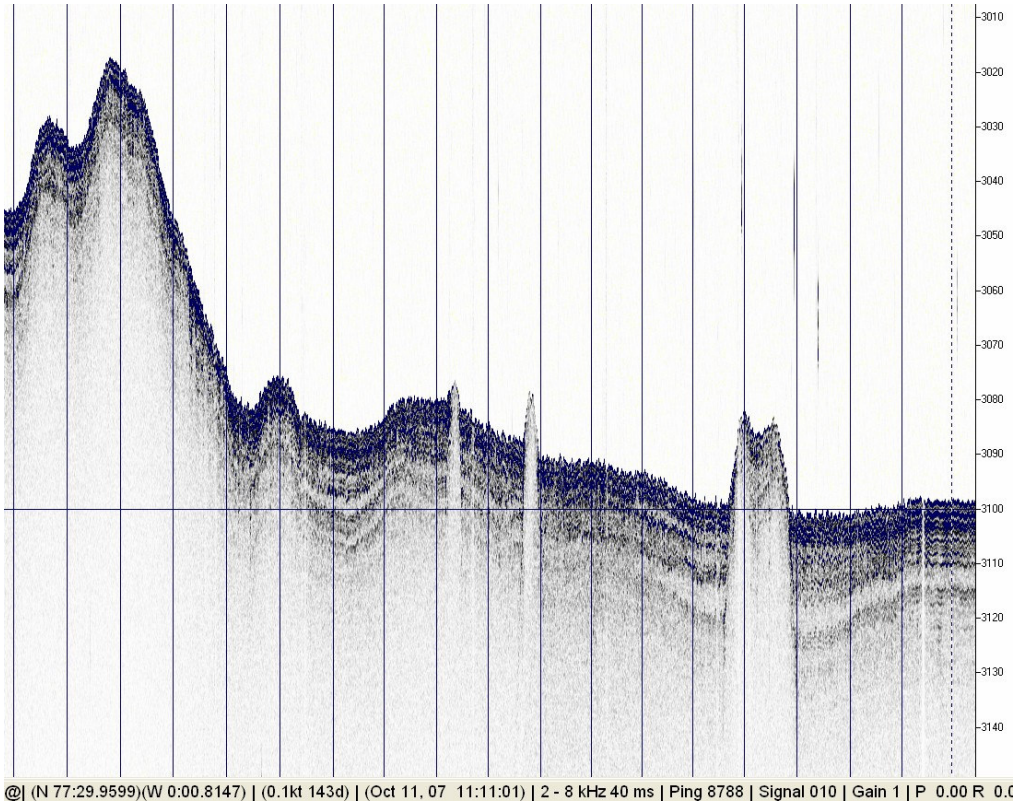
St. JM07 – WP – 174 GC



St. JM07 – WP – 180 MC



St. JM07 – WP – 182 MC



St. JM07 – WP – 183 MC