

B. O. D. S.

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Report on Cruise of RRS Challenger *CRUISE 14/76*

CRUISE 14/76

17th Sept. - 3rd Oct., 1976

by

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Fig. 1. Location Map

Introduction

The cruise fell into two distinct legs separated by a one day demonstration of Consub by BAC off Peterhead.

The first leg was a period of study on the IGS pockmarks area between the Forties and Piper oilfields. This leg began in Southampton on Friday 17th September and ended at midnight of Sunday 26th September when a 24 hour charter of "Challenger" by BAC began.

Following the BAC charter "Challenger" steamed to the west coast of Scotland (via Scrabster) to recover solid rock from outcrop employing the Consub drill and a gravity corer. The cruise ended at Ardrossan on Sunday 3rd October.

Personnel

Leg 1

N.G.T. Fannin	IGS (CSUN)	Senior Scientist
D. Evans	IGS (CSUN)	
A.S. Mould	IGS (MGU)	
P. Jackson	IGS (EGU)	
R. Baria	IGS (EGU)	
G. Skidmore	BAC	
P. Smith	BAC	
C. Davies	BAC	
R. Benjamin	BAC	
M. Ballard	Polytechnic Engineering	
B. Leversley	Polytechnic Engineering	

Leg 2

D. Evans	IGS (CSUN)	Senior Scientist
R. Owens	IGS (CSUN)	
N.A. Ruckley	IGS (CSUN)	
P.J. Wiggins	IGS (CSUN)	
G. Skidmore	BAC	

Leg 2 cont.

P. Smith	BAC
C. Davies	BAC
R. Benjamin	BAC
C. Edwards	BAC
R. Schooling	Vickers Oceanics
T. Howard-Jones	MATSU

Equipment EmployedLeg 1

Consub system (including container)
 Resistivity Probe
 Acoustic Probe
 Gravity Corer (10ft x 4in sediment barrels)
 Atlas Echosounder
 Kelvin Hughes MS47 Side Scan Sonar
 Polytechnic "Autranav" navigation system

Leg 2

Consub system (including container) with rock drill
 Gravity corer (10ft x 4in sediment and rock barrels)
 Atlas Echosounder
 Shipek Grab
 Navigation on Main Chain Decca and Radar.

Cruise Diary (abridged)Leg 1Tuesday 14th September

Commence Mobilisation in Southampton

Wednesday, 15th September

Mobilisation,

Thursday, 16th September

Mobilisation

Friday, 17th September

05.00 Sail from Southampton

Saturday, 18th September

23.00 A. Mould joins ship by pilot cutter from South Shields.
 23.10 Steaming for pockmarks study area.

Sunday, 19th September

20.00 Arrive in pockmarks study area. Begin calibrating Autranav "net".
 21.00 Transponder T5 found to be displaced approximately two miles to SE.

Monday, 20th September

08.00 Complete Autranav net calibration.
 10.15 Begin Consub launch. Earth trip blows; vehicle recovered for repairs.
 12.00 Begin station holding trial, wind SE 10-15 knots, sea state 4-5.
 12.45 Bow thrust control unit fails, standing by for repairs.
 13.45 Begin echosounder survey.
 14.30 Complete echosounder survey. Prepare to launch vehicle while running with weather.
 15.30 Motor failure in Consub. Recover vehicle for repairs.
 17.30 Vehicle repairs complete. Weather state too poor to launch vehicle or hold station for EGU probe trials.
 18.30 Steam for Scapa Flow to carry out Consub trials in sheltered water.

Tuesday, 21st September

10.30 Anchor in Scapa Flow.
 11.00 Launch Consub. Earth trip blows again: recover vehicle for repair.
 13.30 Launch vehicle again. Earth trip blows: recover vehicle again for repair.
 14.00 Test EGU resistivity probe.
 14.30 Relaunch Consub. Bottommanoeuverability trials and comparative trials between AMF and Autranav navigation systems.
 18.30 Vehicle recovered. Pan and tilt camera damaged. Repairs continued while remaining at anchor in severe weather.

Wednesday, 22nd September

09.00 Trials of gravity corer system while at anchor in severe weather.
 11.00 Complete trials.
 11.30 Raise anchor and steam to west coast of Orkney for Consub dive in lee of the islands.
 13.30 Attempting to hold station four cables off the lee shore at Yesnaby.
 14.00 Unable to hold station in SE gale. Dive plans abandoned. Return to Scapa Flow.

- 15.20 Given permission from R.V.B. (Barry) to deploy
Consub with main engine turning.
- 17.30 Consub trial with main engines in sheltered
waters of Scapa Flow.
- 18.45 Trial complete. Ship held station and also steamed
successfully along a set course with vehicle
deployed.
- 19.10 Raise anchor and steam for pockmark study area to
test weather conditions.

Thursday, 23rd September

- 13.45 Arrive in work area.
- 14.30 Begin sampling with gravity corer.
- 20.00 Complete coring.
- 23.00 Begin acoustic and resistivity probe tests.

Friday, 24th September

- 08.00 Complete acoustic and resistivity probe tests.
Repairing damage to hydrographic hoist wire.
- 12.15 Launch Consub. Dive no. SU76-20.
- 12.45 T.V. failure in vehicle. Autranav system on
vehicle functioning irregularly.
- 13.30 Vehicle recovered. Begin echosounder survey.
Repairs to junction box on Consub.
- 18.30 Complete echosounder survey.
- 19.00 Begin acoustic and resistivity probe tests.

Saturday, 25th September

- 07.30 Complete work with acoustic and resistivity probes.
- 07.30 Launch Consub, Dive no. SU76-21. Autranav
transponder on vehicle not functioning. Vehicle
positioning by A.M.F.
- 11.00 Recover vehicle to repair faults.
- 15.30 Vehicle back in water, dive no. SU76-22. Autranav
system still not working.
- 16.42 Power trips go on vehicle. Consub recovered in
dead mode.
- 17.30 Vehicle checked and no faults found.
- 18.00 Begin gravity coring.
- 20.15 Complete sampling.
- 20.30 Consub in water to test hydraulic switch gear.
Still not working.
- 21.00 Continue work with acoustic and resistivity
probes while continuing repairs on Consub.

Sunday, 26th September

- 05.30 Complete acoustic and resistivity work.
- 08.15 Launch Consub. Umbilical cable snags during launch
and is damaged.
- 08.45 Vehicle recovered for repairs to cable.
- 09.00 Attempt to drag for displaced transponder (T5).
- 11.45 Complete dragging without success. Steam for

19.20 BAC demonstration site north-east of Peterhead.
 Deploy Transit Sonar to locate pipeline.
 22.26 Mark pipeline position with Dan Buoy.
 22.45 Steam for Peterhead.

Monday, 27th September

00.00 Ship on charter to BAC for Consub demonstration.
 02.00 Standing by Peterhead outer harbour in thick fog.
 Unable to come alongside. Failure of bridge radar.
 06.00 Autranav equipment put ashore on Pilot Boat.
 A. Mould, P. Jackson, R. Baria, M. Ballard and
 B. Leversley also ashore by Pilot Boat.
 08.30 BAC clients on board. Standing by for repairs on
 bridge radar.
 11.15 Radar repaired. Prepare to leave for demonstration
 site.
 11.45 Proceeding to site at half speed in thick fog.
 15.00 Commence demonstration.
 20.00 Demonstration complete. Steam for Peterhead.
 23.00 Standing by in Peterhead outer harbour to
 disembark BAC clients and N.G.T. Fannin by Pilot
 Boat. R. Owens, N.A. Ruckley, P.J. Wiggins,
 R. Schooling, C. Edwards and T. Howard-Jones join
 the ship.
 23.30 Steam for Scrabster.
 24.00 End of BAC charter.

Leg 2

Tuesday, 28th September

00.00 Steaming to Scrabster
 16.00 Tied up at Scrabster, bunkering.
 18.20 Leave Scrabster, steam for site NE of Skye.

Wednesday, 29th September

00.00 Steaming to Skye.
 07.00 On site, echosounder survey begun.
 11.30 Anchored, delays due to anchoring difficulties.
 12.00 Dive SU76-23 begins.
 14.35 Consub recovered after successful dive.
 15.00 Anchor aweigh steam to adjacent site.
 16.00 Anchored on site after brief survey.
 16.55 Consub launched, dive SU76-24.
 18.40 Vehicle recovered, core sample obtained.
 19.15 Anchor aweigh, head for coring site.
 20.40 Sampling.
 21.30 Steam for site NE of Rhum.

Thursday, 30th September

00.00 Steaming for site NE of Rhum.
 06.10 On site, survey begins.
 07.20 Anchored.
 08.40 Dive SU76-25 begins.
 12.44 Consub recovered but core lost.
 13.50 Dive repeated after repairs to depth gauge.
 15.30 Consub recovered - failure of core retention.

16.02 2nd repeat of dive. -
 17.15 Vehicle on deck - failure of core retention.
 17.26 3rd repeat begins.
 20.06 Dive completed - core again lost.
 20.35 Anchor aweigh, steam to sample station.
 22.40 Begin sampling NW of Coll.

Friday, 1st October

00.00 Sampling. End sampling, steam to Blackstones Bank.
 07.00 On station at Blackstones Bank, brief echosounder survey.
 08.38 Begin dive SU76-26 underway.
 13.02 Dive ends. Drilling not possible due to currents.
 13.20 Steam to Dunstaffnage to put an A.B. ashore.
 20.00 At anchor off Dunstaffnage. Man put ashore.
 Re-buoysing of umbilical begins.
 22.30 Anchor aweigh, steam for site north of Rhum.

Saturday, 2nd October

00.00 Steaming.
 06.00 On site, echosounder survey begins.
 07.20 Anchored on station.
 08.40 Consub launched, dive SU76-28. Successful drilling.
 At this site ship turned through 360° in 5 minutes.
 11.20 Consub recovered.
 11.50 Anchor aweigh.
 12.50 At anchor on Seagull Bank NE of Rhum.
 13.14 Consub launched SU76-29 - successful.
 14.33 Consub recovered.
 14.45 Anchor aweigh, steam to adjacent site.
 15.30 On site and anchored.
 16.05 Dive SU76-30 begins.
 17.10 Vehicle on deck, dive abandoned due to T.V. failure.
 17.40 Anchor aweigh, steam for Rathlin area.

Sunday, 3rd October

00.00 Steaming
 05.50 Rock coring begins.
 13.30 End sampling, steam to Ardrossan.
 20.25 Alongside at Adrossan.

Monday, 4th October

Demobilisation not possible due to Ayrshire public holiday.

Tuesday, 5th October

08.00 Demobilisation begins.
 12.00 'Wash up' meeting on board.
 18.00 Demobilisation completed.

Equipment Performance

(i) The Consub system

After initial problems with faulty leads and a major junction box leak the vehicle performed well with only minor problems, although further leaking of the junction box was experienced at the end of the cruise. Deployment and recovery was generally well performed, even in very marginal conditions. Cable handling was however, excessively labour intensive and requires major improvements, while redesigning of the junction box is strongly recommended.

The colour T.V. camera is not well suited to geological work until the housing is renewed to increase the field of vision. The Consub drill requires modification to increase the size of core and improve the core retention system.

The container system was a considerable asset to mobilisation and performed well during operations although the container requires repeaters of some bridge instruments, particularly ships head and the EMF log. Communications with the bridge could also be improved by joining the bridge to the 'headset' system.

(ii) Acoustic and Resistivity Probes (contribution from R. Baria)

The acoustic and resistivity probes were deployed successfully to measure in-situ acoustic velocity and electrical resistivity within the uppermost meter of sediment. The probes were deployed from the after deck one at a time, to avoid the risk of fouling the propeller.

A total of 72 stations were worked, (27 acoustic and 45 resistivity) of which about 35% were in the pockmark.

Preliminary analyses of the acoustic measurements indicate that the surface sediments have slower acoustic velocities than the overlying seawater and there is a definite trend towards higher

values of acoustic velocity in the pockmark. Similar trends are present in the resistivity measurements with increasing formation factor values towards the centre of the pockmark.

(iii) Polytechnic "Autranav" Transponder System

Initial checks on the array showed that one transponder (T5) had been moved, while transponder T3 which was previously faulty was operating correctly. It was decided to work on a 4 transponder grid using the 4 northern transponders (nos. T1, T2, T3 and T4).

The array worked satisfactorily to provide accurate positions for the ship but the responder attached to Consub failed and the vehicle position had to be located using its own range and bearing system (AMF) relative to the ship.

The Autranav transducer fish was initially towed on a forward port side boom, but due to excessive bowthruster noise the fish was later moved to the hydrographic winch amidships starboard. Only a marginal improvement was noted.

(iv) Ships Handling and Stationkeeping

The ship was unable to hold station in windspeeds greater than 20 knots, even in protected waters. During the cruise permission was obtained from Director R.V.B. to use the main engine while Consub was deployed, provided the ship had $\frac{1}{2}$ knot forward speed. This ruling enabled work to be carried out in the Forties areas which would otherwise have been impossible. Nevertheless, this situation puts greater pressure on cable handling and the present cable handling system is unsuited to such difficulties. It is felt that in future the main engine should only be used when the bowthrust is unable to cope, and not as a normal procedure -

unless cable handling is substantially improved.

Anchoring on ships anchor was generally the most suitable mode of operation for rock drilling with Consub, although seabed inspection could be carried out very successfully underway. Nevertheless, unpredictable swinging of the ship has led to difficulties, suggesting that double forward anchoring should be seriously considered.

(v) Sampling

a) Gravity Coring

These operations were generally successful, but problems were experienced with the positioning of the corer trough on the starboard quarter. Alternative positioning of the trough or greater safety measures (i.e. handrail and decking) must be provided for future cruises. A flexible exhaust system is required for the winch.

b) Shipek Grab

Operations were successful.

(vi) Sounding and Side Scan Sonar

The Atlas echosounder provided good resolution for the pockmarks work and has sufficient range changes to be useful for most geological work, including pipeline location.

The Kelvin Hughes MS47 side scan proved most effective in locating the Shell pipeline off Peterhead, despite adverse weather conditions (force 6 and heavy swell).

Brief Resume of Geological Results

(i) Pockmarks Study Area

The principle aim of the Consub work in the pockmarks area

was to observe bottom conditions in and around a number of pockmarks. However, weather, navigation and technical problems with the vehicle severely curtailed this objective and only about 40 minutes of video tape was obtained on a traverse into a pockmark.

No major difference was observed between the seabed outside and within the pockmark, and no evidence of bubbles in the water body was observed. An interesting feature of the seabed was the intensity of Nephrops burrowing and the high level of biological activity in general.

Accurately positioned gravity core samples were obtained from within and just outside the studied pockmark and a plan of the feature based on echosounder traverses was produced. The resistivity and acoustic probes were successfully deployed on sites inside and outside the pockmark, and some subtle changes in values were observed.

(ii) West Coast of Scotland

a) NE of Skye

Samples of ?Torridonian quartzitic grit and dolerite were recovered from a curved ridge which commonly had a 'morainic' appearance. It is however, considered that the samples are probably from in-situ rock, while the overall morphology of the bodies was also suggestive of outcrop.

b) N of Rhum

A small sample of Torridonian arkosic grit was recovered.

c) NE of Rhum

An ultra basic sample was recovered from the Seagull Bank.

d) Blackstones Bank

No drilling was possible here, but the seabed showed extensive areas of boulders and cobbles.

e) Rathlin Trough

Three good solid rock samples were obtained by gravity coring.

Two to the NW were red sandstone and red marl, while the third sample from the SE was a grey silty, micaceous mudstone. The latter is possibly of Liassic age, thus demonstrating the southeasterly younging of the basin sediments.

Conclusions

During the first leg operations were severely hampered by poor weather conditions. Failure of the Autranav navigation system on the vehicle was a major disappointment and technical problems in the vehicle during leg 1 resulted in a considerable loss of time. The station keeping ability of the ship using the bow thruster only was also disappointing but this was to some extent offset by permission being given to use the main engines in the latter part of leg 1. The operational aspects of umbilical handling are still not satisfactory and require further modification.

Despite these setbacks, some useful additional data was obtained for the continuing study of pockmarks and in particular some profitable work was carried out using the acoustic and resistivity probes.

The second leg enjoyed excellent weather conditions during which the performance of the vehicle was satisfactory. The major problems associated with core retention did however reduce the efficiency of operations. Nevertheless, useful solid rock data were obtained, including those by gravity coring in the Rathlin Trough.

