INSTITUTE OF GEOLOGICAL SCIENCES
CONTINENTAL SHELF NORTHERN UNIT
Internal Report No. 79/12

Report on Trials Leg
17th October - 31st October, 1979.

by

J.A. Chesher

CRUISE 79/WH/08

Contents

A. Introduction

The final two weeks of the Whitethorn marine programme was spent undertaking equipment trials. The main item under test was the new retraction vibrocorer. The area selected for these trials was that of the Malin Sea, so chosen in order that additional geological information might be achieved in this yet uncompleted area.

B. Personnel

J Chesher	(Chief Scientist)
D Evans	(Senior Geologist)
A Skinner	(Night Geologist)
N Ruckley	(Day Navigator)
J McGuigan	(Night Laboratory)
P Wiggins	(Technician)
H Robertson	(Technician)
W Lonie	(Technician)
J Pheasant	(Aimers McLean)
R Wingfield	(IGS Leeds)

R Wingfield and J Pheasant disembarked after the first week of trials.

C. Geological Results

The area under survey comprised the following two sheet areas in the Malin Sea: 55-06 and 55-07. The samples taken in these areas are tabulated below.

Sheet No.	Sample Nos.	GS	CR/CS	VE	
55-06	37-82	44	36	11	
55-07	44-165	117	92	28	
	166	161	128	39	Total

For a description of the geology of the area see The Geology of the Malin Sea by D. Evans. The sediments encountered during this survey ranged from fine quartz sands to coarse shell and lithic

gravels. These sediments varied in thickness but were generally only a few centimetres thick. Underlying the sediments were varying types of glacial deposits ranging from soft Flandrian muds to compact boulder clays.

D. Equipment Trial Results on New Retraction Vibrocorer

i) Introduction

The new retraction vibrocorer designed by IGS was manufactured by Aimers McLean of Galashiels. The concept behind this system was to develop a method of self retraction of the vibrocorer barrel whilst on the sea bed in order that the ship did not need to remain stationary, by anchoring directly above the vibrocorer, to achieve a vertical lift to pull it out of the sea bed. If this system proved satisfactory it could be operated from a 'live' non-anchored ship, and so dispense with the delay caused by anchoring the vessel. In addition, it would provide a system of coring in deep water, greater than 200 metres, where anchoring is not feasible.

ii) Design

A new design of vibrocorer was necessary incorporating a stronger frame in order that the frame could withstand the pull out forces during retraction. An open geometry frame was built for the following reasons:

a) ease of extraction of barrel

b) the signal from the echo sounder penetrometer would not be impeded as from the rings in the old style frame

c) ease of erection of the vibrocorer

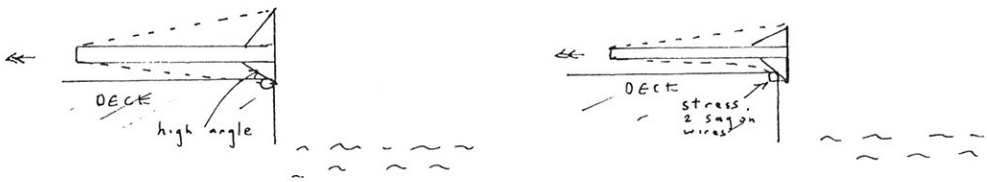
d) possibility of changing the vibrator power unit to a rotary head and converting the vibrocorer to a rotary 6 metre drill.

The retraction force of the electro hydraulic system was designed to provide a maximum pull out load of 12 tons, by use of a 6 tons winch and a double purchase pulley system. The weight of the new vibrocorer is approximately $2\frac{1}{2}$ tons (cf $1\frac{1}{2}$ tons of old style vibrocorer), and costs all up £13,000 (cf £8500 of old vibrocorer).

iii) Results

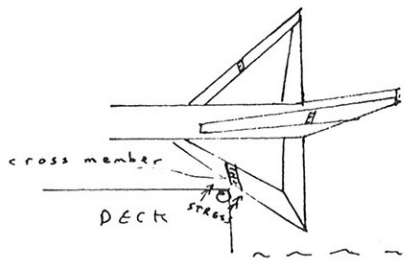
Below is listed a series of comments and suggestions resulting from the trials.

a) The high angle between the legs and the frame, and the sag of the wire rigging means launch and recovery is not quite as smooth as in the old style. During recovery the tugger winch is often under considerable load.



The launch could be improved by strengthening the wire guides or replacing them by rods which would provide a smoother lower angle recovery surface. The load on the rigging could present a safety hazard if the wire rigging parted under load.

b) the legs require a cross member for strengthening during launch and recovery.



c) Electrical cable joint problems were a repeated source of failure.

This was partly due to the self-vulcanising tape not bonding with the PVC coating of the cable. Pre-made moulded cables and joints should be made up prior to next seasons work.

The cable configuration on the vibrocorer needs further consideration. The main problem is a method of securing the flying cable from the base of the frame to the pot to keep the cable away from the guides in order to prevent the cable from being chopped.

d) In several cases the ships moved off station and the slack paid out in the hoist wire and power cable, plus the retraction system, meant barrels were not bent.

e) When barrels were bent the power of the retraction system was so great that it could pull out a badly bent barrel from full penetration, and in several instances, straightened the barrel through the base plate guide. This illustrates the adequate power of the retraction winch.

f) The hydraulics cause a dampening effect on the rate of penetration. This is a disadvantage in soft sediments where the penetration rate would be faster without any dampening. The dampening effect also reduces the value of the chart showing penetration rate, which is a valuable engineering parameter.

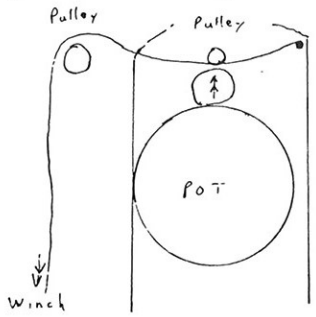
g) In a few instances only a couple of metres penetration was achieved in fine-medium sands, which contrasted to full penetration on other occasions in what appeared to be identical sediment. In the latter part of the cruise the pot stuck 1 metre from the top and this seemed to be due to a blockage in the hydraulics which eventually cleared itself.

The hydraulics system needs checking and perhaps incorporation of filter since the blockage may well have been due to dirt in the hydraulics.

h) When the pot is at the top of the frame the winch load is directly across the head which may well cause frame distortion if the head is not sufficiently strengthened.

i) Slight distortion of the verticals occurred but this did not impair performance, although the pot guides had to be opened due to tightness at the top of the frame. The pull out force from the winch is so powerful that it may be necessary to introduce one strengthening ring to prevent bowing of the verticals.

j) The angle of pull of the winch wire when the pot is at the top of the frame is nearly horizontal, rather than vertical. Extending the head by 1 post would improve this pulling angle.



k) Assembly and breakdown of the system is no quicker than the old system but the individual units are much less bulky. The added height to the new system means it cannot be hung vertically beneath the A frame during assembly aboard ship.

l) Ease of extraction of the barrel is slightly impaired by the winch cable, but this could be amended by repositioning the flying electric cable. The rigging to the head provides a slight hazard when carrying the barrel since persons could trip over it.

iv) Conclusions and Recommendations

a) Using the new vibrocorer from an anchored ship is of marginal benefit in that the lesser number of bent barrels is offset by the longer penetration and retraction time, and the loss of a useable penetration chart.

b) There should be an undoubted advantage in time saving, estimated at 50%, using the new system from a 'live' ship.

c) Station keeping trials on a moored buoy proved successful in conditions up to force 4, but tides proved too strong to test the ship in any worse conditions. The failure of the bow thruster also inhibited further trials. Ideally the ship should maintain a distance of 100 metres from the buoy.

d) A buoy attached to the hoist cable at the correct water depth, when using a floating hoist line is essential to act as a location marker for station keeping.

e) If the retraction system fails, or the electrics fail (when a fault on 1 wire is sufficient) then the 28mm nylon hoist cable can only lift the vibrocorer from the sea bed. The cable does not have sufficient strength to pull it out of the sea bed, since the SWL of the cable is only 3 tons. A cable with greater SWL is not practicable due to the large diameter increase required for a small increase in SWL.

A latch assembly, perhaps similar to that on wireline drilling gear, with a strong hoist wire and winch, must be on standby to recover the vibrocorer. This fail safe recovery must be designed into the system.

f) A power cable drum winch with ship ring assembly would be the best method of deploying the buoyant power cable, in order that the cable can be payed in or out without disconnecting the power supply. A flaking frame would provide an alternative but would be more labour intensive to operate.

g) It would be valuable to reassess the manner in which the Canadians operate their system at Bedford Institute prior to our use next season.

E. Ship Performance

The ship performance proved satisfactory. The main problem encountered was due to the strong tide races in the Malin Sea. This resulted in the necessity for working at slack water in many instances. The vibrocorer programme continued into the hours of darkness, proving the ship capable of laying and recovering anchors in the dark at night. This means a 24 hour programme of vibrocoring could be envisaged in the future. The lack of a bow thrust was a disadvantage when anchoring but did not markedly inhibit the programme.

F. Ship's Log

Wednesday 17 Oct.

0000-2200	In port, Govan
2200-2400	Weighed anchor and steamed to Malin Sea, Port Rush. (S to SW 7-9/11)

Thursday 18 Oct.

0000-1107	Steaming for Malin Sea
1107-1440	Laying and tensioning anchors. Vibrocoring. Drifted off station and bent barrel
1440-1605	Steaming to next site.
1605-1650	Layed anchors and vibrocoring. Drifted off station but no bent barrel.
1650-1800	Lifted anchors and steamed to next site
1800-1930	Vibrocoring
1930-2400	Routine sampling off N Irish Coast.

Friday 19 Oct.

0000-0700	Routine sampling off N Irish coast.
0700-0730	Laying anchors for vibrocorer.
0730-0900	Vibrocoring. Problem with ship's AC supply. NB Penetrometer ran off ship's AC.
0900-0930	Lifting anchors.
0930-1000	Steaming to next site.
1000-1300	Laying anchors and vibrocoring. Electric fault on vibrate side of power cable terminated drilling.
1300-1730	Steaming towards Islay for next site. Heavy swell.
1730-1900	Laying anchors SE of Islay and vibrocoring.
1900-2400	Routine sampling SE of Islay.

Saturday 20 Oct.

0000-0700	Routine sampling.

0700-1000	Laying anchors for vibrocore SE of Islay.
1000-1200	Continued vibrocoring.
1200-1400	Steaming to next station.
1400-1520	Station keeping exercise with buoy S of Islay. (Coe's representative disembarked in Port Charlotte 1700)
1520-1700	Steaming to Loch Indaal.
1700-1900	Vibrocoring in Loch Indaal. Water in cable gave fault on penetrometer.
1900-2100	Vibrocorer station attempted but currents too strong.
2100-2400	Routine sampling SW of Islay.
Sunday 21 Oct.	
0000-0630	Routine sampling W of Islay.
0630-0800	Attempted vibrocorer site W of Island but too strong currents so headed to next site north.
0800-2130	Anchored at vibrocorer station. Electrical fault in cable. Lost stern anchor due to splice parting.
2130-2400	Steaming to Campbeltown to collect new power cables.
Monday 22 Oct.	
0000-0830	Steaming to Campbeltown.
0830-1130	Transfer of cables from fishing boat to ship.
1130-1515	Steaming back to Sound of Jura to continue sampling and trials.
1515-2000	Vibrocoring off Machrihanish.
2000-2200	Effecting repairs to hydraulics on forward winch in lee of Machrihanish.
2200-2400	Routine sampling.
Tuesday 23 Oct.	
0000-0630	Routine sampling N of Islay
0630-0700	Laying anchors for vibrocorer site.

0700-0900	Vibrocorer site.
0900-1000	Lifting anchors and steaming to next site.
1000-1100	Vibrocoring.
1100-1200	Steaming to next site and laying anchors.
1200-1400	Vibrocoring, two attempts into sand but no recovery.
1400-1540	Steaming to next station and vibrocoring.
1540-1700	Lifting anchors and steaming to next site.
1700-1830	Laying anchors and vibrocoring.
1830-1930	Lifting anchors and steaming to next site.
1930-2100	Vibrocoring.
2100-2400	Routine sampling N of Islay.

Wednesday 24 Oct.

0000-0300	Routine sampling.
0300-0730	Steaming to Oban to put R. Wingfield and J. Pheasant ashore.
0730-0800	Above personnel put ashore by Zodiac.
0800-1300	Steaming to Sound of Jura.
1300-1330	Laying anchors for vibrocorer.
1330-2200	Vibrocoring, delay due to earth leakage in power cable, followed by guides possibly jamming. Also dirty hydraulics may cause valve jamming.
2200-2400	Lifting anchors, routine sampling in Sound of Jura.

Thursday 25 Oct.

0000-0630	Routine sampling.
0630-0800	Laying anchors for vibrocorer site in Sound of Jura.
0800-1900	Vibrocoring during day.
1900-2000	Tide too strong to vibrocore, routine sampled.
200-2130	Vibrocore at slack water.
2130-2400	Routine sampling between Rathlin and Islay.

Friday 26 Oct.	
0000-0800	Routine sampling.
0800-1330	Vibrocoring between Islay and Rathlin.
1330-1500	Put A. Skinner ashore by Zodiac, Port Ellen, Islay.
1500-2130	Vibrocoring in Sound of Jura.
2130-2400	Routine sampling NW of Islay.
Saturday 27 Oct.	
0000-0730	Routine sampling W of Islay
0730-2130	Vibrocoring W of Islay.
2130-2400	Routine sampling W of Islay.
Sunday 28 Oct.	
0000-1000	Routine sampling W of Islay.
1000-2000	Vibrocoring N of Loch Foyle.
2000-2400	Routine sampling W of Islay.
Monday 29 Oct.	
0000-0950	Routine sampling W of Islay.
0950-2130	Vibrocoring off N Irish coast.
2130-2400	Routine sampling off N Irish coast.
Tuesday 30 Oct.	
0000-0630	Routine sampling.
0630-1400	Vibrocoring of N Irish coast.
1400-2400	Steaming for Clyde.
Wednesday 31 Oct.	
0000-	Alongside dock at Govan.