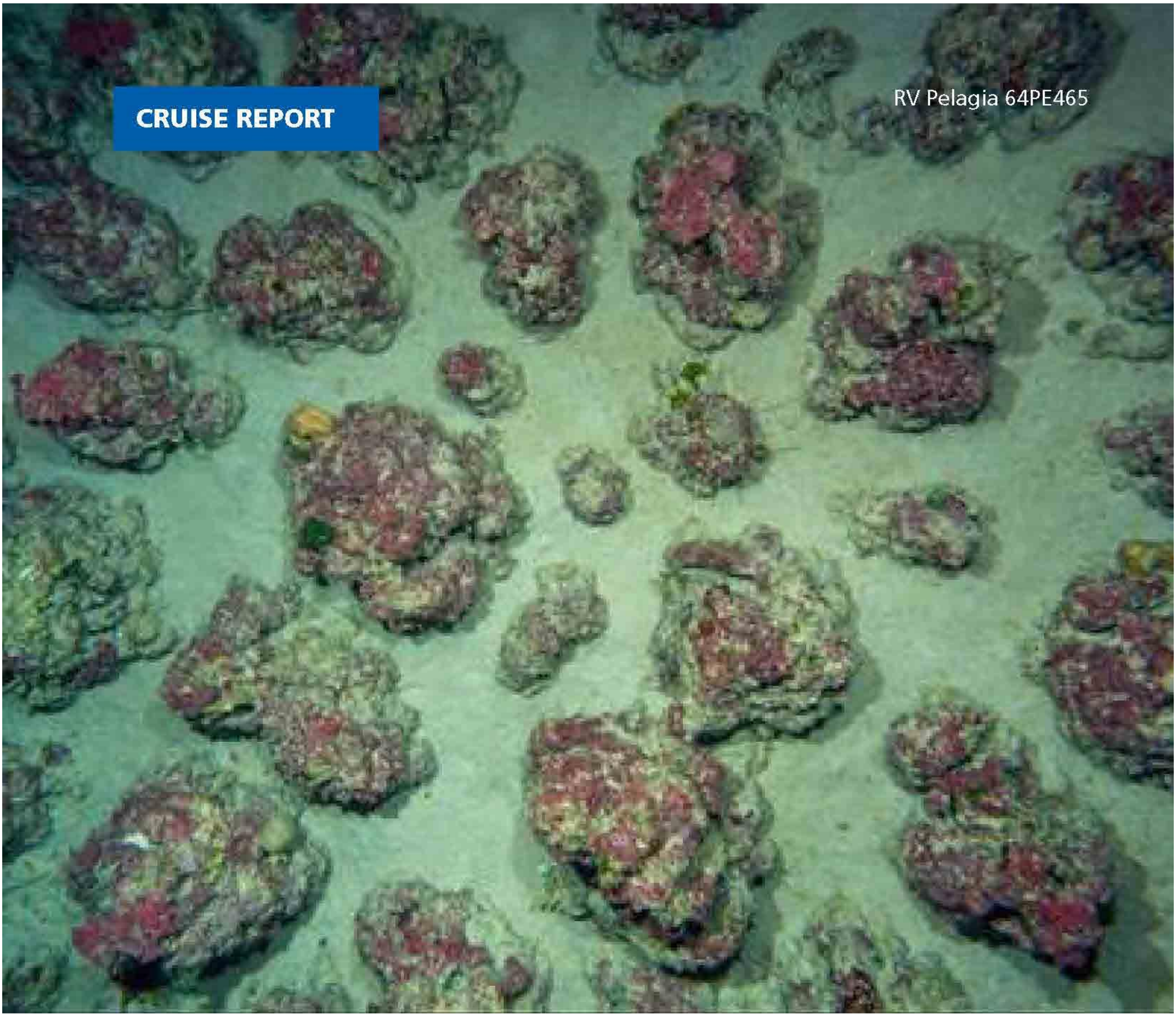
CRUISE REPORT

RV Pelagia 64PE465



Sinkhole expedition Luymes Bank, Saba Bank

5 December - 18 December 2019

Guadeloupe - Guadeloupe

Fleur C. van Duyl and Erik H. Meesters

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In samenwerking met:

WAGENINGEN UNIVERSITY & RESEARCH

NIOZ Royal Netherlands Institute for Sea Research

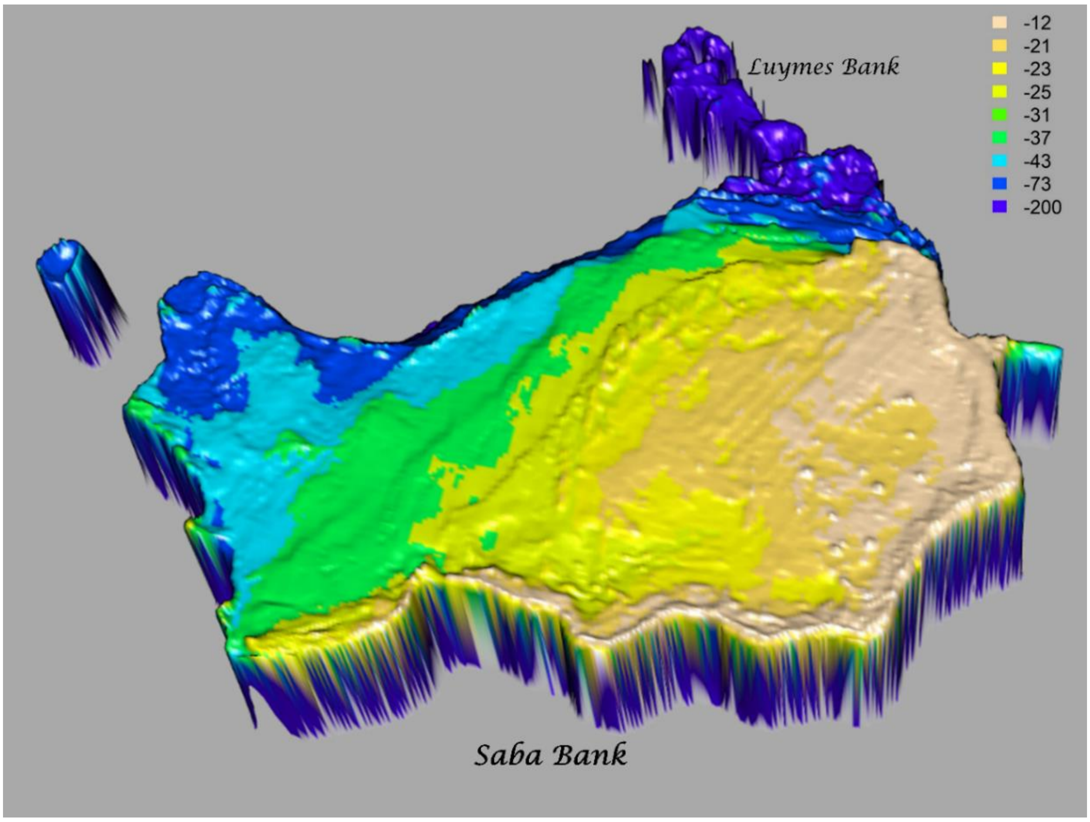
CONTENTS

All participants of the Sinkhole Expedition *2019.*

1. Introduction

1.1. Sinkholes of the Luymes Bank

The Saba Bank is a large (ca 2400 km^2) submerged carbonate platform of 15-40m depth rising up from 800-1000m depth and fringed with coral reefs along the E, ENE, S and SSE sides. In its NW corner it extends into a carbonate peninsula of ca 80m deep (Luymes Bank) which is pockmarked by sinkholes (Fig. 1). More than twenty drowned sinkholes were distinguished in this peninsula based on available bathymetric data. Diameters of sinkholes vary from 70 to 1100 m and depths ranges between 10-300m. The area of the Luymes Bank with sinkholes is ca 66 km^2. During the NICO cruise in 2018 two sinkholes were visited in the Luymes Bank. In one of the two shallow sinkholes, which were only briefly explored with camera's in 2018, we found peculiar pillar-like, probably calcium carbonate accretions with diameters of 40-60cm and protruding up to 1m from the sandy bottom. Pillars were found to stand neatly ordered on the bottom at a depth of ca 110 m. Based on the pink color on top, pillars look like features formed by crustose coralline algae of unusual size and density, almost in a stromatolitic fashion. In the second sinkhole such pillar-like structures were not found. Very little is known about these structures, their distribution and the conditions under which they are formed. Moreover, no information is available of the benthic communities and environmental conditions in the very deep sinkholes of more than 150m m depth. Therefore, the **sinkhole expedition** was completely dedicated to the sinkholes and the platform in which they occur (Luymes Bank).



3D-image of the bathymetry of the submerged Saba Bank (ca 60 km long, 40 km wide, top 15-30m deep). The Luymes bank is in the north-eastern part of the Saba Bank and starts at around 75 meters of water depth and harbours sinkholes (pink pits).

1.2. Aims of the sinkhole expedition

The aims of the expedition were:

1. To study the distribution and environmental conditions (e.g. nutrients O_2, particulate organic matter, water movement) of benthic communities on the platform between sinkholes and in the sinkholes with emphasis on areas with regularly distributed pillar-like structures in sinkholes.
2. To take high resolution pictures of the benthic communities with high-resolution camera system and NIOZ video frame in order to describe the benthic communities.
3. To collect bottom samples in order to determine the species diversity of these communities.
4. To collect pillars and assess the species consortia producing the pillars, their life history strategies, accretion rates and stratigraphic history.
5. To survey and investigate the carbonate chemistry of sinkholes of different size and depth and detect the effects of possible stratification in sinkholes.
6. To determine metagenomics and metabolomics in water samples from sinkholes of different size and depths.
7. To investigate Light-Dark shifts in metagenomics and metabolomics in near bottom water samples in relation to nutrients, O_2, carbonate chemistry and POM in shallow sinkholes (20-40m deep) with and without pillar-like structure and the platform community at approx. 80m depth.
8. To collect plankton samples for closer studies of plankton communities over the Luymes Bank.

1.3. Science party

Fleur C. van Duyl	NIOZ -MMB	Chief scientists/Exp. Leader/ Coral reef microbial ecology
Erik H. Meesters	WMR	Co-chief scientist, Coral reef ecology
Andi Haas	NIOZ-MMB	Metagenomics, Metabolomics
Matthew Humphreys	NIOZ-OCS	Carbonate chemistry
Szabina Karancz	NIOZ-OCS	PhD Marine geology
Siham de Goeyse	NIOZ-OCS	PhD Carbonate chemistry
Karel Bakker	NIOZ-OCS	Chemical analyst, nutrients
Henk de Haas	NIOZ-NMF	Multibeam, bathymetry
Leon Wuis	NIOZ-NMF	Technician

1.4. Acknowledgements

We are grateful for the excellent support of the crew of the RV Pelagia:

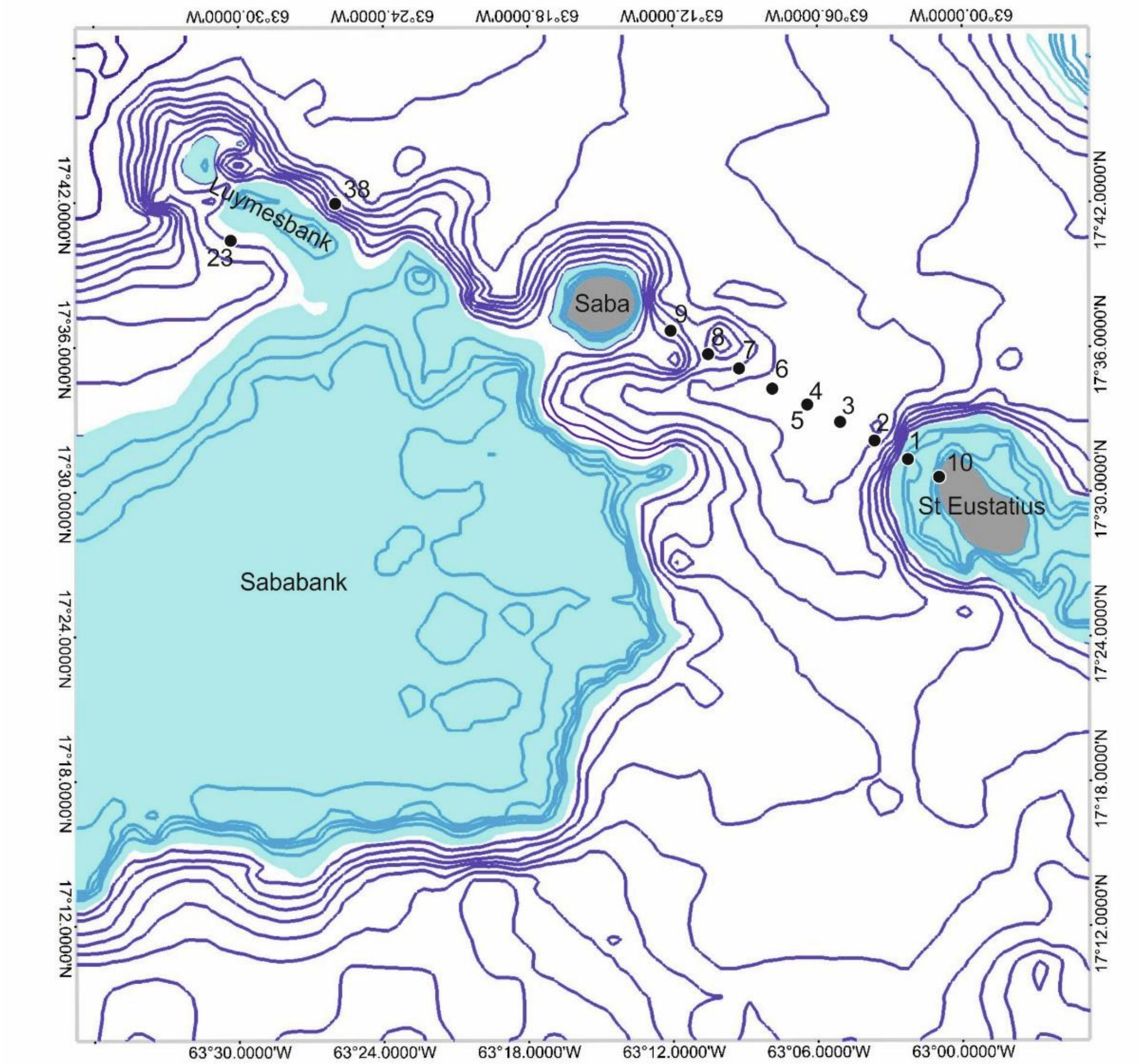
John Ellen	Captain
Len Bliemer	1st Officer
Jolanda Francke	2nd Officer
Bert Hogewerf	Chief engineer
Inno Meijers	Engineer
Sven Wolffers	Electrotechnician
Cor Stevens	Bosun
Martin de Vries	Sailor
Michael Taal	Sailor
Stephan Haanstra	Sailor
Hassan Shams	Cook
Vitali Maksimovs	Steward

We thank NIOZ National Marine Facilities (NMF) for logistic support from the home base of NIOZ-Texel i.e. Erica Koning and Mildred Jourdan. We thank Johan Stapel of CNSI on St Eustatius for arranging our access to the harbor with the RV Pelagia on St Eustatius on 8 December. Masru Spanner and Kimani Kitson-Walters of the CNSI joined us on the RV Pelagia on 8 December 2019 to be instructed about DIC sampling by Matthew Humphreys and Karel Bakker. Without the financial support of NWO and NIOZ basis this cruise would not have been possible. Erik Meesters of WMR was financially supported by the Ministry of Aquaculture, Nature and Food Quality, program BO, theme Caribbean Netherlands (BO-431800256).

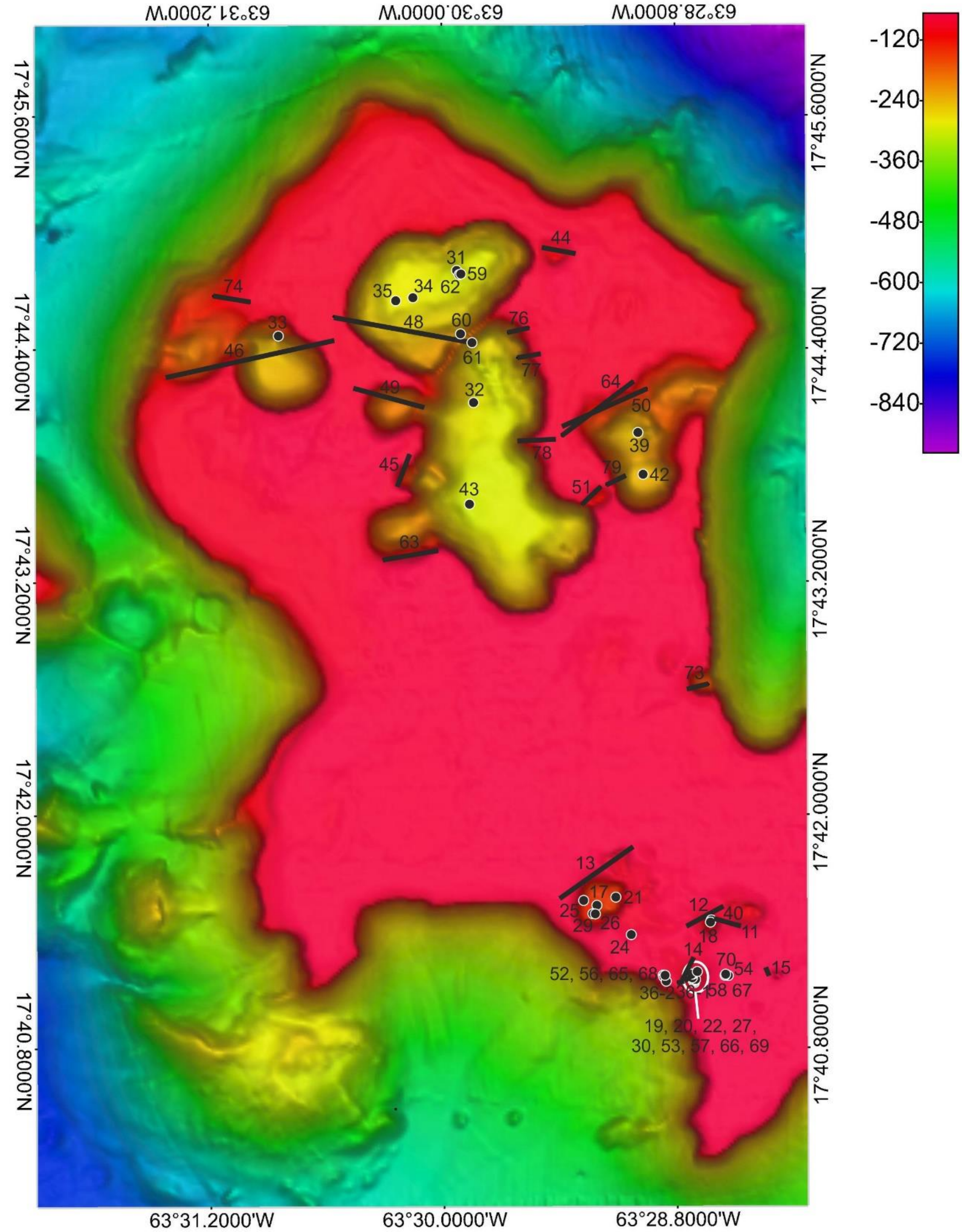
2. Itinerary and sampling equipment

2.1. Cruise route

The cruise started with a transect with surface water sampling for Rijkswaterstaat between St Eustatius and Saba (station 1-10). After that we moved to the Luymes Bank, where we carried out our research program from 9-17 December with station numbers 11-79 (image next page). Deep water stations 23 and 38 (493 and 597m deep) were off the Bank (image below). During several nights multibeam transects we completed along the NW side of the Saba Bank to fill gaps in bathymetric data.



Map with position of Luymes Bank relative to the Saba Bank, Saba and St Eustatius with stations visited between the islands and in deep water E and W of the Luymes Bank.



Map with stations visited and video transects (start and end point) on the Luymes Bank.

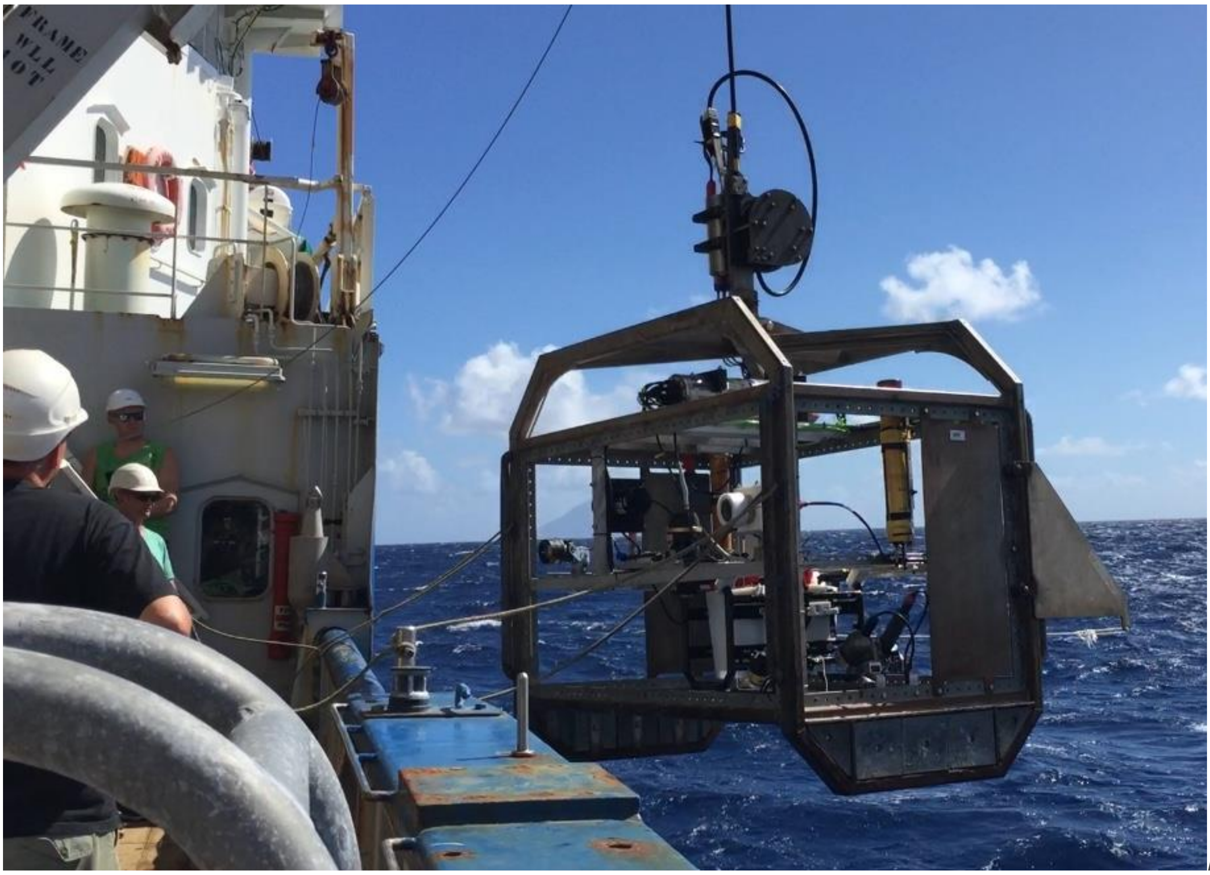
2.2. Large seagoing equipment used

Most important sea survey devices used during this cruise were the

a. **Multibeam** to survey the bathymetry of the deeper parts of the Luymes Bank and missing parts of the Saba Bank (in cooperation with the Dutch Hydrographic Service).

b. **CTD rosette** to obtain profiles of salinity, temperature, density, oxygen concentrations, fluorescence, underwater light measurements (PAR) and collect water samples with Niskin bottles. Initially the old rosette with grey water bottles was used. Because of failure of the step motor, the rosette was replaced with the new rosette with beige bottles and butterfly lids. These lids open under pressure. Altimeter did not work properly.

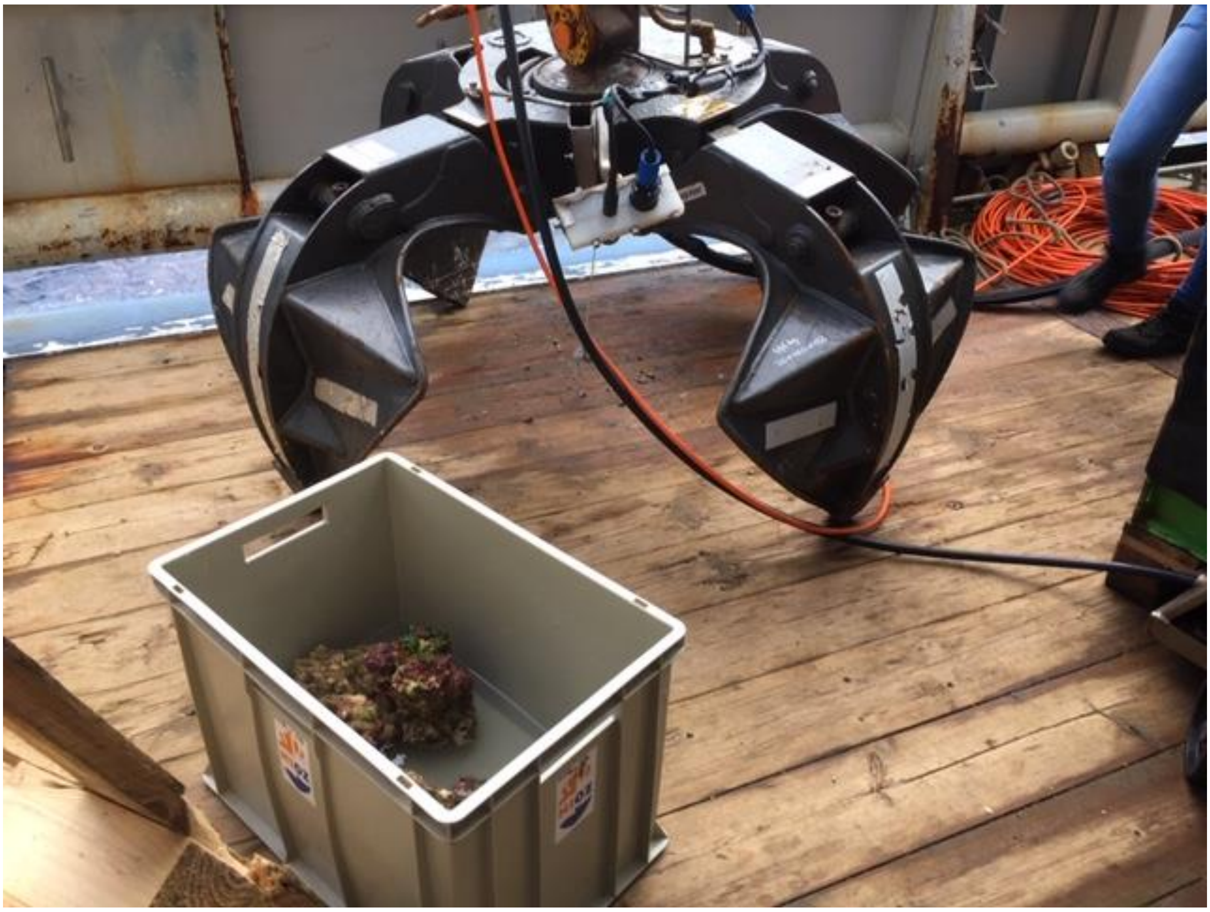
c. **HD-video frame** (**Hopper)** equipped with HD video, two Nikon D800 camera's, a GoPro camera, laser and two sonars (one looking forward and one looking downwards) and a transponder (for exact position determination of the frame in the water). Frame was used for online recording of benthic communities.



HD Video frame

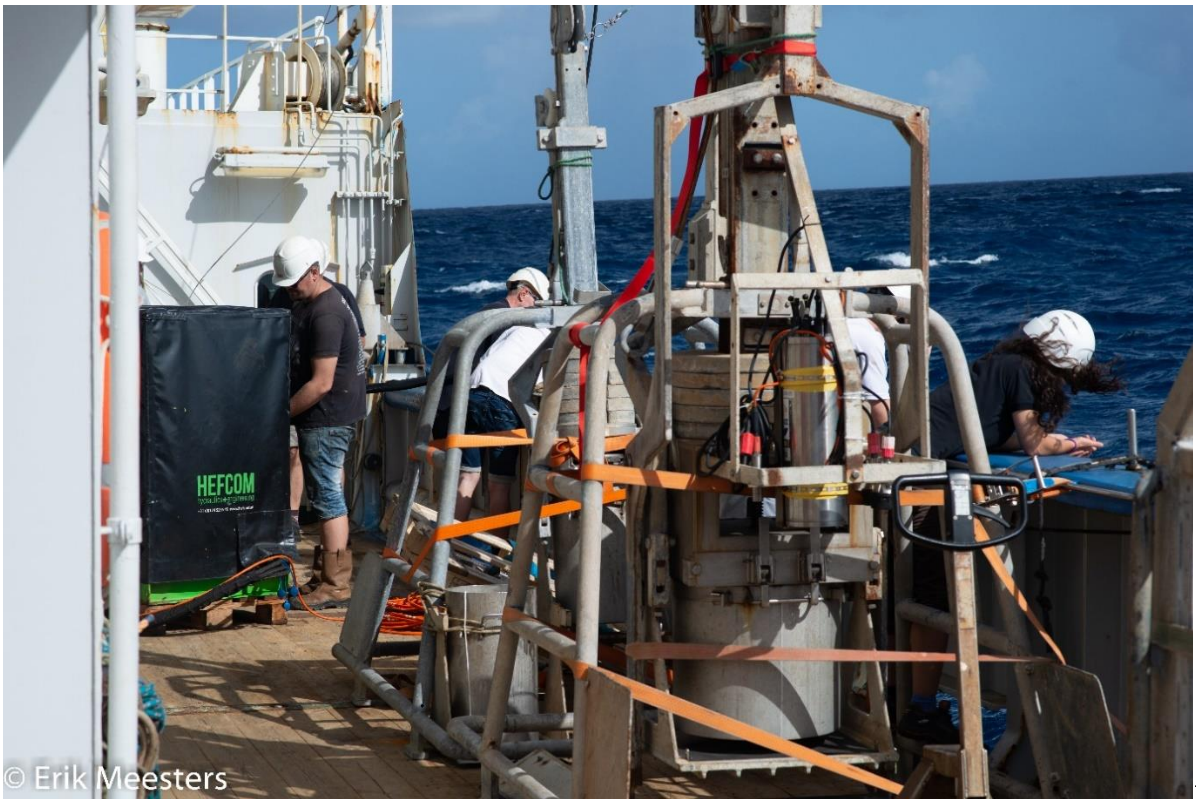
d. **Two Moorings** equipped with sediment trap, Nortek Aquadopp current profiler, oxygen-temperature sensor and light logger. The mooring site was marked at the surface with a buoy with a blinking light and pick up line.

e. **Grabber** via Bluestream (hydraulics for grabber were rented from Hefcom). The grabber was used as a standalone instrument with which we collected protruding pillars from the sinkholes. The system was lowered with a winch and steel cable from the RV Pelagia and had its own communication cable and hydraulic cable, which were taped to the steel cable while lowering the grabber to depths of down to max 120 m in sinkholes. The Grabber was equipped with a video camera and underwater light and could be operated online. Video footage was stored.



Grabber

f. **Boxcorer** with 30cm diameter steel cylinders for taking sediment cores in sinkholes.



The two boxcorers that were available on the ship during the cruise.

g. **Triangle dredge** to collect bottom samples of the platform community.

Triangle dredge

2.3. Equipment damage/Troubleshooting

During the first day of the cruise (8 December) we had short circuit in the CTD cable and communication was lost. Subsequently 2 stepmotors of the old CTD-rosette failed. We decided to replace the old CTD-rosette with the new one. Advantage of the new one is that its water samplers are not contaminated with air. Disadvantage is that it takes more time to operate. Particularly in shallow water this is a disadvantage. The repaired cable with new CTD-rosette was operative again on 10 December.

Sinkholes are hazardous to video and to take water/sediment samples from, particularly the ones with very steep walls (and overhangs) and the very narrow ones (< 60m in diameter). Cables of equipment can easily get hooked under ledges along the sides and get damaged.

The damage of the HD video frame and Kley France Cable was serious on 9 December. Approx. 150m of the Kley France cable had to be removed after it was damaged along a wall. Moreover, a transponder attached to the frame was broken. Connectors on the camera underwater housings were severely damaged/broken. Camera's within housings and sonars were not damaged. System was operative again on 14 December.

The grabber got damaged on the second day we used it, because it got stuck on the side of a sinkhole. The hydraulic cable was damaged. Also lamps of the camera system, which were not very well shielded from the surroundings did not work properly anymore. Spare parts and dedicated tools were not available on board to repair the Grabber. The Grabber was shipped back to the Netherlands from Guadeloupe in a container.

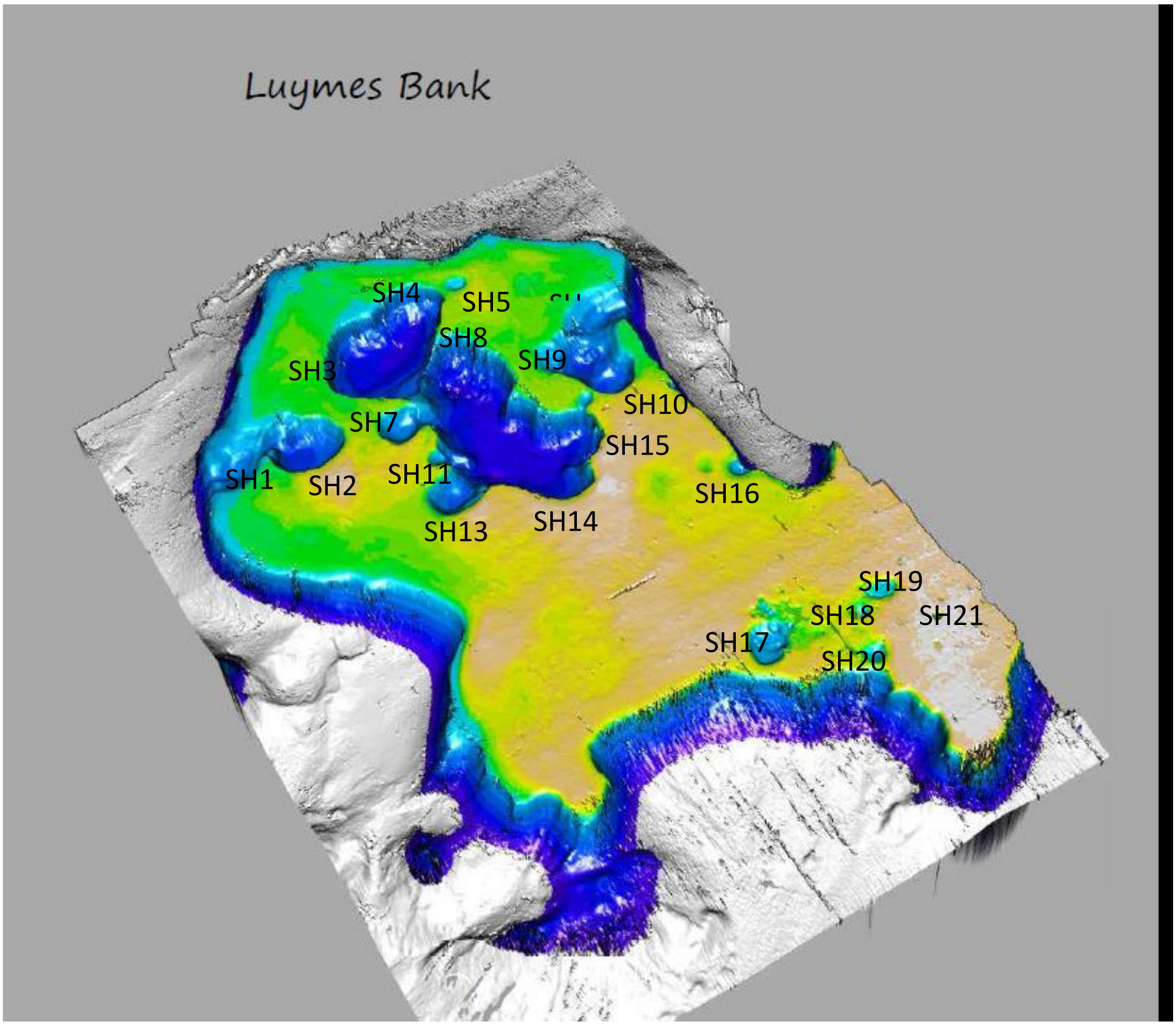
During recovery of one of the moorings the sediment trap was damaged. The polyester hull partly broke almost completely loose from the holder. Motor and sample bottles were not damaged.

3. Reports of scientific activities

3.1. Survey of geomorphology and benthic communities of the Luymes Bank

(Erik Meesters, Fleur van Duyl)

During the cruise sinkholes and the platform between sinkholes were surveyed by underwatervideo with the main aim to determine the distribution and composition of euphotic benthic communities, and for the first time explore the deeper sinkholes (bottom depth > 150m). The Luymes Bank harbours sinkholes of various sizes and depths. The deepest point of 475m was recorded in SH8 (max sinkhole depth 377m). SH8 appears to be formed by several separate sinkholes which were joined due to collapse of walls between them. In the northern part the deep sinkholes were dominant and in the southern part the shallower sinkholes.



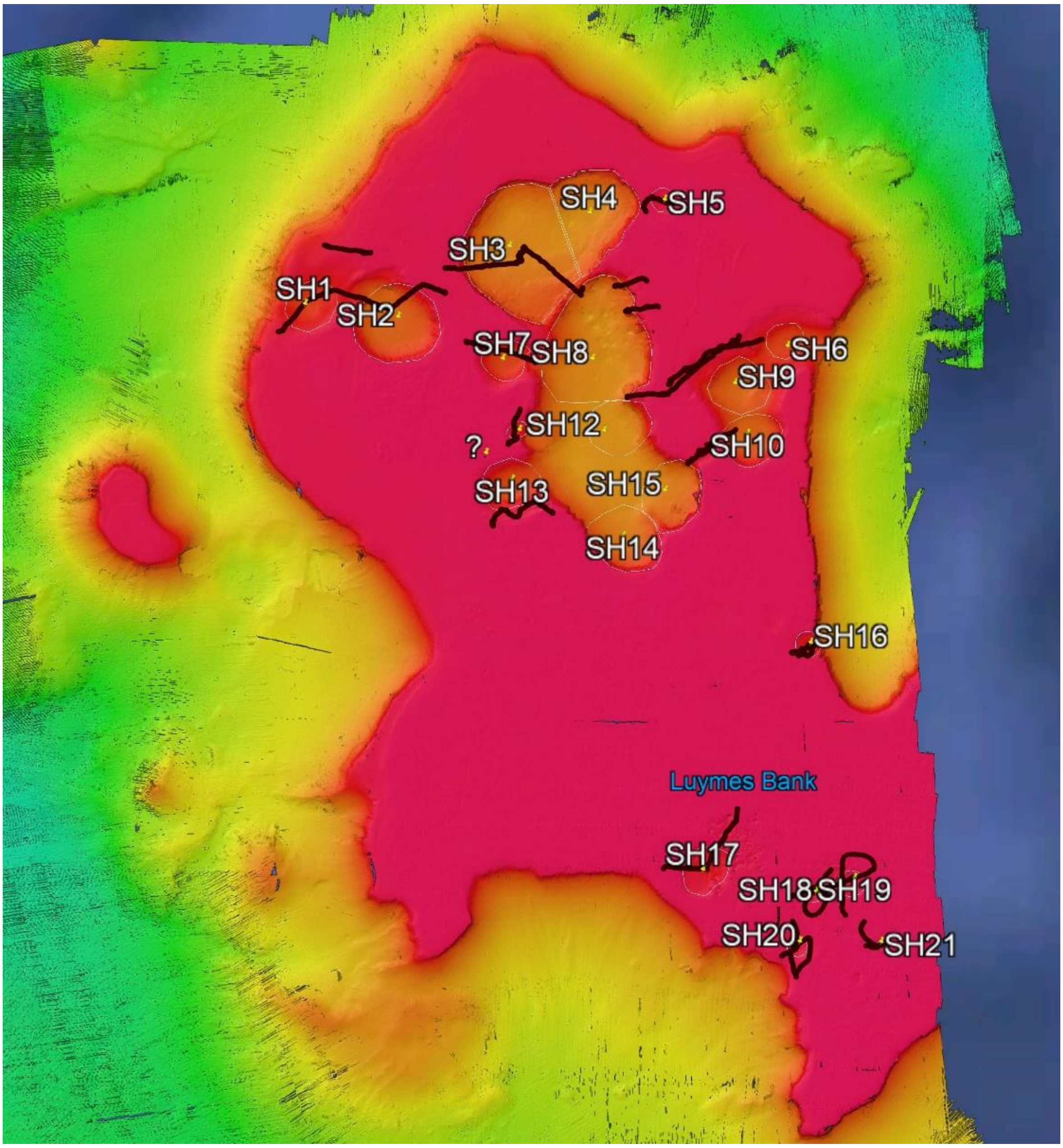
The Luymes Bank with 21 sinkholes indicated. Several of the numbered sinkholes are merged with other sinkholes forming larger sinkholes. See for instance the largest sinkhole in the middle of the bank which encompasses former separate sinkholes 8, 12, 14, 15. Sinkhole 12 (not shown) borders on sinkhole 15.

The length and width of distinguished sinkholes varies from 55 to 1130m. The length of merged sinkholes 8,12,14,15 is 2.9km. A characterization of the sinkholes in terms of physical attributes is given in the following table.

Characteristics of the 21 sinkholes. Depth measurements are from a xyz grid collected during the NICO expedition in 2018. The first four columns give the water depth at the edge and deepest part of the sinkhole, the depth the sinkhole from top to bottom, and the average depth. The coordinates indicate the approximate *centre of the sinkhole, and n, the number of depth measurements within the sinkhole. To avoid overestimating the maximum depth from artefacts in the multibeam data, maximum depth (bottom) has been taken from calculated contour lines.*

name	*Bottom*	*Top*	*Depth*	*Average depth*	*Longitude*	*Latitude*	*n*
Sinkhole 1	*-190*	*-111*	*79*	*-156*	*-63.5213*	*17.74014*	*52162*
Sinkhole 2	*-240*	*-81*	*159*	*-193*	*-63.5141*	*17.74102*	*140760*
Sinkhole 3	*-290*	*-74*	*216*	*-245*	*-63.4985*	*17.74677*	*297990*
Sinkhole 4	*-310*	*-70*	*240*	*-240*	*-63.4971*	*17.74796*	*155219*
Sinkhole 5	*-110*	*-89*	*21*	*-100*	*-63.4903*	*17.74796*	*11407*
Sinkhole 6	*-190*	*-131*	*59*	*-173*	*-63.479*	*17.73605*	*28254*
Sinkhole 7	*-185*	*-109*	*76*	*-162*	*-63.5045*	*17.73453*	*37872*
Sinkhole 8	*-300*	*-99*	*201*	*-253*	*-63.4972*	*17.73551*	*276409*
Sinkhole 9	*-240*	*-132*	*108*	*-206*	*-63.484*	*17.73138*	*67001*
Sinkhole 10	*-230*	*-88*	*142*	*-193*	*-63.4817*	*17.72634*	*61892*
Sinkhole 11	*-150*	*-89*	*61*	*-123*	*-63.5021*	*17.72876*	*6808*
Sinkhole 12	*-290*	*-104*	*186*	*-274*	*-63.4937*	*17.72984*	*72596*
Sinkhole 13	*-205*	*-87*	*118*	*-166*	*-63.5009*	*17.72683*	*62782*
Sinkhole 14	*-260*	*-76*	*184*	*-220*	*-63.4907*	*17.72186*	*95242*
Sinkhole 15	*-255*	*-76*	*179*	*-234*	*-63.4907*	*17.72186*	*85237*
Sinkhole 16	*-155*	*-87*	*68*	*-130*	*-63.4766*	*17.7121*	*12721*
Sinkhole 17	*-135*	*-87*	*48*	*-121*	*-63.487*	*17.69206*	*44374*
Sinkhole 18	*-125*	*-86*	*39*	*-108*	*-63.4773*	*17.69056*	*4857*
Sinkhole 19	*-105*	*-81*	*24*	*-97*	*-63.4736*	*17.69244*	*15629*
Sinkhole 20	*-115*	*-92*	*23*	*-104*	*-63.4788*	*17.6863*	*7551*
Sinkhole 21	*-145*	*-78*	*67*	*-123*	*-63.4714*	*17.68655*	*1167*

HD-video combined with high resolution camera images (7360 x 4912 pixels) were made in sinkholes of which the water depth (water surface to bottom sinkhole) was less than approx. 150 m i.e. SH5, 11, 17, 18, 19, 20, 21. For images of deeper sinkholes the HR cameras were removed. Housing of cameras and flashlights are only watertight until approx. 150m depth. Tracks were made from west to east against the wind and waves to keep the groundspeed of approx. 1-1.5 knot, which is preferable for sharp video images.

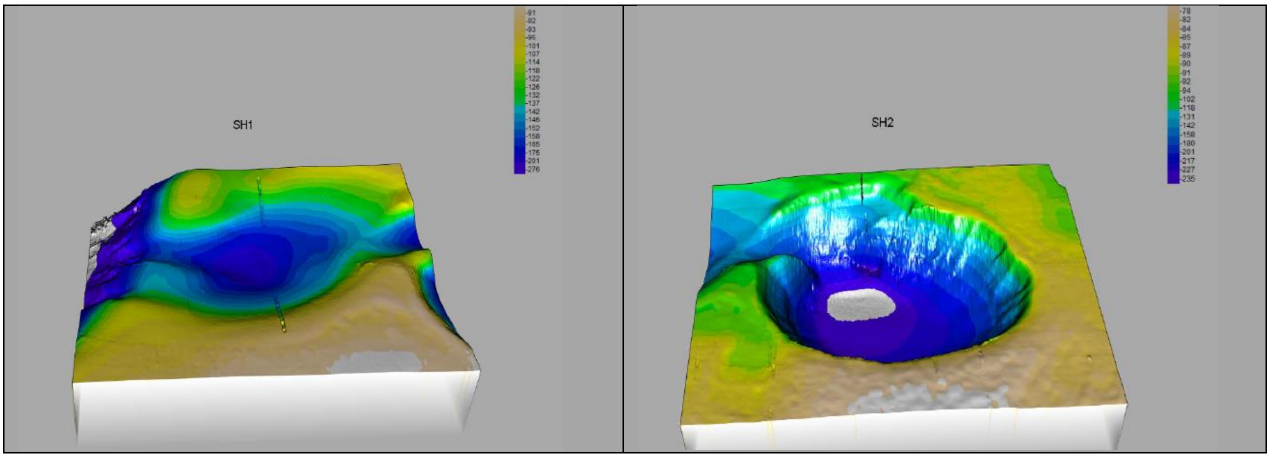


Location of video and camera tracks that were run across and along the sinkholes and over the platform. Platform (ca 80m depth) is red and deep sinkholes are orange.

3.1.1. Northern Sinkholes

Most of the sinkholes in the north of the Luymes Bank are larger and deeper than the sinkholes in the south. The only shallow ones in the north were SH5 and SH11. Regular patterns of small protruding pillars were found on sandy slopes in SH6, SH7, SH11, SH13, SH16 and in a small depression between SH15 and SH10. The depth range in which pillar patterns occur is from 95 to 120m on gently sloping sandy bottoms. Bottom of the deep sinkholes (>200m) was mainly bare sand or mud with occasional gorgonians. In SH3 yellow blobs were detected on the muddy bottom at approximately 300m depth. Crustaceans of approx. 8 cm long appeared to be the main epifauna in this sinkhole. Walls of the deep sinkholes (SH3, 4, 8, 12, 14, 15) were extremely steep and were mainly bare rock with some encrusting organisms.

Sinkhole 1 and 2. Visited 14 December 2019



Sinkhole 1 is connected on its western side to the outside of the bank by a shallow sill that is about 15m high and lays at 157m depth. On its eastern side a valley opens up into sinkhole 2 which is a deep sinkhole with very steep slopes.

The top of the bank west of sinkhole 1 is sandy and coralline algae are not very dense. Sponges are abundant. Below 120m the bottom is mainly sand with occasionally a lot of sand dollars

Top of the bank

On the bottom of sinkhole 1. Sand dollars are sometimes abundant

When approaching the eastern slope of sinkhole 1, coralline algae appear again, but they are mostly under a thick cover of sand. Sinkhole 2 has a very steep slope which appears to consist of almost solely coralline algae with an occasional soft coral. The bottom lays around 280m and consists of sand with holes which are probably burrows of fish.

The wall of sinkhole 2

Burrows in the sand on the bottom of sinkhole 2

Exiting sinkhole 2 on the northeastern side there is again a very steep wall with at the shallower parts, just below 130m, clear pattern formation of coralline algal ridges. On top of the bank around 90m depth is the benthic platform community of coralline algae, sponges and corals, which is characteristic for most of the platform.

Different patterns of burrows in sinkhole 2.

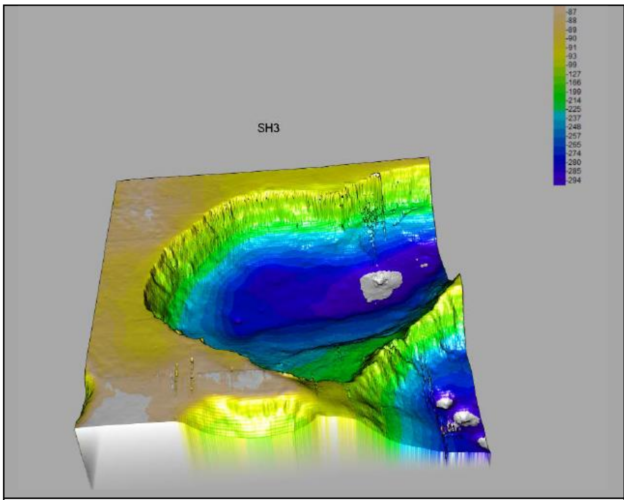
The north-eastern side of sinkhole 2 has steep walls.

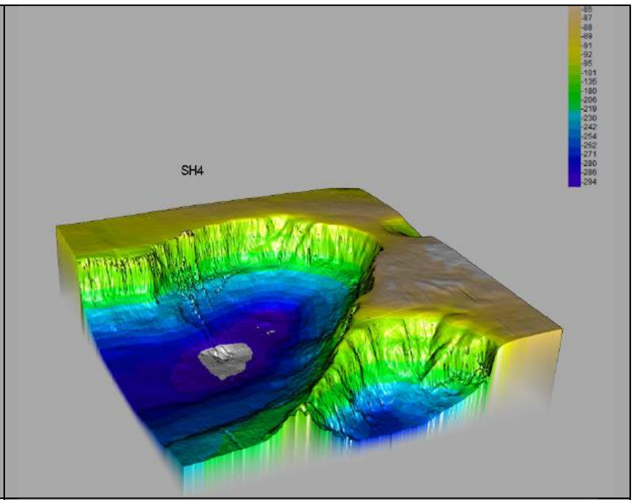
Coralline algae grow along the edges of the sinkhole.

On top of the bank when exiting sinkhole 2.

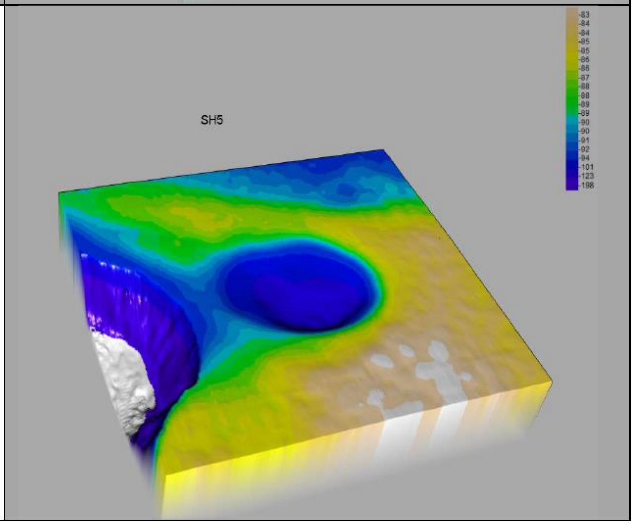
More images from the top (platform) of the Luymesbank just east of sinkhole 2.

Sinkholes 3, 4, and 5. Visited sinkhole 5 on 14 December and 3 and 4 on 15 December.





Sinkhole 3 and 4 create a heart-formed big sinkhole but were clearly once two separate sinkholes. Sinkhole 5 lies at the eastern side of sinkhole 4 and is much shallower than the other two. South of sinkholes 3 and 4 there is a very steep and narrow ridge that separates sinkhole 8 from 3 and 4.



Sinkhole 3 was one of the most interesting sinkholes. Sinkhole 3 and 4 are basically fused together into one sinkhole. The lower part of the sinkhole has a very different chemical constitution, basically forming an acid lake within the sinkhole. With the multibeam we could also identify gas seeps. We tried to locate the sources, and some pictures are included, but it is not sure that these covered the vents because we did not actually find bubbles. For more information on the chemical characteristics of this sinkhole read the multibeam section. The water column of the sinkhole was much more turbid than in the other sinkholes. Within the water column there were mostly jelly fish and no other life. The bottom appeared to be covered by a very dark substance which still needs to be analysed. Within this muddy bottom only small red lobsters were crawling. When exiting sinkhole 3 the dark material gradually disappeared and the carbonate bottom became visible again. We went over a shallow sill into sinkhole 8 where conditions appeared totally different from those in sinkhole 3. Where we did not see any fish in sinkhole 3, they appeared immediately as soon as we entered sinkhole 8.

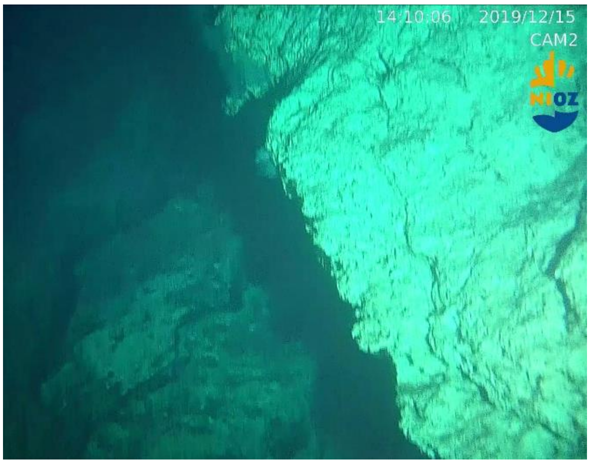
The bottom of sinkhole 3

Small red lobsters within the dark sandy material


Potential gas seep area (290m)

Potential gas seep area (290m)

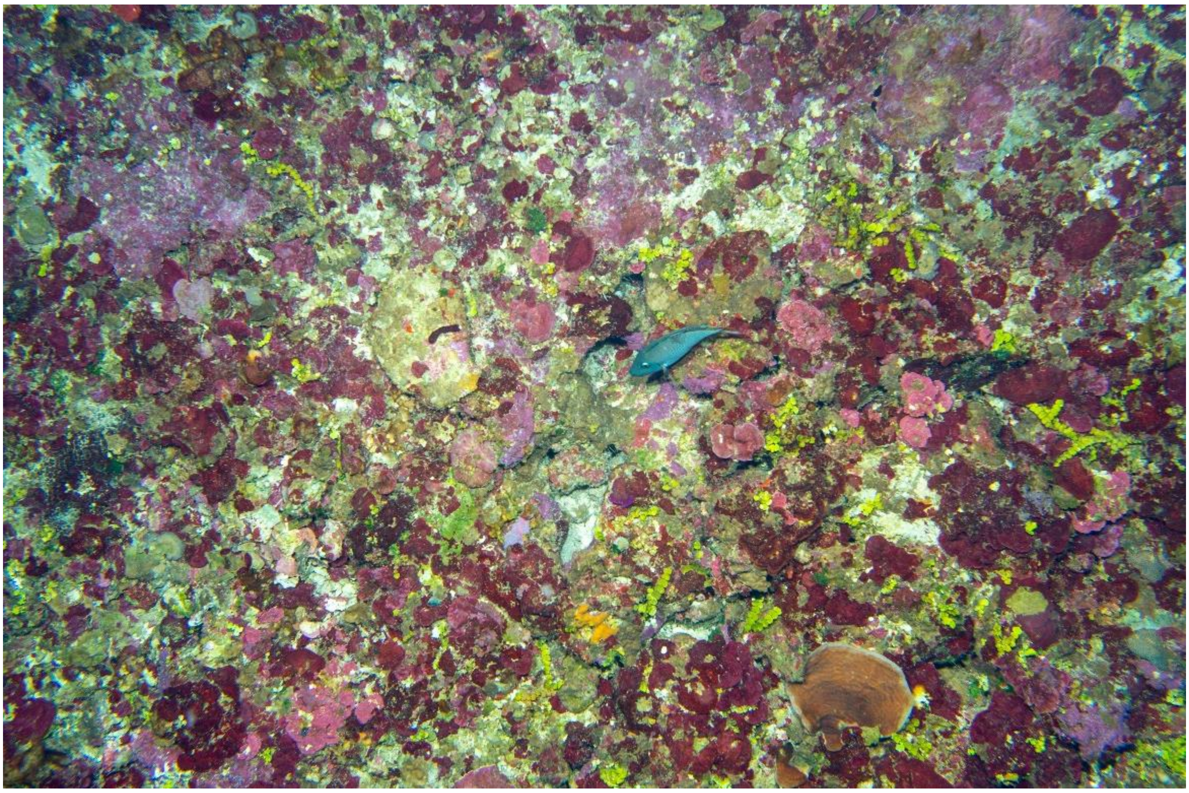
Going up the slope of sinkhole 3 (220m).



The sill from sinkhole 3 to sinkhole 8 (180m).

Sinkhole 4 was not further studied by the camera frame, but we did take CTD measurements there.

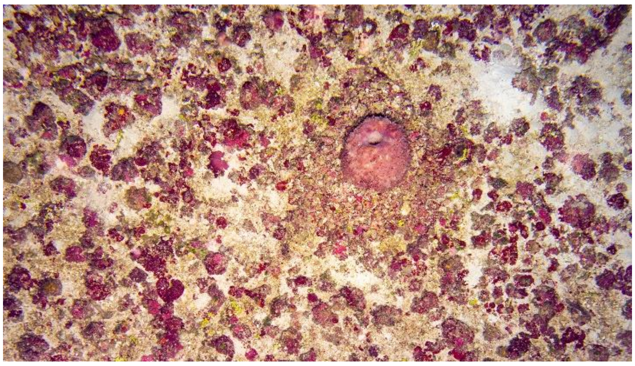
Sinkhole 5 is connected to sinkhole 4, but is very shallow not more than 110m deep, comparable to the southern sinkholes. The slope is very gentle and the bottom is almost everywhere covered by coralline algae and sponges. Corals are present from 90m upward. Holes in the hard bottom are often occupied by fish. The Sargassum triggerfish in a conspicuous inhabitant of these holes.



The top of the bank at 85m. Encrusting coralline algae and Halimeda spec. together with sponges form the dominant living components. A Sargassum triggerfish in the middle just before it vanished into a hole in the reef bottom (90m).

Corals are also abundant on many places along the edge of sinkhole 5.

The bottom with more sand, but coralline algae are still abundant (110m).



On the bottom small coralline algal nodules were present.

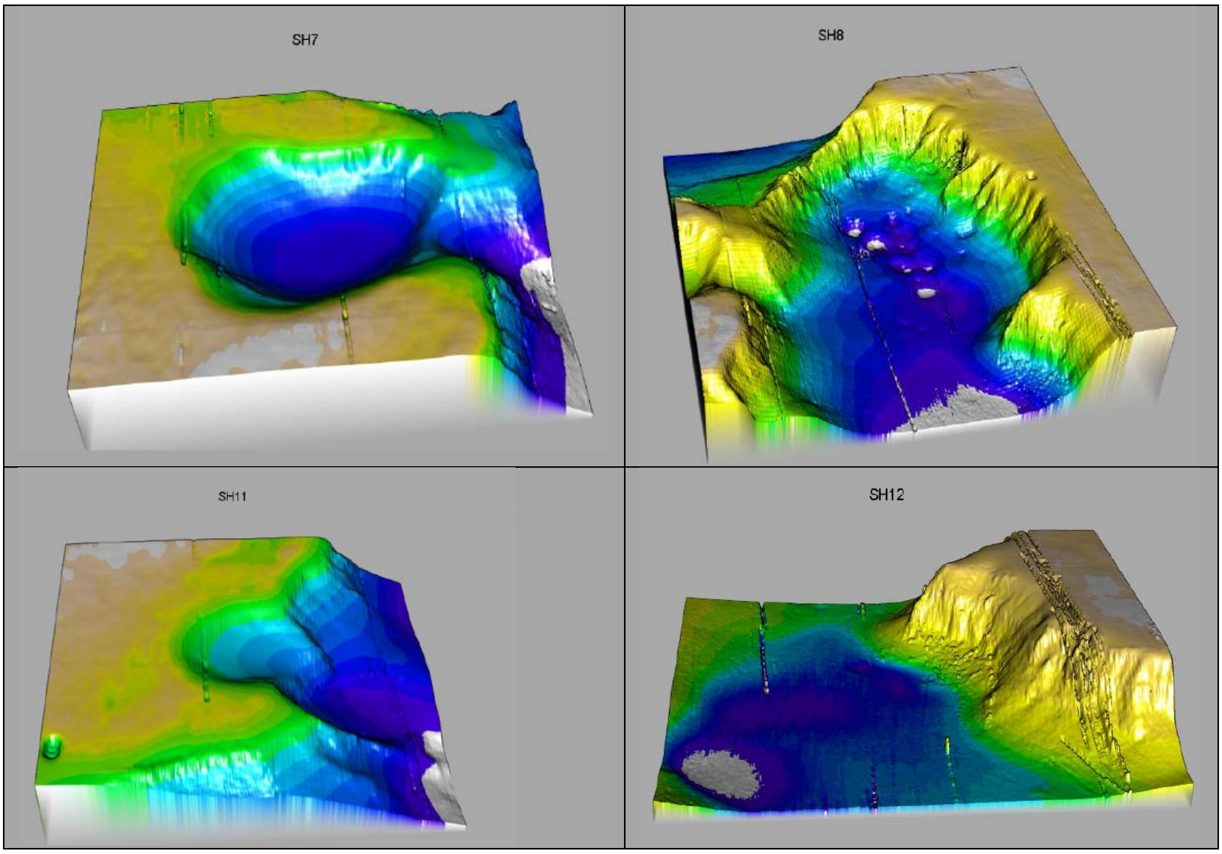
The deepest part of this sinkhole is more sandy, but this appears to cover only a small part of the bottom. Clear pillar structures of coralline algae however were not observed in this sinkhole.

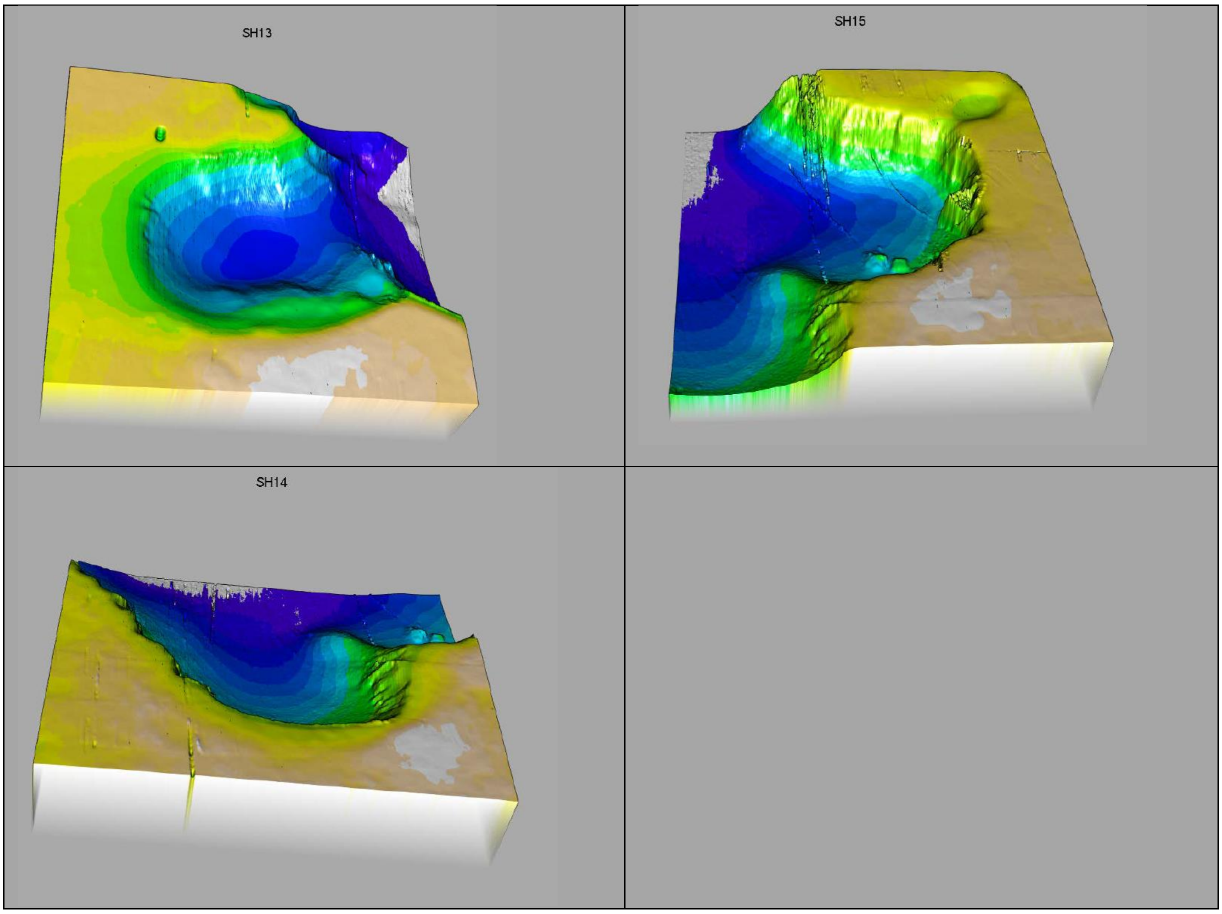
Sinkhole 7, 8, 11, 12, 13, 14, and 15. This is the largest sinkhole of the Luymes bank. It consists of several remnant sinkholes of which the walls have collapsed sometime in the past. These sinkholes are now all connected and form an elongated sinkhole of approx. 2.9 km long. The barrier between sinkhole 8 and 3 is crumbling. A depression at the north-eastern side of sinkhole 15 leads to sinkhole 10. Eight different transects were run within these sinkholes. Sinkhole 7 and 11 were crossed. Sinkhole 13 was followed along its southern edge. Sinkhole 8 was entered during a transect run from sinkhole 3 to 8. Additional 4 transects were run along the eastern slope of sinkhole 8.

When entering sinkhole 8 from sinkhole 3 we observed massive blocks that seemed to indicate that the ridge between the two sinkholes is falling into pieces at its lowest point. Possibly there is occasional influx of acid water from sinkhole 3 into 8, however, conditions in sinkhole 8 appeared much better: water visibility was immediately better and large schools of fish were present.

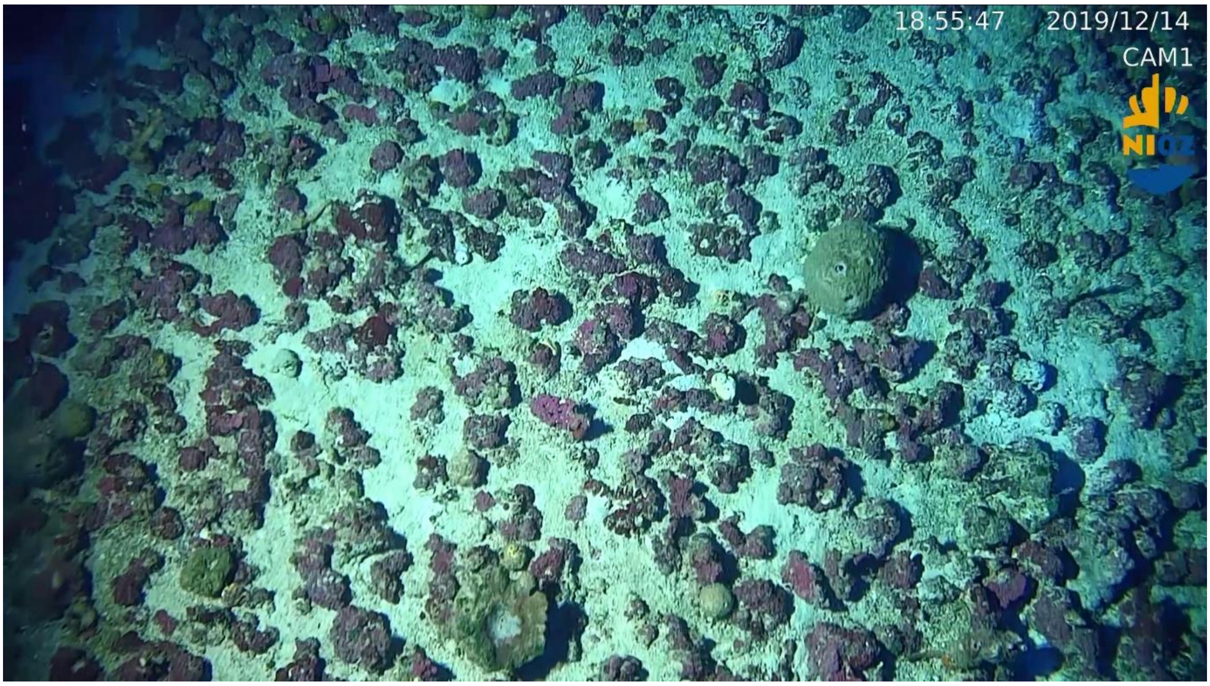
A transect in Sinkhole 7 ran down to approximately 180m. The top of the sinkhole has the common coralline algae/coral/sponge community. Going into the sinkhole, ridges of coralline algae appear that deeper appear to break open into nodules and small pillars, but around 120m depth they disappear into a sandy bottom. The transects continues into sinkhole 8 with a steep ridge that is also covered by coralline algae, however, because its depth is already around 140m, it’s rather sandy.

Going down the slope *from sinkhole 7 into sinkhole 8 coralline ridges appear not to be actively growing.*



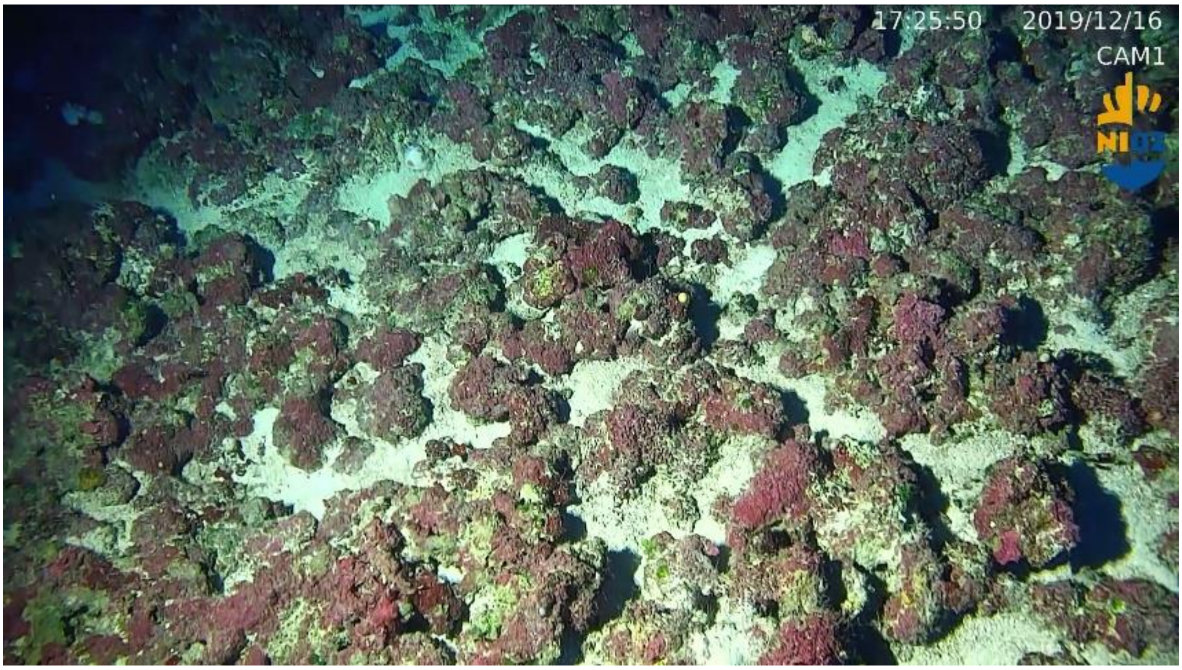


Sinkhole 11 is comparable to sinkhole 7. Along its edge coralline algae are dominating and around 120m they turn into small nodules. Deeper than 140m most of the bottom consists of sandy sediment.

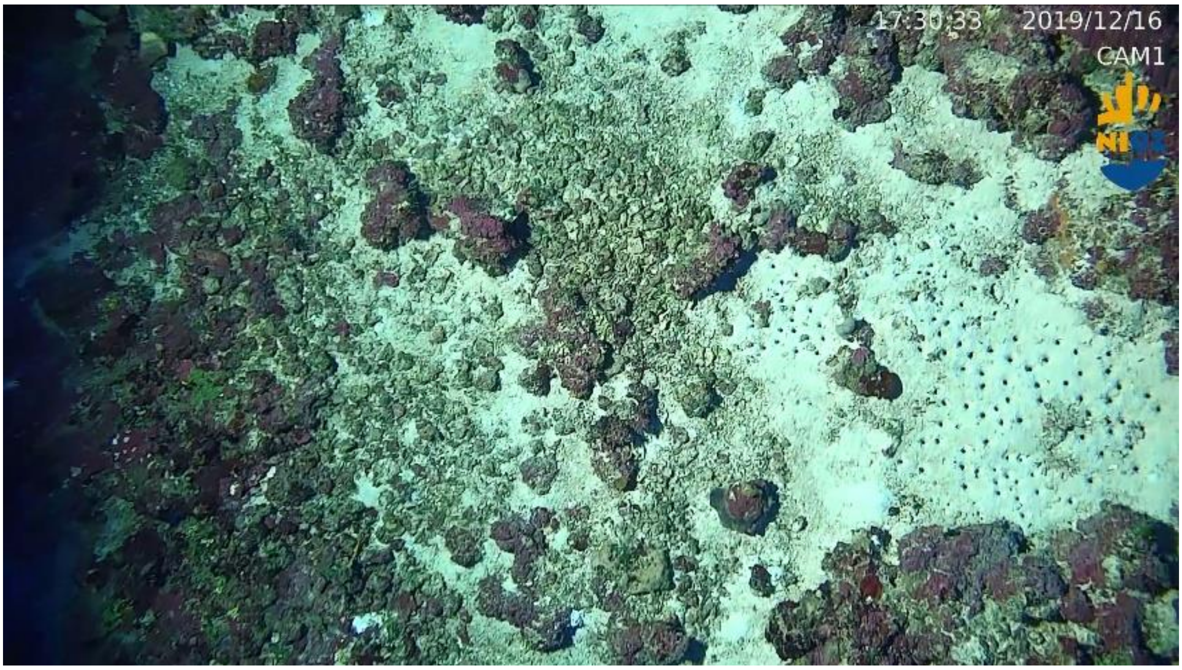


Small coralline algal nodules form the bottom around 120m depth in sinkhole 11 with many small sponge colonies in between. Corals are absent around this depth.

The southern edge of sinkhole 13 showed a lot of topographic complexity in the bathymetric data and was thus investigated thoroughly. At the top the bank is almost completely covered by encrusting coralline algae, corals and sponges. Going down the slope the pattern that appears to be quite general is one where the corals first disappear at around 100m depth, then more sandy areas appear and the coralline algae start to break up into small fused ridges, then small nodules or pillars. Below 120m the sand seems to become more abundant and deeper and holes of burying organisms are often present in the sand.



105m depth in sinkhole 13.

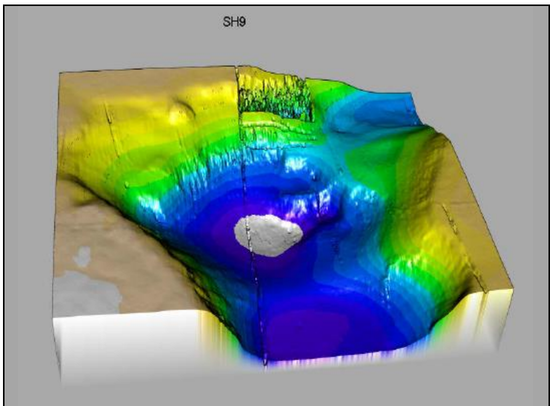


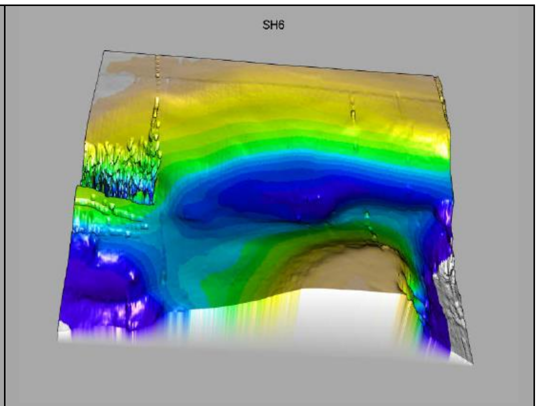
110m

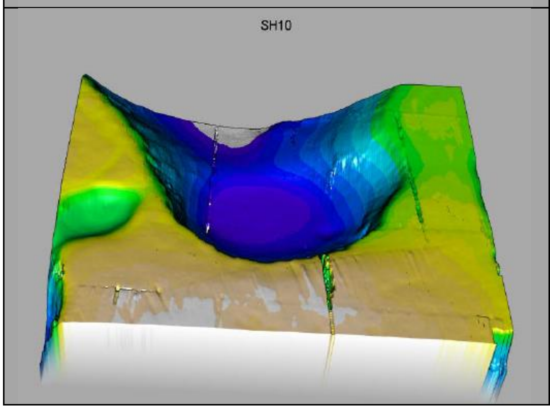
The eastern side of sinkhole 8 has some very steep walls. The small corridor connecting sinkhole 15 to sinkhole 10 was also recorded. It consisted mostly of coralline algae with smaller sand patches. Probably the deeper parts of this corridor are mainly sand.

Around 110m small coralline nodules are giving way to more sand.

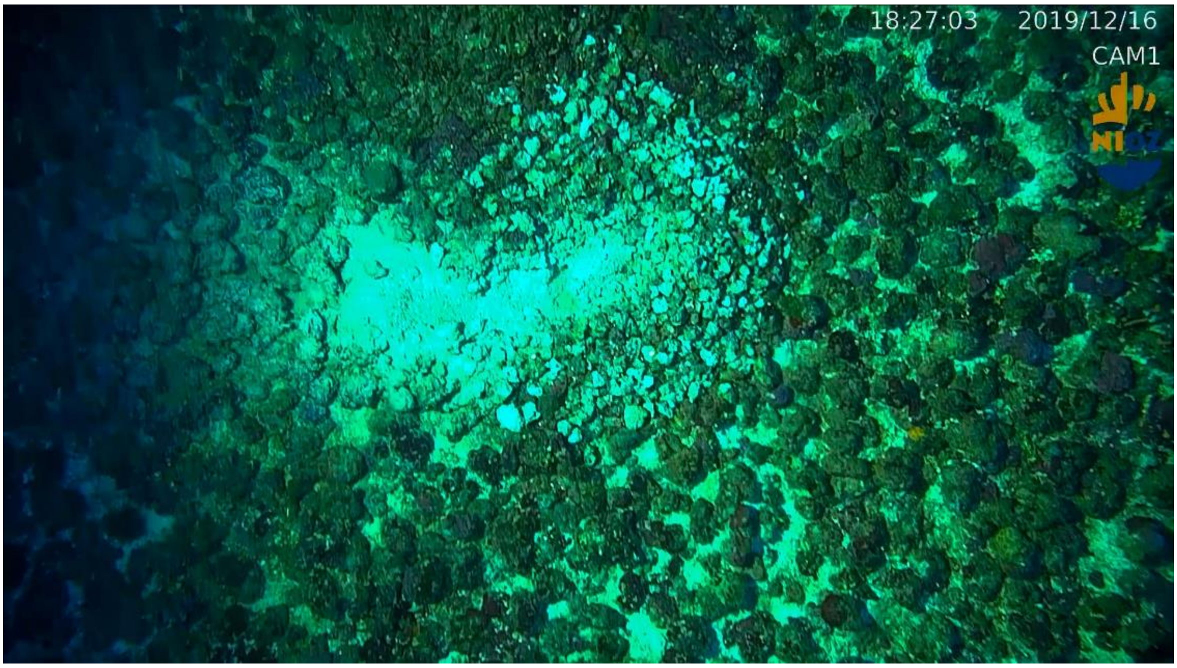
Sinkholes 6, 9 and 10. Sinkhole 6 and 9 were studied by running a transect along the edge from 9 to 6. Sinkhole 10 was not further investigated, except by a transect from sinkhole 15 to sinkhole 10. Along this transect coralline algal nodules were very densely distributed with many signs of fish behaviour actively moving many of the smaller fragments around. At the bottom of the transect around 120m the surface was mainly covered by sand though the underlying hard bottom of coralline algae was sometimes still visible.





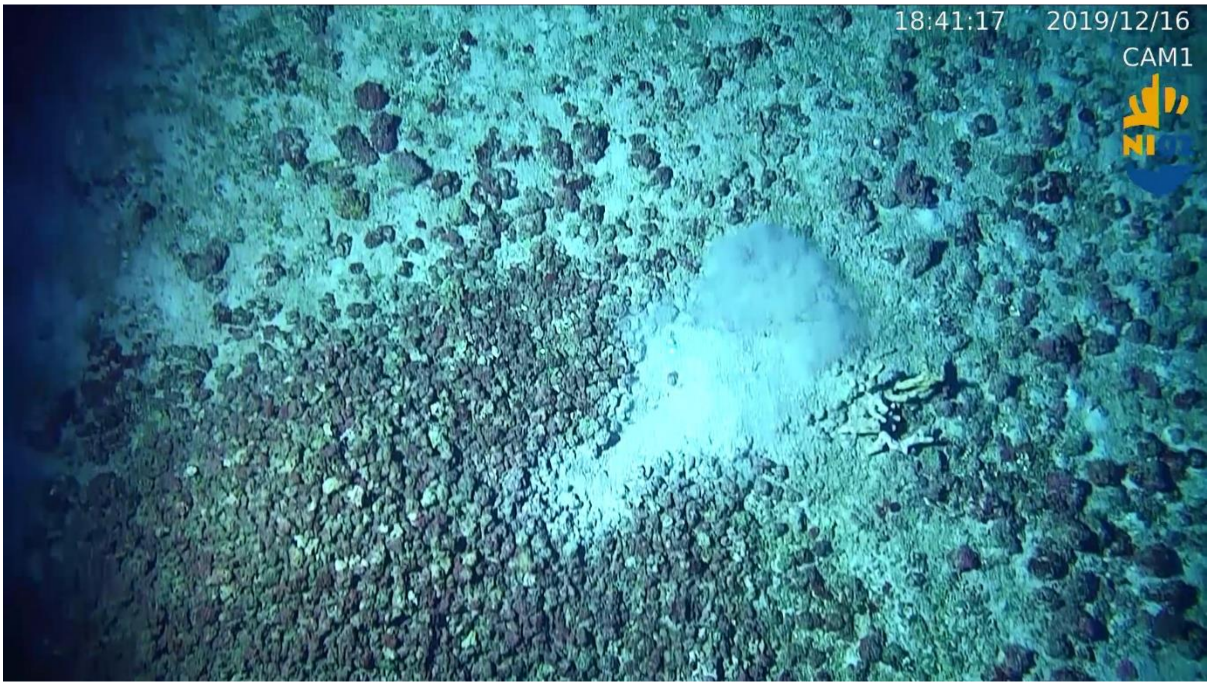


Sinkholes 6 is open to the eastern side of the bank on one end and connected to sinkhole 9 by a shallow threshold. Sinkhole 9 and 10 are separated by a deeper threshold. On the western side of sinkhole 10 there appears to be a shallow connection between this sinkhole and sinkhole 15.

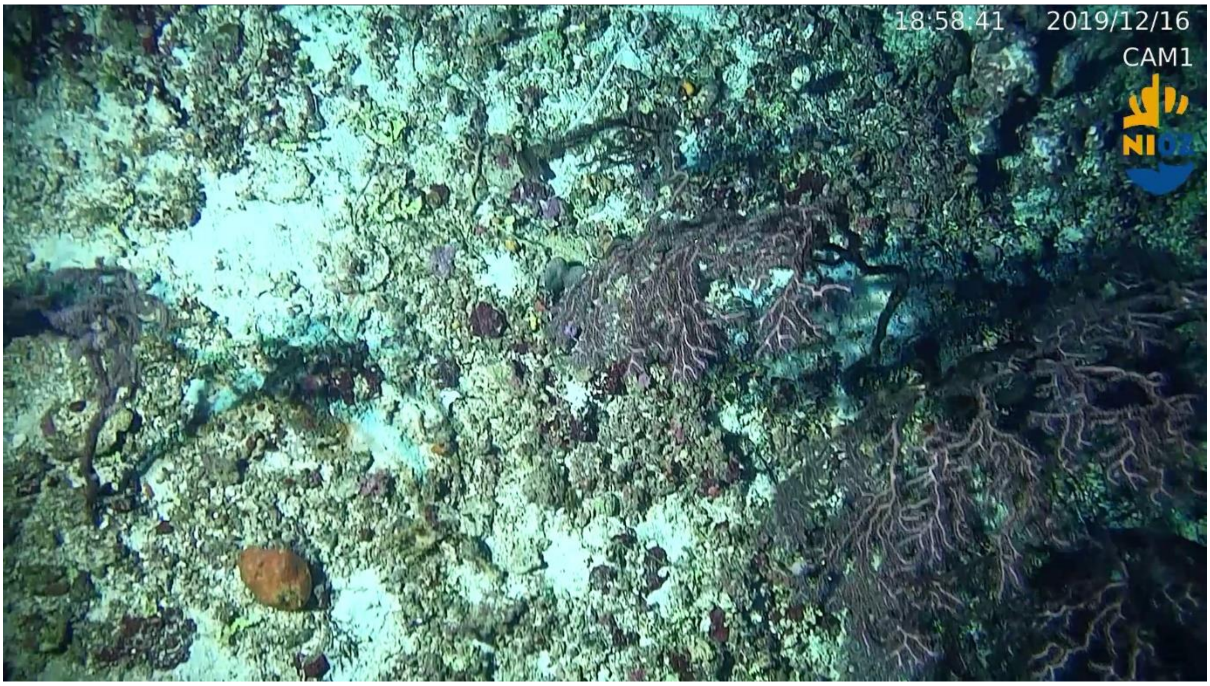


Coralline nodules probably disturbed by fish.

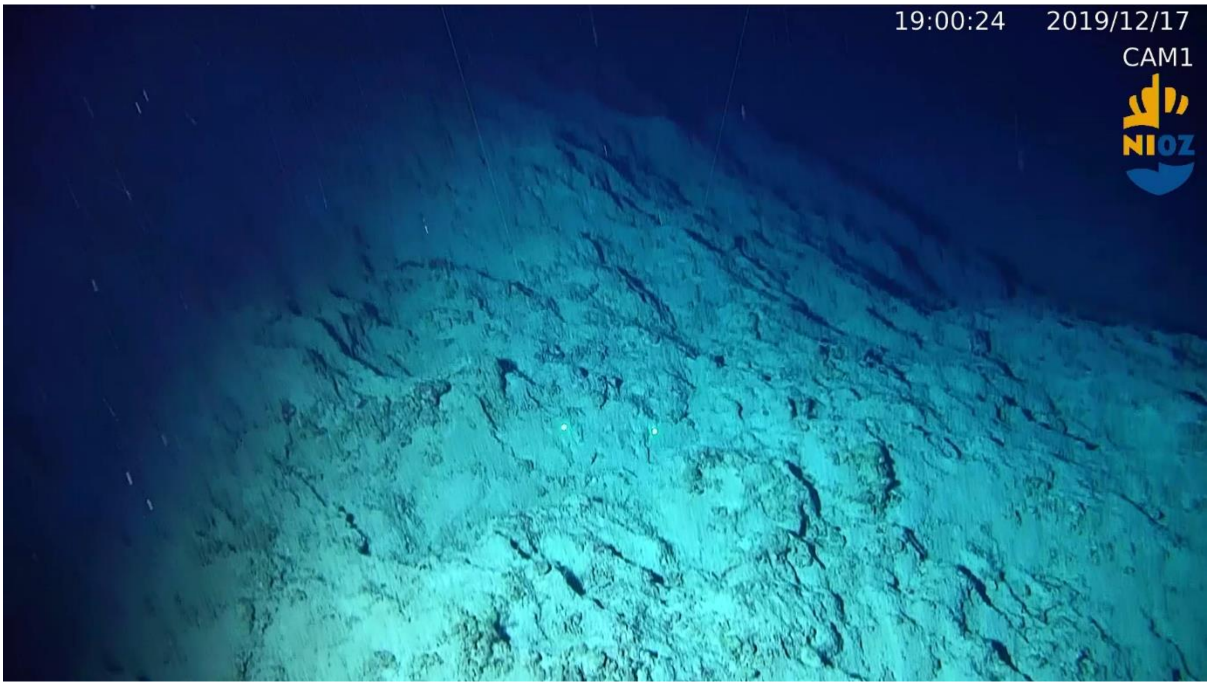
We encountered a large number of burrows of the sandtile fish that together with the Sargassum trigger fish seem to be two very common fish species.



A sand tilefish burrow with a cloud of sand still floating where the sand tilefish had been just before the photograph was taken.

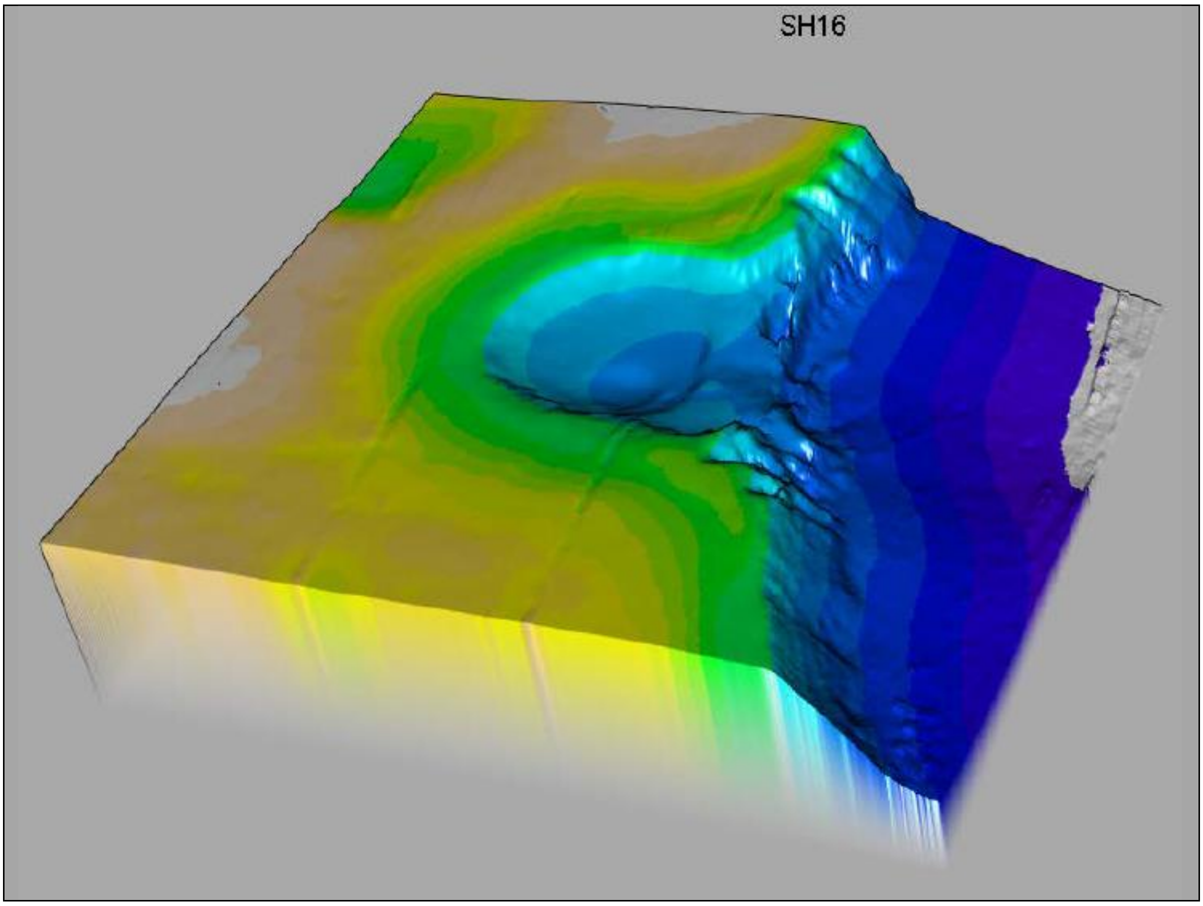


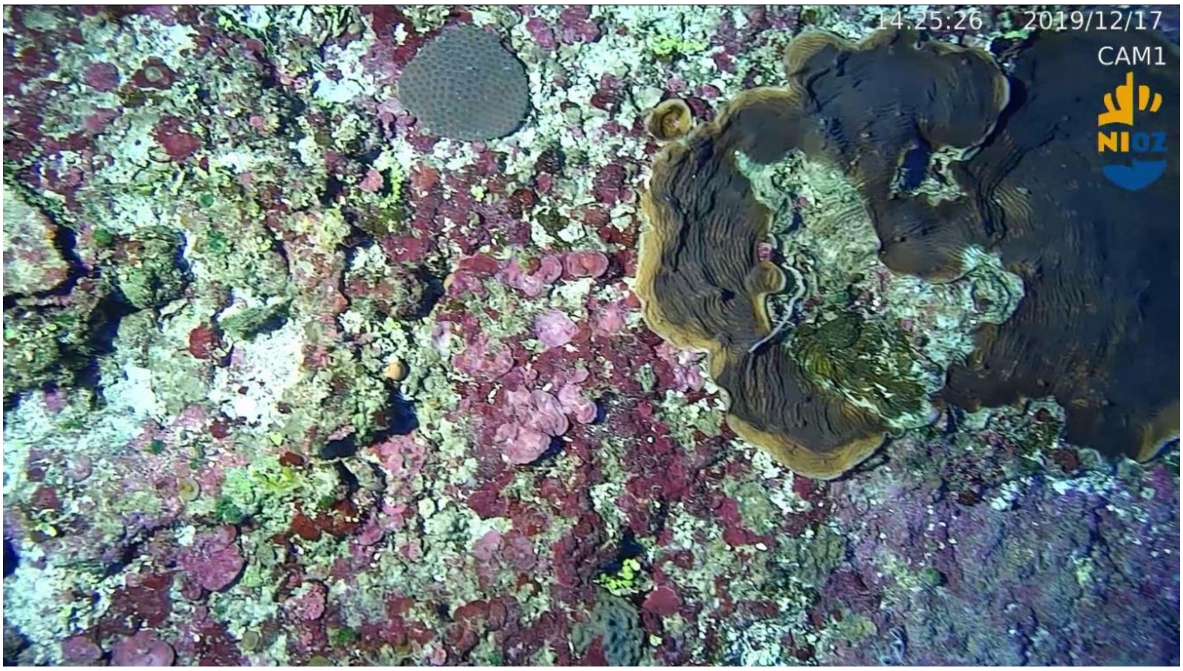
Occasionally stands of soft corals were encountered.



Sinkhole 10 was very similar to the connecting sinkholes 9 and 6, but around 160m depth the wall is almost vertical and drops down steeply to more than 200m.

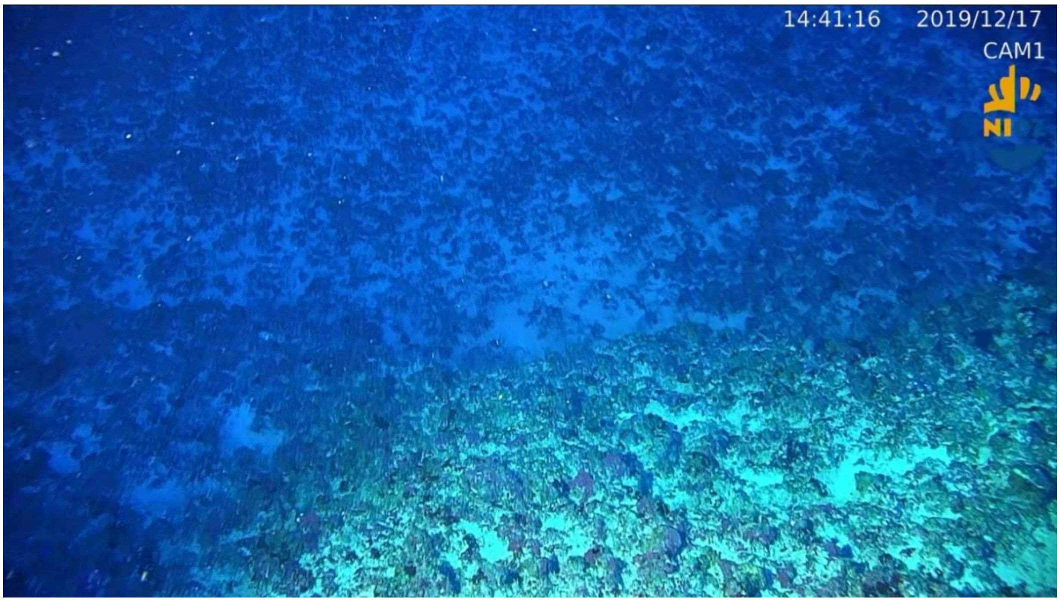
Sinkhole 16. Sinkhole 16 is in between the northern and southern sinkholes. This sinkhole has much coral at the top and appears to have much fish. There are deep carbonate ledges that indicate previous sea levels or periods of strong growth of coralline algae. There are small nodules of coralline algae at around 100m depth.





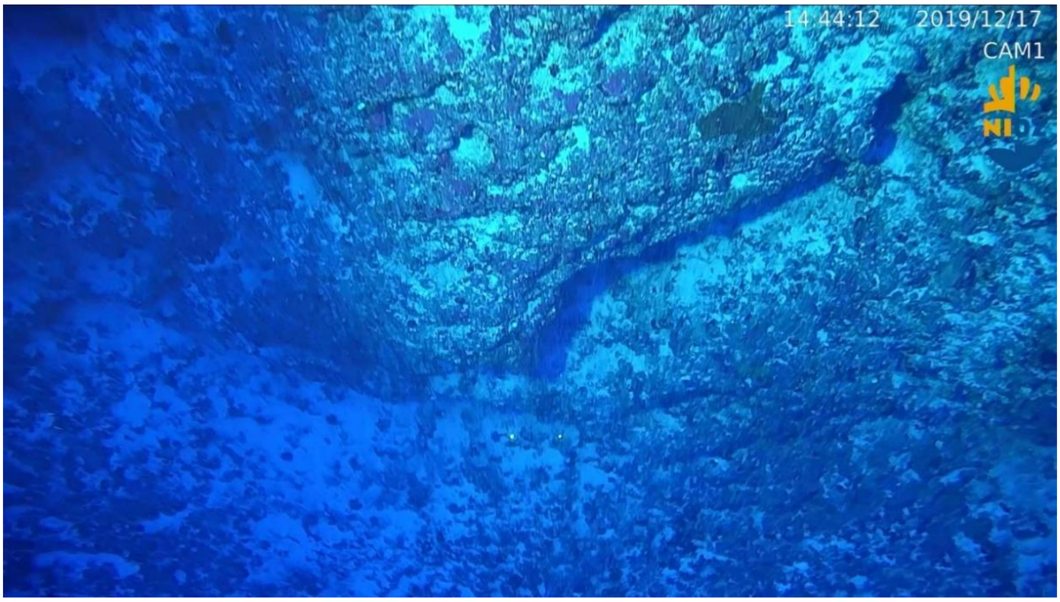
Different coral species on the top of the bank.

The bottom is generally 100% covered by corals, sponges and coralline algae.

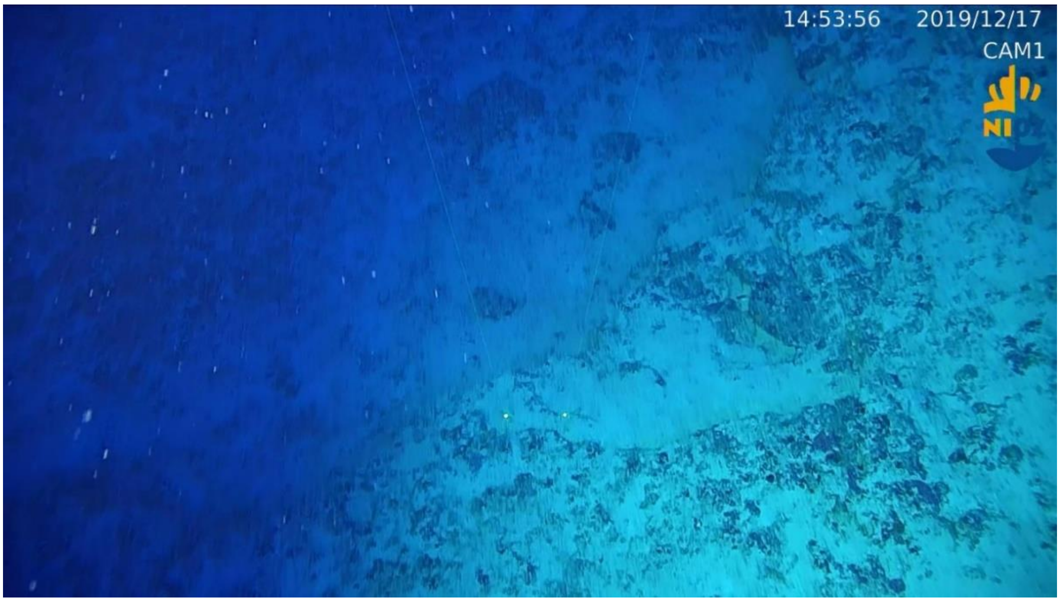


Sometimes coralline algal ledges are very clear in the seescape like here at around 100m depth.

At 120m the coralline algae become smaller and turn into small nodules.



Around the edge ofthe bank steep walls can be encountered.

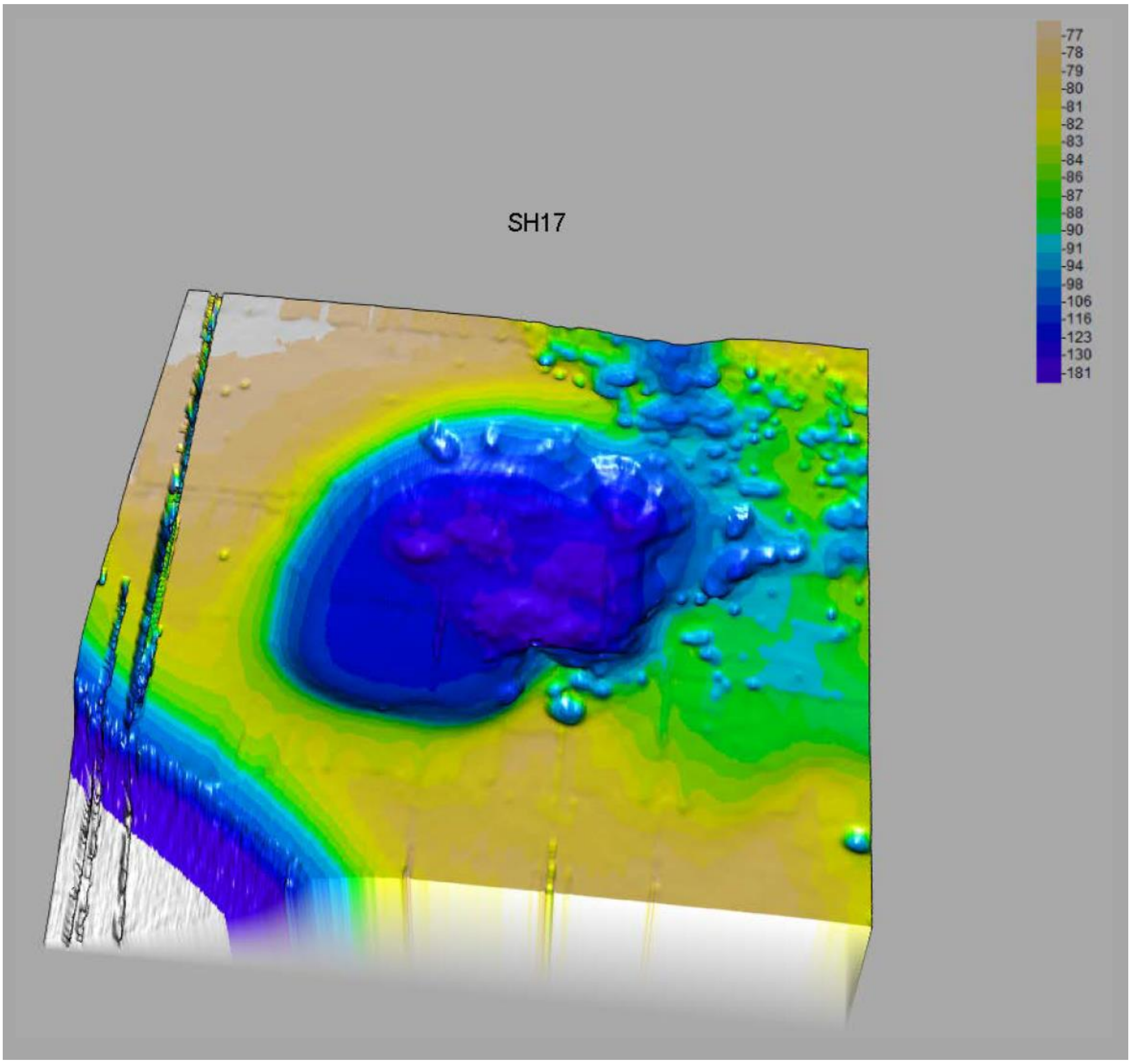


Around 130m depth the scene becomes dominated by sand.

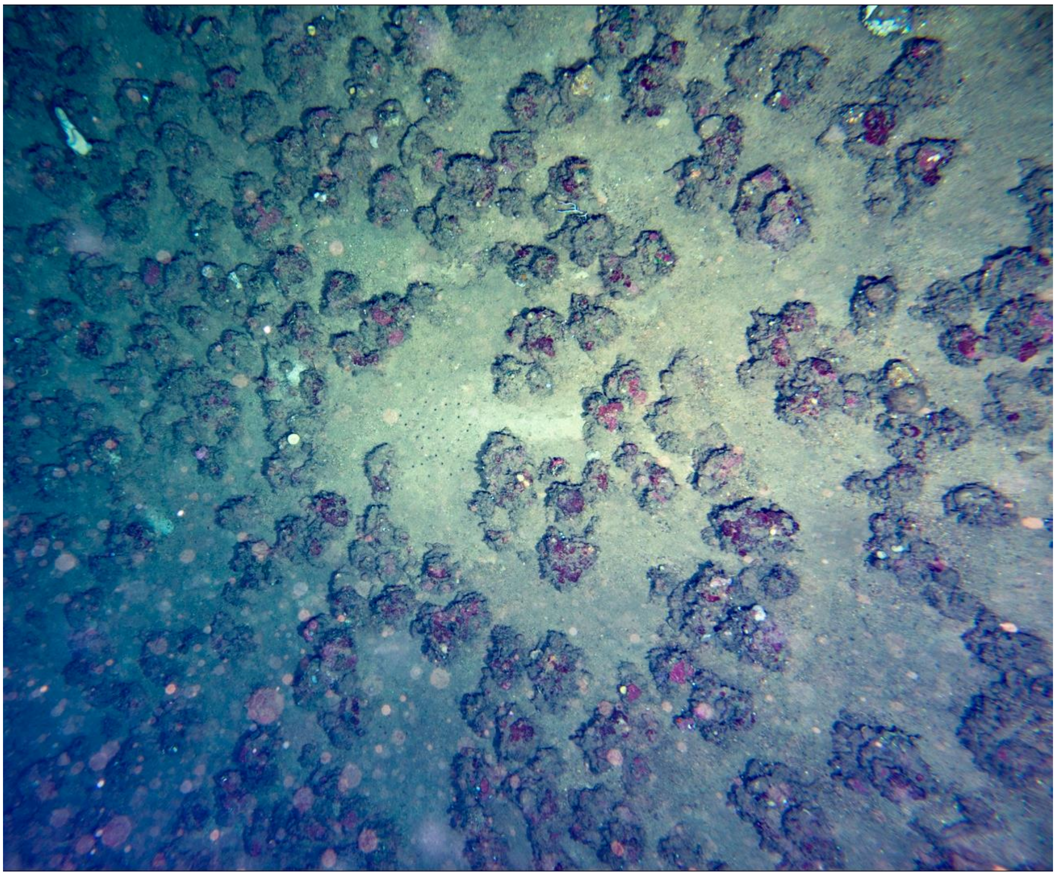
3.1.2. **Southern Sinkholes**

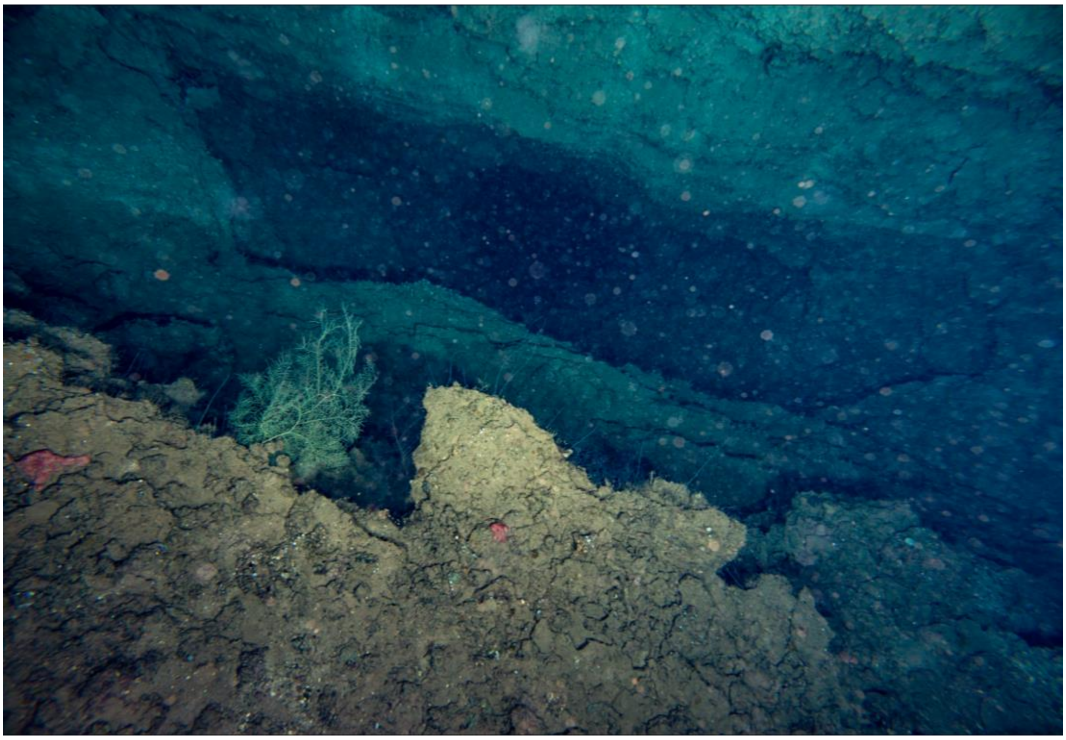
The sinkholes in the south of the Luymes Bank (SH 17 to 21) are all rather shallow and relatively small in size. They start at around 80m at the top of the platform and extend not deeper than 150m. They are close together in an area of approximately 1.3km^2. It is in these sinkholes the most well developed coralline algal pillars were found in distinct patterns. Conditions here appear to favour their growth, more so than in the sinkholes in the northern part. We think that it is mainly the slope, the exposure (calm conditions in sinkholes with respect to water movement) and the depth that determine whether they can be formed. We don't know yet if the main species that form the pillars are the same as the ones on the top of the bank. Within the coralline pillars there are many holes and crevices that provide space for different organisms. As far as we have now seen, the flora and fauna that inhabit these pillars are sponges (mostly crustose), bryozoa, and crustose coralline algae. We also found small cryptic coral colonies not more than 5mm in diameter.

Sinkhole 17. This sinkhole is quite sandy and many coralline pillars appear covered in sediment and in a less favourable condition. In the wall there are caves visible (see pictures below).

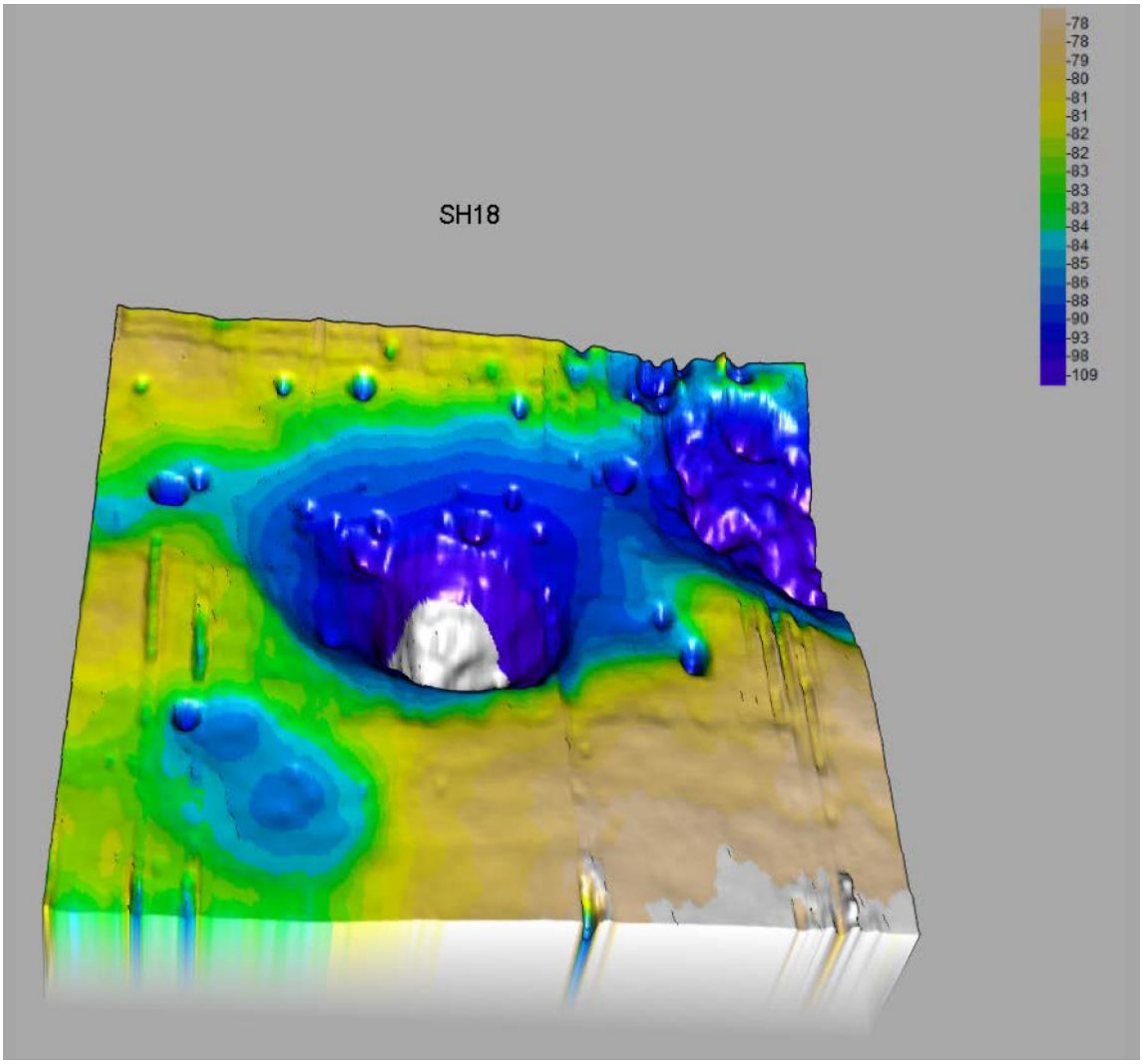


Sinkhole 17 has a number of irregularities in its walls and on the bottom surface possibly indicating the collapse of small areas of the carbonate surface.

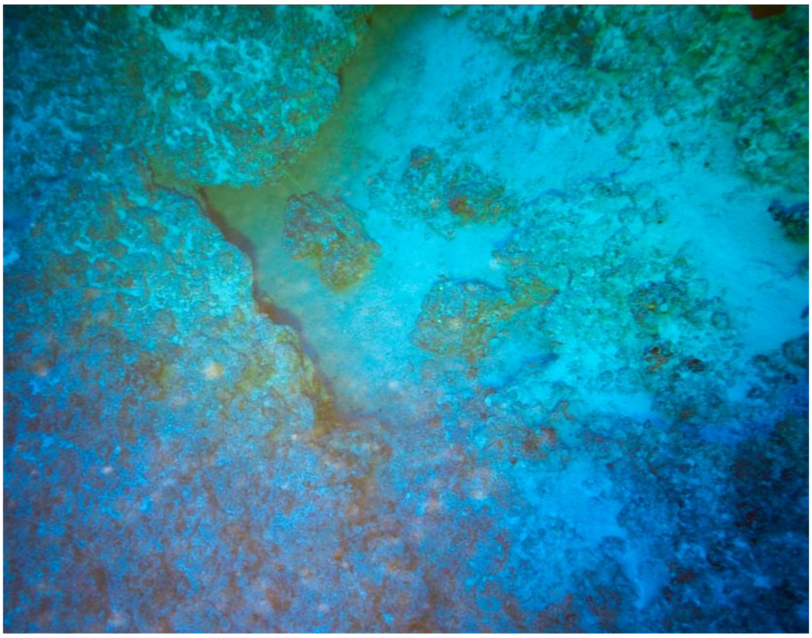

Sediment covered pillars in sinkhole 17.


Cave like openings and ledges are abundant in sinkhole 17.

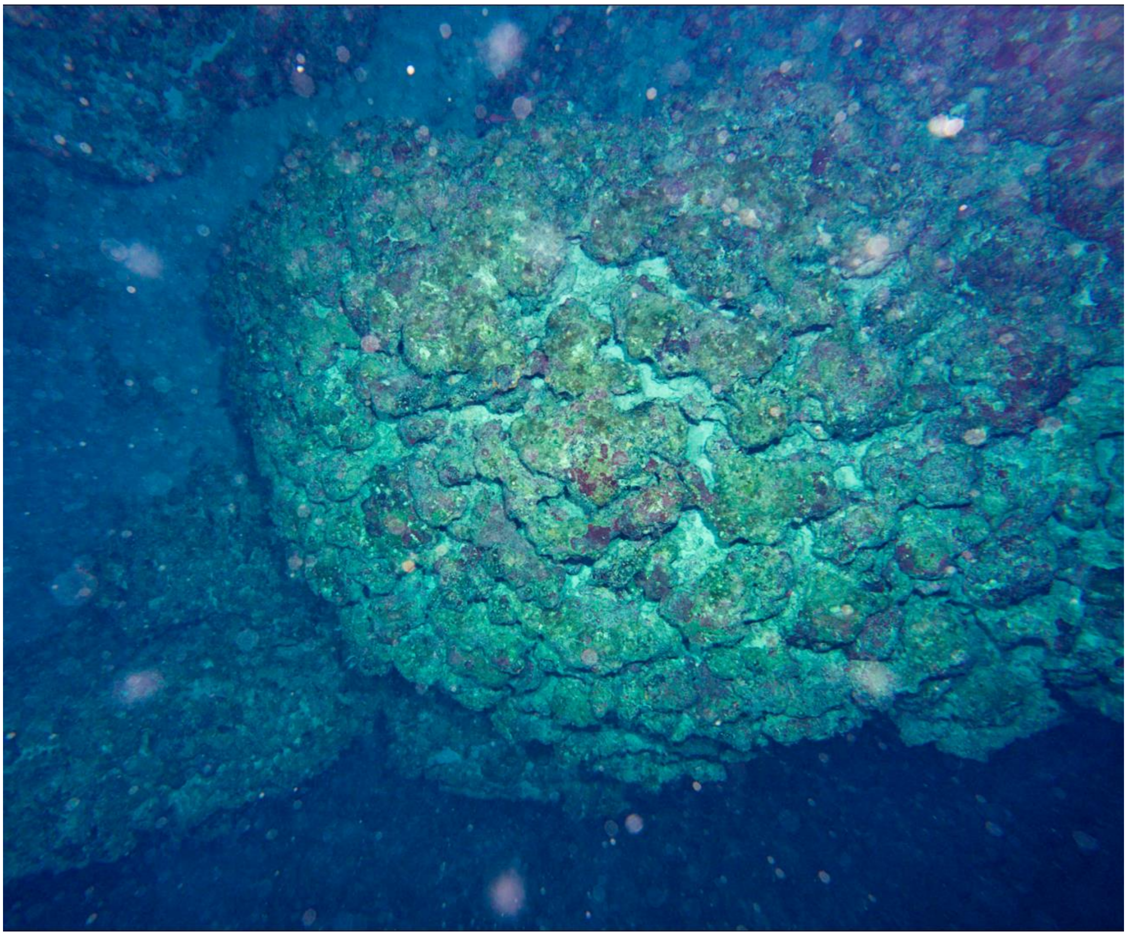
Sinkhole 18. This sinkhole is connected with sinkhole 19 in the ENE. A striking feature at these southern sinkholes are the many small pockmarks around the sinkholes. In this sinkhole calcium carbonate pillars were found comparable to the ones found in sinkhole 20.

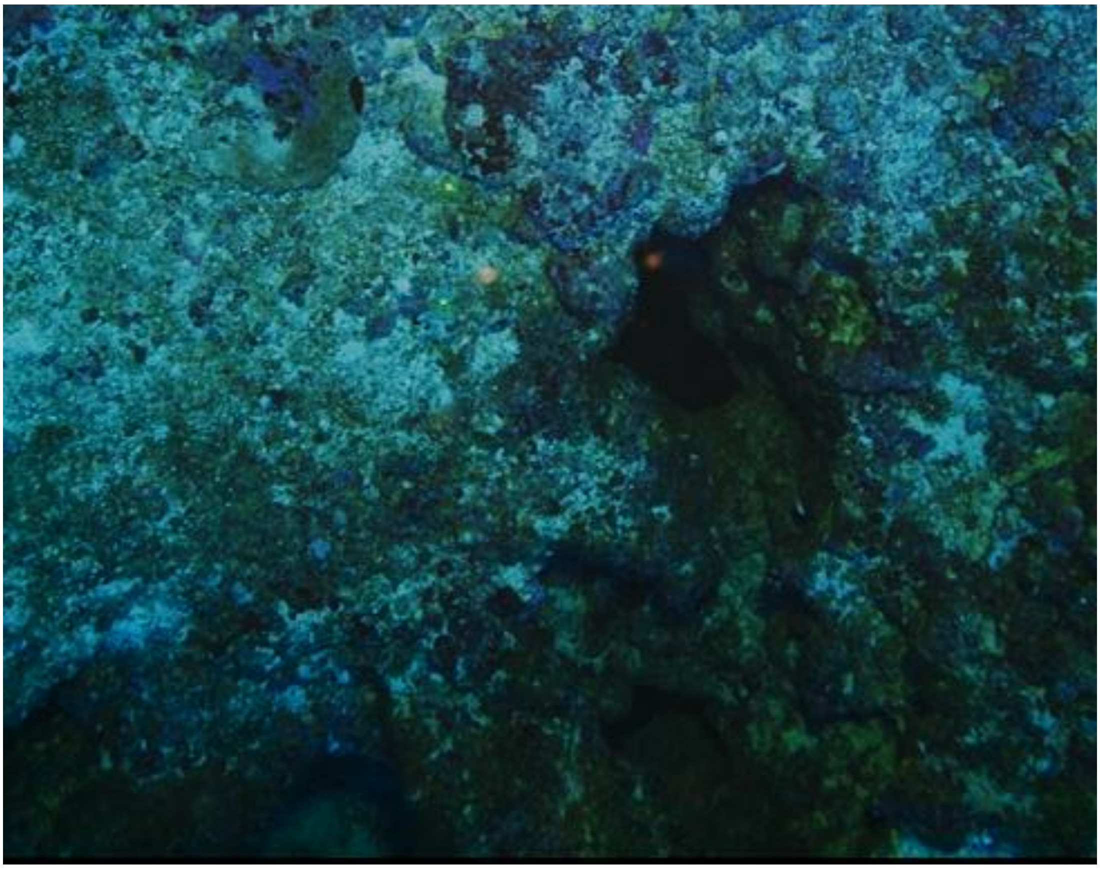


Sinkhole 18 has many small holes in its wall and in the surface of the bank surrounding this sinkhole.

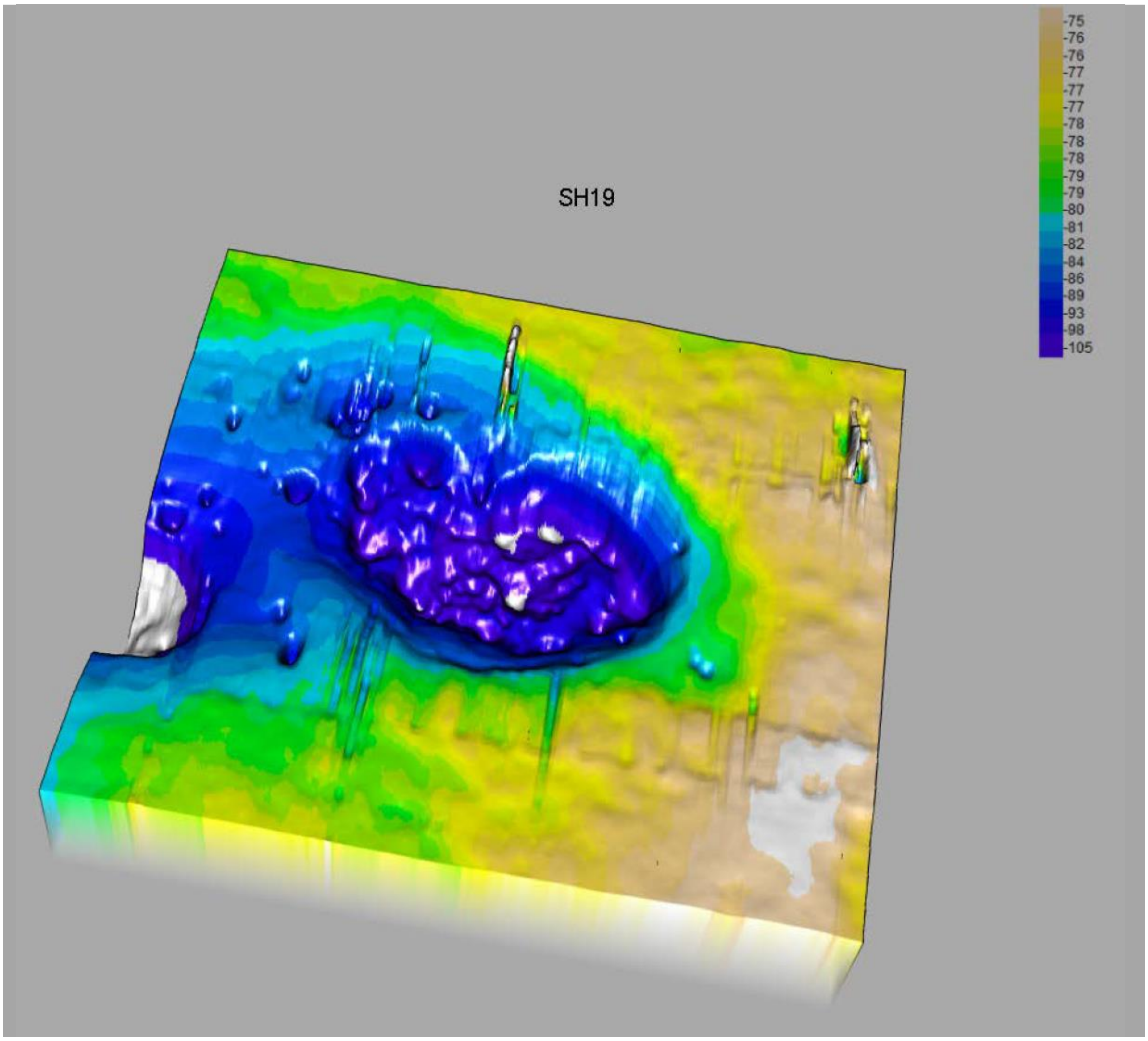


Ledges of fused coralline algae are abundant.


Massive rocks form overhangs and appear to consist of fused coralline algae.


In some parts of the sinkhole deep holes or caves are present.

Sinkhole 19. This sinkhole was surveyed on 9 December. It had a sandy bottom with CCA debris. The pockmarked bottom was striking.



Sinkhole 19 lies next to number 18 and is very similar but less deep.

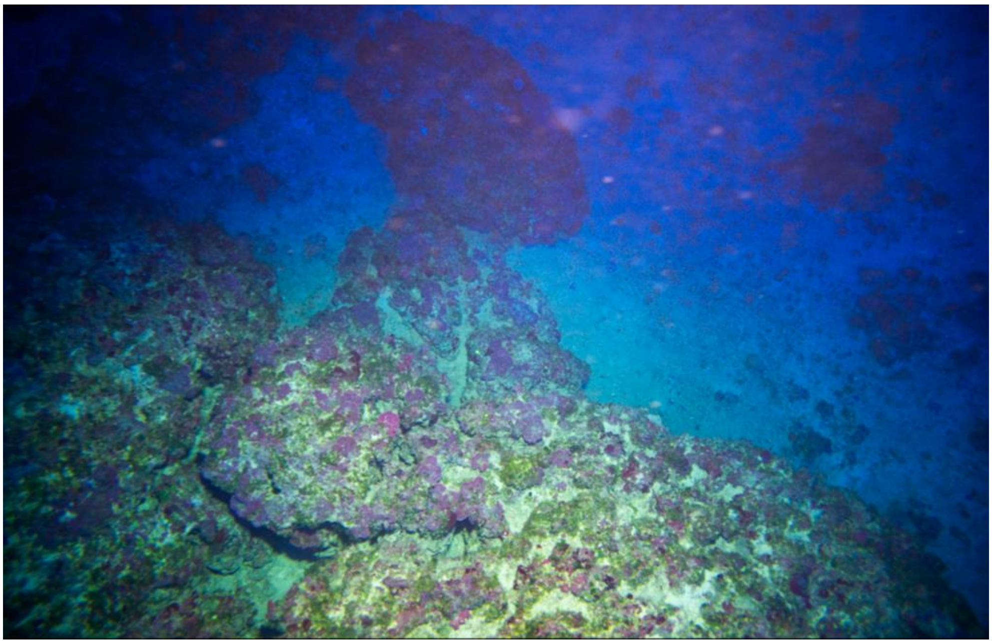
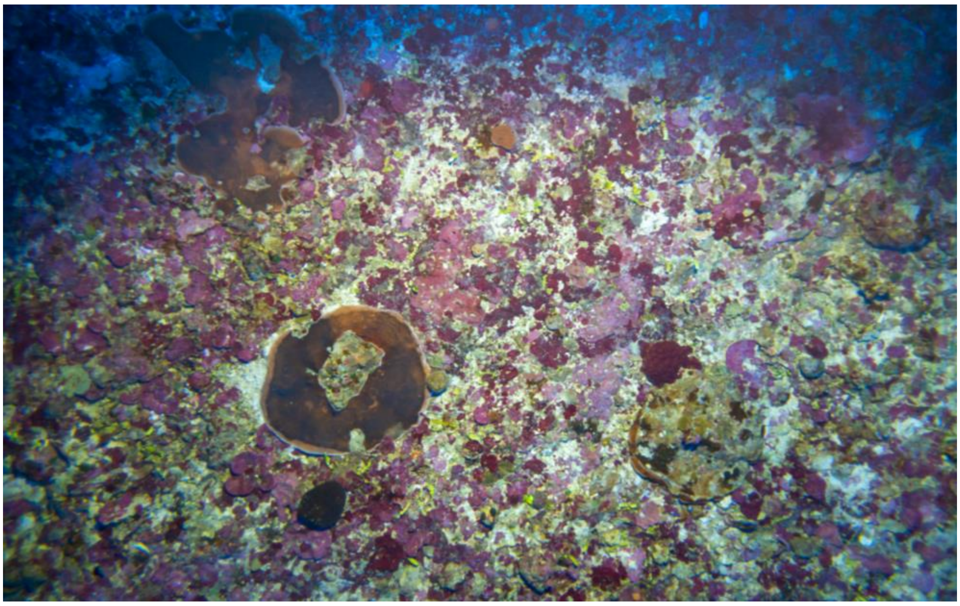
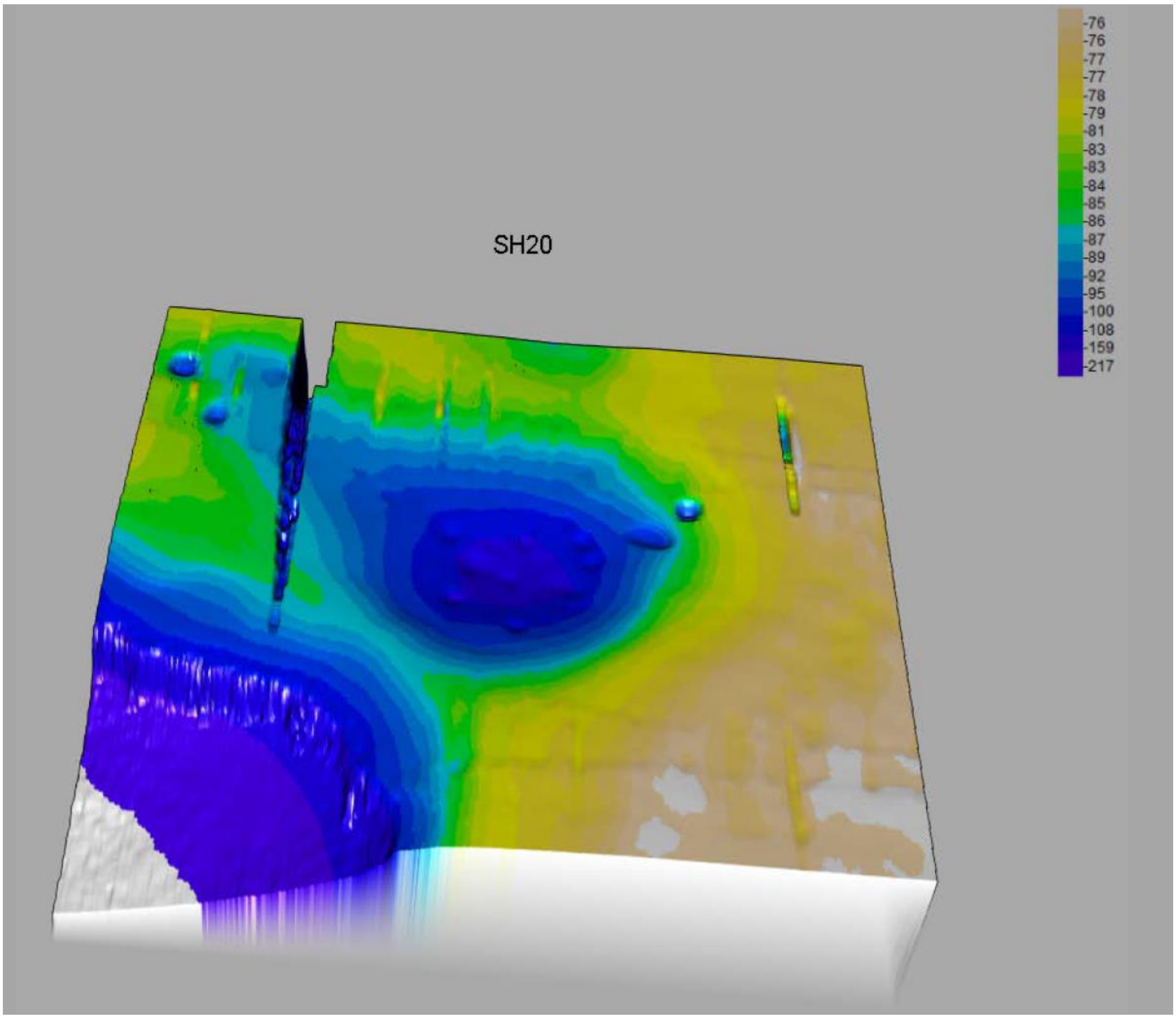


Photo from inside sinkhole 19. Coralline algae are fused into bigger rocks.



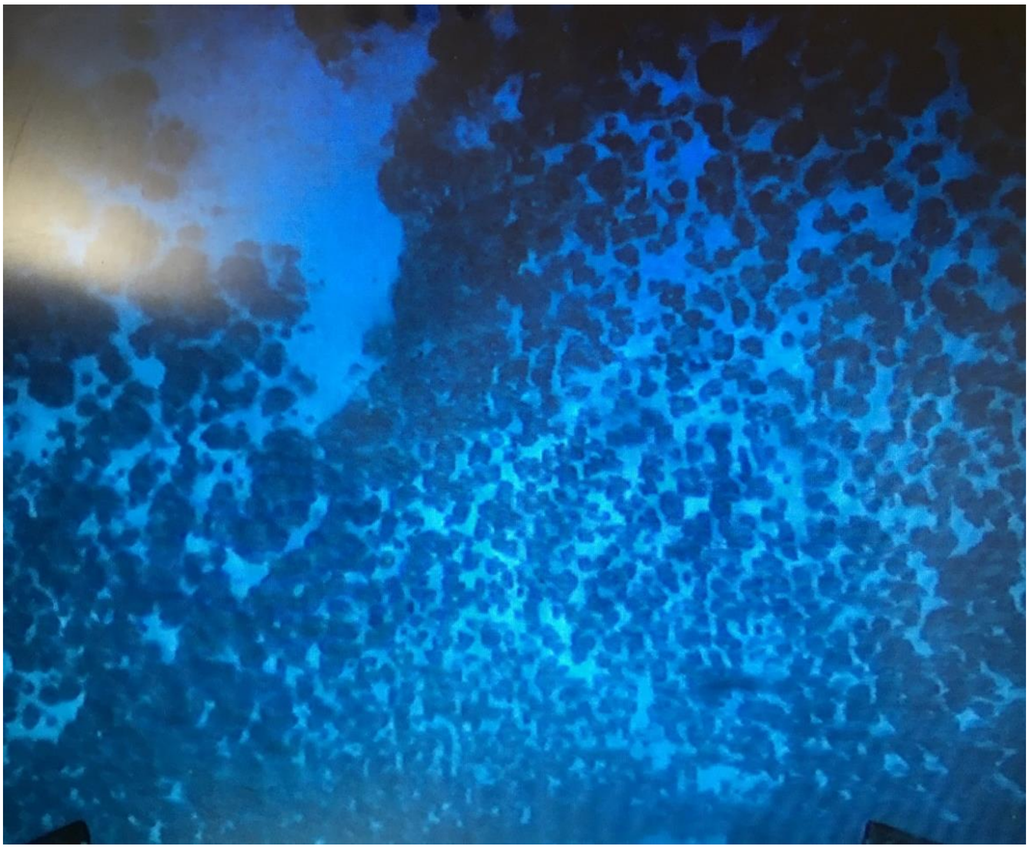
The top of the sinkhole, at the surface of the Luymes Bank, the bottom is densely covered by encrusting coralline algae and encrusting corals.

Sinkhole 20

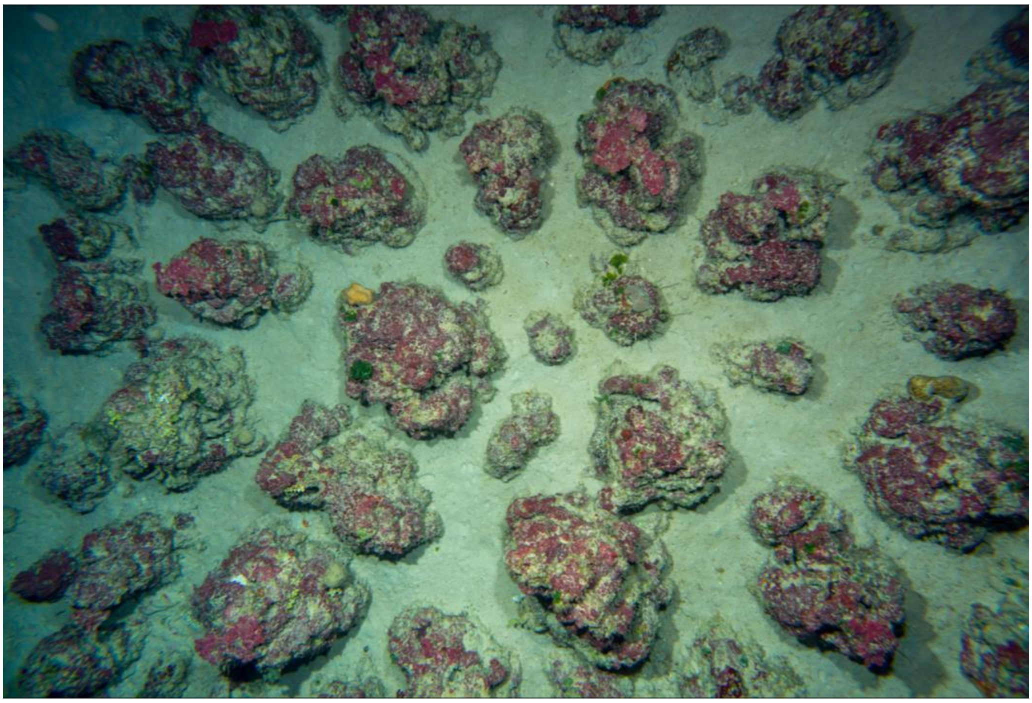


Sinkhole 20 lies close to the edge of the bank. Possibly it is connected to the outside of the bank by tunnels. We observed caves in the wall of the sinkhole.

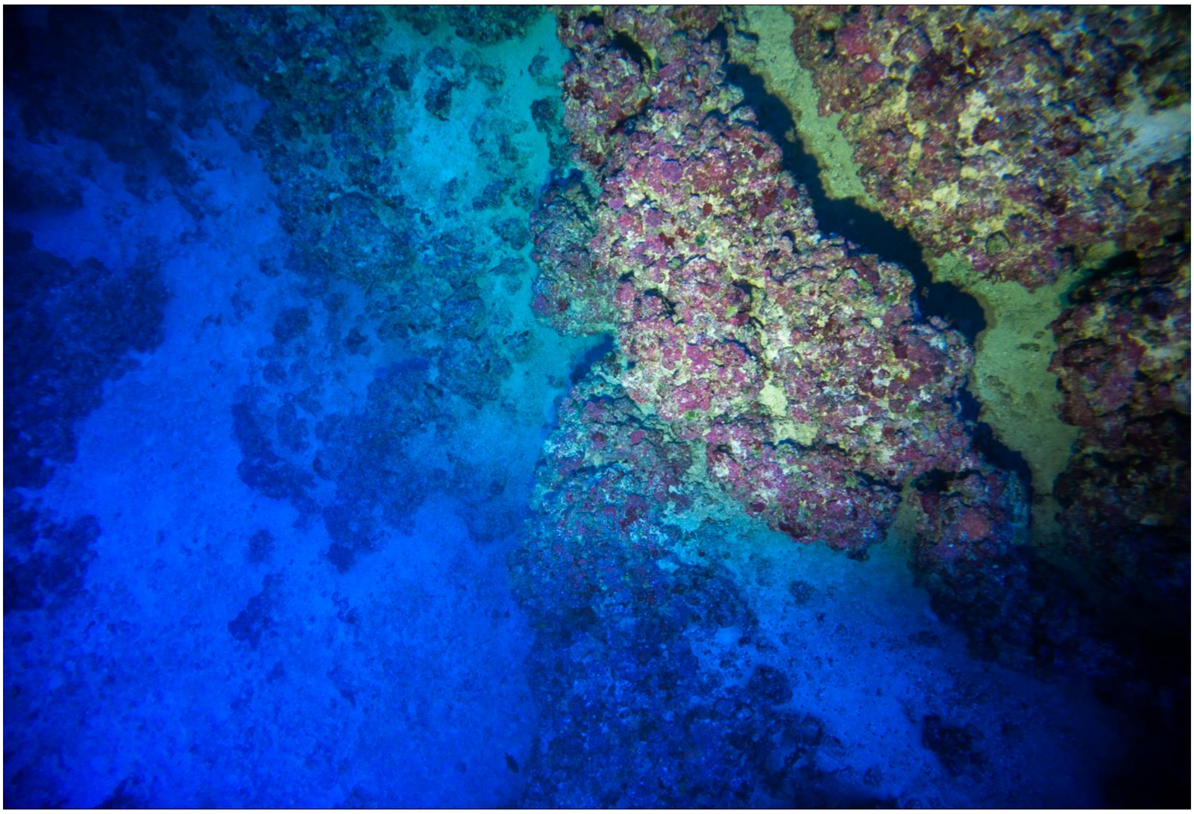
This sinkhole is the one that was discovered in 2018 to contain the coralline pillars and also on this expedition the pillars appear to be in a healthy condition. In many areas of the sinkhole the coralline algae appear to be organized in ordered patterns.



Coralline pillars in a regular pattern in sinkhole 20 from ca 15 meters above the bottom.

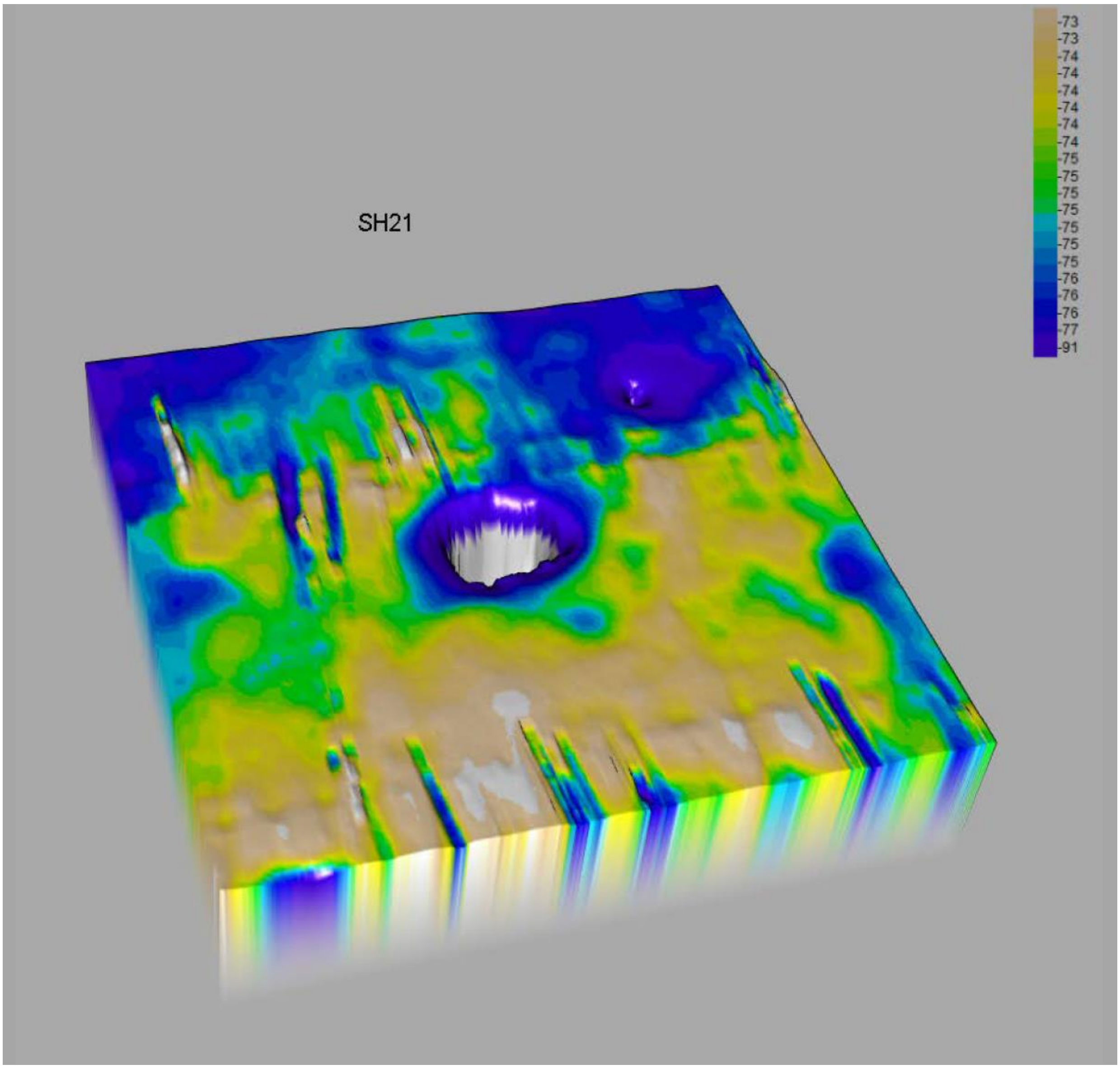


Coralline algal pillars organized in an ordered looking pattern in sinkhole 20 at 110m depth (size of individual pillars, 15-40cm diameter).


Coralline algae have formed many hard structures, ridges along the walls of sinkhole 20.

Crustose coralline algal accretions can be quite massive forming a landscape of ridges, particularly on the upper slopes of sinkholes. Sometimes they are very dense, but regularly, especially at depths between 95 to 120m, regular patterns in their orientation appear, pillar and nodule like structures, though the nodules remain relatively small. We think that this change in growth forms and pattern is related to protection from current and presence of gentle sandy slopes in sinkhole between 95 and 120m depth.

Sinkhole 21



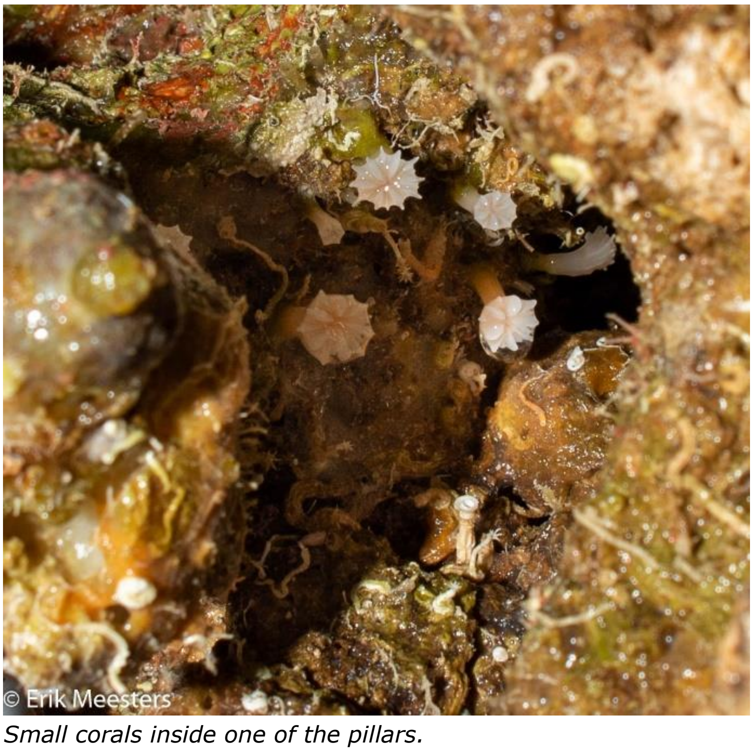
This sinkhole is very small with steep vertical walls. No coralline pillars were observed in it but there are coralline ledges that are very hazardous for the camera frame which became trapped under one of these ledges and suffered heavy damage.

3.1.3. **Grabber samples**.

Bluestream polyp grabber was used to collect the calcifying pillars. The pillars appeared to be solidly cemented to the bottom and were very difficult to get loose. Several trials were needed to collect the top part of a pillar from sinkholes. It was not possible to draw complete pillars from the sediment. The pillars were apparently cemented to a hard bottom below the sand layer or solidly anchored in the sand. With the grabber we could only break off the top part of smaller pillars with a length of approx. 25cm max. We obtained 3 small pillars in total from sinkhole 20 and sinkhole 18.

Example of crustose coralline pillar. This relatively small upper part of a pillar is approximately 25 cm high and 15 cm wide.

In the many holes within the pillars many different organisms were observed, mainly sponges, but also tube worms and some very small coral polyps.



Small corals inside one of the pillars.

3.1.4. **Platform community descriptions.**

The top of the bank (platform) consists of a benthic community dominated by crustose coralline algae and plate-like corals probably *Agaricia lamarcki* or a similar species. Cover of the bottom by these species is most of the time very high (80-100%). All species here are generally very flat and don't protrude much from the bottom. The species that have a more 3-dimensional structure are mainly sponges and sometimes soft corals although the latter tend to occur more in deeper water. Other coral species that have been observed were *Montastrea cavernosa* and *Madracis* species. Another conspicuous calcareous green alga that occurs on the Luymes Bank is *Halimeda*, the exact species is still to be determined. Whether the crustose coralline algae which cover most of the platform belong to the same species complex as the coralline algae found on ridges and pillars, nodules in sinkholes remains to be investigated.

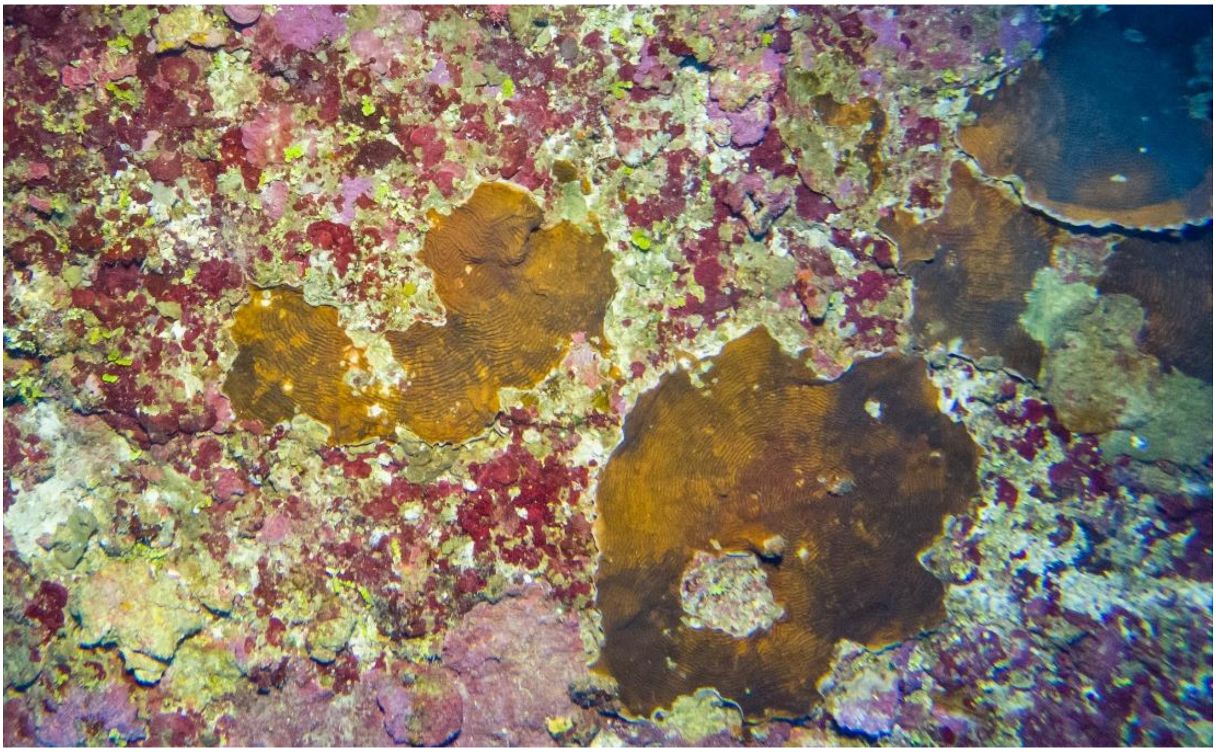
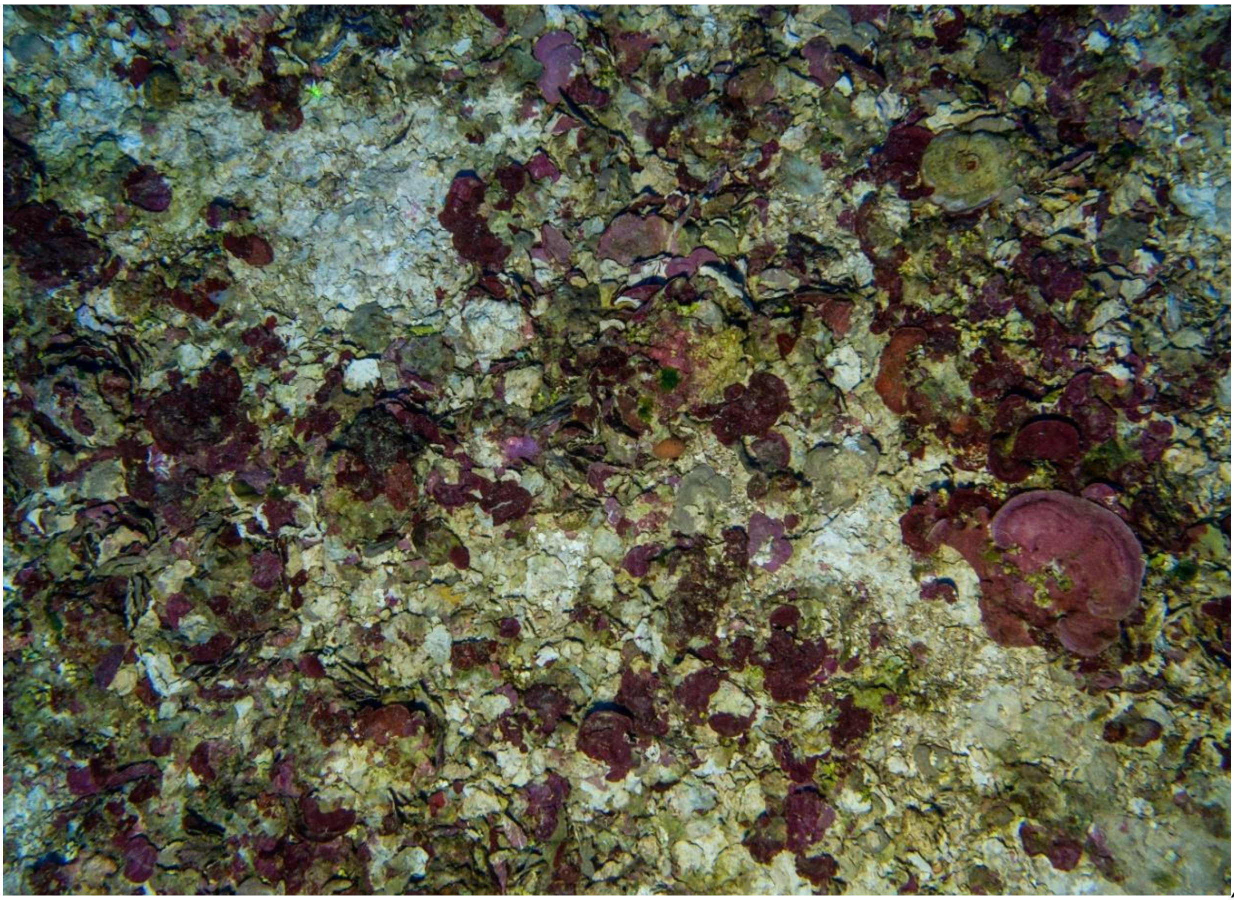


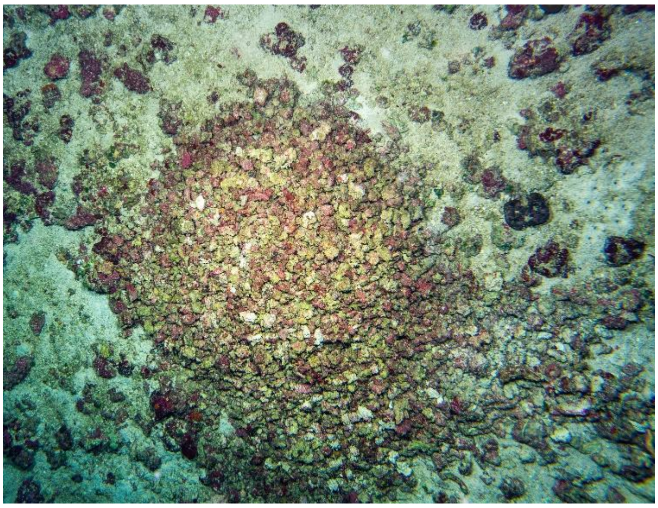
Image of the top of the Luymes bank. Cover by crustose coralline algae (shades of pink, purple) is generally very high with often also high cover of Agaricia corals (brown plates) with in between many small sponges.



A close-up of the top (platform) of the Luymes Bank.

In the bottom are many small crevices that are probably home to a large number of species such as fish and crabs. A fish species that was often seen within this habitat is the Sargassum triggerfish (*Xanthichthys ringens*), but other fishes such as butterfly fishes, squirrel fish and other reef dwelling fish were also seen. On many video transects we observed large burrows of sand tilefish (*Malacanthus plumieri*). This species seems to be quite common at the top of the Luymes Bank and also on the upper slopes of many sinkholes.

Sargassum trigger within the crustose coralline habitat.



Sand tilefish burrow

The platform between sinkholes with an average depth of 80m is a very different environment compared to the sinkholes which likely influences the growth forms and morphology of crustose coralline algae. On the platform coralline algae spread out forming blades covering the bottom. On the sandy slopes in sinkholes, where pillars are found, coralline algae start to form nodules, comparable to rhodoliths, with the exception that these pillars appear to be strongly attached to the bottom

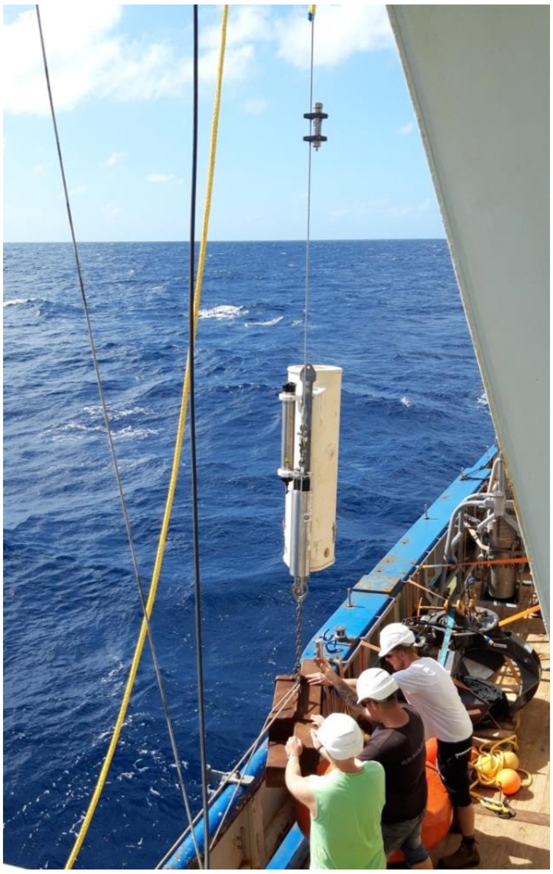
3.1.5. **Dredge samples**

Two dredge samples were taken on the top of the bank (platform). Pictures and samples for morphological and DNA analyses were taken to further analyse in the Netherlands.

A sponge firmly attached to crustose coralline algae on the platform.

3.2. Moorings in southern sinkholes (Siham de Goeyse, Szabina Karancz)

Two identical moorings from NIOZ were deployed in sinkholes 17 and 20 for 5 days. They are composed of a sediment trap, an aquadrop (current sensor), an oxygen optode and a light sensor. Prior to the deployment, the video record suggested that the two sinkholes have different environments. The aim of the deployment was to compare the parameters of the two sinkholes, including sedimentation, temperature, current speed and direction, oxygen concentration and light intensity.



Deployment of the moorings: sediment trap and current sensor on the bottom, oxygen sensor 1.5 m above the current sensor and light sensor on the top.

Sinkhole name	*Latitude*	*Longitude*	*Depth*	*Deployment time (UTC)*	*Recovery time (UTC)*
SH17	*17° 41.571'*	*63° 29.114'*	*ca 120 m*	*11.12.19 13:24*	*16.12.19 12:05*
SH20	*17° 41.189'*	*63°28.701*	*ca 110 m*	*11.12.19 15:11*	*16.12.19 13:00*

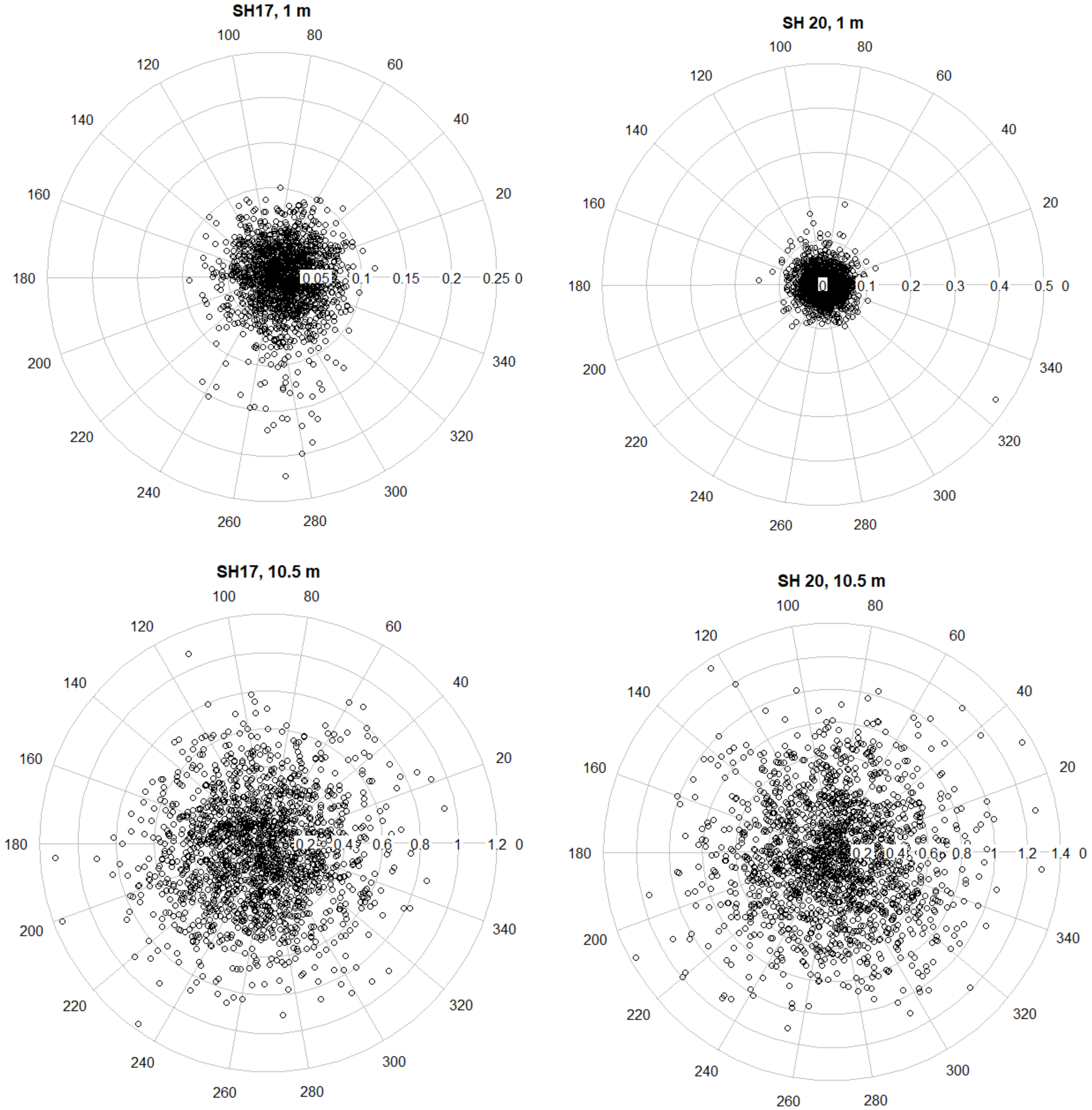
Light sensor. Light sensors (Odyssey) were placed in the sinkholes to determine the light intensity received there. Logger recorded the light intensity every minute during the whole duration of mooring deployment.

The light logger placed in sinkhole 17 was flooded on recovery. The light logger placed in sinkhole 20 was not sensitive enough for the amount of light reaching the depth at which the moorings were located (ca. 110m). The light intensity measured is below the detection limit for the whole time that the sensor was at 110 m (but there was a light signal measured during the descent through the water column).

Current sensor. The Nortek Aquadropp Profiler (Nortek) measures the local pressure and temperature as well as current speed and direction every 0.5 m in the water column between 1 m and 10.5 m above the sensor. The instrument was programmed in AquaPro software and it measured the above-mentioned parameters every 5 minutes.

The sensor detected very low speed (< 1.2 cm/s) at both sites with a slightly stronger current speed at the shallower sinkhole 20. At the bottom of the sinkhole (1 m above current sensor) the speed did not exceed 0.469 cm/s and was on average 0.04297 cm/s. The average speed stays relatively stable in the first 5 meters above the sensor and then increases towards the top of the sinkhole. It reaches 0.3543 cm/s 10.5 m above the sensor.

Sinkhole 20 had a similar behavior (0.03926 cm/s 1 m above the sensor, 0.4419 cm/s 10.5 m above the sensor).



Polar plots of speed against current direction in sinkholes 17 and 20.

Oxygen sensor. The oxygen optode ARO-USB JFE (Advantech Co.) measured the local oxygen level every 5 minutes taking 10 sequential measures spaced by 3 seconds for every measurement time. The data has been retrieved from the instrument and will be processed after the cruise.

Sediment trap. Two acid cleaned (non-poisoned) bottles were placed on each sediment trap. The motor for both sediment traps was set to start at 16:00 on the 11th of December and turn to the second bottle 5 days later, approximately 18h before mooring recovery. Upon recovery, the funnel from the second sediment trap broke (plastic has been damaged on the side).

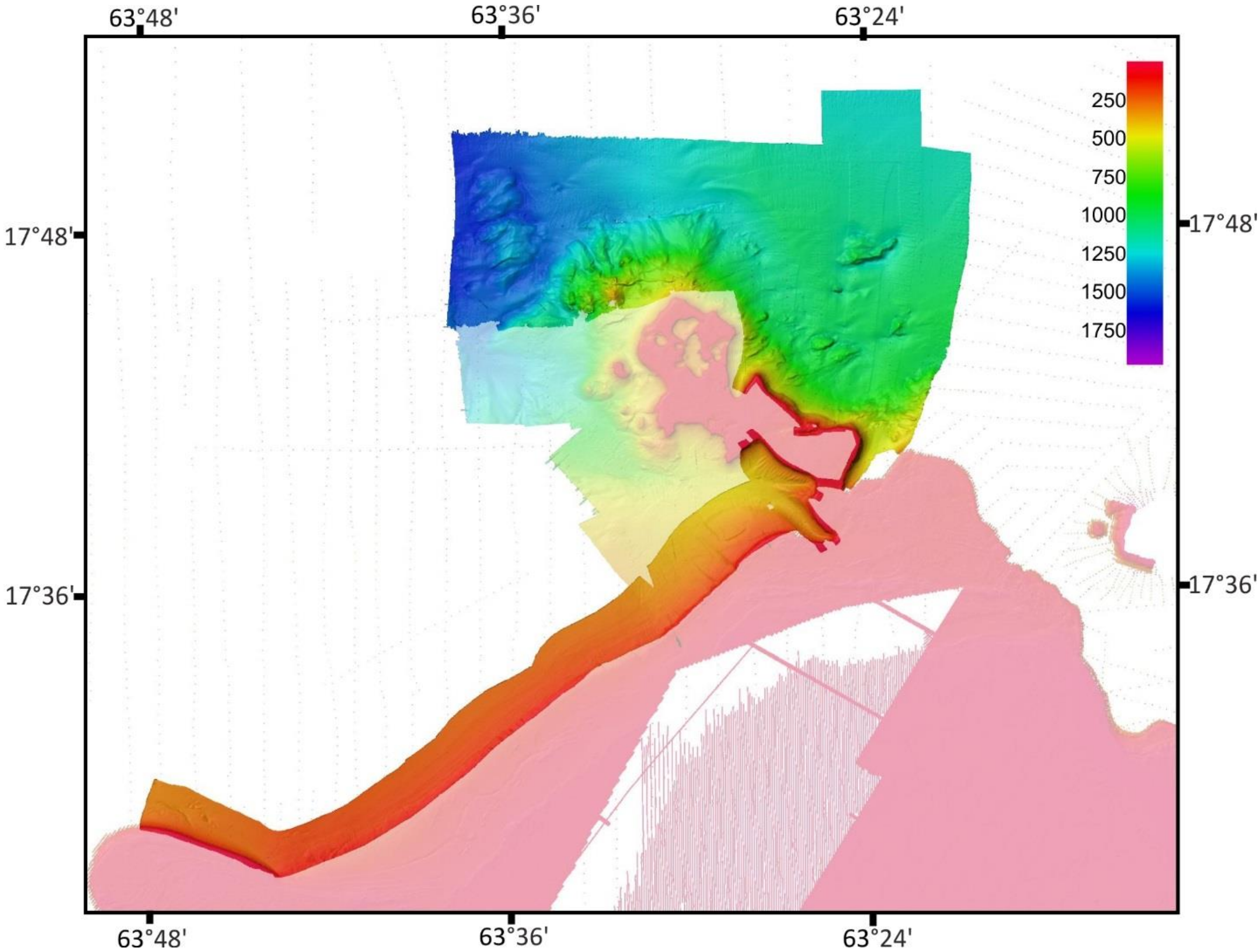
Both bottles successfully collected sediment. The mud from sinkhole 17 had a dark color. From sinkhole 20, less sediment has been caught which had a lighter yellowish color and was characterized by sulfuric smell. The collected sediment and water have not been poisoned and are stored in a 4 °C fridge till the return of RV Pelagia to Texel.

3.3. Multibeam (Henk de Haas)

Methods. The Kongsberg EM 302 multibeam echosounder as installed on board the Pelagia is a 30 kHz echo sounder with a one degree opening angle for the transmitter and a twodegree angle for the receiver. It uses 288 beams with 2-3 depth measurements per beam. The system is equipped with a dual swath, resulting in a maximum number of depth measurements of 864 per ping. The maximum swath opening angle is 150°. Under favourable conditions this can result in a swath width in the order of 5 times the water depth. Under favourable conditions a reasonable swath width can be reached at depths of over 8 km. The transmit fan is split into at maximum 9 individual sectors that can be steered independently to compensate for ships roll, pitch and yaw to get a best fit of the ensonified line perpendicular to the ships track and thus a uniform coverage of the sea bed. The transducers are mounted in a gondola which is placed at the port site of the vessel at about one quarter to one third of the ship’s length from the bow. The motion of the vessel is registered by a Kongsberg MRU-5 motion reference unit. Ships position and heading is determined with two GPS antennas. The motion and position information is combined in a Seapath 380 ships attitude processing unit and send to the Transmit and Receiver Unit (TRU). The system is synchronized by means of a 1 pulse per second (1PPS) signal produced by the Seapath 380 which is send to the TRU. The data from the receiver transducer and the ships attitude are sent through an ethernet connection to the acquisition computer. Data acquisition is done using the Kongsberg SIS (Seafloor Information System) software. The sound velocity profile is calculated from salinity, pressure and temperature data recorded by a Seabird CTD system. The near-transducer sound velocity was taken from the calculated velocity profile. The processing PC is connected to a display on the bridge of the Pelagia through a KVM switch and an ethernet connection allowing operation of the system from the bridge if desired. Data was processed and imaged on board using D-Magic/Fledermaus (bathymetry), Fledermaus Geocoder (backscatter) and Fledermaus Midwater (water column data).

Results Bathymetry. Bathymetric data acquired during the cruise is shown in Fig. 3.3.1. These data were acquired with the idea to extend the multibeam data that was already present from the Saba Bank and Luymes Bank and was acquired by NIOZ colleagues in 2018 and the Hydrographic Service of the Royal Dutch Navy, focussing on the Luymes Bank and surrounding seabed.

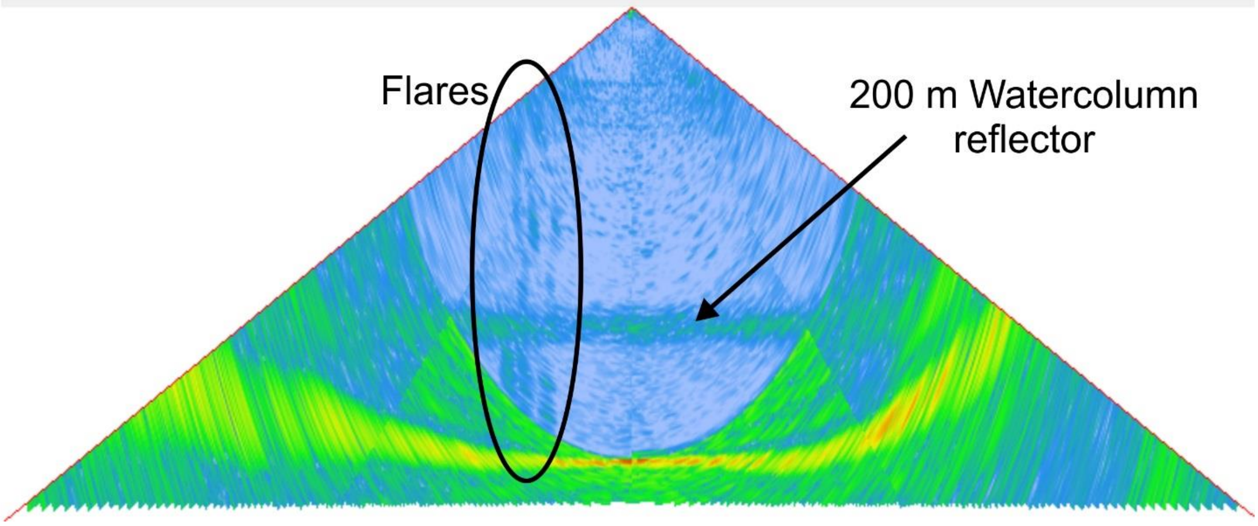
The newly acquired bathymetric data covers mostly the immediate deeper surroundings immediately to the north and east of Luymes Bank, some data gaps in the southern half of Luymes Bank and some parts of the northern slope and adjacent basin of Saba Bank.



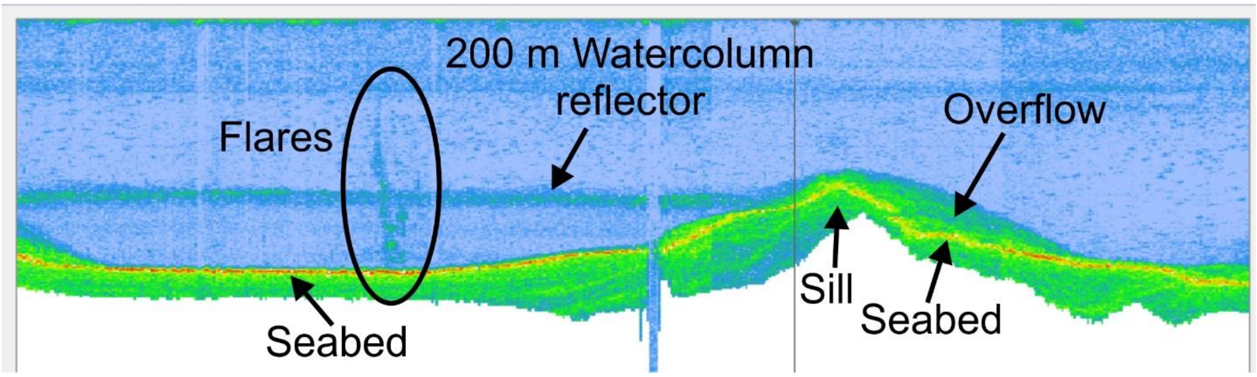
Map showing new multibeam bathymetric data acquired during this cruise on top of already existing multibeam data (as a transparent layer) from an earlier (2018) NIOZ cruise and the RDN Hydrographic Service.

Water column backscatter. The chief scientist was informed that local fisherman suspected the presence of a hot spring in one of the sinkholes we were about to explore. A short multibeam seabed and water column backscatter survey was carried out in the indicated area in order to investigate this further. The seabed data did not give any clues into the presence of a site where hot water would escape from the seabed (changes in reflectivity as a result of a difference in the composition of the seabed sediments due to chemical processes). However, about one hundred meters north of the location given by the fisherman the water column backscatter data clearly showed a small number of flame-like structures originating at the seabed at a water depth of about 280 meters reaching up to maximum about 60 metres below the water surface, indicative of gas escaping from the seabed. An example of the gas flares is shown in Fig 3.3.2. The composition of the gas is not known yet. CTD bottom water has been sampled and stored in glass bottles in order to analyse the type of gas escaping at this location. In addition to this, a strong horizontal reflector was observed in the water column at about 200 m water depth, indicating a clear difference in density between two water masses in the sink hole.

The 200 m water column reflector is isolated from an adjacent sinkhole by means of a sill forming the border between these sinkholes. Water column reflections suggest that the lower water mass partly spills over the sill into the adjacent sinkhole (Fig. 3.3.3).



Multibeam water column image of some of the gas flares. Also the strong water column reflector at 200 m water depth is clearly recognisable.



Multibeam water column profile (centre beams) showing the gas flares and the overflow of the lower water mass from one sinkhole into another.

3.4. Metabolomics, metagenomics (Andi Haas)

Sampling scheme: We took all together 86 samples for microbial and viral cell counts, and 72 for dissolved organic carbon concentrations, metabolomic characterization of dissolved organic matter (DOM) and metagenomic analysis of the microbial communities. The samples were collected at different water depths across 10 of the sinkholes, at 3 locations on the bank between the sinkholes, and at 2 deep off bank sites. Further we took samples from sinkhole 20 and 17 and on the bank next to these sinkholes on three days in a diurnal resolution (4:30am and 4:30pm) (Detailed sampling locations and depths in table below). This sampling scheme was designed to specifically target the biogeochemistry of the sinkhole ecosystems.

Sample processing: For the sample preparation we collected 2 L seawater from each respective Niskin bottle. 1ml of each bottle was fixed with 20uL of Glutataldehyde and flash frozen in liquid nitrogen. The remaining water was filtered through a 0.22 Sterivex filter which will be used to extract the microbial DNA for metagenomic analysis. The Sterivex filters were frozen at -80° Celsius. 40 ml of the filtrate was collected in precombusted glass vials and acidified with hydrochloric acid (38% p.a., LCMS trace metal grade) to a pH of 1.5 for DOC analysis.1L of the filtrate was adjusted to pH 2 with hydrochloric acid (38% p.a., LCMS trace metal grade) and slowly extracted through 1 g bed mass PPL cartridges. Before use, the cartridges were rinsed and activated with one cartridge volume of methanol (LC-MS grade, Fisher Chemical, Belgium) and refilled with methanol for conditioning overnight. Afterwards, the cartridges were rinsed with two cartridge volumes of water (LCMS grade), two cartridge volumes of methanol and two cartridge volumes of water at pH2 (acidified with hydrochloric acid). For extraction, the filtered and acidified seawater was passed through each PPL cartridge with a flow rate below 5ml min^{-1}. Subsequently, remaining salt was removed with three cartridge volumes of pH2 water. After drying with inert pure nitrogen gas the cartridges were frozen for storage until further processing.

Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter at bottom (m)	NISKIN bottle	Sampling depth (m)
2	PE465_S017C02	10.12.2019	12:15	17	17.692	-63.486	126	-	2	120
2	PE465_S017C02	10.12.2019	12:15	17	17.692	-63.486	126	-	4	91
2	PE465_S017C02	10.12.2019	12:15	17	17.692	-63.486	126	-	6	72
2	PE465_S017C02	10.12.2019	12:15	17	17.692	-63.486	126	-	10	5
1	PE465_S18C01	10.12.2019	13:13	18	17.69	-63.477	125	-	1	105
1	PE465_S018C01	10.12.2019	13:13	18	17.69	-63.477	125	-	4	80
1	PE465_S018C01	10.12.2019	13:13	18	17.69	-63.477	125	-	6	68
1	PE465_S018C01	10.12.2019	13:13	18	17.69	-63.477	125	-	14	5
1	PE465_S023C01	11.12.2019	11:55	deep	17.674	-63.503	493	7	2	484
1	PE465_S023C01	11.12.2019	11:55	deep	17.674	-63.503	493	7	10	74
1	PE465_S023C01	11.12.2019	11:55	deep	17.674	-63.503	493	7	16	5
1	PE465_S024C01	11.12.2019	17:40	17-20	17.689	-63.483	81	3	2	78
1	PE465_S024C01	11.12.2019	17:40	17-20	17.689	-63.483	81	3	8	5
1	PE465_S026C01	11.12.2019	20:00	17	17.691	-63.487	120	2	2	117
1	PE465_S026C01	11.12.2019	20:00	17	17.691	-63.487	120	2	4	80
1	PE465_S026C01	11.12.2019	20:00	17	17.691	-63.487	120	2	8	5
1	PE465_S027C01	11.12.2019	20:55	20	17.685	-63.478	110	7	2	102
1	PE465_S027C01	11.12.2019	20:55	20	17.685	-63.478	110	7	4	80
1	PE465_S027C01	11.12.2019	20:55	20	17.685	-63.478	110	7	6	5
1	PE465_S029C01	12.12.2019	8:30	17	17.691	-63.487	120	4	2	116
1	PE465_S029C01	12.12.2019	8:30	17	17.691	-63.487	120	4	4	80
1	PE465_S029C01	12.12.2019	8:30	17	17.691	-63.487	120	4	6	5
1	PE465_S030C01	12.12.2019	9:15	20	17.685	-63.478	108	-	2	102
1	PE465_S030C01	12.12.2019	9:15	20	17.685	-63.478	108	-	4	80
1	PE465_S030C01	12.12.2019	9:15	20	17.685	-63.478	108	-	6	5
1	PE465_S031C01	12.12.2019	12:41	3	17.746	-63.498	311	-	2	289
1	PE465_S031C01	12.12.2019	12:41	3	17.746	-63.498	311	-	8	175
1	PE465_S031C01	12.12.2019	12:41	3	17.746	-63.498	311	-	16	5
1	PE465_S032C01	12.12.2019	14:20	8	17 44. 802	63 29. 932	272	-	2	261
1	PE465_S032C01	12.12.2019	14:20	8	17 44. 802	63 29. 932	272	-	4	150
1	PE465_S032C01	12.12.2019	14:20	8	17 44. 802	63 29. 932	272	-	8	70
1	PE465_S026C01	12.12.2019	15:30	2	17 44. 461	63 30.846	225	-	2	180
1	PE465_S026C01	12.12.2019	15:30	2	17 44. 461	63 30.846	225	-	6	67.9
1	PE465_S026C01	12.12.2019	15:30	2	17 44. 461	63 30.846	225	-	10	4.5
1	PE465_S34C01	12.12.2019	17:05	3	17.74427	-63.502	280	-	2	269.3
1	PE465_S34C01	12.12.2019	17:05	3	17.74427	-63.502	280	-	16	180
1	PE465_S34C01	12.12.2019	17:05	3	17.74427	-63.502	280	-	24	5
1	PE465_S38C01	13.12.2019	12:10	deep	17.6999	-63.4339	597	-	2	590
1	PE465_S38C01	13.12.2019	12:10	deep	17.6999	-63.4339	597	-	10	60.2
1	PE465_S38C01	13.12.2019	12:10	deep	17.6999	-63.4339	597	-	14	4.4
1	PE465_S39C01	13.12.2019	13:49	9	17 41.982	63 25.984	242	-	2	230
1	PE465_S39C01	13.12.2019	13:49	9	17 41.982	63 25.984	242	-	8	80
1	PE465_S39C01	13.12.2019	13:49	9	17 41.982	63 25.984	242	-	12	60
1	PE465_S39C01	13.12.2019	13:49	9	17 41.982	63 25.984	242	-	16	5.3
1	PE465_S42C01	14.12.2019	12:17	10	17 43.76	63 29.00	230	-	2	212
1	PE465_S42C01	14.12.2019	12:17	10	17 43.76	63 29.00	230	-	12	70
1	PE465_S42C01	14.12.2019	12:17	10	17 43.76	63 29.00	230	-	16	4.3
1	PE465_S43C01	14.12.2019	13:36	near 14	17.72652	-63.49751	302	-	2	290
1	PE465_S43C01	14.12.2019	13:36	near 14	17.72652	-63.49751	302	-	14	70
1	PE465_S43C01	14.12.2019	13:36	near 14	17.72652	-63.49751	302	-	20	5
1	PE465_S52C01	15.12.2019	20:03	20	17.6862	-63.4811	86	-	2	78
1	PE465_S53C01	15.12.2019	20:32	20	17.686	-63.479	111	-	2	105
1	PE465_S54C01	15.12.2019	-	20	17.686	-63.476	77	-	2	72
1	PE465_S54C01	15.12.2019	-	20	17.686	-63.476	77	-	10	4
1	PE465_S56C01	16.12.2019	8:35	20	17.685	-63.48	87	3	2	85
1	PE465_S57C01	16.12.2019	9:10	20	17.689	-63.478	101	9	2	98
1	PE465_S58C01	16.12.2019	9:40	20	17.686	-63.475	76	-	2	76
1	PE465_S58C01	16.12.2019	9:40	20	17.686	-63.475	76	-	10	5
1	PE465_S59C01	16.12.2019	12:02	3-4	17 44.783	63 29.910	306	-	3	298
1	PE465_S59C01	16.12.2019	12:02	3-4	17 44.783	63 29.910	306	-	6	275
1	PE465_S59C01	16.12.2019	12:02	3-4	17 44.783	63 29.910	306	-	15	221
1	PE465_S59C01	16.12.2019	12:02	3-4	17 44.783	63 29.910	306	-	20	180
1	PE465_S59C01	16.12.2019	12:02	3-4	17 44.783	63 29.910	306	-	24	5
1	PE465_S65C01	16.12.2019	20:06	20-west	17 41.17	63 28.87	85	-	2	80

1	PE465_S66C01	16.12.2019	20:40	20-cente	17 41.17	63 28.87	105	-	2	101
1	PE465_S67C01	16.12.2019	21:10	20-east	17 41.17	63 28.54	76	-	2	72
1	PE465_S67C01	16.12.2019	21:10	20-east	17 41.17	63 28.54	76	-	15	5
1	PE465_S68C01	17.12.2019	8:36	20-west	17.686	-63.481	85	3	2	82
1	PE465_S69C01	17.12.2019	9:05	20-cente	17.685	-63.478	106	-	2	96
1	PE465_S70C01	17.12.2019	9:40	20-east	17.686	-63.475	77	3	2	74
1	PE465_S70C01	17.12.2019	9:40	20-east	17.686	-63.475	77	3	10	5

3.5. Marine carbonate system (Matthew Humphreys, Siham de Goeyse and Szabina Karancz)

Motivation. Measuring components of the marine carbonate system allows us to calculate seawater properties like pH and carbonate mineral saturation state. These variables are important controls on calcium carbonate formation and dissolution, and therefore pertinent to the calcifying organisms that are almost ubiquitous across the Luymes Bank seafloor. Changes in chemical conditions between the platform and within the sinkholes might be expected to have a role in driving changes in the biota between these environments. Combined with other metadata such as nutrients and dissolved oxygen, the carbonate system variables can be used to quantify the biogeochemical processes that influence the waters within the sinkholes.

Sample collection. Samples were collected following an established protocol (Dickson et al., 2007a) as follows. Seawater was collected from the water samplers on the CTD rosette through a silicone tube into 500 ml borosilicate glass bottles (Corning, Germany). Each bottle was thoroughly rinsed with excess sample and allowed to overflow by at least a full bottle volume before withdrawing the tube and closing with a plastic stopper. Care was taken throughout sampling to avoid any bubble formation in both the tube and the bottles. Samples were stored in the dark at 25 °C until analysis, which was always within 12 hours of sample collection. The bottles and lids were thoroughly rinsed with deionised water after analysis and before re-use. The only diversion from the best-practice protocol was that neither an air headspace nor mercuric chloride were introduced into the sample bottles; these additions were not necessary thanks to the short storage period between sampling and analysis (as confirmed by non-consecutive measurements of sampling duplicates, see later).

A few samples were also collected from the ship's underway seawater supply (aqua-flow), via a tap in the container lab, but otherwise following the same protocol as described above.

Analytical equipment. All measurements were carried out at sea in the NIOZ CO_2 container lab, positioned in the hold of R/V *Pelagia*. We measured dissolved inorganic carbon (DIC) and total alkalinity (TA) using two separate instruments: a VINDTA 3C (for both DIC and TA) and an in-house spectrophotometric titration system (for TA only). The DIC and TA results were all calibrated using regular measurements of batch 171 certified reference material (CRM) seawater obtained from the laboratory of Prof A.G. Dickson (Scripps Institution of Oceanography, CA, USA). Two other CRM batches were also available (100 and 105) but the results of these were highly variable and inconsistent, probably because they were bottled too long ago (i.e. about a decade).

VINDTA 3C

The VINDTA 3C, or "Versatile Instrument for the Determination of Total Alkalinity and DIC" (#17, Marianda, Germany), automatically measures both DIC and TA from a single seawater sample. For DIC, following Dickson et al. (2007b), a c. 20 ml subsample is measured by pipette and added to an excess (i.e. a few drops) of 10% phosphoric acid in a gas stripper. The acid converts all carbonate and bicarbonate ions into CO_2, which is then carried by a nitrogen gas stream out of the stripper, through a condenser to remove water vapour, and into a coulometer cell for DIC measurement (CO_2 Coulometer 5011, UIC Inc., USA). For TA, following Dickson et al. (2007c), a c. 100 ml subsample is measured by a different pipette and delivered to a water-jacketed cell for potentiometric titration with 0.1 M hydrochloric acid (HCl). The HCl solution also contains 0.6 M sodium chloride (NaCl) for a total ionic strength of 0.7 M, similar to seawater, and is delivered into the titration cell by a 719 S Titrino (Metrohm, Germany). The titration cell is rinsed with 0.7 M NaCl between analyses. Total alkalinity will be recalculated from the titration data after the cruise, taking into account the varying nutrient concentrations, using a least-squares fitting approach (e.g. Dickson et al., 2003).

Spectrophotometric TA titration

The NIOZ spectrophotometric TA titrator follows the method of Breland and Byrne (1993) and Yao and Byrne (1998). In short, a volume-calibrated borosilicate glass sample bottle (c. 250 ml, Schott Duran) is totally filled with seawater sample, and 45 µl of purified bromocresol purple indicator dye (10 mM) is added by pipette. The sample is then titrated with 0.2 M HCl (containing 0.5 M sodium chloride for a total ionic strength of 0.7 M, similar to seawater) by a Dosimat 665 (Metrohm, Germany) to approximately reach the total alkalinity endpoint. All CO_2 is then removed by sparging with nitrogen gas for at least 5 minutes. The final pH is recorded from the colour of the indicator dye by a spectrophotometer (Ocean Optics USB4000) opposite a blue-filtered tungsten light source (Ocean Optics).

Rijkswaterstaat transect: Statia to Saba

On Sunday 8th December we completed a transect of 9 sampling stations from Statia to Saba. This was to initiate a long-term sampling initiative funded by the Rijkswaterstaat (RWS). We were accompanied by Masru Spanner and Kimani Kitson-Walters of CNSI (on Statia), who will continue to revisit the transect (or a variant thereof) at 3-monthly intervals. Masru and Kimani were trained to collect samples, as well as to fix and seal them with an air headspace, mercuric chloride and Apiezon M grease, as recommended by Dickson et al. (2007a). The samples they collect on subsequent transect occupations will be sent back to NIOZ Texel for analysis. We delivered 4 boxes each of 32 sample bottles and sampling equipment (pipettes, tubing, etc.) to CNSI, enough for 4 more transect occupations.

Only the surface waters were sampled (5 m nominal depth). We planned a full-depth CTD cast at RWS transect station 5 (seafloor depth c. 850 m) but this was prevented by electronics problems with the CTD rosette.

Locations of the initial RWS transect stations

Latitude / °N	*Longitude / °W*	*RWS transect station*	*64PE465 station*	*Sample type*
17.6100	*63.2000*	*1*	*10*	*UW only*
17.5975	*63.1769*	*2*	*1*	*CTD+UW*
17.5850	*63.1537*	*3*	*2*	*CTD+UW*
17.5725	*63.1306*	*4*	*3*	*CTD+UW*
17.5600	*63.1075*	*5*	*5*	*UW only*
17.5475	*63.0844*	*6*	*6*	*UW only*
17.5350	*63.0612*	*7*	*7*	*UW only*
17.5225	*63.0381*	*8*	*8*	*UW only*
17.5100	*63.0150*	*9*	*9*	*UW only*

The Luymes Bank

Most of the remaining samples were collected on the Luymes Bank platform and in its sinkholes. In general, samples were collected and analysed at every depth that a sampling bottle was fired on the CTD rosette at each station. Every sample was collected in duplicate. Duplicates were analysed when there was time available to do so, and rarely consecutively. In total, 173 samples from the Luymes Bank were analysed during the cruise, of which 41 were duplicates, so there were 132 unique measurements.

At station 59, we also collected a set of 19 seawater samples in 250 ml borosilicate glass bottles with ground glass stoppers (Schott Duran) following the full best-practice protocol (Dickson et al., 2007a), i.e. also adding a 2 ml air headspace and 50 µl saturated mercuric chloride solution, lubricating the stopper with grease (Apiezon M) and holding closed with tape and rubber bands. These samples were stored on R/V *Pelagia* in the dark and refrigerated at 4 °C pending further analysis upon the ship's return to NIOZ Texel.

Data processing. Some simplified data calibration and processing was done on board to assess measurement quality, compare the different instruments, and visualise the results, but the processing will be repeated more rigorously in order to produce the final values, for example taking into account all CRM measurements throughout the cruise, and recalculating TA to account for the varying nutrient concentrations. A suite of variables calculated from the TA and DIC measurements, including seawater pH and the saturation states of different carbonate minerals, will also be reported then.

References

Breland, J. A., and Byrne, R. H. (1993). Spectrophotometric procedures for determination of sea water alkalinity using bromocresol green. *Deep-Sea Res. Pt I* 40, 629–641. doi:10.1016/0967-0637(93)90149-W.

Dickson, A. G., Afghan, J. D., and Anderson, G. C. (2003). Reference materials for oceanic CO_2 analysis: a method for the certification of total alkalinity. *Mar. Chem.* 80, 185–197. doi:10.1016/S0304-4203(02)00133-0.

Dickson, A. G., Sabine, C. L., and Christian, J. R. eds. (2007a). "SOP 1: Water sampling for the parameters of the oceanic carbon dioxide system," in *Guide to Best Practices for Ocean CO_2 Measurements, PICES Special Publication 3* (North Pacific Marine Science Organization, Sidney, BC, Canada), Chapter 4.

Dickson, A. G., Sabine, C. L., and Christian, J. R. eds. (2007b). "SOP 2: Determination of total dissolved inorganic carbon in sea water," in *Guide to Best Practices for Ocean CO_2 Measurements, PICES Special Publication 3* (North Pacific Marine Science Organization, Sidney, BC, Canada), Chapter 4.

Dickson, A. G., Sabine, C. L., and Christian, J. R. eds. (2007c). "SOP 3a: Determination of total alkalinity in sea water using a closed-cell titration," in *Guide to Best Practices for Ocean CO_2 Measurements, PICES Special Publication 3* (North Pacific Marine Science Organization, Sidney, BC, Canada), Chapter 4.

Yao, W., and Byrne, R. H. (1998). Simplified seawater alkalinity analysis: Use of linear array spectrometers. *Deep Sea Research Part I: Oceanographic Research Papers* 45, 1383–1392. doi:10.1016/S0967-0637(98)00018-1.

3.6. Nutrients (Karel Bakker)

Introduction: Nutrient measurements were made on board using a Seal QuAAtro, gas-segmented continuous flow auto analyser operated in an air-conditioned lab-container.

Measurements were made simultaneously for four channels of 249 samples with Phosphate, Ammonium, Nitrate with Nitrite together and Nitrite separate. At some stations approximately 160 sub-samples were collected and preserved for Dissolved Inorganic Carbon (DIC). Some 24 Oxygen samples were preserved with Winkler chemistry, and a total of around 30 for Total Dissolved Phosphorous and Total Dissolved Nitrogen. All measurements were calibrated with stock-standards diluted in low nutrient seawater (LNSW) in the same salinity range as the samples.

Equipment and Methods

The colorimetric methods used:

Phosphate. Ortho-phosphate is measured by formation of a blue reduced Molybdophosphate-complex at pH 0.9-1.1. Potassium Antimonyltartrate used as the catalyst and ascorbic acid as a reducing agent. The absorbency is measured at 880nm. (J.Murphy and J.Riley, 1962. Analytica Chim.Acta)

Ammonium (NH_4) reacts with phenol and sodiumhypochlorite at pH 10.5 to form an indo-phenolblue complex. Citrate is used as a buffer and complexant for calcium and magnesium at this pH. The blue color is measured at 630nm (Helder and de Vries, 1979).

Nitrite: Diazotation of nitrite with sulfanylamide and N-(1-naphtyl)-ethylene diammonium dichloride to form a pink dye measured at 550nm.

Nitrate plus Nitrite (NO_3+NO_2) is mixed with an imidazol buffer at pH 7.5 and reduced by a copperized cadmium column to Nitrite. The Nitrite is diazotized with sulphanyl-amide and naphtyl-ethylene-diamine to a pink colored complex and measured at 550nm. Nitrate is calculated by subtracting the Nitrite value of the Nitrite channel from the 'NO3+NO2' value (Grasshof, 1983. Seawater M methods practical handbook Weinheimverlag).

Sample handling. The samples were collected in 60ml high-density polyethylene syringes connected with a three-way valve via a tubing, taken directly from the CTD-rosette bottles without any air contact. After sampling on deck, the samples were processed immediately in the lab; samples were filtered over a combined 0.8/0.2µm filter. The samples were analysed typically within 4 hours and 10 hours as a maximum. Analyses were carried out using high-density polyethylene "pony-vials" with a volume of 6 ml as sample cups fitting the auto-sampler. and instantly sub-sampled for DIC, Si, and the nutrients PO4, NH4, NO3 and NO2, TDN and TDP.

DIC samples were transferred to glass vials already containing 15µl saturated $HgCl_2$. Glass vials were filled with a round meniscus before being capped and stored upside down in a refrigerator. The other parameters were transferred to pony-vials and kept in the fridge until measurement on board. Si is stored at 4°C in a 100% humidity box in the fridge and TDN, TDP at -20°C in the freezer.

All pony-vials plus caps were pre-rinsed three times with sample before filling. For analysis all pony-vials were covered with "parafilm" to avoid influx from ammonia and evaporation during measurement.

Calibration and Standards. A sampler rate of 60 samples per hour was used. Calibration standards were diluted from stock standards of the different nutrients with 0.2µm filtered LNSW and were freshly prepared every day. LNSW was also used as baseline water for the analysis in-between the samples. Each run of the system had a correlation coefficient of at least 0.9999 for

10 calibration points, but typical 1.0000 for linear chemistry. The samples were measured from the lowest to the highest concentration in order to keep carry-over in the flow system as small as possible, i.e. from surface to deeper waters. Concentrations were recorded in 'µmol per liter' (µM/L) at a lab temperature of 23.5°C. During the cruise each run, a freshly diluted mixed internal nutrient standard (nutrient cocktail), containing, phosphate and nitrate was diluted 250 times in LNSW and measured. The cocktail sample was used to monitor independently of the standards the performance of the system.

Stock standards. Nutrient primary stock standards were prepared at the lab home by weighing nutrient salts p.a. in de-ionised water. All standards are kept in a so-called 100% humidity box at lab temperature to prevent any concentration change by evaporation.

Phosphate: by weighing Potassium dihydrogen phosphate in a calibrated volumetric PP flask to make 1mM PO_4 stock solution.

Ammonium: by weighing Ammonium Chloride in a calibrated volumetric PP flask to make 1mM NH_4 stock solution.

Nitrate: by weighing Potassium nitrate in a calibrated volumetric PP flask set to make a 10mM NO_3 stock solution.

Nitrite: by weighing Sodium nitrite in a calibrated volumetric PP flask set to make a 0.5mM NO_2 stock solution.

Cocktail lab standard: a mixture of Phosphate and Nitrate preserved with addition of 1ml saturated $HgCl_2$

All stock-standards were stored at room temperature in a 100% humidified box. The calibration standards were prepared daily by diluting the separate stock standards, using three electronic pipettes, into four 100ml PP volumetric flasks (pre-calibrated at the NIOZ) filled with diluted LNSW. The background values of the diluted LNSW were measured on-board and added up to the standard values to compute the final calibration-point values.

Statistics Quality Control

Our standards have already been proven by inter-calibration exercises from ICES and Quasimeme, and since 2006 by the Inter Comparison exercises organised by MRI, Japan.

Our cocktail standard was measured every run for two nutrients during this cruise.

To obtain international comparable results, three KANSO CRM's produced by The General Environmental Technos Co., Ltd. Japan were analysed three times in the last run.

To gain some accuracy the Cocktail standard is monitored now since 1997, showing in-between runs reproducibility better than 1.2% for PO4 and 0.7 % for NO3.

Cocktail standard between runs:

	average µM/L	S.D. µM/L	C.v.(%)	n
(250x dilution):				
PO4	0.922	0.011	1.2	34
NO3	14.12	0.097	0.7	34

Method Detection Limits calculated (EPA norm). as 2.82 x S.D. of 2% (*from the full range*) spiked samples (**n=10**).

	µM/L	*full range µM/L*:	SD dev. µM/L (n=3)
PO4	0.010	*1.50*	0.004 uM/L
NH4	0.090	*2.00*	0.032 uM/L
NO3+NO2	0.012	*20.5*	0.004 uM/L
NO2	0.002	*0.50*	0.001 uM/L

Precision in single run: 3 sample bottles at four concentration levels with coefficient of variation.

	level I µM/L	SD dev. µM/L	*C.v. %*	level II µM/L	SD dev. µM/L	*C.v. %*
PO4	0.30	0.002	*0.7*	0.60	0.008	*1.4*
NH4	0.45	0.006	*1.3*	0.85	0.007	*0.8*
NO3	4.00	0.013	*0.3*	8.00	0.057	*0.7*
NO2	0.10	0.001	*0.6*	0.20	0.001	*0.3*

	level III µM/L	SD dev. µM/L	*C.v. %*	level IV µM/L	SD dev. µM/L	*C.v. %*
PO4	1.00	0.009	*0.9*	1.50	0.004	*0.3*
NH4	1.40	0.010	*0.7*	2.00	0.002	*0.1*
NO3+NO2	14.0	0.099	*0.7*	20.0	0.053	*0.3*
NO2	0.35	0.001	*0.3*	0.50	0.002	*0.4*

Accuracy. To obtain accuracy, certified reference material (CRM) for nutrients were measured in the last statistical run in triplicate at **23.5 °C** containing stable homogeneous values for PO_4, and NO_3 and NO_2.

The Reference Material for Nutrients in Seawater (RMNS) or CRM's produced by KANSO lot BY (low nutrient numbers), lot BU and lot CH were used. All concentration converted to µM/kg by given salinity and lab temperature used at calibration.

CRM BY:		*Assigned:*	SD	
	µM/kg	*µM/kg*	µM/kg	
PO4	0.022	*0.039**	0.002	(n=3) *<QDL
NO3	0.079	*0.024**	0.002	(n=3) *<QDL
NO2	0.033	*0.019**	0.001	(n=3) *<QDL

CRM BU:		Assigned:	SD	
	µM/kg	*µM/kg*	µM/kg	
PO4	0.327	*0.345*	0.003	(n=3)
NO3	3.953	*3.937*	0.027	(n=3)
NO2	0.092	*0.072*	0.001	(n=3)

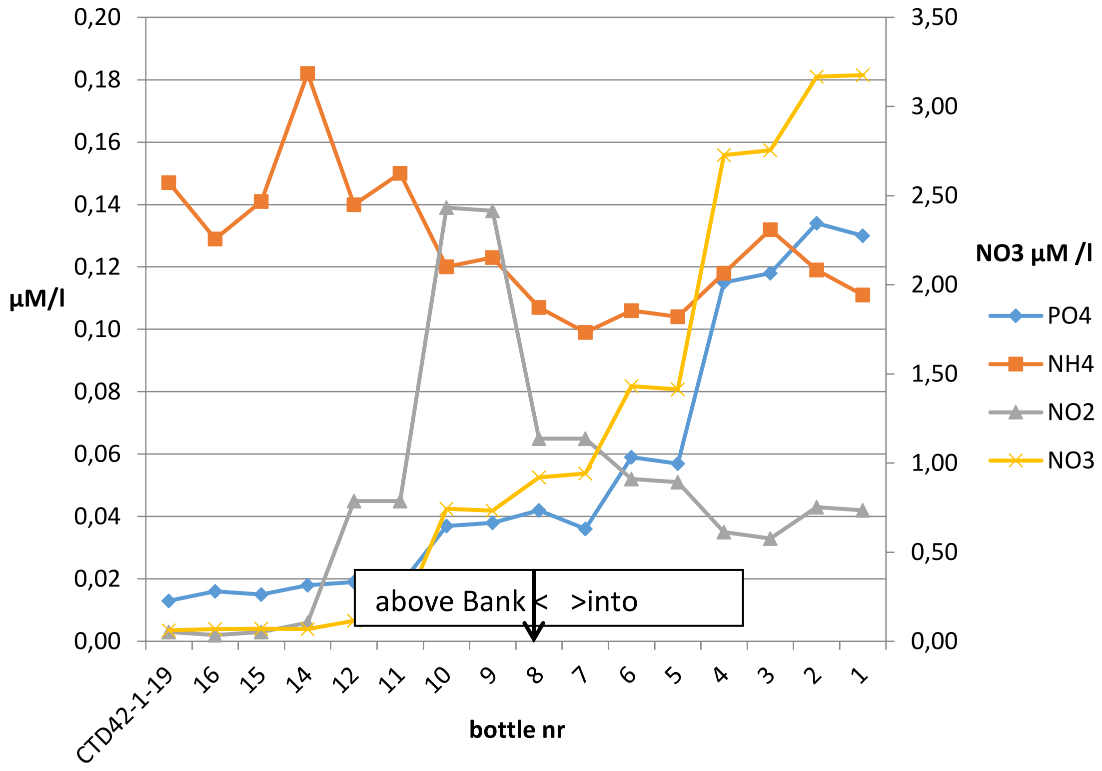
CRM CH:		Assigned:	SD

	µM/kg	µM/kg	µM/kg	
PO4	1.138	*1.172*	0.008	(n=3)
NO3	16.89	*16.94*	0.033	(n=3)
NO2	0.180	*0.159*	0.001	(n=3)

Problems encountered during the cruise in the nutrient container. After a few days the air conditioning system of the lab container stopped during the analyse run, increasing the temperature to 27°C. A quick action by the ship engineers installing a mobile A/C device saved the data in the run. Afterwards being processed for baseline-drift and sensitivity drift.

Halfway during the cruise an unnoticed small leakage of acid from the PO4 manifold dropped on the peristaltic pump. After rinsing with demineralised water and cleaning the rollers and greasing the bearings, the system seems to function normal. However, two days later a serious problem with the bearings one of the rollers got stuck causing a 12 second sinus on the PO4 baseline and peaks, resulting in a bad performance so decreasing precision. The run for statistics was made on the last day of sampling, see results above. The statistics in general will be slightly better than those reported due to the extra noise caused by the enhanced movements of the ship. This imply all results are within the above reported borders.

Post-cruise actions: Samples taken home for Silicate, TDN and TDP as well as DIC and O_2 will be analysed in the home lab at NIOZ-TX.

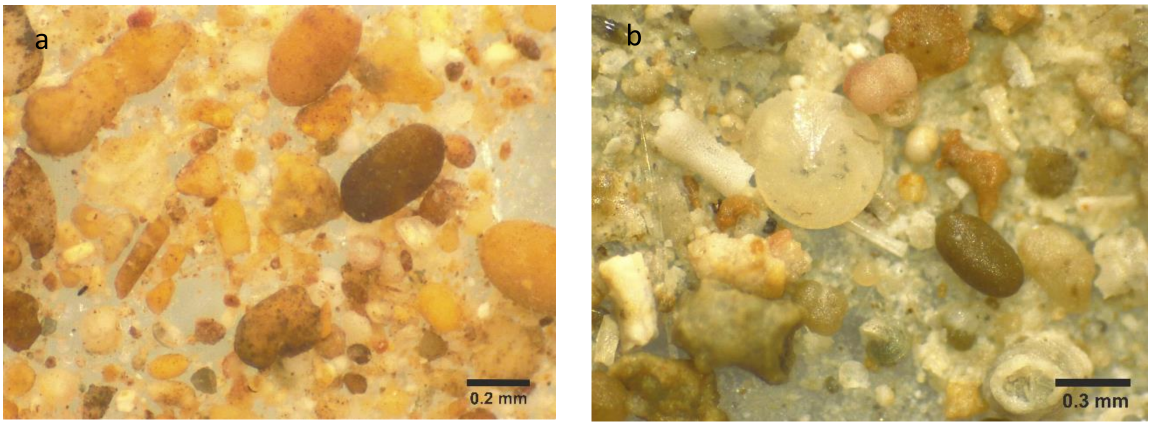


Example of nutrient concentrations analysed above the Luymes bank into a sinkhole. Note: based on analysed duplicate bottles from the same depth of the CTD-rosette.

3.7. Sediments (Szabina Karancz)

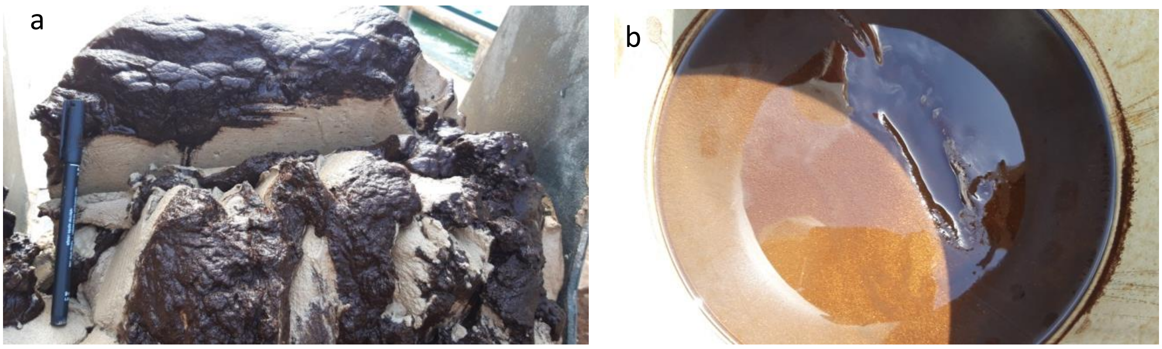
The surface sediment sampling was performed with a NIOZ box core in sinkholes 3 and 17. Sediment samples were collected from each layer and studied under a Leica EZ4 stereo microscope.

The box core was deployed in sinkhole 17 on the 11th of December. Two lithologies could be differentiated in a macroscopic view. On the top of the core, thin (ca. 10 cm) reddish-brown sandy mud could be observed. The reddish-brown layer was followed by grey sandy mud with a gradual transition. Both layers showed a rich fossil record (e.g. molluscs, foraminifera).

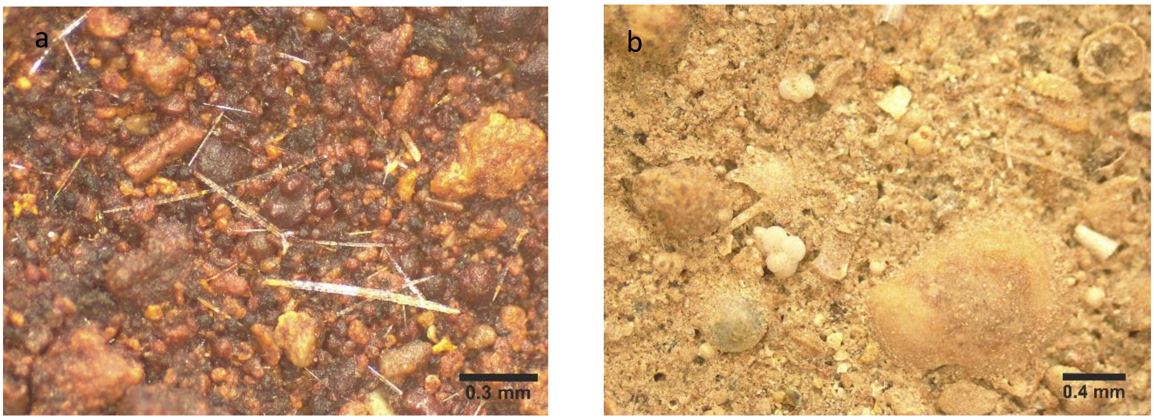


Microscopic view of the top (a) and the bottom (b) of the box core sediment collected from sinkhole 17.

Box core samples have been collected from sinkhole 3 on the 16th of December. The box core was carefully opened as the uppermost layer of the box core was very soft and contained a high amount of water. On top, dark brown (ca. 5 cm) mud could be observed. The high abundance of sponge spicules could be noticed already by touching the sediment and the size of the needles reached 0.2 cm. The dark brown mud was separated from the underlying light brown mud with a sharp boundary. At this boundary, carbonate concretions could be found with a variety of shapes. In the lowermost 5 cm of the box core, grey sandy mud could be recognised. This layer recorded abundant plankton and benthic fauna.



Box core sediment from sinkhole 3 (a) and the surface of the box core (b).



Microscopic view of the top (a) and the bottom (b) of the box core sediment collected from sinkhole 3.

Samples of different sediment layers of material collected at station 25 (SH 17), 34 (SH 3) and 62 (SH 4) were taken for metagenomics. Samples were stored at 4◦C.

3.8. Particulate organic matter and chlorophyll-a (Szabina Karancz, Fleur van Duyl)

Aim: To determine the particulate organic matter concentration in water samples near the bottom in sinkholes and on the platform. This material might be potential food for the benthic community (e.g. filter feeding and suspension feeding benthic organisms in particular). Fluorescence is measured by a sensor on the CTD. To calibrate the sensor a couple of Chlorophyll-a samples were collected.

Method: POM was collected on combusted GF-75 filters with diameter of 25mm. In order to get sufficient material for carbon and nitrogen determination on filters, 2150ml was filtered per depth (2 bottles of 1075ml each). POM samples were standard taken at all stations on the Luymes Bank in water near the bottom, and at station 59 at other depths. Filters were folded after filtration, wrapped in aluminium foil, snap frozen and stored at -80◦C.

Chl-a samples were collected on 47mm GFF filters at station 39, 42, 54, 58, 67 and 70. Water of the surface (ca 5m depth) and of the DCM was sampled. At station 39 muffled filters (GF-F) were used. On the other stations GF-75 (not muffled) filters were used. Water volumes filtered varied at the first stations. This was from station 54 onwards standardized to 7200ml per filter. Filters were folded after filtration, wrapped in aluminium foil, snap frozen and stored at -80◦C.

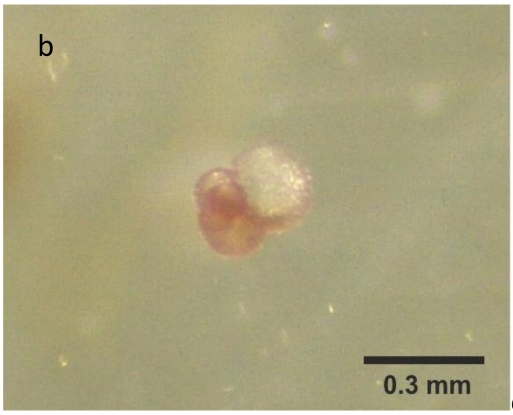
Station-cast-bottle Chl-a	*Deep Chl-a max (ml)*	*Surface (ml)*
39-1-13/39-1-18 *GFF muffled*	*10700 (60m depth)*	*10500 (5 m depth)*
42-1-13/42-1-18 *GF-75 not muffled*	*7100 (70m depth)*	*7800 (4.3m depth)*
54-1-6/54-1-23 *58-1-8/58-1-12* *67-1-6/67-1-15* *70-1-8/70-1-11* *GF-75 not muffled*	*7200 (50m depth)* *" (67m depth)* *" (52.8 m depth)* *" (60mdepth))*	*7200 (4m depth)* *" (5m depth)* *" (5m depth)* *" (5m depth)*

3.9. Planktonpump (Siham de Goeyse , Szabina Karancz)

Methods. A Water pump on board of Pelagia collects water at a depth of 3 m below the sea surface (pumping rate of ~ 1 000 $L.h^{-1}$). The water flows through a 100 µm filter. After a cycle of collection, the planktonic particles are collected from the filter and examined under a microscope before being washed with Milli-Q water and frozen for subsequent analysis.

Date	Time started	Initial water volume	Time stopped	final water volume	Volume filtered (m3)	treatment
13/12/2019	08:37	13693	16:04	13701.5	8.5	frozen
14/12/2019	08:12	13701.5	09:25	13702.5	1	frozen
14/12/2019	14:45	13702.5	17:38	13705	2.5	frozen
15/12/2019	08:11	13705	10:04	13709	4	frozen
15/12/2019	10:20	13709	12:24	13712	3	frozen
15/12/2019	14:51	13712	?	13719	7	frozen
16/12/2019	04:24	13719	06:20	13723	4	frozen
16/12/2019	08:34	13723	13:31	13732	9	frozen
16/12/2019	20:36	13732	04:14	13749	17	frozen
17/12/2019	06:46	13749	10:32	13758	9	frozen
17/12/2019	13:26	13758	18:54	13768	10	frozen
17/12/2019	22:55	13768	08:00	13790	22	frozen

There were numerous copepods in the samples retrieved from the pump, especially the ones collected overnight. Some planktonic foraminifera were also present in the samples, including pink and white *G.ruber.*



Copepod (a) and a foraminiferan (b) specimen from surface water.

4. Appendices

4.1. Complete list of events/activities

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
08/12/2019	13:33:56	17,52223	-63,03823	CTD with samples	CTDBOT	Begin	DIC2	1	1_1	28,748	59,606	36,795	-24815	295,55	0,04	1017	27,6	7,2614	92
08/12/2019	13:36:46	17,52187	-63,03782	CTD with samples	CTDBOT	Bottom		1	1_1	28,715	59,616	36,828	-24812	0	0,04	1017	27,5	7,1493	88
08/12/2019	13:40:03	17,52179	-63,03796	CTD with samples	CTDBOT	End		1	1_1	28,719	59,615	36,824	-24813	284,12	0,04	1017	27,6	8,2226	73
08/12/2019	14:03:35	17,53488	-63,06103	CTD with samples	CTDBOT	Begin	DIC3	2	2_1	28,713	59,702	36,89	-24808	762,81	0,04	1017	27,6	7,3501	87
08/12/2019	14:06:29	17,53468	-63,06104	CTD with samples	CTDBOT	Bottom		2	2_1	28,735	59,697	36,869	-24809	762,81	0,04	1017	27,7	6,7487	52
08/12/2019	14:09:18	17,53489	-63,06101	CTD with samples	CTDBOT	End		2	2_1	28,752	59,726	36,876	-24809	762,41	0,04	1017	27,7	7,1178	51
08/12/2019	14:30:41	17,54761	-63,08398	CTD with samples	CTDBOT	Begin	DIC4	3	3_1	28,745	59,702	36,864	-24810	863,65	0,04	1017	27,7	6,5519	65
08/12/2019	16:05:32	17,54764	-63,08444	CTD with samples	CTDBOT	Bottom		3	3_1	28,638	59,595	36,873	-24809	863,67	0,04	1016	27,2	7,1019	84
08/12/2019	17:13:53	17,56049	-63,10716	CTD with samples	CTDBOT	Begin		4		28,781	59,819	36,918	-24806	871,94	0,04	1015	27,3	5,9183	86
08/12/2019	17:32:52	17,5597	-63,1073	CTD with samples	CTDBOT	Bottom		4		28,828	59,857	36,908	-24806	869,97	0,04	1015	27,5	5,8488	88
08/12/2019	17:32:53	17,55971	-63,1073	CTD with samples	CTDBOT	End		4		28,828	59,856	36,907	-24806	869,16	0,04	1015	27,5	5,2976	88
08/12/2019	17:41:24	17,55969	-63,10641	CTD with samples	CTDBOT	End		3	3_1	28,81	59,844	36,913	-24806	870,3	0,04	1015	27,4	5,6554	95
08/12/2019	17:44:20	17,55971	-63,10588	Aqua flow	aqfl	Start	DIC5	5		28,835	59,856	36,902	-24807	871,54	0,04	1015	27,6	5,9409	88
08/12/2019	17:45:31	17,55971	-63,10565	Aqua flow	aqfl	End		5		28,833	59,864	36,909	-24806	872,73	0,04	1015	27,7	5,6402	92
08/12/2019	18:03:26	17,57322	-63,13167	Aqua flow	aqfl	Start	DIC6	6		28,84	59,889	36,922	-24805	844,75	0,04	1015	27,7	2,2919	306
08/12/2019	18:03:41	17,57336	-63,13194	Aqua flow	aqfl	End		6		28,84	59,887	36,92	-24805	844,43	0,04	1015	27,7	2,6474	306
08/12/2019	18:17:04	17,58493	-63,15426	Aqua flow	aqfl	Start	DIC7	7		28,834	59,849	36,898	-24807	758,08	0,04	1015	27,7	2,7497	307
08/12/2019	18:17:24	17,5851	-63,15458	Aqua flow	aqfl	End		7		28,835	59,85	36,897	-24807	754,53	0,04	1015	27,7	3,2001	305
08/12/2019	18:30:47	17,59678	-63,17653	Aqua flow	aqfl	Start	DIC8	8		28,808	59,889	36,946	-24804	517,36	0,04	1015	27,7	3,761	310
08/12/2019	18:31:13	17,597	-63,17691	Aqua flow	aqfl	End		8		28,805	59,888	36,947	-24803	530,36	0,04	1015	27,7	4,0088	308
08/12/2019	18:44:06	17,6098	-63,20039	Aqua flow	aqfl	Start	DIC9	9		28,844	59,929	36,945	-24804	578,16	0,04	1015	27,8	1,561	313
08/12/2019	18:44:29	17,6102	-63,20114	Aqua flow	aqfl	End		9		28,843	59,929	36,947	-24804	573,24	0,04	1015	27,8	1,8087	319
08/12/2019	20:17:59	17,51006	-63,01524	Aqua flow	aqfl	Start	DIC1	10		28,775	59,636	36,795	-24815	58,37	0,05	1014	27,3	5,5702	91
08/12/2019	20:18:38	17,51009	-63,01488	Aqua flow	aqfl	End		10		28,78	59,635	36,79	-24815	58,36	0,05	1014	27,3	4,5754	89
09/12/2019	01:14:23	17,68667	-63,46552	3.5 kHz Seismics	ECHO	Begin				28,81	59,868	36,93	-24805	77,5	0,05	1017	27,4	4,976	274
09/12/2019	03:21:28	17,68562	-63,49261	3.5 kHz Seismics	ECHO	End				28,758	59,907	36,997	-24800	361,34	0,05	1017	27,2	4,9764	223
09/12/2019	12:22:28	17,69106	-63,47826	HD Video	HD	Begin		11	11_1	28,707	59,827	36,981	-24801	88,96	0,05	1017	26,4	11,253	70
09/12/2019	12:33:04	17,69106	-63,47687	HD Video	HD	Start Track		11	11_1	28,675	59,853	37,024	-24798	0	0,05	1017	26,2	11,415	63
09/12/2019	13:14:18	17,69039	-63,47466	HD Video	HD	End Track		11	11_1	28,683	59,842	37,01	-24799	82,4	0,05	1018	26,4	9,3489	123
09/12/2019	13:19:42	17,68889	-63,47437	HD Video	HD	End		11	11_1	28,693	59,847	37,006	-24799	79,25	0,05	1018	26,4	9,1975	104
09/12/2019	14:05:35	17,69034	-63,47928	HD Video	HD	Begin		12	12_1	28,716	59,901	37,026	-24798	82,8	0,05	1018	27,3	9,3599	64

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
09/12/2019	14:07:49	17,6905	-63,47908	HD Video	HD	Start Track		12	12_1	28,716	59,891	37,019	-24798	82,97	0,05	1018	27,2	9,7012	92
09/12/2019	14:55:31	17,69209	-63,47616	HD Video	HD	End Track		12	12_1	28,737	59,896	37,006	-24799	87,92	0,05	1017	27,3	9,7367	71
09/12/2019	15:00:16	17,69268	-63,47563	HD Video	HD	End		12	12_1	28,704	59,88	37,02	-24798	86,74	0,05	1018	27,4	9,5925	67
09/12/2019	15:21:57	17,69277	-63,49027	HD Video	HD	Begin	SH 17	13	13_1	28,727	59,897	37,014	-24799	81,17	0,05	1017	27,8	11,071	75
09/12/2019	15:23:44	17,69295	-63,49003	HD Video	HD	Start Track		13	13_1	28,719	59,894	37,019	-24798	80,83	0,05	1017	27,8	10,851	91
09/12/2019	16:14:55	17,69717	-63,48388	HD Video	HD	End Track		13	13_1	28,739	59,898	37,006	-24799	82,01	0,06	1017	28	10,116	67
09/12/2019	16:18:12	17,69775	-63,4838	HD Video	HD	End		13	13_1	28,71	59,889	37,023	-24798	79,24	0,05	1017	28	10,425	80
09/12/2019	17:14:52	17,68549	-63,47996	HD Video	HD	Begin		14		28,73	59,905	37,017	-24798	87,28	0,06	1016	27,8	9,654	82
09/12/2019	17:18:16	17,68568	-63,47962	HD Video	HD	Start Track		14		28,739	59,898	37,006	-24799	88,31	0,06	1016	27,9	10,846	81
09/12/2019	18:03:19	17,68763	-63,47866	HD Video	HD	End Track		14		28,748	59,921	37,015	-24799	85,56	0,06	1015	28	10,712	59
09/12/2019	18:06:25	17,6884	-63,479	HD Video	HD	End		14		28,742	59,93	37,026	-24798	83,19	0,06	1015	28	9,3612	75
09/12/2019	18:23:04	17,68634	-63,47258	HD Video	HD	Begin		15		28,752	59,933	37,02	-24798	74,52	0,06	1015	28	8,9484	85
09/12/2019	18:26:56	17,68627	-63,47219	HD Video	HD	Start Track		15		28,78	59,944	37,006	-24799	75,7	0,06	1015	28	10,304	94
09/12/2019	18:43:21	17,68675	-63,47236	HD Video	HD	End Track		15		28,775	59,982	37,037	-24797	74,52	0,06	1015	27,9	9,9757	25
09/12/2019	18:49:46	17,68834	-63,47274	HD Video	HD	End		15		28,79	59,982	37,025	-24798	76,1	0,06	1015	28	10,985	87
10/12/2019	00:03:25	17,71398	-63,49153	3.5 kHz Seismics	ECHO	Begin		16	16_1	28,742	59,944	37,036	-24797	73,98	0,06	1017	27,9	11,001	358
10/12/2019	01:36:51	17,73758	-63,48902	3.5 kHz Seismics	ECHO	End		16	16_1	28,716	59,929	37,045	-24796	88,23	0,06	1017	27,8	11,983	79
10/12/2019	12:00:20	17,69219	-63,48634	CTD with samples	CTDBOT	Begin	SH17	17	17_1	28,602	59,715	36,985	-24801	130,2	0,08	1017	27,4	11,397	84
10/12/2019	12:17:18	17,69233	-63,48665	CTD with samples	CTDBOT	Begin		17	17_2	28,552	59,652	36,979	-24801	126,36	0,08	1017	27,4	13,041	83
10/12/2019	12:20:20	17,69221	-63,48687	CTD with samples	CTDBOT	Bottom		17	17_2	28,55	59,638	36,971	-24802	122,51	0,08	1017	27,5	11,544	84
10/12/2019	12:39:02	17,69212	-63,4864	CTD with samples	CTDBOT	End		17	17_2	28,58	59,65	36,957	-24803	127,13	0,08	1018	27,5	10,556	75
10/12/2019	13:21:35	17,69076	-63,47716	CTD with samples	CTDBOT	Begin	SH18	18	18_1	28,625	59,71	36,963	-24802	111,35	0,08	1018	27,6	12,971	82
10/12/2019	13:27:08	17,69071	-63,47716	CTD with samples	CTDBOT	Bottom		18	18_1	28,661	59,728	36,948	-24803	110,2	0,08	1018	27,6	11,704	82
10/12/2019	13:47:40	17,69075	-63,47727	CTD with samples	CTDBOT	End		18	18_1	28,641	59,742	36,974	-24802	115,2	0,08	1018	27,2	13,057	82
10/12/2019	14:35:00	17,68629	-63,47859	CTD with samples	CTDBOT	Begin	SH 20	19	19_1	28,657	59,763	36,976	-24801	109,21	0,08	1018	27,2	9,8606	81
10/12/2019	14:37:19	17,68628	-63,47867	CTD with samples	CTDBOT	Bottom		19	19_1	28,664	59,757	36,966	-24802	110,58	0,08	1018	27,5	10,008	88
10/12/2019	14:58:43	17,68627	-63,47875	CTD with samples	CTDBOT	End		19	19_1	28,67	59,748	36,955	-24803	110,48	0,08	1018	27,5	11,348	92
10/12/2019	17:49:54	17,68654	-63,47841	Grabber	GRAB	Bottom	Failed	20	20_1	28,74	59,899	37,006	-24799	103,25	0,1	1016	27,7	11,673	89
10/12/2019	19:05:22	17,68689	-63,47838	Grabber	GRAB	Bottom	Failed	20	20_2	28,778	59,923	36,993	-24800	94,42	0,09	1015	27,6	11,74	82
10/12/2019	20:48:14	17,68665	-63,47811	Grabber	GRAB	Bottom	Failed	20	20_3	28,763	59,912	36,997	-24800	95,57	0,09	1015	27,5	10,599	86
10/12/2019	21:04:16	17,68628	-63,47873	Grabber	GRAB	Bottom	SH20	20	20_4	28,756	59,897	36,992	-24800	109,81	0,09	1015	27,7	10,753	88

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
11/12/2019	13:37:22	17,69292	-63,48524	Mooring	MOOR	Deploym	SH 17	21	21_1	28,617	59,743	36,993	-24800	112,5	0,09	1018	26,4	8,6507	85
11/12/2019	15:25:24	17,68652	-63,47829	Mooring	MOOR	Deploym	SH 20	22	22_1	28,662	59,821	37,012	-24799	100,96	0,09	1017	27,4	8	72
11/12/2019	15:54:41	17,67471	-63,50404	CTD with samples	CTDBOT	Begin	deep	23	23_1	28,659	59,816	37,011	-24799	435,32	0,1	1017	27,2	8,3172	73
11/12/2019	16:03:18	17,67481	-63,50415	CTD with samples	CTDBOT	Bottom		23	23_1	28,652	59,777	36,989	-24800	434,17	0,12	1017	27,2	7,2095	72
11/12/2019	16:31:31	17,67407	-63,50377	CTD with samples	CTDBOT	End		23	23_1	28,651	59,821	37,021	-24798	445,33	0,1	1017	23,1	9,8734	44
11/12/2019	17:38:08	17,68944	-63,48381	CTD with samples	CTDBOT	Begin		24		28,638	59,761	36,989	-24800	78,64	0,09	1016	24,7	9,8567	36
11/12/2019	17:43:30	17,68968	-63,48393	CTD with samples	CTDBOT	Bottom		24		28,64	59,742	36,974	-24802	80,57	0,09	1016	25,3	9,0486	54
11/12/2019	17:58:49	17,69069	-63,48491	CTD with samples	CTDBOT	End		24		28,652	59,749	36,969	-24802	84,42	0,09	1015	22,7	14,151	121
11/12/2019	18:35:47	17,69266	-63,48797	Boxcore	BOX125	Bottom	SH17	25	25_1	28,533	59,678	37,013	-24799	119,28	0,09	1015	24,5	5,8162	113
11/12/2019	20:02:25	17,69146	-63,48721	CTD with samples	CTDBOT	Begin	SH17	26		28,666	59,769	36,972	-24802	117,75	0,1	1015	26,3	9,0974	56
11/12/2019	20:04:42	17,6915	-63,48709	CTD with samples	CTDBOT	Bottom		26		28,654	59,779	36,989	-24800	117,39	0,09	1015	26,3	7,6046	44
11/12/2019	20:20:16	17,69156	-63,48719	CTD with samples	CTDBOT	End		26		28,664	59,782	36,983	-24801	117,49	0,09	1014	26,4	11,822	59
11/12/2019	21:00:18	17,68591	-63,47846	CTD with samples	CTDBOT	Begin	SH20	27	27_1	28,659	59,785	36,989	-24800	102,12	0,09	1015	24,9	8,8722	82
11/12/2019	21:03:11	17,68586	-63,47846	CTD with samples	CTDBOT	Bottom		27	27_1	28,651	59,773	36,987	-24801	100,19	0,09	1015	25	6,9572	92
11/12/2019	21:15:48	17,68591	-63,47853	CTD with samples	CTDBOT	End		27	27_1	28,657	59,778	36,987	-24801	107,44	0,1	1015	26,1	5,9932	82
11/12/2019	23:05:18	17,77018	-63,63032	Multibeam	EM302	Begin		28		28,615	59,746	36,996	-24800	1512	0,11	1015	26,8	10,178	95
12/12/2019	04:17:51	17,65846	-63,42336	Multibeam	EM302	End		28		28,437	59,622	37,048	-24796	102,7	0,12	1015	26,4	6,707	282
12/12/2019	08:29:52	17,69153	-63,48723	CTD with samples	CTDBOT	Begin	SH17	29		28,43	59,606	37,043	-24796	120,42	0,11	1013	26,2	9,7507	60
12/12/2019	08:36:29	17,69151	-63,48716	CTD with samples	CTDBOT	Bottom		29		28,4	59,561	37,034	-24797	120,05	0,1	1013	26,3	10,355	58
12/12/2019	08:49:46	17,69159	-63,48709	CTD with samples	CTDBOT	End		29		28,366	59,517	37,03	-24797	120,62	0,1	1013	26,2	8,8958	55
12/12/2019	09:16:41	17,68583	-63,47861	CTD with samples	CTDBOT	Begin	SH20	30	30_1	28,486	59,638	37,021	-24798	105,47	0,1	1013	26,2	10,15	66
12/12/2019	09:17:53	17,68581	-63,47858	CTD with samples	CTDBOT	Bottom		30	30_1	28,491	59,641	37,02	-24798	105,87	0,1	1013	25,8	10,312	53
12/12/2019	09:32:00	17,68587	-63,47862	CTD with samples	CTDBOT	End		30	30_1	28,514	59,678	37,028	-24798	107,44	0,1	1013	26	8,4523	61
12/12/2019	12:45:16	17,74664	-63,499	CTD with samples	CTDBOT	Begin	SH 3	31	31_1	28,447	59,605	37,029	-24797	295,64	0,09	1016	25,6	10,834	42
12/12/2019	12:51:16	17,74672	-63,49876	CTD with samples	CTDBOT	Bottom		31	31_1	28,467	59,617	37,022	-24798	296,03	0,09	1016	24,9	16,001	57
12/12/2019	13:23:51	17,74674	-63,49883	CTD with samples	CTDBOT	End		31	31_1	28,514	59,669	37,021	-24798	299,14	0,09	1017	24,3	17,454	80
12/12/2019	14:22:14	17,73525	-63,49747	CTD with samples	CTDBOT	Begin	SH 8	32	32_1	28,526	59,725	37,051	-24796	271,83	0,1	1016	24,8	14,944	86
12/12/2019	14:28:02	17,73544	-63,49737	CTD with samples	CTDBOT	Bottom		32	32_1	28,515	59,676	37,025	-24798	270,74	0,1	1016	24,8	14,837	84
12/12/2019	14:53:22	17,73558	-63,49732	CTD with samples	CTDBOT	End		32	32_1	28,447	59,626	37,044	-24796	270,74	0,1	1015	25,3	14,199	86
12/12/2019	15:33:31	17,7411	-63,51429	CTD with samples	CTDBOT	Begin	SH 2	33	33_1	28,509	59,685	37,037	-24797	223,95	0,1	1014	25,9	13,157	82
12/12/2019	15:38:02	17,74112	-63,5141	CTD with samples	CTDBOT	Bottom		33	33_1	28,526	59,679	37,019	-24798	153,48	0,1	1015	25,8	13,032	85

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
12/12/2019	16:00:57	17,74102	-63,51417	CTD with samples	CTDBOT	End		33	33_1	28,537	59,69	37,018	-24798	223,95	0,1	1014	26	11,689	88
12/12/2019	17:08:41	17,74413	-63,50295	CTD with samples	CTDBOT	Begin	SH3	34		28,522	59,713	37,046	-24796	279,68	0,1	1013	26,6	11,551	81
12/12/2019	17:22:57	17,74438	-63,50245	CTD with samples	CTDBOT	Bottom		34		28,551	59,736	37,04	-24797	280,47	0,1	1013	26,6	12,595	76
12/12/2019	17:56:07	17,74447	-63,50246	CTD with samples	CTDBOT	End		34		28,552	59,752	37,05	-24796	280,08	0,1	1013	26,9	11,979	83
12/12/2019	18:38:44	17,74435	-63,50229	Boxcore	BOX125	Bottom	SH3	34	34_2	28,547	59,757	37,057	-24795	282,03	0,09	1012	27	10,601	79
12/12/2019	19:10:04	17,74429	-63,50257	Boxcore	BOX125	Bottom		34	34_3	28,567	59,798	37,071	-24794	279,65	0,09	1012	27,2	12,457	83
12/12/2019	19:41:34	17,74419	-63,50395	Boxcore	BOX125	Bottom	SH3	35	35_1	28,6	59,796	37,043	-24796	278,48	0,1	1012	26,7	12,03	77
12/12/2019	20:43:58	17,68552	-63,48	Triangular Dredge	TRINET	Begin		36	36_1	28,58	59,824	37,079	-24794	87,73	0,1	1012	26,8	11,898	79
12/12/2019	20:46:39	17,68574	-63,47944	Triangular Dredge	TRINET	Bottom		36	36_1	28,596	59,808	37,055	-24796	94,83	0,1	1012	27	11,329	75
12/12/2019	20:49:40	17,68604	-63,47883	Triangular Dredge	TRINET	Start Heave		36	36_1	28,605	59,813	37,051	-24796	110,93	0,1	1012	27	13,026	79
12/12/2019	20:52:45	17,68624	-63,47801	Triangular Dredge	TRINET	End		36	36_1	28,607	59,831	37,061	-24795	97,2	0,1	1012	27,1	12,527	73
12/12/2019	21:08:22	17,68538	-63,48076	Triangular Dredge	TRINET	Begin		36	36_2	28,585	59,812	37,066	-24795	93,65	0,1	1012	27,1	12,971	80
12/12/2019	21:11:32	17,68562	-63,47995	Triangular Dredge	TRINET	Bottom		36	36_2	28,592	59,819	37,065	-24795	87,55	0,1	1012	27,1	12,891	78
12/12/2019	21:13:25	17,68572	-63,47947	Triangular Dredge	TRINET	Start Heave		36	36_2	28,597	59,822	37,063	-24795	92,07	0,1	1012	27,1	12,392	69
12/12/2019	21:20:51	17,6863	-63,47792	Triangular Dredge	TRINET	End		36	36_2	28,551	59,791	37,078	-24794	95,22	0,1	1012	27	12,963	80
12/12/2019	21:40:37	17,68081	-63,46804	Multibeam	EM302	Begin		37		28,636	59,83	37,038	-24797	79,05	0,1	1013	27	13,49	122
13/12/2019	10:30:03	17,58531	-63,51739	Multibeam	EM302	End		37		28,187	59,257	36,987	-24801	261,39	0,14	1013	27,1	13,03	71
13/12/2019	12:09:43	17,69981	-63,43395	CTD with samples	CTDBOT	Begin	deep NE	38	38_1	28,376	59,681	37,138	-24790	544,43	0,11	1014	25	18,679	79
13/12/2019	12:23:24	17,6997	-63,43294	CTD with samples	CTDBOT	Bottom		38	38_1	28,384	59,672	37,125	-24790	560,6	0,11	1014	24,5	11,876	88
13/12/2019	12:56:57	17,6997	-63,43304	CTD with samples	CTDBOT	End		38	38_1	28,374	59,686	37,143	-24789	559,44	0,11	1015	26,1	11,265	90
13/12/2019	13:52:23	17,73258	-63,48312	CTD with samples	CTDBOT	Begin	SH 9	39	39_1	28,465	59,734	37,105	-24792	233,32	0,11	1015	27,2	10,78	88
13/12/2019	13:59:43	17,73273	-63,48329	CTD with samples	CTDBOT	Bottom		39	39_1	28,485	59,738	37,093	-24793	241,12	0,11	1015	26,4	16,296	72
13/12/2019	14:26:11	17,73263	-63,48323	CTD with samples	CTDBOT	End		39	39_1	28,494	59,76	37,1	-24792	237,61	0,11	1015	26,7	12,181	91
13/12/2019	18:23:44	17,69093	-63,47707	Grabber	GRAB	Bottom	SH18	40	40_1	28,561	59,842	37,105	-24792	107,05	0,13	1013	26,9	10,362	92
13/12/2019	19:55:47	17,69041	-63,47709	Grabber	GRAB	Bottom	(lights) f	40	40_2	28,59	59,887	37,115	-24791	104,69	0,14	1013	26,8	8,8745	97
13/12/2019	20:46:42	17,65769	-63,43957	Multibeam	EM302	Begin		41		28,631	59,934	37,115	-24791	359,68	0,13	1012	27,4	11,674	112
14/12/2019	10:38:59	17,85492	-63,42406	Multibeam	EM302	End		41		28,235	59,632	37,214	-24784	1132,9	0,12	1014	27,3	0,6311	187
14/12/2019	12:17:20	17,72922	-63,48309	CTD with samples	CTDBOT	Begin	SH 10	42	42_1	28,444	59,691	37,092	-24793	227,33	0,13	1015	27,4	10,347	95
14/12/2019	12:21:50	17,72918	-63,48279	CTD with samples	CTDBOT	Bottom		42	42_1	28,456	59,8	37,158	-24788	226,68	0,12	1015	27,5	8,6496	95
14/12/2019	12:50:22	17,72918	-63,48282	CTD with samples	CTDBOT	End		42	42_1	28,466	59,742	37,11	-24792	226,68	0,13	1016	27,5	9,5438	103
14/12/2019	13:37:23	17,72652	-63,49753	CTD with samples	CTDBOT	Begin	SH 14	43	43_1	28,446	59,728	37,116	-24791	301,88	0,12	1016	27,4	8,9411	97

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
14/12/2019	13:43:07	17,72666	-63,4977	CTD with samples	CTDBOT	Bottom		43	43_1	28,472	59,753	37,113	-24791	303,03	0,13	1016	27,7	10,346	96
14/12/2019	14:14:57	17,72646	-63,49748	CTD with samples	CTDBOT	End		43	43_1	28,504	59,773	37,102	-24792	301,68	0,13	1016	27,2	8,205	113
14/12/2019	17:14:04	17,7475	-63,49181	HD Video	HD	Begin	SH 5	44	44_1	28,526	59,814	37,114	-24791	90,1	0,14	1015	27,3	7,971	104
14/12/2019	17:29:43	17,74872	-63,49126	HD Video	HD	Start Track		44	44_1	28,559	59,828	37,097	-24792	100,35	0,14	1014	27,2	10,335	108
14/12/2019	17:55:46	17,74818	-63,48884	HD Video	HD	End Track		44	44_1	28,61	59,881	37,095	-24793	86,94	0,14	1014	27,2	9,1149	100
14/12/2019	17:57:48	17,74816	-63,4886	HD Video	HD	End		44	44_1	28,581	59,896	37,128	-24790	87,33	0,14	1014	27,3	8,2922	105
14/12/2019	18:39:18	17,72812	-63,50384	HD Video	HD	Begin		45	45_1	28,562	59,843	37,105	-24792	84,87	0,14	1014	27,2	6,4501	105
14/12/2019	18:43:18	17,72827	-63,50377	HD Video	HD	Start Track		45	45_1	28,59	59,876	37,107	-24792	86,15	0,14	1014	27,1	7,234	103
14/12/2019	19:09:58	17,73087	-63,50284	HD Video	HD	End Track		45	45_1	28,564	59,883	37,132	-24790	84,57	0,14	1014	27,3	8,2212	83
14/12/2019	19:11:25	17,73104	-63,50279	HD Video	HD	End		45	45_1	28,546	59,872	37,138	-24789	84,57	0,14	1014	27,2	7,729	79
14/12/2019	19:59:09	17,73748	-63,52393	HD Video	HD	Begin	SH1&2	46	46_1	28,554	59,863	37,126	-24790	107,84	0,15	1014	27,4	9,1986	96
14/12/2019	20:03:10	17,7376	-63,52354	HD Video	HD	Start Track		46	46_1	28,588	59,868	37,102	-24792	109,7	0,15	1014	27,5	8,5278	89
14/12/2019	21:44:57	17,74075	-63,50935	HD Video	HD	End Track		46	46_1	28,575	59,889	37,128	-24790	90,81	0,15	1014	27,2	9,3993	107
14/12/2019	21:51:43	17,7408	-63,50937	HD Video	HD	End		46	46_1	28,561	59,855	37,114	-24791	91,05	0,17	1014	27,4	9,2146	44
14/12/2019	23:49:41	17,70513	-63,40217	Multibeam	EM302	Begin		47		28,444	59,786	37,158	-24788	876,21	0,14	1015	27,7	10,765	148
15/12/2019	09:30:17	17,49841	-63,64876	Multibeam	EM302	End		47		28,192	59,516	37,166	-24787	226,27	0,16	1016	27,1	7,4285	216
15/12/2019	12:19:28	17,74278	-63,50929	HD Video	HD	Begin		48	48_1	28,377	59,611	37,087	-24793	91,07	0,17	1017	27,4	11,095	106
15/12/2019	12:21:50	17,74279	-63,50928	HD Video	HD	Start Track		48	48_1	28,376	59,611	37,089	-24793	91,28	0,18	1017	27,5	10,748	104
15/12/2019	14:16:35	17,74053	-63,49749	HD Video	HD	End Track		48	48_1	28,295	59,654	37,183	-24786	197,77	0,19	1018	27,6	11,796	102
15/12/2019	14:27:33	17,7411	-63,49736	HD Video	HD	End		48	48_1	28,319	59,581	37,112	-24791	174,67	0,19	1018	27,7	10,755	113
15/12/2019	15:00:07	17,73669	-63,50753	HD Video	HD	Begin	video 3	49	49_1	28,328	59,673	37,17	-24787	88,52	0,18	1018	27,8	9,2748	99
15/12/2019	15:01:54	17,7366	-63,50751	HD Video	HD	Start Track		49	49_1	28,322	59,641	37,153	-24788	87,73	0,19	1018	27,7	11,318	95
15/12/2019	15:37:47	17,73506	-63,50161	HD Video	HD	End Track		49	49_1	28,356	59,569	37,075	-24794	150,34	0,22	1017	27,6	9,8162	101
15/12/2019	15:41:40	17,73499	-63,50151	HD Video	HD	End		49	49_1	28,328	59,559	37,09	-24793	168,79	0,19	1017	27,6	10,088	83
15/12/2019	17:13:35	17,73309	-63,48982	HD Video	HD	Begin	Video 5	50	50_1	28,353	59,567	37,076	-24794	87,73	0,2	1016	27,6	11,15	91
15/12/2019	17:17:33	17,73331	-63,48962	HD Video	HD	Start Track		50	50_1	28,353	59,558	37,07	-24795	89,04	0,2	1016	27,7	11,604	107
15/12/2019	18:03:15	17,73654	-63,48249	HD Video	HD	End Track		50	50_1	28,443	59,69	37,091	-24793	125,13	0,21	1015	27,6	10,329	85
15/12/2019	18:08:55	17,73684	-63,48166	HD Video	HD	End		50	50_1	28,459	59,735	37,111	-24792	144,62	0,2	1016	27,5	9,8233	94
15/12/2019	18:29:07	17,7266	-63,48816	HD Video	HD	Begin	video 6	51	51_1	28,364	59,66	37,132	-24790	103,9	0,21	1015	27,5	9,1916	109
15/12/2019	18:33:06	17,72668	-63,48801	HD Video	HD	Start Track		51	51_1	28,384	59,668	37,123	-24791	99,17	0,21	1016	27,6	8,4972	98
15/12/2019	19:04:18	17,72807	-63,48646	HD Video	HD	End Track		51	51_1	28,398	59,604	37,067	-24795	94,44	0,21	1016	27,7	10,39	93

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
15/12/2019	19:04:19	17,72807	-63,48647	HD Video	HD	End		51	51_1	28,399	59,604	37,066	-24795	96,01	0,21	1016	27,7	10,39	93
15/12/2019	20:06:39	17,68618	-63,48112	CTD with samples	CTDBOT	Begin	W- SH20	52	52_1	28,41	59,616	37,065	-24795	84,97	0,21	1016	27,8	9,2503	80
15/12/2019	20:09:24	17,68622	-63,48119	CTD with samples	CTDBOT	Bottom		52	52_1	28,374	59,629	37,103	-24792	85,36	0,21	1016	27,8	10,029	90
15/12/2019	20:19:43	17,68614	-63,48107	CTD with samples	CTDBOT	End		52	52_1	28,399	59,665	37,108	-24792	85,36	0,21	1016	27,8	8,2072	87
15/12/2019	20:33:17	17,686	-63,47875	CTD with samples	CTDBOT	Begin	SH20	53	53_2	28,417	59,697	37,117	-24791	110,32	0,21	1016	27,8	9,093	91
15/12/2019	20:35:45	17,68601	-63,47875	CTD with samples	CTDBOT	Bottom		53	53_2	28,425	59,699	37,112	-24791	109,02	0,21	1016	27,8	9,5294	90
15/12/2019	20:47:34	17,686	-63,47865	CTD with samples	CTDBOT	End		53	53_2	28,434	59,759	37,147	-24789	110,19	0,21	1016	27,7	9,5067	94
15/12/2019	21:01:02	17,68622	-63,47585	CTD with samples	CTDBOT	Begin	E-SH20	54	54_1	28,418	59,756	37,157	-24788	76,68	0,21	1016	27,7	10,616	81
15/12/2019	21:03:17	17,68626	-63,47583	CTD with samples	CTDBOT	Bottom		54	54_1	28,431	59,757	37,147	-24789	76,47	0,21	1016	27,8	9,5608	84
15/12/2019	21:20:17	17,68628	-63,47564	CTD with samples	CTDBOT	End		54	54_1	28,41	59,785	37,184	-24786	77,06	0,22	1016	27,6	10,941	134
15/12/2019	22:01:50	17,60302	-63,52206	Multibeam	EM302	Begin		55		28,215	59,451	37,102	-24792	341,47	0,23	1016	27,7	5,8746	220
16/12/2019	08:07:56	17,65648	-63,45496	Multibeam	EM302	End		55		28,105	59,209	37,018	-24798	412,29	0,23	1016	26,9	9,8275	0
16/12/2019	08:35:59	17,68576	-63,48098	CTD with samples	CTDBOT	Begin	W- SH20	56	56_1	28,134	59,316	37,071	-24794	86,88	0,23	1016	26,6	10,345	71
16/12/2019	08:38:34	17,68571	-63,48094	CTD with samples	CTDBOT	Bottom		56	56_1	28,123	59,304	37,071	-24794	88,52	0,23	1016	26,7	10,506	79
16/12/2019	08:52:11	17,68566	-63,4809	CTD with samples	CTDBOT	End		56	56_1	28,047	59,235	37,082	-24794	89,7	0,24	1016	26,8	10,341	78
16/12/2019	09:08:53	17,68565	-63,4785	CTD with samples	CTDBOT	Begin	SH20	57	57_1	28,116	59,293	37,068	-24795	99,17	0,22	1016	26,8	12,288	73
16/12/2019	09:10:38	17,68565	-63,47855	CTD with samples	CTDBOT	Bottom		57	57_1	28,121	59,301	37,071	-24794	99,17	0,23	1016	26,7	13,906	69
16/12/2019	09:24:10	17,6856	-63,47825	CTD with samples	CTDBOT	End		57	57_1	28,134	59,318	37,072	-24794	93,25	0,24	1016	26,2	9,4029	77
16/12/2019	09:40:57	17,68618	-63,47575	CTD with samples	CTDBOT	Begin	E-SH20	58	58_1	28,095	59,301	37,091	-24793	76,68	0,24	1016	26,8	8,9459	63
16/12/2019	09:43:05	17,68623	-63,47587	CTD with samples	CTDBOT	Bottom		58	58_1	28,082	59,282	37,088	-24793	77,07	0,24	1016	26,9	9,3427	63
16/12/2019	09:59:48	17,6862	-63,47583	CTD with samples	CTDBOT	End		58	58_1	28,078	59,228	37,053	-24796	76,28	0,23	1016	26,8	9,4441	77
16/12/2019	12:04:24	17,74637	-63,4985	CTD with samples	CTDBOT	Begin	SH3/4	59	59_1	28,178	59,363	37,07	-24794	302,64	0,24	1018	27,2	10,81	75
16/12/2019	12:10:26	17,74641	-63,49845	CTD with samples	CTDBOT	Bottom		59	59_1	28,177	59,367	37,073	-24794	300,31	0,24	1018	27,1	11,005	79
16/12/2019	12:49:34	17,74645	-63,4985	CTD with samples	CTDBOT	End		59	59_1	28,17	59,386	37,092	-24793	301,09	0,24	1018	27,5	11,306	83
16/12/2019	13:19:01	17,74644	-63,5048	Multibeam	EM302	Begin				28,262	59,497	37,098	-24792	257,88	0,24	1018	27,3	12,305	114
16/12/2019	13:28:15	17,73853	-63,49493	Multibeam	EM302	End				28,246	59,469	37,091	-24793	276,19	0,24	1018	27,4	12,656	117
16/12/2019	13:56:34	17,74134	-63,49813	CTD with samples	CTDBOT	Begin	SH3	60	60_1	28,192	59,408	37,09	-24793	164,48	0,25	1018	27,3	12,488	80
16/12/2019	14:01:43	17,74125	-63,49861	CTD with samples	CTDBOT	Bottom		60	60_1	28,2	59,395	37,075	-24794	186,43	0,26	1018	27,2	12,092	80
16/12/2019	14:09:23	17,74139	-63,49837	CTD with samples	CTDBOT	End		60	60_1	28,195	59,41	37,089	-24793	175,46	0,25	1018	27,4	12,126	83
16/12/2019	14:19:36	17,7405	-63,49743	CTD with samples	CTDBOT	Begin	SH 8	61	61_1	28,197	59,404	37,083	-24794	195,03	0,25	1018	27,3	12,926	82
16/12/2019	14:25:43	17,74052	-63,49759	CTD with samples	CTDBOT	Bottom		61	61_1	28,212	59,386	37,059	-24795	189,95	0,26	1018	27,4	13,544	87

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
16/12/2019	14:50:12	17,74079	-63,49785	CTD with samples	CTDBOT	End		61	61_1	28,241	59,406	37,05	-24796	187,99	0,26	1018	27,3	12,649	81
16/12/2019	15:23:32	17,74636	-63,49849	Boxcore	BOX125	Bottom	SH4	62	62_1	28,216	59,402	37,067	-24795	299,33	0,27	1018	26,2	11,344	103
16/12/2019	15:39:40	17,74648	-63,49866	Boxcore	BOX125	Bottom	SH4	62	62_2	28,243	59,434	37,069	-24795	299,48	0,26	1017	26,8	9,0016	106
16/12/2019	17:11:56	17,72171	-63,50522	HD Video	HD	Begin		63	63_1	28,303	59,504	37,071	-24794	84,97	0,29	1016	27,1	10,612	89
16/12/2019	17:21:09	17,72197	-63,50506	HD Video	HD	Start Track		63	63_1	28,31	59,491	37,056	-24796	87,33	0,29	1016	27,2	11,373	68
16/12/2019	17:54:50	17,72272	-63,50048	HD Video	HD	End Track		63	63_1	28,324	59,488	37,043	-24797	81,81	0,3	1016	26,9	9,1772	90
16/12/2019	18:00:45	17,72238	-63,49995	HD Video	HD	End		63	63_1	28,293	59,502	37,077	-24794	81,42	0,3	1016	26,9	10,188	74
16/12/2019	18:23:14	17,73227	-63,49048	HD Video	HD	Begin	SH16ret	64	64_1	28,259	59,458	37,073	-24794	85,8	0,3	1015	27,4	10,749	81
16/12/2019	18:26:53	17,73252	-63,48972	HD Video	HD	Start Track		64	64_1	28,269	59,442	37,054	-24796	88,91	0,3	1015	27,3	11,287	72
16/12/2019	19:01:33	17,73713	-63,48367	HD Video	HD	End Track		64	64_1	28,256	59,436	37,06	-24795	93,65	0,31	1015	27,4	11,849	90
16/12/2019	19:02:32	17,73692	-63,4837	HD Video	HD	End		64	64_1	28,257	59,435	37,058	-24795	94,67	0,31	1015	27,3	13,031	110
16/12/2019	20:03:51	17,68617	-63,48111	CTD with samples	CTDBOT	Begin	W-SH20	65	65_1	28,288	59,477	37,063	-24795	85,61	0,3	1015	27,4	10,311	80
16/12/2019	20:07:06	17,68623	-63,48109	CTD with samples	CTDBOT	Bottom		65	65_1	28,275	59,485	37,08	-24794	84,97	0,3	1015	27,5	10,345	75
16/12/2019	20:19:10	17,68617	-63,48105	CTD with samples	CTDBOT	End		65	65_1	28,274	59,531	37,112	-24791	85,76	0,3	1015	27,5	11,88	77
16/12/2019	20:36:44	17,68579	-63,47863	CTD with samples	CTDBOT	Begin	SH20	66	66_1	28,29	59,545	37,11	-24792	107,05	0,3	1015	27,5	13,199	79
16/12/2019	20:39:28	17,68577	-63,47859	CTD with samples	CTDBOT	Bottom		66	66_1	28,297	59,559	37,114	-24791	102,32	0,3	1015	27,4	12,764	80
16/12/2019	20:53:04	17,68563	-63,47838	CTD with samples	CTDBOT	End		66	66_1	28,276	59,573	37,14	-24789	97,2	0,3	1015	27,4	11,597	77
16/12/2019	21:10:43	17,68617	-63,47574	CTD with samples	CTDBOT	Begin	E-SH20	67	67_1	28,315	59,59	37,122	-24791	76,68	0,3	1015	27,1	10,396	78
16/12/2019	21:13:12	17,68619	-63,47564	CTD with samples	CTDBOT	Bottom		67	67_1	28,337	59,605	37,115	-24791	76,25	0,3	1015	27,1	10,955	72
16/12/2019	21:28:48	17,68612	-63,47556	CTD with samples	CTDBOT	End		67	67_1	28,312	59,641	37,161	-24788	76,68	0,3	1015	27	9,4562	74
17/12/2019	08:37:40	17,68613	-63,48113	CTD with samples	CTDBOT	Begin	W-SH20	68	68_1	28,106	59,346	37,114	-24791	85,36	0,31	1014	26,9	8,6358	92
17/12/2019	08:41:29	17,68612	-63,48115	CTD with samples	CTDBOT	Bottom		68	68_1	28,096	59,324	37,107	-24792	85,36	0,31	1014	27	10,597	87
17/12/2019	08:52:44	17,68616	-63,48128	CTD with samples	CTDBOT	End		68	68_1	28,053	59,292	37,117	-24791	86,15	0,31	1015	27	11,047	94
17/12/2019	09:07:38	17,6856	-63,47856	CTD with samples	CTDBOT	Begin	SH20	69	69_1	28,138	59,367	37,103	-24792	97,59	0,3	1015	26,8	11,198	89
17/12/2019	09:09:38	17,68558	-63,47851	CTD with samples	CTDBOT	Bottom		69	69_1	28,134	59,39	37,123	-24791	95,22	0,31	-1	27	9,7648	91
17/12/2019	09:23:26	17,68539	-63,47823	CTD with samples	CTDBOT	End		69	69_1	28,168	59,452	37,14	-24789	88,52	0,31	1015	25,7	5,6669	86
17/12/2019	09:41:53	17,68627	-63,47587	CTD with samples	CTDBOT	Begin	E-SH20	70	70_1	28,215	59,495	37,134	-24790	77,07	0,3	1015	26,8	11,699	86
17/12/2019	09:46:02	17,68637	-63,47587	CTD with samples	CTDBOT	Bottom		70	70_1	28,197	59,513	37,16	-24788	78,65	0,31	1015	25,5	11,448	131
17/12/2019	09:59:16	17,68615	-63,47556	CTD with samples	CTDBOT	End		70	70_1	28,214	59,537	37,164	-24788	76,28	0,3	1015	25,3	10,411	101
17/12/2019	12:07:17	17,69341	-63,48537	Mooring	MOOR	Recover	SH17	71		28,229	59,582	37,184	-24786	129,1	0,32	1017	25,5	10,038	92
17/12/2019	13:04:37	17,68665	-63,47842	Mooring	MOOR	Recover	SH20	72	72_1	28,215	59,57	37,187	-24786	105,38	0,32	1017	26,2	11,44	121

Date	Heure UTC	Latitude	Longitude	Device name	Device code	Action name	Observation	Station number	Cast	Temperature	Conductivity	Salinity	Density	Depth	Chlorophyll(ug/l)	airpressure	airtemp	windspeed (m/s)	direction
17/12/2019	14:15:40	17,71072	-63,479	HD Video	HD	Begin	SH 16	73	73_1	28,254	59,642	37,207	-24784	89,45	0,33	1017	27,1	11,05	98
17/12/2019	14:18:08	17,71081	-63,479	HD Video	HD	Start Track		73	73_1	28,275	59,643	37,191	-24786	88,9	0,33	1017	27,3	10,889	99
17/12/2019	15:12:28	17,71117	-63,47728	HD Video	HD	End Track		73	73_1	28,304	59,71	37,215	-24784	0	0,34	1016	27,8	14,231	98
17/12/2019	15:17:52	17,71142	-63,47712	HD Video	HD	End		73	73_1	28,319	59,7	37,196	-24785	140,12	0,34	1016	27,8	12,647	98
17/12/2019	15:53:33	17,74468	-63,51991	HD Video	HD	Begin		74	74_1	28,219	59,597	37,202	-24785	120,05	0,36	1016	27,7	12,335	101
17/12/2019	15:56:04	17,74456	-63,5196	HD Video	HD	Start Track		74	74_1	28,251	59,602	37,181	-24786	115,95	0,36	1016	27,8	12,988	103
17/12/2019	16:09:53	17,74402	-63,51649	HD Video	HD	End Track		74	74_1	28,254	59,587	37,167	-24787	96,01	0,36	1015	27,9	13,888	105
17/12/2019	16:15:03	17,74408	-63,51586	HD Video	HD	End		74	74_1	28,24	59,541	37,147	-24789	94,04	0,36	1015	27,8	13,472	102
17/12/2019	16:29:15	17,73678	-63,50194	Multibeam	EM302	Begin		75	75_1	28,282	59,551	37,12	-24791	98,38	0,36	1015	27,7	11,438	58
17/12/2019	16:38:19	17,74559	-63,49323	Multibeam	EM302	End		75	75_1	28,252	59,482	37,096	-24793	88,12	0,36	1015	27,7	12,36	57
17/12/2019	17:14:32	17,74131	-63,49406	HD Video	HD	Begin	Line 2	76	76_1	28,276	59,578	37,144	-24789	141,3	0,37	1015	27,7	12,996	102
17/12/2019	17:20:37	17,74136	-63,49434	HD Video	HD	Start Track		76	76_1	28,307	59,616	37,147	-24789	152,3	0,37	1014	27,7	14,022	100
17/12/2019	17:27:34	17,74179	-63,4926	HD Video	HD	End Track		76	76_1	28,306	59,624	37,152	-24788	92,07	0,37	1014	27,7	13,058	93
17/12/2019	17:31:59	17,74171	-63,49174	HD Video	HD	End		76	76_1	28,332	59,642	37,145	-24789	88,8	0,37	1014	27,6	12,748	102
17/12/2019	17:42:29	17,73914	-63,49331	HD Video	HD	Begin	line 3	77	77_1	28,351	59,664	37,145	-24789	137,36	0,37	1014	27,7	11,74	87
17/12/2019	17:47:55	17,7392	-63,49354	HD Video	HD	Start Track		77	77_1	28,29	59,643	37,179	-24787	150,34	0,38	1014	27,8	11,041	87
17/12/2019	17:57:09	17,73955	-63,49165	HD Video	HD	End Track		77	77_1	28,317	59,659	37,169	-24787	92,46	0,37	1014	27,6	13,601	96
17/12/2019	18:01:36	17,73955	-63,49072	HD Video	HD	End		77	77_1	28,316	59,652	37,165	-24788	0	0,37	1014	27,6	13,979	105
17/12/2019	18:14:30	17,732	-63,49346	HD Video	HD	Begin	line 4	78	78_1	28,319	59,716	37,208	-24784	113,35	0,37	1014	27,8	13,746	95
17/12/2019	18:17:08	17,73209	-63,49332	HD Video	HD	Start Track		78	78_1	28,321	59,689	37,187	-24786	110,2	0,38	1014	27,8	13,374	93
17/12/2019	18:30:54	17,7323	-63,49046	HD Video	HD	End Track		78	78_1	28,333	59,673	37,166	-24787	87,33	0,38	1014	27,7	12,384	96
17/12/2019	18:33:09	17,73226	-63,48988	HD Video	HD	End		78	78_1	28,333	59,69	37,178	-24787	0	0,38	1014	27,7	12,79	109
17/12/2019	18:45:16	17,72761	-63,48715	HD Video	HD	Begin	Line 5	79	79_1	28,321	59,72	37,208	-24784	96,8	0,38	1014	27,7	13,671	96
17/12/2019	18:53:50	17,72831	-63,48593	HD Video	HD	Start Track		79	79_1	28,332	59,688	37,178	-24787	89,7	0,39	1014	27,7	12,946	86
17/12/2019	19:00:49	17,72905	-63,48438	HD Video	HD	End Track		79	79_1	28,309	59,698	37,202	-24785	153,87	0,39	1014	27,8	12,725	85
17/12/2019	19:02:09	17,72933	-63,48397	HD Video	HD	End		79	79_1	28,309	59,693	37,199	-24785	197,38	0,39	1014	27,8	11,212	83

4.2. CTD casts with water bottles from which samples were taken

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
1	1	PE465_S01C01	08.12.2019	02:25	-	17,521	-63,030	550	-	1	5	x			x						
1	1	PE465_S01C01	08.12.2019	02:25	-	17,521	-63,030	550	-	2	5				x						
1	1	PE465_S01C01	08.12.2019	02:25	-	17,521	-63,030	550	-	3	5				x						
2	1	PE465_S02C01	08.12.2019	03:03	-	17,535	-63,061	754	-	1	5,5	x			x						
2	1	PE465_S02C01	08.12.2019	03:03	-	17,535	-63,061	754	-	2	5,5	x			x						
3	1	PE465_S03C01	08.12.2019	04:00	-	17,548	-63,084	840	-	1	5	x			x						
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	1	120	x			x						
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	2	120	x	x	x		x					
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	3	90	x			x						
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	4	91	x	x	x							
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	5	72	x			x						
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	6	72	x	x	x							
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	7	42	x			x						
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	8	42	x									
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	9	5	x			x						
17	2	PE465_S17C02	10.12.2019	12:15	17	17,692	-63,486	126	-	10	5	x	x	x							
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	1	105	x			x						
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	1	105	x	x	x		x					
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	3	80	x			x						
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	4	80	x	x	x							
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	5	68	x			x						
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	6	68	x	x	x							
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	7	45	x			x						
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	8	45	x									
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	9	20	x			x						
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	10	20	x									
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	11	5	x			x						
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	12	5	x									
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	13	5	x									
18	1	PE465_S18C01	10.12.2019	13:13	18	17,690	-63,477	110	-	14	5	x	x	x							
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	1	484	x			x			x			
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	2	484	x	x	x		x					
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	3	350	x			x						
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	4	350	x									
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	5	200	x			x						
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	6	200	x									
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	7	120	x			x			x			
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	8	120	x									
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	9	74	x			x			x			

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	10	74	x	x	x							
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	11	52	x			x			x			
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	12	52	x									
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	13	20	x			x						
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	14	20	x									
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	15	5	x			x			x			
23	1	PE465_S23C01	11.12.2019	11:55	deep	17,674	-63,503	493	7	16	5	x	x	x							
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	1	78	x			x						
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	2	78	x	x	x		x					
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	3	50	x			x						
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	4	50	x									
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	5	20	x			x						
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	6	20	x									
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	7	5	x			x						
24	1	PE465_S24C01	11.12.2019	17:40	17-20	17,689	-63,483	81	3	8	5	x	x	x							
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	1	117	x			x						
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	2	117	x	x	x		x					
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	3	80	x									
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	4	80	x	x	x							
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	5	48	x			x						
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	6	48	x									
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	7	5	x			x						
26	1	PE465_S26C01	11.12.2019	20:00	17	17,691	-63,487	120	2	8	5	x	x	x							
27	1	PE465_S27C01	11.12.2019	20:55	20	17,685	-63,478	110	7	1	102	x			x						
27	1	PE465_S27C01	11.12.2019	20:55	20	17,685	-63,478	110	7	2	102	x	x	x		x					
27	1	PE465_S27C01	11.12.2019	20:55	20	17,685	-63,478	110	7	3	80	x									
27	1	PE465_S27C01	11.12.2019	20:55	20	17,685	-63,478	110	7	4	80	x	x	x							
27	1	PE465_S27C01	11.12.2019	20:55	20	17,685	-63,478	110	7	5	5	x									
27	1	PE465_S27C01	11.12.2019	20:55	20	17,685	-63,478	110	7	6	5	x	x	x							
29	1	PE465_S29C01	12.12.2019	08:30	17	17,691	-63,487	120	4	1	116				x						
29	1	PE465_S29C01	12.12.2019	08:30	17	17,691	-63,487	120	4	2	116	x	x	x		x					
29	1	PE465_S29C01	12.12.2019	08:30	17	17,691	-63,487	120	4	3	80										
29	1	PE465_S29C01	12.12.2019	08:30	17	17,691	-63,487	120	4	4	80	x	x	x							
29	1	PE465_S29C01	12.12.2019	08:30	17	17,691	-63,487	120	4	5	5										
29	1	PE465_S29C01	12.12.2019	08:30	17	17,691	-63,487	120	4	6	5	x	x	x							
30	1	PE465_S30C01	12.12.2019	09:15	20	17,685	-63,478	108	-	1	102				x						
30	1	PE465_S30C01	12.12.2019	09:15	20	17,685	-63,478	108	-	2	102	x	x	x		x					
30	1	PE465_S30C01	12.12.2019	09:15	20	17,685	-63,478	108	-	3	80										
30	1	PE465_S30C01	12.12.2019	09:15	20	17,685	-63,478	108	-	4	80	x	x	x							
30	1	PE465_S30C01	12.12.2019	09:15	20	17,685	-63,478	108	-	5	5										

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
30	1	PE465_S30C01	12.12.2019	09:15	20	17,685	-63,478	108	-	6	5	x	x	x							
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	1	289	x			x			X			
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	2	289	x	x	x		x					
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	3	224	x			x			X			
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	4	224	x									
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	5	198	x			x			X			
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	6	198	x									
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	7	175	x			x			X			
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	8	175	x	x	x							
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	9	99,8	x			x			X			
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	10	99,8	x									
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	11	74,6	x			x						
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	12	74,6	x									
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	13	52,4	x			x						
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	14	52,4	x									
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	15	5	x			x			X			
31	1	PE465_S031C01	12.12.2019	12:41	3	17,746	-63,498	311	-	16	5	x	x	x							
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	1	261	x			x						
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	2	261	x	x	x		x					
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	3	150	x			x						
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	4	150	x	x	x							
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	5	90	x			x						
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	6	90	x									
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	7	70	x			x						
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	8	70	x	x	x							
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	9	55	x			x						
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	10	55	x									
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	11	4,8	x			x						
32	1	PE465_S32C01	12.12.2019	14:20	8	17, 7467	-63,499	272	-	12	4,8	x									
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	1	180	x			x						
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	2	180	x	x	x		x					
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	3	79,5	x			x						
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	4	79,5	x									
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	5	67,9	x			x						
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	6	67,9	x	x	x							
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	7	55	x			x						
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	8	55	x									
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	9	4,5	x			x						
33	1	PE465_S33C01	12.12.2019	15:30	2	17,741	-63,514	225	-	10	4,5	x	x	x							
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	1	269,3	x			x						

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	2	269,3	x	x	x		x					
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	3	255,5	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	4	255,5	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	5	235	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	6	235	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	7	270,4	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	8	270,4	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	9	270,4	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	10	270,4	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	11	210,8	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	12	210,8	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	13	195	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	14	195	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	15	180	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	16	180	x	x	x							
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	17	118	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	18	118	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	19	65	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	20	65	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	21	53,8	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	22	53,8	x									
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	23	5	x			x						
34	1	PE465_S34C01	12.12.2019	17:05	3	17,744	-63,502	280	-	24	5	x	x	x							
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	1	590	x			x			x			
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	2	590	x	x	x		x					
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	3	400	x			x						
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	4	400	x									
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	5	250	x			x						
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	6	250	x									
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	7	100	x			x			x			
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	8	100	x									
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	9	60,2	x			x						
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	10	60,2	x	x	x							
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	11	50	x			x						
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	12	50	x									
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	13	4,4	x			x			x			
38	1	PE465_S38C01	13.12.2019	12:10	deep	17,700	-63,434	597	-	14	4,4	x	x	x							
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	1	230	x			x						
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	2	230	x	x	x		x					
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	3	160	x			x						

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	4	160	x									
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	5	100	x			x						
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	6	100	x									
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	7	80	x			x						
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	8	80	x	x	x							
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	9	70	x			x						
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	10	70	x									
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	11	60	x			x						
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	12	60	x	x	x							
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	13	60						x				
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	14	44,5	x									
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	15	44,5	x			x						
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	16	5,3	x	x	x							
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	17	5,3	x			x						
39	1	PE465_S39C01	13.12.2019	13:49	9	17,700	-63,433	242	-	18	5,3	x					x				
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	1	212	x			x						
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	2	212	x	x	x		x					
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	3	168,8	x			x						
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	4	168,8	x									
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	5	155	x			x						
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	6	155	x									
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	7	125	x			x						
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	8	125	x									
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	9	100	x			x						
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	10	100	x									
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	11	70	x			x						
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	12	70	x	x	x							
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	13	70						x				
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	14	49,5	x									
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	15	49,5	x			x						
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	16	4,3	x	x	x							
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	17	4,3	x									
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	18	4,3						x				
42	1	PE465_S42C01	14.12.2019	12:17	10	17,729	-63,483	230	-	19	4,3	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	1	290	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	2	290	x	x	x		x					
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	3	260,8	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	4	260,8	x									
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	5	250	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	6	250	x									

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	7	199	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	8	199	x									
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	9	150,3	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	10	150,3	x									
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	11	100,4	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	12	100,4	x									
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	13	70	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	14	70	x	x	x							
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	15	55	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	16	55	x									
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	17	19	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	18	19	x									
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	19	5	x			x						
43	1	PE465_S43C01	14.12.2019	13:36	near 14	17,727	-63,498	302	-	20	5	x	x	x							
52	1	PE465_S52C01	15.12.2019	20:03	20-west	17,686	-63,481	86	-	1	78	x		x	x						
52	1	PE465_S52C01	15.12.2019	20:03	20-west	17,686	-63,481	86	-	2	78		x	x		x					
52	1	PE465_S52C01	15.12.2019	20:03	20-west	17,686	-63,481	86	-	3	78			x							
53	1	PE465_S53C01	15.12.2019	20:32	20-centre	17,686	-63,479	111	-	1	105	x		x	x						
53	1	PE465_S53C01	15.12.2019	20:32	20-centre	17,686	-63,479	111	-	2	105		x	x		x					
53	1	PE465_S53C01	15.12.2019	20:32	20-centre	17,686	-63,479	111	-	3	105			x							
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	1	72	x			x						
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	2	72	x	x	x		x					
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	3	72										
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	4	72										
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	5	50										
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	6	50						x				
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	7	50	x			x						
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	8	50	x									
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	9	4	x			x						
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	10	4		x	x							
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	23	4						x				
54	1	PE465_S54C01	15.12.2019	21:03	20-east	17,686	-63,476	77	-	24	4	x									
56	1	PE465_S56C01	16.12.2019	08:35	20-west	17,685	-63,480	87	3	1	85				x						
56	1	PE465_S56C01	16.12.2019	08:35	20-west	17,685	-63,480	87	3	2	85	x	x	x		x					
56	1	PE465_S56C01	16.12.2019	08:35	20-west	17,685	-63,480	87	3	3	85			x							
56	1	PE465_S56C01	16.12.2019	08:35	20-west	17,685	-63,480	87	3	4	85			x							
57	1	PE465_S57C01	16.12.2019	09:10	20-centre	17,689	-63,478	101	9	1	98	x			?						
57	1	PE465_S57C01	16.12.2019	09:10	20-centre	17,689	-63,478	101	9	2	98		x	x		x					
57	1	PE465_S57C01	16.12.2019	09:10	20-centre	17,689	-63,478	101	9	3	98			x							
57	1	PE465_S57C01	16.12.2019	09:10	20-centre	17,689	-63,478	101	9	4	98			x							

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	1	76	x			x						
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	2	76	?	x	x		x					
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	3	76			x							
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	4	76			x							
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	5	67	x			x						
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	6	67										
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	7	67										
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	8	67						x				
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	9	5	x									
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	10	5	?	x	x							
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	11	5				x						
58	1	PE465_S58C01	16.12.2019	09:40	20-east	17,686	-63,475	76	-	12	5						x				
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	1	298	x			x				x	x	
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	2	298	x			x				x		
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	3	298	x	x	x		x			x		x
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	4	275	x			x			x	x		
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	5	275	x			x			x	x		
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	6	275	x	x	x		x			x		
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	7	250	x			x				x	x	
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	8	250	x			x				x		
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	9	250	x	x	x		x			x		x
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	10	237	x			x				x		
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	11	237	x			x				x		
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	12	237	x									
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	13	221	x			x					x	
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	14	221	x			x						
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	15	221	x	x	x		x					x
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	16	201	x			x						
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	17	201	x			x						
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	18	201	x									
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	19	180	x			x			x			
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	20	180	x	x	x		x					
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	21	55	x			x						
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	22	55	x									
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	23	5	x			x			x			
59	1	PE465_S59C01	16.12.2019	12:02	3-4	17,746	-63,499	306	-	24	5	x	x	x		x					
60	1	PE465_S60C01	16.12.2019	13:58	3	17,741	-63,498	195				no water sample									
61	1	PE465_S61C01	16.12.2019	14:19	8	17,741	-63,498	245													
61						17,741	-63,498	210													
65	1	PE465_S65C01	16.12.2019	20:06	20-west	17,686	-63,481	85	-	1	80	x			x						

Station	Cast	CTD file name	Date	Time	Sinkhole	Latitude	Longitude	Bottom depth CTD (m)	Altimeter (mab)	NISKIN bottle	Sampling depth (m)	NUTS	Metabolomics	Flowcyto	DIC/Alkalinity	POM	Chl. a	O2	TP/TN	14C (DIC)	14C (POC)
65	1	PE465_S65C01	16.12.2019	20:06	20-west	17,686	-63,481	85	-	2	80		x	x		x					
65	1	PE465_S65C01	16.12.2019	20:06	20-west	17,686	-63,481	85	-	3	80			x							
65	1	PE465_S65C01	16.12.2019	20:06	20-west	17,686	-63,481	85	-	4	80			x							
66	1	PE465_S066C01	16.12.2019	20:40	20-center	17,686	-63,479	105	-	1	101	x			x						
66	1	PE465_S066C01	16.12.2019	20:40	20-center	17,686	-63,479	105	-	2	101		x	x		x					
66	1	PE465_S066C01	16.12.2019	20:40	20-center	17,686	-63,479	105	-	3	101			x							
66	1	PE465_S066C01	16.12.2019	20:40	20-center	17,686	-63,479	105	-	4	101			x							
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	1	72	x			x						
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	2	72		x	x		x					
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	3	72			x							
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	4	72			x							
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	5	52,8										
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	6	52,8						x				
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	7	52,8	x			x						
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	8	52,8										
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	15	5		x	x			x				
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	16	5										
67	1	PE465_S067C01	16.12.2019	21:10	20-east	17,686	-63,476	76	-	17	5	x			x						
68	1	PE465_S068C01	17.12.2019	08:36	20-west	17,686	-63,481	85	3	1	82				x						
68	1	PE465_S068C01	17.12.2019	08:36	20-west	17,686	-63,481	85	3	2	82	x	x	x		x					
68	1	PE465_S068C01	17.12.2019	08:36	20-west	17,686	-63,481	85	3	3	82			x							
68	1	PE465_S068C01	17.12.2019	08:36	20-west	17,686	-63,481	85	3	4	82			x							
69	1	PE465_S069C01	17.12.2019	09:05	20-center	17,685	-63,478	106	-	1	96	x			x						
69	1	PE465_S069C01	17.12.2019	09:05	20-center	17,685	-63,478	106	-	2	96		x	x		x					
69	1	PE465_S069C01	17.12.2019	09:05	20-center	17,685	-63,478	106	-	3	96			x							
69	1	PE465_S069C01	17.12.2019	09:05	20-center	17,685	-63,478	106	-	4	96			x							
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	1	74	x			x						
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	2	74		x	x		x					
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	3	74			x							
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	4	74			x							
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	5	60	x									
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	6	60										
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	7	60				x						
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	8	60						x				
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	9	5				x						
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	10	5	x	x	x							
70	1	PE465_S070C01	17.12.2019	09:40	20-east	17,686	-63,475	77	3	11	5						x				