

Marine geological sampling in the Godthåbsfjord region

Geological cruise report – R/V Sanna 10th - 18th May 2012

Naja Mikkelsen, Ann Lennert, Sofia Ribeiro & Niels Nørgaard-Pedersen



GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
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Geological Cruise Report

1. Participants

Naja Mikkelsen (GEUS),
Ann Lennert (GN)
Sofia Ribeiro (GEUS)
in collaboration with Niels Nørgaard-Pedersen (GEUS).

2. Introduction

A marine geological coring program was undertaken during the 'Marine Basic' cruise of the R.V. Sanna in the Godthåbsfjord Region May 10th – 18th 2012.

Potential coring sites had been selected prior to the cruise and based on seismic lines collected during the 2004 'Galathea3' expedition and on para-sound data from the 2007 'Merian' cruise in the Kangerssuneq IceFjord. The seismic lines were used to identify suitable sedimentary basins with undisturbed sediment sequences.

A total number of 17 sites had been identified as potential coring sites (Fig 1). The coring catalogue was thus extensive (Appendix 1) but compiled to allow for a flexible planning during the cruise. Sites 1 – 8 were selected based on data from seismic lines. The selection of Sites 9 –17 was based on geological judgments of where undisturbed and high sedimentation rate deposits could be expected.



Participants from the Marine Basic program and the Geological Coring program on board R.V. 'Sanna'

The marine geological group received with gratitude the invitation from the Greenland Institute of Natural Resources to take part in the cruise. The flexible planning of the day-to-day program by cruise leader Thomas Juul Pedersen enabled the group to obtain the many valuable cores which we gratefully acknowledge.

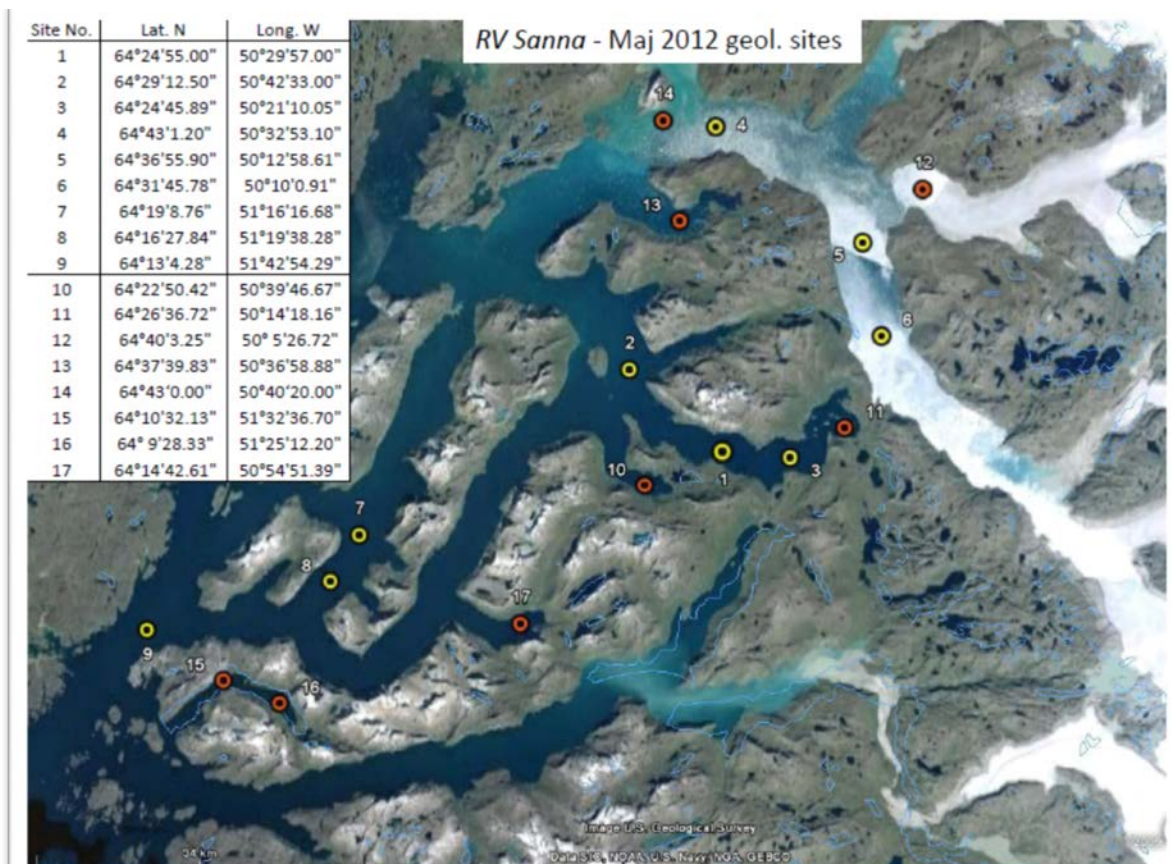


Fig. 1. Proposed coring sites in the inner part of the Godthåbsfjord region. Yellow sites were identified based on seismic lines whereas sites marked in red were selected based on geological judgments of where undisturbed and high sedimentation rate deposits could be expected.

3. Methods

A Rumohr corer was used to retrieve the sediment cores. The corer was equipped with 2 m long plexi glass liners, and a lead weight of 40 kg was placed on top of the corer (Figs. 2, 3). The corer was deployed by the ships crane with a wire speed of 1 or 2 m/sec. The sampling procedure was optimized by deploying approximately 20m extra wire than the actual water depth at position to account for drift, wire angle and bottom currents.

The sediment cores were secured after retrieval and left upright on the deck to allow the sediment to settle before overlying water was removed and the liner portion not covering sediments cut off. The cores were then capped, labeled and sealed.

The sediment cores will be used for paleo-climatic studies and studies of the occurrence of dinoflagellate cysts.

A number of cores were retrieved from the Isua area / Quassuk Fjord area to provide base line material for future studies in relation to the proposed 'London Mining' operations including the proposed port in the Taserarsuk region.



Fig 2: The Rumohr corer is deployed from R.V. Sanna



Fig. 3. Top of core liner showing an undisturbed sediment-water interface

4. Core inventory

A total number of 14 cores were successfully recovered from 6 sites during the cruise (Table 1; Fig. 4). All cores were in perfect condition as the presence of a water column above the undisturbed surface sediment proved that no sediment had been lost during the coring operation – except for the core collected at Station 18.

Core Sa2012	Lat. N	Long. W	Core Length
St. 1 # 1	64°24'46.03"	50°29'38.22"	183 cm
St. 1 # 2	64°24'44.96	50°29'46.99	63 cm
St 3 # 1	64°24'47.63"	50°21'02.06"	47 cm
St 3 # 2	64°24'49.31	50°21'89.38	111 cm
St. 3 # 3	64°24'50.25	50°21'83.97	116 cm
St. 8 # 1	64°16'24.97"	51°19'46.64"	153 cm
St 8 # 2	64°16'30.67	51°19'56.34	150 cm
St 18 # 1	64°39'15.53	50°45'27.96	200 cm (no top)
St 19 # 1	64°40'81.95"	51°12'92.32"	195 cm
St 19 # 2	64°40'78.80"	51°12'92.07"	192 cm
St 20 # 1	64°43'40.42"	51° 08'31.02"	106 cm
St 20 # 2	64°43'40.34"	51°08'27.35"	101 cm
st 20 # 3	64°43'42.27"	51°08'32.33"	117 cm
St 20 # 4	64°43'38.90"	51°08'29.80"	101 cm

Table 1. Cores collected during the R.V Sanna 2012 cruise in the Godthåbsfjord region

Two sites (Sites 1 and 3) were of high priority and both sites were successfully cored. The position of the ice margin in the Kangersuneq Fjord prevented R.V. Sanna to enter the Icefjord. It was therefore decided to sample a number of sites in the Quassuk Fjord where London Mining has planned the construction of a major harbor in relation to the Isua mining project.

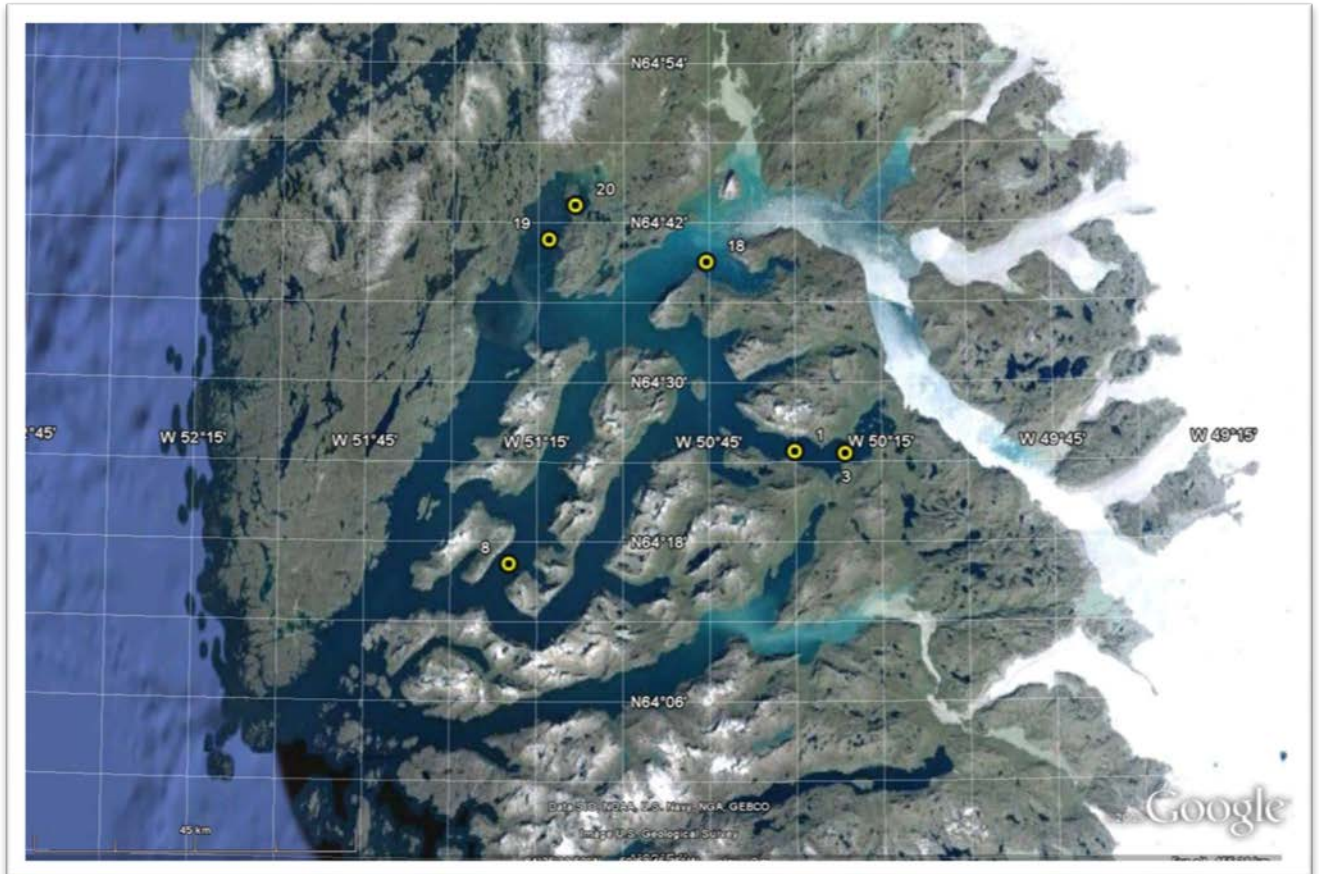
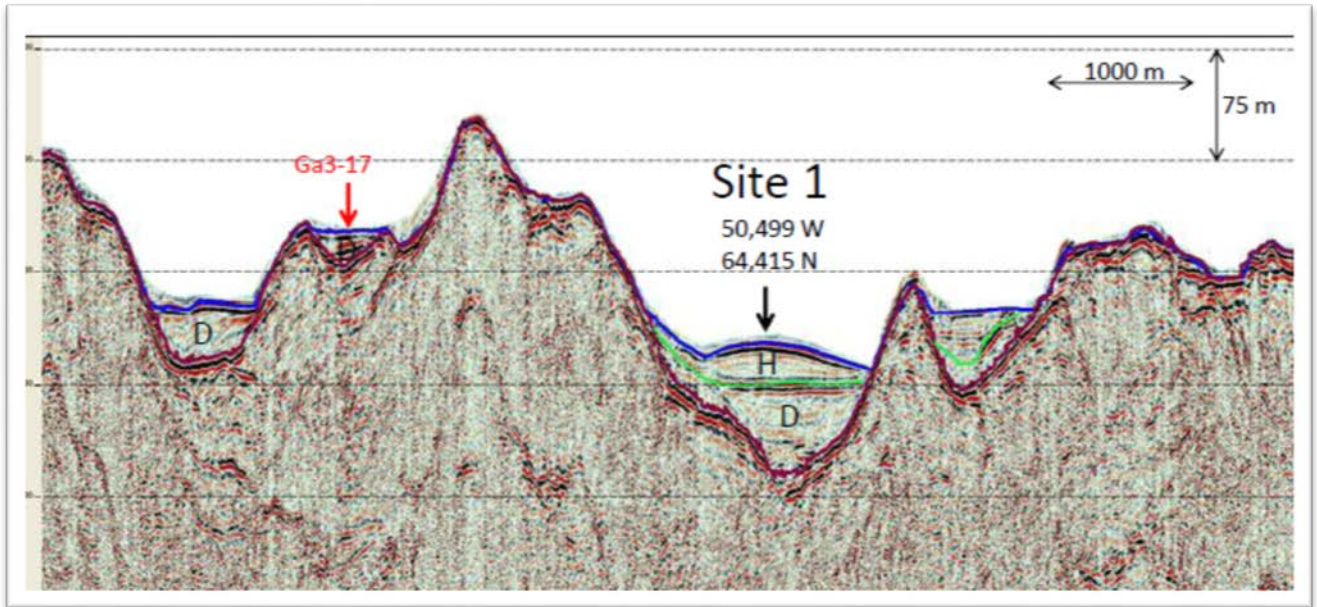


Fig. 4. Coring sites obtained during the RV Sanna cruise 10th–18th May 2012

5. Site and core descriptions

5.1. Geological coring Site 1



All cores at this station were collected with a wire velocity of ca. 1m/sec. The collection was optimized by letting the wire go ca. 20m more than the depth at position, to account for drift/wire angle/bottom currents.

Core: SA2012st.1#1

Date of collection: 13/05/2012

Region: Kapisillit Fjord

Position: 64°24'4603N, 50°29'3822W

Water depth: 220m

Core length: 183cm

Observations: Corer lid closed. Surface undisturbed. Core stayed overnight on deck to settle. Water removed by piercing small holes in the tube. Water/sediment interface collected separately.

Core: SA2012st.1#2

Date of collection: 13/05/2012

Region: Kapisillit Fjord

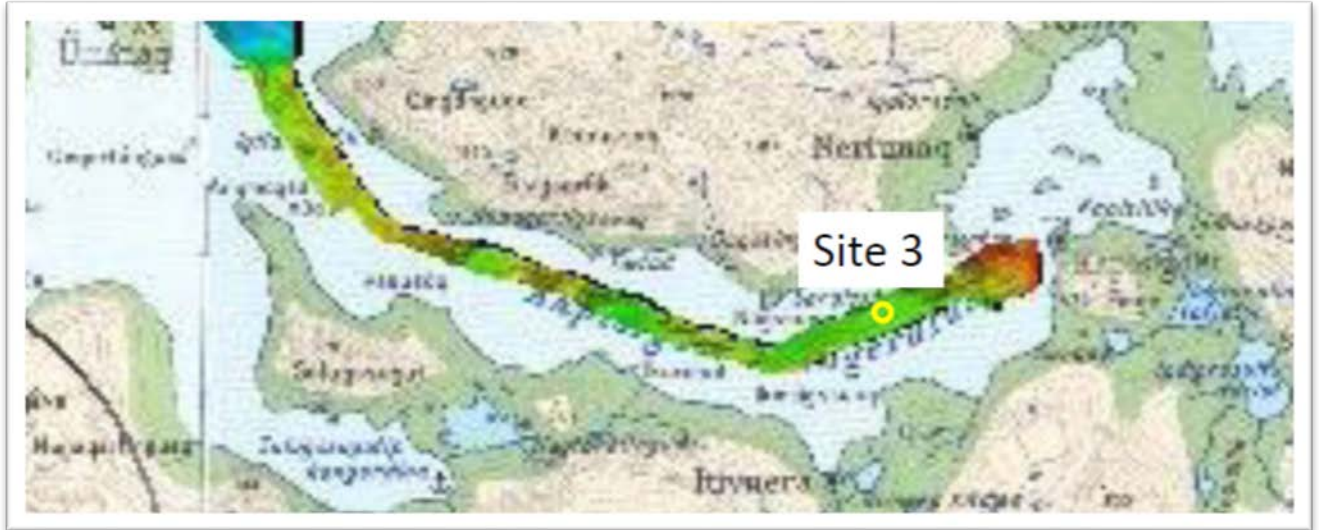
Position: 64°24'4496N, 50°29'4699W

Water depth: 213m

Core length: 63cm

Observations: Corer lid open. Surface recovered but disturbed (tilted). Core stayed overnight on deck to settle. Water removed by piercing holes in the tube. Water/sediment interface collected separately.

5.2 Geological coring Site 3



The settings as used for Site 1 was applied to Site 3 but resulted in a few missed attempts. It was thus evident that the corer had reached the bottom but tilted once it hit the bottom due to a harder substrate. The problem was overcome by increasing the velocity of the wire. All the cores collected at this station were taken with a velocity of ca. 2m/sec.

Core: SA2012st.3#1

Date of collection: 13/05/2012

Region: Kapisillit Fjord

Position: 64°24'4763N, 50°21'0206W

Water depth: 197m

Core length: 47cm

Observations: Corer lid open. Surface undisturbed. Core stayed overnight on deck to settle. Water removed by piercing holes on the tube. Water/sediment interface collected separately.

Core: SA2012st.3#2

Date of collection: 13/05/2012

Region: Kapisillit Fjord

Position: 64°24'4931N, 50°21'8938W

Water depth: 203m

Core length: 111cm

Observations: Corer lid closed. Surface undisturbed. Core stayed on deck overnight to settle. Water removed by piercing holes on the tube. Water/sediment interface collected separately.

Core: SA2012st.3#3

Date of collection: 13/05/2012

Region: Kapisillit Fjord

Position: 64°24'5025N, 50°21'8397W

Water depth: 204m

Core length: 116cm

Observations: Corer lid open. Surface undisturbed. Core stayed on deck overnight to settle. Water removed by piercing holes on the tube. Water/sediment interface collected separately.

5.3 Geological coring Site 18

Core SA2012st.18#1

Date of collection: 14/05/2012

Region: Alternative to station 4, where we couldn't go because of drift ice

Core on deck: 19:35 (UTC)

Position: 64°39'1553N, 50°45'2796W

Water depth: 500m

Core length: 200cm

Observations: Corer lid closed. Over-penetrated (top not recovered). The tube was scratched.

5.4 Geological coring Site 19

Core: SA2012st.19#1

Date of collection: 14/05/2012

Core on deck: 22:56 (UTC)

Region: Isua (Quessuk)

Position: 64°40'8195N, 51°12'9232W

Water depth: 424m

Core length: 195cm

Observations: Corer lid closed. Undisturbed surface. Smell of sulfur (indicating low oxygen/ high sedimentation rate). Core stayed on deck overnight to settle. Water removed by piercing a hole in the tube. Water/sediment interface collected separately.

Core: SA2012st.19#2

Date of collection: 14/05/2012

Core on deck: 23:25 (UTC)

Region: Isua (Quessuk)

Position: 64°40'7880N, 51°12'9207W

Water depth: 425m

Core length: 192cm

Observations: Corer lid closed. Undisturbed surface. Core stayed on deck overnight to settle. Water removed by piercing a hole in the tube. Water/sediment interface collected separately. The tube was scratched.

5.5. Geological coring Site 20

Core: SA2012st.20#1

Date of collection: 14/05/2012

Core on deck: 00:15 (UTC)

Region: Isua (Quessuk) – Close to the “London mining harbor”

Position: 64°43'4042N, 51°08'3102W

Water depth: 174m

Core length: 106cm

Observations: Corer lid closed. Undisturbed surface. Smell of sulfur, sediment with very dark areas, and plant material present all the way to the bottom - indicating a low oxygen environment with high sedimentation rate. Core stayed on deck overnight to settle. Water removed by piercing holes in the tube. Water/sediment interface collected separately.

Core: SA2012st.20#2

Date of collection: 14/05/2012

Core on deck: 00:34 (UTC)

Region: Isua (Quessuk) – Close to the “London mining harbor”

Position: 64°43'4034N, 51°08'2735W

Water depth: 174m

Core length: 101cm

Observations: Corer lid closed. Undisturbed surface. Smell of sulfur, sediment with very dark areas, and plant material present all the way to the bottom - indicating a low oxygen environment with high sedimentation rate. Core stayed on deck overnight to settle. Water removed by piercing holes in the tube. Water/sediment interface collected separately. Tube scratched.

Core: SA2012st.20#3

Date of collection: 14/05/2012

Core on deck: 00:47 (UTC)

Region: Isua (Quessuk) – Close to the “London mining harbor”

Position: 64°43'4227N, 51°08'3233W

Water depth: 174m

Core length: 117cm

Observations: Corer lid closed. Undisturbed surface. Smell of sulfur, sediment with very dark areas, and plant material present all the way to the bottom - indicating a low oxygen environment with high sedimentation rate. Core stayed on deck overnight to settle. Water removed by piercing holes in the tube. Water/sediment interface collected separately.

Core: SA2012st.20#4

Date of collection: 14/05/2012

Core on deck: 01:00am (UTC)

Region: Isua (Quessuk) – Close to the “London mining harbor”

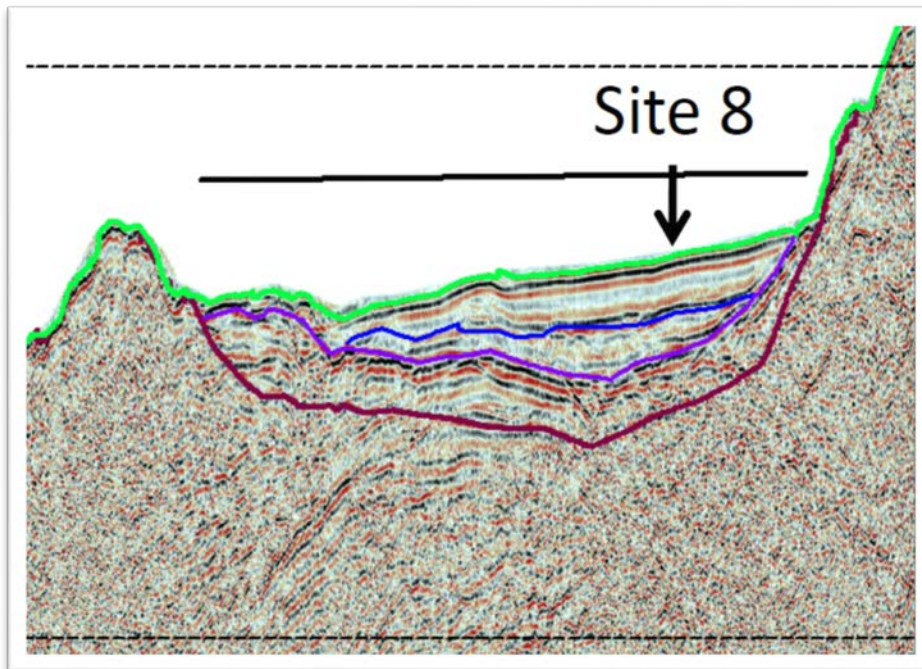
Position: 64°43'3890N, 51°08'2980W

Water depth: 174m

Core length: 101cm

Observations: Corer lid closed. Undisturbed surface. Smell of sulfur, sediment with very dark areas, and plant material present all the way to the bottom - indicating a low oxygen environment with high sedimentation rate. Core stayed on deck overnight to settle. Water removed by piercing holes in the tube. Water/sediment interface collected separately.

5.6 Geological coring Site 8



Core: SA2012st.8#1

Date of collection: 15/05/2012

Region: East coast of Sermitsiaq

Position: 64°16'2497N, 51°19'4664W

Water depth: 503m

Core length: 153 cm

Observations: Corer lid closed. Surface recovered. Smell of sulfur, sediment dark throughout the core. Water removed soon after collection by piercing a hole in the tube. Water/sediment interface collected separately.

Core: SA2012st.8#2

Date of collection: 15/05/2012

Region: East coast of Sermitsiaq

Position: 64°16'3067N, 51°19'5634W

Water depth: 505m

Core length: 150 cm

Observations: Corer lid closed. Surface recovered. Smell of sulfur, sediment dark throughout the core. Water removed soon after collection by piercing a hole in the tube. Water/sediment interface collected separately.

Potential coring sites in the Godthåbsfjord region

Site 1 64°24'55.00"N 50°29'57.00"W ?275m

Optimal site for højt opløseligt yngre Holocæn baseret på Galathea-3 seismisk profil. Sediment fokusering i driftlegeme midt i mindre basin, indenfor tærskel i Kapisillit fjordarmen.
?20 m Holocæn sediment

Site 2 64°29'12.50"N 50°42'33.00"W ?480m

Optimal site for højt opløseligt yngre Holocæn baseret på Galathea-3 seismisk profil. Sediment fokusering i driftlegeme midt i dybere basin, udenfor tærskel i Kapisillit fjordarmen
?20-25 m Holocæn sediment

Site 3 64°24'45.89"N 50°21'10.05"W ?250-300m

Site i dybere basin ind mod Kapissillit. Ingen seismik – baseret på Galathea3 multibeam bathymetri.
Formodet højt opløseligt sediment i område med relativ høj biologisk produktivitet.

Site 4 64°43'1.20"N 50°32'53.10"W 528m

Site skal supplere gravity core Dana'08-19GC med god core top. Parasound profil viser at siden ligger tæt på delta outlet fra Tasersuaq.
Recent – LIA (Sedimentationsrate 0.3-0.5 cm/år baseret på kerner up- og downstream)

Site 5 64°36'55.90"N 50°12'58.61"W ?500m

Site skal dække området mellem Dana'08 kerner mod nordvest og Isfjord 2011 kerner mod sydøst. Siten ligger syd for Narsap Sermia outlet midt i fjorden.
Recent – LIA (Sedimentationsrate 0.3-0.5 cm/år baseret på kerner up- og downstream)

Site 6 64°31'45.78"N 50°10'0.91"W ?440m

Som site 5, men tættere på Isfjord kernepositioner
Recent – LIA (Sedimentationsrate 0.3-0.5 cm/år baseret på kerner up- og downstream)

Site 7 64°19'8.76"N 51°16'16.68"W ?440m

Site for højt opløseligt yngre Holocæn baseret på Galathea-3 seismisk profil i den ydre Godthåbsfjord.
Sediment fokusering i driftlegeme midt i mindre basin. ?30-40 m Holocæn

Site 8 64°16'27.84"N 51°19'38.28"W ?510m

Site for højt opløseligt yngre Holocæn baseret på Galathea-3 seismisk profil i den ydre Godthåbsfjord.
Sediment fokusering i driftlegeme midt i mindre basin. ?30-40 m Holocæn

Site 9 64°13'4.28"N 51°42'54.29"W ?400m

Site for højt opløseligt yngre Holocæn baseret på Galathea-3 seismisk profil i den ydre Godthåbsfjord. Større flat plateau indenfor Nuuk tærskel. ?25-30 m Holocæn - formodentlig ingen turbiditter.

Site 10 64°22'50.42"N 50°39'46.67"W ?100-300m

Site i mindre beskyttet sidefjord i ydre Kapissillit fjord. Formodet højt opløseligt Holocæn. GN bathymetri.

Site 11 64°26'36.72"N 50°14'18.16"W ?100m

Site i inderste Kapissilit bugt. ? adgang m. Sanna p.g.a. tærskel. Formodet højt opløseligt yngre Holocæn. GN bathymetri.

Site 12 64°40'3.25"N 50° 5'26.72"W ?400-500m

Site umiddelbart foran Narsap Sermia gletscher (1-2 km fra front). Der kan forventes større variation med kanaler, fremskudte morænevolde etc. Mulighed for kernetagning af issø-tapnings sedimenter og subrecent sedimentation. Sammenlign med GN bathymetri for eksakt site(s).

Site 13 64°37'39.83"N 50°36'58.88"W ?200-500m

Site i beskyttet side fjord til ydre Kangersuneq. Formodet højt opløseligt yngre Holocæn. Hvis adgang mulig, er den indre smallere del af fjordarmen også interessant.

Site 14 64°43'0.00"N 50°40'20"W ?500m

Site på nedre del af deltafront ud for sedimentrige Tasersuaq udløb. Baseret på Merian'2007 Multibeam. Mulighed for baseline/monitoring af sediment(kemi) variation som følge af planlagt Jernminedrift opstrøms. Baseret på GN bathymetri kan flere sites (mere opstrøms) være interessante.

Site 15 64°10'32.13"N 51°32'36.70"W ?200-400m

Site i Kobbefjord dyb. Formodet højt opløseligt yngre Holocæn. GN baseret bathymetri.

Site 16 64° 9'28.33"N 51°25'12.20"W ?200-400m

Site i inderste Kobbefjord dyb. Formodet højt opløseligt yngre Holocæn. GN baseret bathymetri.

Site 17 64°14'42.61"N 50°54'51.39"W?200-400m

Site i beskyttet side fjord. Formodet højt opløseligt yngre Holocæn.

Sites Tasersuaq

Sites i beskyttet sidefjord med formodet højt opløseligt Yngre Holocæn. Områder er udlagt som potentielt havne- og udskibningsområde for 'London Mining'. Kernerne vil kunne bruges som referencemateriale ved eventuelle base line studier i fremtiden.