SHACKLETON 9/82

CRUISE REPORT

SHACKLETON 9/82 9A + 9B

CAMBRIDGE

leg 9A	Barry via Ponta Delgada to Belem, Brazil.
leg 9B	Belem to Dakar, Senegal.

A.N.B.
C.G.P.
M.C.S.
R.S.W.

Narrative: LEG 9A

The four Cambridge personnel for leg 9A (M. Sinha, A. Bowen, C. Potts & M. Rayner) joined R.R.S. SHACKLETON in Barry, a.m. on Monday 6th September. The ship was due to sail at 11.30a.m. on Tuesday 7th September, however, this was delayed until 1845, because the loading of explosives and the installation of hydraulic equipment for piston coreing both took longer than expected.

Unfortunately, by 2200 (3½ hours after sailing), both gyrocompasses and the E.M. log had all failed, so that it was necessary to return to anchor off Barry for repairs. These repairs took up the whole of Wednesday 8th. As a result, we finally sailed from Barry at 0130 on Thursday 9th September, more than 36 hours late.

The passage from Barry to Ponta Delgada (Azores) was spent on servicing equipment and on four attempts to cure a persistent leak in the E/M log housing, which was allowing water to enter the sensor head. This was finally cured on Monday, 13th September, and the log was calibrated against satellite navigation before arriving at Ponta Delgada.

The Azores port call, to take on fuel and fresh water , was of only 3½ hours duration, from 1830 to 2200 on Tuesday 14th September. During this time, K. Robertson, S. Smith and G. Armstrong of R.V.S. (who had sailed with us from Barry to complete the installation of R.V.S. equipment) left the ship, the remainder of the scientific party (K. Louden, D. Forsyth, D. Locke, L. MacDonald and A. Cumming) were embarked; and a gravity base station reading was obtained.

The passage from Ponta Delgada to the work area took from 2200, Tuesday 14th September to 0900, Thursday 23rd September. Scientific watchkeeping was started at 1200 on Wednesday, 15th September, and there were two short stops to test scientific equipment.

On Thursday 16th, the deep-tow seismic reflection system was tested from 1000 until 2100. The system was deployed using only a single seismic hydrophone, and with a single 40 cu.in. air-gun as sound source, in 3400m of water. Although the 3.5KHz profiler worked well, the seismic channel proved extremely noisy, so that sub-bottom reflectors could not be seen. We also found that, with the wind astern, the ship could not be manoeuvred at speeds less than 2 knots. At this speed it was impossible to bring the deep-tow to closer than 800m from the bottom, even with over 5200m of wire out. On recovery of the deep-tow, we found that in spite of the use of a swivel coupling, the last few tens of metres of the CTD wire had been damaged by becoming partially unlaid. In addition to this, several hundred metres of wire had been affected by twisting, which caused difficulties on subsequent deployments. On completion of the deep-tow trial, echo sounder and magnetometer fishes were streamed and passage to the work area was resumed.

On Saturday 18th September we hove to again for a further five hours, to wire-test a new Cambridge OBS pressure case on the main warp, and to check the operation of the Bedford OBS acoustic releases, again by wire-testing them on the main warp. While hove to we also changed the PES fish, since the electrical connections had flooded on the one which we had been using. At the same time we removed a 40m long damaged section from the outboard end of the CTD wire, and paid out another 300m over the side with a weight and swivel attached, in order to take the turns out of it. Even after this, we continued to be concerned about the state of the CTD wire - quite correctly, as it later turned out.

From Sunday 19th to Wednesday 22nd September we were steaming continuously. We finally arrived at the work area on the morning of Thursday 23rd September. Unfortunately this coincided with a major failure of the data-logger (the only one during the leg) which caused a 14 hour gap in the logger records from 2200 on the 22nd to 1200 on the 23rd. Fortunately it proved possible to recover nearly all the data from teletype printouts, log books and chart records.

From 0900 to 1800/23rd we carried out a detailed survey of the northern end of refraction line R1, where few previous tracks existed. This survey consisted of a series of gravity, magnetic and bathymetric profiles back and forth across the ridge crest and the median valley. On completion of the survey we steamed to the southern end of line R1, at the intersection of the median valley and the fracture zone.

The first Cambridge OBS was laid starting at 2300/23rd, at the extreme southern end of line R1, on the transverse ridge flanking the fracture zone to the south. Deployment of a total of 5 Cambridge and 4 Bedford OBS along the line continued throughout the following day (Friday 24th), finishing at the northern end shortly before midnight. During the afternoon, the ship hove to for 2½ hours between deployments while explosives for the refraction line were carried from the magazine to the after-deck.

After laying the last OBS we carried out a sound velocity meter dip to a depth of 2000m. During recovery of the meter, persistent spooling problems occurred on the CTD winch, with the result that the last of the CTD wire and the velocity meter were not finally recovered until 0700/25th.

Short firing on line R1 was carried out from 0900 to 1830 on Saturday 25th. A total of 48 shots were fired, from north to south along the line. There were two misfires. One of these was shot 46, in a critical location over the deep at the junction of the median valley and the fracture zone. Shot 48 (the last large shot) was therefore fired at the Shot 46 position, thus shortening the line slightly (see Appendix 4).

On completion of shot-firing we steamed to the southernmost (Cambridge) OBS position. A weak return was observed from the OBS when we first arrived at its position, but this vanished almost immediately. We then carried out a 5 hour box-search, in an effort to relocate the OBS. Finally, when we were about to give up, a weak return was again observed, and the OBS was successfully released. It was eventually recovered early a.m. on Sunday 26th September. The first Bedford OBS was recovered without difficulty the same morning, but the third OBS (another Cambridge) again proved extremely difficult to locate. After an initial search failed to find it at all, we began to suspect the RVS deck unit. When we exchanged it for the spare deck unit, we immediately saw a clear signal from the OBS, which we recovered without any further difficulties at 1300/26th. It was therefore clear that the problems we had experienced with the Cambridge OBS's had in fact been due to a faulty receiver module in the RVS deck unit.

During the remainder of Sunday 26th September, we recovered the 2nd Bedford and 3rd Cambridge OBS without difficulty, and then fired a number of closely-spaced airgun shots into the 3rd Bedford OBS as we approached it. The 3rd

Bedford, 4th Cambridge and 4th Bedford OBS were all recovered successfully during the morning of Monday 27th, after firing more airgun shots into the fourth Bedford OBS.

We arrived at the position of the last OBS, at the northern end of the line, at 1030/27th, and started the search. After initially failing to find it, we waited for a good satellite fix before starting a systematic search. After this still failed to find the OBS, we covered the area again, transmitting alternate bursts of the communication and release frequencies in the hope of releasing the OBS even though we couldn't hear it. Finally we carried out a visual search of the area, in the hope that the OBS had released and surfaced; however, this again proved to be unsuccessful. At 1700/27th, after more than 6 hours of searching, we finally abandoned this last Cambridge OBS. We can only speculate about the reason for its loss, but the most likely causes are either a pressure case failure, or a complete failure of the acoustic system so that it would neither respond nor release.

On completion of the refraction line, we steamed to the starting point for the first deep-tow seismic reflection line, in the fracture zone valley some 30Km west of the ridge intersection, arriving at 2300/27th. After lowering the deep-tow and deploying an array of 2 x 300 cu.in. and 1 x 160 cu.in. air-guns, we began profiling at 0330/28th. At 0530, all signals from the deep-tow ceased. On recovering the gear, we found that the outboard end of the CTD wire had again started to unlay itself; and closer inspection of the CTD winch showed that both the winch drum and the spooling gear were shifted laterally out of their correct alignment. In addition the inboard end of the CTD wire was frayed and damaged, and the terminations and connections were badly in need of servicing. All these repairs to the CTD wire and winch took until 1700/28th.

At 1800/28th we relaunched the deep-tow, and began profiling north - eastwards across the intersection of the fracture zone and the median valley. The hydrophone channel was still extremely noisy, but the 3.5KHz channel was working well and providing useful data, so we continued profiling across the intersection and up the north wall of the fracture zone until 1300/29th. We then recovered the deep-tow, with no further wire problems, finishing at 1600/29th.

After completing deep-tow operations, we laid all six Bedford OBS in the north-east corner of the intersection for the earthquake study; and then early a.m. on Thursday 30th September, fired 10 2.5Kg calibration shots in and around the array. Finally, we ran a magnetics/bathymetry/gravity profile south-westwards across the fracture zone and the summit of the southern flanking ridge, before leaving the work area at 1300/30th September.

Throughout the time spent in the work area, the wind and sea states remained consistently at Force 4-5 at the northern end of line R1, decreasing to Force 2-3 at the latitude of the Vema fracture zone. We arrived in Belem on the morning of Monday 4th October.

Narrative: LEG 9B

A party of six Cambridge people (R. S. White, D. White, M. MacCormack, R. Courtney, I. Hutchison and T. Owen) flew out to Belem, Brazil, relieving M. Sinha and M. Rayner. Departure from Belem was delayed by two days, due first to flooding of the electric motor controlling the propeller pitch whilst loading fresh water, and subsequently to failure of one of the three alternators. This could not be repaired in time, so we sailed with severely restricted electric power availability. The main result was that we could not use the main warp so we had to cancel the heat flow and coring programme. Tim Owen and Iain Hutchison therefore flew home. The second restriction the alternator failure caused was to limit our use during deeptow deployment to one of the three main pieces of equipment we would normally have used: the CTD winch, the compressor and the bow thruster.

We left Belem at 13.30 (local) on Friday, 8th October and proceeded directly to recover the six Bedford OBS deployed on the previous leg for earthquake monitoring. All were safely recovered, although on one (at night) the OAR flashing light did not switch on until 30 mins. after it had surfaced and another, in rugged topography, took several hours of command telemetry before it was released. Sea conditions force 4 to 5 throughout. Finished recovery at 02.00/286 (Wednesday).

Next we ran a series of three deeptow reflection profiles (numbered 5 through 7). We could not use the bow-thruster for deployment, but streamed the hydrophone by positioning the ship with the wind on the starboard beam. The first two profiles used a 160" gun plus two 40" guns slung beneath buoys. After these we found that sufficient penetration but with higher resolution could be achieved with just the two 40" guns, so we subsequently kept this arrangement. Several attempts to use the 30m geomécanique streamer failed as the preamplifer flooded. Profile 5 ran across the intersection deep between the Vema fracture zone and the Mid-Atlantic rift and northwards into the spreading centre. Profiles 6 and 7 meandered across the active sedimented transform from south to north. We could maintain speeds of about 6 knots provided the wind lay between dead ahead and the starboard beam.

Starting at 19.00 on Friday, 15th October, we streamed the three channel Geomechanique streamer and a single 160" airgun and ran a reflection profile from east to west along the line of the main shooting track (III) for the subsequent refraction experiment. OBS positions were chosen partly as the basis of this reflection profile.

We began laying OBS at the western end of line III at 0600 on Saturday, 16th October. Four Cambridge OBS with disposable three component geophone packages and five Bedford OBS were laid along the inactive portion of the Vema Fracture Zone, across the intersection with the M.A.R. and across the transverse ridge flanking the southern edge of the fracture zone. On Saturday afternoon we hove-to for three hours while 6 tonnes of explosives were moved aft to the port quarter. A small detailed grid survey was made on the top of the ridge prior to laying two Cambridge OBS there in order to find reasonably flat sites for them.

Explosives shooting began on 0830 on Sunday. The explosives were fired along three lines, between 0830-1110 (line III), 1330-1910 (line IV) and 2030-2300 (line II). See Appendix 4 for details of shot sizes, fuse lengths, etc. In general fuse burning times were very consistent. We think that misfires of the largest shots may have been caused by their sinking too deep before the detonators fired.

Recovery of the buoys started directly after finishing the explosives lines, and lasted until 1400 on Tuesday, 19th October. From initial contact with the OBS until it was onboard took typically 2½ hours. Most of the buoys surfaced within ½ a m of the ship. We generally stayed hove-to on station over the OBS for the first half of its ascent and then manouvered as it came nearer the surface in order to get as close as possible to its eventual surfacing position. One Bedford buoy gave no transponder return so we left it and returned next day at the time of the backup release (1200/293).

However, it still didn't release: either it had pre-released much earlier and floated away or else it had flooded. One Cambridge buoy (OBS 4) responded to our signals for it to release, but stuck on the bottom. We left it for 4 hours whilst we picked up the last Bedford buoy, but on our return it was found floating on the surface. We think that the pyro-releases fired but that the buoy was hung up temporarily on the geophone cable cutters until perhaps slight movement in the currents worked the cutter loose.

After recovery of the OBS used in the refraction experiment we made another deeptow profile (number 7) roughly west to east across the intersection deep at the junction of the Mid Atlantic Ridge and the Vema Fracture Zone. This time we deployed a 50 m Geomechanique section off the array winch, suitably buoyed at front and rear, as the 30m hand deployed section was thoroughly flooded in both the electronics pressure case and in the tow cable. After initial earthing problems were dealt with this surface array gave good results which we shall compare with the deeptow reflection profiles.

Following the abortive attempt to recover the final Bedford OBS, mentioned above, we made a sound-velocimeter dip on the CTD wire. The Plessey velocimeter flooded at 1500 m, well above its design operational depth of 2000m.

Finally, before we left the fracture zone we made one more deeptow profile across the active transform and up onto the northern flank at approximately 42° 15' W. Again the deeptow profiler worked well both on the 3.5k Hz echo sounder and on the hydrophone streamer recording airgun arrivals.

OBS System

The following account of the OBS experiments on Shackleton 9/82 is intended only as a guide to the problems and difficulties encountered. A more thoroughly researched review will be available later.

Preparation

The long passage time to the Vema was filled by the work available. The new OBS was completed just before deployment. The four original machines were checked, tape heads aligned on all sixteen decks, and new battery packs tested and fitted. Although ten Geophone packages and cutter mechanisms had been prepared in Cambridge the final assembly on board of the system was very time consuming.

The Experiments

All the Cambridge Instruments were used in the "Deployed Geophone" mode on both experiments. There was one refraction experiment on each leg of the cruise, both were four to five days duration. It was intended that the Bedford and Cambridge systems should produce separate data sets - to be compared later. This, ultimately, was only partially successful, due to losses and failures.

Deployment

The OBSes were deployed using a single winch, the 'A'-frame, and a variable length rope strop. Until it broke down, the main warp was used, but the deck winch intended for Deep Tow launchings was found to be a more than adequate replacement. This proved to be the simplest and safest deployment method so far.

The new Geophone arms, designed to deploy the new light-weight Geophones, were a failure. As soon as the concrete bottom-weight entered the water the arm tipped and dropped the package. Thus all the remaining phones were weighted and deployed using standard arms. Curiously, the Geophone which pre-deployed gave the best quality records of the cruise. The new Geophones, rated for deeper water than the old packages, were reliable, and compatible with the old units which were used at some sites om both experiments.

The new float for OBS 5, using borrowed RVB floatation balls, was found to be simple to handle and deploy, and is a good substitute for the standard float.

Recovery

One of the two Deck Units of the IOS Release System was faulty (Deck Unit CDU2, RVS 1361), having a very poor receiver module. After two frustrating and time consuming recoveries this fault became evident and the spare unit was used. Location and release then became easier.

One instrument, OBS 3, would not answer the communicate frequency, could not be found, and was eventually presumed lost. Two (main) possible causes of failure have been suggested:-

(1) Leaking due to poor 'O' Ring seal - either due to deformation following pressure test or bad fitting of end-cap.

(2) Wandering of Release Communicate frequency. On testing all the releases, on board, it was found that some were most sensitive to frequencies slightly offset from the assigned values, although all would still, eventually, respond on that frequency. During the next experiment a test was carried out on one machine on the sea-floor and during ascent. It was apparent that this wondering is more marked when the release is deployed, and again, although the release would eventually respond on its assigned frequency, it was made more sensitive and would reply almost immediately, on an offset frequency. This is possibly the cause of failure of OBS 3. There was not time to return to its deployment position to try other communicate frequencies.

Summary of Test Results

Transducer	Communicate	Command	Comment
1 (S/N 2350)	315-325 (320)	255-263 (260)	in range
2 (S/N 2353)	311-324 (320)	340-349 (340)	command wandering
4 (S/N 285)	317-325 (320)	436-447 (440)	in range
5 (S/N 240)	316-325 (320)	237-241 (240)	in range
2 (on seafloor)	317-318 (320)	338-346 (340)	communicate restricted/ wandering

During the second experiment one instrument (OBS 4) did not release for several hours after the pyros were fired. Examination of the cutter and wires indicates that the cutting of the wire was done slowly and un-evenly. Possible reasons:-

(1) Insufficient floatation giving reduced cutting force - possibly due to decay of syntactic foam, since all other floatation was intact.

(2) Wires were pulled too tightly through the release, which results in the cutter blade striking insulation at an oblique angle, so reducing cutting effect.

(3) Blunt blade? (seemed sharp to touch).

It seems likely that the strong bottom currents in the region eventually aided cutting by slight movement of the whole machine in spite of the jammed blade.

OBS 5 ascended much faster than the other instruments. It had the new float, no syntactic foam, and a much shorter, lighter pressure vessel.

Summary of Ascent Rates

OBS	Experiment (9/82)	
	1	2
1	40.0	40.4
2	38.0?	Not recorded
3	Not recorded	-
4	33.7	Not recorded
5	63.0	86.9?

Notes

(1) All rates in meters per minute.

(2) ? Indicates doubtful value.

(3) Main problem in calculating ascent time is that exact surface time is very rarely known.

Data Quality and Instrument Faults

It is not yet possible to give an accurate assessment of data quality, since only a few of the shots recorded have been replayed. However, some general points are already obvious and relevant.

(1) Instrument Failures/Faults

(a) OBH4, First Experiment

This instrument recorded no data. All tapes ran on time, and recorded a remarkably drift-free clockcode. On recovery it was found that the power supply was assymetric, and would not run the modulator boards. This fault disappeared while under investigation, and would not re-occur; it is thought that it was due to pins shorting on the back-wiring plane. All pins on all instruments were cut short for the second experiment, and no such pattern was repeated. An important lesson is that the clock will run even if the supply to the elctronics is faulty - hence it is advisable to check the power rails just before sealing in the pressure vessel.

(b) OBH 1, First Experiment

Two tapes ran early, recording clock and flutter only. This was found to be due to a piece of wire-wrap shorting two pins on the program card. This fault does not show up on a "fast" run (x 100 or x1000) using the test clock - it only occurs when the instrument is run at normal speed. All the program cards for the second experiment were run at normal speed, but this is a time consuming test. (The other two tapes recorded good data).

(c) OBH 5, Both Experiments

This new machine recorded clock, flutter and one data channel on the first experiment. It was overhauled and modified for the second experiment and recorded clock, flutter and two data channels. Tests are still incomplete, and no further comment is possible, except that there is much work to be done on this instrument.

(d) New Clock - Both Experiments

The new clock jumped during both experiments, at about the same time on each. This fault is not yet understood, but since a reserve clock was run anyway, should not be a problem during data reduction.

(2) Data Quality

Records from the first experiment along the Median Valley indicated that the natural background noise level was low, although there was machine induced noise on the hydrophone, and a rocking motion on some geophones, some of the time, (assumed to be due to bottom currents). Conclusions were that the gain settings were, either about right, in the case of the hydrophone channels, or slightly low, in the case of some geophones. Also, it was decided that the Z - component (Vertical) should be allocated the "high" and "low" gain channel facility used on the Y component before. Thus the X component gain was raised slightly, Y set at the same level and Z "low" left as before, leaving Z "high" to be set very high, to detect long range shots.

Records Indicate:-

(1) Data quality on the first experiment was good, in general.

(2) Energy propagation along the F.Z. is very much better than along the Median Valley, so gains were slightly too high on the second experiment.

(3) Periodic bottom currents were more common and stronger at the sites of the OBSes during the second experiment, often causing Z "high" to overscale, and badly affecting the Hydrophone channels.

(4) The Cambridge and Bedford instruments around the intersection of the F.Z. and Median Valley picked up bursts of (presumably) artificial noise during the shooting, and until the end of recording. This appears as regular cycles of pulses and badly obscures data on these instruments. The emitter is possibly a deep-water sonar communications repeater, using the F.Z. as a wave guide.

(5) Z - components of the Geophones seemed to pick up a similar noise to the hydrophones - a noise believed to be machine produced. This is not yet understood.

Summary of Gain Settings

Experiment ONE

Channel	Click Switch (Obs 1, 2, 3,4)	dB	OBS5	dB
X	5	30	3	29
Y	4	24	1	23
Z	7	42	7	41
H	5	50	-	50
Y_H	2	36	A	41
H_H	3	68	-	68

Experiment TWO (Z — Y)

Channel	Click Switch (Obs 1,2,3,4)	dB	OBS5	dB
X	6	36	5	35
Y	6	36	5	35
Z	7	42	7	41
Z_H	3	60	-	59
H	5	50	A	50
H_H	3	68	-	68

Cassettes

Total Deployed	Recorded Data	Lost	Did not Run
36	25	4	7

Bedford Institute Ocean Bottom Seismometers.

The following table gives the deployment positions of Bedford OBS's during legs 9A and 9B/82. Instruments recorded continuously for 5 days during each of the refraction lines and for 11 days for the earthquake survey. All instruments recorded successfully except for:

A) Earthquake survey: E5 did not record its clock; E1 tape jammed around capstan after 7 days; E2 had a low pressure leak which produced a large amount of noise in the seismic amplification after 4 days.

B) Refraction Lines II-IV: The instrument at position n was lost.

BEDFORD OBS POSITIONS

Earthquake Positions

	Lat	Long	Dep	Rec
E1	11° 02.3'N	43° W 37.8'	1918/272	1730/285
E2	11° 05.1'N	43° 38.0'W	2018/272	1930/285
E3	11° 02.7'N	43° W 42.2	2145/272	1420/285
E4	11° 08.3'N	43° 40.8'W	2241/272	2211/285
E5	11° 07.7'N	43° 378.8'W	2331/272	0115/286
E6	11° 06.9'N	43° 32.6'W	0042/273	0322/286

Line II-IV

j	10° 28.6'	43° 47.6'	0900/290	1456/292
n*	10° 51.6'	43° 34.3'	1704/289	-
p	10° 51.7	43° 43.7'	1304/289	2158/291
q	10° 52.0'	44° 03.4'	1026/289	1525/291
r	10° 52.1'	44° 20.8'	0715/289	1033/291

* lost

Line 1

b	10° 47.5'	43° 38.0'	0318/267	0825/269
d	10° 59.8'	43° 41.3'	0822/267	1809/269
f	11° 22.6'	43° 43.5'	1415/267	0228/270
h	11° 47.5	43° 44.7'	2253/267	1155/270

Deeptow Profiles

The deeptow was given a short test deployment two days out of the Azores on Leg 9A using a single hydrophone instead of the streamer which had proved extremely noisy on the previous cruise. We were encouraged to see a sea-bottom return on the 3.5 K Hz record at around 2km altitude, and pleasantly surprised by the fact that the sea- surface return remained visible throughout the deployment. A single 40cc in airgun was floated off behind the ship, but due to the presence of high amplitude low frequency noise on the hydrophone only the direct arrival was clearly visible.

The second deployment used the new 30m streamer and an array of 2 x 40" and 1 x 160" airguns. An acceptable 3.5 K Hz profile across the intersection deep was obtained, however the streamer was again extremely noisy at low frequencies. It was noticed that the noise levels decreased while winching in, thus it was surmised that the streamer was too buoyant. The passage time to and from Belem was used to make several modifications to the system. The streamer was weighted up (with lengths of damaged CTD wire), a longer tail rope was made up (30m of polypropylene and nylon rope) and a 20 Hz high pass filter was incorporated into the electronics package.

These modifications proved effective, and on the five deployments on Leg 9B, sea bottom and basement returns are clearly visible throughout. On these deployments, the 160" airgun was dispensed with in order to shorten the pulse train. By comparing noise leads as the streamer rose and fell in the water, it proved possible to fine tune the weighting of the streamer so as to approach neutral buoyancy more closely.

It became evident that the 6mm conducting wire on which the system is deployed is not really up to what is required of it. The safe working load of $\approx$2500 lbs means that the instrument package has to be very light, and thus not only is it necessary to steam extremely slowly in order to keep the streamer altitude low, but also very small changes in course or speed cause large changes in altitude. The low speeds also severely constrain the direction in which profiles can be made, our one attempt (on the final deployment) to turn and do a reverse profile proving singularly unsuccessful. Nevertheless, we completed a series of three deeptow profiles across the intersection between the spreading centre and the Vema Fracture Zone, and three profiles across the active transform with excellent results.

Appendix I

Scientific Party

Leg 9A

Dr.M. Sinha	P.S.O.
Mr. C. G. Potts	Cambridge
Mr. M. Rayner	"
Mr. A. N. Bowen	"
Dr. K. Louden	Dalhousie
Mr. D. Locke	"
Mr. L. MacDonald	"
Dr. D. Forsyth	Brown
Mr. T. Cummings	R.V.S.
Mr. D. Lewis	"
Mr. R. Lloyd	"
Mr. K. Smith	"

Leg 9B

Dr. R. S. White	P.S.O.
Dr. D.White	Cambridge
Mr. M. MacCormack	"
Mr. C.G. Potts	"
Mr. A. N. Bowen	"
Mr. R. Courtney	"
Dr. K. Louden	Dalhousie
Mr. D. Locke	"
Mr.E. Lawson	R.V.S.
Mr. T. Cummings	"
Mr, S. Smith	"
Mr. D. Lewis	"

Appendix 2: Table of Julian Day Numbers, Leg 9A

Date			Day Number
Tues	7	September 1982	250
Wed	8		251
Th	9		252
Fri	10		253
Sat	11		254
Sun	12		255
Mon	13		256
Tues	14		257
Wed	15		258
Th	16		259
Fri	17		260
Sat	18		261
Sun	19		262
Mon	20		263
Tues	21		264
Wed	22		265
Th	23		266
Fri	24		267
Sat	25		268
Sun	26		269
Mon	27		270
Tues	28		271
Wed	29		272
Th	30		273
Fri	1	October 1982	274
Sat	2		275
Sun	3		276
Mon	4		277

R. R. S. SHACKLETON

CAMBRIDGE

R.R.S.SHACKLETON 9A/1982

Appendix to ROSCOP Report Form

The objective of this cruise was to investigate the crustal structure and tectonics of the Mid-Atlantic ridge (MAR) at its intersection with the western end of the Vema transform fault. Three main elements of the program were planned to achieve this;

(i) To shoot a 130 km long seismic refraction line along the axis of the MAR and across the Vema fracture zone. We planned to use 9 Ocean-Bottom Seismometers (OBS) as receivers, and to fire a total of 48 explosive shots totalling 4.1 tonnes of Geophex along the line. A 1,000 in^3 airgun was also to be used for short-range shots to provide detailed information on shallow structure.

(ii) To carry out deep-tow seismic reflection profiling of sediments in the Vema transform.

(iii) To lay a pattern of 6 earth-quake recording seismometers between the MAR axis and the Vema transform valley, in order to detect and study the natural seismicity of the region.

The seismic refraction line was completed as planned. 45 shots were exploded successfully, with three misfires. Of 9 OBS deployed, 8 were recovered safely, and 7 of these had recorded useful data. 1 Obs, belonging to Cambridge University, was lost.

48 hours of deep-tow profiling was carried out at an average speed of 1 knot. Good records were obtained from a deep-towed 3.5 kHz echo-sounder, achieving penetration of 20-50 m into sediments in water depths of up to 5300 m. Results from a deep-towed hydrophone streamer and an array of 3 airguns were disappointingly noisy, and it is not yet clear whether they will provide useful sub-bottom information.

The 6 earthquake OBS were deployed successfully, and a pattern of 10 small explosive shots were fired to calibrate the array. These OBS will be recovered on the next leg, SHACKLETON 9B/82.

A preliminary scientific report of the cruise objectives should be available around mid-1983.

M. C. Sinha
(P. S. O.)