

I.O.S.

R.V. Starella Cruise 1/79

20 September-19 October

8 November-15 November

Geophysical Surveys on the

East Greenland Margin

D.G. Roberts et. al

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INSTITUTE OF OCEANOGRAPHIC SCIENCES

Wormley, Godalming,  
Surrey, GU8 5UB.  
(042-879-4141)

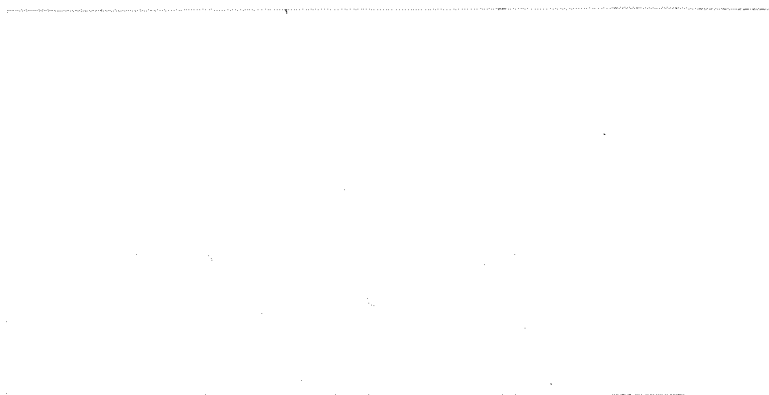
(Director: Dr. A. S. Laughton)

Bidston Observatory,  
Birkenhead,  
Merseyside, L43 7RA.  
(051-652-2396)

(Assistant Director: Dr. D. E. Cartwright)

Crossway,  
Taunton,  
Somerset, TA1 2DW.  
(0823-86211)

(Assistant Director: M.J. Tucker)



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## CONTENTS

	Page
Dates	1
Scientific Personnel	1
Ship's Officers	2
Summary of Cruise Intentions	3
Narrative	3
Project Reports	8
1. Faroe-Shetland Channel-North Rockall Trough	8
2. East Greenland Margin	9
3. N.E. Newfoundland Margin	9
4. GLORIA II	10
5. Seismic Reflection Profiling	11
6. Disposable Sonobuoys	12
7. Compressors	13
8. 1130 Computer	14
Station list	15
Track Chart	

# DATES

Sailed Hull, Yorkshire	20th September	} - Leg 1
Arrived St. John's, Newfoundland	14th October	
Sailed St. John's, Newfoundland	14th October	
Arrived Wood's Hole, Massachusetts	19th October	
Sailed Wood's Hole, Massachusetts	23rd October	} - *Leg 2
Arrived Jacksonville, Florida	8th November	
Sailed Jacksonville, Florida	9th November	} - Leg 3
Arrived San Juan, Puerto Rico	15th November	

\*The scientific objectives, narrative and preliminary results of the IOS-USGS programme carried out during Leg 2, can be found in IOS Cruise Report No. 96

## SCIENTIFIC PERSONNEL

			<u>Leg 1</u>	<u>Leg 3</u>
D.G. Roberts	(Principal Scientist)	IOS (Wormley)	x	x
D.G. Masson		" "	x	
M.L. Somers		" "	x	
J. Revie		" "		x
B.J. Barrow		" "	x	
D.G. Bishop		" "	x	
J. Langford		" "	x	
P.M. Hunter		" "	x	x
C.L. Jacobs		" "	x	
A. Gray		" "	x	
C. Uruski		Durham University	x	
Mrs. C. Leary		IOS (Wormley)	x	
P.R. Miles		" "	x	
Ms. D. Jones		RVS (Barry)	x	
P. Mason		" "	x	
M. Beney		" "		x
R. Lloyd		" "		x
R. Robinson		" "		x
S. Smith		" "		x
P. Hill		Dalhousie University	x	
D. Monahan <sup>1</sup>		Canada Hyd. Office	x	
H. Josenhans <sup>1</sup>		Bedford Inst. Oc.	x	

<sup>1</sup> Joined in St. John's, Newfoundland

SHIP'S OFFICERS

E. Thundercliffe

Master

## SUMMARY OF CRUISE INTENTIONS

The original objective of the cruise was to obtain information on the stratigraphy and structure of that part of the East Greenland margin which prior to 60 ma lay adjacent to the western margin of the Rockall Plateau. The area originally designated for comprehensive study extended from Scoresby Sund in the north to Cap Farvel in the south. The start of the cruise was however substantially delayed by a major engine failure which took place shortly before the planned departure on September 1st. The delay necessitated a reappraisal of the programme reducing the work planned on the Greenland margin. However, it was intended to extend the time spent off East Greenland subject to weather conditions.

### 1. East Greenland Margin

The original objective of the cruise was to comprehensively study the structure and stratigraphy of the East Greenland margin between Scoresby Sund and Cap Farvel. Aspects of the study of particular importance included a comparison of the East Greenland margin with its former conjugate, the Rockall Plateau. In view of time limitations and subject to weather and ice conditions, it was intended to study the distribution of the strongly dipping pre-rift sequence of reflectors developed south of the Denmark Strait and to examine the prolongation of the Mesozoic Jamieson Land Basin south of Scoresby Sund into the Denmark Strait. It was also intended to examine the influence of the outflow of water through the Denmark Strait on the distribution of the margin sedimentary sequence. In addition to seismic reflection and GLORIA, gravity, magnetic and bathymetric data were to be acquired continuously.

### 2. North Rockall Trough

During passage to East Greenland it was intended to make a short GLORIA survey of the upper slope in the Faeroe-Shetland Channel, the northern Rockall Trough and to traverse the Wyville-Thomson Ridge and Faeroe-Bank channel.

### 3. Continental Margin off Eastern Canada

During the transit from Greenland to Woods Hole, it was intended to obtain GLORIA traverses and seismic reflection profiles on the continental margin off Newfoundland and Nova Scotia. The purpose of these traverses was to obtain a preliminary indication of sediment thickness, structure and morphology in preparation for the more detailed geophysical programme to be carried out from RRS Discovery during 1980. Three Canadian observers were to participate in this part of the programme.

## NARRATIVE

After the failure of the gearbox and propulsion motors on September 1st, repairs were completed on September 18. A short sea trial was carried out on September 19 and Starella was accepted on that day. The scientific party rejoined Starella

at 1500/September 20th and Starella sailed from Hull at 1743Z/263 in strong winds. The pilot left Starella at the mouth of the Humber at 2002Z when course was set northward for the measured mile off Newbiggin. Despite making passage close to the coast to obtain a lee from the strong westerly winds, our passage was delayed by pitch problems. Starella arrived on the measured mile at 1400Z/264. Runs were made over the mile in both directions at speeds of 6, 8 and 10 knots and completed at 1510Z/264. As the runs showed that the log was reading low by  $1.043 \pm .003$ , the master unit and bridge repeater were set to the correct values. After completing the runs, the PDR fish was streamed to port and course was set for the Pentland Firth. By the forenoon of day 265, Starella was off Aberdeen. Two power failures were experienced during the day. At 1845/265 Duncansby Head was passed abeam. By 2030Z/265, Starella had cleared the Pentland Firth and course was set to  $310^\circ$  to make for the shelf edge of the Faeroe-Shetland channel. Watchkeeping and logging commenced at 0000Z/266. Starella arrived at the shelf edge at 0800Z but deployment of GLORIA and the seismic gear was delayed until 0930Z to await the weather forecast. GLORIA was launched at 0930Z in sea state 5 conditions and, at 1142Z, the 40 in<sup>3</sup> airgun and RVS short array were deployed followed by the magnetometer at 1200Z. GLORIA recording commenced at 1210 and ranges of up to 10 miles were observed. At 1245Z, course was set to  $242^\circ$ , parallel to the southern slope of the Faeroe-Shetland channel. The eastern end of the Wyville-Thomson Ridge was crossed at 1724Z and course was set to  $295^\circ$  to traverse the northern Rockall Trough. The weather deteriorated rapidly overnight and by 0900Z/267, very heavy spray being shipped overall necessitated a compressor shut down. At 0940Z, the GLORIA and seismic reflection profiling were therefore suspended pending an improvement in weather. At 1220Z, course was altered to  $050^\circ$  to run before the sea and at 1330Z to  $060^\circ$  to make for a lee east off the Faeroes to recover GLORIA. GLORIA recording began again at 1410Z and seismic profiling at 1426Z. Overnight (267/268) a GLORIA and seismic traverse was made of the Faeroe Bank channel and Faeroes Shelf, before obtaining a lee off Stromoy. All gear was recovered by 0630Z/267 and all gear secured. Passage was then made through the Vestmannsund of the Faeroes Group to avoid rough seas south west of the Faeroes. The Vestmannsund was cleared at 1739Z/268 when course was set  $322^\circ$  for Northeast Iceland, to avoid storm conditions to the west and southwest of Iceland. Throughout day 269 Starella proceeded towards northeast Iceland. Progress was slowed by a heavy swell and pitch problems with the propellor. At 0950/270 the Langanes peninsula was abeam and course was set westward to traverse the insular shelf off Iceland. In view of a severe gale 9 forecast for S.E. Iceland, GLORIA was not deployed and the traverse was made with the 160 in<sup>3</sup> airgun and short hydrophone. The traverse was completed in calm conditions by 1300Z/271



when all seismic gear was brought inboard. Some time was spent calibrating and balancing the depth sensors of the multichannel hydrophone before launching GLORIA at 1415Z/271, the magnetometer at 1412Z and the IOS 6-channel array at 1458Z. GLORIA transmissions began at 1455Z. Initially course was set westward across the Icelandic shelf to make for the Denmark Strait in view of continuing bad weather off South East Greenland. At 2007Z/271 course was set to 294° to cross the Denmark Strait. The night was clear giving a splendid view of the aurora but bitterly cold. The traverse across the Denmark Strait was completed at 0713Z/272, when course was set to 088°. At 1015Z, a large iceberg to starboard was detected by GLORIA. At 1442Z, course was set to 028° along the axis of the Denmark Strait. At 2224Z, course was set to 063° to parallel the slope southwest of Scoresby Sund. Overnight 272/273, heavy snow and sleet squalls were encountered. At 0330Z a broken fuel line necessitated a speed reduction to 3 knots and subsequently to 1-2 kts during which time GLORIA sank to 500 ft. At 1125Z course was set to 000° to traverse the slope and outer shelf south of Scoresby Sund. Throughout the day, wind and sea from the NNE progressively increased and by mid-afternoon the vessel was taking heavy spray and ice was beginning to form. At 1615Z, course was altered to 070° and at 1645Z to 188° to run before the wind and sea. By 1945Z, wind and sea had moderated sufficiently to allow a further GLORIA and seismic traverse parallel to the slope southwest of Scoresby Sund. This traverse was continued until 0330Z/274 when course was altered to 195° to tie into an earlier traverse. Between 0530Z and 1330Z a series of traverses were made across the Greenland slope and shelf until increasing wind and sea again forced us to run before a severe gale 9 from the ENE. At 1716 the depth gauge on GLORIA became intermittent. During this southward traverse heavy waves taken to port leaked through the hanger and into the lab. At 0032/275 the GLORIA heading indicator became intermittent finally failing at 0345Z. The compressor failed at 0351Z. As the GLORIA heading indicator indicated a cable malfunction, GLORIA transmissions were stopped at 0805 and all gear recovered by 1000Z. A severe twist found above the GLORIA nose indicated cable damage probably caused the the speed reduction at 0356/273. Course was therefore set for Dyrafjord after permission had been obtained from the Icelandic coast-guard. Whilst recovering the PDR fish at 1400 before entering the fjord, the hydraulic capstan lost power because of a hydraulic pipe burst causing the PDR fish to luckily bottom in the shallow water of the fjord. At 1500Z/275, Starella dropped anchor off Thingureyi. During the evening all hands were occupied winding off the GLORIA cable. At 0925Z/276, Starella weighed anchor and proceeded along side to take on fresh water. Replacement of the GLORIA cable was completed during the day and Starella sailed from Dyrafjordur at 1910Z/276. The PDR fish was deployed at 1930 and course was set for the eastern edge of the Denmark Strait. At 2230Z/276 speed was reduced and GLORIA

launched at 2310Z in moderate swell conditions. Deployment of the seismic gear was completed by 0035/277 and course was set 067° for the axis of the Denmark Strait. In view of the persistent poor weather in the northern Denmark Strait, it was decided to take advantage of ameliorating conditions off East Greenland to occupy a series of traverses both parallel and oblique to the margin as far south as Cap Farvel: these traverses would also provide useful ties to the Durham seismic profiles. At 0634Z the axis of the Denmark Strait was reached and course was set to 226° to begin the first of the southward traverses. Due in part to a heavy following sea, the quality of the seismic data was poor. At 1616Z, the short array was recovered and the multichannel array was rebuilt into a shorter array of two active and two passive sections with appropriate weights added on to the cable. This effected an immediate improvement in signal to noise at the required higher speeds. At 2100Z, course was set to 214° to cross the slope in a south westerly direction and subsequent traverses across the slope were made at 0510Z/278 and 1335Z/278. During day 278, the RVS compressor tripped on three separate occasions. Throughout day 279, we occupied a long southwesterly traverse parallel to the slope occupying a disposable sonobuoy station between 1722 and 1820/279. At 2208/279 course was set to 140° to make for the start of a return traverse at 2344/279 parallel to the slope to mosaic the GLORIA sonographs obtained during the earlier southward traverse. A short traverse up the slope was made between 0002 and 0717/280 and downslope between 1429 and 1730/280 when course was again set southwestwards parallel to the slope. Disposable sonobuoy station 3 was occupied between 1820 and 1930. At 2323 course was altered to 189° to begin a series of zig-zags across the Labrador Sea toward the Newfoundland Basin. Weather conditions deteriorated throughout the day and the magnetometer was brought inboard at 2294/281 as it was fouling the GLORIA cable. At 0152Z/281, the GLORIA transmitters tripped due to failure of the 12v power supply in coincidence with a trip of the RVS compressor. By 0345Z, GLORIA transmissions were resumed. At 1134Z/281 the RVS compressor tripped again due to severe rolling and seismic profiling was suspended temporarily. By 1520Z/281 we were experiencing FORCE 9 beam seas and altered course downwind at 1528/281 to 220°. By 2200Z/282 the weather had moderated and seismic profiling began again. GLORIA transmissions had not been interrupted however. Course alterations were made between 0023 and 0223/283 to bring Starella onto a heading of 197° to cross the North West mid-Ocean Canyon. However, severe pitching necessitated a further alteration to 160° to minimise the strain on the GLORIA cable. By 1552Z/283 the sea had moderated sufficiently to allow a return to the original heading of 180°. At this time excellent sonographs were obtained of the mid-ocean canyon. At 2231Z course was altered to 098° to cross the canyon before turning south again at 0040/284.

At 0145Z/284 the magnetometer was deployed for the traverse to Orphan Knoll. The northern edge of Orphan Knoll - a remarkably steep feature showing 3.5 seconds of relief was crossed at about 1200/284. An abortive attempt was made to occupy disposable sonobuoy station 4 between 1610 and 1700/284. The traverse across the crest of Orphan Knoll was made between 1843 and 2148Z/284 and revealed a number of steep sided hills with a relief of 100-200 m apparently originating in the basement. After crossing the Knoll, course was set for St. John's Newfoundland and disposable sonobuoy station 5 was occupied in the Orphan Basin between 2230 and 2350Z/284. The GLORIA and seismic profile traverse of the Orphan Basin continued throughout day 285 and disposable sonobuoy station 6 was occupied between 1606 and 1720. Speed was reduced to 6 kts at 2300/285 to commence recovery of GLORIA, the seismic gear and magnetometer. All gear was recovered by 0100/286 when course was set for St. John's. At 1230/286 the PDR fish was brought inboard preparatory to entering St. John's to refuel where Starella secured alongside at 1340Z/286. The PDR fish was streamed at 2220Z/286 and course was set for the Laurentian fan. Overnight a ship's power failure occurred at 0400/287 and only slow progress was made in strong southwesterly winds. At 1905Z/287 course was altered to 185° to gain a more southerly point on the Grand Banks shelf to deploy the seismic gear. By 0045Z/288, the wind had backed to the northwest and the seismic gear (160 in<sup>3</sup> airgun) was deployed by 0230Z/288. However, weather conditions did not permit the launch of GLORIA. Seismic profiling was eventually stopped at 0715Z following several compressor failures due to severe rolling and pitching in severe gale 9 conditions. By 2146Z/288 the weather had moderated sufficiently to allow profiling to begin again. However, between 0054/289 and 1020Z/289, eight compressor failures took place. At 1108Z/289, seismic profiling was stopped to deploy GLORIA which was launched by 1224/289. Seismic profiling and GLORIA traverses began at 1225Z/289 and a southwesterly traverse was made in mid-slope depths parallel to the Nova Scotia margin. Excellent sonographs of canyons were obtained to starboard and by 0300/290, the heavy swell had moderated. At 1224Z/290 course was set for the upper slope off Nova Scotia where a small survey of slump-like features was made between 1800Z and 2030Z/290. After completing the survey, course was set to 230° at 2341Z/290 for a traverse of the margin east off Georges Bank which revealed several large diapiric structures. We continued southwestward throughout day 190 parallel to the slope finally turning westward to cross the upslope in the vicinity of Oceanographer Canyon. At 0400Z/291 speed was reduced to 6 knots to recover GLORIA and the seismic gear. Passage was then set for Vineyard Sound overnight. At 1700Z/291 speed was reduced to 1 knot to recover the PDR fish. R.V. Starella arrived Woods Hole to dock alongside Woods Hole Oceanographic Institution at 2000Z/291.

## Leg 2

The narrative for Leg 2 (Woods Hole to Jacksonville) appears in a separate cruise report.

## Leg 3 Jacksonville-San Juan, Puerto Rico

R.V. Starella arrived Jacksonville 1620/312 having successfully completed a study of the East Coast Margin for the United States Geological Survey. The USGS party left R.V. Starella during day 313 and Mr. P. Hunter rejoined; Mr. M. Somers left to fly to San Juan, Puerto Rico to make arrangements for our arrival. R.V. Starella departed Jacksonville, Florida at 2220Z/313 after replenishing the fresh water tanks and taking on further bunkers. After clearing the entrance to the St. John's River at 004Z/314 speed was reduced at 0320Z/314 to deploy the PDR fish. Course was then set for the shelf edge to deploy GLORIA. At 0840Z/314 speed was reduced to 4.5 kts and GLORIA was fully deployed by 0915Z. The 160 in<sup>3</sup> airgun and 2-channel streamer were deployed by 1058Z when speed was increased to 9.5 kts. The airgun failed at 1105Z. An easterly course was maintained to examine the ground under the Gulf Stream. The airgun was repaired by 1857Z but speeds in excess of 8 knots could not be maintained because of high temperatures on the alternators. The autopilot failed at 2001Z and again at 2232Z. The failure was attributed to overheating. Overnight we continued the traverse across the Blake Plateau crossing the Blake Spur shortly before 1300Z/315 when course was set southeastward to examine the Blake-Bahama Outer Ridge. Excellent sonographs were obtained of the system of furrows and mud waves on the Blake-Bahama Outer Ridge. The ship's gyro again failed at 0212Z/316 and an AC compressor trip at 0214Z tripped all GLORIA amplifiers. Successive gyro failures took place at 0223Z, 0430Z and at 1420Z requiring hand steering for short periods. Excellent sonographs were however obtained of the Blake-Bahama Outer Ridge. During the evening, the autopilot fault was traced to broken wires and repairs made throughout day 317. Starella continued southeastward over the edge of the Hatteras abyssal plain crossing over the northern edge of the Caicos Outer Ridge. As in previous days, progress remained slow due to temperature problems in the engine room. At 0712Z/318, the airgun trigger lead failed due to wear at the outboard end of the towing bridle. During the latter part of <sup>the</sup> day, the outer edge of the Puerto Rico Trench was traversed and during day 319 depths of 8000m were observed in the axis of Puerto Rico trench. At 2034/319 speed was reduced to 6 knots and GLORIA, the seismic gear and PDR fish were all brought inboard by 2135Z/319 when course was set for San Juan, Puerto Rico. Starella dropped anchor in San Juan harbour at 0102/320 and proceeded alongside at 1020Z/320.

## PROJECT REPORTS

### 1. Faeroe-Shetland Channel and North Rockall Trough

A GLORIA and seismic reflection profiler traverse (Figure 2) was made parallel

-7-

to the east slope of the Faeroe-Shetland Channel and continuing across the eastern end of the Wyville-Thomson Ridge into the northern Rockall Trough. Preliminary shipboard interpretation of the traverse suggests the presence of small slumps on the slope and may show bedforms associated with the fast currents in the Faeroe-Shetland channel. The traverse illuminated the site of the proposed D of En/BNOC test well in the northern Rockall Trough. GLORIA data show a curious semicircular pattern of mud waves north of Rosemary Bank and on the south flank of the Ymir Ridge. The smooth topography of the south side of the Wyville-Thomson ridge reflects the presence of a large sediment drift. Relict iceberg plough marks were identified on the Faeroe shelf and possibly on the western end of the Wyville-Thomson Ridge.

## 2. East Greenland Margin

The major part of the time off East Greenland was spent in the Denmark Strait and off East Greenland. GLORIA, seismic reflection, magnetics and gravity recordings were made throughout.

Between the Denmark Strait and  $69^{\circ}30'N$ , the margin was studied by means of a series of traverses both parallel and perpendicular to the margin. Icing and poor weather conditions did not permit an examination of the Mesozoic Basin of Jamieson Land to the east of Scoresby Sund. The preliminary interpretation shows the outer shelf and slope to be underlain by <sup>2</sup>2-3 second thick sequence of prograding sediments that thin rapidly toward the axis of the Denmark Strait. Within the Denmark Strait non sequences and unconformities are evidence of active erosion by the strong bottom currents. Within the section, intrusions and active faulting are evident. There is however, little evidence of the tilted block structure that is well known in the Jamieson Land Basin.

A series of traverses were made across the continent-ocean boundary and lower slope off South East Greenland. The purpose of these traverses was to tie together the Durham University seismic lines and to examine in more detail the sequence of pre-rift oceanward dipping reflectors that are also well known on the west side of the Rockall Plateau. Preliminary gravity and magnetics maps were prepared. The GLORIA sonographs show numerous examples of box shaped submarine canyons often lying oblique to the slope. Evidently, the distribution of Neogene sediments on the East Greenland Margin has been strongly influenced by the outflows of water from the Denmark Strait and both erosional and depositional features have been observed.

## 3. North East Newfoundland-Orphan Basin

A GLORIA, seismic reflection, gravity and magnetic traverse were made across the Orphan Knoll and Orphan Basin onto the shelf off N.E. Newfoundland. The traverse across the Orphan Knoll clearly shows a series of rifted blocks that are known from DSDP results to contain Bajocian sediments. The basement rises to the north

of the Knoll where there may be a pronounced unconformity between the late Cretaceous and the pre-Jurassic basement. Both the GLORIA and seismic data revealed a series of prominent 200 m high isolated knolls that apparently arise from the basement. The origin of these features is enigmatic. The traverse between the Orphan Knoll and the Newfoundland Shelf revealed a sedimentary section of at least 3 seconds thickness exhibiting some similarities to seismic sections across the Porcupine Seabight Basin. Slumping was observed on the upper slope. A more detailed examination of the Orphan Basin will be made from RRS Discovery in 1980.

D.G.R.

#### 4. GLORIA II

After sailing from Hull late on 20th September, the 21st and 22nd were spent calibrating the EM log and making passage to the first operational area. The system was launched at 0930 GMT on 23rd September but only veered to 250 metres of cable as the water depth was barely 200 metres. The next 3 hours were spent at slow speed while the seismics were streamed and put into operation. At about 1200 the tape recording was started and the ship came up to speed on her course.

After 24 hours of work in deteriorating weather the system had to be shut down as the ship was taking water over the Portakabin. At this time the spare cable drums broke adrift from their storage in the hangar, and scientific spares were breaking loose below. It took about 3 hours to secure everything safely with the ship rolling heavily in a full gale. Eventually the ship was put on a downwind course to run into the Faeroe Islands and recording recommenced. Early on day 268 (25th September) the gear was recovered in the lee of the Faeroes.

The next launch was on Day 271 (28th September) off the North Cape of Iceland and work continued in fairly poor weather with temperatures down to  $-2^{\circ}\text{C}$  until early on Day 273 when there was a temporary loss of speed due to a fractured fuel line in the engine-room. The vehicle did not apparently go deeper than 500 feet. Later on this same day it was necessary to recover the magnetometer as it was fouling the GLORIA cable. Late on day 274 after some heavy pitching and with the wind blowing force 9 from the ENE there was clear evidence of cable damage, and the ship made her best course for Iceland to recover the vehicle, which was done on Day 275 at about 0930.

There was the familiar cable damage near the vehicle, so the original long length of cable was refitted, and this served without further mishap for the rest of the cruise.

The ship now started working south, and cleared Cape Farewell late on Day 281. After crossing the Labrador Sea the vehicle was recovered on Day 285 to enter

St. John's. On leaving St. John's the weather again blew up and the crossing of the Grand Banks was very slow, so that the vehicle could not be launched again until Day 289, nearly three days after leaving St. John's. From then until recovery at 2300 on Day 291 to enter Woods Hole it was a constant struggle to maintain speed in the prevailing weather conditions. Two and a half days of operation were possible before the vehicle had to be recovered, and the ship entered Woods Hole on Day 292.

During the cruise some 53 tapes were recorded, some 400 hours, and full replays were made except for one tape which had for some reason failed to record a synchronisation signal. The major worry on this cruise was the condition of the tape recorders, one of which had to have a replay head changed and another suffered damage when it slipped from its fiddle in a very heavy roll. The damage was successfully repaired. The Muirhead photo replay machine had periods of poor synchronisation with the tapes, but the backlog of records never got out of hand. It is a cause for considerable satisfaction that in a period of frequent and sustained bad weather not only was cable damage restricted to one end, but so much data was obtained.

M.L.S.

## 5. Seismic Reflection Profiling

Despite a major setback, Starella finally sailed from Hull on day 263, nearly 3 weeks later than scheduled.

After passing through the Pentland Firth, on day 266, the RVS 30 metre array and 40 cu in. airgun were streamed and profiling commenced. For a "first-time" on a charter ship, it made a change not to have to contend with problems of radio transmission and mains interference, although it was not to be long before Starella showed that she had problems of her own.

The following day, 267, in heavy weather and with bad rolling, the ship took a wave over the boat deck flooding the compressor cabin. It was decided to shut the system down until the sea moderated. Fifteen hours later profiling recommenced with the exception of the Bell & Howell tape recorder which, due to very low temperatures in the laboratory, refused to start until the inter lock circuits had been heated with a hot air blower.

Day 268 found us in the lee of the Faroes, sheltering from the bad weather, so that all the equipment could be recovered. Once this had been completed, the ship passed through the Vestmann Fjord and headed towards the northern coast of Iceland where on Day 270 the 30 metre array and 160 in<sup>3</sup> airgun were streamed and towed until we reached the main survey area off Greenland on Day 271. At this point the 30 metre array was recovered and the 6-channel array streamed. This array worked extremely well, was very quiet, and towed within 1° of horizontal. As the weather once

again deteriorated, the quietest channel was selected for monitoring on the EPC. With a following sea this was usually one of the tail end channels, 5 or 6, since the channels nearest the ship were towing within 10-15 feet of the surface and hence excessively noisy.

To recover all the equipment we once again headed for shelter, this time off the NW coast of Iceland on Day 275. As soon as this had been completed, the ship entered and anchored in Dyrafjordur. Here the Gloria cable was changed and general maintenance completed.

On the evening of Day 278 the ship left the fjord and headed NW to the 50 fathom line where the 30 metre array and airgun were streamed. After 16 hours the noise on the array became unacceptable, possibly due to it towing too shallow. However, to overcome this problem, the tail end 4 active and neutral sections of the multi-channel array were removed, and only the front 2 channels, plus an extra weight on the cable, streamed. With the exception of about 10 hours on Day 282 when the compressor cabin once again got flooded, this arrangement remained until late on Day 285 when the equipment was recovered off St. John's.

After bunkering in St. John's the ship left on the evening of Day 256 and headed SW. Due to bad weather and the ship's speed barely in excess of 4 knots, the SRP system wasn't streamed until 0227 on Day 288. With a head wind forcing the vented hot air back into the Portakabin, the RVS compressor continually tripped out due to overheating. This, combined with severe rolling, forced the system to be shut down for 14 hours with the array and gun left streamed. During the evening of Day 288 the sea moderated and the system was switched on again. With the wind remaining head on the compressor problem persisted.

Midday on 281 the array was recovered during the launching of GLORIA and then restreamed. With a flat calm sea, profiling continued at 10 kts until 2200/291. All the equipment was recovered and the system shut down.

With new top housings the airguns gave no trouble at all, one lasting for nearly 8 days. Without new tails, however, the tail locating holes on the housings have started to wear badly. New tails were ordered before the cruise but were not delivered in time to be used. Despite all the bad weather the down time was minimal, most of it being due to the compressors - a problem which will have to be looked into.

D.G.B.

## 6. Disposable Sonobuoys

Four seismic wide angle sonobuoy stations were successfully occupied, two on the Greenland continental margin, one on Orphan Knoll and the fourth on the



Canadian continental slope. Three other buoys failed owing to signal failure, two of which probably fouled the other towed instruments.

The signal reception time on all buoys was short compared with previous operations. This may be attributed to the following:

- a) Ship speed of 8.5-9.0 knots which increased Tx-Rx range more rapidly.
- b) Shallower gun depth owing to ship speed. This changed the frequency of the gun pulse and the surface reflection cancellation pattern.

For the above reasons the data quality was reduced. In particular first arrival refracted events were very weak as monitored on the EPC recorder. The S/N ration decreased rapidly after about 30 minutes in all cases but a complete appraisal is required or an interpretive display. Operationally, no significant difference was apparent between buoys reduced 20dB RMS or Peak to Peak. A broken connection or a central unit circuit board caused a failure in the signal record level indicator.

P.R.M.

## 7. VHP 36 COMPRESSORS

When fitted on Starella in Hull, the compressor would only run corrently on hand operation. It was found that the main DC supply was wired in the wrong polarity; because of diodes in the timers this stopped them working on automatic.

The compressor worked very well until the failure of first the pressure maintaining valve and secondly a blockage in the main pressure switch. Both faults cause the fourth stage relief valve to blow.

Suggested mods to container for working in bad weather and very cold conditions are:-

- a) A heater to be fitted in the container
- b) Weather proofing of motor end vent to prevent spray/<sup>and</sup>rain getting into the main motor.
- c) Heavy rolling causes a great amount of oil to be vented through the crank-case breather. This caused a hazard to personnel because of oil on the floor of the container and the ship's decks.

### Barry Container VHP 36 Compressor

The compressor worked well and for long periods, but for 2 faults:

- a) Thermal cut out switch on the starter resistor banks kept tripping out.
- b) Overheating causing final air temperature switch to trip out regularly.

There were various reasons for this.

No.1: positioning of container with the radiator facing forward. If it had been positioned through 180° then the problem of spray in bad weather getting into the main motor would have been considerable.

- c) An excessive amount of carbon deposit on the second stage valve places.
- d) An air lock was found in the cooling system.
- e) Air leak on reservoir drain valve causing the compressor to work hard.

A.G.

#### 8. 1130 Computer

Considering the variation in power supply, the data logger and computer worked reasonably well. There were some gaps in the data, mainly caused by power failures and once when an end of tape sensor failed, but the navigation data was recovered from various log books and entered into the computer directly. The sensor later recovered and has not failed since. Satellite fixes and uncorrected depths were input to the computer on paper tape.

Once the first few tapes had been processed sufficiently for their data to be plotted, it was noticed that large spikes occurred in the gravity every forty minutes. This is a problem in the gravity filters which returns occasionally and its correction is very time consuming. Many attempts were made to correct this error, which appeared to be exacerbated by the general power level, but eventually it was decided to get as much data as possible and reprocess the gravity later. This was begun once the relevant programs had been rebuilt in St. John's harbour.

The Satellite navigator was used with a T.V. monitor and printer in the lab and a printer on the bridge. The gyro and fore and aft component of the E.M. log were interfaced to it. The instrument worked well, but because of faults in the standby battery system, the unit had to be re-initialised on restoration of ship's power. The system was never inoperative for more than half an hour, so navigational accuracy was unaffected.

The IBM 1130 computer was sometimes difficult to start up, probably because the ship's power was unable to handle this surge. Some minor problems were experienced with the computer peripherals but these were soon resolved.

The container itself was occasionally inundated with water which was forced in around the door jambs, spraying either the rear of the console, or the tape deck and multiplexor. To date, no obvious damage has become apparent.

We would like to express our thanks to Caroline Leary and Peter Miles for their assistance in the preparation, processing and checking of the data.

D.J., P.M.

STATION LIST

No	Type	Day	TIME		START		END		Depth Metres	Comments
			S	E	LAT	LONG	LAT	LONG		
1	5B	279	1620	1652	61°45.5'	39°41.0'	61°41.8'	39°46.8'	1810	Lost tuning
2	5B	279	1722	1820	61°38.0'	39°51.2'	61°30.6'	40°01.4'	2026	OK
3	5B	280	1820	1930	61°38.2'	40°22.8'	61°29.7'	40°34.6'	1740	OK
4	5B	284	1610	1620	51°05.8'	46°24.2'	51°04.3'	46°23.6'	2980	Fouled
4	5B	284	1625	1710	51°03.3'	46°23.5'	50°57.6'	46°22.7'	2970	Repeat fouled
5	5B	284	2230	2350	50°22.6'	46°12.8'	50°22.6'	46°30.1'	1841	OK
6	5B	285	1720	1720	49°09.8'	48°59.8'	48°59.8'	49°21.3'	1782	OK

