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R/V Kronprins Haakon

19-October - 09 November 2019

Longyearbyen – Longyearbyen

19-3 CAGE Cruise report

Calypso giant piston coring in the Atlantic-Arctic gateway – Investigation of continental margin development and effect of tectonic stress on methane release

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Key words: Arctic-Atlantic gateway, Vestnesa Ridge, Tectonics, Paleoceanography, Calypso Giant Piston Coring
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1. Introduction and Scientific Objectives

CAGE 19-3 cruise with RV “Kronprins Haakon” to the Atlantic-Arctic gateway region is organized and funded through the Tromsø Forskningsstiftelse (TFS) and Research Council of Norway (RCN) supported SEAMSTRESS project and the Center of Excellence "CAGE – Centre for Arctic Gas Hydrate, Environment and Climate" at UiT-The Arctic University of Norway in Tromsø. SEAMSTRESS focuses on studies of the effect of tectonic stress on methane release at Arctic continental margins while CAGE studies the amount of methane hydrate and magnitude of methane release in Arctic Ocean environments on time scales from the Neogene to the present. CAGE 19-3 cruise is directed to the Atlantic-Arctic gateway region (Fig. 1) to provide necessary field data for these objectives. From previous cruises, we have identified key localities (Fig. 2) which will be main targets for this cruise.

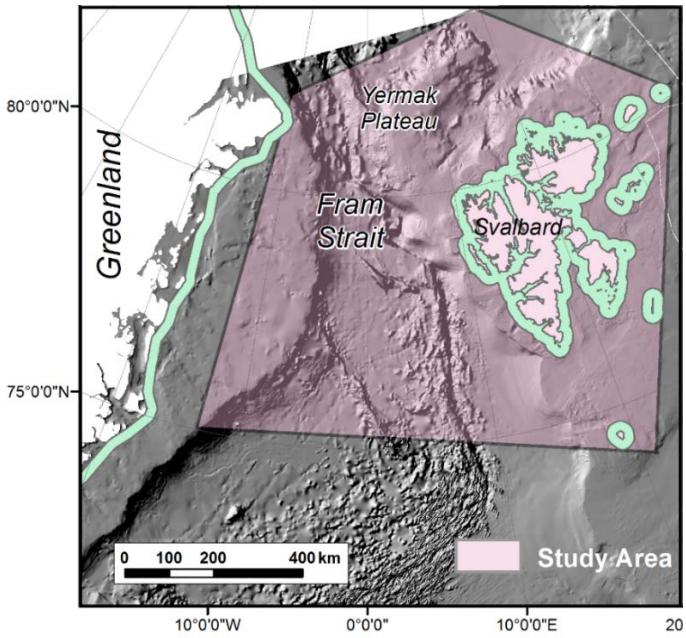

Figure 1. Study area in the Arctic-Atlantic gateway (Fram Strait) region including Yermak Plateau

The cruise is dedicated to the use of the Calypso giant piston coring equipment from IMR and UiB in the Arctic-Atlantic gateway to acquire up to 20 m long sediment cores in the study areas. It will be supplemented by gravity- and multicoring as well as CTD profiles and water column sampling. The exact location will be selected based on SBP300 and TOPAS profiling. Below, we show the map with all sites of highest priority cored during the cruise (Fig. 2). The majority of sites is placed on Vestnesa Ridge, a gas hydrate bearing contourite drift deposit west of Svalbard, which currently releases methane into the water column. This is our key laboratory and we will concentrate on this area as a priority. Additional petrophysical and heat flow experiments will be conducted here. The Ifremer piezometer deployment aims to contribute to the understanding of the potential link between tectonic stress distribution and fluid activities on Vestnesa Ridge and predicting the interplay between near-surface fluid systems and geological carbon capacitors.

Furthermore, we have defined key locations in the gateway region where we have stratigraphic and paleoenvironmental information from previous cruises. Here, the use of Calypso giant piston coring system will provide us with additional stratigraphic and paleoenvironmental information. aDNA sampling (EU-AGENSI, UiB) is conducted on all multicorer and one Calypso sediment core (Superstation 14).

2. Study Area

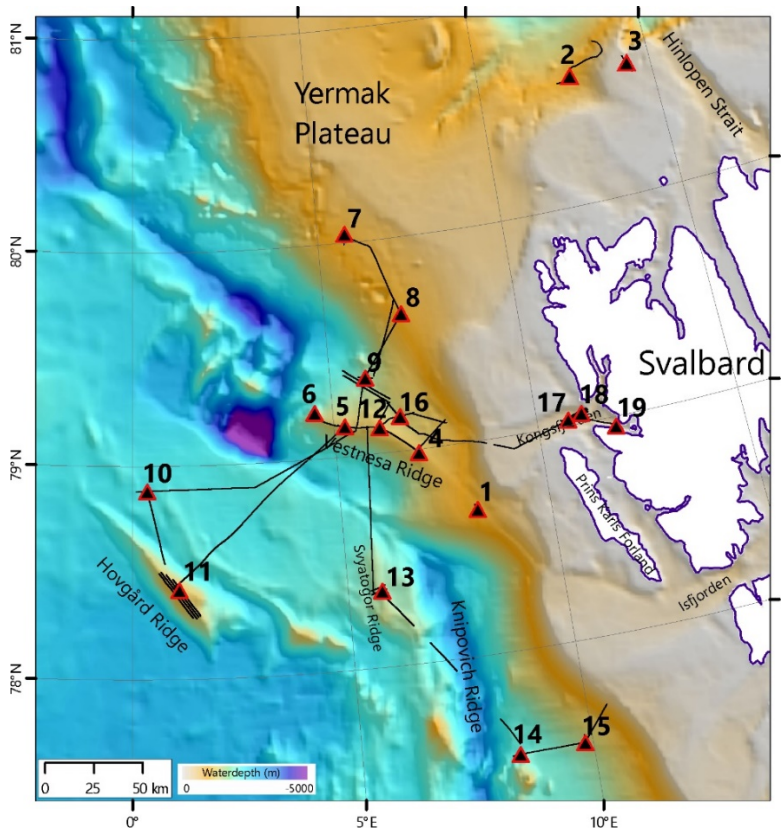

Figure 2. Study area with site locations (black triangles) and sub-bottom profiles (black lines).

Scientific Party

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Roy Robertsen	Engineer, IMR (Instruments)
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Pär Jansson	Researcher, CAGE-UiT (Gravity/Calypso)
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Mickael Roudaut	Technician in mechanics, Ifremer (Piezometer)
Pierre Guyavarch	Technician in electronics, Ifremer (Piezometer)

3. Equipment and Methods used on board

3.1 Seabird 911 plus CTD

The CTD used on the cruise is the Seabird 911 plus from Seabird Scientific (Fig. 3). The CTD has been used for general oceanography on each station, and also to produce sound velocity profiles to the EK80 single-beam echosounder, as well as the EM302 multibeam echosounder for bathymetric mapping. The CTD system consists of the Seabird SBE 11 plus deck unit connected to the subsea SBE 9plus CTD. On the CTD we have a 12 bottle SBE32 carousel for water sampling, but on this cruise most of the stations are without any water sampling.
The CTD is equipped with the following sensors: 2 x SBE3 Temperature sensors, 2 x SBE4 Conductivity sensors, 2 x SBE43 oxygen sensors, 1x PSA916 Altimeter, 1 x Wet Labs C-Star beam transmissometer, 1x Wet Labs ECO-AFL/FL Fluorometer, and 1 x Biospherical PAR sensor with Surface PAR added. The CTD measures all these parameters at a rate of 44Hz and stores it on the top-side computer. Datalogging has been done with The Seasave v. 7.26.7, and for postprocessing we have used SBE Data processing v. 7.26.7 (Fig. 4). Both these software packages are from Seabird.

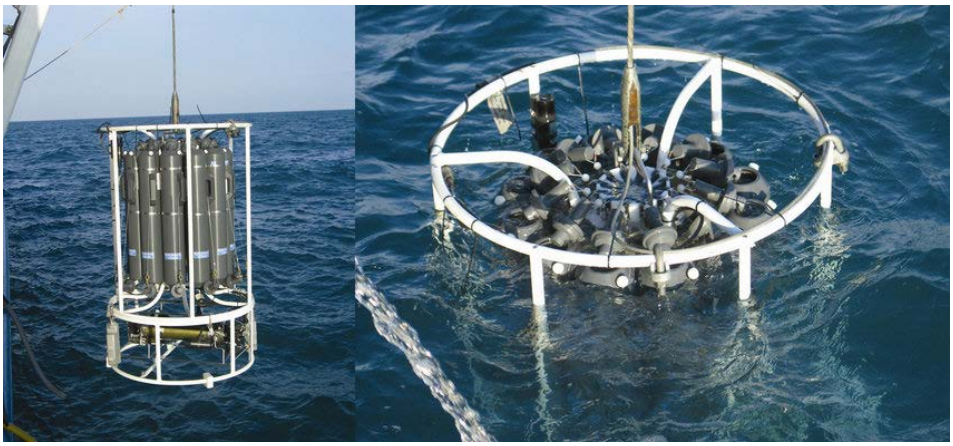

Figure 3. CTD deployment

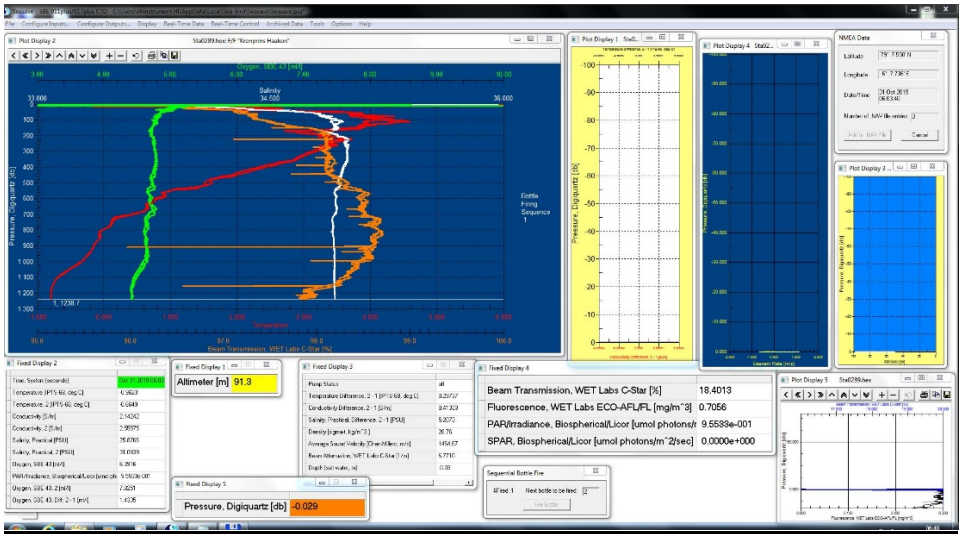

Figure 4. Logging of CTD data using Seasave software

3.2 Kongsberg SBP300 Sub-bottom profiler

For sediment profiling, we have used the Kongsberg SBP300 sub-bottom profiler (Fig. 5). This sub-bottom profiler shares the receiver transducer with the EM302 bathymetric multibeam sonar, but has a separate low frequency transmit transducer. With the transmitter and receiver transducers mounted in a Mills-Cross arrangement this gives a system with very high angular resolution compared to a conventional sub-bottom profiler. The pulse type used for the cruise is a Linear chirp pulse from 2,5kHz to 7 kHz (LFM). The pulse length has been 30ms. Trace length varying between 300ms to 500ms. The system has been set up with logging of raw data as well as real-time logging of SEG-Y files for postprocessing.
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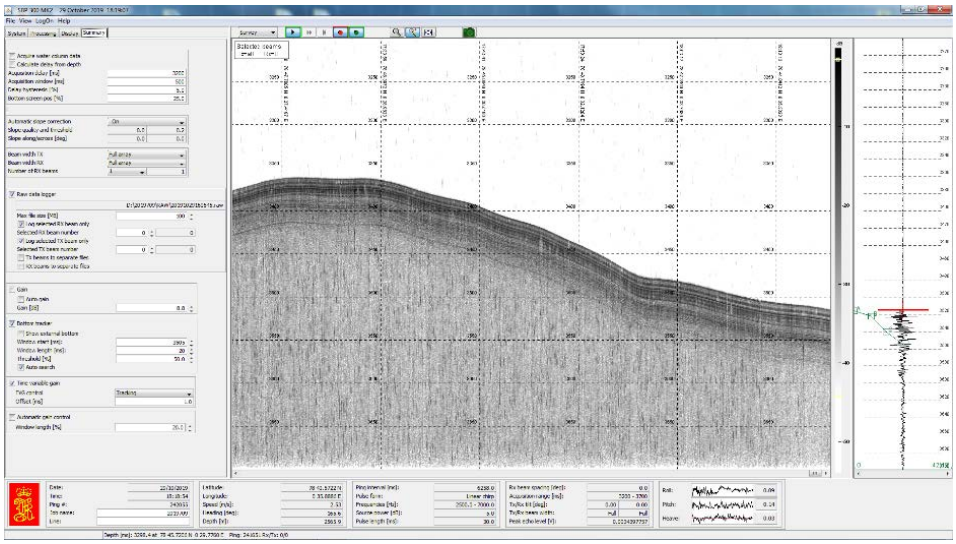

Figure 5. Echogram from SBP300

The data were recorded using the hull-mounted Kongsberg SBP300 MK2 and software system version 1.6.6. The maximum depth of penetration is 40-50m over contourite drifts. The vessel is often ice-breaking and problems with duplicate traces is apparent in data affected by the ice. The chirp pulse form is 'linear chirp up' with 30ms sweep length and frequencies between 2.5 and 7 kHz. The ping rate and bottom tracking is externally controlled by the EM302 multibeam system and varies with depth. Typically, at water depth of 1770 m (e.g. Svyatogor Ridge) a ping interval of 5 seconds is expected. Sample interval is 48 kHz (0.02 ms sample rate with a Nyquist of 24 kHz). The acquisition time window is 500 ms. The vessel velocity is 4-5 knots while surveying and during transits 8 knots. In 1770 m water depth the average trace (ping) interval for a 4.5 knot survey is 2.3m.
The sweep function from the signal is removed using a matched filter based on auto-correlation of the Klauder wavelet. A gain correction is applied, with no AGC or TVG applied prior to the logging of the processed sequence. The vertical resolution is 0.15m, using a sound velocity of 1500 m/s, typical of sea water and shallow sediments. The acquisition processing sequence does not apply the envelope function to the data (instantaneous amplitude) thus, preserves the signal phase of the data, should this be required at a later stage of processing.

The segy data, output from the Kongsberg acquisition system, are further processed using Seismic Unix (SU). Files with the suffix 'processed_UTMXXN' are files output from SU. The XY coordinates are stored in byte positions 73 and 77 and copied to 81 and 85. The data are projected to Universal Transverse Mercator zones (UTM), for which, 31X and 33X are the two zones used for the data acquired. The UTM zone number can be found in byte position 21 (CDP).

The data are logged with varying delay recording time (delrt) to reduce file size in acquisition. The data are shifted back to a constant delay recording time in SU. The range of the minimum and maximum time values are expanded, only when a partial display of data is found in the acquisition window, in the initial output ('raw' segy). Instantaneous amplitude is applied to the processed segy data. This improves the signal-to-noise ratio. The final output has no phase information and displays positive amplitudes only. This is the standard for interpretation of chirp data.

3.3 EM302 Multibeam sonar data

Surveying of the sea bottom and water column is done using EM302 system by Kongsberg. Its operating frequency is 30 Khz and it generates swaths of data covering the width up to 5,5 times the water depth. The output for each line consists of two files:

- File with extension *all contains datapoints corresponding to seabottom
- File with extension *wcd stores all the information recorded for the watercolumn

Processing of the data is performed using QPS software: Qimera and FMMidwater.

Bathymetry
The data is loaded line by line to the project in Qimera. Each part of the line is visually inspected in 3D view and all the data points that deviate from the general trend are being removed. They correspond to part of recordings affected by noise and majority of them are located at the edges of the profile. When the manual cleaning process is done, automatic spline-based filter with varying degree of intensity is applied to segments of each line, with intensity chosen based on the quality of data in the given area of seafloor. Final lines are then converted into surfaces that can be exported as a datapoints for mapping and interpretation.

Water column
Processing of water column information is done in FM Midwater. After import and conversion to internal format all the information from beams is stacked to produced single beam of data for a given position. All of these beams are then displayed next to each other to produce side view of the water column and the sea bottom, which makes it easier to distinguish signal noise and potential gas flares sightings. In this view, all lines are inspected, position by position, with simultaneous check of data recorded for each beam. High-pass frequency filter is also applied individually for each line in order to alleviate parts of the noise present in the data. Each spotted flare is marked and extracted using stacked view, with filtering out beams and depth ranges that do not contain valuable data. This process leads to generation of datapoints with amplitude information of the flare, that can be exported outside software as an ASCII points file. Each point has geographical coordinates, depth and amplitude values assigned. Further clearing of data to bring out flare shape can be done using other tools i.e. Petrel. Finally, generated shape can be overlaid on bathymetry data to correlate seafloor features with gas expulsions.

3.4 Sediment Coring

Multicorer (UiB)
A multicore (MUC) built by KC Denmark A/S with four transparent plastic core liners of 60 cm length was deployed at all stations (Fig. 6). The multicore was attached to the traction winch rope and lowered through the water column at 1m/s. When the MUC reaches the seafloor, a weight of ~400 kg pushes the cores into the sediments. When retracted from the sediments, arms with spatulas close the bottom of each core. The MUC and sediment cores were immediately heaved and brought on board and the bottom of each core was secured with plastic caps. Cores were labelled and subsampled according to a subsampling scheme. When enough cores were recovered, one was kept intact as an archive and stored in a cooling container at 4°C.

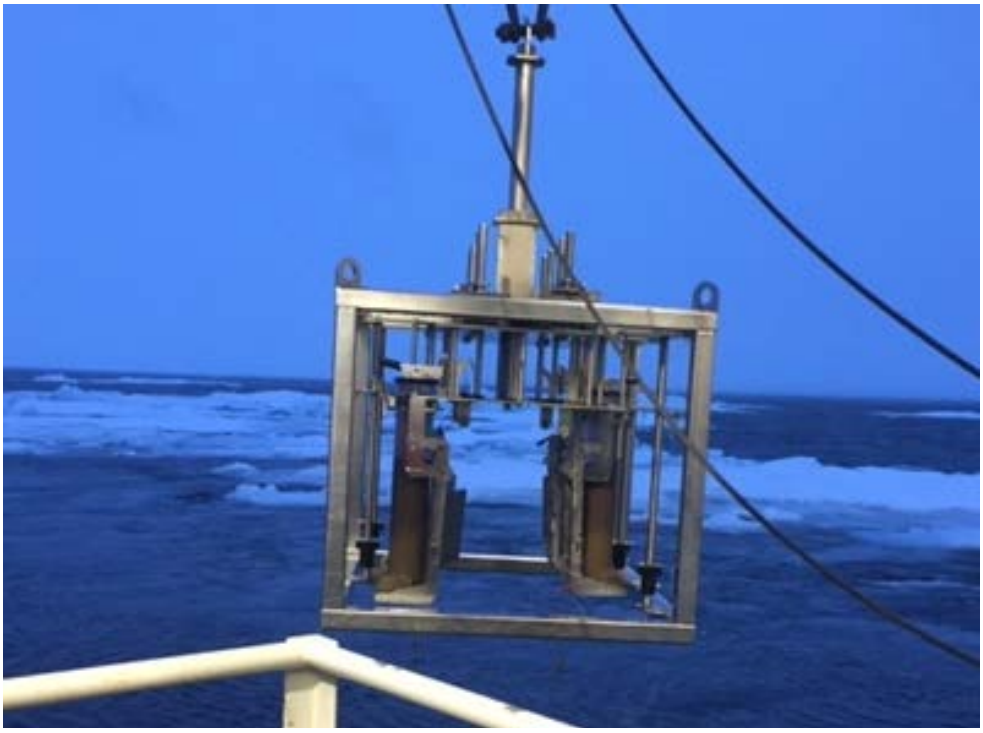

Figure 6. The multicorer being recovered near the ice edge.

Gravity Corer (UiT)

A gravity corer (GC) with a total weight of ~1000 kg was used, which consists of a 6 m long steel barrel with an inner diameter of 11 cm, a steel-mantled led weight at the top, and a core head with a core catcher at the bottom (Fig. 7).

For each deployment, a 5.95 m black plastic liner (pipe) with an outer diameter of 11 cm and inner diameter of 10 cm was inserted into the steel barrel and the core head and catcher was mounted. The gravity core was lifted horizontally by two slings attached to a crane while hooked up to the traction winch rope (see section on Calypso corer). The weight was transferred from the crane slings to the traction winch rope and the corer was rotated to its vertical orientation, and was released from the crane slings. The gravity core was lowered through the water column at 1m/s and further through the sediments by its own weight. The core was left in the sediments for a few minutes, in order for attached temperature sensors to have time to equilibrate (see section on temperature sensors), before it was retrieved back to the ship with a reversed launch procedure. After retrieval, the plastic liner was manually cut into sections of up to 100 cm length, while taking care of the plastic sawdust. The section ends were secured with plastic caps and the sections were labelled. Pore water was extracted from selected core sections (see section on pore water) and all sections were stored in a cooling container at +4ºC.

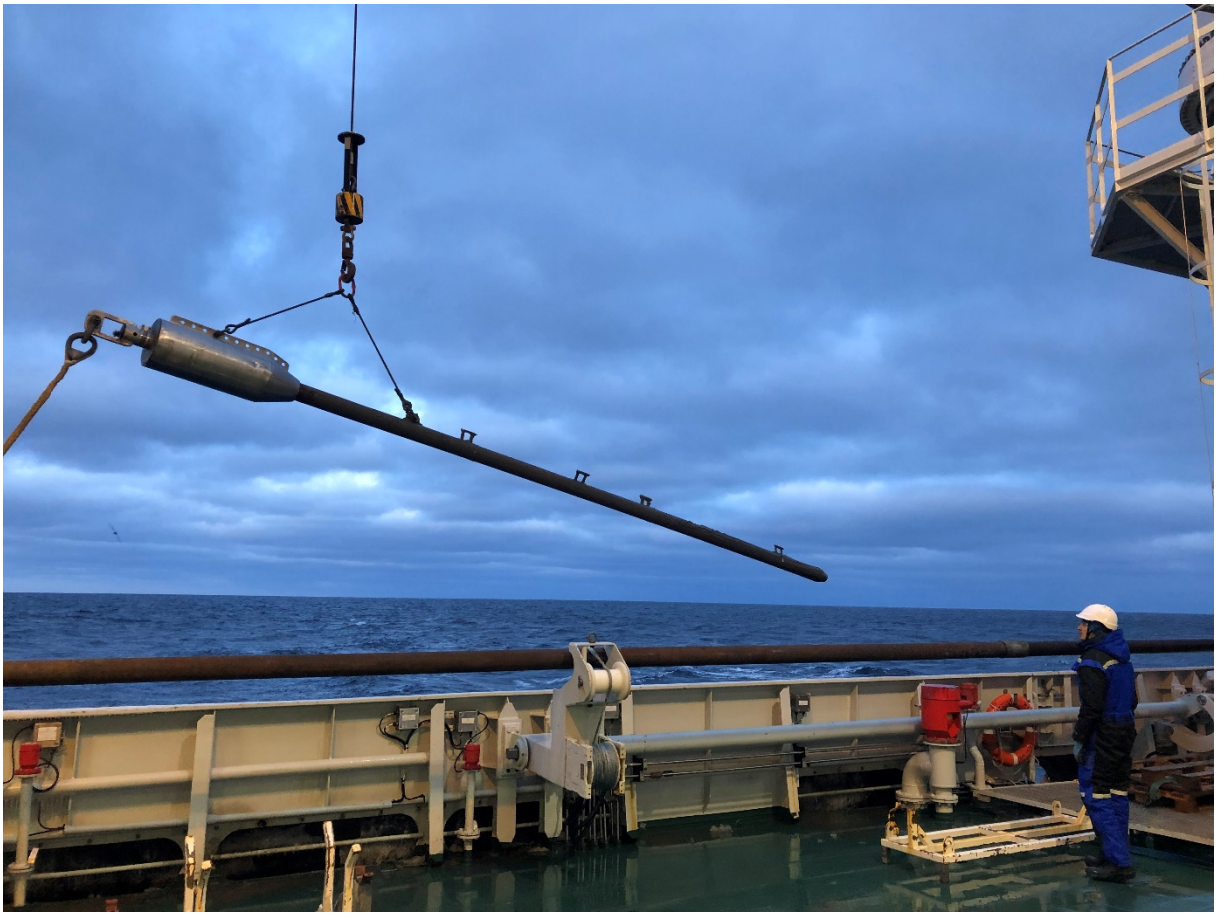

Figure 7. The gravity corer (UiT)

Calypso Giant Piston Corer (IMR/UiB)

The Calypso piston corer is developed by Kley France and IPEV and modified to use on R/V G.O. Sars and Kronprins Haakon by Stig Monsen, UiB. It can be fitted with a tube of up to 25 meter, retrieving cores up to ca 23 m. The Calypso winch is an annular traction winch (Kley France patent) specially developed for the careful manipulation of synthetic rope. 2 stainless steel drums (upper and lower) fitted with free synthetic rings are speed and torque controlled to progressively build the tension along the cable whilst minimising friction. 4800 metres of synthetic rope, Ø24 mm, Dynalight «12 strands. Maximum load 90 kN (Fig. 10).

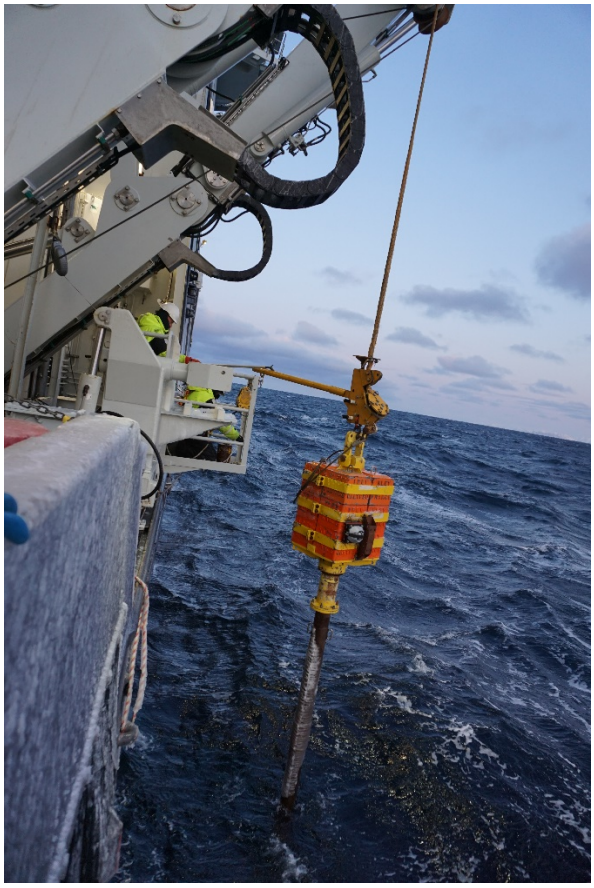

Figure 8. The Calypso Giant Piston Corer

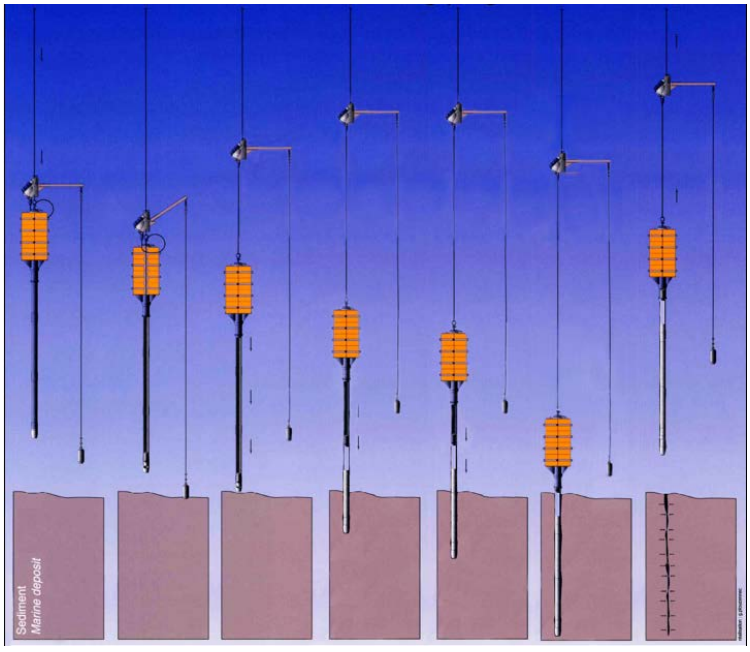

Figure 9. The principles of piston coring

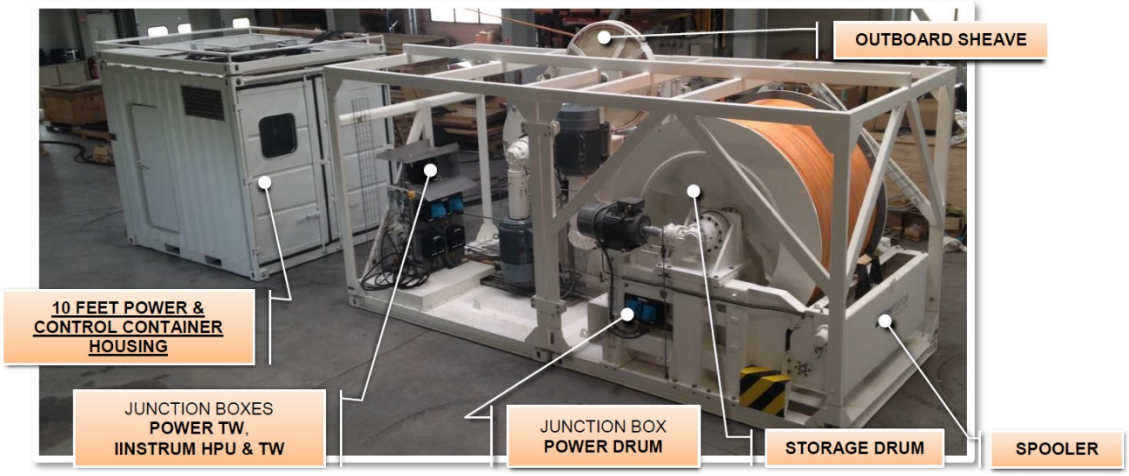

Figure 10. Winch and controlling center for Calypso Giant Piston corer

3.5 Piezometer (Ifremer)

The Ifremer piezometer is a free-fall device with a sediment-piercing lance attached to a recoverable instrument part (Fig. 11). It is ballasted with lead weights (up to 1000 kg) to penetrate a range of sediment types in water depths of up to 6000 m. The length of the lance used depends on the stiffness of the sediment with a maximum length of 12 meters. Pore pressures are measured relative to hydrostatic pressure at different ports on the 60 mm diameter lance using specially adapted differential pressure transducers connected to the pressure ports and the open seawater. The piezometer pore pressure sensors have an accuracy of ± 0.5 kPa. The piezometer lance is also equipped with temperature sensors located at the same level as the pore pressure sensors. Temperature sensors have an accuracy of 0.05 °C.

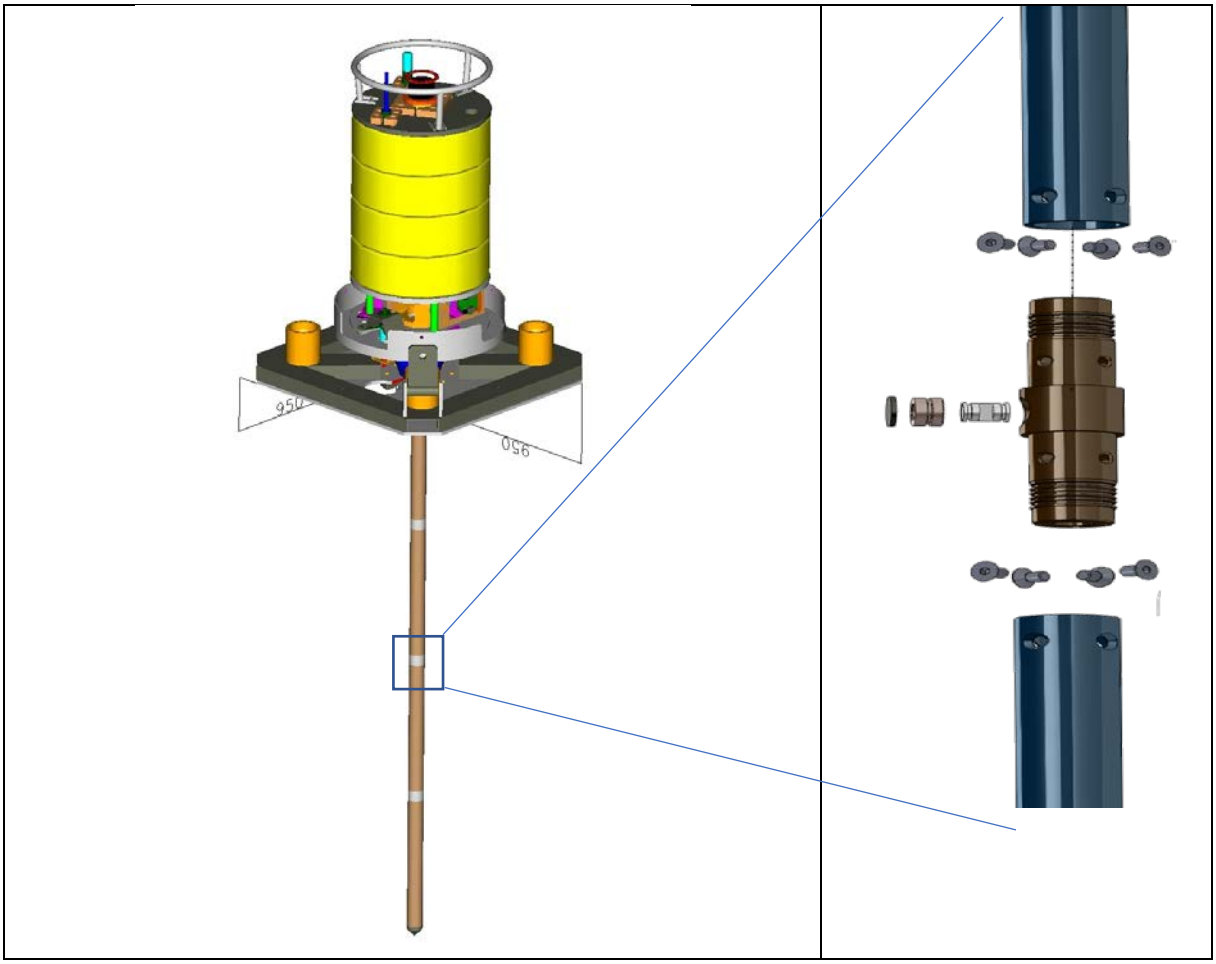

Figure 11. Scheme of the Ifremer piezometer

3.6 Heat flow measurements (CEED-UiO)

Surface heat flow data provide constraints into the tectonic structure of the lithosphere, and is useful for assessing hydrocarbon and methane hydrate distribution. Such measurements in the Arctic Ocean are still sparse, and any opportunity to enhance the existent database of heat flow measurements will contribute to construct or ground-truth regional models that aim to recreate a 3D thermal structure of the lithosphere. New heat flow data north of Svalbard and in the Fram Strait (Fig. 12, Tab. 1) will help to ground-truth a 3D model proposed by Klitzke et al. (2016) that predicts steep thermal gradients in these regions.

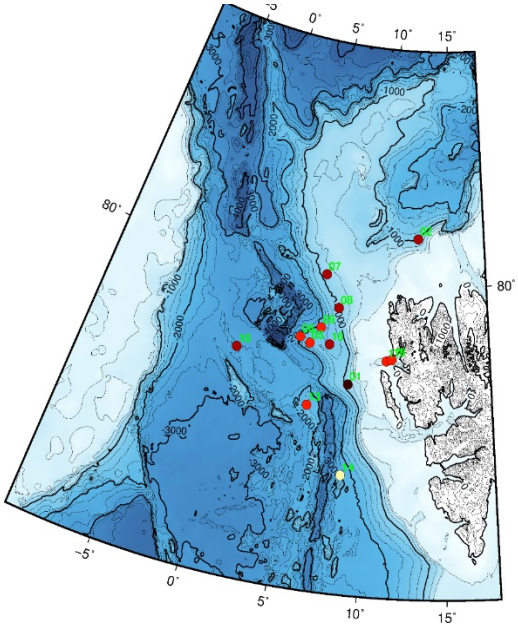

Figure 12. New CAGE 19-3 geothermal gradient and ocean bottom temperature measurements.

	Number of sensors		Depth range (m)	
Station #	**Gravity Corer**	**Calypso**	**Gravity Corer**	**Calypso**
1	4	0	1.5-5.0	
2	3	1	1.5-6.0	14-15
3	0	0		
4	0	3		15-20
5	5		1.5-6.0	
6	5		1.5-6.0	
7	5	3	1.5-6.0	10-12
8	5	2	1.5-6.0	15-17
9	5	2	1.5-6.0	15-17
10	0	2		11-14
11	0	0		
12	0	0		
13	4	2	3.0-6.0	14.5-16.5
14	5	0	1.5-5.5	
15	0	0		
16	5	0	1.5-5.5	
17	4	0	1.5-4.0	
18	5	0	2.0-6.0	
19	7	0	1.5-6.0	
Total #	13	7	20	

Table 1. CAGE19-3 temperature measurements statistics

Equipment

Miniature temperature probes of ~15 cm in length by 1.5 cm diameter (ANTARES), are used to collect in situ temperature data at a resolution of 0.001°C and nominal accuracy of 0.1 °C. A higher accuracy close to the data resolution ensures by calibration of temperature sensors versus a pair of high-precision thermistors in the CTD probe for the pressure range of measurement (Figs. 13-15).

Figure 13. Temperature sensor attached on the CTD frame for calibration.

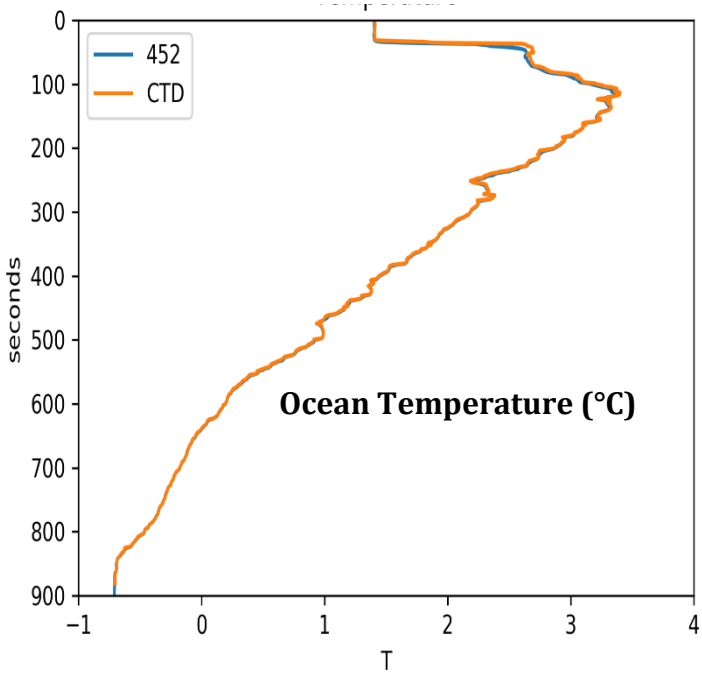

Figure 14. Mounting geothermal sensors on CTD frame (left) and comparison of ocean temperature profile (geothermal sensor ANTARES452- blue, versus mean 2-sensor CTD profile - orange).

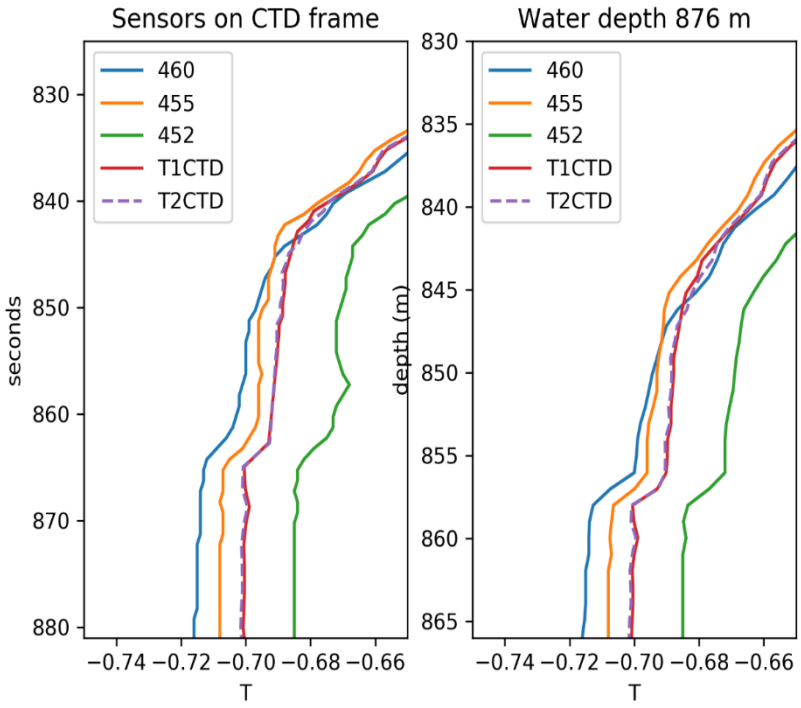

Figure 15. The estimated temperature profiles measured by geothermal and CTD thermistors at station KH-07 in time (left) and depth (right) coordinates. The ID number of ANTARES sensors is indicated

Multiple probes spaced typically ~0.5 - 2 meters apart were attached to the outside of the core barrel, such as a gravity or piston sediment corer (Fig. 16). To avoid effects from frictional heating related to core penetration, the probes were placed inside holders within steel fins (secured with a steel pin or similar) located 10 cm away from the core barrel. The corer remain in the sediment for 5-10 minutes to allow for thermal equilibration within the sediments.

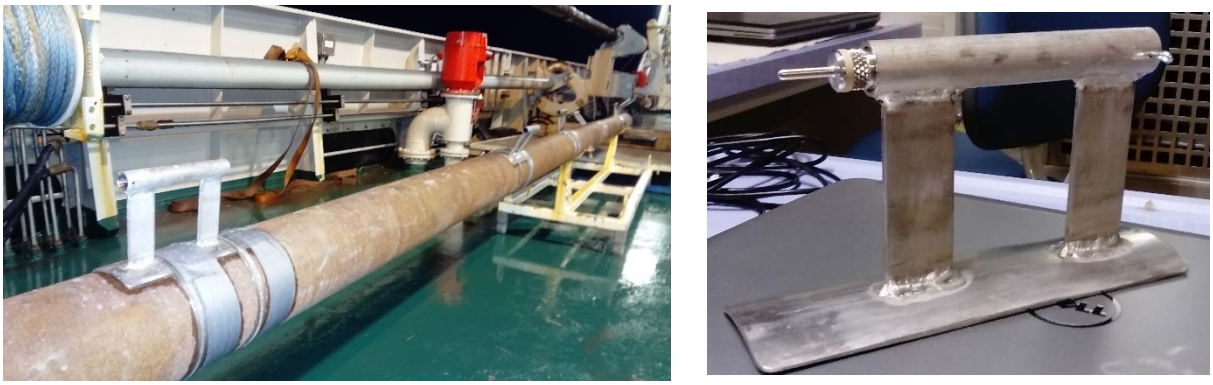

Figure 16. A) Steel holders for temperature sensors attached to the gravity corer. B) thermal probe mounted inside the steel holder.

The distance at which sensors are placed on the barrel is measured relative to a fixed point (distance from the lead weight) before deployment and after recovery of the corer, in order

to calculate the temperature gradient with depth. The data are recorded as time series synchronized to computer time (UTC) (Fig. 17a). The “plateau” in the temperature curves means that the temperature system has equilibrated between the sensor and the host rock. The plateau temperature is used to obtain the thermal gradient (Fig. 17b).

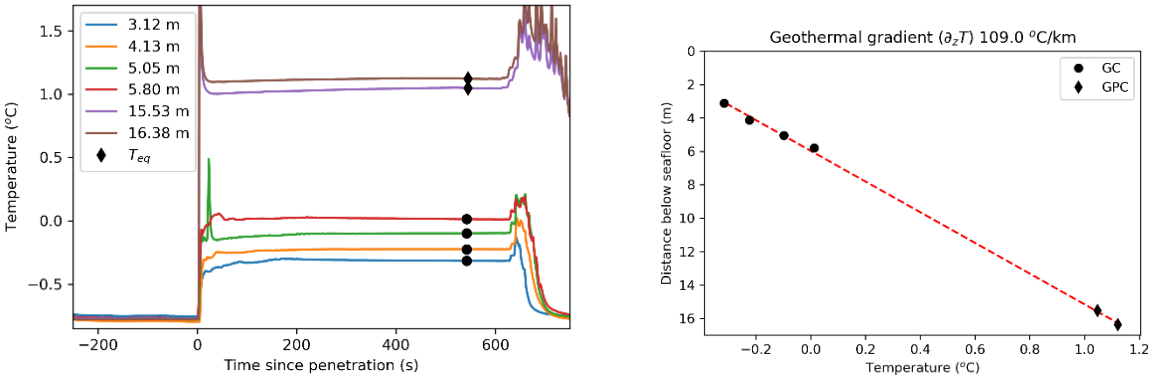

Figure 17. Temperature time series from five sensors deployed on the gravity core at the station KH-5 (a) and geothermal gradient (b) obtained using the equilibrated temperature and distance along core barrel (relative to the lead weight) for each sensor.

The temperature probes are also accompanied with sensors (e.g. Star Oddi www.star-oddi.com), which are placed at the top of the core barrel, mainly to record and correct for an accidental tilt of the barrel during penetration into sediments. These probes can measure temperature, pressure/depth, compass heading, xyz components of tilt, and ambient magnetic inclination and field strength. Thermal property measurements (thermal conductivity, diffusivity and specific heat capacity) specific to the sediments within the recovered cores are gathered through use of a Hot Disk TPS 500 Thermal Constants Analyzer and used in the heat flow calculation.

Thermal property measurements (thermal conductivity, diffusivity and specific heat capacity) specific to the sediments within the recovered cores will be acquired at a later stage on the core material using a needle conductivity probe or a Hot Disk Thermal Constants Analyzer for the heat flow calculation.

3.7 Geotechnical Sampling

Shear Strength

The torvane is produced by Soil Test Inc. The torvane consists of a disc (vane) with blades on the lower surface which is pressed into the soil to be tested. Three different vane diameters are used, 47.6, 25.4 and 19 mm, depending on the strength of the soil tested. The torvane is turned, using a constant rate of speed to failure occurs. The measured scale on the torvane multiplied with a correction factor for the type of vane used, gives the undrained shear strength. The shear strength range is 2 to 250 kPa.

Water Content

Water content sampling: We collected samples for the determination of water content at the top of each section except for section 1. We used 5ml cut-off syringes to retrieve 5 ml of sediment. The sediments put in an over at 105˚C for 24 hours in order to get dry (Fig. 18). The sediment samples were weighed before and after drying, and the water content and density were calculated.

Figure 18: (left) Sediment samples were weighed after being sampled. (center) Sediment samples remain in the oven at 150 ˚C for 24 hours in order to get dry. (right) Dry sediments are weighed.

3.8 aDNA sampling

At selected sites, two cores were dedicated to the AGENSI project for aDNA, IP_{25}, and palynology. The methodology for aDNA sampling onboard KPH utilized several 'ZONES' based in separate laboratories to minimize the potential for cross-contamination. The core moved from 'dirty' locations to progressively 'cleaner' locations as follows (summarized in Figure 19).

Figure 19. Overview schematic of ZONE progression for selected multicores dedicated to the AGENSI project. Most MC were only surface sediment sampled, and selected interest locations were downcore sampled. Not pictured is the transition out of ZONE 2 to the DRY LAB for biomarker and palynology sub-sampling immediately following syringe DNA sampling.

DIRTY

1. Before MUC was deployed, clear plastic liners were rinsed with a chlorine solution and sealed with a plastic film to prevent human contact with inner liner. Immediately before deployment the plastic film was removed with care to avoid contact with inner liner.
   As MUC arrived back on deck, 110 size (pre-bleached) yellow caps were added to secure the MC. Technicians avoided contact with inner portion of cap when securing the sediment.

2. AGENSI team member was handed MC (two at most locations) and transported to 'dirty' benthos lab for cleaning. The capped core was rinsed with fresh water, moved to a pre-bleached portion of workbench, and cleaned with a chlorine solution. Once cleaned the core was only handled by individuals wearing gloves, without leaning the core on clothing. The core was transported from deck-through the hangar and directly to waiting individual in ZONE 1 (Environmental Toxicology Lab).

CLEAN

3. Prior to the core arriving in ZONE 1, all work surfaces and instruments were cleaned with a chlorine solution with ~30 minutes contact time. While in ZONE 1, hairnets, particle mask, safety glasses, and paper suit were worn to avoid cross-contamination. Once the core was delivered (transport personnel DID NOT enter ZONE 1), it was placed in a sink and cleaned with a chlorine solution (with a minimum of 10 minutes contact time). At this time the core was also labelled following cruise convention.

4. MC was drained using a sterile tube. Each multicore was sampled for marine snow (loose sediment at the surface-water interface, typically ~20mL collected using sterile single use pipette), and surface sediment at 0-1cm and 1-2cm depth. DNA sampling was completed first using modified sterile spoons with a 0.5cm depth; modified using a heating tool to 90˚ for easier sampling. Samples stored in pre-labelled falcon tubes and secondary containment in a labelled plastic bag. Bench controls, an open Eppendorf tube placed on bench, were used during sampling and stored in secondary containment bag with sample. Biomarker IP_{25} and palynology designated samples were then taken. After sampling, stored DNA samples at -80˚, IP_{25} at -20˚, and palynology a 4˚.

   If the multicore was only surface sampled, the core was sealed with a portion of *OASIS* green foam that was prepared with a bleached fishing line. The cap was added, taped, and stored in 4˚ cooling container. Select MC were 'downcore sampled'—see below.

5. After preparing the core with *OASIS*, cap, and tape, the work area in ZONE 1was cleaned using a chlorine solution, allowing for ~30 minutes contact time. During the ZONE reset, a Fein tool with rotating blade, steel ruler, stabilization blocks, tape, and a utility knife were prepared via a chlorine solution cleaning. A portion of the workbench was covered in plastic film, which was also bleached, to collect accumulation of micro-plastic debris.

6. The cap was removed and top of the core liner was sliced off using the Fein tool. The cap was re-applied and taped. The core was marked with a sharpie using steel curve ruler to guide splitting. The Fein tool was used to cut through plastic liner and caps; utility knife was used to remove and plastic debris at the edge of the cute site before the core was re-sealed with tape. Individual in ZONE 1 then transported the core (using gloves) to ZONE 2 (Microbiology Lab) to waiting individual.

MOLECULAR CLEAN

7. The core was delivered to an individual waiting in a paper suit, hairnet, particle mask, safety glasses, and gloves. Prior to core delivery, everything in ZONE 2 was cleaned using a 10% chlorine solution. Cleaning included: all worksurfaces, cabinets, lights, light switches, walls, ceiling, floors, and all instruments. Cleaning routine utilized: a first chlorine solution cleaning with several minutes contact time with excess solution wiped away with paper towel, and a second chlorine solution cleaning with ~30-minute contact time with excess solution wiped away with sterile microfibre cloth.

8. Once the core was delivered, it was immediately cleaned with a microfibre cloth and chlorine solution, taking care to avoid excess solution at taped margins of the core. The core was placed in the fume hood for splitting. Two individuals were needed to safely split the core apart. Tape was removed, a bleached single-use fishing line was used to pull through the core and the second individual pulled the two halves apart. One half was designated for sub-sampling and was moved to workbench, the other was covered in plastic film and removed to DRY LAB (COMMON) to be colour logged (see following summary of logging).

9. Gloves were always changed and bleached between fume hood handling and DNA sub-sampling on work bench. The sampling halve of the core was 'cleaned' of 0.2-0.5cm top surface with a cleaned scraper. Note that scarping happened with multiple tools, never to drag sediment from one layer to another.

10. The sub-sampling core half was segmented using a ruler placed at the edge of the plastic liner, and impressions of each cm were made using bleached scraping tools. Modified 10cc syringes were loaded into the sediment every 2cm; syringes were removed via a subtle twisting motion and placed in individual sterile bags. Syringes were removed from oldest (bottom) layers to youngest (top) layers. After sampling, syringes were immediately placed in -80˚. During sampling an open Eppendorf tube was placed on workbench, this sampling control was also included in storage bag. This concluded the aDNA sub-sampling.

11. The core was covered in plastic film and removed from ZONE 2 to DRY LAB (COMMON) for sub-sampling for IP_{25} and palynology.

Note: Chlorine solution for aDNA subsampling was 10% and prepared only with milliQ water. Each cleaning/sampling was accompanied by a freshly made solution to ensure no reduction in potency.

DRY LAB

The surface of the archive half was cleaned to a smooth surface and pictures were taken, moving the core 5 cm for each frame. Plastic film was applied to the surface, making sure there were no air bubbles and the archive was logged for colour every 0,5 cm with a MINOLTA colour scanner.

The remaining sediments after DNA sampling were taken for IP_{25} and dinocyst analysis. The samples were taken at the same depths as the DNA syringes, every 2 cm, for the purpose of comparing methods later on. Samples for IP_{25} and dinocyst analysis were equally distributed from the remaining sediment, put in plastic bags and stored at -20˚ (IP_{25}) and 4 ˚C (dinocysts). Approximately 0,2 mm of the sediment closest to the core liner was not sampled.

3.9 Smear Slides

Smear slides were prepared from preselected cores (both Calypso giant piston corer and gravity cores) to aid in lithological descriptions and to estimate microscopically sediment abundances and composition. Wooden toothpick samples ($5mm^3$) were taken from the top of selected core sections to identify the primary lithology, sediment colour (using Munsell Colour Chart), and to prepare the smear slide. For each smear slide, a small amount of the sediment sample ($1\text{-}2mm^3$) was placed on a 21 mm x 26 mm glass cover slip. A drop of MilliQ (deionized water) was added, and the sediment was homogenised and spread evenly across the cover slip. The dispersed sample was placed in the oven at 50c until dry. A couple of drops of Norland Optical Adhesive No. 61 was added to the glass microscope slide (76 x 26 mm), which was then carefully placed on the dried sample to prevent air bubbles from being trapped in the adhesive. The smear slide was then placed in a UV light box for 15 minutes to cure the adhesive.
Using a transmitted-light petrographic microscope, the smear slides were examined at 10x, 20x and 40x to assess the abundance of detrital and biogenic components. The relative abundance percentages of the sedimentary constituents were visually estimated using the techniques of Rothwell (1989; figure 1), and categorised as follows: TR – trace (≤1%); R – rare (>1%-10%); C – common (>10%-25%); A – abundant (>25%-50%); and D – dominant (>50%). Smear slides provide only a rough estimate of the relative abundance of sediment constituents, and may not match the macroscopic lithology description. In particular, very fine and coarse grains are difficult to observe in smear slides, and their relative proportions can be affected during slide preparation. All smear slide results can be find in the attachments of this report.

4. Station Description

See the exact location of each superstation in the log files (Chapter 6). Below, we briefly show the applied equipment and describe the sampling and measurement performed on each station. CTD data are not reported here. The data can be downloaded at Norwegian Maritime Data Center and CAGE-UiT on request (Fabio.sarti@uit.no).

4.1 Superstation CAGE 19-3-KH-01

Site Location

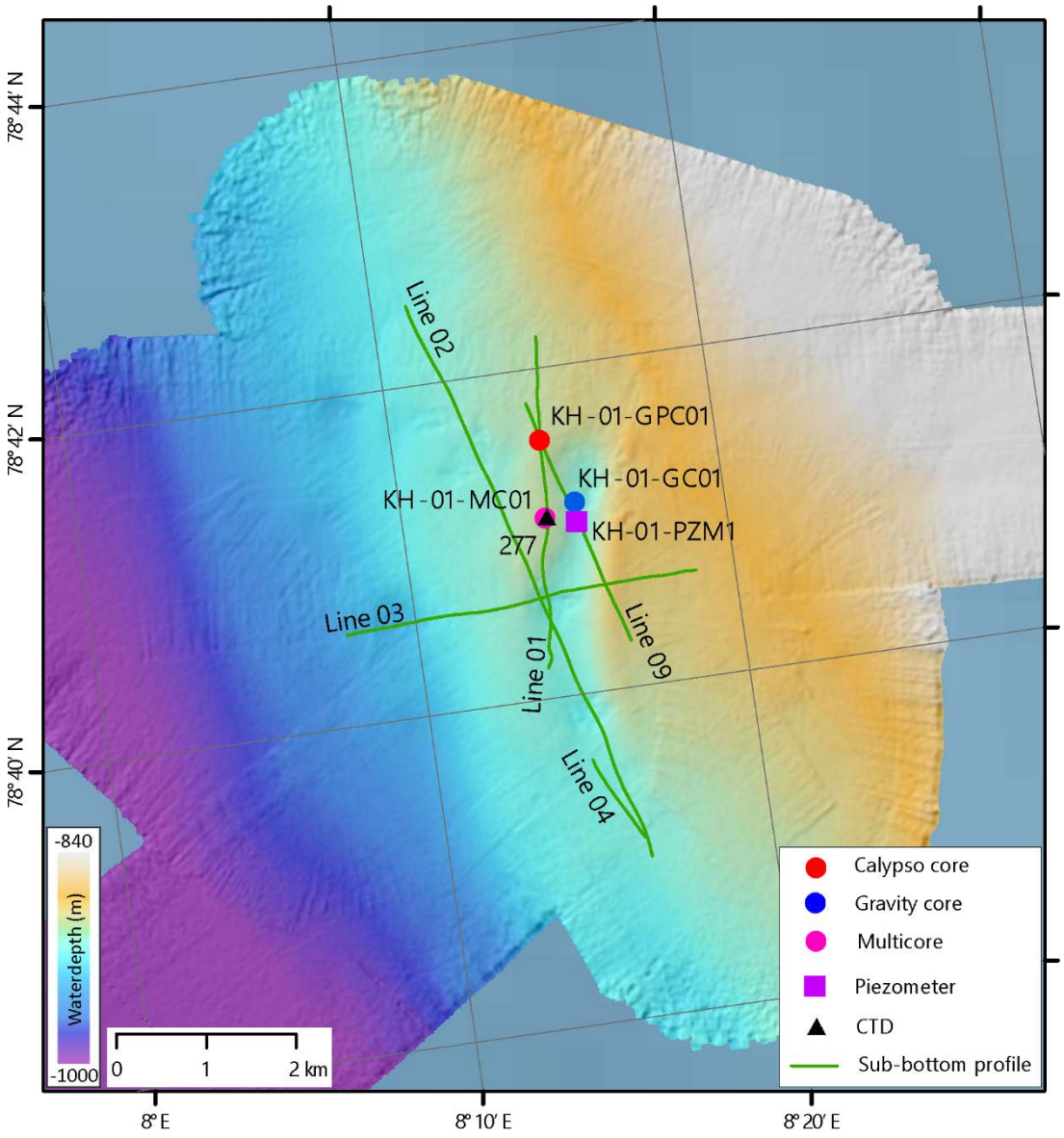

Figure 20. Location of superstation CAGE 19-3-KH-01 at the eastern end of Vestnesa Ridge.

Acoustics

Multibeam bathymetry, water column, and sub-bottom profiles were acquired at superstation 1. Due to bad weather, the multibeam data were particularly noisy rendering it unusable. Sub-bottom profiles were acquired to identify the subsurface sediment distribution. The data had some gaps due to the unstable weather conditions. Four profiles were initially acquired at the station connecting existing 2D seismic profiles, to aid in determining sediment-sampling stations. A fifth line was later added in better weather conditions. The sub-bottom profiles show parallel to semi-parallel layering with a few acoustically transparent packages (Fig. 21). Inside the depression, a vertically transparent region terminates at the seafloor characterized by very high reflectivity. This region could represent accumulations of hydrates or carbonates and/or vertical fluid migration.

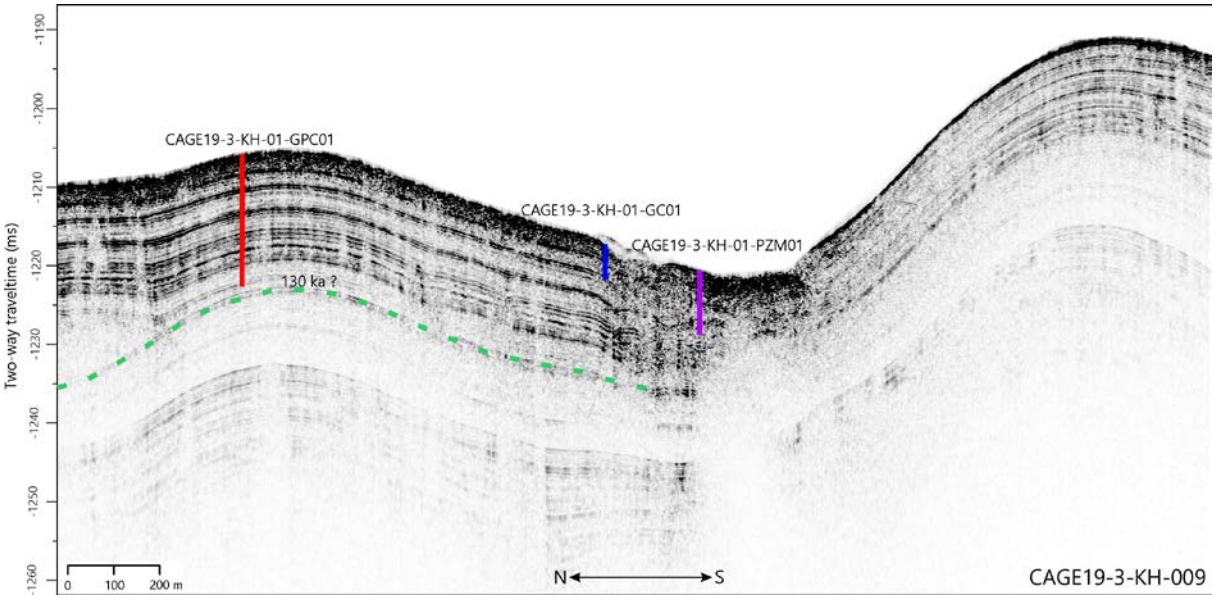

Figure 21. Sub-bottom profile at Superstation CAGE 19-3-KH-01 through the Calypso core, gravity core, and the piezometer stations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s. Approximate stratigraphical interpretation (Dessandier et al., in prep) extended from the Vestnesa Ridge is also shown.

Multicorer

Four cores were recovered with the multicorer with an average length of 34 cm each (Tab. 2). Two cores were dedicated to aDNA studies and 1 core was sliced at 1-cm for a total of 27 samples stored at 4°C. One core was archived together with the Calypso and gravity corer. Surface sediments (0-3 cm bsf) contained abundant IRD grains and pebbles including pluri-cm pebbles. Both MC01-A and B were surface sampled for DNA, biomarkers, and microfossil assemblages (0-1cm). MC01-B was downcore sampled every 2cm for each proxy, DNA sampling took place in ZONE 2 clean lab exclusive for DNA sampling. Core depth was 35cm for MC01-B.

Multi Coring resumen table							
ship	**KPH**	**station**	**1**	**core**	**CAGE19-3-KH-01-MC01**		
n. cores	**4**	**av. length**	**34 cm**	**Date**	**22/10/2019, 07:16**		
Lat. N	**78.6850**		**Long. E**	**8.2400**	**Water depth**	**892 m bsl**	

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (27 samples)
D	Archive 40.9 cm

Table 2. Summary table for CAGE-19-3-KH-01-MC01

Gravity Corer

The gravity corer recovered a total of 320 cm (4 sections). Shear strength was measured on three sections, water content samples were taken on three sections and the core catcher. Headspace samples were taken through pre-drilled holes along the liner, altogether 10 samples (see Table 3).

Gravity Coring resumen table										
ship	**KPH**	**station**	**1**	**core**	**CAGE19-3-KH-01-GC01**			**WC**=water content		
n. sec	**4**	**length**	**320 cm**	**Date**	**25/10/2019, 10:46**			**SS**= smear slides		
Lat. N	**78.6862**		**Long. E**	**8.2564**	**Water depth**	**900.1**		**HS**= Headspace		

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	4	100	220	320		5.6	26		4xHS	pore water at every 15 cm
B	3	100	120	220		9.6	27		3xHS	pore water at every 15 cm
C	2	100	20	120		0.4	28		3xHS	pore water at every 15 cm
D	1	20	0	20		too short				
	CC						25			

Table 3. Summary table for CAGE 19-3-KH-01-GC01

Pore water sampling

For pore water sampling on the gravity core we predrilled holes with a 4mm diameter into the liner at 15 cm intervals. After core recovery, cutting and labelling, we inserted so called rhizon sampler into the sediment through the pre-drilled holes. 20 ml syringes were attached to the rhizons and kept open with wooden spacer to create a vacuum (Figure 22). It took up to 10 hours for the syringes to fill with pore water. Once they were full, we removed the syringes and transferred the pore water into different vials (Figure 23) and stored them in the cooler for onshore analyses. We collected 19 pore water samples from CAGE19-3-KH-01-GC01.

Figure 22. Gravity core sections with rhizons inserted for pore water extraction.

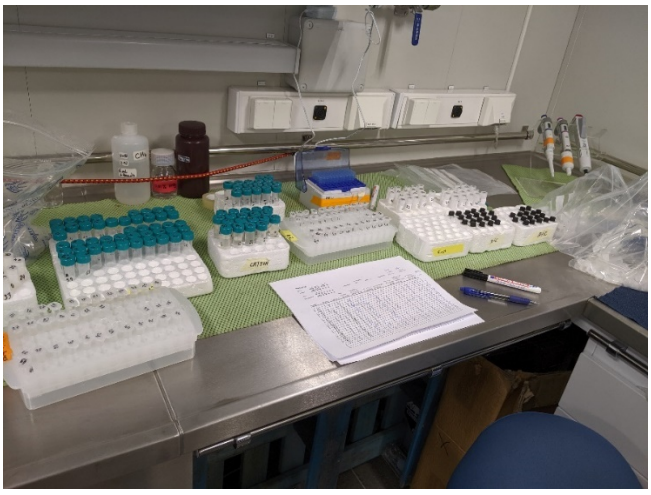

Figure 23. The pore water is transferred to different vials for the analysis of cations, anions, dissolved inorganic carbon, H_2S, phosphate, and Sr isotopes.

Calypso Corer

The calypso core is 12.52 m long, divided in 13 sections mainly composed of clay and silty clay, stiff/ firm at the base of the core and soft/soupy at the top (Table 4). Sections 6 (H) and 7 (G) contained very wet clay sediments (water dropped out from the sections) that may be related to sediment disturbance during coring (sediment core detachment with incorporation of sea water) or gas hydrate dissociation.

Gas sampling: We collected three samples for the determination of gas content at the top of section 13, section 6 and section 3. We used 5ml cut-off syringes to retrieve between 3 and 5 ml sediment which were transferred into 20-ml-glass vials containing NaOH solution. These were sealed, shaken and stored at 4 degreeC for shore-based analyses.

Water content sampling: We collected samples for the determination of water content at the top of each section except for section 1. We used 5ml cut-off syringes to retrieve 5 ml of sediment which was weighed before drying and after drying (105˚C for 24 h).

Smear slides

Fourteen smear slides were prepared using a small sediment sample (1-2mm^3) collected with a toothpick from the top of core sections 2-13, the base of section 13, and the core catcher. Results show variations between clay and silty clay between the sections, and all samples had a predominant terrigenous composition. Sediment colour varied between dark olive gray, dark gray and very dark gray. Cf. smear slides (Table 5).

Calypso Piston Coring resumen table										
ship	**KPH**	**station**	**1**	**core**	**CAGE19-3-KH-01-GPC01**		**WC**=water content			
n. sec	**13**	**length**	**12.52 m**	**Date**	**22/10/2019, 12:45**		**SS**= smear slides			
Lat. N	**78.6929**		**Long. E**	**8.2431**	**Water depth**	**890.78 m bsl**	**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	13	100	1152	1252	stiff clay	7.2	1	2 & 3	X	ss-2 at bottom ss-3 at top
B	12	100	1052	1152	stiff silty clay	16	2	4		
C	11	100	952	1052	stiff clay	14	3	5		
D	10	100	852	952	stiff clay	13.5	4	6		
E	9	100	752	852	stiff sandy clay	15	5	7		
F	8	96	656	752	firm clayly silt	10	6	8		
G	7	100	556	656	wet clay	11.5	7	9		draining water
H	6	100	456	556	wet clay	5	8	10	X	draining water
I	5	100	356	456	firm silty clay	8.3	9	11		
J	4	100	256	356	soft silty clay	4.5	10	12		
K	3	100	156	256	soft silty clay	4.9	11	13	X	
L	2	95	61	156	soupy clay	2.6	12	14		
M	1	61	0	61	-	too short				
	CC				clay			1		

Table 4. Summary table for CAGE 19-3-KH-01-GPC01.

Smear Slide #	Core	Section		Location sample was taken from	Sample Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
1	CAGE19-3-KH-01-GPC01	Core Catcher				5Y 3/2	Dark olive gray	Clay		1	99	Terrigenous	
2	CAGE19-3-KH-01-GPC01	A	13	Base of section	1252	5Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
3	CAGE19-3-KH-01-GPC01	A	13	Top of section	1152	5Y 3/1	Very dark gray	Silty Clay		20	80	Terrigenous	
4	CAGE19-3-KH-01-GPC01	B	12	Top of section	1052	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	
5	CAGE19-3-KH-01-GPC01	C	11	Top of section	952	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	
6	CAGE19-3-KH-01-GPC01	D	10	Top of section	852	5Y 3/1	Very dark gray	Silty Clay		20	80	Terrigenous	
7	CAGE19-3-KH-01-GPC01	E	9	Top of section	752	5Y 3/1	Very dark gray	Silty Clay		20	80	Terrigenous	
8	CAGE19-3-KH-01-GPC01	F	8	Top of section	652	5Y 3/1	Very dark gray	Silty Clay	1	20	79	Terrigenous	
9	CAGE19-3-KH-01-GPC01	G	7	Top of section	552	5Y 4/1	Dark gray	Clay		15	85	Terrigenous	
10	CAGE19-3-KH-01-GPC01	H	6	Top of section	452	5Y 3/1	Very dark gray	Clay		15	85	Terrigenous	
11	CAGE19-3-KH-01-GPC01	I	5	Top of section	352	5Y 3/1	Very dark gray	Silty Clay	1	20	79	Terrigenous	
12	CAGE19-3-KH-01-GPC01	J	4	Top of section	252	5Y 4/1	Dark gray	Silty Clay		20	80	Terrigenous	
13	CAGE19-3-KH-01-GPC01	K	3	Top of section	152	5Y 4/1	Dark gray	Silty Clay		20	80	Terrigenous	
14	CAGE19-3-KH-01-GPC01	L	2	Top of section	52	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	

Table 5. Smear slide overview for CAGE-19-3-KH-01-GPC01

Piezometer

At site KH01-PZM 1 a piezometer of 8.42 m length equipped with 9 sensors (Tab. 6) was deployed the 22/10/2019 to the south of the Vestnesa Ridge. The aim is to determine the hydraulic properties of the near-surface sediment and to characterize the in-situ hydraulic and thermal regimes.

Sensor ID	Section length (cm)	Sensor depth (cmbsf)
1116	75	79
1051	150	234
1132	75	314
1141	75	394
1146	75	474
1233	75	554
1235	75	634
1237	75	714
1241	76	794
Total lance length (cm)		842

Table 6. KH01-PZM 1: position of sensors.

The piezometer was recovered the 25/10/2019. We faced difficulties to recover the instrument and the initial procedure with a cable length equivalent to the double of the water depth will be abandoned for the next deployment.
The piezometer recorded data over more than 3 days (Fig. 24) and the data show that the deployment was successful and the whole rod has penetrated the sediment between 05:28:00 and 5:28:20 (Fig. 25).

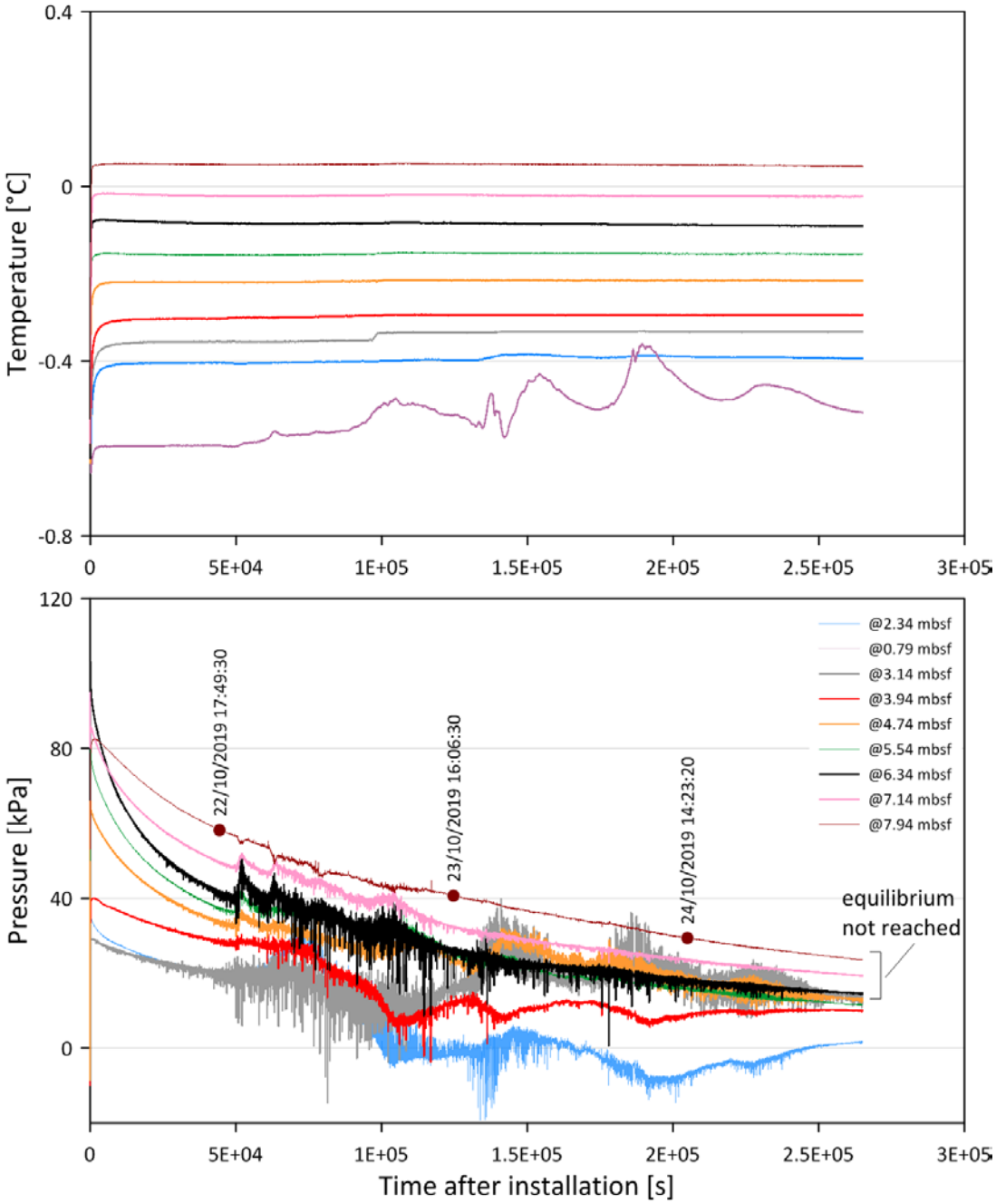

Figure 24. Pore pressure and temperature versus time. Pore pressure data from the first sensor are not shown on this diagram. Important pore pressure fluctuations were recorded at P1.

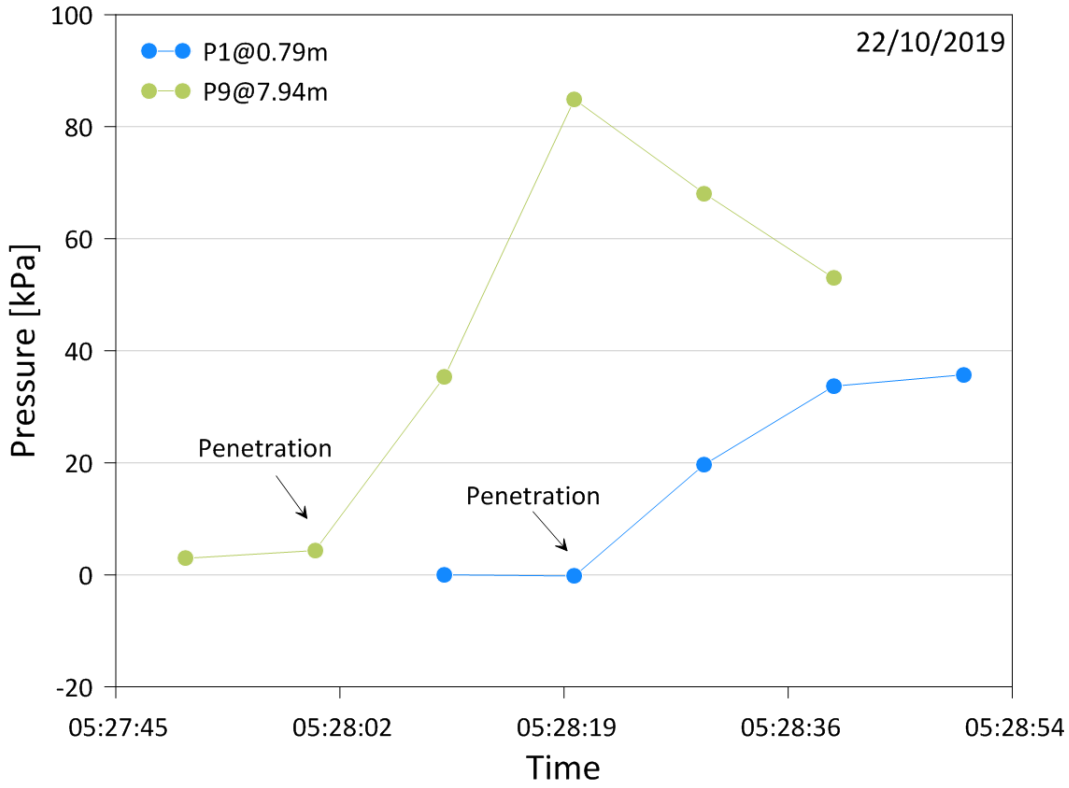

Figure 25. Pore pressure versus time for sensors P1 (top of the piezometer) and P9 (bottom of the piezometer) during the penetration process.

The pore pressure data illustrate the complexity of the hydraulic regime at this site. At least two events of pore pressure accumulation and dissipation were recorded during the deployment (52000 s and 63000s after the piezometer installation). The equilibrium pore pressure was not reached for the deepest 4 sensors (Figure 26).
The temperature data show a thermal transit regime in the first 3 mbsf. The geothermal gradient derived from the deepest 6 sensors shows a value of 87.3°C/Km (Figure 26).

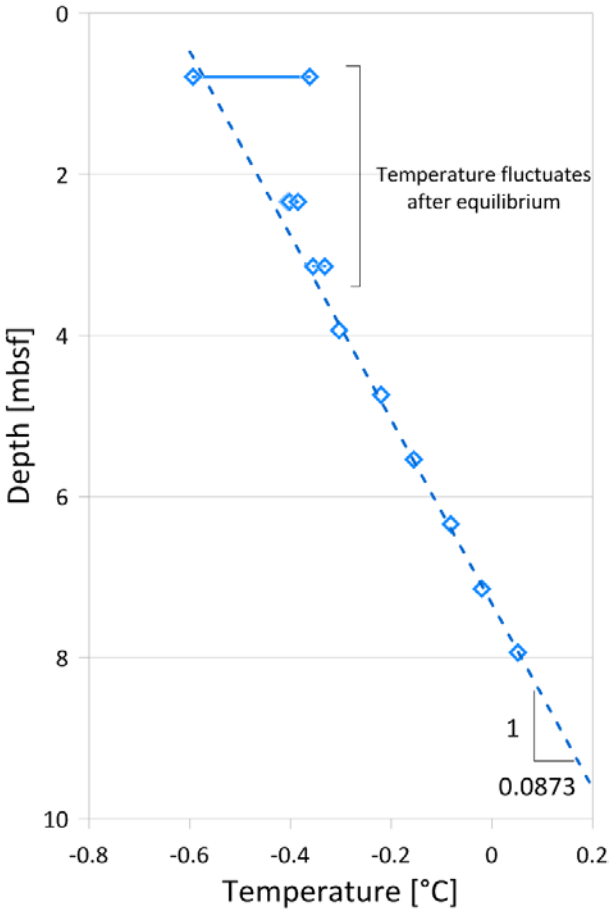

Figure 26. Geothermal gradient showing a thermal transit regime along the first 3 m. The geothermal gradient derived from the deepest 6 sensors shows a value of 87.3°C/Km.

Heat Flow

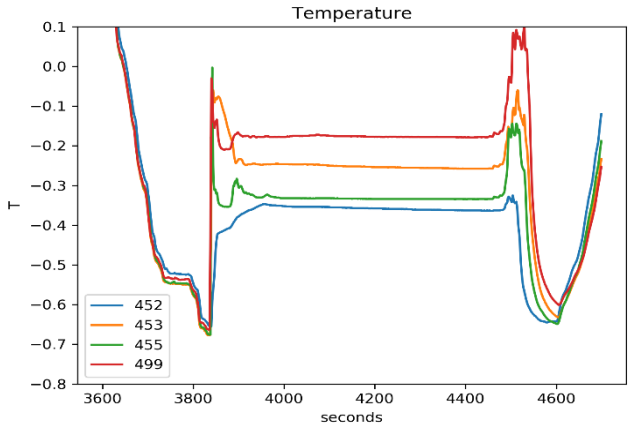

Figure 27: Temperature variation with time at station KH-01 recorded using the temperature sensors attached to the 6-m long gravity core barrel. The ID number of each sensor relative weight is indicated. The zero time corresponds to the penetration of the gravity core barrel.

Superstation CAGE 19-3-KH-02

Site Location

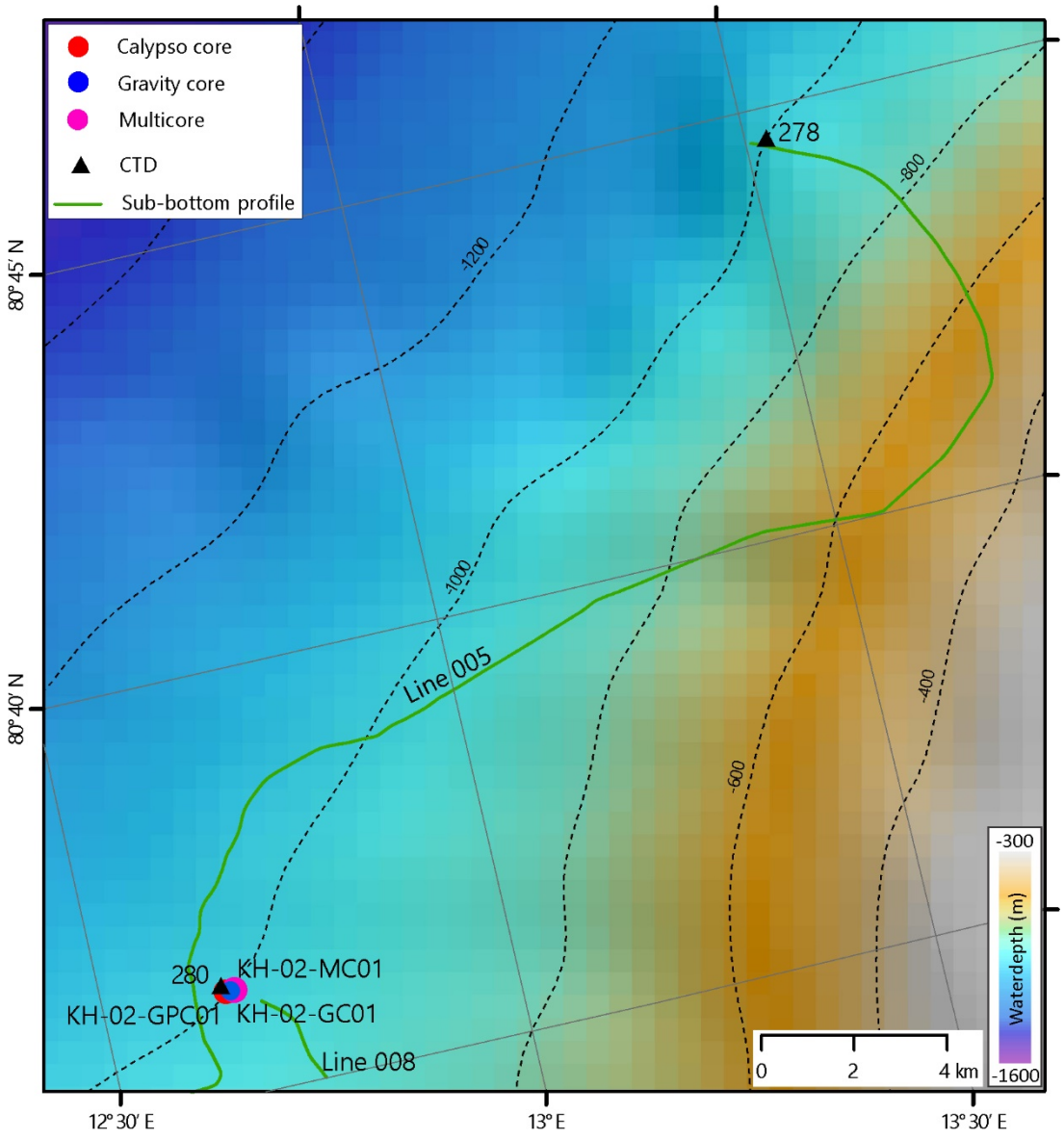

Figure 28. Location of superstation CAGE 19-3-KH-02 at the northern Svalbard slope.

Acoustics

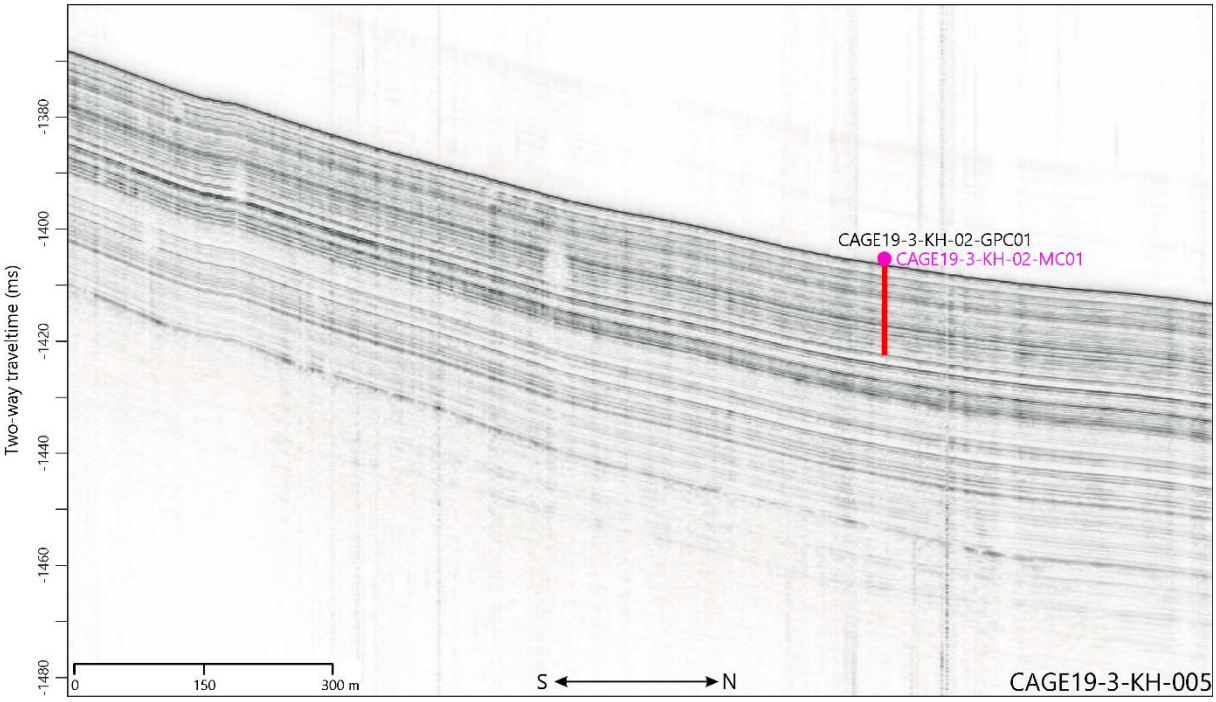

Figure 29. Sub-bottom profile at CAGE 19-3 KH-02 showing well-stratified, parallel/sub-parallel reflections. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

One multicore (43 cm length) was sliced into 1-cm sections and stored in plastic bags in the cold room. Two multicores were sampled for DNA: sampling of the loose sediment at the surface-water interface (~20mL) and sediment sampling of the 0-1cm surface layer. Sterile DNA sampling ~10g wet weight collected, followed by ~20 g wet weight collection for biomarker and another ~20g for microfossil assemblage. After sampling cores are kept at cold storage with oasis (Tab. 7).

Multi Coring resumen table						
ship	**KPH**	**station**	**2**	**core**	**CAGE19-3-KH-02-MC01**	
n. cores	**4**	**av. length**	**43 cm**	**Date**	**24/10/2019, 12:10**	
Lat. N	**80.6045**		**Long. E**	**12.6613**	**Water depth**	**1028 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (42 samples)
D	Archive 44.5 cm

Table 7. Summary table for CAGE-19-3-KH-02-MC01

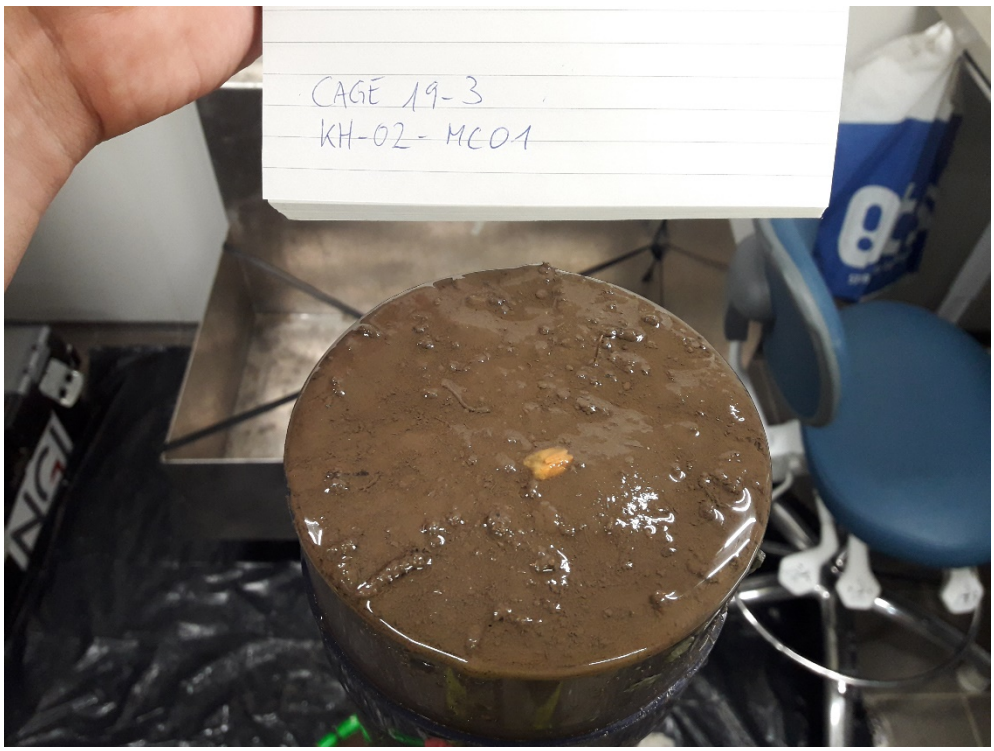

Figure 30. Photo of surface sediment of CAGE-19-3-KH-02-MC01

Gravity Corer

The gravity corer recovered 476,5 m of sediment and was cut into five sections (Table 8).

Gravity Coring resumen table										
ship	**KPH**	**station**	**2**	**core**	**CAGE19-3-KH-02-GC01**		**WC**=water content			
n. sec	**5**	**length**	**476.5 cm**	**Date**	**24/10/2019, 13:22**		**SS**= smear slides			
Lat. N	**80.6045**		**Long. E**	**12.656**	**Water depth**	**1029 m bsl**	**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	5	100	376.5	476.5	wet clay					pore water at 20, 50, 80 cm
B	4	100	276.5	376.5	firm wet clay					pore water at 20, 50, 80 cm
C	3	100	176.5	276.5	soft clay					pore water at 20, 50, 80 cm
D	2	100	76.5	176.5	soft clay					pore water at 20, 50, 80 cm
E	1	76.5	0	76.5	-					pore water at 30, 60 cm
Very cold, ice forming at the plastic liner surfaces										

Table 8. Summary table for CAGE 19-3-KH-02-GC01

Pore water sampling

14 pore water samples were taken between 30 cm depth and 456,5 cm depth.
Pore water splits for the determination of anions, cations, trace elements, sulfide, nutrients, DIC and Sr-isotopes were taken. (**Note**: ice persistently forming at the plastic liner surfaces, although cleaned many times with warm water)

Calypso Corer

The Calypso corer recovered 11.75 m (12 sections) of mainly clayey sediments (Tab. 9). Wet clay with draining water was observed at sections 4, 5, 6, and 8 located between 278–578 m bsf and 675–775 m bsf respectively (sediment disturbance during coring?).

Calypso Piston Coring resumen table											
ship	**KPH**	**station**	**2**	**core**	**CAGE19-3-KH-02-GPC01**			**WC**=water content			
n. sec	**12**	**length**	**11.75 m**	**Date**	**24/10/2019, 08:38**			**SS**= smear slides			
Lat. N	**80.6045**		**Long. E**	**12.65**	**Water depth**	**1031 m bsl**		**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	12	100	1075	1175	stiff clay	5	13 (4.2 cc)	16	X		
B	11	100	975	1075	stiff silty clay	6.4	14	17			
C	10	100	875	975	stiff silty clay	5	15	18			
D	9	100	775	875	silty clay	2	16	19	X		
E	8	100	675	775	firm wet clay	9.6	17	20	X	draining water	
F	7	97	578	675	stiff clay	9.4	18, 19	21			
G	6	100	478	578	firm wet silty clay	9.2	20	22		draining water	
H	5	100	378	478	firm wet clay	6.4	21 (4cc)	23		draining water	
I	4	100	278	378	firm wet clay	5	22	24		draining water	
J	3	100	178	278	soft clay	3.4	23	25			
K	2	100	78	178	soft clay	2.2	24	26	X		
L	1	78	0	78	-	not complete cannot measure		27			
	CC				very stiff clay			15			

Table 9. Summary table for CAGE 19-3-KH-02-GPC01.

Gas sampling: We collected four samples for the determination of gas content at the top of section 12,9,8, and section 2.

Water content samples and shear strength measurements were taken at the top of each section except for section 1.

Smear slides: Thirteen smear slides were prepared using a small sediment sample (1-2mm3) collected with a toothpick from the top of core sections 1-12, and the core catcher. Results show variations between clay and silty clay between the sections, and all samples had a predominant terrigenous composition. Section 2 had a 5% biogenic component. Sediment colour varied between dark olive gray, dark gray and very dark gray. Cf. smear slides in Table 10.

Smear Slide #	Core	Section		Location sample was taken from	Sample Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
15	CAGE19-3-KH-02-GPC01	Core Catcher				5Y 3/1	Very dark gray	clay		5	95	Terrigenous	
16	CAGE19-3-KH-02-GPC01	A	12	Top of section	1075	5Y 4/1	Dark gray	Silty Clay		15	85	Terrigenous	
17	CAGE19-3-KH-02-GPC01	B	11	Top of section	975	5Y 3/1	Very dark gray	Clay	2	5	93	Terrigenous	
18	CAGE19-3-KH-02-GPC01	C	10	Top of section	875	5Y 3/1	Very dark gray	Clay		3	97	Terrigenous	
19	CAGE19-3-KH-02-GPC01	D	9	Top of section	775	5Y 3/1	Very dark gray	Clay		1	99	Terrigenous	
20	CAGE19-3-KH-02-GPC01	E	8	Top of section	675	5Y 3/1	Very dark gray	Clay		1	99	Terrigenous	
21	CAGE19-3-KH-02-GPC01	F	7	Top of section	575	5Y 4/1	Dark gray	Clay	1	5	94	Terrigenous	
22	CAGE19-3-KH-02-GPC01	G	6	Top of section	475	5Y 3/1	Very dark gray	Clay		2	98	Terrigenous	
23	CAGE19-3-KH-02-GPC01	H	5	Top of section	375	5Y 4/1	Dark gray	Clay		3	97	Terrigenous	
24	CAGE19-3-KH-02-GPC01	I	4	Top of section	275	5Y 4/1	Dark gray	Clay		3	97	Terrigenous	
25	CAGE19-3-KH-02-GPC01	J	3	Top of section	175	5Y 4/1	Dark gray	Silty Clay		3	97	Terrigenous	
26	CAGE19-3-KH-02-GPC01	K	2	Top of section	75	5Y 3/1	Very dark gray	Silty Clay	1	20	79	Terrigenous	5% biogenics
27	CAGE19-3-KH-02-GPC01	L	1	Top of section	0	5Y 3/2	Dark olive gray	Silty Clay		20	80	Terrigenous	

Table 10. Smear slide overview for CAGE-19-3-KH-02-GPC01

4.2 Superstation CAGE 19-3-KH-03

Site Location

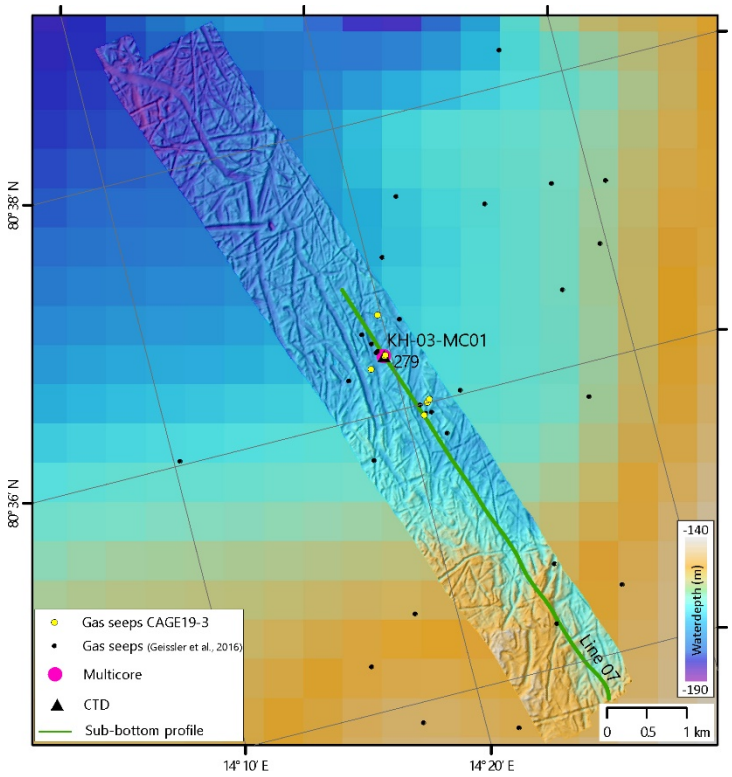

Figure 31. Location of superstation CAGE 19-3-KH-03 at the shelf close to the Hinlopen submarine slide, along with acquired multibeam bathymetry and observed gas flares.

Acoustics

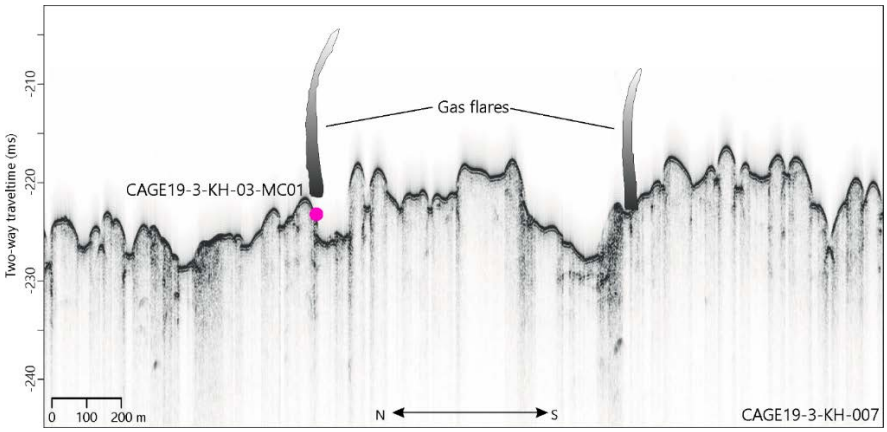

Figure 32: Sub-bottom profile at CAGE 19-3 KH-03 showing irregular seafloor and a thin section of recent sediments. The irregular seafloor represents iceberg ploughmarks. Also shown are the location of observed gas flares and multicore sample.

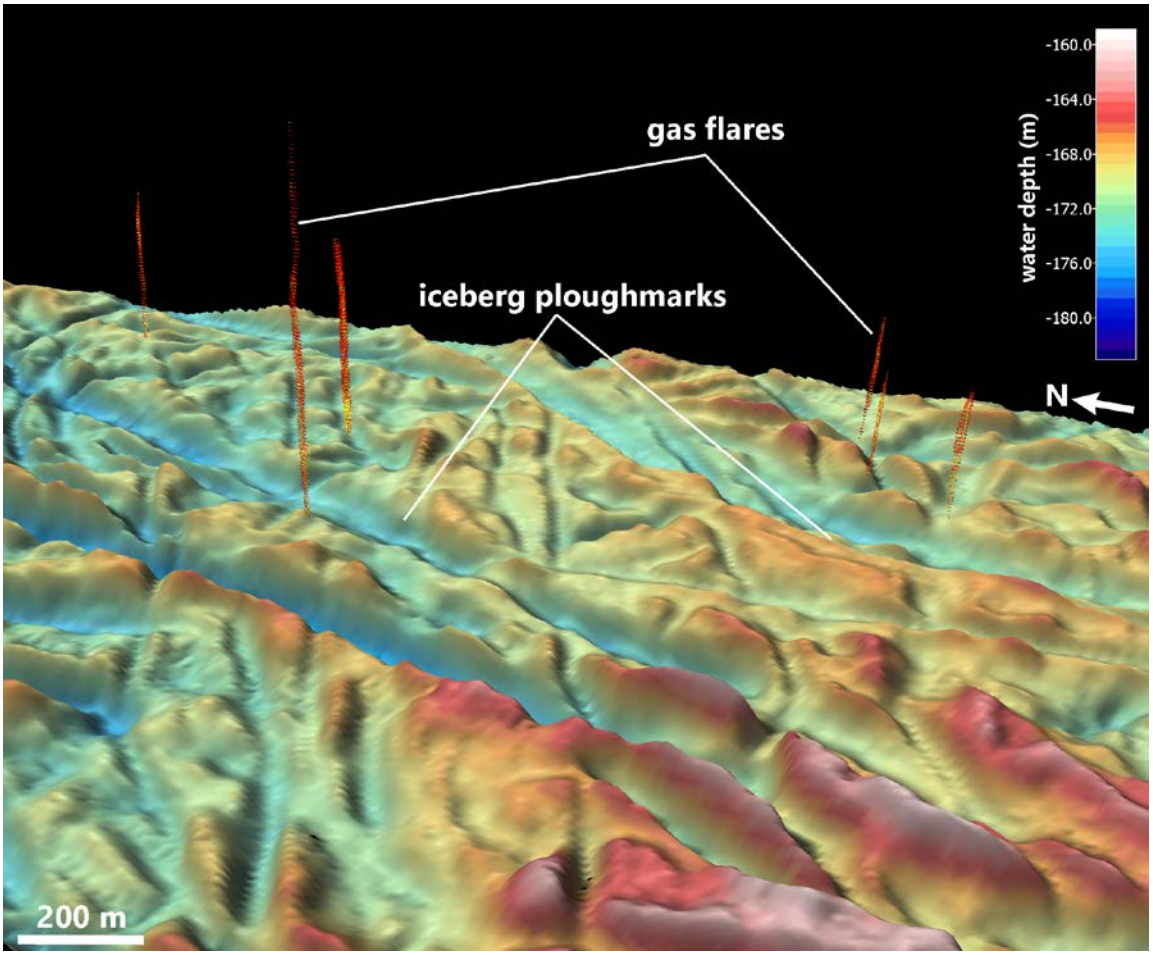

Figure 33. Observed flares at superstation CAGE 19-3-KH-03 superimposed on the bathymetry.

CTD – Water sampling

After the CTD with the rosette (12 Niskin bottles at different water depths between 155 m and the surface) was back on deck we transferred 120 ml of seawater from each Niskin bottle into glass bottles. After adding 1 ml of NaOH solutions the bottles were crimp sealed, ideally without any air bubble. Subsequently, 5 ml of seawater was removed from the bottle and replaced with nitrogen gas to create a headspace. The bottles are then stored in the fridge for shore-based analysis of methane concentration.

Multicorer

The first attempt (MC01) did not recover any multicores. On the second attempt, only one MC was recovered. CAGE 19-03 KH03-MC02 had ~7cm of sediment (Tab. 11). This core was surface sampled for DNA, IP_{25}, and microfossil assemblages. There was significant biological activity, including a starfish (which was archived at -20 in ethanol). Sampling was somewhat impeded by a large piece of gravel between 0.5cm-1.5cm layer; the rock was removed and kept.

Multi Coring resumen table						
ship	**KPH**	**station**	**3**	**core**	**CAGE19-3-KH-03-MC02**	
n. cores	**4**	**av. length**	**7 cm**	**Date**	**22/10/2019, 12:45**	
Lat. N	**80.6066**		**Long. E**	**14.3280**	**Water depth**	**167.6 m bsl**

Core	Analyses/Destination
A	DNA (7 cm)
B	empty
C	empty
D	empty

Table 11. Summary table for CAGE-19-3-KH-03-MC01

4.3 Superstation CAGE 19-3-KH-04

Site Location

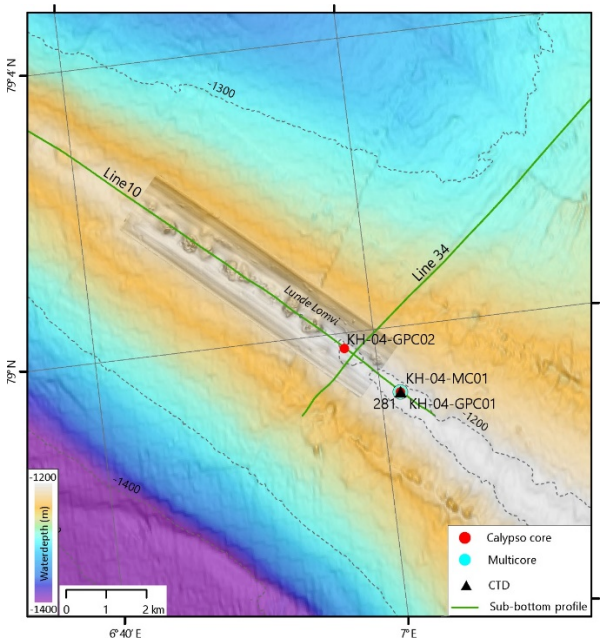

Figure 34. Location of superstation CAGE 19-3-KH-04 at the actively seeping part of Vestnesa Ridge.

Acoustics

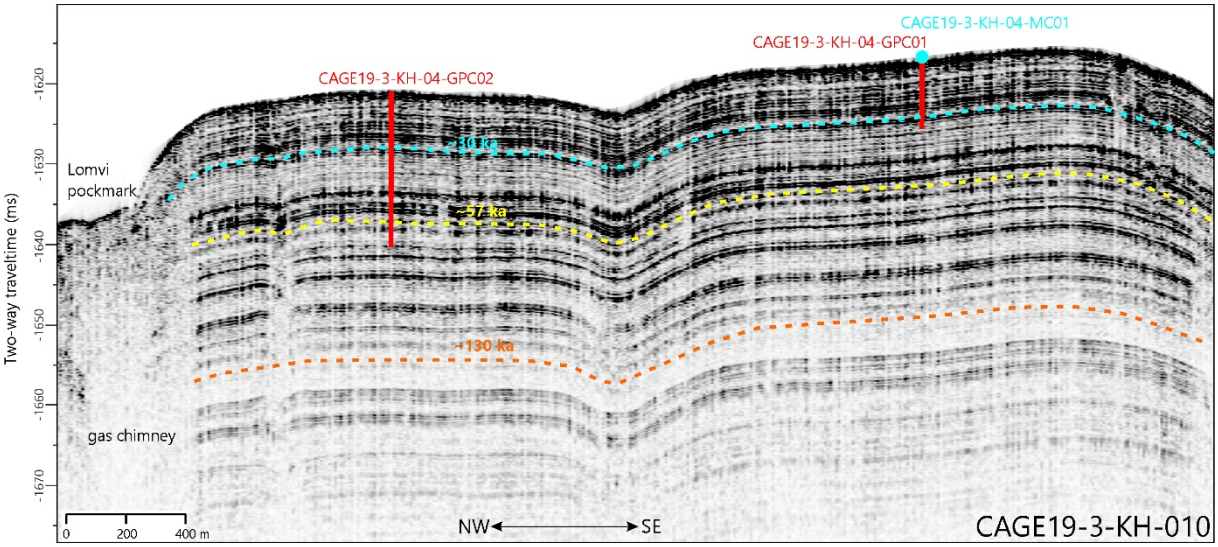

Figure 35. Sub-bottom profile at CAGE 19-3 KH-04 showing well-stratified, parallel/sub-parallel reflections as well as the active Lomvi pockmark. Approximate ages of the observed reflections are adapted from Dessandier et al. (in prep) and Schneider et al. (2018). Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

Three multicores (42 cm, on average) on the first attempt recovered adequate sediment, the fourth incurred an issue while capping and majority of sediment was lost (Tab. 12). The fourth core was not sampled due to some visible disturbance at the sediment-water interface. One of the remaining three cores was dedicated to DNA studies. CAGE 19-03 KH-04-MC01-A was sampled for DNA, palynology and biomarkers at the 0-1cm and 1-2cm layers. Notable biologic activity at the surface, mostly filter feeders.

Multi Coring resumen table						
ship	**KPH**	**station**	**4**	**core**	**CAGE19-3-KH-04-MC01**	
n. cores	**4**	**av. length**	**42 cm**	**Date**	**25/10/2019, 15:07**	
Lat. N	**78.9854**		**Long. E**	**7.0233**	**Water depth**	**1191 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (41 samples)
D	Archive 42.6 cm

Table 12. Summary table for CAGE-19-3-KH-04-MC01

Calypso Corer

The first Calypso corer bended and recovered 614 cm (7 sections) (Tab. 13). A headspace sample was taken from the top of section 4,6, and 7 for gas analysis. Samples for water content were taken at the top of each section except for section 1. The shear strength was measured at the top of each section except for section 1. The second Calypso corer recovered 1441 cm (Tab. 14).

Calypso Piston Coring resumen table										
ship	**KPH**	**station**	**4**	**core**	**CAGE19-3-KH-04-GPC01**			**WC**=water content		
n. sec	**7**	**length**	**6.14m**	**Date**	**25/10/2019, h 17:07**			**SS**= smear slides		
Lat. N	**78.9854**		**Long. E**	**7.0233**	**Water depth**	**1191 m bsl**		**HS**= Headspace		
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	7	100	514	614		7.6	29 (4cc)		X	
B	6	100	414	514		9.4	30		X	
C	5	100	314	414		6.2	31			
D	4	100	214	314		5	32 (4.5cc)		X	
E	3	90	124	214		4.4	33			
F	2	94	30	124		1.4	34			
G	1	30	0	30		too short				
	CC									

Table 13. Summary table for CAGE 19-3-KH-04-GPC01.

Calypso Piston Coring resumen table											
ship	**KPH**	**station**	**4**	**core**	**CAGE19-3-KH-04-GPC02**					**WC**=water content	
n. sec	**15**	**length**	**14.41 m**	**Date**	**04/11/2019, h 15:08**					**SS**= smear slides	
Lat. N	**78.9967**		**Long. E**	**6.9635**	**Water depth**	**1194.74 m bsl**				**HS**= Headspace	
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	15	100	1341	1441	stiff clay		172 (3.6cc)		X	Black sediments expanding all over the core length by gas pressure (often difficult to close the end's caps). Nevertheless, there is a lack of H2S smell	
B	14	100	1241	1341	stiff clay		173		X		
C	13	100	1141	1241	stiff clay		174		X		
D	12	100	1041	1141	stiff clay		175 (4.6cc)				
E	11	100	941	1041	firm silty clay		176				
F	10	95	846	941	firm silty clay		177				
G	9	100	746	846	firm clay		178				
H	8	100	646	746	firm clay		179 (4.2cc)				
I	7	100	546	646	firm clay		180		X		
J	6	100	446	546	firm clay		181 (4.8cc)				
K	5	100	346	446	firm clay		182				
L	4	95	251	346	soft clay		183				
M	3	100	151	251	soft clay		184				
N	2	100	51	151	soft clay		185				
O	1	51	0	51	soft sandy clay						
	CC				soft clay						

Table 14. Summary table for CAGE 19-3-KH-04-GPC02.

4.4 Superstation CAGE 19-3-KH-05

Site Location

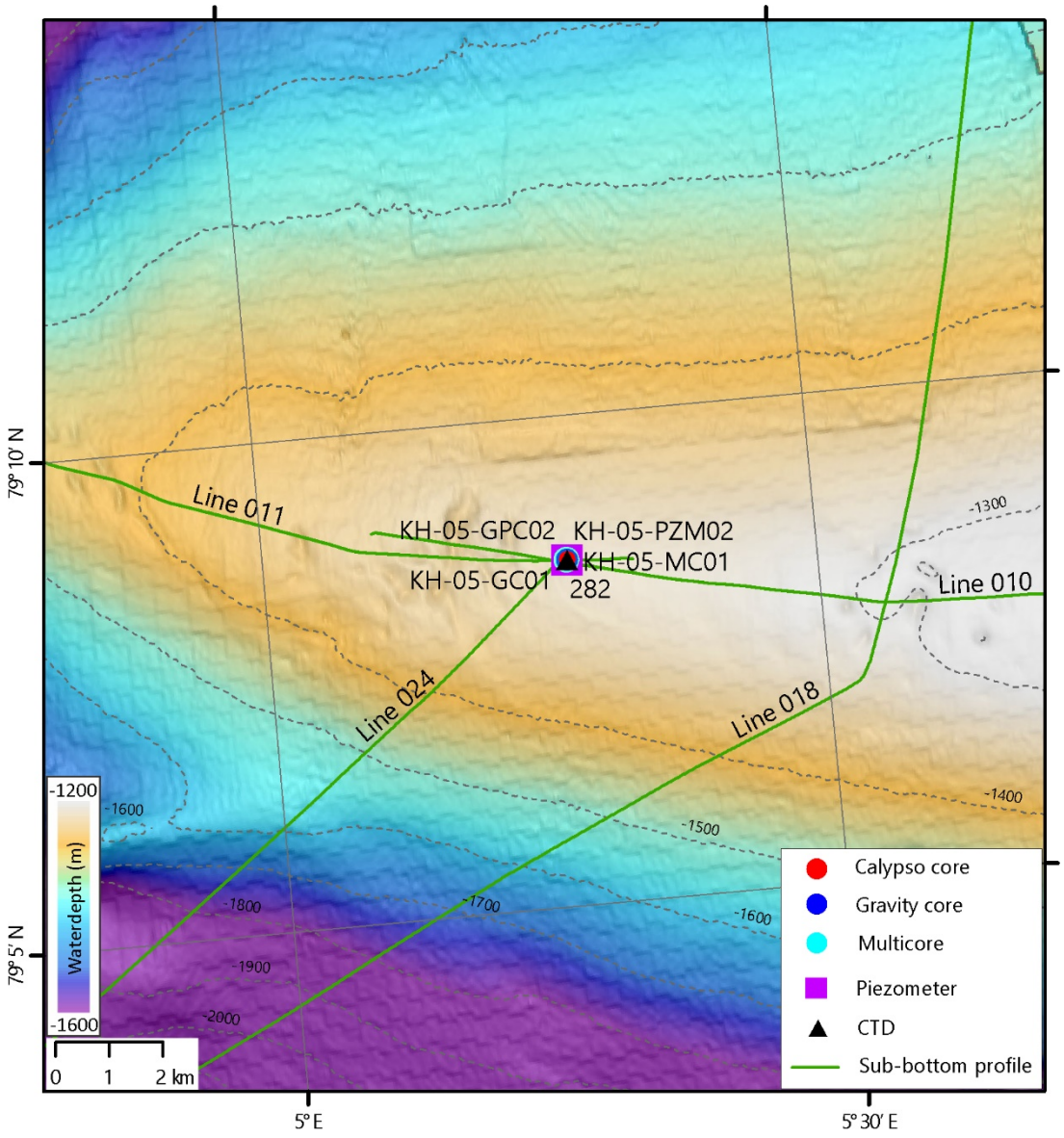

Figure 36. Location of superstation CAGE 19-3-KH-05 at the western inactive part of the Vestnesa Ridge.

Acoustics

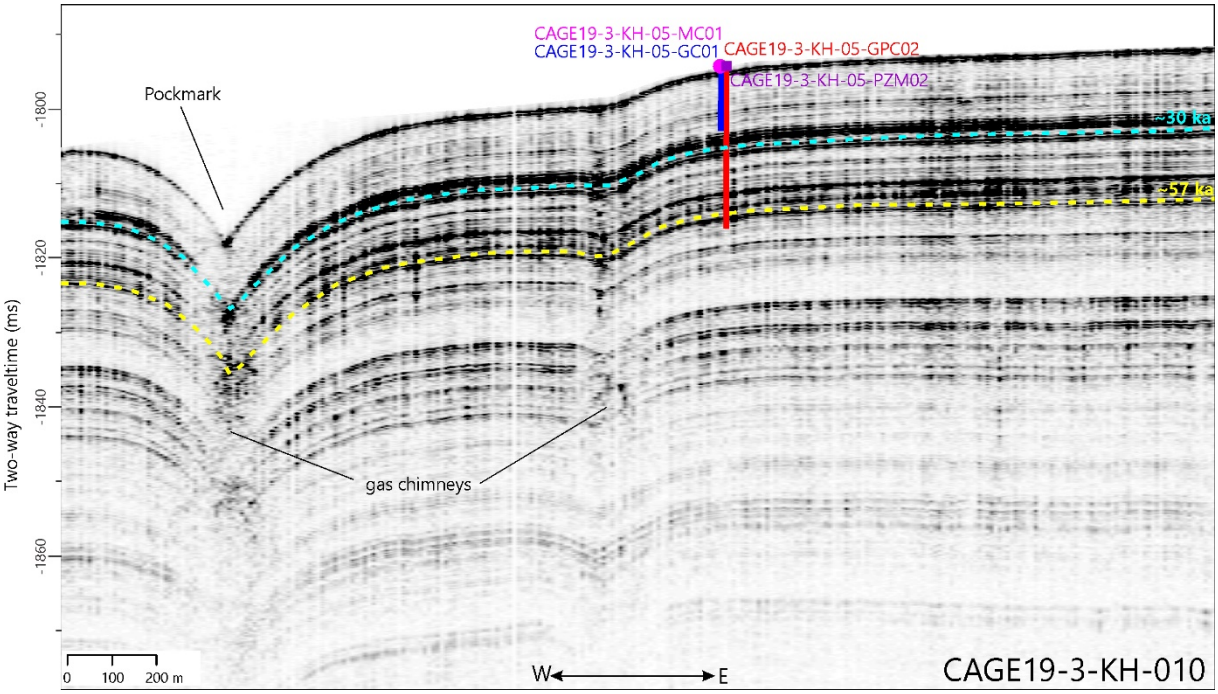

Figure 37. Sub-bottom profile at CAGE 19-3 KH-05 showing well-stratified, parallel/sub-parallel reflections as well as inactive pockmarks with underlying gas chimneys. Approximate ages of the observed reflections are adapted from Dessandier et al. (in prep) and Schneider et al. (2018). Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

All four multicorer (44.5 cm on average) were recovered on the first attempt (Tab. 15). MC01-A was sampled for surface sediment DNA, biomarker, and palynology. Samples 0-1cm and 1-2cm after a 1 hour resting period in cold storage prior to sampling (DNA sampled within 1.5hours post recovery). One multicorer tube was sliced in 1 cm slices and stored in the refrigerator. One multicorer tube was archived.

Multi Coring resumen table						
ship	**KPH**	**station**	**5**	**core**	**CAGE19-3-KH-05-MC01**	
n. cores	**4**	**av. length**	**44.5 cm**	**Date**	**26/10/2019, 08:52**	
Lat. N	**79.1426**		**Long. E**	**5.2741**	**Water depth**	**1325 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (42 samples)
D	Archive 47.5 cm

Table. 15. Summary table for CAGE-19-3-KH-05-MC01

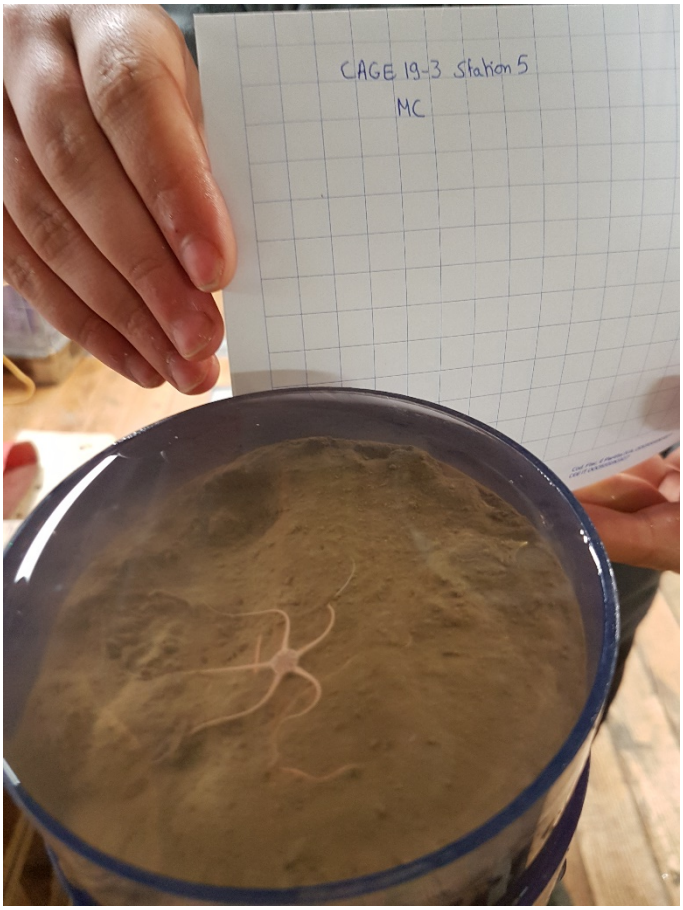

Figure 38. Photo of the surface of CAGE-19-3-KH-05-MC01

Calypso Corer

Calypso Coring resumen table							
ship	**KPH**	**station**	**5**	**core**	**CAGE19-3-KH-05-GPC02**		**WC**=water content
n. sec	**16**	**length**	**15.67 m**	**Date**	**31/10/2019, 12:23**		**SS**= smear slides
Lat. N	**79.1427**		**Long. E**	**5.27493**	**Water depth**	**1321**	**HS**= Headspace

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	16	100	1467	1567	stiff silty clay	16.2	106 (4.2cc)		X	
B	15	100	1367	1467	stiff clay	17.8	107		X	
C	14	100	1267	1367	stiff clay	15.2	108			
D	13	100	1167	1267	stiff clay	14.2	109 (3.2cc)		X	wet sediments*
E	12	100	1067	1167	stiff clay	16	110			
F	11	95	972	1067	stiff clay	11.2	111 (3.8cc)			
G	10	100	872	972	stiff clay	16	112 (4.2cc)	disturbed top (cut of ~2 cm for shear strenght analysis. Slice re-adjusted at the top)		
H	9	100	772	872	firm clay	16	113			as above
I	8	100	672	772	firm clay	11.4	114 (4.8cc)			
J	7	100	572	672	soft clay	8.2	115			
K	6	100	472	572.00	soft sandy clay	8.8	116 (4.8cc)			
L	5	95	377	472.00	soft clay	disturbed surface	117			
M	4	100	277	377.00	soft clay	3.8	118			
N	3	100	177	277.00	soft clay	6	119			
O	2	100	77	177	soupy clay	not possible	120			
P	1	77	0	77	soupy clay	too short				

Table 16. Summary table for CAGE 19-3-KH-05-GPC01.

Gravity Corer

The gravity corer recovered a total of 583,5 cm which were cut into 6 sections. We took three headspace samples at the top of section 3, 5, and 6 for gas analysis. Water content samples and shear strength measurements were taken at the top of each section (Tab. 17).

Gravity Coring resumen table										
ship	**KPH**	**station**	**5**	**core**	**CAGE19-3-KH-05-GC01**		**WC**=water content			
n. sec	**6**	**length**	**583.5 cm**	**Date**	**26/10/2019, 08:52**		**SS**= smear slides			
Lat. N	**79.1426**		**Long. E**	**5.2741**	**Water depth**	**1320 m bsl**	**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	6	100	483.5	583.5	silty clay	8	35		x	
B	5	100	383.5	483.5	clay	5.2	36 (4.5cc)		x	
C	4	100	283.5	383.5	clay	5.2	37 (4cc)			
D	3	100	183.5	283.5	clay	4	38		x	
E	2	100	83.5	183.5	clay	3.2	39 (4cc)			
F	1	83.5	0	83.5	clay	2.2	40 (4.5cc)			

Table 17. Summary table for CAGE-19-3-KH-05-GC01

Piezometer

Sensor ID	Section length (cm)	Sensor depth (cmbsf)
1116	75	79
1051	150	234
1132	75	314
1055	150	469
1146	75	549
1235	150	704
1237	75	784
1144	75	864
1246	75	944
Total length (cm)		991.5

Table 18. Piezo KH-PZM 2: position of sensors

At site KH-PZM 2 a piezometer of 9.92 m length equipped with 9 sensors was deployed. The position of sensors is shown in Table 18. KH-PZM 2 measured pore pressure and temperature during more than 4 days.

The data show that the deployment and the recovery were successful and the whole rod has penetrated the sediment the 26/10/2019 between 13:17:05 and 13:17:25 (Figure 39) while the pull-out take place 31/10/2019 between 01:32:55 and 01:33:15.

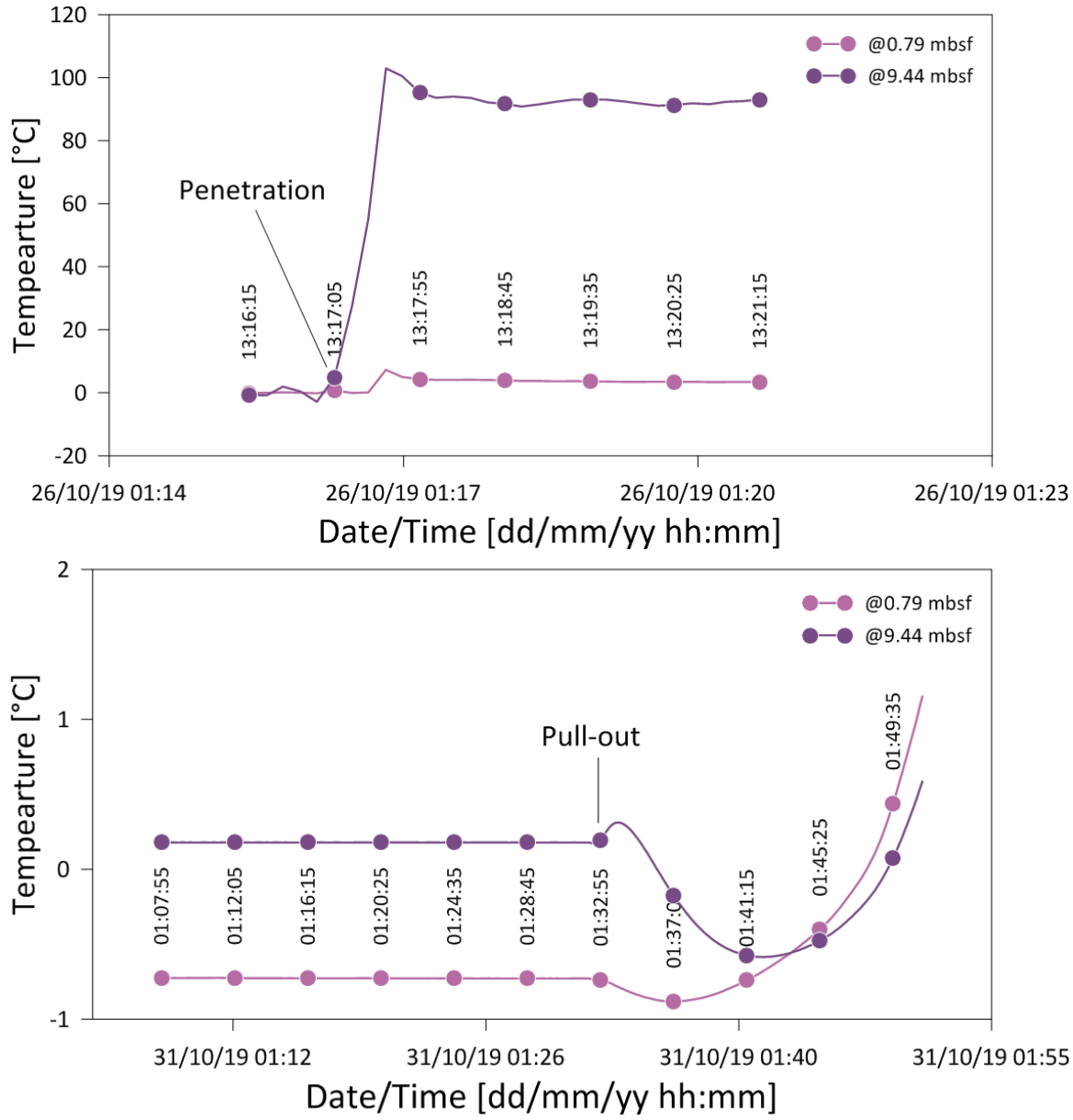

Figure 39. Temperature versus time for sensors P1 (top of the piezometer) and P9 (bottom of the piezometer) during the installation and b) pore pressure versus time for sensors P1 (top of the piezometer) and P9 (bottom of the piezometer) during the retrieval process.

Temperature data from the first two sensors show some fluctuations during the recording period (Figure 40). The pore pressure fluctuations recorded by the upper first 4 sensors indicate the presence of free gas within the sediment (Figure 41). The gas concentration is proportional to the fluctuation amplitude. The pore-pressure fluctuation periods fit well with the tide velocity shown in Figure 41.

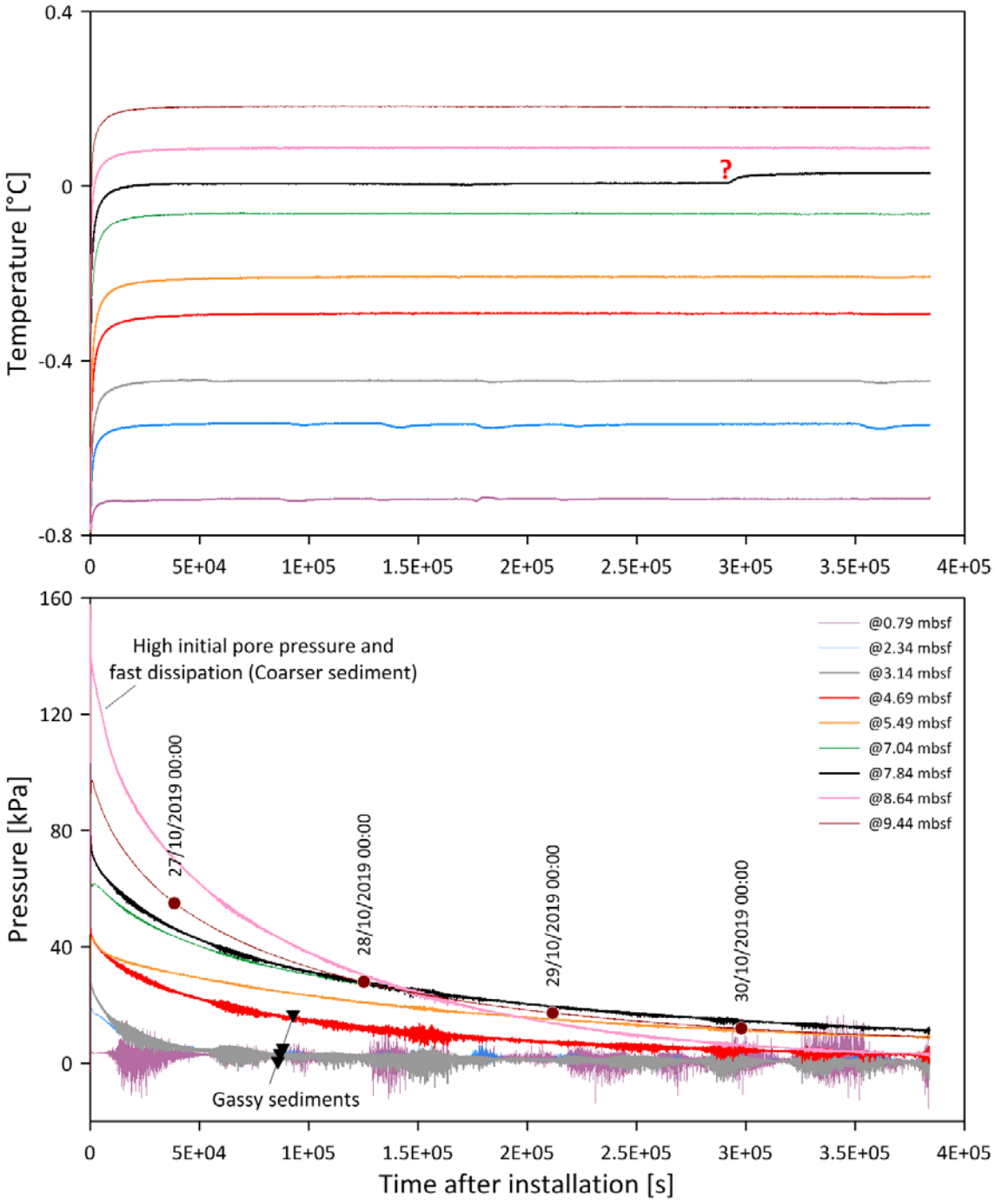

Figure 40. Pore pressure and temperature versus time.

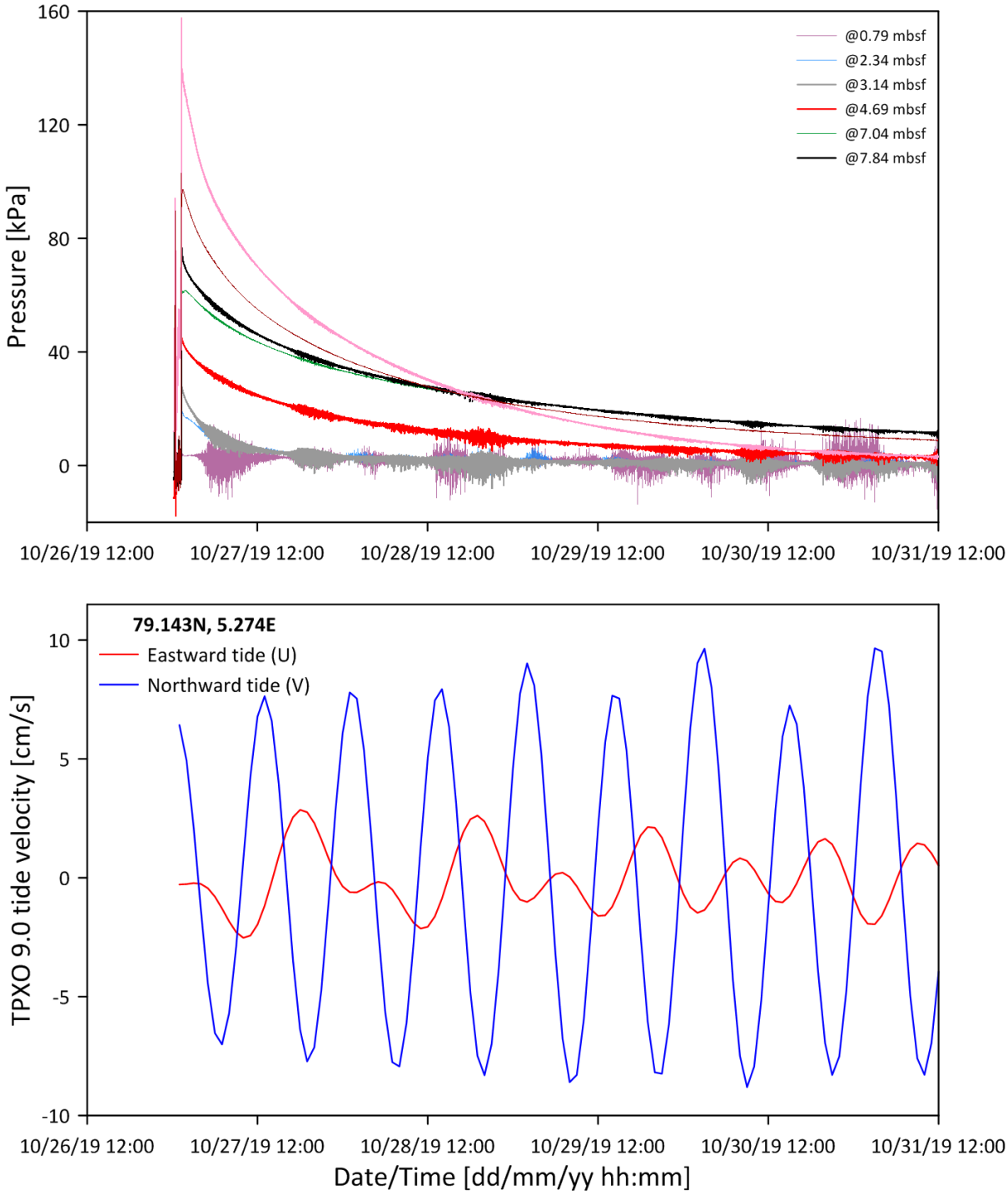

Figure 41. Pore pressure versus time compared to the tide velocity (source TPXO 9.0).

Geothermal gradient derived from the deepest 7 sensors shows a value of 98.1°C/Km (Figure 42).

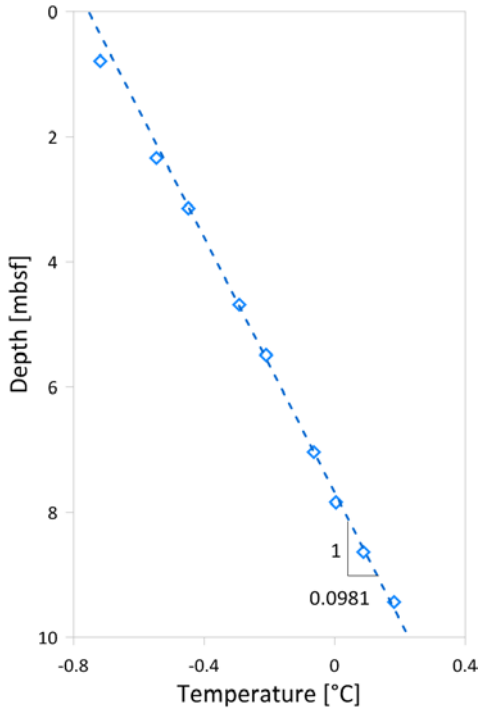

Figure 42. Geothermal gradient derived from the deepest 7 sensors showing a value of 98.1°C/Km.

Heat Flow

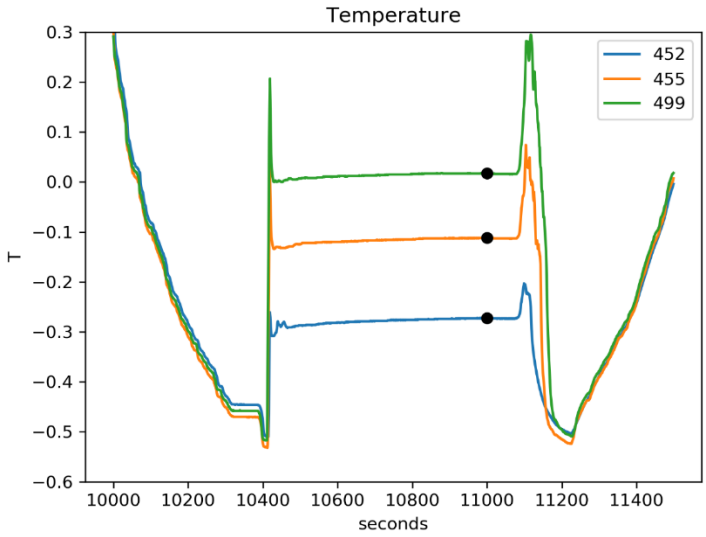

Figure 43. Temperature variation with time at station KH-02 recorded using the temperature sensors attached to the 6.4-m long gravity core barrel. The ID number of each sensor relative weight is indicated. The zero time corresponds to the penetration of the gravity core barrel.

Superstation CAGE 19-3-KH-06

Site Location

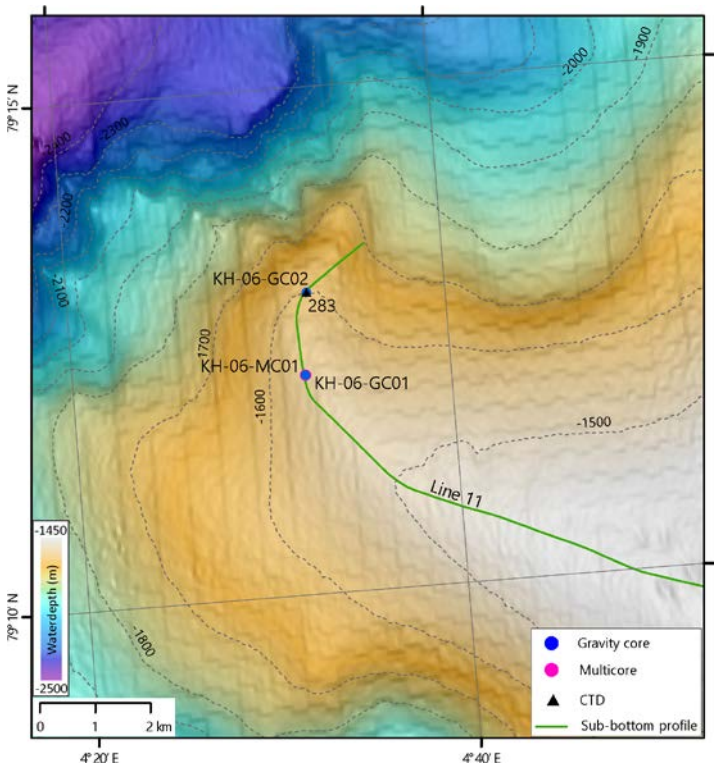

Figure 44. Location of superstation CAGE 19-3-KH-06 at the western tip of Vestnesa Ridge.

Acoustics

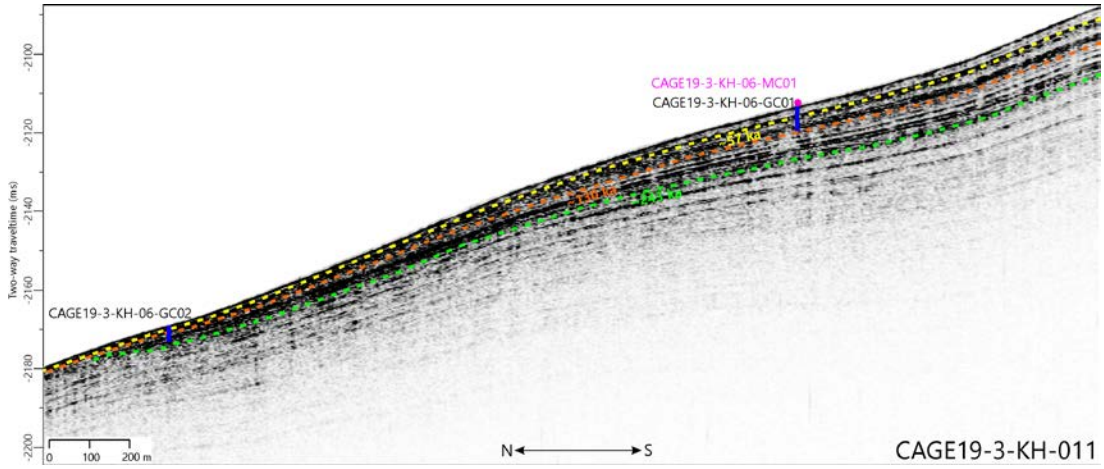

Figure 45. Sub-bottom profile at CAGE 19-3 KH-06 showing well-stratified, parallel/sub-parallel reflections. Approximate ages of the observed reflections are adapted from Dessandier et al. (in prep). Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

All four recovered MC had more than 40 cm sediment (Tab. 19). Of the recovered MCs, 2 were sampled for DNA, IP_{25}, and Palynology for the AGENSI project. Both MC01-A and MC01-B were sampled simultaneously (within 1-hour post recovery) at 0-1cm and 1-2cm.

Multi Coring resumen table						
ship	**KPH**	**station**	**6**	**core**	**CAGE19-3-KH-06-MC01**	
n. cores	**4**	**av. length**	**46.5 cm**	**Date**	**26/10/2019, 17:43**	
Lat. N	**79.2029**		**Long. E**	**4.5386**	**Water depth**	**1551 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (43 samples)
D	Archive 49.8 cm

Table 19. Summary table for CAGE-19-3-KH-06-MC01

Figure 46. Photo of the surface of CAGE-19-3-KH-06-MC01C

Gravity Corer/Heat Flow

At Superstation CAGE 19-3-KH-06 we recovered two gravity cores.

Gravity core GC01:
The first gravity core recovered a total length of 432 cm which were cut into 5 sections. Water content samples and shear strength measurements were taken at the top of each section except section 1. Three headspace samples were taken at the top of section 3, 4, and 5 for gas analysis (Table 20).

Gravity Coring resumen table										
ship	**KPH**	**station**	**6**	**core**	**CAGE19-3-KH-06-GC01**			**WC**=water content		
n. sec	**5**	**length**	**432 cm**	**Date**	**26/10/2019, h 18:57**			**SS**= smear slides		
Lat. N	**79.2029**		**Long. E**	**4.5387**	**Water depth**	**1551 m bsl**		**HS**= Headspace		
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	5	100	332	432	firm clay	7.4	41 (4.5 cc)	29	X	
B	4	100	232	332	firm clay	7	42	30	X	
C	3	100	132	232	firm silty clay	8.6	43	31	X	
D	2	100	32	132	soft clay	1.8	44	32		
E	1	32	0	32	soupy silty clay	too short		33		
CC					pebbly clay			28		

Table 20. Summary table of CAGE-19-3-KH-06-GC01

Gravity core GC02:
The second gravity core recovered a total length of 282,5 cm which were cut into 3 sections. Water content samples and shear strength measurements were taken at the top of section 2 and 3. Two headspace samples were taken at the top of section 2 and 3 for gas analysis (Table 21).

Gravity Coring resumen table											
ship	**KPH**	**station**	**6**	**core**	**CAGE19-3-KH-06-GC02**			**WC**=water content			
n. sec	**3**	**length**	**282.5 cm**	**Date**	**26/10/2019, h 20:36**			**SS**= smear slides			
Lat. N	**79.2165**		**Long. E**	**4.5450**	**Water depth**	**1594 m bsl**		**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	3	100	182.5	282.5	very stiff silty clay	15.8	45	35	X		
B	2	100	82.5	182.5	stiff silty clay	18.4	46		X		
C	1	82.5	0	82.5	soupy sandy clay	too short					
CC					stiff sandy clay			34			

Table 21. Summary table of CAGE-19-3-KH-06-GC02

Smear slides:

Gravity core GC01: Six smear slides were prepared using a small sediment sample (1-2mm3) collected with a toothpick from the top of core sections 1-5, and the core catcher. Results show variations between clay (core catcher and sections 3-5) and silty clay (sections 1-2) with a predominant terrigenous composition in all sections except the sample from section 1 which had a mixed composition of terrigenous and biogenic. In addition, the sample from section four was foraminifera-bearing clay, the sample from section 2 was biosiliceous-bearing silty clay, and the sample from the top of section 1 was biosiliceous-rich silty clay. Sediment colour varied between olive gray, dark gray and very dark gray. Cf. smear slides in Table 22.

Gravity core GC02: Four smear slides were prepared using a small sediment sample (1-2mm3) collected with a toothpick from the top of core sections 1-3, and the core catcher. Results show variations between sandy clay in the core catcher and silty clay in the remainder of the sections. Samples from the core catcher and sections 2-3 were predominantly terrigenous, with the sample from the top of section 1 having a mixed composition. This sample is a biosiliceous-rich silty clay. Sediment colour varied between dark olive gray, olive gray, and dark gray. Cf. smear slides in Table 22.

Smear Slide #	Core	Section		Location sample was taken from	Sample Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
28	CAGE19-3-KH-06-GC01	Core Catcher				5Y 4/1	Dark gray	Clay	1	3	96	Terrigenous	Pebbles in the CC
29	CAGE19-3-KH-06-GC01	A	5	Top of section	332	5Y 3/1	Very dark gray	Clay		3	97	Terrigenous	
30	CAGE19-3-KH-06-GC01	B	4	Top of section	232	5Y 4/1	Dark gray	Clay		5	95	Terrigenous	Foram-bearing
31	CAGE19-3-KH-	C	3	Top of section	132	5Y 4/2	Olive gray	Clay		10	90	Terrigenous	
32	CAGE19-3-KH-06-GC01	D	2	Top of section	32	5Y 4/1	Dark gray	Silty clay		20	80	Terrigenous	Biosiliceous-bearing silty clay
33	CAGE19-3-KH-06-GC01	E	1	Top of section	0	5Y 4/1	Dark gray	Silty Clay	1	20	79	Mixed	Biosiliceous-rich silty clay
34	CAGE19-3-KH-	Core Catcher				5Y 4/1	Dark gray	Sandy clay	20	5	75	Terrigenous	
35	CAGE19-3-KH-06-GC02	A	3	Top of section	182.5	5Y 3/2	Dark olive gray	Silty Clay	1	20	79	Terrigenous	
36	CAGE19-3-KH-	B	2	Top of section	82.5	5Y 4/2	Olive gray	Silty Clay	1	20	79	Terrigenous	
37	CAGE19-3-KH-06-GC02	C	1	Top of section	0	5Y 3/2	Dark olive gray	Silty Clay	1	20	79	Mixed	Biosiliceous-rich silty clay

Table 22: Smear slide overview for CAGE-19-3-KH-06-GC01 and –GC02

Heat flow

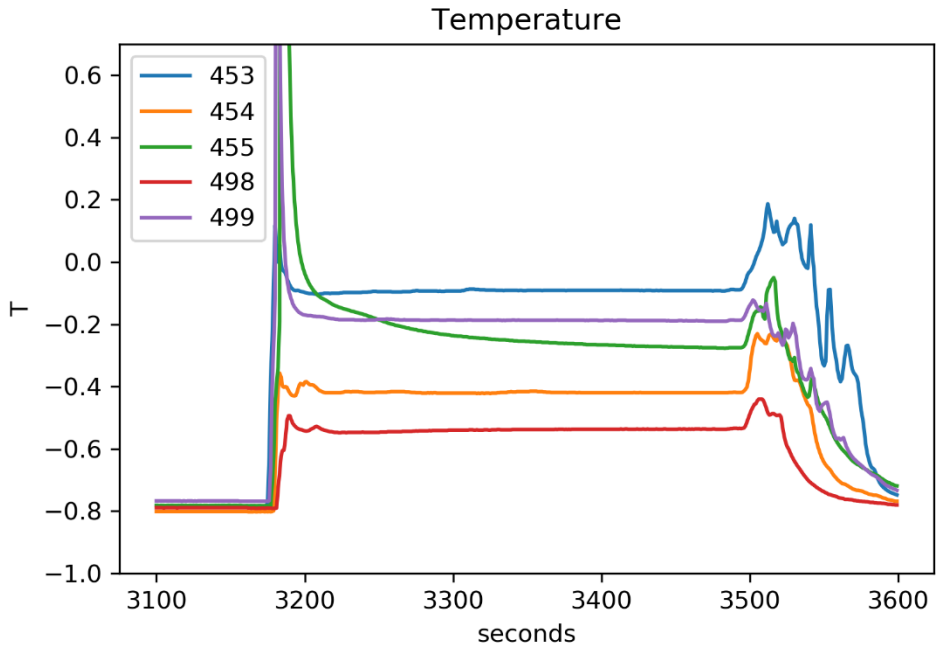

Figure 47: Temperature variation with time at station KH-06 recorded using the temperature sensors attached to the 6-m long gravity core barrel. The zero time corresponds to the penetration of the gravity core barrel.

4.5 Superstation CAGE 19-3-KH-07

Site Location

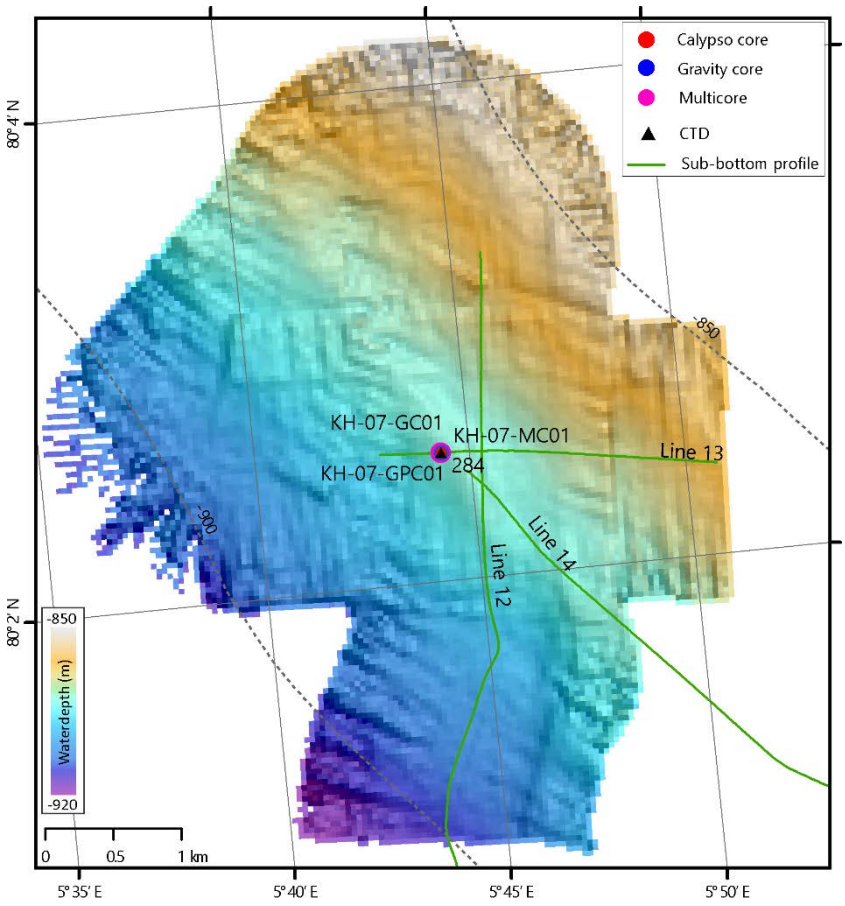

Figure 48. Location of superstation CAGE 19-3-KH-07 adjacent to the ODP 912 drill site.

Acoustics

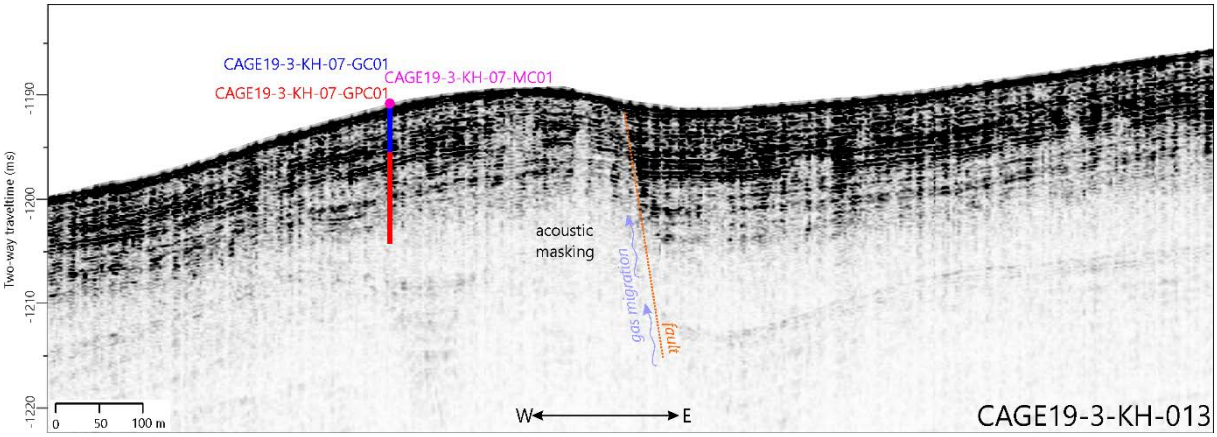

Figure 49. Sub-bottom profile at CAGE 19-3 KH-07 showing well-stratified, parallel/sub-parallel reflections. Acoustic masking adjacent to observed fault might indicate migration of gas upto the shallow sediments. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

CAGE 19-3-KH-07-MC01D was 38 cm long (Tab. 23). We took 5 pore water samples between 2 cm and 32 cm depth (>15 ml per sample), and 2 headspace samples at 27 cm and 32 cm depth. After the sampling was finished, this core was stored as an archive.

Multi Coring resumen table						
ship	**KPH**	**station**	**7**	**core**	**CAGE19-3-KH-07-MC01**	
n. cores	**4**	**av. length**	**35 cm**	**Date**	**27/10/2019, 08:46**	
Lat. N	**80.0420**		**Long. E**	**5.7390**	**Water depth**	**875.8 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (35 samples)
D	Archive (38cm), 5x pore water and 2 x headspace

Table 23. Summary table for CAGE-19-3-KH-07-MC01

Figure 50. Photo of the surface sediment of CAGE-19-3-KH-07-MC01.

Gravity Corer

The gravity corer recovered a total of 308 cm of sediment which was cut into 4 sections (Tab. 24). Water content samples and shear strength measurements were taken at the top of section 2,3, and 4. After core curation 8 headspace samples were taken through pre-drilled holes. Furthermore, 10 pore water samples (between 7 and 20 ml) were taken with the rhizon technique and split for the following analyses: anions, cations, trace elements, H2S, nutrients, DIC and Sr-isotopes.

Gravity Coring resumen table											
ship	**KPH**	**station**	**7**	**core**	**CAGE19-3-KH-07-GC01**					**WC**=water content	
n. sec	**4**	**length**	**308 cm**	**Date**	**27/10/2019, 10:14**					**SS**= smear slides	
Lat. N	**80.0420**		**Long. E**	**5.7391**	**Water depth**	**876.1 m bsl**				**HS**= Headspace	
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	4	100	208	308.00	firm silty clay	8	47 (3.2cc)		3x	4x pore water	
B	3	100	108	208.00	firm silty clay	7.8	48 (4.6cc)		2x	3 x pore water	
C	2	100	8	108	soft silty clay	6.6	49		3x	3x pore water	
D	1	8	0	8		too short					

Table 24. Summary table for CAGE19-3-KH-07-GC01

Calypso Corer

The Calypso giant piston corer recovered a total of 968 cm of sediment which was cut into 10 sections (Tab. 25). Water content samples and shear strength measurements were taken at the top of each section except for section 1. Headspace samples were taken at the top of section 7, 9, and 10 for gas analysis. Furthermore we took 16 pore water samples between 40 cmbsf and 943 cmbsf which were split for the following on-shore analyses: anions, cations, trace elements, H2S, dissolved inorganic carbon, nutrients and Sr isotopes.

Calypso Coring resumen table											
ship	**KPH**	**station**	**7**	**core**	**CAGE19-3-KH-07-GPC01**					**WC**=water content	
n. sec	**10**	**length**	**968 cm**	**Date**	**27/10/2019,**					**SS**= smear slides	
Lat. N	**80.0420**		**Long. E**	**5.7392**	**Water depth**	**876.4 m bsl**				**HS**= Headspace	
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	10	100	868	968	stiff silty clay	16.2	50 4.2cc)		X	smell of H2S pore water	
B	9	100	768	868	stiff silty clay	9.4	51 (3cc)		X	smell of H2S pore water	
C	8	100	668	768	stiff silty clay	10.8	52			pore water	
D	7	100	568	668	stiff silty clay	9.8	53 (4.8cc)		X	pore water	
E	6	100	468	568	stiff silty clay	9.6	54			pore water	
F	5	94	374	468	stiff silty clay	8.8	55 (4.5cc)			pore water	
G	4	100	274	374	firm silty clay	5.4	56			pore water	
H	3	100	174	274	firm silty clay	6	57 (4.7cc)			pore water	
I	2	100	74	174	firm clay	5.8	58 (4.5cc)			pore water	
J	1	74	0	74		too short				top polluted by saw ing microplastics/ pore w ater	
* possible coring disturbance: wet sediments with draining water											

Table 25. Summary table for CAGE 19-3-KH-07-GPC01.

Heat Flow

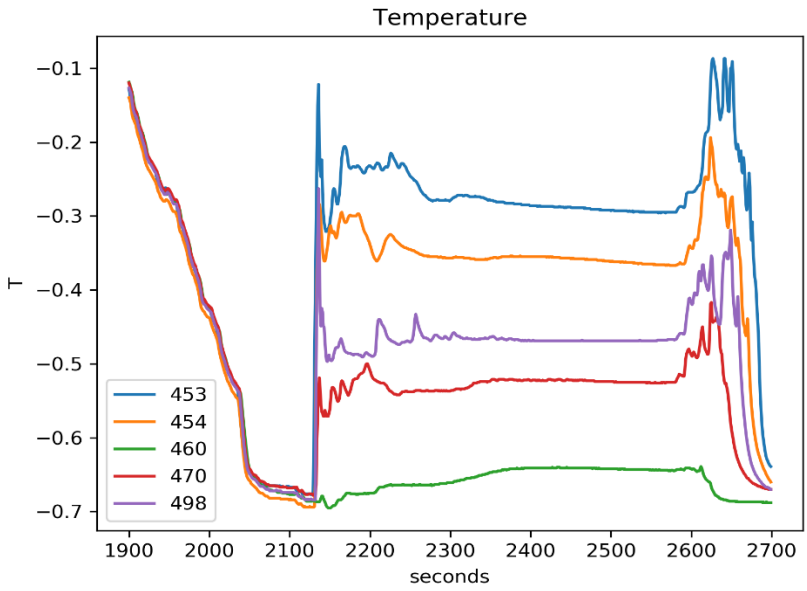

Figure 51: Temperature variation with time at station KH-07 recorded using the temperature sensors attached to the 6-m long gravity core barrel. The position of each sensor relative to the lower edge of the lead weight is indicated. The zero time corresponds to the penetration of the core barrel. The black dots indicate the equilibration temperature.

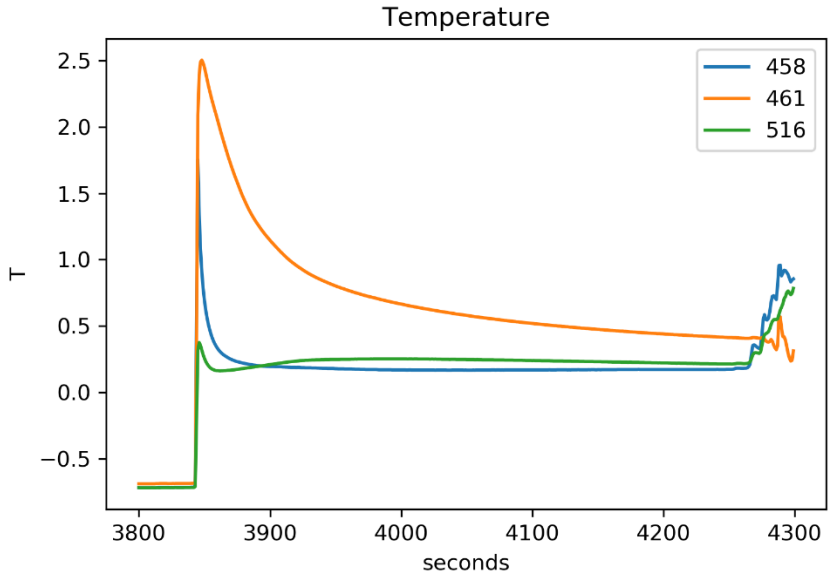

Figure 52: Temperature variation with time at station KH-07 recorded using the temperature sensors attached to the Calypso core barrel. The ID number of each sensor relative weight is indicated. The zero time corresponds to the penetration of the core barrel.

4.6 Superstation CAGE 19-3-KH-08

Site Location

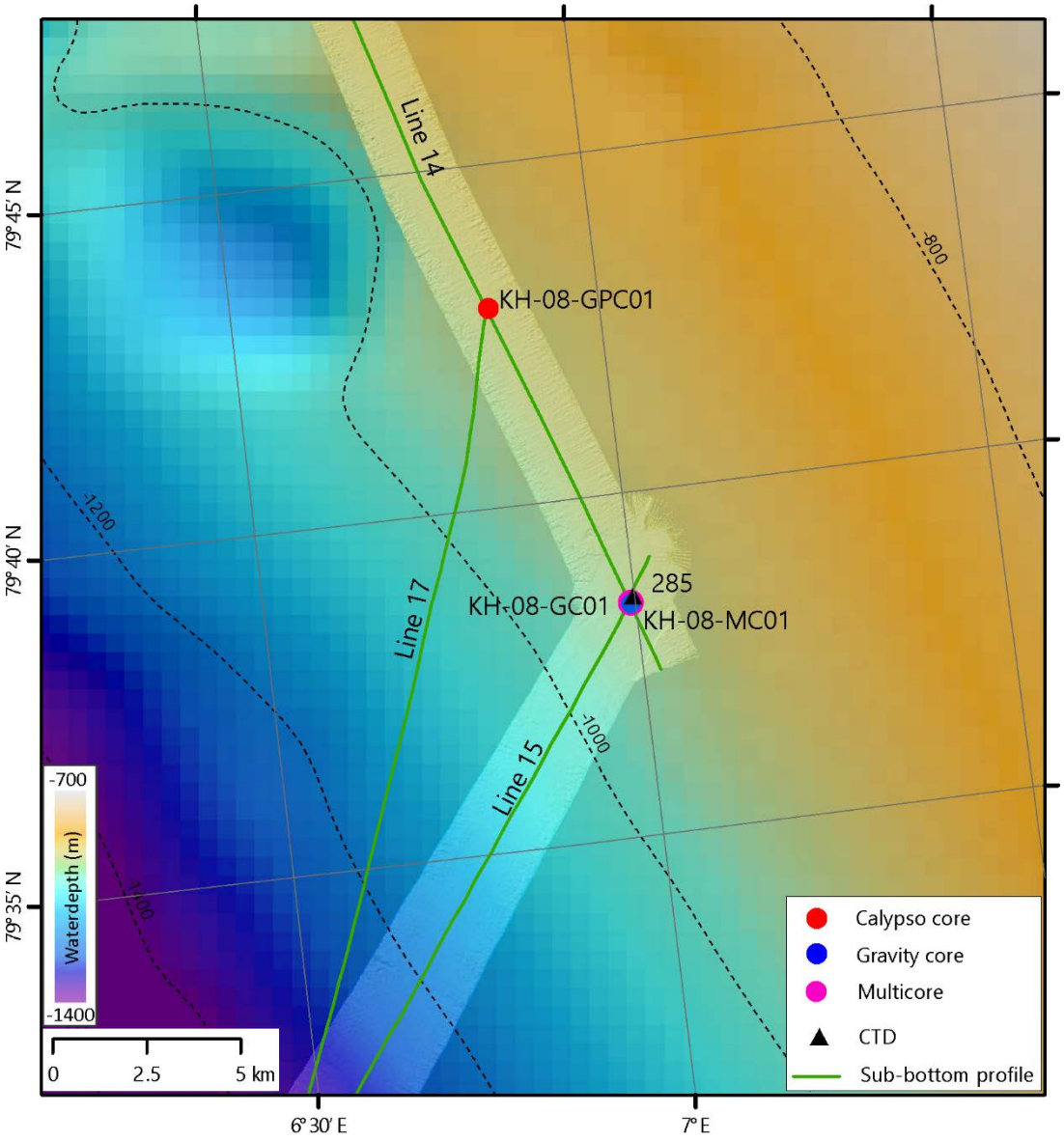

Figure 53. Location of superstation CAGE 19-3-KH-08 at the NW Svalbard slope.

Acoustics

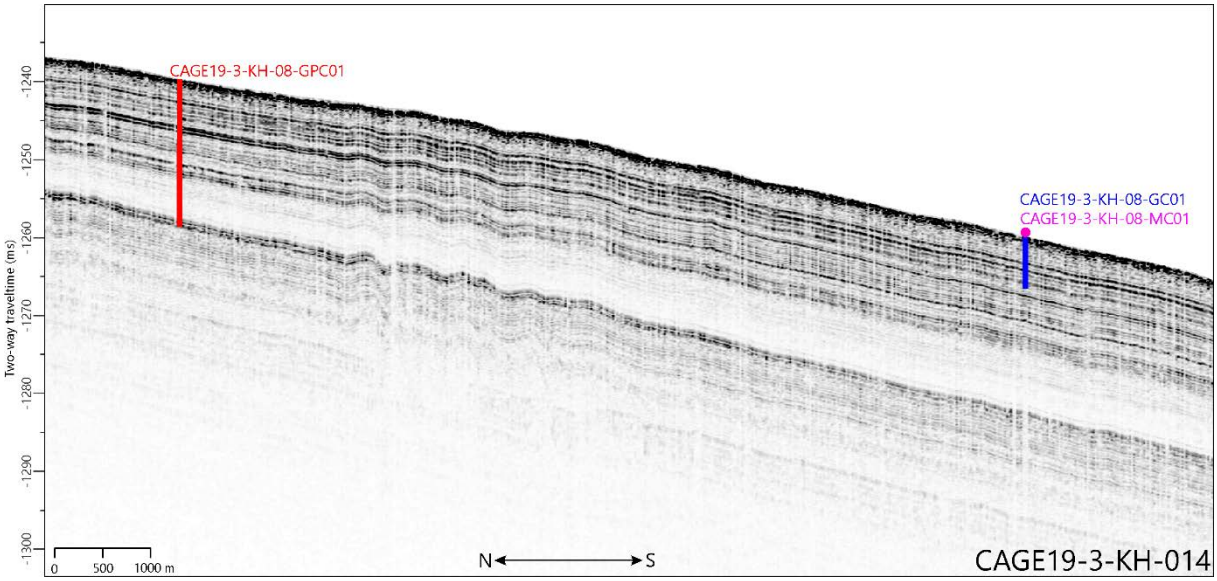

Figure 54. Sub-bottom profile at CAGE 19-3 KH-08 showing well-stratified, parallel/sub-parallel reflections Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

Four multicorer were recovered. MC01-C was sliced and MC01-D was archived (Tab. 26). MC01-A and MC01-B were sampled for DNA, biomarkers and microfossil assemblages at 0-1cm and 1-2cm. In both cores, sampling from 1-2cm interval was impeded by the distribution of gravel—sampled around as much as possible. In addition, biologic activity in core A included several shrimp and tube worms—again tried to remove as much as possible from sediment samples.

Multi Coring resumen table						
ship	KPH	station	8	core	CAGE19-3-KH-08-MC01	
n. cores	4	av. length	33 cm	Date	27/10/2019, 18:50	
Lat. N	79.6402		Long. E	6.9938	Water depth	926 m bsl

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (38 samples)
D	Archive 28 cm

Table 26. Summary table for CAGE-19-3-KH-08-MC01

Figure 55. Photo of the surface sediment of CAGE-19-3-KH-08-MC01

Gravity Corer/Heat Flow

The gravity corer recovered a total of 486 cm which was cut into 5 sections and stored in the cooler (Tab. 27).

Gravity Coring resumen table											
ship	**KPH**	**station**	**8**	**core**	**CAGE19-3-KH-08-GC01**					**WC**=water content	
n. sec	**5**	**length**	**486 cm**	**Date**	**27/10/2019, 19:33**					**SS**= smear slides	
Lat. N	**79.6401**		**Long. E**	**6.9938**	**Water depth**	**926.2 m bsl**				**HS**= Headspace	
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	5	100	386	486	firm clay						
B	4	100	286	386	soft clay						
C	3	100	186	286	soft silty clay						
D	2	100	86	186	soft silty clay						
E	1	86	0	86	soft sandy clay						

Table 27. Summary table for CAGE 19-3-KH-08-GC01.

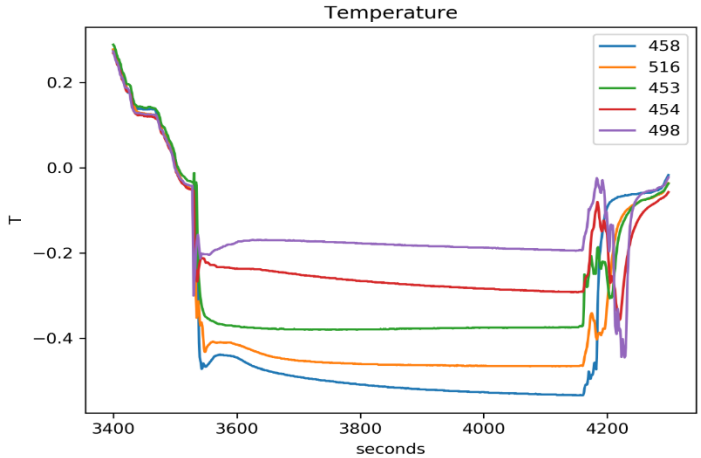

Figure 56: Temperature variation with time at station KH-08 recorded using the temperature sensors attached to the 6-m long gravity core barrel. The position of each sensor relative to the lower edge of the lead weight is indicated. The zero time corresponds to the penetration of the core barrel. The black dots indicate the equilibration temperature.

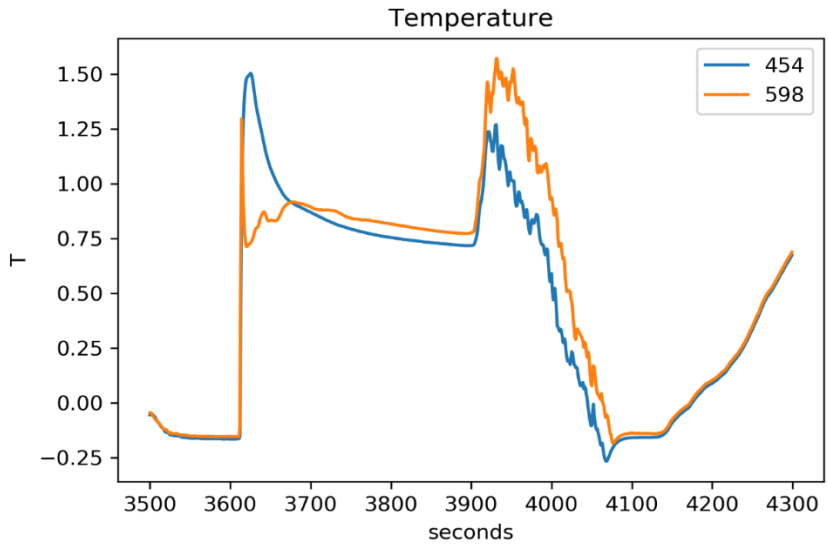

Figure 57. Temperature variation with time at station KH-08 recorded using the temperature sensors attached to the Calypso core barrel. The ID number of each sensor relative weight is indicated. The zero time corresponds to the penetration of the core barrel

Calypso Corer

The Calypso giant piston corer recovered a total of 14,05 m of sediment which were cut into 15 sections. Water content samples and shear strength measurements were taken at the top of each section except for section 1 and 4 (Table 28). Headspace samples were taken from the top of section 11, 14, and 15.

Calypso Coring resumen table											
ship	**KPH**	**station**	**8**	**core**	**CAGE19-3-KH-08-GPC01**			**WC**=water content			
n. sec	**15**	**length**	**14.05 m**	**Date**	**28/10/2019, 08:24**			**SS**= smear slides			
Lat. N	**79.7151**		**Long. E**	**6.8504**	**Water depth**	**914.9 m bsl**		**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	15	100	1305	1405	very stiff clay	19.2	59 (4.2cc)	38 & 39	X	ss at the base and top	
B	14	100	1205	1305	very stiff clay	12.4	60		X		
C	13	100	1105	1205	very stiff clay	12	61	40			
D	12	100	1005	1105	stiff clay	14.8	62				
E	11	100	905	1005	stiff clay	14.6	63	41	X		
F	10	95	810	905	stiff clay	14.4	64 4.2cc)	42			
G	9	100	710	810	stiff clay	12.6	65	43			
H	8	100	610	710	stiff clay	10.8	66 /4cc)			draining water	
I	7	100	510	610	firm clay	9.8	67 (4.5cc)	44		draining water	
J	6	100	410	510	firm clay	6	68			draining water	
K	5	100	310	410	firm clay	7.6	69	45		draining water	
L	4	95	215	310	firm sticky clay	cannot measure	-			draining water	
M	3	100	115	215	soft silty clay	4.6	70	46			
N	2	100	15	115	soft sandy clay	0.4	71				
O	1	15	0	15							

Table 28. Summary table for CAGE 19-3-KH-08-GPC01.

Smear slides:
Nine smear slides were prepared using a small sediment sample (1-2mm3) collected with a toothpick from the top of every second core section (sections 3, 5, 7, 9, 10, 11, 13, 15), and the base of the core section 15. Results show variations between silty clay in the deepest section (section 15) and clay throughout the rest of the core sections (sections 3-13), with a

predominant terrigenous composition throughout. Sediment colour observed along all the sections is very dark gray. Cf. smear slides in Table 29.

Smear Slide #	Core	Section		Location sample was taken from	Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
38	CAGE 19-3-KH-08-GPC01	A	15	Base of section	1405	5 Y 3/1	Very dark gray	Silty Clay		20	80	Terrigenous	
39	CAGE 19-3-KH-08-GPC01	A	15	Top of section	1305	5 Y 3/1	Very dark gray	Silty Clay	1	20	79	Terrigenous	
49	CAGE 19-3-KH-08-GPC01	C	13	Top of section	1105	5 Y 3/1	Very dark gray	Clay		3	97	Terrigenous	
41	CAGE 19-3-KH-08-GPC01	E	11	Top of section	905	5 Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
42	CAGE 19-3-KH-08-GPC01	F	10	Top of section	810	5 Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
43	CAGE 19-3-KH-08-GPC01	G	9	Top of section	710	5 Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
44	CAGE 19-3-KH-08-GPC01	I	7	Top of section	510	5 Y 3/1	Very dark gray	Clay		1	99	Terrigenous	
45	CAGE 19-3-KH-08-GPC01	K	5	Top of section	310	5 Y 3/1	Very dark gray	Clay		1	99	Terrigenous	
46	CAGE 19-3-KH-08-GPC01	M	3	Top of section	115	5 Y 3/1	Very dark gray	Clay		3	97	Terrigenous	

Table 29: Smear slide overview for CAGE-19-3-KH-08-GPC01

4.7 Superstation CAGE 19-3-KH-09

Site Location

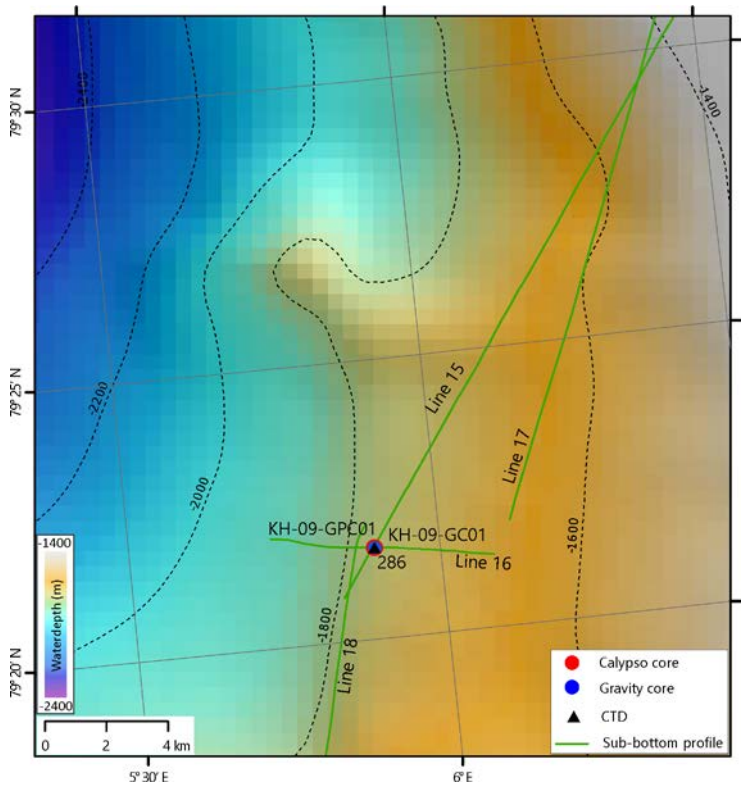

Figure 58. Location of superstation CAGE 19-3-KH-09 at the NW Svalbard slope.

Acoustics

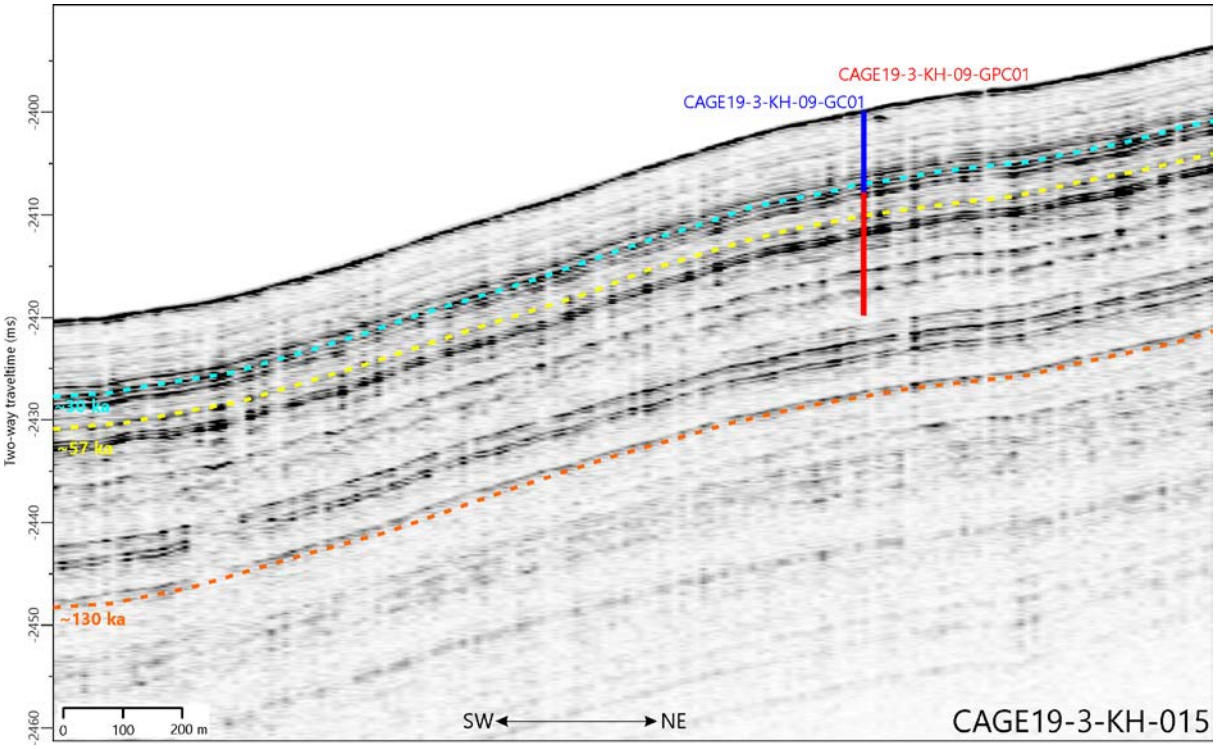

Figure 59. Sub-bottom profile at CAGE 19-3 KH-09 showing well-stratified, parallel/sub-parallel reflections. Approximate ages of the observed reflections Dessandier et al. (in prep) and Schneider et al. (2018) are extended from the Vestenesa Ridge. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

The Multicorer was not deployed due to strong current and potential for equipment damage. In its place, a Gravity Corer was deployed.

Gravity Corer/Heat Flow

The gravity corer recovered a total of 575 cm of sediment which was cut into 6 sections. The four deepest segments were sampled for DNA work, the top 2 segments (~1.5m) were not sampled. These samples will be analyzed back in Bergen as part of a methods study for environmental DNA found in Arctic cores. DNA samples were taken from the top of section 3,4,5, and 6 (Table 30).

Gravity Coring resumen table											
ship	**KPH**	**station**	**9**	**core**	**CAGE19-3-KH-09-GC01**					**WC**=water content	
n. sec	**6**	**length**	**575 cm**	**Date**	**28/10/2019, 17:51**					**SS**= smear slides	
Lat. N	**79.3607**		**Long. E**	**5.89406**	**Water depth**	**1766 m bsl**				**HS**= Headspace	
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	6	100	475	575	firm clay					DNA	
B	5	100	375	475	firm clay					DNA	
C	4	100	275	375	soft clay					DNA	
D	3	100	175	275	soft clay					DNA	
E	2	100	75	175	soft clay						
F	1	75	0	75							

Table 30. Summary table for CAGE 19-3-KH-09-GC01

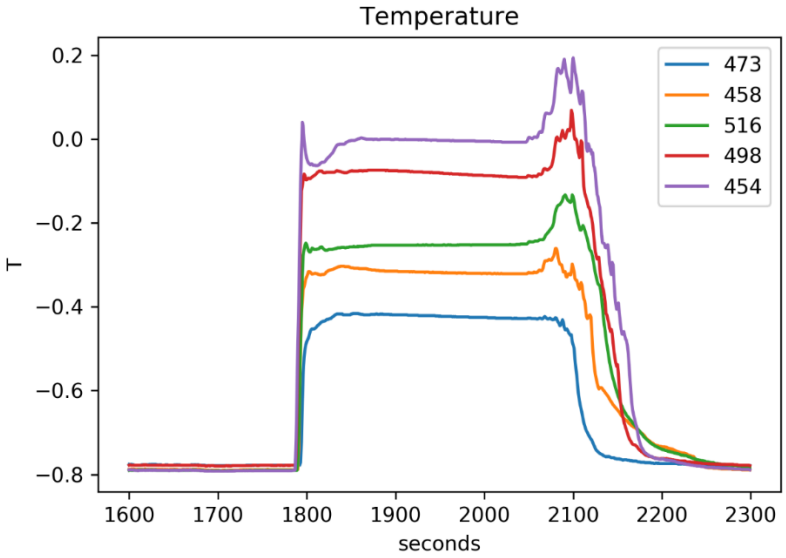

Figure 60: Temperature variation with time at station KH-09 recorded using the temperature sensors attached to the 6-m long gravity core barrel. The position of each sensor relative to the lower edge of the lead weight is indicated. The zero time corresponds to the penetration of the core barrel. The black dots indicate the equilibration temperature

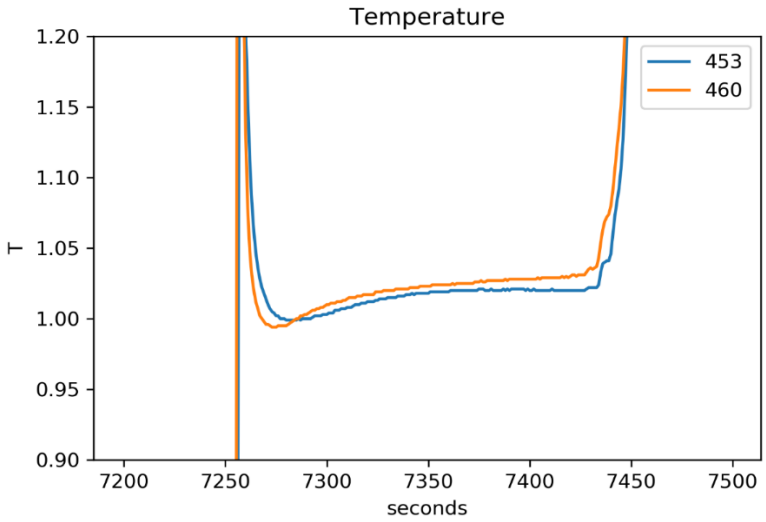

Figure 61: Temperature variation with time at station KH-09 recorded using the temperature sensors attached to the Calypso core barrel. The ID number of each sensor relative weight is indicated. The zero time corresponds to the penetration of the core barrel.

Calypso Corer

The Calypso giant piston corer recovered a total of 14.81 m sediment which were cut into 15 sections. Water content samples and shear strength measurements were taken at the top of each section except for section 1. For sections 10 and 4, water content samples were taken at the base of each section. We took three headspace samples from the top of section 12, 14, and 15 for gas analysis (Table 31).

Calypso Coring resumen table											
ship	**KPH**	**station**	**9**	**core**	**CAGE19-3-KH-09-GPC01**			**WC**=water content			
n. sec	**15**	**length**	**14.81 m**	**Date**	**28/10/2019, 14:51**			**SS**= smear slides			
Lat. N	**79.3607**		**Long. E**	**5.89411**	**Water depth**	**1767 m bsl**		**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	15	100	1381	1481	very stiff clay	17.4	72	47	x		
B	14	100	1281	1381	very stiff clay	16.8	73		x		
C	13	100	1181	1281	very stiff clay	18	74				
D	12	100	1081	1181	very stiff clay	18	75	48	x	draining water	
E	11	100	981	1081	very stiff clay	14	77			draining water	
F	10	95	886	981	firm clay	13.8	78 base			draining water	
G	9	100	786	886	soft clay	11	76	49		draining water	
H	8	100	686	786	firmclay	8.2	79			draining water	
I	7	100	586	686	firm clay	8.8	80			draining water	
J	6	100	486	586	firm clay	7.6	81 (4.5cc)	50		draining water	
K	5	100	386	486	soft clay	7.2	82 (4.6cc)			draining water	
L	4	95	291	386	soft clay	7.4	83 base			draining water	
M	3	100	191	291	soft clay	3.8	84	51		draining water	
N	2	100	91	191	soft clay	3.4	85			draining water	
O	1	91	0	91		too short				draining water	

Table 31. Summary table for CAGE 19-3-KH-09-GPC01.

Smear Slides

Calypso core GPC01: Five smear slides were prepared using a small sediment sample (1-2mm3) collected with a toothpick from the top of every third core section (sections 3, 6, 9, 10, 11, 12, 15). The lithology observed along the sections is clay with a terrigenous composition. The sample from section 12 had a 3% biogenic component. Sediment colour varied between very dark gray and dark gray. Cf. smear slides in Table 32.

Smear Slide #	Core	Section		Location sample was taken from	Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
47	CAGE 19-3-KH-09-GPC01	A	15	Top of section	1381	5 Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
48	CAGE 19-3-KH-09-GPC01	D	12	Top of section	1081	5 Y 3/1	Very dark gray	Clay		5	95	Terrigenous	3% biogenic
49	CAGE 19-3-KH-09-GPC01	F	9	Top of section	786	5 Y 4/1	Dark gray	Clay		5	95	Terrigenous	
50	CAGE 19-3-KH-09-GPC01	J	6	Top of section	486	5 Y 4/1	Dark gray	Clay		5	95	Terrigenous	
51	CAGE 19-3-KH-09-GPC01	M	3	Top of section	191	5 Y 3/1	Very dark gray	Clay		5	95	Terrigenous	

Table 32: Smear slide overview for CAGE-19-3-KH-09-GPC01

4.8 Superstation CAGE 19-3-KH-10

Site Location

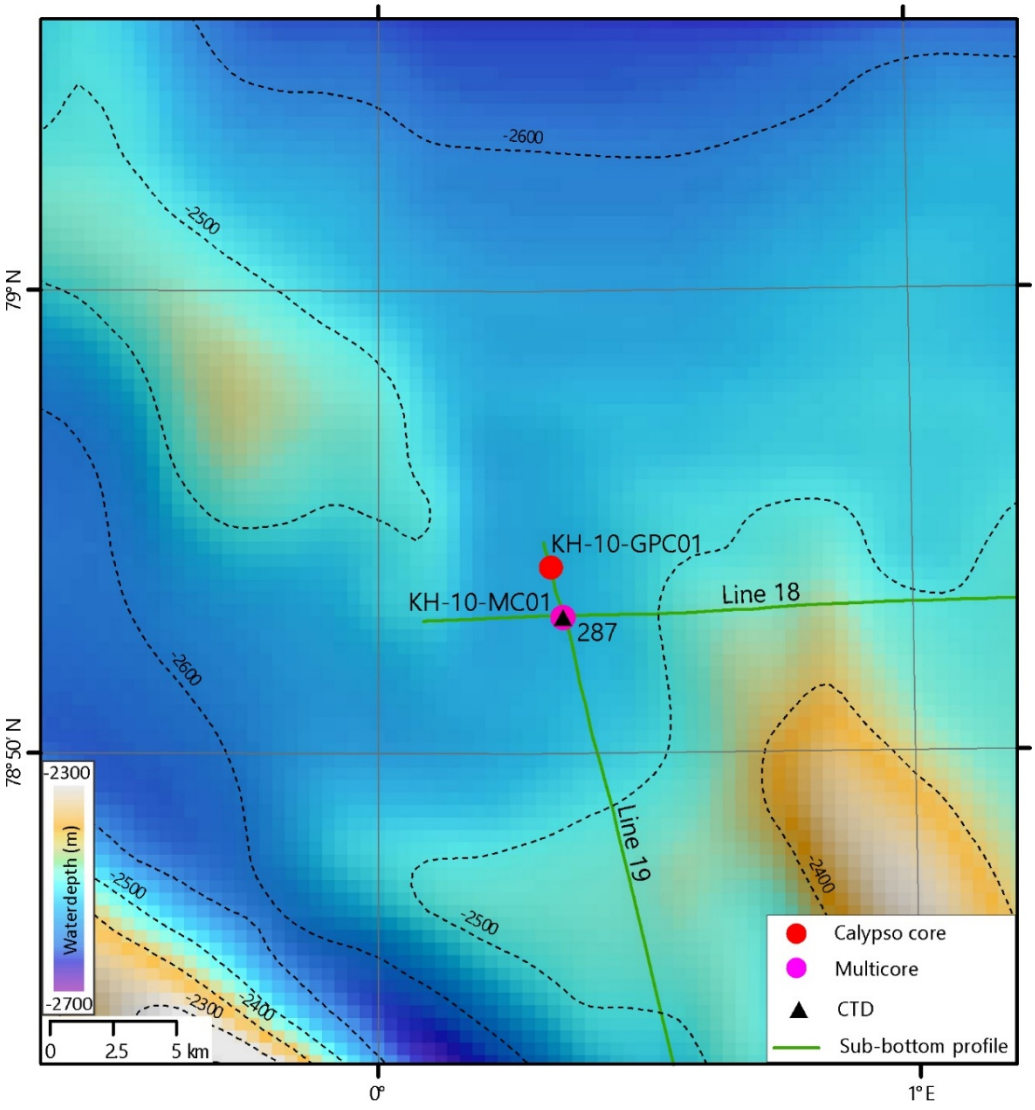

Figure 62. Location of superstation CAGE 19-3-KH-10 at the central Fram Strait.

Acoustics

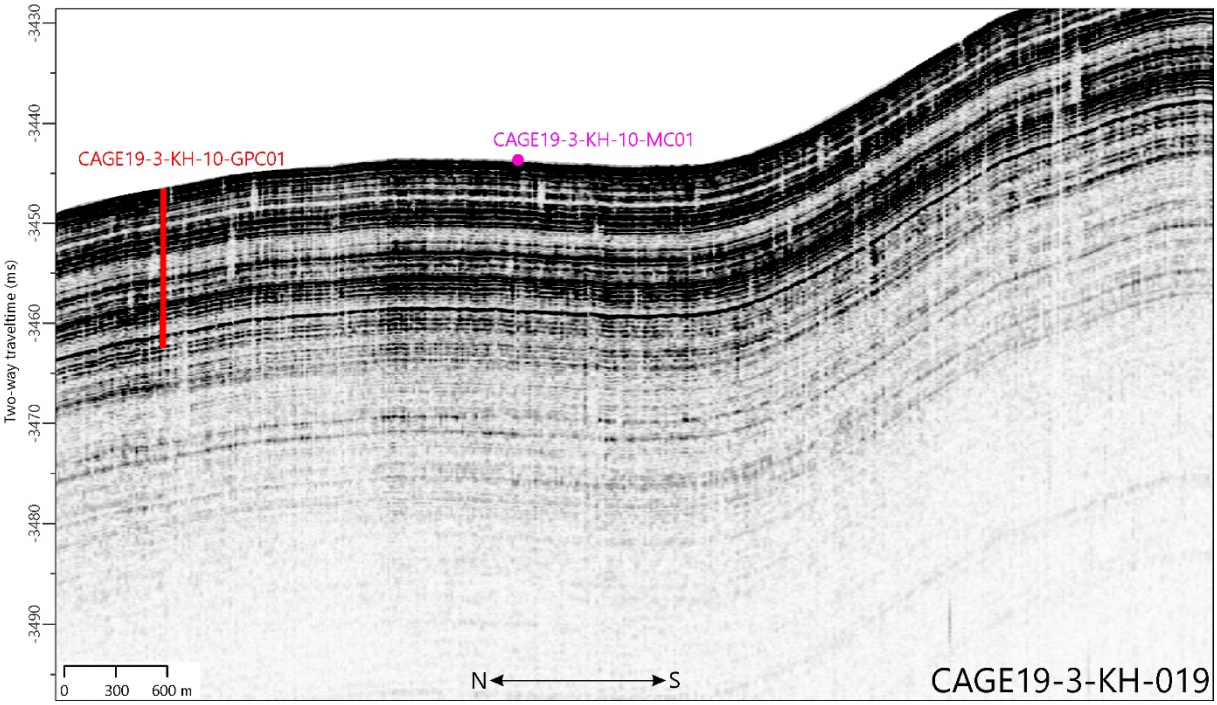

Figure 63. Sub-bottom profile at CAGE 19-3 KH-10 showing well-stratified, parallel/sub-parallel reflections. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

Two multicores were dedicated to DNA work—MC01-A (40 cm of sediment) and MC01-B (39.5 cm of sediment). Each core was sampled within one hour of recovery. Surface sediment samples were collected from the 0-1cm layer and 1-2cm layer for environmental DNA, biomarker, and palynology. DNA samples for each layer averaged 25.4 g (wet weight) while biomarker samples averaged 39.6 g (wet weight), and palynology samples averaged 45.8 g (wet weight). Both the A and B core had a lot of shell fragments present at the surface. MC01-B had a rock present at the 0-2cm interval but pressed against the core liner and was easily sampled around. Analysis of surface sediments will be completed in Bergen. MC01-C was sliced and MC01-D was archived (Table 33).

Multi Coring resumen table					
ship	KPH	station	10	core	CAGE19-3-KH-10-MC01
n. cores	4	av. length	38 cm	Date	29/10/2019, 09:56
Lat. N	78.8836	Long. E	0.34583	Water depth	2541 m bsl

Core	Analyses/Destination
A	DNA (40 cm)
B	DNA (39.5 cm)
C	Sliced at 1-cm (38 samples)
D	Archive

Table 33. Summary table for CAGE 19-3-KH-10-MC01

Figure 64. Photo of the surface sediment of CAGE-19-3-KH-10-MC01

Calypso Corer

The Calypso giant piston corer recovered a total of 1175 cm of sediment which were cut into 12 sections (Tab. 34). Water content samples and shear strength measurements were taken

from the top of each section except for sections 1 and 7. Headspace samples were taken from the top of section 9, 11, and 12 (Table 34).

Calypso Coring resumen table										
ship	**KPH**	**station**	**10**	**core**	**CAGE19-3-KH-10-GPC01**		**WC**=water content			
n. sec	**12**	**length**	**11.75 m**	**Date**	**29/10/2019, 12:53**		**SS**= smear slides			
Lat. N	**78.9005**		**Long. E**	**0.32351**	**Water depth**	**2542 m bsl**	**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	12	86	1089	1175	very stiff clay	19	86 (4.6cc)	52	X	
B	11	100	989	1089	very stiff clay	25	87		X	
C	10	100	889	989	stiff clay	11	88	53		
D	9	100	789	889	stifgf clay	10.8	89		X	
E	8	100	689	789	firm clay	12	90	54		
F	7	95	594	689	firm clay	12				
G	6	100	494	594	firm clay	10	91 (3.6cc)	55		
H	5	100	393.5	493.5	soft clay	8.8	92 (4cc)			
I	4	100	293.5	393.5	soft clay	10	93 (4.3cc)	56		
J	3	100	193.5	293.5	soft silty clay	4.8	94			
K	2	100	93.5	193.5	soft silty clay	5.6	95	57		
L	1	93.5	0	93.5	soupy silty clay					

Table 34. Summary table for CAGE 19-3-KH-10-GPC01.

Smear slides:
Six smear slides were prepared using a small sediment sample (1-2mm3) collected with a toothpick from the top of every second section (section 2, 4 6, 8, 10 and 12). Results show variations between clay (sections 2, 4, 8 and 10) and silty clay (sections 6 and 12) with a predominant terrigenous composition in all sections. Sediment colour varied between olive gray, dark olive gray, olive brown, dark gray and very dark gray. Cf. smear slides in Table 35.

Smear Slide #	Core	Section		Location sample was taken from	Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
52	CAGE 19-3-KH-10-GPC01	A	12	Top of section	1089	5 Y 3/1	Very dark gray	Silty Clay	5	20	75	Terrigenous	
53	CAGE 19-3-KH-10-GPC01	C	10	Top of section	889	5 Y 3/1	Very dark gray	Clay	1	5	94	Terrigenous	
54	CAGE 19-3-KH-10-GPC01	E	8	Top of section	689	5 Y 3/2	Dark olive gray	Clay		5	95	Terrigenous	
55	CAGE 19-3-KH-10-GPC01	G	6	Top of section	494	5 Y 4/1	Dark gray	Silty Clay	5	20	75	Terrigenous	
56	CAGE 19-3-KH-10-GPC01	I	4	Top of section	293.5	5 Y 4/2	Olive gray	Clay		3	97	Terrigenous	
57	CAGE 19-3-KH-10-GPC01	K	2	Top of section	93.5	2,5 Y 4/3	Olive brown	Clay		5	95	Terrigenous	

Table 35. Smear slide overview for CAGE-19-3-KH-10-GPC01

4.9 Superstation CAGE 19-3-KH-011

Site Location

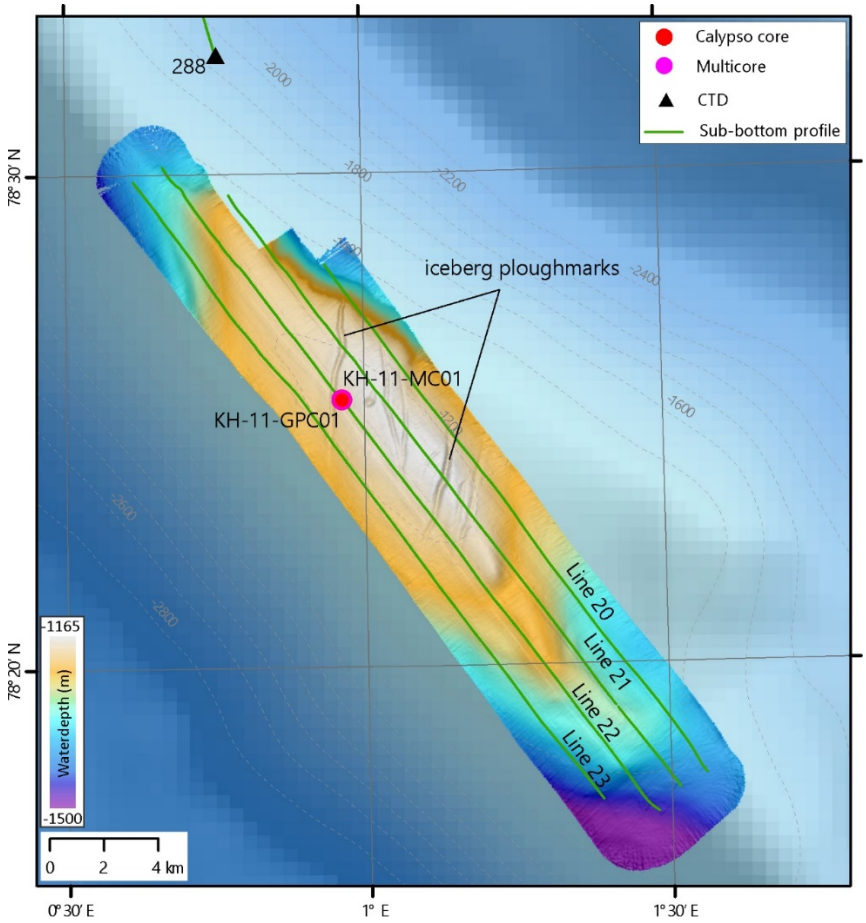

Figure 65. Location for superstation CAGE 19-3-KH-11 at the crest of Hovgård Ridge in the Fram Strait. The acquired multibeam bathymetry highlight the iceberg ploughmarks on the seafloor.

Acoustics

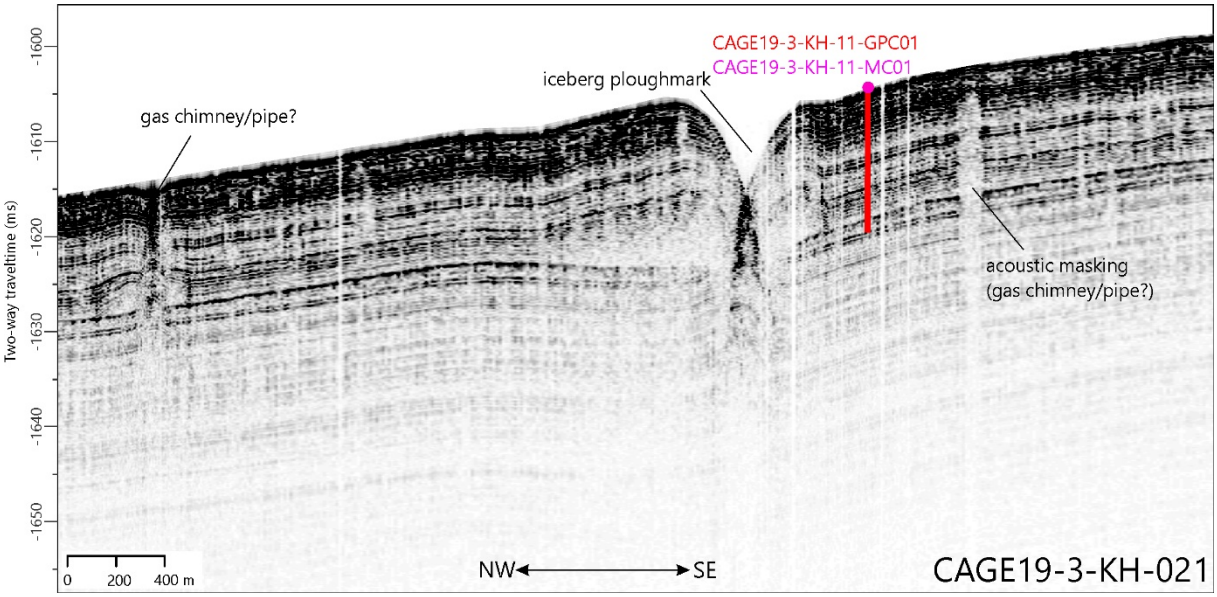

Figure 66. Sub-bottom profile at CAGE 19-3 KH-11 showing well-stratified, parallel/sub-parallel reflections along with an iceberg ploughmark. Chaotic reflections at the deeper parts of the ploughmarks might indicate deformation of sediments. Vertical regions of acoustic masking are also observed suggesting potential pathways for fluid migration. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

The multicorer recovered 4 cores. MC01-C was sliced and MC01-D was archived (Table 36). MC01-A and -B were dedicated to DNA studies.

Multi Coring resumen table							
ship	**KPH**	**station**	**11**	**core**	**CAGE19-3-KH-11-MC01**		
n. cores	**4**	**av. length**	**38 cm**	**Date**	**30/10/2019, 10:24**		
Lat. N	**78.4236**		**Long. E**	**0.96223**	**Water depth**	**1182 m bsl**	

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (34 samples)
D	Archive 39 cm

Table 36. Summary table for CAGE 19-3-KH-11-MC01

Figure 67. Photo of surface sediment of CAGE-19-3-KH-11-MC01

Calypso Corer

The Calypso giant piston corer recovered a total of 1083 cm of sediment which was cut into 12 sections (Table 37).

Calypso Coring resumen table										
ship	**KPH**	**station**	**11**	**core**	**CAGE19-3-KH-11-GPC01**		**WC**=water content			
n. sec	**11**	**length**	**10.83 m**	**Date**	**30/10/2019, 12:51**		**SS**= smear slides			
Lat. N	**78.4236**		**Long. E**	**0.96223**	**Water depth**	**1182**	**HS**= Headspace			

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	11	100	983	1083	very stiff clay	17.2	96 (4.5cc)	58	X	
B	10	100	883	983	very stiff clay	16.6	97		X	
C	9	100	783	883	stiff clay	8	98	59		
D	8	100	683	783	stifgf clay	25	99 (4.8cc)		X	
E	7	100	583	683	firm clay	18	100 (2.6cc)	60		wet sediment*
F	6	95	488	583	firm clay	17.6	101			wet sediment*
G	5	100	388	488	firm clay	8	102	61		wet sediment*
H	4	100	288	388	soft clay	11.2	103			wet sediment*
I	3	100	188	288	soft clay	7.4	104	62		wet sediment*
J	2	100	88	188	soft silty clay	6.2	105			wet sediment*
K	1	88	0	88	soft silty clay	disturbed surface		63		

* coring disturbance

Table 37. Summary table for CAGE 19-3-KH-11-GPC01.

Smear slides:
Six smear slides were prepared using a small sediment sample (1-2mm3) collected with a toothpick from the top of every second section (sections 1, 3, 5, 7, 9 and 11). Results show variations between silty clay (sections 1, 3, 5, 7 and 11) and sandy clay (sections 9), with a predominant terrigenous composition in all sections except section 1, which was a

biosiliceous-bearing silty clay with a mixed composition of terrigenous (80%) and biogenic (20%). Sediment colour varied between dark olive gray, dark gray and very dark gray. Cf. smear slides in Table 38.

Smear Slide #	Core	Section		Location sample was taken from	Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
58	CAGE 19-3-KH-11-GPC01	A	11	Top of section	983	5Y 3/1	Very dark gray	Silty Clay	3	20	77	Terrigenous	
59	CAGE 19-3-KH-11-GPC01	C	9	Top of section	783	5Y 4/1	Dark gray	Sandy clay	15	10	70	Terrigenous	
60	CAGE 19-3-KH-11-GPC01	E	7	Top of section	583	5Y 4/1	Dark gray	Silty Clay		20	80	Terrigenous	
61	CAGE 19-3-KH-11-GPC01	G	5	Top of section	388	5Y 4/1	Dark gray	Silty Clay	3	20	77	Terrigenous	
62	CAGE 19-3-KH-11-GPC01	I	3	Top of section	188	5Y 3/2	Dark olive gray	Silty Clay	3	20	77	Terrigenous	
63	CAGE 19-3-KH-11-GPC01	K	1	Top of section	0	5Y 3/2	Dark olive gray	Silty Clay	3	20	77	Terrigenous	Biosiliceous-bearing silty clay

Table 38. Smear slide overview for CAGE-19-3-KH-11-GPC01

Heat Flow

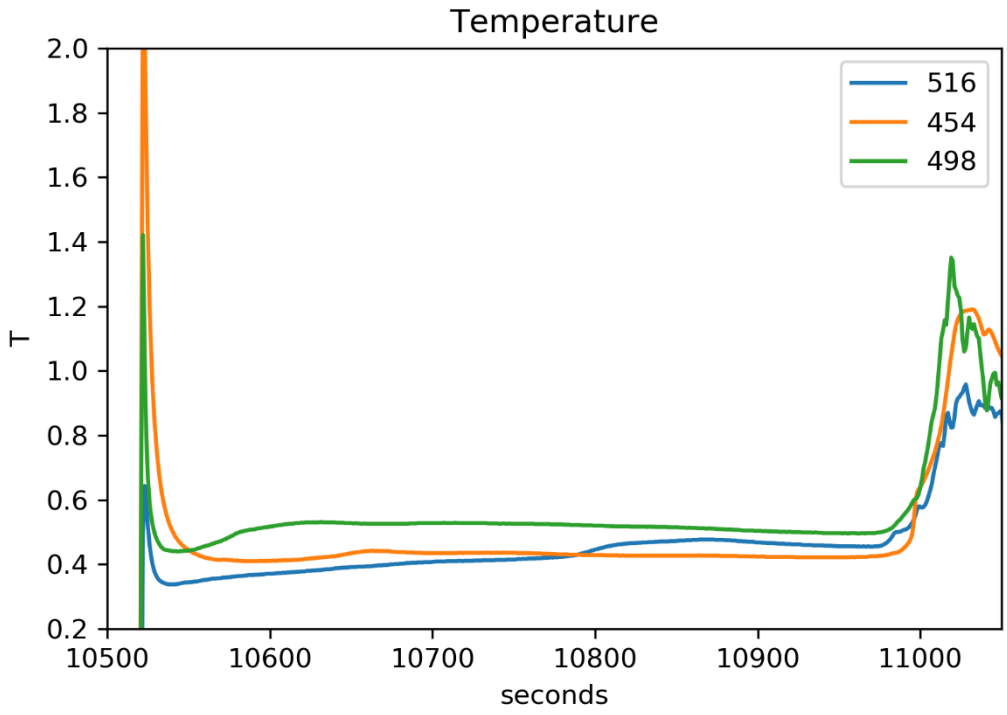

Figure 68: Temperature variation with time at station KH-10 recorded using the temperature sensors attached to the Calypso core barrel. The ID number of each sensor relative weight is indicated. The zero time corresponds to the penetration of the core barrel.

4.10 Superstation CAGE 19-3-KH-12

Site Location

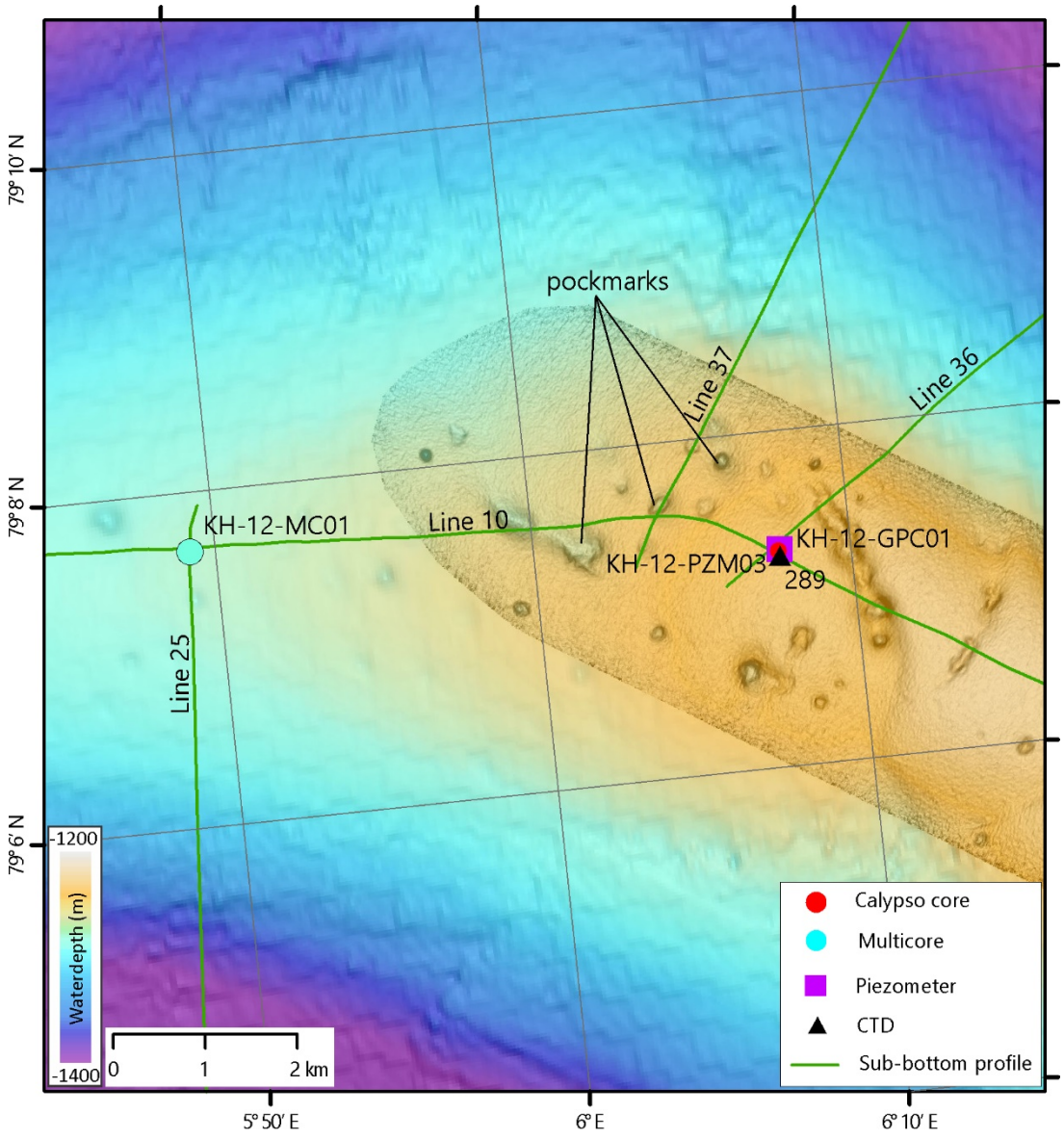

Figure 69. Location of superstation CAGE 19-3-KH-12 at the central heavily pockmarked, inactive region of the Vestnesa Ridge. High-resolution bathymetry from CAGE-18-4 cruise.

Acoustics

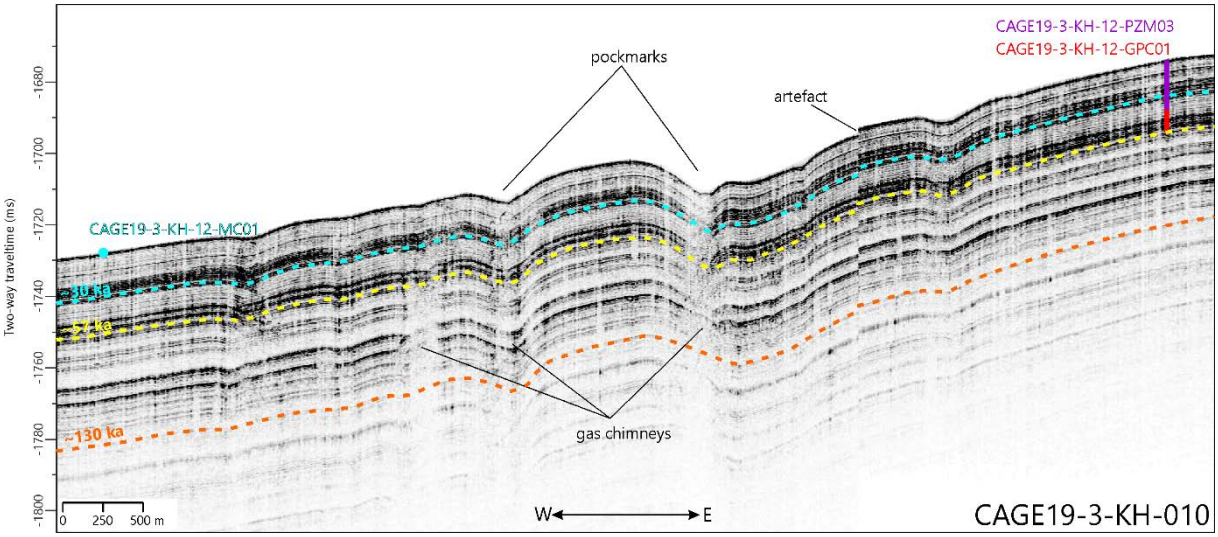

Figure 70. Sub-bottom profile at CAGE 19-3 KH-12 showing well-stratified, parallel/sub-parallel reflections disturbed by vertical fluid migration pathways and pockmarks. Approximate ages of the observed reflections from Dessandier et al. (in prep) and Schneider et al. (2018). Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

Four MC were recovered from the first deployment (Tab. 39). MC01-A and MC01-B dedicated to AGENSI project for DNA sampling; sampled the surface for marine snow, 0-1cm, and 1-2cm. Sediment collected for aDNA, IP_{25}, and palynology.

Multi Coring resumen table						
ship	**KPH**	**station**	**12**	**core**	**CAGE19-3-KH-12-MC01**	
n. cores	**4**	**av. length**	**45 cm**	**Date**	**31/10/2019, 20:30**	
Lat. N	**79.1276**		**Long. E**	**5.8201**	**Water depth**	**1271 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (44 samples)
D	Archive 47.5 cm

Table 39. Summary table for CAGE 19-3-KH-12-MC01

Calypso Corer

The Calypso giant piston corer recovered 14.6 m of sediment which were cut into 15 sections (Tab. 40). Water content and shear strength measurements were taken from the top of each section, except section 1. Headspace samples were collected from the top of section 12, 13, 14, 15 and from the core catcher. One pore water sample was taken from each section, because of interesting data from the piezometer.

Calypso Coring resumen table										
ship	**KPH**	**station**	**12**	**core**	**CAGE19-3-KH-12-GPC01**		**WC**=water content			
n. sec	**15**	**length**	**14.60 m**	**Date**	**04/11/2019, 08:42**		**SS**= smear slides			
Lat. N	**79.1216**		**Long. E**	**6.12847**	**Water depth**	**1234.13 m bsl**	**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	15	100	1360	1460	firm clay	16.2	158 (3.8cc)		X	1x pore water
B	14	101	1259	1360	firm clay	12.8	159		X	wet sediments*, 1x pore water
C	13	100	1159	1259	firm clay	10.2	160		X	wet sediments, 1x pore water
D	12	100	1059	1159	firm silty clay	8.4	161		X	lot of water, 1x pore water
E	11	100	959	1059	firm clay	10	162 (3.8cc)			1x pore water
F	10	95	864	959	soft clay	9.6	163 (4.6cc)			wet sediments, 1x pore water
G	9	100	764	864	firm clay	9.4	164 (4.4cc)			1x pore water
H	8	100	664	764	firm clay	8.8	165			1x pore water
I	7	100	564	664	soft clay	8.4	166 (3.4cc)			1x pore water
J	6	100	464	564	soft clay	5.6	167			1x pore water
K	5	100	364	464	soft sandy clay	5.8	168 (5.2cc)			1x pore water
L	4	95	269	364	soft silty clay	5.8	169			1x pore water
M	3	100	169	269	soft clay	5.6	170 (4.6cc)			1x pore water
N	2	100	69	169	soft clay	4.4	171			1x pore water
O	1	69	0	69		too short				16 cm of foam
	CC						157 (4.4cc)		X	

Table 40. Summary table for CAGE 19-3-KH-12-GPC01

Piezometer

At station CAGE 19-3-KH-12, a piezometer (KH-PZM3) of 9.92 m length equipped with 9 sensors was deployed. The position of sensors is shown in Table 41. KH-PZM 3 is expected to measure pore pressure and temperature during 4 days.

Sensor ID	Section length (cm)	Sensor depth (cmbsf)
1116	75	79
1051	150	234
1132	75	314
1055	150	469
1146	75	549
1235	150	704
1237	75	784
1144	75	864
1246	75	944
Total length (cm)		991.5

Table 41. Piezometer KH-PZM 3: position of sensors.

4.11 Superstation CAGE 19-3-KH-13

Site Location

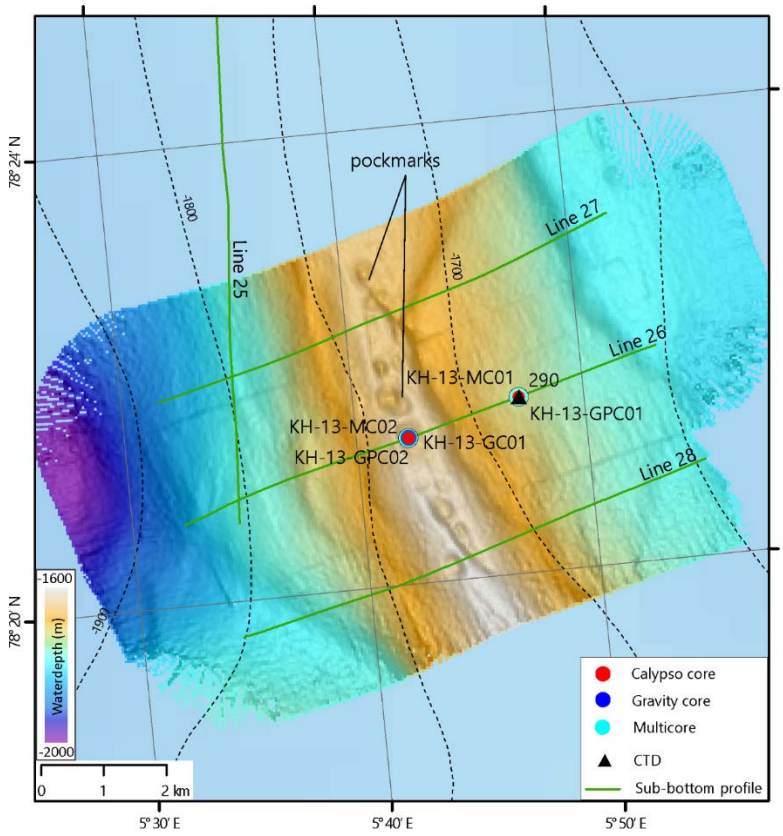

Figure 71. Location of superstation CAGE 19-3-KH-13 at the Svyatogor Ridge along with acquired multibeam bathymetry highlighting pockmarks at the seafloor.

Acoustics

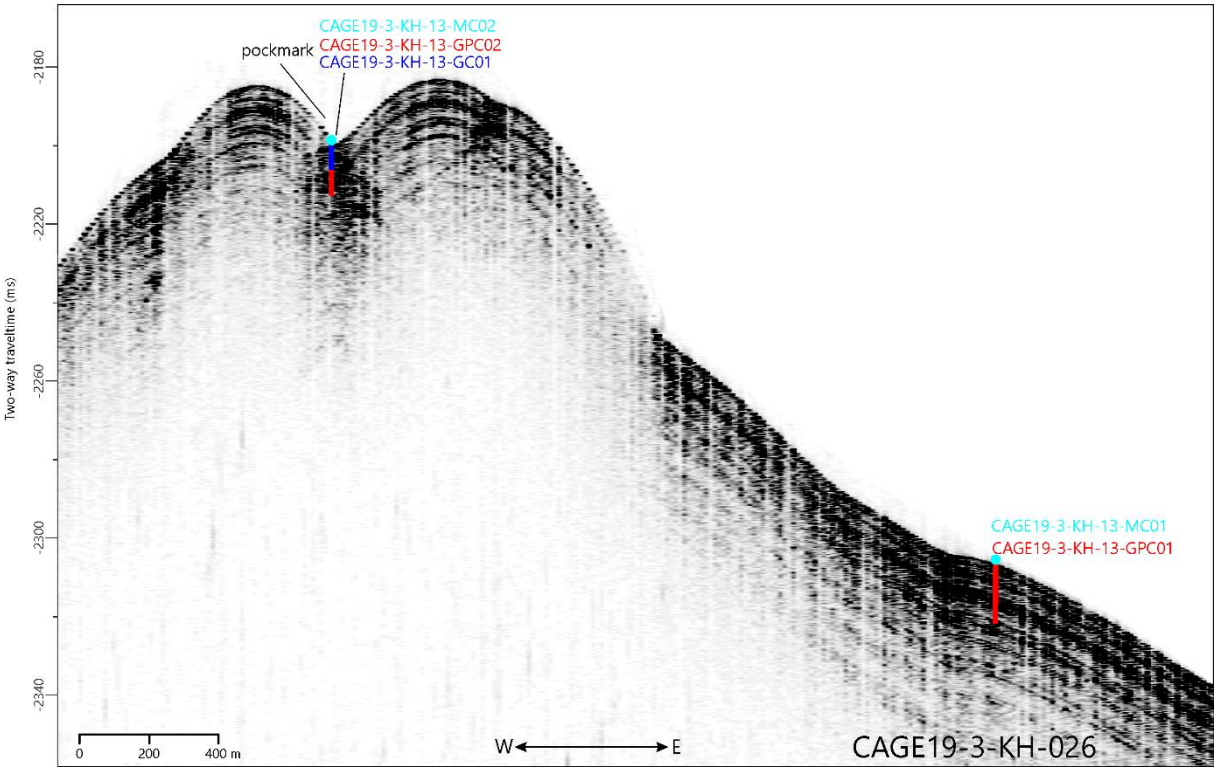

Figure 72. Sub-bottom profile at CAGE 19-3 KH-13 showing well-stratified, parallel/sub-parallel reflections disturbed by gas chimney and pockmark at the crest of the Svyatogor Ridge. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

We deployed the multicorer twice at station KH-13. MC01-A and -B and MC02-A and -B were dedicated to DNA sampling. MC01-C and MC02-C were sliced at 1-cm intervals for a total of 42 samples and 38 samples, respectively (Table 42 and 43). MC01-D was stored as an archive and MC02-D was sampled for pore water, altogether 6 samples for the analysis of anions, cations, nutrients, dissolved inorganic carbon, H2S, and Sr isotopes. After pore water extraction core MC02-D was also stored as an archive.

Multi Coring resumen table							
ship	**KPH**	**station**	**13**	**core**	**CAGE19-3-KH-13-MC01**		
n. cores	**4**	**av. length**	**42 cm**	**Date**	**01/11/2019, 08:23**		
Lat. N	**78.3591**		**Long. E**	**5.7866**	**Water depth**	**1695 m bsl**	

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (42 samples)
D	Archive 42 cm

Table 42. Summary table for CAGE-19-3-KH-13-MC01

Multi Coring resumen table							
ship	**KPH**	**station**	**13**	**core**	**CAGE19-3-KH-13-MC02**		
n. cores	**4**	**av. length**	**37 cm**	**Date**	**01/11/2019, 14:09**		
Lat. N	**78.3546**		**Long. E**	**5.7043**	**Water depth**	**1618 m bsl**	

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (38 samples)
D	Archive 37.5 cm (6x pore water)

Table 43. Summary table for CAGE-19-3-KH-13-MC02

Figure 73. Photo of the surface sediment of CAGE-19-3-KH-13-MC01

Gravity corer

The gravity corer recovered 426 cm of sediment which was cut into five sections. We took headspace samples and pore water samples from Section 2, 3, 4, and 5 (Tab. 44).

Gravity Coring resumen table											
ship	**KPH**	**station**	**13**	**core**	**CAGE19-3-KH-13-GC01**					**WC**=water content	
n. sec	**5**	**length**	**426 cm**	**Date**	**01/11/2019, 15:13**					**SS**= smear slides	
Lat. N	**78.3547**		**Long. E**	**5.7043**	**Water depth**	**1617m bsl**				**HS**= Headspace	
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	5	100	326	426					X	2xpore water	
B	4	100	226	326					X	2xpore water	
C	3	100	126	226					X	2xpore water	
D	2	100	26	126					X	2xpore water	
E	1	26	0	26							

Table 44. Summary table for CAGE-19-3-KH-13-GC01

Calypso Corer

We deployed the Calypso giant piston corer twice at station KH-13 (Tab. 45 and 46). GPC01 is 11.14 m long, cut into 12 sections and GPC02 is 9.31 m long, cut into 10 sections. For both GPC's headspace samples were taken from the top of each section except for the uppermost section. At the base of both cores we noticed a smell of H_2S.

Calypso Coring resumen table										
ship	**KPH**	**station**	**13**	**core**	**CAGE19-3-KH-13-GPC01**			**WC**=water content		
n. sec	**12**	**length**	**11.14 m**	**Date**	**01/11/2019, 10:01**			**SS**= smear slides		
Lat. N	**78.3591**		**Long. E**	**5.7866**	**Water depth**	**1695 m bsl**		**HS**= Headspace		
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	12	100	1014	1114	firm clay	18.4	121 (4.6cc)	64	X	slight H2S smell
B	11	100	914	1014	firm clay	18.2	122 (4.6cc)		X	slight H2S smell
C	10	100	814	914	firm clay	17.4	123	65	X	slight H2S smell
D	9	100	714	814	firm clay	16.8	124		X	
E	8	100	614	714	soft clay	13.8	125	66	X	
F	7	95	519	614	soft clay	8.8	126 (3cc)		X	
G	6	100	419	519	stiff silty clay	19.2	127 (4cc)	67	X	
H	5	100	318.5	419	soft clay	13.2	128 (4.5cc)		X	
I	4	100	218.5	319	soft-ish clay	10	129	68	X	
J	3	100	118.5	219	soft silty clay	9	130		X	
K	2	100	18.5	119	soft clay	6.2	131 (4.4cc)	69	X	
L	1	18.5	0	18.5	soupy sandy clay	too short				

Table 15. Summary table for CAGE-19-3-KH-13-GPC01

Calypso Coring resumen table											
ship	**KPH**	**station**	**13**	**core**	**CAGE19-3-KH-13-GPC02**					**WC**=water content	
n. sec	**10**	**length**	**9.31 m**	**Date**	**01/11/2019, 17:20**					**SS**= smear slides	
Lat. N	**78.3547**		**Long. E**	**5.7044**	**Water depth**	**1617 m bsl**				**HS**= Headspace	
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	10	100	831	931	stiff silty clay	17.2	133 (4cc)		X	smell of H2S, 2x pore water	
B	9	100	731	831	firm silty clay	14.2	134		X	2x pore water	
C	8	100	631	731	firm silty clay	14.2	135 (3cc)		X	2x pore water	
D	7	100	531	631	firm clay	13.2	136 (4cc)		X	2x pore water	
E	6	100	431	531	soft-ish clay	10	137 (4cc)		X	2x pore water	
F	5	95	336	431	soft clay	9.2	138 (4.5cc)		X	2x pore water	
G	4	100	236	336	soft silty clay	9.2	130		X	2x pore water	
H	3	100	136	236	soft clay	7.6	140		X	2x pore water	
I	2	100	36	136	soft soupy clay	4.6	141 (4cc)		X	2x pore water	
J	1	36	0	36							
	CC								X	smell of H2S	

Table 46. Summary table for CAGE-19-3-KH-13-GPC02

Smear Slides: Six smear slides were prepared from GPC01 using a small sediment sample (1-2mm^3) collected with a toothpick from the top of every second section (sections 2, 4, 6, 8, 10, and 12). Results show variations between clay (sections 2, 8, 10, 12) and silty clay (sections 4 and 6), with a predominant terrigenous composition in all sections. The sample from section 4 has a 10% biogenic component. Sediment colour varied between very dark gray and dark gray. Cf. smear slides in Table 47.

Smear Slide #	Core	Section		Location sample was taken from	Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
64	CAGE 19-3-KH-13-GPC01	A	12	Top of section	1014	5 Y 4/1	Dark gray	Clay		1	99	Terrigenous	
65	CAGE 19-3-KH-13-GPC01	C	10	Top of section	814	5 Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
66	CAGE 19-3-KH-13-GPC01	E	8	Top of section	614	5 Y 4/1	Dark gray	Clay		3	97	Terrigenous	
67	CAGE 19-3-KH-13-GPC01	G	6	Top of section	419	5 Y 3/1	Very dark gray	Silty Clay		15	85	Terrigenous	
68	CAGE 19-3-KH-13-GPC01	I	4	Top of section	218.5	5 Y 3/1	Very dark gray	Silty Clay		9	91	Terrigenous	Biogenic ~10%
69	CAGE 19-3-KH-13-GPC01	K	2	Top of section	18.5	5 Y 4/2	Olive gray	Clay		5	95	Terrigenous	

Table 47. Smear slide overview for CAGE-19-3-KH-13-GPC01

4.12 Superstation CAGE 19-3-KH-14

Site Location

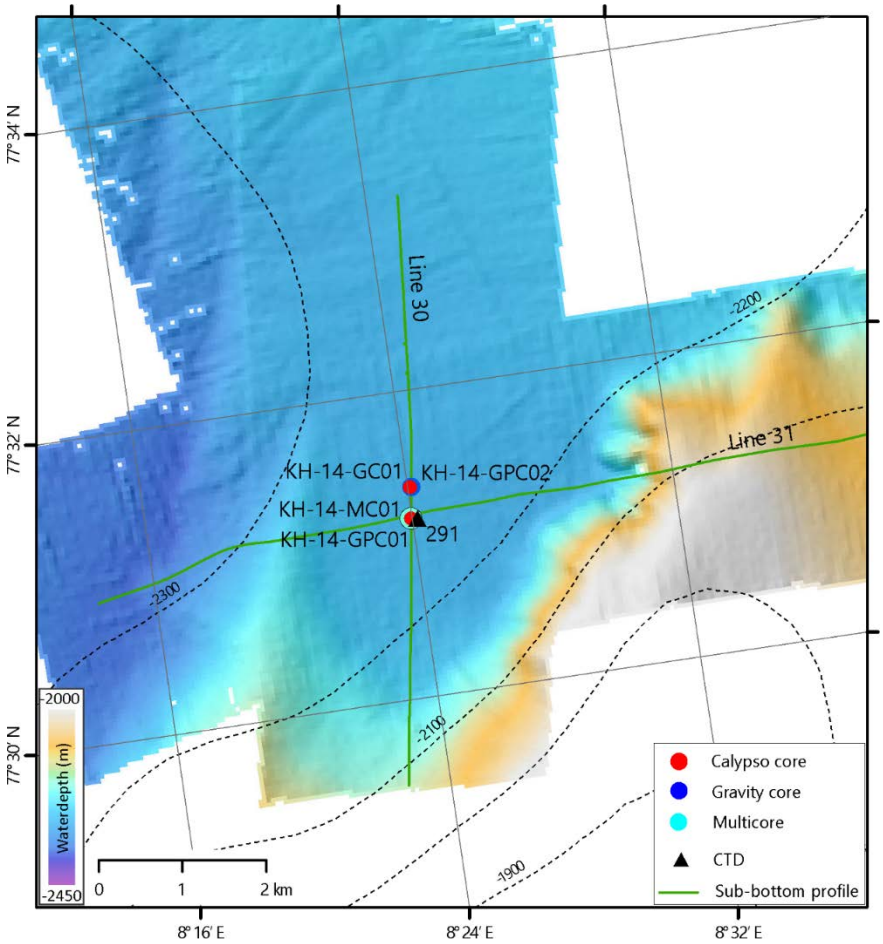

Figure 74. Location of superstation CAGE 19-3-KH-14 off Isfjorden trough mouth fan.

Acoustics

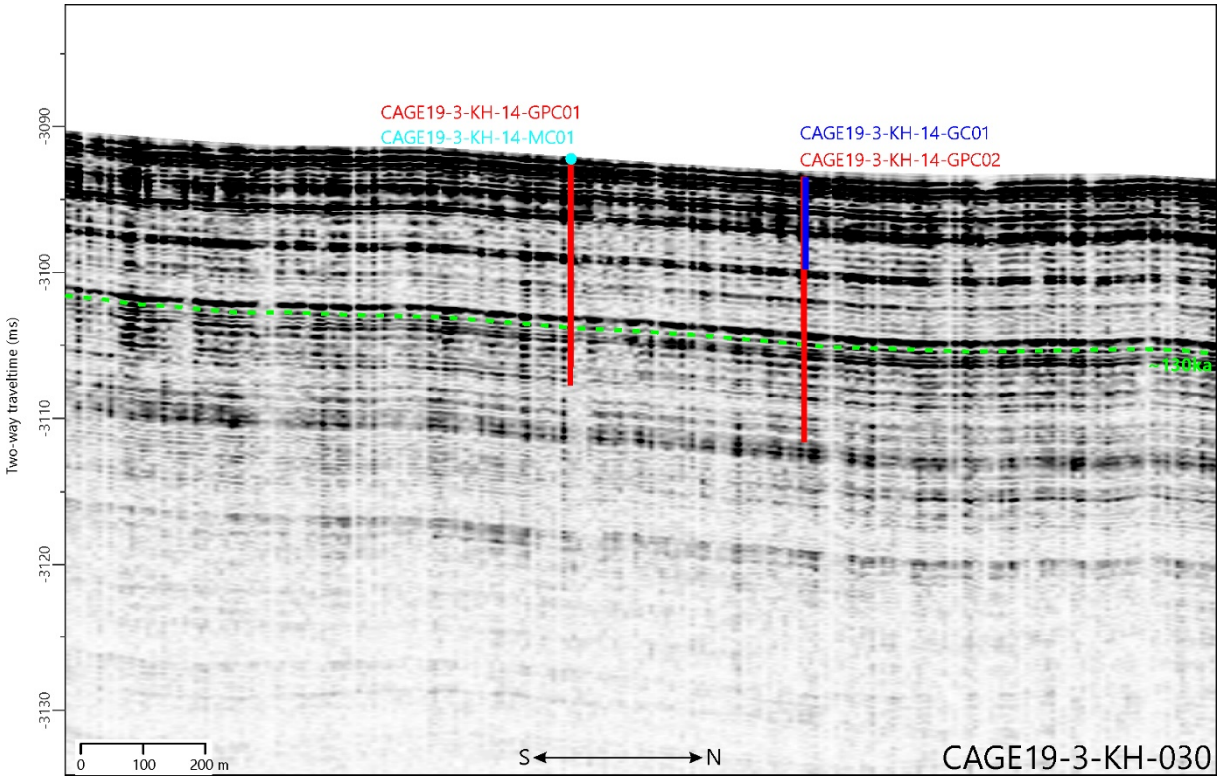

Figure 75. Sub-bottom profile at CAGE 19-3 KH-14 showing well-stratified, parallel/sub-parallel reflections. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s. Approximate ages of the observed reflections from Risebrobakken et al., 2006.

Multicorer

Four multicores were retrieved on the first deployment of the MUC. MC01-A and MC01-B were dedicated to aDNA sub-sampling (Tab. 48). The surface-water interface was sampled, ~20mL of marine snow for each core. Surface sediment was sampled at 0-1cm and 1-2cm depths, each with their own sampling bench control (an open Eppendorf 1.5mL tube). DNA subsampling occurred at the center of the core with no contact with sediment around the edges of the layer. Samples were immediately stored at -80˚C. Following aDNA subsampling, the remaining sediment in the layer was equally divided for biomarker IP_{25} and palynology. MC01-B was then downcore sampled in ZONE 2 (Microbiology Lab) with sterile syringes, sampled every 2cm with modified 10cc syringe. Again following DNA subsampling, biomarker and palynology samples were collected in the DRY LAB (Common).

Multi Coring resumen table						
ship	KPH	station	14	core	CAGE19-3-KH-14-MC01	
n. cores	4	av. length	36 cm	Date	02/11/2019, 06:54	
Lat. N	77.5196		Long. E	8.3996	Water depth	2271 m bsl

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (35 samples)
D	Archive 38 cm

Table 48. Summary table for CAGE 19-3-KH-14-MC01

Gravity Corer

CAGE-19-3-KH-14-GC01 was 461.5 cm long (with upper 1cm cut-off) in five sections (Table 49). The top of each segment was sampled for aDNA with 2 10cc modified syringes. The hangar segmenting of the GC was done with additional controls for cross-contamination. The following controls were used for aDNA sampling:

- Reduced number of individuals working on the core to reduce pace of processing and limit foot traffic during sampling. Two individuals to cut segments, one individual to carry segment to work space, one individual to clean and mark the core, two individuals to sample.
- All instruments were washed with 10% chlorine solution or ethanol (diluted with milliQ water).

Gravity Coring resumen table										
ship	**KPH**	**station**	**14**	**core**	**CAGE19-3-KH-14-GC01**			**WC**=water content		
n. sec	**5**	**length**	**4.62 m**	**Date**	**03/11/2019, 15:27**			**SS**= smear slides		
Lat. N	**77.523**		**Long. E**	**8.4018**	**Water depth**	**2275.54 m bsl**		**HS**= Headspace		
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	5	100	362	462						DNA 2x10cc from top*
B	4	101	261	362						DNA 2x10cc from top*
C	3	100	161	261						DNA 2x10cc from top*
D	2	100	61	161						DNA 2x10cc from top*
E	1	60.5	0	60.5						DNA 2x10cc from top*
* cut-off the upper 1 cm										

Table 49. Summary table for CAGE 19-3-KH-14-GC01

Calypso Corer

At station KH-14 we deployed the Calypso giant piston corer twice because the pipe came back bent after the first deployment (GPC01). The piston corer was fixed and then deployed again the following day (GPC02). Both GPC01 and GPC02 were dedicated to DNA studies (Table 50 and 51). GPC01 was 11.5 m long and cut into 13 sections, GPC02 was 13.5 m long and cut into 14 sections.

Calypso Coring resumen table										
ship	**KPH**	**station**	**14**	**core**	**CAGE19-3-KH-14-GPC01**		**WC**=water content			
n. sec	**13**	**length**	**11.50 m**	**Date**	**02/11/2019, 10:23**		**SS**= smear slides			
Lat. N	**77.5196**		**Long. E**	**8.3996**	**Water depth**	**2281.42 m bsl**	**HS**= Headspace			

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	13	100	1050	1150						DNA 2x10cc from top*
B	12	100	950	1050						DNA 2x10cc from top*
C	11	100	850	950						DNA 2x10cc from top*
D	10	100	750	850						DNA 2x10cc from top*
E	9	101	649	750						DNA 2x10cc from top*
F	8	95.5	553	649						DNA 2x10cc* from top+base
G	7	100	453	553						DNA 2x10cc from top*
H	6	100	353	453						DNA 2x10cc from top*
I	5	100	253	353						DNA 2x10cc from top*
J	4	100	153	253						DNA 2x10cc from top*
K	3	100	53	153						DNA 2x10cc from top*
L	2	37	16	53						DNA 2x10cc from top*
M	1	16	0	16						DNA 2x10cc from top*

* cut-off the upper 1 cm

- the pipe of the Calypso corer was bent

Table 50. Summary table for CAGE 19-3-KH-14-GPC01.

Calypso Coring resumen table										
ship	**KPH**	**station**	**14**	**core**	**CAGE19-3-KH-14-GPC02**			**WC**=water content		
n. sec	**14**	**length**	**13.50 m**	**Date**	**03/11/2019, 13:42**			**SS**= smear slides		
Lat. N	**77.523**		**Long. E**	**8.40138**	**Water depth**	**2275.38 m bsl**		**HS**= Headspace		
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	14	100	1250	1350						DNA 2x10cc from top*
B	13	100	1150	1250						DNA 2x10cc from top*
C	12	100	1050	1150						DNA 2x10cc from top*
D	11	100	950	1050						DNA 2x10cc from top*
E	10	100	850	950						DNA 2x10cc from top*
F	9	95	755	850						DNA 2x10cc from top*
G	8	100	655	755						DNA 2x10cc from top*
H	7	100	555	655						DNA 2x10cc from top*
I	6	100	455	555						DNA 2x10cc from top*
J	5	100	355	455						DNA 2x10cc from top*
K	4	100	255	355						DNA 2x10cc from top*
L	3	95	160	255						DNA 2x10cc from top*
M	2	100	60	160						DNA 2x10cc from top*
N	1	60	0	60						DNA 2x10cc from top*
* cut-off the upper 1 cm										

Table 51. Summary table for CAGE 19-3-KH-14-GPC02.

Heat Flow

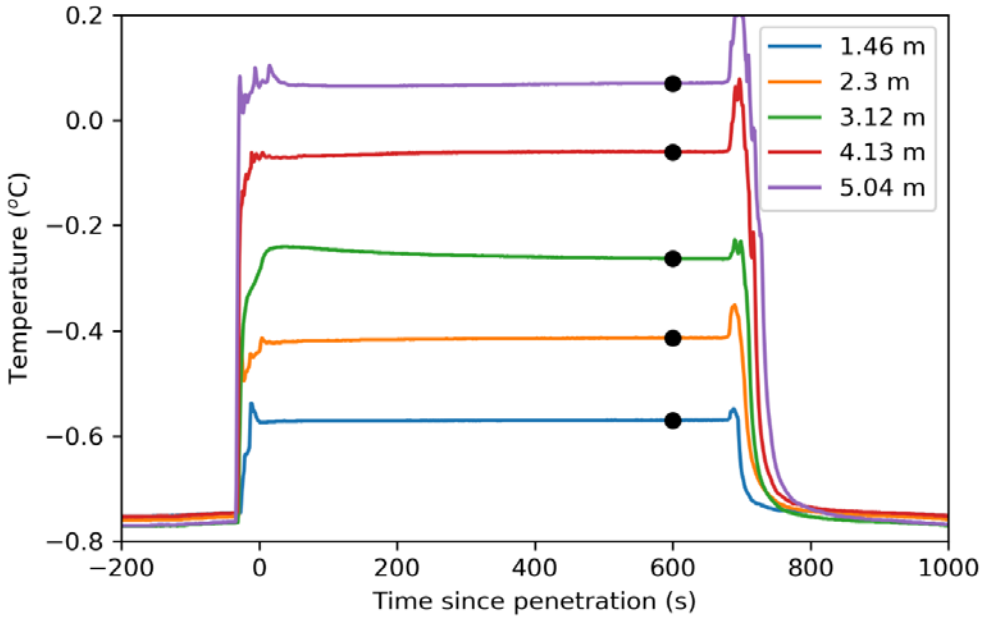

Figure 76. Temperature variation with time at station KH-06 recorded using the temperature sensors attached to the 6-m long gravity core barrel. The zero time corresponds to the penetration of the gravity core barrel.

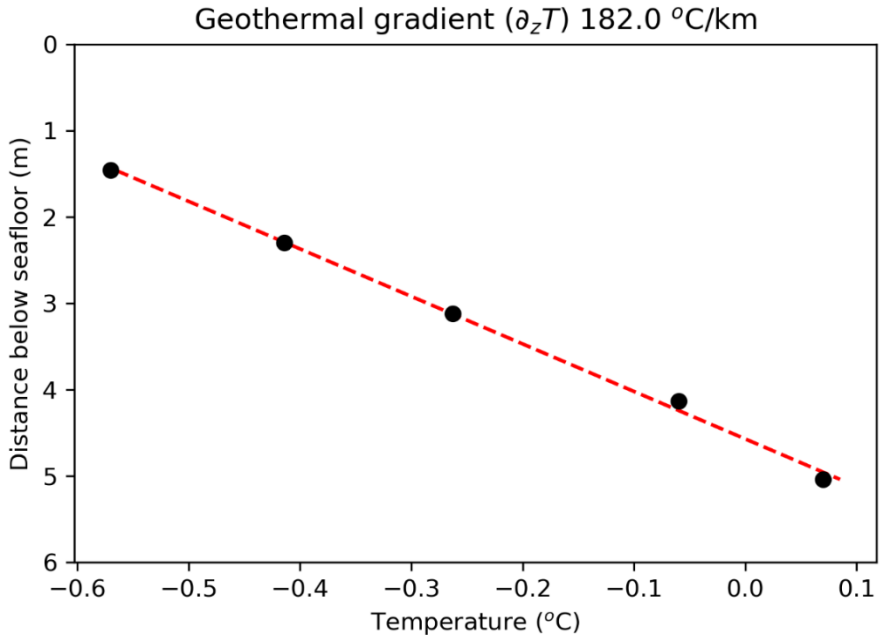

Figure 77. Geothermal gradient of 182 °C/km at station KH-14, obtained using the least squares fit (red line) of equilibrated temperatures (black dots) versus distance along the core barrel for each sensor (depth below seafloor).

4.13 Superstation CAGE 19-3-KH-15

Site Location

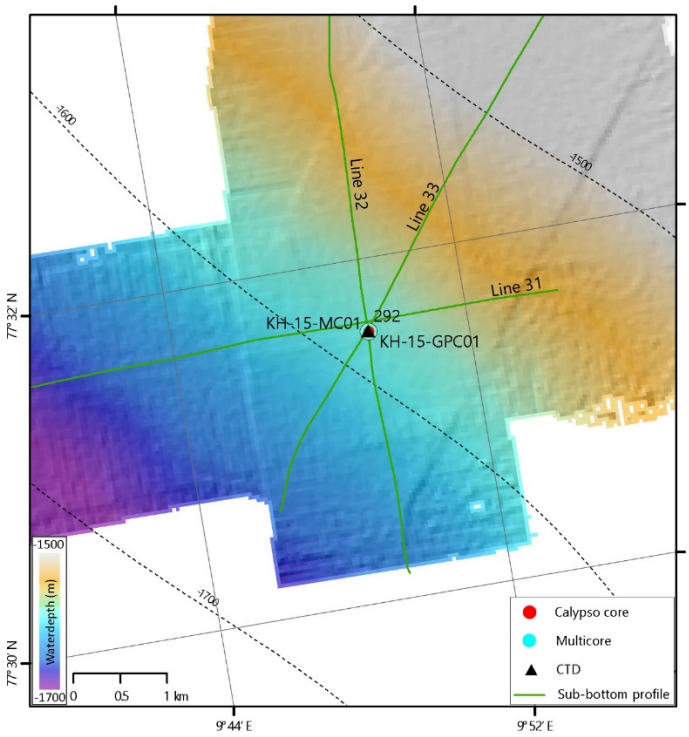

Figure 78. Location for superstation CAGE 19-3-KH-15 at the Isfjorden drift.

Acoustics

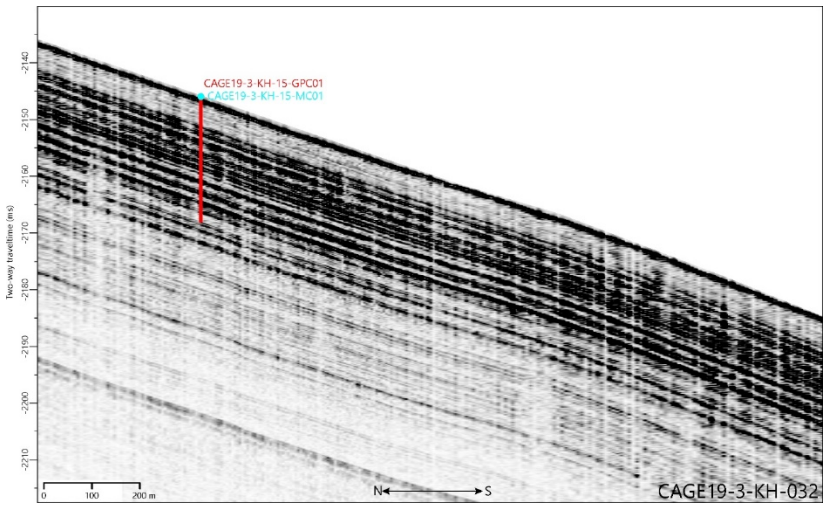

Figure 79. Sub-bottom profile at CAGE 19-3 KH-15 showing well-stratified, parallel/sub-parallel reflections. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

The multicorer recovered sediment in all 4 tubes. MC01-A and -B were sampled for DNA studies. MC01-C was 39 cm long and sliced at 1-cm intervals. MC01-D was stored as an archive (Tab. 52).

Multi Coring resumen table							
ship	KPH	station	15	core	CAGE19-3-KH-15-MC01		
n. cores	4	av. length	39.5 cm	Date	03/11/2019, 05:05		
Lat. N	77.5263		Long. E	9.8217	Water depth	1580 m bsl	

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (39 samples)
D	Archive 40 cm

Table. 52. Summary table for CAGE 19-3-KH-15-MC01

Calypso Corer

The Calypso giant piston corer recovered 15.73 m of sediment which was cut into 16 sections. Water content samples and shear strength measurements were taken at the top og each section except for section 1 (Tab. 53). Headspace samples were taken from the top of section 15 and 16.

Calypso Coring resumen table										
ship	**KPH**	**station**	**15**	**core**	**CAGE19-3-KH-15-GPC01**			**WC**=water content		
n. sec	**16**	**length**	**15.73 m**	**Date**	**02/11/2019, 10:01**			**SS**= smear slides		
Lat. N	**77.5263**		**Long. E**	**9.8218**	**Water depth**	**1579 m bsl**		**HS**= Headspace		
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	16	93	1480	1573	firm clay	17.6	142	71	X	
B	15	100	1380	1480	firm clay	19.2	143 /4.3cc)	72	X	
C	14	100	1280	1380	firm clay	17.8	144 (4.5cc)	73		
D	13	100	1180	1280	firm clay	13.4	145	74		
E	12	100	1080	1180	firm clay	4.8	146 (4.8cc)	75		
F	11	95	985	1080	soft clay	3.2	147	76		
G	10	100	885	985	stiff silty clay	3.8	148	77		
H	9	100	785	885	firm clay	3.6	149 (4.8cc)	78		
I	8	100	685	785	soft clay	9.4	150	79		
J	7	100	585	685	stiff clay	10.8	151	80		
K	6	100	485	585	firm clay	10.4	152	81		
L	5	95	390	485	soft silty clay	6	153 (4.4cc)	82		
M	4	100	290	390	soft clay	5.4	154	83		
N	3	100	190	290	soft soupy clay	5.2	155	84		
O	2	100	90	190	soft soupy clay	3.4	156	85		
P	1	90	0	90	soft soupy clay	too short		86		
	CC				stiff clay			70		

Table. 53 Summary table for CAGE 19-3-KH-15-GPC01.

Smear Slides

Seventeen smear slides were prepared using a small sediment sample (1-2mm^3) collected with a toothpick from the top of every section and the core catcher. The main lithology for all sections is clay, except section 6 which is silty clay. The samples have predominant terrigenous composition in all sections, except sections 1 and 2 which are biosiliceous-rich clay. Four of the core sections with a biogenic component are as follows, section 3 (1% biogenic), section 7 (15% biogenic), section 9 (10% biogenic), and section 14 (25% biogenic). Sediment colour varied between very dark gray, dark gray and dark olive brown. Cf. smear slides in Table 54.

Smear Slide #	Core	Section		Location sample was taken from	Core depth (cm)	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
70	CAGE 19 -3-KH-15-GPC01	Core Catcher				5Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
71	CAGE 19 -3-KH-15-GPC01	A	16	Top of section	1480	5Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
72	CAGE 19 -3-KH-15-GPC01	B	15	Top of section	1380	5Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
73	CAGE 19 -3-KH-15-GPC01	C	14	Top of section	1280	5Y 3/1	Very dark gray	Clay		3	97	Terrigenous	25% biogenic
74	CAGE 19 -3-KH-15-GPC01	D	13	Top of section	1180	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	
75	CAGE 19 -3-KH-15-GPC01	E	12	Top of section	1080	5Y 3/1	Very dark gray	Clay		15	85	Terrigenous	
76	CAGE 19 -3-KH-15-GPC01	F	11	Top of section	985	5Y 3/1	Very dark gray	Clay		2	98	Terrigenous	
77	CAGE 19 -3-KH-15-GPC01	G	10	Top of section	885	5Y 3/1	Very dark gray	Clay		1	99	Terrigenous	
78	CAGE 19 -3-KH-15-GPC01	H	9	Top of section	785	5Y 3/1	Very dark gray	Clay		4	96	Terrigenous	10% biogenic
79	CAGE 19 -3-KH-15-GPC01	I	8	Top of section	685	5Y 3/1	Very dark gray	Clay		4	96	Terrigenous	
80	CAGE 19 -3-KH-15-GPC01	J	7	Top of section	585	5Y 3/1	Very dark gray	Clay		7	93	Terrigenous	15% biogenic
81	CAGE 19 -3-KH-15-GPC01	K	6	Top of section	485	5Y 3/1	Very dark gray	Silty Clay		20	80	Terrigenous	
82	CAGE 19 -3-KH-15-GPC01	L	5	Top of section	390	5Y 4/1	Dark gray	Clay		5	95	Terrigenous	
83	CAGE 19 -3-KH-15-GPC01	M	4	Top of section	290	5Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
84	CAGE 19 -3-KH-15-GPC01	N	3	Top of section	190	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	1% Biogenic
85	CAGE 19 -3-KH-15-GPC01	O	2	Top of section	90	5Y 3/1	Very dark gray	Clay		5	95	Mixed	Biosiliceous-rich clay
86	CAGE 19 -3-KH-15-GPC01	P	1	Top of section	0	2.5Y 3/3	Dark Olive Brown	Clay		5	95	Mixed	Biosiliceous-rich clay

Table 54. Smear slide overview for CAGE-19-3-KH-15-GPC01

4.14 Superstation CAGE 19-3-KH-16

Site Location

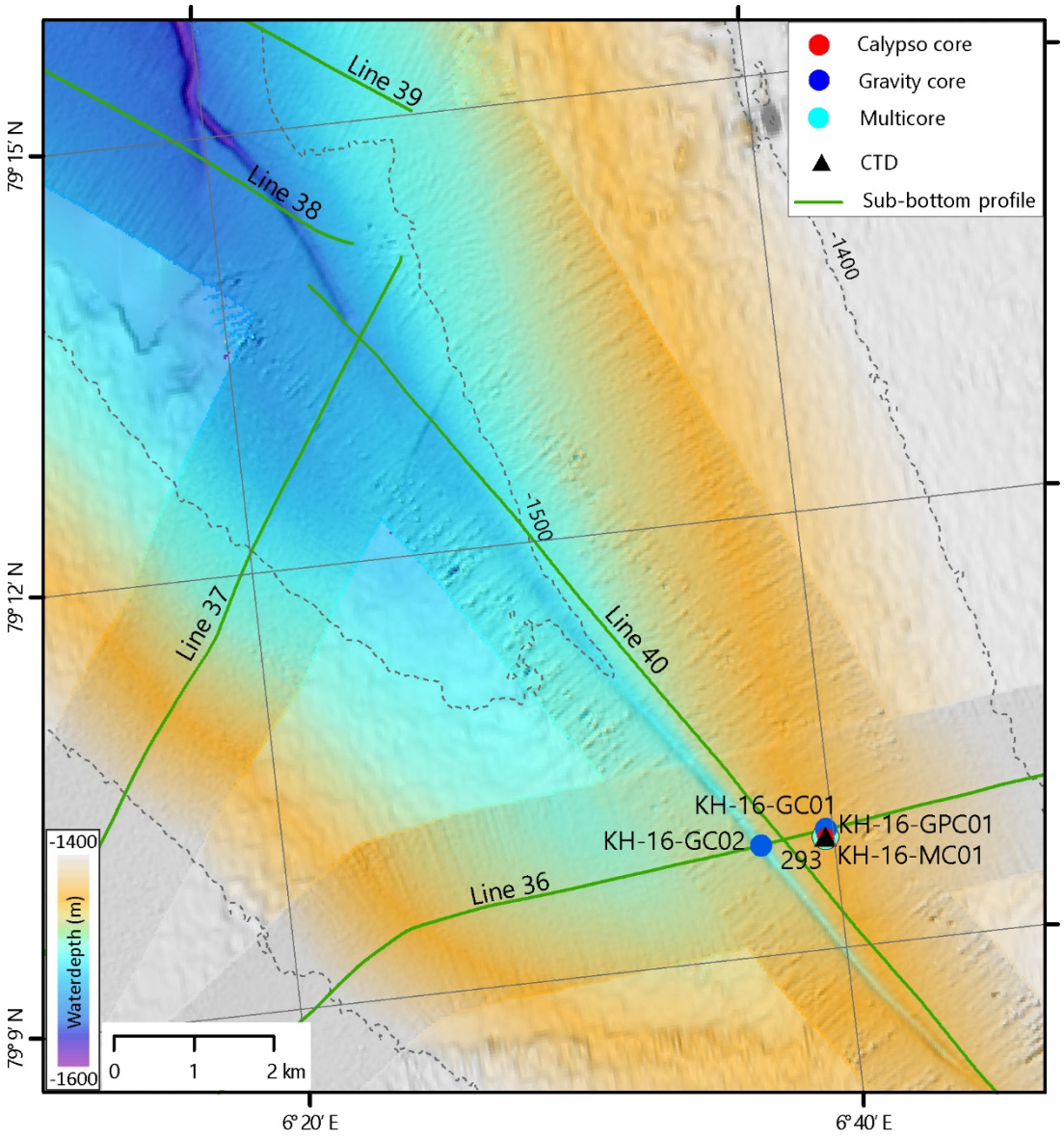

Figure 80. Location of superstation CAGE 19-3-KH-16 at the flank of Kongsfjorden fan channel system

Acoustics

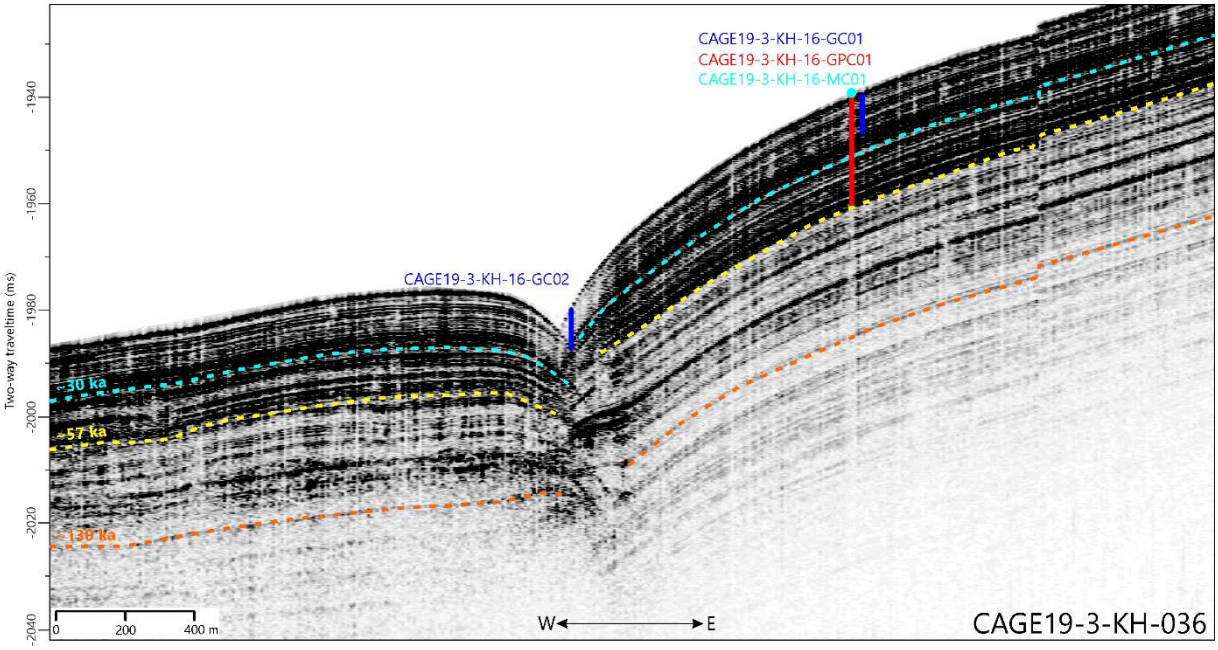

Figure 81. Sub-bottom profile at CAGE 19-3 KH-16 showing well-stratified, parallel/sub-parallel reflections and the recent deposits at the channel valley. Approximate ages of reflections from Dessandier et al. (in prep) and Schneider et al. (2018) are extended from the Vestnesa Ridge. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

The first deployment of the MUC recovered all four multicores (Tab. 55). MC01-A and MC01-B were dedicated to DNA sampling. Each MC was surface sampled for DNA, IP_{25}, and palynology at 0-1cm and 1-2cm. After sampling MCs were stored at 4˚C for transport.

Multi Coring resumen table						
ship	**KPH**	**station**	**16**	**core**	**CAGE19-3-KH-16-MC01**	
n. cores	**4**	**av. length**	**45.5 cm**	**Date**	**05/11/2019, 08:46**	
Lat. N	**79.1630**		**Long. E**	**6.6614**	**Water depth**	**1429.76 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (46 samples)
D	Archive 45 cm

Table 55. Summary table for CAGE-19-3-KH-16-MC01

Calypso Corer

Calypso Piston Coring resumen table										
ship	**KPH**	**station**	**0.16**	**core**	**CAGE19-3-KH-16-GPC01**		**WC**=water content			
n. sec	**16**	**length**	**15.16 m**	**Date**	**05/11/2019, h 09:58**		**SS**= smear slides			
Lat. N	**79.163**		**Long. E**	**6.6614**	**Water depth**	**1429.61 m bsl**	**HS**= Headspace			

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	16	100	1416	1516	firm silty clay	18.8	187 (4.6cc)	87		
B	15	100	1316	1416	very stiff silty clay	29	188			
C	14	100	1216	1316	soft-ish silty clay	28	189	88		
D	13	100	1116	1216	firm silty clay	20	190 (3.8cc)			
E	12	100	1016	1116	firm silty clay	17	191	89		
F	11	95	921	1016	stiff clay	16	192 (4.3cc)			wet sediments
G	10	100	821	921	stiff silty clay	16	193 (4cc)	90		expanding sediments
H	9	100	721	821	firm clay	17	194 (4.2cc)			
I	8	100	621	721	firm clay	15	195	91		
J	7	100	521	621	firm clay	9.4	196 (3.5cc)			
K	6	100	421	521	firm clay	8	197	92		
L	5	96.5	324	421	soft silty clay	8.2	198			IRD at the base
M	4	100	224	324	soft silty clay	5.4	199 (4.8cc)	93		
N	3	100	124	224	soft silty clay	4.6	200			
O	2	100	24	124	soft soupy silty clay	3.4	201	94		
P	1	24	0	24	very soupy silty clay	too short				
	CC						186			

***T*able 56.** Summary table for CAGE-19-3-KH-16-GPC01

Smear slides

Eight smear slides were prepared using a small sediment sample (1-2mm^3) collected with a toothpick from the top of every second section (sections 2, 4, 6, 8, 10, 12, 14, and 16). The main lithology varies between clay (sections 2, 6, 10, and 16), silty clay (sections 4, 8, 14) and sandy clay (section 12). All sections have a predominant terrigenous component, however section 2 has 30% biogenic component and is a biosiliceous bearing clay. Sections 10 and 16 have 1% biogenic component. Sediment colour is dark gray with one section of very dark gray sediment. Cf. smear slides in Table 57.

Smear Slide #	Core	Section		Location sample was taken from	Core depth	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
87	CAGE 19 -3-KH-16-GPC01	A	16	Top of section	1416	5Y 4/1	Dark gray	Clay		3	97	Terrigenous	1% Biogenic
88	CAGE 19 -3-KH-16-GPC01	C	14	Top of section	1216	5Y 4/1	Dark gray	Silty Clay		20	80	Terrigenous	
89	CAGE 19 -3-KH-16-GPC01	E	12	Top of section	1016	5Y 4/1	Dark gray	Sandy clay	20	5	75	Terrigenous	
90	CAGE 19 -3-KH-16-GPC01	G	10	Top of section	821	5Y 4/1	Dark gray	Clay	1	10	89	Terrigenous	1% Biogenic
91	CAGE 19 -3-KH-16-GPC01	I	8	Top of section	621	5Y 4/1	Dark gray	Silty Clay		20	80	Terrigenous	
92	CAGE 19 -3-KH-16-GPC01	K	6	Top of section	421	5Y 4/1	Dark gray	Clay		3	97	Terrigenous	
93	CAGE 19 -3-KH-16-GPC01	M	4	Top of section	224	5Y 3/1	Very dark gray	Silty Clay	5	15	80	Terrigenous	
94	CAGE 19 -3-KH-16-GPC01	O	2	Top of section	24	5Y 4/1	Dark gray	Clay		5	95	Terrigenous	30% Biogenic - Biosiliceous bearing clay

Table 57. Smear slide overview for CAGE-19-3-KH-16-GPC01

Gravity Corer

Gravity Coring resumen table											
ship	**KPH**	**station**	**16**	**core**	**CAGE19-3-KH-16-GC01**			**WC**=water content			
n. sec	**5**	**length**	**5.09 m**	**Date**	**05/11/2019, h 15:08**			**SS**= smear slides			
Lat. N	**79.1638**		**Long. E**	**6.6624**	**Water depth**	**1428.73 m bsl**		**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	6	100	400	509	soft clay					DNA 1x10cc from base	
B	5	100	300	409	soft clay					DNA 3x10cc from base	
C	4	100	200	309	soft clay					DNA 3x10cc from base	
D	3	100	100	209	soft silty clay					DNA 3x10cc from base	
E	2	100	9	109	soft soupy silty clay					DNA 3x10cc from base	
F	1	9	0	9							

Table 58: Summary table for CAGE-19-3-KH-16-GC01

Gravity Coring resumen table										
ship	**KPH**	**station**	**16**	**core**	**CAGE19-3-KH-16-GC02**		**WC**=water content			
n. sec	**6**	**length**	**5.51 m**	**Date**	**05/11/2019, h 15:08**		**SS**= smear slides			
Lat. N	**79.1628**		**Long. E**	**6.6622**	**Water depth**	**1460.52 m bsl**	**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	6	100	400	551	soft clay	9.4	202 (4cc)			
B	5	100	300	451	soft clay	4.4	203 (4cc)			
C	4	100	200	351	soft silty clay	7.4	204 (4.4cc)			
D	3	100	100	251	soft soupy silty clay	5.6	205			
E	2	100	51	151	soft soupy silty clay	3.8	206			
F	1	51	0	51		too short				

Table 59: Summary table for CAGE-19-3-KH-16-GC02

4.15 Superstation CAGE 19-3-KH-17

Site Location

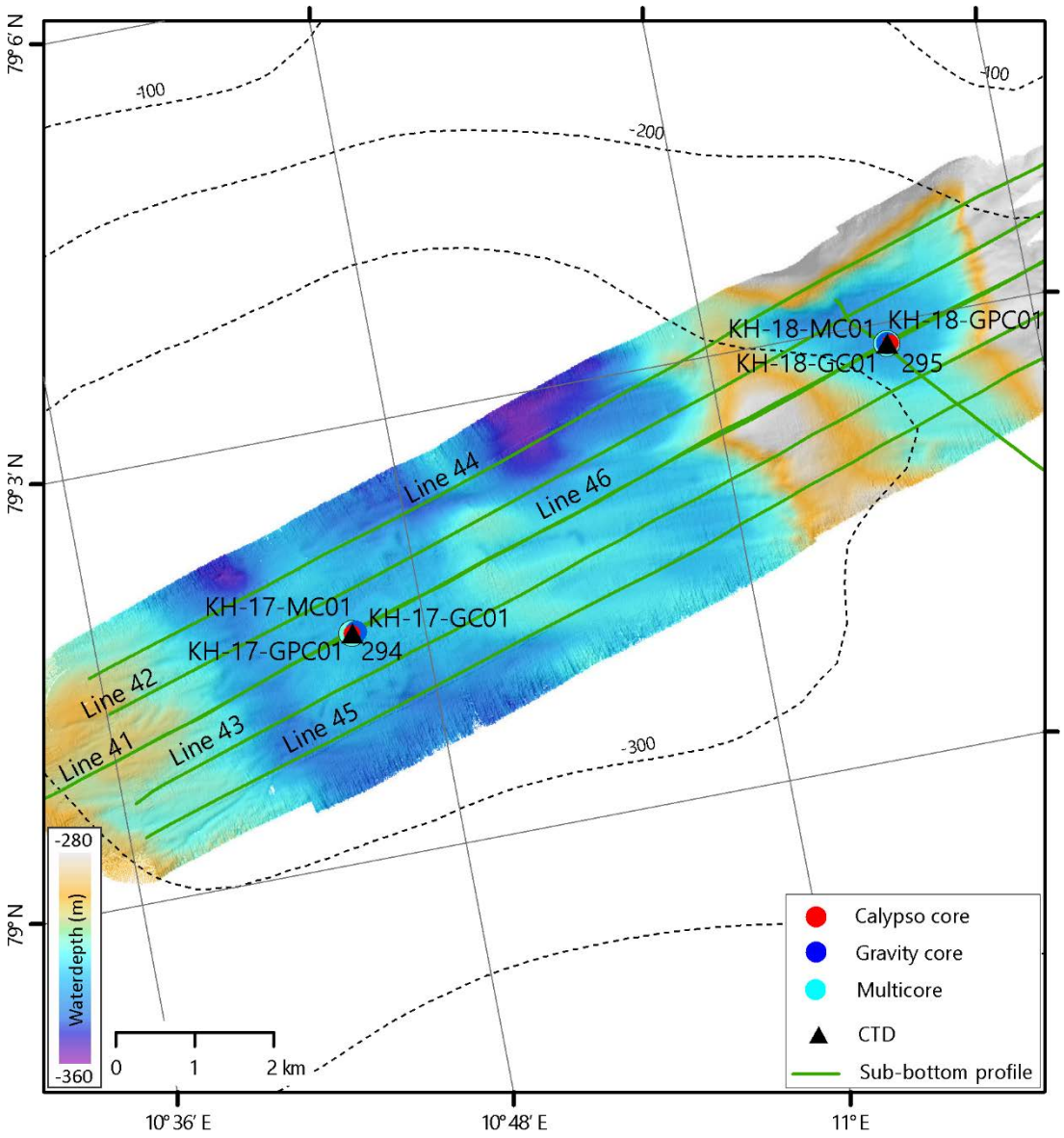

Figure 82: Location of superstation CAGE 19-3-KH-17 in the Kongsfjorden along with acquired multibeam bathymetry.

Acoustics

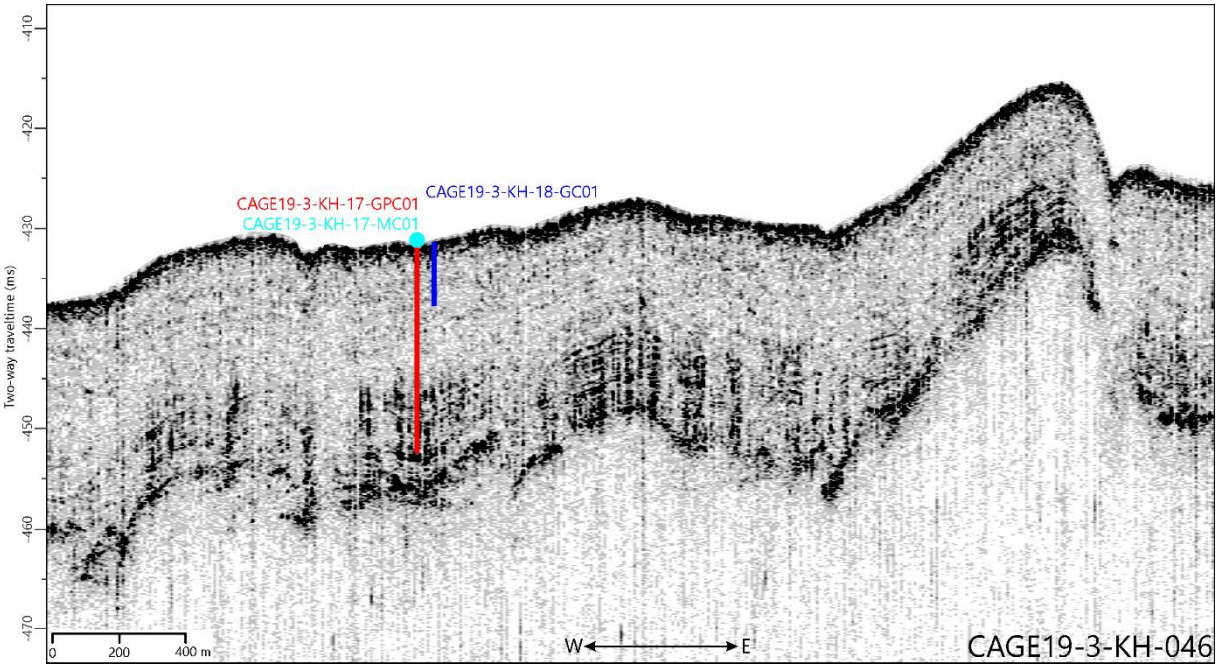

Figure 83: Topas sub-bottom profile at CAGE19-3-KH-17 showing the recent sedimentation at the shallow part along with older well-stratified sediments. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

Four multicores were recovered with the first deployment of the MUC. MC01-A was 40.1cm, MC01-B was 36.4cm; both were dedicated to aDNA sub-sampling (marine snow, 0-1cm, 1-2cm). MC01-C was 40 cm long and sliced at 1-cm intervals. MC01-D was stored as an archive (Table 60).

Multi Coring resumen table							
ship	**KPH**	**station**	**17**	**core**	**CAGE19-3-KH-17-MC01**		
n. cores	**4**	**av. length**	**41 cm**	**Date**	**06/11/2019, 09:21**		
Lat. N	**79.0255**		**Long. E**	**10.7558**	**Water depth**	**324.74 m bsl**	

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (40 samples)
D	Archive 42.5 cm

Table. 60. Summary table for CAGE 19-3-KH-17-MC01

Gravity Corer

The gravity corer recovered 466 cm of sediment which was cut into 5 sections (Tab. 61). Water content samples were taken from sections 2, 3, 4, and 5.

Gravity Coring resumen table										
ship	**KPH**	**station**	**17**	**core**	**CAGE19-3-KH-17-GC01**		**WC**=water content			
n. sec	**5**	**length**	**4.66 m**	**Date**	**06/11/2019, h 11:40**		**SS**= smear slides			
Lat. N	**79.0266**		**Long. E**	**10.758**	**Water depth**	**324.57 m bsl**	**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	5	98.5	367.5	466.0	firm clay		223	103		
B	4	100	267.5	367.5	firm clay		224	105		
C	3	100	167.5	267.5	soft silty clay		225 (3.8cc)	107		
D	2	100	67.5	167.5	soft clay		226 (4cc)			
E	1	67.5	0	67.5	soft clay					

Table 61: Summary table for CAGE 19-3-KH-17-GC01

Calypso Corer

The Calypso giant piston corer recovered 15.24 m of sediment which was cut into 17 sections (Tab. 63). A strong smell of H_2S was noticed from section 2 to 6.

Smear slides
Eight smear slides were prepared using a small sediment sample (1-2mm^3) collected with a toothpick from the top of every second section (sections 3, 5, 7, 9, 11, 13, 15, and 17). The main lithology varies between clay (sections 3, 5, 7, 13, 15, and 17) and silty clay (sections 9 and 11). All sections have a predominant terrigenous component, however there is a greater relative abundance of biogenics in sections 5 (1% biogenic), 7 (15% biogenics), 9 (30% biogenics – biosiliceous bearing silty clay), 11 (40% biogenics – biosiliceous rich clay), 13 (40% biogenics – biosiliceous rich clay), and 15 (1% biogenics). Sediment colour varies between black and very dark gray. Cf. smear slides in Table 62.

Smear Slide #	Core	Section		Location sample was taken from	Core depth	Colour (Munsell Color Chart)		Lithology	Sand%	Silt%	Clay%	Main composition	Comments
95	CAGE 19 -3-KH-17-GPC01	A	17	Top of section	1511	5Y 3/1	Very dark gray	Clay		5	95	Terrigenous	
96	CAGE 19 -3-KH-17-GPC01	C	15	Top of section	1311	5Y 2.5/1	Black	Clay		3	97	Terrigenous	1% Biogenic
97	CAGE 19 -3-KH-17-GPC01	E	13	Top of section	1122	5Y 2.5/1	Black	Clay		5	95	Terrigenous	40% Biogenic - Biosiliceous rich clay
98	CAGE 19 -3-KH-17-GPC01	G	11	Top of section	927	5Y 2.5/1	Black	Silty Clay		20	80	Terrigenous	40% Biogenic - Biosiliceous rich clay
99	CAGE 19 -3-KH-17-GPC01	I	9	Top of section	727	5Y 3/1	Very dark gray	Silty Clay	1	20	79	Terrigenous	30% Biogenic - Biosiliceous bearing silty clay
100	CAGE 19 -3-KH-17-GPC01	K	7	Top of section	526	5Y 3/1	Very dark gray	Clay		3	97	Terrigenous	15% Biogenic
101	CAGE 19 -3-KH-17-GPC01	M	5	Top of section	329	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	1% Biogenic
102	CAGE 19 -3-KH-17-GPC01	O	3	Top of section	128	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	
103	CAGE 19 -3-KH-17-GC01	A	5	Top of section	367.5	5Y 3/1	Very dark gray	Clay	1	10	89	Terrigenous	
104	CAGE 19 -3-KH-17-GC01	C	3	Top of section	167.5	5Y 3/1	Very dark gray	Clay		10	90	Terrigenous	
105	CAGE 19 -3-KH-17-GC01	E	1	Top of section	0	5Y 3/2	Dark olive gray	Clay		5	95	Terrigenous	

Table 62. Smear slide overview for CAGE-19-3-KH-17-**GPC**01 and CAGE-19-3-KH-17-**GC**01

Calypso Piston Coring resumen table											
ship	**KPH**	**station**	**17**	**core**	**CAGE19-3-KH-17-GPC01**			**WC**=water content			
n. sec	**17**	**length**	**15.24 m**	**Date**	**06/11/2019, h 10:00**			**SS**= smear slides			
Lat. N	**79.0265**		**Long. E**	**10.756**	**Water depth**	**324.80 m bsl**		**HS**= Headspace			
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**	
A	17	13.5	1511	1524	firm clay		207	95	X	15 cm foam	
B	16	100	1411	1511	firm clay		208		X		
C	15	100	1311	1411	firm clay		209	96	X		
D	14	89	1222	1311	firm clay		210			void at the top 11 cm	
E	13	100	1122	1222	firm clay		211 (4.6cc)	97			
F	12	100	1022	1122	firm clay		212				
G	11	95	927	1022	firm clay		213	98			
H	10	100	827	927	firm clay		214 (4.7cc)				
I	9	100	727	827	firm silty clay		215 (4.5cc)	99			
J	8	100	627	727	firm clay		216 (4cc)				
K	7	101	526	627	firm clay		217 (5.1cc)				
L	6	100	426	526	firm clay		218 (4.6cc)			H2S smell	
M	5	96.5	329	426	firm clay		219 (4.4cc)			H2S smell	
N	4	101	228	329	firm clay		220			H2S smell	
O	3	100	128	228	soft clay		221 (4.6cc)			H2S smell	
P	2	101	27	128	soft silty clay		222			H2S smell	
Q	1	27	0	27							

Table. 63. Summary table for CAGE 19-3-KH-17-GPC01.

4.16 Superstation CAGE 19-3-KH-18

Site Location

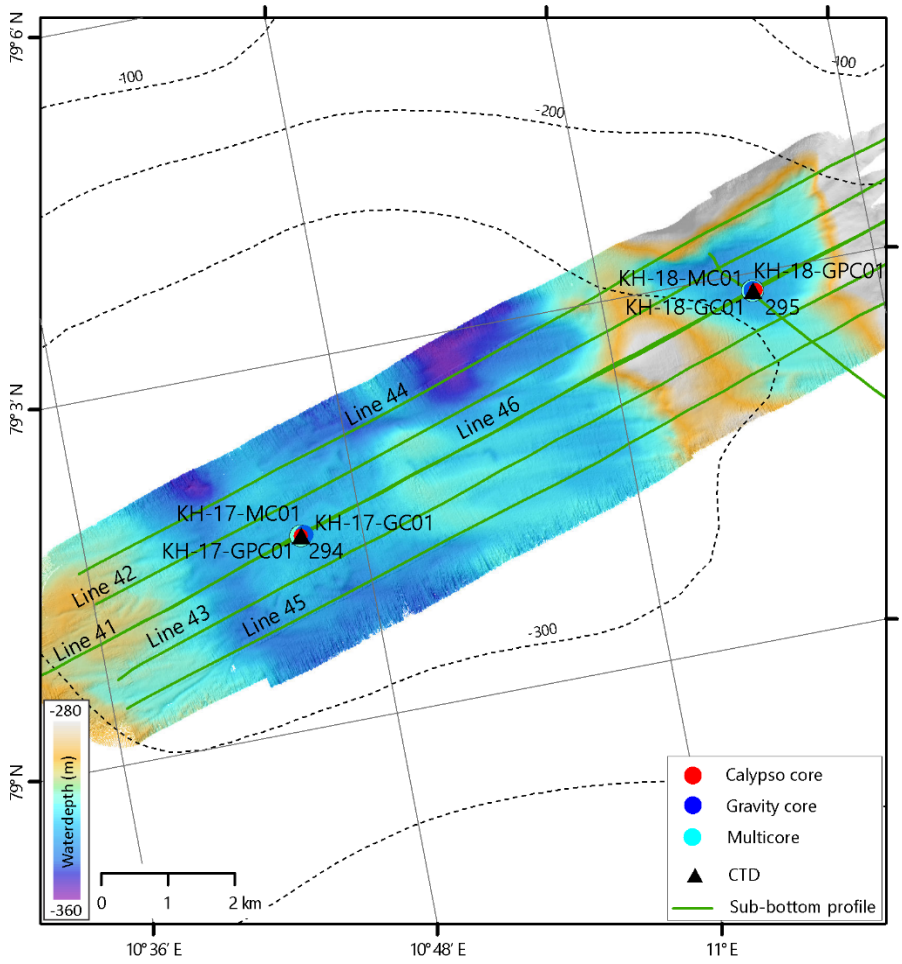

Figure 84: Location of superstation CAGE 19-3-KH-18 in the Kongsfjorden along with acquired multibeam bathymetry.

Acoustics

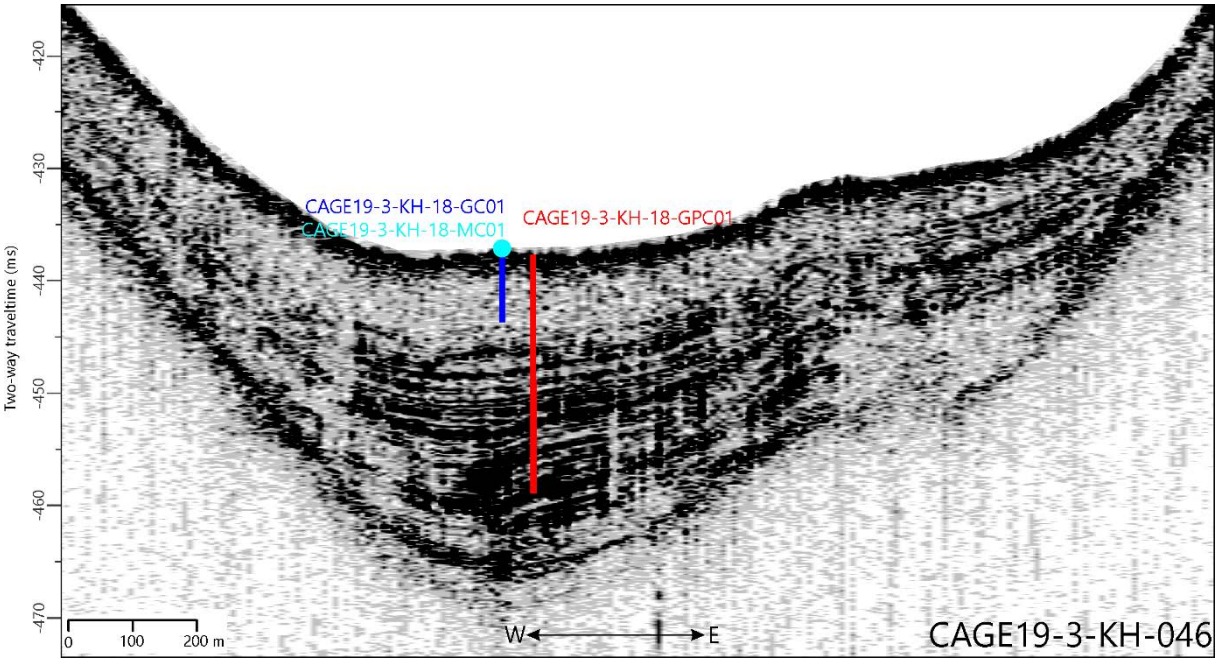

Figure 85: Topas sub-bottom profile at CAGE19-3-KH-18 showing the recent sedimentation at the shallow part along with older well-stratified sediments. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

The multicorer recovered sediment in all four tubes (Tab. 64). MC01-A and -B were dedicated to DNA sampling. MC01-C was 40 cm long and sliced at 1-cm intervals. MC01-D was 42.5 cm long and stored as an archive.

Multi Coring resumen table						
ship	**KPH**	**station**	**17**	**core**	**CAGE19-3-KH-18-MC01**	
n. cores	**4**	**av. length**	**41 cm**	**Date**	**06/11/2019, 09:21**	
Lat. N	**79.0255**		**Long. E**	**10.7558**	**Water depth**	**324.74 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (40 samples)
D	Archive 42.5 cm

Table. 64. Summary table for CAGE 19-3-KH-18-MC01

Gravity Corer

The gravity corer recovered 454 cm which was cut into five sections (Tab. 65). Water content samples were taken from the top of section 2, 3, 4, and 5.

Gravity Coring resumen table										
ship	**KPH**	**station**	**18**	**core**	**CAGE19-3-KH-18-GC01**		**WC**=water content			
n. sec	**5**	**length**	**4.54 m**	**Date**	**06/11/2019, h 14:12**		**SS**= smear slides			
Lat. N	**79.0477**		**Long. E**	**11.109**	**Water depth**	**329.08 m bsl**	**HS**= Headspace			

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	5	100	354.0	454.0	firm silty clay		227			
B	4	100	254.0	354.0	firm silty clay		228 (4.2cc)			
C	3	100	154.0	254.0	firm silty clay		229			
D	2	100	54	154.0	soft silty clay		230			
E	1	54	0	54.0						

Table 65. Summary table for CAGE 19-3-KH-18-GC01

Calypso Corer

The Giant Piston corer recovered 15.64 m which were cut into 16 sections (Tab. 66). Water content samples were taken from the top of section 3 to 15. Headspace samples for gas analyses were taken from the top of section 8 and 12.

Calypso Piston Coring resumen table

ship	**KPH**	**station**	**18**	**core**	**CAGE19-3-KH-18-GPC01**		**WC**=water content
n. sec	**16**	**length**	**15.64 m**	**Date**	**06/11/2019, h 15:11**		**SS**= smear slides
Lat. N	**79.0477**		**Long. E**	**11.111**	**Water depth**	**329.08 m bsl**	**HS**= Headspace

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	16	100	1464	1564	soft sandy clay					expanding sediments
B	15	100	1364	1464	firm silty caly		231 (4.7cc)			expanding sediments
C	14	100	1264	1364	firm silty clay		232 (3.5cc)			expanding sediments
D	13	100	1164	1264	firm silty clay		233			expanding sediments
E	12	100	1064	1164	firm silty clay		234		X	expanding sediments
F	11	95	969	1064	silty clay		235 (4.8cc)			EXPANDING !
G	10	100	869	969	soft clay		236 (4.2cc)			expanding sediments
H	9	100	769	869	soft clay		237			
I	8	100	669	769	firm silty clay		238 (4.6cc)		X	
J	7	100	569	669	firm silty clay		239 (4.4cc)			
K	6	100	469	569	soft silty clay		240 (3.6cc)			H2S smell
L	5	96.5	372	469	firm silty clay		241 (4.6cc)			H2S smell expanding!
M	4	100	272	372	silty clay		242			H2S smell
N	3	100	172	272	soft silty clay		243			
O	2	100	72	172	soft clay					
P	1	72	0	72						

Table 66. Summary table for CAGE 19-3-KH-18-GPC01.

4.17 Superstation CAGE 19-3-KH-19

Site Location

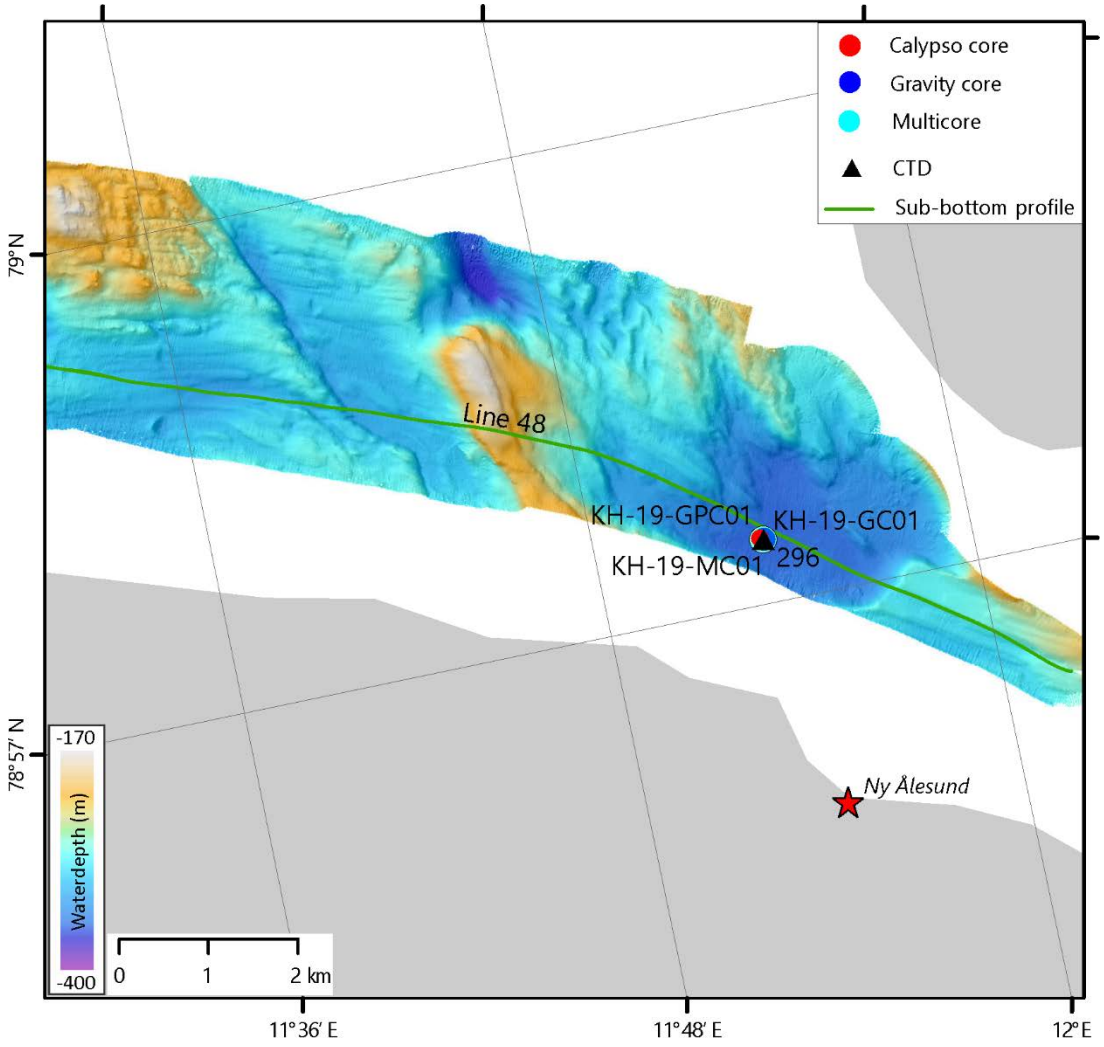

Figure 86. Location of superstation CAGE 19-3-KH-19 in the Kongsfjorden off Ny-Ålesund along with acquired multibeam bathymetry.

Acoustics

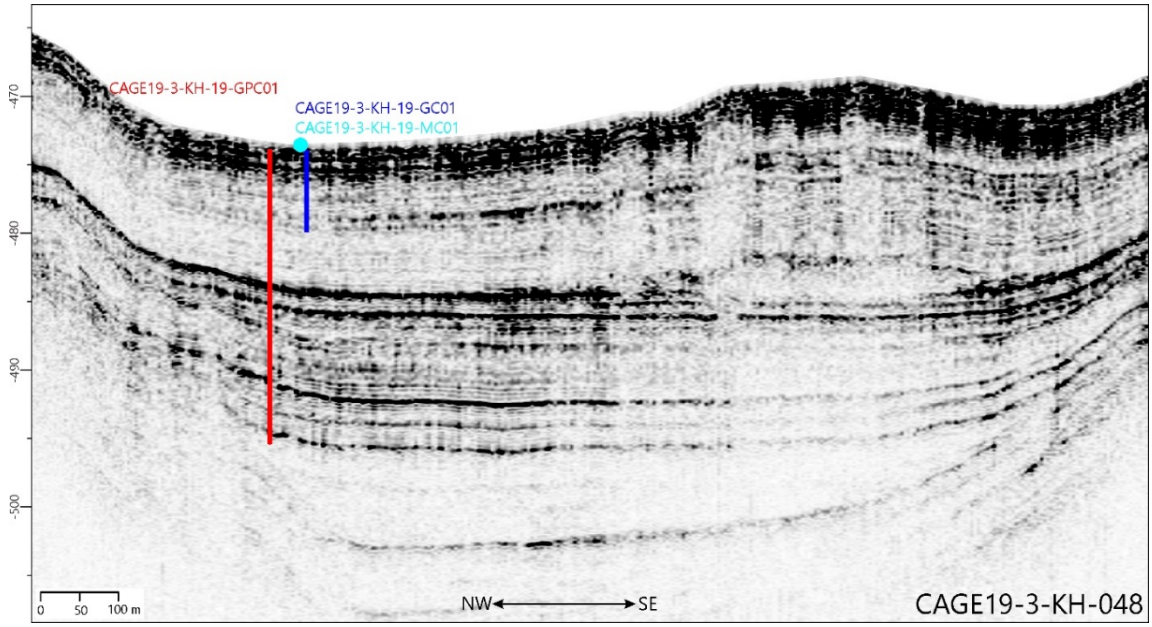

Figure 87. Topas sub-bottom profile at CAGE19-3-KH-19 showing the recent sedimentation at the shallow part along with older well-stratified sediments. Also shown are the projected sampling locations. The depth of penetration of the stations are converted to two-way time using a constant velocity of 1500 m/s.

Multicorer

Multi Coring resumen table						
ship	**KPH**	**station**	**19**	**core**	**CAGE19-3-KH-19-MC01**	
n. cores	**4**	**av. length**	**42 cm**	**Date**	**07/11/2019, 07:24**	
Lat. N	**78.9567**		**Long. E**	**11.8898**	**Water depth**	**356.82 m bsl**

Core	Analyses/Destination
A	DNA
B	DNA
C	Sliced at 1-cm (41 samples)
D	Archive 43 cm

Table. 67. Summary table for CAGE 19-3-KH-19-MC01

Gravity Corer

Gravity Coring resumen table										
ship	**KPH**	**station**	**19**	**core**	**CAGE19-3-KH-19-GC01**			**WC**=water content		
n. sec	**5**	**length**	**4.37 m**	**Date**	**07/11/2019, h 08:13**			**SS**= smear slides		
Lat. N	**78.9567**		**Long. E**	**11.89**	**Water depth**	**356.39 m bsl**		**HS**= Headspace		
sec from bottom	**sec from top**	**length (cm)**	**top sec depth bsf**	**bot. sec depth bsf**	**lithology at section top**	**shear strength kPa**	**WC**	**SS**	**HS**	**note**
A	5	100	337	437						
B	4	100	237	337						
C	3	100	137	237						
D	2	100	37	137						
E	1	37	0	37						

Table. 68 Summary table for CAGE 19-3-KH-19-GPC01.

Calypso Corer

Calypso Piston Coring resumen table										
ship	**KPH**	**station**	**19**	**core**	**CAGE19-3-KH-19-GPC01**			**WC**=water content		
n. sec	**17**	**length**	**16.03 m**	**Date**	**07/11/2019, h 08:54**			**SS**= smear slides		
Lat. N	**78.9569**		**Long. E**	**11.888**	**Water depth**	**329.08 m bsl**		**HS**= Headspace		

sec from bottom	sec from top	length (cm)	top sec depth bsf	bot. sec depth bsf	lithology at section top	shear strength kPa	WC	SS	HS	note
A	17	100	1503	1603	stiff clay		248			
B	16	100	1403	1503	firm clay		249			
C	15	100	1303	1403	firm clay		250			
D	14	100	1203	1303	firm clay		251 (4.2cc)			
E	13	100	1103	1203	firm clay		252 (4.6cc)			
F	12	95	1008	1103	stiff silty clay		253			
G	11	100	908	1008	stiff clay		254			
H	10	100	808	908	firm clayly silt		255			
I	9	100	708	808	softish clay		256			
J	8	100	608	708	soft clayly silt		257 (4.4cc)			
K	7	100	508	608	firm clayly silt		258 (4.4cc)			
L	6	95	413	508	firm silty clay		259			
M	5	100	313	413	firm silty clay		260 (4.6cc)			
N	4	100	213	313	soft clayly silt		261 (4cc)			
O	3	100	113	213	soft clayly silt		262 (4.6cc)			
P	2	53	60	113	soupy soft clay		263			
Q	1	60	0	60						

Table. 69. Summary table for CAGE 19-3-KH-19-GPC01.

5. Logs

Table 70. CAGE 19-3 Site locations, sediment cores

Ship Station	Activity	Station Id	Latitude		Longitude		Equipment	Recovery	Water Depth
01	Multicore	CAGE19-3-KH-01-MC01	78° 41' 6.000"	N	8° 14' 24.000"	E	Multicorer	0.28	891.97
01	Giant Piston Core	CAGE19-3-KH-01-GPC01	78° 41' 34.440"	N	8° 14' 35.160"	E	Calypso corer	12.52	891
03	Multicore	CAGE19-3-KH-03-MC01	80° 36' 23.760"	N	14° 19' 40.800"	E	Multicorer	0.05	167.6
02	Giant Piston Core	CAGE19-3-KH-02-GPC01	80° 36' 16.200"	N	12° 39' 1.440"	E	Calypso corer	11.75	1030.78
02	Multicore	CAGE19-3-KH-02-MC01	80° 36' 16.200"	N	12° 39' 40.680"	E	Multicorer	0.42	1027.93
02	Gravity core	CAGE19-3-KH-02-GC01	80° 36' 16.200"	N	12° 39' 20.880"	E	Gravity corer	4.765	1028.77
01	Gravity core	CAGE19-3-KH-01-GC01	78° 41' 10.320"	N	8° 15' 23.040"	E	Gravity corer	3.2	900.1
04	Multicore	CAGE19-3-KH-04-MC01	78° 59' 7.440"	N	7° 1' 23.880"	E	Multicorer	0.42	1191.12
04	Giant Piston Core	CAGE19-3-KH-04-GPC01	78° 59' 7.440"	N	7° 1' 23.880"	E	Calypso corer	6.14	1191.14
05	Multicore	CAGE19-3-KH-05-MC01	79° 8' 33.360"	N	5° 16' 26.760"	E	Multicorer	0.42	1324.51
05	Gravity core	CAGE19-3-KH-05-GC01	79° 8' 33.360"	N	5° 16' 26.760"	E	Gravity corer	5.835	1320.18
06	Multicore	CAGE19-3-KH-06-MC01	79° 12' 10.440"	N	4° 32' 18.960"	E	Multicorer	0.43	1551.24
06	Gravity core	CAGE19-3-KH-06-GC01	79° 12' 10.440"	N	4° 32' 19.320"	E	Gravity corer	4.32	1551.48
06	Gravity core	CAGE19-3-KH-06-GC02	79° 12' 59.400"	N	4° 32' 42.000"	E	Gravity corer	2.825	1594.2
07	Multicore	CAGE19-3-KH-07-MC01	80° 2' 31.200"	N	5° 44' 20.400"	E	Multicorer	0.38	875.82
07	Gravity core	CAGE19-3-KH-07-GC01	80° 2' 31.200"	N	5° 44' 20.760"	E	Gravity corer	3.08	876.07
07	Giant Piston Core	CAGE19-3-KH-07-GPC01	80° 2' 31.200"	N	5° 44' 21.120"	E	Calypso corer	9.68	876.38
08	Multicore	CAGE19-3-KH-08-MC01	79° 38' 24.720"	N	6° 59' 37.680"	E	Multicorer	0.33	926.02
08	Gravity core	CAGE19-3-KH-08-GC01	79° 38' 24.360"	N	6° 59' 37.680"	E	Gravity corer	4.86	926.15
08	Giant Piston Core	CAGE19-3-KH-08-GPC01	79° 42' 54.360"	N	6° 51' 1.440"	E	Calypso corer	14.05	914.93
09	Giant Piston Core	CAGE19-3-KH-09-GPC01	79° 21' 38.520"	N	5° 53' 38.760"	E	Calypso corer	14.81	1766.78
09	Gravity core	CAGE19-3-KH-09-GC01	79° 21' 38.520"	N	5° 53' 38.760"	E	Gravity corer	5.75	1766.18
10	Multicore	CAGE19-3-KH-10-MC01	78° 52' 57.360"	N	0° 20' 44.880"	E	Multicorer	0.38	2540.85
10	Giant Piston Core	CAGE19-3-KH-10-GPC01	78° 54' 1.800"	N	0° 19' 24.600"	E	Calypso corer	11.75	2542.39
11	Multicore	CAGE19-3-KH-11-MC01	78° 25' 24.960"	N	0° 57' 43.920"	E	Multicorer	0.38	1182.02
11	Giant Piston Core	CAGE19-3-KH-11-GPC01	78° 25' 24.960"	N	0° 57' 43.920"	E	Calypso corer	10.83	1182.28
05	Giant Piston Core	CAGE19-3-KH-05-GPC01	79° 8' 35.160"	N	5° 16' 27.840"	E	Calypso corer	Empty	1321
05	Giant Piston Core	CAGE19-3-KH-05-GPC02	79° 8' 33.720"	N	5° 16' 29.640"	E	Calypso corer	15.67	1321
12	Multicore	CAGE19-3-KH-12-MC01	79° 7' 39.360"	N	5° 49' 12.360"	E	Multicorer	0.45	1270.89
13	Multicore	CAGE19-3-KH-13-MC01	78° 21' 32.760"	N	5° 47' 11.760"	E	Multicorer	0.42	1694.79
13	Giant Piston Core	CAGE19-3-KH-13-GPC01	78° 21' 32.760"	N	5° 47' 11.760"	E	Calypso corer	11.14	1694.95
13	Multicore	CAGE19-3-KH-13-MC02	78° 21' 16.920"	N	5° 42' 15.480"	E	Multicorer	0.37	1617.75
13	Gravity core	CAGE19-3-KH-13-GC01	78° 21' 16.920"	N	5° 42' 15.480"	E	Gravity corer	4.26	1617.34
13	Giant Piston Core	CAGE19-3-KH-13-GPC02	78° 21' 16.920"	N	5° 42' 15.840"	E	Calypso corer	9.31	1617.08
14	Multicore	CAGE19-3-KH-14-MC01	77° 31' 10.560"	N	8° 23' 58.560"	E	Multicorer	0.36	2270.85
14	Giant Piston Core	CAGE19-3-KH-14-GPC01	77° 31' 10.560"	N	8° 23' 58.560"	E	Calypso corer	11.5	2281.42
15	Multicore	CAGE19-3-KH-15-MC01	77° 31' 34.680"	N	9° 49' 18.120"	E	Multicorer	0.395	1579.74
15	Giant Piston Core	CAGE19-3-KH-15-GPC01	77° 31' 34.680"	N	9° 49' 18.480"	E	Calypso corer	15.73	1579.07
14	Giant Piston Core	CAGE19-3-KH-14-GPC02	77° 31' 22.800"	N	8° 24' 5.040"	E	Calypso corer	13.5	2275.38
14	Gravity core	CAGE19-3-KH-14-GC01	77° 31' 22.800"	N	8° 24' 6.480"	E	Gravity corer	4.62	2275.54
12	Giant Piston Core	CAGE19-3-KH-12-GPC01	79° 7' 17.760"	N	6° 7' 42.600"	E	Calypso corer	14.6	1234.13
4	Giant Piston Core	CAGE19-3-KH-4-GPC02	78° 59' 48.120"	N	6° 57' 48.600"	E	Calypso corer	14.41	1194.74
16	Multicore	CAGE19-3-KH-16-MC01	79° 9' 46.800"	N	6° 39' 41.040"	E	Multicorer	0.395	1429.76
16	Giant Piston Core	CAGE19-3-KH-16-GPC01	79° 9' 46.800"	N	6° 39' 41.040"	E	Calypso corer	15.16	1429.61
16	Gravity core	CAGE19-3-KH-16-GC01	79° 9' 49.680"	N	6° 39' 44.640"	E	Gravity corer	5.09	1428.73
16	Gravity core	CAGE19-3-KH-16-GC02	79° 9' 46.080"	N	6° 37' 20.280"	E	Gravity corer	5.51	1460.52
17	Multicore	CAGE19-3-KH-17-MC01	79° 1' 35.400"	N	10° 45' 20.880"	E	Multicorer	0.41	324.74
17	Giant Piston Core	CAGE19-3-KH-17-GPC01	79° 1' 35.400"	N	10° 45' 20.880"	E	Calypso corer	15.24	324.8
17	Gravity core	CAGE19-3-KH-17-GC01	79° 1' 35.760"	N	10° 45' 28.800"	E	Gravity corer	4.66	324.57
18	Multicore	CAGE19-3-KH-18-MC01	79° 2' 51.720"	N	11° 6' 31.320"	E	Multicorer	0.41	328.89
18	Gravity core	CAGE19-3-KH-18-GC01	79° 2' 51.720"	N	11° 6' 31.320"	E	Gravity corer	4.54	328.89
18	Giant Piston Core	CAGE19-3-KH-18-GPC01	79° 2' 51.720"	N	11° 6' 39.960"	E	Calypso corer	15.64	329.08
19	Multicore	CAGE19-3-KH-19-MC01	78° 57' 24.120"	N	11° 53' 23.280"	E	Multicorer	0.42	356.82
19	Gravity core	CAGE19-3-KH-19-GC01	78° 57' 24.120"	N	11° 53' 25.080"	E	Gravity corer	4.37	356.39
19	Giant Piston Core	CAGE19-3-KH-19-GPC01	78° 57' 24.840"	N	11° 53' 17.880"	E	Calypso corer	16.03	356.58

Table 70. CAGE 19-3 Site locations, CTD

Site/Area	Ship Station	Activity	Station Id	Latitude		Longitude		Water Depth
Vestnesa South	277	CTD	CAGE19-3-KH-277-CTD	78° 41' 6.360"	N	8° 14' 28.176"	E	898.41
North Svalbard Slope	278	CTD	CAGE19-3-KH-278-CTD	80° 44' 39.480"	N	13° 31' 31.080"	E	987.26
Hinlopen	279	CTD	CAGE19-3-KH-279-CTD	80° 36' 23.760"	N	14° 19' 41.880"	E	168.14
North Svalbard Slope	280	CTD	CAGE19-3-KH-280-CTD	80° 36' 21.240"	N	12° 38' 45.240"	E	1033.69
Vestnesa East	281	CTD	CAGE19-3-KH-281-CTD	78° 59' 7.440"	N	7° 1' 23.952"	E	1192.18
Vestnesa West	282	CTD	CAGE19-3-KH-282-CTD	79° 8' 33.360"	N	5° 16' 26.616"	E	1324.32
Vestnesa West	283	CTD	CAGE19-3-KH-283-CTD	79° 12' 59.400"	N	4° 32' 41.856"	E	1594.56
Southern Yermak Plateau	284	CTD	CAGE19-3-KH-284-CTD	80° 2' 31.200"	N	5° 44' 20.580"	E	876.75
NW Svalbard	285	CTD	CAGE19-3-KH-285-CTD	79° 38' 30.120"	N	6° 59' 54.024"	E	924.14
NW Svalbard	286	CTD	CAGE19-3-KH-286-CTD	79° 21' 38.520"	N	5° 53' 38.148"	E	1767.75
Fram Strait	287	CTD	CAGE19-3-KH-287-CTD	78° 52' 57.360"	N	0° 20' 44.916"	E	2535.13
Hovgaard Ridge	288	CTD	CAGE19-3-KH-288-CTD	78° 32' 25.800"	N	0° 45' 25.272"	E	1805.73
Vestnesa Transition	289	CTD	CAGE19-3-KH-289-CTD	79° 7' 15.960"	N	6° 7' 44.256"	E	1232.89
Svyatogor Ridge	290	CTD	CAGE19-3-KH-290-CTD	78° 21' 32.760"	N	5° 47' 11.580"	E	1694.9
Isfjorden fan	291	CTD	CAGE19-3-KH-291-CTD	77° 31' 10.200"	N	8° 24' 9.072"	E	2271.69
Isfjorden fan	292	CTD	CAGE19-3-KH-292-CTD	77° 31' 35.040"	N	9° 49' 17.616"	E	1586.3
Kongsfjorden channel	293	CTD	CAGE19-3-KH-293-CTD	79° 9' 46.800"	N	6° 39' 41.040"	E	1430.03
Kongsfjorden	294	CTD	CAGE19-3-KH-294-CTD	79° 1' 35.400"	N	10° 45' 20.880"	E	324.61
Kongsfjorden	295	CTD	CAGE19-3-KH-295-CTD	79° 2' 51.720"	N	11° 6' 31.320"	E	328.87
Kongsfjorden	296	CTD	CAGE19-3-KH-296-CTD	78° 57' 24.120"	N	11° 53' 23.280"	E	356.44

Table 71. CAGE 19-3 Site locations, Chirp lines

Site/Area	Activity	Line Id	Time (UTC)	Latitude		Longitude		End Time (UTC)	Latitude (end)		Longitude (end)		Equipment
Vestnesa South	Chirp	CAGE19-3-KH-001-Chirp	0.35	78° 40' 9.840"	N	8° 13' 43.752"	E	0.367361111	78° 42' 11.880"	N	8° 14' 55.874"	E	SBP300
Vestnesa South	Chirp	CAGE19-3-KH-002-Chirp	0.481782407	78° 42' 28.800"	N	8° 11' 4.416"	E	0.516469907	78° 38' 58.200"	N	8° 16' 11.748"	E	SBP300
Vestnesa South	Chirp	CAGE19-3-KH-003-Chirp	0.560694444	78° 40' 33.960"	N	8° 7' 57.108"	E	0.592615741	78° 40' 39.360"	N	8° 18' 47.880"	E	SBP300
Vestnesa South	Chirp	CAGE19-3-KH-004-Chirp	0.753032407	78° 39' 5.760"	N	8° 16' 1.956"	E	0.757766204	78° 39' 36.000"	N	8° 14' 48.109"	E	SBP300
North Svalbard Slope	Chirp	CAGE19-3-KH-005-Chirp	0.400162037	80° 35' 18.600"	N	12° 37' 19.200"	E	0.557662037	80° 44' 54.060"	N	13° 24' 5.328"	E	SBP300
Hinlopen	Chirp	CAGE19-3-KH-006-Chirp	0.97599537	80° 38' 42.720"	N	14° 14' 12.840"	E	0.0375	80° 33' 27.000"	N	14° 25' 48.864"	E	PS40, SBP300
Hinlopen	Chirp	CAGE19-3-KH-007-Chirp	0.042766204	80° 33' 41.040"	N	14° 25' 14.880"	E	0.079861111	80° 36' 54.360"	N	14° 18' 41.400"	E	SBP300
North Svalbard Slope	Chirp	CAGE19-3-KH-008-Chirp	0.316666667	80° 35' 0.816"	N	12° 44' 46.320"	E	0.327777778	80° 36' 4.320"	N	12° 41' 22.704"	E	SBP300
Vestnesa South	Chirp	CAGE19-3-KH-009-Chirp	0.503472222	78° 40' 20.640"	N	8° 16' 26.148"	E	0.520138889	78° 41' 48.120"	N	8° 14' 19.529"	E	SBP300
Vestnesa Ridge	Chirp	CAGE19-3-KH-010-Chirp	0.959722222	78° 58' 45.840"	N	7° 3' 32.436"	E	0.189583333	79° 8' 59.496"	N	5° 6' 2.375"	E	SBP300
Vestnesa West	Chirp	CAGE19-3-KH-011-Chirp	0.606944444	79° 8' 30.120"	N	5° 19' 49.728"	E	0.711111111	79° 13' 25.602"	N	4° 35' 55.205"	E	SBP300
Southern Yermak Plateau	Chirp	CAGE19-3-KH-012-Chirp	0.233333333	79° 59' 33.000"	N	5° 41' 42.252"	E	0.272916667	80° 3' 18.455"	N	5° 45' 43.974"	E	SBP300
Southern Yermak Plateau	Chirp	CAGE19-3-KH-013-Chirp	0.2875	80° 2' 37.680"	N	5° 38' 42.072"	E	0.309722222	80° 2' 22.107"	N	5° 50' 42.427"	E	SBP300
NW Svalbard	Chirp	CAGE19-3-KH-014-Chirp	0.636111111	80° 2' 23.640"	N	5° 45' 8.172"	E	0.763888889	79° 37' 23.585"	N	7° 1' 24.127"	E	SBP300
NW Svalbard	Chirp	CAGE19-3-KH-015-Chirp	0.953472222	79° 39' 2.160"	N	7° 1' 34.176"	E	0.161805556	79° 20' 47.776"	N	5° 50' 18.082"	E	SBP300
NW Svalbard	Chirp	CAGE19-3-KH-016-Chirp	0.167361111	79° 21' 59.040"	N	5° 43' 39.756"	E	0.203472222	79° 21' 18.400"	N	6° 5' 5.010"	E	SBP300
NW Svalbard	Chirp	CAGE19-3-KH-017-Chirp	0.209027778	79° 21' 55.080"	N	6° 7' 0.120"	E	0.325694444	79° 42' 52.751"	N	6° 50' 51.380"	E	SBP300
Fram Strait	Chirp	CAGE19-3-KH-018-Chirp	0.838194444	79° 21' 57.240"	N	5° 52' 37.848"	E	0.315972222	78° 52' 52.474"	N	0° 5' 10.290"	E	SBP300
Fram Strait	Chirp	CAGE19-3-KH-019-Chirp	0.670833333	78° 54' 34.560"	N	0° 18' 36.000"	E	0.835416667	78° 32' 25.440"	N	0° 45' 25.920"	E	SBP300
Hovgaard Ridge	Chirp	CAGE19-3-KH-020-Chirp	0.889583333	78° 32' 25.080"	N	0° 45' 23.832"	E	0.026388889	78° 17' 31.920"	N	1° 30' 36.360"	E	SBP300
Hovgaard Ridge	Chirp	CAGE19-3-KH-021-Chirp	0.034027778	78° 17' 0.240"	N	1° 28' 32.232"	E	0.161296296	78° 30' 9.696"	N	0° 39' 52.373"	E	SBP300
Hovgaard Ridge	Chirp	CAGE19-3-KH-022-Chirp	0.170833333	78° 29' 49.200"	N	0° 37' 2.028"	E	0.288599537	78° 17' 15.232"	N	1° 23' 10.872"	E	SBP300
Hovgaard Ridge	Chirp	CAGE19-3-KH-023-Chirp	0.311111111	78° 17' 44.880"	N	1° 33' 30.672"	E	0.4025	78° 28' 9.792"	N	0° 56' 8.802"	E	SBP300
NW Svalbard	Chirp	CAGE19-3-KH-024-Chirp	0.643055556	78° 26' 4.920"	N	0° 59' 45.276"	E	0.948611111	79° 8' 32.640"	N	5° 16' 1.200"	E	SBP300
NW Svalbard	Chirp	CAGE19-3-KH-025-Chirp	0.905555556	79° 7' 53.760"	N	5° 49' 30.936"	E	0.120833333	78° 20' 42.685"	N	5° 34' 37.768"	E	SBP300
Svyatogor Ridge	Chirp	CAGE19-3-KH-026-Chirp	0.129166667	78° 20' 43.440"	N	5° 32' 20.940"	E	0.168055556	78° 21' 52.512"	N	5° 53' 18.276"	E	SBP300
Svyatogor Ridge	Chirp	CAGE19-3-KH-027-Chirp	0.184722222	78° 23' 2.760"	N	5° 51' 33.300"	E	0.221550926	78° 21' 48.192"	N	5° 31' 40.068"	E	SBP300
Svyatogor Ridge	Chirp	CAGE19-3-KH-028-Chirp	0.240972222	78° 19' 41.520"	N	5° 34' 27.408"	E	0.266111111	78° 20' 50.688"	N	5° 54' 57.780"	E	SBP300
W Svalbard	Chirp	CAGE19-3-KH-029-Chirp	0.868055556	78° 21' 14.040"	N	5° 43' 23.916"	E	0.142291667	77° 34' 9.024"	N	8° 25' 32.166"	E	SBP300
Isfjorden fan	Chirp	CAGE19-3-KH-030-Chirp	0.143738426	77° 34' 5.880"	N	8° 25' 30.792"	E	0.184594907	77° 29' 27.328"	N	8° 22' 44.118"	E	SBP300
Isfjorden fan	Chirp	CAGE19-3-KH-031-Chirp	0.746527778	77° 30' 55.800"	N	8° 14' 35.844"	E	0.877777778	77° 31' 37.488"	N	9° 54' 42.300"	E	SBP300
Isfjorden fan	Chirp	CAGE19-3-KH-032-Chirp	0.9	77° 33' 39.960"	N	9° 49' 50.196"	E	0.929861111	77° 30' 7.776"	N	9° 49' 25.680"	E	SBP300
Isfjorden fan	Chirp	CAGE19-3-KH-033-Chirp	0.000694444	77° 30' 41.760"	N	9° 46' 16.068"	E	0.060416667	77° 41' 7.416"	N	10° 25' 54.956"	E	SBP300
Kongsfjorden Channel	Chirp	CAGE19-3-KH-034-Chirp	0.783333333	78° 58' 56.280"	N	6° 54' 6.048"	E	0.867361111	79° 7' 10.503"	N	7° 45' 42.278"	E	SBP300
Kongsfjorden Channel	Chirp	CAGE19-3-KH-035-Chirp	0.878472222	79° 6' 21.600"	N	7° 46' 49.620"	E	0.954166667	79° 10' 24.026"	N	6° 55' 16.337"	E	SBP300
Kongsfjorden Channel	Chirp	CAGE19-3-KH-036-Chirp	0.974305556	79° 10' 20.640"	N	7° 0' 59.976"	E	0.052083333	79° 7' 6.524"	N	6° 5' 55.092"	E	SBP300
Kongsfjorden Channel	Chirp	CAGE19-3-KH-037-Chirp	0.05625	79° 7' 18.480"	N	6° 3' 14.832"	E	0.095138889	79° 13' 59.831"	N	6° 26' 34.198"	E	SBP300
Kongsfjorden Channel	Chirp	CAGE19-3-KH-038-Chirp	0.097916667	79° 14' 11.040"	N	6° 24' 47.160"	E	0.182581019	79° 22' 50.720"	N	5° 20' 58.008"	E	SBP300
Kongsfjorden Channel	Chirp	CAGE19-3-KH-039-Chirp	0.197199074	79° 24' 14.272"	N	5° 20' 25.230"	E	0.283888889	79° 15' 2.112"	N	6° 27' 39.486"	E	SBP300
Kongsfjorden Channel	Chirp	CAGE19-3-KH-040-Chirp	0.761111111	79° 13' 54.480"	N	6° 23' 13.956"	E	0.947222222	78° 56' 19.968"	N	9° 20' 14.772"	E	PS40, SBP300
Kongsfjorden	Chirp	CAGE19-3-KH-041-Chirp	0.950694444	78° 56' 25.800"	N	9° 23' 3.876"	E	0.092361111	79° 3' 21.648"	N	11° 15' 43.055"	E	Topas PS40
Kongsfjorden	Chirp	CAGE19-3-KH-042-Chirp	0.099305556	79° 3' 42.840"	N	11° 15' 50.760"	E	0.146261574	79° 1' 20.796"	N	10° 36' 5.695"	E	Topas PS40
Kongsfjorden	Chirp	CAGE19-3-KH-043-Chirp	0.152083333	79° 0' 42.120"	N	10° 36' 29.880"	E	0.2009375	79° 3' 3.920"	N	11° 15' 47.067"	E	Topas PS40
Kongsfjorden	Chirp	CAGE19-3-KH-044-Chirp	0.207638889	79° 3' 56.160"	N	11° 14' 43.440"	E	0.249409722	79° 1' 36.963"	N	10° 35' 36.182"	E	Topas PS40
Kongsfjorden	Chirp	CAGE19-3-KH-045-Chirp	0.256944444	79° 0' 26.640"	N	10° 36' 22.680"	E	0.300902778	79° 2' 49.567"	N	11° 16' 43.236"	E	Topas PS40
Kongsfjorden	Chirp	CAGE19-3-KH-046-Chirp	0.306944444	79° 3' 23.400"	N	11° 16' 24.960"	E	0.348796296	79° 1' 3.901"	N	10° 36' 48.328"	E	Topas PS40
Kongsfjorden	Chirp	CAGE19-3-KH-047-Chirp	0.740972222	79° 3' 11.880"	N	11° 5' 5.280"	E	0.801388889	78° 59' 10.224"	N	11° 34' 10.394"	E	Topas PS40
Kongsfjorden	Chirp	CAGE19-3-KH-048-Chirp	0.828472222	78° 59' 16.440"	N	11° 32' 50.280"	E	0.88125	78° 56' 13.323"	N	12° 2' 15.527"	E	Topas PS40