Institute of
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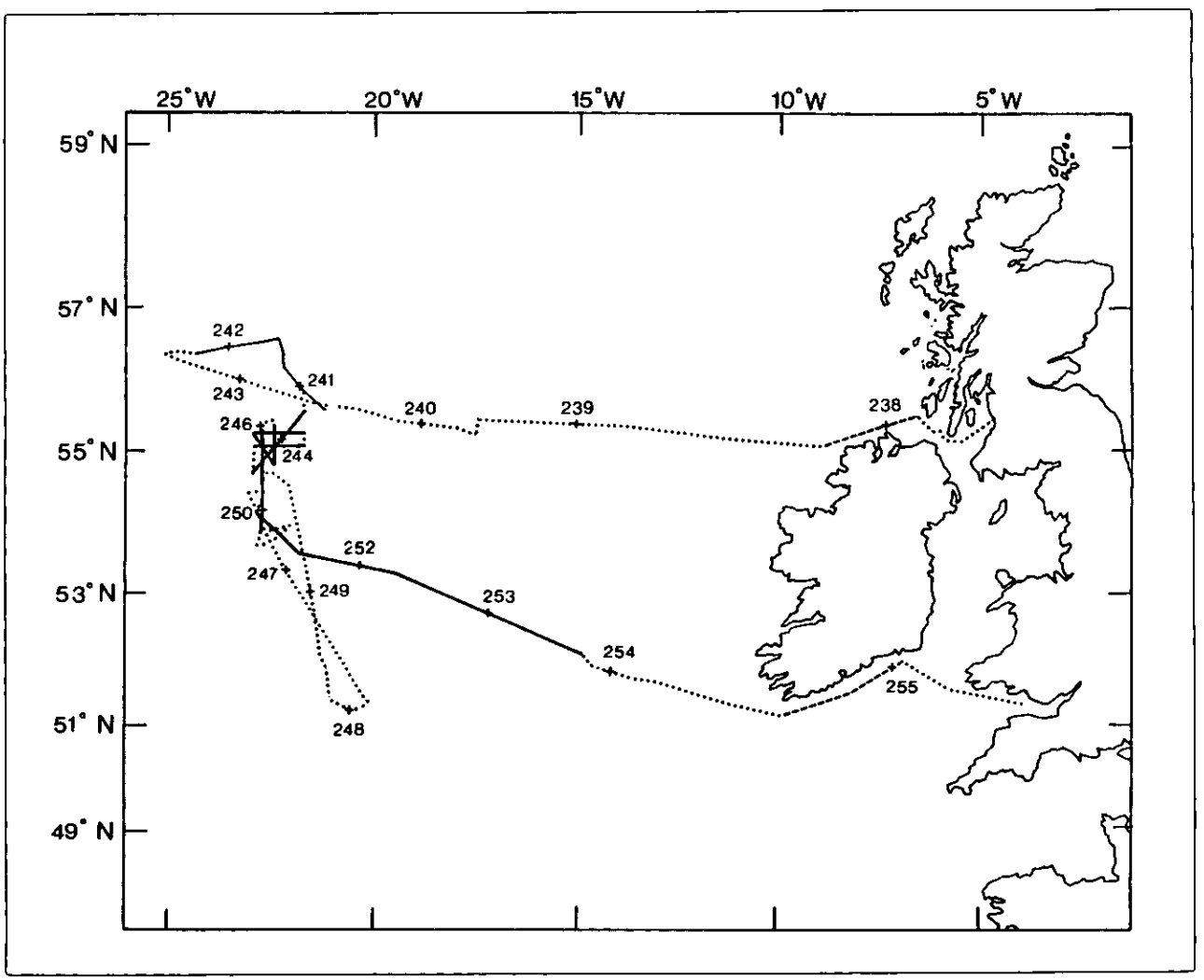
Deacon Laboratory

RRS Charles Darwin Cruise 52

25 Aug - 13 Sep 1990

Multichannel seismic reflection survey of the southern margin of the Rockall Plateau

Cruise Report No 218 1990



Natural Environment Research Council

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CRUISE REPORT NO. 218

RRS CHARLES DARWIN CRUISE 52
25 AUG-13 SEP 1990

Multichannel seismic reflection survey of the southern margin of the Rockall Plateau

Principal Scientist
D G Masson

1990

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ABSTRACT

The main objective of the cruise was to collect multichannel seismic reflection profiles over the southern margin of the Rockall Plateau. These profiles were for use in defining drillsites for upgrading a preliminary Ocean Drilling Programme proposal entitled "The sedimentary equivalent of dipping reflectors". The main objective of drilling in this area would be to penetrate early Tertiary sedimentary strata equivalent in age to the enormous thickness of volcanic strata which characterise the western margin of the Rockall Plateau and which were erupted during the separation of Rockall from East Greenland. The sedimentary strata should preserve a record of the tectonic and volcanic events which accompanied this separation, and which cannot be examined directly by drilling into the volcanic sequence because of its extreme thickness and a lack of biostratigraphic markers.

R. R. S. Charles Darwin sailed from Troon on the 25th August, 1990 and Docked at Barry on the 12th September. Despite much lost time due to bad weather, over 550 line miles of multichannel seismic reflection data was collected. Preliminary analysis of the data based on single channel monitor records suggests that it is of good quality.

KEYWORDS

ATLANTIC(NE)
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ROCKALL PLATEAU
SEISMIC REFLECTION PROFILES

ISSUING ORGANISATION

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SCIENTIFIC PERSONNEL

MASSON, Douglas G. (Principal Scientist)	IOSDL
SAUNDERS, Martin R.	IOSDL
DAVIES, Timothy	IOSDL
MORTON, Andrew	BGS, Keyworth
BRETT, Colin	BGS, Edinburgh
JONES, Neil	University of Cambridge
CUMMING, Tony	RVS
PAULSON, Chris	RVS
TEARE, Dave	RVS
DAVIES, Mike	RVS
POOLE, Tony	RVS
KNIGHT, Gareth	RVS
WHITE, Gary	RVS
HILL, Andy	RVS
TAYLOR, Alan	RVS

SHIP'S PERSONNEL

AVERY, K.O.	Master
EVANS, P.A.	Chief Officer
SYKES, S.	Second Officer
PROCTOR, G.	Third Officer
SHELDON, M.J.	Radio Officer
ANDERSON, D.E.	Chief Engineer
GIMBER, G.	Second Engineer
LOVELL, V.E.D.	Third Engineer
PARKER, P.G.	Electrical Engineer
HARRISON, M.A.	Chief Petty Officer
HOPKINS, L.N.	Seaman
COOK, S.C.	Seaman
SCRIVEN, A.G.	Seaman
BUFFERY, D.G.	Seaman
OLDS, A.E.	Seaman
WOOD, G.H.	Chief Petty Officer
BISHOP, P.J.	Cook
STEPHEN, R.H.	Second Steward
JENKINS, D.E.	Steward
DUHAMEAU, P.	Steward
BAILLIE, D.	Motorman

ITINERARY

Sailed Troon, Scotland	25th August, 1990
Arrived Barry, South Wales	12th September, 1990

CRUISE OBJECTIVES

The main objective of the cruise was to collect multichannel seismic reflection profiles over the southern margin of the Rockall Plateau. These profiles were for use in defining drillsites for upgrading a preliminary Ocean Drilling Programme proposal entitled "The sedimentary equivalent of dipping reflectors". The main objective of drilling in this area would be to penetrate early Tertiary sedimentary strata equivalent in age to the enormous thickness of volcanic strata which characterise the western margin of the Rockall Plateau and which were erupted during the separation of Rockall from East Greenland. The sedimentary strata should preserve a record of the tectonic and volcanic events which accompanied this separation, and which cannot be examined directly by drilling into the volcanic sequence because of its extreme thickness and a lack of biostratigraphic markers.

Secondary objectives were the collection of multichannel seismic reflection profiles from the southern Rockall Trough, which were to be used to define a drillsite alternative to that south of the Rockall Plateau, and the collection of gravity profiles across the continental shelf while on passage to and from the main study area.

NARRATIVE

R. R. S. Charles Darwin sailed from Troon at 1500/237 in good weather (all times are GMT, and Julian Day 237 = 25th August). On passage to the main study area, a gravity and magnetics line, requested by J. Edwards of BGS Edinburgh, was run along the north coast of Ireland from 55° 35'N, 6° 40'W to 55° 10'N, 9° 00'W. The magnetometer was deployed at 1910 and logging of magnetics data began at 1920. This line was completed overnight, and a course was then set for the main study area at 55° 45'N, 21° 25'W. Passage speed initially averaged over 12kts in calm seas, but decreased to 10 to 11kts as the weather worsened. At 0800/239, we were some 140 nautical miles from the study area, and it was decided to recover the magnetometer and to deploy the 10 and 3.5kHz fish prior to beginning tests on the hydrophone streamer. This was completed by 0850. Streamer deployment began at 0910. Thirteen depth controllers ('birds') were fitted and tested

during deployment and the eight depth sensors were calibrated. Deployment was completed at 1300 when tests on controlling the streamer depth were begun. One depth sensor proved to be inoperative, and at 1300 recovery of the first 500m of the streamer began so that this sensor could be repaired. This was completed and the streamer redeployed by 1630/239. We then continued to steam west at 5kts toward the first survey line, since no time would have been gained by retrieving the streamer, steaming at a higher speed, and redeploying the streamer.

Deployment of the airgun array began at 1200/240, and the single 466in^3 airgun (Figure 1) was deployed on the port side by 1330. Deployment of the outer starboard airgun beam (Figure 1) began at 1330, and was completed at 1530, after delays caused by a hydraulic hose failure and the need to replace the 120in^3 gun, which refused to seal. Deployment of the inner starboard airgun beam began at 1545/240, but was again delayed by gun sealing and firing problems. In the meantime, weather conditions had deteriorated markedly, with winds reaching 30kts from the NW, and by 1900 it was clearly impossible to continue the launch. We therefore decided to steam slowly into the wind overnight, while hoping for an improvement in the weather. However, the weather deteriorated further during the night, with winds reaching 50kts by mid-morning. Considerable difficulty was experienced in keeping some forward motion on the ship to prevent the streamer from sinking. At 1300/241, the tail of the streamer sank below 150ft, apparently causing one of the emergency flotation bags to inflate. The tail of the streamer rose rapidly to about 20ft subsurface, but then sank back to over about 120ft, suggesting that the bag had been deflated or had been torn off in the rough seas.

The weather moderated overnight, but by this time we were over 100 miles to the west of our study area, and at 0800/242 it was decided to recover the airguns and streamer, prior to steaming back to the area. This would also allow repairs to a faulty gun and gun hydrophone, and a check of the streamer for possible damage to the birds, emergency flotation, and tail buoy. All the airguns were secured onboard by 0930, and the magnetometer switched off prior to recovery at 0950. Recovery of the streamer began at 1200, and was completed by 1600, at which time the magnetometer was redeployed and we began passage back to our original start point at 55° 45'N, 21° 25'W, some 125 miles away.

At 0830/243 we were back on station, and deployment of the streamer began. This was completed by 1100. Deployment of the airguns began at 1130 and was completed by 1330. The magnetometer was redeployed at 1715, just before the start of the first multichannel line, which began at 1721/243 (Table 1). Between this time and 0825/246, we recorded 240 miles of multichannel seismic data along lines 1-6 (Table 1, Figures 2, 3). The weather during this time was variable, with winds ranging up to force 9, with a prolonged period of rough seas during the first part of day 246 giving rise to marginal conditions for multichannel recording. At 0825/246, one of

the tape decks on the multichannel recording system failed, causing the premature termination of line 6.

Although the tape deck was repaired by 1050, the approach of hurricane Gustav dictated that surveying be terminated, so that we could run south to avoid the centre of the storm. Recovery of the streamer, airguns and magnetometer began at 1130/246, and was completed by 1630. On recovery, it was discovered that the inner airgun boom had been chafing the streamer, probably on starboard turns, when the short airgun tow adjusts to the new course much more quickly than the 2.5km long streamer. The outer sleeve of the tow cable had been chafed through, and the two lead spring sections of the streamer had been punctured. Temporary repairs were carried out in order to get the streamer inboard, as it was clear that the spring sections would need to be changed, and no time was available at this point. We then ran south at full speed collecting magnetics, gravity and 3.5 and 10kHz profile data. By 0730/247, it was judged that we were clear of the storm path, and the magnetometer was recovered so that the ship could heave to. We remained hove to until 1130/248, by which time the weather had moderated sufficiently for us to proceed back northward to resume survey work.

The survey area was reached at 1130/249, and although the wind and sea were now moderate, the continuing large swell prevented deployment of the multichannel streamer and the full airgun array. Instead, it was decided that we would complete line 6 using the single channel hydrophone and a single airgun beam supporting three guns (300, 100 and 80in^3). This was deployed between 1200 and 1500/249. Line 6 was completed by 0500/250, by which time the swell had also abated and it was possible to deploy the multichannel streamer and the full airgun array. Recovery of the single channel array and magnetometer began at 0755 and was completed by 0845. Deployment and repair of the multichannel streamer began at 0900 and was completed by 1600. However problems with the airguns delayed the start of shooting until 2100/250. Between this time and 1830/253 we recorded 325 miles of multichannel seismic data along lines 7-10 (Table 1, Figures 2, 3) in excellent weather conditions.

Recovery of the multichannel streamer and airguns, and the 3.5kHz and 10kHz fish took place between 1830 and 2230/253, at which time we set course at full speed for the western end of a gravity line along the south coast of Ireland, which had been requested by the British Geological Survey. This gravity line was run between 1300/254 and 0100/255. *R. R. S. Charles Darwin* docked at Barry at 1500/255.

DGM

RESULTS AND CONCLUSIONS

Although much time was lost to bad weather, it was still possible to record 565 miles of multichannel seismic reflection data on this cruise. The multichannel seismic profiling system performed well and little time was lost as a result of system problems. Initial assessment of the single channel monitor records suggests that the data is of high quality.

TABLE 1

Multichannel seismic reflection lines collected during Charles Darwin cruise 52

Line No.	Start	Start Time	End	End Time
1	55° 35.2'N 21° 40.2'W	1721/243	54° 46.3'N 22° 50.9'W	0630/244
2	55° 07.7'N 22° 48.9'W	1144/244	55° 07.5'N 21° 44.0'W	1910/244
3	55° 18.0'N 21° 48.6'W	2157/244	55° 18.8'N 22° 49.8'W	0503/245
4	55° 16.1'N 22° 47.8'W	0550/245	54° 52.1'N 22° 28.0'W	1110/245
5	54° 54.8'N 22° 21.3'W	1239/245	52° 29.0'N 22° 22.0'W	2006/245
6	55° 27.4'N 22° 41.1'W	2332/245	53° 44.8'N 22° 41.2'W	0825/246
7	54° 04.1'N 22° 38.9'W	2148/250	54° 13.9'N 22° 39.1'W	2355/250
8	54° 09.3'N 22° 43.9'W	0304/251	53° 37.8'N 21° 49.2'W	1157/251
9	53° 36.7'N 21° 44.8'W	1229/251	53° 18.2'N 19° 16.6'W	0719/252
10	53° 18.1'N 19° 16.1'W	0723/252	52° 05.4'N 14° 48.5'W	1832/253

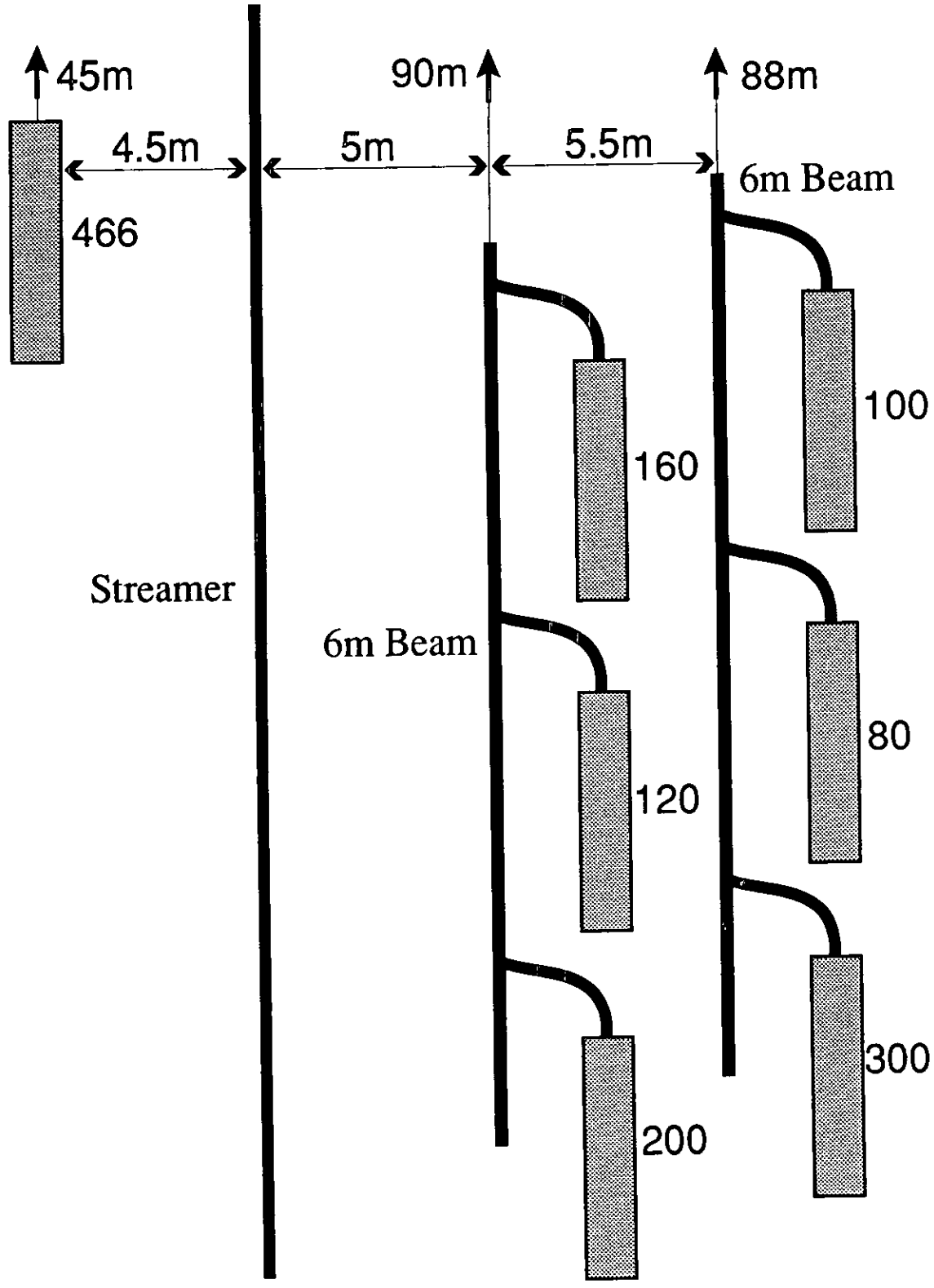

Figure 1. Airgun array configuration used during *Charles Darwin* Cruise 52 (not to scale). Airgun sizes are in cubic inches.

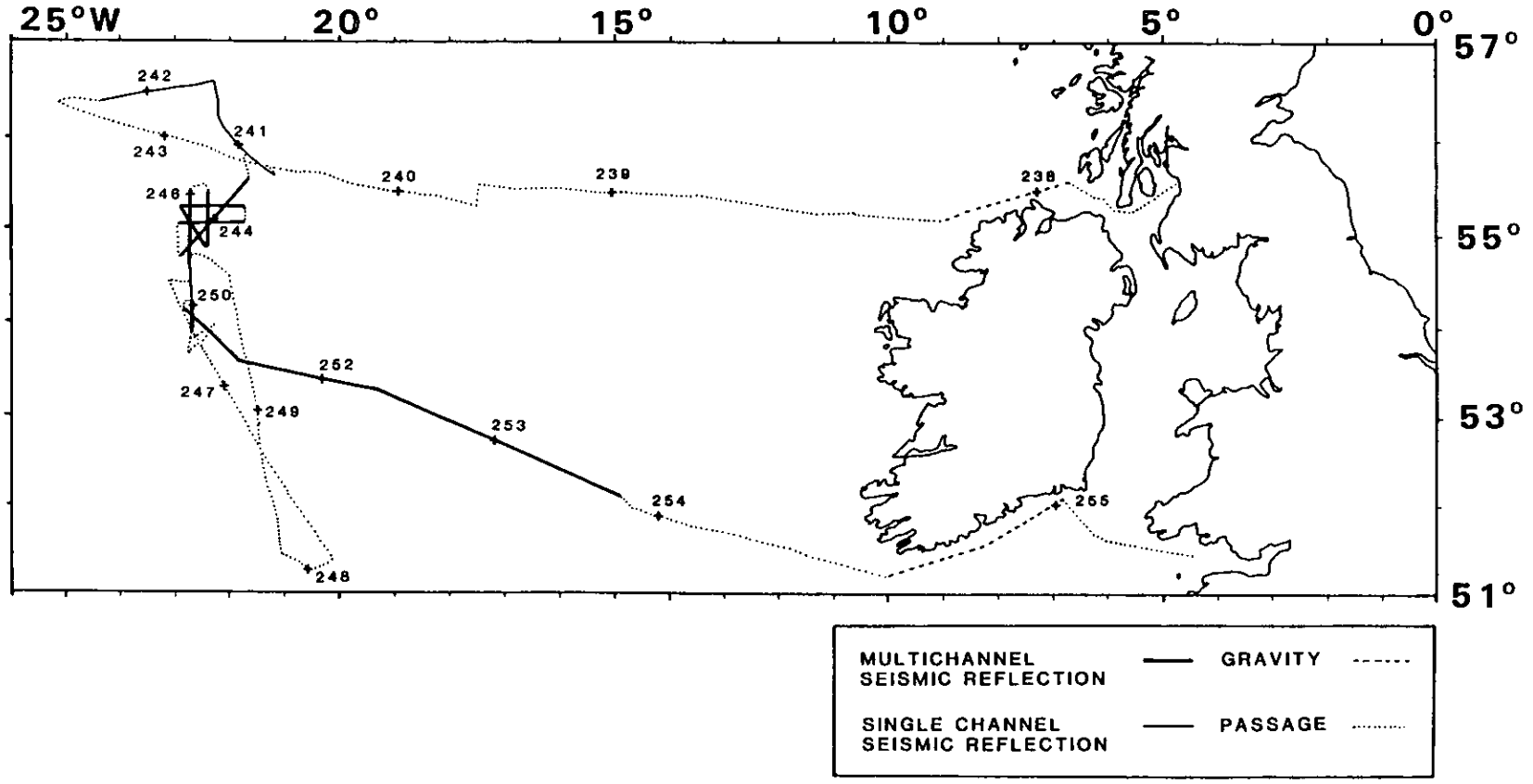

Figure 2. Track chart for *Charles Darwin* Cruise 52 25 Aug-13 Sep 1990. Multichannel seismic reflection lines are shown in heavy print. Day numbers are shown at 0000 hrs.

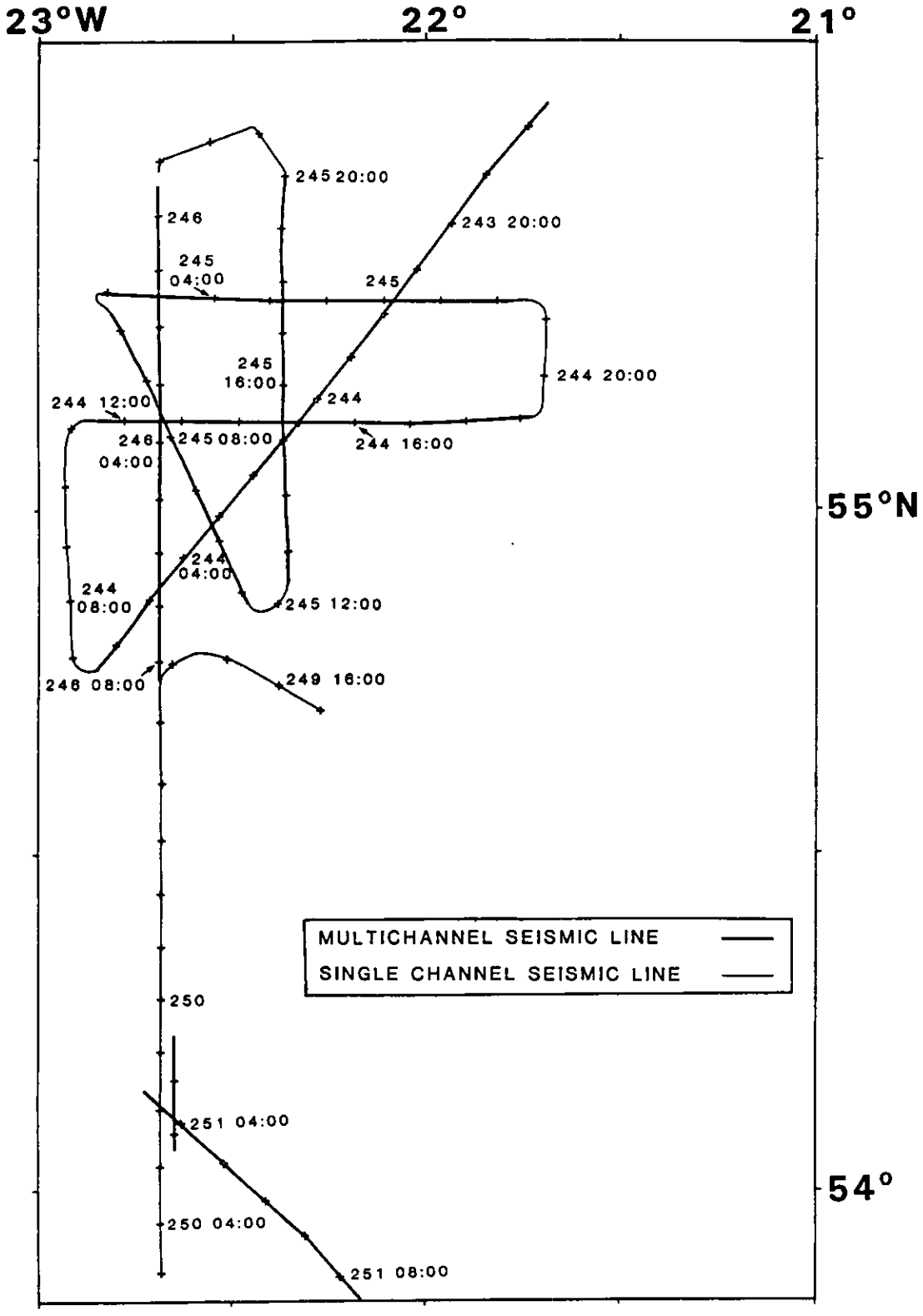

Figure 3. Detailed track chart for the main multichannel seismic survey area for *Charles Darwin* Cruise 52. For details of lines see Table 1.