R/V Helmer Hanssen

07-05-24 to 19-05-24

Tromsø – Tromsø

UiT-IG24-4 Cruise Report

2D Seismic, Sub-bottom profiling and Bathymetry in the Norwegian and north Greenland Sea

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PREFACE and ACKNOWLEDGEMENT

This document reports on the acquisition and processing of the seismic, sub-bottom profiling (SBP), and multibeam, acquired during a cruise with the UiT research vessel RV Helmer Hanssen from 7 May to 19 May 2024. This expedition targeted the Mohns Ridge investigating areas of interest and testing the capability of the high resolution 2D seismic and SBP systems.

We thank the captain and his crew of R/V Helmer Hanssen for their excellent support during this scientific survey.

Tromsø, 2024

INTRODUCTION AND OBJECTIVES

The purpose of the cruise is to collect high-resolution 2D seismic at the Mohns ridge (Figure 1). This is to be supplemented with sub-bottom-penetrating sonar data collected alongside seismic acquisition. Opportunistic collection of bathymetry data is planned during bad weather windows.

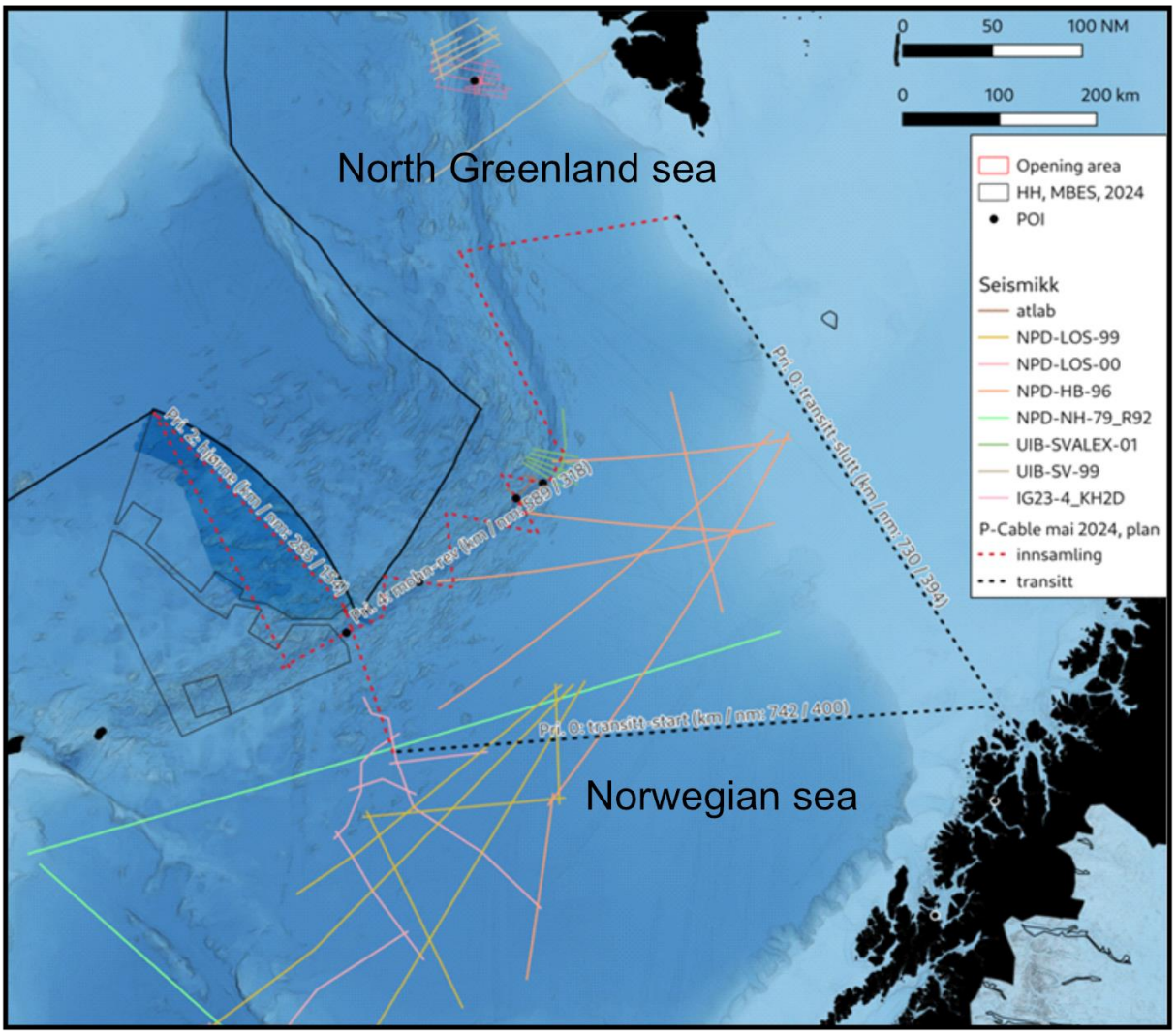

Figure 1: Location of the study area including existing seismic lines and planning for this cruise (red dashed line).

METHODS

Seafloor bathymetry (EM302)

The EM 302 multibeam echo sounder has an operating frequency of 30 kHz and is designed to perform seabed mapping with high resolution and accuracy to a maximum depth of more than 7000 m. Beam focusing is applied both during reception and transmission. EM 302 is equipped with a function to reduce the transmission power in order to avoid disturbing mammals if they are close by.

The system has up to 432 soundings per swath with pointing angles automatically adjusted according to achievable coverage or operator defined limits. With dual swath (two swaths per ping) the transmit fan is duplicated and transmitted with a small difference in along-track tilt. The applied tilt takes into account depth, coverage and vessel speed to give a constant sounding separation along track. In dual swath mode, 2 swaths are generated per ping cycle, with up to 864 soundings. The beam spacing is equidistant or equiangular.

The transmit fan is split in several individual sectors with independent active steering. This allows stabilization, which compensates for the vessel movements: yaw, pitch and roll. Each transmit sector has individual beam focusing.

Sub-bottom profiler

During this cruise, a narrow beam parametric sub-bottom profiler (SBP) was operated constantly during seismic lines and also on other occasions when multibeam did not take priority. The SBP used is an Innomar deep-36 and runs with two frequencies: 36 kHz (high frequency) and 7 kHz (low frequency). The system was mostly triggered internally pinging between 2.5 and 3 pings per seconds when operating under multi-ping mode and less frequently at 6 pings per second when externally triggered and syncing with the multibeam. When the system is on a multi-ping setting (as it was while collecting 2D seismic) it has a combination of 3 ping frequencies (4, 5 and 6 kHz). The SBP acquires full-waveform data providing ultra high-resolution 2D seismic data of the upper 10s of meters below the seabed in areas with soft sediments. The data file format provided after acquisition is '.ses3', and it must be converted to '.segy' via Innomar software 'SESconvert'. During the conversion, heave correction is applied and a depth range correction.

Seismic system

The primary tool for the expedition was the UiT high-resolution P-cable system, re-configured into 2D mode to acquire 2D data. The seismic system consists of a multi-channel 2D seismic streamer and two mini-Gi guns with a combined volume of 45/45 in^3. During this cruise 12 streamer sections were used for a 300 m total length active hydrophone cable with 96 channels at a receiver spacing of 3.125 m. The lead-in cable to the active streamer had a length of 50 m behind the ship. The depth of the streamer cable was controlled by two ION Digicourse II birds and set to 2.5 m. The digital data was recorded using Geometrics GeoEel software.

Details on the acquisition parameters like recording length, sampling rates, etc. can be found in tables below and the seismic line log in the Appendix of this report.

SHORT NARRATIVE OF THE CRUISE

The expedition was mobilized on the 6th and 7th May. The scientific team embarked on the evening of the 7th May and at 20:22 UTC we left Tromsø sailing out to the working area.

We arrived in the working area after breakfast 9th May. Bad weather, with winds up to 17 m/s delayed the start of the seismic acquisition by ~36 hours. While we waited for good weather, we transited 3.5 hours west and collected bathymetry data at multibeam site 1. We had planned for a CTD before starting the bathymetry, but the weather was too bad. The CTD was deployed instead after the first two bathymetry lines.

A total of 5 2D seismic lines were acquired over almost five days, interrupted only by short maintenance breaks for the airguns and a short time spent investigating electrical (strumming) noise that started during line 2 and continued during the remainder of the survey.

Weather was calm during this time and did not impact seismic acquisition until 16th May, affecting the plan for a final seismic line crossing the ridge and site of interest (Loki Castle). By 17th May the winds were in excess of 20 m/s and bathymetry data was collected while waiting for a weather window at multibeam site 2 northeast of multibeam site 1. The weather window did not arrive in time before the end of the cruise so a SBP line was acquired instead of 2D seismic, crossing the site of interest, before leaving the working area 18th May and returning to Tromsø 19th May.

Multi-beam data

Multibeam (MB) data were acquired in two areas (MB area 1 and area 2; Figure 2). The data were processed and cleaned using QPS Qimera software and subsequently gridded to 75 m resolution. Total MB coverage is shown during this cruise (only by area) and by MB data from a prior cruise (Figure 2).

A CTD cast was conducted after the first two lines of MB area 1 and before line 3, to extract information about different (T, S) properties of water masses to calculate the speed of sound for calibrating the acoustic systems. The sound velocity profile provided (Kongsberg ASVP format) was not applied to the first two bathymetry lines of MB area 1, due to licensing restrictions. This can be followed up upon request. This means that the first two lines I MB area 1 have incorrect depth readings.

2D seismic acquisition

The primary target area for high-resolution seismic acquisition was at the Mohns Ridge. The location of the 2D seismic lines were planned prior to the cruise based on existing high-resolution bathymetric data and the position of the Mohns Ridge (“innsamling”; Figure 1). A total of four 2D seismic lines were acquired in this area (Figure 2) with lines 2 and 3 divided into two parts each, labelled as 2a, 2b, 3a and 3b. Two of the four seismic lines crossed the Mohns Ridge, and one line followed the rift valley northeast.

Seismic imaging in a rift valley is difficult, as there are many volcanic edifices, structures with rough topography and high dips, causing seismic energy to scatter, resulting in the decision to abandon additional lines planned in the rift valley.

Parameters for the 2D seismic acquisition are provided (Table 1), and a sketch of the 2D seismic acquisition geometry is shown (Figure 3). The geometry was set using navigation from the gun GPS interpolated for every second. The assigned geometry was checked by predicting the direct arrivals using calculated offsets. Further details on the acquisition parameters like recording length, sampling rates, etc. are also given (Table 1).

Onboard seismic processing and QC of the seismic data provided preliminary migrated seismic sections for quality assessment and preliminary interpretations using RadEx Pro seismic data processing software.

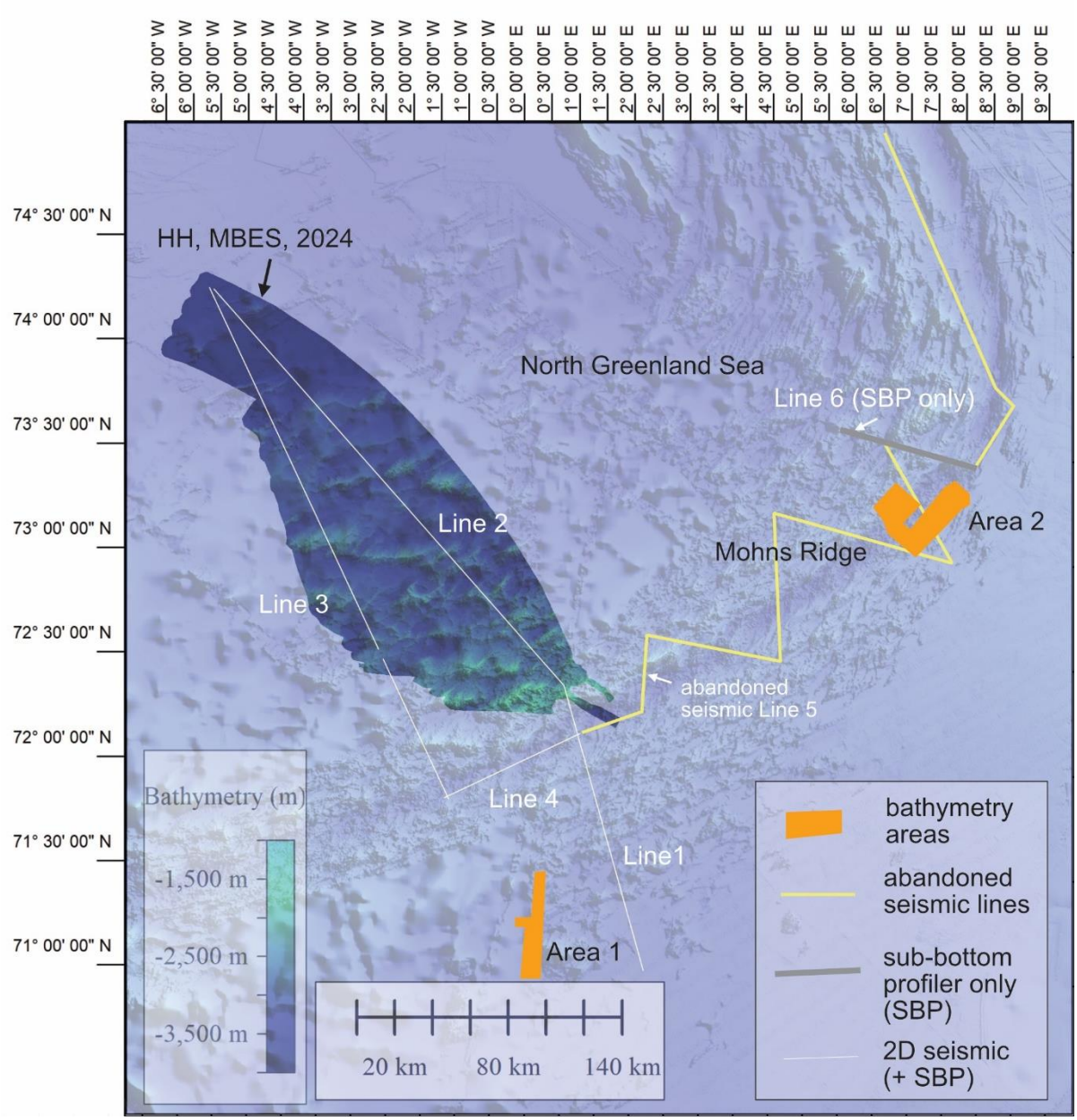

Figure 2: Map showing an overview of the total acquired data: 2D seismic data, sub-bottom profiler (SBP) data, and multibeam data, acquired during this expedition with RV Helmer Hanssen (HH) at Mohns Ridge. The high-resolution bathymetry (MBES) (overlain on IBCAO bathymetry) was obtained from a previous HH UiT cruise, 2024.

Table 1: The detailed survey parameters for the 2D seismic survey.

Survey parameters	
Deployment / recovery	0.5 h
Survey speed	4-4.5 kt
Source	1 mini GI 30/30 in^3 & 1 mini GI 15/15 in^3
Across track position of source relative to ship's aft GPS	0
Along track position of source relative to ship's aft GPS	45 m
Shooting rate	6-7 s
Shooting pressure	170 bar
Source towing depth	1.8 m
Dominant frequency (bandwidth)	140-180 Hz (20-400 Hz)
Positioning	GPS transponder on gun raft
Streamer length	310 m
Active section	300 m
Across track position of streamer relative to ship's aft GPS	10 m to port
Along track position of streamer relative to ship's aft GPS	17 m
Number of channels	96
Receiver group spacing	3.125 m
Streamer towing depth, 2 ION DigiCourse II Depth birds	2-2.5 m
Sampling rate / interval	2000 Hz / 0.5 ms
Recording length	3-4 s, delay of 1-3.5 s in deep water
Gun delay	-95 ms

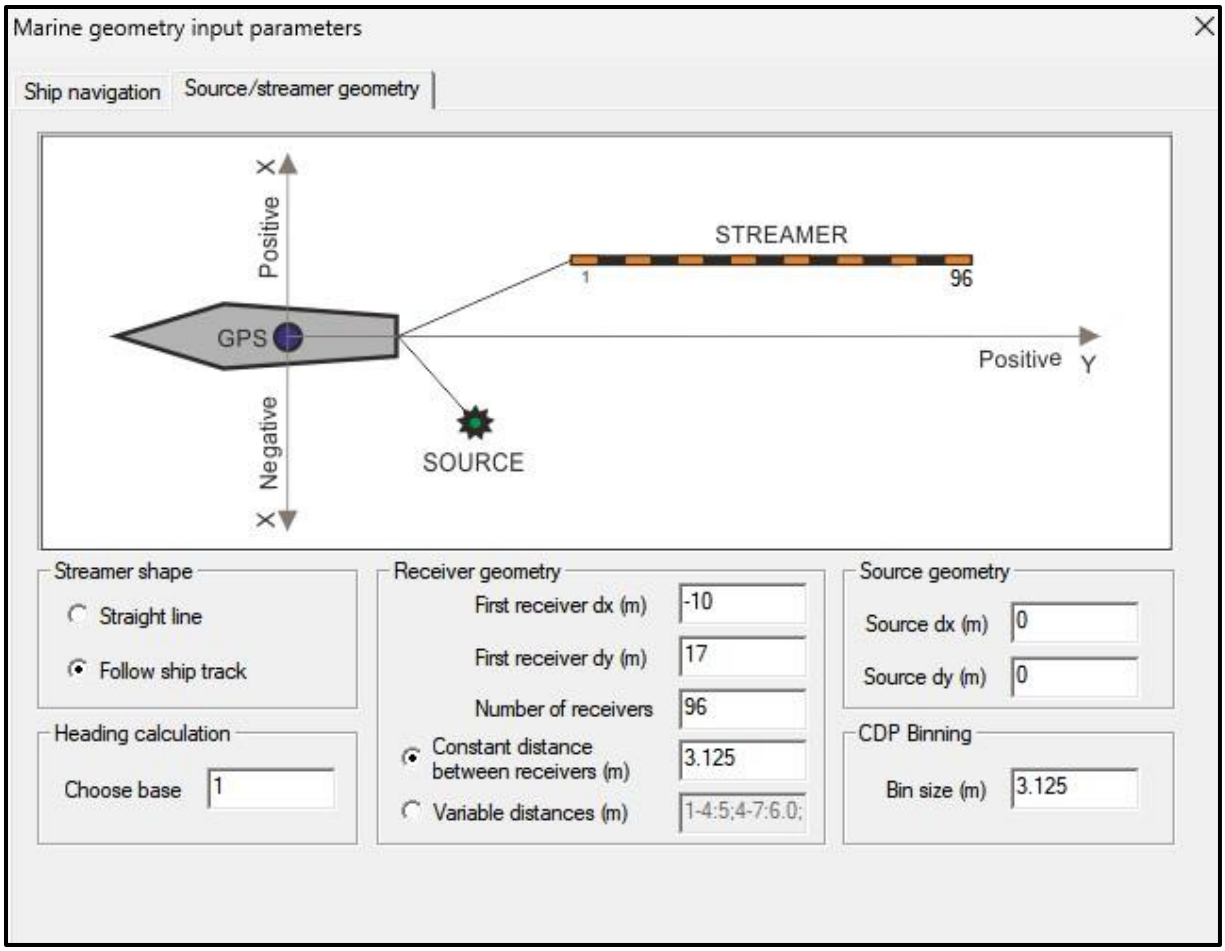

Figure 3: Schematic for geometry assignment. The streamer had 300 m of active section, corresponding to 96 receivers (channels) with a 3.125 m group spacing. The navigation came from the source/gun GPS.

2D seismic processing

Data were re-processed ashore using RadEx Pro software, following a standard processing routine, consisting of SEG-D import, geometry assignment, denoising, CDP binning, NMO/stacking, and migration (processing details; Table 2, example of migrated line; Figure 4a). The geometry parameters for this survey are outlined (Table 1, Figure 3). Bad/dead channels were removed. Simple bandpass filters were parameterized to 20-30-300-400 Hz and burst noise removal were applied to remove "cross feed" from the lines (Figure 4b). On particularly noisy lines due to problems with "strumming" on the streamer (after line 2a), two passes of F-K filter were also applied, to remove the directional noise (Figure 4b).

Static corrections for adjusting recording lengths and gun delay were applied prior to NMO correction and stacking. The 2D lines were migrated using the Kirchhoff method, applied using a constant water velocity and variable aperture as a function of depth. Improvement to the

velocity model would require application of published velocity information, which was not considered due to the long line lengths.

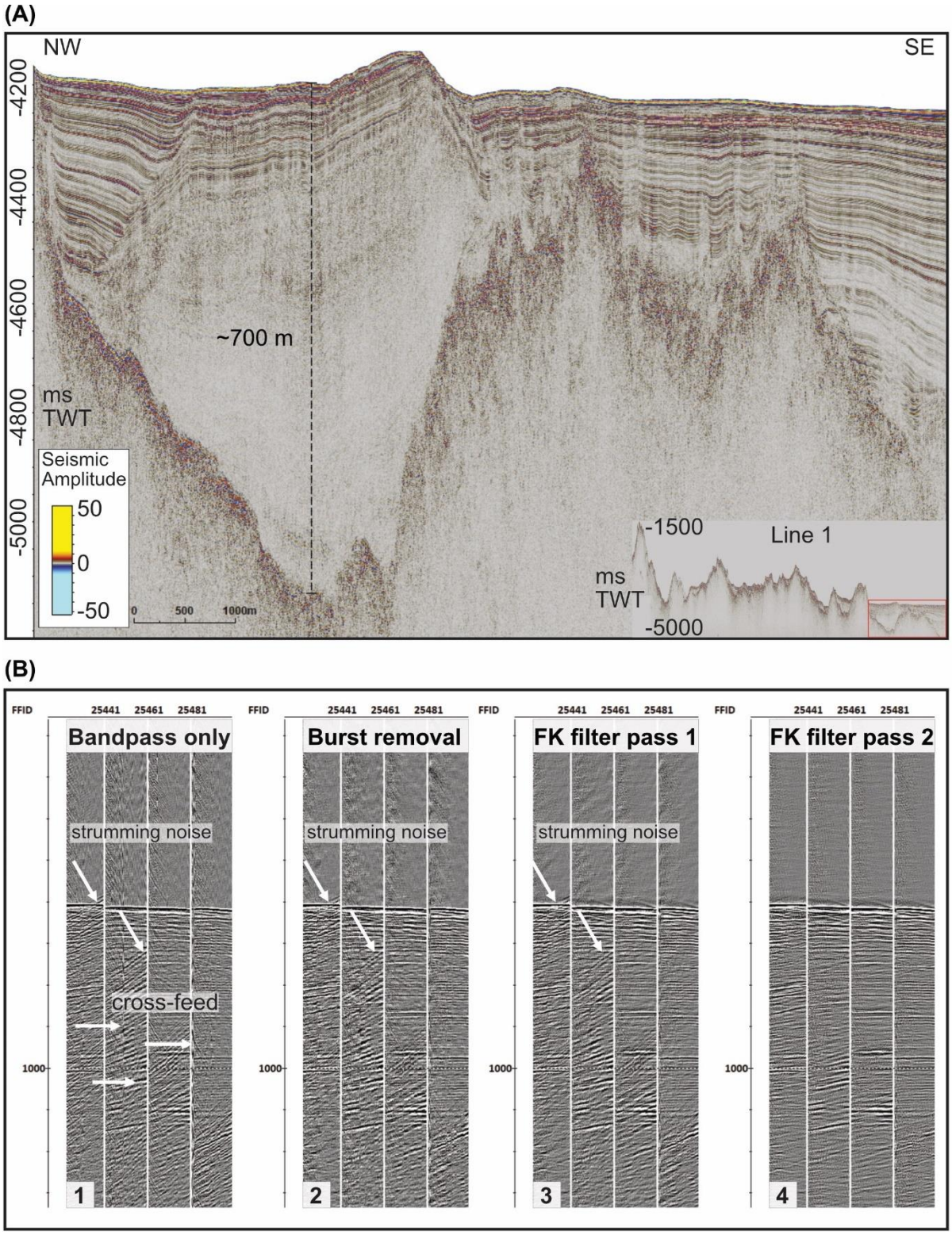

Figure 4: (A) Example of a migrated seismic line (seismic Line 1) showing the maximum depth of the sedimentary interval to the basement (>700 m), (B) Four example (seismic Line 2b), shot

(FFID-channel) gathers for each processing stage, after the initial bandpass filter (1-4), showing the removal of the cross-feed noise (indicated by horizontal white arrows) during burst removal (2) and the subsequent removal of the strumming noise on the streamer (indicated by diagonal white arrows) after the second F-K filter (4).

Table 2: Processing parameters for the 2D seismic survey.

Seismic processing flow	
SEG-D import and geometry assignment	Input of SEG-D files Geometry assignment and offset calculation, including gun delay
Filtering in the shot gathers	Removal of bad channels Bandpass filter 20-30-300-400 Hz Burst noise removal Two passes of F-K filter (Lines 2b, 3 and 4 only)
NMO and stacking	NMO (1474 m/s) Ensemble Stack
Migration (tested only)	Post-Stack Kirchhoff Time Migration; constant Vp 1474 m/s; aperture (time (ms):range (m)) 0:100, 200:350, 500:700, 700:800, 900:1100, 2000:2200
SEG-Y output	IBM floating point CDP_X,4R,IBM,181/ CDP_Y,4R,IBM, 185 Coordinate system: WGS-84-UTM31N

Sub-bottom profiling data

Sub-bottom profiling data (SBP) were acquired along all 2D seismic lines (except for Line 4). Lines were converted from the proprietary '.ses3' format to '.segy', requiring some files to be resampled (decimated) during conversion for successful import into Innomar processing software.

All files were split into smaller (125 MB) segments to improve data handling and then quality controlled (listed in the Appendix). In deep water, SBP data have poor quality due to low signal strength, steep dips and rough seafloor topography, therefore sections of lines that do not track the seafloor and show no penetration are marked in red and are not processed (see Appendix).

An example of a processed SBP profile is shown (inset Figure 5). The profile segment has 'reflection strength' attribute applied (i.e., amplitudes are positive) to enhance the visibility of abrupt lithological transitions near the surface, approximately ~50 ms TWT, corresponding to ~35 – 40 metres below the seafloor (mbsf).

The UTM zone applied in the acquisition set up was incorrect (UTM 33N) and differed from the 2D seismic (UTM 31N). Note that after 'Line2a-SBPfile13-042014', positioning errors

occurred in the exported 'UTM zone 33N' .segy files due to the ship crossing the Prime Meridian (i.e., 0° longitude). Consequently, subsequent files were converted to their appropriate UTM zone (see Appendix). Those lines processed before 'Line2a-SBPfile13-042014' however, remain in UTM 33N because of successful spatial loading.

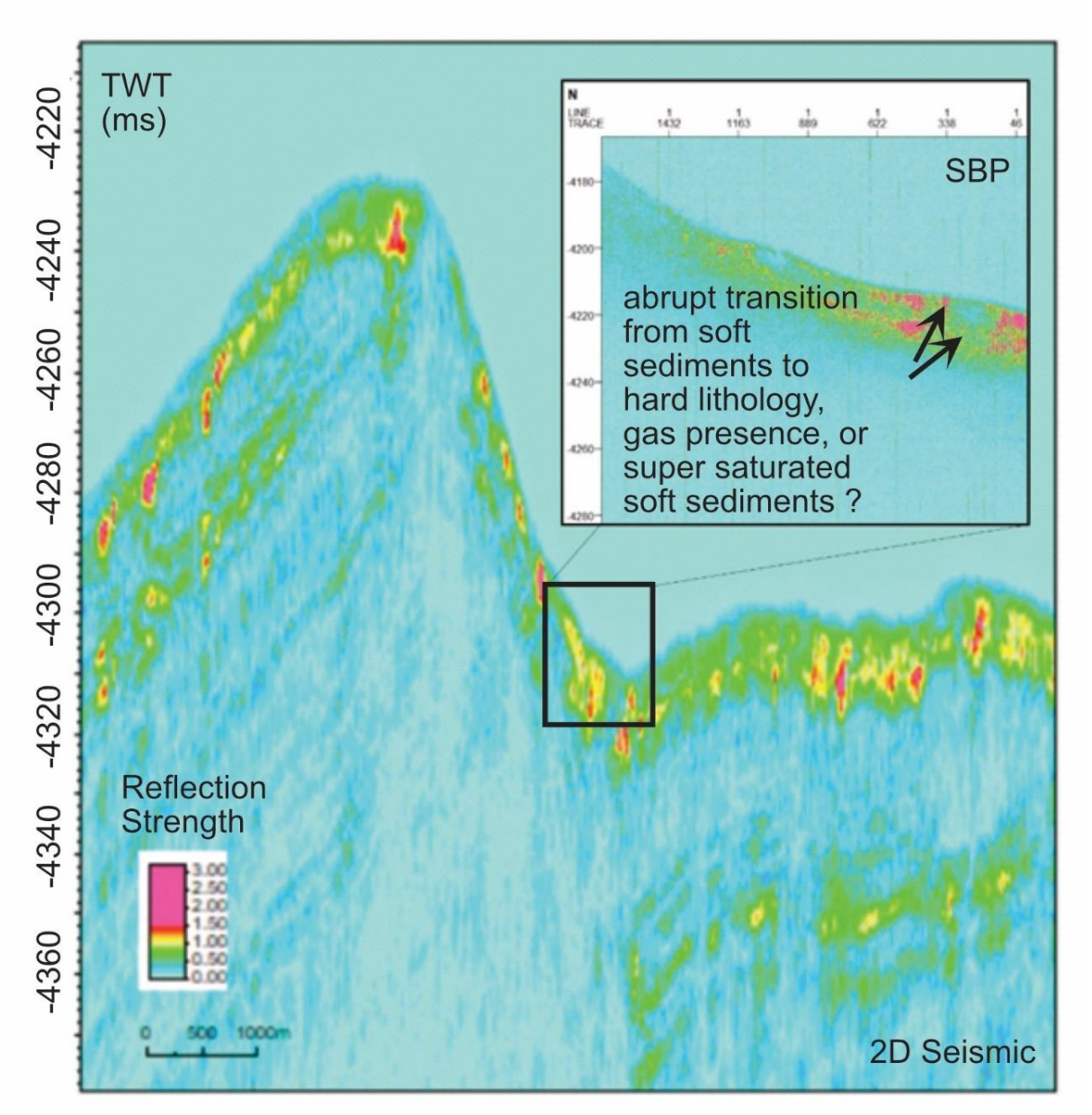

Figure 5: Data example of the 2D seismic and sub-bottom profiler (inset) (both have the 'reflection strength' attribute applied) acquired along Seismic Line 1.

APPENDIX

Shortened tables of station and line logs are included in this report. More extensive information in spreadsheets is available on request.

Station log IG24-4

Location	Station Id	Date	Time (UTC)	Lat. [N] Long. [E]	Bottles fired [#]	Water Depth [m]	Notes
Multibeam area 1	UiT-IG24-4-737-CTD	10.05	06:16	71°09.270' 01°03.416'		2880	Sound velocity profile only applied before the start of MB line 3

Line log IG24-4

Survey parameters, e.g. shooting rate, ship's speed etc are listed in Table 1.

Location	Line ID	Date	Time (UTC) START	Lat. [N] Long. [E] START	Time (UTC) STOP	Lat. [N] Long. [E] STOP	Pulse mode	Shot Rate (HZ)	Ship Speed (kn)	Comments
Multibeam area 1	UiT-IG24-4-1-MB	09.05	10:05	71°09.561' 01°09.039'	16:19	71°40.327' 01°11.859'			5	Rough weather (unable to deploy CTD -sound velocity profile incorrect)
Multibeam area 1	UiT-IG24-4-2-MB	09.05	16:54	71°40.174' 01°07.006'	21:42	71°25.743' 01°06.305'			5	Rough weather (unable to deploy CTD -sound velocity profile incorrect)
Multibeam area 1	UiT-IG24-4-3-MB	10.05	04:55	71°26.275' 01°06.294'	06:11	71°09.240' 01°03.752'			5	Rough weather. Deployed CTD before line 3 – sound velocity profile correct but not applied to MB lines 1 and 2
Multibeam area 1	UiT-IG24-4-4-MB	10.05	08:22	71°57.993' 00°57.993'	11:34	61°25.098' 01°01.115'			5	Rough weather

Mohns Ridge	UiT-IG24-4-1-2D	10.05	21:34	71°11.723' 02°43.969'	18:19 +1 day	72°33.870' 01°26.233'	mini GI 30/30 and 15/15	0.5	4	Survey type: 2D; sea temp: 5.4 deg; air temp: 4.2 deg; windspeed 6.7 m/s from SW; sailing direction NNW; water depth 3148 m at start. Gun type: mini GI airgun; Gun 1, volume: 30/30 and Gun 2, 15/15 furthest from vessel, pressure 170bar; birds 1 and 2 at 2.5 m depth Shooting interval 7 sec at the start of this line, 2.5 sec delay and 3 sec trace length and 0.5 sample interval: from shot 1822 to 11754, then shooting interval 6 sec and 1 sec delay and 4 sec trace length and 0.5 sample interval at 2040 m depth from shot 11755 at around 16.55 UTC. Disabled channels 35, 51, 87, at start of line, at shot 2172 disabled channel 9 spiking well over 180. Noisy channels 38, 39, 56, 63, 72, 92, 95
Mohns Ridge	UiT-IG24-4-1-CHIRP	10.05	21:46	71°11.723' 02°43.969'	18:19 +1 day	72°33.870' 01°26.233'	CW			Stopped the chirp for a couple of minutes to see if it was interfering with the seismic data. It was found not to be interfering.

Mohns Ridge	UiT-IG24-4-2a-2D	11.05	21:49	72°33.763' 01°26.533'	20:33 +1 day	73°45.685' -02°41.851'		0.5	4	Sea temp 3.6 deg, wind speed 4.1 from WNW and sail line direction NW. Start the line 1 sec delay and 4 sec trace length, 0.5 sample interval from shot 12621 to 12990. Pressure decreased at around shot 12966 to change the gun trigger to 7 seconds. File 12991 change delay to 2.5 and trace length to 3 sec. At shot 23414, changed the delay to 3.5 second because geology observed at the bottom of the trace. 20:44 guns taken in for inspection (weak signal?). Stop to check possible air leak., shot number 25389. Line 2 now split into two and Line2b is overlapping the end of 2a. The time stamps before this line may not be in UTC!!!
Mohns Ridge	UiT-IG24-4-2a-CHIRP	11.05	21:53	72°34.361' 01°24.609'	20:33 +1 day		CW			Interesting SBP file 141147 (73 29.492N, 001 40.370W).

Mohns Ridge	UiT-IG24-4-2b-2D	12.05	23:46	73°44.815' -02°37.333'	12:51 +1 day	74°19.808' -04°58.147'		0.5	4	Sea temp 0.4, wind speed 9m/s and wind direction NE, ship line direction NW. Starting line 2 again after gun 1 fixed air leak. From shot 25604 add in all channels 1-96 after testing a few shots before what happens if disable channels. Start line from 25604 to avoid problems in geometry after messing around with removing and adding channels between start of line shot and shot 25604. A lot of electrical noise is observed in data from the start of this line. Delay 3.5, trace length 3 sec shooting interval 7 seconds, water depth 3026 m
Mohns Ridge	UiT-IG24-4-2b-CHIRP	12.05	23:46	73°44.985' -02°37.948'	12:51 +1 day	74°19.808' -04°58.147'	CW			

Mohns Ridge	UiT-IG24-4-3a-2D	13.05	13:57	74°18.641' -04°57.123'	18:12	72°36.800' -01°24.307'		0.5	4	Delay starting the line because newline hadn't been started. Sea temp 0.5, wind speed 10.6m/s and wind dir NE, ship line dir SE. A lot of electrical noise is observed in data from the start of this line. Delay 3.5, trace length 3 sec shooting interval 7 seconds, water depth 3486 m. No channels disabled but noisy channels listed remain the same. Auxiliary channels activated? Check next line. Guns stopped firing for a couple of minutes, restarted hotshot. Shot 37735 change delay to 2.5 and trace length at 3 and trigger at 6 secs. wind dropped to 2 m/s and sea temp 0.38 deg at shot 37928. Line 3 not complete but stopping to investigate issue with electrical noise.
Mohns Ridge	UiT-IG24-4-3a-CHIRP	13.05	13:57	74°18.641' -04°57.123'	18:14	72°36.800' -01°24.307'	CW			Line extn SBP 013533, interesting line. Interesting line 161914 a lot of penetration. End SBP file 181438, start new line while investigating problem with electrical noise file 181439

Mohns Ridge	UiT-IG24-4-3b-2D	14.05	19:56	72°38.700' -01°26.260'	07:08 +1 day	72°00.254' -00°16.860'		0.5	4	Sea temp 0.41, windspeed 7 m/s, wind dir NNW, ship dir SSE, line started overlapping 3a, delay 2.5, trace length 3, gun 6 secs, 1 sec delay 4 sec trace length at shot 51872
Mohns Ridge	UiT-IG24-4-3b-CHIRP	14.05	19:57	72°38.700' -01°26.260'	07:09 +1 day	72°00.254' -00°16.860'	CW		4	
Mohns Ridge	UiT-IG24-4-4-2D	15.05	07:45	72°00.713' -00°20.034'	17:50	72°20.970' -01°48.390'		0.5	4	Sea temp 3.36, windspeed 7.9 m/s, wind dir NNW, ship dir NE, delay 1, trace length 4 (55189-55467), gun 6 secs. Delay 2.5, trace length 3 sec, trigger 6 starting at 55467. Line aborted because data bad. Direction of line is not suitable
Mohns Ridge	UiT-IG24-4-4-CHIRP	15.05	07:45	72°00.713' -00°20.034'	17:50	72°20.970' -01°48.390'	CW		4	Change in ping interval at UT 12:35 from internal trigger to external trigger. This was done in order to get better MB data. SBP data not worth using because of line direction, end of line file extn name 16448

Mohns Ridge	UiT-IG24-4-5-2D	15.05	20:25	72°27.189' 02°39.951'	01:51	72°49.608' -02°45.022'		0.5	4	Sea temp 5 degrees, wind speed 5.9, direction NW and ship dir NNW. Delay 3.5 and trace length 3 sec, trigger 6 sec. A bit before shot 62499 - trace 1138, this part of the line is better as it is now out of the ridge. Shot 63231 change delay to 0 and trace length to 4 and trigger 5 secs.
Mohns Ridge	UiT-IG24-4-5-CHIRP	15.05	20:25	72°27.189' 02°39.951'	01:51	72°49.608' -02°45.022'	CW			Rough weather
Multibeam area 2	UiT-IG24-4-5-MB	16.05	15:34	73°29.594' 07°52.885'	16:32	73°24.313' 08°07.328'				Rough weather
Multibeam area 2	UiT-IG24-4-6-MB	16.05	16:57	73°22.257' 08°01.194'	17:47	73°27.128' 07°47.810'				Rough weather
Multibeam area 2	UiT-IG24-4-7-MB	16.05	18:06	73°25.853' 07°42.425'	18:59	73°21.073' 07°55.758'				Rough weather
Multibeam area 2	UiT-IG24-4-8-MB	16.05	19:22	73°19.625' 07°49.792'	20:02	73°23.416' 07°39.410'				Rough weather
Multibeam area 2	UiT-IG24-4-9-MB	16.05	20:25	73°21.948' 07°34.349'	21:04	73°18.323' 07°44.344'				Rough weather

Multibeam area 2	UiT-IG24-4-10-MB	16.05	21:26	73°16.946' 07°39.071'	22:06	73°20.519' 07°28.472'				Rough weather
Multibeam area 2	UiT-IG24-4-11-MB	16.05	22:27	73°19.074' 07°23.336'	23:09	73°15.665' 07°34.160'				Rough weather
Multibeam area 2	UiT-IG24-4-12-MB	16.05	23:25	73°14.593' 07°29.651'	00:06	73°18.057' 07°17.880'				Rough weather
Multibeam area 2	UiT-IG24-4-13-MB	17.05	00:21	73°16.832' 07°14.135'	01:05	73°13.321' 07°25.117'				Rough weather
Multibeam area 2	UiT-IG24-4-14-MB	17.05	01:24	73°12.103' 07°20.042'	02:08	73°15.924' 07°07.685'				Rough weather
Multibeam area 2	UiT-IG24-4-15-MB	17.05	02:27	73°14.573' 07°02.681'	03:16	73°10.774' 07°14.553'				Rough weather
Multibeam area 2	UiT-IG24-4-16-MB	17.05	04:58	73°18.879' 06°49.712'	05:41	73°23.259' 06°36.809'				Rough weather
Multibeam area 2	UiT-IG24-4-17-MB	17.05	06:08	73°24.471' 06°41.142'	07:19	73°20.021' 06°54.195'				Rough weather

Multibeam area 2	UiT-IG24-4-18-MB	17.05	07:45	73°21.107' 06°58.443'	08:39	73°25.691' 06°45.865'				Rough weather
Multibeam area 2	UiT-IG24-4-19-MB	17.05	09:01	73°26.686' 06°49.628'	12:05	73°21.841' 07°03.877'				Rough weather
Multibeam area 2	UiT-IG24-4-20-MB	17.05	10:34	73°23.282' 07°07.479'	11:27	73°27.975' 06°53.932'				Rough weather
Multibeam area 2	UiT-IG24-4-21-MB	17.05	12:00	73°23.065' 06°58.757'	13:18	73°24.621' 07°12.360'				Rough weather
Multibeam area 2	UiT-IG24-4-22-MB	17.05	13:38	73°24.001' 07°14.363'	14:59	73°18.335' 06°51.940'				Rough weather
Multibeam area 2	UiT-IG24-4-23-MB	17.05	15:01	73°18.368'	15:55	73°22.314' 06°39.567'				Rough weather
Mohns Ridge	UiT-IG24-4-6-CHIRP	17.05	23:55	73°33.014' 08°18.053'	06:28	73°42.043' 06°49.179'	CW			Rough weather
Mohns Ridge	UiT-IG24-4-24-MB	18.05	00:50	73°34.538' 08°04.180'	02:48	73°37.379' 07°36.460'				Rough weather

Sub-bottom profiler (SBP) Line QC and UTM zone file conversion

Folder Name	Split File 1	Split File 2	Split File 3	Split File 4
Line1-SBPfile1-214610				
Line1-SBPfile2-222446				
Line1-SBPfile3-230322				
Line1-SBPfile4-234158				
Line1-SBPfile5-000000				
Line1-SBPfile6-003835				
Line1-SBPfile7-011711	X	X		
Line1-SBPfile8-015649				
Line1-SBPfile9-023739				X
Line1-SBPfile10-031916	Poor	tracking	but ok	X
Line1-SBPfile11-040123	X	ok		
Line1-SBPfile12-042240				Good pen
Line1-SBPfile13-050053		Poor	X	XX
Line1-SBPfile14-054305	gap	ship stopped		
Line1-SBPfile15-062251	first part good	Poor		XX
Line1-SBPfile16-070524	Poor			X
Line1-SBPfile17-074521	Poor	X	Poor	interesting
Line1-SBPfile18-082516			XX	XX
Line1-SBPfile19-090446		Poor	Poor	Poor
Line1-SBPfile20-094442	Poor	X	Poor	
Line1-SBPfile21-102702	X		interesting	
Line1-SBPfile22-111013	Poor		interesting	interesting
Line1-SBPfile23-115407	Poor	X	X	X
Line1-SBPfile24-123511		X		
Line1-SBPfile25-125944	Poor	X	X	interesting
Line1-SBPfile26-133947	interesting	Poor	interesting	
Line1-SBPfile27-142322	X	X	X	X
Line1-SBPfile28-150712	X			
Line1-SBPfile29-152317	X			
Line1-SBPfile30-152930	X			
Line1-SBPfile31-154500	X	X	X	Poor
Line1-SBPfile32-162615	X	X	X	X
Line1-SBPfile33-170712	X	X	Poor	X
Line1-SBPfile34-174357	X	X	X	X
Line1-SBPfile35-181744	X	X		Poor
Line1-SBPfile36-185620	X	X	X	X
Line1-SBPfile37-192921	X			

Folder Name	Split File 1	Split File 2	Split File 3	Split File 4	Converted to segy and txt				UTM zone
Line2-SBPfile1-195943					x				UTM33N
Line2a-SBPfile2-204144	Poor	Poor			x	x			UTM33N
Line2a-SBPfile3-212426	Poor		Poor		x	x	x		UTM33N
Line2a-SBPfile4-220912	bad start	Poor	Poor	Poor	x	x	x	x	UTM33N
Line2a-SBPfile5-225210				Poor	x	x		x	UTM33N
Line2a-SBPfile6-233546	Poor				x				UTM33N
Line2a-SBPfile7-000000					x	x	x	x	UTM33N
Line2a-SBPfile8-004304					x	x		x	UTM33N
Line2a-SBPfile9-012522				Poor	x			x	UTM33N
Line2a-SBPfile10-020757									UTM33N
Line2a-SBPfile11-025300							x		UTM33N
Line2a-SBPfile12-033908	Poor				x		x	x	UTM33N
Line2a-SBPfile13-042014	Poor				x				UTM33N
Line2a-SBPfile14-050430		Poor				x	x		UTM31N
Line2a-SBPfile15-055124			Poor	Poor	x	x	x	Issue with converstion	UTM30N
Line2a-SBPfile16-063801	Good				x	x	x		UTM30N
Line2a-SBPfile17-072116	Good	Poor			x	x	x		UTM30N
Line2a-SBPfile18-080459	Poor			Poor	Issue with converstion			x	UTM30N
Line2a-SBPfile19-085038		Poor	Poor	Good		x	x	x	UTM30N
Line2a-SBPfile20-093800	Good	Good	Good	Good	x	x	x	x	UTM30N
Line2a-SBPfile21-102337	Poor	Poor	Poor		x	x	x		UTM30N
Line2a-SBPfile22-110948	Good	Good	Poor		x	x	x	x	UTM30N
Line2a-SBPfile23-115022					x				UTM30N
Line2a-SBPfile24-115149	Poor	First part			x	x			UTM30N
Line2a-SBPfile25-123727	Poor	Poor		Poor	x	x	x	x	UTM30N
Line2a-SBPfile26-132523					x	x		x	UTM30N
Line2a-SBPfile27-141147	Poor				x	x	x	x	UTM30N
Line2a-SBPfile28-150032	Poor		Poor	Good	x		x	x	UTM30N
Line2a-SBPfile29-154815	Good			Good	x	x	x	x	UTM30N
Line2a-SBPfile30-163601	Good	Good	Good		x	x	x	x	UTM30N
Line2a-SBPfile31-172516								x	UTM30N
Line2a-SBPfile32-181300	Good	Good	Poor		x	x	x		UTM30N
Line2a-SBPfile33-190043	Poor	Poor		Poor	x	x		x	UTM30N
Line2a-SBPfile34-194805							x	x	UTM30N
Line2a-SBPfile35-203551				Poor	x	x	x	x	UTM30N
Line2a-SBPfile36-212428		Poor			x	x			UTM30N
Line2a-SBPfile37-221306		Poor	Poor			x	x		UTM30N
Line2a-SBPfile38-230144					x			x	UTM30N

Folder Name	Split File 1	Split File 2	Split File 3	Split File 4	Converted to segy and txt				Converted UTM
Line2b-SBPfile01-234609					x	x			UTM30N
Line2b-SBPfile02-000000		Good	Good		x	x	x	x	UTM30N
Line2b-SBPfile03-004803		Good			x	x	x		UTM30N
Line2b-SBPfile04-013321			Poor	Poor	x	x	x	x	UTM30N
Line2b-SBPfile05-022047	Poor	Poor	Good	Good	x	x	x	x	UTM30N
Line2b-SBPfile06-030622	Great	Great	Great	Great	x	x	x	x	UTM30N
Line2b-SBPfile07-035154	Poor		Poor	needs resplitting/shifting	x	x	x		UTM30N
Line2b-SBPfile08-043934		Poor	needs resplitting/ shifting		x	x		x	UTM30N
Line2b-SBPfile09-052719				shifted but interesting feature	x	x	x	x	UTM30N
Line2b-SBPfile10-061411	Good			Good	x	x	x	x	UTM30N
Line2b-SBPfile11-070154	Poor	Poor	ok	Good interesting	x	x	x	x	UTM30N
Line2b-SBPfile12-074714		Good	Poor	Poor	x	x	x	x	UTM30N
Line2b-SBPfile13-083146			ok	Poor	x	x	x	x	UTM30N
Line2b-SBPfile14-091628		ok	Poor	ok		x	x	x	UTM30N
Line2b-SBPfile15-100304	Poor	interesting	ok	Poor	x	x	x	x	UTM30N
Line2b-SBPfile16-104844	Poor		Poor		x		x		UTM30N
Line2b-SBPfile17-113542		ok	ok	Good		x	x	x	UTM30N
Line2b-SBPfile18-122223					x	x	x		UTM30N
Line2b-SBPfile19-125224					x	x	x	x	UTM30N
Line2b-SBPfile20-133843					x				UTM30N
Line2b-SBPfile21-134233					x				UTM30N
Line2b-SBPfile22-134757					x				UTM30N
Line2b-SBPfile23-135905					x	x	x		UTM30N

Folder Name	Split File 1	Split File 2	Split File 3	Split File 4
Line3a-SBPfile1-135905	Poor	Poor	Poor	
Line3a-SBPfile2-144535			ok	
Line3a-SBPfile3-153336		ok	ok	ok
Line3a-SBPfile4-162001	Poor	ok	ok	ok
Line3a-SBPfile5-170609	ok	Poor		ok
Line3a-SBPfile6-175132				
Line3a-SBPfile7-183604				
Line3a-SBPfile8-192036				
Line3a-SBPfile9-200508				
Line3a-SBPfile10-204940	gap			
Line3a-SBPfile11-213546	Poor	good	Poor	
Line3a-SBPline12-222646		good	good	
Line3a-SBPfile13-231447	Poor	Poor		
Line3a-SBPfile14-000000			Poor	Poor
Line3a-SBPfile15-004856		good	good	good
Line3a-SBPfile16-013533		Poor	good	
Line3a-SBPfile17-022241			Poor	
Line3a-SBPfile18-031017				
Line3a-SBPfile19-035739				
Line3a-SBPfile20-044543		Poor		
Line3a-SBPfile21-053140				
Line3a-SBPfile22-061655			Poor	
Line3a-SBPfile23-070401				
Line3a-SBPfile24-075238				
Line3a-SBPfile25-083956			Poor	Poor
Line3a-SBPfile26-092158			Poor	
Line3a-SBPfile27-100627			Poor	good
Line3a-SBPfile-28-105155			good	good
Line3a-SBPfile29-113935	good			
Line3a-SBPfile30-122715		Poor		
Line3a-SBPfile31-131218	Poor	Poor	Poor	good example
Line3a-SBPfile32-135815	Poor			Poor
Line3a-SBPfile33-144410			Poor	Poor
Line3a-SBPfile34-153300		good	Poor	
Line3a-SBPfile35-161914	Poor		Poor	
Line3a-SBPfile36-170216	Poor			
Line3a-SBPfile37-174515	Poor		Poor	
Line3a-SBPfile38-181439	Poor			Poor

Folder Name	Split File 1	Split File 2	Split File 3	Split File 4	Converted to segy and txt				Converted UTM
Line3b-SBPfile1-195708		ok	ok		x	x	x		UTM30N
Line3b-SBPfile2-204254		Poor				x			UTM30N
Line3b-SBPfile3-213056				Poor				x	UTM30N
Line3b-SBPfile4-221535		ok	Poor			x	x		UTM30N
Line3b-SBPfile5-225913			ok				x	x	UTM30N
Line3b-SBPfile6-234045	ok	ok			x	x			UTM30N
Line3b-SBPfile7-000000									UTM30N
Line3b-SBPfile8-004218	Poor	Poor	Poor	Poor	x	x	x	x	UTM30N
Line3b-SBPfile9-012604			Poor				x		UTM30N
Line3b-SBPfile10-021155									UTM30N
Line3b-SBPfile11-030052				Poor				x	UTM30N
Line3b-SBPfile12-034558	Poor	ok	Poor	ok	x	x	x	x	UTM30N
Line3b-SBPfile13-042902	ok		ok	Poor	x		x	x	UTM30N
Line3b-SBPfile14-051156	Poor	Poor	Poor	Poor	x	x	x	x	UTM30N

SBP turned off during seismic line 4 and (abandoned) seismic line 5

Folder Name	Split File 1	Split File 2	Split File 3	Split File 4	Converted to segy and txt				Converted UTM
Line6-SBPfile1-235012									
Line6-SBPfile2-000000		Poor				x			UTM31N
Line6-SBPfile3-004404									
Line6-SBPfile4-012839						x	x	x	UTM31N
Line6-SBPfile5-021214				Poor	x			x	UTM31N
Line6-SBPfile6-025533	OK				x				UTM31N
Line6-SBPfile7-034045			Poor				x		UTM31N
Line6-SBPfile8-042338				Poor				x	UTM31N
Line6-SBPfile9-050828	Poor	Poor		OK	x	x		x	UTM31N