CRUISE REPORT FOR M.V. CHARTERER. 22 JULY - 14 AUGUST, 1975.

HEBRIDEAN MARGIN SEISMIC PROJECT

In the cruise which was part of the Hebridean Margin Seismic Project, the Charterer had two roles to fulfil:

1. To provide a hydrophone receiving station at the seaward ends of the shot lines.

2. To carry explosives for the project, to be transferred to the shooting ship R.R.S. Challenger on two occasions.

Ships Movements and Operations

Charterer left Research Vessel Base Barry at 1720 on Tuesday 22nd July on completion of embarkation of scientific personnel and equipment, and arrived at RNAD Newton Noyes, Milford Haven, to take on depth charges on Wednesday, 23rd at 1245. Westerly force 7 winds had delayed her progress from Barry. After taking on 108 depth charges as deck cargo the Charterer left at 1640 for the project area. The 24th and 25th of July were spent on passage along the east coast of Ireland and through the Sea of the Hebrides (passing west of Tiree). At 0855 on the 26th Mr P.J. Grant was put ashore at Stornoway via the pilot boat for medical reasons. He had been suffering from an increasing numbness of the left side of his body. At 1305 the magnetometer fish was streamed and magnetics were logged along the trackline which followed the shot line until the position of L11 (Lat. 59° 52·5'N long. 9° 32·2'W) was reached at 1245 on 27 July. A dhan buoy was laid but during the laying operation it was overrun by the ship and floated on its side with only the radar reflector above water. The buoy was retrieved and the wire fastening re-positioned. However, it was dragged under the ship again and slowly sank. At 1605 a second Dhan buoy was successfully laid with an extra flotation buoy obtained from Challenger taking the weight of the wire. At 1220 shot L9 was received by Charterer using a single static hydrophone. Shots L11 and L10 had been fired before Charterer reached L11; L11 in the afternoon of the 26th and L10 on the morning of the 27th. At 1945 the Flexotir hydrophone streamer was streamed for the first time (there had not been enough time to do this earlier). Various courses were made around L11 until 0700 on the 28th when Challenger announced that she was breaking

off shooting because of bad weather and proceeding to the North Minch. From 0715 - 0915 the Flexotir array and the hullside mounted sonar transducer were brought inboard. By this time contact with the Dhan buoy had been lost and the Master of the Charterer considered that conditions were too rough to try and retrieve it.(wind was then Force 6-7 with rough sea and moderate swell worsening rapidly). The weather was such that from 1100 until 2030 the vessel was hove to on a southerly course (wind SSW7-8 rough sea and heavy swell). As the wind slowly veered towards the west the Charterer turned and made various courses starting with 075° to make the Butt of Lewis which was reached at 1200 on the 29th. Dr C.S. Exley was landed at Stornoway by the pilot boat at 1535. He had been suffering badly from seasickness ever since the beginning of the cruise. At 1650 the sparker and receiving streamer were streamed. From 1730 until 2250 the sparker was run eastwards along the G shot line (Lat. 58°N) across the North Minch. After which Charterer proceeded to the North Western end of Loch Torridon where at 0330 on 30 July sparking was commenced along the H shot line towards the NW, finishing part way along at 0800. At 0850 the Flexotir seismic array streamer was streamed and during the morning reception of shots G14, H16 and H15 was attempted from a position in the region of H11. These appeared to be unsuccessful as the water wave arrivals from the shots were not clearly detected. The array was tested using the sparker, and while this showed it to be operating it was clearly not working as well as it should. From 1430 to 1530 the Flexotir was retrieved and Charterer then proceeded to shot position H13. At this position Shots H12, H11, H10, and H9 were received using the static hydrophone. During this day the weather was good: the wind slowly decreasing from Force 3 to Force 1. At 2340 the sparker was streamed and the remainder of shot Line H was completed at 0250 on 31 July.

At 0630 on 31 July Charterer anchored in Branahuie Bay east of Stornoway. At 0910 Challenger came alongside and commenced unloading depth charges onto Charterer. At 1100 Challenger departed to Stornoway to bunker. At 1825 Charterer hove up her anchor and sailed to Broad Bay where she anchored at 2100. The wind which had freshened to Force 7 from the SSW had made Branahuie Bay untenable as an anchorage. At 0930 on 1 August Challenger came alongside Charterer causing slight damage in the process. Depth charges were transferred to Challenger and she

departed at 1300. At 1500 Charterer departed for station K14 (Lat. 58°N. Long. 12° 1·8W). At 2140 the magnetometer was streamed and magnetics were measured until K14 was reached at 0800 on the 3rd August. For the remainder of the day Charterer was hove to west of K14 as the weather was too bad for shot firing. The wind reached Force 8 from the SSW around midday.

During the morning of 4th August Charterer stood off from K14 while Challenger fired a shot at the position. This shot was delayed because of a naval exercise. During the afternoon Charterer made two unsuccessful attempts to lay a Dhan buoy at K14. The mooring cable parted both times. At 1815 Charterer in position at K14 deployed 3 static hydrophones to receive shot K12, but this misfired.

At 0830 on 5 August Challenger laid a Dhan buoy at K14 on which Charterer kept station and navigational systems were compared between the two ships. At 1430 shot K12 was received. During the afternoon a small bathmetric survey was made of the area around K14. At 1910 shot K11 was received.

At 0810 on 6 August it was noticed that the Dhan buoy had drifted from its original position and Charterer made a course for K14 to be in position in time for shot K9 which was received at 1006. Shot K7 was received at 1550. The wind had been freshening all day, and by 1900 the weather was too bad for shot K5 to be fired (wind Force 6-7 from SE with heavy swell).

Position was maintained at K14 overnight, but at 1000 on the 7 August it was decided that the weather which had worsened to wind Force 8 SE with a steep swell prohibited any further work. Charterer was hove to on a southerly course until 1800 when a course of 050° was steered. Various easterly courses were made until Stornoway was reached at 2000 on 8 July. The ship was anchored in a small bay in the southern part of the harbour. At 0530 9 August Challenger came alongside and depth charges were transferred to Charterer. At 0800 Charterer came alongside the jetty in Stornoway.

Charterer left Stornoway in the early evening of 11August after transferring all the remaining charges to Challenger and arrived at Lowestoft at 1400 on 14 August.

Equipment

Loran C DL91 Receiver. This was installed at Milford Haven on 23 July after being taken off Challenger. The Decca engineer who installed it had never seen the set before and apart from plugging it in and connecting the aerial could give no indication of whether it was working correctly. The set did not function in the manner described in the operators manual at any time during the cruise. The set worked in limited fashion for three days with one slave on a skywave match with the master ground wave. This was only achieved after much experimentation in feeding in the expected Loran coordinates to the set. Given the importance of Loran C in navigating the ship in the project area the malfunction of the set was a serious limitation on the accuracy of navigation.

Edo Western Echo Sounder. This performed satisfactorily, but the mounting of the transducer on a scaffold pole fixed to the ship side meant that speeds in excess of 3-4 knots could not be achieved whilst the echo sounder was operating.

Geomechanique Flexotir Seismic Streamer

The streamer was tried as the sensor for 3 shots in the North Minch. The water wave was not seen however and consequently the streamer was not used any more in the project. It would seem that the noise induced by towing and shallow depth at which it was towed made the system fairly insensitive. The seismic streamer was supplied without the lead weights which are attached to the head of the streamer to keep it at the correct depth. The streamer was also overinflated with oil so that it floated. The tail was on the surface even when the head was weighted down with chain. The third active section was leaking slowly. The buoyancy of the streamer could have been remedied by letting out oil, but sufficient time and a suitable place for this operation were not available. The array was tested using the sparker and while the direct wave was visible on the record other arrivals were not. A variation in sensitivity of the sections was noted: section 2 being noticeably less sensitive than the other sections. Had the array been correctly balanced before the cruise started, it would probably have been more successful. In view of past problems with balancing the array it would seem worthwhile for I.O.S. to obtain the equipment needed for this.

Dhan Buoys

Four Dhan buoys were supplied with three reels of cable and 10 lcwt lengths of sinking chain. A small hand winch was supplied for the cable. Unfortunately, the hand winch did not come apart as it should do so that it was not possible to put the full reels of wire directly on the winch and the wire had to be reeled off the reels on to the winch. This meant that on one occasion the wire broke when it sagged because the wire was not wound on firmly enough. The other occasion when the wire broke was when two pieces of wire had to be joined together to make up the length required the first section which had been stopped off broke before the second length could be added. As noted above one Dhan buoy was lost initially at L11 because of inadequate buoyancy and damage from the ship. Another Dhan buoy was abandoned at L11 because of bad weather and loss of contact with the buoy. A further Dhan buoy (laid by Challenger) was abandoned at K14 after it had drifted off position during the night. The necessity of being on position for the shots during the day prevented retrieval until later when poor weather again prevented the ship from making any attempt to retrieve it. Four lengths of sinking chain and 2500 metres of wire were lost in two unsuccessful attempts to lay a Dhan buoy at K14.

Data collected

Shot nos. L9, H15, H14, H12, H11, H10, H9, K12, K11, K9, & K7 were recorded by Charterer. H12, H11, H10, H9, K12, K11, K9 & K7 all show arrivals before the water wave.

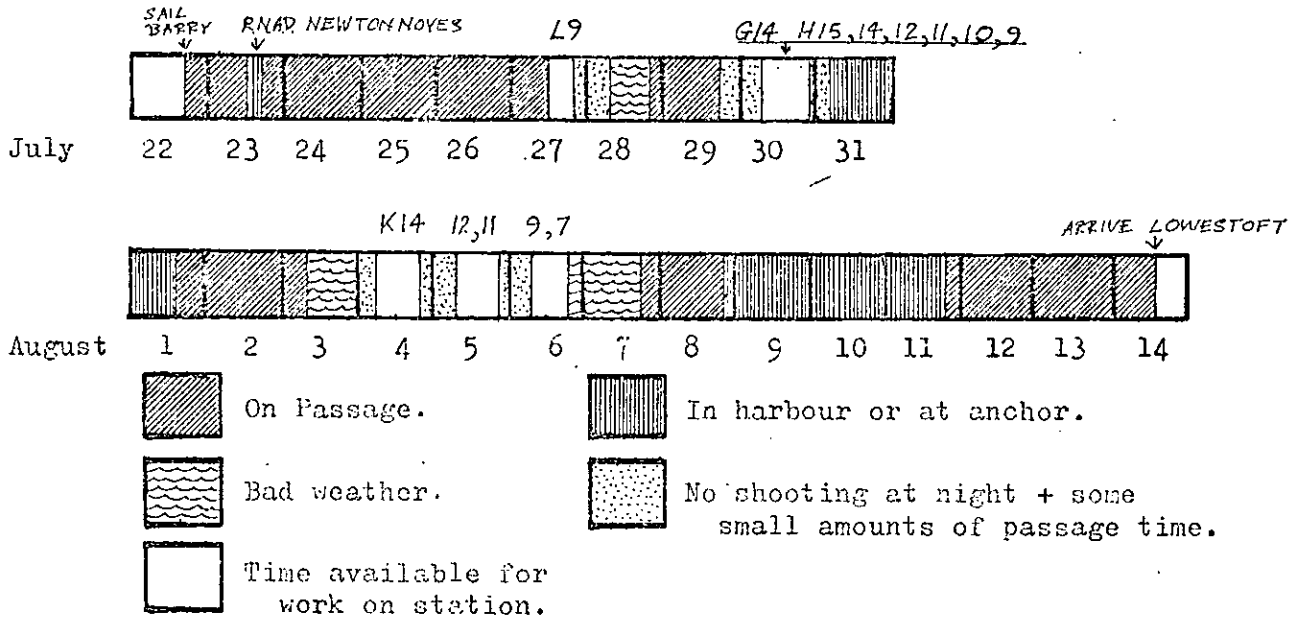
Sparker profiles were made along the G & H shot lines in the North Minch.

The Earth's total magnetic field was measured along shot line L and along a course from Lewis to K14.

Comments

Comparatively little receiving was done by Charterer during the time that she was engaged on the project. This was the result of the combination of four principal factors:

1. The weather
2. Challenger's endurance
3. The need to transfer charges to Charterer before Challenger could bunker
4. Charterer's speed



The diagram above gives a breakdown of how the time was spent by Charterer on different tasks. It can be seen that half the time was spent on passage to and from the general area of the survey and between Stornoway and Stations K11 and K14. Only four and a half days were available for receiving (one of these being in the Minch which was not originally planned). Three days were lost directly through bad weather on station and the weather also slowed down progress to and from stations. Four days were spent at anchor or in harbour holding depth charges while Challenger bunkered.

While the Charterer is well suited for coring on the continental shelf (on which she was employed with IGS immediately prior to the cruise) and the task of carrying depth charges, she is not as she is presently fitted out particularly suitable for general geophysical work. The main reason being the situation of the laboratory at the stern of the ship, where at sea speed (6½-9 knots depending on the weather) it undergoes excessive vibration from the engine, shaft and screw causing the equipment, even that which is shock mounted, to be shaken strongly with deleterious effects on any sensitive equipment. Also the combination of ships motion and vibration makes the laboratory very uncomfortable in any sort of sea. Fortunately, this did not affect receiving the shots because the ship was stationary or moving slowly. However, when measuring magnetics at sea speed the laboratory was too uncomfortable for continuous occupation by the scientific watch-keeper.

Flexotir v static hydrophones - The hydrophone streamer has several apparent advantages over static hydrophones. The much larger number of sensors gives a better signal to noise ratio under the same conditions of background noise. The ship is underway while operating the array and can theoretically work under worse weather conditions than with static hydrophones as the ship does not have to be stationary risking broaching to and dragging which induces much noise on static hydrophones. In a seismic project of this nature, however, the advantages are not so clear. Firstly the frequency response of the system is rather high for long range refracted waves (low end of flat range 5 HZ), and the towed depth is too close to the surface to avoid considerable destructive interference of the long wave length arrivals. The sensors should be deeper than 75 metres. A further difficulty arises because the ship is required to occupy the same position when shots are received, but must also be underway when towing the streamer. This means that the time of the shot must be known well in advance to ensure that the array is passing through the receiving point when the shot is detonated. This was not possible because of the complicated preparation entailed in firing large multicharge shots. If the position is overrun it cannot be re-occupied for about 1½-2 hours; that being the minimum time taken to turn with the array and make a course back to the position. The turning time also means that the ship is beam onto the sea for a long time with restricted manoeuvering ability. A situation which was quite unacceptable to the Master of the Charterer in the sea conditions that were prevailing on 6 August when shots K9 and K7 were received. In this seismic experiment therefore the advantages of the array were completely negated. Better systems for this type of work would be seabed seismometers and/or hydrophones operated from a buoy.

Appendices: 1. Scientific personnel.

2. Track chart.

G.K. Westbrook

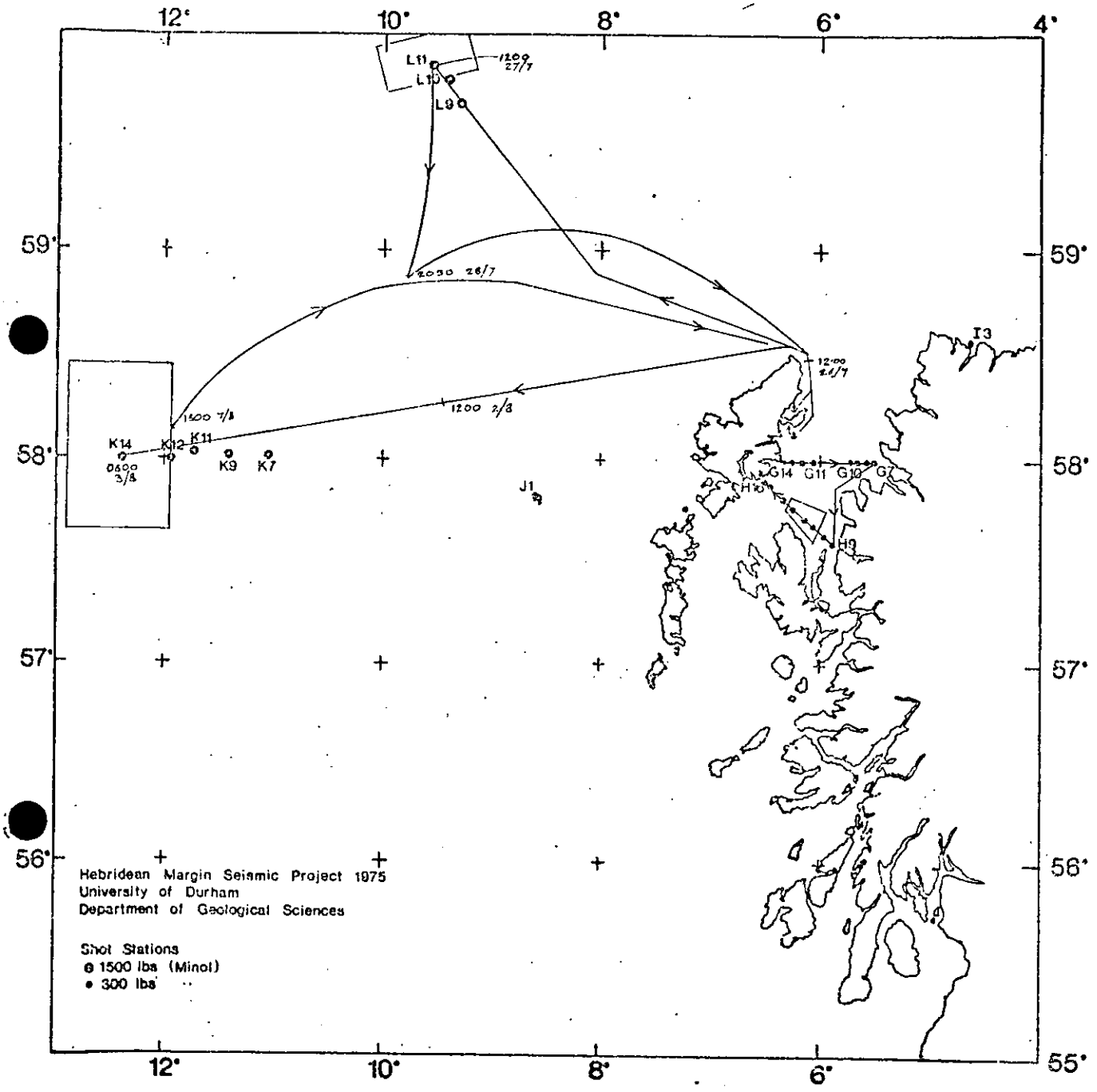
6 October, 1975.

Appendix 1. Scientific Personnel.

Dr G.K. Westbrook	Senior Scientist	University of Keele
Dr C.S. Exley		
Mr M. Lake		
Mr S.A. Crombie		University of Durham
Mr P.S. Grant		
Mr T. Fitton		I.O.S., Barry

Appendix 2

Track Chart for M.V. Charterer in the area of the Hebridean Margin Seismic Project. Cruise 2 1975.



Various courses were steered in the areas enclosed by boxes on the chart.