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R/V G.O. Sars

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Tromsø – Tromsø

In collaboration with the Norwegian Petroleum Directorate

CAGE21-6 cruise report

Hydrocarbon leakage in Hopendjupet, central Barents Sea

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CAGE - Centre for Arctic Gas Hydrate Environment and Climate Report Series 71 (2021)

1 Contents

1 Scientific objectives and study area

The cruise was part of the Centre of Excellence (SFF) Centre for Arctic Gas Hydrate. Environment and Climate (CAGE) at UiT The Arctic University of Norway, in collaboration with the Norwegian Petroleum Directorate (NPD).

The study area for the cruise was Hopendjupet in the central Barents Sea (Fig. 1). This area has been visited on two previous CAGE cruises (CAGE20-2 and CAGE21-4), during which evidence for extensive hydrocarbon leakage was found. CAGE21-6 is the first to visit the area with a remotely operated vehicle (ROV), allowing targeted sampling and imaging of the seafloor, combined with coordinated sampling of the water column and air. The cruise had the following scientific objectives:

- ROV sampling of gas, oil and sediments at natural hydrocarbon leakage sites;
- ROV surveying and sampling to characterize micro and macro-biological activity/communities on the seafloor, within the water column and on the sea surface at hydrocarbon leakage sites;
- Acquisition of visual and acoustic datasets to facilitate the quantification of hydrocarbon leakage;
- Water column sampling to inform on methane, heavier hydrocarbon and nutrient concentrations in the water column at natural hydrocarbon seepage sites;
- Air sampling to assess methane and heavier hydrocarbon concentrations associated with natural hydrocarbon seepage sites.

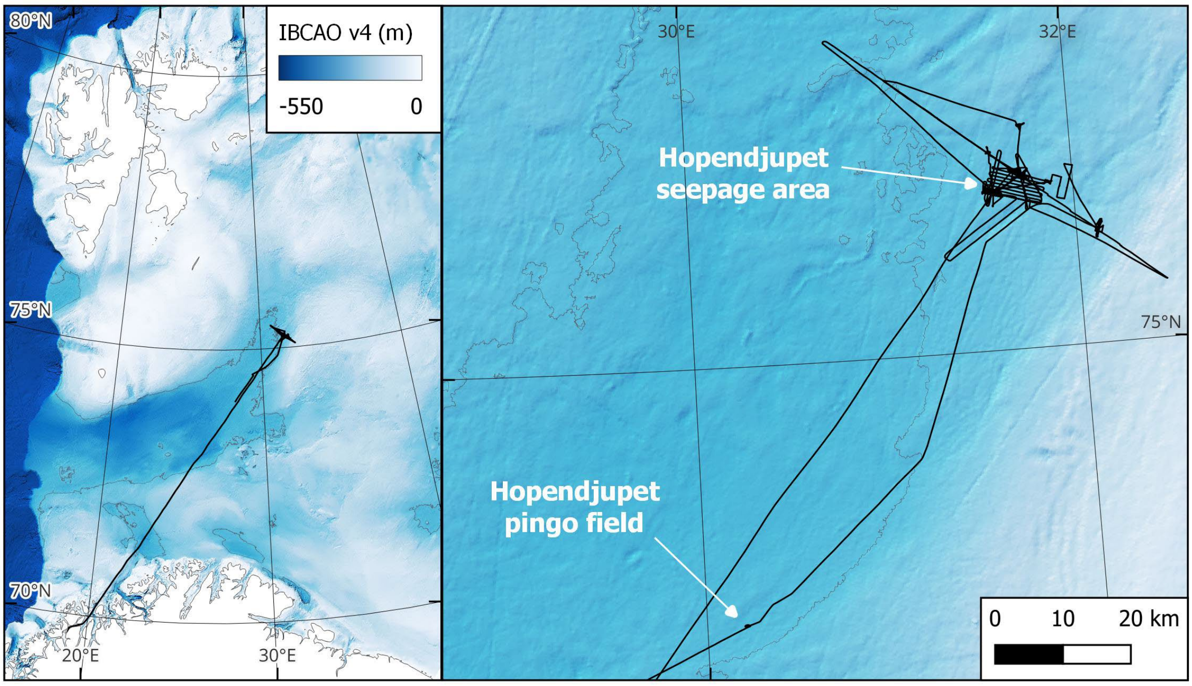

Figure 1. Working areas for cruise CAGE21-6 in Hopendjupet. The ship track is shown in black.

Geologically, Hopendjupet (the Hopen Deep) represents a viable setting for significant gas flaring linked to thermogenic source rocks. The area is bounded by outcropping Jurassic-age reservoir rocks (Realgrunnen Sub-Group), indicating where Cretaceous age rocks have since been eroded by the Cenozoic ice sheets. On and around the structural highs, Triassic-age rocks (Upper Triassic Snadd Fm and Middle Triassic Kobbe Fm) subcrop at the seafloor. The major regional geological structures include the Sentralbanken (east) and the Gardarbanken (west) highs, which route and act as focus points for the migration of free gas from the subsurface. Fault zones associated with these structural elements provide additional pathways to the seafloor. Within this area CAGE cruises 20-2 and 21-4 have identified extremely intense gas seepage, gas hydrate pingos and sea surface oil slicks. Today the gas hydrate stability zone lies at around 360 metres water depth in this region.

2 Cruise participants

Name	Position (Institution)
Monica Winsborrow (cruise leader)	Associate Professor (CAGE)
Jochen Knies (cruise leader)	Senior Researcher (NGU/CAGE)
Rune Mattingsdal	Geologist (NPD)
André Jensen	Geologist (NPD)
Henry Patton	Researcher (CAGE)
Marie Stetzler	PhD (CAGE)
Christine Tømmervik Kollsgård	PhD (IG)
Mariana Esteves	Communications Advisor/ Researcher (CAGE)
Vincent Carrier	Researcher (CAGE)
Mauro Pau	Postdoc (CAGE)
Clea Fabian	Technician (NGU)
Arunima Sen	Ass. Professor (UNIS)
Karina Weiler	MSc (UiT)
Eyvind Ernstsen	ROV pilot (HI)
Jörn Patrick Meyer	ROV pilot (HI)
Hibert Grovg	ROV pilot (Omega Subsea)
Martin Dahl	Instrument chief (HI)

Table 1. CAGE21-6 cruise participants

Work was organised in two time shifts. Shift 1: 08:00-20:00 Shift 2: 20:00-08:00 (TOS time). The ROV was deployed during shift 1. We departed from Tromsø 05.12 at 21:00, transiting to Hopendjupet, and arriving at the study area at 11:17 on the 07.12. We left the study area at 1200 on 14.12.21, arriving into port in Tromsø at 06:00 on 16.12.

A map-based blog was created for the cruise, with approximately daily updates from cruise participations. This documented both the scientific programme of the cruise as well as giving an insight into the day-to-day life onboard the vessel. This blog will be archived and can be accessed at the following address:
https://storymaps.arcgis.com/stories/b9418e4ae353426ca4c021a47b2cd42f

3 Equipment used

3.1 Multibeam echosounder

Multibeam echosounders use a swath of beams giving off-track depth. Basic components of a multibeam system are two linear transducer arrays in a Mills cross configuration with separate units for transmitting and receiving. Echosounders measure the two-way travel time that a sound wave initiated by the transmitter needs to reach the seafloor and be reflected back to the receiver. The time-depth conversion can be done using the sound velocity through seawater calculated from the closest CTD measurements.

R/V G.O. Sars is equipped with the hull-mounted Kongsberg Simrad EM302 multibeam echosounder system. Its nominal sonar frequency of the sound waves is 30 kHz with an angular coverage sector of up to 150° and 432 beams per ping. The system was mainly used with a 60°/60° opening angle. The ping rate depends on the water depth and switched frequently between 0.5 and 2 Hz. The EM302 provides high-resolution bathymetric data up to a water depth of 7000 m. The achievable swath width on the seafloor depends on the water depth and the selected opening angle.

During the cruise, the EM302 was used to monitor the water column. The acquired data were analysed using the QPS FM Midwater software. Before any analysis could be done, the provided sonar source files (*.all, *.wcd) had to be converted to the generic water column file format (*.gwc).

The objective of analysing water column data was the detection of acoustic flares indicating gas seepage from the seafloor to the water column.

3.2 Single beam echosounder

Single beam echosounders are common among all types of ships. Their primary purpose is to estimate the depth of the seafloor. In a single beam echosounder, the transducer projects a sound pulse through water in a controlled direction and the reflected wave is received. The depth is calculated from the travel time of the sound pulse. R/V G.O. Sars has a keel-mounted Simrad EK 80 split beam echosounder with transducers at different frequencies: 18, 38, 70, 120, 200 and 333 kHz. The 18 kHz transducer can be used for water depths up to 10 km whereas 38 kHz and 120 kHz can only be used for depths up to 2 km and 500 m, respectively. Single beam echosounder data was collected at multiple locations, to monitor the water column and acquire data over gas flaring areas.

3.3 ADCP

The G.O. Sars is equipped with a hull-mounted Acoustic Doppler Current Profiler (ADCP), a hydroacoustic system used to measure current speed and direction (corrected for ship motion) in up to ca.700m depth. It is capable of operating at 75 and 150 kHz. Both systems have been used, depending on water column properties, assessed from CTD casts. If the water was too stratified, the lower frequency of 75kHz was preferred to ensure continuous data quality along layer transition. Surveys were often carried out in parallel to single beam echosounder surveys. The data will help assess methane distributions.

3.4 CTD and water sampling

CTD (Conductivity, Temperature, Depth) sensors measure the physical properties of seawater. In addition to measuring the conductivity, temperature and pressure (from which depth is calculated), the CTD sensors measure or calculate salinity of seawater, density, sound velocity, turbidity, fluorescence/chlorophyll and oxygen content. Furthermore, the CTD deck unit can trigger closing of Niskin bottles at discrete depths. Water samples may be taken from the Niskin bottles for further analysis.

R/V G.O. Sars uses a SBE 911plus CTD for producing vertical profiles of seawater properties. A winch is used to lower the CTD system into the water. The SBE 911plus CTD can measure physical properties of the seawater from up to eight auxiliary sensors, in marine or fresh-water environments at depths up to 6000 m. The CTD sensors record data at a rate of 24 samples per second. The 911plus system uses the modular SBE 3plus temperature sensor, SBE 4C conductivity sensor, SBE 5T submersible pump, and TC duct. The submersible pump pumps water along the sensor to measure the conductivity. The TC duct makes sure that temperature and conductivity are measured on the same parcel of water.

CTD data was collected at intervals during the cruise to measure variations in the sound velocity profile of the water column – a necessary calibration for multibeam echosounder surveying. Further targeted CTD data and water samples were collected at seven sites during the cruise with the aim of tracing the passage of methane through the water column. Samples were collected at various depths in the water column, most commonly acquiring samples 10 m and 30 m from the seafloor, 5 m from the sea surface and several samples in the middle part of the water column. Figure 2 shows an example of a CTD cast and water sampling station.

Figure 2. Sampling of water from the CTD (Photo: M. Esteves).

Water samples were prepared for measurement of methane and higher hydrocarbon concentrations at 39 stations. After rinsing to minimise carry-over, seawater was drawn from the Niskin bottles into 120 ml glass vials. 1 ml water was then removed by using a pipette, and replaced by 1 ml of 1 M NaOH solution to stop microbial activity. Any air bubbles present were eliminated carefully. The vials were sealed with rubber septa and aluminium caps prior to being stored dark and refrigerated at 4 °C.
At 11 of all stations further water samples were collected for nutrient (nitrate, phosphate, ammonium) and dissolved organic carbon analysis. For this, water was filled in 60ml plastic vials

to ca 4/5th of their volume to account for ice expansion when freezing the samples at -20°C. At certain stations water samples were also taken into 20ml glass vials for $\delta^{18}O$ analysis and stored at 4°C. At most stations 2 duplicate samples were taken from the deepest bottle.

3.5 Air sampling

Air samples were collected for analysis by Norwegian Institute for Air Research (NILU). Samples were collected in air canisters from the bow of the ship (Fig. 3), ensuring that the bow was facing into the wind to avoid contamination from the ship. At most sampling sites, air samples were collected simultaneously to CTD casts. Samples were sent to NILU for analysis of methane and heavier hydrocarbon concentrations.

Figure 3. Air sampling canister (Photo: M. Esteves)

3.6 Oil slick sampling

The working boat was used to attempt to sample a sea surface oil slick identified in satellite imagery. The sampling was done using a ETFE membrane which is optimal for sampling oil sheets from the water surface. The membrane is subjected to an extensive solvent cleaning procedure to make sure it is not contaminated and must therefore be handled with care. It is handled with plastic gloves and attached to the end of a telescopic pole which is then placed onto the sea surface. The ETFE membrane encourages the oil to be drawn from the water surface and coat the surface of the ETFE. It can be repeatedly exposed to the sheen in order to build up the maximum amount of oil coating. When the ETFE membrane has a good visual covering of oil, it is placed into a sample bottle with the help of a wooden spatula. The oil samples were collected by NPD and will be sent off for geochemical analysis.

3.7 Remotely Operated Vehicle (ROV) Ægir6000

The ROV Ægir6000 is a work-class ROV 150 Hp (Fig. 4). It is specially equipped for scientific research with samplers and sensors, sufficiently powered to operate seafloor drilling systems and to install and maintain seafloor observatories, and designed for operation from both RVs G.O. Sars and Kronprins Haakon.

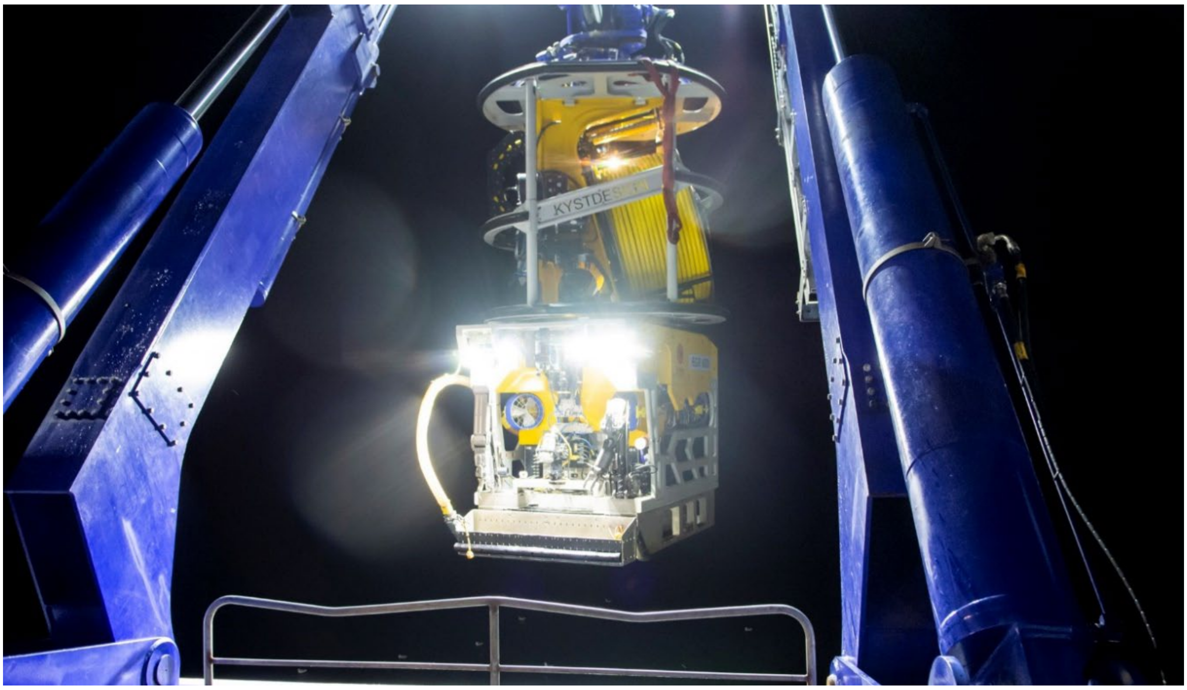

Figure 4. ROV Ægir 6000 being deployed from R.V. G. O. Sars (Photo: M. Pau).

The ROV was deployed together with a 750 m+ Tether Management System (TMS), allowing it to decouple from the ship's motion when submerged and enabling it to operate at greater distances from the vessel. Its manipulators consist of pincers, able to collect precise samples, with the ROV's 7 cameras enabling the technicians to precisely grab targeted objects once on the seafloor. The acquired samples are then put into the bio drawer, where they await analysis once the unit is brought back onboard in seawater. ROV Ægir 6000 is also equipped with coring devices, gas and water samplers (Fig. 5), oceanographic and geochemical sensors (including a methane sensor) as well as a multibeam system, in order to image the seafloor on a more precise scale.

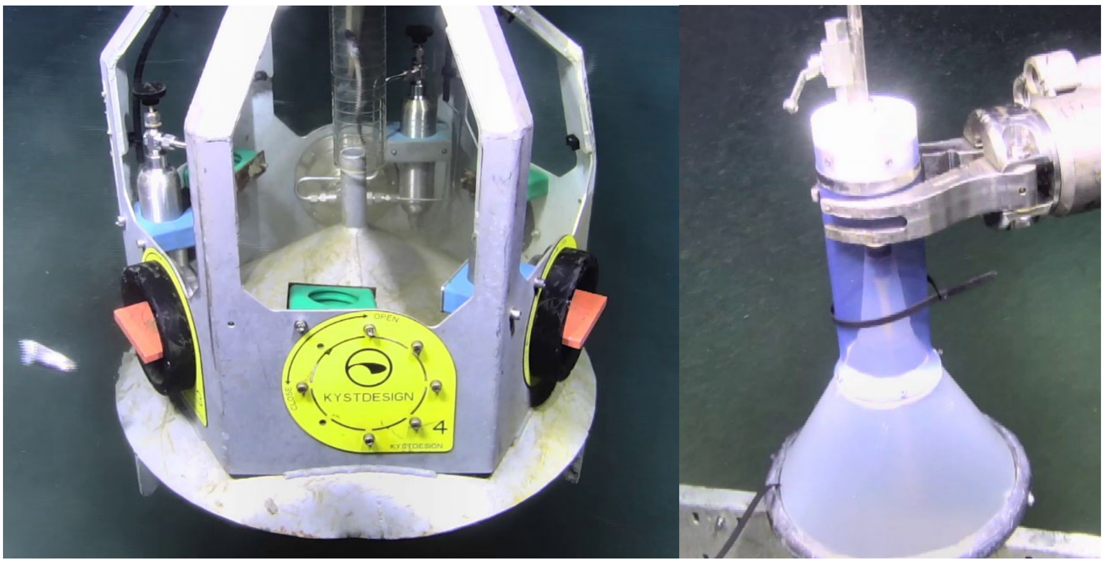

Figure 5. Both a gas (left) and oil (right) sampler were deployed using the ROV Ægir 6000.

3.8 Gas in sediments

We extracted samples for headspace gas analysis from thirteen selected push cores immediately after retrieval or, for three of them, after porewater extraction (Table 2). Samples of sediment for headspace gas were taken concurrently with those for biological analyses by extruding the cores, except for core CAGE21-6-GS-06-PUSC-003 where pre-drilled holes were used. The samples were collected every centimetre down to 4 cm below sea floor, and subsequently at alternate intervals of 2 cm (4–6 cm, 8–10 cm, etc.). Core CAGE21-06-GS-01-PUSC-020 was sampled continuously, whereas core CAGE21-6-GS-06-PUSC-003 was not sampled between 1 and 4 cm below sea floor. We used a 5 ml syringe without the luer tip to collect 5 ml of sediments (2 ml for cores CAGE21-06-GS-01-PUSC-020 and CAGE21-06-GS-01-PUSC-030). The sediment sample was transferred to a 20 ml serum vial (Fig. 6), and 5 ml of 1 M NaOH solution was added to stop microbial degradation (1 ml for cores CAGE21-06-GS-01-PUSC-020 and CAGE21-06-GS-01-PUSC-030). The vial was immediately closed with a rubber septum and an aluminium crimp seal. The headspace gas samples were then stored at 4 °C for onshore analyses.

Core	Headspace gas	Microbiology	Meio- and macrofauna	Porewater
CAGE21-6-GS-01-PUSC-020	•	•	•	
CAGE21-6-GS-01-PUSC-030	•	•	•	
CAGE21-6-GS-01-PUSC-031	•	•		•
CAGE21-6-GS-01-PUSC-036	•	•		•
CAGE21-6-GS-01-PUSC-048	•	•		•
CAGE21-6-GS-01-PUSC-049	•	•	•	
CAGE21-6-GS-01-PUSC-050				•
CAGE21-6-GS-01-PUSC-051	•	•	•	
CAGE21-6-GS-02-PUSC-001				•
CAGE21-6-GS-02-PUSC-003	•	•	•	
CAGE21-6-GS-02-PUSC-005				•
CAGE21-6-GS-02-PUSC-006	•	•	•	
CAGE21-6-GS-02-PUSC-008	•	•	•	
CAGE21-6-GS-02-PUSC-009				•
CAGE21-6-GS-04-PUSC-003	•	•	•	
CAGE21-6-GS-04-PUSC-006	•	•	•	
CAGE21-6-GS-04-PUSC-008				•
CAGE21-6-GS-04-PUSC-013				•
CAGE21-6-GS-05-PUSC-003				•
CAGE21-6-GS-06-PUSC-003	•			
CAGE21-6-GS-06-PUSC-004				•

Table 2. Overview of the samplings conducted on the push cores.

Figure 6. Sampling of sediments for headspace gas analysis (Photo: M. Pau).

3.9 Porewater sampling

We collected porewater at 2 cm intervals along 11 selected push cores (Table 2) using 50-mm long Rhizon samplers fitted to 12 ml, low-pressurised syringes (Fig. 7). A first subsample was drawn into 5 ml Eppendorf tubes for sulphate analysis and stored frozen at -20 °C. A second subsample was drawn into 5 ml Eppendorf tubes for H_2S analysis, added 2 ml of 23.8 mM zinc acetate solution to stop microbial activity and stored refrigerated at 4 °C. Subsamples for H_2S analysis from cores CAGE21-6-GS-01-PUSC-031, CAGE21-6-GS-01-PUSC-036 and CAGE21-6-GS-01-PUSC-048 were not collected on board, but will be drawn onshore from the vials used for the sulphate analysis. Finally, a third subsample was collected for dissolved inorganic carbon analysis, transferred to 1.5 ml vials with screw cap containing 20 μl of saturated $HgCl_2$ solution to stop microbial activity and stored refrigerated at 4 °C.

Figure 7. Porewater sampling (Photo: M. Pau).

3.10 Microbiology sampling

Microbial communities have been analysed from both marine sediments and water column (within and at the surface).

3.10.1 Sediment sampling

For benthic communities, three superstations were sampled: two oil-influenced sites (superstation 1 with visual sign of oil emissions, and superstation 4 without visual sign of oil emissions with bacterial mats), and one reference site (superstation 2). At each superstation, clusters of two cores were taken within a few tens of cm distance and simultaneously: a push core for porewater analyses (PW) and a push core for microbial analyses (MB). After retrieval, two complete clusters were retrieved at the oil-influenced site (superstation 1), and three at the reference site. However no complete cluster could be retrieved at the second oil-influenced site (superstation 4). Incomplete clusters where only one of the core in a duo were retrieved were also further processed. The list of cores analysed can be found in Table 2.

Once onboard, MB cores were immediately moved to cold temperature until being further processed, while PW cores were taken into the lab for analyses. Subsampling of sediment from both MB and PW cores were extruded at different depth intervals. At the oil- and methane-influenced sites; one cm intervals between 0 to 4 cm below seafloor (cmbsf) and two cm intervals from 4 cmbsf and below were subsampled. For cores taken at the reference site, similar subsampling strategy was implemented down to 10 cmbsf. Further below, two cm intervals of sediments were subsampled at each 5 cm step. Maximum depth sampled and number of samples taken for each core can be found in Table 2. Subsampled sediments were stored in Whirl-Pak® sterile sampling bags (Nasco, United States). Sediments for microbial studies were collected in combination with sampling for headspace and meiofauna.

3.10.2 Water column sampling and incubation series

During the sampling campaign, we also set up a time series experiment to observe simultaneous changes in oil biodegraded compounds and in microbial community structure. The experiment involved both the collection of oil seeping from the seafloor and of seawater. Three parallel mixtures have been set up: (1) autoclaved seawater with oil, (2) autoclaved oil with seawater, and (3) autoclaved oil and autoclaved seawater. For the mixtures 1 and 2, the incubation will last for 96 days, where at 8 time points both microbial communities and oil compounds will be analysed. For each time point and each set up, 2 bottles will be used to extract DNA/RNA and 2 will be used to measure oil compounds (2 set ups x 8 times points x 4 bottles = 64 bottles). Solutions from the DNA/RNA bottles will also be retained for nutrients analyses. For the third mixture, the incubation will last for 96 days with five time points (1 set up x 5 time points x 4 bottles = 20 bottles). For further details on a similar experiment, see Gomes et al. (2022).

The preparation of the incubations involved two key sampling steps:

<u>Preparation of the oil mixed Water Accomodated Fraction (WAF):</u> The oil was collected using a homemade device described in section 3.7 (Fig. 5). Seawater was collected using a Niskin bottle mounted on a rosette with a SBE 911plus CTD. Temperature and salinity profiles were retrieved during descent of the rosette and seawater was collected at 30m depth, corresponding to Atlantic waters based on the CTD profile. Onboard, the seawater was first filter through sterivex to remove particles larger than 0.22μm. Required volumes of filtered seawater and oil were autoclaved at 121°C for 21 minutes. Three different WAF were prepared according to the set ups described

above with 10ml of oil was added per 1l volume. Each three mixture were continuously mixed for 24h.

Preparation of the incubations: Prior to preparing the incubations, seawater was collected following a similar approach to first identify Atlantic waters and sample at 30m water depth, corresponding to Atlantic waters. The seawater was filtered through a 20µm filter and required volume for mixture 1 and 3 was autoclaved. Afterwards, for each incubation, a 1:1 ratio 50 ml mixture of seawater and WAF was added in each incubation bottles. Bottles were capped with an aluminium cover to prevent contamination but allow flow of gas. For the time point zero, for each time series, two bottles were filtered through sterivex for DNA/RNA analyses and were subsequently stored at -80°C. Filtered water were stored at -20°C in 15 mL Eppendorf tubes for further nutrients analyses. The two other bottles were stored at -20°C to inhibit further oil biodegradation. The remaining incubation bottles were continuously mixed.

3.10.3 Surface oil slicks

Oil slicks were detected via satellite imagery (in collaboration with CIRFA, UiT) during the sampling campaign and attempts were subsequently made to identify these visually (challenging due to 24 hr darkness). Surface oil slick samples were collected using the ship's working boat. A clean sampling cloth was attached to a long sampling stick. The cloth was then wiped across the sea surface to collect the oil slick. Segments of the oil were transferred into 50 ml Falcon tubes and stored at -80°C.

In parallel, surface seawater was collected using a Niskin bottle mounted on a rosette at a location where oil slicks were not detected both visually and on satellite imagery. A volume of 2L of seawater was filtered through a sterivex (0.22µm) and the filter was subsequently stored at -80°C.

3.10.4 Post-campaign work

After the sampling campaign, subsamples will be selected based on porewater and headspace profiles at reference and oil sites. Total nucleotides will be extracted at UiT and be sequenced to identify microbes and their level of activity. The incubation series in section 3.10.2 will be continued on land until Day 96. Total nucleotides from Sterivex filters will be extracted at UiT and be sequenced to identify microbes and potentially analyse activity levels. Measurements of oil biodegradation will be done by or in cooperation with NPD. Finally, for samples in section 3.10.3, total nucleotides will be extracted from the oil slick-cloth and the sterivex filters. They will subsequently be sequenced to identify the microbial community composition.

3.11 Biological sampling

3.11.1 Video mosaicking

Video mosaics were constructed at three stations:

1. Superstation 1: just north of the oil seep site where detailed sediment and push core sampling was conducted.
2. Superstation 1: a carbonate ridge surrounded by siboglinid worm tufts and bacterial mats approximately 150m away from the first mosaic site and sampling station.
3. Superstation 3: where bacterial mats, yellow sediment (possibly due to high iron content) and a different type of sibolginind worm tufts were observed.

All indviduals of all visible species will be marked in the mosaics to assess the megafaunal and epifaunal communities.

3.11.2 Faunal sampling

3.11.2.1 Sediment macrofauna
Push cores from the ROV team (8.5 cm diameter) were taken along with microbe and porewater samples (for information on which cores see Table 2). At superstation 1, 3 replicate cores were taken among siboglinid worm tufts and three were taken from bacterial mats. At superstation 4, two replicate cores were taken from the two microhabitats. Additionally, similar to porewater and microbe cores, 2 macrofauna cores were taken at the reference station. Macrofauna cores were sieved over a 0.5 mm mesh (Fig. 8) and fixed immediately in borax buffered 4% formaldehyde with Rose Bengal for later identification and enumeration of species/taxa in the lab.

Figure 8. Sieving of sediment macrofauna samples (Photo: M. Esteves).

3.11.2.2 Sediment meiofauna
Cores used for headspace and microbes samples were additionally used for collecting sediment meiofauna samples (see Table 2). A part of the slices down till 10 cm was fixed in borax buffered 4% formaldehyde with Rose Bengal for quantification of sediment meiofauna communities. Four replicate cores were taken from the oil seep station and 2 replicate cores were taken from the reference station for meiofauna. The slices that were preserved for meiofauna were: 0-1 cm, 1-2 cm, 2-3 cm, 3-4 cm, 4-6 cm, 6-8 cm and 8-10 cm.

3.11.2.3 Isotope samples
A number of individual animals were collected from the different stations to conduct carbon and nitrogen stable isotope analyses. Carbon isotope values differ based on food sources being

photosynthetic in origin versus chemosynthetic (and further differentiates between methane and sulfide as the energy source), therefore these collections will enable us to assess whether chemosynthetically fixed carbon (by microbes and symbiont bearing animals) gets transferred higher up the food chain. Coupled with nitrogen isotope values which change based on trophic levels, this will allow us to model the food web and the extent to which carbon in the food web is fixed either chemosynthetically or from phytodetrital sources.

3.12 Checkerboards and hydrophones

The checkerboard experiment is a frame on which 2 checkerboards have been mounted perpendicular to each other, along with 2 cameras in deep sea cases, each facing a checkerboard, (at 90° to each other). It also entails a hydrophone and a light (Fig. 9). Placed over a seep, its purpose is to quantify seep bubble parameters, such as rising speeds and sizes. The ROV deploys the checkerboard over a seep, films the scene from crucial perspectives for reference, then moves to ca. 25m away to minimize noise on the hydrophone. The cameras are recording the bubbles rising in front of the checkerboards, while the hydrophone is recording their sound. Due to technical issues, the ROV's cameras had once to record the set up instead of the experiment's cameras, and the hydrophone encountered a minor issue. Nevertheless, the experiment was successful on 3 out of 4 deployments and managed to observe a total of 6 bubble streams over 10 minutes each.

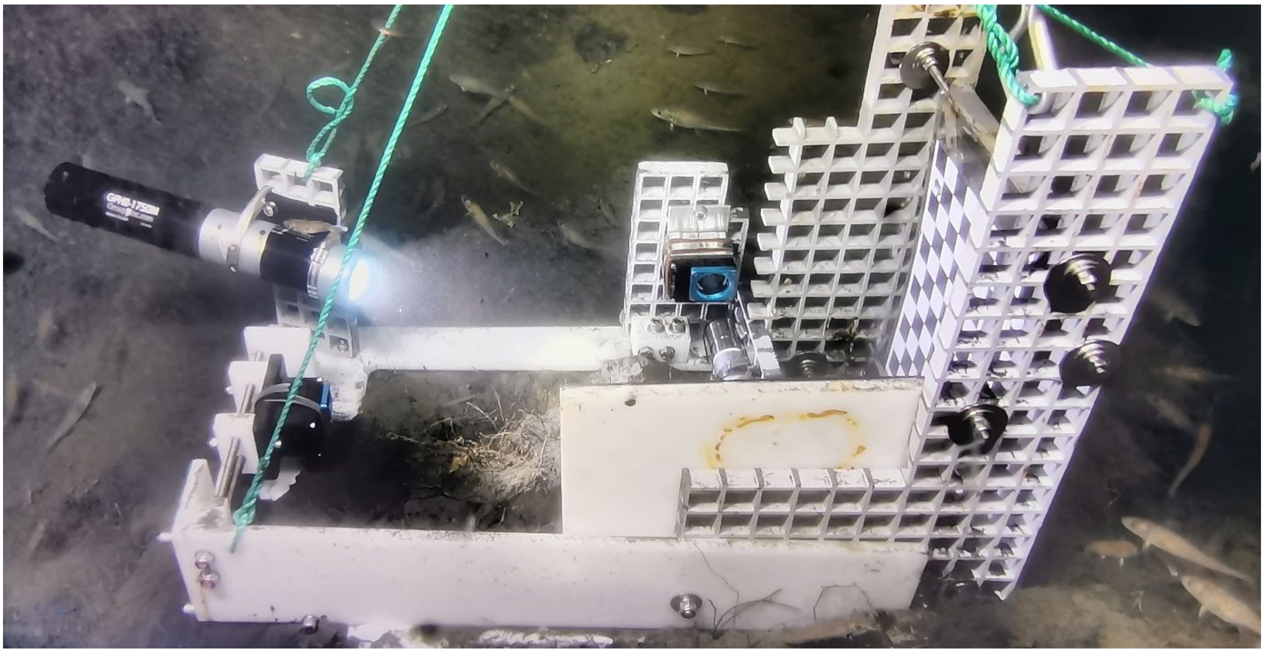

Figure 9. The checkerboard experiment deployed with ROV Ægir 6000.

4 Study areas and ship tracks

The study area for cruise CAGE21-6 was Hopendjupet in the central Barents Sea. Within Hopendjupet a series of hydrocarbon seepage sites were targeted with ROV surveying and sampling (Southern seep, Northern seep, Middle seep and Gas seepage site), in addition to a gas hydrate pingo site first identified during CAGE20-2 and a control site outside of the active seepage area (Fig. 10). The sampling and sampling campaign has been divided into a series of 9 superstations. Each superstation represents a combination of ROV dives, acoustic surveys and water/air sampling transects (Fig. 10). The following sections document the sampling and surveying carried out at each superstation, whilst full details can be found in the station and line logs (sections 6.1 and 6.2).

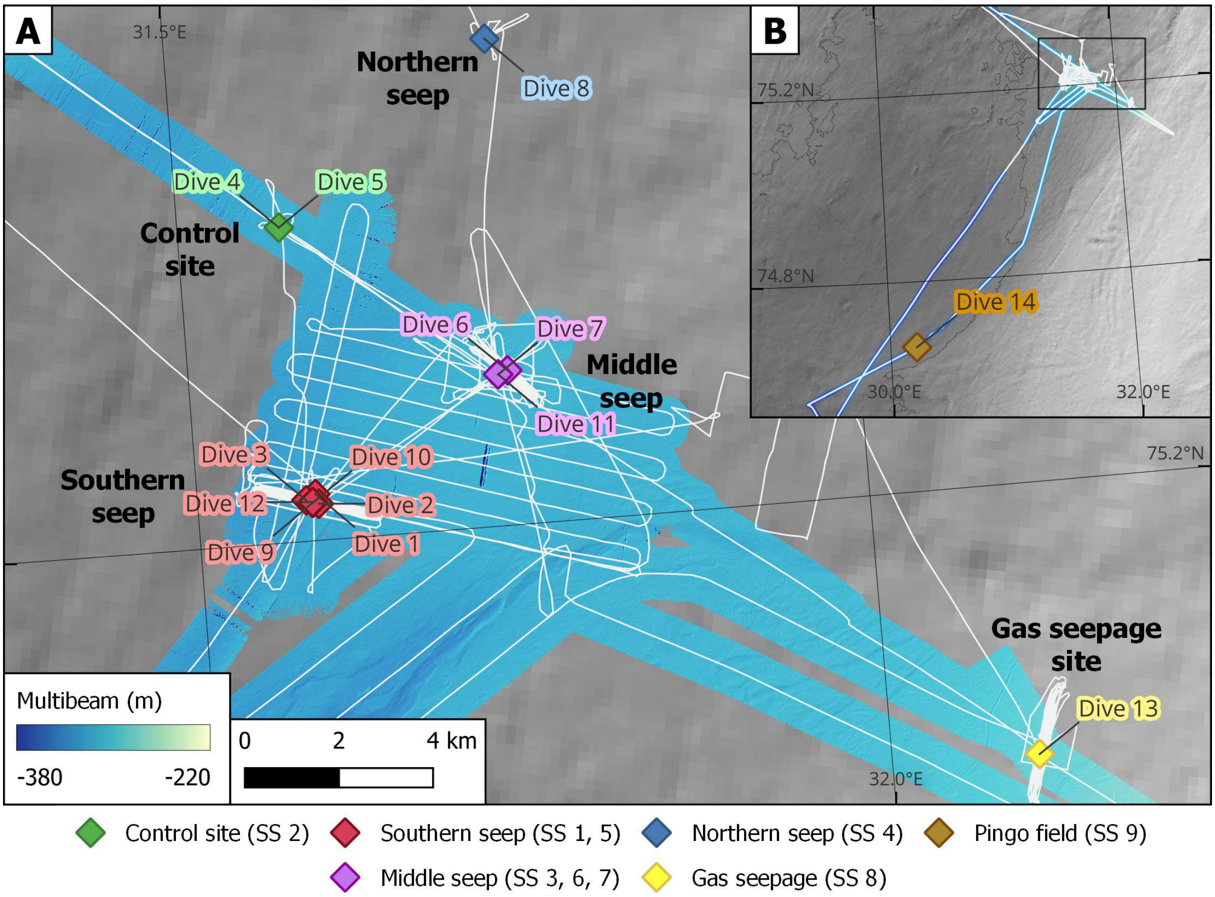

Figure 10. Map detailing the location of the sites targeted for ROV surveying and sampling, indicating the ROV dive and superstation numbers for each site. The inset box shows dive 14 at the Hopendjupet pingo field.

5 Superstation summary

5.1 Superstation 1- Southern seep site and CTD/air transects

On Superstation 1, three ROV dives were completed (Dives 1-3) at the southernmost hydrocarbon seepage site identified in CAGE21-4 (Fig. 11). We applied the suction sampler to collect 2 biological samples (shrimps). The push corer was deployed 25 times to collect sediments for porewater extraction, headspace analyses, microbial experiments, and macro/meio fauna analyses. Niskin bottles were released both directly above the seep sites and ca. 20 m above the escaping gas at the seafloor. Two carbonate crust samples were collected nearby the active seepage. For the first time, we tried to collect seeping oil from the seafloor. Finally, the checkerboard was deployed to analyse the bubble size and fluxes at the active sites. 2 video mosaics of different settings were recorded.

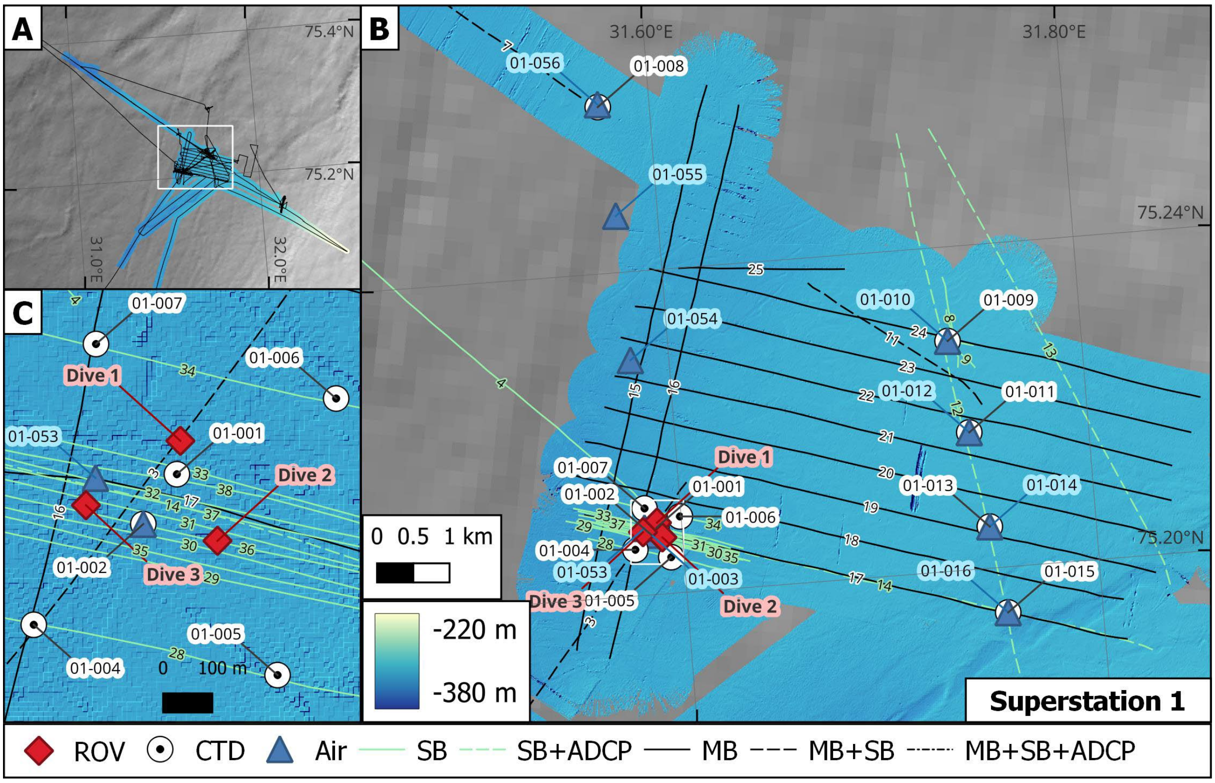

Figure 11. Map showing the ROV dives, sampling and surveying carried out at superstation 1. All samples are labelled with the station id, and all survey lines are labelled with the line number. For full details see logs in section 6.

At superstation 1, 11 CTD surveys and water sampling stations were completed (Fig. 11). Of these, 6 were located around the site of the ROV dives (the southern seep site), whilst 4 were taken along a transect to the east of the site, and 1 ~6 km north of the seep site. Air samples were also collected at 9 locations at superstation 1: 4 of these along the eastern CTD transits, 2 close to the ROV dive site, and 3 in a transect going north from the seepage site (the northernmost of which was at the same location at the northernmost CTD sampling site (Fig. 11).

Several acoustic surveys were carried out with various combinations of multibeam echosounder, single beam echosounder and ADCP at superstation 1 (see Fig. 11 for locations).

5.2 Superstation 2- Control site

Superstation 2 represents a background/control site and was located outside the geological structure associated with active gas flaring where we observed no indications of seepage (Fig. 10). Two ROV dives were completed at this site (Fig. 12; dives 4 and 5) leading to the acquisition of 9 push cores collected for porewater, microbial, headspace and faunal analyses (see Table 2) and the acquisition of one biological sample using the ROV arm.

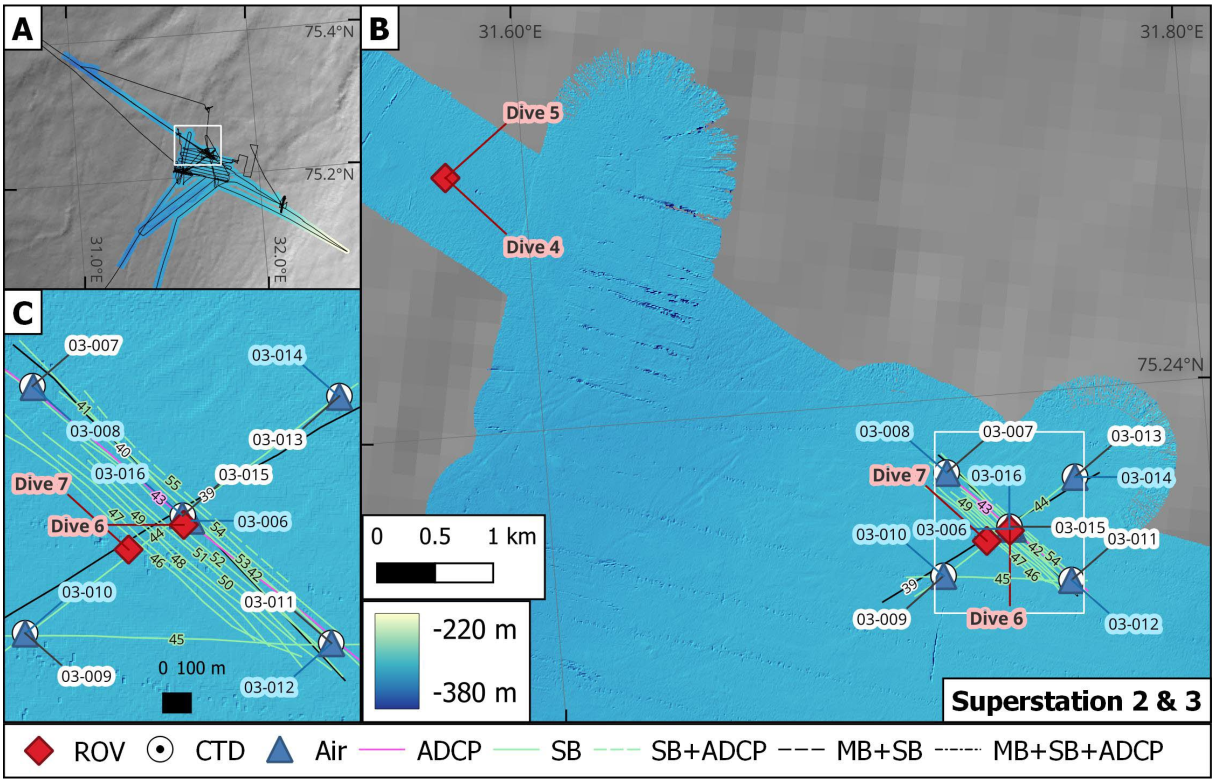

Fig 12. Map showing the ROV dives, sampling and surveying carried out at superstations 2 and 3. For full details see logs in section 6.

5.3 Superstation 3- Middle seep site

Superstation 3 was located at the middle hydrocarbon leakage site (Fig. 10). Two ROV dives were completed (dives 6, 7) and ROV Ægir inspected numerous locations prior to sampling (Fig. 12). Active gas flaring was observed at many sites, however, one location was selected for deployment of the oil and gas sampler, as well as the checkboard (dive 6). Water samples were collected ca. 20 m above the seep sites with two Niskin bottles. Finally, one video mosaic was recorded (dive 7).

A survey of 5 CTD and 5 air samples was carried out around the location of dive 6, along with the acquisition of a single beam echosounder survey, and one APCP profile (Fig. 12).

5.4 Superstation 4- Northern seep site

Superstation 4 was selected after ROV inspection of the northern seep site (Figs. 10, 13). Both oil and gas sampler were deployed over potential active seeps. 10 push cores were taken for porewater, headspace and microbial analyses, and numerous biological samples were taken.

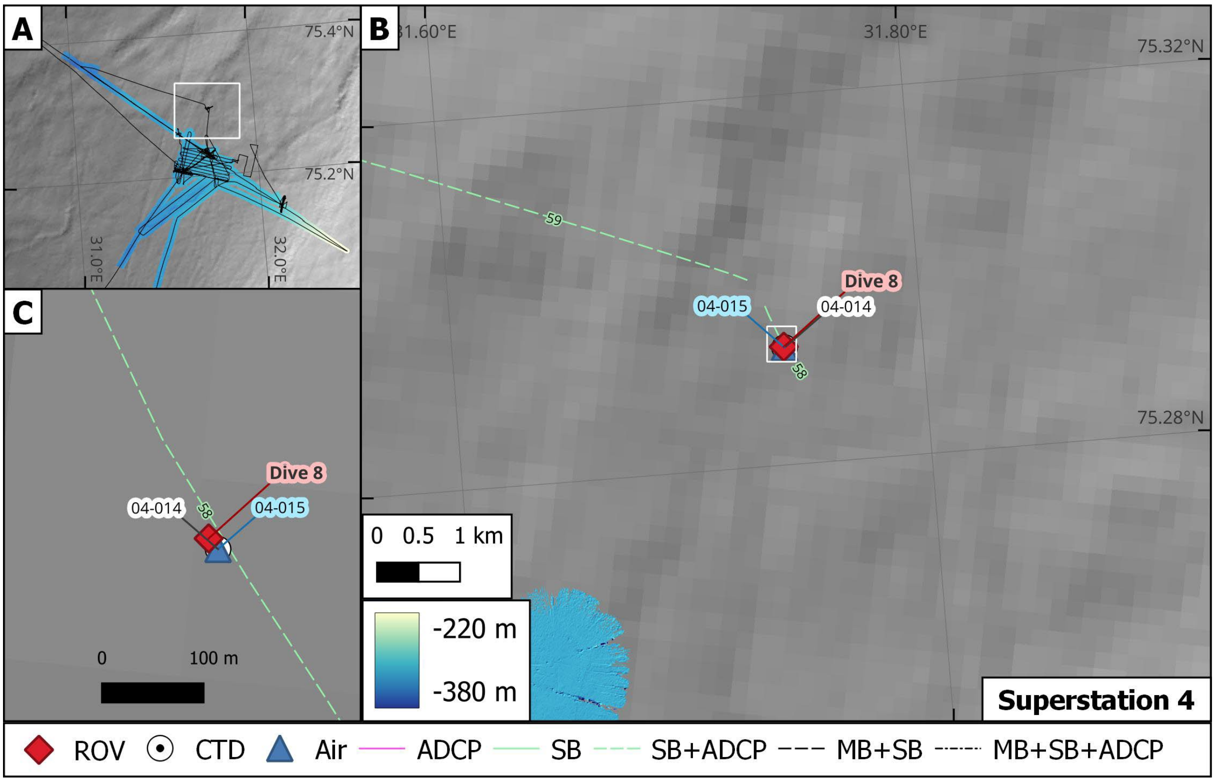

Figure 13. Map showing the ROV dives, sampling and surveying carried out at superstation 4. For full details see logs in section 6.

5.5 Superstation 5- Southern seep site and CTD/air sampling transect

The southern seep site was again inspected for additional oil sampling at the seafloor, along with a transect of water and air samples, and acoustic surveying. In addition to this, we conducted a short survey of potential oil slicks at the sea surface using the working boat (Fig. 14). The ROV dives (9, 10, 12) led to the collection of 2 push cores for additional porewater analyses, whilst the checkerboard was deployed again for monitoring the active oil, oil/gas, and pure gas seeps. Numerous biological samples (macrofauna) around the seeps were taken.
Seven air and CTD samples was collected along a transect running NW-NE of the seep site, with 1 further CTD sample collected just south of the site. The northwestern-most CTD station of the transect functions as a reference site for CTD water sampling, since it lies outside of the geological structure associated with seepage. Profiling of multibeam, single beam and ADCP was carried out along this transect, and over the ROV site (lines 60-71).

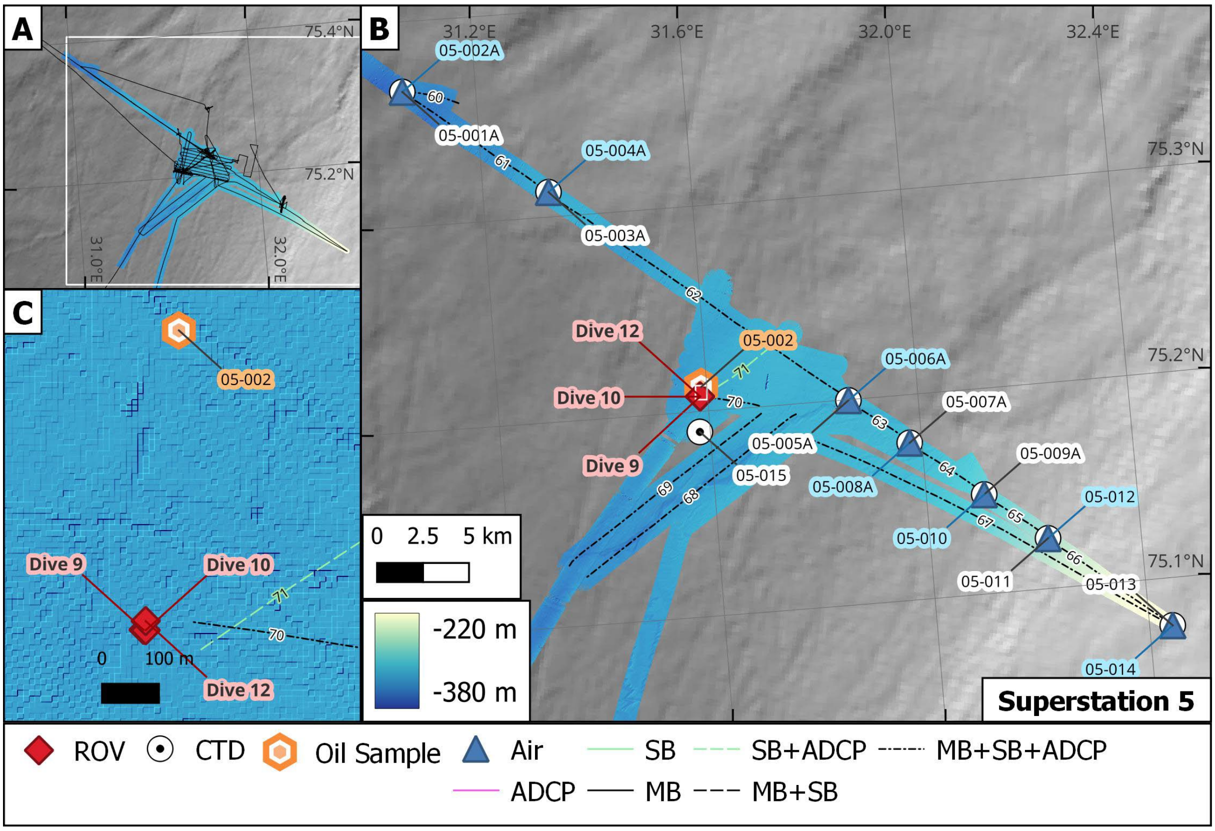

Figure 14. Map showing the ROV dives over the Southern seep site and associated sampling and surveying carried out at superstation 5. For full details see logs in section 6.

5.6 Superstations 6 and 7- Middle and southern seep sites, CTD grid

At superstation 6 the middle seep site was re-visited to recover two additional push cores for porewater and headspace analyses (Fig. 15). In addition, several biological samples (macrofauna) were taken around the seep site. This was then followed by a superstation 7, where a single beam survey at the southern seep site (lines 72-84) and grid of CTD water samples and single beam surveying (lines 86-95) to the east of the middle seep site was conducted.

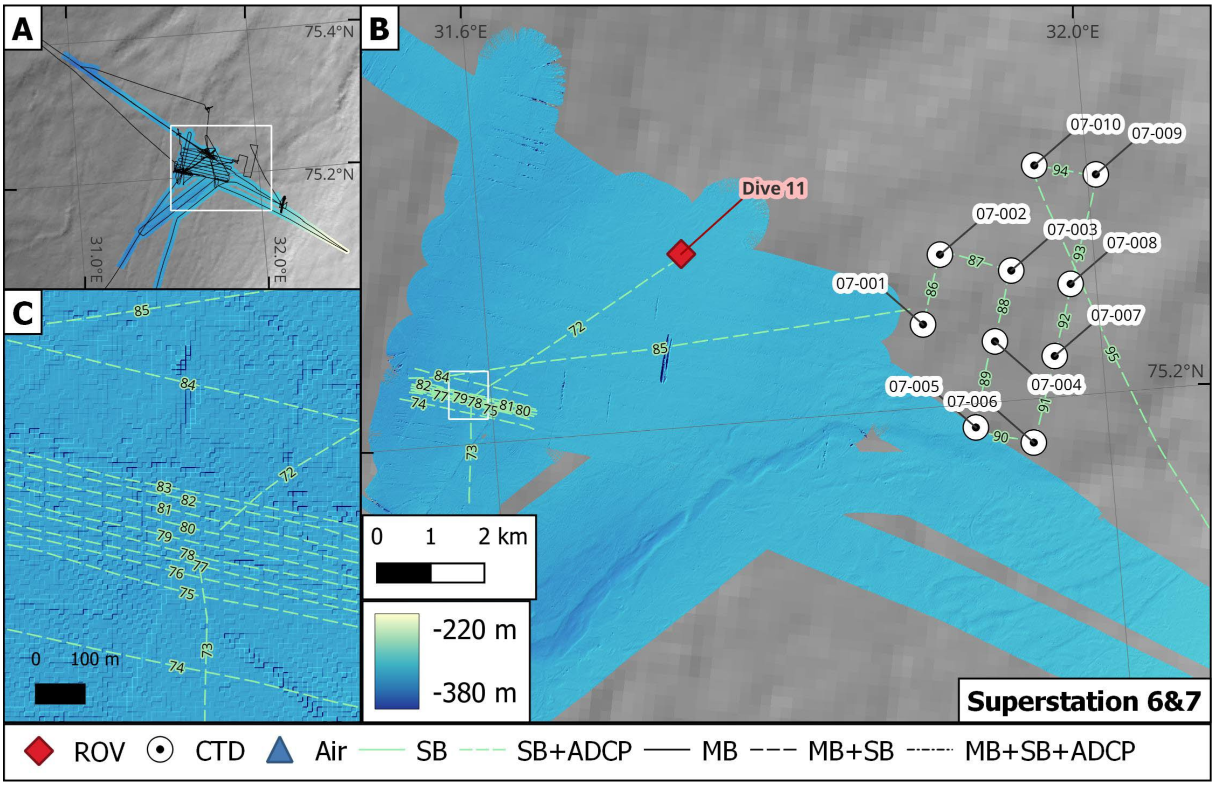

Figure 15. Map showing the ROV dives, sampling and surveying carried out at superstations 6 and 7. For full details see logs in section 6.

5.7 Superstation 8- Gas seepage site

ROV Ægir 6000 inspected numerous gas flares on Superstation 8 during ROV dive 13, in the eastern part of the Hopendjupet (Fig. 16). The gas sampler was deployed on a continuous stream of gas bubbles at two locations. In addition, we collected the only two pieces of carbonate crust we detected during the entire survey. Finally, the checkerboard was launched over the same flare we collected the first gas sample. Four Niskin water samples ca. 1 m above the seep site finalized the ROV sampling work on Superstation 8.

Sampling at superstation 8 continued with a water sampling survey comprising 6 CTD casts around the ROV dive site, followed by an extensive single beam and ADCP survey of this area (lines 97-110).

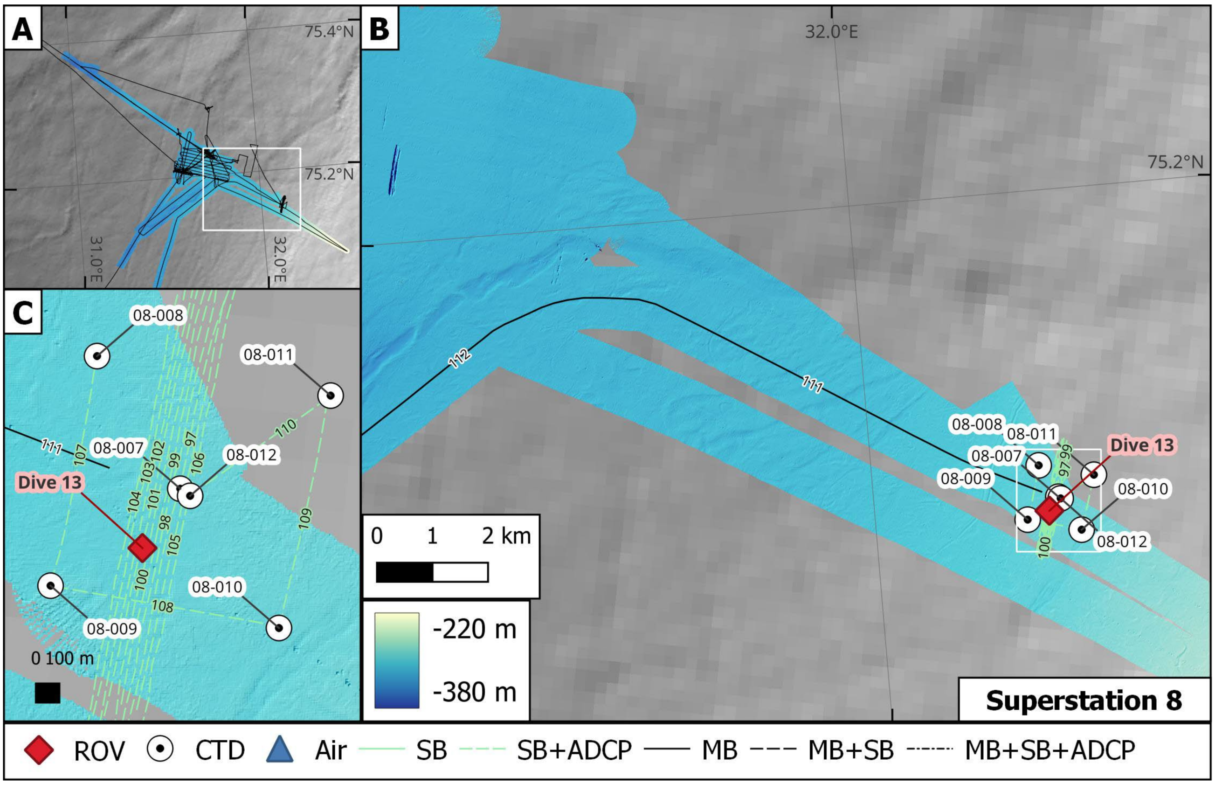

Figure 16. Map showing the ROV dives, sampling and surveying carried out at superstation 8 at the gas seepage site. For full details see logs in section 6.

5.8 Superstation 9- Hopendjupet pingo field

The final ROV dive of the cruise (dive 14) was taken over the Hopendjupet pingo field (Fig. 17). Here, the gas sampler was deployed above a gas seepage site, along with a Niskin water sample. Water sampling was then carried out with a CTD cast over the ROV dive site. As we left the area, a final air sample was collected ~20 km SE of the pingo ROV site in an area with no evidence of hydrocarbon leakage.

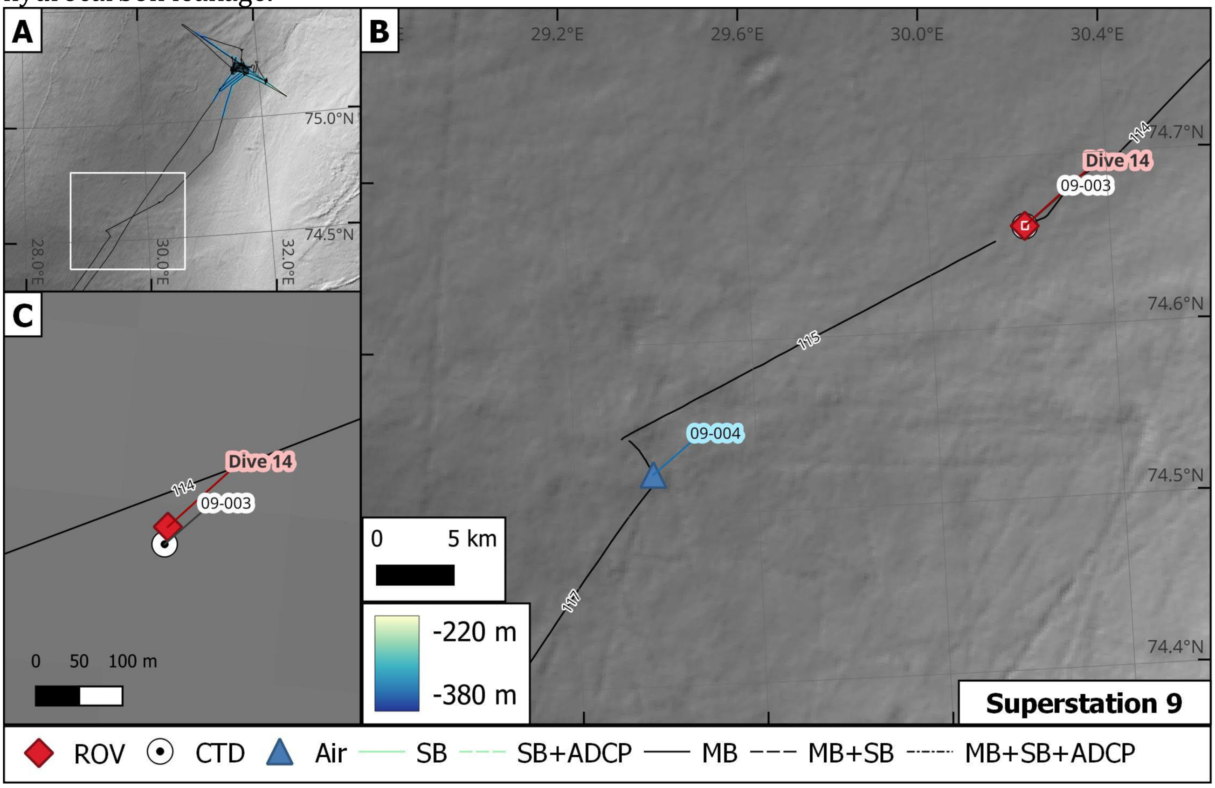

Figure 17. Map showing the ROV dives, sampling and surveying carried out at superstation 9 within the Hopendjupet pingo field. For full details see logs in section 6.

6 Logs

6.1 Station log

Location	Station Id	Activity	Date	Time (UTC)	Lat. [N] Long. [E]	Bottles fired [#]	Water Depth [m]	Notes/ship station
Bjørnøyrenna	CAGE21-6-GS-01-CTD001	CTD	07.12	10:17	75°12.495' 31°35.262'	0	343	347. S/V profile and equip learning
Hopendjupet seeps	CAGE21-6-GS-01-CTD002	CTD	07.12	13:15	75°12.444' 31°35.103'	11	343	348. 5 point survey around southernmost seep
Hopendjupet seeps	CAGE21-6-GS-01-Air003	Air	07.12	13:28	75°12.444' 31°35.103'	1	0	
Hopendjupet seeps	CAGE21-6-GS-01-CTD004	CTD	07.12	14:18	75°12.344' 31°34.603'	11	342	349
Hopendjupet seeps	CAGE21-6-GS-01-CTD005	CTD	07.12	15:59	75°12.268' 31°35.625'	11	341	350
Hopendjupet seeps	CAGE21-6-GS-01-CTD006	CTD	07.12	17:30	75°12.564' 31°35.966'	11	341	351

Hopendjupet seeps	CAGE21-6-GS-01-CTD007	CTD	07.12	18:11	75°12.644' 31°34.960'	11	342	352
Hopendjupet seeps	CAGE21-6-GS-01-CTD008	CTD	08.12	00:12	75°15.635' 31°34.505'	11	335	353. ctd along seismic line
Hopendjupet seeps	CAGE21-6-GS-01-CTD009	CTD	08.12	01:33	75°13.703' 31°44.117'	11	329	354. CTD along seismic line&above middle seep
Hopendjupet seeps	CAGE21-6-GS-01-Air010	Air	08.12	01:43	75°13.703' 31°44.117'	1	0	
Hopendjupet seeps	CAGE21-6-GS-01-CTD011	CTD	08.12	03:50	75°13.016' 31°44.533'	11	329	355. CTD transect south
Hopendjupet seeps	CAGE21-6-GS-01-Air012	Air	08.12	03:57	75°13.016' 31°44.533'	1	0	
Hopendjupet seeps	CAGE21-6-GS-01-CTD013	CTD	08.12	04:32	75°12.308' 31°44.910'	11	330	356. CTD transect south

Hopendjupet seeps	CAGE21-6-GS-01-Air014	Air	08.12	04:47	75°12.308' 31°44.910'	1	0	
Hopendjupet seeps	CAGE21-6-GS-01-CTD015	CTD	08.12	05:18	75°11.663' 31°45.243'	11	334	357. CTD transect south
Hopendjupet seeps	CAGE21-6-GS-01-Air016	Air	08.12	05:36	75°11.663' 31°45.243'	1	0	
Hopendjupet seeps	CAGE21-6-GS-01-Biol017	ROV Biology	08.12	10:12	75°12.438' 31°35.058'		341	ROV Biology - BS 1
Hopendjupet seeps	CAGE21-6-GS-01-Biol018	ROV Biology	08.12	11:03	75°12.420' 31°35.424'		339	ROV Biology - BS 2
Hopendjupet seeps	CAGE21-6-GS-01-PusC019	ROV Push Core	08.12	12:20	75°12.444' 31°35.058'		341	ROV Push Core - PC1
Hopendjupet seeps	CAGE21-6-GS-01-PusC020	ROV Push Core	08.12	12:34	75°12.438' 31°35.058'		341	ROV Push Core - core ID 12 (PC2)

Hopendjupet seeps	CAGE21-6-GS-01-PusC021	ROV Push Core	08.12	12:35	75°12.438' 31°35.058'		341	ROV Push Core - core ID 11 (PC3)
Hopendjupet seeps	CAGE21-6-GS-01-PusC022	ROV Push Core	08.12	12:50	75°12.438' 31°35.058'		340	ROV Push Core - core ID 19 (PC4)
Hopendjupet seeps	CAGE21-6-GS-01-PusC023	ROV Push Core	08.12	12:54	75°12.438' 31°35.058'		340	ROV Push Core - core ID 18 (PC5)
Hopendjupet seeps	CAGE21-6-GS-01-PusC024	ROV Push Core	08.12	13:08	75°12.438' 31°35.058'		341	ROV Push Core - core ID 3 (PC6)
Hopendjupet seeps	CAGE21-6-GS-01-PusC025	ROV Push Core	08.12	13:10	75°12.438' 31°35.064'		341	ROV Push Core - core ID 2 (PC7)
Hopendjupet seeps	CAGE21-6-GS-01-PusC026	ROV Push Core	08.12	13:22	75°12.444' 31°35.058'		341	ROV Push Core - core ID 9 (PC 8)
Hopendjupet seeps	CAGE21-6-GS-01-PusC027	ROV Push Core	08.12	13:26	75°12.444' 31°35.064'		341	ROV Push Core - core ID 10 (PC 9)

Hopendjupet seeps	CAGE21-6-GS-01-PusC028	ROV Push Core	08.12	13:37	75°12.444' 31°35.058'		341	ROV Push Core - core ID 17 (PC 10)
Hopendjupet seeps	CAGE21-6-GS-01-PusC029	ROV Push Core	08.12	13:40	75°12.444' 31°35.070'		341	ROV Push Core - core ID 20 (PC 11)
Hopendjupet seeps	CAGE21-6-GS-01-PusC030	ROV Push Core	08.12	13:51	75°12.438' 31°35.064'		341	ROV Push Core - core ID 13 (PC 12)
Hopendjupet seeps	CAGE21-6-GS-01-PusC031	ROV Push Core	08.12	13:53	75°12.438' 31°35.064'		341	ROV Push Core - core ID 4 (PC 13)
Hopendjupet seeps	CAGE21-6-GS-01-PusC032	ROV Push Core	08.12	14:04	75°12.444' 31°35.070'		340	ROV Push Core - core ID 21 (PC 14)
Hopendjupet seeps	CAGE21-6-GS-01-PusC033	ROV Push Core	08.12	14:09	75°12.438' 31°35.064'		341	ROV Push Core - core ID 15 (PC 15)
Hopendjupet seeps	CAGE21-6-GS-01-PusC034	ROV Push Core	08.12	14:11	75°12.438' 31°35.064'		341	ROV Push Core - core ID 16 (PC 16)

Hopendjupet seeps	CAGE21-6-GS-01-PusC035	ROV Push Core	08.12	16:06	75°12.444' 31°35.064'		341	ROV Push Core - core ID 14 (PC 17)
Hopendjupet seeps	CAGE21-6-GS-01-PusC036	ROV Push Core	08.12	16:07	75°12.444' 31°35.064'		341	ROV Push Core - core ID 6 (PC 18)
Hopendjupet seeps	CAGE21-6-GS-01-PusC037	ROV Push Core	08.12	16:09	75°12.444' 31°35.064'		341	ROV Push Core - core ID 5 (PC 19), failed
Hopendjupet seeps	CAGE21-6-GS-01-PusC038	ROV Push Core	08.12	16:41	75°12.438' 31°35.058'		341	ROV Push Core - core ID 5 (PC 20), failed
Hopendjupet seeps	CAGE21-6-GS-01-PusC039	ROV Push Core	08.12	17:10	75°12.438' 31°35.058'		342	ROV Push Core - core ID 7 (PC 21) redo for ID 5
Hopendjupet seeps	CAGE21-6-GS-01-WatS040	ROV Water Sampling	09.12	15:01	75°12.480' 31°34.860'		340	ROV Water Sampling - Niskin, water samples, 2 bottles above gas seep site
Hopendjupet seeps	CAGE21-6-GS-01-CarC041	ROV Carbonate Crust Collection	09.12	15:14	75°12.486' 31°34.836'		339	ROV Carbonate Crust Collection - Carbonate Crust 1

Hopendjupet seeps	CAGE21-6-GS-01-CarC042	ROV Carbonate Crust Collection	09.12	15:27	75°12.486' 31°34.830'		340	ROV Carbonate Crust Collection - Carbonate Crust 2
Hopendjupet seeps	CAGE21-6-GS-01-GasS043	ROV Gas Sampling	09.12	15:44	75°12.480' 31°34.860'		340	ROV Gas Sampling - Free Gas, Cylinder ID 1
Hopendjupet seeps	CAGE21-6-GS-01-WatS044	ROV Water Sampling	09.12	16:51	75°12.444' 31°35.058'	1	341	ROV Water Sampling - Niskin, water sample, 1 bottle over seep failed
Hopendjupet seeps	CAGE21-6-GS-01-Hydr045	ROV Hydrophone	09.12	17:04	75°12.444' 31°35.058'		341	ROV Hydrophone - Checkerboard
Hopendjupet seeps	CAGE21-6-GS-01-GasS046	ROV Gas Sampling	09.12	17:45	75°12.438' 31°35.058'		342	ROV Gas Sampling - Free Gas, Cylinder ID 3
Hopendjupet seeps	CAGE21-6-GS-01-GasS047	ROV Gas Sampling	09.12	18:20	75°12.438' 31°35.058'		342	ROV Gas Sampling - Oil Seep Sampler
Hopendjupet seeps	CAGE21-6-GS-01-PusC048	ROV Push Core	09.12	19:14	75°12.438' 31°35.058'		342	ROV Push Core - Push Core ID 8

Hopendjupet seeps	CAGE21-6-GS-01-PusC049	ROV Push Core	09.12	19:19	75°12.438' 31°35.058'		341	ROV Push Core - Push Core ID 13
Hopendjupet seeps	CAGE21-6-GS-01-PusC050	ROV Push Core	09.12	19:22	75°12.438' 31°35.058'		341	ROV Push Core - Push Core ID 06
Hopendjupet seeps	CAGE21-6-GS-01-PusC051	ROV Push Core	09.12	19:26	75°12.438' 31°35.004'		341	ROV Push Core - Pushcore ID 09
Hopendjupet seeps	CAGE21-6-GS-01-WatS052	ROV Water Sampling	09.12	19:48	75°12.444' 31°35.058'	1	322	ROV Water Sampling - Niskin, water sample, 1 bottle 20 m over seep
Hopendjupet seeps	CAGE21-6-GS-01-Air053	Air	10.12	06:08	75°12.498' 31°34.914'	1	0	Strong smell of diesel?
Hopendjupet seeps	CAGE21-6-GS-01-Air054	Air	10.12	06:23	75°13.746' 31°34.884'	1	0	No diesel smell. Wind from 191 (SSW)
Hopendjupet seeps	CAGE21-6-GS-01-Air055	Air	10.12	06:38	75°14.820' 31°34.782'	1	0	No diesel smell. Wind from 193 (SSW)

Hopendjupet seeps	CAGE21-6-GS-01-Air056	Air	10.12	06:50	75°15.654' 31°34.500'	1	0	Wind from 180 (s)
Hopendjupet seeps	CAGE21-6-GS-02-PusC001	ROV Push Core	10.12	08:39	75°15.606' 31°34.536'		334	ROV Push Core - Push Core ID 1
Hopendjupet seeps	CAGE21-6-GS-02-PusC002	ROV Push Core	10.12	08:46	75°15.606' 31°34.536'		334	ROV Push Core - Push Core ID 13
Hopendjupet seeps	CAGE21-6-GS-02-PusC003	ROV Push Core	10.12	08:50	75°15.606' 31°34.536'		334	ROV Push Core - Push Core ID 9
Hopendjupet seeps	CAGE21-6-GS-02-PusC004	ROV Push Core	10.12	08:57	75°15.606' 31°34.536'		334	ROV Push Core - Push Core UiB ID 19
Hopendjupet seeps	CAGE21-6-GS-02-PusC005	ROV Push Core	10.12	10:01	75°15.600' 31°34.542'		334	ROV Push Core - Push Core ID 2
Hopendjupet seeps	CAGE21-6-GS-02-PusC006	ROV Push Core	10.12	10:06	75°15.600' 31°34.542'		334	ROV Push Core - Push Core ID 12

Hopendjupet seeps	CAGE21-6-GS-02-PusC007	ROV Push Core	10.12	10:14	75°15.600' 31°34.542'		334	ROV Push Core - Push Core UiB ID 18
Hopendjupet seeps	CAGE21-6-GS-02-PusC008	ROV Push Core	10.12	10:18	75°15.600' 31°34.536'		334	ROV Push Core - Push Core ID 14
Hopendjupet seeps	CAGE21-6-GS-02-PusC009	ROV Push Core	10.12	10:24	75°15.600' 31°34.536'		334	ROV Push Core - Push Core ID 3
Hopendjupet seeps	CAGE21-6-GS-02-Biol010	ROV Biology	10.12	11:03	75°15.600' 31°34.536'		334	ROV Biology - Biological Samples
Hopendjupet seeps	CAGE21-6-GS-03-OilS001	ROV Oil Sample	10.12	13:22	75°13.788' 31°44.298'		327	Oil sampler
Hopendjupet seeps	CAGE21-6-GS-03-GasS002	ROV Gas Sampling	10.12	15:33	75°13.788' 31°44.280'		328	ROV Gas Sampling - Gas sampler
Hopendjupet seeps	CAGE21-6-GS-03-WatS003	ROV Water Sampling	10.12	16:06	75°13.788' 31°44.280'		327	ROV Water Sampling - Niskin 1

Hopendjupet seeps	CAGE21-6-GS-03-WatS004	ROV Water Sampling	10.12	16:11	75°13.788' 31°44.280'		327	ROV Water Sampling - Niskin 2
Hopendjupet seeps	CAGE21-6-GS-03-Hydr005	ROV Hydrophone	10.12	16:54	75°13.788' 31°44.298'		327	ROV Hydrophone - Checkerboard
Hopendjupet seeps	CAGE21-6-GS-03-Air006	Air	10.12	19:56	75°13.776' 31°44.358'	1	0	Wind 270 deg 5.3 m/s
Hopendjupet seeps	CAGE21-6-GS-03-CTD007	CTD	11.12	00:18	75°14.060' 31°43.236'	10	331	358
Hopendjupet seeps	CAGE21-6-GS-03-Air008	Air	11.12	00:24	75°14.058' 31°43.242'	1	0	Wind 319 deg 3.8 m/s
Hopendjupet seeps	CAGE21-6-GS-03-CTD009	CTD	11.12	00:51	75°13.585' 31°43.031'	11	331	359. Bottle 9 did not fire
Hopendjupet seeps	CAGE21-6-GS-03-Air010	Air	11.12	01:01	75°13.584' 31°43.032'	1	0	Wind 333 deg 3.5 m/s

Hopendjupet seeps	CAGE21-6-GS-03-CTD011	CTD	11.12	01:24	75°13.519' 31°45.340'	11	328	360
Hopendjupet seeps	CAGE21-6-GS-03-Air012	Air	11.12	01:28	75°13.518' 31°45.342'	1	0	Wind 339 deg 4.1 m/s
Hopendjupet seeps	CAGE21-6-GS-03-CTD013	CTD	11.12	01:52	75°13.993' 31°45.553'	11	327	361
Hopendjupet seeps	CAGE21-6-GS-03-Air014	Air	11.12	01:57	75°13.992' 31°45.552'	1	0	Wind 334 deg 4.4 m/s
Hopendjupet seeps	CAGE21-6-GS-03-CTD015	CTD	11.12	02:24	75°13.787' 31°44.294'	11	330	362
Hopendjupet seeps	CAGE21-6-GS-03-Air016	Air	11.12	02:29	75°13.788' 31°44.292'	1	0	Wind 338 3.9 m/s
Hopendjupet seeps	CAGE21-6-GS-04-GasS001	ROV Gas Sampling	11.12	12:04	75°17.562' 31°44.514'			ROV Gas Sampling - Gas sampler, Northern seep site

Hopendjupet seeps	CAGE21-6-GS-04-Biol002	ROV Biology	11.12	13:38	75°17.754' 31°45.138'			ROV Biology - Biological Samples
Hopendjupet seeps	CAGE21-6-GS-04-PusC003	ROV Push Core	11.12	14:47	75°17.754' 31°45.138'			ROV Push Core - Push Core ID 7
Hopendjupet seeps	CAGE21-6-GS-04-PusC004	ROV Push Core	11.12	14:53	75°17.754' 31°45.138'			ROV Push Core - Push Core ID 13
Hopendjupet seeps	CAGE21-6-GS-04-PusC005	ROV Push Core	11.12	14:56	75°17.754' 31°45.138'			ROV Push Core - Push Core UiB ID 21
Hopendjupet seeps	CAGE21-6-GS-04-PusC006	ROV Push Core	11.12	15:02	75°17.754' 31°45.138'			ROV Push Core - Push Core UiB ID 20
Hopendjupet seeps	CAGE21-6-GS-04-PusC007	ROV Push Core	11.12	15:11	75°17.754' 31°45.138'			ROV Push Core - Push Core ID 9
Hopendjupet seeps	CAGE21-6-GS-04-PusC008	ROV Push Core	11.12	15:14	75°17.754' 31°45.138'			ROV Push Core - Push Core ID 8

Hopendjupet seeps	CAGE21-6-GS-04-PusC009	ROV Push Core	11.12	15:24	75°17.754' 31°45.138'			ROV Push Core - Push Core UiB ID 17
Hopendjupet seeps	CAGE21-6-GS-04-PusC010	ROV Push Core	11.12	15:42	75°17.748' 31°45.138'			ROV Push Core - Push Core ID 4
Hopendjupet seeps	CAGE21-6-GS-04-PusC013	ROV Oil Sample	11.12	16:01	75°17.754' 31°45.144'			ROV Push Core - Push Core ID 16
Hopendjupet seeps	CAGE21-6-GS-04-PusC012	ROV Push Core	11.12	16:09	75°17.754' 31°45.138'			ROV Push Core - Push Core ID 3
Hopendjupet seeps	CAGE21-6-GS-04-OilS011	ROV Push Core	11.12	17:13	75°17.754' 31°45.138'			Oil sampler
Hopendjupet seeps	CAGE21-6-GS-04-CTD014	CTD	11.12	19:42	75°17.560' 31°44.469'	11	331	363. Long CTD transect NE-SW
Hopendjupet seeps	CAGE21-6-GS-04-Air015	Air	11.12	19:57	75°17.560' 31°44.469'	1	0	Wind 236 deg 3.7 m/s

Hopendjupet seeps	CAGE21-6-GS-05-CTD01A	CTD	11.12	21:52	75°21.953' 31°03.536'	11	358	364. Long CTD transect NE-SW
Hopendjupet seeps	CAGE21-6-GS-05-Air02A	Air	11.12	22:04	75°21.953' 31°03.536'	1	0	Wind 229 deg 4.7 m/s
Hopendjupet seeps	CAGE21-6-GS-05-CTD03A	CTD	11.12	22:49	75°18.729' 31°19.554'	11	340	365. Long CTD transect NE-SW
Hopendjupet seeps	CAGE21-6-GS-05-Air04A	Air	11.12	22:57	75°18.729' 31°19.554'	1	0	Wind 219 deg 4.2 m/s
Hopendjupet seeps	CAGE21-6-GS-05-CTD05A	CTD	12.12	00:24	75°11.982' 31°52.027'	11	331	366
Hopendjupet seeps	CAGE21-6-GS-05-Air06A	Air	12.12	00:30	75°11.982' 31°52.027'	1	0	Wind 230 deg 3.7 m/s
Hopendjupet seeps	CAGE21-6-GS-05-CTD07A	CTD	12.12	01:02	75°10.596' 31°58.606'	11	323	367

Hopendjupet seeps	CAGE21-6-GS-05-Air08A	Air	12.12	01:15	75°10.596' 31°58.606'	1	0	Wind 229 deg 4.9 m/s
Hopendjupet seeps	CAGE21-6-GS-05-CTD09A	CTD	12.12	01:46	75°08.907' 32°06.573'	11	297	368
Hopendjupet seeps	CAGE21-6-GS-05-Air010	Air	12.12	01:46	75°08.907' 32°06.573'	1	0	Wind 231 deg 4.8 m/s
Hopendjupet seeps	CAGE21-6-GS-05-CTD011	CTD	12.12	02:23	75°07.468' 32°13.382'	11	269	369
Hopendjupet seeps	CAGE21-6-GS-05-Air012	Air	12.12	02:31	75°07.468' 32°13.382'	1	0	Wind 239 deg 4.8 m/s
Hopendjupet seeps	CAGE21-6-GS-05-CTD013	CTD	12.12	03:15	75°04.606' 32°26.607'	11	220	370
Hopendjupet seeps	CAGE21-6-GS-05-Air014	Air	12.12	03:18	75°04.606' 32°26.607'	1	0	Wind 230 deg 4.2 m/s

Hopendjupet seeps	CAGE21-6-GS-05-OilS001	ROV Oil Sample	12.12	07:49	75°12.444' 31°35.058'		340	Oil sampler, failed to recover
Hopendjupet seeps	CAGE21-6-GS-05-OilS002	Oil Sample	12.12	10:00	75°12.714' 31°35.352'		340	Oil Slick sample, sea surface
Hopendjupet seeps	CAGE21-6-GS-05-OilS005	ROV Push Core	12.12	10:59	75°12.444' 31°35.064'		341	Oil sampler
Hopendjupet seeps	CAGE21-6-GS-05-PusC003	ROV Push Core	12.12	11:54	75°12.444' 31°35.064'		341	ROV Push Core - Push core ID 13
Hopendjupet seeps	CAGE21-6-GS-05-PusC004	ROV Oil Sample	12.12	11:58	75°12.444' 31°35.064'		341	ROV Push Core - Push core ID 04
Hopendjupet seeps	CAGE21-6-GS-06-Biol001	ROV Hydrophone	12.12	13:50	75°13.734' 31°43.872'		328	ROV Biology - Biological Samples
Hopendjupet seeps	CAGE21-6-GS-06-Biol002	ROV Biology	12.12	13:56	75°13.728' 31°43.872'		328	ROV Biology - Biological Samples

Hopendjupet seeps	CAGE21-6-GS-06-PusC003	ROV Carbonate Crust Collection	12.12	14:33	75°13.728' 31°43.878'		328	ROV Push Core - Push Core ID 14
Hopendjupet seeps	CAGE21-6-GS-06-PusC004	ROV Carbonate Crust Collection	12.12	14:38	75°13.728' 31°43.878'		328	ROV Push Core - Push Core ID 11
Hopendjupet seeps	CAGE21-6-GS-06-Biol005	ROV Biology	12.12	15:00	75°13.728' 31°43.878'		328	ROV Biology - ROV Scoop sample
Hopendjupet seeps	CAGE21-6-GS-05-Hydr006	ROV Biology	12.12	16:59	75°12.438' 31°35.064'		341	ROV Hydrophone - Checkerboard
Hopendjupet seeps	CAGE21-6-GS-05-Biol007	ROV Push Core	12.12	17:30	75°12.438' 31°35.064'		341	ROV Biology - Biological Samples
Hopendjupet seeps	CAGE21-6-GS-05-CTD015	ROV Push Core	12.12	18:43	75°11.408' 31°34.811'	3	339	371. Water for Vincent's oil expt.
Hopendjupet seeps	CAGE21-6-GS-05-CarC008	ROV Biology	12.12	18:50	75°12.438' 31°35.064'		341	ROV Carbonate Crust Collection - Carbonate Crust

Hopendjupet seeps	CAGE21-6-GS-05-CarC009	CTD	12.12	19:00	75°12.438' 31°35.064'		341	ROV Carbonate Crust Collection - Carbonate Crust
Hopendjupet seeps	CAGE21-6-GS-07-CTD001	CTD	13.12	01:04	75°12.835' 31°53.092'	11	329	372
Hopendjupet seeps	CAGE21-6-GS-07-CTD002	CTD	13.12	01:49	75°13.517' 31°53.977'	11	317	373
Hopendjupet seeps	CAGE21-6-GS-07-CTD003	CTD	13.12	02:22	75°13.299' 31°56.712'	11	318	374
Hopendjupet seeps	CAGE21-6-GS-07-CTD004	CTD	13.12	02:55	75°12.607' 31°55.843'	11	324	375
Hopendjupet seeps	CAGE21-6-GS-07-CTD005	CTD	13.12	03:25	75°11.765' 31°54.823'	11	326	376
Hopendjupet seeps	CAGE21-6-GS-07-CTD006	CTD	13.12	03:54	75°11.567' 31°57.031'	11	328	377

Hopendjupet seeps	CAGE21-6-GS-07-CTD007	CTD	13.12	04:30	75°12.411' 31°58.129'	11	323	378
Hopendjupet seeps	CAGE21-6-GS-07-CTD008	CTD	13.12	05:04	75°13.117' 31°58.988'	11	318	379
Hopendjupet seeps	CAGE21-6-GS-07-CTD009	CTD	13.12	05:44	75°14.186' 32°00.333'	11	317	380
Hopendjupet seeps	CAGE21-6-GS-07-CTD010	CTD	13.12	06:20	75°14.327' 31°57.956'	11	318	381
Hopendjupet seeps	CAGE21-6-GS-08-CarC001	ROV Carbonate Crust Collection	13.12	09:09	75°08.856' 32°06.378'		295	ROV Carbonate Crust Collection - Carbonate Crust
Hopendjupet seeps		ROV Carbonate Crust Collection	13.12	13:43	75°08.898' 32°06.942'		295	ROV Carbonate Crust Collection - Carbonate Crust
Hopendjupet seeps	CAGE21-6-GS-08-GasS003	ROV Gas Sampling	13.12	15:16	75°08.892' 32°06.558'		296	ROV Gas Sampling - Gas Sample Cylinder 1

Hopendjupet seeps	CAGE21-6-GS-08-GasS004	ROV Gas Sampling	13.12	15:48	75°09.006' 32°07.014'		294	ROV Gas Sampling - Gas Sample Cylinder 5
Hopendjupet seeps	CAGE21-6-GS-08-Hydr005	ROV Hydrophone	13.12	17:00	75°09.006' 32°07.014'		294	ROV Hydrophone - Checkerboard
Hopendjupet seeps	CAGE21-6-GS-08-WatS06A	ROV Water Sampling	13.12	18:41	75°09.006' 32°07.014'	1	294	ROV Water Sampling - Niskin bottles, directly above (1 m) the seep site, next to checkerboard
Hopendjupet seeps	CAGE21-6-GS-08-WatS06B	ROV Water Sampling	13.12	18:41	75°09.006' 32°07.014'	1	294	ROV Water Sampling - Niskin bottles, directly above (1 m) the seep site, next to checkerboard
Hopendjupet seeps	CAGE21-6-GS-08-WatS06C	ROV Water Sampling	13.12	18:41	75°09.006' 32°07.014'	1	294	ROV Water Sampling - Niskin bottles, directly above (1 m) the seep site, next to checkerboard
Hopendjupet seeps	CAGE21-6-GS-08-WatS06D	ROV Water Sampling	13.12	18:41	75°09.006' 32°07.014'	1	294	ROV Water Sampling - Niskin bottles, directly above (1 m) the seep site, next to checkerboard
Hopendjupet seeps	CAGE21-6-GS-08-CTD007	CTD	13.12	19:33	75°09.024' 32°06.956'	5	296	382. Water for Vincent

Hopendjupet seeps	CAGE21-6-GS-08-CTD008	CTD	14.12	00:06	75°09.343' 32°06.318'	11	299	383. Survey around dive site in flaring area
Hopendjupet seeps	CAGE21-6-GS-08-CTD009	CTD	14.12	00:42	75°08.829' 32°05.728'	11	299	384
Hopendjupet seeps	CAGE21-6-GS-08-CTD010	CTD	14.12	01:11	75°08.687' 32°07.726'	11	295	385
Hopendjupet seeps	CAGE21-6-GS-08-CTD011	CTD	14.12	01:39	75°09.207' 32°08.365'	11	296	386
Hopendjupet seeps	CAGE21-6-GS-08-CTD012	CTD	14.12	02:09	75°09.008' 32°07.038'	11	296	387
Hopendjupet pingos	CAGE21-6-GS-09-GasS001	ROV Gas Sampling	14.12	10:01	74°39.528' 30°12.708'	1	361	ROV Gas Sampling - Gas transformed into hydrate at the seafloor, collected gas in the cylinder on the way up
Hopendjupet pingos	CAGE21-6-GS-09-WatS002	ROV Water Sampling	14.12	11:00	74°39.528' 30°12.708'	1	361	ROV Water Sampling - Water sample, 1 bottle above (1 m) seep site where gas has been collected

Hopendjupet pingos	CAGE21-6-GS-09-CTD003	CTD	14.12	11:01	74°39.529' 30°12.738'	11	362	388. Above pingo
Bjørnøyrenna	CAGE21-6-GS-09-Air004	Air	14.12	14:26	74°31.440' 29°22.320'	1	0	On transit home

6.2 Line log

Line name/ number	Activity	Line ID	Date (UTC) START	Time (UTC) START	Lat START	Long START	Time (UTC) STOP	Lat STOP	Long STOP	Equipment	Speed kn	Notes
001	Multibeam	CAGE21-6-GS-001-MB	06.12	14:01:00	72 17.2	24 9.46	15:44:00	72 33.06	24 41.51	Simrad EM302	11	transit
002	Multibeam	CAGE21-6-GS-002-MB	06.12	15:51:00	72 34.15	24 43.71	08:27:00	75 01.51	31 1.26	Simrad EM302	11	transit
003	Multibeam	CAGE21-6-GS-003-MB	07.12	08:51:00	75 04.83	31 11.74	10:03:00	75 12.81	31 36.22	Simrad EM302	11	transit
004	Single beam	CAGE21-6-GS-004-SB	07.12	18:30:00	75 12.69	31 34.90	19:16:00	75 16.88	31 18.75	Simrad EK80	7	Transit to start of seismic line
005	Single beam	CAGE21-6-GS-005-SB	07.12	19:16:00	75 16.88	31 18.75	20:50:00	75 25.15	30 45.53	Simrad EK80	7	With ADCP on. Transit to start of seismic line
006	Single beam	CAGE21-6-GS-006-SB	07.12	20:55:00	75 25.28	30 46.94	21:35:00	75 23.19	30 57.40	Simrad EK80	5	

007	Multibeam	CAGE21-6-GS-007-MB	07.12	21:35:00	75 23.19	30 57.40	23:54:00	75 15.72	31 34.02	Simrad EM302	5	ADCP off. Single beam still on
008	Single beam	CAGE21-6-GS-008-SB	08.12	02:01:00	75 13.66	31 44.84	02:10:00	75 13.51	31 44.36	Simrad EK80	5	3 lines over middle seep
009	Single beam	CAGE21-6-GS-009-SB	08.12	02:14:00	75 13.49	31 44.85	02:22:00	75 13.93	31 44.15	Simrad EK80	5	3 lines over middle seep
010	Single beam	CAGE21-6-GS-010-SB	08.12	02:31:00	75 13.66	31 44.84	02:38:00	75 13.82	31 43.08	Simrad EK80	5	3 lines over middle seep
011	Multibeam	CAGE21-6-GS-011-MB	08.12	03:26:00	75 14.21	31 40.22	03:38:00	75 13.22	31 44.96	Simrad EM302	5	
012	Single beam	CAGE21-6-GS-012-SB	08.12	06:12:00	75 11.06	31 45.47	07:00:00	75 15.26	31 43.12	Simrad EK80	5	ADCP lines
013	Single beam	CAGE21-6-GS-013-SB	08.12	07:04:00	75 15.28	31 44.06	07:27:00	75 11.78	31 49.99	Simrad EK80	5	ADCP line over seeps
014	Single beam	CAGE21-6-GS-014-SB	08.12	07:53:00	75 11.30	31 49.32	08:40:00	75 12.53	31 34.43	Simrad EK80	5	ADCP line over seeps
015	Multibeam	CAGE21-6-GS-015-MB	08.12	22:29:00	75 11.64	31 32.69	23:26:00	75 15.73	31 37.71	Simrad EM302	4	Survey over southermosts seeps
016	Multibeam	CAGE21-6-GS-016-MB	08.12	23:31:00	75 15.56	31 38.60	00:15:00	75 11.56	31 33.62	Simrad EM302	6	
017	Multibeam	CAGE21-6-GS-017-MB	09.12	00:29:00	75 12.63	31 33.22	01:12:00	75 11.40	31 48.61	Simrad EM302	6	
018	Multibeam	CAGE21-6-GS-018-MB	09.12	01:20:00	75 11.69	31 48.59	02:04:00	75 12.95	31 32.84	Simrad EM302	6	
019	Multibeam	CAGE21-6-GS-019-MB	09.12	02:07:00	75 13.17	31 33.41	02:51:00	75 11.87	31 49.59	Simrad EM302	6	
020	Multibeam	CAGE21-6-GS-020-MB	09.12	02:56:00	75 12.15	31 49.69	03:37:00	75 13.41	31 34.05	Simrad EM302	6	
021	Multibeam	CAGE21-6-GS-021-MB	09.12	03:41:00	75 13.64	31 34.41	04:23:00	75 12.39	31 50.21	Simrad EM302	6	

022	Multibeam	CAGE21-6-GS-022-MB	09.12	04:29:00	75 12.65	31 50.31	05:11:00	75 13.92	31 34.68	Simrad EM302	6	
023	Multibeam	CAGE21-6-GS-023-MB	09.12	05:15:00	75 14.14	31 35.16	05:57:00	75 12.88	31 50.94	Simrad EM302	6	
024	Multibeam	CAGE21-6-GS-024-MB	09.12	06:02:00	75 13.14	31 51.29	06:44:00	75 14.41	31 35.66	Simrad EM302	6	
025	Multibeam	CAGE21-6-GS-025-MB	09.12	06:49:00	75 14.34	31 36.50	07:01:00	75 14.29	31 41.28	Simrad EM302	6	
026	ROV Video Mapping	CAGE21-6-GS-026-ROV VMap	09.12	09:35:00	75,2075	31,5837	10:56:00	75,2074	31,5839		6	ROV mosaic 1
027	ROV Video Mapping	CAGE21-6-GS-027-ROV VMap	09.12	11:15:00	75,208	31,5811	12:42:00	75,2079	31,5808			ROV mosaic 2
028	Single beam	CAGE21-6-GS-028-SB	10.12	02:12:00	75 12.453	31 33.258	02:26:00	75 12.112	31 37.590	Simrad EK80	5	survey with just SB over southern seep
029	Single beam	CAGE21-6-GS-029-SB	10.12	02:31:00	75 12.208	31 37.682	02:47:00	75 12.593	31 32.668	Simrad EK80	5	
030	Single beam	CAGE21-6-GS-030-SB	10.12	02:51:00	75 12.601	31 33.043	03:05:00	75 12.238	31 37.413	Simrad EK80	5	
031	Single beam	CAGE21-6-GS-031-SB	10.12	03:10:00	75 12.260	31 37.583	03:22:00	75 12.575	31 33.5444	Simrad EK80	5	
032	Single beam	CAGE21-6-GS-032-SB	10.12	03:29:00	75 12.605	31 33.414	03:42:00	75 12.300	31 37.346	Simrad EK80	5	
033	Single beam	CAGE21-6-GS-033-SB	10.12	03:47:00	75 12.294	31 37.716	04:01:00	75 12.682	31 32.916	Simrad EK80	5	
034	Single beam	CAGE21-6-GS-034-SB	10.12	04:05:00	75 12.783	31 32.974	04:18:00	75 12.477	31 37.132	Simrad EK80	5	
035	Single beam	CAGE21-6-GS-035-SB	10.12	04:48:00	75 12.195	31 37.884	05:03:00	75 12.586	31 32.975	Simrad EK80	5	

036	Single beam	CAGE21-6-GS-036-SB	10.12	05:08:00	75 12.583	31 33.287	05:20:00	75 12.262	31 37.240	Simrad EK80	5	
037	Single beam	CAGE21-6-GS-037-SB	10.12	05:27:00	75 12.323	31 36.987	05:39:00	75 12.630	31 33.050	Simrad EK80	5	
038	Single beam	CAGE21-6-GS-038-SB	10.12	05:43:00	75 12.660	31 33.043	05:56:00	75 12.314	31 37.219	Simrad EK80	5	
039	Multibeam	CAGE21-6-GS-039-MB	10.12.2021	20:18:00	75 14.002	31 45.993	20:30:00	75 13.487	31 41.894	Simrad EM302	6	
040	Multibeam	CAGE21-6-GS-040-MB	10.12.2021	20:58:00	75 14.142	31 43.117	21:07:00	75 13.444	31 45.421	Simrad EM302	6	
041	Single beam	CAGE21-6-GS-041-SB	10.12.2021	21:12:00	75 13.453	31 45.406	21:23:00	75 14.149	31 43.168	Simrad EK80	5	
042	Single beam	CAGE21-6-GS-042-SB	10.12.2021	21:38:00	75 14.111	31 42.948	21:50:00	75 13.419	31 45.720	Simrad EK80	5	
043	ADCP	CAGE21-6-GS-043-ADCP	10.12.2021	21:56:00	75 13.463	31 45.615	22:07:00	75 14.097	31 43.036		5	
044	Single beam	CAGE21-6-GS-044-SB	11.12.2021	04:11:00	75 14.014	31 45.697	04:23:00	75 13.502	31 42.486	Simrad EK80	5	survey over middle seep
045	Single beam	CAGE21-6-GS-045-SB	11.12.2021	04:28:00	75 13.591	31 42.362	04:39:00	75 13.510	31 45.618	Simrad EK80	5	
046	Single beam	CAGE21-6-GS-046-SB	11.12.2021	04:44:00	75 13.497	31 45.106	04:54:00	75 13.999	31 42.826	Simrad EK80	5	
047	Single beam	CAGE21-6-GS-047-SB	11.12.2021	04:57:00	75 14.016	31 42.990	05:06:00	75 13.535	31 44.762	Simrad EK80	5	
048	Single beam	CAGE21-6-GS-048-SB	11.12.2021	05:12:00	75 13.522	31 44.868	05:19:00	75 13.922	31 43.389	Simrad EK80	5	
049	Single beam	CAGE21-6-GS-049-SB	11.12.2021	05:19:00	75 13.922	31 43.389	05:33:00	75 13.477	31 45.103	Simrad EK80	5	
050	Single beam	CAGE21-6-GS-050-SB	11.12.2021	05:33:00	75 13.477	31 45.104	05:44:00	75 13.908	31 43.614	Simrad EK80	5	
051	Single beam	CAGE21-6-GS-051-SB	11.12.2021	05:50:00	75 13.939	31 43.569	05:57:00	75 13.531	31 45.069	Simrad EK80	5	

052	Single beam	CAGE21-6-GS-052-SB	11.12.2021	06:01:00	75 13.509	31 45.269	06:09:00	75 13.966	31 43.484	Simrad EK80	5	
053	Single beam	CAGE21-6-GS-053-SB	11.12.2021	06:14:00	75 13.978	31 43.631	06:22:00	75 13.529	31 45.307	Simrad EK80	5	
054	Single beam	CAGE21-6-GS-054-SB	11.12.2021	06:25:00	75 13.533	31 45.420	06:34:00	75 14.044	31 43.438	Simrad EK80	5	
055	Single beam	CAGE21-6-GS-055-SB	11.12.2021	06:38:00	75 14.042	31 43.628	06:45:00	75 13.644	31 45.049	Simrad EK80	5	
056	ROV Video Mapping	CAGE21-6-GS-056-ROVVMap	11.12.2021	08:29:00	75,2285	31,7322	09:52:58	75,2285	31,7315		0	
057	Single beam	CAGE21-6-GS-057-SB	11.12.2021	20:20:00	75 17.732	31 44.189	20:24:00	75 17.427	31 44.781	Simrad EK80	5	2 lines on north seep
058	Single beam	CAGE21-6-GS-058-SB	11.12.2021	20:28:00	75 17.359	31 44.919	20:35:00	75 17.833	31 44.058	Simrad EK80	5	
059	Single beam	CAGE21-6-GS-059-SB	11.12.2021	20:40:00	75 18.017	31 43.642	21:38:00	75 21.512	31 09.932	Simrad EK80	10	
060	Multibeam	CAGE21-6-GS-060-MB	11.12.2021	21:38:00	75 21.512	31 09.932	21:49:00	75 21.985	31 03.705	Simrad EM302	10	Long CTD transit. + SB+ADCP
061	Multibeam	CAGE21-6-GS-061-MB	11.12.2021	22:13:00	75 21.945	31 03.583	22:46:00	75 18.737	31 19.387	Simrad EM302	10	Long CTD transit. + SB+ADCP
062	Multibeam	CAGE21-6-GS-062-MB	11.12.2021	23:14:00	75 18.636	31 19.724	00:18:00	75 12.057	31 51.973	Simrad EM302	10	Long CTD transit. + SB+ADCP
063	Multibeam	CAGE21-6-GS-063-MB	12.12.2021	00:42:00	75 11.923	31 52.149	00:58:00	75 10.614	31 58.571	Simrad EM302	10	Long CTD transit. + SB+ADCP
064	Multibeam	CAGE21-6-GS-064-MB	12.12.2021	01:19:00	75 10.557	31 58.587	01:38:00	75 8.926	32 6.499	Simrad EM302	10	Long CTD transit. + SB+ADCP

065	Multibeam	CAGE21-6-GS-065-MB	12.12.2021	02:01:00	75 8.857	32 6.564	02:17:00	75 7.519	32 13.034	Simrad EM302	10	Long CTD transit. + SB+ADCP
066	Multibeam	CAGE21-6-GS-066-MB	12.12.2021	02:42:00	75 7.401	32 13.516	03:14:00	75 4.613	32 26.573	Simrad EM302	10	Long CTD transit. + SB+ADCP
067	Multibeam	CAGE21-6-GS-067-MB	12.12.2021	03:30:00	75 4.618	32 26.535	04:42:00	75 11.052	31 46.475	Simrad EM302	10	Long CTD transit. + SB+ADCP
068	Multibeam	CAGE21-6-GS-068-MB	12.12.2021	04:48:00	75 11.792	31 45.923	05:47:00	75 7.381	31 20.457	Simrad EM302	8	Channel mapping
069	Multibeam	CAGE21-6-GS-069-MB	12.12.2021	05:52:00	75 7.793	31 18.837	06:45:00	75 11.817	31 42.040	Simrad EM302	8	Channel mapping + SB
070	Multibeam	CAGE21-6-GS-070-MB	12.12.2021	06:47:00	75 11.980	31 42.150	07:01:00	75 12.439	31 35.317	Simrad EM302	8	
071	Single beam	CAGE21-6-GS-071-SB	12.12.2021	12:54:00	75 12.412	31 35.343	13:12:00	75 13.719	31 43.763	Simrad EK80	5	
072	Single beam	CAGE21-6-GS-072-SB	12.12.2021	15:23:00	75 13.695	31 43.805	15:44:00	75 12.463	31 35.275	Simrad EK80	5	
073	Single beam	CAGE21-6-GS-073-SB	12.12.2021	18:29:00	75 12.422	31 35.171	18:41:00	75 11.423	31 34.821	Simrad EK80	5	
074	Single beam	CAGE21-6-GS-074-SB	12.12.2021	19:21:00	75 12.106	31 37.557	19:37:00	75 12.506	31 32.445	Simrad EK80	5	
075	Single beam	CAGE21-6-GS-075-SB	12.12.2021	19:41:00	75 12.566	31 32.832	19:55:00	75 12.207	31 37.403	Simrad EK80	5	
076	Single beam	CAGE21-6-GS-076-SB	12.12.2021	19:59:00	75 12.261	31 37.376	20:13:00	75 12.586	31 32.916	Simrad EK80	5	
077	Single beam	CAGE21-6-GS-077-SB	12.12.2021	20:18:00	75 12.592	31 32.905	20:33:00	75 12.232	31 37.594	Simrad EK80	5	
078	Single beam	CAGE21-6-GS-078-SB	12.12.2021	20:37:00	75 12.251	31 37.709	20:52:00	75 12.612	31 33.000	Simrad EK80	5	

079	Single beam	CAGE21-6-GS-079-SB	12.12.2021	20:58:00	75 12.616	31 32.908	21:12:00	75 12.272	31 37.453	Simrad EK80	5	
080	Single beam	CAGE21-6-GS-080-SB	12.12.2021	21:18:00	75 12.287	31 37.492	21:32:00	75 12.638	31 32.951	Simrad EK80	5	
081	Single beam	CAGE21-6-GS-081-SB	12.12.2021	21:37:00	75 12.645	31 32.957	21:52:00	75 12.282	31 3726	Simrad EK80	5	
082	Single beam	CAGE21-6-GS-082-SB	12.12.2021	21:57:00	75 12.302	31 37.686	22:11:00	75 12.657	31 33.120	Simrad EK80	5	
083	Single beam	CAGE21-6-GS-083-SB	12.12.2021	22:19:00	75 12.630	31 33.597	22:31:00	75 12.340	31 37.332	Simrad EK80	5	
084	Single beam	CAGE21-6-GS-084-SB	12.12.2021	22:35:00	75 12.445	31 37.408	22:49:00	75 12.798	31 33.124	Simrad EK80	5	
085	Single beam	CAGE21-6-GS-085-SB	12.12.2021	22:57:00	75 12.708	21 32.856	23:35:00	75 12.997	31 52.612	Simrad EK80	5	
086	Single beam	CAGE21-6-GS-086-SB	13.12.2021	01:22:00	75 12.859	31 53.125	01:33:00	75 13.501	31 53.954	Simrad EK80	5	
087	Single beam	CAGE21-6-GS-087-SB	13.12.2021	02:07:00	75 13.540	31 54.0145	02:20:00	75 13.301	31 56.693	Simrad EK80	5	
088	Single beam	CAGE21-6-GS-088-SB	13.12.2021	02:38:00	75 13.295	31 56.701	02:51:00	75 12.605	31 55.838	Simrad EK80	5	
089	Single beam	CAGE21-6-GS-089-SB	13.12.2021	03:10:00	75 12.605	31 55.836	03:24:00	75 11.771	31 54.817	Simrad EK80	5	
090	Single beam	CAGE21-6-GS-090-SB	13.12.2021	03:40:00	75 11.761	31 54.796	03:52:00	75 11.580	31 57021	Simrad EK80	5	
091	Single beam	CAGE21-6-GS-091-SB	13.12.2021	04:09:00	75 11.570	31 57.034	04:25:00	75 12.411	31 58.122	Simrad EK80	5	
092	Single beam	CAGE21-6-GS-092-SB	13.12.2021	04:44:00	75 12.412	31 58.125	04:56:00	75 13.103	31 59.007	Simrad EK80	5	
093	Single beam	CAGE21-6-GS-093-SB	13.12.2021	05:20:00	75 13.152	31 59.042	05:37:00	75 14.182	32 0.332	Simrad EK80	5	
094	Single beam	CAGE21-6-GS-094-SB	13.12.2021	05:59:00	75 14.187	32 0.294	06:08:00	75 14.324	31 57.995	Simrad EK80	5	

095	Single beam	CAGE21-6-GS-095-SB	13.12.2021	06:38:00	75 14.305	31 57.864	07:07:00	75 10.026	32 04.653	Simrad EK80	10	
096	Multibeam	CAGE21-6-GS-096-MB	13.12.2021	07:07:00	75 10.026	32 4.653	07:15:00	75 8.950	32 6.535	Simrad EM302	5	Survey over dive in seepage area
097	Single beam	CAGE21-6-GS-097-SB	13.12.2021	20:13:00	75 9.442	32 7.491	20:25:00	75 8.478	32 6.281	Simrad EK80	5	Survey over dive in seepage area
098	Single beam	CAGE21-6-GS-098-SB	13.12.2021	20:31:00	75 8.458	32 6.212	20:44:00	75 9.521	32 7.473	Simrad EK80	5	
099	Single beam	CAGE21-6-GS-099-SB	13.12.2021	20:51:00	75 9.521	32 7.475	21:03:00	75 8.545	32 6.267	Simrad EK80	5	
100	Single beam	CAGE21-6-GS-100-SB	13.12.2021	21:09:00	75 8.435	32 6.133	21:23:00	75 9.556	32 7.459	Simrad EK80	5	
101	Single beam	CAGE21-6-GS-101-SB	13.12.2021	21:30:00	75 9.529	32 7.339	21:43:00	75 8.478	32 6.047	Simrad EK80	5	
102	Single beam	CAGE21-6-GS-102-SB	13.12.2021	21:49:00	75 8.502	32 6.059	22:02:00	75 9.579	32 7.349	Simrad EK80	5	
103	Single beam	CAGE21-6-GS-103-SB	13.12.2021	22:08:00	75 9.573	32 7.287	22:21:00	75 8.526	32 6.007	Simrad EK80	5	
104	Single beam	CAGE21-6-GS-104-SB	13.12.2021	22:07:00	75 8.493	32 5.941	22:39:00	75 9.466	32 7.080	Simrad EK80	5	
105	Single beam	CAGE21-6-GS-105-SB	13.12.2021	22:45:00	75 9.507	32 7.615	22:57:00	75 8.530	32 6.401	Simrad EK80	5	
106	Single beam	CAGE21-6-GS-106-SB	13.12.2021	23:03:00	75 8.480	32 6.417	23:16:00	75 9.476	32 7.608	Simrad EK80	5	
107	Single beam	CAGE21-6-GS-107-SB	14.12.2021	00:28:00	75 9.314	32 6.284	00:37:00	75 8.832	32 5.726	Simrad EK80	5	between CTDs
108	Single beam	CAGE21-6-GS-108-SB	14.12.2021	00:57:00	75 8.826	32 5.755	01:06:00	75 8.690	32 7.752	Simrad EK80	5	
109	Single beam	CAGE21-6-GS-109-SB	14.12.2021	01:27:00	75 8.688	32 7.731	01:37:00	75 9.199	32 8.334	Simrad EK80	5	

110	Single beam	CAGE21-6-GS-110-SB	14.12.2021	01:59:00	75 9.204	32 8.345	02:07:00	75 9.007	32 7.037	Simrad EK80	5	
111	Multibeam	CAGE21-6-GS-111-MB	14.12.2021	02:28:00	75 9.086	32 6.337	02:57:00	75 11.319	31 49.084	Simrad EM302	10	
112	Multibeam	CAGE21-6-GS-112-MB	14.12.2021	03:57:00	75 11.319	31 49.084	03:37:00	75 8.639	31 31.918	Simrad EM302	8	One line over channel again
113	Multibeam	CAGE21-6-GS-113-MB	14.12.2021	03:37:00	75 8.639	31 31.918	05:22:00	74 51.960	31 07.617	Simrad EM302	10	transit to pingo field
114	Multibeam	CAGE21-6-GS-114-MB	14.12.2021	05:22:00	74 51.960	31 07.617	07:40:00	74 39.455	30 11.419	Simrad EM302	10	
115	Multibeam	CAGE21-6-GS-115-MB	14.12.2021	11:45:00	74 39.047	30 8.728	13:36:00	74 32.726	29 18.359	Simrad EM302	10	
116	Multibeam	CAGE21-6-GS-116-MB	14.12.2021	13:43:00	74 32.653	29 19.346	14:31:00	74 31.233	29 22.757	Simrad EM302	10	
117	Multibeam	CAGE21-6-GS-117-MB	14.12.2021	14:31:00	74 31.233	29 22.757	17:45:00	74 04.907	28 10.097	Simrad EM302	10	