National Oceanography Centre, Southampton

Cruise Report No. 21

SV *Kommandor Jack* Cruise Leg 2

26 JUL - 21 AUG 2002

DTI 'Northern Triangle' Environmental Survey:
seabed survey of the deep waters to the
north of Shetland

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2007

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ABSTRACT

This cruise formed part of the continuing Atlantic Margin Environmental Survey (AMES). The general objective of this cruise was to carry out a seabed environmental survey of the deep waters to the North of Shetland within the UKCS (United Kingdom Continental Shelf) area. The cruise carried out seabed sampling and photography:

(a) To describe and characterise the 'iceberg ploughmark zone' on the North Shetland Slope.

(b) To assess alongslope variation in sediments and associated fauna on the North Shetland Slope.

(c) To examine the potential contourite deposit and its associated fauna at the foot of the North Shetland Slope.

(d) To investigate the seabed environment and fauna of the 'Pilot Whale Diapirs'.

(e) To describe and characterize 'hard ground' areas of the NE Faroe Plateau.

(f) To investigate the Tampen Slide area in the extreme north of the UKCS.

In each of these areas seabed samples were obtained (Day grab, box corer, Megacorer, gravity corer) to study various environmental parameters (hydrocarbons, heavy metals, particle size) and macrobenthos communities. Photographic and video observations (SOC WASP system) of the seabed and its fauna were also undertaken.

ACKNOWLEDGEMENTS:

All data and survey results presented herein were acquired during a wide area survey project undertaken in 2002 on behalf of the UK Department of Trade and Industry. The project was carried out as a joint venture between the George Deacon and Challenger Divisions of the Southampton Oceanography Centre and was managed by Geotek Ltd

KEYWORDS

AMES, Atlantic Margin Environmental Survey, benthos, box cores, *Charles Darwin*, continental slope, contourites, cruise 2002 leg 2, Day grab, Faroe Plateau, gravity cores, heavy metals, hydrocarbons, *Kommandor Jack*, macrobenthos, Megacorer, NE Atlantic, North Shetland Slope, ocean floor, particle size, photography, Pilot Whale Diapirs, ploughmarks, sediments, Tampen Slide, videotape recordings, WASP

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Roger Hollies	SOC-George Deacon Division
Ben Boorman	SOC-George Deacon Division
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2. SHIP'S PERSONNEL

James Paterson	Master
Robert Peace	Chief Officer
Tadeusz Marcinkowski	Second Officer
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Ramon Ranoa	Second Engineer
Marcelino Goc-Ong	AB
Ruben Rodeo	AB
William Rosaldo	AB
Glenn Barrientos	Motorman
Piotr Broda	Chief Cook
Bernardo Gendrala	Steward
Elve Ricfuerto	Steward

3. ITINERARY

Sailed Peterhead	26 July 2002	
Arrived survey area		27 July
Departed survey area		19 August
Docked Leith	21 August 2002	

4. OBJECTIVES

The general objective of this cruise was to carry out a seabed environmental survey of the deep waters to the North of Shetland within the UKCS (United Kingdom Continental Shelf) area. The work to involve swath bathymetric mapping, seabed sampling and photography, to be carried out in a manner that extends, and is complimentary to, existing large-scale regional assessments of the UK Atlantic Margin environment (e.g. AFEN 1996[1] and 1998[2], and DTI 1999[3] and 2000[4]). The survey to be undertaken in two stages, the first (leg 1)[5] a swath bathymetric mapping of the area with additional interpretation of the swath backscatter data, the second (leg 2, present cruise) to carry out the seabed sampling and photography. The primary objectives of leg 2 included:

(a) To describe and characterise the 'iceberg ploughmark zone' on the North Shetland Slope.
(b) To assess alongslope variation in sediments and associated fauna on the North Shetland Slope.
(c) To examine the potential contourite deposit and its associated fauna at the foot of the North Shetland Slope.
(d) To investigate the seabed environment and fauna of the 'Pilot Whale Diapirs'[6].
(e) To describe and characterize 'hard ground' areas of the NE Faroe Plateau.
(f) To investigate the scarp edge backscatter variation area in the extreme north of the UKCS.

[1] Bett, B.J., et al., 1997. RRS "Charles Darwin" Cruise 101C Leg 2, 14 Jul-20 Aug 1996. Atlantic Margin Environmental Survey: seabed survey of the shelf edge and slope west of Shetland. Southampton: Southampton Oceanography Centre. 127pp. Southampton Oceanography Centre Cruise Report, No. 7.

[2] Bett, B.J., et al., 1999. RRS "Charles Darwin" Cruise 112C, 19 May-24 Jun 1998. Atlantic Margin Environmental Survey: seabed survey of deep-water areas (17th round Tranches) to the north and west of Scotland. Southampton: Southampton Oceanography Centre. 171pp. Southampton Oceanography Centre Cruise Report; No. 25.

[3] Bett, B.J., Jacobs, C.J., et al., 2007. RRS *Charles Darwin* Cruise 119C Leg B, 13 Aug - 14 Sep 1999. White Zone (WhiZ) environmental survey: seabed survey of the deep waters to the north and west of Shetland. Southampton, UK, National Oceanography Centre Southampton, 120pp. (National Oceanography Centre Southampton Cruise Report, 19.

[4] Bett, B.J. et al., 2007. RRS Charles Darwin Cruise 123C3-4, 19 Jul - 15 Sep 2000. Atlantic Margin Environmental Surveys and North Sea Environmental Surveys. Southampton, UK, National Oceanography Centre Southampton, 221pp. (National Oceanography Centre Southampton Cruise Report, 20)

[5] Masson, D.G. & Le Bas, T.P., 2002. "Kommandor Jack" Cruise Leg 1, 1 Jul-23 Jul 2002. Multibeam survey of the UKCS north of Shetland. Southampton: Southampton Oceanography Centre. 27pp. Southampton Oceanography Centre Research and Consultancy Report, 62.

[6] Haflidason, H., King, E.L., Brett, C., Stevenson, A.G., Wallis D.G., Campbell, N.C., Sejrup, H.P. & Waage, B., 1996. Marine geological/geophysical cruise report of the North Sea margin: Upper North Sea Fan, Miller Slide and Faeroe-Shetland Channel. R/V 'Hakon Mosby' Cruise No 110-96. ENAM II Cruise Report No.2.

5. NARRATIVE

5.1. Diary

Tuesday 23 July.
SOC party travel to Peterhead. Meeting is held between Chief Scientists of leg 1 (Masson, SOC) and leg 2 (Bett, SOC) together with geologists from leg 1 (Holmes, BGS) and leg 2 (Wynn, SOC; Leslie, BGS) to discuss the observations and interpretations of the leg 1 swath survey and to consider options for follow-up ground-truthing on leg 2. In discussion with the ship's mobilization officer (Garrow, Hayes) it is decided to install a section of solid bulwark on the starboard side of the afterdeck at the coring position.

Wednesday 24 July.
SOC party joins the vessel and onloads all SOC equipment. Other members of the scientific party join the vessel during the day. New solid bulwarks are fitted as previously discussed. Still awaiting arrival of final components of winch monitoring system.

Thursday 25 July.
Stowage and installation continues. Final components of winch monitoring system arrive. The instrumented sheave is swung from the crane wire, but on inspection this does not appear to be a good option – the wire is likely to be quickly chaffed by the movement of the sheave. A solid steel bridal is manufactured and fitted to the end of the crane as an alternative point to swing the sheave. This arrangement is successfully loaded tested to 8.5T, although there is some slight deformation to the bridal at the highest loads. Subsequently a cross-brace is added to the bridal, to reduce the chance of further deformation. A trial deployment of a triggered box core is then undertaken. During the deployment the bridal bends alarmingly, through some 45 degrees in total. There is also a loss of some crane function (will not knuckle in) during this trial deployment. It is decided to replace one of the crane's outboard pulley blocks with a swinging attachment point for the sheave. Work to remove the crane pulley begins well, but removal of a second pulley (required to remove the first) is stalled with the pivot pin jamming. Work to remove this pin continues through the night, involving welding temporary rigs to the end of the crane and the use of hydraulic jacks and power packs.

Friday 26 July.
The pin is finally extracted at 02:30 and dimensions taken for the construction of the new "pawl" piece. The pawl is fabricated and delivered to the ship around 07:00. On inspection it is decided to reduce the radius between the pawl pivot center and the point at which the sheave will be slung. The pawl is returned to the fabricators for this modification. A shore-side electrician also arrives to examine the problem with the crane control system; some modifications are undertaken that appear to solve the problem. The pawl is re-delivered to the ship, and offered up to the crane head for fitting. It is found to be too wide to refit and is consequently returned to the fabricators to have 2.5mm milled from each cheek face. The pawl is, yet again, re-delivered to the ship. With some considerable effort the pawl is eventually fitted to the crane. During the latter, the scientific party receives a safety briefing and familiarization from the Chief Officer. Additional welding is undertaken on the crane head, adding straps between the cheeks and further webbing to the cheek faces themselves. A trial deployment of a triggered box corer is then undertaken without incident. There being no outstanding issues the decision is made to sail. Final stowage and securing of gear is undertaken, and S/V *Kommandor Jack* sailed from Peterhead at 17:00 BST. A short trial of the vessel's dynamic positioning system was undertaken shortly thereafter. Proceeding *en route* for first station.

Saturday 27 July.
Proceeding *en route* to first station. Plan to begin work on an along-slope transect (c. 800m; "NSAS" sites) to assess variation in fauna and sediment silt-clay content previously detected from AFEN surveys[7]. Science meeting and briefing held at 10:00 and preparations made for the first coring operations. Arrive at the work sites c. 23:30, and begin preparations for the first deployment of the Megacorer (MgC) at site NSAS1 as Station (Stn) 57001#1. Winch control is difficult and somewhat arduous with the sprung lever system – recommend dial control is available in future. Also difficulty with the winch control and winch monitoring system being remote from one another – for the future recommend as a minimum a winch monitoring system display that is weather proof and can be co-located with the winch controls; ideally two control and two monitoring units should be available, one set for deck use and one set for lab use. Winch rate readout is not really effective, continuously flicking between readings; a longer period for data integration or an analogue dial display might be more effective.

Sunday 28 July.
At first deployment touchdown, the metres of wire out (mwo) readout matches SIMRAD echo sounder depth (corrected by sound velocity profiles from the previous leg), with the ultra-short base-line (USBL) beacon reading some 10m deeper. The corer (Stn 57001#1) is recovered, yielding 7/8 good cores, these are taken for hydrocarbon (HC), heavy metal (HM), particle size analysis (PSA), and four for macrobenthos (4xMAC), the eighth somewhat disturbed core is used as a BGS geology samples (BGS-geol). The Megacorer is redeployed at site NSAS1 as Stn 57001#2. It returns 7/8 good cores, which are taken for 6xMAC and SOC-geol. The sheave is removed and lashed, the USBL probe retracted and we steam for site NSAS2.

At site NSAS2, deploy Megacorer as Stn 57002#1. It returns, only 3/8 cores, all of which are disturbed, and so discarded. The Megacorer is redeployed as Stn 57002#2, returning 8/8 good cores that are all taken for 8xMAC. The corer is deployed for a third time as Stn 57002#3, returning, 8/8 good cores, that are taken for HC, HM, PSA, BGS-geol and SOC-geol. The USBL, sheave and crane are stowed and we relocate to site NSAS3.

At site NSAS3 the Megacorer is deployed as Stn 57003#1 and returns 8/8 good cores that are all taken for 8xMAC. On attempting to redeploy the corer, the crane suffers a major hydraulic leak (c. 14:50) before the gear is over the side; the corer is quickly landed as the crane loses power. The scientific watch and the crewman on deck quickly deploy pollution prevention measures to limit the slip hazard and the loss of oil to the sea. Ship's engineers assess the damage and prospects of repair at sea. At 21:00 the crane is brought back in to action. Deployment of Stn 57003#2 recommences at c. 21:30 (i.e. about 7 hours lost). Corer returns with 6/8 good cores, yielding HC, HM, PSA, BGS-geol and SOC-geol. USBL, sheave and crane are stowed for transit to site NSAS4.

Monday 29 July.
At site NSAS4 deploy Megacorer as Stn 57004#1, returning 7/8 good cores that are taken for HC, HM, PSA and 4xMAC. Corer redeployed as Stn 57004#2, returning 6/8 good cores that are used for 4xMAC, BGS-geol and SOC-geol. USBL probe, sheave and crane are stowed for the steam to site NSAS5.

[7] Bett, B.J., 2001. UK Atlantic margin environmental survey: introduction and overview of bathyal benthic ecology. *Continental Shelf Research*, **21**, 917-956.

At site NSAS5 the Megacorer is deployed as Stn 57005#1, it returns 6/8 good cores that are used for HC, HM, PSA and 3xMAC. The corer is redeployed as Stn 57005#2, Returning 8/8 good cores, yielding 6xMAC, BGS-geol and SOC-geol. USBL probe, sheave and crane are stowed for the steam to site NSAS6.

At site NSAS6 deploy Megacorer as Stn 57006#1, it returns 7/8 good cores, yielding HC, HM, PSA and 4xMAC (one of the latter contained a nice specimen of a plumose stalked sponge that was preserved separately). The corer was redeployed as Stn 57006#2, again returning 7/8 good cores that were taken as 5xMAC, BGS-geol and SOC-geol. (*Note that site NSAS6 is shallower, c. 750m, than the other "NSAS" sites, it is off the leg 1 swath map*). With only a short steam to NSCS6, the USBL probe and crane are left deployed for the transit at 6 knots.

At site NSCS6 deploy the Megacorer as Stn 57007#1, it returns 7/8 good cores that are taken for HC, HM, PSA and 4xMAC. Redeploy the corer as Stn 57007#2, it again returns 7/8 good cores that provide 5xMAC, BGS-geol and SOC-geol. USBL probe, sheave and crane are stowed for the transit to site NSCS5.

At site NSCS5 deploy the Megacorer as Stn 57008#1, returning 6/8 good cores that are taken for HC, HM and 4xMAC. Redeploy corer as Stn 57008#2, it returns only 4/8 good cores that are all taken as a 4xMAC, and a somewhat cloudy core is taken as a reserve PSA. On recovery of this last deployment (c. 22:30), the coring wire was damaged when it jammed in the scrolling gear sheave. This was a rather likely incident given the relative motions of the crane and the scrolling gear. After some difficulty in locating the termination kits – they were in a box marked "the wrong bow thrust spares" – about 10m of wire was cropped and the re-termination procedure begun.

Tuesday 30 July.
Work on the re-termination completed at c. 01:00 and the new termination left to cure. The re-termination was successfully load tested (3T) at 13:00 and operations recommenced. The Megacorer was deployed at site NSCS5 as Stn 57008#3, returning 7/8 good cores, that were taken for PSA, 4xMAC, BGS-geol and SOC-geol. WASP was then deployed in the vicinity of site NSCS5 as Stn 57009#1 and run near bottom for 30 minutes. No film was run during the deployment (see further below); however, the video obtained was good and particularly notable for the abundance and apparently highly aggregated distribution of "giant" sea pens (*Umbellula*). The USBL probe, sheave and crane were then stowed for the steam to site NSCS4.

At site NSCS4 preparations were made to deploy WASP, however, the video lamps lit at initial start up and on a second attempt. This is an abnormal condition for WASP and risks the lamps burning out in air; consequently WASP was stood down for inspection. The Megacorer was deployed as Stn 57010#1, returning 6/8 good cores that were taken for HC, HM and 4xMAC. The corer was redeployed as Stn 57010#2, returning 7/8 good cores, taken for PSA, 4xMAC, BGS-geol and SOC-geol. The USBL probe, sheave and crane were then stowed for the steam to site NSCS3.

Wednesday 31 July.
At site NSCS3 deploy the Megacorer as Stn 57011#1, it returns 8/8 good cores that all taken for 8xMAC. Redeploy the corer as Stn 57011#2, returning 7/8 good cores that are used to

provide HC, HM, PSA, BGS-geol and SOC-geol. The USBL probe, sheave and crane were then stowed for the steam to site NSCS1 (*note there is no NSCS2* – this location is covered by samples from previous surveys, AFEN 1998[8] and DTI 2000[9]). The USBL probe, sheave and crane were then stowed for the steam to site NSCS1.

At site NSCS1 deploy the Megacorer as Stn 57012#1, it returns 5/8 good cores that are all taken for 5xMAC. Corer redeployed as 57012#2, returning 5/8 good cores that are taken for 4xMAC and BGS-geol. Redeploy corer as Stn 57012#3, it returns 6/8 good cores that are used for HC, HM, PSA and SOC-geol. The USBL probe, sheave and crane were then stowed for the steam to site NSPM10. Preparations are made for Day grab operations at the NSPM sites.

At site NSPM10 deploy the Day grab as Stn 57016#1.

Thursday 1 August.
The grab (Stn 57016#1) returns with a good sample that is taken for HC, HM, PSA and the remainder used for BGS-geol. Grab redeployed as Stn 57016#2, again returning a good sample that is taken for MAC. The USBL probe, sheave and crane are stowed for the steam to site NSPM1.

At site NSPM1 deploy Day grab as Stn 57017#1, its returns a good sample that is taken for MAC. Redeploy the grab as Stn 57017#2, again it returns a good sample that is used for HC, HM, PSA and BGS-geol. The USBL probe, sheave and crane are stowed for the steam to site NSPM3.

At site NSPM3 deploy Day grab as Stn 57018#1, it returns a good sample that is used for HC, HM, PSA and BGS-geol. Redeploy the grab as Stn 57018#2, it returns with a good sample that is taken for MAC. Steam for site NSPM4.

At site NSPM4 deploy Day grab as Stn 57019#1, yet again it returns a good sample that is used for HC, HM, PSA and BGS-geol. Redeploy the grab as Stn 57019#2 and again get a good sample that is taken for MAC. The USBL probe, sheave and crane are stowed for the steam to site NSPM5.

At site NSPM5 deploy Day grab as Stn 57020#1, returning a good sample that is taken for MAC. Redeploy the grab as Stn 57020#2, again returning a good sample that is used for HC, HM, PSA and BGS-geol. The USBL probe, sheave and crane are stowed for the steam to site NSPM6.

At site NSPM6 deploy the Day grab as Stn 57021#1, it returns failed with a rock in the jaws. Redeploy the grab as Stn 57021#2, it returns a good sample that is used for MAC. Redeploy the grab as 57021#3, again it returns a good sample that is used for HC, HM, PSA and BGS-geol. The USBL probe, sheave and crane are stowed for the steam to site NSPM7.

At site NSPM7 deploy Day grab as Stn 57022#1 returning a good sample that is taken for

[8] Bett, B.J., et al., 1999. RRS "Charles Darwin" Cruise 112C, 19 May-24 Jun 1998. Atlantic Margin Environmental Survey: seabed survey of deep-water areas (17th round Tranches) to the north and west of Scotland. Southampton: Southampton Oceanography Centre. 171pp. Southampton Oceanography Centre Cruise Report; No. 25.

[9] Bett, B.J. et al., 2007. RRS Charles Darwin Cruise 123C3-4, 19 Jul - 15 Sep 2000. Atlantic Margin Environmental Surveys and North Sea Environmental Surveys. Southampton, UK, National Oceanography Centre Southampton, 221pp. (National Oceanography Centre Southampton Cruise Report, 20)

MAC. Redeploy the grab as Stn 57022#2, again it returns a good sample that is used for HC, HM, PSA and BGS-geol. The USBL probe, sheave and crane are stowed for the steam to site NSPM8.

At site NSPM 8 deploy the Day grab as Stn 57023#1, returning a good sample that is taken for MAC. Redeploy the grab as Stn 57023#2, again it returns a good sample that is used for HC, HM, PSA and BGS-geol. The last grab completes sampling operations in the upper slope / shelf break iceberg ploughmark area. The work has been markedly more successful than in previous cruises, with 20 good Day grab samples obtained from only 23 deployments, including a run of 12 back-to back successes. It may be that the ground North of Shetland is easier to work than that West of Shetland, but it is also possible that the used of the heavy coring cable has contributed to the success, light “hydro” wires have been used on previous occasions. It is also notable that the winch monitoring system (the instrumented sheave supplied by Underwater Systems Engineering and the PC-based unit supplied by Geotek) performed very well during the grab operations, giving very clear indication of the grab bottoming.

The USBL probe, sheave, crane and everything else are stowed, as we expect a lumpy passage to site NSDS1. We are taking big green ones over the starboard deck and up the fish ramp while on station. The passage begins in a Force 8, with the ship making only 4 knots and unable to make a direct course to site NSDS1, intention to tack to the site.

Friday 2 August.
Still only making slow progress towards site NSDS1. Later morning, tack and make directly towards the site at full speed, with the wind and sea behind us. Arrive at site NSDS1 at c. 12:30 and go on DP, we can hold position, but there are just too many big pitches for us to handle the gear safely. We heave to in the vicinity of site NSDS1, to review weather / sea state in 3-4 hours.

At 15:30, we are still pitching too much and taking waves over the starboard deck to work safely, will review weather / sea state at the change of bridge watch.

At c. 20:00, move on to site NSDS1 and go on to DP to assess weather / sea state. There is some improvement but large pitches are still too frequent, and we are still pooping, to restart operations; will review again at change of science watch.

Saturday 3 August.
Come on station and on DP at c. 00:00. Sea state has improved somewhat, although it is still bouncy on the afterdeck. Prepare to recommence Megacorer operations at site NSDS1. Deploy Megacorer as Stn 57024#1, it returns 6/8 good cores that are taken for HC, HM, PSA, BGS-geol and SOC-geol. Redeploy (Mega10) corer as Stn 57024#2, but it returns only 2/10 good cores that are taken for 2xMAC. Redeploy (Mega08) the corer again as Stn 57024#3, returning 6/8 good cores that are all taken as 6xMAC. Stow USBL, sheave and crane for the steam to site NSDS2.

At site NSDS2 deploy the Megacorer as Stn 57025#1. At c. 10:30 there is an emergency muster drill that causes no interruption to scientific operations. The corer returns 5/8 good cores although one is subsequently lost on deck (very soft muds and frequent large burrows are a handling problem in the NSDS area) the remaining four are used for 4xMAC. The corer is redeployed as Stn 57025#2, returning only 2/8 good cores that are taken for HC and BGS-

geol. The soft mud and extensive burrow systems are continuing to give problems. To aid positive triggering, two scaffold poles cut to the frame diameter in length are lashed to the base of the corer. The corer is then redeployed as Stn 57025#3, it returns 6/8 good cores that are taken for HM, PSA and 4xMAC. The USBL probe, sheave and crane are stowed for the steam to site NSDS3.

At site NSDS3 the Megacorer is deployed as 57026#1, it returns with 8/8 good cores that are all taken as 8xMAC. The corer is redeployed as Stn 57026#2. During descent the winch stalls and a quick inspection reveals that the break sleeve has got somewhat hot (!). As we are close to the bottom the deployment is continued. The brake sleeve cools during subsequent hauling. The corer returns 8/8 good cores that are used for HC, HM, PSA, BGS-geol, SOC-geol and one core is frozen whole as archive material. The USBL probe, sheave and crane are stowed for the steam to site NSDS4.

At site NSDS4 deploy the Megacorer as station 57027#1.

Sunday 4 August.
Corer (Stn 57027#1) returns with 8/8 good cores that are all taken as 8xMAC. Redeploy corer as Stn 57027#2, it returns 6/8 good cores that are used for HC, HM, PSA, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane for the steam to site NSDS5.

At site NSDS5 deploy the box corer (USNEL MkII; UKORS yellow, mild steel version) for the first time during this cruise as Stn 57028#1. The box corer is both difficult to deploy and recover with the crane arrangement. The corer returns a good sample, with some slumping at one edge. Opposite side is sub-sampled to generate a $0.1m^2$ MAC; however, the chemistry side proves too soft and fluid to obtain useful samples. As only soft mud was encountered, and not the strange plastic mud seen previously at this diapir site[10], the Megacorer is deployed as Stn 57028#2. The corer returns 5/8 good cores that are used for HC, HM, PSA, BGS-geol and SOC-geol. The sheave and the crane are stowed for the transit to site NSDS6.

At site NSDS6 deploy Megacorer as Stn 57029#1, it returns 8/8 good cores that are all taken as 8xMAC. The corer is redeployed as Stn 57029#2, it returns with 8/8 good cores that are used for HC, HM, PSA, BGS-geol, SOC-geol and one core is frozen whole. Stow USBL probe, sheave and crane and steam for site NSDS7.

At site NSDS7 deploy Megacorer as Stn 57030#1, it returns 8/8 good cores that are all taken as 8xMAC. Redeploy the corer as Stn 57030#2, it returns another 8/8 good cores that are used for HC, HM, PSA, BGS-geol, SOC-geol and one core is frozen whole. Stow sheave and crane for the short steam to site NSDS8.

At site NSDS8 deploy Megacorer as Stn 57031#1, it returns 6/8 good cores that are taken for HC, HM and 4xMAC. Redeploy the corer as Stn 57031#2.

Monday 5 August.
The corer (Stn 57031#2) returns with 7/8 good cores that are taken for PSA, 4xMAC, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and steam for site NSDS9.

[10] Bett, B.J., Jacobs, C.J. et al., 2007. RRS *Charles Darwin* Cruise 119C Leg B, 13 Aug - 14 Sep 1999. White Zone (WhiZ) environmental survey: seabed survey of the deep waters to the north and west of Shetland. Southampton, UK, National Oceanography Centre Southampton, 120pp. National Oceanography Centre Southampton Cruise Report, 19.

At site NSDS9 deploy Megacorer as Stn 57032#1, it returns 8/8 good cores that are all taken for 8xMAC. Redeploy the corer as Stn 57032#2, it returns 7/8 good cores that are used for HC, HM, PSA, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and steam for site NSTS1.

At site NSTS1 deploy Megacorer as Stn 57033#1 deploy Megacorer as Stn 57033#1, it returns 8/8 good cores that are all taken as 8xMAC. Redeploy the corer as Stn 57033#2, it returns 8/8 good cores that are used for HC, HM, PSA, BGS-geol, SOC-geol and microbiology. The core split for BGS-geol shows some evidence of a turbidity flow at this channel site. Make short transit to site NSTS2.

At site NSTS2 deploy Megacorer as Stn 57034#1 it returns 8/8 good cores that are all taken as 8xMAC. Redeploy corer as Stn 57034#2, it returns 8/8 good cores that are used for HC, HM, PSA, BGS-geol, SOC-geol and microbiology. Stow USBL probe, sheave and crane and steam for site NSTS3. Prepare WASP for its second deployment.

At site NSTS3 deploy WASP as Stn 57035#1. Start up system with video lamps turned off and wait for flash to complete test sequence. Reconnect video lamps and begin deployment. Video lamps light and are hosed down as best as possible as WASP is launched. At depth there are no camera data requests (? another film jam). Load cell gives no data during this deployment.

Tuesday 6 August.
Recover WASP (Stn 57035#1), the video lamps light as it touches down on deck and are cooled with hoses; no useful film or video run. Reposition vessel to site NSTS3.

At site NSTS3 deploy Megacorer as Stn 57036#1, it returns 8/8 good cores that are all taken as 8xMAC. Redeploy corer as Stn 57036#2, it returns 6/8 good cores (two others short, slumped with big burrows) that are used for HC, HM, PSA, BGS-geol and SOC-geol. (Load cell dead throughout these deployments). Stow USBL probe, sheave and crane and steam for site NSTS4.

At site NSTS4 deploy Megacorer as Stn 57037#1 deploy Megacorer as Stn 57037#1, it returns 7/8 good cores that are taken for HC, HM, PSA and 4xMAC. Redeploy corer as Stn 57037#2, it returns 8/8 good cores, that are used for 4xMAC, BGS-geol, SOC-geol and microbiology. One small holothurian (20mm), "*Oneirophanta*-like", noted on the surface of one of the MAC cores. Stow sheave and crane and steam for site NSTS5.

At site NSTS5 deploy the Megacorer as Stn 57038#1, it returns 6/8 good cores that are taken for HC, HM, and 4xMAC. Corer redeployed as Stn 57038#2, it returns 7/8 good cores that are taken for PSA, 4xMAC, BGS-geol and SOC-geol. Stow sheave and crane for steam to site NSTS6. WASP is prepared for another deployment. The load cell is removed for inspection.

At site NSTS6 carry out a trial of the load cell under load (WASP). There appears to be no output from the cell although it is getting power. The cell appears to be fully "potted" within so no further "tweaking" can be done and the cell appears to be effectively dead. WASP is then deployed as Stn 57039#1. This time the video lamps are unplugged for start up, and after the test sequence flashes are seen WASP is swung over the side and then brought tight to the rail. The video lamps are then plugged in (with 'safety' hoses going), the lamps do not light although there is the odd stray flash and the deployment proceeds. Three short (one minute)

camera activations are seen during the descent, suggesting that the camera has at least not jammed immediately on this deployment.

The WASP run (Stn 57039#1) is rather "strange", and certainly not a good one for testing whether the camera 'fixes' have been effective. On site on DP the Simrad shows a rather 'odd' bottom; a continuous soft return at 2,120m and a good hard return at 2,150m. The WASP run in altimeter locks on at 100mab, but becomes indistinct at around 50mab. Subsequently there are no useful periods of gated altimeter returns (perhaps similar to previous occasions when phytodetritus layers have been present (e.g. AFEN 1998 survey[11]). These troubles are added to by the drift carrying us over the steep scarp and, therefore, having to chase WASP after the descending seabed. Subsequent coring and (hopefully) video may reveal more of what happened during this strange tow, which in the end was effectively abandoned as "unfishable".

Wednesday 7 August.
WASP (Stn 57039#1) recovered, lamps unplugged over the side. Mud (possibly of the "diapir block" type) evident all over WASP – it has clearly been on the bottom. No u/w video, full tape has run on deck prior to launch! (reason unknown, ? wiring up pressure switch connection). Mk7 removed for quick check, it indicates 217 fames taken.

Reposition on site NSTS6 and deploy the Megacorer as Stn 57040#1, it returns 5/8 good cores that are taken for HC and 4xMAC. Corer redeployed as Stn 57040#2; it returns 7/8 good cores that are taken for HM, PSA, 4xMAC and BGS-geol. Steam for site NSTS7.

At site NSTS7 deploy Megacorer as Stn 57041#1 it returns 8/8 good cores that are all taken as 8xMAC. Redeploy corer as 57041#2 it returns 8/8 good cores that are taken for HC, HM, PSA, BGS-geol, SOC-geol and microbiology.

Deploy WASP at site "NSTS7" as Stn 57042#1. For this launch the video lamps and monitor to video lead are left unplugged until the gear is over the side. Batteries are only plugged in immediately prior to start up. The forward video lamp lights briefly as it is plugged in. An uneventful, gentle one-hour tow. Telemetry fair, though with some periods of little or no gated altimeter data. On recovery the video appears to be good and have run the full hour on the bottom. The Mk7 still camera indicated 353 frames shot, consistent with a full hour of bottom photographs. Stow sheave and crane and head for site NSTS8.

At site NSTS8 deploy the Megacorer as Stn 57043#1, it returns 7/8 good cores that are taken for HC, HM, PSA and 4xMAC. Redeploy the corer as Stn 57043#2.

Thursday 8 August.
The corer (57043#2) returns with 7/8 good cores that are taken for 4xMAC, BGS-geol and SOC-geol. Stow USBL, sheave and crane and steam for site NSTS9.

At site NSTS9 deploy Megacorer as Stn 57044#1, it returns 8/8 good cores that are all taken as 8xMAC. Redeploy corer as Stn 57044#2, it returns 7/8 good cores that are used for HC, HM, PSA, BGS-geol, SOC-geol and microbiology. Make first deployment of gravity corer as Stn 57045#1 (600kg bomb weight, 1.5m barrel, two catchers fitted in tandem), it returns 0.7m

[11] Bett, B.J., Jacobs, C.J. et al., 2007. RRS *Charles Darwin* Cruise 119C Leg B, 13 Aug - 14 Sep 1999. White Zone (WhiZ) environmental survey: seabed survey of the deep waters to the north and west of Shetland. Southampton, UK, National Oceanography Centre Southampton, 120pp. National Oceanography Centre Southampton Cruise Report, 19.

of a somewhat disturbed core, 30cm of which is subsequently lost on deck; a 40cm sample is retained (equivalent in length, but not quality, to a Megacorer geology sample – ho hum) plus a bag of the scrapings from the catchers and end cap. Deploy WASP as Stn 57046#1, a good gentle tow with fair telemetry throughout. On recovery the full 65 mins of DV has run and end of tape review looks good, Mk7 has run c. 350 frames (full 30m load with 57047#1). During the WASP deployment, the tape from the previous deployment (Stn 57042#1) is fully reviewed, and it is apparent that the aft video lamp is not lit. The lamp is checked and the bulb found to be blown, the entire lamp unit is replaced. Stow USBL probe, sheave and crane and steam for site NSTS8.

At site NSTS8 deploy WASP as Stn 57047#1, a fair tow, but there is near total loss of gated altimeter data for the later half of the tow (Excess voltage drop, aft battery problem?). On recovery, brief review of the tape indicates 60 mins DV run that appears to be good; Mk7 has run c. 350 frames (full 30m load with 57046#1). Relocate on site NSTS8 and deploy gravity corer (1.5m, single catcher) as Stn 57048#1, somewhat hastily as the vessel has not come on DP, hold the corer alongside as DP is established and then continue deployment.

Friday 9 August.
Recover corer (Stn 57048#1), it returns a 1.5m core. Stow USBL probe, sheave and crane and steam for site NSTS7.

At site NSTS7 deploy gravity corer as Stn 570499#1, it returns a 1.5m core. Stow USBL probe, sheave and crane and steam for site NSTS10.

At site NSTS10 deploy Megacorer as Stn 57050#1 (including trial of stainless steel core tube intended for use on forthcoming RRS *Charles Darwin* cruise in the Gulf of Oman), it returns 8/8 good cores that are all taken as 8xMAC. Corer redeployed as Stn 57050#2 it returns 8/8 good cores that are used for HC, HM, PSA, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and steam for site NSTS5.

At site NSTS5 deploy WASP as Stn 57051#1 for a gentle tow with good telemetry throughout. 65 mins of DV run that look OK on quick inspection, with the Mk7 camera running some 350 frames. Stow USBL probe, sheave and crane and steam for site NSDS10.

At site NSDS10 deploy WASP as Stn 57052#1 for a good tow with some indication of seabed topography; camera data requests throughout.

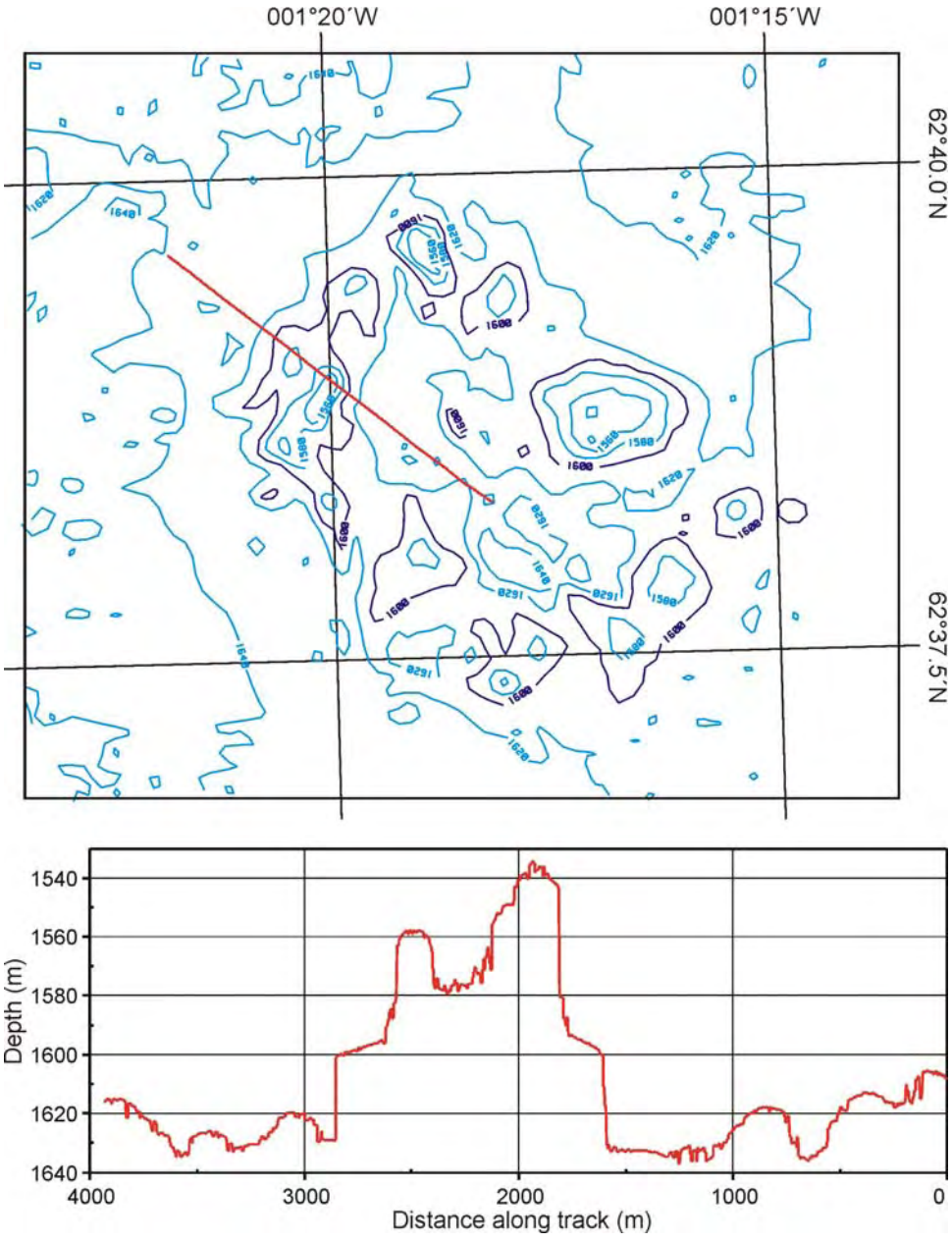
Saturday 10 August.
Recover WASP (Stn 57052#1), 65 mins of DV have run and appear to include an encounter with ‘diapiric blocks’; the Mk7 camera has run some 350 frames. Reposition on site NSDS10 and deploy Megacorer as Stn 57053#1, it returns 8/8 good cores that are all taken as 8xMAC. Redeploy corer as Stn 57053#2, it returns 7/8 good cores that are used for HC, HM, PSA, BGS-geol and SOC-geol. Relocate to site NSDS11.

At site NSDS11 deploy Megacorer as Stn 57054#1, it returns 6/8 good cores that are taken for HC, HM, PSA, BGS-geol, SOC-geol and microbiology. Relocate to site NSDS12.

At site NSDS12 deploy Megacorer as Stn 57055#1 it returns 3/8 good cores and one slightly disturbed core; the three good cores are taken for HC, HM and PSA and the disturbed one for BGS-geol. During this deployment an emergency muster and boat drill are performed.

Relocate to site NSDS13.

At site NSDS13 deploy Megacorer as Stn 57056#1 it returns with only two short ‘lumps’ of diapiric mud, these are placed together in a bucket of formalin in the hope that they may disaggregate somewhat. The material does appear to be burrowed and there is certainly specimen biological material in the sample. Deploy the box corer as Stn 57056#2 in an attempt to obtain a more substantial sample. The corer returns empty bar a little gravel. Redeploy the box corer as Stn 57056#3 it returns only washed out chunks of mud / gravel / cobbles, the material is sieved out (0.5mm) and retained. Make a final attempt with the Megacorer, fitted with only four cores, but it returns empty bar water. Abandon the site and make a brief echo-sounding transect from the centre of the southwest sub-feature outwards, on approximately the same line as the WASP run make during the DTI 1999 survey that encountered diapiric blocks. It is clear that the swath map does not do justice to the topography of these features – the knolls are flanked by 50m step-like topography.



Relocate to site NSDS14. At site NSDS14 deploy Megacorer as Stn 57057#1, once again in search of diapiric block material. It returns with 3/4 good cores of 'normal' mud that are taken for HC, HM and PSA. The location of the site is 'nudged' slightly to more closely match the WASP track (Stn 57052#1) that encountered the diapiric blocks and the corer redeployed as Stn 57057#2.

Sunday 11 August.
Recover corer (Stn 57057#2) it returns 4/4 good cores that are taken for BGS-geol and SOC-geol. Relocate to site NSDS15.

At site NSDS15 deploy Megacorer as Stn 57058#1, it returns 4/4 good cores that are taken for HC, HM, PSA and SOC-geol. Relocate to site NSDS16.

At site NSDS16 deploy Megacorer as Stn 57059#1, it returns 7/8 good cores that are taken for HC, HM, PSA and 4xMAC. Redeploy the corer as Stn 57059#2, it returns 6/8 good cores (and two shorter cores) that are taken for 4xMAC, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and steam for site NSDS13.

En route to site NSDS13 stop to deploy amphipod trap[12] as Stn 57060#1 and continue onwards to site NSDS13. At site NSDS13 deploy WASP as Stn 57061#1, a good tow, where we appear to 'bump' into things then go steeply downslope off the knoll of the diapir. Recover WASP, 65 mins DV and film run that show diapiric mud block and scree-like terrain. Stow USBL probe sheave and crane and steam for site NSDS17.

At site NSDS17 deploy Megacorer as Stn 57062#1, it returns 7/8 good cores that are used for HC, HM, PSA, BGS-geol, SOC-geol and microbiology. Stow sheave and crane and head for site NSDS7.

At site NSDS7 deploy WASP as Stn 57063#1 for a gentle tow over apparently level ground (high backscatter region downslope of the low relief diapir sampled as sites NSDS15-17). Recover WASP; film and video run. Stow USBL probe, sheave and crane and steam for site NSDS13 for a final coring assault on the diapiric muds.

At site NSDS13 deploy Megacorer (with four tubes fitted, two of which are the new stainless steel versions) as Stn 57064#1.

Monday 12 August.
Recover the corer (Stn 57064#1), it returns 2/4 good cores that are taken for HC and BGS-geol. Redeploy corer as Stn 57064#2, it returns only washed out material. Try again as Stn 57064#3, it returns 3/4 good cores that are taken for HC, HM and PSA. Make one final attempt with the Megacorer as Stn 57064#4, but the corer has clearly fallen over at the seabed and recovers no samples. Try the gravity corer as Stn 57064#5, it returns a 1m core that includes diapiric material (two hydrocarbon samples are taken from the split core; one near top, one near base). Plan to recover amphipod trap at this time is postponed in roughening seas. Stow USBL probe, sheave and crane, and lash everything for a steam to the west in beam seas. Making for Faroe Plateau North sites previously during the DTI 1999 survey cruise (RRS *Charles Darwin* cruise 119[13]).

[12] Opportunistic sampling carried out by cruise participant Dr Tammy Horton (SOC, BP deep-sea biodiversity research fellow) who is engaged in taxonomic studies of amphipod material collected during previous AFEN and DTI Atlantic Margin survey cruises.

[13] Bett, B.J., Jacobs, C.J. et al., 2007. RRS *Charles Darwin* Cruise 119C Leg B, 13 Aug - 14 Sep 1999. White Zone (WhiZ) environmental survey: seabed survey of the deep waters to the north and west of Shetland. Southampton, UK, National Oceanography Centre Southampton, 120pp. National Oceanography Centre Southampton Cruise Report, 19.

Heave to at site FPN1800 c. 12:30 awaiting repairs to seawater pipework in the bowthrust compartment. At c. 14:20 another seawater pipework leak is detected and further repairs are required. At c. 16:15 repairs are completed and the vessel relocates on site FPN1800. Deploy Megacorer as Stn 57065#1, it returns largely un-triggered (? bad first contact) and with only two very short (<10cm cores) that are discarded. Redeploy corer as Stn 57065#2, it returns the same result, with only 3 very sort (<10cm cores). This is a most unlike coincidence with such a reliable piece of equipment. All coring units are removed and the crane used to test lower the coring head to the deck. The head jams after only 6-8 inches of travel; clearly the main top bars are bent, undoubtedly resulting from the corer having fallen over at the seabed during the deployment at Stn 57064#4. Further Megacorer operations are postponed until repairs are undertaken. Stow the USBL probe, sheave and crane and steam for site FPN1100 where the box corer is required.

At site FPN1100 deploy the box corer as Stn 57066#1. In the meantime the two top bars of the Megacorer are removed and examined. There are indeed badly bent at the point where their threaded lower end screws through the top plate of the piston cylinder. Such a bend in 15mm stainless steel bar is not “fixable”. Instead the bars are inverted, although this makes firmly securing them to the corer top plate difficult, and the crane again used to test lower the coring head to the deck. Head lowers quite freely, although the ‘twist’ in the top bars causes the guide rollers to leave the guide bars. The position on the guide rollers is adjusted and further trial lowerings of the head appear to be fully successful.

Tuesday 13 August.
Recover the box corer (Stn 57066#1), it returns a short (c.15cm) but good sample that is processed in the normal fashion to produce HC, HM, PSA, 0.1xMAC and BGS-geol. Stow the USBL probe, sheave and crane and steam for site FPN1400.

At site FPN1400 deployed the repaired Megacorer as Stn 57067#1, it returns 9/10 good cores that are taken for 8xMAC and BGS-geol (chemistry samples are available from a previous cruise). Stow the USBL probe, sheave and crane and steam for site FPN1800.

At site FPN1800 deploy Megacorer as Stn 57068#1, it returns 10/10 good cores that are taken for 8xMAC, BGS-geol and SOC-geol (chemistry samples are available from a previous cruise). Stow the USBL probe, sheave and crane and steam for the Shetland Slope area.

En route, stop to pick up the amphipod trap (Stn 57060#1); the rig is rather lacking in buoyancy and only the lazy float is visible at the surface. Nevertheless, the rig is safely recovered and yields a fair haul of amphipods. Continue on transit to the Shetland Slope area, making for site NSCS1.

At site NSCS1 deploy WASP as Stn 57069#1 for an uneventful 30min tow with good telemetry throughout; film and video run. Stow the USBL probe, sheave and crane and steam for site NSCS3.

At site NSCS3 deploy WASP as Stn 57070#1 for a rather swelly 30min tow with good telemetry throughout; film and video run Stow the USBL probe, sheave and crane and steam for site NS1000

Wednesday 14 August.
At site NS1000 deploy Megacorer as Stn 57071#1, it returns 9/10 good cores that are taken

for 8xMAC, PSA and SOC-geol (NB the latter two are taken from the same core, i.e. SOC-geol is minus the top 2cm of the sediment column). Stow sheave and crane and steam for site NS950.

At site NS950 deploy Megacorer as Stn 57072#1, it returns 10/10 good cores that are taken for HC, HM, PSA, BGS-geol and SOC-geol. Stow sheave and crane and steam for site NS900.

At site NS900 deploy Megacorer as Stn 57073#1, it returns 9/12 good cores that are taken as 8xMAC, PSA and SOC-geol (NB the latter two are taken from the same core, i.e. SOC-geol is minus the top 2cm of the sediment column). On this deployment the winch wire had dropped through the Megacorer top ring and snagged under one of the drop bar top weights. At recovery the drop bar was severely damaged and the winch wire kinked and graunched. Suspend wire work to make re-termination (i.e. 12 hours required to cure the "wirelock" chemical termination) after cropping some 5m from the wire.

Come on to the line of the NS1000-NS800 sites and echo-sound inshore to establish the positions of the 100m contours from 600 to 200m (i.e. region not covered by swath survey).

At the 200m contour location deploy Widescan as Stn 57074#1 to make a brief initial examination of the iceberg ploughmark zone between the 200 and 300m contours. During the descent phase the towfish loses its tail fin (? knocked off by longline) and plummets to the seabed. However, other than the loss of some paintwork, the fish appears to be intact on recovery. Widescan was redeployed, but with no range / depth scale bars or altimeter data displayed on the deck units the tow was aborted. The problem was traced to a loose connector on the data-logging unit. Vessel relocates to the start of the intended line and Widescan is deployed again. On this occasion the pay out is halted at about 200mwo with a significant tangle on the winch (note the winch was installed off centre and not angled to compensate; also aggravated by the rapid hauling to recover the fish after the loss of its tail fins. With the wire stoppered off, some 500m of cable are pulled off by hand to the deck and re-laid on the drum. During this period, Widescan was flying at 75-100mab. The data collected was consequently of limited resolution. With the cable re-laid, further pay out was possible and the survey continued with the fish flying at about 40-50mab, acquiring good imagery of the iceberg ploughmark fabric.

Thursday 15 August.
Widescan (Stn 57074#1) successfully recovered. The "Wirelock" termination now having cured it is subject to a static load test (as we have no functional load cell); the termination successfully holds the test load of 1375kg (gravity core bomb and amphipod trap weights). Steam for site NS400.

At site NS400 deploy the box core as Stn 57075#1, following a large, but unquantifiable, pull out, it returns a good core that is sampled for HC, HM, PSA, 0.1 MAC and BGS-geol. Stow USBL probe, sheave and crane and steam for site NS500.

At site NS500 deploy the box core as Stn 57076#1 it returns a good core that is sampled for HC, HM, PSA, 0.1 MAC, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and head for site NS900.

At site NS900 deploy the amphipod trap as Stn 57077#1 and return to the coring programme as interrupted by the graunching of the wire. Head up slope to NS850.

At site NS850 deploy Megacorer as Stn 57078#1, it returns 8/8 good cores that are taken for HC, HM, PSA, BGS-geol, SOC-geol and microbiology. Stow sheave and crane and steam for site NS800.

At site NS800 deploy Megacorer as Stn 57079#1, it returns 11/12 good cores that are taken for PSA, 8xMAC, BGS-geol and SOC-geol. Stow sheave and crane and head for site NS700.

At site NS700 deploy Megacorer as Stn 57080#1, it returns 12/12 good cores that are taken for PSA, 8xMAC, BGS-geol and SOC-geol. Stow sheave and crane and make for site NS600.

At site NS600 deploy Megacorer as Stn 57081#1, it returns 0/12 cores – we have hit the edge of the iceberg ploughmark zone. Redeploy corer, with reduced number of tubes, as Stn 57081#2, it returns 8/8 good cores that are all taken for 8xMAC. Redeploy the corer as Stn 57081#3, it returns 7/8 good cores that are taken for PSA, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and steam for site NSAS6. Intention to locate a new site (NSAS7) by echo sounding for the 800m contour between sites NSAS6 and NSCS6.

En route to site NSAS6, seas begin to increase and the ship's speed is reduced to limit propeller cavitation.

Friday 16 August.
Eventually arrive in the vicinity of the intended new site (NSAS7) c. 02:30, but the sea state is too great for safe working. Heave to in the area, with reviews of conditions at 04:00 and 08:00 – conditions not improved; heavy swell.

Check weather at 12:00; swell still too high for safe working. Revise plans and steam for shallow water (site NS200), in the hope of being able to use the Day grab earliest as the sea state improves.

On arrival at site NS200 conditions have abated sufficiently to begin Day grab operations immediately. The grab is deployed as Stn 57082#1 and returns a good sample that is taken as 0.1 MAC. The grab is redeployed as Stn 57082#2, again returning a good sample that is taken for HC, HM, PSA and BGS-geol. Stow USBL probe, sheave and crane and echo-sound towards site NS300 to locate the 250m contour and a position for site NS250.

At site NS250 deploy Day grab as Stn 57083#1, it returns a good sample that is taken as 0.1 MAC. Redeploy grab as Stn 57083#2, again it returns a good sample that is taken for HC, HM, PSA and BGS-geol. Stow USBL probe, sheave and crane and head for site NS300.

At site NS300 deploy Day grab as Stn 57084#1, it returns with a minimal scraping of sediment that is discarded. Redeploy grab as Stn 57084#2, returning a good sample that is taken as 0.1 MAC. Redeploy the grab again as Stn 57084#3, producing another good sample that is taken for HC, HM, PSA and BGS-geol. Stow USBL probe, sheave and crane and steam for site NS350.

At site NS350 deploy box corer as Stn 57085#1, it returns a good sample, though inevitably the top water is cloudy given the rough recovery with the crane.

Saturday 17 August.
The box core (Stn 57085#1) is processed for HC, HM, PSA, 0.1 MAC, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and steam for NS450.

At site NS450 deploy box core as Stn 57086#1, it returns a good core that is processed for HC, HM, PSA, 0.1 MAC, BGS-geol and SOC-geol. Stow USBL probe, sheave and crane and steam for NS550.

At site NS550 deploy Megacorer as Stn 57087#1, it returns 1/10 good cores with the others very short or washed out (not enough penetration); the single good core is taken as PSA. Redeploy the corer as Stn 57087#2, it returns 8/8 good cores that are all taken as 8xMAC. Stow USBL probe, sheave and crane and steam for NS650.

At site NS650 deploy Megacorer as Stn 57088#1, it returns 10/10 good cores that are taken for PSA, 8xMAC and BGS-geol. Stow USBL probe, sheave and crane and steam for NS900.

At site NS900 release and recover amphipod trap (Stn 57077#1) and then deploy gravity corer as Stn 57089#1. The corer returns a good core of c. 1.5m. Stow sheave and crane and steam for NS950.

At site NS950 deploy gravity corer as Stn 57090#1 it returns a good core of c. 1.5m. Stow sheave and crane and head for site NS1000.

At site NS1000 deploy gravity corer as Stn 57091#1, it returns a good core of c. 1.5m. Stow sheave and crane and head for site NS850.

At site NS850 deploy gravity corer as Stn 57092#1, it returns a good core of c. 1.5m. Stow sheave and crane and head for site NS800.

At site NS800 deploy gravity corer as Stn 57093#1, it returns a good core of c. 1.5m. Stow sheave and crane and head for site NSCS4.

At site NSCS4 deploy WASP as Stn 57094#1 for a surprisingly gentle 30 min tow given the worsening weather; video problem?, film run. Stow USBL probe, sheave and crane and steam for NSCS6.

Sunday 18 August.
Arrive at site NSCS6 at c. 02:30, but ship's motion is too excessive for safe operations. Heave to, to await better conditions.

At c. 06:30 conditions have improved sufficiently, and WASP is deployed at site NSCS6 as Stn 57095#1 for a relatively gentle 30 minute tow; video problem?, film run. Stow sheave and crane and echo-sound towards site NSAS6 to locate the 800m contour and a position for new site NSAS7 (improving depth achieved for NSAS6).

At site NSAS7 deploy Megacore as Stn 57096#1, it returns 8/8 good cores that are all taken as 8xMAC. Redeploy corer as Stn 57096#2, it returns 8/8 good cores that are taken for HC, HM, PSA, BGS-geol and SOC-geol. Two stainless steel core tubes fitted to the last drop (57096#2) will be returned to SOC intact for a trial of a new sediment acoustic properties system[14]. Stow USBL probe, sheave and crane and steam for site NSPM7.

[14] Contact: Dr Angus Best, Challenger Division for Seafloor Processes, Southampton Oceanography Centre

At site NSPM7 deploy WASP as Stn 57097#1 for a somewhat swelly tow of 65 mins; film and video run. From the WASP recovery point prepare to deploy the Widescan system and tow inshore.

Widescan is deployed (site WS3) as station 57098#1 and towed for c. 3 hours between soundings of c. 250 and 200m. At end of Widescan line deploy WASP (site NSW1) as Stn 57099#1 for a fairly gentle 65 min tow; video problem?, film run. Stow USBL probe, sheave and crane and head for site NS150.

Monday 19 August.
At site NS150 deploy the Day grab as Stn 57100#1, it returns a good sample that is taken for HC, HM, PSA and BGS-geol. Redeploy the grab as Stn57100#2, again it returns a good sample that is taken as 0.1 MAC. Stow sheave and crane and steam for site NSPM11 (new site to improve depth previously achieved).

Just short of site NSPM11 deploy the amphipod trap as Stn 57101#1. Position on site NSPM11 and deploy the Day grab as Stn 57102#1, it returns with a good sample that is taken for 0.1 MAC. Redeploy the grab as Stn 57102#2 and yet again it returns a good sample that is taken as HC, HM, PSA and BGS-geol. The nightwatch have now had 100% success with the Day grab for the duration of the cruise – they have not seen a failure!

In the vicinity of site NSPM11 deploy WASP as Stn 57103#1 for an extended run (c. 2-hours) for additional photographs; 65 mins DV run and some 550 frames taken.

Recovery the amphipod trap (Stn 57101#1) after an initial illusory release, it returns a good writhing catch in the DEMAR cage, but next to nothing in the VET cage. Stow USBL probe, sheave and cane and head for site NSW2.

At site NSW2 deploy WASP as Stn 57104#1 for a gentle 1-hour tow; 65 mins of DV and film run. Stow USBL probe, sheave and crane and steam for site NSW3.

At site NSW3 deploy WASP as Stn 57105#1 for a gentle 30 minute tow; film and video run. Stow USBL probe, sheave and crane and steam for site NSPM2.

At site NSPM2 deploy WASP as Stn 57106#1 and carry out an extended run for additional photographs beyond the nominal 30 minutes of video remaining tow; film and video run. There being insufficient time remaining to complete any further operations, all gear is secured, the survey ends and we set on course for the Port of Leith at c. 23:30.

20-22 August.
Tuesday. Continuing on passage to Leith. Science wash up meeting held and audit of samples collected made. Cleaning up and packing proceed. *Wednesday.* Dock Leith c. 16:30, with a barbeque on deck shortly afterwards. *Thursday.* Demobilisation commences, and is completed c. 13:00. Scientific party disperses.

5.2. Acknowledgements

I would like to thank the ship's entire compliment for making this a successful cruise. I should particularly thank Ben Boorman and Jez Evans for providing round-the-clock winch operations and other technical support.

6. SURVEY DESIGN (see Figure 1)

In general, the primary objective of the various surveys planned is to establish a regional description of the current state of the seabed environment. This basic objective encompasses both the need for "baseline" environmental data and the need to identify larger-scale regional environmental patterns and processes. Other study area specific objectives are considered in the designs below. Where appropriate all of the proposed work will be carried out using the protocols developed for the AFEN 1996 and 1998 surveys. The various studies have been tailored to compliment the existing data and other information from the AFEN surveys and the DTI 1999 and 2000 surveys.

6.1. Tampen Slide (see Figure 2)

The Tampen Slide area survey was not pre-planned but based on the results of leg 1 (e.g. swath bathymetry and backscatter). The work progressed in an initial large-scale exploratory mode at sites as follows:

NSTS1	channel thalweg c. 1800m
NSTS2	adjacent slope c. 1800m
NSTS3	low backscatter area of Tampen Slide scar (i.e. north of scarp) c. 2060m
NSTS4	background slope environment south of scarp c. 2060m
NSTS5	high backscatter area south of scarp c. 2060m
NSTS6	slight high above major scarp, previously identified as diapir-type terrain from TOBI DTI '99 (near WASP run from same), c. 2160m
NSTS10	in vicinity of previous WASP (DTI '99) showing diapir-type blocks, c. 2150m
NSTS7	high backscatter area immediately below (i.e. north of) of the steep scarp, c. 2320m
NSTS8	low backscatter area in slide scar c. 2320m
NSTS9	background area in slide scar c. 2320m

A complete set of standard samples (e.g. HC, HM, PSA and MAC) was obtained from each site, as were geology samples (including three gravity cores, NSTS7-9). Visual surveys of the seabed (WASP) were carried out at sites NSTS5-9.

6.2. Faroe Platform North (see Figure 3)

Sites FPN1100, 1400 and 1800 were previously investigated during the DTI 1999 survey (RRS *Charles Darwin* cruise 119) and were successfully re-occupied to obtain biological samples, representing a bathymetric transect down the northern slope of the plateau just within the UKCS.

6.3. Pilot Whale Diapirs (see Figure 4)

The Pilot Whale Diapirs area survey was not pre-planned but based on the results of leg 1 (e.g. swath bathymetry and backscatter). The work progressed in an initial large-scale exploratory mode; sites were selected to investigate the backscatter variations by means of common depth comparators in the surrounding area.

NSDS1	background area, c. 1540m
NSDS6	low backscatter halo, c. 1540m
NSDS2	background area, c. 1640 m
NSDS3	low backscatter halo, c.1640m
NSDS4	low backscatter area, diapir central low, c. 1600m
NSDS7	high backscatter patch within halo, c. 1600m
NSDS8	low backscatter halo, c. 1600m
NSDS9	background area, c. 1600m
NSDS5	diapir major topographic high
NSDS10-14	exploration of SW sub-feature
NSDS15-17	exploration of NE low relief sub-feature

A complete set of environmental samples (e.g. HC, HM, PSA and GEOL) was obtained from each site; macrobenthos samples were obtained from sites NSDS1-10 and 16 (an additional qualitative sample was obtained from site NSDS13). Visual surveys of the seabed (WASP) were carried out at sites NSTS7, 10 and 13.

6.4. North Shetland Slope (see Figure 5)

The North Shetland Slope survey was undertaken as a number of planned sub-studies as detailed below. These were designed in particular bathymetric intervals to acknowledge the likely strong control on region ecology exerted by water column temperature regime (see Figure 6) as previously noted West of Shetland[15].

North of Shetland transect (NS sites)
A bathymetric transect of the North Shetland Slope to act as a comparator to the West of Shetland transect sampled during the AFEN 1996 and 1998 surveys and the DTI 2000 survey (RRS *Charles Darwin* cruises 101, 112 and 123). Sites were occupied at 50m intervals from 150-700m (NS150-NS700) and at 100m intervals to 1000m (NS800, 900 and 1000). Two additional sites (NS850 and 950) were sampled to provide further coverage for the contourite study (see below). Macrobenthos and particle size samples were obtained from all of the primary sites (i.e. excluding NS850 and 950); see Section 8 for full details of all samples retained.

[15] Bett, B.J., 2001. UK Atlantic Margin Environmental Survey: introduction and overview of bathyal benthic ecology. *Continental Shelf Research*, **21**, 917-956.

Iceberg ploughmark zone (NSPM sites)
A survey of the upper slope (iceberg ploughmark zone) was undertaken to enhance general coverage in this area to a level comparable to that available for the West of Shetland area (i.e. AFEN 1996 survey). Five and six sites, respectively, were randomly located in two depth strata (100-200m; NSPM1, 3-5, 11) (200-300m; NSPM2, 6-10). A complete set of standard samples (e.g. HC, HM, PSA and MAC) was obtained from each site. In addition, six WASP deployments were carried out in the iceberg ploughmark zone (sites NSPM2, 7 and 11, and NSW1-3).

Alongslope study (NSAS sites)
The alongslope study was designed to examine potential systematic variation in sediment particle size distributions between North and West of Shetland studies (see Figure 7). This variation is thought to influence the species composition of the macrobenthos in the region[16]. A six site transect was established along the 800m isobath to examine the potential variation in sediments and macrobenthos across the transition from open basin conditions North of Shetland to channel conditions West of Shetland. Note that site NSAS6 was initially located based on GEBCO bathymetry, and was subsequently replaced by site NSAS7. A complete set of standard samples (e.g. HC, HM, PSA and MAC) was obtained from each site, as were geology samples. (For subsequent analysis purposes, note that site NS800 provides macrobenthos and sediment particle size samples from the same isobath).

Contourite study (NSCS sites)
A study of a suspected contourite band was undertaken in a parallel fashion to the alongslope study (see above), with sites located on the 900m isobath. Note that no site NSCS2 was occupied, as samples are already available from an appropriate location surveyed during DTI 2000. A complete set of standard samples (e.g. HC, HM, PSA and MAC) was obtained from each site, as were geology samples. Visual surveys of the seabed (WASP) were also carried out at each site occupied (NSCS1, 3-6). (For subsequent analysis purposes, note that site NS900 provides macrobenthos and sediment particle size samples from the same isobath).

Other operations
a) A limited series of sidescan (Widescan) sonar surveys were also undertaken in the North Shetland Slope area. The three deployments were designated ‘sites’ WS1-3. Consult Sections 9 and 10 for further details.
b) An amphipod trap (see Figure 80) was opportunistically deployed at three location (sites AT1, AT2 [NS900], AT3 [NSPM11]).

[16] Bett, B.J., 2001. UK Atlantic Margin Environmental Survey: introduction and overview of bathyal benthic ecology. Continental Shelf Research, 21, 917-956.

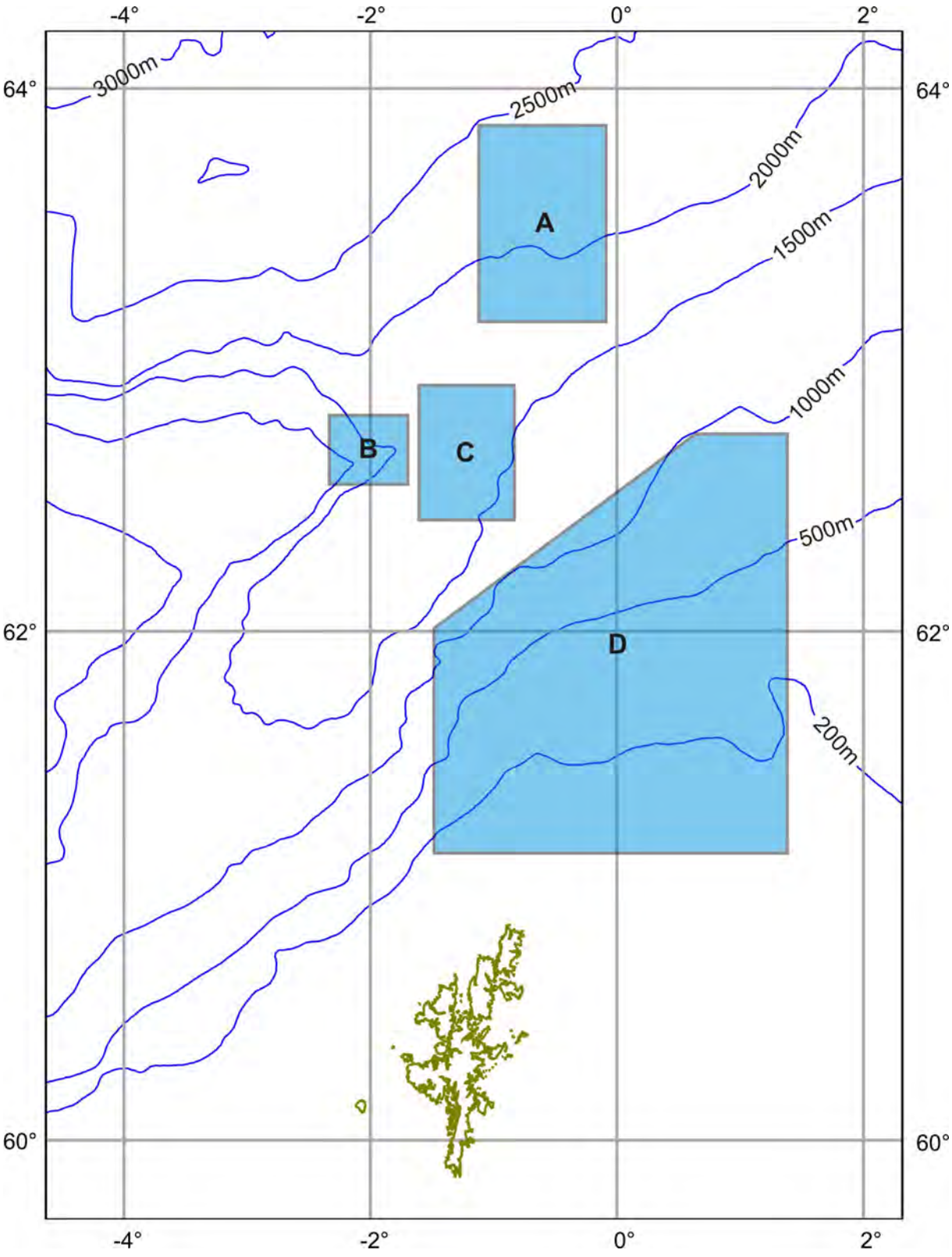


Figure 1. S/V *Kommandor Jack* cruise 2002 leg 2. Indicating survey areas in the North of Shetland region (Norwegian Basin): A, Tampen Slide; B, Faroe Plateau North; C Pilot Whale Diapirs; D, North Shetland Slope.

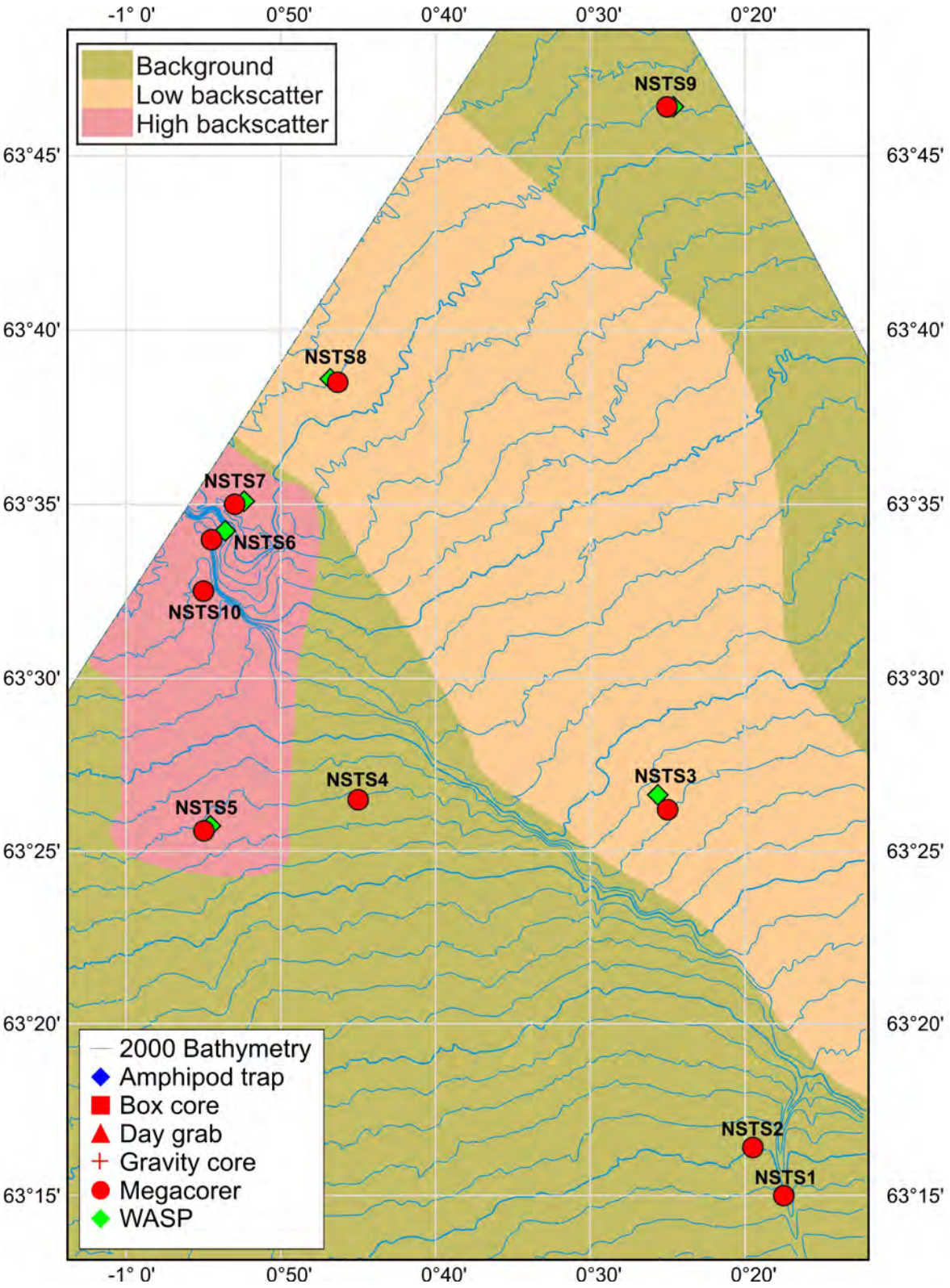


Figure 2. Survey sites in the Tampen Slide area.

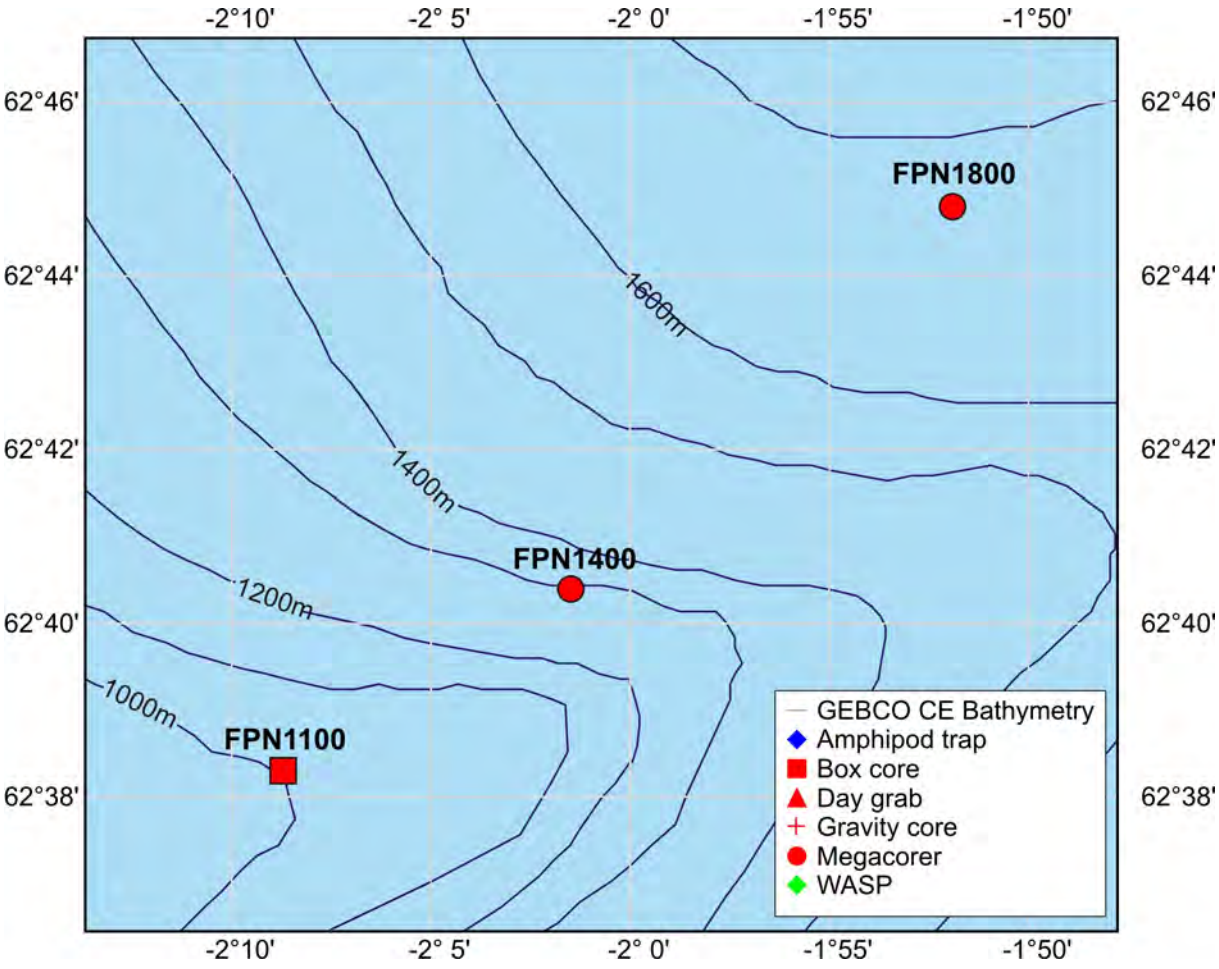


Figure 3. Survey sites in the Faroe Platform North area.

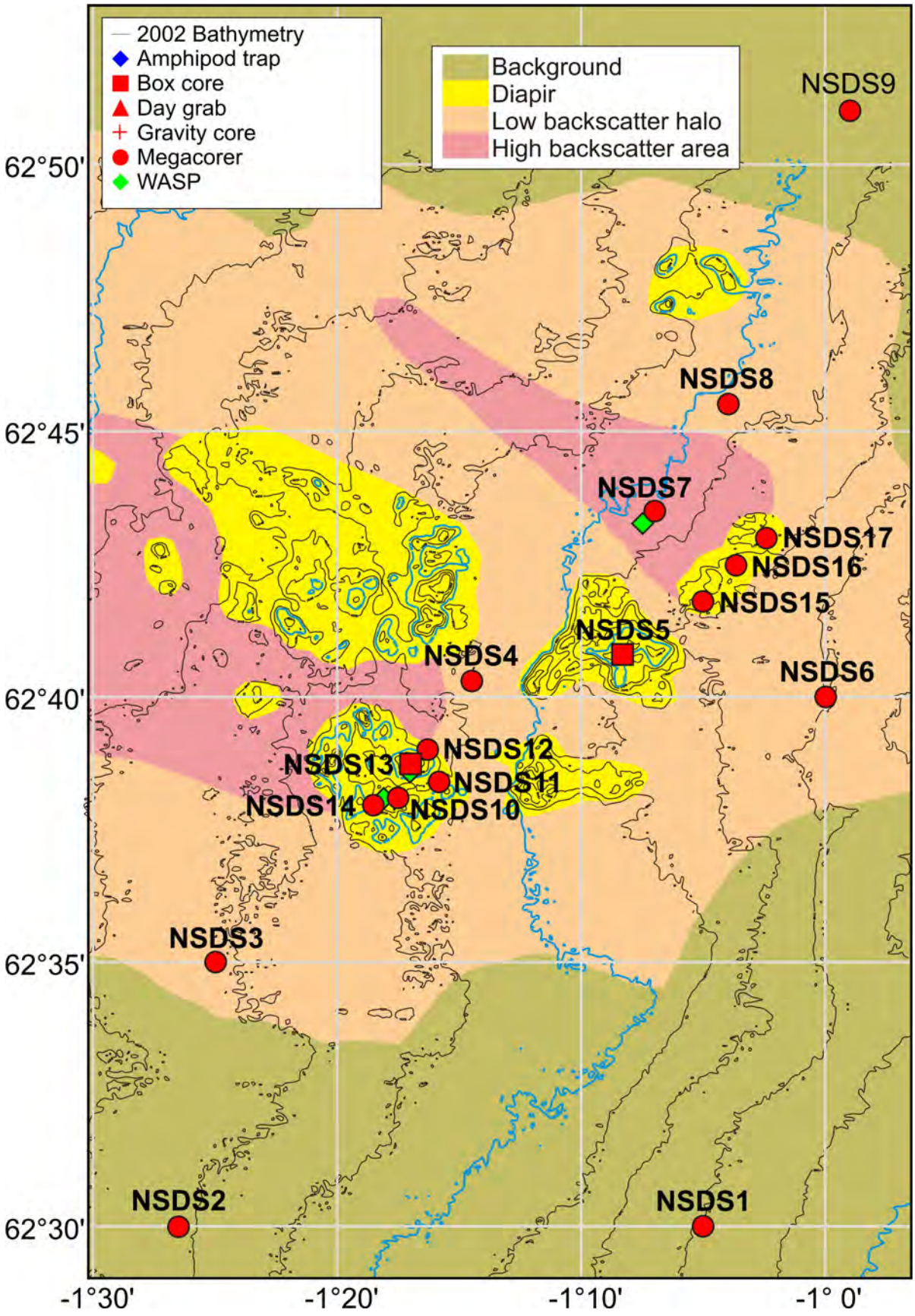


Figure 4. Survey sites in the Pilot Whale Diapirs area.

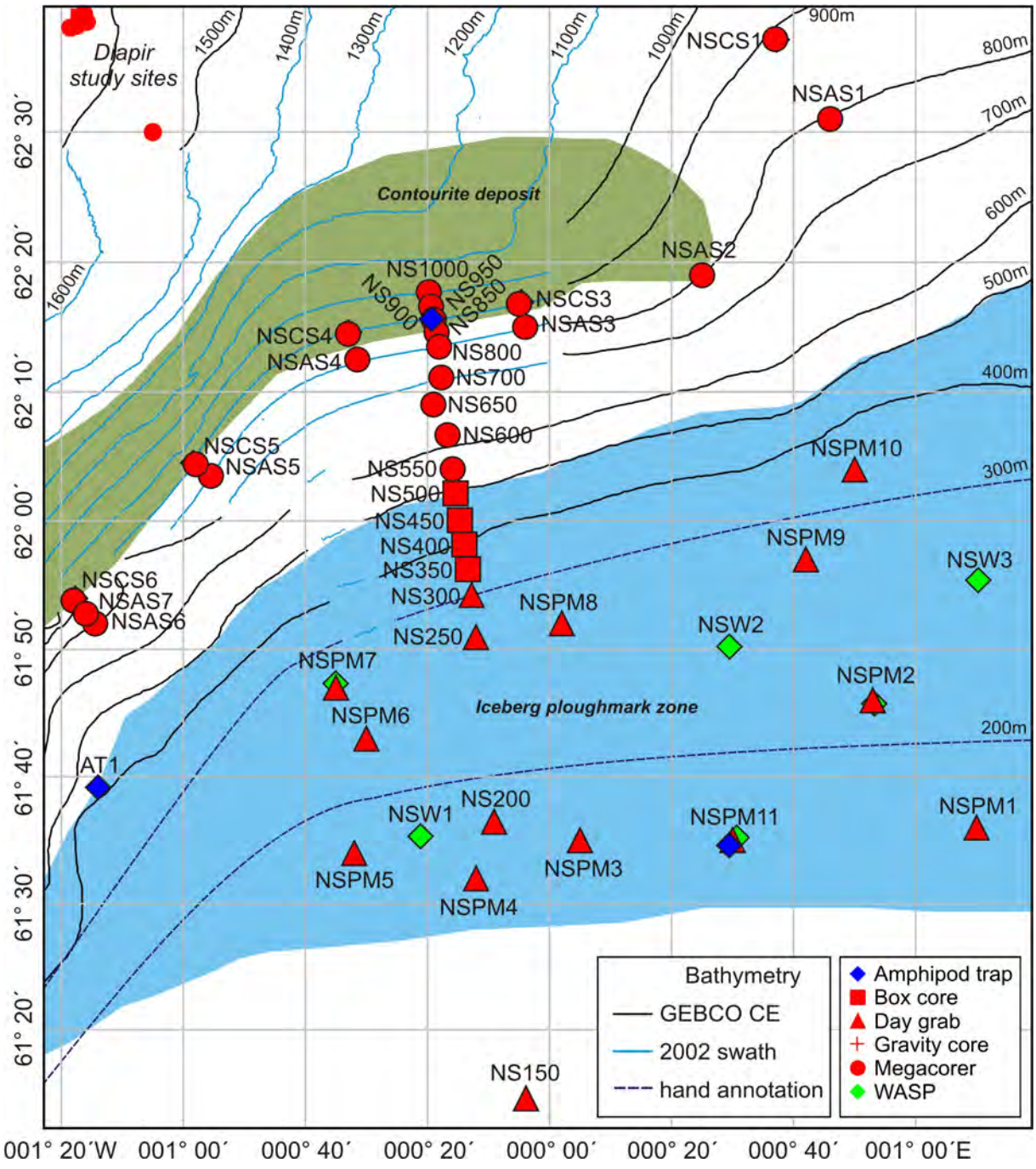


Figure 5. Survey sites in the North Shetland Slope area.

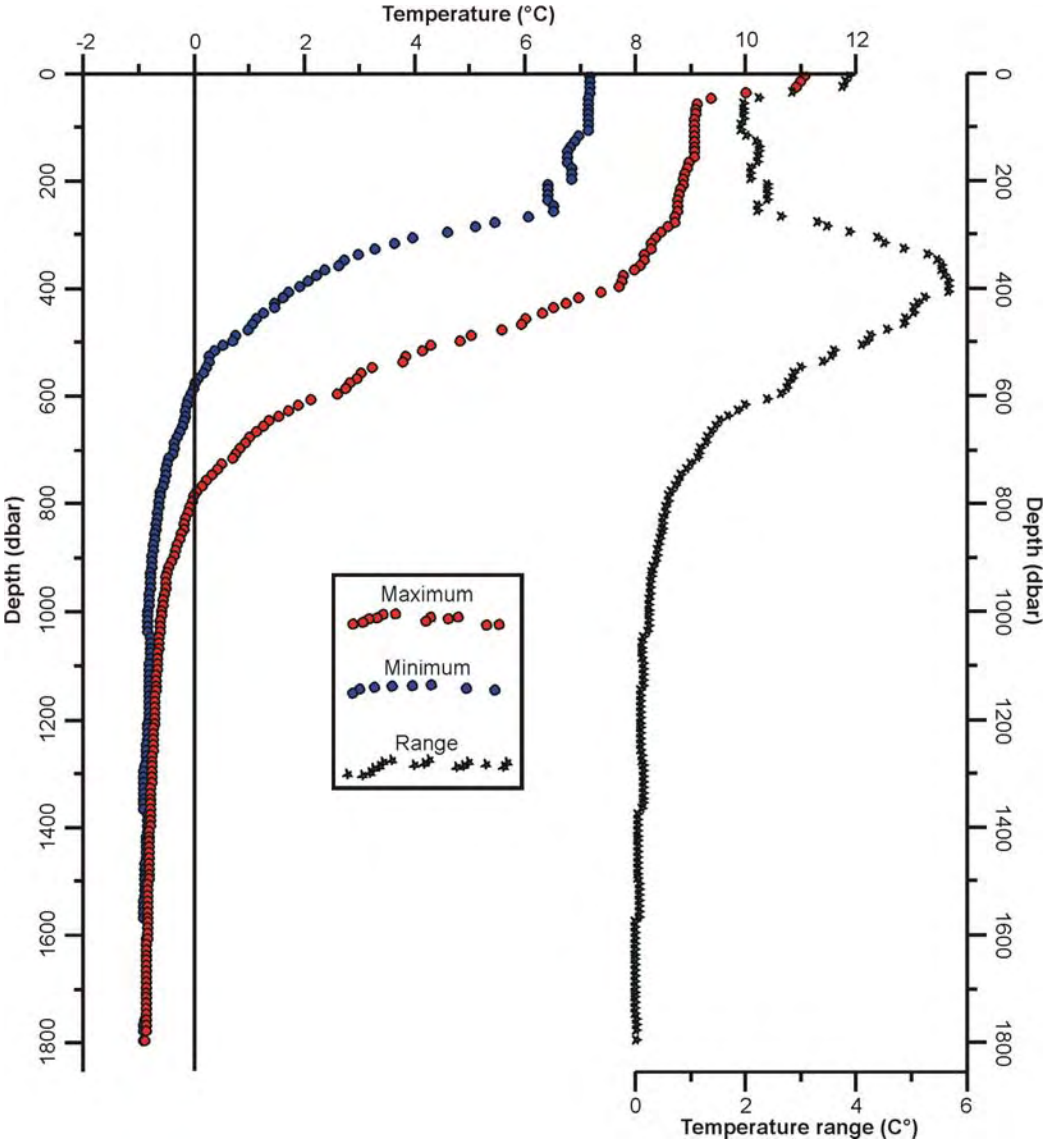


Figure 6. Water column temperature regime in the North Shetland Slope area. Derived from a British Oceanographic Data Centre CTD data search incorporating the following datasets:

Dataset	Lat.	Long.	Date	Time (UTC)	Sounding (m)	MinCTD Depth(m)	MaxCTD depth(m)	CruiseID
1	62.0066	-1.9383	24-May-1987	16:17	1579	2.5	1546.7	CR15/87
2	61.88	-1.66	24-May-1987	19:50	1359	2.5	1350	CR15/87
3	61.77	-1.33	24-May-1987	22:58	691	2.5	679.8	CR15/87
4	61.6716	-1.015	25-May-1987	01:41	341	2.5	329.1	CR15/87
5	61.5752	1.9593	14-Dec-1996	16:12	332	1	309.8	SC1996
6	62.5333	0.0268	07-Dec-1998	04:06	1103	2	1017.6	2098S
7	63.6578	0.0693	07-Dec-1998	12:25	2260	1	1751.3	2098S
8	63.6468	0.6345	07-Dec-1998	23:37	1400	2	1122.9	2098S
9	63.9025	1.7782	30-Apr-2000	02:50	1813	2	1766	GS06/00
10	63.8925	1.8018	22-Jul-2000	10:31	1794	2	1751.3	GS08/00
11	63.8983	1.805	30-Nov-2000	23:06	1820	4	1770.9	JH15/00
12	63.8983	1.8047	09-Jan-2001	05:58	1790	4	1738.5	JH01/01
13	63.8992	1.7983	16-Mar-2001	18:45	1797	5	1585.3	JH03/01
14	63.8955	1.7997	05-May-2001	18:02	1795	3	1727.7	JH06/01
15	62.0018	-0.4953	11-Dec-2001	20:25	506	1	487.7	1801S
16	62.0038	0.244	12-Dec-2001	00:08	360	1	338.4	1801S

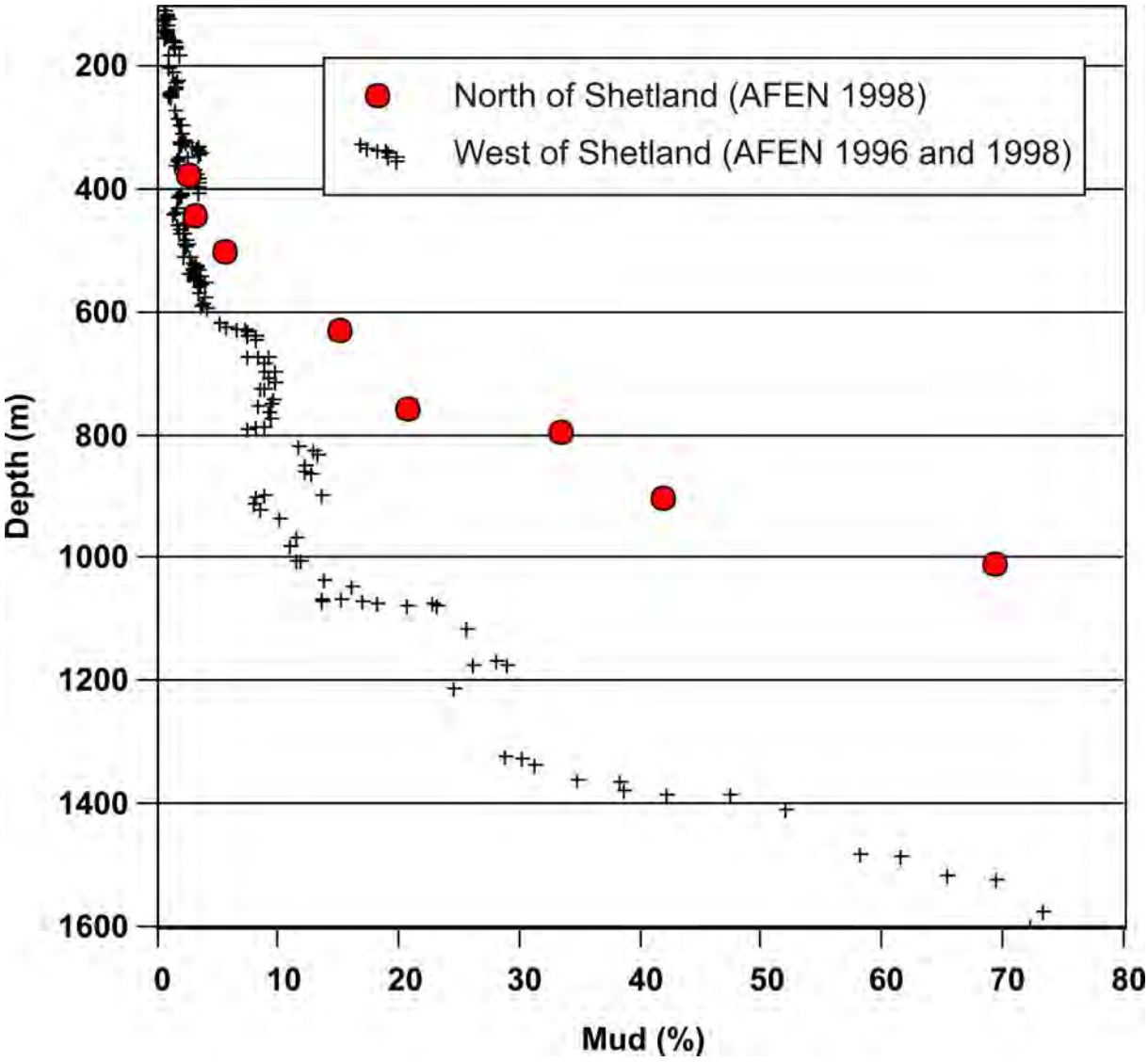


Figure 7. Apparent variation in sediment mud content (% <63µm) between North and West Shetland areas suggested by AFEN 1996 and 1998 data. (Note that the West of Shetland data is illustrated as a smoothed moving average by depth).

7. SAMPLING EQUIPMENT & PROTOCOLS

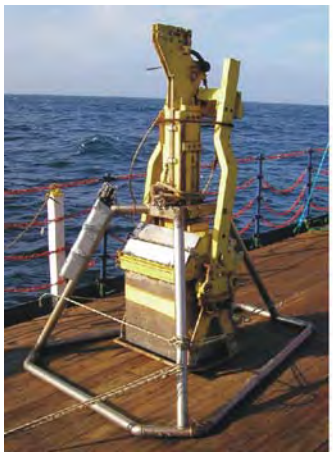
7.1. Sampling Equipment

Day Grab

A standard 0.1 m² Day grab, supplied by RVS[17], was employed during the cruise; it was generally rigged and deployed in the conventional manner. A total of 34 Day grab deployments were made during the cruise, of which 30 produced useful samples (i.e. 88% success). This was a substantially higher success rate than during previous AFEN and DTI surveys, this may be attributed to use of a 'heavy' coring warp rather than a 'light' "hydro wire" as previously used with the Day grab.

Box core

A modified USNEL-type 0.25 m² spade box core, supplied by RVS, was used during the survey; it was rigged and deployed in the conventional manner. A total of 8 box core deployments were made during the cruise, of which 6 produced useful samples (i.e. 75% success).



[17] Now the National Marine Facilities Division at the National Oceanography Centre, Southampton.

Megacorer

A Bowers & Connelly Megacorer, supplied by the DEEPSEAS Group[18], equipped with up to twelve 10cm internal diameter cores was used during the survey. Generally the corer was rigged and deployed in the conventional manner, with the number of coring units on the head and the ballast load varied to suit seabed conditions. A total of 98 Megacorer deployments were made during the cruise, of which 91 produced useful samples (i.e. 93% success).

WASP

The WASP camera platform, supplied by the DEEPSEAS Group, was used during the cruise. Briefly, WASP is a self-contained, off-bottom, towed camera vehicle that provides still and video footage of the seabed, and is capable of operation to 6,000m water depth on a simple mechanical cable (i.e. conducting or fibre-optic cable not required). As deployed during this cruise, WASP was fitted with: OSIL Mk7 (stills) camera, OSIL 1200J flash gun, SOC OceanCam6000V (digital video) camera, 2 x 250W DSPL video lamps, 3 x DSPL 24V batteries, Simrad Mesotech 200kHz altimeter, and a SOC acoustic telemetry system (10kHz). Data from the altimeter is telemetered to a ship borne display enabling the operator to make fine adjustments of the amount of cable deployed with the aim of keeping the vehicle at c. 3m above the seabed. The still and video cameras are both automatically activated by the altimeter when the range to the seabed is <10m. For all deployments made during the cruise, the still camera was loaded with 30m of Kodak Vision 250D (colour negative film) and the video camera loaded with a 63 minute MiniDV tape.

[18] www.soc.soton.ac.uk/obe/PROJECTS/DEEPSEAS/

The acoustic telemetry from WASP was monitored using a “Waterfall” display system (PC-based continuous display of acoustic signals) fed from a receiver box (providing timing and signal attenuation controls) connected to a submerged transducer (IOS ‘Dolphin’).

WASP was deployed 20 times during the cruise, in all cases returning still film and in all but two cases video film. In 14 cases film and video was recovered, in four cases only film, in one case video only, and in one case no film or video.

Operators notes: At first trial start up no flash fires were seen, the camera to flash lead was replaced by a new cable. At subsequent start up, flashes were seen, but not enough / at the correct intervals. On next start up for deployment (Stn 57009#1) only one flash fire was seen. Acoustic telemetry was good via the dolphin and midwater group Mk5 deck unit and waterfall. However, no camera data requests were seen, suggesting that the Mk7 was not running (indeed no film was run underwater). The video was, however, successful. On recovery the video lamps appear to have switched on just below the surface or immediately on surfacing, switching off just as WASP was landed on deck. The intended subsequent deployment was abandoned, when on start up the video lamps turned on. A number of trial start ups were then tried; on each occasion the lamps lit (now in buckets of water) for the two minute start up sequence then went out. A cause might be the pressure switch. Wiring to the switch was too tight for the switch to be removed for test. Instead the video control / power boards were opened and the two wires from the switch traced to a joint (component), resistance was tested at this point; with the switch open resistance was 600ohms, with the switch closed resistance was a few ohms. On further advice from shore-side the test was repeated on voltage with one battery connected to the system. This suggested that there was a resistance path through the switch when it was open, i.e. probably seawater.

The switch was disconnected from the video control circuit boards and removed for inspection. The switch had indeed leaked and was wet inside, with corrosion on at least the low pressure sealing face. The switch was cleaned and dried then reassembled and refitted to the system. Several deck tests suggested that it was now functioning as a switch in air. Attention then moved to the failure of the Mk7 still camera. No problem was immediately apparent. The system was eventually fully reconnected with the Mk7 exposed to view the LCD panel. On start up the LCD indicated “no film of film ended”. This had not occurred during any of the preceding bench tests. The camera was opened but there was no film jam and no obvious over tension in the system. The film transport mechanism was dismantled. The only apparent fault was that the take-up spindle was a little “sticky”. It and its bush were cleaned and the camera re-assembled. The apparent film jam clear immediately on a motor wind and the camera was reloaded for the next deployment.

When all fully re-assembled a number of trial start-ups were performed; during these the flash fired normally during the test sequence, suggesting that the problem with the Mk7 was cured; however, on these start-ups the video lamps lit, indicating that the pressure switch was no longer functional even in air. Therefore, for the second deployment the video lamps were disconnected at start-up and only reconnected after the test sequence. The lamps did turn on during the launch, but appeared to be successfully hosed down to provide cooling.

During second WASP run there were again no camera data requests suggesting that the Mk7 was not running. On recovery the camera had again only taken 28 shots, and was giving the “no film of film ended” error. This could not be cleared with several motor winds, film reloads nor disassembly and “tweaking” the film transport mechanism. Eventually the front

end of the camera was disassembled to expose the film gate, and this area given a good clean including the photodiodes etc that detect film presence and passage. On reassembly the "no film of film ended" error clearer immediately and the camera ran a full 30m length of film on the bench. The video camera also failed during this deployment. It shot only the vehicles launch and subsequent touch down on deck; there was no underwater footage. There is no apparent cause for this, but possible suspicion that the wet pressure switch may have caused the problem. The pressure switch was disconnected and wired ON inside the pressure casing.

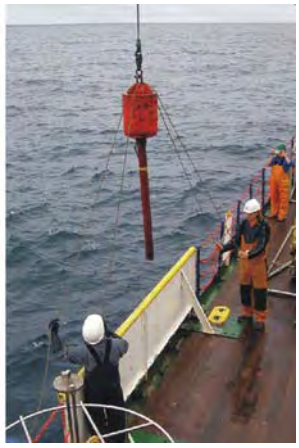
With the above fixes to both cameras the WASP system was prepared for another deployment as normal. Prior to launch all connections were made bar the battery to flash (i.e. supplying power to the monitor) and the video lamps. For this launch, the lamp leads were left disconnected at start up and the vehicle swung outboard before the lamps were connected. This deployment proved to be a difficult tow (see narrative), but camera data requests occurred suggesting that the Mk7 was running. On recovery the Mk7 had run an appropriate number of shots (217) and was not showing the "no film of film ended" error. The video, however, had run the full 65 minutes prior to launch; i.e. while powered up, but with the monitor not powered and switched off. Why this should occur is uncertain, but may be linked to the now permanently ON pressure switch.

For the following deployment (57042#1) no further mods were made to the cameras and only the launch procedure was altered. No connections to the video camera were made at assembly; none of the batteries were plugged in. Immediately prior to launch all three batteries were plugged in and the monitor switched on. Five test flashes were seen on start up and the vehicle swung over the side. Monitor to video and video lamps connections were then made (the forward lamp lit briefly at connection). The deployment then proceeded as normal. On recovery the full 65 mins of DV had run, all apparently at the seabed. The Mk7 still camera indicated 353 frames shot, consistent with a full hour of bottom photographs.

Gravity corer

A gravity corer (500kg bomb, 1.5m barrel), supplied by BGS[19], was used during the cruise. The corer was deployed 9 times, in all cases producing useful samples.





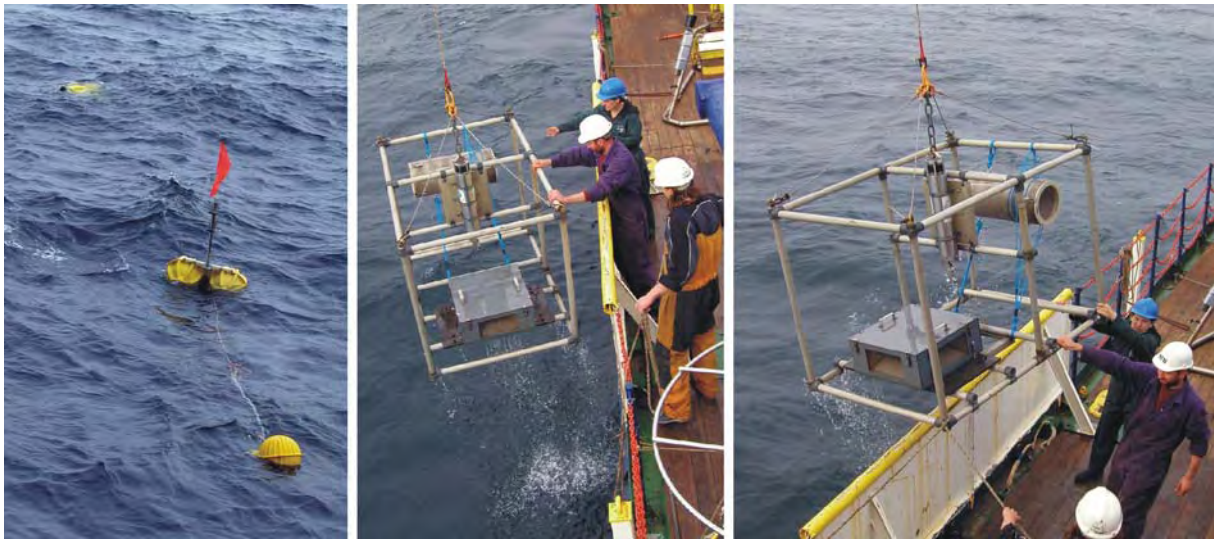
Widescan

A Widescan sidescan sonar towfish (100 and 325kHz) was deployed on three occasions, returning useful data from the upper slope area of the North Shetland Slope.

[19] British Geological Survey (www.bgs.ac.uk)

Amphipod trap

A free-fall amphipod trap system (see Figure 8), supplied by the DEEPSEAS Group, was deployed opportunistically on three occasions.



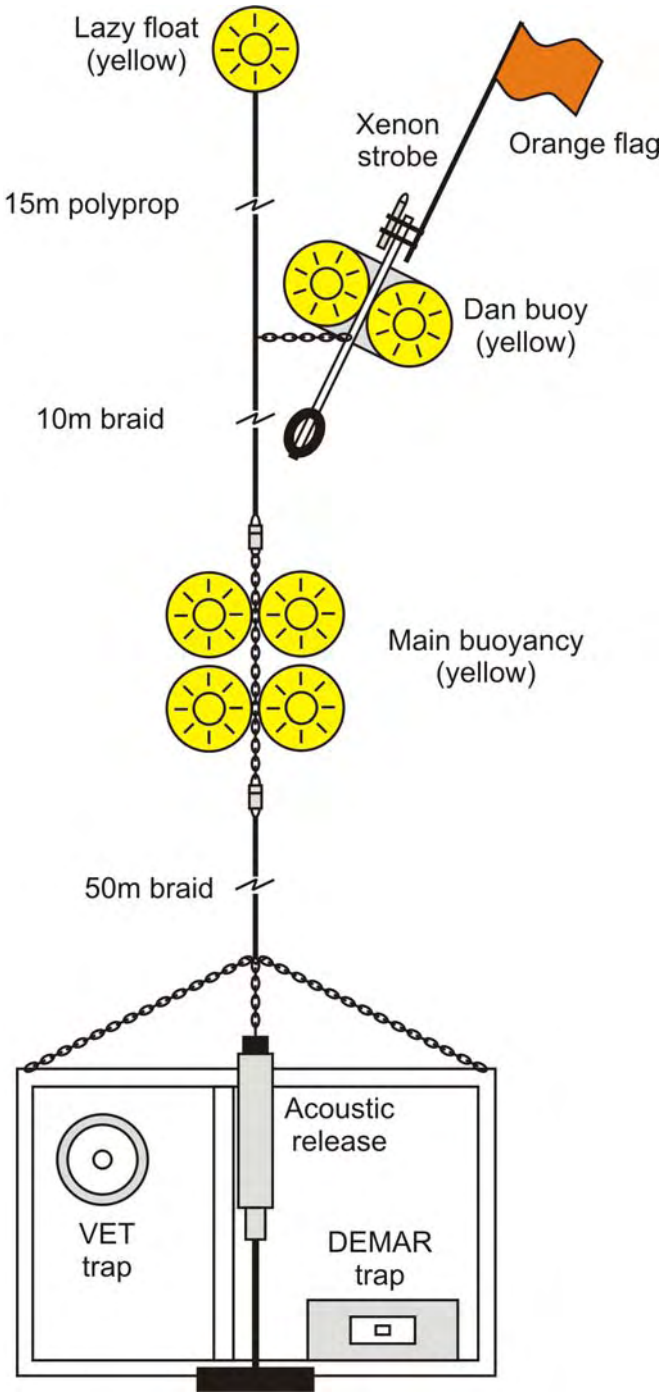


Figure 8. Schematic of amphipod trap equipment and associated mooring.

7.2. Sampling Protocols

'Standard' sampling protocol

As far as possible standard sampling protocols followed (or were consistent with) those of earlier 'Atlantic Margin Environmental Survey' cruises (AFEN'96[20] and '98[21], DTI '99[22] and 2000[23]). Of necessity, variant protocols were followed for samples from the Megacorer, box corer and Day grab.

Megacorer

On recovery of the corer, the function of each coring unit was checked and recorded. Core lengths were measured and recorded and any surface and profile features noted. Sample acceptance was based on the following criteria: cores >10cm in length; core surfaces essentially level; and, the sediment-water interface intact. The latter criterion was partly relaxed where localised disturbance had been caused by the dislodgement of gravel during core penetration. Acceptable cores were removed from the corer and transferred to the ship's laboratories for subsequent processing. In all cases, processing began with the careful removal of the supernatant water using gentle overflow, pump siphon and / or syringe as appropriate to the sediment type.

For macrobenthos samples, cores were further processed as follows. Cores were extruded (by plunger from below) and the 0-10cm horizon sectioned off. Corresponding horizons from successive cores were pooled to produce a nominal sample size of eight cores. Macrobenthos samples were then elutriated through a 500µm mesh sieve. The resultant residue was fixed and preserved in 10% borax buffered formalin.

Hydrocarbon samples were processed by extruding the cores into a pre-cleaned metal collar and sectioning off the 0-2 cm horizon. The samples were preserved, in pre-cleaned glass pots, by freezing at -20ºC.

Heavy metal samples were processed by extruding the cores into a pre-cleaned polycarbonate collar and sectioning off the 0-2cm horizon. The samples were preserved, in pre-cleaned polycarbonate pots, by freezing at -20ºC.

Particle size samples were processed by extruding the cores into a polycarbonate collar and sectioning off the 0-5cm horizon. The samples were preserved, in polythene bags, by freezing at -20ºC. This material was also used to provide a total organic carbon and nitrogen sample.

Box corer

On recovery of the corer, its function was checked and recorded. If, on inspection through the top vents, the core appeared to be acceptable, the box and spade were dismounted and moved to a clear deck space. Sample acceptance was based on the following criteria: cores >10cm in

[20] Bett, B.J. et al., 1997 RRS *Charles Darwin* Cruise 101C Leg 2, 14 Jul-20 Aug 1996. Atlantic Margin Environmental Survey: seabed survey of the shelf edge and slope west of Shetland. Southampton, UK, Southampton Oceanography Centre, 127pp. (Southampton Oceanography Centre Cruise Report, 7)

[21] Bett, B.J. et al., 1999. RRS *Charles Darwin* Cruise 112C, 19 May-24 Jun 1998. Atlantic Margin Environmental Survey: seabed survey of deep-water areas (17th round Tranches) to the north and west of Scotland. Southampton, UK, Southampton Oceanography Centre, 171pp. (Southampton Oceanography Centre Cruise Report, 25).

[22] Bett, B.J., Jacobs, C.J. et al., 2007. RRS *Charles Darwin* Cruise 119C Leg B, 13 Aug - 14 Sep 1999. White Zone (WhiZ) environmental survey: seabed survey of the deep waters to the north and west of Shetland. Southampton, UK, National Oceanography Centre Southampton, 120pp. (National Oceanography Centre Southampton Cruise Report, 19)

[23] Bett, B.J. et al., 2007. RRS *Charles Darwin* Cruise 123C3-4, 19 Jul - 15 Sep 2000. Atlantic Margin Environmental Surveys and North Sea Environmental Surveys. Southampton, UK, National Oceanography Centre Southampton, 221pp. (National Oceanography Centre Southampton Cruise Report, 20)

length; core surfaces essentially level (excepting relief deemed to be natural); sediment surface covering the full cross-sectional area of the box (excepting limited, 5cm or less, lateral compression); and, essentially clear supernatant water (limited resuspension, particularly following a recovery that crashed the box core off the ship's hull was deemed acceptable). Processing of acceptable cores started with the division of the core's surface into macrobenthos and chemistry areas. A metal insert of either 0.1m² or 0.15m² was pushed into the sediment with one of its edges against one side of the box. The open sediment area and that enclosed by the insert were then separately drained of supernatant water using a pump siphon. The overlying water from the 0.1m² area (whether enclosed or open) was drained through a 500µm sieve and any residue subsequently combined with the 0-10cm sediment layer (see below). The overlying water from the 0.15m² area (whether enclosed or open) was drained to waste. Once drained, the surface of the core was examined and a record made of any surface features and / or fauna of note.

For macrobenthos samples, cores were further processed as follows. The front of the box was removed and the sediment underlying the 0.1m² area trowelled out from the 0-10cm horizon. Macrobenthos samples were then elutriated through a 500µm sieve mesh. The resultant residue was fixed and preserved in 10 % borax buffered formalin.

Hydrocarbon samples were collected from the 0.15m² area using a pre-cleaned metal scoop to a nominal depth of 2cm. The samples were preserved, in pre-cleaned glass pots, by freezing at -20ºC.

Heavy metal samples were collected from the 0.15m² area using a pre-cleaned plastic scoop to a nominal depth of 2cm. The samples were preserved, in pre-cleaned polycarbonate pots, by freezing at -20ºC.

Particle size samples were collected from the 0.15m² area using a plastic scoop to a nominal depth of 5cm. The samples were preserved, in polythene bags, by freezing at -20ºC. This material was also used to provide a total organic carbon and nitrogen sample.

Day grab

On recovery of the grab, its function was checked and recorded. Sample acceptance was based on the following criteria: grab fully closed; grab holding or only slowly leaking supernatant water.

Macrobenthos samples were then processed by elutriating the complete contents of the grab though a 500µm sieve mesh. The resultant residue was fixed and preserved in 10% borax buffered formalin.

Hydrocarbon samples were collected from the grab using a pre-cleaned metal scoop to a nominal depth of 2cm. The samples were preserved, in pre-cleaned glass pots, by freezing at -20ºC.

Heavy metal samples were collected from the grab using a pre-cleaned plastic scoop to a nominal depth of 2cm. The samples were preserved, in pre-cleaned polycarbonate pots, by freezing at -20ºC.

Particle size samples were collected from the grab using a plastic scoop to a nominal depth of 5cm. The samples were preserved, in polythene bags, by freezing at -20ºC. This material was also used to provide a total organic carbon and nitrogen sample.

Geology samples

In addition to the standard suite of samples, where possible, geological samples were also collected, both for BGS (represented onboard by Alick Leslie) and NOC (represented onboard by Russell Wynn). General (BGS) procedures were as follows. Megacorer and box corer: in the Megacorer the sample is extruded from barrel; for the box corer a barrel is pushed into the box. The sample is then split in two, placed in guttering and given an exclusive BGS number based on degree squares of latitude and longitude. One half of the split core is cleaned and the core is then photographed. Basic geological descriptions (colour, grain size, composition, mineralogy and structure) are noted and where possible geotechnical measurements (compressive and shear strength) are taken. No sub-sampling is carried out. Day grab: a c. 250g sample is removed from the grab using a plastic scoop and given a BGS number. This sample is then described (colour, grain size, composition and mineralogy) and stored in a sealed sample bag. Gravity corer: the liner is removed from the core barrel, washed and the sample inspected and given a BGS sample number. If sample is greater than 1.0m, the basal 0.15m is sub sampled for geochemical analysis. The remaining sample, still in the liner tube, is marked with a cut line, labelled with BGS sample number, cut into two sections of <1.0m in length and capped. The caps are then coated in wax. The sample tube is then cut and the sample split in two. One half of the split core is cleaned and the core is then photographed. Basic geological descriptions (colour, grain size, composition, mineralogy and structure) are noted and where possible geotechnical measurements (compressive and shear strength) are taken. See Appendix I for shipboard geological observation and testing data (see also BGS cruise report[24]).

Whole cores

Whole frozen cores were collected opportunistically to provide material for additional chemical or geological analyses as may be appropriate. Megacore samples were slowly extruded to gently overflow the supernatant water, the core is then bunged top and bottom and placed in a -20ºC freezer in an upright position. When fully frozen (24+ hours) the core tube is allowed to warm gently in air or by running warm water over the tube. The frozen core is then extruded on to a dichloromethane-cleaned sheet of tin foil, wrapped and returned to the freezer.

Microbiology

Microbiology samples were collected opportunistically on behalf of Michael Maggiulli of the Technische Universitaet, Berlin[25]. It is hoped this material will contribute to a European Union funded programme concerned with microbial biodiversity in deep-sea sediments. Superficial sediments were retained chilled (c. 4°C) and in formalin to produce these samples.

Seabird and cetacean observations

Dr Russell Wynn[26] recorded ad hoc observations of seabird and cetaceans; see Appendix II.

[24] Leslie, A.B., 2002. MV *Kommandor Jack* Cruise 2002. Geological sample descriptions. British Geological Survey Report CR/02/230, 77p.

[25] Michael Maggiulli, technische Universitaet Berlin, Inst. Fuer Land- und Seeverkehr, FG Maritime Technik, Mueller-Breslau-Str. D-10623 Berlin, Germany. Tel. +49 30 31184280, Fax. +49 30 31184200, e-mail maggiu@vws.tu-berlin.de

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8. SAMPLE CATALOGUE

The following tables list the various samples retained in the course of S/V *Kommandor Jack* cruise 2002 leg 2. Samples are listed by site within each of the main survey areas:

For detailed information on individual samples / deployments please consult the Station List (Section 9).

8.1. Tampen Slide

AREA	SITE	DEPTH	HC	HM	PSA	MAC	BGS	SOC	DV	PH	GC	MIC	Other
TS	NSTS1	1800	Y	Y	Y	8	Y	Y				Y	
TS	NSTS2	1800	Y	Y	Y	8	Y	Y				Y	
TS	NSTS3	2050	Y	Y	Y	8	Y	Y					
TS	NSTS4	2050	Y	Y	Y	8	Y	Y				Y	
TS	NSTS5	2050	Y	Y	Y	8	Y	Y	Y	Y			
TS	NSTS6	2150	Y	Y	Y	8	Y			Y			
TS	NSTS7	2300	Y	Y	Y	8	Y	Y	Y	Y	1.5	Y	
TS	NSTS8	2300	Y	Y	Y	8	Y	Y	Y	Y	1.5		
TS	NSTS9	2300	Y	Y	Y	8	Y	Y	Y	Y	0.4	Y	
TS	NSTS10	2150	Y	Y	Y	8	Y	Y					

8.2. Faroe Plateau North

AREA	SITE	DEPTH	HC	HM	PSA	MAC	BGS	SOC	DV	PH	GC	MIC	Other
FPN	FPN1100	1100	Y	Y	Y	0.1	Y						
FPN	FPN1400	1350				8	Y						
FPN	FPN1800	1750				8	Y	Y					

8.3. Pilot Whale Diapirs

AREA	SITE	DEPTH	HC	HM	PSA	MAC	BGS	SOC	DV	PH	GC	MIC	Other
PWD	NSDS1	1550	Y	Y	Y	8	Y	Y					
PWD	NSDS2	1650	Y	Y	Y	8	Y						
PWD	NSDS3	1650	Y	Y	Y	8	Y	Y					Whole frozen core
PWD	NSDS4	1600	Y	Y	Y	8	Y	Y					
PWD	NSDS5	1450	Y	Y	Y	0.1	Y	Y					
PWD	NSDS6	1550	Y	Y	Y	8	Y	Y					Whole frozen core
PWD	NSDS7	1600	Y	Y	Y	8	Y	Y	Y	Y			Whole frozen core
PWD	NSDS8	1600	Y	Y	Y	8	Y	Y					
PWD	NSDS9	1600	Y	Y	Y	8	Y	Y					
PWD	NSDS10	1600	Y	Y	Y	8	Y	Y	Y	Y			Video and film
PWD	NSDS11	1600	Y	Y	Y		Y	Y				Y	
PWD	NSDS12	1600	Y	Y	Y		Y						
PWD	NSDS13	1500	2Y	Y	Y		Y		Y	Y	1.0		Qualitative MAC; diapiric mud
PWD	NSDS14	1600	Y	Y	Y		Y	Y					
PWD	NSDS15	1550	Y	Y	Y			Y					
PWD	NSDS16	1550	Y	Y	Y	8	Y	Y					
PWD	NSDS17	1550	Y	Y	Y		Y	Y				Y	

(Depth, approximate depth [m]; HC, hydrocarbon sample; HM, heavy metal sample; PSA, particle size sample; MAC, macrobenthos sample [number of Megacores, e.g. 8, or area sampled, e.g. $0.1m^2$]; BGS, BGS geology sample; SOC, SOC geology sample; DV, video footage; PH, still photographs; GC, gravity core [length]; MIC, microbiology sample).

8.4. North Shetland Slope

AREA	SITE	DEPTH	HC	HM	PSA	MAC	BGS	SOC	DV	PH	GC	MIC	Other
Bathymetric transect													
NSS	NS150	150	Y	Y	Y	0.1	Y	-					
NSS	NS200	200	Y	Y	Y	0.1	Y	-					
NSS	NS250	250	Y	Y	Y	0.1	Y	-					
NSS	NS300	300	Y	Y	Y	0.1	Y	-					
NSS	NS350	350	Y	Y	Y	0.1	Y	Y					
NSS	NS400	400	Y	Y	Y	0.1	Y	-					
NSS	NS450	450	Y	Y	Y	0.1	Y	Y					
NSS	NS500	500	Y	Y	Y	0.1	Y	-					
NSS	NS550	550	-	-	Y	8	-	-					
NSS	NS600	600	-	-	Y	8	Y	Y					
NSS	NS650	650	-	-	Y	8	Y	-					
NSS	NS700	700	-	-	Y	8	Y	Y					
NSS	NS800	800	-	-	Y	8	Y	Y			1.5		
NSS	NS850	850	Y	Y	Y	-	Y	Y			1.5	Y	
NSS	NS900	900	-	-	Y	8	-	(Y)			1.5		
NSS	NS950	950	Y	Y	Y	-	Y	Y			1.5		
NSS	NS1000	1000	-	-	Y	8	-	(Y)			1.5		
Iceberg ploughmark zone													
NSS	NSPM1	200	Y	Y	Y	0.1	Y	-					
NSS	NSPM2	200	Y	Y	Y	0.1	Y	-	Y	Y			
NSS	NSPM3	200	Y	Y	Y	0.1	Y	-					
NSS	NSPM4	200	Y	Y	Y	0.1	Y	-					
NSS	NSPM5	200	Y	Y	Y	0.1	Y	-					
NSS	NSPM6	200	Y	Y	Y	0.1	Y	-					
NSS	NSPM7	250	Y	Y	Y	0.1	Y	-	Y	Y			
NSS	NSPM8	250	Y	Y	Y	0.1	Y	-					
NSS	NSPM9	250	Y	Y	Y	0.1	-	-					
NSS	NSPM10	300	Y	Y	Y	0.1	-	-					
NSS	NSPM11	200	Y	Y	Y	0.1	Y	-	Y	Y			
Alongslope study													
NSS	NSAS1	800	Y	Y	Y	10	Y	Y					
NSS	NSAS2	800	Y	Y	Y	8	Y	Y					
NSS	NSAS3	800	Y	Y	Y	8	Y	Y					
NSS	NSAS4	800	Y	Y	Y	8	Y	Y					
NSS	NSAS5	800	Y	Y	Y	9	Y	Y					
NSS	NSAS6	750	Y	Y	Y	9	Y	Y					Stalked sponge
NSS	NSAS7	800	Y	Y	Y	8	Y	Y					2 whole cores (s.s. tubes)
Contourite study													
NSS	NSCS1	900	Y	Y	Y	9	Y	Y	Y	Y			
NSS	NSCS3	900	Y	Y	Y	8	Y	Y	Y	Y			
NSS	NSCS4	900	Y	Y	Y	8	Y	Y	?	Y			
NSS	NSCS5	900	Y	Y	Y	12	Y	Y	Y	Y			
NSS	NSCS6	900	Y	Y	Y	9	Y	Y	?	Y			
WASP deployments													
NSS	NSW1	200	-	-	-	-	-	-		Y			
NSS	NSW2	250	-	-	-	-	-	-	Y	Y			
NSS	NSW3	300	-	-	-	-	-	-	Y	Y			
Widescan deployments													
NSS	WS1	250	-	-	-	-	-	-					Sidescan
NSS	WS2	200	-	-	-	-	-	-					Sidescan
NSS	WS3	200	-	-	-	-	-	-					Sidescan
Amphipod trap deployments													
NSS	AT1	1600	-	-	-	-	-	-					Amphipods
NSS	AT2 (NS900)	900	-	-	-	-	-	-					Amphipods
NSS	AT3 (NSPM11)	200	-	-	-	-	-	-					Amphipods

(Depth, approximate depth [m]; HC, hydrocarbon sample; HM, heavy metal sample; PSA, particle size sample; MAC, macrobenthos sample [number of Megacores, e.g. 8, or area sampled, e.g. $0.1m^2$]; BGS, BGS geology sample; SOC, SOC geology sample; DV, video footage; PH, still photographs; GC, gravity core [length]; MIC, microbiology sample).

9. STATION LIST

The following listing details station information and the primary survey samples collected.

Station number Station and series number. The first five digits are the station number, which is separated from the series number by the hash (#) mark. The station number increments by one each time the vessel locates to another nominal site, regardless of whether that site has been sampled previously. The series number increments by one for each deployment made at a station.

Site name The site name identifies a particular nominal survey location. Site names are unique within the cruise but do not uniquely identify particular deployments.

Gear type

A.TRAP	Free-fall amphipod trap
BC	USNEL-type spade box corer (0.25m^2)
DG	Day grab (0.1m^2)
G.CORE	BGS gravity corer
MEGAxx	Megacorer (with xx core units fitted)
WASP	Wide-Angle Seabed Photography vehicle with video and still cameras fitted
WIDES	Widescan sidescan sonar system

Date Date on which deployment was made (note that towed gear and mooring deployments may span two dates).

Time The time or times given relate to sample / data collection. In the case of grabs and cores the time given is that of bottom contact. In the case of WASP and moorings the times reflect the duration of near- or on-bottom operations. All times given are UTC / GMT.

Navigation Navigation type: S, ship's position (DGPS); G, deployed gear's position (DGPS plus USBL).

Position Sample position / track. In the case of grabs, cores and moorings, the position given is that of the vessel or gear at the time of bottom contact. In the case of WASP and Widescan, the positions given are the start and end points of the track of near-bottom operations. Consult the corresponding deployment track chart in Section 10 for details of individual tracks. All positions are given in degrees and decimal minutes based on the WGS84 datum.

Depth The depth or depths given relate to sample / data collection. In the case of grabs, cores and moorings the depth given is that below the vessel at the time of bottom contact. In the case of WASP and Widescan the depths reflect the range covered during the time of near- or on-bottoms operations. For WASP these are the range of depths covered below the vessel [and/or derived from USBL data] between the times given. All depths given are in corrected metres.

HC Hydrocarbon. Y, sample for hydrocarbon analysis collected (-, no sample collected).
HM Heavy metals. Y, sample for elemental analysis collected (-, no sample collected).
PSA Particle size. Y, sample for particle size analysis collected (-, no sample collected).
MAC Macrobenthos sample (sample size indicated as number of Megacore tubes, 0.1 m^2 box core sample; Q-qualitative)
BGS-G BGS geology sample
SOC-G SOC geology sample

Comment Deployment comment and additional samples

Station number	Site name	Gear type	Date 2002	Time (UTC)	Navigation	Position Lat	Position Long	Depth (m)	Samples HC	HM	PSA	MAC	BGS-G	SOC-G	Comment
57001#1	NSAS1	MEGA08	27/07	23:25	G	62 31.00 N	0 45.98 E	801	Y	Y	Y	4	Y	-	7/8 Good cores
57001#2	NSAS1	MEGA08	28/07	01:21	G	62 31.00 N	0 45.98 E	801	-	-	-	6	-	Y	7/8 Good cores
57002#1	NSAS2	MEGA08	28/07	06:00	G	62 19.00 N	0 24.97 E	807	-	-	-	-	-	-	No useful cores
57002#2	NSAS2	MEGA08	28/07	07:30	G	62 19.01 N	0 25.00 E	807	-	-	-	8	-	-	8/8 Good cores
57002#3	NSAS2	MEGA08	28/07	09:07	G	62 19.01 N	0 24.99 E	807	Y	Y	Y	-	Y	Y	8/8 Good cores
57003#1	NSAS3	MEGA08	28/07	12:47	G	62 15.00 N	0 3.98 W	803	-	-	-	8	-	-	8/8 Good cores
57003#2	NSAS3	MEGA08	28/07	21:02	G	62 15.02 N	0 3.98 W	803	Y	Y	Y	-	Y	Y	6/8 Good cores
57004#1	NSAS4	MEGA08	29/07	00:34	G	62 12.51 N	0 31.48 W	803	Y	Y	Y	4	-	-	7/8 Good cores
57004#2	NSAS4	MEGA08	29/07	02:07	G	62 12.51 N	0 31.50 W	803	-	-	-	4	Y	Y	6/8 Good cores
57005#1	NSAS5	MEGA08	29/07	05:29	G	62 3.50 N	0 55.51 W	800	Y	Y	Y	3	-	-	6/8 Good cores
57005#2	NSAS5	MEGA08	29/07	07:03	G	62 3.50 N	0 55.49 W	799	-	-	-	6	Y	Y	8/8 Good cores
57006#1	NSAS6	MEGA08	29/07	10:25	G	61 52.01 N	1 14.48 W	753	Y	Y	Y	4	-	-	7/8 Good cores; stalked sponge preserved separately
57006#2	NSAS6	MEGA08	29/07	12:01	G	61 52.01 N	1 14.46 W	753	-	-	-	5	Y	Y	7/8 Good cores
57007#1	NSCS6	MEGA08	29/07	13:57	G	61 53.81 N	1 17.99 W	888	Y	Y	Y	4	-	-	7/8 Good cores
57007#2	NSCS6	MEGA08	29/07	15:45	G	61 53.80 N	1 17.99 W	888	-	-	-	5	Y	Y	7/8 Good cores
57008#1	NSCS5	MEGA08	29/07	19:05	G	62 4.40 N	0 58.03 W	897	Y	Y	-	4	-	-	6/8 Good cores
57008#2	NSCS5	MEGA08	29/07	20:44	G	62 4.39 N	0 58.05 W	897	-	-	(Y)	4	-	-	4/8 Good cores; PSA a bit cloudy; wire damaged on recovery
57008#3	NSCS5	MEGA08	30/07	12:48	G	62 4.40 N	0 58.00 W	898	-	-	Y	4	Y	Y	7/8 Good cores, 1 slider snapped
57009#1	NSCS5	WASP	30/07	15:11	G	62 4.50 N	0 58.10 W	899	-	-	-	-	-	-	Good tow
			30/07	15:43	G	62 4.52 N	0 58.66 W	916	-	-	-	-	-	-	30 mins DV, no film run
57010#1	NSCS4	MEGA08	30/07	19:26	G	62 14.49 N	0 33.02 W	893	Y	Y	-	4	-	-	6/8 Good cores
57010#2	NSCS4	MEGA08	30/07	21:10	G	62 14.49 N	0 33.02 W	893	-	-	Y	4	Y	Y	7/8 Good cores
57011#1	NSCS3	MEGA08	31/07	00:37	G	62 16.80 N	0 5.01 W	894	-	-	-	8	-	-	8/8 Good cores
57011#2	NSCS3	MEGA08	31/07	02:17	G	62 16.80 N	0 5.01 W	894	Y	Y	Y	-	Y	Y	7/8 Good cores
57012#1	NSCS1	MEGA08	31/07	07:19	G	62 37.10 N	0 36.97 E	895	-	-	-	5	-	-	5/8 Good cores
57012#2	NSCS1	MEGA08	31/07	09:00	G	62 37.10 N	0 36.98 E	894	-	-	-	4	Y	-	5/8 Good cores
57012#3	NSCS1	MEGA08	31/07	10:34	G	62 37.10 N	0 36.97 E	894	Y	Y	Y	-	-	Y	6/8 Good cores
57013#1	NSPM10	DG	31/07	15:30	S	62 3.99 N	0 49.99 E	302	-	-	-	-	-	-	Failed, rock in jaws
57013#2	NSPM10	DG	31/07	16:01	S	62 3.99 N	0 49.99 E	302	-	-	-	0.1	-	-	Good sample
57013#3	NSPM10	DG	31/07	16:33	S	62 3.99 N	0 49.99 E	302	Y	Y	Y	-	-	-	Good sample
57014#1	WS1	WIDES	31/07	17:37	S	62 3.80 N	0 49.83 E	254	-	-	-	-	-	-	Trial run, good tow
			31/07	19:54	S	61 56.19 N	0 41.45 E	300	-	-	-	-	-	-	Iceberg ploughmark fabric
57015#1	NSPM9	DG	31/07	20:39	S	61 57.01 N	0 42.01 E	259	-	-	-	-	-	-	Failed, rock in jaws
57015#2	NSPM9	DG	31/07	21:07	S	61 57.01 N	0 42.01 E	259	-	-	-	0.1	-	-	Good sample
57015#3	NSPM9	DG	31/07	21:38	S	61 57.01 N	0 42.01 E	259	Y	Y	Y	-	-	-	Good sample

Station number	Site name	Gear type	Date 2002	Time (UTC)	Navigation	Position Lat	Position Long	Depth (m)	Samples HC	Samples HM	Samples PSA	Samples MAC	Samples BGS-G	Samples SOC-G	Comment
57016#1	NSPM2	DG	31/07	23:54	S	61 45.99 N	0 52.99 E	217	Y	Y	Y	-	Y	-	Good sample
57016#2	NSPM2	DG	01/08	00:24	S	61 45.99 N	0 52.99 E	217	-	-	-	0.1	-	-	Good sample
57017#1	NSPM1	DG	01/08	02:34	S	61 35.99 N	1 9.98 E	187	-	-	-	0.1	-	-	Good sample
57017#2	NSPM1	DG	01/08	02:54	S	61 35.99 N	1 9.98 E	188	Y	Y	Y	-	Y	-	Good sample
57018#1	NSPM3	DG	01/08	06:46	S	61 34.99 N	0 4.99 E	198	Y	Y	Y	-	Y	-	Good sample
57018#2	NSPM3	DG	01/08	07:12	S	61 34.99 N	0 4.99 E	198	-	-	-	0.1	-	-	Good sample
57019#1	NSPM4	DG	01/08	08:39	S	61 31.99 N	0 12.02 W	194	Y	Y	Y	-	Y	-	Good sample
57019#2	NSPM4	DG	01/08	09:04	S	61 31.99 N	0 12.02 W	194	-	-	-	0.1	-	-	Good sample
57020#1	NSPM5	DG	01/08	10:58	S	61 33.98 N	0 32.01 W	193	-	-	-	0.1	-	-	Good sample
57020#2	NSPM5	DG	01/08	11:19	S	61 33.98 N	0 32.01 W	193	Y	Y	Y	-	Y	-	Good sample
57021#1	NSPM6	DG	01/08	13:13	S	61 42.99 N	0 30.02 W	226	-	-	-	-	-	-	Failed, rock in jaws
57021#2	NSPM6	DG	01/08	13:34	S	61 42.99 N	0 30.02 W	226	-	-	-	0.1	-	-	Good sample
57021#3	NSPM6	DG	01/08	14:06	S	61 42.99 N	0 30.02 W	226	Y	Y	Y	-	Y	-	Good sample
57022#1	NSPM7	DG	01/08	15:31	S	61 46.99 N	0 35.01 W	255	-	-	-	0.1	-	-	Good sample
57022#2	NSPM7	DG	01/08	15:57	S	61 46.99 N	0 35.01 W	255	Y	Y	Y	-	Y	-	Good sample
57023#1	NSPM8	DG	01/08	19:31	S	61 52.00 N	0 2.00 E	243	-	-	-	0.1	-	-	Good sample
57023#2	NSPM8	DG	01/08	19:56	S	61 52.02 N	0 2.02 E	243	Y	Y	Y	-	Y	-	Good sample
57024#1	NSDS1	MEGA08	03/08	00:38	G	62 29.99 N	1 5.01 W	1533	Y	Y	Y	-	Y	Y	6/8 Good cores
57024#2	NSDS1	MEGA10	03/08	03:10	G	62 30.00 N	1 5.00 W	1533	-	-	-	2	-	-	2/10 Good cores
57024#3	NSDS1	MEGA08	03/08	05:23	G	62 30.00 N	1 5.00 W	1533	-	-	-	6	-	-	6/8 Good cores
57025#1	NSDS2	MEGA08	03/08	10:21	G	62 29.99 N	1 26.49 W	1637	-	-	-	4	-	-	5/8 Good cores
57025#2	NSDS2	MEGA08	03/08	12:40	G	62 29.99 N	1 26.49 W	1636	Y	-	-	-	Y	-	2/8 Good cores
57025#3	NSDS2	MEGA08	03/08	15:07	G	62 29.99 N	1 26.50 W	1636	-	Y	Y	4	-	-	6/8 Good cores
57026#1	NSDS3	MEGA08	03/08	18:10	G	62 35.00 N	1 24.99 W	1640	-	-	-	8	-	-	8/8 Good cores
57026#2	NSDS3	MEGA08	03/08	20:19	G	62 35.00 N	1 24.98 W	1640	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one whole frozen core
57027#1	NSDS4	MEGA08	03/08	23:37	G	62 40.29 N	1 14.50 W	1614	-	-	-	8	-	-	8/8 Good cores
57027#2	NSDS4	MEGA08	04/08	01:57	G	62 40.30 N	1 14.48 W	1614	Y	Y	Y	-	Y	Y	6/8 Good cores
57028#1	NSDS5	BC	04/08	04:50	G	62 40.80 N	1 8.30 W	1453	-	-	-	0.1	-	-	Good core; too soupy for chemistry
57028#2	NSDS5	MEGA08	04/08	07:11	G	62 40.80 N	1 8.30 W	1454	Y	Y	Y	-	Y	Y	5/8 Good cores
57029#1	NSDS6	MEGA08	04/08	10:19	G	62 40.00 N	0 59.98 W	1536	-	-	-	8	-	-	8/8 Good cores
57029#2	NSDS6	MEGA08	04/08	12:28	G	62 40.00 N	0 59.98 W	1536	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one whole frozen core
57030#1	NSDS7	MEGA08	04/08	15:28	G	62 43.50 N	1 7.00 W	1588	-	-	-	8	-	-	8/8 Good cores
57030#2	NSDS7	MEGA08	04/08	17:43	G	62 43.50 N	1 6.98 W	1588	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one whole frozen core
57031#1	NSDS8	MEGA08	04/08	20:22	G	62 45.51 N	1 3.97 W	1593	Y	Y	-	4	-	-	6/8 Good cores

Station number	Site name	Gear type	Date 2002	Time (UTC)	Navigation	Position Lat	Position Long	Depth (m)	Samples HC	Samples HM	Samples PSA	Samples MAC	Samples BGS-G	Samples SOC-G	Comment
57031#2	NSDS8	MEGA08	04/08	22:31	G	62 45.51 N	1 3.97 W	1593	-	-	Y	4	Y	Y	7/8 Good cores
57032#1	NSDS9	MEGA08	05/08	01:43	G	62 51.00 N	0 58.99 W	1598	-	-	-	8	-	-	8/8 Good cores
57032#2	NSDS9	MEGA08	05/08	04:00	G	62 51.01 N	0 58.98 W	1599	Y	Y	Y	-	Y	Y	7/8 Good cores
57033#1	NSTS1	MEGA08	05/08	09:43	G	63 15.00 N	0 17.49 W	1806	-	-	-	8	-	-	8/8 Good cores
57033#2	NSTS1	MEGA08	05/08	12:14	G	63 15.00 N	0 17.49 W	1806	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one core for microbiology
57034#1	NSTS2	MEGA08	05/08	14:47	G	63 16.40 N	0 19.49 W	1804	-	-	-	8	-	-	8/8 Good cores
57034#2	NSTS2	MEGA08	05/08	17:05	G	63 16.40 N	0 19.49 W	1804	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one core for microbiology
57035#1	NSTS3	WASP	05/08	21:23	G	63 26.34 N	0 25.21 W	2066	-	-	-	-	-	-	Good tow
			05/08	22:30	G	63 26.92 N	0 26.04 W	2080	-	-	-	-	-	-	No u/w DV; No u/w film run
57036#1	NSTS3	MEGA08	06/08	01:32	G	63 26.21 N	0 25.01 W	2064	-	-	-	8	-	-	8/8 Good cores
57036#2	NSTS3	MEGA08	06/08	04:16	G	63 26.20 N	0 25.00 W	2064	Y	Y	Y	-	Y	Y	6/8 Good cores
57037#1	NSTS4	MEGA08	06/08	08:17	G	63 26.49 N	0 44.99 W	2056	Y	Y	Y	4	-	-	7/8 Good cores
57037#2	NSTS4	MEGA08	06/08	11:03	G	63 26.49 N	0 45.00 W	2056	-	-	-	4	Y	Y	8/8 Good cores, plus one core for microbiology
57038#1	NSTS5	MEGA08	06/08	14:38	G	63 25.58 N	0 54.96 W	2052	Y	Y	-	4	-	-	6/8 Good cores
57038#2	NSTS5	MEGA08	06/08	17:13	G	63 25.59 N	0 54.97 W	2052	-	-	Y	4	Y	Y	7/8 Good cores
57039#1	NSTS6	WASP	06/08	22:09	G	63 34.12 N	0 54.20 W	2105	-	-	-	-	-	-	Difficult tow
			06/08	23:34	G	63 34.35 N	0 52.97 W	2321	-	-	-	-	-	-	No u/w DV; 217 frames indicated on Mk7
57040#1	NSTS6	MEGA08	07/08	03:12	G	63 33.96 N	0 54.48 W	2153	Y	-	-	4	-	-	5/8 Good cores
57040#2	NSTS6	MEGA08	07/08	06:02	G	63 33.98 N	0 54.48 W	2153	-	Y	Y	4	Y	-	7/8 Good cores
57041#1	NSTS7	MEGA08	07/08	09:12	G	63 35.00 N	0 52.98 W	2315	-	-	-	8	-	-	8/8 Good cores
57041#2	NSTS7	MEGA08	07/08	12:14	G	63 35.00 N	0 52.98 W	2314	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one core for microbiology
57042#1	NSTS7	WASP	07/08	15:53	G	63 35.06 N	0 52.92 W	2302	-	-	-	-	-	-	Good tow
			07/08	17:01	G	63 35.12 N	0 51.81 W	2312	-	-	-	-	-	-	65 mins DV; c. 350 frames
57043#1	NSTS8	MEGA08	07/08	20:49	G	63 38.50 N	0 46.30 W	2314	Y	Y	Y	4	-	-	7/8 Good cores
57043#2	NSTS8	MEGA08	07/08	23:42	G	63 38.51 N	0 46.32 W	2314	-	-	-	4	Y	Y	7/8 Good cores
57044#1	NSTS9	MEGA08	08/08	04:20	G	63 46.39 N	0 25.05 W	2312	-	-	-	8	-	-	8/8 Good cores
57044#2	NSTS9	MEGA08	08/08	07:22	G	63 46.40 N	0 25.04 W	2313	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one core for microbiology
57045#1	NSTS9	G.CORE	08/08	10:38	G	63 46.40 N	0 25.03 W	2313	-	-	-	-	Y	-	0.4m core
57046#1	NSTS9	WASP	08/08	13:52	G	63 46.38 N	0 24.99 W	2312	-	-	-	-	-	-	Good tow
			08/08	14:58	G	63 46.43 N	0 24.26 W	2315	-	-	-	-	-	-	65 mins DV; c. 350 frames
57047#1	NSTS8	WASP	08/08	20:33	G	63 38.50 N	0 46.36 W	2316	-	-	-	-	-	-	Fair tow, altimeter failing
			08/08	21:40	G	63 38.71 N	0 47.25 W	2323	-	-	-	-	-	-	60 mins DV; c. 350 frames

Station number	Site name	Gear type	Date 2002	Time (UTC)	Navigation	Position Lat	Position Long	Depth (m)	Samples HC	Samples HM	Samples PSA	Samples MAC	Samples BGS-G	Samples SOC-G	Comment
57048#1	NSTS8	G.CORE	08/08	23:34	G	63 38.50 N	0 46.30 W	2315	-	-	-	-	Y	-	1.5m core
57049#1	NSTS7	G.CORE	09/08	03:10	G	63 35.00 N	0 53.00 W	2315	-	-	-	-	Y	-	1.5m core
57050#1	NSTS10	MEGA08	09/08	06:31	G	63 32.49 N	0 55.01 W	2143	-	-	-	8	-	-	8/8 Good cores
57050#2	NSTS10	MEGA08	09/08	09:20	G	63 32.50 N	0 55.00 W	2144	Y	Y	Y	-	Y	Y	8/8 Good cores
57051#1	NSTS5	WASP	09/08	13:19	G	63 25.62 N	0 54.95 W	2052	-	-	-	-	-	-	Good tow
			09/08	14:26	G	63 25.85 N	0 54.15 W	2052	-	-	-	-	-	-	65 mins DV; c. 350 frames
57052#1	NSDS10	WASP	09/08	22:04	G	62 38.09 N	1 17.56 W	1610	-	-	-	-	-	-	Good tow
			09/08	23:11	G	62 38.09 N	1 18.62 W	1575	-	-	-	-	-	-	65 mins DV; c. 350 frames
57053#1	NSDS10	MEGA08	10/08	03:59	G	62 38.10 N	1 17.45 W	1621	-	-	-	8	-	-	8/8 Good cores
57053#2	NSDS10	MEGA08	10/08	03:59	G	62 38.10 N	1 17.50 W	1622	Y	Y	Y	-	Y	Y	7/8 Good cores
57054#1	NSDS11	MEGA08	10/08	06:18	G	62 38.40 N	1 15.82 W	1613	Y	Y	Y	-	Y	Y	6/8 Good cores, plus one core for microbiology
57055#1	NSDS12	MEGA08	10/08	08:30	G	62 39.01 N	1 16.29 W	1624	Y	Y	Y	-	Y	-	3/8 Good cores
57056#1	NSDS13	MEGA08	10/08	11:09	G	62 38.75 N	1 16.97 W	1518	-	-	-	(Q)	Y	-	Two short lumps of diapiric mud
57056#2	NSDS13	BC	10/08	13:20	G	62 38.74 N	1 17.00 W	1518	-	-	-	-	-	-	Nil bar a little gravel
57056#3	NSDS13	BC	10/08	15:34	G	62 38.74 N	1 16.99 W	1518	-	-	-	(Q)	-	-	Washed out mud / gravel / cobble lump; sieved 0.5mm
57056#4	NSDS13	MEGA04	10/08	17:45	G	62 38.75 N	1 17.00 W	1518	-	-	-	-	-	-	0/4 cores, water only
57057#1	NSDS14	MEGA08	10/08	21:29	G	62 37.96 N	1 18.53 W	1592	Y	Y	Y	-	-	-	3/8 Good cores
57057#2	NSDS14	MEGA04	10/08	23:00	G	62 37.96 N	1 18.51 W	1594	-	-	-	-	Y	Y	4/4 Good cores
57058#1	NSDS15	MEGA04	11/08	02:36	G	62 41.80 N	1 5.01 W	1560	Y	Y	Y	-	-	Y	4/4 Good cores
57059#1	NSDS16	MEGA08	11/08	04:57	G	62 42.48 N	1 3.65 W	1545	Y	Y	Y	4	-	-	7/8 Good cores
57059#2	NSDS16	MEGA08	11/08	07:04	G	62 42.48 N	1 3.65 W	1545	-	-	-	4	Y	Y	6/8 Good cores
57060#1	AT1	A.TRAP	11/08	10:00	S	61 39.16 N	1 13.97 W	1611	-	-	-	-	-	-	Fair catch
			13/08	08:31	-	- -	- -	-	-	-	-	-	-	-	46.5 hour soak time
57061#1	NSDS13	WASP	11/08	11:27	G	62 38.76 N	1 17.00 W	1515	-	-	-	-	-	-	Good tow
			11/08	12:33	G	62 38.41 N	1 17.02 W	1624	-	-	-	-	-	-	65 mins DV; 350 frames
57062#1	NSDS17	MEGA08	11/08	15:54	G	62 42.99 N	1 2.41 W	1561	Y	Y	Y	-	Y	Y	7/8 Good cores, plus one core for microbiology
57063#1	NSDS7	WASP	11/08	19:14	G	62 43.47 N	1 7.04 W	1587	-	-	-	-	-	-	Good tow, very level
			11/08	20:23	G	62 43.06 N	1 7.91 W	1586	-	-	-	-	-	-	65 mins DV; 350 frames
57064#1	NSDS13	MEGA04	11/08	23:06	G	62 38.76 N	1 17.00 W	1515	Y	-	-	-	Y	-	2/4 Good cores
57064#2	NSDS13	MEGA04	12/08	01:19	G	62 38.77 N	1 17.03 W	1514	-	-	-	-	-	-	0/4 Cores; all washed out
57064#3	NSDS13	MEGA04	12/08	03:34	G	62 38.70 N	1 17.02 W	1517	Y	Y	Y	-	-	-	3/4 Good cores
57064#4	NSDS13	MEGA04	12/08	05:48	G	62 38.73 N	1 17.04 W	1514	-	-	-	-	-	-	0/4 Cores; corer fell over at seabed
57064#5	NSDS13	G.CORE	12/08	08:13	G	62 38.71 N	1 17.00 W	1515	(2)	-	-	-	-	-	1m Core; including diapiric mud; HC from near top and base

Station number	Site name	Gear type	Date 2002	Time (UTC)	Navigation	Position Lat	Position Long	Depth (m)	Samples HC	HM	PSA	MAC	BGS-G	SOC-G	Comment
57065#1	FPN1800	MEGA10	12/08	16:45	G	62 44.78 N	1 51.90 W	1740	-	-	-	-	-	-	0/10 Good cores (2 v. short only)
57065#2	FPN1800	MEGA10	12/08	17:55	G	62 44.78 N	1 51.91 W	1740	-	-	-	-	-	-	0/10 Good cores (3 v. short only); main bars are bent from 57064#4
57066#1	FPN1100	BC	12/08	22:29	G	62 38.30 N	2 8.71 W	1094	Y	Y	Y	0.1	Y	-	Good core
57067#1	FPN1400	MEGA10	13/08	01:42	G	62 40.40 N	2 1.49 W	1366	-	-	-	8	Y	-	9/10 Good cores
57068#1	FPN1800	MEGA10	13/08	04:48	G	62 44.80 N	1 51.91 W	1741	-	-	-	8	Y	Y	10/10 Good cores
57069#1	NSCS1	WASP	13/08	16:35	G	62 37.10 N	0 37.02 E	896	-	-	-	-	-	-	Good tow
			13/08	17:06	G	62 37.01 N	0 37.50 E	892	-	-	-	-	-	-	30 mins DV; film run
57070#1	NSCS3	WASP	13/08	21:44	G	62 16.82 N	0 4.92 W	896	-	-	-	-	-	-	"Swelly" tow
			13/08	22:16	G	62 17.06 N	0 4.32 W	907	-	-	-	-	-	-	30 mins DV; film run
57071#1	NS1000	MEGA10	14/08	00:59	G	62 17.71 N	0 19.80 W	990	-	-	Y	8	-	(Y)	9/10 Good cores; (geol minus top 2cm)
57072#1	NS950	MEGA10	14/08	02:57	G	62 16.60 N	0 19.4 W	940	Y	Y	Y	-	Y	Y	10/10 Good cores
57073#1	NS900	MEGA12	14/08	05:04	G	62 15.60 N	0 18.99 W	890	-	-	Y	8	-	(Y)	9/12 Good cores; (geol minus top 2cm)
57074#1	WS2	WIDES	14/08	12:33	S	61 36.58 N	0 9.40 W	200	-	-	-	-	-	-	Problematic tow
			15/08	02:51	S	61 51.63 N	0 14.06 W	291	-	-	-	-	-	-	some good imagery
57075#1	NS400	BC	15/08	05:21	G	61 58.17 N	0 13.96 W	400	Y	Y	Y	0.1	Y	-	Good core
57076#1	NS500	BC	15/08	07:54	G	62 2.14 N	0 15.40 W	500	Y	Y	Y	0.1	Y	-	Good core
57077#1	NS900	A.TRAP	15/08	11:17	S	62 15.64 N	0 19.27 W	890	-	-	-	-	-	-	Fair catch
			17/08	09:10	-	- - -	- - -	-	-	-	-	-	-	-	46 hour soak time
57078#1	NS850	MEGA08	15/08	12:19	G	62 14.61 N	0 18.51 W	843	Y	Y	Y	-	Y	Y	8/8 Good cores, plus one core for microbiology
57079#1	NS800	MEGA12	15/08	14:00	G	62 13.50 N	0 18.10 W	793	-	-	Y	8	Y	Y	11/12 Good cores
57080#1	NS700	MEGA12	15/08	15:55	G	62 11.13 N	0 17.73 W	700	-	-	Y	8	Y	Y	12/12 Good cores
57081#1	NS600	MEGA12	15/08	17:50	G	62 6.66 N	0 16.72 W	602	-	-	-	-	-	-	0/12 Cores; all washed out
57081#2	NS600	MEGA08	15/08	18:47	G	62 6.66 N	0 16.73 W	602	-	-	-	8	-	-	8/8 Good cores
57081#3	NS600	MEGA08	15/08	19:46	G	62 6.66 N	0 16.73 W	602	-	-	Y	-	Y	Y	7/8 Good cores
57082#1	NS200	DG	16/08	15:50	S	61 36.45 N	0 9.08 W	200	-	-	-	0.1	-	-	Good sample
57082#2	NS200	DG	16/08	16:08	S	61 36.45 N	0 9.08 W	200	Y	Y	Y	-	Y	-	Good sample
57083#1	NS250	DG	16/08	18:53	S	61 50.94 N	0 12.06 W	251	-	-	-	0.1	-	-	Good sample
57083#2	NS250	DG	16/08	19:14	S	61 50.94 N	0 12.06 W	251	Y	Y	Y	-	Y	-	Good sample
57084#1	NS300	DG	16/08	20:24	S	61 54.23 N	0 12.77 W	300	-	-	-	-	-	-	No useful sample
57084#2	NS300	DG	16/08	20:47	S	61 54.23 N	0 12.77 W	300	-	-	-	0.1	-	-	Good sample
57084#3	NS300	DG	16/08	21:09	S	61 54.23 N	0 12.77 W	300	Y	Y	Y	-	Y	-	Good sample
57085#1	NS350	BC	16/08	22:28	G	61 56.25 N	0 13.37 W	349	Y	Y	Y	0.1	Y	Y	Good core
57086#1	NS450	BC	17/08	00:58	G	62 0.05 N	0 14.68 W	454	Y	Y	Y	0.1	Y	Y	Good core
57087#1	NS550	MEGA10	17/08	02:58	G	62 4.03 N	0 15.88 W	550	-	-	Y	-	-	-	1/10 Good core
57087#2	NS550	MEGA08	17/08	05:11	G	62 4.03 N	0 15.87 W	550	-	-	-	8	-	-	8/8 Good cores

Station number	Site name	Gear type	Date 2002	Time (UTC)	Navigation	Position Lat	Position Long	Depth (m)	Samples HC	Samples HM	Samples PSA	Samples MAC	Samples BGS-G	Samples SOC-G	Comment
57088#1	NS650	MEGA10	17/08	07:28	G	62 9.03 N	0 19.03 W	650	-	-	Y	8	Y	-	10/10 Good cores
57089#1	NS900	G.CORE	17/08	11:09	S	62 15.60 N	0 19.03 W	890	-	-	-	-	Y	-	Good core, c. 1.5m
57090#1	NS950	G.CORE	17/08	12:42	S	62 16.60 N	0 19.42 W	940	-	-	-	-	Y	-	Good core, c. 1.5m
57091#1	NS1000	G.CORE	17/08	14:16	S	62 17.71 N	0 19.88 W	990	-	-	-	-	Y	-	Good core, c. 1.5m
57092#1	NS850	G.CORE	17/08	16:16	S	62 14.61 N	0 18.49 W	843	-	-	-	-	Y	-	Good core, c. 1.5m
57093#1	NS800	G.CORE	17/08	17:51	S	62 13.51 N	0 18.10 W	793	-	-	-	-	Y	-	Good core, c. 1.5m
57094#1	NSCS4	WASP	17/08	20:33	G	62 14.52 N	0 32.86 W	889	-	-	-	-	-	-	Good tow
			17/08	21:05	G	62 14.69 N	0 32.83 W	898	-	-	-	-	-	-	Video problem ?; film run
57095#1	NSCS6	WASP	18/08	07:31	G	61 53.82 N	1 17.98 W	886	-	-	-	-	-	-	Good tow
			18/08	08:07	G	61 54.10 N	1 17.50 W	888	-	-	-	-	-	-	Video problem ?; film run
57096#1	NSAS7	MEGA8	18/08	09:16	G	61 52.76 N	1 15.97 W	800	-	-	-	8	-	-	8/8 Good cores
57096#2	NSAS7	MEGA8	18/08	10:38	G	61 52.77 N	1 15.98 W	800	Y	Y	Y	-	Y	Y	8/8 Good cores; plus two cores retained whole in s.s. tubes
57097#1	NSPM7	WASP	18/08	14:26	G	61 47.03 N	0 35.00 W	255	-	-	-	-	-	-	Swelly tow
			18/08	15:33	G	61 47.61 N	0 35.08 W	260	-	-	-	-	-	-	65mins DV; film run
57098#1	WS3	WIDES	18/08	16:49	S	61 45.49 N	0 32.59 W	201	-	-	-	-	-	-	Short tow
			18/08	19:30	S	61 35.83 N	0 21.90 W	240	-	-	-	-	-	-	
57099#1	NSW1	WASP	18/08	20:22	G	61 35.15 N	0 21.05 W	200	-	-	-	-	-	-	Good tow
			18/08	21:31	G	61 35.47 N	0 21.25 W	200	-	-	-	-	-	-	No video; film run
57100#1	NS150	DG	19/08	01:34	S	61 14.54 N	0 3.85 W	158	Y	Y	Y	-	Y	-	Good sample
57100#2	NS150	DG	19/08	01:49	S	61 14.54 N	0 3.85 W	158	-	-	-	0.1	-	-	Good sample
57101#1	NSPM11	A.TRAP	19/08	06:12	S	61 34.59 N	0 29.46 E	199	-	-	-	-	-	-	Good catch
			19/08	11:44	-	- - -	- - -	-	-	-	-	-	-	-	5.5 hour soak time
57102#1	NSPM11	DG	19/08	06:57	S	61 35.01 N	0 29.99 E	198	-	-	-	0.1	-	-	Good sample
57102#2	NSPM11	DG	19/08	07:17	S	61 35.01 N	0 29.99 E	198	Y	Y	Y	-	Y	-	Good sample
57103#1	NSPM11	WASP	19/08	08:11	G	61 35.04 N	0 30.02 E	199	-	-	-	-	-	-	Good tow (extended)
			19/08	10:01	G	61 35.37 N	0 31.34 E	199	-	-	-	-	-	-	65 mins DV; 550 frames
57104#1	NSW2	WASP	19/08	14:28	G	61 50.04 N	0 29.93 E	226	-	-	-	-	-	-	Good tow
			19/08	15:33	G	61 50.37 N	0 29.04 E	227	-	-	-	-	-	-	65 mins DV; film run
57105#1	NSW3	WASP	19/08	18:26	G	61 55.00 N	1 10.04 E	295	-	-	-	-	-	-	Good tow
			19/08	18:58	G	61 55.79 N	1 10.44 E	298	-	-	-	-	-	-	65 mins DV; film run
57106#1	NSPM2	WASP	19/08	21:08	G	61 45.94 N	0 53.04 E	218	-	-	-	-	-	-	Good tow (extended)
			19/08	21:55	G	61 45.55 N	0 53.37 E	217	-	-	-	-	-	-	65 mins DV; film run

11. CHARTS

Chart 1.	Ports and survey areas
Chart 2.	All primary deployment sites
Charts 3-6.	Primary deployment sites by survey areas
Charts 7-26.	Individual WASP vehicle tracks illustrating ship's track (solid line) and WASP position data (symbols) from onboard USBL beacon. *Note that these charts are shown as UTM coordinates, a table providing latitude and longitude for the centre point of each chart preceeds Chart 7.*
Chart 27.	Widescan deployments.

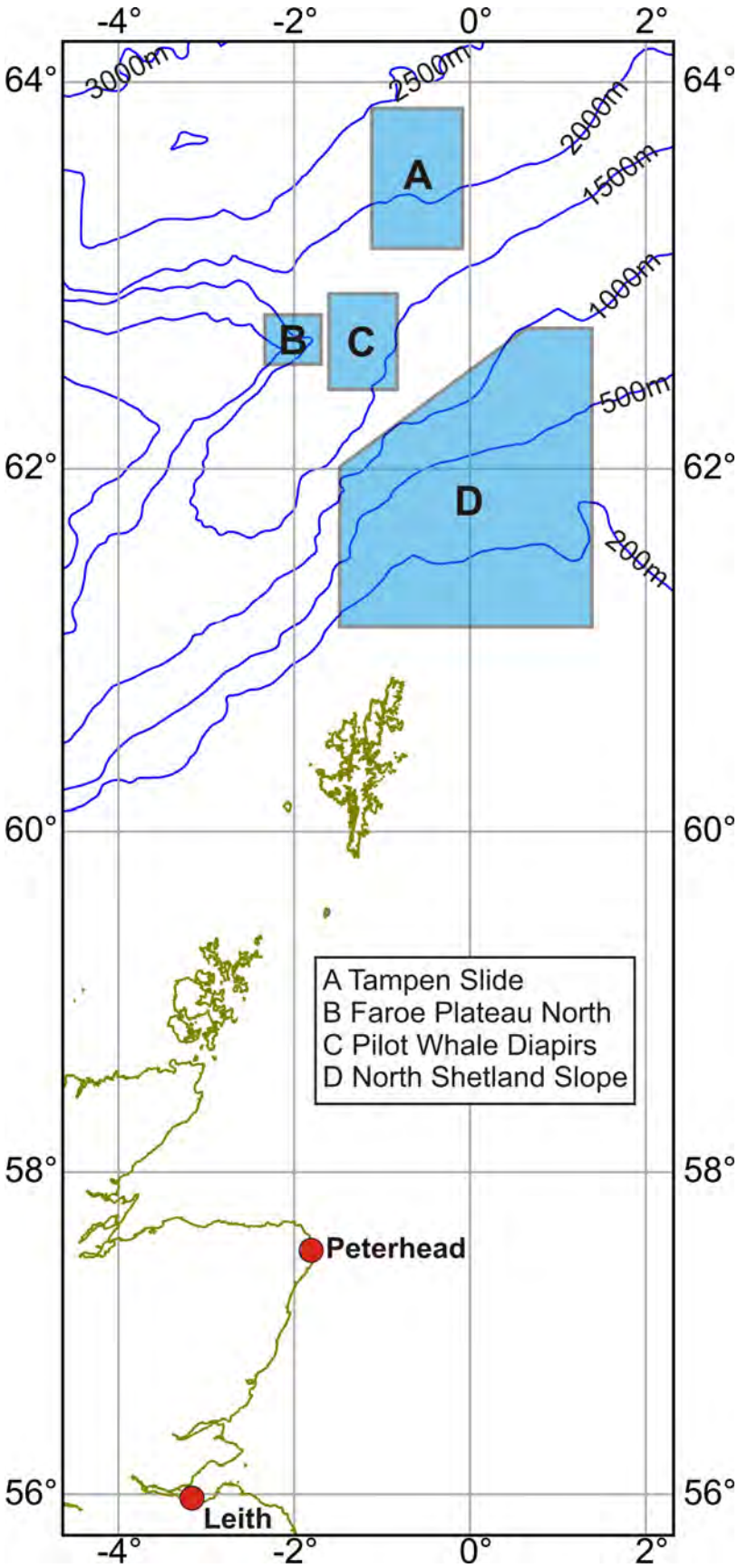

Chart 1. S/V *Kommandor Jack* cruise 2002 Leg 2. Chart indicating ports and survey areas visited during the cruise.

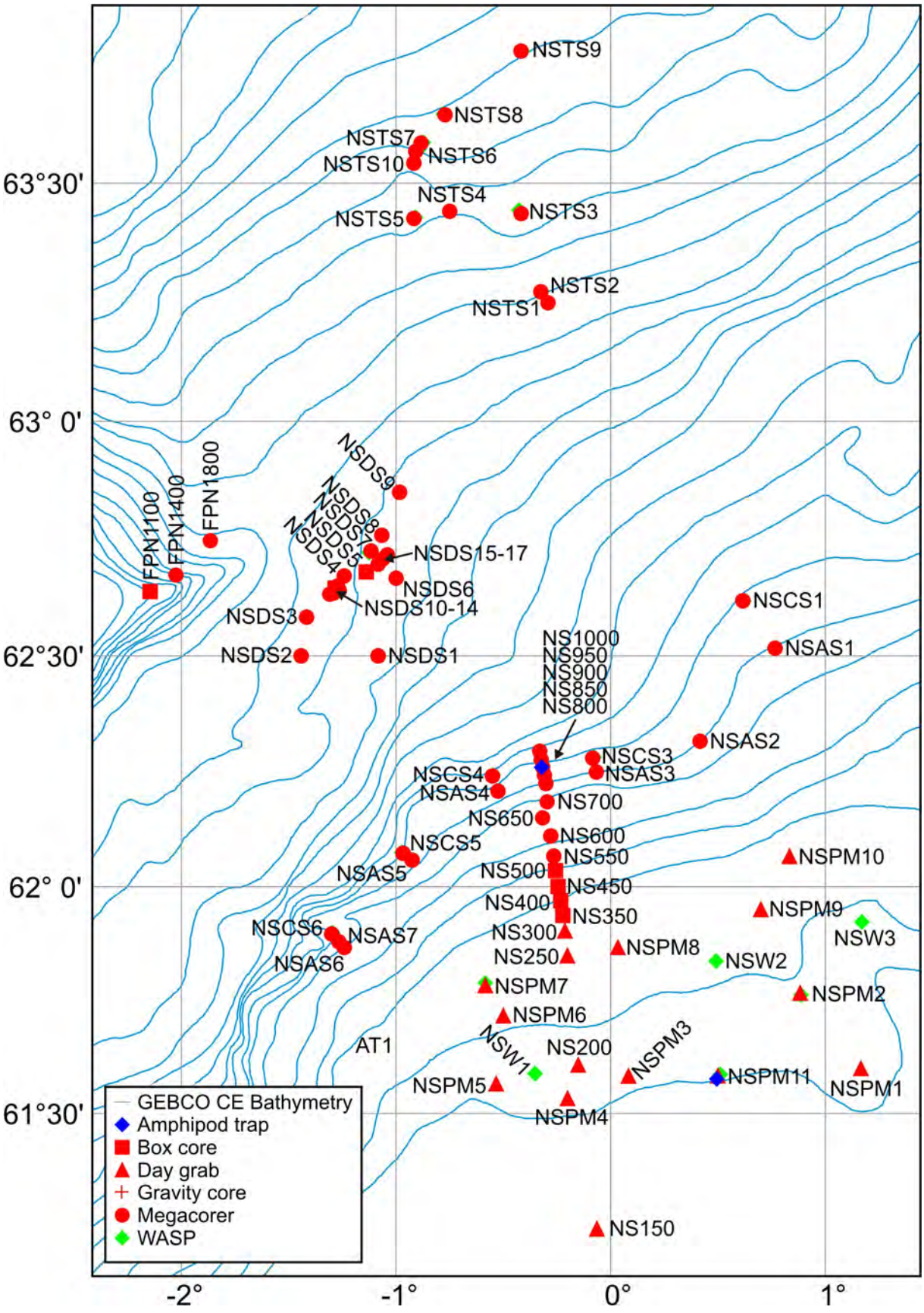

Chart 2. S/V *Kommandor Jack* cruise 2002 Leg 2. Chart indicating all deployment sites.

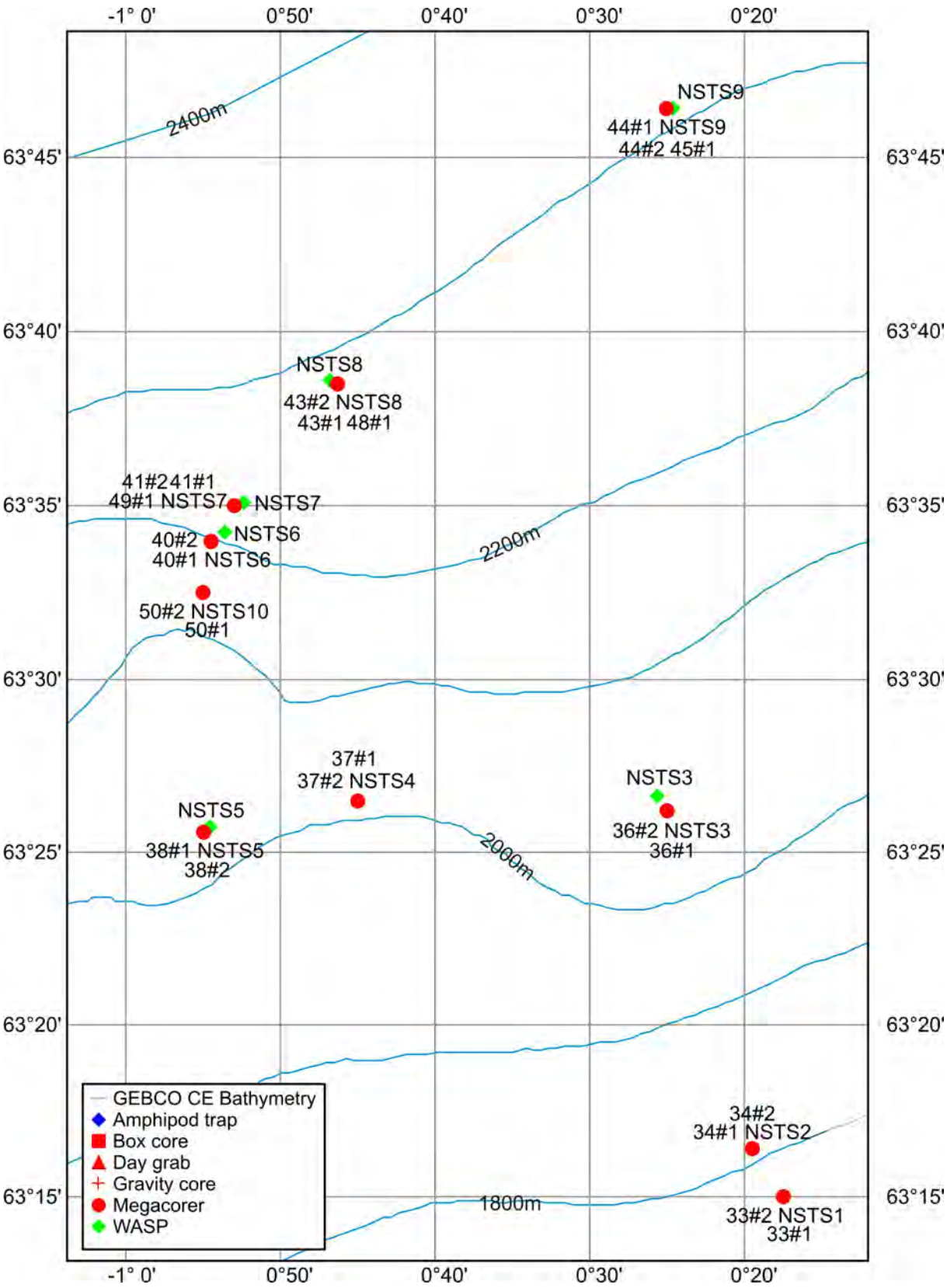

Chart 3. S/V *Kommandor Jack* cruise 2002 Leg 2. Chart indicating deployment in the Tampen Slide area.

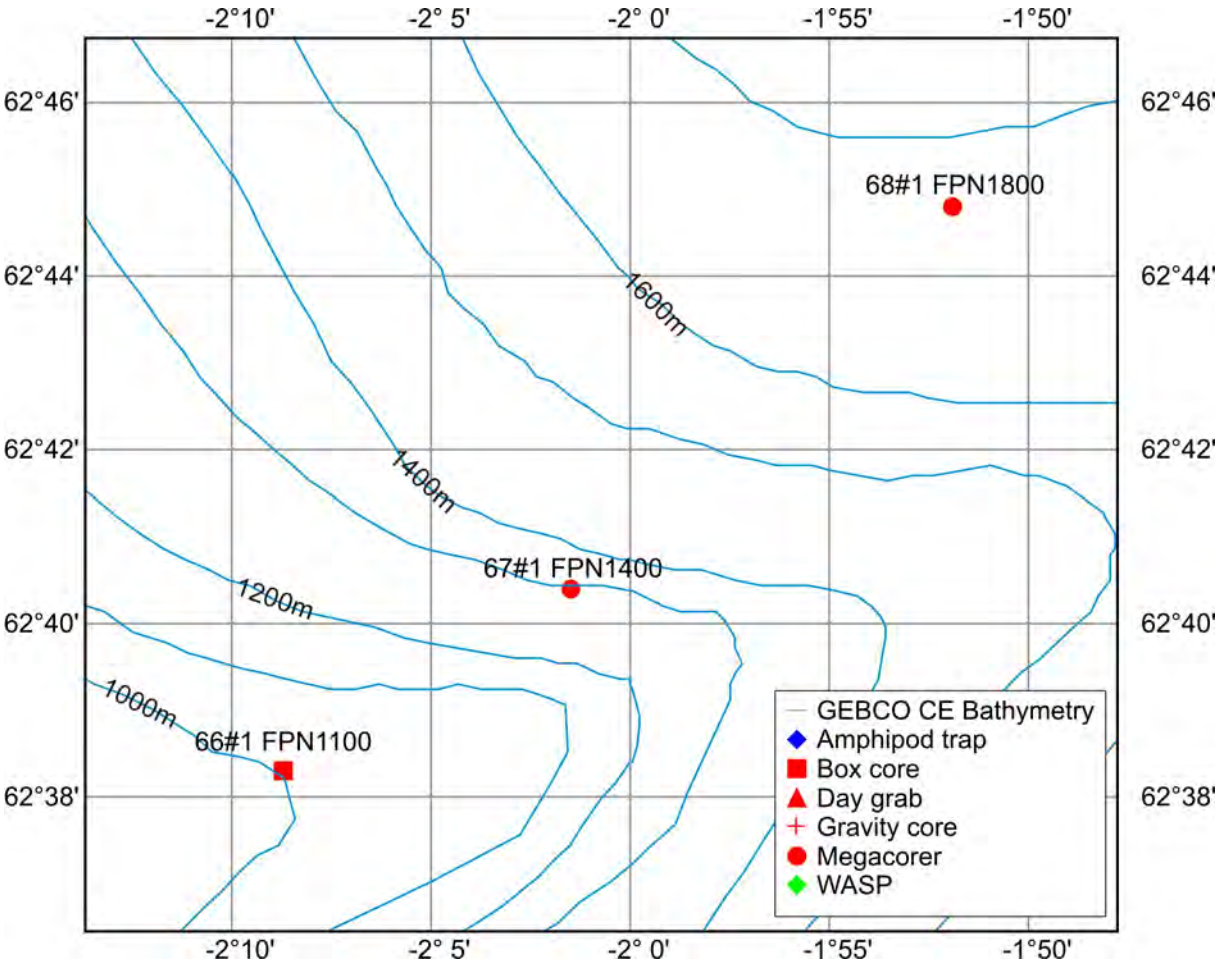

Chart 4. S/V *Kommandor Jack* cruise 2002 Leg 2. Chart indicating deployment in the Faroe Plateau North area.

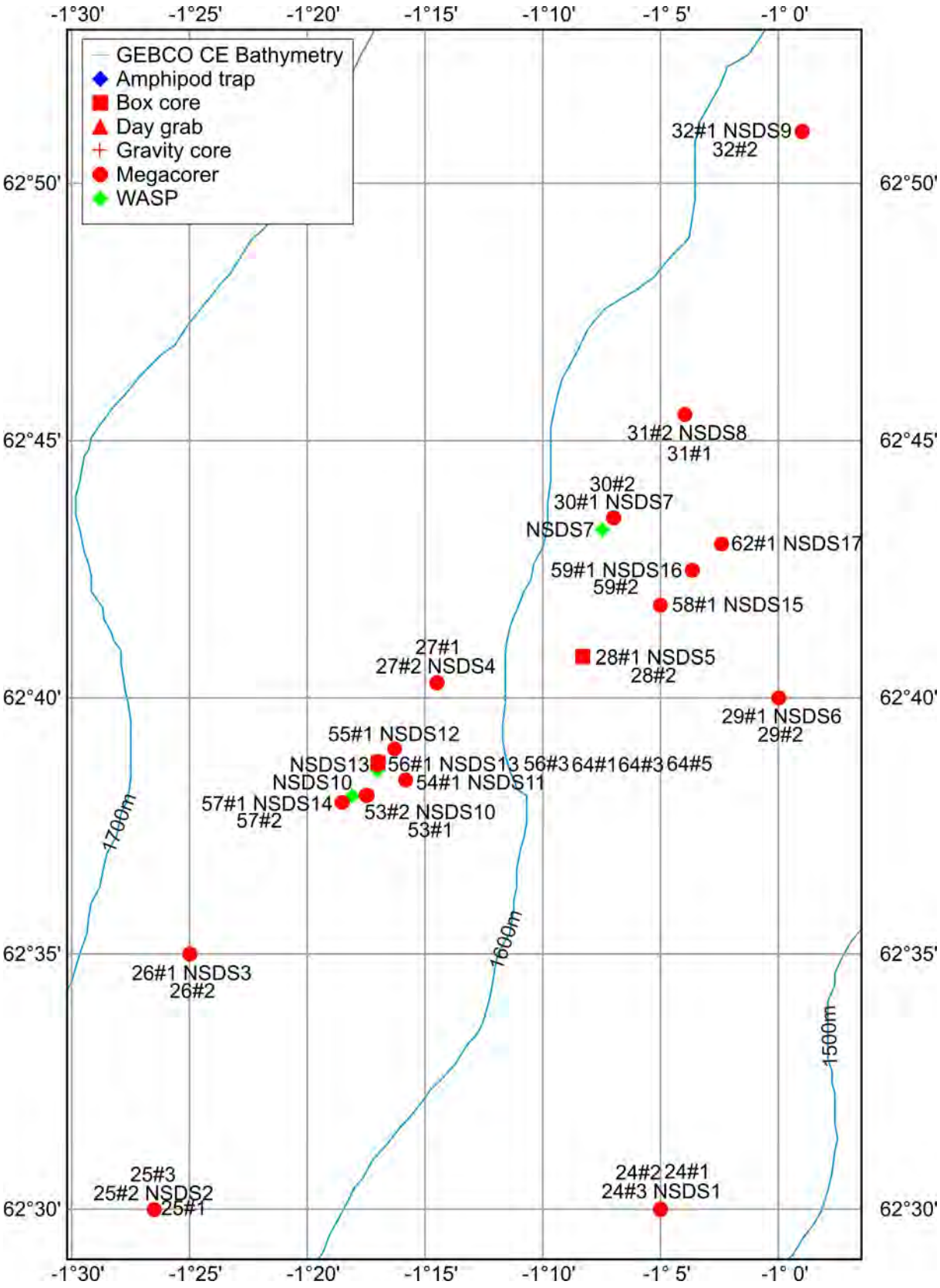

Chart 5. S/V *Kommandor Jack* cruise 2002 Leg 2. Chart indicating deployment in the Pilot Whale Diapirs area.

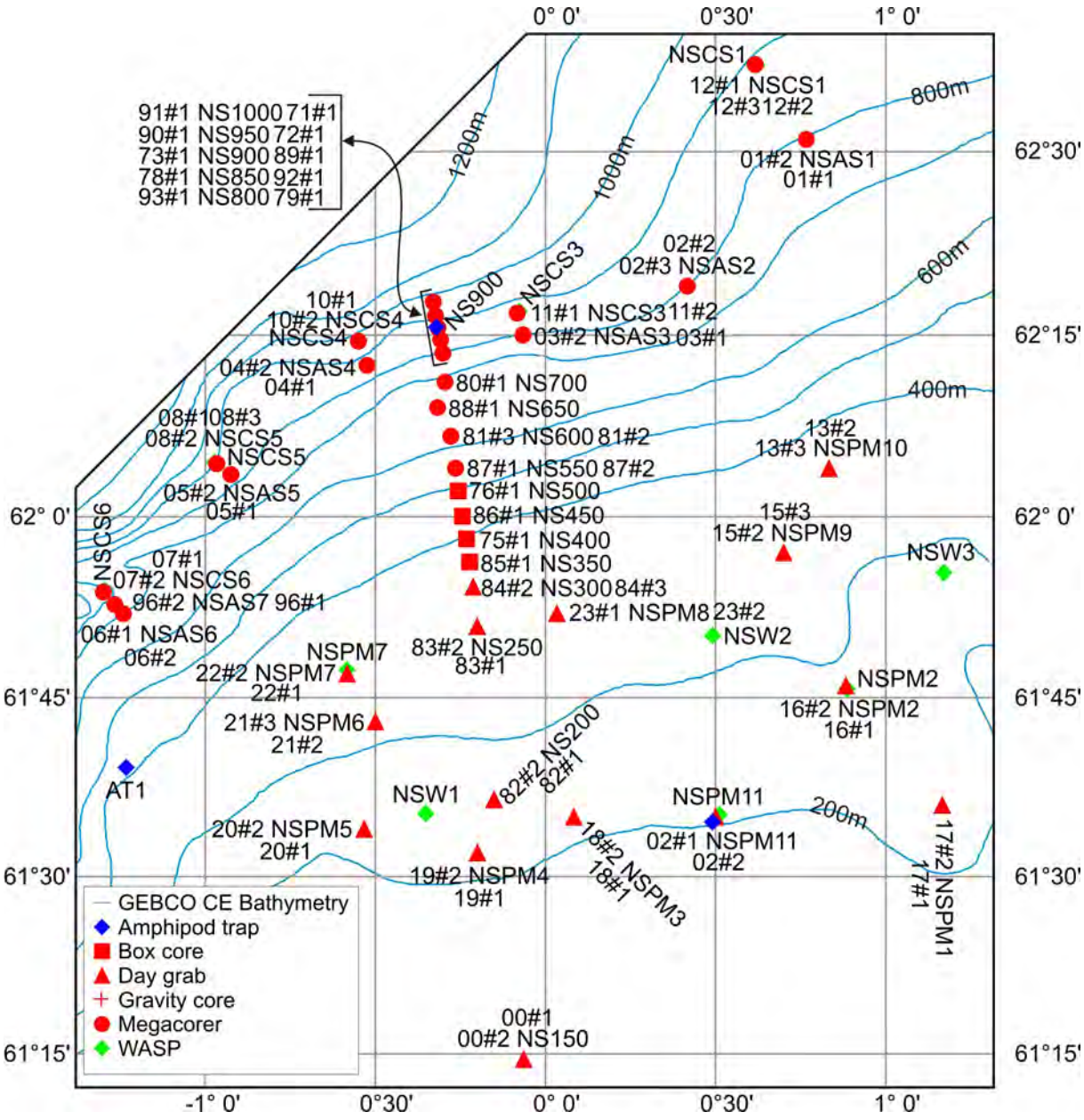

Chart 6. S/V *Kommandor Jack* cruise 2002 Leg 2. Chart indicating deployment in the North Shetland Slope area.

Note that the following WASP track charts are shown as UTM coordinates, the table below provides the latitude and longitude of the centre point of each chart.

Chart	Station	Site	Centre position UTM grid			
7	57009#1	NSCS5	62°	04.505´N	000°	58.432´W
8	57035#1	NSTS3	63°	26.620´N	000°	25.706´W
9	57039#1	NSTS6	63°	34.213´N	000°	53.488´W
10	57042#1	NSTS7	63°	35.084´N	000°	52.274´W
11	57046#1	NSTS9	63°	46.399´N	000°	24.516´W
12	57047#1	NSTS8	63°	38.949´N	000°	47.803´W
13	57051#1	NSTS5	63°	25.744´N	000°	54.532´W
14	57052#1	NSDS10	62°	37.983´N	001°	18.212´W
15	57061#1	NSDS13	62°	38.534´N	001°	17.010´W
16	57063#1	NSDS7	62°	43.260´N	001°	07.463´W
17	57069#1	NSCS1	62°	37.037´N	000°	37.327´E
18	57070#1	NSCS3	62°	16.933´N	000°	04.612´W
19	57094#1	NSCS4	62°	14.598´N	000°	32.859´W
20	57095#1	NSCS6	61°	54.043´N	001°	17.570´W
21	57097#1	NSPM7	61°	47.316´N	000°	35.038´W
22	57099#1	NSW1	61°	35.310´N	000°	21.159´W
23	57103#1	NSPM11	61°	35.193´N	000°	30.668´E
24	57104#1	NSW2	61°	50.207´N	000°	29.510´E
25	57105#1	NSW3	61°	54.892´N	001°	10.267´E
26	57106#1	NSPM2	61°	45.758´N	000°	53.242´E

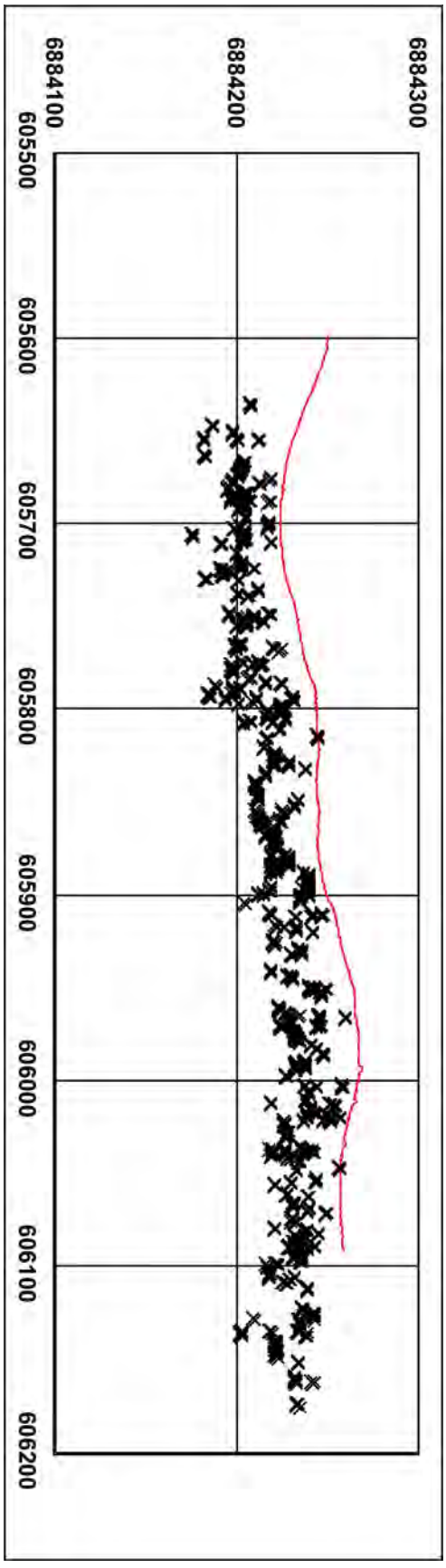

Chart 7. WASP 57009#1, Site NSCS5.

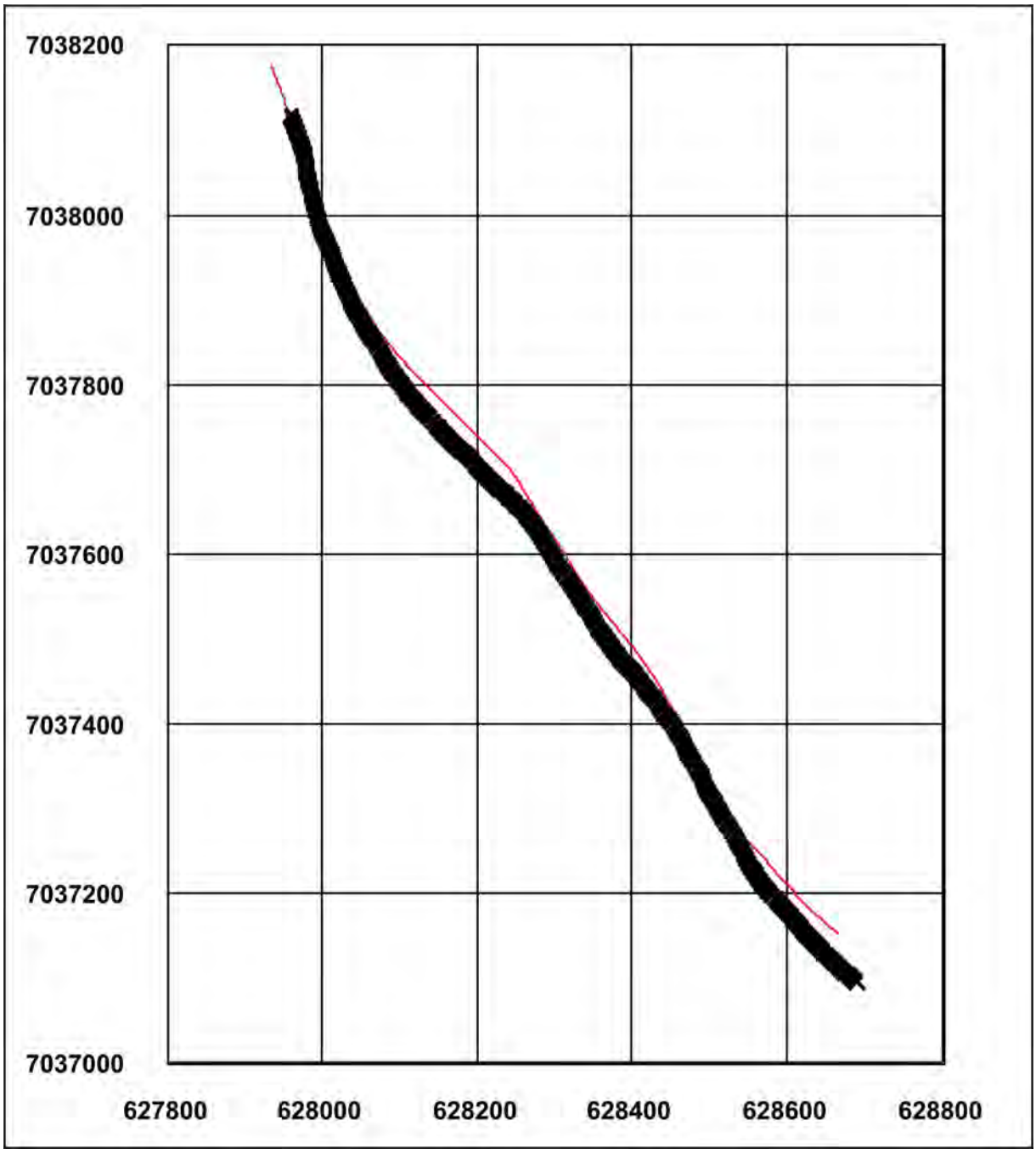

Chart 8. WASP 57035#1, Site NSTS3.

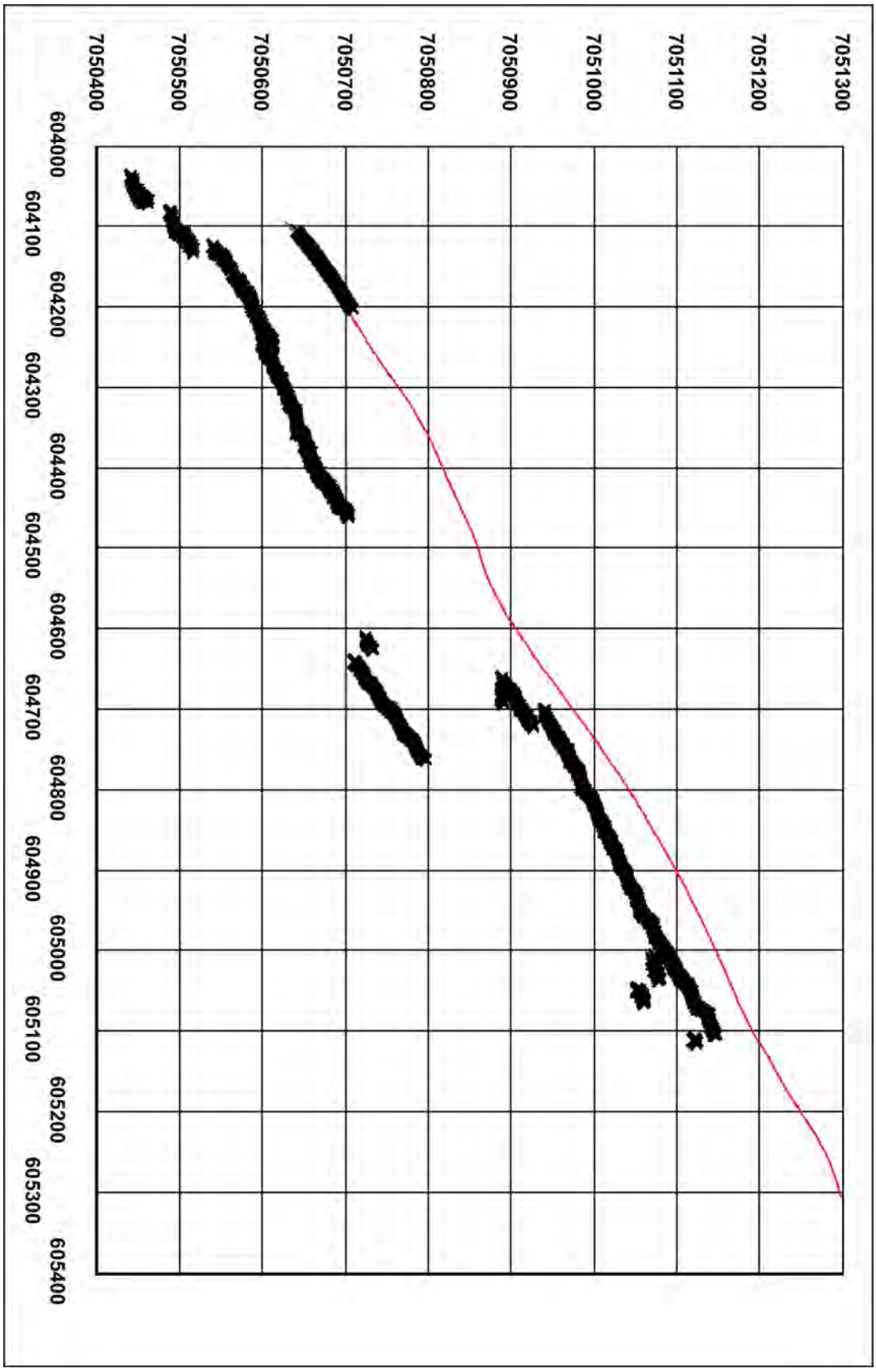

Chart 9. WASP 57039#1, Site NSTS6.

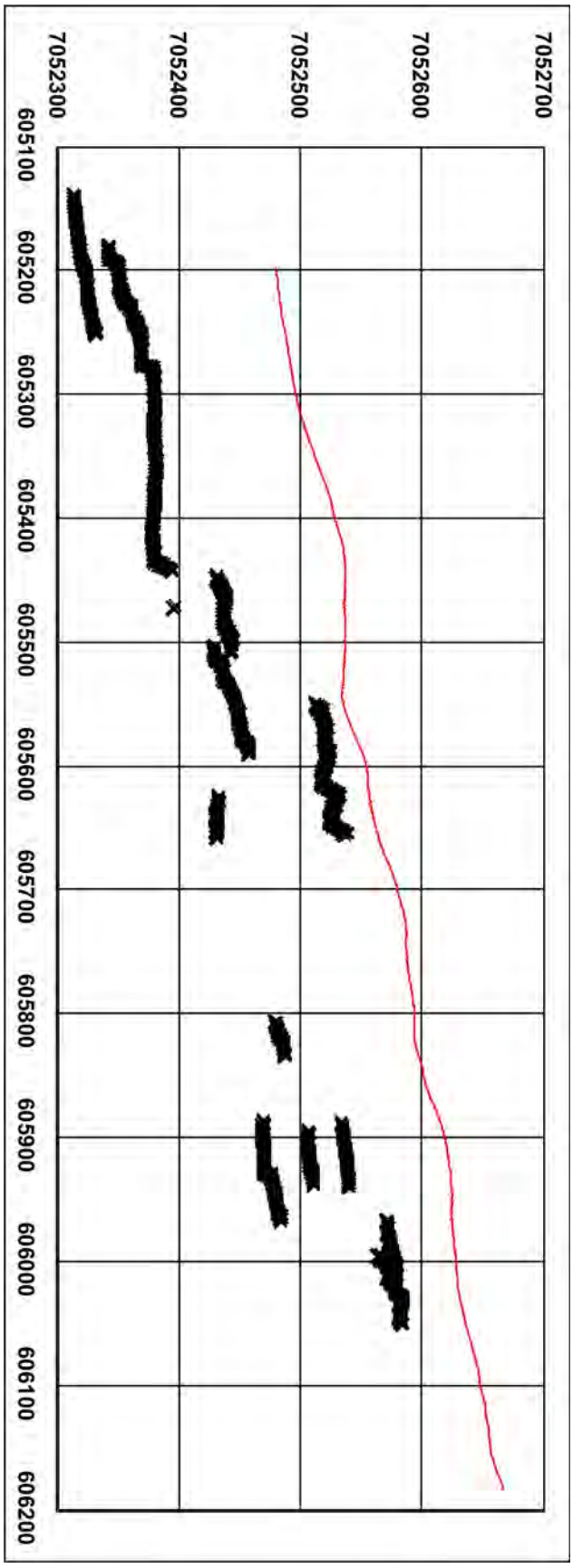

Chart 10. WASP 57042#1, Site NSTS7.

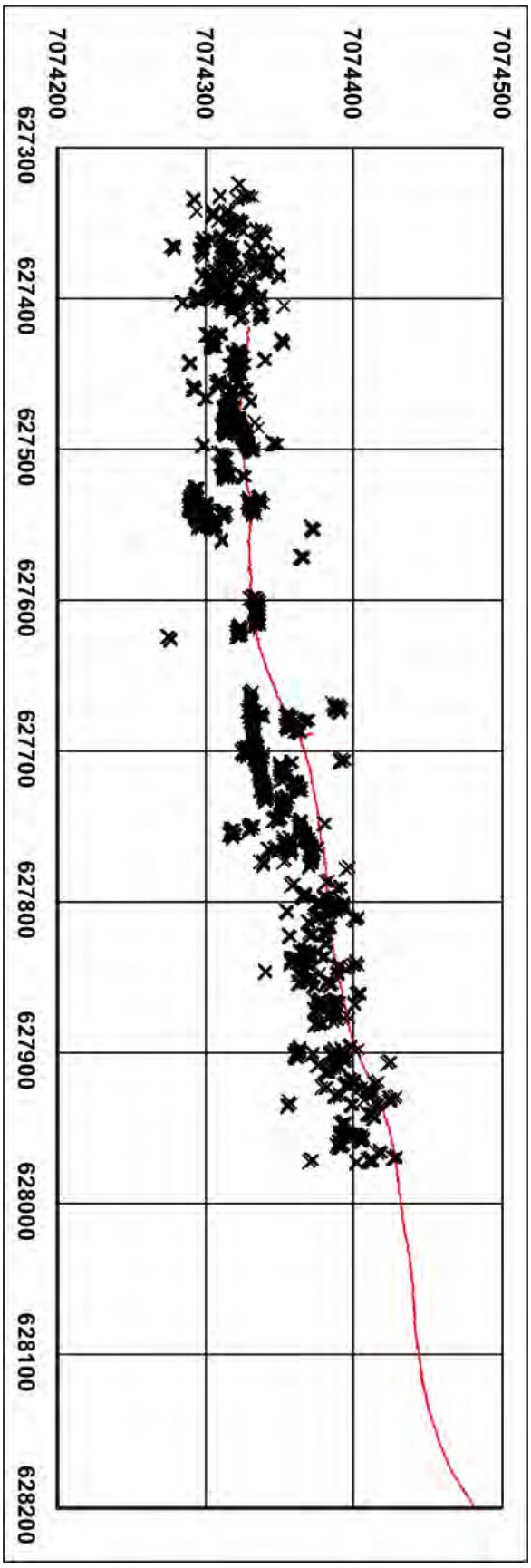

Chart 11. WASP 57046#1, Site NSTS9.

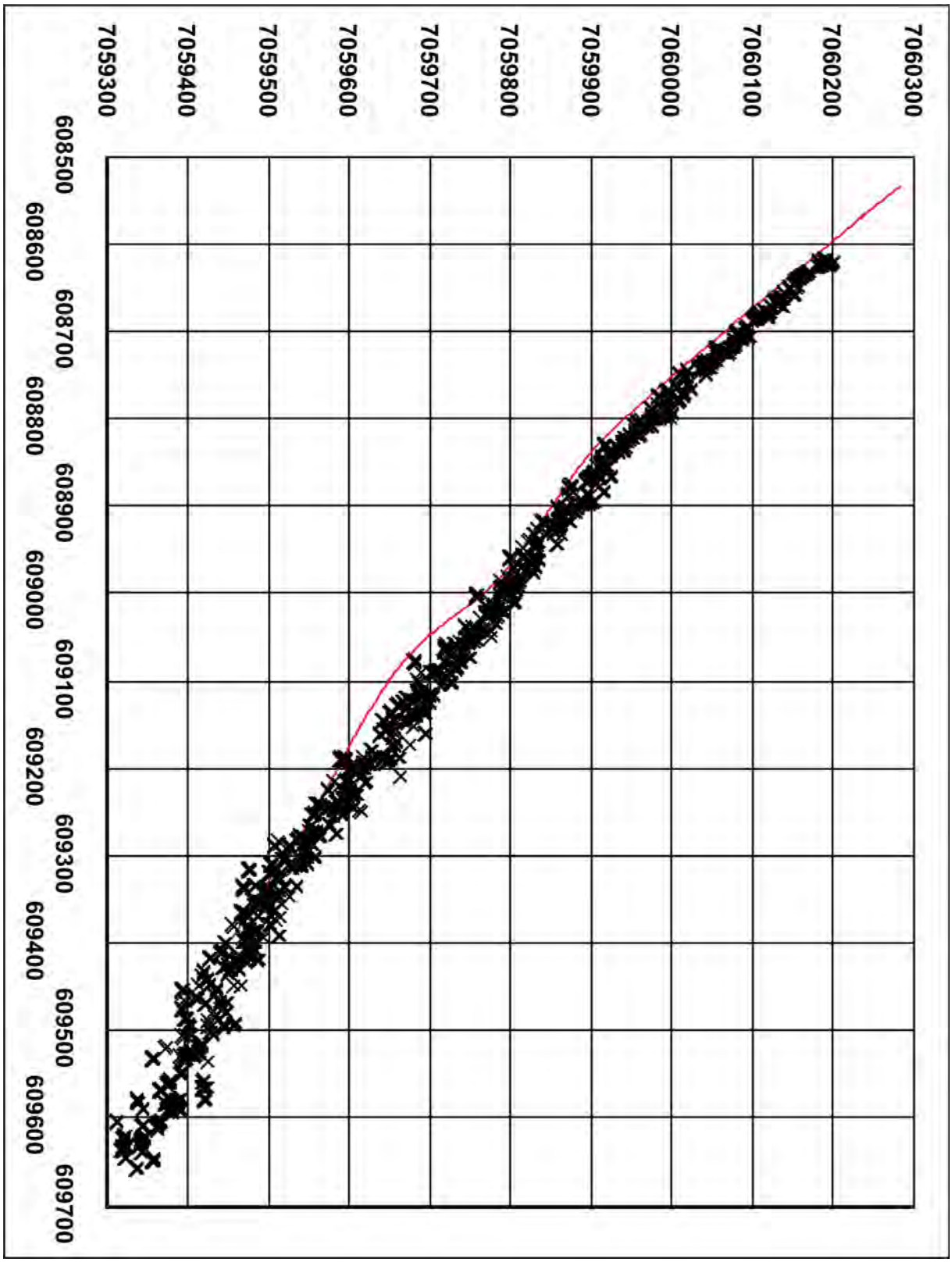

Chart 12. WASP 57047#1, Site NSTS8.

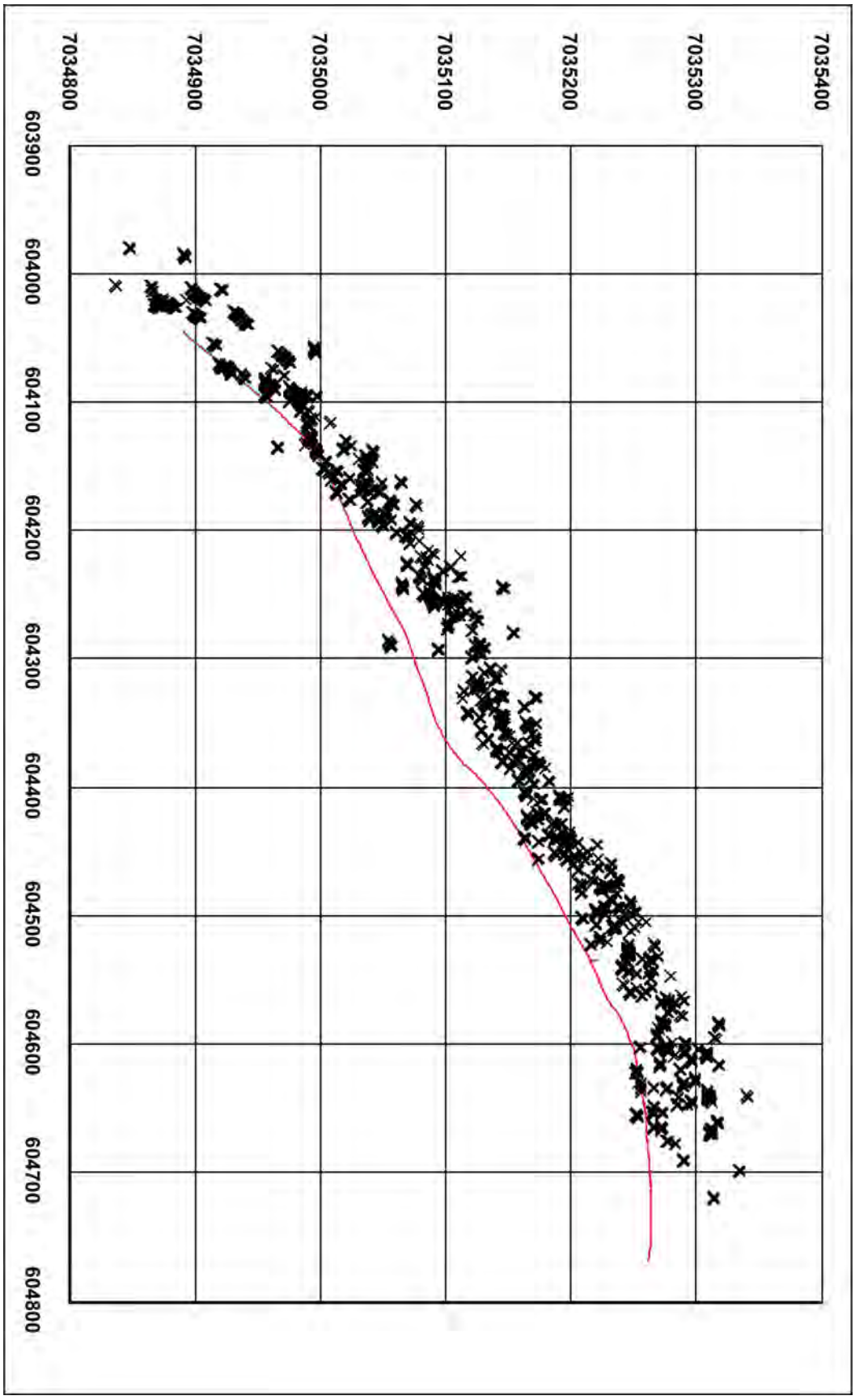

Chart 13. WASP 57051#1, Site NSTS5.

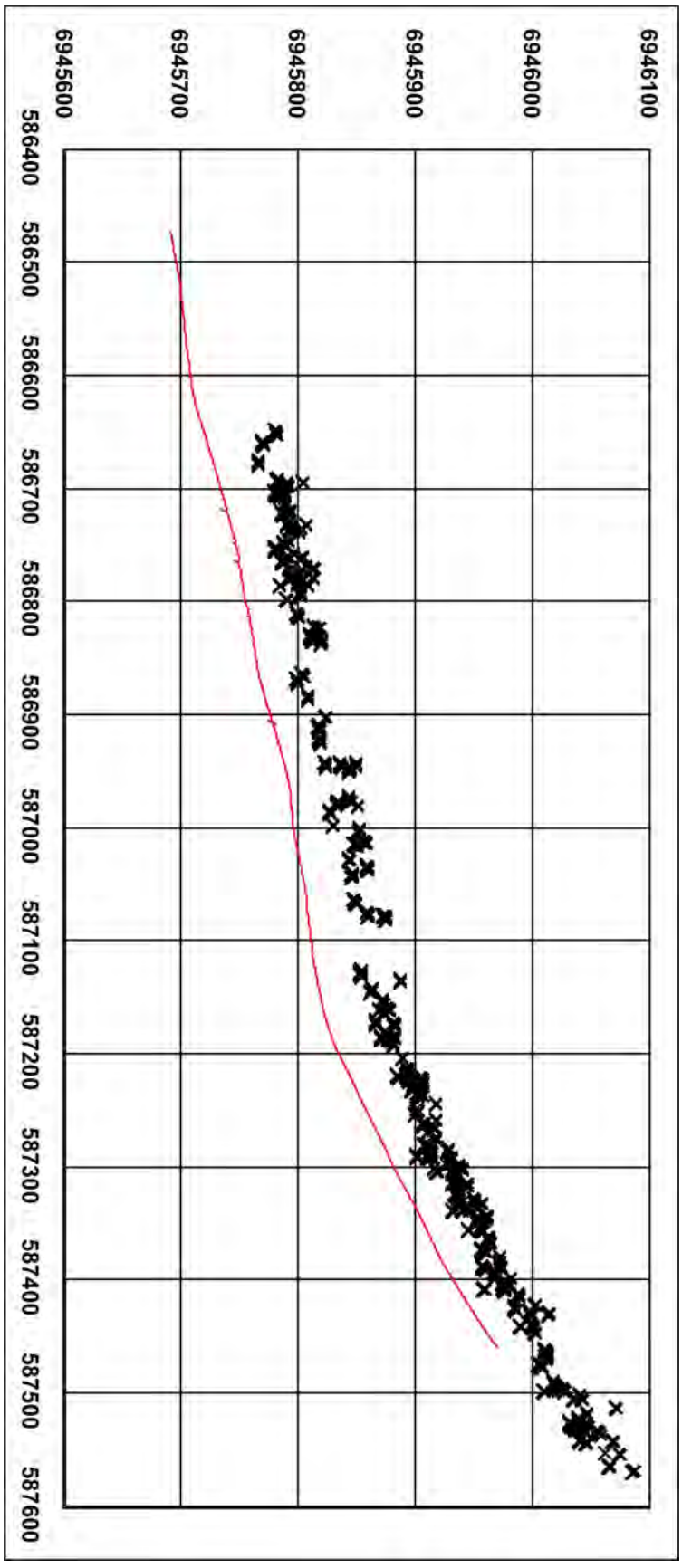

Chart 14. WASP 57052#1, Site NSDS10.

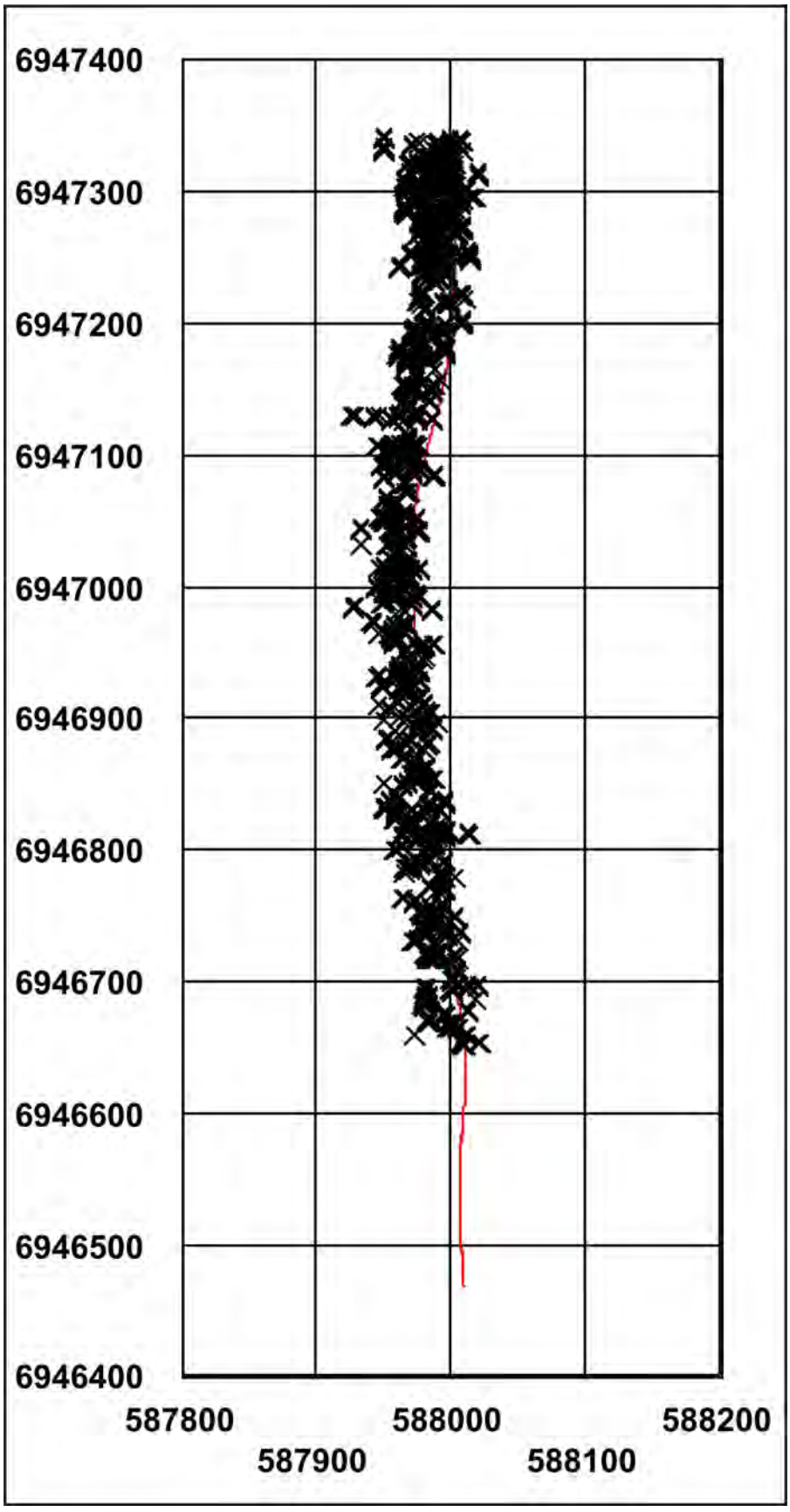

Chart 15. WASP 57061#1, Site NSDS13.

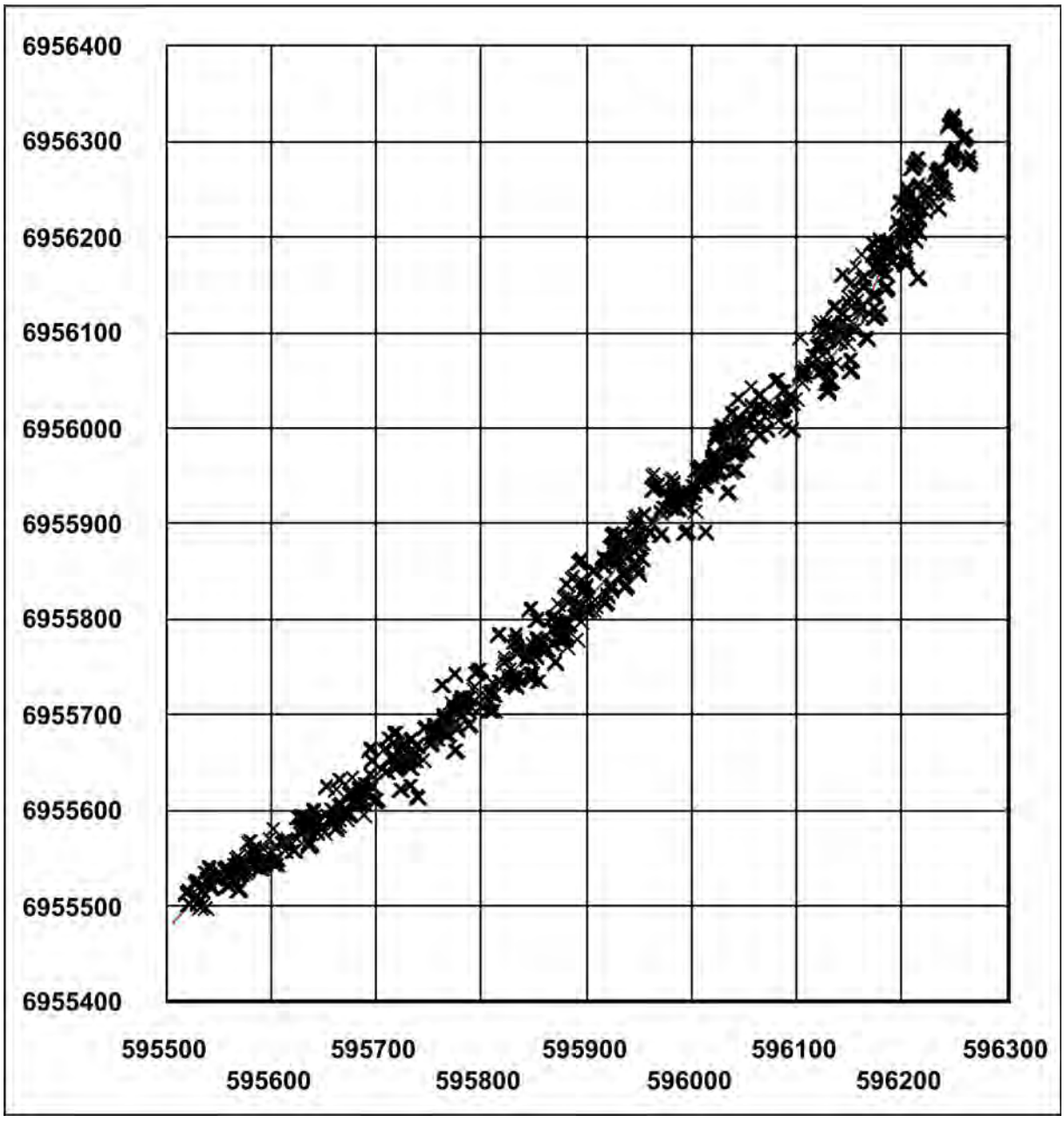

Chart 16. WASP 57063#1, Site NSDS7.

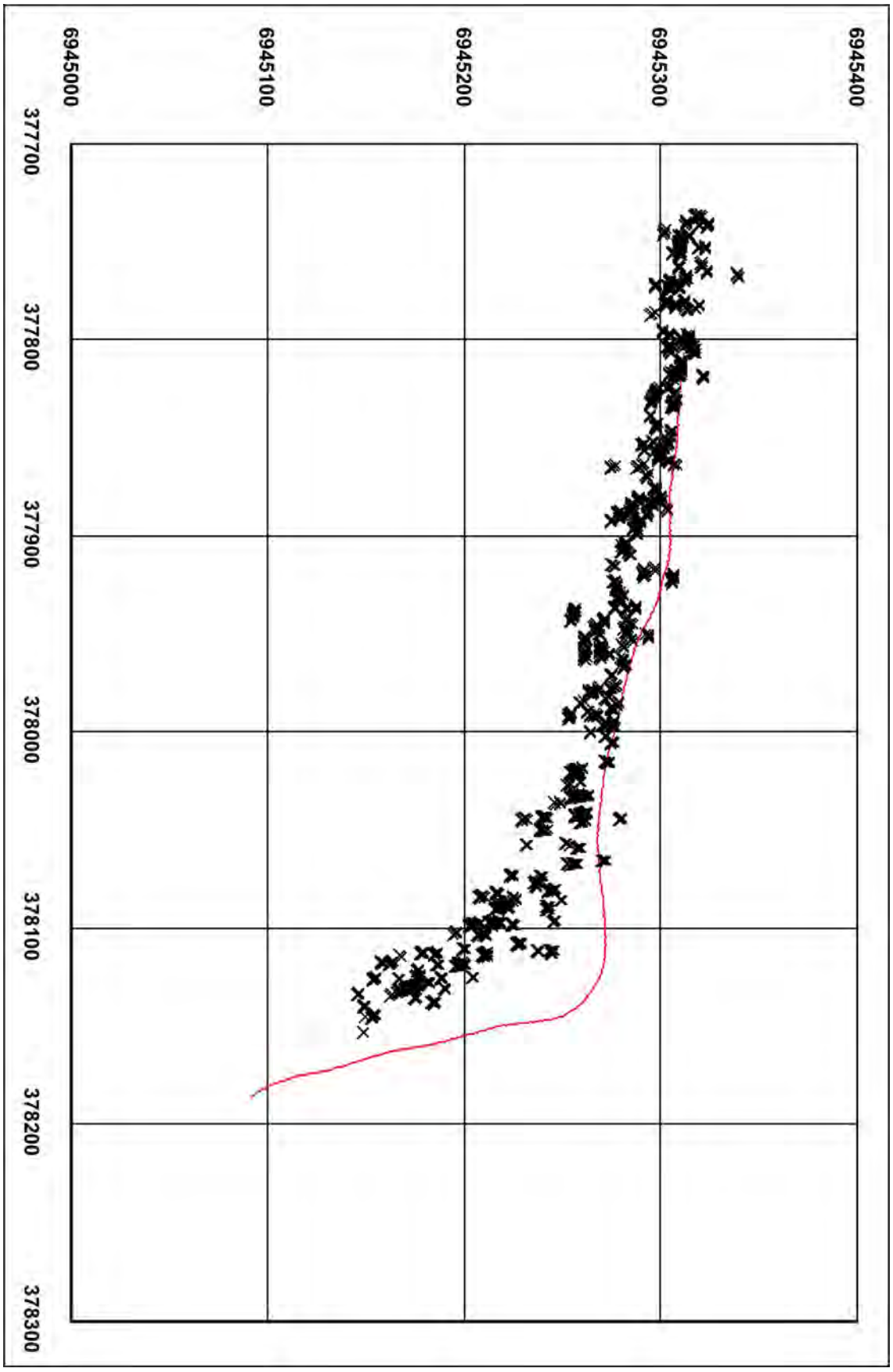

Chart 17. WASP 57069#1, Site NSCS1.

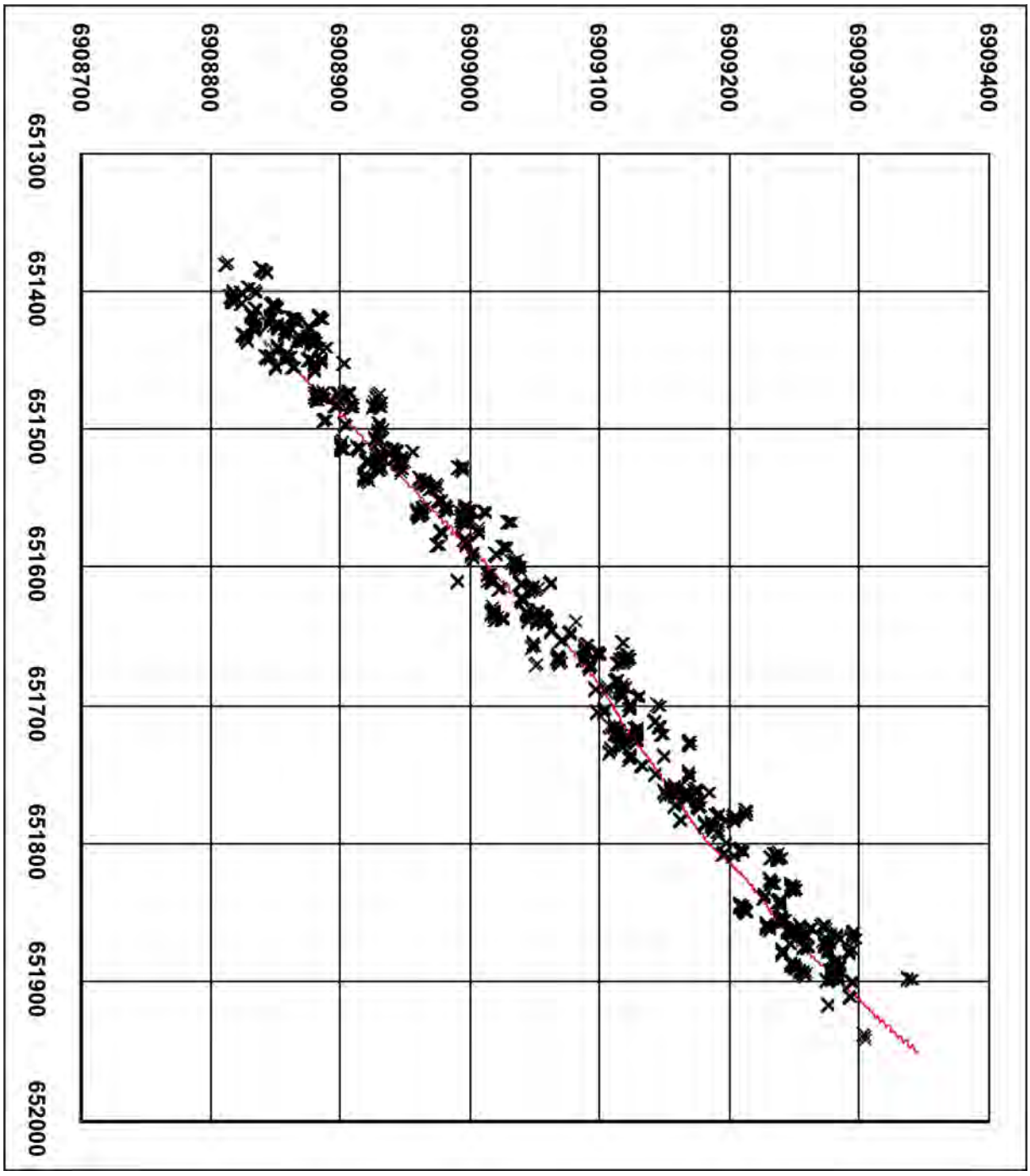

Chart 18. WASP 57070#1, Site NSCS3.

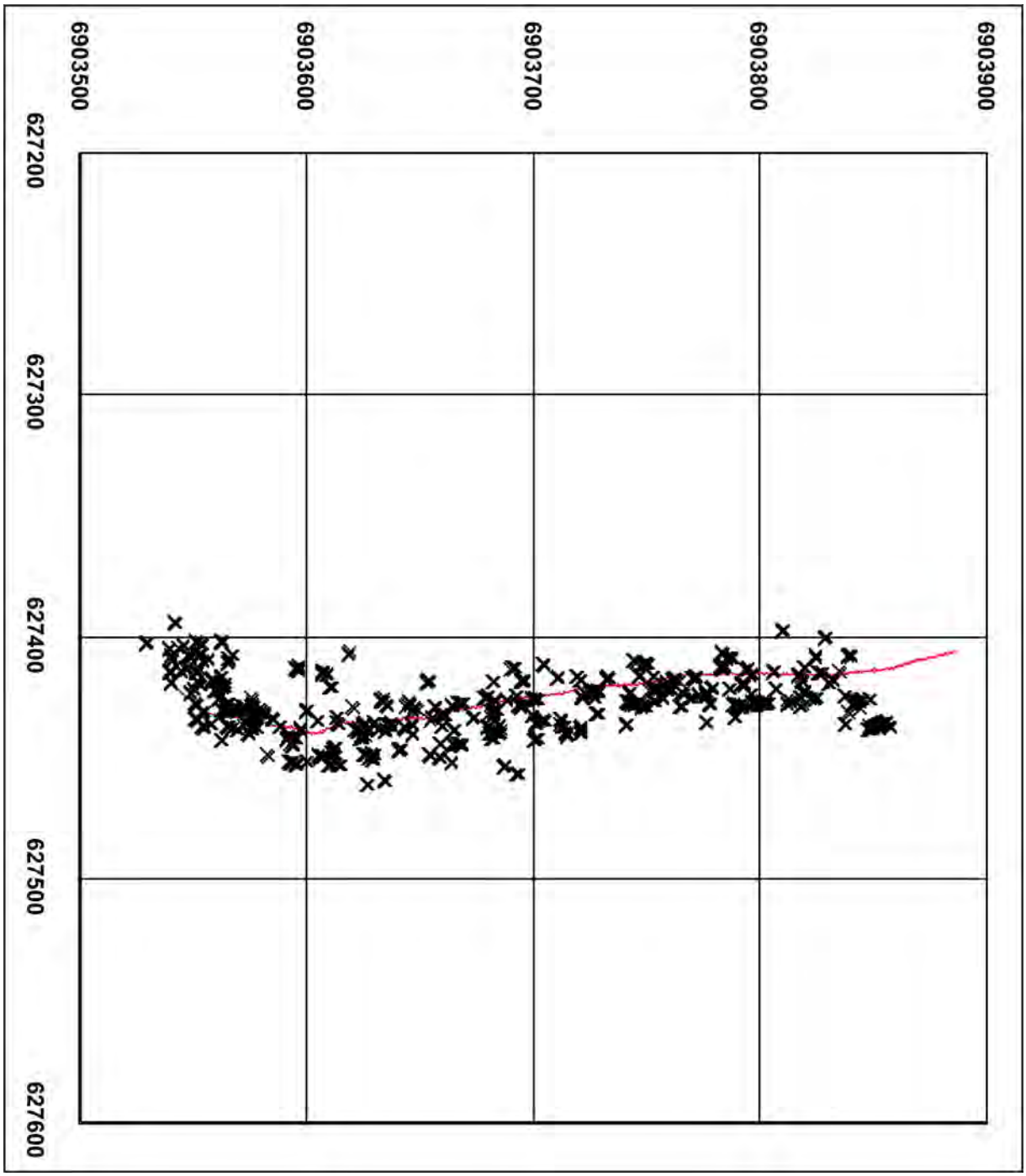

Chart 19. WASP 57094#1, Site NSCS4.

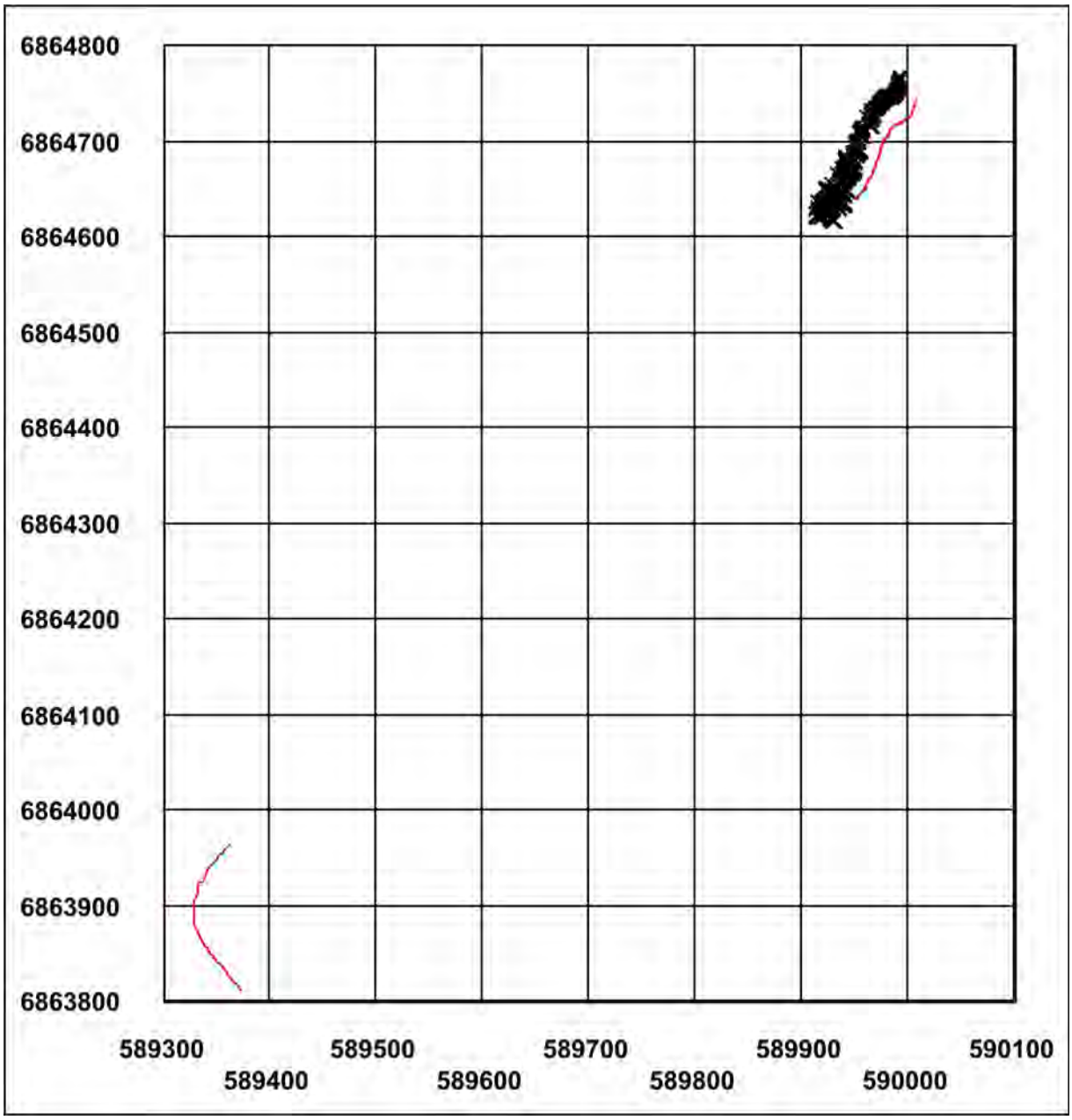

Chart 20. WASP 57095#1, Site NSCS6.

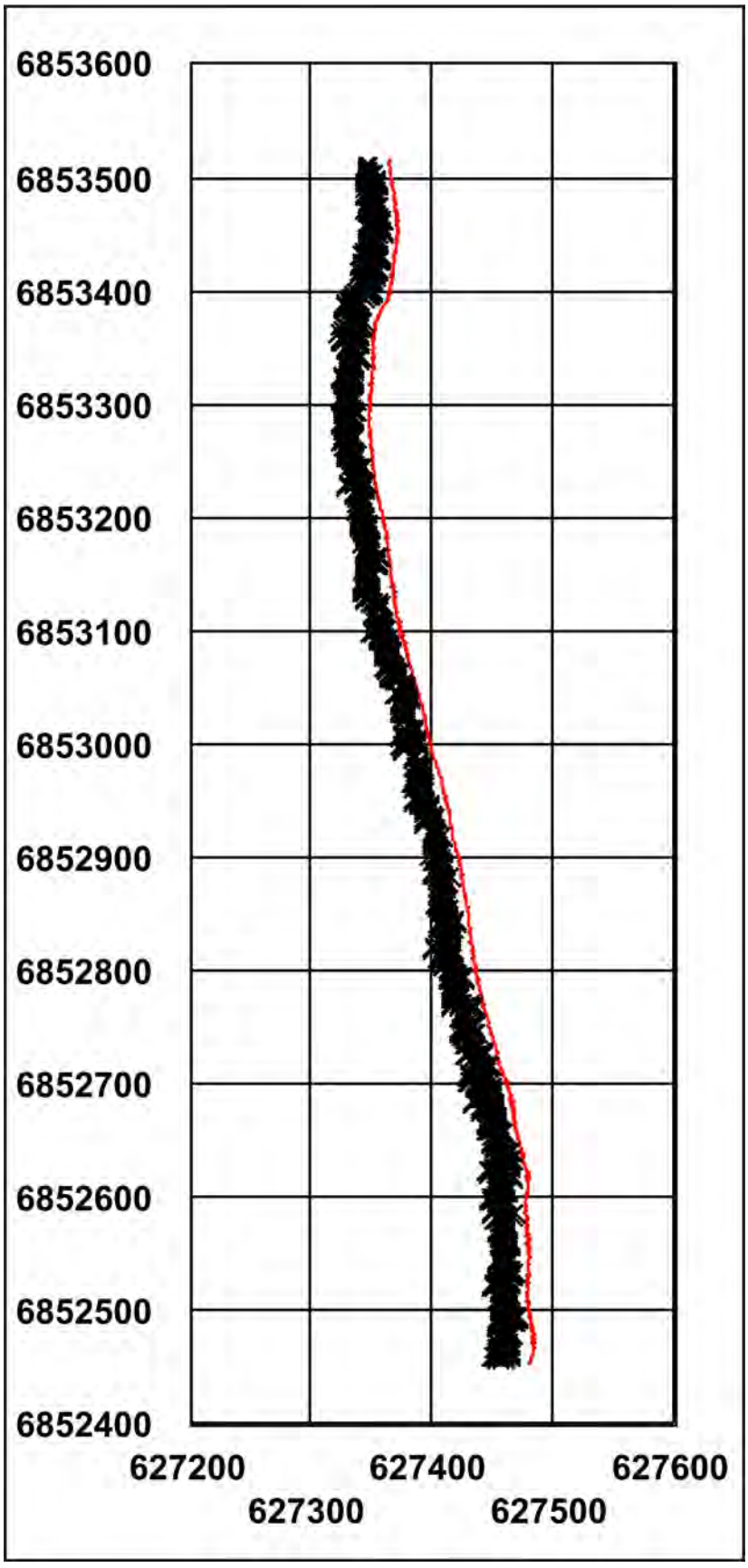

Chart 21. WASP 57097#1, Site NSPM7.

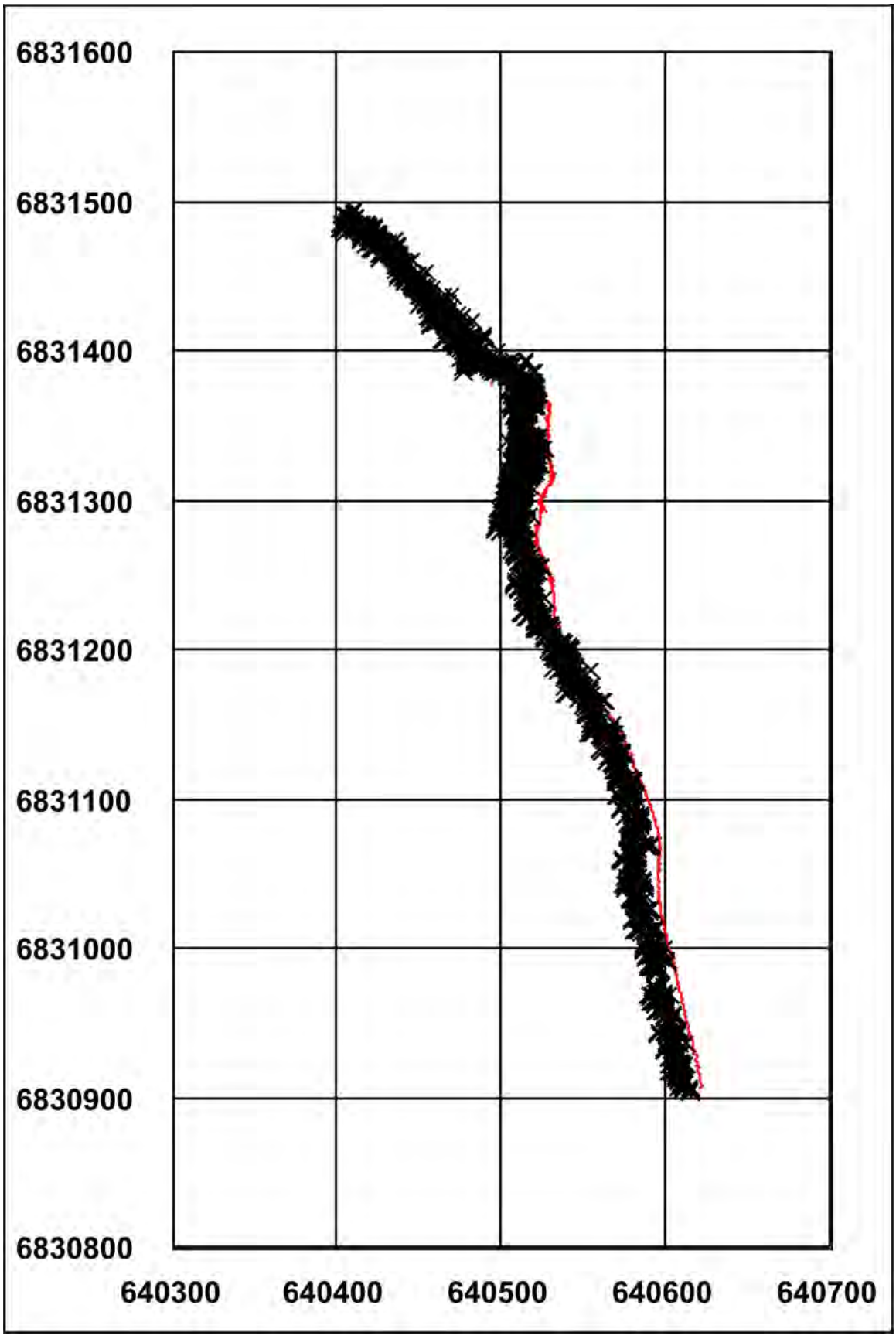

Chart 22. WASP 57099#1, Site NSW1.

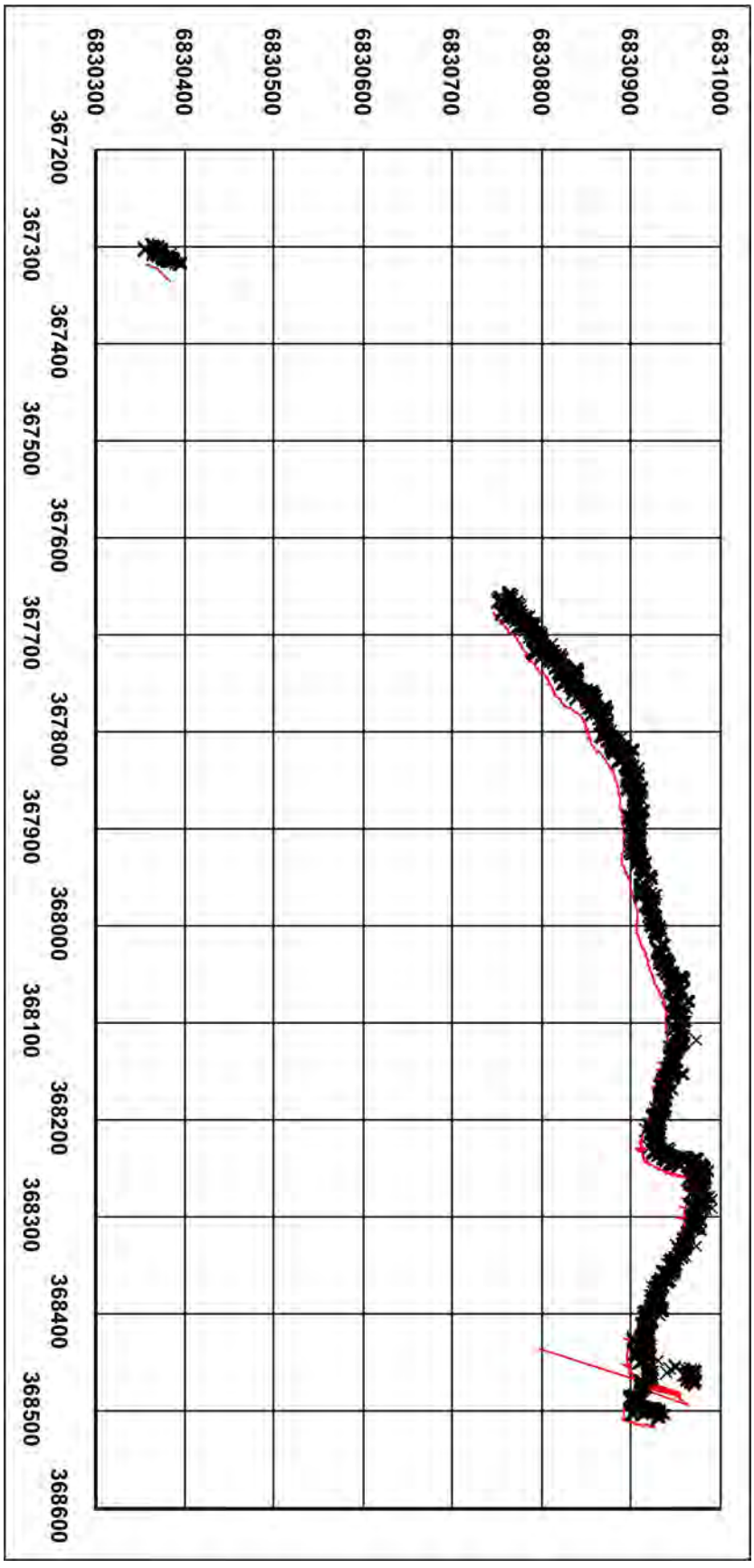

Chart 23. WASP 57103#1, Site NSPM11.

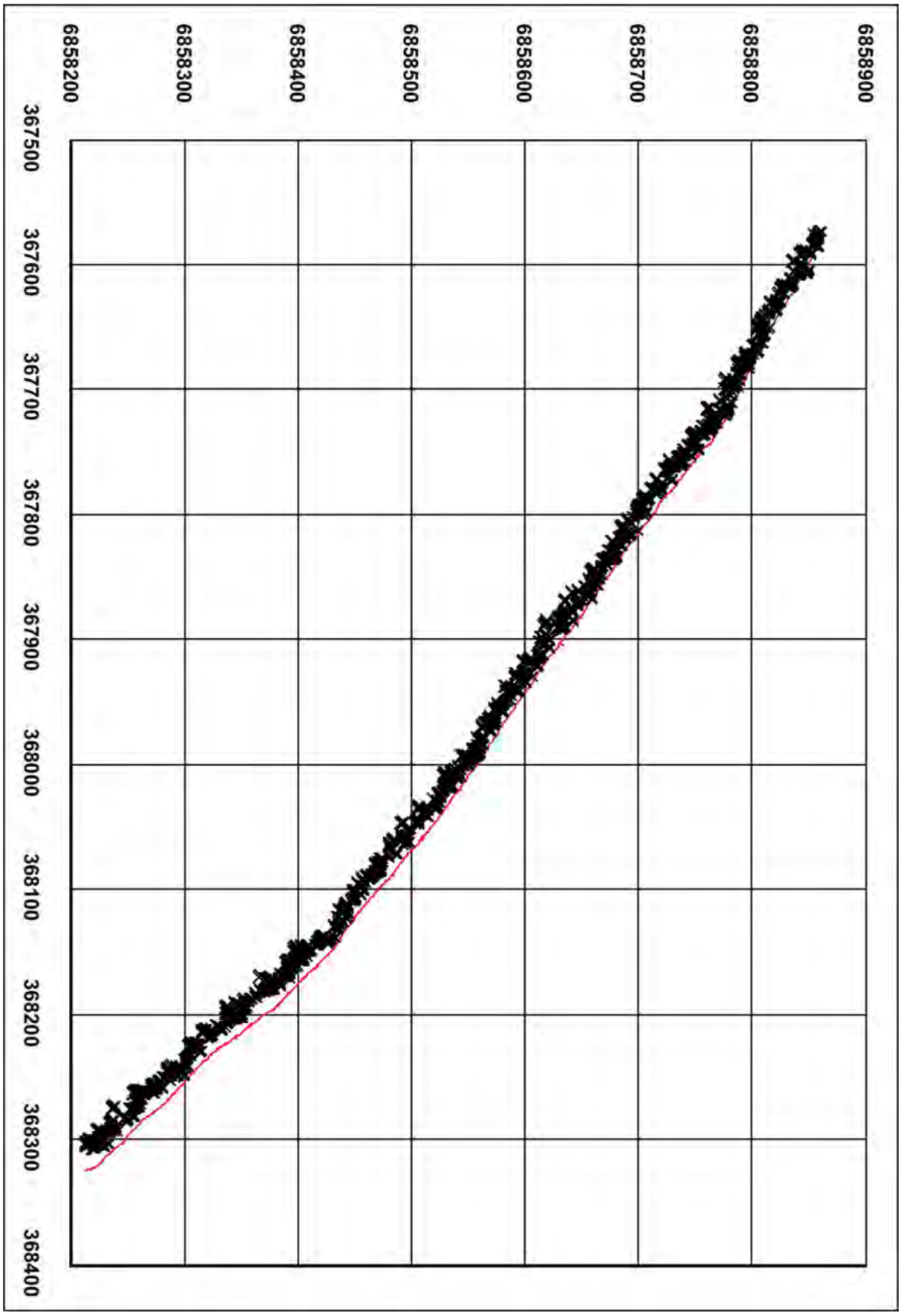

Chart 24. WASP 57104#1, Site NSW2.

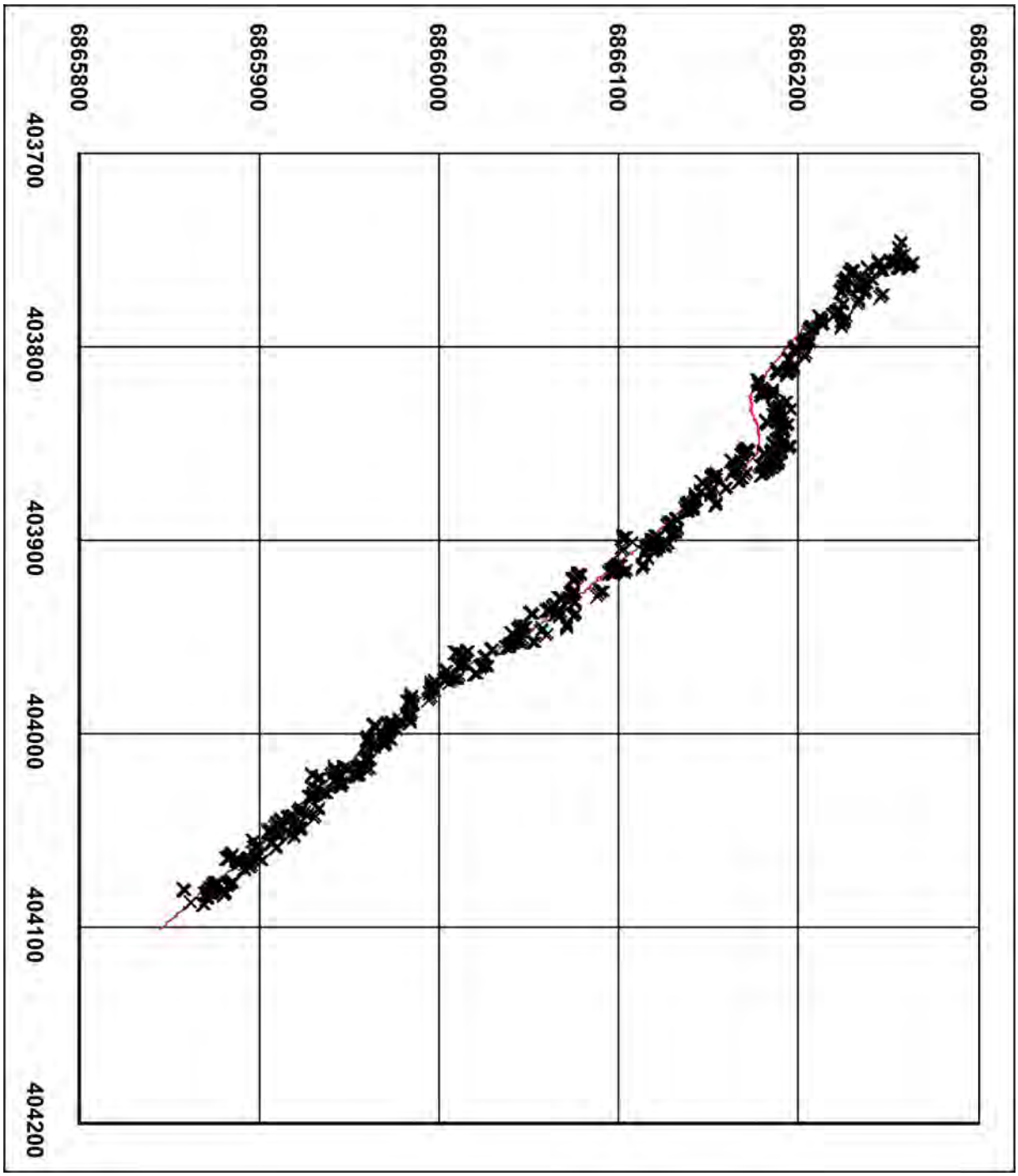

Chart 25. WASP 57105#1, Site NSW3.

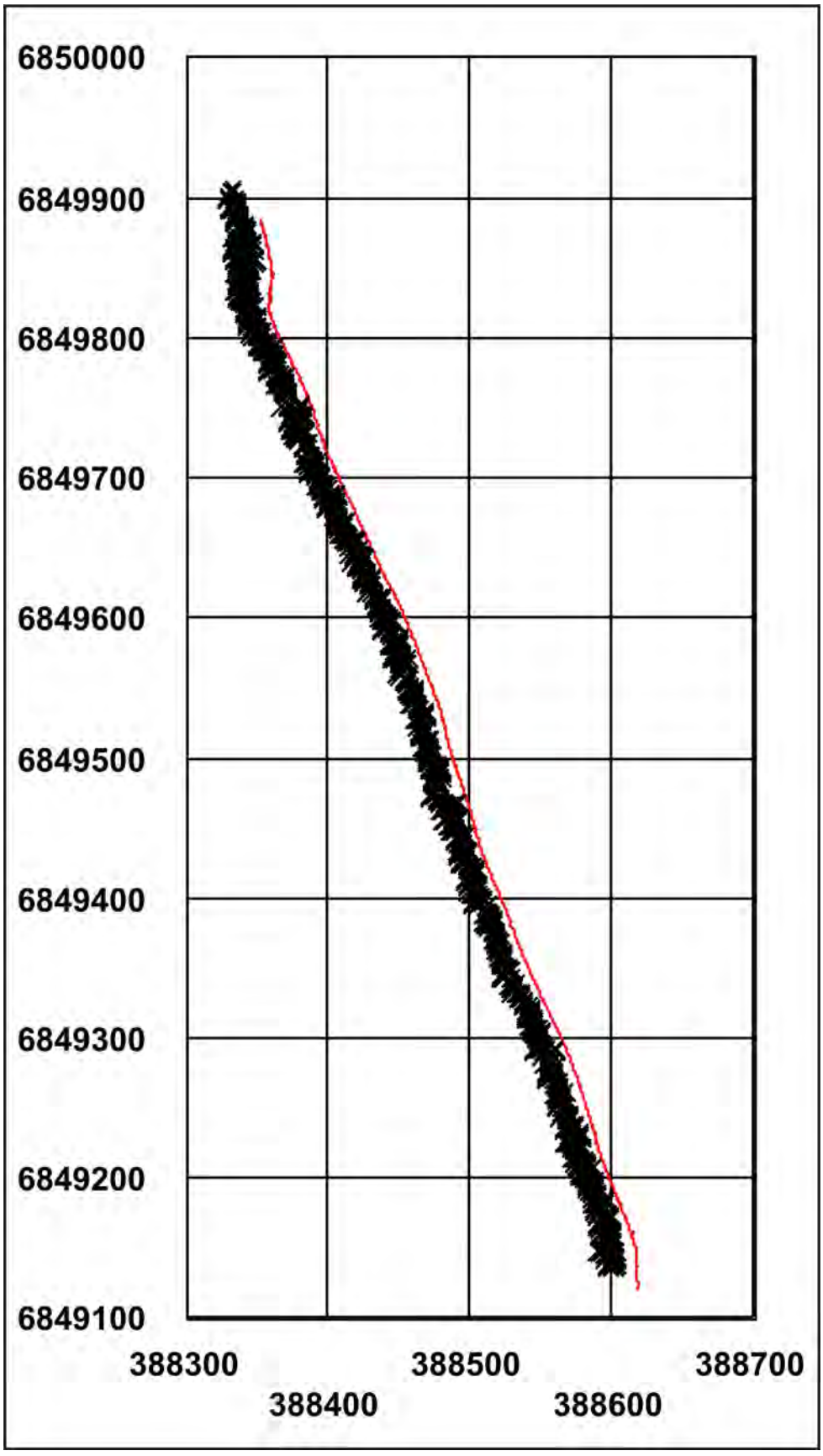

Chart 26. WASP 57106#1, Site NSPM2.

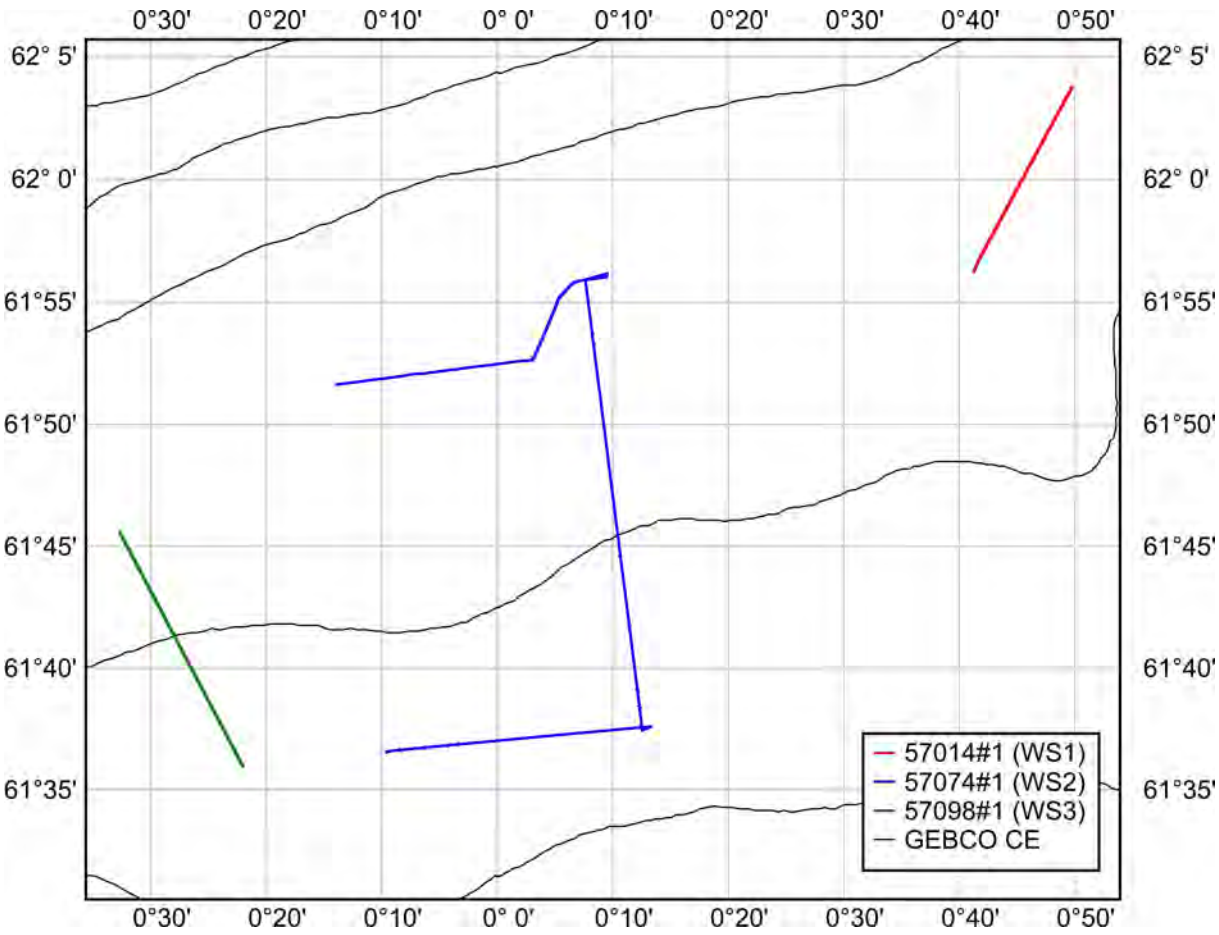

Chart 27. Widescan deployments.

11. APPENDICES

11.1. Summary of geological and geotechnical assessments, (provided by Alick Leslie, BGS)

					Sea Bed Sediment								Quaternary Sediments						Geotechnical Measurements			Comments
Stn	Site	BGS No.	Gear	Depth of Core (m)	Munsell Colour	Surface sediment (m)	Sand Grain Size	Folk	Sorting clastics	Sorting overall	Forams	Carbonate	DTB Oxidation (m)	DTB Bioturbation (m)	Munsell Colour	Folk	Disturbance	Quaternary Comments	Test Depth (m)	Compressive Strength (kPa)	Shear Strength (kPa)	
001#1	NSAS1	62 +00 95	MgC	0.32	10YR 5/2	0.12	M	SM	M	M	y	y			10YR 5/1	M	y	Very soft mud	0.08	2.5		
		62 +00 95																	0.25	2.5		
002#3	NSAS2	62 +00 96	MgC	0.38	10 YR 5/3	0.04	M	SM	M	M	y	y		?0.06	10YR 5/1	M		Iron oxyhydroxides in mud.	0.14	8.7		
		62 +00 96																	0.22		10.5	
003#2	NSAS3	62 -01 03	MgC	0.38	10YR 5/4	0.04	M	MS					0.04	>0.38	10YR 5/2	M		muddy sand over sand	0.6	4	7.5	
004#2	NSAS4	62 -01 04	MgC	0.38	10YR 5/3	0.05	M	MS	M	M	Y	Y	0.05	>0.38	10YR 5/1	M		Bioturbated boundary	0.18		5	
		62 -01 04																	0.26	4		
005#2	NSAS5	62 -01 05	MgC	0.33	10YR 5/3	0.04	M	MS		M	Y	Y	0.04	>0.33	10YR 5/2	M	Y	Lithic clasts common.	0.08	8.3		
		62 -01 05																	0.2		7	
006#2	NSAS6	61 -02 187	MgC	0.4	10YR 5/3	0.05	M	MS					0.05	>0.35	10YR 4/2	MS+M			0.28	2	8	
		61 -02 187																	0.38	5.4	9	
007#2	NSCS6	61 -02 188	MgC	0.38	10YR 4/2	0.04	M	MS					0.04		10YR 4/1	MS			0.22	16.5	8.5	
008#3	NSCS5	62 -01 06	MgC	0.26	10YR 5/4	0.06	M	MS					0.06		10YR 4/1	MS		Structureless.	0.13	17.4	5	
010#2	NSCS4	62 -01 07	MgC	0.38	10YR 4/2	0.06	M	SM					0.06		10YR 4/1	MS			0.2	9	8	
011#2	NSCS3	62 -01 08	MgC	0.39	10YR 5/3	0.06	M	SM	M		Y	Y	0.06		10YR 4/1	MS			0.24	10		
		62 -01 08																	0.28	5		
012#2	NSCS1	62 +00 97	MgC	0.4	10YR 5/3	0.02	M	SM			Y	Y	0.06	>0.4	10YR 5/1	M		Very soft sand. Oxidised horizon below lithological boundary.	0.14	8.7		
		62 +00 97																	0.22	10.5		
013#2	NSPM10	62 +00 98	DG					(G)MS				Y										
015#2	NSPM9	61 +00 249	DG					GS				Y										
016#1	NSPM2	61 +00 250	DG		2.5Y 5/2		M F	(M) S	M			Y										
017#2	NSPM1	61 +01 962	DG		2.5Y 5/2		M	MS				Y										
018#1	NSPM3	61 +00 251	DG		2.5Y 5/2		M F	MS	M		Y	Y										
019#1	NSPM4	61 -01 102	DG		2.5Y 4/2		M	MS	M		Y	Y										
020#2	NSPM5	61 -01 103	DG		5Y 4/3			MS	M			Y										
021#3	NSPM6	61 -01 104	DG		5Y 4/4		M	(G) MS	M			Y										
022#2	NSPM7	61 -01 105	DG		5Y 4/3		C	GMS				Y										
023#2	NSPM8	61 +00 252	DG		5Y 4/3		M	GMS				Y										
024#1	NSDS1	62 -02 05	MgC	0.38	2.5Y 4/4	0.1	F	SM				Y	0.1	>0.38	10YR 5/1	M	Y		0.18	2.5	3	
		62 -02 05																	0.3		2	
025#2	NSDS2	62 -02 06	MgC	0.34	10YR 4/3	0.07		M			Y	Y	0.07	>0.34	10YR 5/1	M			0.2	1.3	6	
026#2	NSDS3	62 -02 07	MgC	0.32	10YR 4/6	0.07		M					0.07	>0.32	10YR 5/1	M			0.25	1.3	5	
027#2	NSDS4	62 -02 08	MgC	0.37	2.5Y 5/4	0.1		M			Y	Y	0.1	>0.37	10YR 5/1	M			0.25	3.3	2.5	

					Sea Bed Sediment								Quaternary Sediments						Geotechnical Measurements			
Stn	Site	BGS No.	Gear	Depth of Core (m)	Munsell Colour	Surface sediment (m)	Sand Grain Size	Folk	Sorting clastics	Sorting overall	Forams	Carbonate	DTB Oxidation (m)	DTB Bioturbation (m)	Munsell Colour	Folk	Disturbance	Quaternary Comments	Test Depth (m)	Compressive Strength (kPa)	Shear Strength (kPa)	Comments
028#2	NSDS5	62 -02 09	MgC	0.32	2.5Y 5/2	0.19		(S)M			Y	Y	0	>0.32	2.5Y 4/2	GM		No oxidised horizon at top of core	0.1	3.5		
		62 -02 09																	0.17		2.3	
		62 -02 09																	0.25	10		
029#2	NSDS6	62 -01 09	MgC	0.32	10YR 4/2	0.07		M			Y	Y	0.07	>0.32	10YR 4/1	M			0.25	5.1	5	
030#2	NSDS7	62 -02 10	MgC	0.35	10YR 4/2	0.08		M					0.08	>0.35	10YR 4/1	M			0.25	4	5	
031#2	NSDS8	62 -02 11	MgC	0.31	10YR 5/3	0.11		M			Y	Y	0.11	>0.31	10YR 5/1	M			0.2	5.7	4	
032#2	NSDS9	62 -01 10	MgC	0.34	10YR 5/3	0.18		M			Y	Y	0.18	>0.34	10YR 5/1	M			0.1	2.5		
		62 -01 10																	0.25	10	2	
033#2	NSTS1	63 -01 02	MgC	0.4	10YR 4/2	0.2		SM			Y			>0.40	10YR 5/3	M		Sharp upper contact to turbidite bed.	0.1	5	5	
		63 -01 02																	0.3	10	9	
034#2	NSTS2	63 -01 03	MgC	0.39	10YR 4/2	0.39		SM			Y			>0.39					0.25	2.8	8	
036#2	NSTS3	63 -01 01	MgC	0.38	10YR 5/2	0.24	M	SM	W	M	Y	Y		>0.38	10YR 5/3	M		Bioturbated contact	0.12	6	4	
		63 -01 01																	0.35	2.7		
037#2	NSTS4	63 -01 04	MgC	0.31	10YR 4/2	0.31		M			Y								0.23	5.2	6	
038#2	NSTS5	63 -01 05	MgC	0.32	10YR 4/2	?0.16		M							10YR 5/1	M		2 possible turbidites (angled basal contact) over background mud.	0.2	2.5	4	
040#2	NSTS6	63 -01 06	MgC	0.32	2.5Y 5/4	?0.32		SM			Y	Y						Possibly base of surface sediment at 0.28 m.	0.17	3.7	2.8	
041#2	NSTS7	63 -01 07	MgC	0.39	10YR 4/2	0.13		M			Y			>0.39	10YR 5/3	M		Possible turbidite at 0.13 - 0.27 m	0.23	2.5	9	
043#2	NSTS8	63 -01 08	MgC	0.35	2.5Y 5/4	0.31		M			Y			>0.35	2.5Y 4/4	M		Possible turbidite at 0.31 m.	0.15	6.3	3	
044#2	NSTS9	63 -01 09	MgC	0.37	10YR 5/2	0.22		M			Y			0.35	10YR 5/1	M		Turbidite at base of core, grey mud near base of upper layer.	0.15	5	7	
045#1	NSTS9	63 -01 10	GC	0.4	10YR 4/3	0.4		M			Y			>0.40				Disturbed core.	0.15	2.8	8	
048#1	NSTS8	63 -01 11	GC	1.2	10YR 5/4	0.6	FM	M			Y		?0.6	0.6	5Y 4/1	M		Homogeneous mud.	0.26	6	4	
		63 -01 11																	0.9	7.5	8	
049#1	NSTS7	63 -01 12	GC	1.2	10YR 5/3	0.38		M			Y		?0.38	0.38	10YR 5/1	M		Possible turbidites in upper oxidised sediment.	0.26	8	5	
		63 -01 12																	0.8	6	6	
050#2	NSTS10	63 -01 13	MgC	0.39	10YR 4/2	0.26		M			Y			>0.39	10YR 4/3	M			0.25	5.3	8	
053#2	NSDS10	62 -02 12	MgC	0.34	10YR 5/4	0.23		M			Y		0.23	>0.34	10YR 4/1	M			0.08	6		
		62 -02 12																	0.17	5		
054#1	NSDS11	62 -02 13	MgC	0.36	2.5Y 5/3	0.07		M			Y		0.07	>0.36	2.5Y 4/3	M			0.17	7.8		
055#1	NSDS12	62 -02 14	MgC	0.38	2.5Y 4/3	0.1		M			Y		0.1	>0.38	2.5Y 5/0	M			0.22	4	2.2	
056#3	NSDS13	62 -02 16	BC					G														Gravel sample containing? Consolidated mud.
057#2	NSDS14	62 -02 15	MgC	0.29	10YR 5/3	0.1		M			Y		0.1	0.1	10YR 4/1	M						
059#2	NSDS16	62 -02 17	MgC	0.35	10YR 4/3	0.09		M			Y		0.09	>0.35	10YR 5/1	M			0.2	6.3		
062#1	NSDS17	62 -02 18	MgC	0.28	10YR 4/4	0.08		M			Y		0.08	?0.10	10YR 5/1	M			0.22	3.5	5	
064#1	NSDS13	62 -02 19	MgC	0.28	10YR 2/2	0.03		G					0.08	>0.28	10YR 5/2	M		Nodular (Fe / Mn?) body at base of core.	0.2	Too low		
064#5	NSDS13	62 -02 20	GC	1.05	10YR 5/3	0.82		G M			Y		0.82	>1.05	2.5Y 6/2	SM		Greenish sandy mud.				0.03 m gravel at top of core. Sampled for hydrocarbons at top and base.
066#1	FPN1100	62 -03 05	BC	0.13	10YR 5/2	0.05	C - F	SM			Y	Y		>0.13	10YR 5/2	M		Gravel common, basaltic, metamorphic and sedimentary clasts.	0.1	36.3		Very stiff grey mud.
067#1	FPN1400	62 -03 06	MgC	0.3	10YR 4/2	0.23		M			Y		0.23	>0.3	10YR 4/1	M			0.15	5.5	4.2	Slightly sandy mud in upper 0.02 m.

					Sea Bed Sediment								Quaternary Sediments						Geotechnical Measurements			
Stn	Site	BGS No.	Gear	Depth of Core (m)	Munsell Colour	Surface sediment (m)	Sand Grain Size	Folk	Sorting clastics	Sorting overall	Forams	Carbonate	DTB Oxidation (m)	DTB Bioturbation (m)	Munsell Colour	Folk	Disturbance	Quaternary Comments	Test Depth (m)	Compressive Strength (kPa)	Shear Strength (kPa)	Comments
068#1	FPN1800	62 -02 21	MgC	0.3	10YR 5/3	0.11		M			Y		0.11	>0.3	2.5Y 4/1	M			0.15	2.5		
072#1	NS950	62 -01 11	MgC	0.37	10YR 5/2	0.06	MF	MS	M	P	Y		0.06	>0.37	10YR 4/1	M			0.25	5	3	
075#1	NS400	61 -01 106	BC	0.24	10YR 5/2	0.07	M	GMS	M	P	Y	Y	0.07	0.2	10YR 4/1	M			0.2	32.5		
076#1	NS500	62 -01 12	BC	0.29	10YR 5/2	0.15	MF	GMS	M	P	Y	Y	0.15	0.15	10YR 4/1	M			0.2	27.5		
078#1	NS850	62 -01 13	MgC	0.31	10YR 4/2	0.08		MS				Y	0.08		10YR 4/1	M			0.23	13.1	11	
079#1	NS800	62 -02 14	MgC	0.28	10YR 4/3	0.08		MS					0.08		10YR 4/2	M			0.2	4.5	5	
080#1	NS700	62 -01 15	MgC	0.34	10YR 4/2	0.07		MS					0.07		10YR 4/1	M			0.25	8.7	8	
081#3	NS600	62 -01 16	MgC	0.22	10YR 4/2	0.15		GMS			Y	Y	0.15		10YR 4/1	M			0.2	4	7	
082#2	NS200	61 -01 107	DG		2.5Y 4/2		M	S				Y										
083#2	NS250	61 -01 108	DG		2.5Y 4/2		M	S				Y										
084#3	NS300	61 -01 109	DG		10YR 4/2		M	GS				Y										
085#1	NS350	61 -01 110	BC	0.28	10YR 5/2	0.04	MF	MS	M	P	Y	Y		0.14	10YR 5/2	M			0.2	4.5		
086#1	NS450	62 -01 17	BC	0.23	2.5Y 5/2	0.09	MF	GMS	M	P	Y	Y	0.09	>0.23	10YR 4/1	M			0.18	6.13		
088#1	NS650	62 -01 18	MgC	0.25	10YR 5/2	0.06	MF	MS			Y	Y	0.06	0.18	10YR 5/1	M			0.15	10.5		Top 0.05 m removed for PSA.
089#1	NS900	62 -01 19	GC	1.2																		Uncut core.
090#1	NS950	62 -01 20	GC	1.21																		Uncut core.
091#1	NS1000	62 -01 21	GC	1.2																		Uncut core.
092#1	NS850	62 -01 22	GC	1.21																		Uncut core.
093#1	NS800	62 -01 23	GC	1.21																		Uncut core.
096#2	NSAS7	61 -02 189	MgC	0.38	10YR 4/3	0.27		MS					0.27	0.27	10YR 4/2	MS			0.3	5.4	5	
100#1	NS150	61 -01 111	DG		2.5Y 5/2		FM	MS	M	M	Y	Y										
102#2	NSPM11	61 +00 253	DG		2.5Y 5/2		M	S	M	M	Y	Y										

11.2. Wildlife observations (provided by Russell Wynn, NOC)

This report details the wildlife observations made during the S/V *Kommandor Jack* cruise from July 26th to August 21st. The report includes observations made during the passage from Peterhead to the study area, and also from the study area back to Leith. The study area itself was between 100 and 300km north of Shetland. No specific technique was used for observation and therefore these details relate to casual observations only. For cetaceans, minimum figures or a range of figures are used to account for the difficulties in observing these animals. All sightings are confirmed, no probable or possible sightings have been included.

Part 1) Trip totals in the study area (excluding passage to and from port)

Seabirds

5270	Fulmar	50	Arctic Tern	5	LBBGull
1035	Gannet	30	Common Gull	5	Manx Shearwater
460	Kittiwake	25	Common/Arctic Tern	3	Herring Gull
260	Storm-Petrel	16	Sooty Shearwater	2	Black-headed Gull
225	Great Skua	11	'Blue' Fulmar	1	Little Gull
105	Puffin	8	GBBGull	1	Red-throated Diver
75	Guillemot	6	Arctic Skua		

Waders included 20 Turnstone, two Curlew, two Bar-tailed Godwit, two Golden Plover and single Oystercatcher, Ringed Plover, Dunlin, Ruff and Redshank. Passerines included five White Wagtails, three Crossbill, two Lesser Whitethroat, two Garden Warbler and single Greenish Warbler, Grasshopper Warbler, Reed Warbler, Whitethroat and Whinchat.

Cetaceans included up to 615 White-sided Dolphin, 72 Pilot Whale, 37 Fin Whale, seven Minke Whale, and one Sperm Whale. Also a single Common Seal.

Insects included three Silver-Y Moths and one Painted Lady butterfly

Part 2) Detailed observations arranged by date (including passage to and from port)

Day 1 (July 26th)
Summary: The evening passage out from port produced large numbers of auks and Kittiwakes, as well as a Minke Whale and small numbers of Harbour Porpoises and Grey Seals. 1800-2100 hrs. On Passage - offshore Peterhead Harbour to 55km NNE of Rattray Head (58°05´N 01°30´W) Weather: F2, Cloudy, 17°C.

1 Minke Whale; 13 Harbour Porpoise (4, 5, 3, 1); 25+ Grey Seals

2 Manx Shearwaters; 3 Arctic Skuas (2 d/p ads + 1 p/p ad); 10 Great Skuas; 3 Storm-Petrels; 15 Commic Terns; 1 Common Gull; 1 LBBGull; 3 GBBGulls; 30 Puffins; 70 Gannets; 550 Kittiwakes; 350 Guillemots; 200 Razorbills; 100 Fulmars

Day 2 (July 27th)
Summary: A murky start to the day saw a bedraggled Purple Sandpiper spend several hours on the foredeck, with a Turnstone seen circling the ship in the afternoon. The northward steam in the morning passed to the east of Fair Isle and then Shetland, and was notable for

good numbers of Great Skuas. Early afternoon, to the NE of Shetland, saw more Great Skuas and good numbers of Storm-Petrels noted, including one loose feeding gathering of at least 100 birds. 0500-0730 hrs. On passage, 50km E of Fair Isle (59°30´N 00°48´W) to 20 km E of Sumburgh Head (59°51´N 00°38´W). Weather: F3, cloudy and damp, 17°C.

4 Harbour Porpoise

18 Storm-Petrels; 13 Great Skuas; 310 Fulmars; 55 Gannets; 14 Puffins; 2 Guillemots; 1 Razorbill; 2 Kittiwakes; 2 Commic Terns

0815-1000 hrs. On passage, 50km ENE of Sumburgh Head (60°00´N 00°33´W) to 20km ESE of Outer Skerries (60°17´N 00°24´W). Weather: F3, cloudy, 17°C.

1 adult Purple Sandpiper on ship; 65 Gannets; 10 Kittiwakes; 35 Great Skuas; 4 Commic Terns; 100 Fulmars; 1 Storm –Petrel; 25 Puffins; 1 Arctic Skua (d/p ad); 2 Guillemots

1230-1530 hrs. On passage, 40km E of Unst (60°43´N 00°07´W) to 65km NE of Unst (61°13´N 00°06´W). Weather: F2, bright, 19°C.

1 adult Turnstone circling ship; 55 Great Skuas; 30 Kittiwakes; 200 Fulmars; 100 Gannets; 150 Storm-Petrels including one large group of about 100; 25 Puffins; 3 LBBGulls; 1 Common Gull; 1 Guillemot

1830-2100 hrs. On passage, 115km NE of Shetland (61°42´N 00°20´E) to 150km NNE of Shetland (62°06´N 00°34´E). Weather: F2, bright, 17-14°C.

200 Fulmars; 30 Puffins; 15 Storm-Petrels; 5 Great Skuas; 35 Gannets; 10 Kittiwakes; 3 Guillemots; 4 Commic Terns

Passage totals (26th-27th Peterhead to Study Area)

900	Fulmars	125	Puffins	4	Arctic Skuas
325	Gannets	600	Kittiwakes	2	Manx Shearwaters
120	Great Skuas	360	Guillemots	25	Commic Terns
190	Storm-Petrels	200	Razorbills		

Day 3 (July 28th)

Summary: Murky conditions early in the day saw one Turnstone around the ship but otherwise bird sightings were unexceptional. A couple of Fin Whales were the only cetaceans noted. 150km NNE of Shetland (62°15´N 00°03´W) Depth 800m (Upper/Middle slope). Weather, SW F5-2, Cloudy with rain then sun, 14-12°C.

2 Fin Whales

1 adult Turnstone circling ship; 1 Arctic Skua (d/p ad); 5 Great Skuas; 100 Fulmars; 20 Gannets; 6 Puffins; 5 Storm-Petrels; 1 adult Common Gull; 40 Kittiwakes

Day 4 (July 29th)

Summary: Excellent weather led to good numbers of the commoner species being recorded, with a Sooty Shearwater being the highlight. The ship was literally surrounded by a large

feeding group of cetaceans in the evening, and totals of one Minke Whale, five to ten Fin Whales and 100+ White-sided Dolphins were probably under-estimates. 120km N of Shetland (62°03´N 00°55´W) Depth 800m (Upper/Middle slope). Weather, Variable F1, Sunny and clear, 17°C.

1 Minke Whale; 5-10 Fin Whales; 100+ White-sided Dolphins

1 Sooty Shearwater; 1 juv Arctic Tern; 350 Fulmars; 70 Kittiwakes; 2 adult LBBGulls; 1 juv GBBGull; 30 Great Skuas; 30 Puffins; 50 Gannets; 15 Commic Terns; 30 Storm-Petrels; 25 Guillemots

Day 5 (July 30th)
Summary: A murky day was brightened up by a few notable sightings. Cetaceans included a Minke Whale, three or four Fin Whales and a group of at least seven Pilot Whales. A Sooty Shearwater spent most of the morning with the resident Fulmars despite being frequently singled out for harassment by a Great Skua which caused it to plunge-dive frequently as a means of escape. 120km N of Shetland (62°00´N 00°55´W) Depth 900 m (Upper/Middle slope). Weather, NE F3-4-2, cloudy with rain/drizzle, 14°C.

1 Minke Whale; 3-4 Fin Whales; 7+ Pilot Whales

1 Sooty Shearwater (seen plunge-diving to evade attack by Great Skua); 1 Manx Shearwater; 2 Arctic Terns (ad + juv); 1 Arctic Skua (d/p ad); 10 Storm-Petrels; 5 Great Skuas; 10 Puffins; 30 Gannets; 30 Kittiwakes; 200 Fulmars; 5 Guillemots; 4 Commic Terns; 1 adult LBBGull

Day 6 (July 31st)
Summary: A cold NE wind produced very little, with no cetaceans seen and only average numbers of the commoner species. One Blue Fulmar was briefly seen in flight. 190km NNE of Shetland (62°37´N 00°36´E) Depth 900 m (Upper/Middle slope). Weather, NE F4, cloudy, 14°C.

40 Fulmars; 10 Gannets; 10 Kittiwakes; 1 adult Arctic Tern; 1 Storm-Petrel; 1 Puffin

130km NE of Shetland (62°04´N 00°50´E) Depth 300 m (Upper slope). Weather, NE F4-3, Cloudy then bright, 14°C.

1 Blue Fulmar; 150 Fulmars; 2 Great Skuas; 1 Storm-Petrel; 1 Manx Shearwater; 10 Gannets; 10 Kittiwakes

Day 7 (Aug 1st)
Summary: A strong NE wind and bright sun made viewing difficult and only average numbers of the regular species were noted, with no cetaceans seen. 100 km NNE of Shetland (61°43´N 00°30´W) Depth 200 m (Upper slope). Weather, NE F6-7, Sunny, 14°C.

300+ Fulmars; 5-10 Great Skuas; 1 Storm-Petrel; 50+ Gannets; 20+ Kittiwakes; 5+ Commic Terns

Day 8 (Aug 2nd)
No observation as a result of poor weather. Weather, NE F8-7, Sunny, 14°C

Day 9 (Aug 3rd)
Summary: Although the NE wind had eased a large swell and bright sun made viewing difficult and only small numbers of the regular species were noted. No cetaceans noted. 170km N of Shetland (62°30´N 01°26´W) Depth 1600 m (Middle slope at entrance to Faroe-Shetland Channel). Weather, NE F4, bright and sunny, 14°C.

7 Storm-Petrels; 10 Great Skuas; 3 Puffins; 25 Kittiwakes; 55 Gannets; 120 Fulmars

Day 10 (Aug 4th)
Summary: The day started well with a large feeding group of Pilot Whales and White-sided Dolphins surrounding the ship, accompanied by large numbers of plunge-diving Gannets. A Blue Fulmar present for most of the day was observed feeding on a live jellyfish, as were several 'standard' Fulmars. Otherwise, despite good viewing conditions, it was generally very quiet. 200km N of Shetland (62°40´N 01°00´W) Depth 1500 m (Middle slope at entrance to Faroe-Shetland Channel). Weather, ENE F3, Sunny, 16°C.

25-30 Pilot Whales; 50-100 White-sided Dolphins

1 Blue Fulmar (seen eating a live jellyfish!); 5 Storm-Petrels; 10 Great Skuas; 6 Arctic Terns; 1 3rd summer GBBGull; 25 Kittiwakes; 180 Gannets; 200 Fulmars

Day 11 (Aug 5th)
Summary: An excellent day; the calm weather saw predictably high totals of most of the commoner species and also produced a couple of rarities. A Sooty Shearwater passed by with a marked eastward passage of Fulmars and Gannets but the undoubted highlight was an adult Long-tailed Skua that scattered the resident Kittiwakes before soaring away high to the NW. Fulmars were again seen feeding on jellyfish, and one or two intermediate-morph birds were seen. The only cetacean seen was a Minke Whale, despite the perfect conditions. 250km NNE of Shetland (63°15´N 00°17´W) Depth 1800 m (Middle slope). Weather, SSE F2-1, sunny then light cloud, 16°C.

1 Minke Whale

1 adult Long-tailed Skua passed ship and departed high NW; 1 d/p ad Arctic Skua W; 1 Manx Shearwater; 1 Sooty Shearwater E; 1-2 intermediate phase Fulmars; 10 Arctic Terns; 10 Puffins; 25 Guillemots; 40 Storm-Petrels; 10 Great Skuas; 20 Kittiwakes; 150 Gannets; 450 Fulmars

Day 12 (Aug 6th)
Summary: The day started with murky conditions and a bedraggled juvenile Ruff onboard for several hours. There was also an impressive flock of at least 700 Fulmars around the ship for much of the day, with two Blue Fulmars and two intermediate-morph birds also present. Other than the inevitable entertainment during 'feeding time', little else of note was seen and no cetaceans were recorded. 280km N of Shetland (63°26´N 00°49´W). Weather, S F1-3, fog/drizzle then cloud, 15°C.

1 juvenile Ruff onboard for several hours; 700+ Fulmars (including several seen mischievously nibbling Gannet tails!); 2 Blue Fulmars; 2 intermediate phase Fulmars; 7 Storm-Petrels; 45 Gannets; 12 Great Skuas; 5 Kittiwakes; 5 Arctic Terns; 1 Guillemot

Day 13 (Aug 7th)
Summary: An interesting day, with the highlight being a pale phase adult Pomarine Skua that passed close by the ship giving binocular-filling views before continuing south-westwards. In addition, two Sooty Shearwaters moved east/north-east, one Manx Shearwater was seen and a juvenile Crossbill rested onboard for half an hour. The only cetaceans seen were at least 275 White-sided Dolphins that passed by rapidly on their way south-eastwards in one large group. 300km N of Shetland (63°35´N 00°53´W). Weather, SSW F2 – SE F5, murky low cloud and drizzle, 14°C.

275+ White-sided Dolphins SE in one large group

1 p/p ad Pomarine Skua SW; 2 Sooty Shearwaters E/NE; 1 Manx Shearwater SE; 1 juvenile Crossbill onboard for 30 minutes; 1 2nd summer LBBGull; 5 Puffins; 8 Guillemots; 5 Kittiwakes; 250+ Fulmars; 40+ Gannets; 6 Great Skuas; 16 Storm-Petrels

Day 14 (Aug 8th)
Summary: The close proximity of several fishing vessels, combined with fairly calm conditions, led to large numbers of Fulmars being counted, with over 1000 seen during the day. Good numbers of Storm-Petrels and Great Skuas were also seen, but otherwise seabird interest was restricted to a couple of dark-morph Fulmars. Migrants included a Red-throated Diver, a Golden Plover and two Black-headed Gulls moving south, while two Dunlin circled the ship late morning. No cetaceans were positively identified, despite the good conditions. 300km N of Shetland (63°46´N 00°25´W). Weather: SW F3-2, light cloud and sunny spells, 14°C.

30 Great Skuas; 65 Gannets; 1000+ Fulmars; 15 Puffins; 75 Storm-Petrels; 2 Dunlin circled ship; 1 adult Golden Plover SSW; 2 adult Black-headed Gulls S; 3 Arctic Terns W; 1 intermediate-morph Fulmar; 1 Blue Fulmar; 1 d/p Arctic Skua NW; 1 Red-throated Diver S; 2 Kittiwakes; 7 Guillemots; 1 adult GBBGull S

Day 15 (Aug 9th)
Summary: A quiet day, with the highlight being a female Crossbill that settled in to roost overnight. A Blue Fulmar and a juvenile Common Gull provided the only other interest. No cetaceans were observed. 280km N of Shetland (63°25´N 00°55´W). Weather: SSE F3-2, murky with intermittent showers and drizzle, 14°C.

1 Blue Fulmar; 5 Kittiwakes; 10 Storm-Petrels; 300+ Fulmars; 15 Gannets; 6 Great Skuas; 3 Puffins; 2 Commic Terns; 1 juvenile Common Gull E; 1 adult female Crossbill roosted on ship overnight

Day 16 (Aug 10th)
Summary: A very wet day was brightened up by several interesting sightings. Four Fin Whales and a single Minke Whale were seen, with Fin Whales noted breaching and flipper-slapping. Single Crossbill and Turnstone were seen, as well as a couple of Blue Fulmars and another Sooty Shearwater (seen in the same field of view as two Fin Whales!). However, the highlight was a juvenile Long-tailed Skua which passed over the ship before heading south-

westwards. 180km N of Shetland (62°38´N 01°17´W). Weather: NE F3 – NW F4, murky and wet, 14°C.

4 Fin Whales; 1 Minke Whale

1 Crossbill circled ship then headed SE; 1 adult Herring Gull; 1 adult Turnstone circled ship; 2 Blue Fulmars; 7 Arctic Terns; 25 Storm-Petrels; 3 Puffins; 11 Great Skuas; 70 Fulmars; 40 Gannets; 10 Common Gulls (9 adults + 1 2nd summer); 20 Kittiwakes; 1 juvenile Long-tailed Skua SSW (intermediate phase); 1 Sooty Shearwater

Day 17 (Aug 11th)
Summary: The best day of the cruise so far, with excellent viewing conditions in the calm weather up to early evening. A large gathering of cetaceans seen late morning included 10 Fin Whales, a couple of Minke Whales, 25-30 Pilot Whales and at least 135 White-sided Dolphins. A short steam late afternoon to a site about 10km to the NE then produced a different group of nine Fin Whales and a single Minke Whale. During the day Fin Whales were noted breaching and tail-slapping, and at one stage a group of three animals could be seen pursuing a shoal of fish fry near the surface. Wader passage was noticeable in the middle of the day, with Ringed Plover, Curlew, Bar-tailed Godwit and a flock of Turnstones all seen moving south. Seabirds included a dark juvenile Long-tailed Skua harassing the large flock of Kittiwakes around the ship, as well as one or two Sooty Shearwaters and a Blue Fulmar. 180km N of Shetland (62°38´N 01°15´W). Weather, Var F1 – NE F5, sunny then murky and wet, 14°C.

19 Fin Whales (two loose gatherings of 10 and 9); 3 Minke Whales; 25-30 Pilot Whales; 135+ White-sided Dolphins

1 Ringed Plover S; 14 Turnstones circled ship and headed S; 1 Curlew S; 1 Bar-tailed Godwit S; 100 Gannets; 12 Great Skuas; 350+ Fulmars; 1 Blue Fulmar; 80 Kittiwakes; 10 Storm-Petrels; 15 Puffins; 1 d/p Arctic Skua; 1 Manx Shearwater; 7 Arctic Terns; 1 juvenile Long-tailed Skua harassing Kittiwakes (dark phase); 3 adult Common Gulls; 1-2 Sooty Shearwaters; 2 2nd summer GBBGulls

Day 18 (Aug 12th)
Summary: A quieter day, largely due to the deterioration in the weather. Up to four Sooty Shearwaters were around the ship late morning but more surprising was a juvenile Little Gull associating with juvenile Kittiwakes (numbers of which have increased markedly in recent days). Another Sooty Shearwater was seen in the afternoon, and a migrant Silver-Y Moth arrived onboard at midnight. Poor viewing conditions meant that a mixed group of Pilot Whales and White-sided Dolphins almost passed the ship unnoticed. 180km N of Shetland (62°38´N 01°17´W). Weather, N F6, murky with rain, 14°C.

5+ Pilot Whales; 5+ White-sided Dolphins

4 Sooty Shearwaters around ship; 2 2nd summer GBBGulls; 1 Great Skua; 10 Gannets; 25 Kittiwakes; 50 Fulmars; 1 juvenile Little Gull with Kittiwakes; 1 Storm-Petrel

200km NNW of Shetland (62°44´N 01°51´W). Weather: NW F4-3, cloudy with intermittent drizzle, 14°C.

1 Silver-Y Moth

2 Arctic Terns; 25 Kittiwakes; 2 2nd summer GBBGulls; 4 Great Skuas; 40+ Fulmars; 1 Sooty Shearwater NE; 1 p/p ad Arctic Skua SW; 25 Gannets; 4 Storm-Petrels

Day 19 (Aug 13th)
Summary: A quiet day, with just a couple of Sooty Shearwaters and a Blue Fulmar of note. Passage from 180km N of Shetland (62°39´N 01°13´W) to 150km NNE of Shetland (62°16´N 00°04´W). Weather: S F5, bright with sunny spells, 15°C.

3 Puffins; 15 Great Skuas; 3 Storm-Petrels; 25 Kittiwakes; 50 Gannets; 180 Fulmars; 1 2nd summer GBBGull; 1 Blue Fulmar; 2 Sooty Shearwaters moving E/NE; 3 Guillemots

Day 20 (Aug 14th)
Summary: There was very little observation time today. An oiled juvenile Kittiwake which landed on the ship was caught, cleaned and released, and a juvenile White Wagtail was seen in the evening. Nothing else of note was recorded. 80km NE of Shetland (61°36´N 00°09´W). Weather: S F3-4, bright sun then rain, 15°C.

1 juvenile White Wagtail onboard; 1 oiled juvenile Kittiwake caught, cleaned and released; 5+ Great Skuas

Day 21 (Aug 15th)
Summary: Another day of restricted observations. A flock of Turnstones was heard in the early hours, and a group of four White Wagtails were seen around the ship late morning, with one staying until late afternoon. For the third day running no cetaceans were recorded. 150km NNE of Shetland (62°14´N 00°18´W). Weather: SSE F5-4, sunny, 16°C.

4 White Wagtails onboard; 1+ Turnstone heard at night; 3 Great Skuas; 1 Puffin; 100+ Fulmars; 25 Gannets; 1 Storm-Petrel; 5 Kittiwakes; 3 Arctic Terns

Day 22 (Aug 16th)
Summary: An adult Golden Plover circling the ship was the only notable sighting. 100km NE of Shetland (61°50´N 00°12´W). Weather: SW F5-1, bright with sun later, 15°C.

1 adult Golden Plover circled ship; 20+ Great Skuas; 150+ Fulmars; 5 Puffins; 5 Storm-Petrels; 30+ Gannets; 1 adult LBBGull

Day 23 (Aug 17th)
Summary: The day began with good views of a Sperm Whale (the first of the trip), but this was interrupted by the unusual sight of a young Common Seal swimming around the boat, at one stage carrying a freshly caught eel in its mouth. It appeared to be exhausted and after several failed attempts it was eventually hauled to the top of the after deck ramp on a wooden pallet. It then rested for several hours before shuffling back into the sea as darkness fell, one can only wonder where it was heading to! There were no bird observations of note. 150km NNE of Shetland (62°15´N 00°18´W). Weather, SE F4 – S F6, light cloud then murky with fog, 16°C.

1 Sperm Whale

1 young Common Seal rested on after deck ramp for 8 hours

1 Arctic Tern; 1 adult Common Gull; 2 Storm-Petrels; 2 Great Skuas; 20+ Fulmars; 5+ Gannets; 5 Kittiwakes

Day 24 (Aug 18th)
Summary: Single Sooty Shearwater and Blue Fulmar were the only seabirds of note, and a juvenile Turnstone was seen onboard in the afternoon. 100km NNE of Shetland (61°45´N 00°32´W). Weather: SSE F3-4, cloudy with fog then hazy sunshine, 16°C.

1 adult GBBGull; 1 adult Herring Gull; 1 adult Common Gull; 5 Gannets; 5 Kittiwakes; 1 Storm-Petrel; 3 Great Skuas; 1 Blue Fulmar; 1 Sooty Shearwater (seen plunge-diving to evade attack by Great Skua); 1 juvenile Turnstone onboard

Day 25 (Aug 19th)
Summary: An extraordinary day, with SSE winds and thick fog and drizzle leading to a major fall of migrants on and around the ship. Waders noted included Oystercatcher, Turnstone, Redshank, Curlew and Bar-tailed Godwit, while small passerines included Lesser Whitethroat, Whitethroat, Garden Warbler, Grasshopper Warbler, Reed Warbler and Whinchat; many of these were seen eating the numerous small moths which appeared onboard during the day. Good numbers of gulls were also noted, including an influx of Common Gulls. However, the highlight appeared in the early evening in the form of a small wing-barred *phylloscopus* warbler. After a couple of hours of close observation down to two metres it could be positively identified as a Greenish Warbler, and it remained onboard until dusk at least. The other major surprise was a Painted Lady butterfly, which appeared in amongst the large numbers of moths. 110km NE of Shetland (61°55´N 01°10´E). Weather: SSE F4 – SW F2, very murky with fog then heavy rain, 16°C.

11 Great Skuas; 13 Common Gulls; 2 GBBGulls (adult + 3rd summer); 1 3rd summer Herring Gull; 1 Storm-Petrel; 25 Gannets; 150+ Fulmars; 1 Oystercatcher onboard; 2 Turnstones circling ship; 1 Redshank circling ship; 1 Curlew circling ship; 1 Bar-tailed Godwit circling ship; 2 Lesser Whitethroats onboard (one roosted); 1 Whinchat onboard; 2 Garden Warblers onboard; 1 Whitethroat onboard; 1 Grasshopper Warbler onboard; 1 Reed Warbler onboard (caught and released); 1 Greenish Warbler onboard from 1820-2050 at least

2 Silver-Y Moths; 1 Painted Lady

Day 26 (Aug 20th)
Summary: The Greenish Warbler was still onboard early morning and feeding actively, but it disappeared close to the Outer Skerries and presumably headed for land. No other migrants from the previous day remained onboard but two Redshank moved south in the morning and a Curlew passed over in the afternoon. Otherwise just the regular seabird species were noted. On passage c. 5km NE of Outer Skerries, Shetland (60°31´N 00°32´W). Weather: W F1, cloudy then sunny, 16°C.

1 Greenish Warbler still onboard from 06:20-08:00 when disappeared; 25+ Great Skuas; 10+ Puffins; 2 Redshank S; 2 Herring Gulls (adult + juvenile); 50+ Gannets; 100+ Fulmars

Passage from 10km S of Fair Isle (59°16´N 01°32´W) to 70km E of North Ronaldsay, Orkney (58°47´N 01°32´W). Weather, NW F1, Sunny and warm, 17°C.

260+ Fulmars; 4 Storm-Petrels; 11 Guillemots; 7 Puffins; 200+ Gannets; 50 Great Skuas; 1-3 juvenile Common Gulls; 1 juvenile Arctic Tern; 6 Commic Terns; 1 Curlew S

Day 27 (Aug 21st)
Summary: A lovely day for the final leg of the homeward passage produced large numbers of the regular species, to the extent that they were not specifically counted. Hundreds of Guillemots, Razorbills, Puffins, Gannets, Fulmars and Kittiwakes were seen, but otherwise just a fly-over Whimbrel and four Manx Shearwaters were noted. A Minke Whale close inshore off Fife Ness in just 30m of water was a surprise. Passage from close inshore off Aberdeen to final port call in Leith, Edinburgh. Weather: W F1-0, bright and sunny, 16°C.

1 Minke Whale; 2+ Harbour Porpoises; 10+ Grey Seals

1+ Whimbrel heard calling overhead; 4 Manx Shearwaters; 1 adult Common Gull S