# **IODP** Proposal Cover Sheet

909 - Add

NW Greenland Glaciated Margin

Received for: 2019-10-01

Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transec (CENICE)	t drilling in r	oortheast Baffin Bay
Proponents	Paul Knutz, Calvin Campbell, Paul Bierman, Anne de Vernal, Mads Huuse, DeConto, Karsten Gohl, Kelly Hogan, John Hopper, Benjamin Keisling, And Rebschläger, Kasia Sliwinska, Elizabeth Thomas, Eske Willerslev, Chuang	Anne Jennir Irew Newtor Xuan, Josej	ngs, David Cox, Rob n, Lara Perez, Janne oh Stoner
Keywords	Arctic, climate, interglacial, ocean circulation	Area	Baffin Bay
	Proponent Information		
Proponent	Paul Knutz		
Affiliation	Geological survey of Denmark and Greenland		
Country	Denmark		

Permission is granted to post the coversheet/site table on www.iodp.org

#### Abstract

Understanding the long-term history of the Greenland Ice Sheet (GrIS) is key to understanding northern hemisphere glaciation, to elucidating mechanisms underlying amplification of glacial cycles since the late Pliocene and to predicting how the GrIS will respond to modern climate warming. To address current knowledge gaps in the evolution and variability of the GrIS and its role in Earth's climate system, we propose to drill along a transect across the northwest Greenland margin extending from the shelf to Baffin Bay where thick Cenozoic sedimentary successions primarily reflect the evolution of the northern GrIS (NGrIS). The mission strategy is to retrieve a composite stratigraphic succession representing the Late Cenozoic era from Oligocene/early Miocene to Holocene. The proposed drill sites will specifically target high-accumulationrate deposits associated with contourite drifts and potential interglacial deposits within a trough-mouth-fan system including proximal shelf deposits, all densely covered by excellent quality 2-D and 3-D seismic data. We seek to test if the NGRIS underwent near-complete deglaciations in the Pleistocene and assess recent models for the change in orbital cyclicities through the Mid-Pleistocene transition. Moreover, the proposal will examine a possible linkage between the general decrease in atmospheric CO2 from the Oligocene to the early Miocene and arrival of cold and possibly glacially-dominated environments in northwest Greenland and establish the timing for tectonic margin adjustments inferred from the seismic record. Finally, records will be produced that can test hypothesis that glacial expansion of the NGrIS is linked with intensification of northern hemisphere glaciations (3.3-2.8 Ma) and unravel marine heat transport through the western North Atlantic and Baffin Bay as a potential cause for the Pliocene high Arctic warmth. The detailed information obtained from these paleoclimate archives will be of great value for predictive models addressing how the GrIS may respond to global warming in the near future. The overall aim is to investigate the full range of forcing and feedbacks - oceanic, atmospheric, orbital, tectonic - that influence the GrIS over a range of time scales, as well as conditions prevailing at the time of glacial inception and deglacial to interglacial periods. The scientific objectives of this proposal are of key significance in addressing the challenges "How do ice sheets and sea level respond to a warming climate?" and "How does Earth's climate system respond to elevated levels of atmospheric CO2?" under the Climate and Ocean Change theme of the IODP science plan.

909 - Add

#### Scientific Objectives

1. Test the hypothesis that the northern Greenland Ice Sheet (NGrIS) underwent significant deglaciation at intervals within the frequency range of orbital eccentricity (~100-400 ka).

2. Test the hypothesis that the general decrease in pCO2 from the early-middle Oligocene to the early Miocene is linked to cold and possibly glacially-dominated environments in northwest Greenland.

3. Provide information on timing, sedimentary processes and changes in NGrIS erosion related to tectonic adjustments inferred from the seismic record.

4. Test the hypothesis that major glacial expansion of the NGrIS is linked with intensification of NHG (3.3-2.8 Ma).

Assess recent models for the change in orbital cycles through the MPT, by analyzing sediment maturity and regolith history.
 Test the hypothesis that the high Arctic warmth of the early-mid Pliocene is related to heat advection through the western North Atlantic

Ocean and Baffin Bay.

Non-standard measurements technology needed to achieve the proposed scientific objectives

Proposed Sites (Total propos	ed sites: 21; pri:	7; alt:	14; N/S:	0)
------------------------------	--------------------	---------	----------	----

Cita Noma	Position	Water	Per	netration	(m)	Drief Site energific Objectives		
Sile Name	(Lat, Lon)	(m)	Sed	Bsm	Total	Brief Site-specific Objectives		
MB-23A (Primary)	72.9840 -62.9805	1821	422	0	422	Recover a high-resolution paleoceanographic record of a early/middle- late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-23A is targeting expanded intervals of units 9, 10 and 11 and overlaps stratigraphically with the strata drilled at site MB-2C. MB-23A is moved 0.45 km NW of nearest crossing line to stay clear of disturbances at the edge of the channel system. The site is selected as primary because of high reflection continuity and a better seismic quality/ resolution than for site MB-1C.		
<u>MB-01C</u> ( <u>Alternate)</u>	73.0001 -63.0065	1809	473	0	473	Recover a high-resolution paleoceanographic record of a early/middle- late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-1C is targeting expanded intervals of units 9, 10 and 11 and overlaps stratigraphically with the strata drilled at site MB-2C. Site was moved from 1B position to avoid amplitude anomaly at target depth. MB-1C is located 3.9 km from nearest crossing line to provide optimal coverage of units 9, 10 and 11.		
<u>MB-20A</u> ( <u>Alternate)</u>	72.9118 -63.0642	1928	464	0	464	Recover a high-resolution paleoceanographic record of a middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-20A targets expanded intervals of units 9, 10 and 11 and overlaps stratigraphically with the strata drilled at site MB-2C. The site is located ~1.2 km NW of nearest crossing line to avoid strong reflections at target depth (e.g. channel sands).		
<u>MB-02C</u> (Primary)	73.1150 -63.7904	1957	522	0	522	Recover a high-resolution paleoceanographic record of a early/middle- late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-2C targets an expanded interval of unit 8 and overlaps stratigraphically with the strata drilled at site MB-1C. The site is located ~1 km off the nearest crossline to obtain optimal stratigraphic coverage of unit 8 (beween horizons 7-8) and avoid amplitude anomaly at the base of this unit.		
MB-22A (Alternate)	73.1388 -63.6402	1850	611	0	611	Recover a high-resolution paleoceanographic record of a early/middle- late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-22A targets an expanded interval of unit 8 and overlaps stratigraphically with the strata drilled at site MB-1C. The site is located ~1 km off the nearest crossline to obtain optimal stratigraphic coverage of unit 8 (beween horizons 7-8) and avoid drilling into strong reflections (e.g. channel sands).		
<u>MB-31A</u> (Primary)	73.5607 -62.1512	531	282	0	282	Recover deglacial and interglacial intervals of potentially early-middle Pleistocene age within top-set strata of the trough-mouth fan. High priority for scientific objectives 1 and 5. Site MB-31A penetrates a package of flat-lying, semi-continuous reflections that onlap glacial unconformities of units 6, 7 and 8. TD is a positive reflection below horizon 6. The location is based on optimizing stratigraphic coverage and avoid strong reflections in the upper 100 ms interval. The site is also covered by deep seismic ANU-3D data. Site 31A is the primary choice since it will drill through a thinner and less complex overburden than at sites 8A and 3B.		
<u>MB-08A</u> ( <u>Alternate)</u>	73.4870 -62.2682	497	370	0	370	Recover deglacial and interglacial intervals of potentially early-middle Pleistocene age within top-set strata of the trough-mouth fan. High priority for scientific objectives 1 and 5. Site MB-8A penetrates a package of flat-lying, semi-continuous reflections that onlap glacial unconformities of units 6, 7, 8 and 9 (target depth is a positive reflection above horizon 6). The site is ~1 km offset from the nearest crossline to optimize recovery of the identified onlapping reflections.		
<u>MB-03B</u> ( <u>Alternate</u> )	73.5032 -62.4861	498	375	0	375	Recover deglacial and interglacial intervals of potentially early-middle Pleistocene age within top-set strata of the trough-mouth fan. High priority for scientific objectives 1 and 5. Site MB-3B penetrates a package of flat-lying, semi-continuous reflections that onlap glacial unconformities of units 6, 7, 8 and 9 (TD = top unit 6). The site is placed ~2.7 km off the nearest crossline to optimize recovery of onlapping reflections.		

# Proposed Sites (Continued; total proposed sites: 21; pri: 7; alt: 14; N/S: 0)

Cita Nama	Position	Water	Penetration (m)		(m)	Drief Site engelije Objectives			
Site Name	(Lat, Lon)	(m)	Sed	Bsm	Total	Brief Site-specific Objectives			
MB-30A (Primary)	73.9013 -61.8540	618	303	0	303	Recover deglacial and interglacial intervals of potentially early Pleistocene age within top-set strata of the trough-mouth fan (scientific objectives 1 and 5). MB-30A penetrates a package of flat-lying, continuous reflections that onlap a major glacial unconformity (Horizon 3). Depth target is a series of semi-parallel horizons infilling a small depression below Horizon 3. MB-30A is identified on high-res LAKO data, line 1035, located offset from nearest crossline to optimize stratigraphic layering. MB-30A is a primary site due to an evenly stratified sediment package above TD.			
<u>MB-04C</u> ( <u>Alternate)</u>	73.8734 -62.0528	628	305	0	305	Recover deglacial and interglacial intervals of potentially early Pleistocene age within top-set strata of the trough-mouth fan (scientific objectives 1 and 5). MB-4C penetrates a package of flat-lying, semi- continuous reflections that onlap a major glacial unconformity (horizon 3). Depth target is a series of positive-phase semi-parallel horizons infilling a small depression below unit 3. MB-4C is identified on the high-res LAKO data, located slightly offset from nearest crossline to optimize stratigraphic penetration of units 3-4. The site is an alternate site to MB-30A.			
<u>MB-06D</u> (Primary)	74.1283 -60.9744	614	561	0	561	Recover Neogene contourite drift sediments that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-6D overlaps stratigraphically with the lowermost section drilled at site MB-17A (and alternates 5B, 13A and 14A). The main target is an expanded section of a mounded contourite drift that may contain a high-resolution early Pliocene record. TD is placed above a marked reflection package below the drift body. MB-6D is located within the ANU-3D cube, and is crossed by a high-res profile LAKO_1044.			
MB-15A (Alternate)	74.1217 -60.9909	605	582	0	582	Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-15A overlaps stratigraphically with the lowermost section drilled at site MB-5B (and alternates 13A and 14A). The main target is an expanded section of the drift deposit that may contain a high-resolution early Pliocene record. TD is placed 30 ms below a prominent reflection draping over a slide scar. High priority for scientific objectives 3, 4 and 6. MB-15A is located within the ANU-3D cube.			
MB-17A (Primary)	74.2323 -61.0374	655	230	0	230	(1) Capture deposits corresponding to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene sediments of likely early Pliocene age that can elucidate paleoceanographic conditions prior to the major expansion of the GrIS (scientific objectives 3, 4 and 6). MB-17A targets the stratigraphically younger interval drilled at site MB-6D. The site is located within the ANU-3D cube, and is covered by high-res line LAKO_1033. Selected as primary site in favour of sites 5B, 13A and 14A due to optimal recovery of the youngest sediments, and for avoiding having to drill through thick clinoform deposits.			
<u>MB-05B</u> ( <u>Alternate)</u>	74.2116 -61.3397	704	520	0	520	(1) Capture a thin wedge of progradational deposits that may correspond to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). MB-5B targets the stratigraphically younger interval of the drift deposit that overlaps with the section drilled at site MB-6C. The site is located within the ANU-3D cube. Selected as primary site due to most optimal recovery of the youngest sediments.			
MB-13A (Alternate)	74.2118 -61.3958	707	540	0	540	(1) Capture a thin wedge of progradational deposits that may correspond to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-13A (alternate for 5B) targets the stratigraphically younger interval of the drift deposit that overlaps with the section drilled at site MB-6C. The site is located within the ANU-3D cube.			
<u>MB-14A</u> ( <u>Alternate)</u>	74.2109 -61.2704	663	510	0	510	(1) Capture a thin wedge of progradational deposits that may correspond to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-14A (alternate for 5B) targets the stratigraphically younger interval of the drift deposit that overlaps with the section drilled at site MB-6C. The site is located within the ANU-3D cube.			

# Proposed Sites (Continued; total proposed sites: 21; pri: 7; alt: 14; N/S: 0)

Cita Nomo	Position	Water	Per	netration	(m)	Drief Site engelije Objectives
Sile Name	(Lat, Lon)	(m)	Sed	Bsm	Total	Brief Site-specific Objectives
MB-07B (Primary)	74.4925 -60.5832	736	978	0	978	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon horizon with TD at the top of a sedimentary wedge of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Located within PITU-3D high-res cube, and covered by high-resolution 2D seismic line LAKO_1033. Site 7B is selected as the primary site on the basis of its optimal stratigraphy and clear depth target on the 3D data.
<u>MB-16A</u> ( <u>Alternate)</u>	74.5507 -60.7990	734	1089	0	1089	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon horizon with TD at the top of a sedimentary wedge of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Located at the northern limit of the PITU-3D high-res cube, and 0.9 km offset from the high-resolution 2D line LAKO_1035. Site 16A is an alternate site with a stratigraphic structure similar to site 7A but with TD located ~ 100 m deeper.
<u>MB-11A</u> ( <u>Alternate)</u>	74.4283 -60.4086	747	1015	0	1015	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon (d1) with TD at horizon d2 of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Located within PITU-3D high- res cube.
MB-12A (Alternate)	74.4597 -60.5049	739	971	0	971	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon (d1) with TD at horizon d2 of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Alternate site for 7A. Located within PITU-3D high-res cube.
MB-10A (Alternate)	74.4584 -61.1792	698	1200	0	1200	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon (d1) with TD at horizon d2 of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). MB-10A is located on the edge of the PITU-3D seismic data. Alternate position to site MB-07A.

#### **Contact Information**

Contact Person:	Paul Knutz
Department:	Geophysics
Organization:	Geological Survey of Denmark and Greenland
Address:	Øster Voldgade 10 Copenhagen Denmark 001350 Denmark
E-mail/Phone:	pkn@geus.dk; Phone: +45 91333925

# Proponent List

First Name	Last Name	Affiliation	Country	Role	Expertise
Paul	Knutz	Geological survey of Denmark and Greenland	Denmark	Principal Lead	Marine geology, sedimentology, paleoceanography
Calvin	Campbell	Geological Survey of Canada	Canada	Data Lead	Marine geoscience, sedimentology
Paul	Bierman	University of Vermont	United States	Other Lead	Cosmogenic geochemistry and geomorphology
Anne	de Vernal	GEOTOP, Université du Québec à Montréal	Canada	Other Lead	Biostratigraphy, paleoceanography
Mads	Huuse	University of Manchester	United Kingdom	Other Lead	Marine geology, sedimentary basins, fluid flow
Anne	Jennings	INSTAAR, University of Colorado	United States	Other Lead	Paleoclimate, paleoceanography, biostratigraphy
David	Cox	Manchester University	United Kingdom	Other Proponent	Marine Geophysics; Subsurface Geohazards
Rob	DeConto	University of Massachusetts	United States	Other Proponent	Earth system modeling
Karsten	Gohl	Alfred Wegener Institute	Germany	Other Proponent	Marine Geophysics; Co-chief scientist Exp. 379
Kelly	Hogan	British Antarctic Survey	United Kingdom	Other Proponent	Marine Geophysics; Sedimentology
John	Hopper	Geological Survey of Denmark and Greenland	Denmark	Other Proponent	Marine geophysics, Arctic basin tectonics
Benjamin	Keisling	University of Massachusetts	United States	Other Proponent	Ice Sheet/Climate Modelling
Andrew	Newton	Queen's University Belfast	United Kingdom	Other Proponent	Marine Geophysics; Quaternary Science
Lara	Perez	British Antarctic Survey	United Kingdom	Other Proponent	Marine Geophysics
Janne	Rebschläger	Max-Planck-Institut für Chemie, Mainz	Germany	Other Proponent	Foraminifera, Mg/Ca, alkenones
Kasia	Sliwinska	Geological Survey of Denmark and Greenland	Denmark	Other Proponent	Micropaleontology; Oligocene-Miocene Paleoclimate
Elizabeth	Thomas	University of Buffalo	United States	Other Proponent	Organic geochemistry, biomarkers, stable isotopes
Eske	Willerslev	University of Copenhagen	Denmark	Other Proponent	geogenetics

909 - Add

# Proponent List (Continued)

First Name	Last Name	Affiliation	Country	Role	Expertise
Chuang	Xuan	University of Southampton	United Kingdom	Other Proponent	Paleomagnetics, stratigraphy
Joseph	Stoner	Oregon State University	United States	Other Proponent	Sedimentology; Paleomagnetics

# ADDENDUM to Proposal 909-Full2 "Cenozoic Evolution of the Northern Greenland Ice Sheet" (CENICE)

The overall aim of Proposal 909Full-2 is to unravel the long-term evolution of the northern Greenland Ice Sheet accomplished by drilling a composite late Cenozoic succession on the West Greenland margin, NE Baffin Bay. The strategy is to drill 7 sites along a transect representing deep basin to inner shelf positioned between two major trough-mouth fan systems. The proposed sites range from Quaternary to Pliocene-Miocene, and potentially Oligocene deposits, with contourites, hemipelagic and glacial-marine deposits as the key drilling targets. The site identification was based on industry reflection seismic data: (1) regional 2D seismic surveys collected by TGS (BB2007, BB2008, BB2009 and BB2010) and (2) two 3D surveys (Cairn-PITU-3D-2011; Shell-ANU-3D-2012). The seismic stratigraphy and preliminary age model of the Quaternary and Neogene succession are presented in (Knutz et al., 2015) and (Knutz et al., 2019). Studies of seabed features and recent glacial processes are provided by (Dowdeswell and Fugelli, 2012; Slabon et al., 2016); (Newton et al., 2017). One of the main reasons for this addendum is that EPSP, SEP and external reviewers of Proposal 909Full-2 recommended the identification of alternate sites for some of the primary sites as a contingency for environmental hazards, notably icebergs. In addition, one of the reviewers asked for high-resolution seismic data to substantiate the interpretation of reflection onlaps, and identification of potential interglacial sediments buried within gentle depressions of the glacigenic aggrading wedge (linked with Scientific Objective 1).

Below is an account of new data seismic data collected in August 2019 to support of proposal 909, followed by an explanation of the site changes and new sites identified based on the high-resolution seismic data in combination with the existing 3D data volumes. Finally, we provide an update of the drilling plan, including prioritization of the proposed sites.

#### New seismic data

High-resolution reflection seismic data (15-300 Hz), totalling 861 line-km, was collected in NE
Baffin Bay using RDMS *Lauge Koch* and the Aarhus University/GEUS airgun seismic equipment (Fig.
1). The objectives of the expedition were to: (1) provide more detailed information around the

primary sites with early-middle Pleistocene targets (MB-1B, MB-2B), (2) identify additional sites with potential for coring interglacial deposits within the mid-shelf aggradational wedge (e.g. MB-4B, MB-8A), and (3) acquire long profiles along the transect to ensure high-resolution coverage of the primary Neogene targets (MB-5A, MB-6C and MB-7A). The seismic acquisition was optimized to gain enhanced resolution in the top 500 m of the sedimentary section, complementary to the existing industry data. We opted for a basic setup that used a 90 cu. in. Gl-gun as a seismic source, configured with a 45 cu. in. main chamber and 45 cu. in. injection chamber. Shot time was 4.0 s for most of the data and record length varying between 2.0-3.5 s. Shots were recorded on a Geometrics GeoEel streamer, which included five 25 m active sections of 8 channels each (40 channels total) with a group spacing of 3.125 m.

The overall data quality is excellent. The small GI-gun performed well and the small group spacing and shot interval resulted in very good high-resolution imaging of the upper 500 ms below seabed. This is also the case on the shelf where there were some initial concerns about penetration below the hard seabed. The main complication with processing the data is the rough seabed on the shelf, which is marked by significant short wavelength variations from glacial scouring and iceberg plough marks. Initial processing was performed on the ship but final processing remains, including deconvolution to zero-phase data, and confirmation of static and delay correction. Nonetheless, on the present migrated version, seismic horizons can be transferred from the industry data without issue (e.g. Fig. 2). The new high-resolution data is clearly of significant value for the refinement and selection of additional sites for the CENICE mission (Knutz et al.; 909Full-2).

The high-resolution data have not added new information to sediment velocities. For the timedepth conversion we have used the same Vp values as described in the Full-2 submission (Table 1) that was based on commercial seismic data and borehole/well information. It is noted that due to the limited time between acquiring the data and the Addendum submission it was necessary to focus on areas considered most important for achieving the key drilling objectives. Additional data are additional data are available to refine positions if required by EPSP or JRFB.

#### **Other data collected**

Innomar sediment echosounder and multibeam data were collected. However, on the shelf areas the Innomar data was of poor quality because of a compacted seabed. It is also noted that bathymetry covering all sites has already been uploaded to the SSDB (Fig. 2). Three gravity cores, recovering between 4.5- 5.0 m of gray-brown unconsolidated mud were obtained at the deepwater sites MB-1C, MB-2C and MB-20A. The cores have not been opened yet, but based on the full penetration of the 6-m gravity corer and the sediment colour/texture noticed during cutting it is assumed that they are mainly of Late Pleistocene to Holocene age.



**Figure 1**. Top left: RDMS *Lauge Koch* coring in Baffin Bay. Top right: Proposed sites of the CENICE drilling proposal and coverage of new site survey data. Bottom: High-resolution seismic profile across one of the deep-water locations compared with the corresponding industry profile (courtesy of TGS).



**Figure 2.** Map showing coring sites proposed in 909Full-2 and seismic data base, including new highresolution survey LAKO-2019 (black lines). TGS industry surveys are shown with thin lines. 3D seismic surveys ANU and PITU are marked by square polygons (dark blue and light blue, respectively). The detailed bathymetry shown is from Newton et al. (2017). Bathymetric contouring is based on IBCAO v3 (Jakobsson et al., 2012).

#### Middle Shelf sites; Late Oligocene and Miocene

#### Changes to existing sites

The LAKO data indicated that site MB-7A was located in close vicinity to vertical noisy features, e.g. "chimneys" (Fig. 3a). These features were also noticed on the PITU-3D data, although these anomalies did not directly intersect the location. A new site was selected based on the LAKO\_1033 profile in combination with the PITU-3D high-resolution data cube. This location, MB-7B, penetrates flat-lying strata within a 1-1.5 km wide block bordered by keystone faults (Figs. 3a-b). The base of the parallel stratified package onlaps a sedimentary wedge containing clinoform features, possibly representing Oligocene fan deposits above the Melville Bay Ridge. The strategy is to drill the top of the wedge but not through it. With a TD of 963 m, site 7B is ~200 m shallower than 7A, which will benefit the drilling schedule.



**Figure 3a.** Site MB-7B shown on the LAKO high-resolution data in relationship to the original site 7A. Mid-Miocene Unconformity shown in green. Punctuated horizons follow internal reflectors within the upper Miocene package (MU-C). Position of composite profile shown in Fig. 1.



**Figure 3b.** Site 7B displayed on an inline section of the PITU HR 3D seismic data. MMU = Mid-Miocene Unconformity. Position of profile shown in Fig. 1.

#### **New sites**

MB-16A is an alternate site for site 7B, based on LAKO\_1035 in combination with the PITU-HR-3D seismic cube. Site 16A is about 1 km offset from the LAKO profile in order to optimize the depth target. This site carries the same drilling objective as site 7B, 11A and 12A, and has a similar stratigraphic setting at the edge of the Melville Bay Graben. To reach a corresponding depth target (top of wedge below onlap surface) site 16A is about 90 m deeper than MB-7B. With a location 9.2 km NE of the primary site 7B, it provides additional contingency for icebergs.

#### Middle Shelf Sites; late Miocene and Pliocene

#### Changes to existing sites

Site MB-6D is covered by LAKO line 1044 and the ANU-3D data cube (Fig. 4a-b). The highresolution seismic data, in combination with mapping of anomalies in the ANU-3D data (David Cox, PhD research) prompted us to relocate this site to what is now site 6D. The total depth for site 6D is placed at 1428 ms (including rathole) above the stacked anomalies seen at the base of the Pliocene mound between 1450-1500 ms. The new position also avoids drilling through strong reflections seen in the shallow section above and below the late Pliocene unconformity (LPU; red) horizon (Fig. 4a).



**Figure 4a.** Composite high-resolution seismic section (1033 and 1044) covering sites MB-6D (moved from 6C) and MB-17A (new). Position of profile shown in Fig. 1. Internal horizons highlighted by dotted lines. LPU = Late Pliocene Unconformity.



**Figure 4b.** Sites 6D and 6C covered by two seismic intersections of the ANU-3D cube (left; right). The two sites and corresponding seismic intersections are displayed on the anomaly map in the middle. The bright spots flagged on the seismic profiles, and highlighted by the bright red areas on the map, may reflect gas charged sand and, hence, should be avoided. The area in between, corresponding to the central parts of the Pliocene contourite mound, looks evenly stratified and free of bright events. However, to be cautious we decided to move the site to a downdip position of the anomalies. Position of LAKO-1044 profile shown by thin green line.

#### **New sites**

Site MB-17A is covered by LAKO line 1033 and the ANU-3D data cube (Fig. 4a). The purpose is to core the younger portion of the contourite drift deposits at a shallower location than the original sites MB-5B, 13A and 14A targeting this interval. In this way, we avoid having to drill through a +100 m section of prograding glaciogenic clinoforms above the late Pliocene unconformity (LPU), which will benefit the operations plan. MB-17A will core through a sequence of evenly layered strata at a position where the LPU is located about 60 m below the seafloor, and continue through stacked asymmetric deposits that thin out over the main body of the contourite drift. The position is selected to optimize the drilled stratigraphy and to avoid amplitude anomalies observed over the updip flank of the dipping wedge. With a TD in the upper section of the mounded drift, 17A will replace site 5B as a primary site and will also serve as an alternate for MB-6D. This leaves two options to be decided at sea:

*Option 1:* TD set in the upper part of the older drift mound, below the purple horizon (see Fig. 4a). In this case 17A will be drilled to 230 mbsf and partly overlap the stratigraphic section of MB-6D. *Option 2:* If site 6D is unsuccessful in coring through the mounded drift, site 17A will be drilled deeper (to ~400 mbsf) to obtain as much of the assumed Pliocene record as possible.

#### **Pleistocene shelf sites**

#### Changes to existing sites

MB-4B was covered by two crossing lines as part of a local survey conducted around this site (Fig. 2). Based on the new high-resolution data, it can be observed that site 4B penetrates a section between horizons 3 and 4 that appears more noisy than neighbouring sections. It was decided to move the site, now MB-4C, 0.6 km northwest of the crossing line where the strata package shows more continuity (Site Figure MB-4C). The depth target is now better defined, seen as a dipping erosional surface within the upper part of TMF Unit 3. Drilling into the clinoforms below this surface should be avoided, therefore the new location has a TD of 285 mbsf; ~30 m less than 4B.

There is scope for further refinements based on the detailed high-resolution data grids, notably the additional study area south of the main transect which has not been fully analysed (Fig. 2).

#### **New sites**

MB-30A was identified on LAKO\_1035 about 7 km from site 4B (Fig. 2). As for 4B, site 30A targets onlapping strata above and below Horizon 3, with an unconformable horizon below Horizon 3 as TD (Site Figure 30A). Mapping of this horizon on the LAKO data indicate a small depression infilled by onlapping sediments, in a configuration similar to that seen at site 4C. MB-30A is selected as a primary site due to overall high reflection continuity and apparently uncomplicated seabed. In addition, the site is covered by inline 14776/xline 13020 of the ANU-3D data.

MB-31A was identified on LAKO\_1033 at a position 9 km north of site 8A (Fig. 2). The site objective is to recover stratified intervals between horizons 6, 7 and 8 that may contain marine interglacial deposits of Early – Middle Pleistocene age (Site Figure MB-31A). There are no high-resolution

crossing profiles, but inline/xline crossings of the ANU-3D data is available. The site is marked by good strata continuity and uncomplicated seabed morphology. Strong reflections are seen locally within the package above horizon 8 but are absent at the position of site 31A. At the current state of analyses, it is selected as the most optimal site for gaining stratigraphic information from the outer shelf aggrading wedge. At 262 mbsf the horizon 6 target is ~80 m more shallow than at site 8B which leaves more room in the drilling plan. The plan is to core two holes. Hole A using RCB and, preferably, core Hole B by a combination of flushing and APC/XCB to optimize recovery through muddy intervals.

#### **Deep Water Sites; Middle to Late Pleistocene**

#### Changes to existing sites

Site 21A has been omitted due to its location on the lower fan wedge of the Melville Bugt TMF. As for the Pleistocene shelf sites, there is scope for further refinements for coring the deep-water intra-channel drift mounds, but this necessitates a more detailed analyses of this data set.

#### **New sites**

Site MB-23A was added based on LAKO\_1012 (Site Figure MB- 23A). The data quality of this line is outstanding but due the sea state worsening on day 2 of the seismic operation other seismic profiles were more noisy, including LAKO\_1022 covering site 1C. Site MB-23A is selected as a primary site because of high reflection continuity and a well defined depth target that, for the reason mentioned above, is superior over site 1C.

#### **Revised drilling plan**

The drilling plan has been revised to accommodate the critical point that coring of the 7 sites will take longer than included in the current plan (Table 1). The new operations schedule was completed with assistance from JRSO and includes a 5 day portcall in St. Johns. With amendments to operations and drilling depths total expedition days is 54.8 in addition to 1.5 WOI days. Aside from the 1.5 WOI days there is now built in contingency of about 6 days, which should leave room for delaying issues such as slow drilling, getting stuck in holes ect. The drilling priority has also

been revised (Table 2). The plan is to proceed with drilling along the transect in a sequence that prioritize the primary and alternate sites, in a general sequence going from younger to older strata. However, iceberg conditions may require changes to this prioritization that will have to be decided at sea.

Proposed site	Lat. Long (dec. degrees)	Seafloor depth (mbss)	Sed. depth (mbsf)	Seismic data; SP/Inline/Xline	Operations description	Transit/port call (days)	Coring/drilling (days)	Logging (days)
					Start of expedition: St. John's, NF, Canada	5		0.17
-					Transit to MB-1C	6.2		
MB-23A	72.9840	1821	422	LAKO_1012; 14841	Hole A: APC to refusal (~250 mbsf)		1.7	
	-62.9805			P. S. Manual Contractor	Hole B: APC to refusal (~250 mbsf)		1.2	
					Hole C: APC to refusal, XCB to TD		2.2	
					Log: Triple Combo, FMS sonic, VSI (Hole C)			1.3
				The second s	Transit to MB-2C	0.1		
MB-2C	73.1150	1957	537	BB10-5063125; 12768	Hole B: APC to refusal (~250 mbsf)		1.5	
	-63.7904				Hole A: APC to refusal (~250 mbsf)	1	1.2	
· · · · ·	1	-		-	Hole C: APC to refusal, XCB to TD		2.7	
			· · · · · · · · · · · · · · · · · · ·		Log: Triple Combo, FMS sonic, VSI (Hole C)	1		1.3
				and the second se	Transit to MB-31A	0.2		
MB-31A	73.5607	531	282	LAKO 1033; 46083	Hole A: RCB to TD		1.3	
	-62.1512				Hole B: Drill to 70 mbsf, APC/XCB to TD.		1.3	
					Log: Triple Combo, FMS sonic, VSI (Hole A)			1
			and the second second	The subscription of the local division of the local division of the local division of the local division of the	Transit to MB-30A	0.1	-	
MB-30A	73.9013	618	303	LAKO 1035; 71423	Hole A: RCB to TD.		1.3	
	61.8540		· · · · · · · · · · · · · · · · · · ·		Log: Triple Combo, FMS sonic		·	0.8
	Including the local day			A REAL PROPERTY AND ADDRESS OF	Transit to MB-6D	0.1	and the second se	
MB-6D	74.1283	614	571	LAKO_1044; 88383	Hole A: RCB to TD		2.3	
	-60.9744	1.1.1	2	1.00 000 000 000 000	Log: Triple Combo, FMS sonic, VSI-checkshot			1.3
				And the second second	Transit to MB-17A	0,1		
MB-17A	74.2323	655	231	LAKO 1033; 56182	Hole A: RCB to TD		1.1	
	-61.0374				Log: Triple Combo, FMS sonic			0.8
a la companya da series de la companya			and the second second	No. of Concession, Name	Transit to MB-7D	0.1		
MB-7B	74.4925	736	983	PITU 3D; 2499/7230	Hole A: RCB coring to 600 mbsf.		2.7	
1.	-60.5832		(		Log Hole A: Triple Combo, FMS sonic, VSI			1.3
					Hole B: Install HRT w. 600 m of casing; RCB to TD		5.4	
					Log B: Triple Combo, FMS sonic, VSI			1.2
				the second se	Transit to St. John's	6.5		
-	_				End of expedition	18.4	25.9	9
Transit de	illing and logate						52.2	
Maiting -	ming and loggin						15	
waiting o	n-ice:					-	1.0	
Total expe	aution days:	1					54.8	

Table 1

Proposed site	Lat.	Long.	Seafloor depth (mbss)	Horizon target (mbsf)	Sediment depth (mbsf)*	Average Vp	Priority	Objectives
MB-23A	72.9840	-62.9805	1821	402	422	1800	1.1	1&5
MB-1C	73.0001	-63.0065	1809	455	473	1800	1.2	1& 5
MB-20A	72.9118	-63.0642	1928	446	464	1800	1.3	1 & 5
MB-2C	73.1150	-63.7904	1957	518	537	1800	2.1	1&5
MB-22A	73.1388	-63.6402	1850	583	611	1800	2.2	1 & 5
MB-31A	73.5607	-62.1512	531	262	282	2200	3.1	1&5
MB-8B	73.4951	-62.2560	503	282	302	2200	3.2	1&5
MB-3C	73.4959	-62.4239	497	395	415	2200	3.3	1 & 5
MB-30A	73.9013	-61.8540	618	283	303	2200	4.1	1&5
MB-4C	73.8734	-62.0528	628	285	305	2200	4.2	1 & 5
MB-6D	74.1283	-60.9744	614	571	591	2000	5.1	3,4&6
MB-15A	74.1217	-60.9909	605	562	582	1950	5.2	3,4&6
MB-17A (op 1)	74.2323	-61.0374	655	211	231	1950	6.1	3,4&6
MB-17A (op 2)	74.2323	-61.0374	655	391	411	1950	6.1	3, 4 & 7
MB-5B	74.2116	-61.3397	704	500	520	1900	6.2	3,4&6
MB-13A	74.2118	-61.3958	707	520	540	1900	6.3	3,4&6
MB-14A	74.2109	-61.2704	663	490	510	1900	6.4	3,4&6
MB-7B	74.4925	-60.5832	736	963	983	2050	7.1	2&3
MB-16A	74.5507	-60.7990	734	1069	1089	2050	7.2	2&3
MB-11A	74.4283	-60.4086	747	990	1010	2050	7.3	2&3
MB-12A	74.4597	-60.5049	739	951	971	2050	7.4	2&3
MB-10A	74.4584	-61.1792	698	1129	1149	2050	7.5	2&3

#### Table 2

#### References

Dowdeswell, J.A., Fugelli, E.M.G., 2012. The seismic architecture and geometry of grounding-zone wedges formed at

the marine margins of past ice sheets. Geological Society of America Bulletin, 124(11-12): 1750-1761.

- Jakobsson, M., Mayer, L., Coakley, B., Dowdeswell, J.A., Forbes, S.e.a., 2012. International Bathymetric Chart of the Arctic Ocean (IBCAO) Version 3.0. Geophysical Research Letters, 39: L12609.
- Knutz, P.C., Hopper, J.R., Gregersen, U., Nielsen, T., Japsen, P., 2015. A contourite drift system on the Baffin Bay-West Greenland margin linking Pliocene Arctic warming to poleward ocean circulation. Geology, 43(10): 907-910.
- Knutz, P.C. et al., 2019. Eleven phases of Greenland Ice Sheet shelf-edge advance over the past 2.7 million years. Nature Geoscience, 12: 361–368.
- Newton, A.M.W. et al., 2017. Ice stream reorganization and glacial retreat on the northwest Greenland shelf. Geophys. Res. Lett., 44.
- Slabon, P. et al., 2016. Greenland ice sheet retreat history in the northeast Baffin Bay based on high-resolution bathymetry. Quaternary Science Reviews, 154: 182-198.

#### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover a high-resolution paleoceanographic record of a early/middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-23A is targeting expanded intervals of units 9, 10 and 11 and overlaps stratigraphically with the strata drilled at site MB-2C. MB-23A is moved 0.45 km NW of nearest crossing line to stay clear of disturbances at the edge of the channel system. The site is selected as primary because of high reflection continuity and a better seismic quality/resolution than for site MB-1C.
List Previous Drilling in Area	

## Section B: General Site Information

Site Name:	MB-23A	Area or Location: Melville Bay, NE Baffin	Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 72.9840	Jurisdiction: Greenland	
Longitude:	Deg: -62.9805	Distance to Land: (km) 215	
Coordinate System:	WGS 84		
Priority of Site:	Primary:	Water Depth (m): 1821	
Coordinate System: Priority of Site:	WGS 84 Primary:	(km) Water Depth (m): 1821	

# Section C: Operational Information

	Sediments				Basen	nent
Proposed Penetration (m):	422			0		
	Total Sediment Thickness (m)	2500				
	L			Total Penetra	ation (m):	422
General Lithologies:	Clayey-silty mud with d	ropstones				
Coring Plan: (Specify or check)	Hole A: APC to refusal Hole B: APC to refusal Hole C: APC to refusal; XCB to T APC	хсв 🔽	RCB	Re-entry	PCS	
Wireline Logging	Standard Measurements	Special Tool	s			
Plan:	WL     ✓       Porosity     ✓       Density     ✓       Gamma Ray     ✓       Resistivity     ✓       Sonic (Δt)     ✓       Formation Image (Res)     ✓       VSP (zero offset)     ✓       Formation Temperature & Pressure     ✓	Magnetic Susceptibilit Borehole Temperature Formation Image (Acoustic) VSP (walkaway) LWD		Other tools:		
	Other Measurements:				1	
Estimated Days:	Drilling/Coring: 5.	1 Logg	ing:	1.3	Total C	on-site: 6.4
Observatory Plan:	Longterm Borehole Observation	Plan/Re-entry Plan				
Potential Hazards/	Shallow Gas	Complicated Seabed Condition		Hydrothermal Activit	у	Preferred weather window
weather.	Hydrocarbon	Soft Seabed		Landslide and Turbid	ity	July-September
	Shallow Water Flow	Currents		Gas Hydrate		
	Abnormal Pressure	Fracture Zone		Diapir and Mud Volc	ano	
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault		High Temperature		
	H <sub>2</sub> S	High Dip Angle		Ice Conditions	$\checkmark$	
	CO <sub>2</sub>					
	Sensitive marine habitat (e.g., reefs, vents)					
	Other:					

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-23A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1012 Position: 14841
1b High resolution seismic seismic reflection (crossing)	yes	Line: LAKO_1015 Position: 18017
2a Deep penetration seismic reflection (primary)	yes	Line: BB10-5068125 Position: 13370
2b Deep penetration seismic reflection (crossing)	yes	
3 Seismic Velocity	no	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

## Form 4 - Environmental Protection

Proposal #:	909 - Add	Site #:	MB-23A	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Triple-APC/XCB; logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precuations
7. What abandonment procedures need to be followed?	Standard abandonment procedures
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard); gas-charged sands (unknown but site selected to avoid amplitude anomalies)

# Form 5 - Lithologies

Proposal #:         909 -         Add         Site #:         MB-23A         Date Form Submitted:         2020-01-30 09:48:5	roposal #: 909 - Add
--	----------------------

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Horizons 10, 9 and 8 mapped regionally	Possibly up to 1 Ma	1800	Clayey-silty mud with dropstones	Contourite, hemipelagic	~500	

# Site Figure

## Proposal 909, Addendum to Full-2 Site MB-23A (primary)

#### Scientific Objectives: 1 and 5

Coordinates: 72.9840/-62.9805 Shot point: 14841 (LAKO\_1012) Penetration: 422 m Water depth: 1809 m

#### **SSDB** locations:

Location map: Map\_MB-23A\_MB-1C.jpg Seismic data figure: LAKO\_1012.jpg SEG-Y data: LAKO\_1012.sgy Navigation: LAKO\_1012.txt

Additional information: Multibeam, parasounder profiles, seismic velocity data

В

**Site MB-23A:** (A) Bathymetry map of the lower slope below the Melville Bugt Trough-Mouth Fan shown with 50 m depth contours. High-resolution seismic data with shot points (LAKO; black), regional deep seismic data (TGS; blue) and coring sites (red) are indicated. (B) Primary seismic section shown with interpreted horizons. The sedimentary package is interpreted as a contourite drift incised by downslope channels. The section below the stratified units display discontinous to chaotic reflections interpreted as mass-transport deposits and buried channels. MB-23A is expected to recover silty mud with scattered dropstones likely of Middle to Late Quaternary age. The site is located 0.45 km from the nearest crossing point to avoid disturbances seen at the edge of the channel. MB-23A is ranked as a primary site due to high reflection continuiety and a better seismic data quality than for site MB-1C..





0 0.1 0.2 0.3 0.4 0.5

#### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover a high-resolution paleoceanographic record of a early/middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-1C is targeting expanded intervals of units 9, 10 and 11 and overlaps stratigraphically with the strata drilled at site MB-2C. Site was moved from 1B position to avoid amplitude anomaly at target depth. MB-1C is located 3.9 km from nearest crossing line to provide optimal coverage of units 9, 10 and 11.
List Previous Drilling in Area	

## Section B: General Site Information

Site Name:	MB-01C	Area or Location:	Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 73.0001	Jurisdiction:	Greenland
Longitude:	Deg: -63.0065	Distance to Land: (km)	215
Coordinate System:	WGS 84		
Priority of Site:	Primary: Alternate:	Water Depth (m):	1809

# Section C: Operational Information

	Sedin		Basement			
Proposed Penetration (m):	473			0		
	Total Sediment Thickness (m)	2500				
	L			Total Penetra	ation (m):	473
General Lithologies:	Clayey-silty mud with d	ropstones				
Coring Plan: (Specify or check)	Hole A: APC to refusal Hole B: APC to refusal Hole C: APC to refusal; XCB to T APC	D XCB 🔽 RCE		Re-entry	PCS	
Wireline Logging	Standard Measurements	Special Tools	-	<u> </u>		
Plan:	WL     ✓       Porosity     ✓       Porosity     ✓       Density     ✓       Gamma Ray     ✓       Resistivity     ✓       Sonic (Δt)     ✓       Formation Image (Res)     ✓       VSP (zero offset)     ✓       Formation Temperature & Pressure     ✓	Magnetic Susceptibility Borehole Temperature Formation Image (Acoustic) VSP (walkaway) LWD		Other tools:		
	Other Measurements.		_		[	
Estimated Days:	Drilling/Coring: 5.	2 Logging	:	1.3	Total C	On-site: 6.5
Observatory Plan:	Longterm Borehole Observation	Plan/Re-entry Plan				
Potential Hazards/	Shallow Gas	Complicated Seabed Condition		Hydrothermal Activit	у	Preferred weather window
weather.	Hydrocarbon	Soft Seabed		Landslide and Turbid Current	ity	July-September
	Shallow Water Flow	Currents		Gas Hydrate		
	Abnormal Pressure	Fracture Zone		Diapir and Mud Volc	ano	
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault		High Temperature		
	H <sub>2</sub> S	High Dip Angle		Ice Conditions	$\checkmark$	
	CO <sub>2</sub>					
	Sensitive marine habitat (e.g., reefs, vents)					
	Other:					

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site

Site #: MB-01C

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1011 Position: 14035
1b High resolution seismic seismic reflection (crossing)	yes	Line: LAKO_1022 Position: 24911
2a Deep penetration seismic reflection (primary)	yes	Line: BB10-5068125 Position: 13424 This data is currently confidential (TGS)
2b Deep penetration seismic reflection (crossing)	yes	Line: BB10-10525 Position: 14612 This data is currently confidential (TGS)
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	Parasound profiles
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

## Form 4 - Environmental Protection

Proposal #:	909 - Add	Site #:	MB-01C	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Triple-APC/XCB; logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precuations
7. What abandonment procedures need to be followed?	Standard abandonment procedures
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard); gas-charged sands (unknown but site selected to avoid amplitude anomalies)

# Form 5 - Lithologies

	Proposal #:	909 - Add	Site #: MB-01C	Date Form Submitted: 2020-01-30 09:48:57
--	-------------	-----------	----------------	--

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

# **Site Figure**

## Proposal 909-Full-2 Site MB-01C (alternate)

#### Scientific Objectives: 1 and 5

Coordinates: 73.0001/-63.0065 Shot point: 13424 (BB10-5068125) Penetration: 473 m Water depth: 1809 m

#### **SSDB** locations:

Location map: Map\_MB-1C\_MB-20A.jpg Seismic data figure: BB10-5068125.jpg SEG-Y data: bb10\_line-5068125\_flt-scl-stk\_t101845\_crop.sgy Navigation: bb10-5068125-navigation-utm-lat-lon.txt

Additional information: Multibeam, parasounder profiles, seismic velocity data

**Site MB-1C: (A)** Bathymetry map of the lower slope below the Melville Bugt Trough-Mouth Fan shown with 100 m depth contours. The crossing seismic lines are shown with shot points. (**B**) Seismic section shown with interpreted horizons. The strata package above horizon 7 (depth target), displaying a wavy, semi-continous reflection character, is interpreted as a contourite drift formed in juxtaposition to a channel system. The strong reflections below horizon 7 are interpreted as channel deposits (e.g. slumps, turbidites, plumites?). MB-1C is expected to recover silty-sandy muds; presumably of Early/Middle - Late Pleistocene age. Site was moved from position 1B position to avoid reflection amplitude at horizon 8. MB-1C is located 3.9 km from nearest crossing line to provide optimal coverage of units 9, 10 and 11 (horizon 8 to seabed).





#### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover a high-resolution paleoceanographic record of a middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-20A targets expanded intervals of units 9, 10 and 11 and overlaps stratigraphically with the strata drilled at site MB-2C. The site is located ~1.2 km NW of nearest crossing line to avoid strong reflections at target depth (e.g. channel sands).
List Previous Drilling in Area	

## Section B: General Site Information

MB-20A	Area or Location:	Melville Bay, NE Baffin Bay
Deg: 72.9118	Jurisdiction:	Greenland
Deg: -63.0642	Distance to Land: (km)	216
WGS 84		
Primary: Alternate:	Water Depth (m):	1928
	MB-20A       Deg:     72.9118       Deg:     -63.0642       WGS 84       Primary:     Alternate:	MB-20A Area or Location:   Deg: 72.9118   Deg: -63.0642   WGS 84 Distance to Land: (km)   WGS 84 Water Depth (m):

# Section C: Operational Information

	Sed	iments	Base	Basement		
Proposed Penetration (m):	4	64	0			
	Total Sediment Thickness (m)	2500				
			Total Penetration (m):	464		
General Lithologies:	Clayey-silty mud with	dropstones				
Coring Plan: (Specify or check)	Hole A: APC to refusal Hole B: APC to refusal Hole C: APC to refusal; XCB to APC	TD XCB 🖊 RCB	Re-entry PCS			
Wireline Logging	Standard Measurements	Special Tools				
Plan:	WL ✓ Porosity ✓ Density ✓ Gamma Ray ✓ Resistivity ✓ Sonic (∆t) ✓ Formation Image (Res) ✓ VSP (zero offset) ✓ Formation Temperature ✓ Pressure	Magnetic Susceptibility Borehole Temperature Formation Image (Acoustic) VSP (walkaway) LWD	Other tools:			
	Other Measurements:		·			
Estimated Days:	Drilling/Coring: 5	5.1 Logging:	1.3 Total	On-site: 6.4		
Observatory Plan:	Longterm Borehole Observation	n Plan/Re-entry Plan				
Potential Hazards/	Shallow Gas	Complicated Seabed Condition	Hydrothermal Activity	Preferred weather window		
weather.	Hydrocarbon	Soft Seabed	Landslide and Turbidity	July-September		
	Shallow Water Flow	Currents	Gas Hydrate			
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano			
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature			
	H <sub>2</sub> S	High Dip Angle	Ice Conditions			
	CO <sub>2</sub>					
	Sensitive marine habitat (e.g., reefs, vents)					
	Other:			1		

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-20A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	no	
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: BB08-105 Position: 25254
2b Deep penetration seismic reflection (crossing)	yes	Line: BB09-506875 Position: 13028
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

## Form 4 - Environmental Protection

Proposal #:	909 - Add	Site #:	MB-20A	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Triple-APC/XCB; logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Standard abandonment procedures
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazardy); gas-charged sands (unknown but site selected to avoid amplitude anomalies)

# Form 5 - Lithologies

Proposal #:	909 - Ado	d Site #	: MB-20A	Date Form Submitted: 2020-01-30 09:48:57

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							
## **Site Figure**

### Proposal 909-Full-2 Site MB-20A (alternate)

### Scientific Objectives: 1 and 5

Coordinates: 72.9118/-63.0642 Shot point: 25254 (BB08-105) Penetration: 464 m Water depth: 1928 m

#### **SSDB** locations:

Location map: Map\_MB-1C\_MB-20A.jpg Seismic data figure: BB08-105.jpg SEG-Y data: BB08-105\_crop.sgy Navigation: bb08-105-navigation-utm-lat-lon.txt

Additional information: Multibeam bathymetry, seismic velocity data

Site MB-20A: (A) Bathymetry map of the lower slope below the Melville Bugt Trough-Mouth Fan shown with 100 m depth contours. The crossing seismic lines are shown with shot points.
(B) Seismic section shown with interpreted horizons. The strata package above horizon 7 (depth target), displaying a wavy, semi-continous reflection character, is interpreted as a contourite drift formed in juxtaposition to a channel system. The strong reflections below horizon 7 are interpreted as channel deposits (e.g. slumps, turbidites, plumites?). MB-20A is expected to recover silty-sandy muds; presumably of Middle - Late Pleistocene age. Site is located ~1.2 km away from crossing line to avoid strong reflections at target depth that might be channel sands.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover a high-resolution paleoceanographic record of a early/middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-2C targets an expanded interval of unit 8 and overlaps stratigraphically with the strata drilled at site MB-1C. The site is located ~1 km off the nearest crossline to obtain optimal stratigraphic coverage of unit 8 (beween horizons 7-8) and avoid amplitude anomaly at the base of this unit.
List Previous Drilling in Area	

### Section B: General Site Information

MB-02C	Area or Location:	Melville Bay, NE Baffin Bay
Deg: 73.1150	Jurisdiction:	Greenland
<sup>Deg:</sup> -63.7904	Distance to Land: (km)	260
WGS 84		
imary:	Water Depth (m):	1957
De	MB-02C g: 73.1150 g: -63.7904 WGS 84 ary: Alternate:	MB-02C     Area or Location:       g:     73.1150       g:     -63.7904       WGS 84       ary:     Alternate:   Water Depth (m):

# Section C: Operational Information

	S	Sedir	nents			Basement				
Proposed Penetration (m):	522					0				
	Total Sediment Thickness (	(m)		2500						
·						Total	Penetrat	ion (m):	522	
General Lithologies:	Clayey-silty mud w	rith dr	ropstones	3						
Coring Plan: (Specify or check)	Hole A: APC to refusal (~250 mbsf) Hole B: APC to refusal (~250 mbsf) Hole A: APC to refusal (~250 mbsf),	XCB to T	D				<b>—</b> .	<b>-</b>		
W/institute for a line	APC		XCB		RCB	Re-entry		cs		
Wireline Logging Plan:		ents	Sp	ecial 10						
	Porosity	$\overline{\mathbf{N}}$	Borehole	Temperatu		Other tools:				
	Density	$\Box$	Formation	n Image						
	Gamma Ray		(Acoustic	)						
	Resistivity	$\Box$	VSP (wal	kaway)						
	Sonic ( $\Delta t$ )	$\checkmark$	LWD							
	Formation Image (Res)	$\checkmark$								
	VSP (zero offset)	$\square$								
	Formation Temperature & Pressure									
	Other Measurements:									
Estimated Days:	Drilling/Coring:	5.4	4	Lo	gging:	1.3		Total O	on-site: 6	.7
Observatory Plan:	Longterm Borehole Observ	vation .	Plan/Re-en	try Plan						
Potential Hazards/ Weather:	Shallow Gas	$\checkmark$	Complicat Condition	ed Seabed		Hydrotherma	al Activity		Preferred weather	r window
	Hydrocarbon		Soft Seabe	ed		Landslide an Current	ıd Turbidity		July-Septe	ndei
	Shallow Water Flow		Currents			Gas Hydrate	:			
	Abnormal Pressure		Fracture Z	lone		Diapir and Mud Volcano		ю		
	Man-made Objects (e.g., sea-floor cables, dump sites)		Fault			High Tempe	rature			
	$H_2S$		High Dip .	Angle		Ice Condition	ns	$\checkmark$		
	CO <sub>2</sub>									
	Sensitive marine habitat (e.g., reefs,									
	vens)									
	Other:									

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site

Site #: MB-02C

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1010 Position: 10145
1b High resolution seismic seismic reflection (crossing)	yes	Line: LAKO_1005 Position: 5190
2a Deep penetration seismic reflection (primary)	yes	Line: BB10-5063125 Position: 12768 This data is currently confidential (TGS)
2b Deep penetration seismic reflection (crossing)	yes	Line: BB09-1055 Position: 13471 This data is currently confidential (TGS)
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	Parasound profiles
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

-						
Proposal #:	909 -	Add	Site #:	MB-02C	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Triple-APC/XCB; logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Standard abandonment procedures
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard); gas-charged sands (unknown but site selected to avoid amplitude anomalies)

## Form 5 - Lithologies

Proposal #:	909 - Add	Site #: MB-02C	Date Form Submitted: 2020-01-30 09:48:57

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

# **Site Figure**

# Proposal 909 Site MB-02C (primary)

### Scientific Objectives: 1 and 5

Coordinates: 73.1150; -63.7904 Shot point: 12768 (BB10-5063125) Penetration: 522 m Water depth: 1957 m

#### **SSDB** locations:

Location map: Map\_MB-1B\_MB-2B.jpg Seismic data figure: BB10-5063125.jpg SEG-Y data: bb10\_line-5063125\_flt-scl-stk\_t101845\_crop.sgy Navigation: bb10-5063125-navigation-utm-lat-lon.txt

Additional information: Multibeam, parasounder profiles, seismic velocity data,

**Site MB-2C: (A)** Bathymetry map of the lower slope below the Melville Bugt Trough-Mouth Fan shown with 50 m depth contours. The crossing seismic lines are shown with shot points. **(B)** Seismic section shown with interpreted horizons. The strata package above target horizon 7, displaying a continous reflection character, is interpreted as a contourite drift abounding a channel system. MB-2C is expected to recover silty-sandy muds; presumably of Early/Middle - Late Pleistocene age. The site is located 1 km off the nearest crossline to obtain optimal stratigraphic coverage of unit 8 (beween horizons 7-8) and avoid amplitude anomaly at the base of this unit.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover a high-resolution paleoceanographic record of a early/middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history (scientific objectives 1 and 5). Site MB-22A targets an expanded interval of unit 8 and overlaps stratigraphically with the strata drilled at site MB-1C. The site is located ~1 km off the nearest crossline to obtain optimal stratigraphic coverage of unit 8 (beween horizons 7-8) and avoid drilling into strong reflections (e.g. channel sands).
List Previous Drilling in Area	

### Section B: General Site Information

Site Name:	MB-22A	Area or Location: Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		
Latitude:	Deg: 73.1388	Jurisdiction: Greenland
Longitude:	Deg: -63.6402	Distance to Land: (km) 220
Coordinate System:	WGS 84	
Priority of Site:	Primary: Alternate:	Water Depth (m): 1850

# Section C: Operational Information

	S	Sedim	ents			Basement				
Proposed Penetration (m):		611						0		
	Total Sediment Thickness (1	m)		2500						
		-				Total I	Penetrati	on (m):	611	
General Lithologies:	Clayey-silty mud wi	ith dro	opstones							
Coring Plan: (Specify or check)	Hole A: APC to refusal (~250 mbsf) Hole B: APC to refusal (~250 mbsf) Hole A: APC to refusal (~250 mbsf), >					1_				
	APC		XCB		RCB	Re-entry		cs		
Wireline Logging Plan:	Standard Measureme	nts	Spe							
	Porosity	<u>_</u>	Borehole T	emperatur	re	Other tools:				
	Density	$\overline{\mathbf{V}}$	Formation	Image						
	Gamma Ray	7	(Acoustic)							
	Resistivity	$\overline{\mathbf{V}}$	VSP (walk	away)						
	Sonic ( $\Delta t$ )	$\overline{\mathbf{V}}$	LWD							
	Formation Image (Res)	$\checkmark$								
	VSP (zero offset)									
	& Pressure									
	Other Measurements:									
Estimated Days:	Drilling/Coring:	5.7		Log	ging:	1.3		Total C	n-site:	7
Observatory Plan:	Longterm Borehole Observa	ation P	lan/Re-entr	y Plan			I			
Potential Hazards/ Weather:	Shallow Gas		Complicate Condition	d Seabed		Hydrotherma	l Activity		Preferred weath	er window
	Hydrocarbon		Soft Seabed	l		Landslide and Turbidity Current				
	Shallow Water Flow		Currents			Gas Hydrate				
	Abnormal Pressure	<u> </u>	Fracture Zo	ne		Diapir and M	ud Volcan	o		
	Man-made Objects (e.g., sea-floor cables, dump sites)	י	Fault			High Temper	ature			
	H <sub>2</sub> S	<u> </u>	High Dip A	ngle		Ice Condition	IS	$\checkmark$		
	CO <sub>2</sub>									
	Sensitive marine habitat (e.g. reefs									
	vents)									
	Other:									

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-22A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	no	
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: BB09-506375 Position: 12939 This data is currently confidential
2b Deep penetration seismic reflection (crossing)	yes	Line: BB09-1055 Position: 13610 This data is currently confidential
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #	000	٨dd	Sito #	MR 22A	Data Form Submitted:	2020 01 20 00.48.57
FIOPOSAI #.	909 -	Auu	Sile #.	IVID-22A	Date Form Submitted.	2020-01-30 09.46.57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Triple-APC/XCB; logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	Not known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Standard abandonment procedures
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard); gas-charged sands (unknown but site selected to avoid amplitude anomalies)

## Form 5 - Lithologies

Proposal #:	909 - Add	Site #:	MB-22A	Date Form Submitted:	2020-01-30 09:48:57

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

# Site Figure

### Proposal 909-Full-2 Site MB-22A (alternate)

### Scientific Objectives: 1 and 5

Coordinates: 73.1388/-63.6402 Shot point: 12939 (BB09-506375) Penetration: 611 m Water depth: 1850 m

#### **SSDB** locations:

Location map: Map\_MB-2B\_MB-22A.jpg Seismic data figure: BB09-506375.jpg SEG-Y data: BB09-506375\_crop.sgy Navigation: bb09-506375-navigation-utm-lat-lon.txt

Additional information: Multibeam bathymetry, seismic velocity data

**Site MB-22A:** (A) Bathymetry map of the lower slope below the Melville Bugt Trough-Mouth Fan shown with 50 m depth contours. Crossing seismic lines are shown with shot points. (B) Seismic section shown with interpreted horizons. The strata package above target horizon 7, displaying a semi-continous reflection character, is interpreted as a contourite drift abounding a channel system. MB-22A is expected to recover silty-sandy muds; presumably of Early/Middle - Late Pleistocene age. Early depositional stage of unit 8 is marked by punctuated line. The site is placed between two crosslines to optimize stratigraphic coverage of unit 8 (beween horizons 7-8) and avoid drilling onto strong reflectures (e.g. channel sands).





0 000 1000 r

### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover deglacial and interglacial intervals of potentially early-middle Pleistocene age within top-set strata of the trough-mouth fan. High priority for scientific objectives 1 and 5. Site MB-31A penetrates a package of flat- lying, semi-continuous reflections that onlap glacial unconformities of units 6, 7 and 8. TD is a positive reflection below horizon 6. The location is based on optimizing stratigraphic coverage and avoid strong reflections in the upper 100 ms interval. The site is also covered by deep seismic ANU-3D data. Site 31A is the primary choice since it will drill through a thinner and less complex overburden than at sites 8A and 3B.
List Previous Drilling in Area	N/A

### Section B: General Site Information

Site Name:	MB-31A	Area or Location: Melville Bay, NE Baffin Bay	Area or Location:
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 73.5607	Jurisdiction: Greenland	Jurisdiction:
Longitude:	Deg: -62.1512	Distance to Land: (km) 197	Distance to Land: (km)
Coordinate System:	WGS 84		
Priority of Site:	Primary:	Water Depth (m): 531	Water Depth (m):

# Section C: Operational Information

	Sedi	ments	Basement			
Proposed Penetration (m):	2	82	0			
	Total Sediment Thickness (m)	4000				
			Total Penetration (m):	282		
General Lithologies:	Diamicton, mud with d mud	ropstones, sandy-silty				
Coring Plan: (Specify or check)	Hole A: RBC to TD. Hole B: Drill to 70 mbsf, APC/XC	B to TD.				
	APC 🗸	XCB 🗸 RCB 🗸	Re-entry PCS			
Wireline Logging Plan:	Standard Measurements	Special Tools       Magnetic Susceptibility	Other			
	Porosity Density	Borehole Temperature	10015.			
	Gamma Ray 🖌 Resistivity	VSP (walkaway)				
	Sonic ( $\Delta t$ )	LWD				
	Formation Image (Res)					
	VSP (zero offset)					
	& Pressure					
	Other Measurements:					
Estimated Days:	Drilling/Coring: 2	.6 Logging:	1 Total C	Dn-site: 3.6		
Observatory Plan:	Longterm Borehole Observation	Plan/Re-entry Plan				
Potential Hazards/ Weather:	Shallow Gas	Complicated Seabed	Hydrothermal Activity	Preferred weather window		
	Hydrocarbon	Soft Seabed	Landslide and Turbidity Current			
	Shallow Water Flow	Currents	Gas Hydrate			
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano			
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature			
	H <sub>2</sub> S	High Dip Angle	Ice Conditions			
	Sensitive marine habitat (e.g., reefs,					
	vents)					
	Other: Compact gravel-r	ich seabed may be expected	l, dropstones			

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-31A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1033 Position: 46083
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: Line: Site-31A_ANU-3D_IL-13392 Position: XL-6920 This is data extracted from Shell-ANU-3D seismic volume
2b Deep penetration seismic reflection (crossing)	yes	Line: Line: Site-31A_ANU-3D_XL-6920 Position: IL-13392 This is data extracted from Shell-ANU-3D seismic volume
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling		
14a Water current data		
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #:	909 -	Add	Site #:	MB-31A	Date Form Submitted:	2020-01-30 09:48:57
r roposar ".	000	7100	Onco II.	NID OTA	Date i onn oubmitted.	2020 01 00 00.40.07

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Hole A: RCB coring; Hole B: APC/XCP coring if possible, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Fill hole with mud/heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability); boulders in the shallow sediments (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard)

## Form 5 - Lithologies

Proposal #: 909 - Add Site #: MB-31A Date	orm Submitted: 2020-01-30 09:48:57
---	------------------------------------

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Glacial unconformities Horizon 8, 7 and 6.	Pleistocene	2200	Diamicton, mud with dropstones	Subglacial, glacial- marine, deep shelf	N/A	

# Site Figure

# Proposal 909, Addendum to Full2 Site MB-31A (primary)

### Scientific Objectives: 1 and 5

Coordinates:73.5607 ; -62.1512 Shot point: 46083 (LAKO\_1033) Penetration: 282 m Water depth: 531 m

#### **SSDB** locations:

Location map: Map\_MB-31A.jpg Seismic data figure: LAKO\_1033.jpg SEG-Y data: LAKO\_1033.sgy Navigation: LAKO\_1033.txt

#### Additional information: Multibeam, seismic velocity data

**Site MB-31A:** (A) Bathymetry map of the outer shelf margin of the Melville Bugt Trough-Mouth Fan shown with 50 m depth contours. High-resolution LAKO lines with shot points (black), regional TGS 2D seismic data (gray) and coring sites (red) are indicated. (B) Seismic section shown with interpreted horizons. Site MB-31A is aimed at recovering the stratified intervals between horizons 6, 7 and 8. The expected lithologies are proximal glacigenic deposits, e.g. tills, interlayered with muddy marine/glacial-marine strata, probably of Early - Middle Pleistocene age. The site is placed ~1 km off the nearest crossline (BB10-107375) to optimize penetration of flatlying/onlapping reflections and avoid strong reflections in the upper 100 ms interval.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover deglacial and interglacial intervals of potentially early-middle Pleistocene age within top-set strata of the trough-mouth fan. High priority for scientific objectives 1 and 5. Site MB-8A penetrates a package of flat- lying, semi-continuous reflections that onlap glacial unconformities of units 6, 7, 8 and 9 (target depth is a positive reflection above horizon 6). The site is ~1 km offset from the nearest crossline to optimize recovery of the identified onlapping reflections.
List Previous Drilling in Area	

### Section B: General Site Information

Site Name:	MB-08A	Area or Location:	Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 73.4870	Jurisdiction:	Greenland
Longitude:	Deg: -62.2682	Distance to Land: (km)	197
Coordinate System:	WGS 84		
Priority of Site:	Primary: Alternate:	Water Depth (m):	497

# Section C: Operational Information

	Sedin	ments	Basement		
Proposed Penetration (m):	37	70	0		
	Total Sediment Thickness (m)	4000			
			Total Penetration (m):	370	
General Lithologies:	Diamicton, mud with dr mud	opstones, sandy-silty			
Coring Plan: (Specify or check)	Hole A: RBC to TD. Hole B: Drill to 70 mbsf, APC/XCI	B to TD.			
Wireline Legging	Arc V	ACB V RCB V	Re-entry PCS		
Wireline Logging Plan:	Standard Measurements         WL       Image: Construction         Porosity       Image: Construction         Density       Image: Construction         Gamma Ray       Image: Construction         Gamma Ray       Image: Construction         Gamma Ray       Image: Construction         Resistivity       Image: Construction         Sonic (\Deltat)       Image: Construction         Formation Temperature       Image: Construction         Formation Temperature       Image: Construction         Other Measurements:       Image: Construction	Magnetic Susceptibility     Image       Borehole Temperature     Image       Formation Image     Image       (Acoustic)     Image       VSP (walkaway)     Image       LWD     Image	Other tools:		
Estimated Days:	Drilling/Coring: 2	8 Logging	1 Total C	n-site: 3.8	
Observatory Plan:	Longterm Borehole Observation	Plan/Re-entry Plan			
Potential Hazards/	Shallow Gas	Complicated Seabed	Hydrothermal Activity	Preferred weather window	
weather.	Hydrocarbon	Soft Seabed	Landslide and Turbidity	July-September	
	Shallow Water Flow	Currents	Gas Hydrate		
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature		
	H <sub>2</sub> S	High Dip Angle	Ice Conditions		
	CO <sub>2</sub>				
	Sensitive marine habitat (e.g., reefs, vents)				
	Other: Compact gravel-ri	ch seabed may be expected			

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-08A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	no	
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: BB10-5068125 Position: 15796 This data is currently confidential
2b Deep penetration seismic reflection (crossing)	yes	Line: BB09-10725 Position: 21378 This data is currently confidential
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Industry data
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling		
14a Water current data		
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #:	909 -	Add	Site #:	MB-08A	Date Form Submitted:	2020-01-30 09:48:57
r ropoda ".	000	7100	0110 //.		Dato i onni Gabrinttoa.	2020 01 00 00.10.07

Pollution & Safety Hazard	Comment
1. Summary of operations at site	RCB coring; possibly APC/XCP, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Fill hole with mud/heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability); boulders in the shallow sediments (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard)

## Form 5 - Lithologies

Proposal #:	909 - Add	Site #: MB-08A	Date Form Submitted: 2020-01-30 09:48:57

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

# **Site Figure**

## Proposal 909-Full-2 Site MB-08A (Primary)

### Scientific Objectives: 1 and 5

Coordinates:73.4870 ; -62.2682 Shot point: 15796 (BB10-5068125) Penetration: 370 m Water depth: 497 m

#### **SSDB** locations:

Location map: Map\_MB-3B\_MB-8A.jpg Seismic data figure: BB10-5068125.jpg SEG-Y data: bb10\_line-5068125\_flt-scl-stk\_t101845\_crop.sgy

Additional information: Multibeam, seismic velocity data

**Site MB-8A: (A)** Bathymetry map of the outer shelf margin of the Melville Bugt Trough-Mouth Fan shown with 50 m depth contours. The seismic lines crossing site MB-8A are shown with shot points. **(B)** Seismic section shown with interpreted horizons. Site MB-8A will recover the stratified section above seismic horizon 5. The expected lithologies are proximal glacigenic deposits, e.g. tills, interlayered with muddy marine/glacial-marine strata, probably of Early - Middle Pleistocene age. The site is placed ~1 km off the nearest crossline to optimize penetration of flatlying, onlapping reflections.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover deglacial and interglacial intervals of potentially early-middle Pleistocene age within top-set strata of the trough-mouth fan. High priority for scientific objectives 1 and 5. Site MB-3B penetrates a package of flat- lying, semi-continuous reflections that onlap glacial unconformities of units 6, 7, 8 and 9 (TD = top unit 6). The site is placed ~2.7 km off the nearest crossline to optimize recovery of onlapping reflections.
List Previous Drilling in Area	

### Section B: General Site Information

Site Name:	MB-03B	Area or Location:	Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 73.5032	Jurisdiction:	Greenland
Longitude:	Deg: -62.4861	Distance to Land: (km)	190
Coordinate System:	WGS 84		
Priority of Site:	Primary: Alternate:	Water Depth (m):	498

# Section C: Operational Information

	Sed	ments	Basement		
Proposed Penetration (m):	3	75	0		
	Total Sediment Thickness (m)	4000			
			Total Penetration (m):	375	
General Lithologies:	Diamicton, mud with d mud	ropstones, sandy-silty			
Coring Plan: (Specify or check)	Hole A: RBC to TD. Hole B: Drill to 70 mbsf, AF				
Witeline Logging	Standard Measurements	Special Tools	Re-entry PCS		
Wireline Logging Plan:	Standard Measurements         WL          Porosity          Density          Gamma Ray          Resistivity          Sonic (Δt)          Formation Image (Res)          VSP (zero offset)          Formation Temperature          Other Measurements:	Special Tools         Magnetic Susceptibility         Borehole Temperature         Formation Image         (Acoustic)         VSP (walkaway)         LWD	Other tools:		
Estimated Days:	Drilling/Coring: 2	.7 Logging:	1 Total C	On-site: 3.7	
Observatory Plan:	Longterm Borehole Observation	n Plan/Re-entry Plan	· ·		
Potential Hazards/	Shallow Gas	Complicated Seabed	Hydrothermal Activity	Preferred weather window	
weather.	Hydrocarbon	Soft Seabed	Landslide and Turbidity	July-September	
	Shallow Water Flow	Currents	Gas Hydrate		
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature		
	H <sub>2</sub> S	High Dip Angle	Ice Conditions		
	CO <sub>2</sub>				
	Sensitive marine habitat (e.g., reefs, vents)				
	Other: Compact gravel-r	ich seabed may be expected			

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-03B

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	no	
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: BB10-5066875 Position: 15463 This data is currently confidential
2b Deep penetration seismic reflection (crossing)	no	Line: BB09-10725 Position: 21096 This data is currently confidential
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	Single Parasound profile
7 Swath bathymetry	yes	Industry data
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Dramanal #	000	۸ ما ما	Cite #		Data Carra Culturalitta du	0000 01 00 00 40 57
Proposal #:	909 -	Add	Sile #	INIB-03B	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	RCB coring; possibly APC/XCP, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	Not known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Fill hole with mud/heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability); boulders in the shallow sediments (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard)

## Form 5 - Lithologies

Proposal #:	909 - Add	Site #: MB-03B	Date Form Submitted: 2020-01-30 09:48:57
		· · · ·	

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

# **Site Figure**

### Proposal 909-Full-2 Site MB-03B (alternate)

### Scientific Objectives: 1 and 5

Coordinates: 73.5032; -62.4861 Shot point: 15463 (BB10-5066875) Penetration: 375 m Water depth: 498 m

#### **SSDB** locations:

Location map: Map\_MB-3B\_MB-8A.jpg Seismic data figure: BB10-5066875.jpg SEG-Y data: bb10\_line-5066875\_flt-scl-stk\_t101845\_crop.sgy

Additional information: Multibeam, seismic velocity data

**Site MB-3B: (A)** Bathymetry map of the outer shelf margin of the Melville Bugt Trough-Mouth Fan shown with 50 m depth contours. The seismic lines crossing site MB-3B are shown with shot points. **(B)** Seismic section shown with interpreted horizons. Site MB-3B will recover the stratified section above seismic 6 (depth target). The expected lithologies are proximal glacigenic deposits, e.g. tills, interlayered with muddy marine/glacial-marine strata, probably of Early - Middle Pleistocene age. The site is placed ~2.7 km off the nearest crossline to optimize penetration of flatlying, onlapping reflections.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover deglacial and interglacial intervals of potentially early Pleistocene age within top-set strata of the trough-mouth fan (scientific objectives 1 and 5). MB-30A penetrates a package of flat-lying, continuous reflections that onlap a major glacial unconformity (Horizon 3). Depth target is a series of semi-parallel horizons infilling a small depression below Horizon 3. MB-30A is identified on high-res LAKO data, line 1035, located offset from nearest crossline to optimize stratigraphic layering. MB-30A is a primary site due to an evenly stratified sediment package above TD.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 100 km toward N)

### Section B: General Site Information

Site Name:	MB-30A	Area or Location:	Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 73.9013	Jurisdiction:	Greenland
Longitude:	Deg: -61.8540	Distance to Land: (km)	145
Coordinate System:	WGS 84		
Priority of Site:	Primary:	Water Depth (m):	618

# Section C: Operational Information

	Q - 1		Decement			
	Sedi	ments		Basement		
Proposed Penetration (m):	3	03			0	
	Total Sediment Thickness (m)	5500				
				Total Penetra	tion (m):	303
General Lithologies:	Diamiatan mud with d	ranatanaa laandu ailtu				
General Littiologies.	mud	ropsiones, sandy-silly				
Coring Plan:	Hole A: RCB to TD					
(Specify or check)	APC		св 🔽			
****						
Wireline Logging Plan:	Standard Measurements	Special Tools		1		
	WL VI	Magnetic Susceptibility		Other tools:		
		Borehole Temperature		100151		
	Density	Formation Image (Acoustic)				
	Gamma Ray 🗸	VSP (walkaway)				
	Resistivity 🖌					
	Sonic ( $\Delta t$ )	LWD				
	Formation Image (Res)					
	VSP (zero offset)					
	Formation Temperature & Pressure					
	Other Measurements:					
Estimated Days:	Drilling/Coring: 1	.3 Loggi	ng:	0.8	Total O	on-site: 2.1
Observatory Plan:	Longterm Borehole Observation	Plan/Re-entry Plan				
Potential Hazards/ Weather:	Shallow Gas	Complicated Seabed Condition	$\checkmark$	Hydrothermal Activity	у 🗌	Preferred weather window
Weather.	Hydrocarbon	Soft Seabed		Landslide and Turbidi Current	ity	July-September
	Shallow Water Flow	Currents		Gas Hydrate		
	Abnormal Pressure	Fracture Zone		Diapir and Mud Volcano		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault		High Temperature		
	H <sub>2</sub> S	High Dip Angle		Ice Conditions	$\checkmark$	
	CO <sub>2</sub>			1		
	Sensitive marine habitat (e.g., reefs,	-				
	vents)					
	Compact gravel-r	ich seabed may be ex	pected			
	Other: Compact graver					

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-30A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1035 Position: 71423
1b High resolution seismic seismic reflection (crossing)	yes	Line: LAKO_1036 Position: 72941
2a Deep penetration seismic reflection (primary)	yes	Line: Site-30A_ANU-3D_IL-14776 Position: Xline 13020
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-30A_ANU-3D_XL-13020 Position: Inline 14776
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #:	909 - Add	Site #:	MB-30A	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	RCB coring in single hole; logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Fill hole with mud/heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability); boulders in the shallow sediments(low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard)

## Form 5 - Lithologies

Proposal #: 909 - Add	Site #: MB-30A	Date Form Submitted: 2020-01-30 09:48:57
-----------------------	----------------	--

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Glacial unconformities; horizons 4 and 3	Pleistocene	2200	Diamicton, mud with dropstones	Subglacial, glacial- marine, marine (deep shelf)	N/A	
# Site Figure

### Proposal 909, Addendum to Full2 Site MB-30A (primary)

#### Scientific Objectives: 1 and 5

Coordinates: 73.9013; -61.8540 Shot point: 71423 (LAKO\_1035) Penetration: 303 m Water depth: 618 m

#### **SSDB** locations:

Location map: Map\_MB-30A\_MB-4C.jpg Seismic data figure: LAKO\_1035.jpg SEG-Y data: LAKO\_1035.jpg Navigation: LAKO\_1035.txt

Additional information: 3D seismic data, multibeam, seismic velocity data,

**Site MB-30A:** (A) Multibeam bathymetry map of the middle shelf region south of the Melville Bugt trough shown with 50 m depth contours. High-resolution seismic data (LAKO) with shot numbers (black), TGS regional 2D data (gray) and core sites (red) are displayed. (B) Seismic section with interpreted horizons and ages. MB-30A captures the pinch-out of a basal unit within TMF Unit 4 over Horizon 3. The depth target is the bottom of a mini-basin developed at this position below Horizon 3 (light green). Expected recovery of proximal glacigenic deposits interlayered with muddy marine/glacial-marine strata, likely Early Pleistocene age. MB-30A is offset 3.2 km from nearest high-resolution crossline to achieve optimal stratigraphic coverage of units 3-4. Selected as primary site due to overall high reflection continuity.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover deglacial and interglacial intervals of potentially early Pleistocene age within top-set strata of the trough-mouth fan (scientific objectives 1 and 5). MB-4C penetrates a package of flat-lying, semi-continuous reflections that onlap a major glacial unconformity (horizon 3). Depth target is a series of positive-phase semi- parallel horizons infilling a small depression below unit 3. MB-4C is identified on the high-res LAKO data, located slightly offset from nearest crossline to optimize stratigraphic penetration of units 3-4. The site is an alternate site to MB-30A.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 101 km toward N)

### Section B: General Site Information

Site Name:	MB-04C	Area or Location: Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		
Latitude:	Deg: 73.8734	Jurisdiction: Greenland
Longitude:	Deg: -62.0528	Distance to Land: 150 (km)
Coordinate System:	WGS 84	
Priority of Site:	Primary: Alternate:	Water Depth (m): 628

# Section C: Operational Information

	Sedi	ments	Basement		
		linents	Basement		
Proposed Penetration (m):	30	05	0		
	Total Sediment Thickness (m)	5500			
			Total Penetration (m):	305	
General Lithologies:	Diamicton, mud with dr	ropstones			
Coring Plan: (Specify or check)	Hole A: RCB to TD				
(- <b>1</b> )	APC	XCB RCB 🗸	Re-entry PCS		
Wireline Logging	Standard Measurements	Special Tools			
Plan:	WL 🗸	Magnetic Susceptibility	Other		
	Porosity 🗸	Borehole Temperature	tools:		
	Density 🗸	Formation Image			
	Gamma Ray	(Acoustic)			
	Resistivity	VSP (walkaway)			
	Sonic ( $\Delta t$ )	LWD			
	Formation Image (Res)				
	VSP (zero offset)				
	Formation Temperature				
	Other Measurements:	•	•		
Estimated Days:	Drilling/Coring: 1	.3 Logging:	0.8 Total C	On-site: 2.1	
Observatory Plan:	Longterm Borehole Observation	Plan/Re-entry Plan			
Potential Hazards/ Weather:	Shallow Gas	Complicated Seabed Condition	Hydrothermal Activity	Preferred weather window	
	Hydrocarbon	Soft Seabed	Landslide and Turbidity	July-September	
	Shallow Water Flow	Currents	Gas Hydrate		
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature		
	H <sub>2</sub> S	High Dip Angle	Ice Conditions		
	CO <sub>2</sub>				
	Sensitive marine habitat (e.g., reefs, vents)				
	Other: Compact gravel-ri	ch seabed may be expected	; dropstones		

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-04C

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1037 Position: 74530
1b High resolution seismic seismic reflection (crossing)	yes	Line: LAKO_1041 Position: 77698
2a Deep penetration seismic reflection (primary)	yes	Line: Site-4C_ANU_Inline_13756.sgy Position: Xline 12520
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-4C_ANU_XLine_12520.sgy Position: Inline 13756
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #:	909 - A	Add	Site #:	MB-04C	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	RCB coring in single hole; logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known
6. What "special" precautions will be taken during drilling?	Standard precautions
7. What abandonment procedures need to be followed?	Fill hole with mud/heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability); boulders in the shallow sediments(low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard)

## Form 5 - Lithologies

Proposal #: 909 - Add	Site #: MB-04C	Date Form Submitted: 2020-01-30 09:48:57
-----------------------	----------------	--

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Glacial unconformities, horizon 3 and 4	Pleistocene	2200	Diamicton, mud with dropstone	Subglacial, glacial- marine, marine (deep shelf)	N/A	

# Site Figure

### Proposal 909, Addendum to Full-2 Site MB-04C (alternate)

#### Scientific Objectives: 1 and 5

Coordinates: 73.8734; -62.0528 Shot point: 74530 (LAKO\_1037) Penetration: 305 m Water depth: 628 m

#### **SSDB** locations:

Location map: Map\_MB-30A\_MB-4C.jpg Seismic data figure: LAKO\_1037.jpg SEG-Y data: LAKO\_1037.jpg Navigation: LAKO\_1037.txt

Additional information: Multibeam, seismic velocity data, deep seismic data

**Site MB-4C: (A)** Multibeam bathymetry map of the middle shelf region south of the Melville Bugt trough shown with 50 m depth contours. High-resolution seismic data (LAKO) with shot points (black), TGS regional 2D data (gray lines) and core sites (red) are displayed.(**B**) High-resolution seismic section with interpreted horizons and ages. MB-4C captures the pinch-out of a basal unit within TMF Unit 4 over Horizon 3. Depth target is a reflection onlap over an internal unconformity (light green) below Horizon 3. The site is expected to recover proximal glacigenic deposits interlayered with muddy marine/glacial-marine strata, probably of Early Pleistocene age. MB-4C is offset 0.6 km from high-res crossline to achieve optimal stratigraphic coverage of the depth target.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover Neogene contourite drift sediments that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-6D overlaps stratigraphically with the lowermost section drilled at site MB-17A (and alternates 5B, 13A and 14A). The main target is an expanded section of a mounded contourite drift that may contain a high-resolution early Pliocene record. TD is placed above a marked reflection package below the drift body. MB-6D is located within the ANU-3D cube, and is crossed by a high-res profile LAKO_1044.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 85 km toward NNW)

### Section B: General Site Information

Site Name:	MB-06D	Area or Location: Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		
Latitude:	Deg: 74.1283	Jurisdiction: Greenland
Longitude:	Deg: -60.9744	Distance to Land: (km)
Coordinate System:	WGS 84	
Priority of Site:	Primary:	Water Depth (m): 614

# Section C: Operational Information

	Sedi	ments	Basement		
Proposed Penetration (m):	56	61	0		
	Total Sediment Thickness (m)	3000			
			Total Penetration (m):	561	
General Lithologies:	Silty to sandy mudston	e			
Coring Plan: (Specify or check)	Single hole RCB to TD				
	APC	XCB RCB	Re-entry PCS		
Wireline Logging Plan:	Standard Measurements	Special Tools			
	WL V Porosity V	Magnetic Susceptibility	Other tools:		
	Density 🗸	Formation Image			
	Gamma Ray	(Acoustic)			
	Resistivity	VSP (walkaway)			
	Sonic ( $\Delta t$ )	LWD			
	Formation Image (Res)				
	VSP (zero offset)				
	Formation Temperature & Pressure				
	Other Measurements:	•			
Estimated Days:	Drilling/Coring: 2	.3 Logging:	1.3 Total C	Dn-site: 3.6	
Observatory Plan:	Longterm Borehole Observation	Plan/Re-entry Plan			
Potential Hazards/ Weather:	Shallow Gas	Complicated Seabed Condition	Hydrothermal Activity	Preferred weather window	
() cullor:	Hydrocarbon	Soft Seabed	Landslide and Turbidity	July-September	
	Shallow Water Flow	Currents	Gas Hydrate		
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature		
	H <sub>2</sub> S	High Dip Angle	Ice Conditions		
	CO <sub>2</sub>				
	Sensitive marine habitat (e.g., reefs, vents)				
	Other: Compact gravel-ri	ich seabed may be expected		1	

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site

Site #: MB-06D

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1044 Position: 88058
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: Site-6D_ANU-3D_IL-18992 Position: XL 19032 This is data extracted from Shell-ANU-3D seismic volume
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-6D_ANU-3D_XL-19032 Position: IL 18992 This is data extracted from Shell-ANU-3D seismic volume
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	Navigation file extracted from SEGY
17 Other	no	

### Form 4 - Environmental Protection

Proposal #:	909 -	Add	Site #:	MB-06D	Date Form Submitted:	2020-01-30 09:48:57
r ropoda ".	000	7100	0110 //.	INE COE	Dato i onni oubinittoa.	2020 01 00 00.10.07

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Single hole RCB, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	No
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known. Sites 5B, 6D, 13A, 14A and 15A have been identified based on Shells ANU-3D cube, combined with single line high.res. seismic data. No major anomalies were observed and minor anomalies were avoided.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Fill hole with heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability), boulders, gas sands (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Gas-charged sands (unknown but obvious seismic amplitude anomalies are avoided).

## Form 5 - Lithologies

Proposal #: 909 - Add Site #: MB-06D Date Form Si	omitted: 2020-01-30 09:48:57
---	------------------------------

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Late Pliocene Unconformity	Possibly 3-5 Ma	2000	Diamicton, mudstone with silty-sandy intervals	Proglacial, nearshore to deep marine, e.g. contourite drift setting	30-40	

# Proposal 909, Addendum to Full-2 Site MB-06D (primary)

#### Scientific Objectives: 3, 4 and 6

Coordinates: 74.1283; -60.9744 Shot point: 88058 (LAKO\_1044) Penetration depth: 561 m Water depth: 614 m

Additional information: Multibeam, seismic velocity data, 3D seismic data

#### **SSDB** locations:

Location map: Map\_MB-6D\_MB-17A.jpg Seismic data figure: LAKO\_1044.jpg SEG-Y data: LAKO\_1044.sgy Navigation: LAKO\_1044.txt

**Site MB-6D: (A)** Multibeam bathymetry map of the middle shelf region fringing the Melville Bugt trough shown with 50 m depth contours. Seismic crossing lines are displayed with shot points. **(B)** High-res. seismic section with interpreted horizons and ages. MB-6D penetrates an expanded interval of contourite drift sediments of likely Pliocene age. Site 6D overlaps with MB-17A, MB-5B, MB-13A and 14-A to produce a composite succession. TD is placed above a strong reflector covering a major slide scar. Sites 15A and 17A are alternate sites to 6D.





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-15A overlaps stratigraphically with the lowermost section drilled at site MB-5B (and alternates 13A and 14A). The main target is an expanded section of the drift deposit that may contain a high-resolution early Pliocene record. TD is placed 30 ms below a prominent reflection draping over a slide scar. High priority for scientific objectives 3, 4 and 6. MB-15A is located within the ANU-3D cube.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 85 km toward NNW)

### Section B: General Site Information

Site Name:	MB-15A	Area or Location:	Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 74.1217	Jurisdiction:	Greenland
Longitude:	Deg: -60.9909	Distance to Land: (km)	111
Coordinate System:	WGS 84		
Priority of Site:	Primary: Alternate:	Water Depth (m):	605

# Section C: Operational Information

	Sedir	nents	Basen	nent
Proposed Penetration (m):	58	2	0	
	Total Sediment Thickness (m)	3000		
			Total Penetration (m):	582
General Lithologies:	Silty to sandy mudstone	9		
Coring Plan: (Specify or check)	Single hole RCB to TD			
		XCB RCB	Re-entry PCS	
Wireline Logging Plan:	Standard MeasurementsWLPorosityPorosityOensityGamma RayResistivitySonic (Δt)Formation Image (Res)VSP (zero offset)Formation Temperature& PressureOther Measurements:	Special Tools     Magnetic Susceptibility     Borehole Temperature     Formation Image     (Acoustic)     VSP (walkaway)     LWD	Other tools:	
Estimated Days:	Deilling/Corring: 0		12 Tatal C	
Ol N N	Drilling/Coring: 2.	Blan/Pa antra Plan		on-site: 3.6
Observatory Plan:	Longierm borenoie Observation	Fian/Ke-entry Fian		
Potential Hazards/ Weather:	Shallow Gas	Complicated Seabed	Hydrothermal Activity	Preferred weather window
weather.	Hydrocarbon	Soft Seabed	Landslide and Turbidity	
	Shallow Water Flow	Currents	Gas Hydrate	
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano	
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature	
	H <sub>2</sub> S	High Dip Angle	Ice Conditions	
	CO <sub>2</sub>			
	Sensitive marine habitat (e.g., reefs, vents)			
	Other: Compact gravel-rie	ch seabed may be expected		

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-15A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)		
1b High resolution seismic seismic reflection (crossing)		
2a Deep penetration seismic reflection (primary)	yes	Line: Site-15A_ANU-3D_IL-18916.segy Position: XL 17068 Line extracted from Shell-ANU-3D data cube
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-15A_ANU-3D_XL-17068.segy Position: IL 18916 Line extracted from Shell-ANU-3D data cube
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)		
5b Refraction (bottom)		
6 3.5 kHz		
7 Swath bathymetry		
8a Side looking sonar (surface)		
8b Side looking sonar (bottom)		
9 Photography or video		
10 Heat Flow		
11a Magnetics		
11b Gravity		
12 Sediment cores		
13 Rock sampling		
14a Water current data		
14b Ice Conditions		
15 OBS microseismicity		
16 Navigation	yes	
17 Other		

### Form 4 - Environmental Protection

Broposal #	bbA 000	Sito #	MR 150	Data Form Submitted	2020 01 20 00:48:57
FTOPOSal #.	909 - Auu	Sile #.	NID-1JA	Date I Unit Submitted	2020-01-30 09.40.37

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Single hole RCB, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known. Sites 5B, 6C, 13A, 14A and 15A have been identified based on Shells ANU-3D cube. No major anomalies were observed and minor anomalies were avoided.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Fill hole with heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability), boulders, gas sands (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Gas-charged sands (unknown but obvious seismic amplitude anomalies are avoided).

## Form 5 - Lithologies

	Proposal #:	909 - Add	Site #: MB-15A	Date Form Submitted: 2020-01-30 09:48:57
--	-------------	-----------	----------------	--

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

### Site Figure

#### Proposal 909-Full-2 Site MB-15A (alternate)

#### Scientific Objectives: 3, 4 and 6

Coordinates: 74.12174136; -60.99091559 Inline-Xline Number: 18916, 17068 Penetration: 625 m Water Depth: 605 m

#### SSDB locations:

Location map: Map\_MB-15A.jpg Seismic data figure: Site-15A\_ANU-3D\_IL-18916.jpg, Site-15A\_ANU-3D\_XL-17068.jpg SEG-Y data: Site-15A\_ANU-3D\_IL-18916.segy, Site-15A\_ANU-3D\_XL-17068.segy Navigation: Site-15A\_ANU-3D\_IL-18916\_nav.txt, Site-15A\_ANU-3D\_XL-17068\_nav.txt

#### Additional information: seismic velocities, horizon grids, multibeam data

**Site MB-15A**: Drill site aimed at recovering a composite sequence of high-accumulation-rate contourite drifts of mega-unit B (likely Pliocene age) and the earliest glacial clinoforms of mega-unit A (late Pliocene and Early Pleistocene). (**A**) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-15A. (**B**) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.





74.2°

74.1° N

### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	(1) Capture deposits corresponding to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene sediments of likely early Pliocene age that can elucidate paleoceanographic conditions prior to the major expansion of the GrIS (scientific objectives 3, 4 and 6). MB-17A targets the stratigraphically younger interval drilled at site MB-6D. The site is located within the ANU-3D cube, and is covered by high-res line LAKO_1033. Selected as primary site in favour of sites 5B, 13A and 14A due to optimal recovery of the youngest sediments, and for avoiding having to drill through thick clinoform deposits.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 72 km toward NNW)

### Section B: General Site Information

Site Name:	MB-17A	Area or Location:	Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 74.2323	Jurisdiction:	Greenland
Longitude:	Deg: -61.0374	Distance to Land: (km)	110
Coordinate System:	WGS 84		
Priority of Site:	Primary:	Water Depth (m):	655

# Section C: Operational Information

	Sed	iments	Basement				
Proposed Penetration (m):	2	230	0				
	Total Sediment Thickness (m)	4000					
I			Total Penetration (m):	230			
General Lithologies:	Silty to sandy mudstor muds (upper 50 m).	ne; gravel-rich sands and					
Coring Plan: (Specify or check)	Single hole RCB to TD		Be entry D DCS D				
Wirolino Logging	Standard Massuraments	Special Tools	Re-enuly PCS				
Plan:	WL ✓   Porosity ✓   Density ✓   Gamma Ray ✓   Resistivity ✓   Sonic (Δt) ✓   Formation Image (Res) ✓   VSP (zero offset) ✓   Formation Temperature & Pressure ✓   Other Measurements: ✓	Magnetic Susceptibility   Borehole Temperature   Formation Image (Acoustic)   VSP (walkaway)   LWD	Other tools:				
Estimated Days:	Drilling/Coring:	1.1 Logging:	0.8 Total C	Dn-site: 1.9			
Observatory Plan:	Longterm Borehole Observatio	n Plan/Re-entry Plan					
Potential Hazards/	Shallow Gas	Complicated Seabed	Hydrothermal Activity	Preferred weather window			
weather.	Hydrocarbon	Soft Seabed	Landslide and Turbidity	July-September			
	Shallow Water Flow	Currents	Gas Hydrate				
	Abnormal Pressure	Fracture Zone	Diapir and Mud Volcano				
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault	High Temperature				
	H <sub>2</sub> S	High Dip Angle	Ice Conditions				
	CO <sub>2</sub>						
	Sensitive marine habitat (e.g., reefs, vents)						
	Other: Compact gravel-	rich seabed may be expected					

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-17A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1033 Position: 56099
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: Site-17A_ANU_Inline_18624.sgy Position: Xline 19032 This is data extracted from Shell-ANU-3D seismic volume
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-17A_ANU_XLine_19032.sgy Position: Inline 18624 This is data extracted from Shell-ANU-3D seismic volume
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #:	909 -	Add	Site #:	MB-17A	Date Form Submitted:	2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Single hole RCB, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known. Sites 17A, 5B, 6C, 13A, 14A and 15A have been identified based on Shells ANU-3D cube and single line high-res seismic data. No major anomalies were observed and minor anomalies were avoided.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Fill hole with heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability), boulders, gas sands (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Gas-charged sands (unknown but obvious seismic amplitude anomalies are avoided).

## Form 5 - Lithologies

Proposal #: 909 - Add Site #: MB-17A Date Form Submitted: 2020-01-30 09:48:57
---

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Late Pliocene Unconformity	2.5-5	1950	Diamict, mudstone, silty-sandy intervals	Proglacial, nearshore to deep marine, e.g. contourite drift setting	N/A	

# Proposal 909, Addendum to Full-2 Site MB-17A (primary)

### Scientific Objectives: 3, 4 and 6

Coordinates: 74.2323; -61.0374 Shot point: 56099 (LAKO\_1033) Penetration depth: 231 m; or 411 m if acting as a contingency site for MB-6D Water depth: 655 m

Additional information: Multibeam, seismic velocity data, 3D seismic data **SSDB locations:** 

Location map: Map\_MB-6D\_MB-17A.jpg Seismic data figure: LAKO\_1033.jpg SEG-Y data: LAKO\_1033.sgy Navigation: LAKO\_1033.sgy

**Site MB-17A**: Site aimed at recovering a composite sequence of high-accumulation-rate contourite drifts of mega-unit B (likely Pliocene age) and the earliest glacial clinoforms of mega-unit A (late Pliocene and Early Pleistocene). (**A**) Bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 50 m contours. High-resolution seismic data (LAKO; black lines) with shot points, regional TGS 2D data (gray lines) and drilling sites (red) are indicated. (**B**) High-res. seismic section with interpreted horizons and ages. The target depth is located below the mounded unit (Option 1) but may be extended to a deeper level in case 17A is alternating for MB-6D (Option 2).





### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	(1) Capture a thin wedge of progradational deposits that may correspond to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). MB-5B targets the stratigraphically younger interval of the drift deposit that overlaps with the section drilled at site MB-6C. The site is located within the ANU-3D cube. Selected as primary site due to most optimal recovery of the youngest sediments.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 72 km toward NNW)

### Section B: General Site Information

Site Name:	MB-05B	Area or Location: Melville Bay, NE Baffin Bay	
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 74.2116	Jurisdiction: Greenland	
Longitude:	Deg: -61.3397	Distance to Land: (km)	
Coordinate System:	WGS 84		,
Priority of Site:	Primary: Alternate:	Water Depth (m): 704	
	LL		

# Section C: Operational Information

	Codimente				Basement				
		eannents			Basement				
Proposed Penetration (m):		520	20				0		
	Total Sediment Thickness (m	n)	4000						
					Total P	Penetratio	on (m):	520	
General Lithologies:	Silty to sandy mudst muds (upper 50 m).	tone; gravel-	rich sands	s and					
Coring Plan: (Specify or check)	Hole A: RCB to TD				1				
( <b>F</b> • • • • • • • • • • • • • • • • • • •	APC	XCB		RCB 🖌	Re-entry	PC:	s 🗌		
Wireline Logging	Standard Measuremen	nts Sp	ecial Too	ols					
Plan:	WL .		Susceptibil	ity 🔽	04				
	Porosity		Temperatur	., <b>Г</b>	tools:				
	Density	Formation	n Image						
		(Acoustic	z)						
	Gamma Ray		lkaway)						
	Somia (At)								
	Formation Image (Bas)								
	VSP (zero offset)								
	Formation Temperature	=							
	& Pressure								
	Other Measurements:								
Estimated Days:	Drilling/Coring:	2.2	Log	ging:	1.2	,	Total O	n-site:	3.4
Observatory Plan:	Longterm Borehole Observat	tion Plan/Re-en	ntry Plan						
Potential Hazards/ Weather:	Shallow Gas	Complication	ted Seabed	$\checkmark$	Hydrothermal	Activity		Preferred weather	er window
	Hydrocarbon	Soft Seab	ed		Landslide and Turbidity Current			oury copie	
	Shallow Water Flow	Currents			Gas Hydrate				
	Abnormal Pressure	Fracture Z	Zone		Diapir and Mud Volcano				
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault			High Temperature				
	H <sub>2</sub> S	High Dip	Angle		Ice Conditions		$\checkmark$		
	CO <sub>2</sub>								
	Sensitive marine habitat (e.g., reefs, vents)								
	Other: Compact grave	el-rich seabe	d may be	expected					

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site

Site #: MB-05B

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1022 Position: 66675
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: Site-5B_ANU-3D_IL-17168.segy Position: XL 18616 Line extracted from Shell-ANU-3D data cube
2b Deep penetration seismic reflection (crossing)	no	Line: Site-5B_ANU-3D_XL-18616.segy Position: IL 17168 Line extracted from Shell-ANU-3D data cube
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Industry data
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #:	909 -	Add	Site #:	MB-05B	Date Form Submitted:	2020-01-30 09:48:57
r ropoda ".	000	7100	0110 //.	INE COE	Bater offit Gabrintoa.	2020 01 00 00.10.07

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Single hole RCB, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known. Sites 5B, 6C, 13A, 14A and 15A have been identified based on Shells ANU-3D cube. No major anomalies were observed and minor anomalies were avoided.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Fill hole with heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability), boulders, gas sands (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Gas-charged sands (unknown but obvious seismic amplitude anomalies are avoided).

## Form 5 - Lithologies

Proposal #:	909 - Add	Site #: MB-05B	Date Form Submitted: 2020-01-30 09:48:57
			•

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

### Site Figure

#### Proposal 909-Full-2 Site MB-5B (primary)

#### Scientific Objectives: 3, 4 and 6

Coordinates: 74.21160000; -61.33970000 Inline-Xline Number: 17168, 18616 Penetration: 520 m Water Depth: 704 m

#### SSDB locations:

Location map: Map\_MB-5B.jpg Seismic data figure: Site-5B\_ANU-3D\_IL-17168.jpg, Site-5B\_ANU-3D\_XL-18616.jpg SEG-Y data: Site-5B\_ANU-3D\_IL-17168.segy, Site-5B\_ANU-3D\_XL-18616.segy Navigation: Site-5B\_ANU-3D\_IL-17168\_nav.txt, Site-5B\_ANU-3D\_XL-18616\_nav.txt

Additional information: seismic velocities, horizon grids

**Site MB-5B**: Drill site aimed at recovering a composite sequence of high-accumulation-rate contourite drifts of mega-unit B (likely Pliocene age) and the earliest glacial clinoforms of mega-unit A (late Pliocene and Early Pleistocene). (A) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-5B. (B) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.





Inline 17168

### Form 1 – General Site Information

909 - Add

### Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	(1) Capture a thin wedge of progradational deposits that may correspond to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-13A (alternate for 5B) targets the stratigraphically younger interval of the drift deposit that overlaps with the section drilled at site MB-6C. The site is located within the ANU-3D cube.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 70 km toward NNW)

### Section B: General Site Information

Site Name:	MB-13A	Area or Location: Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		
Latitude:	Deg: 74.2118	Jurisdiction: Greenland
Longitude:	Deg: -61.3958	Distance to Land: (km) 121
Coordinate System:	WGS 84	
Priority of Site:	Primary: Alternate:	Water Depth (m): 707

# Section C: Operational Information

	S	Sediments				Basement		
Proposed		540				0		
Penetration (m):								
	Total Sediment Thickness (r	n)	4000					
					Total Per	netration (m):	540	
General Lithologies:	Silty to sandy muds muds (upper 50 m).	stone; gravel-r	rich sands a	and				
Coring Plan: (Specify or check)	Hole A: RCB to TD	_	_					
	APC	XCB	I	RCB 🖌	Re-entry	PCS		
Wireline Logging	Standard Measuremen	nts Sp	ecial Tools	3				
i iaii.	WL .	✓ Magnetic	Susceptibility		Other tools:			
	Density	Borehole	Temperature					
	Density	Formation (Acoustic	n Image					
	Gamma Ray	VSP (wal	kaway)					
	Resistivity							
	Sonic ( $\Delta t$ )							
	VSP (zero offset)							
	Formation Temperature							
	Other Measurements:							
	Other Weasurements.		1					
Estimated Days:	Drilling/Coring:	2.2	Logg	ing:	1.2	Total C	n-site: 3	.4
Observatory Plan:	Longterm Borehole Observa	ttion Plan/Re-en	try Plan					
Potential Hazards/ Weather:	Shallow Gas	Complicat Condition	ted Seabed	$\checkmark$	Hydrothermal A	ctivity	Preferred weather	window
	Hydrocarbon	Soft Seabe	ed		Landslide and Tu Current	urbidity	July-Septer	ibei
	Shallow Water Flow	Currents			Gas Hydrate			
	Abnormal Pressure	Fracture Z	Cone		Diapir and Mud	Volcano		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault			High Temperatur	re		
	H <sub>2</sub> S	High Dip .	Angle		Ice Conditions	$\checkmark$		
	CO <sub>2</sub>							
	Sensitive marine habitat (e.g., reefs, vents)							
	Other: Compact grave	el-rich seabed	d may be e>	<pre>cted</pre>				

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-13A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)		
1b High resolution seismic seismic reflection (crossing)		
2a Deep penetration seismic reflection (primary)	yes	Line: Site-13A_ANU-3D_IL-16896.segy Position: XL 18616
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-13A_ANU-3D_XL-18616.segy Position: IL 16896
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)		
5b Refraction (bottom)		
6 3.5 kHz		
7 Swath bathymetry		
8a Side looking sonar (surface)		
8b Side looking sonar (bottom)		
9 Photography or video		
10 Heat Flow		
11a Magnetics		
11b Gravity		
12 Sediment cores		
13 Rock sampling		
14a Water current data		
14b Ice Conditions		
15 OBS microseismicity		
16 Navigation	yes	
17 Other		

### Form 4 - Environmental Protection

Duran a sal #	000 4 -1 -1		Data Farm Octority de 0000 01 00 00 10 F7
Proposal #:	909 - Add	Site #: MB-13A	Date Form Submitted: 2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Single hole RCB, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known. Sites 5B, 6C, 13A, 14A and 15A have been identified based on Shells ANU-3D cube. No major anomalies were observed and minor anomalies were avoided.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Fill hole with heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability), boulders, gas sands (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Gas-charged sands (unknown but obvious seismic amplitude anomalies are avoided).

## Form 5 - Lithologies

Proposal #:	909 - Add	Site #: MB-13A	Date Form Submitted: 2020-01-30 09:48:57

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							
## Site Figure

### Proposal 909-Full-2 Site MB-13A (alternate)

#### Scientific Objectives: 3, 4 and 6

Coordinates: 74.21184154; -61.39578223 Inline-Xline Number: 16896, 18616 Penetration: 540 m Water Depth: 707 m

#### SSDB locations:

Location map: Map\_MB-13A.jpg Seismic data figure: Site-13A\_ANU-3D\_IL-16896.jpg, Site-13A\_ANU-3D\_XL-18616.jpg SEG-Y data: Site-13A\_ANU-3D\_IL-16896.segy, Site-13A\_ANU-3D\_XL-18616.segy Navigation: Site-13A\_ANU-3D\_IL-16896\_nav.txt, Site-13A\_ANU-3D\_XL-18616\_nav.txt

#### Additional information: seismic velocities, horizon grids

**Site MB-13A**: Drill site aimed at recovering a composite sequence of high-accumulation-rate contourite drifts of mega-unit B (likely Pliocene age) and the earliest glacial clinoforms of mega-unit A (late Pliocene and Early Pleistocene). (**A**) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-13A. (**B**) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.



61.5° W

61° W

62° W



Inline 16896

### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	(1) Capture a thin wedge of progradational deposits that may correspond to the earliest shelf-based glaciations in NW Greenland; (2) Recover Neogene contourite drift sediments of likely Pliocene age that can elucidate paleoceanographic conditions prior to the major basinward expansion of the Greenland Ice Sheet (scientific objectives 3, 4 and 6). Site MB-14A (alternate for 5B) targets the stratigraphically younger interval of the drift deposit that overlaps with the section drilled at site MB-6C. The site is located within the ANU-3D cube.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 72 km toward NNW)

### Section B: General Site Information

Site Name:	MB-14A	Area or Location: Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		
Latitude:	Deg: 74.2109	Jurisdiction: Greenland
Longitude:	Deg: -61.2704	Distance to Land: (km)
Coordinate System:	WGS 84	
Priority of Site:	Primary: Alternate:	Water Depth (m): 663

# Section C: Operational Information

	0			Pacamant					
	Se	ediments			Basement				
Proposed Penetration (m):		510					0		
	Total Sediment Thickness (m	n)	4000						
					Total F	Penetratio	on (m):	510	
General Lithologies:	Silty to sandy mudst muds (upper 50 m).	tone; gravel-	rich sands	s and					
Coring Plan:	Hole A: RCB to TD				I				
(Specify or check)	APC	ХСИ	з 🔲	RCB 🗸	Re-entry	PC:	s 🔲		
Wireline Logging	Standard Measuremen	nts Si	pecial Too	ols	-				
Plan:	WL	Magneti	c Susceptibil	lity 🔽	Other				
	Porosity	Borehole	e Temperatur	re	tools:				
	Density	Formatic	n Image						
	Commo Bay	Acousti	c)						
	Resistivity		llkaway)						
	Sonic ( $\Delta t$ )								
	Formation Image (Res)	3							
	VSP (zero offset)	<b>F</b>							
	Formation Temperature & Pressure	5							
	Other Measurements:	•				·			
Estimated Days:	Drilling/Coring:	2.1	Log	gging:	1.1	,	Total O	n-site:	3.2
Observatory Plan:	Longterm Borehole Observat	tion Plan/Re-e	ntry Plan			·			
Potential Hazards/ Weather:	Shallow Gas	Complica Condition	nted Seabed	$\checkmark$	Hydrothermal	Activity		Preferred weather	er window
Weather.	Hydrocarbon	Soft Seab	oed		Landslide and Turbidity Current			July-Septe	mber
	Shallow Water Flow	Currents			Gas Hydrate				
	Abnormal Pressure	Fracture	Zone		Diapir and Mud Volcano				
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault			High Temperature				
	H <sub>2</sub> S	High Dip	Angle		Ice Conditions		$\checkmark$		
	CO <sub>2</sub>								
	Sensitive marine habitat (e.g., reefs, vents)								
	Other: Compact grave	el-rich seabe	ed may be	expected					

## Form 2 - Site Survey Detail

Proposal #: 909 - Add Site #: MB-14A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)		
1b High resolution seismic seismic reflection (crossing)		
2a Deep penetration seismic reflection (primary)	yes	Line: Site-14A_ANU-3D_IL-17504.segy Position: XL 18616
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-14A_ANU-3D_XL-18616.segy Position: IL 17504
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)		
5b Refraction (bottom)		
6 3.5 kHz		
7 Swath bathymetry		
8a Side looking sonar (surface)		
8b Side looking sonar (bottom)		
9 Photography or video		
10 Heat Flow		
11a Magnetics		
11b Gravity		
12 Sediment cores		
13 Rock sampling		
14a Water current data		
14b Ice Conditions		
15 OBS microseismicity		
16 Navigation	yes	
17 Other		

### Form 4 - Environmental Protection

Proposal #:	909 -	Add	Site #:	MB-14A	Date Form Submitted:	2020-01-30 09:48:57
· ·						

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Single hole RCB, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	None that we are aware of
5. Are there reasons to expect hydrocarbon accumulations at this site?	None known. Sites 5B, 6C, 13A, 14A and 15A have been identified based on Shells ANU-3D cube. No major anomalies were observed and minor anomalies were avoided.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Fill hole with heavy mud
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability), boulders, gas sands (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Gas-charged sands (unknown but obvious seismic amplitude anomalies are avoided).

## Form 5 - Lithologies

	Proposal #: 909 - A	Add Site #:	MB-14A	Date Form Submitted: 2020-01-30 09:48:57
--	---------------------	-------------	--------	--

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

## Site Figure

#### Proposal 909-Full-2 Site MB-14A (alternate)

#### Scientific Objectives: 3, 4 and 6

Coordinates: 74.21088557; -61.27037114 Inline-Xline Number: 17504, 18616 Penetration: 510 m Water Depth: 663 m

#### SSDB locations:

Β

-800

IL 17504 XL 17612

S

17504 17772 17504 17932

Location map: Map\_MB-14A.jpg Seismic data figure: Site-14A\_ANU-3D\_IL-17504.jpg, Site-14A\_ANU-3D\_XL-18616.jpg SEG-Y data: Site-14A\_ANU-3D\_IL-17504.segy, Site-14A\_ANU-3D\_XL-18616.segy Navigation: Site-14A\_ANU-3D\_IL-17504\_nav.txt, Site-14A\_ANU-3D\_XL-18616\_nav.txt

#### Additional information: seismic velocities, horizon grids

**Site MB-14A**: Drill site aimed at recovering a composite sequence of high-accumulation-rate contourite drifts of mega-unit B (likely Pliocene age) and the earliest glacial clinoforms of mega-unit A (late Pliocene and Early Pleistocene). (**A**) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-14A. (**B**) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.

17504 19212 17504 19372 17504 19532

Ν

-800

Two-way-time (ms)

-1400



61.5° W

61° W

62° W

17504 17504 17504 17504 17504 17504 17504 17504 18092 18252 18412 18572 18732 18892 19052 1000 2000m MB-14A

Inline 17504



### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon horizon with TD at the top of a sedimentary wedge of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Located within PITU-3D high-res cube, and covered by high-resolution 2D seismic line LAKO_1033. Site 7B is selected as the primary site on the basis of its optimal stratigraphy and clear depth target on the 3D data.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 62 km toward NW)

### Section B: General Site Information

MB-07B	Area or Location: Melville Bay, NE Baffin Bay
Deg: 74.4925	Jurisdiction: Greenland
Deg: -60.5832	Distance to Land: (km)
WGS 84	
Primary:	Water Depth (m): 736
	MB-07B   Deg: 74.4925   Deg: -60.5832   WGS 84   Primary: ✓   Alternate:

# Section C: Operational Information

	S	Basement								
Proposed Penetration (m):	978							0		
	Total Sediment Thickness (n	n)		6000						
						Total	Penetrat	ion (m):	978	
General Lithologies:	Sandy to silty muds ooze	tone, c	claystor	ne, sillice	ous					
Coring Plan: (Specify or check)	Hole A: RCB coring to 6 Hole B: Install HRT w. 6	600 mbs 600 m o	sf. of casing	; RCB to T	D					
	APC		XCB	<u> </u>	RCB 🗸	Re-entry				
Wireline Logging Plan:	Standard Measuremer	nts	Spe							
	Porosity	⊻∣™ ∕⊓ в	lagnetic	Susceptibil Temperatu		Other tools:				
	Density		ormation	Image						
	Gamma Ray	_ 7 (4	Acoustic)	Ũ						
	Resistivity	<u>,</u> v	SP (wall	(away)	Ц					
	Sonic ( $\Delta t$ )		WD							
	Formation Image (Res)	☑								
	VSP (zero offset)	<u> </u>								
	Formation Temperature & Pressure									
	Other Measurements:									
Estimated Days:	Drilling/Coring:	8.1		Log	gging:	2.4		Total C	n-site: 10	).5
Observatory Plan:	Longterm Borehole Observa	tion Pla	n/Re-ent	ry Plan						
Potential Hazards/ Weather:	Shallow Gas		omplicate ondition	ed Seabed		Hydrotherma	al Activity		Preferred weather	window
	Hydrocarbon		oft Seabe	d		Landslide and Turbidity		У	July-Septer	liber
	Shallow Water Flow		urrents			Gas Hydrate				
	Abnormal Pressure	Fr	acture Z	one		Diapir and Mud Volcano		10		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fa	ault		$\checkmark$	High Temperature				
	H <sub>2</sub> S	Hi	igh Dip A	Angle		Ice Conditions		$\leq$		
	CO <sub>2</sub>					-				
	Sensitive marine habitat (e.g., reefs, vents)									
	Other: Site 7B and alt distance from f	ternate fluid-re	es 11A a	and 12A, nomalies	and 16A or deep	are identifie seated fault	ed using s	a high-res	s 3D cube ensu	ring

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site

Site #: MB-07B

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: LAKO_1033 Position: 60045
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: Site-7B_PITU-3D_IL-2499.segy Position: Xline 7230 SEGY files extracted from PITU-HR-3D seismic volume
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-7B_PITU-3D_XL-7230.segy Position: Inline 2499 SEGY files extracted from PITU-HR-3D seismic volume
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Proposal #	000	Add	Sito #	MR 07P	Data Forr	n Submitted	2020 01 20 00:48:57
FIOPOSAI #.	909 -	Auu	Sile #.	IVID-U/D	Date Full	n Submitteu.	2020-01-30 09.46.57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Hole A: RCB coring to 600 mbsf, log hole; Hole B: Install HRT w. 600 m of casing; RCB to TD and log hole
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	BSR's identified in the PITU-3D seismic cube within strata over the Melville Bay Ridge may represent gas hydrates. Sites 7B, 11A and 12A and 16A are located >2.5 km away from the gas hydrate risk zone.
5. Are there reasons to expect hydrocarbon accumulations at this site?	The Melville Bay Ridge hosts a likely gas accumulation seen as bright soft reflections and push- down reflections along its crest in the PITU-3D area. Areas containing bright reflections have been avoided in site selection and the chance of encountering shallow gas or hydrates is considered low.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Displacement of hole with heavy mud.
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Shallow gas (seismic anomalies in 3D cube avoided, so low probability).

## Form 5 - Lithologies

Proposal #: 909 - Add Site #: MB-07B Date Form Submitted: 2020-01-30 09:48:57
---

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Mid-Miocene unconformity	Potentially 6-30 Ma	2050	Clay stone with silty to sandy intervals	Marine; Hemi- pelagic	Possibly 40-45	

# Site Figure

### Proposal 909, Addendum to Full-2 Site MB-7B (primary)

Scientific Objectives: 2 and 3

Coordinates: 74.4925; -60.5832 Inline-Xline Number: 2499, 7230 Penetration: 978 m Water Depth: 736 m

#### SSDB locations:

Location map: Map\_MB-7B.jpg Seismic data figure: Site-7B\_PITU-3D\_IL-2499.jpg, Site-7B\_PITU-3D\_XL-7230.jpg SEG-Y data: Site-7B\_PITU-3D\_IL-2499.segy, Site-7B\_PITU-3D\_XL-7230.segy Navigation: Site-7B\_PITU-3D\_IL-2499\_nav.txt, Site-7B\_PITU-3D\_XL-7230\_nav.txt

Additional information: seismic velocities, horizon grids, multibeam data

**Site MB-7B**: Drill site aimed at recovering Oligocene and Miocene successions that are expected to be finegrained hemipelagic sediments of mega-units C and D. (A) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-7B. (B) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.







Inline 2499

Two-way-time (ms)

### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon horizon with TD at the top of a sedimentary wedge of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Located at the northern limit of the PITU-3D high-res cube, and 0.9 km offset from the high-resolution 2D line LAKO_1035. Site 16A is an alternate site with a stratigraphic structure similar to site 7A but with TD located ~ 100 m deeper.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 62 km toward NW)

### Section B: General Site Information

Site Name:	MB-16A	Area or Location:	Melville Bay, NE Baffin Bay
site is a reoccupation of an d DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 74.5507	Jurisdiction:	Greenland
Longitude:	Deg: -60.7990	Distance to Land: (km)	100
Coordinate System:	WGS 84		
Priority of Site:	Primary: Alternate:	Water Depth (m):	734
Longitude: Coordinate System: Priority of Site:	Deg: -60.7990   WGS 84   Primary:	Distance to Land: (km) Water Depth (m):	734

# Section C: Operational Information

	Se	ediments		Basement				
Proposed Penetration (m):		1089					0	
	Total Sediment Thickness (m	i)	6000					
					Total P	enetration	n (m):	1089
General Lithologies:	Sandy to silty mudst ooze	one, claysto	ne, silliceo	ous				
Coring Plan: (Specify or check)	Hole A: RCB coring to 600 mbsf. Hole B: Install HRT w. 600 m of casing; RCB to TD						_	
	APC	XCB		RCB 🖌	Re-entry	PCS		
Wireline Logging Plan:	Standard Measuremen	ts Sp	ecial Tool	ls				
	WL Porosity	Magnetic	Susceptibili	ty 🖌	Other tools:			
	Density	Formation	1 Image					
	Gamma Ray	(Acoustic	)					
	Resistivity	VSP (wal	kaway)					
	Sonic ( $\Delta t$ )							
	Formation Image (Res)	2						
	VSP (zero offset)	2						
	Formation Temperature & Pressure	2						
	Other Measurements:							
Estimated Days:	Drilling/Coring:	9	Logg	ging:	2.6	1	Fotal O	Dn-site: 11.6
Observatory Plan:	Longterm Borehole Observat	ion Plan/Re-en	try Plan			ł		
Potential Hazards/ Weather:	Shallow Gas	Complicat Condition	ed Seabed		Hydrothermal	Activity		Preferred weather window
	Hydrocarbon	Soft Seabo	ed		Landslide and Current	Turbidity		July-September
	Shallow Water Flow	Currents			Gas Hydrate			
	Abnormal Pressure	Fracture Z	lone		Diapir and Mud Volcano			
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault		$\checkmark$	High Tempera	ture		
	H <sub>2</sub> S	High Dip	Angle		Ice Conditions	5	$\checkmark$	
	CO <sub>2</sub>							
	Sensitive marine habitat (e.g., reefs, vents)							
	Other: Site 7B and alte distance from fl	ernates 11A luid-related a	and 12A, a nomalies	and 16A or deep s	are identified seated faults	d using a h	nigh-res	s 3D cube ensuring

# Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-16A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	no	
1b High resolution seismic seismic reflection (crossing)	yes	Line: LAKO_1035 Position: 61758 Site MB-16A is located about 1 km from nearest high-res crossing line.
2a Deep penetration seismic reflection (primary)	yes	Line: Site-16A_PITU-3D_IL-2825.segy Position: At crossing of Xline 2960 extracted from Full Volume PITU-3D Data extracted from two 3D cubes: PITU-HR-3D seismic volume (Inline) and Full Volume PITU-3D (Xline)
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-16A_PITU-3D-Full-Volume_XL-2960.segy Position: At crossing of Inline 2825 extracted from PITU-HR-3D seismic volume Data extracted from two 3D cubes: PITU-HR-3D seismic volume (Inline) and Full Volume PITU-3D (Xline)
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Dropood #:	000	۸dd	Sito #	MD 16A	Data Form Submitted	2020 01 20 00.49.57
FIOPOSAI #.	909 -	Add	Sile #.	IVID-TOA	Date Form Submitted	2020-01-30 09.46.57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Hole A: RCB coring to 600 mbsf, log hole; Hole B: Install HRT w. 600 m of casing; RCB to TD and log hole
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	BSR's identified in the PITU-3D seismic cube within strata over the Melville Bay Ridge may represent gas hydrates. Sites 7B, 11A and 12A and 16A are located >2.5 km away from the gas hydrate risk zone.
5. Are there reasons to expect hydrocarbon accumulations at this site?	The Melville Bay Ridge hosts a likely gas accumulation seen as bright soft reflections and push- down reflections along its crest in the PITU-3D area. Areas containing bright reflections have been avoided in site selection and the chance of encountering shallow gas or hydrates is considered low.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Displacement of hole with heavy mud.
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Shallow gas (seismic anomalies in 3D cube avoided, so low probability).

## Form 5 - Lithologies

Proposal #: 909 - Add Site #: MB-16A Date Form Submitted: 2020-01-30 0	8:57
--	------

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Mid-Miocene Unconformity	Potentially 6-30 Ma	2050	Claystone with silty to sandy intervals	Marine; Hemipelagic	Potentially 42	

# Site Figure

#### Proposal 909, Addendum Site MB-16A (alternate)

#### Scientific Objectives: 2 and 3

Coordinates: 74.5507; -60.7990 Inline-Xline Number: 2825, 2960 Penetration: 1089 m Water Depth: 734 m

#### SSDB locations:

#### Location map: Map MB-16A.jpg

Seismic data figure: Site-16A\_PITU-3D\_IL-2825.jpg, Site-16A\_PITU-3D-Full-Volume\_XL-2960.jpg SEG-Y data: Site-16A PITU-3D IL-2825.segy, Site-16A PITU-3D-Full-Volume XL-2960.segy Navigation: Site-16A PITU-3D IL-2825 nav.txt, Site-16A PITU-3D-Full-Volume XL-2960 nav.txt

#### Additional information: seismic velocities, horizon grids, multibeam data

Site MB-16A: Drill site aimed at recovering Oligocene and Miocene successions that are expected to be finegrained hemipelagic sediments of mega-units C and D. (A) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-16A. Dashed and dotted red lines show the high-resolution subcrop and standard 3D data outlines, respectively. (B) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.



Inline 2825





Xline 2960

### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon (d1) with TD at horizon d2 of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Located within PITU-3D high-res cube.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 74 km toward NW)

### Section B: General Site Information

Site Name:	MB-11A	Area or Location: Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		
Latitude:	Deg: 74.4283	Jurisdiction: Greenland
Longitude:	Deg: -60.4086	Distance to Land: (km) 89
Coordinate System:	WGS 84	
Priority of Site:	Primary: Alternate:	Water Depth (m): 747

# Section C: Operational Information

	Sediments				Basement				
Proposed Penetration (m):		1015					0		
	Total Sediment Thickness (m	n)	6000						
					Total	Penetrat	ion (m):	1015	
General Lithologies:	Sandy to silty mudst ooze	tone, clays	tone, sillice	eous					
Coring Plan: (Specify or check)	Hole A: RCB coring to 600 mbst. Hole B: Install HRT w. 600 m of casing; RCB to 1	TD			1		_		
	APC			RCB 🗸	Re-entry	P	CS		
Wireline Logging Plan:	Standard Measuremen		Special To	ols					
	Porosity	Magne	tic Susceptib		Other tools:				
	Density	Format	tion Image						
	Gamma Ray		stic)						
	Resistivity		valkaway)						
	Sonic ( $\Delta t$ )								
	Formation Image (Res)								
	VSP (zero offset)								
	& Pressure								
	Other Measurements:								
Estimated Days:	Drilling/Coring:	8.1	Lo	gging:	2.5		Total O	n-site: 10	).6
Observatory Plan:	Longterm Borehole Observat	tion Plan/Re-	entry Plan			·			
Potential Hazards/ Weather:	Shallow Gas	Compli Conditi	cated Seabed on		Hydrotherma	l Activity		Preferred weather	window
	Hydrocarbon	Soft Se	abed		Landslide and Turbidity		у	buly ocpies	liber
	Shallow Water Flow	Current	S		Gas Hydrate				
	Abnormal Pressure	Fractur	e Zone		Diapir and Mud Volcano		10		
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault		$\checkmark$	High Temper	rature			
	H <sub>2</sub> S	High D	ip Angle		Ice Condition	15	$\checkmark$		
	CO <sub>2</sub>								
	Sensitive marine habitat (e.g., reefs, vents)								
	Other: Site 7A and alte from fluid-relate	ernates 11 ed anomali	A and 12 A es or deep	A are ident seated fa	ified using a ults	a high-re	s 3D cube	ensuring dista	ince

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-11A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	no	
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: Site-11A_PITU-3D_IL-2280.segy Position: XL 8578 SEGY files extracted from PITU-HR-3D seismic volume
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-11A_PITU-3D_XL-8578.segy Position: IL 2280 SEGY files extracted from PITU-HR-3D seismic volume
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)		
5b Refraction (bottom)		
6 3.5 kHz		
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)		
8b Side looking sonar (bottom)		
9 Photography or video		
10 Heat Flow		
11a Magnetics		
11b Gravity		
12 Sediment cores		
13 Rock sampling		
14a Water current data		
14b Ice Conditions		
15 OBS microseismicity		
16 Navigation	yes	
17 Other		

### Form 4 - Environmental Protection

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Hole A: RCB coring to 600 mbsf, log hole; Hole B: Install HRT w. 600 m of casing; RCB to TD and log hole $% \left[ {\left[ {{\left[ {{\left[ {\left[ {\left[ {\left[ {\left[ {\left[ {\left$
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	BSR's identified in the PITU-3D seismic cube within strata over the Melville Bay Ridge may represent gas hydrates. Sites 7A, 11A and 12 A are located >2.5 km away from the gas hydrate risk zone.
5. Are there reasons to expect hydrocarbon accumulations at this site?	The Melville Bay Ridge hosts a likely gas accumulation seen as bright soft reflections and push- down reflections along its crest in the PITU-3D area. Areas containing bright reflections have been avoided in site selection and the chance of encountering shallow gas or hydrates is considered low.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Displacement of hole with heavy mud.
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Shallow gas (seismic anomalies in 3D cube avoided, so low probability).

## Form 5 - Lithologies

Proposal #: 909 - Add Site #: MB-11A Date Form Submitted: 2020-01-30 09:48:57
---

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

## Site Figure

### Proposal 909-Full-2 Site MB-11A (alternate)

#### Scientific Objectives: 2 and 3

Coordinates: 74.42826067; -60.40858689 Inline-Xline Number: 2280, 8578 Penetration: 1015 m Water Depth: 747 m

#### SSDB locations:

#### Location map: Map\_MB-11A.jpg

Seismic data figure: Site-11A\_PITU-3D\_IL-2280.jpg, Site-11A\_PITU-3D\_XL-8578.jpg SEG-Y data: Site-11A\_PITU-3D\_IL-2280.segy, Site-11A\_PITU-3D\_XL-8578.segy Navigation: Site-11A\_PITU-3D\_IL-2280\_nav.txt, Site-11A\_PITU-3D\_XL-8578\_nav.txt Velocity data:

#### Additional information: seismic velocities, horizon grids, multibeam data

**Site MB-11A**: Drill site aimed at recovering Oligocene and Miocene successions that are expected to be finegrained hemipelagic sediments of mega-units C and D. (**A**) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-11A. (**B**) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.





[wo-way-time (ms)

0 500 1000m

- Hart

### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon (d1) with TD at horizon d2 of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). Alternate site for 7A. Located within PITU-3D high-res cube.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 70 km toward NW)

### Section B: General Site Information

Site Name:	MB-12A	Area or Location: Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		
Latitude:	Deg: 74.4597	Jurisdiction: Greenland
Longitude:	Deg: -60.5049	Distance to Land: (km) 95
Coordinate System:	WGS 84	
Priority of Site:	Primary: Alternate:	Water Depth (m): 739

# Section C: Operational Information

	Sediments				Basement			
Proposed Penetration (m):		971					0	
	Total Sediment Thickness (m)	)	6000					
					Total P	enetration	n (m):	971
General Lithologies:	Sandy to silty mudsto	one, claysto	ne, sillicec	ous				
Coring Plan: (Specify or check)	Hole A: RCB coring to 600 mbsf. Hole B: Install HRT w. 600 m of casing;	RCB to TD	_				_	
	APC	XCB		RCB 🗸	Re-entry	PCS		
Wireline Logging Plan:	Standard Measurement	ts Sp	ecial Too	ls				
	VL VI Porosity	Magnetic Rerehele	Susceptibili		Other tools:			
	Density 🗸	Formation	1 Image					
	Gamma Ray	(Acoustic	)					
	Resistivity	VSP (wal	kaway)					
	Sonic ( $\Delta t$ )							
	Formation Image (Res)							
	VSP (zero offset)	]						
	Formation Temperature & Pressure	ן ב						
	Other Measurements:							
Estimated Days:	Drilling/Coring:	8.1	Log	ging:	2.4	Т	Fotal O	n-site: 10.5
Observatory Plan:	Longterm Borehole Observati	ion Plan/Re-en	try Plan			ł		
Potential Hazards/ Weather:	Shallow Gas	Complicat Condition	ed Seabed		Hydrothermal	Activity		Preferred weather window
	Hydrocarbon	Soft Seabe	ed		Landslide and Current	Turbidity		July-September
	Shallow Water Flow	Currents			Gas Hydrate			
	Abnormal Pressure	Fracture Z	lone		Diapir and Mud Volcano			
	Man-made Objects (e.g., sea-floor cables, dump sites)	Fault		$\checkmark$	High Tempera	iture		
	H <sub>2</sub> S	High Dip .	Angle		Ice Conditions	3	$\checkmark$	
	CO <sub>2</sub>							
	Sensitive marine habitat (e.g., reefs, vents)							
	Other: Site 7A and alte from fluid-relate	ernates 11A ed anomalies	and 12 A a s or deep s	are ident seated fa	ified using a ults	high-res 3	D cube	ensuring distance

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-12A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)		
1b High resolution seismic seismic reflection (crossing)		
2a Deep penetration seismic reflection (primary)	yes	Line: Site-12A_PITU-3D_IL-2413.segy Position: XL 7902 SEGY files extracted from PITU-HR-3D seismic volume
2b Deep penetration seismic reflection (crossing)	yes	Line: Site-12A_PITU-3D_XL-7902.segy Position: IL 2413 SEGY files extracted from PITU-HR-3D seismic volume
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)		
5b Refraction (bottom)		
6 3.5 kHz		
7 Swath bathymetry	yes	Multibeam
8a Side looking sonar (surface)		
8b Side looking sonar (bottom)		
9 Photography or video		
10 Heat Flow		
11a Magnetics		
11b Gravity		
12 Sediment cores		
13 Rock sampling		
14a Water current data		
14b Ice Conditions		
15 OBS microseismicity		
16 Navigation	yes	
17 Other		

### Form 4 - Environmental Protection

Proposal #: 909 - Add Site #:	MB-12A	Date Form Submitted: 2020-01-30 09:48:57
-------------------------------	--------	--

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Hole A: RCB coring to 600 mbsf, log hole; Hole B: Install HRT w. 600 m of casing; RCB to TD and log hole $% \left[ {\left[ {{\left[ {{\left[ {\left[ {\left[ {\left[ {\left[ {\left[ {\left$
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None that we are aware of
4. Indications of gas hydrates at this location	BSR's identified in the PITU-3D seismic cube within strata over the Melville Bay Ridge may represent gas hydrates. Sites 7A, 11A and 12 A are located >2.5 km away from the gas hydrate risk zone.
5. Are there reasons to expect hydrocarbon accumulations at this site?	The Melville Bay Ridge hosts a likely gas accumulation seen as bright soft reflections and push- down reflections along its crest in the PITU-3D area. Areas containing bright reflections have been avoided in site selection and the chance of encountering shallow gas or hydrates is considered low.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Displacement of hole with heavy mud.
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Shallow gas (seismic anomalies in 3D cube avoided, so low probability).

## Form 5 - Lithologies

Proposal #:	909 - Add	Site #: MB-12A	Date Form Submitted: 2020-01-30 09:48:57
•		•	

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
N/A							

## Site Figure

### Proposal 909-Full-2 Site MB-12A (alternate)

#### Scientific Objectives: 2 and 3

Coordinates: 74.45966394; -60.50491767 Inline-Xline Number: 2413, 7902 Penetration: 1145 m Water Depth: 739 m

#### SSDB locations:

#### Location map: Map\_MB-12A.jpg

Seismic data figure: Site-12A\_PITU-3D\_IL-2413.jpg, Site-12A\_PITU-3D\_XL-7902.jpg SEG-Y data: Site-12A\_PITU-3D\_IL-2413.segy, Site-12A\_PITU-3D\_XL-7902.segy Navigation: Site-12A\_PITU-3D\_IL-2413\_nav.txt, Site-12A\_PITU-3D\_XL-7902\_nav.txt Velocity data:

#### Additional information: seismic velocities, horizon grids, multibeam data

**Site MB-12A**: Drill site aimed at recovering Oligocene and Miocene successions that are expected to be finegrained hemipelagic sediments of mega-units C and D. (**A**) Shaded relief bathymetry map of the middle shelf region within the Melville Bugt Trough, shown with 100 m contours. Seismic crossing lines displayed in panel (B) are shown in the thick white. Thin white lines show the 2D seismic grid. Inset shows the areal coverage of 3D seismic data used to help refine target location. Black circles shows the proposed alternate drill site location and the red circle shows the drill site location for MB-12A. (**B**) Key Inline and Xline seismic sections from the 3D seismic cube (zero-phase). Mega-unit boundaries are shown.





### Form 1 – General Site Information

909 - Add

## Section A: Proposal Information

Proposal Title	Cenozoic evolution of the northern Greenland Ice Sheet exposed by transect drilling in northeast Baffin Bay (CENICE)
Date Form Submitted	2020-01-30 09:48:57
Site-Specific Objectives with Priority (Must include general objectives in proposal)	Recover an upper Miocene interval and continue coring through the Middle Miocene horizon (d1) with TD at horizon d2 of possible Oligocene age. The scope is to elucidate past ocean and terrestrial climates in NE Baffin Bay/Greenland and the onset of ephemeral glaciation in NW Greenland (scientific objectives 2 and 3). MB-10A is located on the edge of the PITU-3D seismic data. Alternate position to site MB-07A.
List Previous Drilling in Area	Exp. 344S; sites U0100 and U0110 (distance 53 km toward NW)

### Section B: General Site Information

Site Name:	MB-10A	Area or Location:	Melville Bay, NE Baffin Bay
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 74.4584	Jurisdiction:	Greenland
Longitude:	Deg: -61.1792	Distance to Land: (km)	120
Coordinate System:	WGS 84		
Priority of Site:	Primary: Alternate:	Water Depth (m):	698
Thomy of Site.	Primary:		

# Section C: Operational Information

	S	Basement								
Proposed Penetration (m):	1200							0		
	Total Sediment Thickness (1	m)		6000						
		-				Total	Penetrat	ion (m):	1200	
General Lithologies:	Sandy to silty mudstone, claystone, silliceous ooze									
Coring Plan: (Specify or check)	Hole A: RCB coring to 6 Hole B: Install HRT w. 6	600 n 600 n	nbsf. n of casing	; RCB to T		- - -				
Winding Leasing	APC		XCB			Re-entry				
Wireline Logging Plan:		nts	Sp	Sussentibi		· · ·				
	Porosity	<u>_</u>	Borehole	Temperatu	re	Other tools:				
	Density	<u>_</u>	Formation	n Image						
	Gamma Ray	7	(Acoustic	)						
	Resistivity		VSP (wal	kaway)						
	Sonic ( $\Delta t$ )		LWD							
	Formation Image (Res)									
	VSP (zero offset)									
	& Pressure									
	Other Measurements:									
Estimated Days:	Drilling/Coring:	9.5	5	Log	gging:	2.7		Total C	n-site: 12	2.2
Observatory Plan:	Longterm Borehole Observa	ation I	Plan/Re-en	try Plan			·			
Potential Hazards/ Weather:	Shallow Gas	2	Complicat Condition	ed Seabed		Hydrotherma	l Activity		Preferred weather	window
	Hydrocarbon		Soft Seabe	ed		Landslide and Current	d Turbidity		July-Septer	IIDei
	Shallow Water Flow		Currents			Gas Hydrate				
	Abnormal Pressure		Fracture Z	lone		Diapir and M	lud Volcan	ю 🗌		
	Man-made Objects (e.g., sea-floor cables, dump sites)		Fault		$\checkmark$	High Temper	ature			
	H <sub>2</sub> S		High Dip .	Angle		Ice Condition	15	$\mathbf{\nabla}$		
	CO <sub>2</sub>									
	Sensitive marine habitat (e.g., reefs, vents)									
	Other: Site 10A is loc priority than sit	ated tes 7	within th , 11 and	e PITU-3 12.	BD area bi	ut just outsic	le the hig	gh-res cul	be - hence lowe	r

## Form 2 - Site Survey Detail

Proposal #: 909 - Add

Site #: MB-10A

Date Form Submitted: 2020-01-30 09:48:57

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	no	
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	yes	Line: BB10-5065625 Position: 19946
2b Deep penetration seismic reflection (crossing)	yes	Line: BB10-109125 Position: 25337
3 Seismic Velocity	yes	
4 Seismic Grid	yes	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	
7 Swath bathymetry	yes	Industry data
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	
11b Gravity	no	
12 Sediment cores	no	
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	
17 Other	no	

### Form 4 - Environmental Protection

Dueneed #	000		Data Form Cubraittade 0000 01 00 00:40-57
Proposal #:	909 - Add	SITE #: MIB-TUA	Date Form Submitted: 2020-01-30 09:48:57

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Single hole RCB, casing, logging
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	None based on ODP Exp. 645 results (SE Baffin Bay). EXP 344S encountered methane gas at sites U0110/100 drilling into Cretaceous sediments on the apex of the Melville Bay Ridge (~50 km NW of the 909 transect).
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	None
4. Indications of gas hydrates at this location	BSR's identified in the PITU-3D seismic cube within strata over the Melville Bay Ridge may represent gas hydrates. Site 10A is located >1 km away from the gas hydrate risk zone.
5. Are there reasons to expect hydrocarbon accumulations at this site?	The Melville Bay Ridge hosts a likely gas accumulation seen as bright soft reflections and push- down reflections along its crest in the PITU-3D area. Areas containing bright reflections have been avoided in site selection and the chance of encountering shallow gas or hydrates is considered low.
6. What "special" precautions will be taken during drilling?	Closely monitoring of headspace gas using the protocol developed during the Exp. 344S that drilled into Cretaceous sediments north of the proposed sites.
7. What abandonment procedures need to be followed?	Displacement of hole with heavy mud.
8. Natural or manmade hazards which may affect ship's operations	Drifting icebergs (low probability)
9. Summary: What do you consider the major risks in drilling at this site?	Icebergs (known hazard). Shallow gas (seismic anomalies in 3D cube avoided, so low probability).

## Form 5 - Lithologies

Proposal #: 909 - Add Site #: MB-10A	Date Form Submitted: 2020-01-30 09:48:57
--------------------------------------	--

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 0	Mid-Miocene Unconformity	Potentially 6-30	2050	Claystone with silty-sandy intervals	Hemipelagic	N/A	
## Site Figure

Proposal 909-Full-2 Site MB-10A (alternate)

## Scientific Objectives: 2 and 3

Coordinates: 74.4584; -61.1792 Shot point: 19946 (BB10-5065625) Penetration: 1200 m Water depth: 685 m

SSDB locations: Location map: Location map not uploaded Seismic data figure: BB10-5065625.jpg SEG-Y data: bb10 line-5065625 flt-scl-stk t101845.sgy

Additional information: 3D seismic data, multibeam, seismic velocity data,

**Site MB-10A:** (A) Multibeam bathymetry map of the middle shelf region, situated within the Melville Bugt trough, shown with 50 m depth contours. Seismic crossing lines are displayed with shot points. 3D data cube outlined in orange. (B) Key seismic section with interpreted horizons and assumed ages. MB-10A penetrates the Late Miocene and Early Miocene successions separated by horizon d1. TD is horizon d2 of possible Oligocene age. The site is expected to recover mainly fine-grained hemipelagic sediments, possible with smectite and intervals rich in opal CT.



