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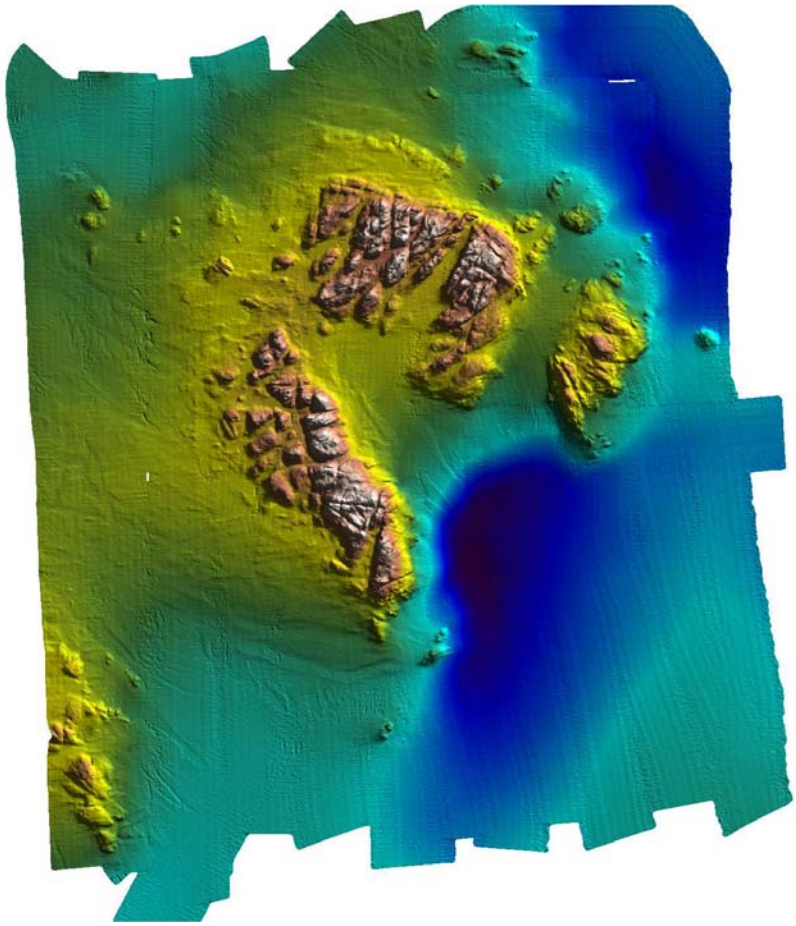
Report on a survey over Stanton Bank 4 for MESH, June 2006

Marine, Coastal and Hydrocarbons Programme

Internal Report IR/06/130



MESH MAPPING EUROPEAN SEABED HABITATS

This project has received European Regional Development Funding through the INTERREG III B Community Initiative

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BRITISH GEOLOGICAL SURVEY

MARINE, COASTAL AND HYDROCARBONS PROGRAMME

INTERNAL REPORT IR/06/130

Report on a survey over Stanton Bank 4 for MESH, June 2006

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Seabed image of Stanton Bank 4 derived from multibeam survey by the Marine Institute, Galway.

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Foreword

This report provides both a cruise report and initial interpretations of data collected by BGS on cruise CD180 of the RV Charles Darwin in June 2006 across part of the Stanton Banks, west of Scotland. The area is known as Stanton Banks 4 in the MESH offshore Ireland surveys (Figure 1). The opportunity arose late in the day to gather additional data across this area. The results will be of use in BGS's regional mapping programme and the MESH habitat survey. In particular, backscatter analysis for habitat mapping, led by Dr. Craig Brown at University of Ulster, is focussing on Stanton Bank 4 as a test area (Figure 2) and it is anticipated that results from this cruise will assist this study.

Acknowledgements

As with any field operation a large number of individuals contributed to the success of the cruise. A full list of BGS personnel and observers can be found in Appendix 1 of the Operations Report (Smith, 2006) and their contribution is acknowledged. Thanks are also due to Captain Peter Sarjeant, the officers and crew of the *RRS Charles Darwin* and the technical support provided by NOCS UKORS. The main part of the cruise was funded by the BGS Rockall Consortium which, in 2006, comprised BGS and Chevron, DTI, ENI, Shell and Statoil.

Heather Stewart was the Senior Scientist for BGS cruise 06/02

The provision of the seabed image by the Marine Institute, Galway greatly assisted the selection of survey lines.

The Mapping European Seabed Habitats (MESH) project, an EU INTERREG IIIb project, is greatly acknowledge for funding the brief time that the survey vessel was in the area.

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1 Introduction

This report provides both a cruise report and initial interpretations of some of the data collected by BGS on cruise CD180 of the RV Charles Darwin in June 2006 across an area of interest to MESH. The opportunity arose late in the day to gather additional data across this area with details of proposed lines sent to the ship whilst at sea.

MESH is an EU funded project within the INTERREG IIIb programme, entitled Mapping European Seabed Habitats .

2 BGS cruise 06/02 (CD180)

BGS had access to the final cruise of the RV Charles Darwin before its sale by NERC. It undertook a series of geophysical profiles across the Hatton-Rockall Basin, Hatton Bank, Lousy Bank, Bill Bailey's Bank, Faroe Bank and the Faroe Bank Channel on behalf of BGS's offshore regional mapping programme and to support studies funded by the BGS Rockall Consortium. Due to the highly successful data gathering and the excellent weather conditions, additional time was available for further work, so co-ordinates for additional survey lines were supplied too the vessel for areas south of St Kilda and in the vicinity of Stanton Bank 4. Only the later was considered relevant to MESH and is presented in this report.

3 Stanton Bank

Stanton Bank is a bathymetric term applied to various topographic highs between 7°30' and 8°30'W and between 55°50' and 56°20'N located 50-60 km south of Barra Head that have been known to fishermen for centuries. They rise up to 35 m water depth but deeps between the banks locally reach 180m water depth. The banks consist of Lewisian rocks. Visual surveys show that the seabed is a glaciated surface swept clean of any cover (Eden et al., 1971) and although rounded by glacial action is fissured and extremely rugged. It is divided by hollows and gullies with coarse shell sand and fringed by aprons of boulders and cobbles. Samples collected by shallow drilling and by divers comprise granites and gneisses, similar to the rocks that comprise the Outer Hebrides. The pink microcline granites are comparable to Laxfordian granites within the Lewisian rocks further north (Binns et al., 1974) and have been dated to between 1400 and 1600 Myr old.

In a search to validate claims that the cold water coral *Lophelia pertusa* had been gathered by fishermen from Stanton Banks, two small areas were surveyed in 2003 (Roberts et al., 2004). These were termed Stanton Banks 1 and Stanton Banks 2. They were unsuccessful but in the light of successfully identifying coral reefs offshore Mingulay two alternative areas of search on Stanton Banks were suggested (Long and Wilson 2003) where bare rock occurs below 110m water depth and is in close proximity

to deep water such that that deepwater currents may be swept across the bedrock outcrops. These were termed Stanton Banks 3 and Stanton Banks 4 and were included in north of Ireland surveys conducted by BGS, DARD and the Marine Institute as part of the Mapping European Seabed Habitats (MESH) project.

3.1 STANTON BANK 4

The area termed Stanton Bank 4 covers approximately 50km^2 between 7°30' and 8°30'W and between 55°50' and 56°20'N. It is located to the west of the main area known as Stanton Banks. It rises to less than 50m water depth. Various seismic profiles had been gathered across this area by BGS as part of its regional mapping programme since 1970 (Figure 4). These consisted of sidescan sonar, pinger, sparker and airgun. The area was covered by a multibeam survey by the Marine Institute in 2005 (Figure 5).

New seismic lines (Figure 4) were selected to traverse features seen on the seabed image and associated backscatter image (Figure 2) so that the third dimension could be evaluated. Most notably streaks seen on the backscatter image that correlated with very shallow gullies that flow within the troughs between the topographic highs. These features have a distinctive acoustic signal. Other proposed survey lines were chosen to intercept existing sample sites (Figure 5).

The final line (06/02/30) was extended south east out of the Stanton 4 area towards the final port call (Fairlie) to cross Stanton Bank 1 and an area covered in the 2005 MESH survey (MESH survey number 12-06-01) (Wallis, 2006) and thereby improve correlations between the various survey areas (Figure 6). The line continued as far south east wards as possible before it was necessary to increase the transit speed in order to dock at Fairlie at the planned time and to allow demobbing of equipment. These objectives were met.

4 Equipment used

4.1 SPARKER SYSTEM

Source: An EG&G, nine candle, multi-tip sparkarray with 135 tips was utilised as the sparker source.

High voltage power supply: An Applied Acoustic Engineering CSP2200 capacitor charging unit provided the power for the sparker system. This is a single unit, powered from the ship's 240VAC supply incorporating switchable output energy up to a maximum of 2200 J. A power of 700J was used on lines 27-30.

Hydrophone: A seven channel Teledyne 10m hydrophone, summing on the most part, all channels to give a single output, was utilised as the receiver for the sparker data.

Recording: This utilised the same CODA DA200 four-channel digital recording and processing system as the airgun, with the data recorded on the same file to Flipdisk in CODA format. The data were recorded with a sampling frequency of 5kHz, record

length of 1.9 seconds and a bandpass filter of 100-1730 Hz. The start of recording was delayed in deep water to permit a minimum of one second of data below the sea bed. Time and date were recorded with every shot.

On line processing: The sparker data were processed on line. Processes applied were time varied gain (TVG), time varied filtering (TVF) and trace mixing. In extremely large amplitude sea swell situations a swell filter was also utilised. Both TVG and TVF were applied from the sea bed, which was tracked automatically. A hard copy output could not be obtained on line as the BGS only has one thermal printer that will operate with the CODA. During long transits and weather downtime hard copies were generated. A 700 milliseconds record length was used for the hard copy, with a delay adjusted to give an optimum record in the prevailing water depth.

4.2 PINGER

The 3.5kHz pinger is a transducer mounted in a tow fish towed over the starboard side. This was controlled by an IOS transceiver with the data recorded on a CODAOctopus360 acquisition system and was part of the standard shipboard equipment. The pinger gave poor sub-bottom records compared with the sparker system and was affected by the sparker in the Stanton Bank area due to the fast rate that the sparker was fired at, every 0.6 seconds.

4.3 PRECISION ECHOSOUNDER

The Precision Echosounder (PES) is a 10kHz IOS transducer mounted in a tow fish deployed off the port side close to amidships. This is controlled by a Simrad EA500 transceiver and display and was compensated for fish height with the depth recorded.

4.4 OTHER EQUIPMENT

In addition to the sparker, other equipment was run on these lines although the data collected it was not needed for the MESH study. This included a ZLS Corporation UltraSys controlled LaCoste and Romberg sensor gravimeter and the ship's multibeam system (Simrad EM12). Though data was acquired it is considered to be erroneous due to difficulties in calibrating the system. For further operational details see Smith 2006.

5 Data collected

Four lines (06/02/27, 28, 29 and 30) were successfully gathered.

Line	SOL				EOL			
	Latitude		Longitude		Latitude		Longitude	
	degree	minute	degree	minute	degree	minute	degree	minute
06/02/27	56	22.353	8	17.578	56	18.058	8	2.880
06/02/28	56	19.495	8	3.055	56	16.913	8	16.605
06/02/29	56	16.459	8	14.830	56	21.613	8	4.959
06/02/30	56	19.779	8	3.928	55	58.406	7	33.996

Table 1 Start-of-Line and End-of-Line coordinates for sparker lines across Stanton Bank 4 collected on BGS cruise 06/02 (MESH cruise 12-06-01)

Line	Date	Start time	End time	Coda data filename	Length km	sparker	multibeam	echosounder	pinger	gravimeter
06/02/27	07/06/06	7.54	10.18	070606.075417	15.3	X	X	X	X	X
06/02/28	07/06/06	10.50	12.57	070606.105027	14.5	X	X	X	X	X
06/02/29	07/06/06	13.22	15.10	070606.132155	14.5	X	X	X	X	X
06/02/30	07/06/06	15.39	22.04	070606.133841	50	X	X	X	X	X

Table 2 Survey lines metadata

6 Initial interpretations

These four high resolution seismic lines (Figure 6) were acquired in order to infill data gaps in the existing regional coverage, provide geophysical control on existing BGS samples and to allow correlation between separate survey areas within the greater Stanton Banks area.

The sparker records (Figures 7, 8 and 9) show a seabed penetrated by topographic highs of the Lewisian bedrock palaeo-topography with only a thin infill between the exposed pinnacles. The sections to the west (right hand side on all figures) show several irregular

reflectors within the Quaternary sequence above the bedrock. The seismic units show few internal reflectors and are comparable to glacial sequences and may indicate numerous fluctuations in the position of the ice and location of glacial processes. To the east in the deepest waters the seismic units show well layered internal reflectors with a few unconformities suggesting breaks in the infilling of the depression. These sequences are comparable to late / post glacial marine sedimentation and reflect changes associated with oceanographic and tectonic changes.

Line 30 shows similar features to lines 27, 28 and 29 indicating that similar units to those seen on Stanton Bank 4 can be found across the whole Stanton Bank area but is too long to include in this report. The final part of the record indicates a possible buried debris slide and allows improved mapping of the feature noted in the 2005 MESH survey (MESH cruise 12-05-01) (Wallis, 2006).

References

Most of the references listed below are held in the Library of the British Geological Survey at Keyworth, Nottingham. Copies of the references may be purchased from the Library subject to the current copyright legislation.

BINNS, P E, MCQUILLIN, R. and KENOLTY, N. 1974. The Geology of the Sea of the Hebrides. *Institute of Geological Sciences Report 73/14*.

EDEN, R A, ARDUS, D A, BINNS, P E, MCQUILLIN, R. and Wilson, J B. 1971. Geological investigations with a manned submersible off the west coast of Scotland 1969-1970. *Institute of Geological Sciences Report 71/16.*

LONG, D and WILSON C K. 2003. Geological background to coldwater coral occurrences in the Minch. British Geological Survey Internal Report, IR/03/149. 59pp.

ROBERTS, J M, BROWN, C J, LONG, D, WILSON, C K, BATES, R, MITCHELL, A and SERVICE, M. 2004 Mapping Inshore Coral Habitats the MINCH project. Report for the Scottish Executive and Scottish Natural Heritage.

SMITH, D J. 2006. BGS cruise to Rockall-Hatton-Faroes region. Project 06/02 RRS Charles Darwin CD180 Operations Report. *British Geological Survey Internal Report*, IR/06/076.

STEWART, H and TUITTT, A. 2006. Hatton Bank-Faroe Bank Channel Geophysical Survey. RRS Charles Darwin Cruise CD180, BGS Cruise 06/02, Geological Summary Report.. *British Geological Survey Internal Report*, CR/06/190.

WALLIS, DG. 2006. Rockall-North Channel MESH Geophysical Survey, RRS Charles Darwin Cruise CD174, BGS Project 05/05 Operations Report. *British Geological Survey Internal Report*, IR/05/132.

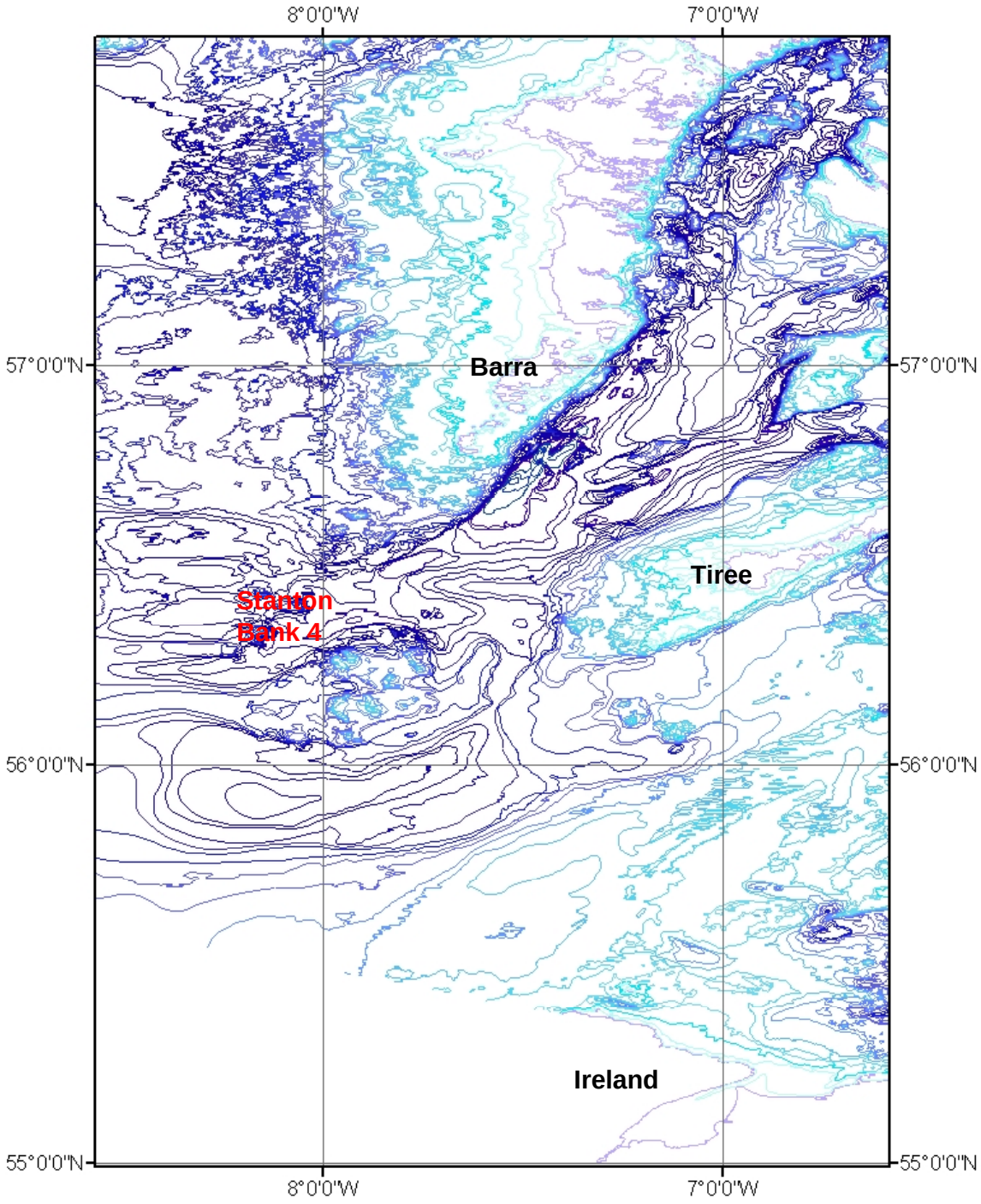

Figure 1 Location of Stanton Bank 4

Figure 2 Backscatter of Stanton Bank 4

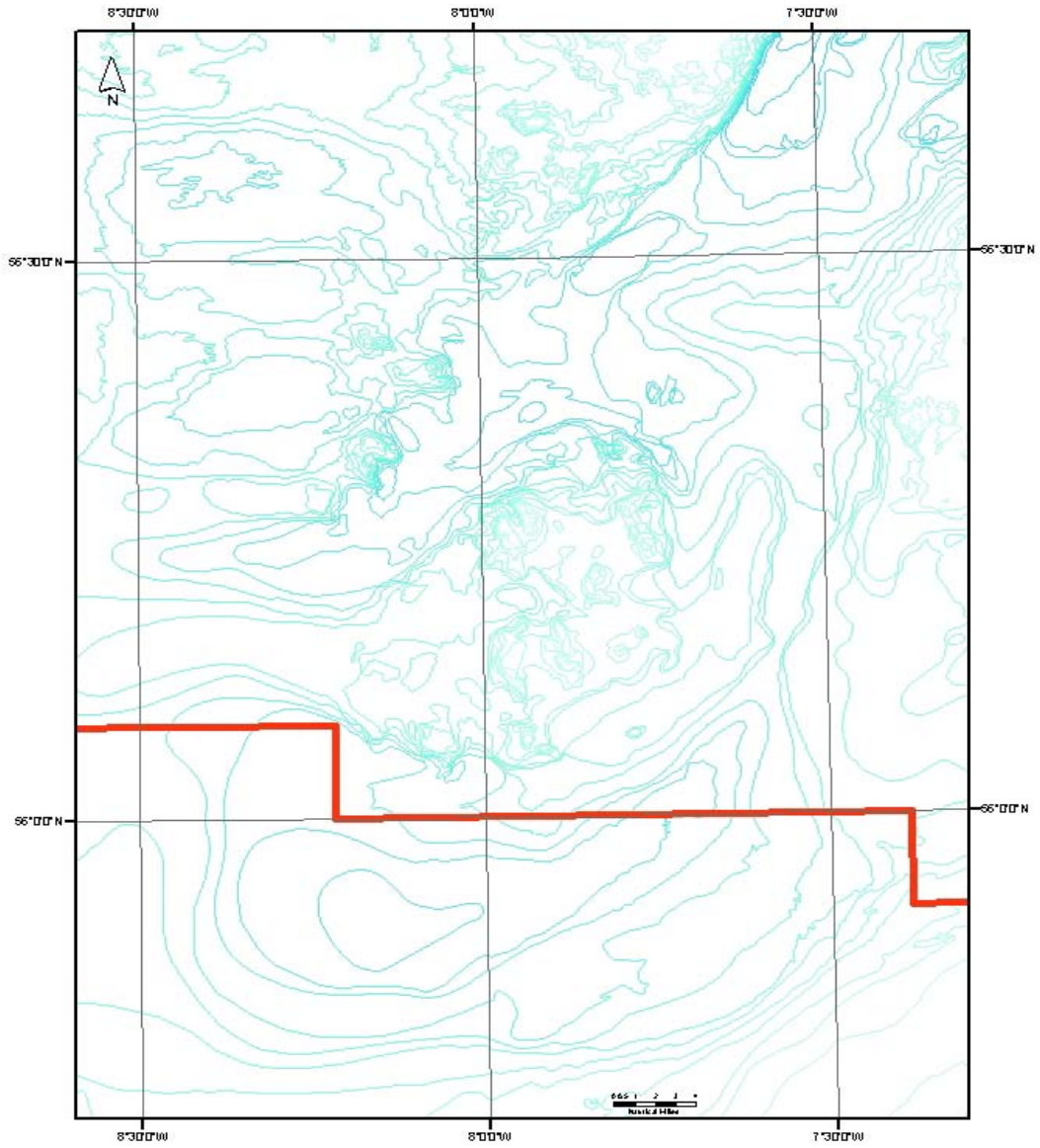

Figure 3 Stanton Bank (contours from BGS DigBath250)

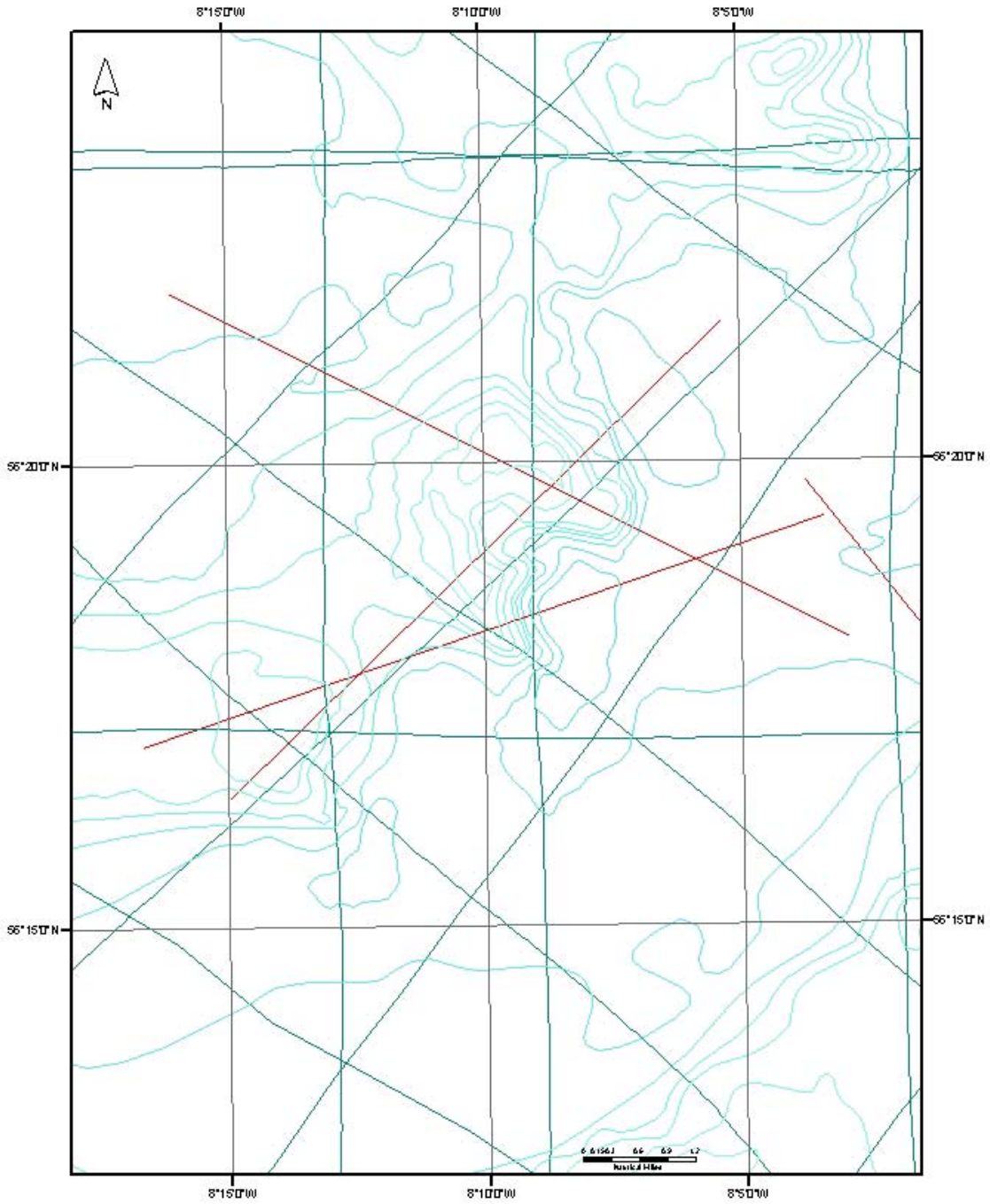

Figure 4 Existing BGS seismic profiles and planned lines across Stanton Bank 4

Existing BGS survey lines in blue, proposed lines in red

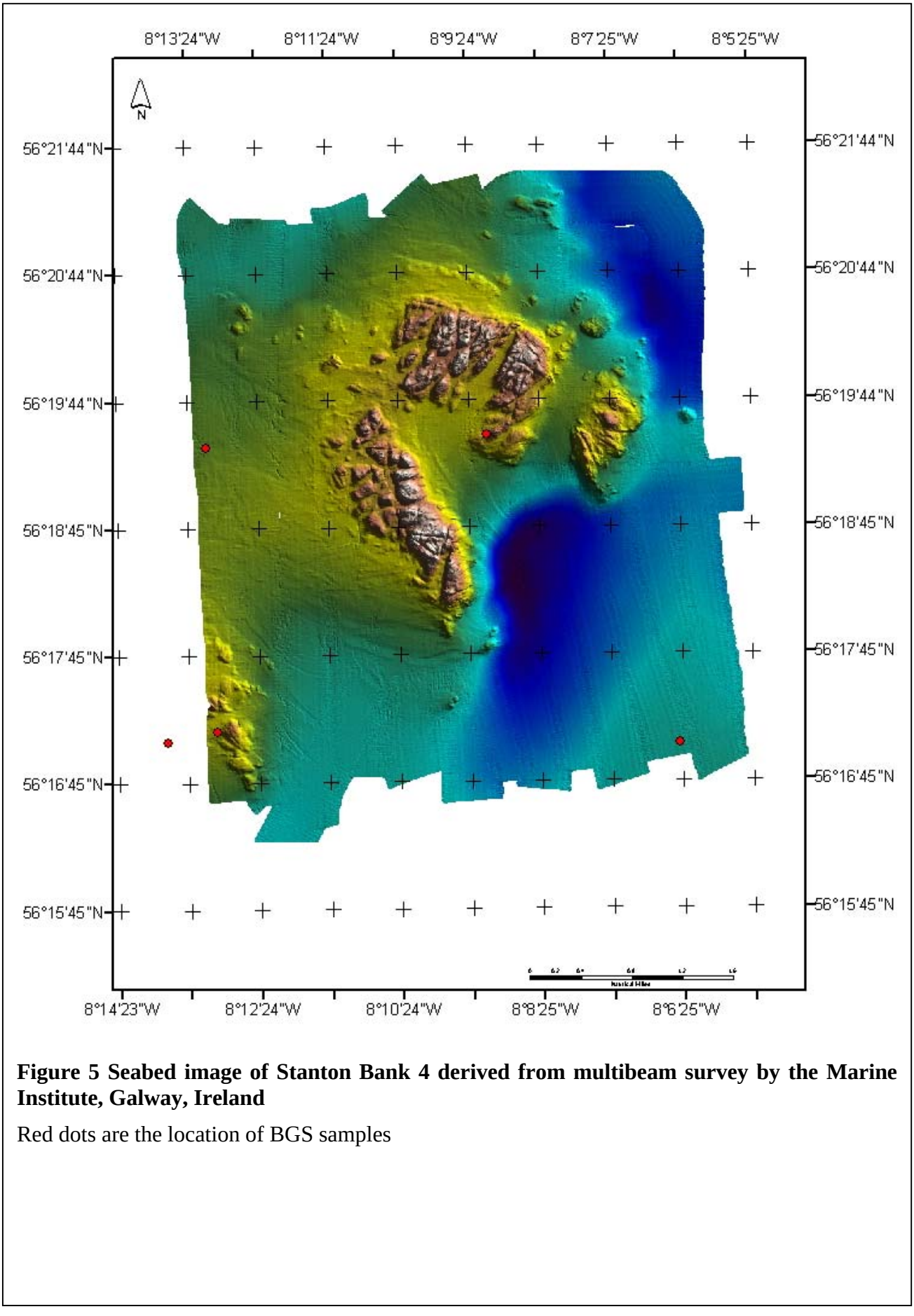

Figure 5 Seabed image of Stanton Bank 4 derived from multibeam survey by the Marine Institute, Galway, Ireland

Red dots are the location of BGS samples

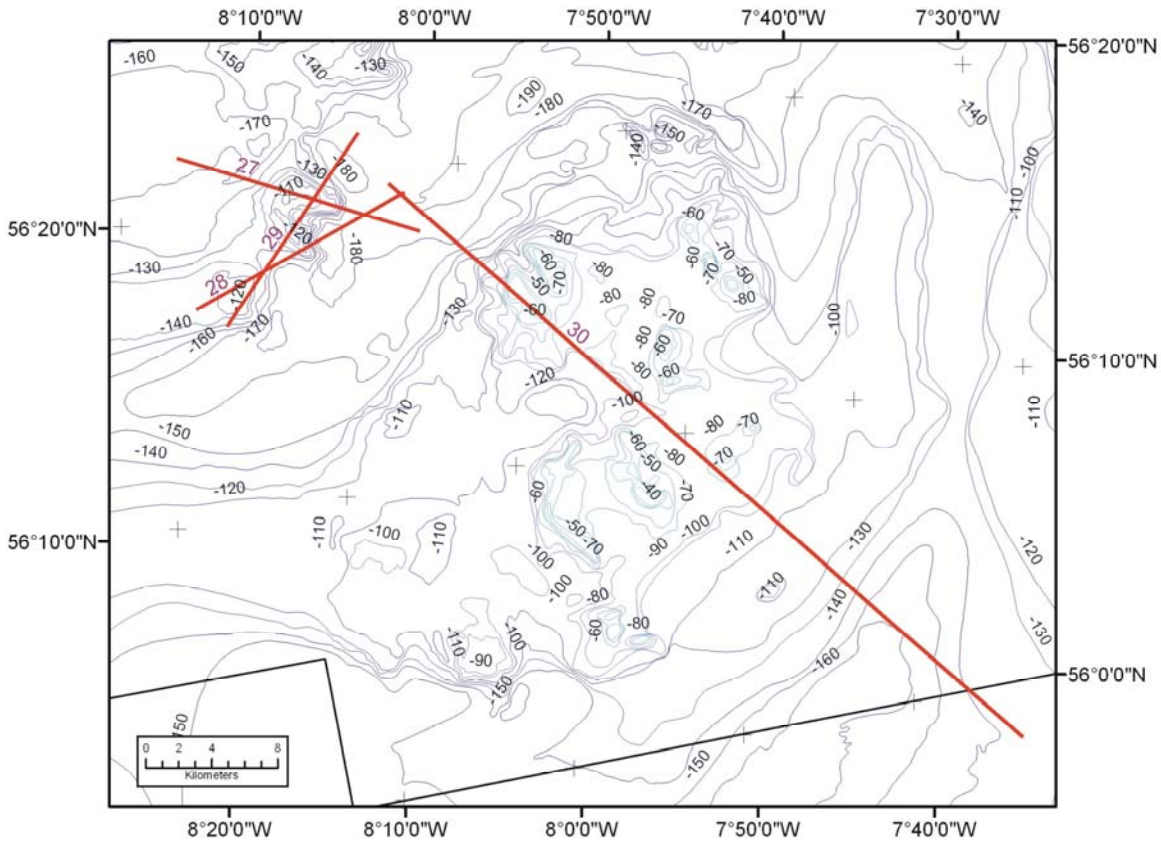

Figure 6 Location of lines 06/02/27-30 collected on MESH cruise 12-06-01

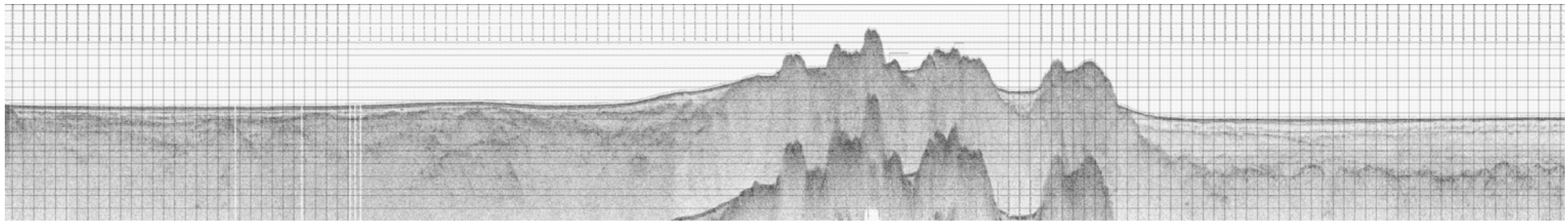

Figure 7 Line 06/02/27 sparker

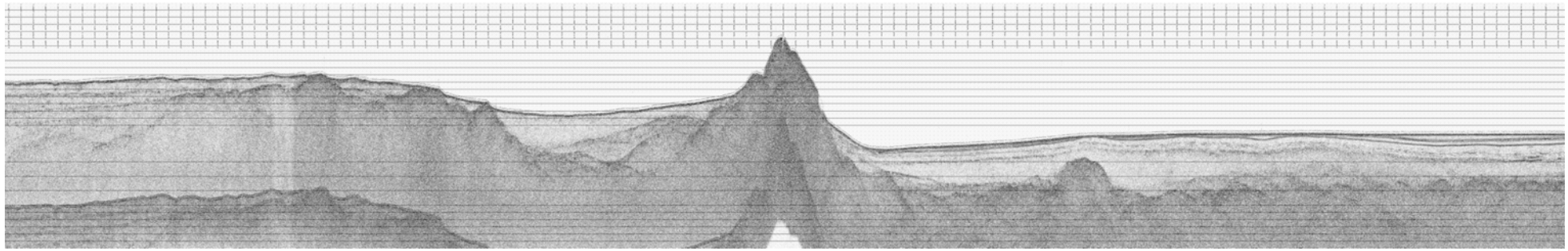

Figure 8 Line 06/02/28 sparker

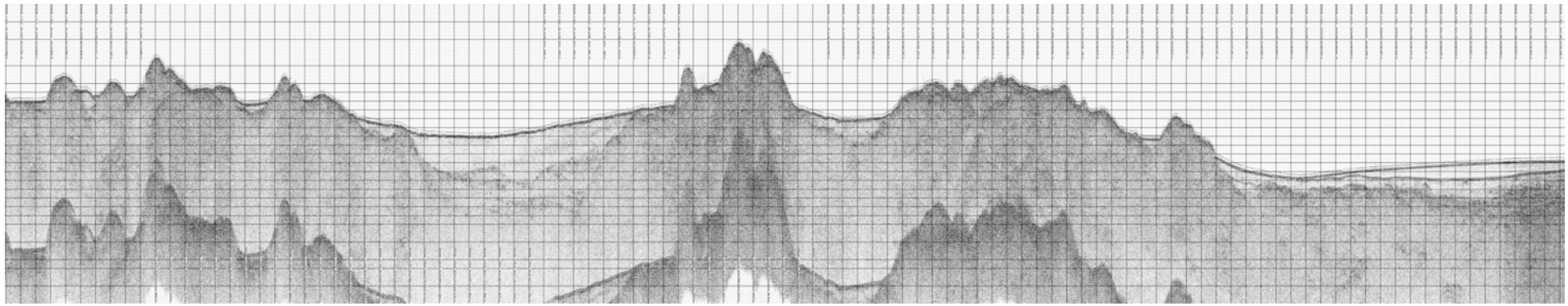

Figure 9 Line 06/02/29 sparker