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# **CRUISE REPORT**

CAGE21-2- Planktic foraminifera sampling for culturing experiments,  
central Greenland Sea 75°N

on R/V Helmer Hanssen, June 28<sup>th</sup> – July 3<sup>rd</sup> 2021

Mohamed Ezat, Julie Meilland, Adele Westgård, Thomas B. Chalk, Tine L. Rasmussen,  
Naima El bani Altuna, Christine Lockwood-Ireland

DEPARTMENT OF GEOLOGY, UNIVERSITY OF TROMSØ, N-9037 TROMSØ,  
NORWAY



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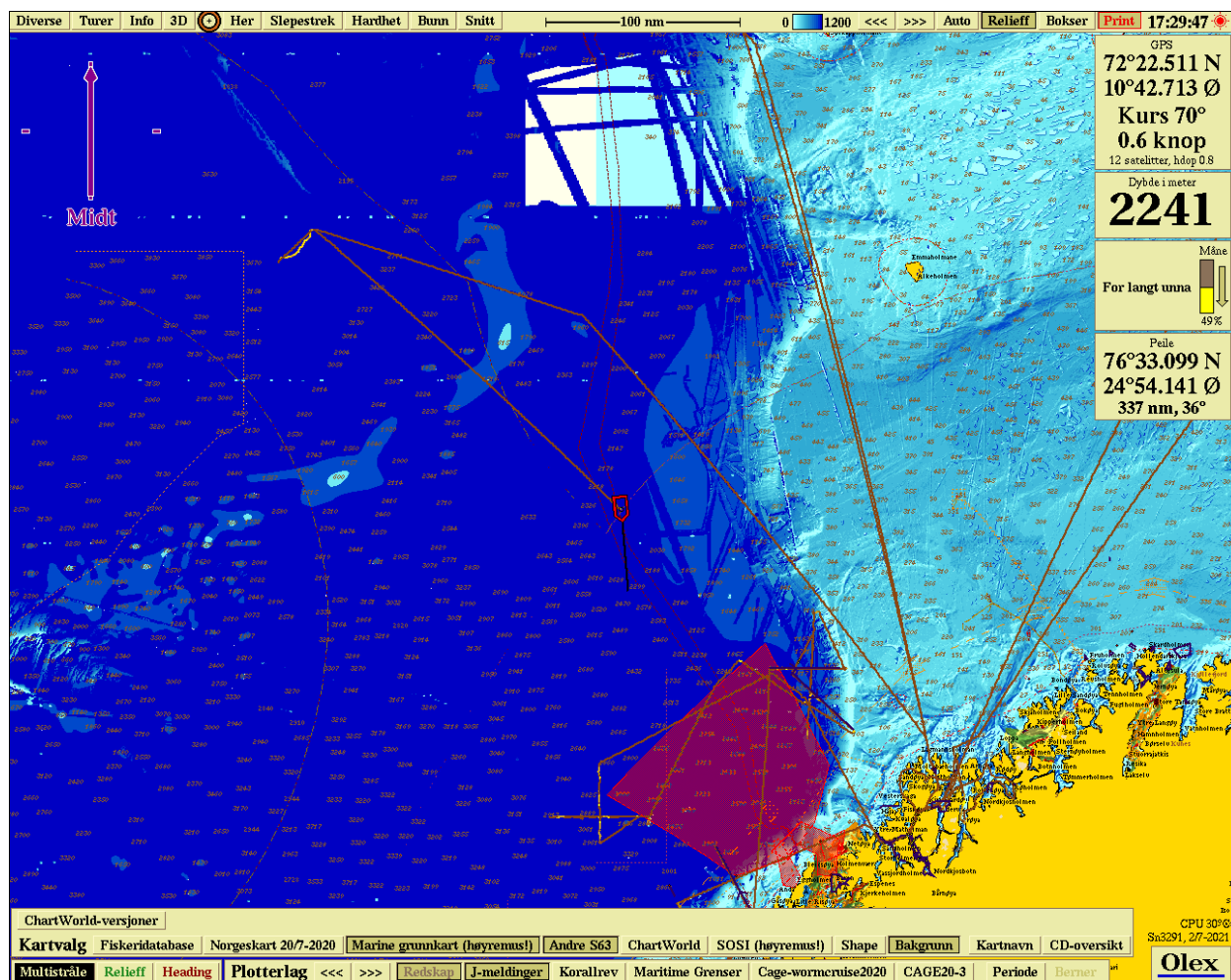
This report was finalized on July 3<sup>rd</sup> 2021.

## Summary

From the morning of June 28<sup>th</sup> to the morning of July 3<sup>rd</sup> 2021, the Department of Geosciences at UiT the Arctic University of Norway, arranged a scientific cruise on R/V “Helmer Hanssen aimed at sampling living planktic foraminifera (primarily *Neogloboquadrina pachyderma*) for culturing experiments both onboard and continued at the culturing laboratory at the Department. The purpose is to investigate the physiological and calcification responses of this species to a wide range of temperature, salinity and carbonate chemistry as well as to establish proxy calibration for paleoceanographic reconstructions.

The sampling is planned to take place in the Greenland Sea (for locations see Fig. 1). Seawater for the culturing experiments were also collected. The scientific sampling was done within the framework of the ongoing TFS-financed project “ARCLIM, The Arctic Ocean under warm climates” at the Department of Geosciences, UiT the Arctic University of Norway.

A total of 12 plankton net casts and 12 CTD (conductivity-temperature-depth) casts were performed in the Greenland Sea to collect living specimens of the planktic foraminiferal species *Neogloboquadrina pachyderma* and one station at 72°N for sampling subpolar species for various analyses.



**Figure 1:** Overview map based on map from OLEX, the route from Tromsø to the working area and to Tromsø with last sampling station on the way.

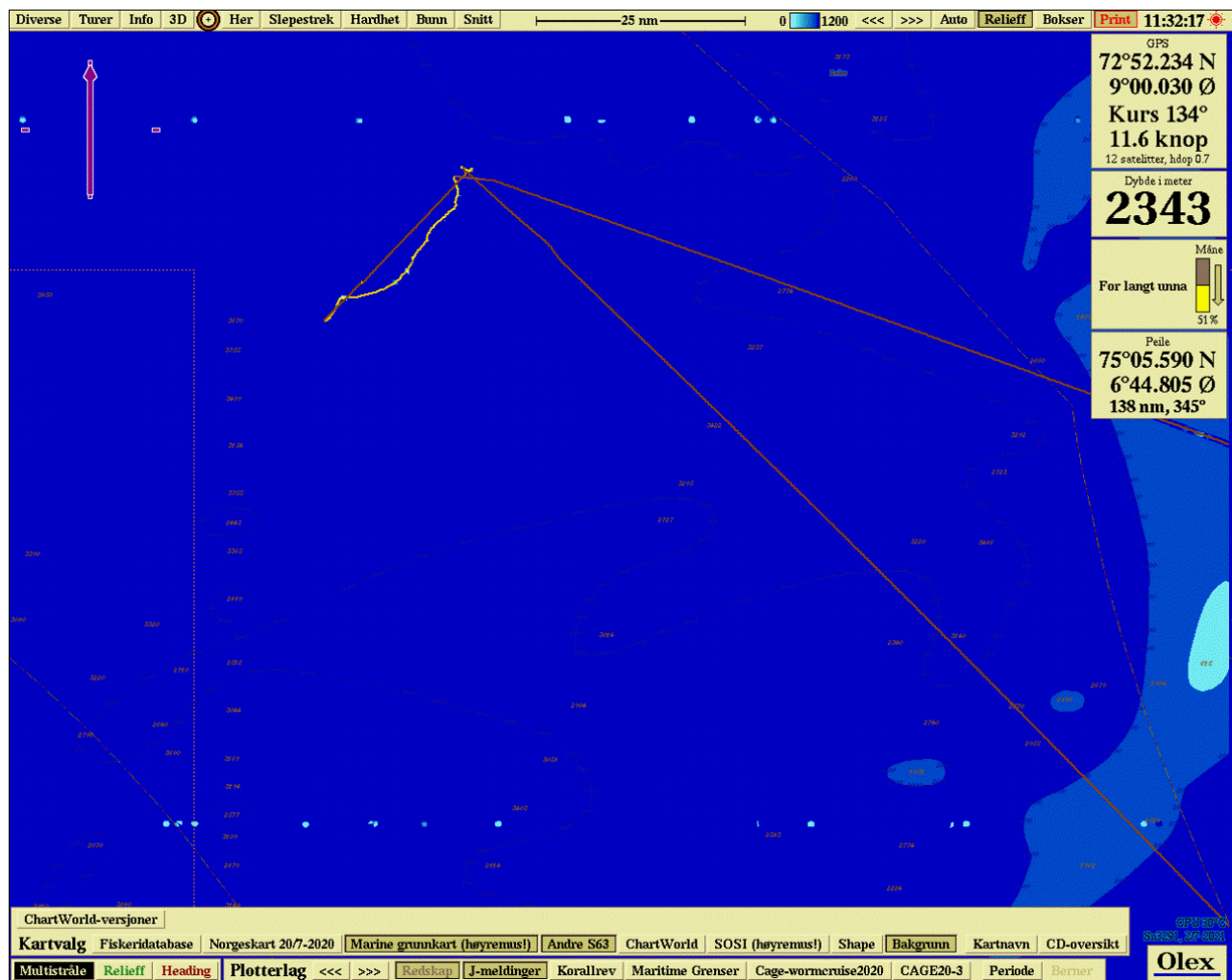


Figure 2: Detail of main sampling area in the central Greenland Sea

## Participants

Scientific crew:

Participants	Affiliation
Mohamed Ezat (Researcher, chief scientist)	UiT
Tine L. Rasmussen (Professor; co-chief scientist)	UiT
Julie Meilland (Researcher, co-chief scientist)	Marum, Bremen University
Adele Westgård (PhD student)	UiT
Tom Chalk (Post Doc)	'UoS', Southampton
Christine Lockwood-Ireland	UiT
Naima El bani Altuna	UiT

UiT = University of Tromsø, Norway

Marum = Bremen, Germany

'UoS' = University of Southampton

## Equipment/Methods

Plankton/water sampling

Plankton nets (WP-2 net from HydroBios) were cast together with CTD-stations for capture of live planktic foraminifera for culturing experiments. The tows were done at 50 m, 60 m and 100 m. The water properties – temperature, salinity – were measured using a *Seabird 911 Plus* CTD. Data collection was performed during downcasts at a speed of approx. 1.0 m/s. The data of selected CTD stations were used for records of modern water mass properties for the experimental studies of living planktic foraminifera.

## Journal

Remark: The journal below focuses on plankton net sampling, CTD's and water samples.

### Monday, June 28<sup>th</sup> 2021

Weather: cloudy, 11 °C; winds 8-12 m/s increasing in the afternoon to 20-21 m/s, some swell 3.4 m, light cloud cover. Evening winds up to 27 m/s.

#### *Summary*

Embarkation of the vessel and departure 0800 (UTC) for the Fram Strait 77N, 0E.

#### *Protocol of Monday June 28<sup>th</sup> (times in UTC)*

~0800: Embarkation and departure of the vessel at "Kulkaia" in Tromsø. Heading for position 77N, =E

~1100: set up of microscopes, the water filtration system and digital meters for pH, salinity.

## **Tuesday, June 29<sup>th</sup> 2021**

Weather: heavily overcast, low clouds, 7.6 °C; winds still high 18-20 m/s, heavy swells also during the night. Still heading north. Winds decreasing to 12-16 m/s and continuing to decrease during day time – 11-14 m/s in late afternoon.

### *Summary*

Transit during the night and the day. Because of weather forecast predicting bad weather for Wednesday the course is set for west to avoid the worst and be able to sample.

## **Wednesday, June 30<sup>th</sup> 2021**

Weather: cloudy, foggy, 5.3°C; winds 18-21 m/s. Winds supposed to decrease in the morning to 16-18 m/s. Mid-day up again to 17->21 m/s and to rough seas for more sampling.

### *Summary*

Transit during the night. Plankton net sampling planned for tomorrow morning to check for *N. pachyderma*- first net to 50 m to check, if successful, CTD and water sampling and more net sampling (to 100 m). First tow very successful – staying on this station for several day net-towing, CTD casting and water sampling. Afternoon winds and waves too high for more sampling.

### *Protocol of June 30<sup>th</sup> (times in UTC)*

0627: PN station HH21-775PNstart (central Greenland Sea at 74.47N, 01.56E, 2950 m water depth), 0-50 m

0645: Plankton net station HH21-775PNstop, 0-50 m, contained > 100 specimens of *N. pachyderma* with red color from lipids

0646: CTD station HH21-776CTDstart, 0-400 m, water sampling 100-200 m

0731: CTD station HH21-776CTDstop, 0-400 m, water sampling 100-200 m

0920: PN station HH21-777PNstart, 0-60 m

0937: Plankton net station HH21-777PNstop, 0-60 m

1202: PN station HH21-778PNstart, 0-60 m

1203: Plankton net station HH21-778PNstop, 0-60 m

1229: PN station HH21-779PNstart, 0-60 m

1239: Plankton net station HH21-779PNstop, 0-60 m

1243: CTD station HH21-780CTDstart, 0-300 m, water sampling 100-200 m

1259: CTD station HH21-780CTDstop, 0-300 m, water sampling 100-200 m

1959: PN station HH21-781PNstart, 0-60 m

2004: Plankton net station HH21-781PNstop, 0-60 m

2007: CTD station HH21-782CTDstart, 0-300 m, water sampling 100-200 m

2023: CTD station HH21-782CTDstop, 0-300 m, water sampling 100-200 m

## **Thursday, July 1<sup>st</sup> 2021**

Weather: overcast, foggy, winds 16->20 m/s and decreasing, temperature 2.3°C, afternoon winds

12-16 m/s, temperature 4°C.

### *Summary*

Staying at the mid-Greenland Sea station because of presence of numerous *N. pachyderma*. Because of bad weather with strong winds > 20 m/s and huge swells, the sampling will wait until it settles later during the day. During the last 24 hours, we have drifted quite far southwest and sail back to first station in the late morning. One stop for a PN and CTD on the way 0942. More plankton and CTD and water samples during the day. At 1800 begin transit to Tromsø, one station planned at 72N, PN and CTD. Transit during the evening and night

### *Protocol of July 1<sup>st</sup> (times in UTC)*

0750: PN station HH21-783PNstart (central Greenland Sea), 0-60 m  
0802: Plankton net station HH21-783PNstop, 0-60 m  
0942: PN station HH21-784PNstart, 0-60 m  
0950: Plankton net station HH21-784PNstop, 0-60 m  
0951: CTD station HH21-785CTDstart, 0-300 m, water sampling 100-200 m  
1008: CTD station HH21-785CTDstop, 0-300 m, water sampling 100-200 m  
1229: CTD station HH21-786CTDstart, 0-300 m, water sampling 100-200, 50 m and 30 m  
1243: CTD station HH21-786CTDstop, 0-300 m, water sampling 100-200, 50 m and 30 m  
1245: PN station HH21-787PNstart, 0-60 m  
1252: Plankton net station HH21-787PNstop, 0-60 m  
1514: CTD station HH21-788CTDstart, 0-200 m, water sampling 100-200  
1522: CTD station HH21-788CTDstop, 0-200 m, water sampling 100-200  
1524: PN station HH21-789PNstart, 0-60 m  
1530: Plankton net station HH21-789PNstop, 0-60 m  
1606: CTD station HH21-790CTDstart, 0-200 m, water sampling 100-200  
1617: CTD station HH21-790CTDstop, 0-200 m, water sampling 100-200  
1623: PN station HH21-791PNstart, 0-100 m  
1635: Plankton net station HH21-791PNstop, 0-100 m  
1643: CTD station HH21-792CTDstart, 0-200 m, water sampling 100-200  
1655: CTD station HH21-792CTDstop, 0-200 m, water sampling 100-200  
1718: CTD station HH21-793CTDstart, 0-200 m, water sampling 100-200  
1730: CTD station HH21-793CTDstop, 0-200 m, water sampling 100-200  
c. 1800: begin transit to Tromsø, one station on the way at 72N

### **Friday, July 2<sup>nd</sup> 2021**

Weather: calmed down during the night, morning sunny, 'low' winds (8-12 m/s), temperature 5°C, cloudy later, 4.2°C at 1130, winds 6-10 m/s, afternoon temperature 6.3°C.

### *Summary*

Transit during the night continuing during the day until 72N. Morning 0600 at 73.19N. Station for PN and 2 CTD's planned at 72N. Stop for CTD and PN at c. 72.23N, 10.4E, c. 1340

1339: CTD station HH21-794CTDstart, 0-300 m, water sampling 100-200  
1353: CTD station HH21-794CTDstop, 0-300 m, water sampling 100-200  
1355: PN station HH21-795PNstart, 0-100 m  
1407: Plankton net station HH21-795PNstop, 0-100 m  
1439: CTD station HH21-796CTDstart, 0-300 m, water sampling 100-200  
1457: CTD station HH21-796CTDstop, 0-300 m, water sampling 100-200



1527: CTD station HH21-797CTDstart, 0-200 m, water sampling 100-200  
 1538: CTD station HH21-797CTDstop, 0-200 m, water sampling 100-200  
 1540: PN station HH21-798PNstart, 0-50 m  
 1545: Plankton net station HH21-798PNstop, 0-50 m  
 1553: continued transit to Tromsø

## Saturday, July 3<sup>rd</sup> 2021

Weather: sunny, winds 0-2 m/s in the morning, temperature 7.7°C, rising at noon time to 5 m/s and 8.2 °C.

### Summary

Continued transit to Tromsø, expected time of arrival 15.00,

1400: Arrival Tromsø and embarkation

## Preliminary results and outcome of the cruise

### Scientific goals:

We succeeded in getting all wanted CTD's and plankton net tows for the experiments and cultivation projects. We also managed to filter >300L of seawater on board. The central Greenland Sea (75N, 1E) proved a very good station for sampling *N. pachyderma* at this time of year and > 1000 live specimens were obtained.

A total of 2 stations were visited and 12 CTD casts were done. A total of 12 plankton net tows to 50 m (two stations) and 60 m water depth (8 stations), and 100 m water depth (two stations). The content was sorted and sampled onboard. The samples will be used for cultivation and experiments at the Department of Geoscience, University of Tromsø in the framework of the TFS-funded ARCLIM project.

## Tables of collected data

**Table 1:** Conductivity-temperature-depth stations.

Station	Date	Time (UTC)	Location	Latitude [N] Longitude [E]	Water depth [m]	Comments
HH21-776-CTDstart	30/06-21	0646	Central Greenland Sea	74.46.907' 001.53.425'	?	Central Greenland Sea for water properties (0-400 m) and collecting water (100-200 m)
HH21-776-CTDstop	30/06-21	0731	Central Greenland Sea	74.467267' 001.54.398'	2425	Central Greenland Sea for water properties (0-400 m) and collecting water (100-200 m)

HH21-780-CTDstart	30/06-21	1243	Central Greenland Sea	74.43.349' 001.53.768'	3722	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m)
HH21-780-CTDstop	30/06-21	1259	Central Greenland Sea	74.43.311' 001.53.225'	3722	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m)
HH21-782-CTDstart	30/06-21	2007	Central Greenland Sea	74.37.367' 001.35.770'	2494	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m)
HH21-782-CTDstop	30/06-21	2023	Central Greenland Sea	74.37.126' 001.35.915'	3178	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m)
HH21-785-CTDstart	01/07-21	0951	Central Greenland Sea	74.34.622' 001.13.606'	2669	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m)
HH21-785-CTDstart	01/07-21	1008	Central Greenland Sea	74.34.330' 001.13.498'	2459	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m)
HH21-786-CTDstart	01/07-21	1229	Central Greenland Sea	74.48.064' 002.01.513'	2629	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m) and at 50 m and 30 m
HH21-786-CTDstop	01/07-21	1243	Central Greenland Sea	74.47.980' 002.01.334'	2446	Central Greenland Sea for water properties (0-300 m) and collecting water (100-200 m) and at 50 m and 30 m
HH21-788-CTDstart	01/07-21	1514	Central Greenland Sea	74.48.330' 001.56.951'	2416	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-788-CTDstop	01/07-21	1522	Central Greenland Sea	74.48.315' 001.56.897'	2409	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-790-CTDstart	01/07-21	1606	Central Greenland Sea	74.48.300' 001.57.142'	2403	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-790-CTDstop	01/07-21	1617	Central Greenland Sea	74.48.328' 001.57.296'	2413	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-792-CTDstart	01/07-21	1643	Central Greenland Sea	74.48.441' 001.57.418'	2411	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-792-CTDstop	01/07-21	1655	Central Greenland Sea	74.48.450' 001.57.328'	2392	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-793-CTDstart	01/07-21	1718	Central Greenland Sea	74.48.388' 001.57.407'	2401	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-793-CTDstop	01/07-21	1730	Central Greenland Sea	74.48.369' 001.57.230'	2408	Central Greenland Sea for water properties (0-200 m) and collecting water (100-200 m)
HH21-794-CTDstart	02/07-21	1339	Western Barents Sea slope (BIF)	72.22.650' 010.40.346'	2125	Bear Island Fan for water properties (0-300 m) and collecting water (100-200 m)
HH21-794-CTDstop	02/07-21	1353	Western Barents Sea slope (BIF)	72.22.644' 010.40.575'	2248	Bear Island Fan for water properties (0-300 m) and collecting water (100-200 m)
HH21-796-CTDstart	02/07-21	1439	Western Barents Sea slope (BIF)	72.22.500' 010.41.438'	2287	Bear Island Fan for water properties (0-300 m) and collecting water (100-200 m)
HH21-796-CTDstop	02/07-21	1457	Western Barents Sea slope (BIF)	72.22.500' 010.41.834'	2121	Bear Island Fan for water properties (0-300 m) and collecting water (100-200 m)
HH21-797-CTDstart	02/07-21	1527	Western Barents Sea slope (BIF)	72.22.508' 010.42.639'	2210	Bear Island Fan for water properties (0-200 m) and collecting water (100-200 m)
HH21-797-CTDstop	02/07-21	1538	Western Barents Sea slope (BIF)	72.22.515' 010.42.928'	2253	Bear Island Fan for water properties (0-200 m) and collecting water (100-200 m)

**Table 2:** Plankton net stations (Havtrekksstasjon)

HH21-775- PNstart	30/6-21	0628	Central Greenland Sea	74.47.187' 001.53.200'	3152	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-50 m – contained 100's of specimens, red-coloured cytoplasm, rather small
HH21-775- PNstop	30/6-21	0646	Central Greenland Sea	74.46.915' 001.53.433'	?	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-50 m – contained 100's of specimens, red-coloured cytoplasm, rather small
HH21-777- PNstart	30/6-21	0920	Central Greenland Sea	74.45.170' 001.55.092'	3580	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-777- PNstop	30/6-21	0937	Central Greenland Sea	74.45.116' 001.55.281'	2594	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-778- PNstart	30/6-21	1202	Central Greenland Sea	74.43.825' 001.54.936'	2583	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-778- PNstop	30/6-21	1203	Central Greenland Sea	74.43.808' 001.54.366'	?	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-779- PNstart	30/6-21	12.29	Central Greenland Sea	74.43.334' 001.54.106'	?	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-779- PNstop	30/6-21	1239	Central Greenland Sea	74.43.348' 001.54.366'	3547	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-781- PNstart	30/6-21	1959	Central Greenland Sea	74.37.428' 001.35.508'	2600	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-781- PNstop	30/6-21	2004	Central Greenland Sea	74.37.388' 001.35.592'	2520	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-783- PNstart	01/07-21	0751	Central Greenland Sea	74.30.492' 000.59.382'	2426	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-783- PNstop	01/07-21	0802	Central Greenland Sea	74.30.356' 000.59.624'	2405	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-784- PNstart	01/07-21	0942	Central Greenland Sea	74.34.780' 001.13.587'	3173	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-784- PNstop	01/07-21	0950	Central Greenland Sea	74.34.649' 001.13.619'	2719	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-787- PNstart	01/07-21	1245	Central Greenland Sea	74.47.972' 002.01.445'	2428	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-787- PNstop	01/07-21	1252	Central Greenland Sea	74.47.951' 002.01.460'	2419	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-789- PNstart	01/07-21	1524	Central Greenland Sea	74.48.321' 001.56.981'	2414	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-789- PNstop	01/07-21	1530	Central Greenland Sea	74.48.336' 001.56.938'	2417	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-60 m –
HH21-791- PNstart	01/07-21	1623	Central Greenland Sea	74.48.353' 001.57.263'	2407	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-100 m –
HH21-791- PNstop	01/07-21	1635	Central Greenland Sea	74.48.433' 001.57.486'	2414	Central Greenland Sea for planktic foraminifera <i>N. pachyderma</i> : 0-100 m –
HH21-795- PNstart	02/07-21	1355	Western Barents Sea slope (BIF)	72.22.636' 010.40.610'	2212	Bear Island Fan for subpolar planktic foraminifera <i>T. quinqueloba</i> and <i>G. bulloides</i> : 0-100 m
HH21-795- PNstop	02/07-21	1407	Western Barents Sea slope (BIF)	72.22.589' 010.40.837'	2123	Bear Island Fan for subpolar planktic foraminifera <i>T. quinqueloba</i> and <i>G. bulloides</i> : 0-100 m
HH21-798- PNstart	02/07-21	1540	Western Barents Sea slope (BIF)	72.22.511' 010.42.989'	2216	Bear Island Fan for subpolar planktic foraminifera <i>T. quinqueloba</i> and <i>G.</i>

						<i>bulloides</i> : 0-50 m
HH21-798- PNstop	02/07-21	1545	Western Barents Sea slope (BIF)	72.22.547' 010.4.103'	2218	Bear Island Fan for subpolar lanktic foraminifera <i>T. quinqueloba</i> and <i>G.</i> <i>bulloides</i> : 0-50 m