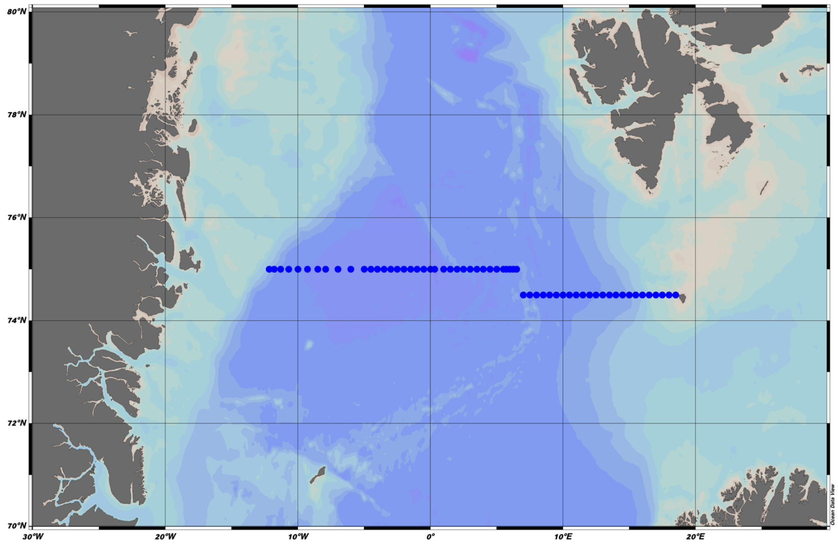
# CRUISE REPORT: 75N

Updated: May 17, 2024




## Highlights

### Cruise Summary Information

| | |
|---|---|
| Section Designation | **75N** |
| Expedition Designation (ExpoCode) | **58GS20060721** |
| Chief Scientist | Are Olsen / UIB |
| Dates | 21 July – 3 August 2006 |
| Ship | G.O. Sars |
| Ports of Call | Akureyri, Iceland – Tromso, Norway |
| Geographic Boundaries | 75° ”N<br>12° 17”W 18° 5”E<br>74° 5”N |
| Stations | 68 |
| Floats and Drifters Deployed | 0 |
| Moorings Deployed and Recovered | 0 |
| | |

**Contact Information:**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Report assembled by Savannah Lewis

**Links to Selected Topics**
Shaded sections are not relevant to this cruise or were not available when this report was compiled.

| Cruise Summary Information | | Hydrographic Measurements | |
|---|---|---|---|
| Description of Scientific Program | | **CTD Data:** | |
| Geographic Boundaries | | Acquisition | |
| Cruise Track (Figure): PI | CCHDO | Processing | |
| Description of Stations | | Calibration | |
| Description of Parameters Sampled | | Temperature | Pressure |
| Bottle Depth Distribution (figure) | | Conductivity | Oxygen |
| | | | |
| Deployments | | **Bottle Data** | |
| Moorings Deployed or Recovered | | Salinity | |
| | | Oxygen | |
| Programs and Principal Investigators | | Nutrients | |
| Scientific Personnel | | DIC | |
| | | CFCs and $SF_6$ | |
| | | Total Alkalinity | |
| | | pH | |
| | | | |
| **Underway Data Information** | | Lowered Acoustic Doppler Current Profiler | |
| Navigation | Bathymetry | | |
| Acoustic Doppler Current Profiler | | | |
| Thermosalinograph | | | |
| XBT and/or XCTD | | | |
| $pCO_2$ | | **References** | |
| Atmospheric Chemistry Data | | | |
| Meteorological Observations | | | |

**Cruise report & Diary, G.O. Sars 2006 (Cruise 2006111, 58GS20060721)**

**Compiled by Are Olsen**

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## Plan

The plan was to go from Akureyri, Iceland at least within noon 21/7/06, sail north to 75ºN and then do a section across from the ice edge to 20º 30'E. Station every 30' $CO_2$ chemistry profiles (Ct, AT, CFC, nuts, $\delta^{13}C$, $\delta^{18}O$) at every second station (the whole degree ones) and only CTD profiling and nutrients at the stations between (the 1/2º).

In addition DOC samples would be drawn for post cruise analysis at IMR, Bacterial production measurements would be carried out onboard (K.Y. Børsheim) and on three stations radioactivity samples would be taken at three depths (bottom, middle and top) + box core sample (these at 15 ºV, 10 ºE and 16 ºE).

After that we planned to sail down to 72 º 30' ~20 º E, sample a bit around a $CO_2$ mooring put out there June 2006. This in order to ground truth the SAMI (i.e. the $CO_2$ sensor at the mooring). Do stations as time allows.

Additionally the ship was equipped by Wade McGillis and Christopher Zappa with equipment for micrometeorological flux measurements (latent heat, momentum, $CO_2$)

Truls Johannessen was the intended chief scientist, but was prevented to come. Are Olsen took over.

**Participants & responsibilities**

| | |
|---|---|
| Kelly Brown | Winkler Oxygen. Sampling and analysis (PI). |
| Linda Fonnes | Nutrients. Sampling and analysis. DOC sampling. Radioactivity sampling. |
| Yngve Børsheim | Bacterial production, DOC sampling. |
| Martin Dahl | CTD |
| Helene Frigstad | Oxygen sampling |
| Judith Hauck | CT and At |
| Terje Hovland | CTD |
| Emil Jeanson | CFC |
| Solveig Kringstad. | CT and At |
| Siv Lauseth | CT and At |
| Lene Mathisen | CT and At, Nuts and DOC sampling |
| Craig Neill | Carbon group engineer, $\delta^{13}C$ sampling |
| Anita Nybakk | Nutrients (PI),. |
| Are Olsen | Chief Scientist, $\delta^{13}C$ sampling |
| Anders Olsson | CFC (PI) |
| Abdirahman Omar | CT & At (PI) |
| Benjamin Pfeil | Salinity and $\delta^{18}O$ sampling, data manager |
| Fredrik Svendsen | Salinity and $\delta^{18}O$ sampling, salinity measurements (portasal) |

## WATCHES & DUTY LIST

| | | |
|---|---|---|
| **CFCs & SF6 (sometimes)** | | |
| Anders | 04-12 & 16-20 | Sampling & analysis |
| Emil | 20-04 & 12-16 | Sampling & analysis |
| | | |
| **$O_2$** | | |
| Kelly | 00-12 | Sampling and analysis |
| Helen | 12-00 | Sampling |
| | | |
| **CT & AT** | | |
| Solveig and Siv | 04-12 & 16-20 | Sampling and analysis |
| Abdir and Judith | 20-04 & 12-16 | Sampling and analysis |
| | | |
| **$\delta^{13}C$** | | |
| Craig | 00-12 | Sampling |
| Lene | 00-12 | Bottle organising |
| Are | 12-00 | Sampling |
| Helene | 12-00 | Bottle organising |
| | | |
| **Nutrients** | | |
| Anita | 08-20 | Sampling & analysis |
| Linda | 06-12 & 18-00 | Sampling & analysis |
| Lene | 00-06 | Sampling |
| | | |
| **DOC** | | |
| Yngve | 06-18 | Sampling |
| Linda | 18-00 | Sampling |
| Lene | 00-06 | Sampling |
| | | |
| **$\delta^{18}O$** | | |
| Fredrik | 00-06 & 12-18 | Sampling |
| Benjamin | 06-12 & 18-00 | Sampling |
| Helene | 12-00 | Bottle organising |
| Lene | 00-12 | Bottle organising |
| | | |
| **Salinity** | | |
| Fredrik | 00-06 & 12-18 | Sampling |
| Benjamin | 06-12 & 18-00 | Sampling |
| | | |
| **CTD** | | |
| Terje | 00-06 & 12-18 | |
| Martin | 06-12 & 18-00 | |
| | | |
| **Chief Scientist** | | |
| Are | 12-00 | |
| Craig | 00-12 | |

## Instruments

CTD

SBE911 with two sets of sensors. There were quite a few problems with the CTD. These were amongst other things attributed to a leak plug. However it was ultimately discovered that the problems were caused by excessive power consumption by one of the pumps. The problem was alleviated by using a new pump, in order to accomplish this one set of the sensors were taken of the CTD (each sensor pair has its own pump, we did not know which of the pumps were bad, but we had one new one, and so to increase the success rate to 100% both of the old pumps were taken of and one new mounted). This was a quite easy decision because one of the sensor pairs gave clearly too high salinities. The good sensor pair has serial numbers:
Temperature: 4535
Conductivity: 3012

This pair was used as secondary sensors through to station 255. And as primary after that. In the master data file only data from the good pair is given.

The CTD was also equipped with a seabird oxygen sensor and an Aanderaa optode (except for stations 260 until ~291) Contact Anita Nybakk for the Optode data).

The CTDSAL in the file have been corrected using the bottle salinities
The CTDOXY values have been corrected using the Winkler oxygen data

Winkler oxygen

Oxygen concentrations in water samples were determined using Winkler titration on an instrument designed & built at Scripps. Approximately 517 samples were measured.

Carbon chemistry

Abdir Omar

Three measurement systems were installed onboard the ship for the analyses of the carbon system parameters. Two of these systems measured total dissolved inorganic carbon ($C_T$), the other measured total alkalinity.

During each chemical station (roughly each 0.5 longitude degree along a west-to-east section on the 75° N) 5 - 24 samples were drawn from the CTD-bottles into 500 ml glass bottles with glass stoppers and were analyzed for $C_T$ and $A_T$ within few hours after the collection. The water sampling was carried out according to the WOCE water sampling protocol. Until station 271 a 24-bottle rosette was used and all samples were drawn from the first cast. From station 271 onwards a 12-bottle rosette was put in use so that whenever more than 12 samples were to be taken 5 – 6 samples were drawn from the first cast and the rest of the samples were taken from the second cast.

The collected samples were first brought to the desired measurement temperatures (15 °C for $C_T$ and 25 °C for $A_T$) then each sample was analyzed first for $C_T$ and then for $A_T$. Whenever the samples could not be analyzed immediately for some reason, they were stored in a refrigerator.

$C_T$ was determined using a SOMMA system (Single-Operator Multiparameter Metabolic Analyzer System) with coulometric detection as described in Johnson et al. (1985) and Johnson et al. (1987). Normally, a new coulometer-cell solution was prepared for each station although sometimes two consecutive stations were analyzed using the same cell solution.
$A_T$ was determined with the potentiometeric titration method described in Haraldson et al. (1997) using a VINDTA (Versatile INstrument for the Determination of Total carbon and Alkalinity) system.
The accuracy of the $A_T$ and $C_T$ measurement systems was kept under control by frequent measurements (every 3 – 4 hours for $A_T$ and 8 – 10 hours for $C_T$) of Certified Reference Material (CRM) supplied by Andrew Dickson (Scripps Institute of Oceanography, USA).

The measurement systems functioned well throughout the cruise. However at a few occasions the VINDTA system malfunctioned and the $A_T$ measurements were paused. These incidents introduced long backlog in the $A_T$ measurements and, thus, about 50 $A_T$ samples were inevitably emptied into the sink. Therefore, slightly fewer samples (~450) were analyzed for At than for Ct (~500).

NOTE by Are Olsen, December 2008. After the data have been worked up we realise that the At data are not of opimal quality. They seem to high (~5 $\mu$mol kg-$^{1}$ compared with previous data) as well as a bit scattered.

Nutrients

Anita Nybakk

There have been sampled nutrients at 67 stations, totally 825 samples. The samples were analysed fresh, without conservations, on an Alpkem Autoanalyser within 48 hours. The stations were a half degree apart, and trough the Artic front a quarter degree apart, which have given a thoroughly coverage of the Bear Island West section.

In addition there were also taken radioactivity samples (Pu, Tc, Sr and Ra) at three stations. At two stations 375 litres bottom water, 375 litres surface water, 375 litres in the middle of the water column, sediments two cores, two surface sediments samples and filtrated 400 litres surface water for Cs analyses. At the last radioactivity station 375 litres surface water were sampled and 400 litres were filtrated for Cs analyses.

Bacterial production & DOC

Knut Yngve Børsheim

The biological transfer of carbon in the oceans and the flux of $CO_2$ between ocean and atmosphere are important links in the global carbon cycle. One important aspect is that a remarkably large part of the carbon fixed by photosynthesis in the euphotic zone of Arctic seawater accumulates as dissolved organic carbon (DOC) during the productive season (Børsheim and Myklestad 1997; Børsheim 2000). Accumulation of DOC, along with sedimentation of particulate organic carbon, forms part of the biological pump that increase assimilation of atmospheric $CO_2$ by the surface waters (Noji et al. 1999). In order to incorporate the DOC fluxes in models of carbon cycling, it is important to know the magnitude of the transient DOC pool and the fate of the material after the productive season. The project collected samples for the analysis of DOC concentration from selected locations in the Greenland Sea. In addition, bacterial production was measured, in order be able to calculate degradation rates of DOC.

Table 1. Overview of samples analysed

| Station | Longitude | DOC | Bacteria | Production |
|---|---|---|---|---|
| 254 | 011 18.00 W | 18 | 5 | 5 |
| 255 | 011 47.99 W | 18 | 5 | 5 |
| 256 | 012 10.02 W | 10 | | |
| 257 | 009 59.42 W | 1 | 5 | 5 |
| 258 | 009 17.55 W | 10 | 5 | 5 |
| 260 | 007 54.01 W | 10 | | |
| 261 | 006 59.64 W | 10 | | |
| 262 | 005 59.73 W | 6 | 5 | 5 |
| 263 | 004 59.95 W | 6 | 5 | 5 |
| 265 | 004 00.02 W | 10 | 5 | 5 |
| 269 | 002 00.13 W | 10 | 5 | 5 |
| 270 | 001 29.94 W | | 5 | 5 |
| 272 | 001 29.94 W | | 5 | 5 |
| 273 | 000 29.95 W | | 5 | 5 |
| 274 | 000 00.06 W | 5 | | |
| 275 | 000 00.08 W | 10 | | |
| 277 | 001 00.08 E | | 5 | 5 |
| 278 | 001 00.08 E | | 5 | 5 |
| 279 | 001 30.18 E | | 5 | 5 |
| 281 | 001 59.98 E | 10 | 5 | 5 |
| 282 | 002 30.19 E | | 5 | 5 |
| 285 | 003 59.99 E | 2 | | |
| 286 | 004 00.00 E | 10 | | |
| 289 | 005 00.04 E | | 5 | 5 |
| 290 | 005 29.95 E | | 5 | 5 |
| 293 | 006 00.00 E | | 5 | 5 |
| 294 | 006 15.04 E | | 5 | 5 |
| 299 | 008 00.04 E | | 5 | 5 |
| 301 | 009 00.00 E | | 5 | 5 |
| 303 | 010 00.09 E | | 5 | 5 |

DOC was measured using high temperature catalytic oxidation (Suzuki 1993). Replicate 5 ml samples were acidified with 50 μl 0.5 N HCL and kept refrigerated until analysed on a Scimadzu 5000 TOC analyzer within two months after sampling.

Bacterial total counts were measured using epifluorescence microscopy after staining with SYBR Green I (Noble and Fuhrman 1998). Bacterial production was measured by the $^{3}$H-[methyl]-thymidine method (Fuhrman and Azam 1982).

Salinity

A Portasal instrument was used. Nominal accuracy ± 0.003.
Samples for salinity determination were drawn from all bottles at the full chemistry CTD casts and from ~4 bottles at the CTD & nuts casts.

CFCs

Anders Olsson

Transient chlorofluorocarbon (CFC) tracers samples were collected on all full-chemistry stations throughout the cruise, in total 505 samples. The CFCs evaluated were CFC-11, CFC-12, CFC-113 and carbon tetrachloride. The samples were taken from the Niskin bottles in glass syringes (100 ml), which were stored immersed in cold seawater and analysis took place within six hours after sampling. The analysis is based on purge-and-trap work-up of the water samples followed by gas chromatographic separation and electron capture detection of the different compounds. The analytical technique is described by Fogelqvist (1999). The analytical precision, given as the standard deviation for multiple samples taken from 23 different Niskin bottles fired at the same depth, ranged from close to 1 % for CFC-11 up to around 5 % for CFC-113.
The standardisation was achieved by calibration gas prepared at Brookhaven National Laboratory (Happell and Wallace, 1997) and cross-calibrated against gas prepared at Scripps Institute of Oceanography. The standard gases were calibrated against the SIO-93 scale.

**DIARY**

All times are Norwegian time (summertime, UTC +2) unless noted.

**20/7**
The ship was in port in Akureyri from the morning.
Started to install equipment in the labs & people coming in over the day.
Wade & Chris installed the mast with the micrometeorological flux equipment in the bow, with help from different people.
Finished at *2330* (Norwegian time).

**21/7**
Set sail at *0000*. Headed towards 75 ºN. Sailed all day

**22/7.**
*00-06*. Searched for surfaced buoy. The buoy had surfaced a few months before & we had a request if we could pick it up. Unfortunately the batteries ran out the 21st or so. We went to the last position & searched for 6hrs. Not found

At *1000* we did a test station,
station # 250
lat 70.42`52``  long 16.24`75`` bottom depth 1548
- ca 500 m all bottles fired
- primary temperature 1 was unstable (leakage in plug? – will be checked and tested)
The rest of the day Terje & Martin tried to fix the sensor. Turn out that it's OK going down. On the way up it spikes as if to resist change.
Decided to go ahead despite of this, Secondary sensor is good & will reported in the bottle files. Both sensors will be reported in the CTD (downcast) files.
During the course of this work some more test stations were done.

Met some ice late at evening, forces us to turn east to get around.

**23/7.**
Heading towards first station at 75ºN 11º 18'W. Have to go around the ice at several occasions. The plan is to sample the 11º 18'W station, then go west with stations at every 500 depth level until we hit ice. Do a radioactivity sample there.

First station at *1450*: #253 (obviously 251 & 252 were tests), 2990 depth. Some distant ice.
75 º 00N
10 º 41W
Here the primary conductivity sensor acted up. The temperature and conductivity sensor had been swapped inside the sensor tube.
At ~50 m, very high salinities.

Later on to 11 º 18
Station 254

Close to ice shelf, ~10 nm? But captain said we see land 80 nm from here, seems more likely judging by the map
Sensor pump was changed before this. Seems like problem fixed, still primary sensor seems higher than secondary.

Station 254 (deleted).
CTD acts up at 700 m. Shortcut in plug. Martin dries, changes o-ring.

**24/7**
*~0030*. Station 255 (deleted).
Short cut in plug at 700 m. Leak. Now we will change the winch (from optical to analogue).

Changed winch.
Did station 254 (i.e. the 254 & 255 run before this deleted)
All good but sensors (salinity secondary) started spiking at bottom.
Still, station counted as good and samples collected.
Change sonde housing.

*1600*
CTD housing changed.
Now, the secondary sensor pair has been turned into being the primary pair on this probe.
This was because the pump tended to stop on the old probe. Martin thought that this was because the primary sensor acted up, and it is the primary sensor that makes the pump stop.

*~1700*
Station 255. Looks good
Extra depths 1200 & 900 m.
Still, in the file strange values in the surface. Didn't show up when the probe went down.

*~2100*
Station 256
Very much mixing action in upper 500 m. Tried to sample in the salinity minimums.
Note that the salinities in the CTD and the bottle file will be different in this depth range because the gradients had moved as the CTD came up.
This is the station closest to the ice edge, 1 nm, the captain seemed pretty definite & we could see it on the radar.
Also, the air valves on the niskins were open, Niskin 7 & 8 leaked.
Did the radioactivity sampling and box core (2 tries) here as well.

**25/7**
*~900*
station 257 at 10W. Just CTD & nutrients.
Rosette hit bottom, the brakes on the winch weren't strong enough to hold it back.
From now on we only go to 3000 m to avoid having too much heavy cable out.

*~1300*

Station 258.
Sampled at 320 m instead of 300 m to make sure we got water from a salinity minimum.
NB, bottle 1, salt drawn first.
259
Sampled at 320 m instead of 300 m to get a salinity maximum.

Smells burnt brakes all over. Smoke on the way up .Now they have to take the winch apart.

*~2300*
Unable to repair winch. Switched back to fiberoptic cable winch. Down to ~2000 m, leak in plug.
Next vulc tape.

**26/7**
*1000*
Did not help with vulc. Also during night, a different winch was tried out (analogue, for the 12 bottle rosette). Same problem. CTD pump won't start

*1300*
Martin has opened up the CTD housing. There is a burnt resistor & transistor in there. Let's hope that this was caused by the short cut in the fiberoptic cable plug.
Now the card has been changed.

*2100*
Winch 103 repaired (So back to analogue). Brakes replaced.
CTD repaired.
At 3000 m, CTD pump stopped.
Resistor on card broken off. Something is using too much power. One of the pumps? Took off both old pumps. Put on one new one. Will have to do with one pair of temperature & conductivity sensors.
Took the optode off as well.

station 260.
Decided to spare the brakes, not stop at all depths. Here though we'll make an exception & stop at the double sampling depth 500 m, fire as we stop (#7) and then twice after 30 secs.
After this we'll stop at all double sampling depths, but not anywhere else before we have consulted the chief.

Also, this station is only to 2500 m (to be on the safe side)

Bottle file did not record temperature.

**27/7**
Station 261 (ccn)
CTD logging software is still configured such that bottle file does not contain temperature. We wrote down the temperatures manually when the bottles were fired.
We stopped the winch for each bottle at depths 800 and up to make it easier to record

the proper temperature (Martin fixed the configuration before the next station and produce a bottle file for this one as well).

Fired duplicate bottles at 800 meters. The first (bottle 7) was fired immediately upon reaching 800m. The second (bottle 8) was fired after waiting 30 seconds or so. The two temperatures agreed to the 3rd digit.

At higher depths (where the temperature gradients were much greater) I watched the temperature data as the winch stopped and found that the temperature changes by up to 0.2 degrees from when the winch stops until it stabilizes. Some examples:

| Depth | T(winch stop) | T(stable) |
|---|---|---|
| 200 | -0.07 | -0.048 |
| 150 | 0.256 | 0.313 |
| 100 | ~0.73 | 0.750 |
| 75 | 1.67 | 1.791 |
| 50 | 1.997 | 2.028 |
| 30 | 4.076 | 4.281 |
| 6 | 4.673 | 4.669 |

For now I have asked the instrument engineers to stop the winch when closing bottles above 800 m depth.

The temperature data looked noisy at around 800 – 500 meters. Not sure if it was real changes or sensor noise. Should look at profile data.

Got no bottle confirmation when bottle 18 was fired (the deck unit beeped and showed a red line on the plot, but the number of bottles fired did not increase). We fired one more at the same (6m) depth. The package came on board with 18 bottles closed, indicating that the first 6m bottle did not fire.

Stn 262 (ccn)
No problems except that we are moving too fast to keep up with samples. Suggest either doing some intermediate CTDs or slowing the ship down between stations.

*1200*
Go back to intermediate CTDs
The stations at 7 º 30 W, 6 º30W & 5 º30W dropped.
Station 263 at 5 ºE.

After 263.
I have asked around, & it seems as if people believe it is safe to stop at all depth. Thus, from now on we'll stop at all depths.

264
Phys & nuts. Bottle at 150 m not fired – even though button pressed. Same problem as this night.

265
Full chemistry, bottle 3 leaked

*~2300*
Sta. 266
At 3270 m, smells burnt again.
Stop the winch & fire on the go.

Message from captain, deepest allowed depth is 2500 m No stops on the way up. Tomorrow morning they'll find out exactly how deep we can go, most likely even more shallow casts.
The problem is that the cable on the winch is too heavy, so it can't get across some depth (say 2000 m or so) because the leverage (torque on the winch) is too big because there is a lot of cable left on the winch.

I think it was this day that Terje measure the power consumption of the CTD pumps that had been taken of. He found that one of them seemed unstable and used to much current. It seems as if the bearing is broken. Most likely this has been the cause of all the CTD problems we've had.

**28/7**
*0230*
sta. 267
Analogue winch caput
changing back to fiber
duplicate at surface, will, will alternate dups. between srf. and 2000 m.
Interesting CTD profile, moved 1500 m sample to 1400 m and added 1700 sample. Also added 1200 m.

Sta 269
Also interesting. Oxygen saturation max down to 900 m.
Extra bottle at 1200 m

Sta 270
Only Nuts.

Sta 271
*1334*
Started to use 12 btl rosette, small winch, this can go all the way to the bottom.
Two casts, upper one is 272
NB, this station took 1 hr more than normal because of problems getting the rosette up from water.

*1905*
Sta 273. Nuts & CTD only

Sta 274
Bottle 4 did not close.  Did not give it a sticker number, so station has only 11 numbers

Sta 275

Bottle 4 did not close again. Again used only 11 sticker numbers.
Adjusted bottle 4's lanyard. Will stop using it if it fails again.

**29/7**
Sta 276
No eddy – sampled as normal physics/nuts station

Sta 277
First of 2 at 1 E (six deep samples). Niskin 6 leaked a little.
Still no eddy.

Sta 278
Second of two 1 E. 12 shallow samples.
Bottle 4 didn't fire.

Sta 279
Nuts & CTD, OK

Sta. 280 & 281 Double cast chemistry station. OK.

Sta 282
Nuts & CTD, OK

Sta 283
Full chem. So shallow (~2500) that only 12 bottles were required.
All air valves on the niskins were open.

Sta 284
Nuts & CTD

**30/7**
Sta 285 & 286
Double full chemistry. On 285 all Niskin air vents open. On 286 air vents were checked and we fired the deepest bottle at the same depth (1000m) as the highest bottle in 285. Oxygen data indicated no problem from the open vent (same value from 1000m on both casts).

Sta 287
Nuts & CTD

Sta 288/289
Double full chemistry.
288 niskin # 6 leaks.

Sta 290
Nuts & CTD

Sta 291
Nuts & CTD, 1/4 °, Arctic front

Sta 292/293
Double full chemistry.

Sta 294
Nuts & CTD, 1/4 °, Arctic front

Sta 295
Nuts & CTD, Oxygen sampled as well because of AOU max just below Atlantic layer.

**31/7**

Sta 296
Would have been full chemistry. All bottle vents were open so we did it again with a new station number (kept CTD data as sta 296)

Sta 297
Full chemistry. Second station at 7E because of open vents on sta 296.

Sta 298
Nuts & CTD

Sta 299
Full chemistry.

Sta 300
Nuts & CTD

Sta 301
Full chemistry

Sta 302
Nuts & CTD

303
Full chemistry

At ~*2100*, 10E
Here we collected water for radioactivity samples & box core.

**1/8**

304, 305, 306 & 307. No problem!

308T&309. No problem.

2/8

310 nuts

311 chem, all vents open

312 nuts

313 chem

**2/8**
Stations 314 to 320. Eventless except that btl. 4 did not close at station 319.

**3/8**
From 0020 until 0420, steamed within ½ nm from the $CO_2$ mooring.

## STATION SUMMARY TABLE

| Station | lon | Purpose | Issues |
|---|---|---|---|
| 250 | - | Test | All btls at 500 m |
| 251 | - | Test | CTD test |
| 252 | - | Test | CTD test |
| 253 | -10.7 | Full chemistry | Primary C sensor acting up.$\delta^{18}O$ isotope labes shifted? |
| 254 | -11.3 | Full chemistry, -istp? | Secondary sensors spiking going up. Analogue Winch (103). |
| 255 | -11.8 | Full Chemistry | |
| 256 | -12.2 | Full Chemistry | Niskin vents open, 7&8 leak. |
| 257 | -10 | CTD & Nuts. | Unable to brake winch, rosette hit bottom. |
| 258 | -9.3 | Full chem. | 300 – 320 swap. #salt drawn first. |
| 259 | -8.5 | CTD & Nuts | 300-320 swap. Winch (103) break down. |
| 260 | -7.9 | Full chemistry | Winch 103 repaired. 2500 m depth limit (careful). #7 not sampled. |
| 261 | -7 | Full chemistry, At lp. –istp. | |
| 262 | -6 | Full chemistry | |
| 263 | -5 | Full chemistry, At lp. –istp. | |
| 264 | -4.5 | CTD & Nuts | 150 m not fired. |
| 265 | -4 | Full chemistry | #3 leaked |
| 266 | -3.5 | CTD & Nuts | Winch breakdown (analog, 103) |
| 267 | -3 | Full chemistry, At lp. –istp. | Winch 104 (optic). But max allowed depth 2000 |
| 268 | -2.5 | CTD & Nuts | Max allowed depth 2000 |
| 269 | -2 | Full chemistry | max allowed depth 2000, #13 leaking. |
| 270 | -1.5 | CTD & Nuts | max allowed depth 2000 |
| 271 | -1 | Full chemistry, At lp. | 12btl. rosette, deepest of two. |
| 272 | -1 | Full chemistry, At lp. | Upper of two |
| 273 | -0.5 | CTD & Nuts | One cast, standard depths |
| 274 | 0 | Full Chemistry | Lower of two. Btl. 4 not closed. |
| 275 | 0 | Full chemistry | Upper of two. Btl. 4 not closed. |
| 276 | 0.5 | CTD & Nuts | One cast standard depths. |
| 277 | 1 | Full chemistry, At lp. | Lower of two. # 6 leak (small) |
| 278 | 1 | Full chemistry, At lp. | Upper of two. #4 not fired. |
| 279 | 1.5 | CTD & Nuts | One cast, standard depths. |
| 280 | 2 | Full Chemistry | Lower of two |
| 281 | 2 | Full Chemistry | Upper of two |
| 282 | 2.5 | CTD & Nuts | One cast, standard depths. |
| 283 | 3 | Full chemistry, At lp. | 2500 m. One cast. All Niskin vents open. |
| 284 | 3.5 | CTD & Nuts | One cast, standard depths |
| 285 | 4 | Full chemistry | Lower of two. All niskin vents open |
| 286 | 4 | Full chemistry | Upper of two |
| 287 | 4.5 | CTD & Nuts | One cast, standard depths |
| 288 | 5 | Full chemistry, At lp. | Lower of two. # 6 leaks. |
| 289 | 5 | Full chemistry, At lp. | Upper of two. |
| 290 | 5.5 | CTD & Nuts | One cast standard depths. |

| | | | |
|---|---|---|---|
| 291 | 5.75 | CTD & Nuts | Arctic front. 1000m |
| 292 | 6 | Full chemistry | Lower of two |
| 293 | 6 | Full chemistry | Upper of two |
| 294 | 6.15 | CTD & nuts | Arctic front. 1000m |
| 295 | 6.5 | CTD & nuts | |
| 296 | 7 | Full chemistry | Vents open, discarded. |
| 297 | 7 | Repeat of 296. | Use this instead of 296. |
| 298 | 7.5 | CTD & nuts | |
| 299 | 8 | Full chemistry | |
| 300 | 8.5 | CTD & nuts | # 4 not closed |
| 301 | 9 | Full chemistry | |
| 302 | 9.5 | CTD & Nuts | |
| 303 | 10 | Full chemistry | 13C green, 18O, red. |
| 304 | 10.5 | CTD & Nuts | |
| 305 | 11 | Full chemistry | |
| 306 | 11.5 | CTD & Nuts | |
| 307 | 12 | Full chemistry | |
| 308 | 12.5 | CTD & Nuts | NB, written as 307 in log sheet, corrected? |
| 309 | 13 | Full chemistry | NB, written as 308 in log sheet, corrected? |
| 310 | 13.5 | CTD & Nuts | |
| 311 | 14 | Full chem | All vents open |
| 312 | 14.5 | CTD & Nuts | |
| 313 | 15 | Full chem | |
| 314.5 | 15.5 | CTD & Nuts | |
| 315 | 16 | Full chem | |
| 316 | 16.5 | CTD & Nuts | |
| 317 | 17 | Full chem | |
| 318 | 17.5 | CTD & Nuts | |
| 319 | 18 | Full chem | Bottle 4 not closed. |
| 320 | 18.5 | Full chem | |

At lp. Alkalinity samples low priority.
-istp. No isotope samples ($\delta^{13}C$ & $\delta^{18}O$), NB not absolutely sure.

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