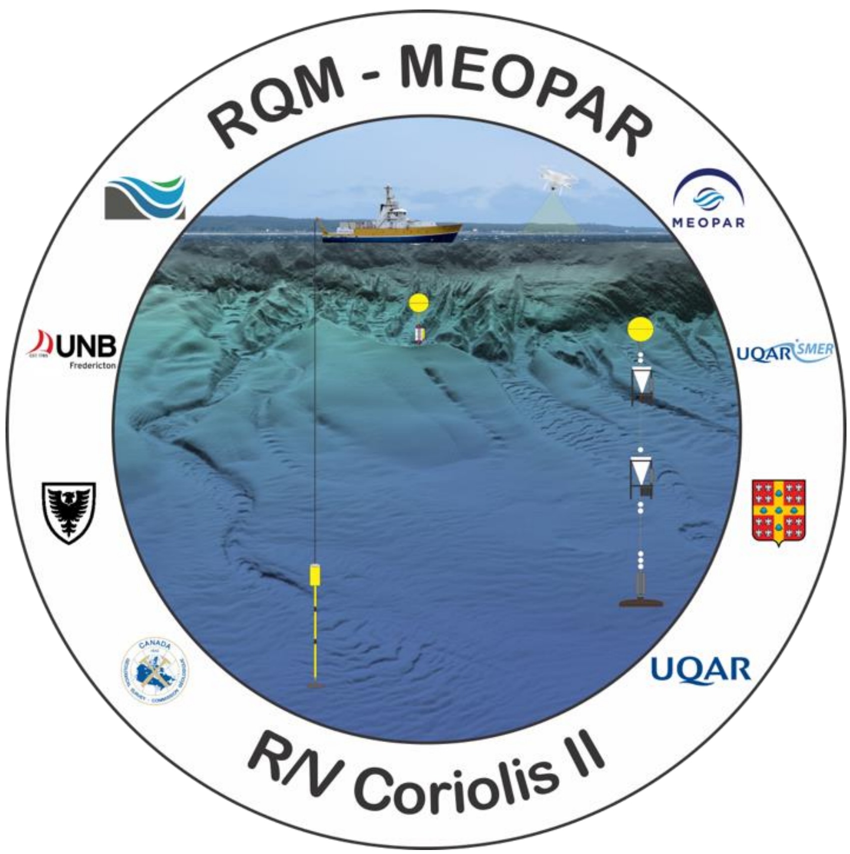
R/V Coriolis II expedition RQM-MEOPAR – COR2001: Monitoring natural hazards during coastal to offshore sediment remobilization and its impacts on primary production dynamics in the Lower St. Lawrence Estuary

July 5-15, 2020



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Publications in this series have not been edited; they are released as submitted by the author.

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ACKNOWLEDGMENTS

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1. BACKGROUND AND OBJECTIVES

Submarine canyons and channels serve as conduits for episodic turbidity currents that transport large volumes of carbon- and nutrient-rich terrigenous sediment to the seafloor. These currents and other hydrodynamic processes lead to mixing within the water column which favors primary and secondary productivity in many places. In eastern Canada, the Lower St. Lawrence Estuary (LSLE) bathymetry is bounded by steep slopes (often ≥5°) which allowed inner-shelf submarine canyons and channels to form during the Late Quaternary. Sediments flowing through these canyons and channels mainly originate from rivers, longshore drift, and remobilization of shelf and slope sediments. However, triggers of turbidity currents in the LSLE remain poorly understood due to few direct measurements and even fewer long-term (> 50 years) recurrence documentation. Likewise, while the offshore waters of the Québec North Shore are important in terms of primary production and biomass accumulation, important seedbeds of *Alexandrium catenella* (formerly *Alexandrium tamarense*; 300 to 600 cysts/cm^3) have been localized in the shallow sediment from Manicouagan/aux-Outardes Rivers to Pointe-des-Monts. Nevertheless, the role and connectivity between the spatio-temporal changes in sediment remobilization from nearshore to offshore, currents within LSLE canyons and channels and surface productivity has never been investigated.

In this context, we developed a network of researchers (including scientists from the fields of marine geology, geochemistry, micro-paleontology, geography, literary creation and ethics) from universities and the federal government. Together, we will test the hypothesis that sediment remobilization events and hydrodynamic processes within canyons and channels play important roles in the regional primary productivity by: 1) influencing the pathways and rate by which nutrients and sediment are delivered to the water column, and 2) facilitating the resuspension and dispersal of algal benthic resting stages, thereby potentially playing a role in the initiation of algal blooms, including those associated with harmful species. We also postulate that the coastal populations in LSLE are not fully aware of the existence of such a dynamic underwater environment and the roles it may play on what is manifested at the surface (e.g., regular sightings of marine mammals).

Based on a transdisciplinary approach, the purpose of this RQM-MEOPAR funded expedition is to carry out CTD-rosette measurements, hydroacoustic surveys (high-resolution multibeam bathymetry and sub-bottom profiles), sediment coring operations, plankton net sampling and collect geopoetics and literary material to 1) investigate long term hydrodynamic processes and natural hazards during coastal to offshore sediment remobilization and its impact on primary productivity dynamics in the LSLE and 2) explore the heuristic process of scientific and artistic knowledge, and expand both by a creative common shared experience and reflection.

The scientific cruise took place on board the R/V Coriolis II, a research vessel owned by Reformar and able to accommodate 28 people. For the COR2001 cruise, only 6 scientists and 9 crew members were able to participate because of the COVID-19 pandemic.

2. Participants

Scientific participants of the *COR2001* cruise consisted of three Université du Québec à Rimouski (UQAR) researchers, one University of New Brunswick (UNB) researcher, and one shore-based scientist from the Geological Survey of Canada (GSC) (Table 1, Fig. 1).

Table 1: Scientific participants of the 2019Nuliajuk cruise

Name	Organization	Role
Jean-Carlos Montero-Serrano	Professor, UQAR-ISMER	Co-chief Scientist. Responsible of coring operations
Audrey Limoges	Professor, UNB	Co-chief Scientist. Responsible of plankton net sampling and core processing
Anne Corminboeuf	M.Sc., UQAR-ISMER	Core processing, plankton net sampling, and co-responsible of the cruise report
Tina Laphengphratheng	M.A., UQAR	Core processing, plankton net sampling, and co-responsible of the cruise report
Alex Normandeau	GSC	Shore-based scientist

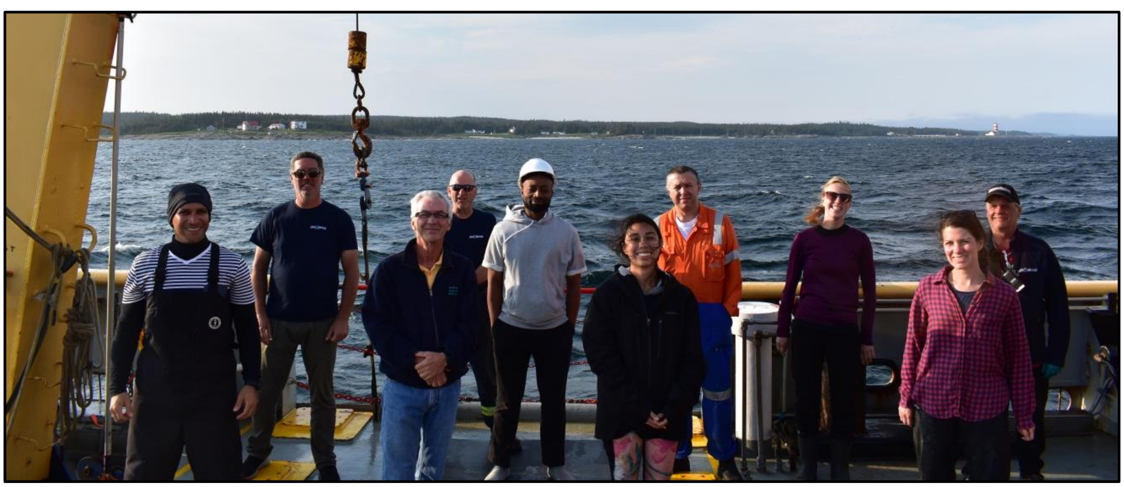

Figure 1: Participants of the COR2001 cruise. From left to right: Michel Miron, Gilles Desmeules, Victor Garvey, Anne Corminboeuf, Dominic Ndeh Munang, Gilles Pelletier, Jean-Carlos Montero-Serrano, Robert Bélanger, Tina Laphengphratheng, and Audrey Limoges.

3. SUMMARY OF ACTIVITIES

The COR2001 RQM-MEOPAR cruise, called 2020CORIOLIS for the purpose of GSC archiving, started in Rimouski. During the mobilization, the following equipment and lab spaces were installed and organized: the CTD-Rosette, the core processing laboratory, the giant gravity corer and the acquisition room. When the mobilization ended, the ship immediately left the port with the afternoon tide to reach the first station and start its sampling.

The cruise was separated into 6 areas of priority (Fig. 2): Pointe-des-Monts, Godbout and Baie-Comeau (high priority), Franquelin and Manicouagan (secondary priority) and Betsiamites (tertiary priority). Those areas were sampled during daytime, while every hydroacoustic survey lines were performed at night. The COVID-19 pandemic could not allow full personnel capacity; hence the normal sampling schedule was from 7h00 to 19h00 for the main sampling (CTD, plankton nets and sediment coring).

Sampling consisted of CTD profiles, plankton nets and coring (gravity coring, box coring and grab sampling). Material for the literary part of the project was created along with other samplings (i.e. photos, thoughts, poems). Every plankton and sediment samples were stored until demobilization, which took place in Rimouski. In total, 45 stations where sampled with 31 CTD profiles, 25 plankton nets, 15 Van Veen grabs, 28 box cores, 6 gravity cores, 11 giant gravity cores, 50 fragments of thoughs, 90 geopoetic fragments and 1000 km of hydroacoustic data.

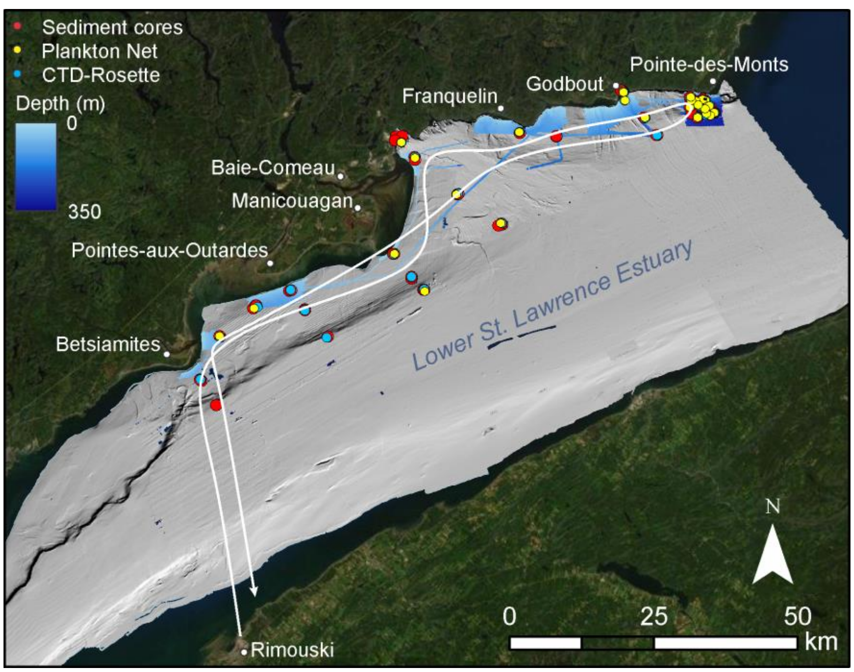

Figure 2: Summary of activities during COR2001. Blue shaded areas are multibeam surveys completed during COR2001 and dots are all the samples collected.

Table 2: Summary of activities. During the mission 4 BC, 15 GC and 6 GGC did not work due to the sandy nature of the seabed. Note that these failed operations are not reported in the table.

Date	JD	Location	VV	GGC	GC	BC	CTD	PN	3.5 kHz	MBES	Notes
July 5	187	Betsiamites							x	x	Mobilization
July 6	188	Betsiamites		1	1	2	1	1	x	x	
July 6	188	Pointe-aux-Outardes					1	1	x	x	
July 7	189	Pointe-aux-Outardes		1	1				x	x	
July 7	189	Manicouagan		1	2	2	2	2	x	x	
July 8	190	Manicouagan	2	1	1	1	2	2	x	x	
July 8	190	Franquelin				1	1	1	x	x	
July 9	191	Pointe-des-Monts	5			1	3	3	x	x	
July 10	192	Pointes-des-Monts		2		5	4	4	x	x	
July 11	193	Pointes-des-Monts	1			6	6	6	x	x	
July 12	194	Godbout	3	1		1	4	3	x	x	
July 13	195	Manicouagan	2	1		3	3	2	x	x	
July 13	195	Franquelin		1	1	1			x	x	
July 14	196	Pointe-aux-Outardes	1	1		3	2		x	x	
July 14	196	Betsiamites	1	1		2	2		x	x	
July 15	197	Rimouski									Demobilisation
TOTAL			15	11	6	28	31	25			

4. Preliminary Results

4.1 Cruise statistics

45 stations were sampled during the cruise for a total of 105 physical samples and 140 literary fragments

1. 31 CTD profiles,
2. 25 plankton nets,
3. 15 Van Veen grabs,
4. 28 box cores,
5. 6 gravity cores,
6. 11 giant gravity cores,
7. 1000 km of multibeam bathymetry data
8. 50 fragments of thoughts,
9. 90 geopoetic fragments

4.2 Key preliminary results

High-resolution seafloor mapping in all the areas surveyed revealed the presence of bedforms that suggest modern active sediment transport. Three examples of preliminary results are provided below, illustrating the dynamic nature of the nearshore environment of the Lower St. Lawrence Estuary.

4.2.1 Betsiamites

Offshore the Betsiamites River, seafloor mapping completed in 2005 by the Canadian Hydrographic Service hinted at the presence of bedforms on the delta slopes. These bedforms were mapped at a higher resolution during this COR2001 cruise. A comparison of the 2005 to the 2020 datasets, a 15-year difference, shows that offshore sediment remobilization has occurred (Fig. 3). A slope failure occurred on the slope, evidenced by up to 3 m of erosion on the slope. This dataset clearly shows that slopes failures and sediment density flows occur in the nearshore environment of the Québec North Shore.

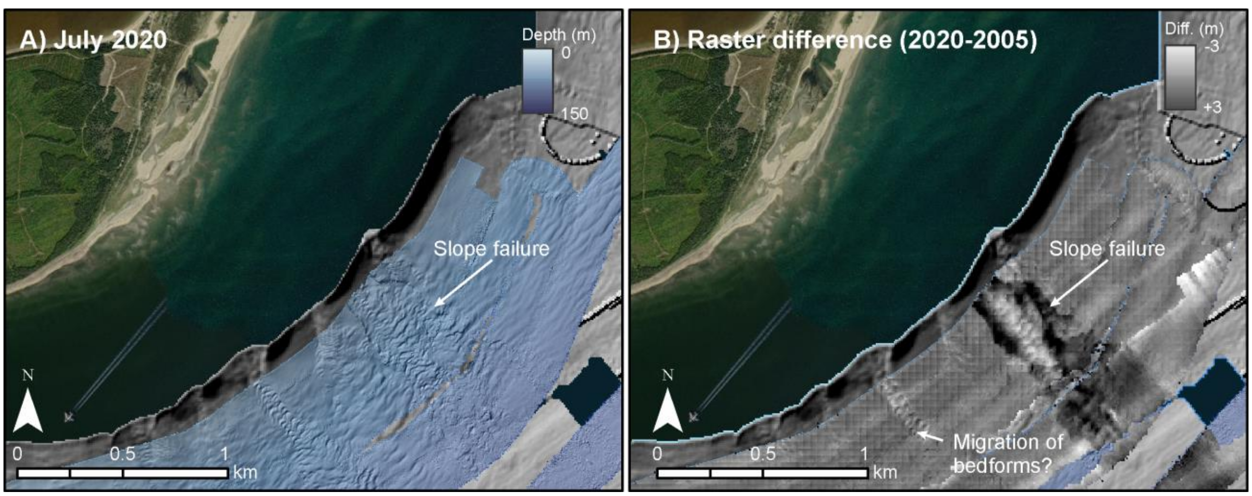

Figure 3: Recent (post 2005) slope failure on the Betsiamites delta, evidencing recent sediment remobilization offshore. A) 2020 multibeam bathymetry; B) Difference in bathymetry between 2005 and 2020.

4.2.2 Franquelin

Offshore the Franquelin River, a large slope failure was imaged in greater detail. Within the head of this large slope failure, seafloor bedforms are imaged, suggesting that sediment density flows occur at the mouth of the delta. These bedforms remain limited to the nearshore environment and do not appear to extend downslope to the Laurentian Channel. A small littoral cell also transports sediment eastward where the shelf narrows and sediment overspill on the slope, creating another field of seafloor bedforms (Fig. 4).

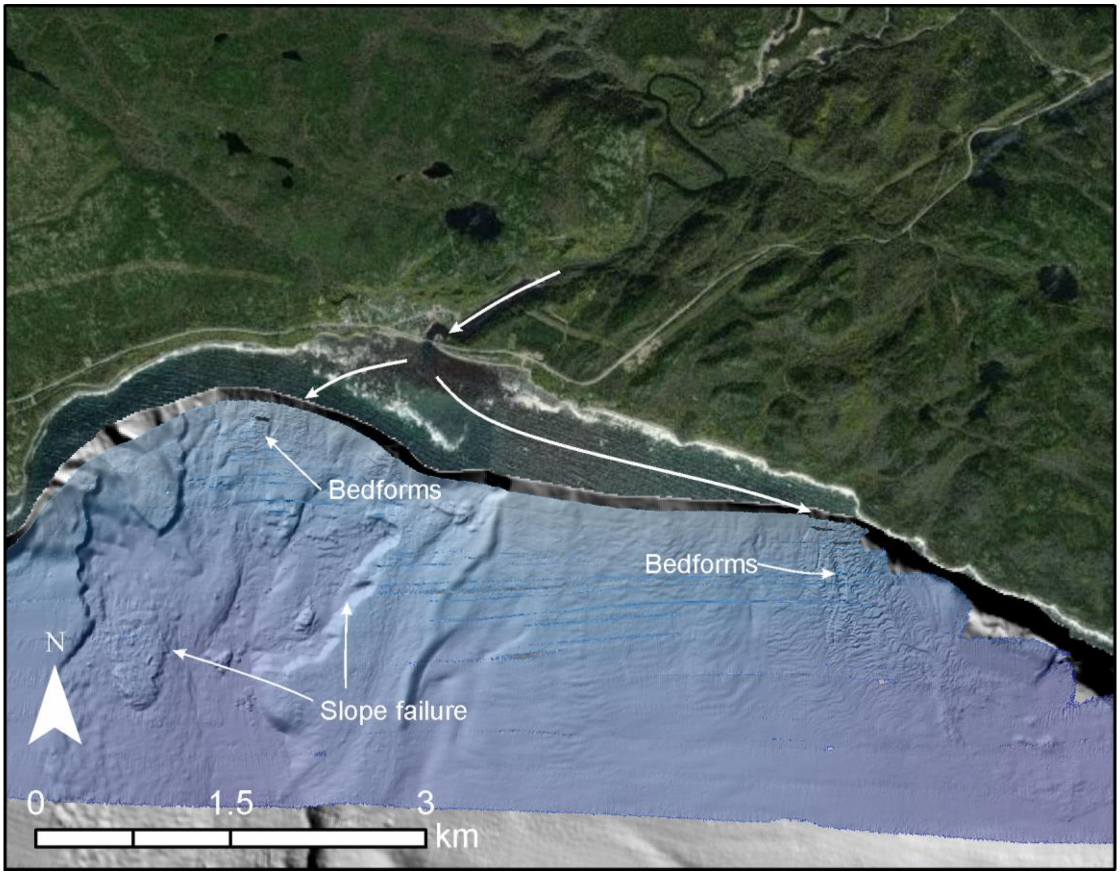

Figure 4: Evidence of slope failure and offshore sediment transport in the Franquelin area. Bedforms suggest sediment density flows occur at the mouth of the river and at the end of a small littoral cell to the east.

4.2.3 Pointe-des-Monts

Offshore Pointe-des-Monts, submarine canyons are known to be active, through the passage of sediment density flows. The comparison of multibeam bathymetry collected in 2019 and 2020 reveals that turbidity currents have occurred in the past year. In addition, a box core collected on the submarine fan shows the presence of a sand layer, interpreted as a turbidite (Fig. 5). Examination of the Plankton Net and CTD-R will help understand the role these events play on primary productivity.

Figure 5: Evidence of a 'recent' turbidite in box core 08, in Pointe-des-Monts.

5. DAILY NARRATIVE

*All date/time in Eastern Standard Time.

5.1 JD187 – July 5, 2020 – Rimouski

Every scientific member was onboard before 7h00. The familiarization tour was performed at 8h00 and the R/V Coriolis II departed the marina of Rimouski at 13h30 (scheduled departure time was 15h00) heading towards Betsiamites. After departure, the deck crew verified the main winch to conclude that it was not functional. They tried to fix it, but when we arrived on site 37 at 15h00, the winch was not ready for use. Instead of sampling, the SVP measurements and patch tests for the multibeam sonars were performed from 18h30 to 19h00 in the Betsiamites area. At 19h30, when the crew left the deck, the main winch was still not functional. We decided to wait until the next day to try to fix it before taking another decision.

5.2 JD188 – July 6, 2020 – Betsiamites

During the night, bathymetric survey lines were performed in the Betsiamites area. Crew members converted the 3-ton winch on the upper deck and used it instead of the 5-ton winch. Sampling at station 35 was performed from 9h34 to 17h15 in this order: CTD cast, plankton net, box core, gravity core and giant gravity core, which will be the usual sampling line-up for the cruise. At 15h05, another problem occurred: the counting pulley maintaining the cable to the winch dropped when the gravity core hit the bottom. It does not appear to have affected the coring since the core recovered was 1.65m long. The ship did a short transit to reach station 34 which was sampled from 18h36 to 19h35 with a CTD cast, a plankton net and a box core. For the first deployment of every equipment, it took longer than expected as everyone was still developing a routine and locating required material.

5.3 JD189 – July 7, 2020 – Pointes-aux-Outardes

During the night, bathymetric survey lines were performed in the Pointe-aux-Outardes area (partially completed). We finished sampling station 34 with a gravity core at 8h34. It took a long time to get prepared because many screws used for the GGC couplings were either stripped or dirty, and therefore impossible to use. A special care should be given during the storage process and grease should be applied on those pieces. We also tried the 9 m long giant gravity corer, but it did not perform well (recovered core = 2.05m). Hence, we decided to keep a barrel length of 6 m for the giant gravity core for the next deployment. At 9h18, we transited to station 23M where sampling started at 12h46 and ended at 15h09. During the box core recovery, the box hit the side of the ship, which disturbed the surficial sediments. We then transited to station 24, where sampling was performed from 16h10 to 17h32. We determined that an efficient way to proceed was to deploy the box core and subsample it while the gravity corer is being deployed. This method was successfully used for the 2 stations today.

5.4 JD190 – July 8, 2020 – Manicouagan

During the night, bathymetric survey lines were performed in the Pointe-aux-Outardes area (completed survey of this sector) and Manicouagan area (partially surveyed). At 7h11, we were ready to deploy the CTD at station 28. Sampling continued with a PN at 7h28. Coring at this station was unsuccessful: 05BC, 05GC, 06GC and 07GC failed because of the sandy nature of the substrate. Also, the counting pulley handling the cable from the winch and going to the A-frame dropped twice (8h14 and 8h26). We moved a little further to station 38, where sampling started at 9h23. Cores 08GC and 09GC also failed because of the sandy nature of the substrate. Therefore, for the first time, we deployed the Van Veen Grab at 9h35. At 9h38, we left station 38 for station 40, which was sampled from 9h57 to 10h16. There, 10GC failed, but 11GC was successful with a recovered core of 1.28 m. Then, the ship reached the port of Baie-Comeau where material (liners and caps for gravity corer of 1.5m) arrived from UQAR-ISMER with the morning ferry. At 11h47, the sampling at station 39 started with a Van Veen Grab and ended at 11h32 with a failed 12GC. We then moved to station 27, where sampling started at 12h38 and ended at 13h52 with a failed 13GC. Station 26 was sampled from 14h27 to 14h32 with a successful GGC of 4.55 m length. Finally, sampling at station 22 started at 16h24 and ended at 17h32. Once again, because of the presence of a relatively thick layer of fine sand at the surface, the BC was almost empty (07BCA = 14 cm and 07BCB = 18 cm) and the 05GCC failed.

5.5 JD191 – July 9, 2020 – Pointe-des-Monts

During the night, bathymetric survey lines were performed in the Manicouagan area (completed) and Godbout area (partially surveyed). This morning, from 7h00 to 7h31, we were searching for an alternate station 01 with suitable substrate. At 7h31, the CTD was in the water. At 8h10, we tried a Van Veen Grab to evaluate the substrate. At 8h36, we decided to try a gravity core, but it was unsuccessful, like the next gravity core. At 9h00, we started a short transit towards station 03, where CTD profiling started at 9h41. At 10h00, we had a loss of hydraulic power that took 10 minutes to repair. At 10h11, we were ready for the plankton net. We had another loss of hydraulic power right after the net, at 10h20, and also an oil spill from the winch that took 20 minutes to contain. At 10h57, we were ready for a Van Veen Grab, and then left for the next station at 11h09. At 11h34, we were on station 05 and ready for a CTD, but we had to reposition the ship. The CTD was finally deployed at 11h45. Sampling was performed until 13h43, when a major problem occurred: during the box core lowering, the cable got stuck in the counting pulley (the one providing the speed and depth to the operator). From 13h43 to 14h24, crew members worked to repair the counting pulley. At 14h29, the box core was back on deck, but empty. From 14h30 to 15h12, crew members worked to remove the counting pulley. Therefore, next deployments were performed without indication of the speed and current depth. At 16h01, sampling resumed and led to a successful box core and an unsuccessful giant gravity core. At 17h14, we moved for the final Van Veen Grab at station 05-M-2, which took place from 17h41 to 17h52.

5.6 JD192 – July 10, 2020 – Pointe-des-Monts

During the night, bathymetric survey lines were performed in the Godbout area (partially surveyed). At 7h09, the CTD was ready for deployment at station 05-M, followed by a PN and a BC. We then moved slightly to come back to station 05-M-2 at 9h12. We left at 10h47 for station 07, which was sampled from 12h25 to 14h46. Station 06 was sampled from 15h19 to 16h15, and station 02 was sampled from 16h50 to 17h43. After the last BC, members of the cruise reunited on the deck for a group photo. Today, coring operations had a limited success: the sandy seabed did not allow a good penetration of the corers and sampled cores were smaller than those obtained previously from silt/clay seabeds.

5.7 JD193 – July 11, 2020 – Pointe-des-Monts

During the night, bathymetric survey lines were performed in the Godbout (completed) and Franquelin (partially surveyed) areas. This morning, we sampled station 10. The CTD was in the water at 7h08 and was completed by 7h20, but the data archiving was not activated. We performed a second CTD from 7h26 to 7h38 and the sampling at this station ended at 8h22 with a box core from which only surface sediments were sampled. We then transited to station 9, which was sampled from 8h51 to 9h41. Once again, only surface sediments were taken from the box core. We transited to station 8 where the original station was modified based on sub-bottom data. The CTD was in the water at 10h48, but the data archiving was not activated again. A second CTD was performed from 11h14 to 11h31. At 12h46, we left the station and transited to station 13. During the CTD that started at 13h20, a problem with the cable occurred. The CTD was brought back onboard and deployed again from 13h32 to 13h44. At 14h30, we left station 13 and transited to station 12, where sampling was performed from 15h03 to 15h40. Sampling at station 11 was performed from 16h22 to 16h56, and sampling at station 41 was performed from 17h30 to 17h37 (which consisted of a single box core). Coring operations were better than yesterday since the substrate was fine sand with a higher content of silt/clay

5.8 JD194 – July 12, 2020 – Pointe-des-Monts

During the night, bathymetric survey lines were completed in the Godbout area and the partial survey of the Godbout-C area took slightly longer than usual. Therefore, we were ready to start the sampling at station 16 at 7h48. It was decided to first deploy the CTD, PN and BC at all stations, and then come back to complete with the GC deployments. Stations 16 (7h48 to 8h27), station 18 (9h19 to 9h44, with a failed 21BC), station 20 (11h43 to 12h56, with a failed 22BC), station 42 (13h33 to 13h53) and station 43 (14h09 to 14h17) were sampled first. We then came back to station 20 (14h51 to 14h55, with failed 09GGC and 10GGC). We moved further to station 20-1 (15h52 to 16h13), where 17GC and 18GC failed. We moved again further to station 20-2 (16h41 to 16h46), where 11GGC failed. We finished the day at station 16 (17h36 to 17h44) with a successful 12GGC (4.06m). Again, sampling operation had a limited success due to the layer of fine sand overlying a relatively thick layer of finer sediment, the latter being inferred from sub-bottom profiles. It appears that our equipment cannot go through this layer to reach the silt/clay layer underneath. Many trials were made to find the perfect speed to prevent the corer to lay on the seabed, but it was unsuccessful.

5.9 JD195 – July 13, 2020 – Godbout

During the night, bathymetric survey lines were performed in the Godbout (partially surveyed) and Franquelin (partially surveyed) areas. Station 29 was sampled from 7h12 to 7h53. Sediments in the 23BC were washed out and only the bulk sediments were subsampled. We then transited to station 30 and sampled from 8h33 to 9h15. Station 31 was sampled from 9h58 to 11h44. Station 44 was sampled from 12h56 to 12h58 and only with a GCC, which failed because of the sandy bottom. Finally, after a 2.5-hour transit, station 21 was sampled from 15h32 to 16h58.

5.10 JD196 – July 14, 2020 – Manicouagan

During the night, bathymetric survey lines were performed in the Franquelin area. Station 32 was sampled from 7h06 to 8h23 (failed 20GC and 21GC). Station 33 was sampled from 9h02 to 9h32. A problem occurred with the CTD system: we had to bring back the CTD and start over. Station 45 was sampled from 10h29 to 11h38 (failed 29BC). A marked fluorescence peak, the highest of the cruise, was noted during the CTD profile. Station 33 was sampled from 13h22 to 13h30 with a successful assembled 9m-GGC of 6.20m. Station 37 was sampled from 15h12 to 17h07. Finally, station 36 was sampled from 17h58 to 18h07.We transited toward Rimouski, where we docked with the night tide at 20h00.

5.11 JD197 – July 15, 2020 – Rimouski

Demobilisation was performed between 8h00 and 12h00 in Rimouski dock. All samples collected were transport and stored at 4°C in the cool room of the UQAR-ISMER. End of program.

6. EQUIPMENT AND PROCEDURES

6.1 Edgetech X-Star 2.1 sub-bottom profiler

This sub-bottom profiler allows the acquisition of high-resolution subsurface data (sediment stratigraphy). The echo sounder transmits FM acoustic waves (0.5 to 12 kHz, centered on 4.5 or 6 kHz) with 9 transducers that serve as both transmitters (TX) and receiver (RX). During the cruise, the data from the EdgeTech echosounder were all acquired using the seismic wave (pulse) Hull 2_8_40WB (frequency modulation from 2 to 8 kHz, pulse duration of 40 ms) and a frequency of 3 Hz. The acquisition and visualization of the profiles was done with the version 2.1 of the Edgetech Discover X-Star software. However, the raw JSF data were converted to SegY following a routine conversion. The SegY data were then converted into JP2 format using SegyJp2 software.

6.2 EM-2040 multibeam echosounder

The EM-2040 is a shallow-water multibeam echosounder (MBES) that allows the mapping of the seabed at a maximum depth of ~500 m. A transducer (TX) emits an acoustic wave that is reflected from the seabed and picked up by a receiver (RX). The EM-2040 echosounder operates at a frequency that varies between 200, 300 and 400 kHz depending on the depth and resolution required. It has 400 pings per swath and allows coverage of 5.5 times water depth. During this expedition, a frequency of 300 kHz was used, which allowed mapping the seabed to a maximum depth of 480 m while maintaining a very good resolution. An Applanix POS M/V was positioned near the center of gravity of the ship to record the motion of the vessel and the data were integrated using the multibeam echosounder's acquisition software (SIS). The static and dynamic calibrations (patch tests) were carried out at the beginning of the expedition. The MBES data were processed using the CARIS software during the night watches and gridded surfaces were ready to view in the morning (~7h00). Final surfaces can be gridded at 1 m horizontal resolution.

Table 3: Specifications of the EM2040

Beams	400 (HD Equi-Distant)
Frequency	200kHz - 400kHz (used 300 kHz)
Swath	Greater than four times water depth
Max Swath Angle	120 degrees
Depth Range	10m-500m

In order to georeference MBES data, sound velocity profiles (SVP) were done during the surveys. SVPs are used to correct the ray tracing of the MBES data. The most efficient way to perform sound velocity profiles was to stop the vessel and deploy the profiler with a winch. This operation was performed 3 times during each night of mapping operations: 1) at the beginning, during the day/night shift transition, 2) in the middle of the night, and 3) at the night/day shift transition. This deployment required two persons: 1 hydrographer and 1 deck assistant (winch operator). During this expedition the SVP AML Minos sensor was used. This sensor was lowered in the water column using a weight of approximately 9 kg (20 lbs). It is suggested to use up to 3 shackles available in the BOSEN store during this operation. The assembly to lower the profiler requires a pulley to direct the rope to the aft deck of the vessel. For the deployment, the profiler was attached with a shackle on the rope and lowered at the water level with the winch. The winch counter was reset to 0 and the probe was deployed to 90% of the last observed depth at a speed of ~90 m/min (1.5 m/s). The probe was then brought back up and recovered by the hydrographer. The hydrographer then integrated the SVP profile in the SIS acquisition software to calibrate the MBES data.

6.3 Coring

6.3.1 Van Veen grab sampler (VV).

The VV grab sampler is a rapid and simple method to collect sediment samples at the seabed. When the grab sampler touches bottom, it closes, holding surficial sediments. It can collect up to 0.008 m^3 of sediment. This sampling device was used to verify the nature of the substrate before using the box corer or when the box corer was unsuccessful in collecting sediments. The VV was lowered at an average speed of 50 m/min (0.83 m/s).

6.3.2 Box corer (BC).

The BC collects up to 0.125 m^3 of soft sediments at the seafloor and is suitable for any water depths (limited by winch cable length). It is used for minimum disturbance of the sediment/water interface. The BC was lowered at an average speed of 50 m/min (-0.83 m/s). When the sampler was approximately at 100 m above the seabed, wire payout was slowed to approximately 20-25 m/min (0.33 to 0.42 m/s). On contact with the seafloor, a little extra wire was given to allow box penetration, and the winch was stopped. A few seconds thereafter, the corer was uplifted back at a slow rate, at approximately 10 m/min (0.17 m/s). It is at this time that the spade is levered into the mud and the apparatus is pulled out: thus the wire speed was increased to 50 m/min (0.83 m/s). During the expedition, two push-cores (PVC tubes of 10 cm diameter and ~60 cm length) were taken from each box core with the aid of a vacuum pump to reduce compaction. The sediment/water interface (0-1 cm surface sample) from each box-core location was subsampled into two Whirl-Pak bags for subsequent identification of microfossils (e.g., dinoflagellate cysts and non-pollen palynomorphs, diatoms, etc.) as well as grain size, mineralogical, geochemical, and magnetic analyses. Each push core and surface sediment samples were stored in the refrigerated container (4°C).

6.3.3 Gravity core (GC).

During the expedition, two GC of different lengths (1.5 and 3 m) were deployed. The 3 m GC has a maximum recovery length of ~2.80 m (in a 3 m aluminum barrel), uses a stainless-steel cutting head and penetrates the sediment under a 165 kg weight. The 1.5 m GC has a maximum recovery length of ~1.5 m (in a 1 m galvanized steel barrel), uses a manganese bronze cutting head and penetrates the sediment under 80 kg of weight. In both GC, a check valve was installed at the top end of the corer's main body to allow a water flow through the liner during the descent and to block the water during the ascension. This valve prevents the water from flushing out the collected sample. A core catcher keeps the sediment in the GCs during uplift. Winch speeds (lowering) ranged from 60 to 70 m/min (1 to 1.17 m/s) depending on hypothesized substrate properties. After a tension drop at the point of penetration, about 2-3 m of cable was given to ensure that the weight could allow a full penetration of the corer into the sediment. After penetration into the sediment, the corer was heaved at a speed of 10 m/min (0.17 m/s) until it was free from the bottom. Then the corer was heaved at a speed of 60 m/min (1m/s) on board. Once on deck, the cores were cut into 1.5 m long sections and stored in a cold room at 4°C.

6.3.4 Giant gravity corer (GGC).

The GGC operates with a core head of 817 kg with two or three 3.05 m steel core barrels (91 kg each) connected with steel coupling sleeves attached with set screws, and a steel cutting head. A core catcher helps keep the sediment in the corer when the latter is pulled upward. A valve (rubber butterfly flaps) of 3.5 inches long was installed at the top end of the first 3m liner to allow a water flow through the liners during the descent and blocks water during the ascension. This valve prevents the water from flushing out the collected sample. This coring instrument allows the collection of long cores of up to a maximum length of 6 or 9 m. The GCC was lowered with an average speed of 60 m/min (1 m/s). The corer was lowered at about 80 m, stopped above the seafloor for 1 min and then lowered at a speed of 25-30 m/min (0.4-0.5 m/s) depending on sediment substrate properties determined previously through box coring. After a tension drop at the point of penetration about 10 m of cable slack was given to ensure that the weight allowed full penetration of the corer into the sediment. After penetration into the sediment, the corer was heaved at a speed of 10 m/min (0.17 m/s) until it was free from the sediment. Then the corer was heaved at a speed of 60 m/min (1 m/s) until near the sea surface. Once on deck, the plastic liner was cut into 1.5 m long sections and these sections were stored in a cold room (4°C). Note that the BC collected in conjunction with the GGC allows recovery of the undisturbed sediment-water interfaces, which are usually perturbed when the GGC enters the sediments. Ideally, push cores from box-cores can be correlated visually, chronostratigraphically, or geochemically with GGC from the same site.

6.3.5 Samples and core identification and labelling

The sediment core and phytoplankton samples were labelled using the following numbering system:

COR2001-01BC

COR = Coriolis II

20 = Year 2020

01 = Leg # 1

01 = Station # 1

BC = Corer type (e.g., VV = Van Veen grab, BC = box core, GC= gravity core, GCC = giant gravity core, PN: phytoplankton net, CTD = CTD-Rosette)

AB = Core section if applicable

The 1.5 m subsections of the giant gravity and gravity cores were labelled as per Fig. 6 with “A” identifying the base and section AB corresponding to the lowest, oldest section, followed by BC, CD etc. sequentially. When multiple push cores were taken from a box core, they were labelled using a sequential alphabetical identifier, e.g. 03BC-A, 03BC-B, 03BC-C, etc.

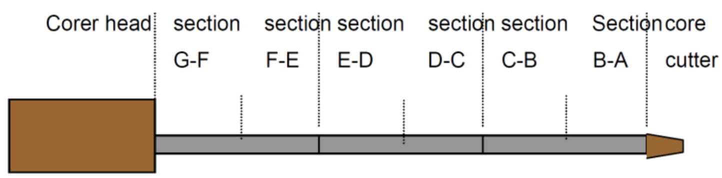

Figure 6: Labelling system for the sections of the gravity cores

The core samples were stored vertically in a refrigerated container on the R/V Coriolis II during Leg 1. Cores, surface sediment and phytoplankton net samples were transported to Rimouski during the demobilization, where they were stored before analyses. A selection of cores (See Appendix A) was also shipped to Geological Survey of Canada (Dartmouth) and one set of twin surface sediment samples was directly transported to UNB for microfossil analyses.

6.4 Plankton Net sampling

Plankton samples were collected with a 30 cm diameter net with a 20 µm mesh size. A heavy lead weight of 10kg was fixed at the base of the cod-end and the net was lowered vertically down to 100m in the water column. After 30 seconds, the net was hauled back at a constant speed of 30 m/min (0.5 m/s). The net was rinsed from top to bottom with seawater from the sampling site, and the inside of the net was rinsed with sea water from the sampling site to ensure that all the organisms were collected. The concentrated samples were transferred into 250 mL plastic jars, preserved with 10 mL of formaldehyde (37%) and stored in a refrigerator (4°C).

6.5 CTD-Rosette

During this expedition the CTD-R was composed of 12 Niskin-type bottles of 12 L with an automatic closing system that normally allows the sampling of seawater at specific depths. A CTD probe, which continuously measures the conductivity, temperature, density, dissolved oxygen, pH, % light transmission and the fluorescence was also attached to the rosette. Note that we did not collect water samples during this expedition. Deployment steps were as follow: 1) Immerse the rosette in the surface (about 5 meters) and turn the pump on; 2) wait 30 seconds for the plumbing system to flush (Check that the probes stabilize); 3) Start archiving (recording) in SeaSave; 4) Descend at 1 meter/second (if possible with a winch) to 10 meters from the bottom; 5) Slow down to 20 meters from the bottom by checking the altimeter to stop at 10 meters from the bottom; 6) If bottom water is required, wait 30 seconds (or wave stabilization) and then close the desired number of bottles; 7) ascend to the requested depths by following the same procedure before closing the bottles (waiting for wave stabilization); 8) Once at the surface and water sampling has been completed, turn the pump off; 9) Stop archiving and close deck unit.

7. CONCLUSIONS

This mission was a success on many levels: water column profiling (CTD), and phytoplankton (PN) and sediment (VV, BC, GC, GGC) sampling were done at every planned station. In addition, it was possible to conduct opportunistic sediment sampling despite being on a reduced team. All the priority areas defined for the bathymetric surveys were completed. Material was also collected for the literary part of the project. Sampling activities were recorded with photos and short videos, about fifty fragments of thoughts and reflections for a potential essay and about ninety ideas for geopoetic fragments and poems were written. The texts for the essay revolve around the similarities and differences between scientific methods and creative methods in literature, which both aim at understanding the world from different perspectives. For the poetic fragments, the ideas take source from a glossary of words about the "nature" and the "sea". A major theme exploited at this early stage of the project is the quest for identity. Here is a fragment quote: « *J'ai froid sous ma peau /mes os frétillent / ma mâchoire serrée /mes muscles pétrifiés / les halos de chaleur se résorbent quand / je les frôle / dans les interstices du vide je / tricote / un nuage / fait bouillir le soleil* ».

APPENDIX A: STATION SUMMARY

Table A1: Summary of core stations

Station number	COR2001 ID	GSC ID	Date (d/m/y)	Location	Time (24h, ET)	Latitude	Longitude	Water depth (m)	Length (cm)	Comments
35	01BC		06/07/20	Betsiamites	13h15	48.9453	-68.5521	105	A=46.5	~5cm compression +2 surface samples
35	01GC		06/07/20	Betsiamites	15h02	48.9453	-68.5527	105	AB=150 BC=46.5	
35	01GGC	0001	06/07/20	Betsiamites	17h04	48.9462	-68.5537	106	A˚B˚=24 AB=153 BC=154 CD=155 DE=16	A˚B˚ = cutter + bag
34	02BC	0002	06/07/20	Betsiamites	19h25	48.9892	-68.4734	125	A=53.5 B=54.5	+2 surface samples
34	02GC		07/07/20	Betsiamites	8h23	48.9939	-68.4679	116	AB=149 BC=77	
34	02GGC	0003	07/07/20	Betsiamites	9h07	48.9935	-68.4662	117	AB=150 BC=55	
23M	03BC		07/07/20	Baie-Comeau	13h27	49.1163	-67.8794	203	A=50.5 B=52	+2 surface samples
23M	03GC		07/07/20	Baie-Comeau	14h13	49.1178	-67.8819	202	AB=150 BC=75	
23M	03GGC		07/07/20	Baie-Comeau	14h57	49.1146	-67.8878	201	A˚B˚=24 AB=149.5 BC=149	A˚B˚ = cutter + bag
24	04BC		07/07/20	Baie-Comeau	16h49	49.1644	-67.9844	139	A=48 B=52	+2 surface samples
24	04GC		07/07/20	Baie-Comeau	17h24	49.1653	-67.9825	140	AB=150 BC=33.5	
28	05BC		08/07/20	Baie-Comeau	7h46	49.2470	-68.1187	51		Failed
28	05GC		08/07/20	Baie-Comeau	8h13	49.2465	-68.1191	48		Failed
28	06GC		08/07/20	Baie-Comeau	8h25	49.2463	-68.1194	47		Failed
28	07GC		08/07/20	Baie-Comeau	8h43	49.2466	-68.1203	46		Failed
38	08GC		08/07/20	Baie-Comeau	9h24	49.2558	-68.1303	21		Failed
38	09GC		08/07/20	Baie-Comeau	9h26	49.2560	-68.1304	21		Failed
38	01VV		08/07/20	Baie-Comeau	9h36	49.2561	-68.1297	31		Bulk sample
40	10GC		08/07/20	Baie-Comeau	9h59	49.2566	-68.1152	75		Failed
40	11GC		08/07/20	Baie-Comeau	10h15	49.2563	-68.1144	76	AB=128	
39	02VV		08/07/20	Baie-Comeau	11h18	49.2500	-68.1319	12		Bulk sample
39	12GC		08/07/20	Baie-Comeau	11h31	49.2498	-68.1317	11		Failed
27	06BC		08/07/20	Baie-Comeau	13h22	49.2234	-68.0860	71	A=42 B=41	+2 surface samples
27	13GC		08/07/20	Baie-Comeau	13h51	49.2222	-68.0866	71		Failed

26	04GGC	0004	08/07/20	Baie-Comeau	14h29	49.2188	-68.0854	71	A˚B˚=22 AB=150 BC=155 CD=148	A˚B˚ = cutter + bag
22	07BC		08/07/20	Franquelin	16h51	49.2587	-67.8341	139	A=14 B=18	+2 surface samples
22	05GGC		08/07/20	Franquelin	17h28	49.2590	-67.8351	138		Failed
1	03VV		09/07/20	Pointe-des-Monts	8h15	49.3044	-67.3903	177		Bulk sample
1	14GC		09/07/20	Pointe-des-Monts	8h40	50.9705	-67.3890	178		Failed
1	15GC		09/07/20	Pointe-des-Monts	8h58	49.3044	-67.3898	176		Failed
31	04VV		09/07/20	Manicouagan	11h04	49.2940	-67.3769	254		Bulk sample
5	05VV		09/07/20	Pointe-des-Monts	13h16	49.2855	-67.3684	291		Bulk sample
5	06VV		09/07/20	Pointe-des-Monts	15h16	49.2852	-67.3693	291		Bulk sample
5	08BC		09/07/20	Pointe-des-Monts	16h06	49.2857	-67.3695	290	A=49.5 B=49.5	+2 surface samples
5	06GGC		09/07/20	Pointe-des-Monts	17h09	49.2850	-67.3695	292		Failed
05M-2	07VV		09/07/20	Pointe-des-Monts	17h47	49.2853	-67.3798	278		Bulk sample
05M	09BC		10/07/20	Pointe-des-Monts	8h08	49.2904	-67.3818	266		+2 surface samples
05M-2	07GGC		10/07/20	Pointe-des-Monts	9h21	49.2839	-67.3798	278	AB=93.5	
05M-2	16GC		10/07/20	Pointe-des-Monts	10h08	49.2863	-67.3806	274		Failed
05M-2	10BC		10/07/20	Pointe-des-Monts	10h38	49.2847	-67.3796	277	A=37 B=38	+2 surface samples
7	11BC		10/07/20	Pointe-des-Monts	13h29	49.2841	-67.3883	291	A=48 B=49	+2 surface samples
7	08GGC		10/07/20	Pointe-des-Monts	14h42	49.2836	-67.3867	290	AB=56.5	
6	12BC		10/07/20	Pointe-des-Monts	16h11	49.2928	-67.3927	263	A=25 B=26.5	+2 surface samples
2	13BC		10/07/20	Pointe-des-Monts	16h57	49.3069	-67.3965	152	A=22 B=22.5	+2 surface samples
10	14BC		11/07/20	Pointe-des-Monts	8h18	49.3038	-67.4140	175		only surface samples
9	15BC		11/07/20	Pointe-des-Monts	9h37	49.2966	-67.4125	215		only surface samples
8	16BC		11/07/20	Pointe-des-Monts	12h41	49.2780	-67.4099	295	A=51 B=51	+2 surface samples
13	17BC		11/07/20	Pointe-des-Monts	14h25	49.2951	-67.4266	218	A=32 B=33	+2 surface samples
12	18BC		11/07/20	Pointe-des-Monts	15h40	49.3043	-67.4234	170	A=27 B=25	+2 surface samples BCA : worm taken off at ~6cm from top
11	08VV		11/07/20	Pointe-des-Monts	16h56	49.3101	-67.4261	142		Bulk sample
41	19BC		11/07/20	Pointe-des-Monts	17h34	49.2842	-67.4224	200	A=45 B=46.5	+2 surface samples
16	20BC		12/07/20	Godbout	8h24	49.2523	-67.5063	258	A=52 B=52	2 layers of shells +2 surface samples
16	12GGC	0005	12/07/20	Godbout	17h40	49.2522	-67.5079	257	AB=150 BC=157 CD=94	

18	21BC		12/07/20	Godbout	9h57	49.2798	-67.5360	190		Failed
18	09VV		12/07/20	Godbout	10h36	49.2800	-67.5365	188		Bulk sample
20	22BC		12/07/20	Godbout	12h55	49.3071	-67.5832	75		Failed
42	10VV		12/07/20	Godbout	13h52	49.3208	-67.5858	30		Bulk sample
43	11VV		12/07/20	Godbout	14h16	49.3228	-67.5895	30		Bulk sample
20	09GGC		12/07/20	Godbout	14h53	49.3017	-67.5852	90		Failed
20	10GGC		12/07/20	Godbout	15h25	49.3017	-67.5848	90		Failed
20-Jan	17GC		12/07/20	Godbout	15h54	49.3023	-67.5755	91		Failed
20-Jan	18GC		12/07/20	Godbout	16h11	49.3031	-67.5750	95		Failed
20-Feb	11GGC		12/07/20	Godbout	16h47	49.2999	-67.5697	143		Failed
29	12VV		13/07/20	Manicouagan	7h32	49.0728	-68.1379	60		Bulk sample
29	23BC		13/07/20	Manicouagan	7h52	49.0725	-68.1392	57		Only bulk sample
30	13VV		13/07/20	Manicouagan	8h51	49.0331	-68.0964	133		Bulk sample
30	24BC		13/07/20	Manicouagan	9h13	49.0364	-68.0968	119	A=25.5 B=24	+2 surface samples
31	25BC	0006	13/07/20	Manicouagan	10h48	49.0158	-68.0684	265	A=50.5 B=53	+2 surface samples
31	13GGC	0007	13/07/20	Manicouagan	11h39	49.0159	-68.0670	263	A˚B˚=21 AB=152 BC=128	A˚B˚= cutter + bag
44	14GGC		13/07/20	Manicouagan	12h57	49.0505	-68.1183	75		Failed
21	26BC	0008	13/07/20	Franquelin	15h34	49.2528	-67.7463	211	A=45 B=46 C=42	BCC : infiltrated water during pumping +2 surface samples
21	15GGC	0009	13/07/20	Franquelin	16h30	49.2535	-67.7467	146	AB=150.5 BC=156 CD=151	
21	19GC		13/07/20	Franquelin	16h55	49.2532	-67.7470	146	AB=163	
32	14VV		14/07/20	Pointe-aux-Outardes	7h23	49.0160	-68.3874	95		Bulk sample
32	27BC		14/07/20	Pointe-aux-Outardes	7h47	49.0173	-68.3833	94	A=43 B=44.5	+2 surface samples
32	20GC		14/07/20	Pointe-aux-Outardes	8h14	49.0161	-68.3808	88		Failed
32	21GC		14/07/20	Pointe-aux-Outardes	8h22	49.0159	-68.3791	83		Failed
33	28BC	0010	14/07/20	Pointe-aux-Outardes	9h30	48.9867	-68.3507	135	A=52 B=55	+2 surface samples
45	29BC		14/07/20	Pointes-aux-Outardes	11h04	48.9436	-68.2971	336		Failed
45	30BC		14/07/20	Pointe-aux-Outardes	11h33	48.9444	-68.2969	335	A=36 B=34.5	Tilted sample +2 surface samples
33	16GGC	0011	14/07/20	Pointe-aux-Outardes	13h25	48.9855	-68.3503	134	A˚B˚ = 31 AB=100 BC=100 CD=104 DE=100 EF=101 FG=109 GH=10	A˚B˚ = cutter GH = mixed

37	15VV		14/07/20	Betsiamites	15h35	48.8786	-68.6006	126		Bulk sample
37	17GGC	0012	14/07/20	Betsiamites	16h06	48.8766	-68.5973	126	AB=100 BC=65	
37	31BC	0013	14/07/20	Betsiamites	17h07	48.8778	-68.6006	126	A=51.5 B=51	+2 surface samples
36	32BC		14/07/20	Betsiamites	18h02	48.8378	-68.5625	254	A=53 B=54	+2 surface samples

Table A2: Summary of CTD stations

Station number	COR2001 ID	Date	Location	Time	Latitude	Longitude	Water depth (m)
35	01CTD	06-07-2020	Betsiamites	9h34 9h40 9h46	48.94 48.94 48.94	-68.55 -68.55 -68.56	100
34	02CTD	06-07-2020	Pointe-aux-Outardes	18h36 18h44 18h48	48.99 48.99 48.99	-68.46 -68.47 -68.47	128
23M	03CTD	07-07-2020	Baie-Comeau	12h46 12h52 12h57	49.12 49.12 49.12	-67.88 -67.88 -67.88	200
24	04CTD	07-07-2020	Baie-Comeau	16h10 16h16 16h19	49.17 49.17 49.17	-67.98 -67.99 -67.99	137
28	05CTD	08-07-2020	Baie-Comeau	7h11 7h15 7h17	49.25 49.25 49.25	-68.12 -68.12 -68.12	53
27	06CTD	08-07-2020	Baie-Comeau	12h38 12h42 12h44	49.22 49.22 49.22	-68.09 -68.09 -68.08	73
22	07CTD	08-07-2020	Franquelin	16h01 16h08 16h13	49.26 49.26 49.26	-67.84 -67.84 -67.84	136
1	08CTD	09-07-2020	Pointe-des-Monts	7h31 7h39 7h46	49.30 49.30 49.31	-67.39 -67.39 -67.39	176
3	09CTD	09-07-2020	Pointe-des-Monts	9h41 9h51 9h59	49.30 49.30 49.30	-67.38 -67.38 -67.38	256
5	10CTD	09-07-2020	Pointe-des-Monts	11h45 11h56 12h04	49.29 49.29 49.29	-67.37 -67.37 -67.37	289
05M	11CTD	10-07-2020	Pointe-des-Monts	7h09 7h19 7h28	49.29 49.28 49.28	-67.38 -67.38 -67.38	280
7	12CTD	10-07-2020	Pointe-des-Monts	12h25 12h30 12h40	49.28 49.28 49.28	-67.39 -67.39 -67.39	293
6	13CTD	10-07-2020	Pointe-des-Monts	15h19 15h28 15h36	49.29 49.29 49.29	-67.39 -67.39 -67.40	265
2	14CTD	10-07-2020	Pointe-des-Monts	16h50 16h57 17h01	49.31 49.31 49.30	-67.40 -67.40 -67.40	152
10-1	15CTD	11-07-2020	Pointe-des-Monts	7h08	49.30	-67.41	176

				7h15 7h20	49.30 49.30	-67.42 -67.42	
10-2	15CTD	11-07-2020	Pointe-des-Monts	7h26 7h33 7h38	49.30 49.30 49.30	-67.42 -67.42 -67.42	193
9	16CTD	11-07-2020	Pointe-des-Monts	8h51 9h00 9h06	49.30 49.30 49.29	-67.40 -67.41 -67.41	220
8	17CTD	11-07-2020	Pointe-des-Monts	10h48 10h58 11h06	49.28 49.28 49.28	-67.41 -67.41 -67.41	295
8	17CTD	11-07-2020	Pointe-des-Monts	11h14 11h22 11h31	49.28 49.28 49.28	-67.41 -67.41 -67.41	294
13	18CTD	11-07-2020	Pointe-des-Monts	13h32 13h38 13h44	49.30 49.29 49.29	-67.43 -67.43 -67.43	217
12	19CTD	11-07-2020	Pointe-des-Monts	15h03 15h10 15h14	49.30 49.30 49.30	-67.42 -67.42 -67.43	168
11	20CTD	11-07-2020	Pointe-des-Monts	16h22 16h26 16h30	49.31 49.31 49.31	-67.43 -67.43 -67.43	145
16	21CTD	12-07-2020	Godbout	7h48 7h59 8h00	49.25 49.25 49.25	-67.51 -67.51 -67.51	258
18	22CTD	12-07-2020	Godbout	9h19 9h29 9h30	49.28 49.28 49.28	-67.54 -67.54 -67.54	190
20	23CTD	12-07-2020	Godbout	11h43 11h50 11h52	49.31 49.31 49.31	-67.58 -67.58 -67.58	67
42	24CTD	12-07-2020	Godbout	13h33 13h38 13h40	49.32 49.32 49.32	-67.59 -67.59 -67.59	50
29	25CTD	13-07-2020	Manicouagan	7h12 7h15 7h18	49.07 49.07 49.07	-68.14 -68.14 -68.14	61
30	26CTD	13-07-2020	Manicouagan	8h33 8h38 8h42	49.04 49.04 49.03	-68.10 -68.10 -68.10	120
31	27CTD	13-07-2020	Manicouagan	9h58 10h06 10h14	49.02 49.02 49.01	-68.07 -68.07 -68.07	264
32	28CTD	14-07-2020	Pointe-aux-Outardes	7h06 7h10 7h14	49.02 49.02 49.02	-68.39 -68.39 -68.39	93

33	29CTD	14-07-2020	Pointe-aux-Outardes	9h08 9h13 9h17	48.99 48.99 48.98	-68.35 -68.35 -68.35	136
45	30CTD	14-07-2020	Betsiamites	10h29 10h38 10h48	48.94 48.94 48.94	-68.30 -68.30 -68.30	337
37	31CTD	14-07-2020	Betsiamites	15h12 15h19 15h24	48.88 48.88 48.88	-68.60 -68.60 -68.60	127

Table A3: Summary of plankton nets

Station number	Identifier	Date (d/m/y)	Location	Time (24hr, ET) (Surface/Bottom/Surface)	Latitude (N)	Longitude (W)	Water depth (m)	Net depth (m)
35	01PN	06-07-2020	Betsiamites	10h03 10h07 10h12	48.9465 48.9469 48.9475	-68.5545 -68.5553 -68.5549	102	90
34	02PN	06-07-2020	Pointe-aux-Outardes	18h55 19h02 19h06	48.9893 48.9892 48.9890	-68.4725 -68.4742 -68.4750	127	100
23M	03PN	07-07-2020	Baie-Comeau	12h57 13h09 13h12	49.1181 49.1179 49.1178	-67.8840 -67.8848 -67.8853	200	100
24	04PN	07-07-2020	Baie-Comeau	16h27 16h31 16h33	49.1645 49.1643 49.1640	-67.9886 -67.9896 -67.9904	135	100
28	05PN	08-07-2020	Baie-Comeau	7h28 7h30 7h31	49.2470 49.2471 49.2471	-68.1180 -68.1180 -68.1181	57	50
27	06PN	08-07-2020	Baie-Comeau	12h52 12h55 12h57	49.2225 49.2222 49.2220	-68.0864 -68.0860 -68.0857	72	65
22	07PN	08-07-2020	Franquelin	16h24 16h28 16h31	49.2601 49.2601 49.2601	-67.8360 -67.8375 -67.8385	136	100
1	08PN	09-07-2020	Pointe-des-Monts	7h55 7h59 8h02	49.3041 49.3041 49.3043	-67.3903 -67.3899 -67.3896	183	100
3	09PN	09-07-2020	Pointes-des-Monts	10h11 10h15 10h17	49.2962 49.2963 49.2961	-67.3813 -67.3808 -67.3802	252	100
5	10PN	09-07-2020	Pointe-des-Monts	12h55 12h58 13h00	49.2852 49.2853 49.2855	-67.3694 -67.3690 -67.3680	290	100
05M	11PN	10-07-2020	Pointe-des-Monts	7h35 7h38 7h41	49.2806 49.2798 49.2793	-67.3793 -67.3788 -67.3784	299	100
7	12PN	10-07-2020	Pointe-des-Monts	12h50 12h53 12h56	49.2842 49.2836 49.2831	-67.3886 -67.3891 -67.3892	290	100
6	13PN	10-07-2020	Pointe-des-Monts	15h45 15h48 15h51	49.2919 49.2914 49.2907	-67.3922 -67.3940 -67.3949	265	100
2	14PN	10-07-2020	Pointe-des-Monts	17h12	49.3064	-67.3975	145	100

				17h16 17h18	49.3059 49.3058	-67.3994 -67.4011		
10	15PN	11-07-2020	Pointe-des-Monts	7h52 7h55 7h58	49.3041 49.3039 49.3036	-67.4138 -67.4141 -67.4139	173	100
9	16PN	11-07-2020	Pointe-des-Monts	9h15 9h18 9h21	49.2979 49.2977 49.2974	-67.4083 -67.4138 -67.4140	207	100
8	17PN	11-07-2020	Pointe-des-Monts	11h40 11h43 11h46	49.2782 49.2779 49.2775	-67.4102 -67.4100 -67.4098	295	100
13	18PN	11-07-2020	Pointe-des-Monts	13h50 13h53 13h56	49.2942 49.2940 49.2937	-67.4273 -67.4276 -67.4277	223	100
12	19PN	11-07-2020	Pointe-des-Monts	15h21 15h24 15h27	49.3048 49.3047 49.3045	-67.4237 -67.4239 -67.4242	167	100
11	20PN	11-07-2020	Pointe-des-Monts	16h40 16h43 16h46	49.3102 49.3102 49.3101	-67.4245 -67.4252 -67.4259	141	100
18	21PN	12-07-2020	Godbout	9h38 9h42 9h44	49.2796 49.2798 49.2802	-67.5355 -67.5355 -67.5354	188	100
20	22PN	12-07-2020	Godbout	12h40 12h42 12h44	49.3071 49.3072 49.3072	-67.5828 -67.5827 -67.5826	77	70
42	23PN	12-07-2020	Godbout	13h44 13h45 13h47	49.3204 49.3206 49.3207	-67.5859 -67.5857 -67.5856	50	42
29	24PN	13-07-2020	Manicouagan	7h23 7h25 7h26	49.0723 49.0718 49.0720	-68.1379 -68.1378 -68.1376	61	55
31	25PN	13-07-2020	Manicouagan	10h18	49.0131	-68.0664	270	100

APPENDIX B: GEOGRAPHIC LOCATIONS OF STATIONS

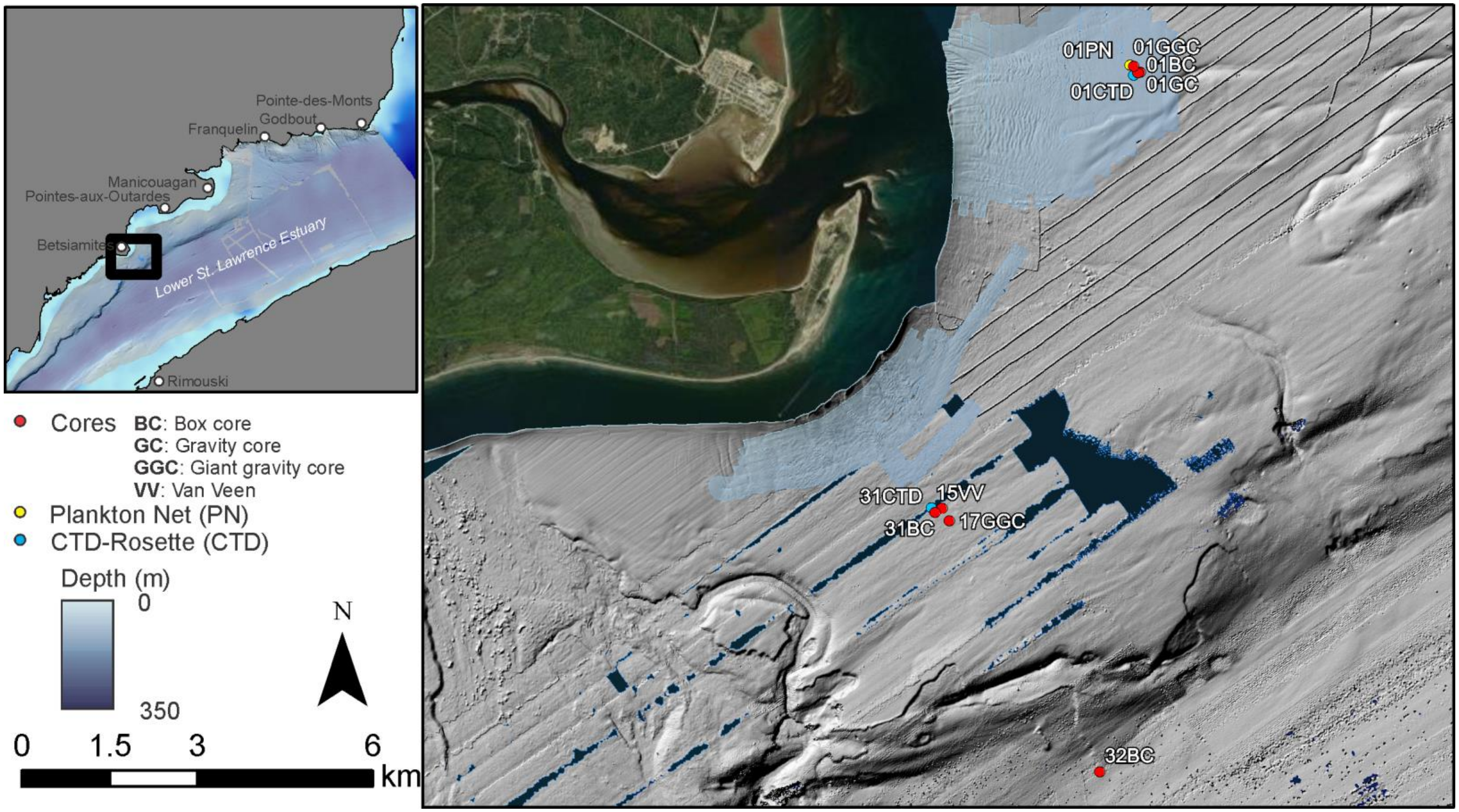

Figure B1: Location of coring, CTD-R and plankton nets in the Betsiamites area collected during COR2001

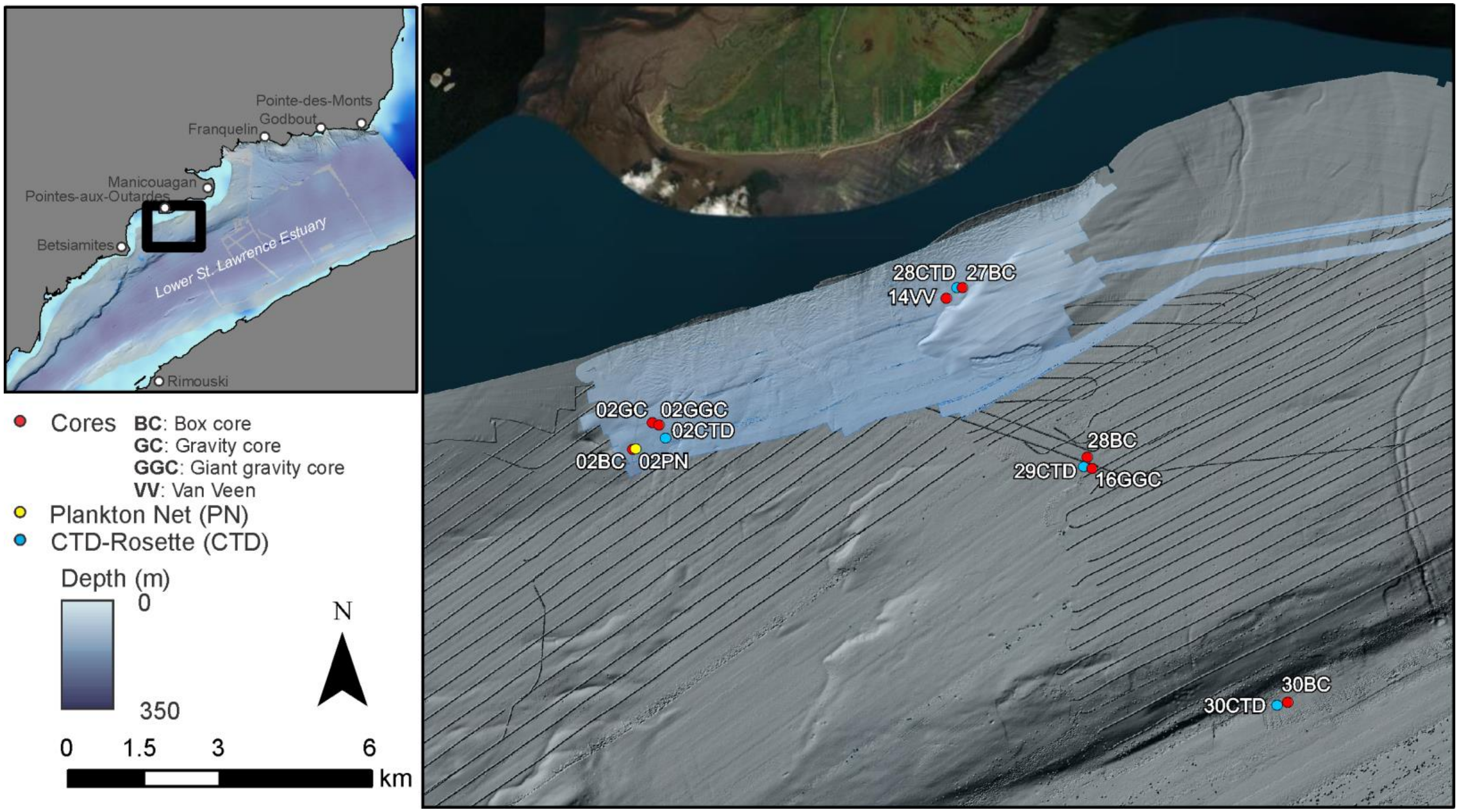

Figure B2: Location of coring, CTD-R and plankton nets in the Pointes-aux-Outardes area collected during COR2001

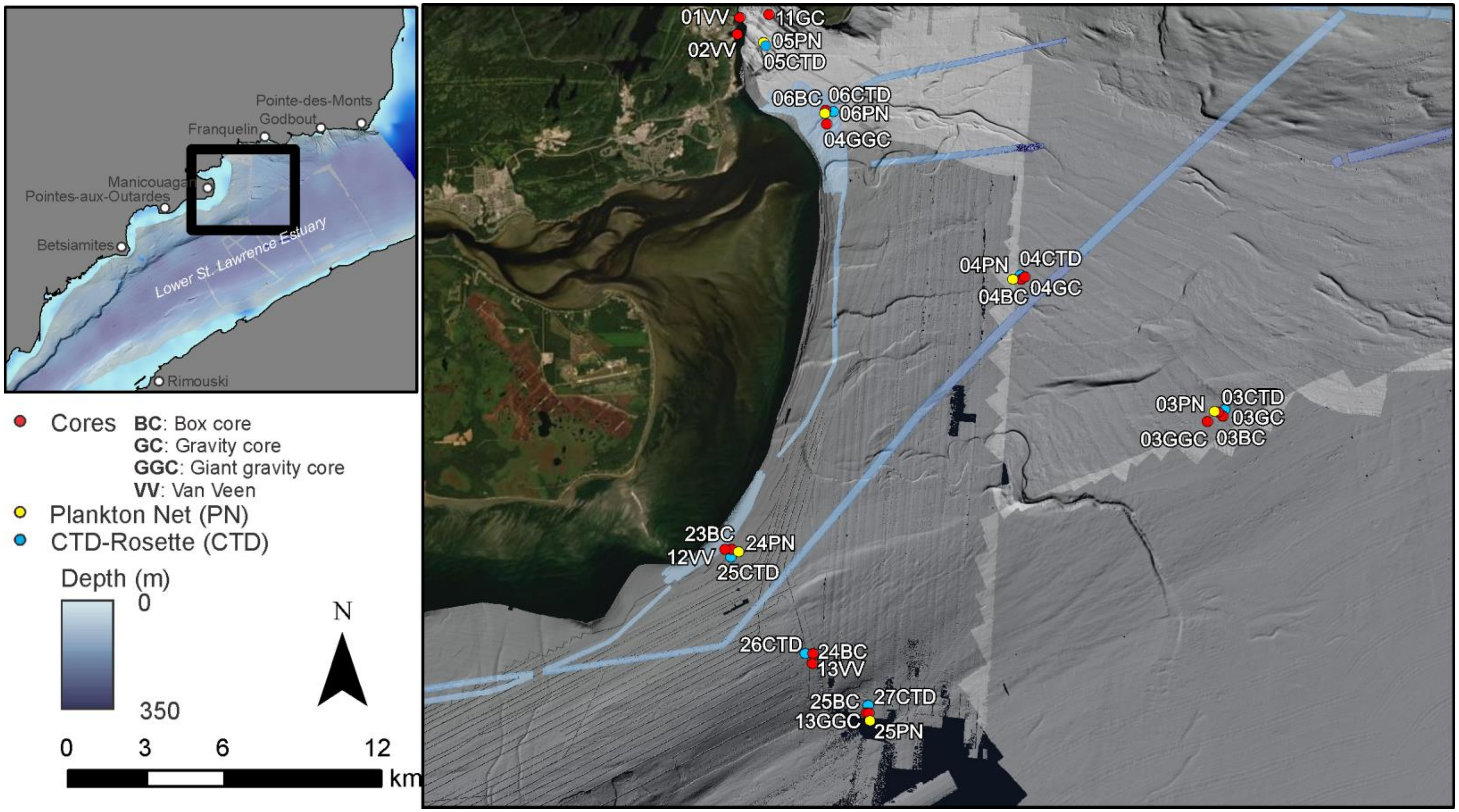

Figure B3: Location of coring, CTD-R and plankton nets in the Manicouagan area collected during COR2001

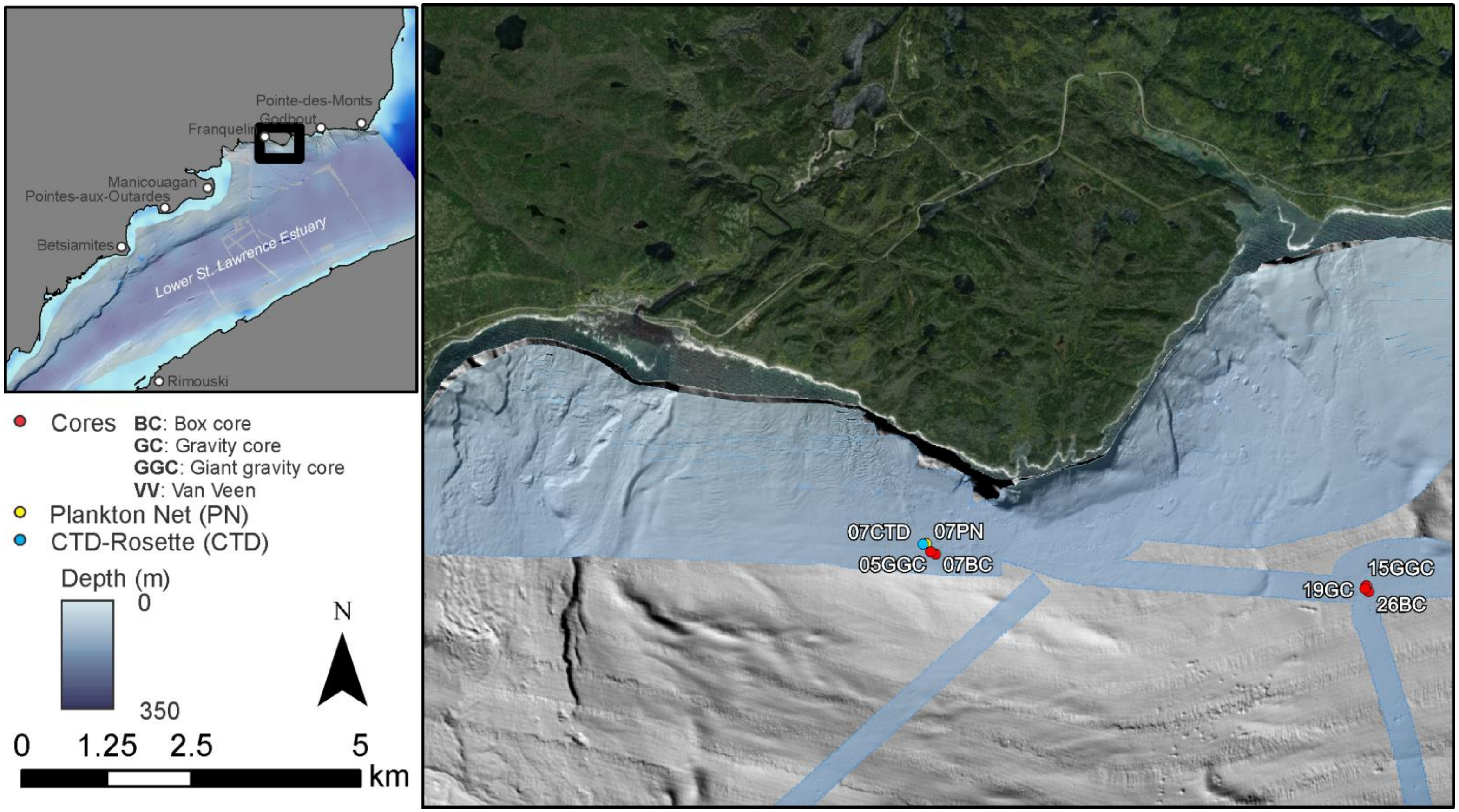

Figure B4: Location of coring, CTD-R and plankton nets in the Franquelin area collected during COR2001

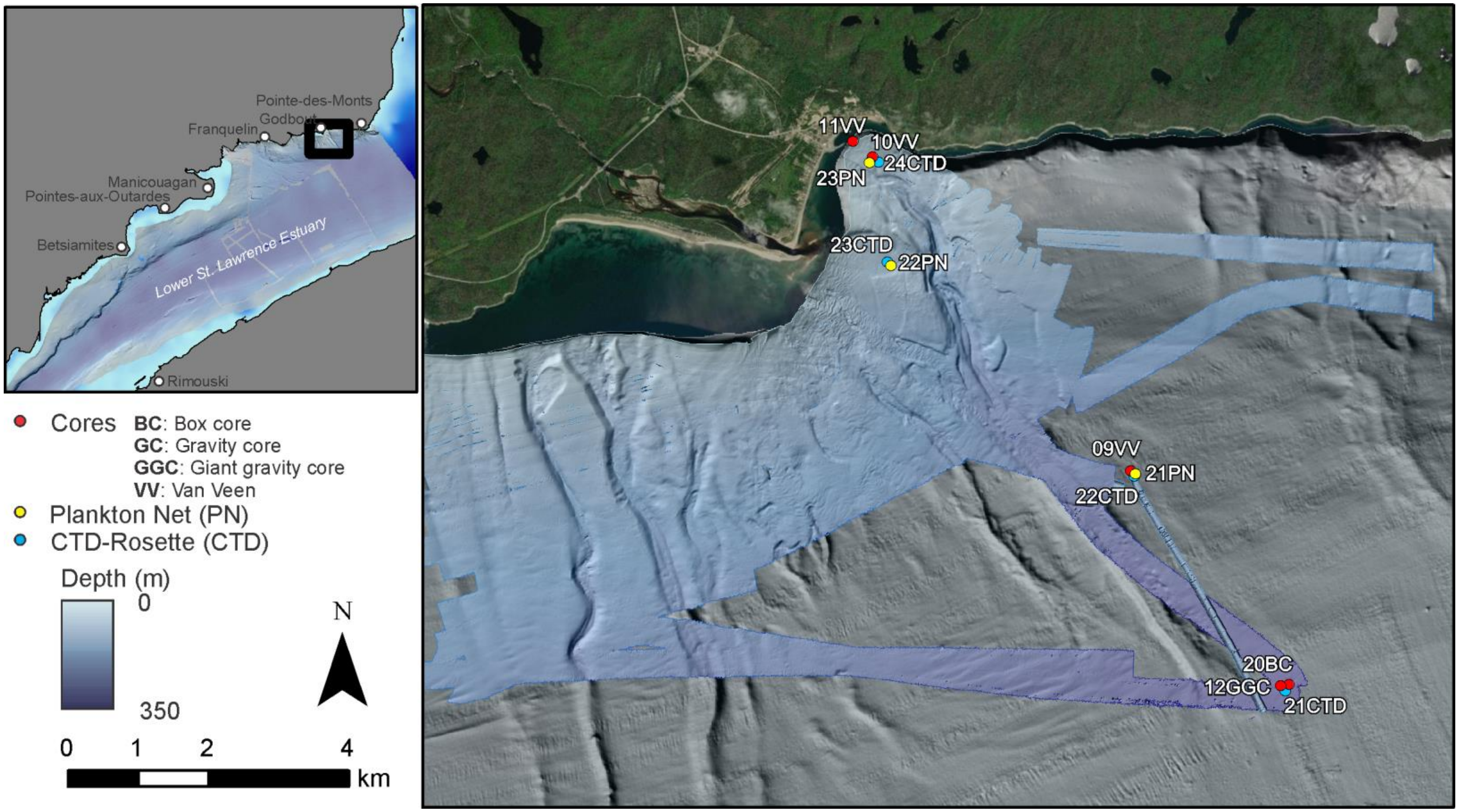

Figure B5: Location of coring, CTD-R and plankton nets in the Godbout area collected during COR2001

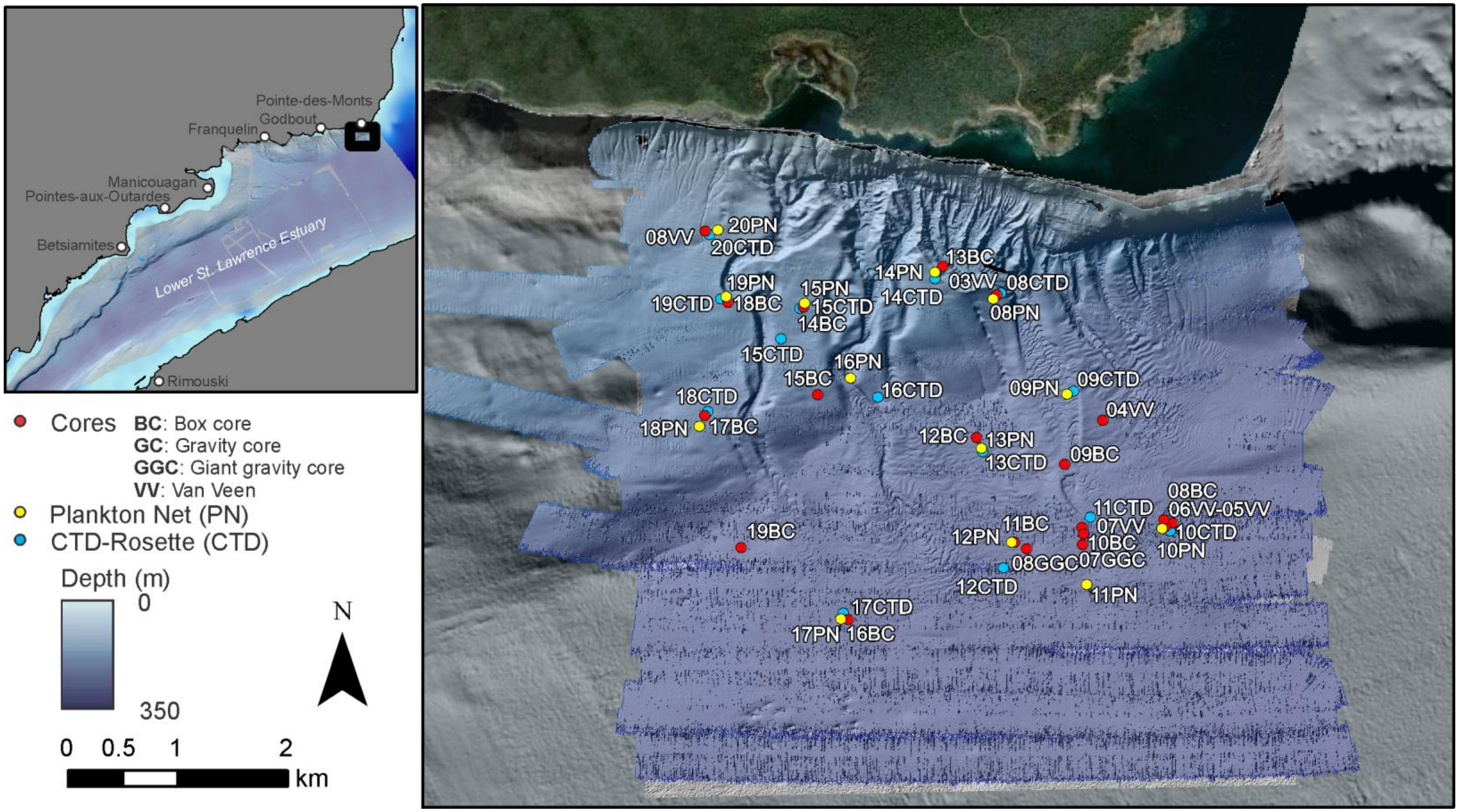

Figure B6: Location of coring, CTD-R and plankton nets in the Pointe-des-Monts area collected during COR2001

APPENDIX C: STRATIGRAPHIC POSITIONS OF SEDIMENT CORES

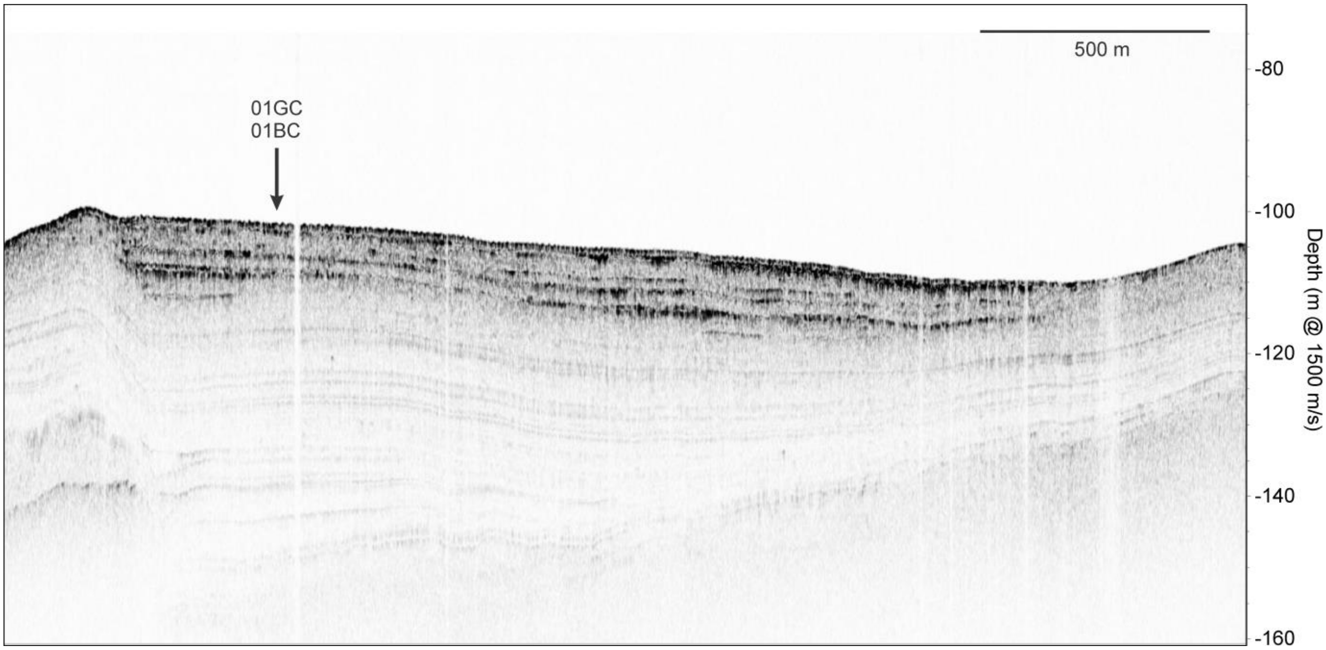

Figure C1: Approximate stratigraphic positions of cores COR2001-01BC and 01GC

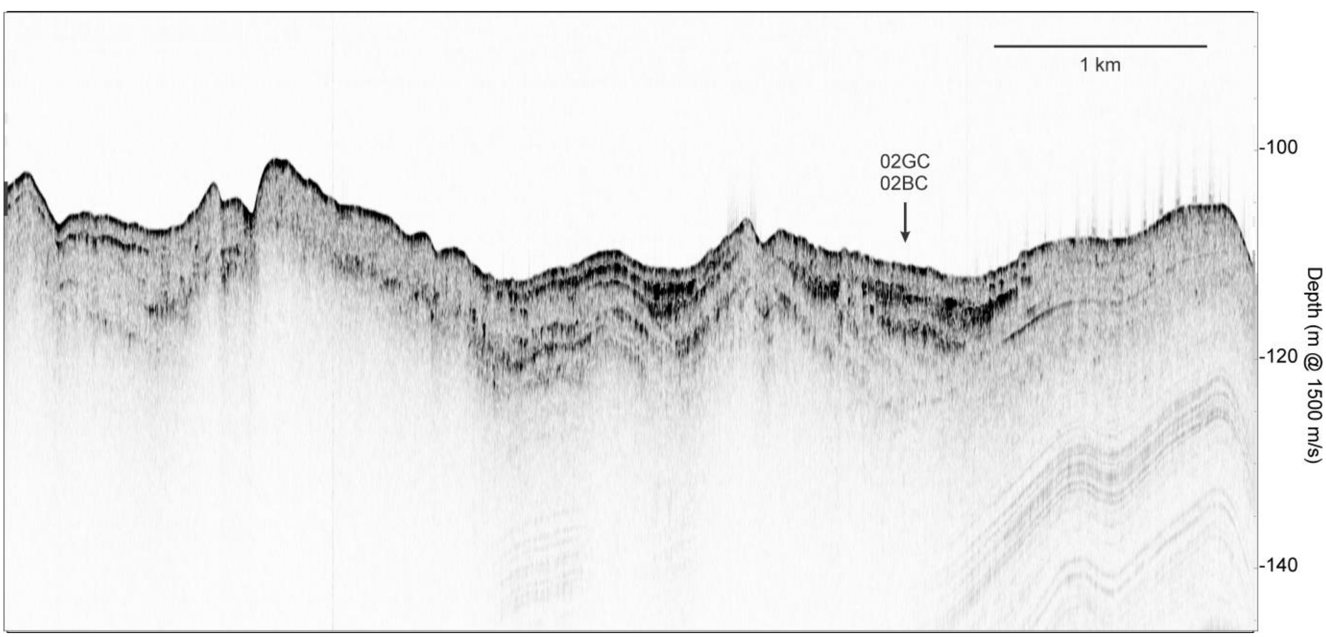

Figure C2: Approximate stratigraphic positions of cores COR2001-02BC and 02GC

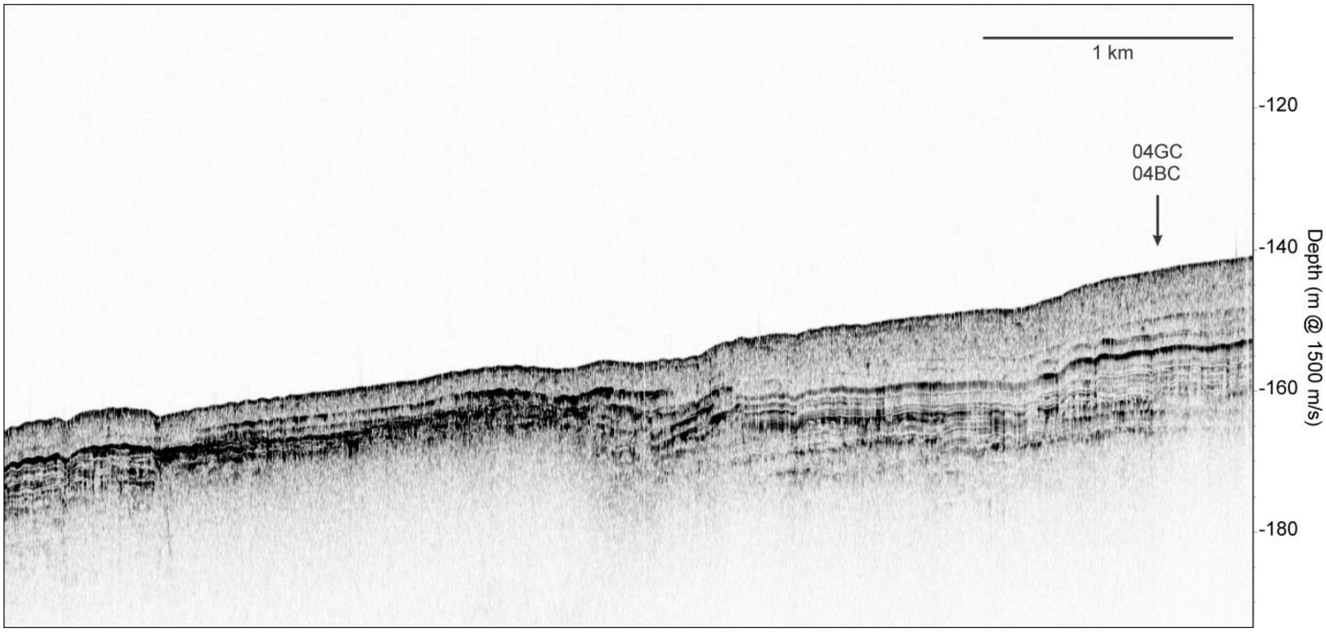

Figure C3: Approximate stratigraphic positions of cores COR2001-04BC and 04GC

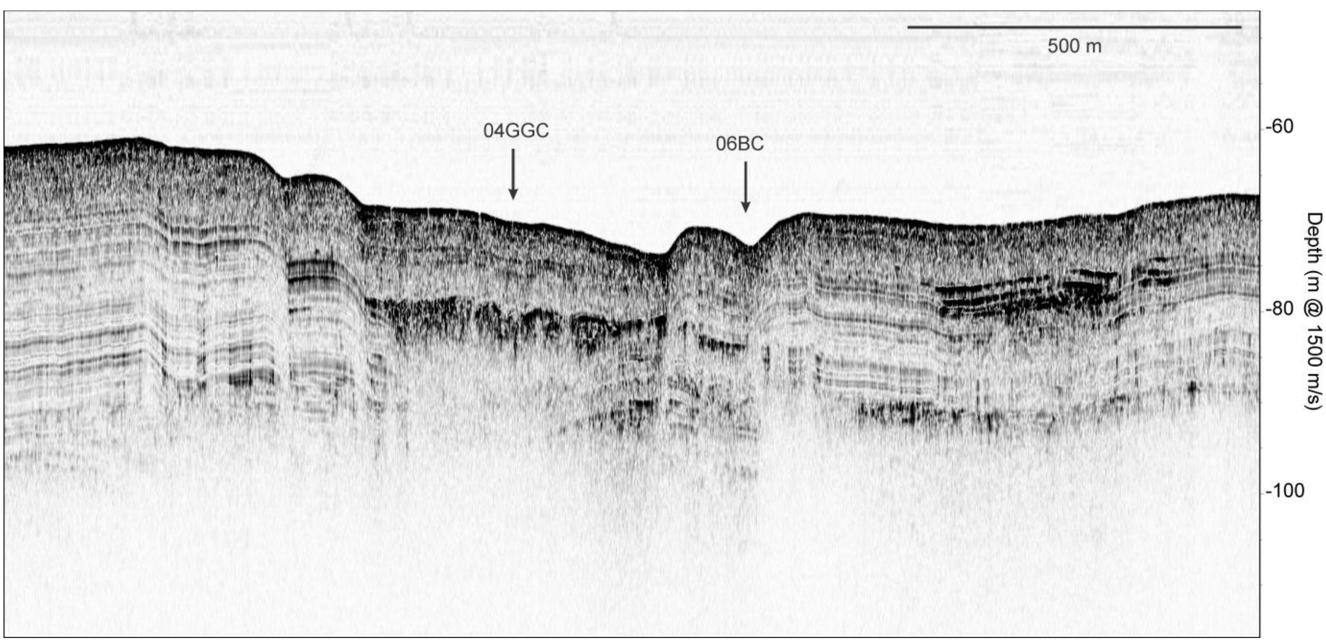

Figure C4: Approximate stratigraphic positions of cores COR2001-04GGC and 06BC

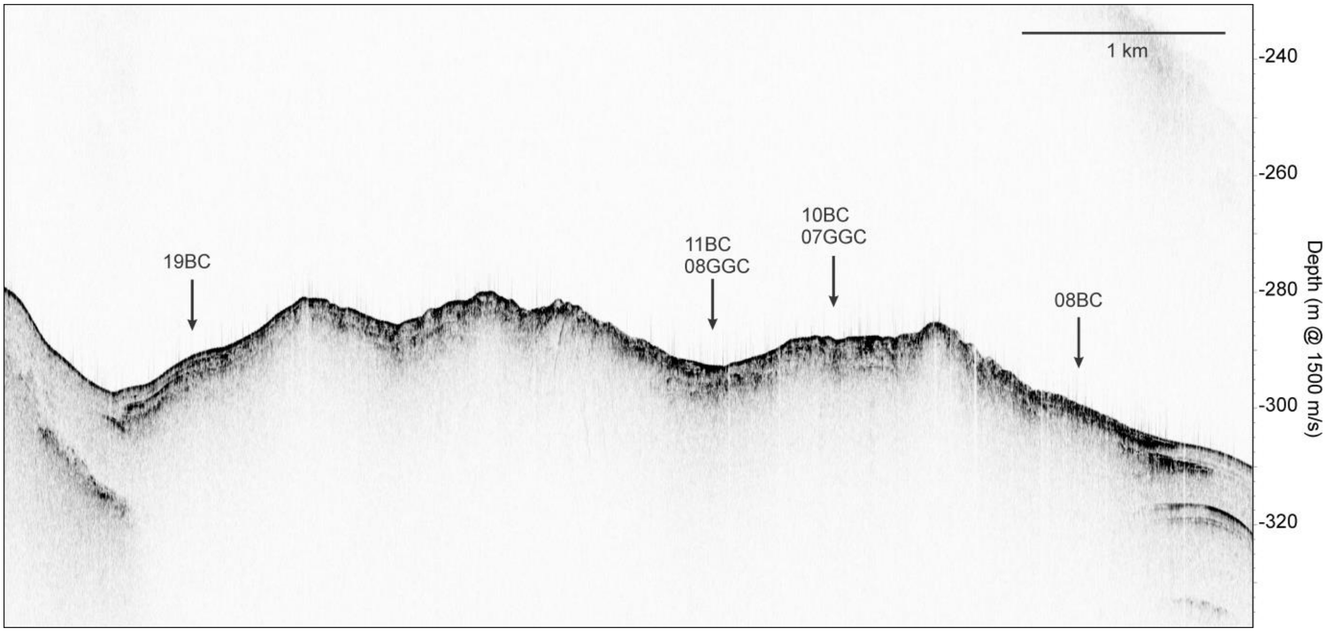

Figure C5: Approximate stratigraphic positions of cores COR2001-07GGC, 08BC, 08GGC, 10BC, 11BC, and 19BC

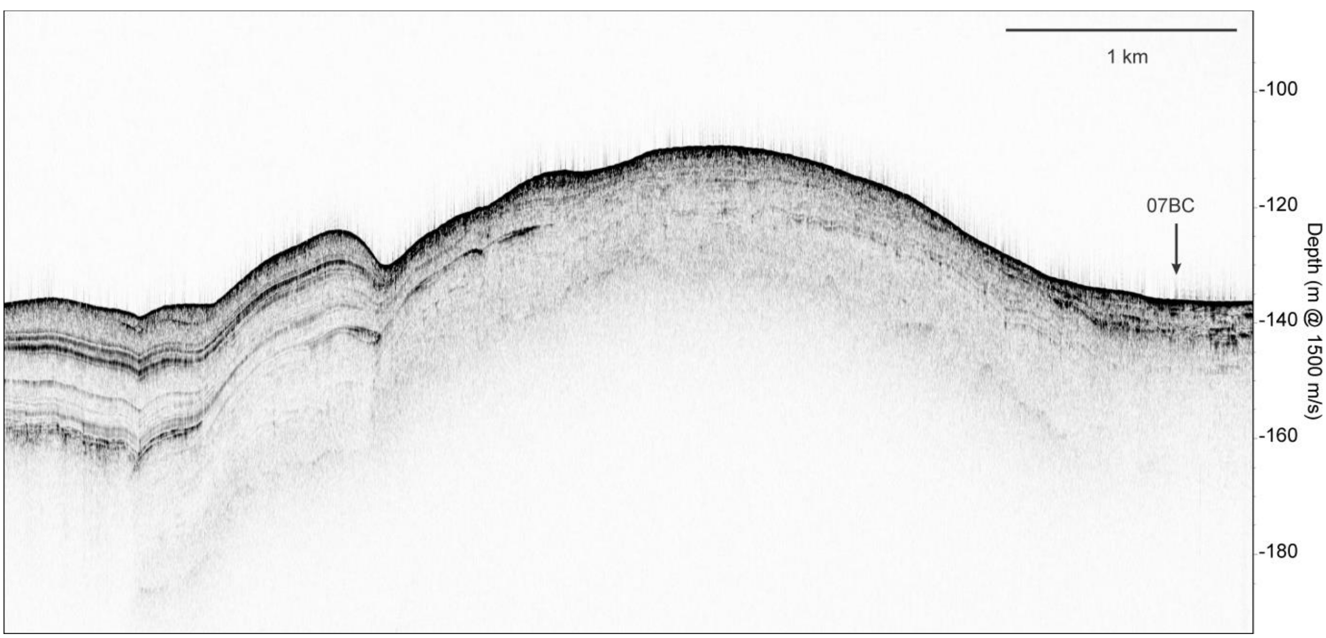

Figure C6: Approximate stratigraphic position of core COR2001-07BC

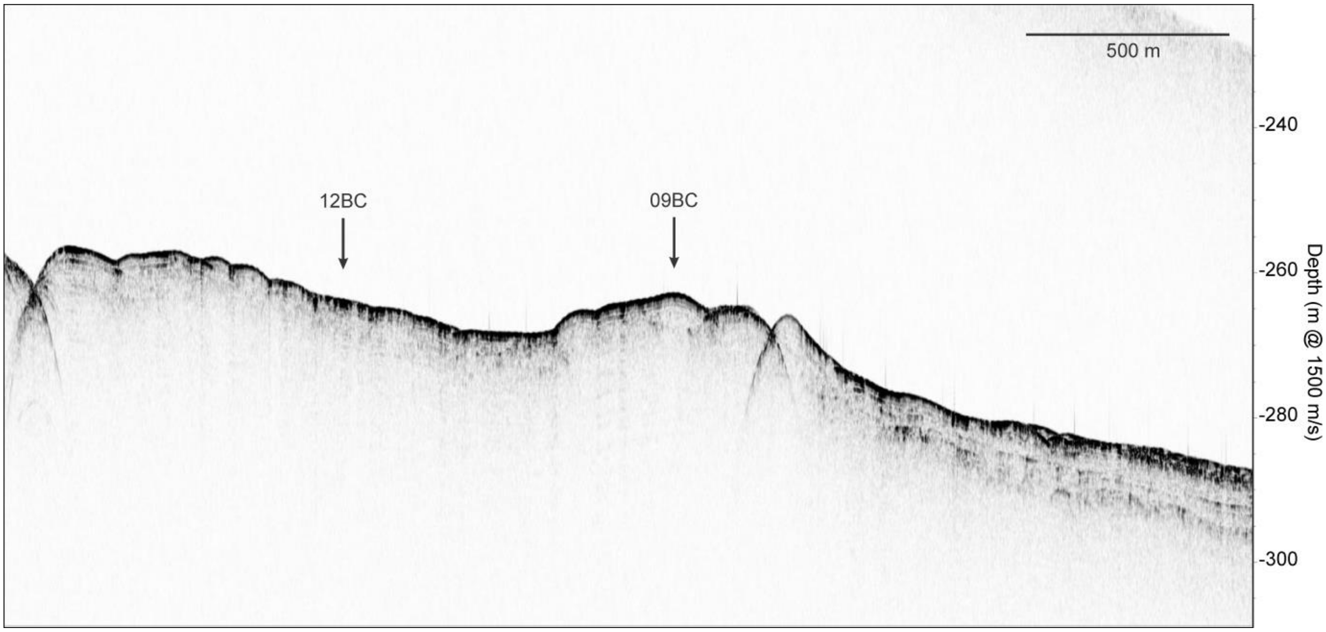

Figure C7: Approximate stratigraphic positions of cores COR2001-09BC and 12BC

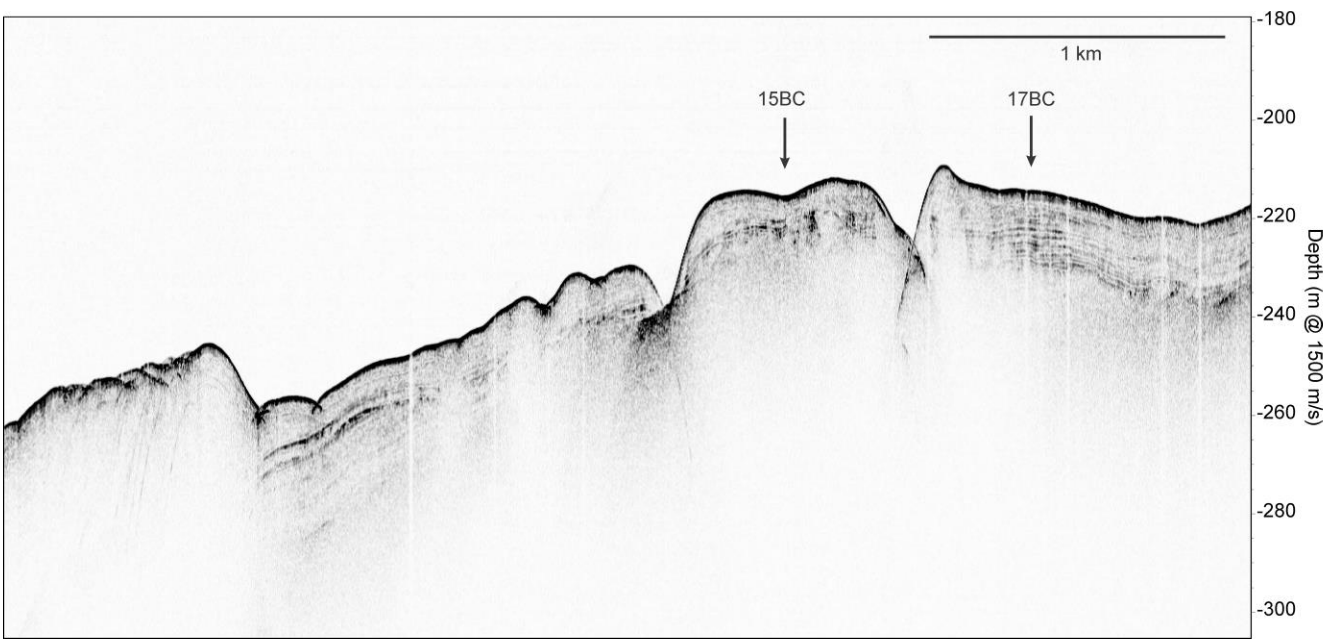

Figure C8: Approximate stratigraphic positions of cores COR2001-15BC and 17BC

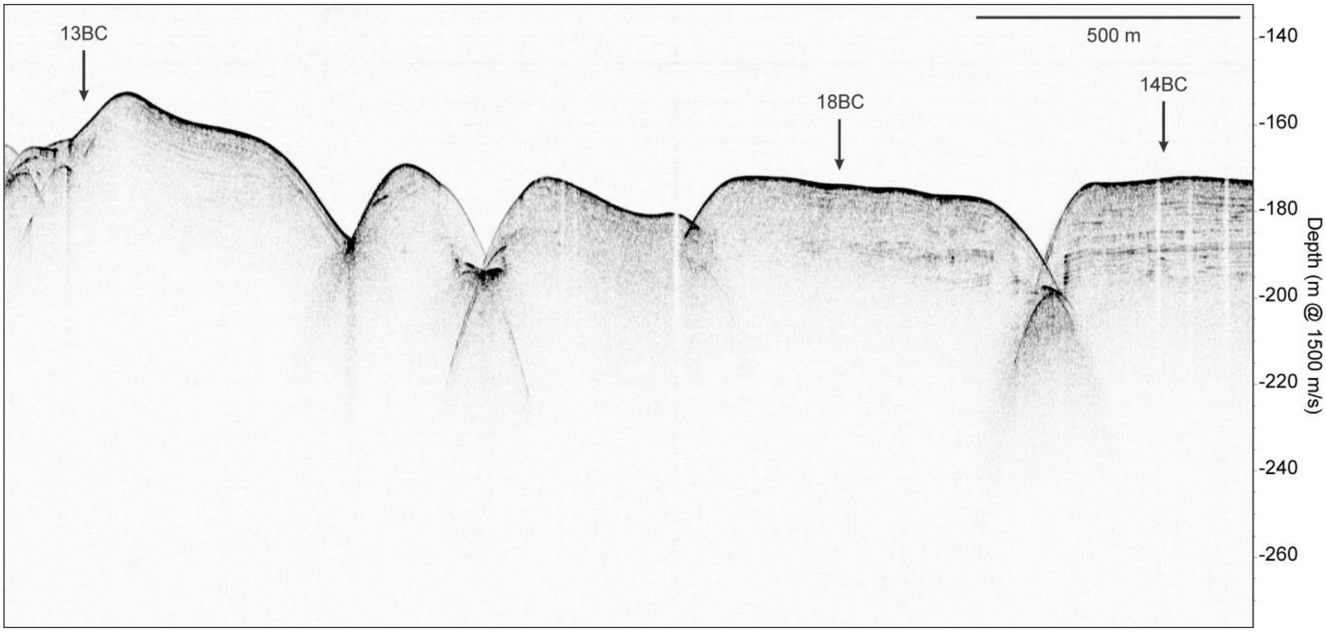

Figure C9: Approximate stratigraphic positions of cores COR2001-13BC, 14BC and 18BC

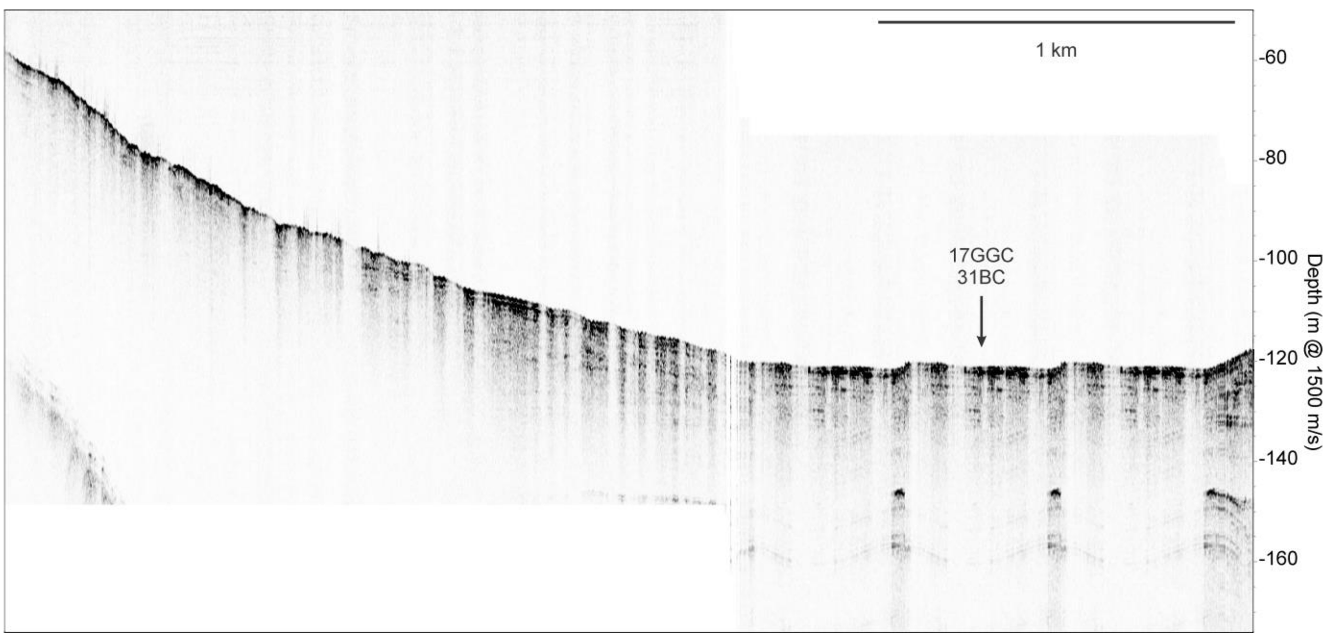

Figure C10: Approximate stratigraphic positions of cores COR2001-17GGC and 31BC

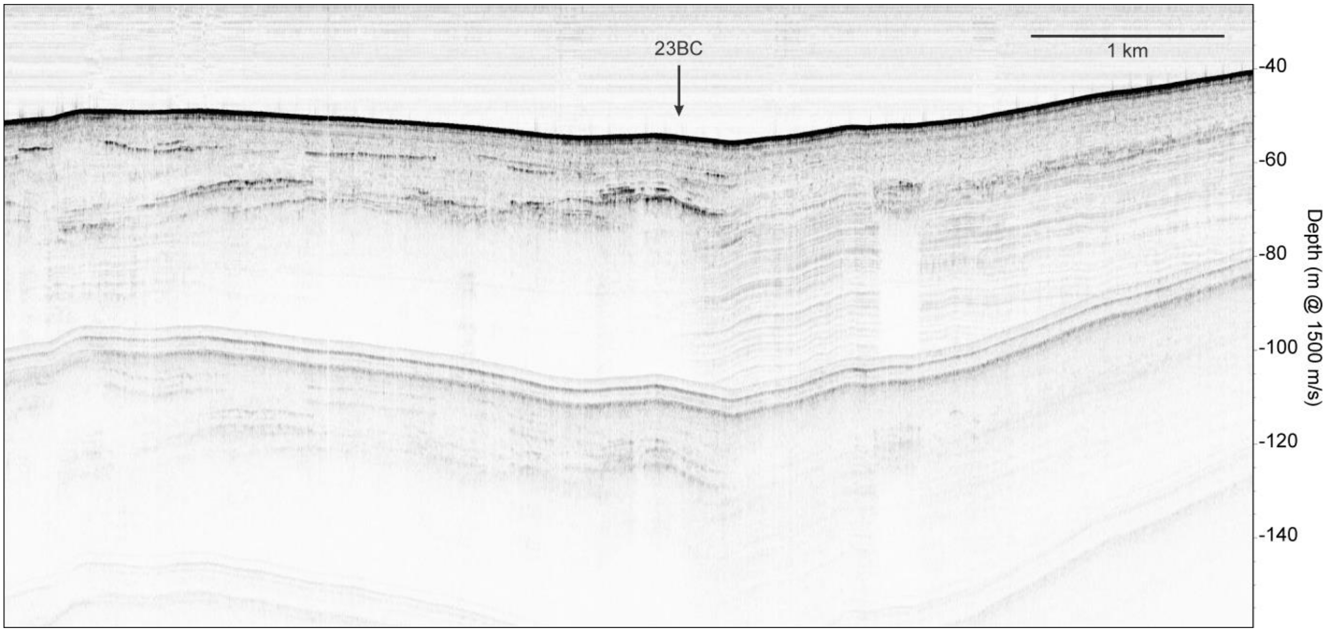

Figure C11: Approximate stratigraphic position of core COR2001-23BC

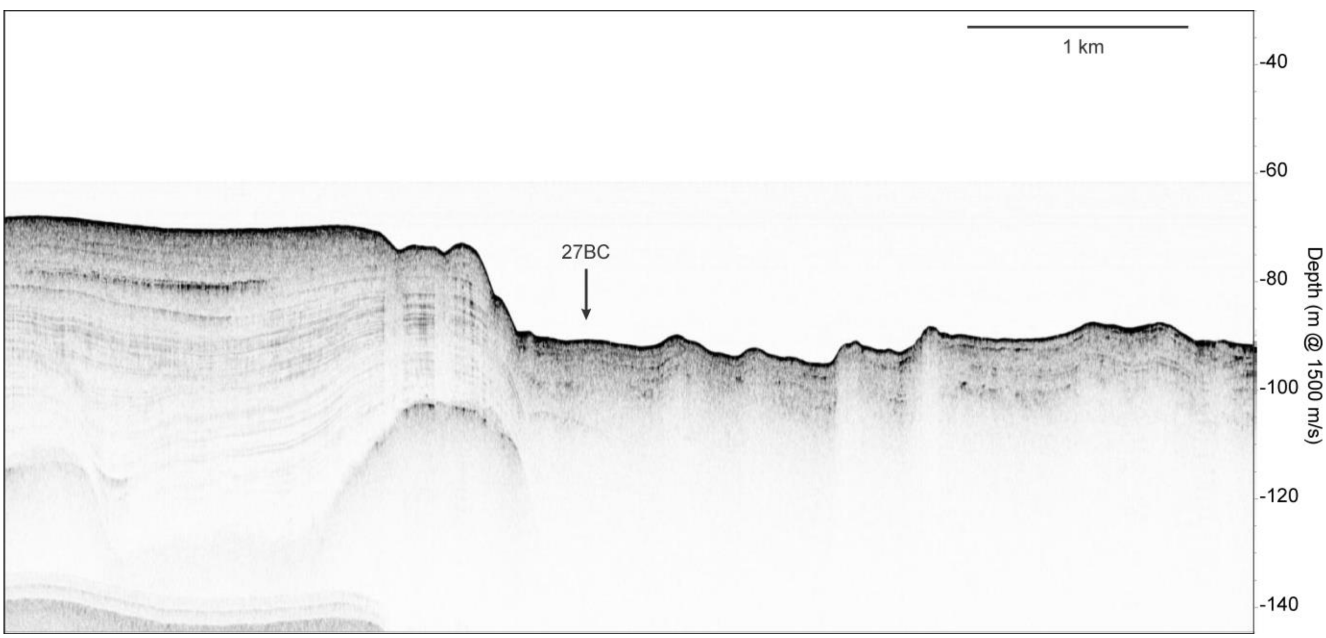

Figure C12: Approximate stratigraphic position of core COR2001-27BC

APPENDIX D: CTD PROFILES

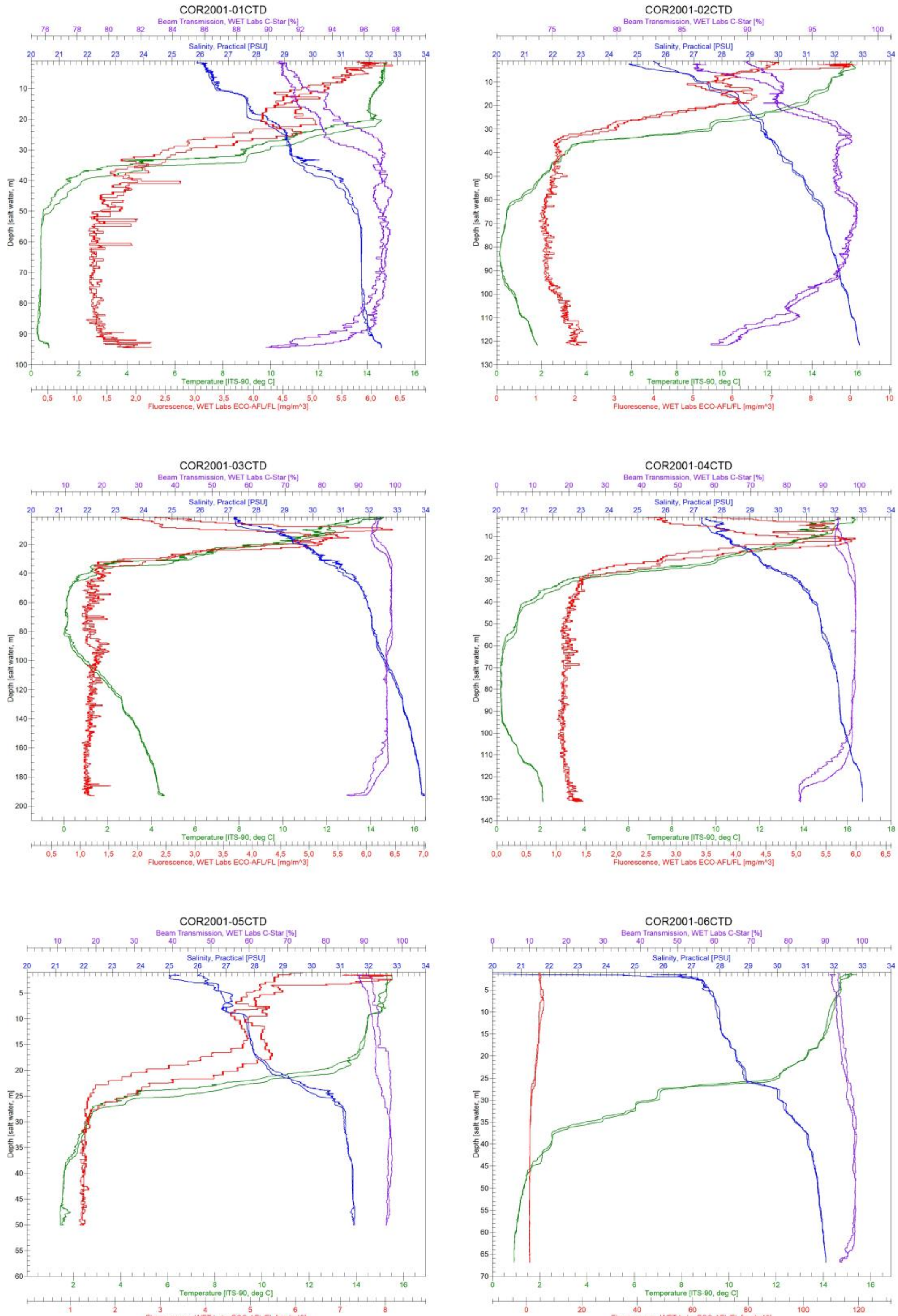

Figure D1: CTD profiles COR2001-01-06

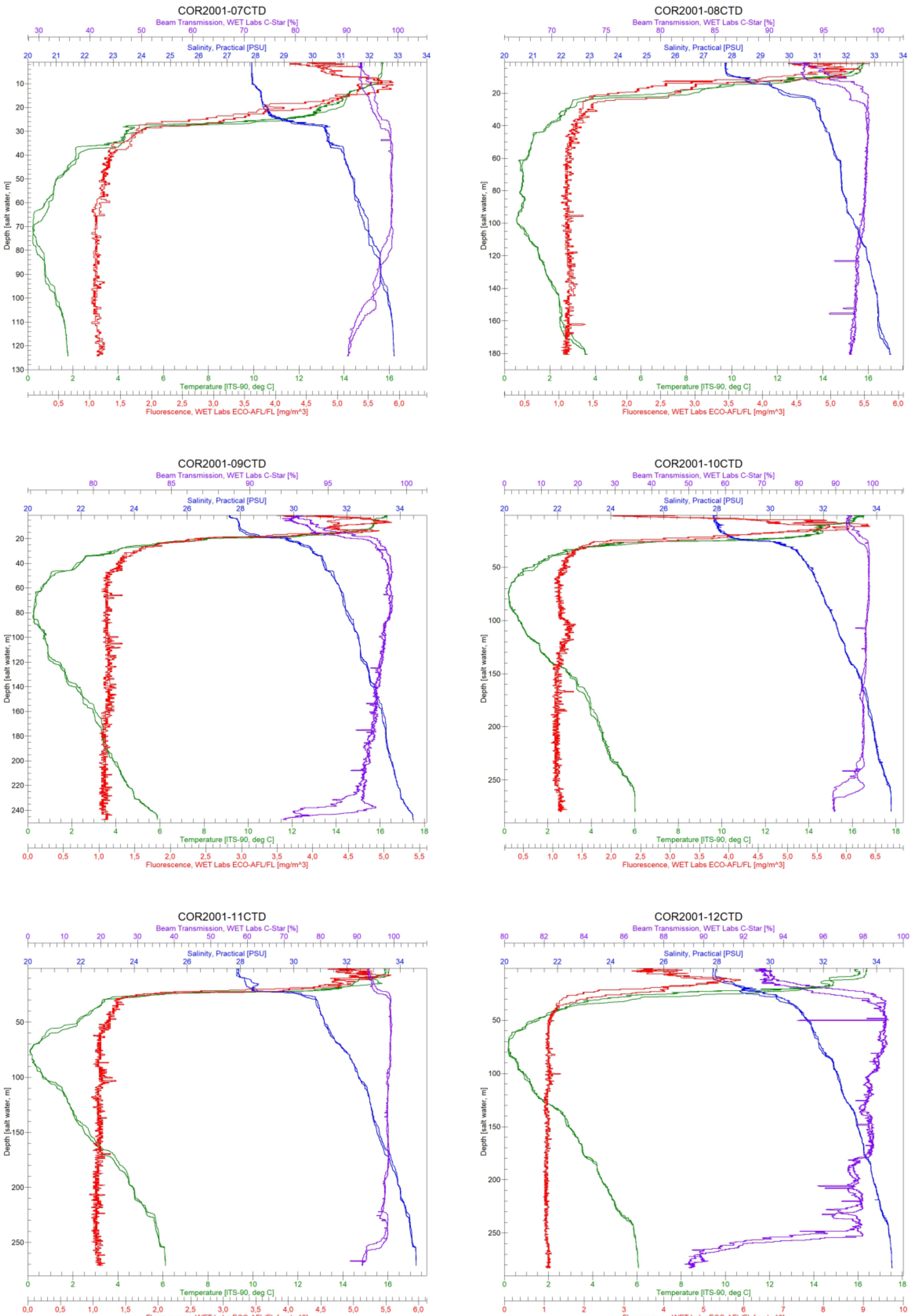

Figure D2: CTD profiles COR2001-07-12

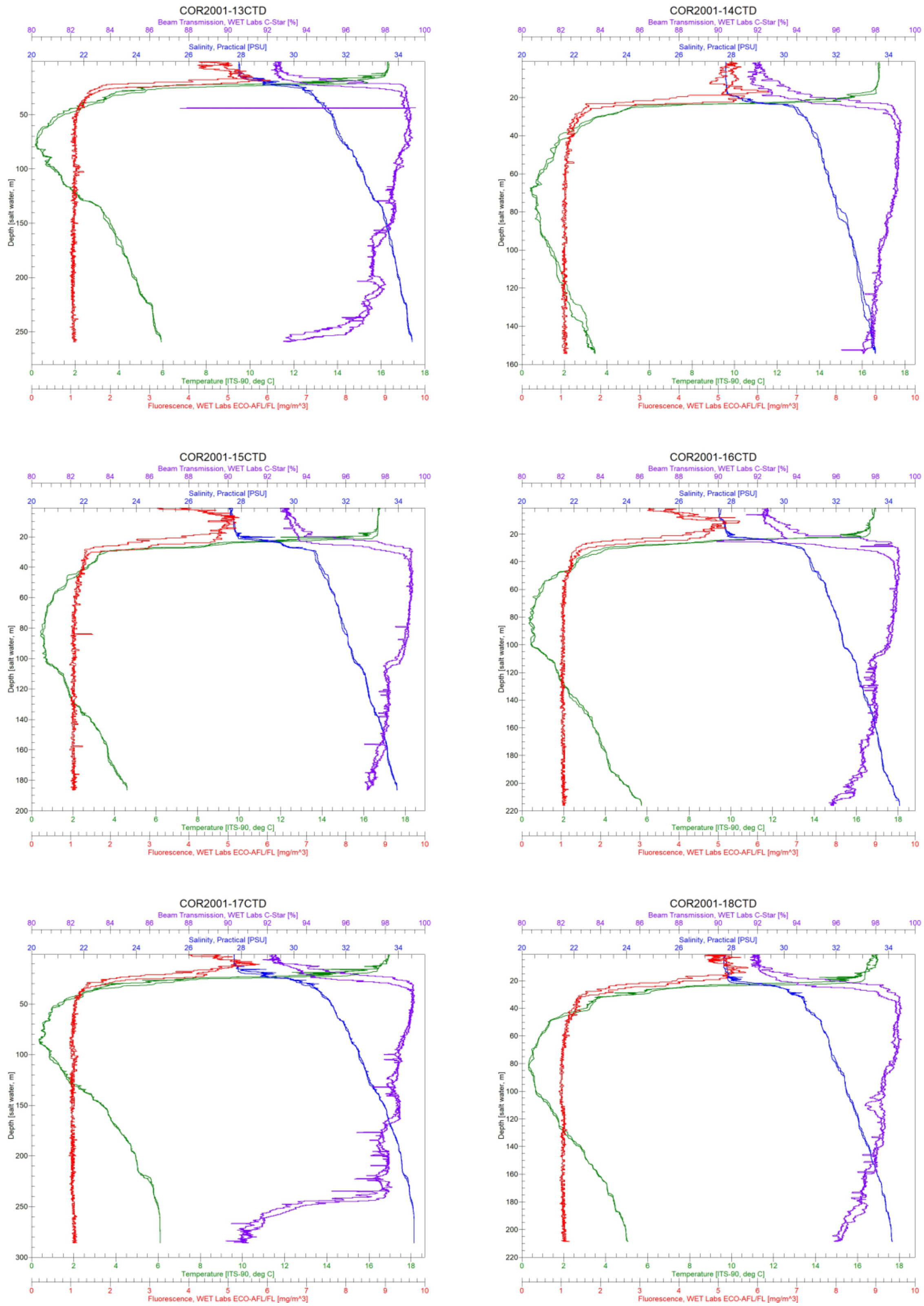

Figure D3: CTD profiles COR2001-13-18

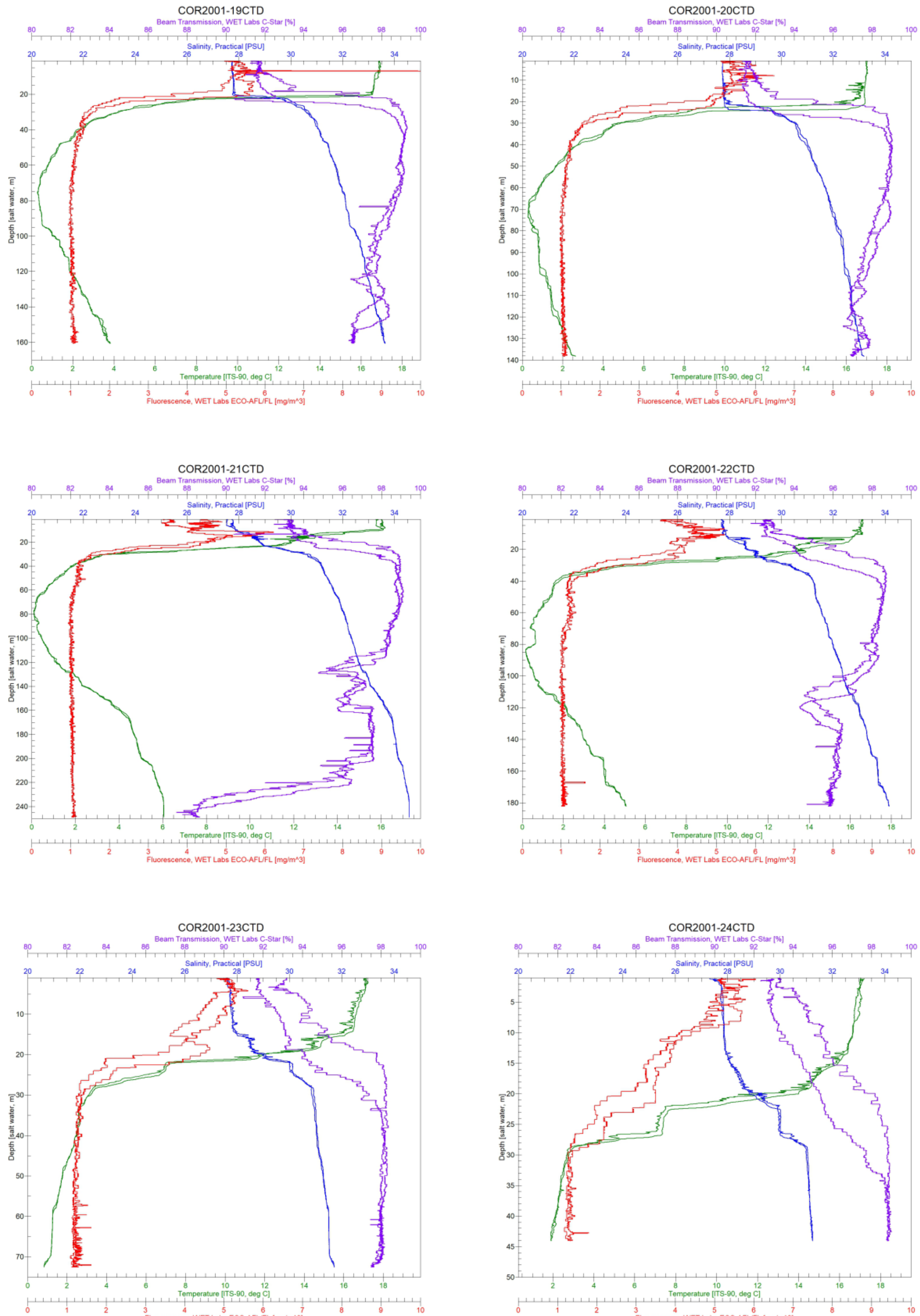

Figure D4: CTD profiles COR2001-19-24

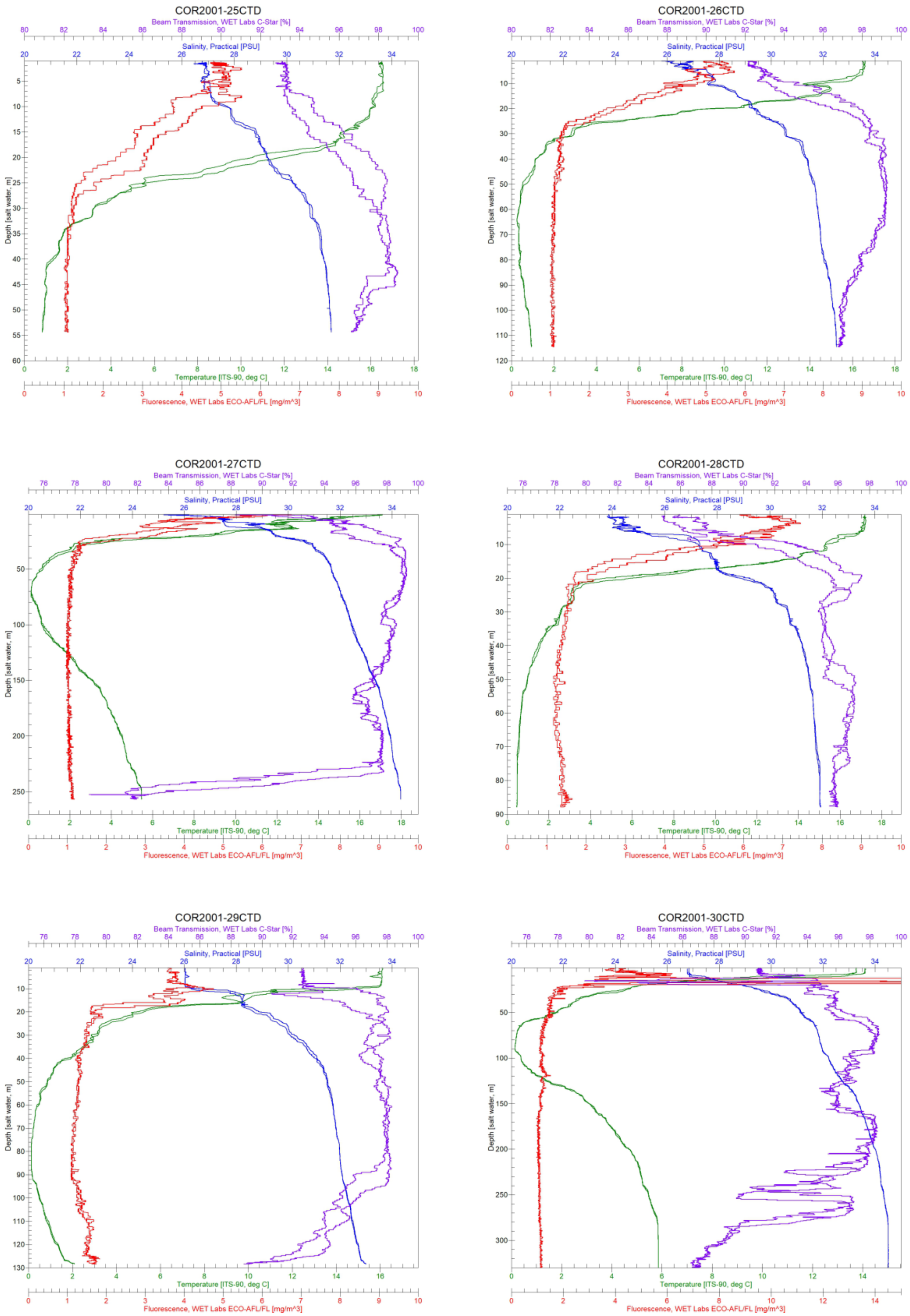

Figure D5: CTD profiles COR2001-25-30

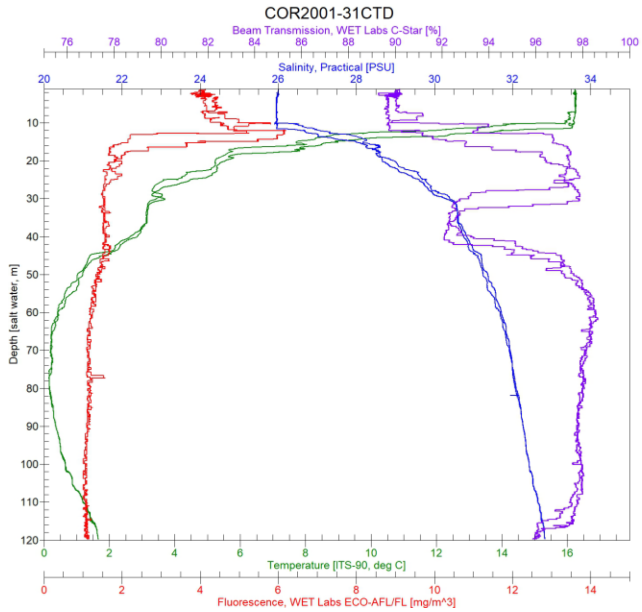

Figure D6: CTD profile 31

APPENDIX E: BOX CORE PHOTOGRAPHS

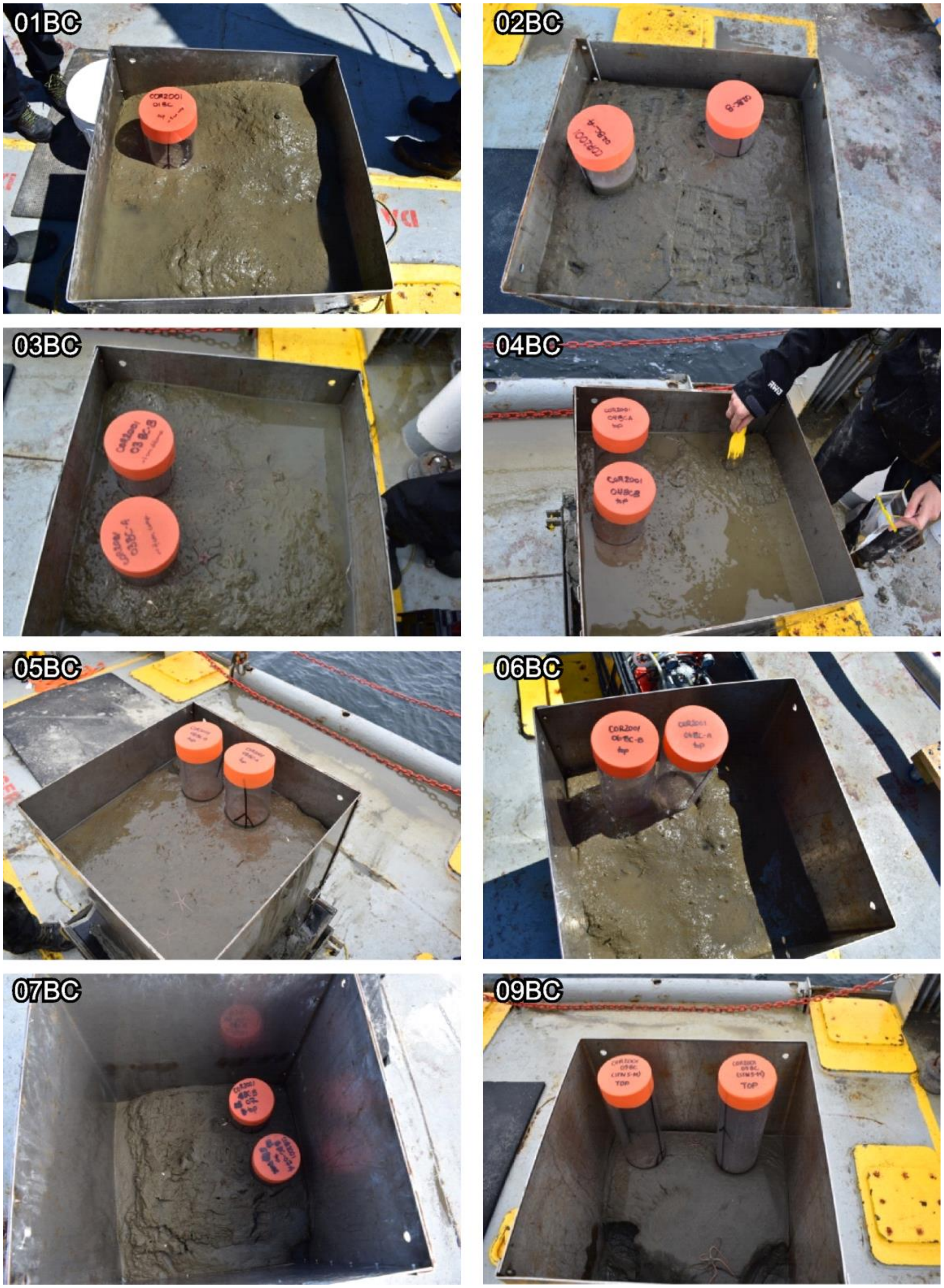

Figure E1: Photos of successful box cores COR2001-01-09 recovered during the mission.

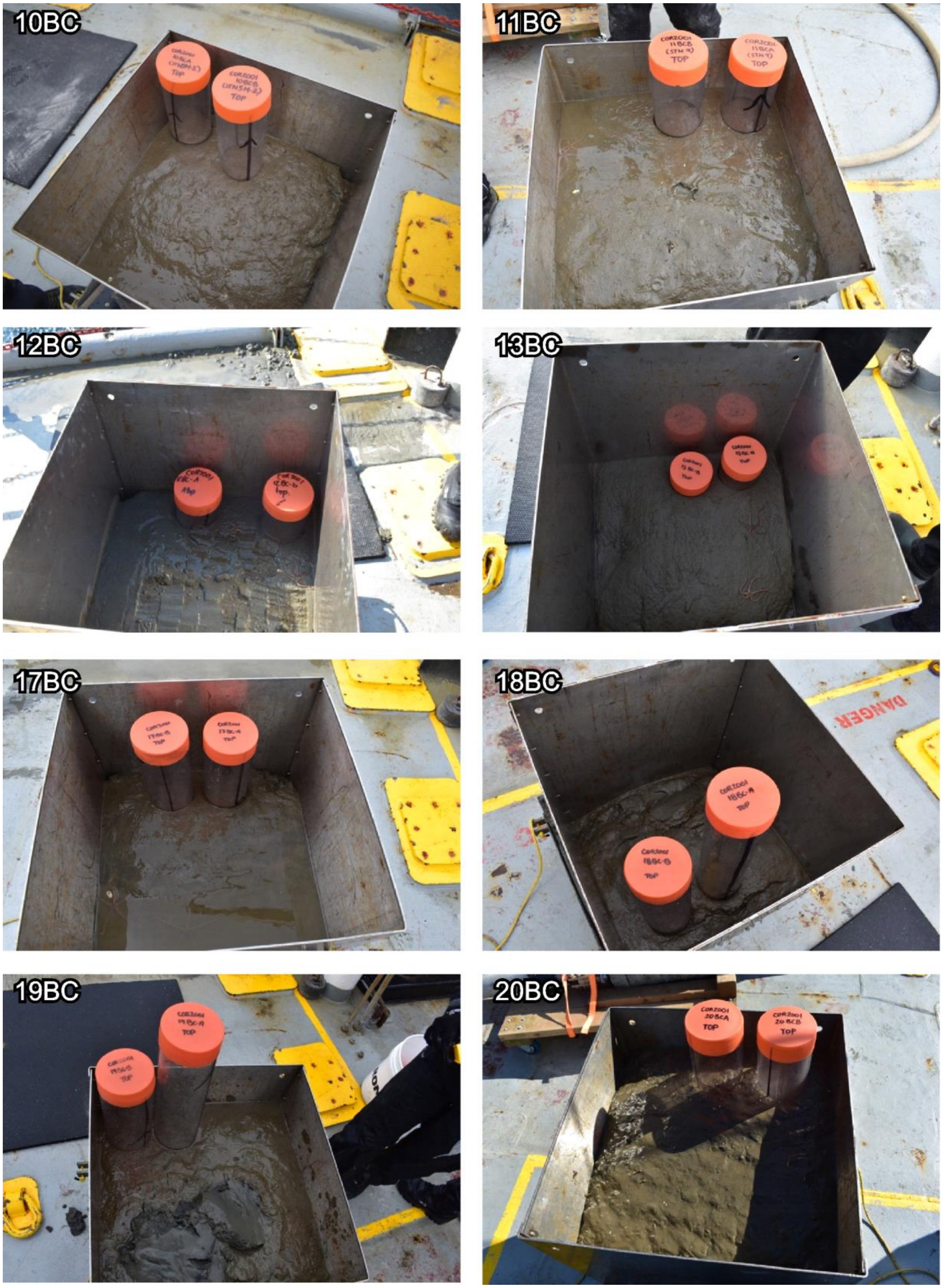

Figure E2: Photos of successful box cores COR2001-10-20 recovered during the mission.

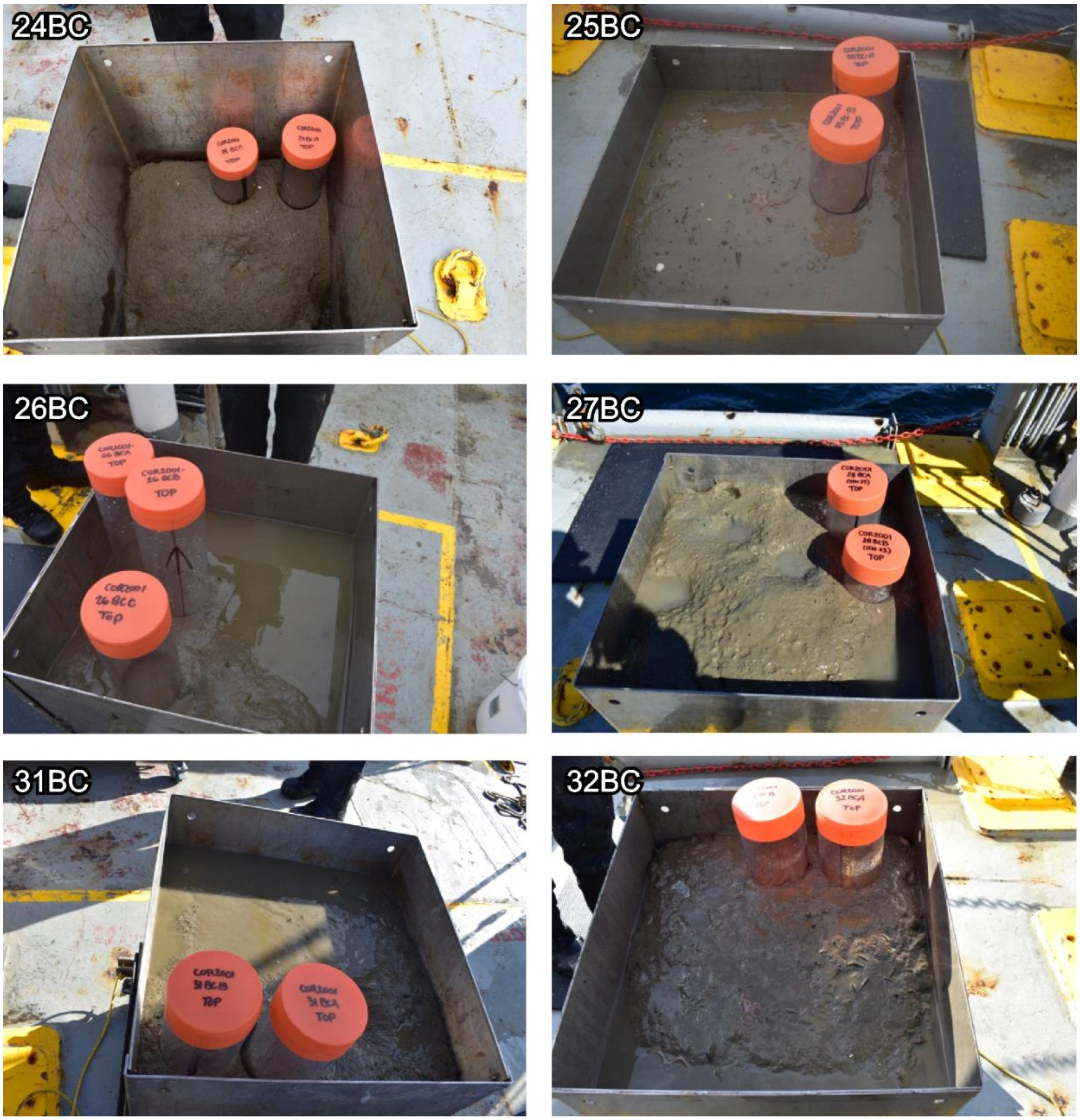

Figure E3: Photos of successful box cores COR2001-24-32 recovered during the mission.