ANTARCTIC MARINE GEOPHYSICS 1978-9

RRS BRANSFIELD

CRUISE REPORT

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1 Introduction

In many respects the marine geophysical programme aboard RRS Bransfield in 1978-9 was like that of the previous season. The data set was similarly confined to magnetic, bathymetric and seismic reflection profiles, and most of the necessary equipment was again loaned by Research Vessel Services (RVS) at Barry. The cost of shiptime in excess of shortest passage time was again assessed, as fuel costs at nominal daily consumptions of 20 tons for two engine working and 12 tons for single engine working, against funds granted by N.E.R.C. to the University of Birmingham. The major difference from last season was in the time allocation. The very short and early John Biscoe season and other logistic commitments meant that BAS could only make available 20 days for geophysics, instead of the expected 30, and even then only in April, at the end of the normal Antarctic season rather than after Halley Bay relief in January.

This situation was unpromising on several counts, besides the obvious reduction in time. It was unlikely that our highest priority survey area in the western Weddell Sea, would be accessible in April (although in fact the issue remained in doubt until the last minute), and we could look forward to less daylight and worse weather than in January, making the work more onerous for all onboard whatever the survey area. The weather was bad during the main survey period, but its effects were partly circumvented by continually modifying the survey plan in favour of quieter courses, a process which could have been carried further and operated more efficiently if weather forecasts had been available.

An additional drawback of the time allocation lay in its separation from the period of Halley Bay relief. We felt that in our present state of knowledge of the region, the opportunity of collecting magnetic data on the associated Weddell Sea transits could not be neglected. Fortunately it was possible for Derek Lewis of RVS and Ed King to join Bransfield in December for this purpose. Derek flew home in early February and by remaining aboard Ed King was able to collect some extremely valuable data on passage to and from the Peninsula. Such long seasons south, however, are an extravagent use of Birmingham's rather limited manpower, which we would not want to repeat.

Comments on equipment comprise a separate section of this report, but we would like here to record our gratitude for the invaluable watchkeeping assistance provided by BAS wintering personnel and others, and for the unstinting help of the engineer officers in overcoming the vagories of compressor and winch motors and Captain Lawrence (particularly) and the deck officers in squeezing the last drop of bathymetric data from a still inadequate echo sounder.

2. Narrative

RRS Bransfield left Port Stanley for South Georgia on 29th December 1978 with Derek Lewis of RVS and Ed King of Birmingham University aboard as the geophysics team. Reports that the sea ice at Halley Bay was breaking out rapidly caused Captain Cole to make all speed along the direct route to South Georgia, so that no new geophysical data could be obtained, but the opportunity of testing the magnetometer was taken on the short run between Bird I. and Grytviken on

1st January 1979.

The ship sailed for Halley Bay on 3rd January, omitting the scheduled call at Signy I., and heading just south of S. Thule to about 20°W to avoid reported pack ice. Ice was in fact encountered north of S. Thule, late on 4th January, and clear water was only reached on 5th, after a diversion north of Montague I. with the magnetometer inboard. A SE course was made through streamers of light pack to 62°S, 18.3°W, where the ship headed south and the magnetometer remained streamed until the morning of 9th January, when thick fog and heavy pack were encountered at 72.6°S 26°W.

The ship arrived at Halley Bay on 10th January and left on 15th after a fast and straightforward relief, taking a line northward approximately along 22°W. Apart from the loss of 8 hours of soundings because of an equipment fault on 16th, data collection continued uninterrupted until light pack was met at 63°S 23°W on 19th January, forcing the ship to divert northward of the planned track to Signy I., and thus miss the little known eastern South Scotia Ridge.

The ship reached Signy I. on 21st January and left again on 26th for Bird I. making a dog-leg through 57.4°S 38.2°W to improve our magnetic coverage of the Central Scotia Sea spreading system. Bird I. was reached on 28th and later the same day the ship moved round to Grytviken to water. On passage from there to Port Stanley a small southward diversion was made into the Scotia Sea to examine a possible triple junction linking the Drake Passage and Central Scotia Sea spreading systems.

Port Stanley was reached on 2nd February and Punta Arenas on 7th. Derek Lewis returned home and the ship sailed on 11th February for the Antarctic Peninsula, via the eastern end of the Straits of Magellan and the Straits of LeMaire. On this passage, an additional 20 hours was available to permit a long southeastward approach to the Peninsula to search for a postulated fourth spreading section to the three-section spreading centre which forms the western boundary of the Drake plate ("A" in Figure 1).

Spreading at the known sections stopped 4Ma ago, for no apparent reason, and it had been suggested that, if a fourth section existed, its collision with the South Shetland trench might well have caused the stoppage. It was gratifying therefore to discover a magnetic anomaly sequence which dated the marginal area at 4Ma. This result was sufficiently important to the evolution of the Pacific margin of the Peninsula to justify a second confirmatory dogleg on the return journey north from the Peninsula to Port Stanley between the 19th and 23rd March.

Peter Armitage of RVS, and Paul Barber and Peter Barker of Birmingham joined the ship in Port Stanley in preparation for the main period of geophysical work (after further calls at South Georgia and Signey I.). The ship left Port Stanley on 28th March and arrived at Grytviken on 31st, having made a small southward diversion en route to acquire a second magnetic profile in easternmost Drake Passage (see the track chart). After a call at Bird I. on 1st April, a similar short diversion on the way to the South Orkney Is. provided a second north-south crossing of the spreading centre in the northern part of the Central Scotia Sea. During this passage to Signy I. (reached on 3rd April) the ship finally received satellite-derived information about sea ice distribution (from FLEWEAFAC via Palmer Station) which clearly showed that our highest priority working area, the western Weddell Sea between 63^{o} and 68^{o}S was inaccessible. Thus, after refuelling the Signy I. base the ship headed eastward on 6th April for our second priority area, east of the South Sandwich Is., ("B" in Figure 1).

The problem to be investigated in this area is best understood if the Scotia Sea, whose complicated evolution we have been working on for many years, is viewed as a massive and growing distortion of the boundary between the much larger South American (SAM) and Antarctic (ANT) lithospheric plates. Figure 1 shows that the Scotia Sea region at present is made up of four small plates, and that only farther east, between the South Sandwich trench and the SAM-AFR-ANT triple junction in the South Atlantic, is the SAM-ANT boundary relatively straightforward. It seems very likely, from what we know of Scotia Sea evolution, that this situation has persisted over the past 30 or 40Ma - a straightforward SAM-ANT boundary in the east and a Scotia Sea in the west growing progressively larger, more complicated, and more dissociated from SAM-ANT motion. However, nothing is actually known of SAM-ANT motion over the past 40Ma, against which to assess this complexity, a defect which we believe is becoming a barrier to our greater understanding of Scotia Sea evolution. The objective of this survey, therefore, was to remedy that defect by an examination of a part of the relatively simple eastern spreading centre. The principal means were magnetic survey to obtain sea-floor ages, and a combination of echo sounding and reflection profiling to trace dead fracture zones by means of their effects on seabed topography.

We had made a start on this problem in the previous season, when three days were spent in the area between the South Sandwich Is. and 20°W. This time, however, we were forced to go much further east, onto the eastern flank of the spreading centre, because the older parts of the western flank were inaccessible, having sunk beneath the South Shetland trench. The plan was firstly to map precisely the presently active fracture zone which extends eastward from the South Sandwich Is. and which is approximately delineated by the line of earthquake epicentres in Figure 1. This could be done by zigzagging across the 6000m trough which is its topographic expression. With this trend precisely delineated we could then continue zigzagging generally eastward, hoping to map the now-dead eastward extension of this same fracture zone. Recognizing that its topographic expression would have changed, and may have been erased at the seabed by later sedimentation, we had made provision for seismic reflection profiling as necessary. Finally, having thuswise greatly refined our ideas of where magnetic anomalies undisturbed by fracture zones should lie, we would run sufficient long magnetics lines to permit an unambiguous identification of the anomaly sequence, and thus obtain a spreading history.

Essentially, these objectives were achieved over the 17-day period away from Signy I., but not entirely in the way which had been planned. The ship made good time eastward from Signy I., alternating two-engine working by day with single engine working by night, and making small deviations en route to improve our knowledge of the eastern South Scotia Ridge. Although winds reached Force 8 strength they were westerly and did not impede progress. The active fracture zone was duly mapped, and on 9th April in 19°W the reflection profiler was finally streamed in anticipation of sedimentary cover on the inactive fracture zone farther to the east. We found, however, that the new compressor would not run continuously, the air gun would not re-cock above 1200psi and a series of splits developed in the cover of the inboard spring section of the hydrophone streamer as it unwound from the drum. Moreover the weather (wind SW Force 9) would have made the next leg of the zigzag rather uncomfortable for the ship and the essential bathymetric data could not have been obtained. The ship therefore continued northeastward on a magnetics line until the next afternoon, while most of the profiler problems were overcome and the weather moderated slightly. The profiler was then restreamed and a zigzag course resumed.

Over the next three days it became clear that very little sediment had accumulated anywhere within the survey area, even at 8°W, where the ocean floor was 30 to 40Ma old. The remoteness of the area from terrigenous sediment sources, the low present-day biological productivity and the likelihood of a more southerly position in the past for the circumpolar current axis provide a reasonable explanation for this. It meant, however, that echo sounding should adequately map oceanic basement structures, so that when the air gun again failed early on 13th April it was decided to recover the profiling gear in the hope of being able to survey at a greater speed. This was not so obvious a decision as it may now appear, however, since the combination of rough and deep seabed topography and bad weather had several times made it impossible to see the seabed on the echo sounder even with the ship moving at profiling speeds of 5 to 7kts.

By this time the ship was heading west on the first of the set of approximately east-west magnetics tracks. Before starting a second, however, it was necessary to fill in the gap in the zigzag pattern caused by the events of 9th April, referred to above. Because of this gap a small ambiguity had crept into the fracture zone tracing and we were thus unsure of the optimal orientation of the magnetic profiles. It soon became clear, however, that reasonably well-formed and recognizable magnetic anomalies were being seen and by 19th April the long magnetics lines and a further zigzag had rounded off the survey.

It is too early at present to say exactly what the areas spreading history has been, but anomalies 6 to 8 are recognizable and the sequence back to 11 (32 Ma) may be present. It seems possible also that the eastern end of the area contains an anomaly sequence which was not formed at the SAM-ANT boundary, so that the start of SAM-ANT motion may have been detected. Preliminary signs are therefore quite encouraging, but a more rigorous assessment must await computer processing of the data set.

Leaving the survey area, the ship headed west on a line directly south of the long, active fracture zone, hoping to detect, it it ever existed, any southerly extension of the spreading system which we had just been surveying. There was some time in hand before our scheduled arrival at Signy I. which it was proposed to devote to a long reflection profile This would extend from the northernmost Weddell Sea at about 62.3°S 37°W, across a small basin on the eastern flank of the South Orkneys block and onto the block itself, in preparation for a more detailed survey which it is hoped to accomplish next season. However, the bad weather, whose worst effects it had been possible to circumvent within the survey area by re-orienting ship tracks, now began to disrupt data collection on this inevitably westward track. Also, thin new pancake was encountered, firstly at 26°W on the morning of the 20th April and then more frequently over the next two days. The ship's planned track wasmaintained, in the hope that the profiler line would be clear, but although patches of open water did occur they were never more than 30 miles wide. Despite protecting the towed magnetometer bottle by recovering and restreaming it through a centre fairlead on a reduced length of cable, and reducing speed so that the quite thin ice was pushed aside rather than overriden, the bottle was lost after collision with ice in the ship's wake on the evening of the 21st April. Strong winds had been blowing all day and by this time a heavy swell was indicating the proximity of the ice edge; shortly afterwards the ship hove to in a northerly Force 9 and overnight gradually emerged into open water. When the weather moderated slightly (NW8) some slow progress was possible towards Signy I. The second magnetometer bottle was streamed and the ship headed directly for the South Orkneys at best speed, since a profiler line of the desired length was no longer feasible.

The ship reached Signy I. one day early, on 23rd April and left the next day for Bird I. The direct passage to, and straightforward relief of Bird I., completed on 26th April, permitted the geophysics time carried forward to be spent on a short reflection profiler survey of the northwestern continental margin of South Georgia ("C" in Figure 1), before arrival at Grytviken on the morning of 28th April. The object of the four crossings of the base of the continental slope which were possible, was to check the suggestion on one existing profile that young sediments might be being actively deformed. This was confirmed, on some very convincing profiles. The existence of an apparent east-west deformational front is capable of further checking because some of the features have seabed topographic expression, and can therefore be detected on bathymetric profiles. The prospect arises that this study will yield a direction of relative motion along the SAM-Scotia plate boundary (Figure 1) which would be extremely useful.

After a very welcome two days stay at Grytviken the ship headed north for Rio de Janeiro on 30th April, making a small initial northwestward diversion to add to existing magnetic data. Marine geophysics stopped at 48°S and the journey to Rio has been occupied by re-stowing the lab., preparing data for processing, and writing this report. The ship is due in Rio on 7th May and Southampton on 29th May.

3. Cruise Statistics

As has been described, at least one geophysicist was aboard Bransfield between 28th December 1978 (Port Stanley) and 8th May (Rio de Janeiro), a total of 131 days. Most of this time, of course, was unavailable to geophysics. For example, about 70 days were spent alongside, at anchor or on short passages associated with base relief and ship replenishment. A further 15 days were spent on passage where geophysical work was inappropriate, being in territorial waters, out of our area of interest or where our data coverage was already adequate.

The remaining time, in which geophysical measurements might usefully have been made, is estimated at 46.3 days. This period is made up of two, or perhaps three different kinds of time. Firstly, on eight occasions, routine passage between BAS bases could be transformed into useful geophysical lines by the addition of very small amounts (2 hours) of additional passage time. This accounted for 23.4 days of potential data collection at a 'cost' (additional to shortest passage) of only 0.6 days. This evident efficiency is of course balanced by the fact that in some instances the data collected provide only 'background' information - the geophysical problems in those particular regions may already have been solved in essence, or may not yet have been properly formulated.

Secondly, in direct contrast, 17.2 days were made vailable in April, in which the ship's facilities were devoted entirely to geophysics. In the sense used above, this is 'inefficient' use of the ship, but there is of course a balancing efficiency in the ability to devote to a high priority problem, remote from normal passage routes, exactly those facilities which are required to solve it.

The remaining 5.7 days included 3.3 days of chargeable time, and were thus intermediate between the two extremes above. The problems (in western Drake Passage and north of South Georgia) were sufficiently important to merit a considerable deviation from the shortest passage, but the presence of the ship close to that particular area was in the first place a consequence of BAS logistic operations.

A.	Port Stanley to Rio de Janeiro	131 days
	At anchor, alongside or around bases	70 days
	Unusable passage time (wrong area)	15 days
	Potential Geophysics time	46.3 days
	Distance steamed in 46.3 days	19,900 km.
B.	Unused magnetics time (ice)	2.7 days
	" " distance	580 km.
	Unused bathymetry time (faults)	0.5 days
	" " " (ice, weather)	1.7 days
	" " distance	490 km
	Reflection profiler time	3.5 days
	" " distance	1050 km.
	Average speed over 46.3 days	9.7 kts
	" profiling speed	6.8 kts

Thus 'down time', when data were not being acquired, was about 5% by time, but only 2.5% by distance. This difference occurs because most of the data gaps were caused by bad weather, and/or ice, when the ship speed was below the average value.

C. Chargeable geophysics time.

Single engine working	16.8 days
Two engine working	4.4 days
Total	21.2 days
Data collected in chargeable time	20.1 days
" " on uncharged passage	23.7 days

This illustrates the main difference between this and the previous season; in 1977-8 only 6.4 days of data were collected on uncharged passage. This season's increase, however, was achieved at the expense of having Ed King away from Birmingham for 140 days, and required an additional 40 man-days from RVS.

4. Equipment

As last year, most of the equipment used has been on loan from RVS and at different times two RVS electronics technicians have spent time aboard to ensure its smooth running or speedy repair. It need hardly be said how highly we value this service. The two main changes from last season were the provision of a new, larger and electrically driven air compressor and the installation over last summer of a double hull beneath the echo sounder, at Kelvin Hughes' recommendation. The use of disposable sonobuoys with the reflection profiler had also been newly provided for, but was not required because the survey area in which they would have been used was inaccessible.

A. Echo Sounder.

The ship's MS38 system consists of a receiver on the Bridge and 2 hullmounted transducers located amidships about 30ft forward of the break of the Bridge. After unsatisfactory results (ie weak echoes) last season a second steel plate of hull thickness was interposed between the transducers and the hull, at a 'turned' distance from the hull. This was at Kelvin Hughes' recommendation when it was found that installation of a fibreglass plate beneath the transducers, as we had requested, could not be carried out in the available time. The predicted signal to noise improvement is 6db, but it is difficult to say whether any improvement has in fact resulted. This difficulty arises from the subjective nature of the assessment, and the changing circumstances (weather, depth, ship noise, reflectivity) in which it has to be made. There is no doubt, however, that the echo sounder has been barely adequate for this season's work and that an inordinate amount of time and effort has had to be devoted to extracting depth information from it.

It would be helpful to consider the problem in more detail. In good weather, with the ship moving easily, an echo of reasonable quality is normally returned from all but the greatest depths, provided that the seabed is not too rough. If any one of these conditions is not met, however marginally, it becomes more difficult to see the seabed. Thus, it would seem that greater power and/or sensitivity are required, but the difficulty experienced in deciding whether the improvement predicted for the double plate arrangement did occur suggests that this is not the whole story.

Loss of echoes in bad weather results from the absorption of the outgoing or return pulse in the layer of aerated water which can migrate or be produced beneath the ship. Also, since the echo souder transducer is directional, the signal is degraded if the beam axis is not pointing in the same direction when the echo returns as it was when the downward pulse was transmitted. These are problems which all ships face and in the case of rolling, about which little can be done. It is likely however, that in Bransfield's case her icebreaker bow and hull shape somehow increase the amount of aerated water in the vicinity of the transducers. Put another way, in terms of her hull structure, Bransfield's transducers may be located too far forward.

There are thus several options open for improving the ship's sounding capability, singly or in combination.

1. A new, more powerful echo sounder
2. Ceramic transducers to replace the existing scroll type, which are less efficient.
3. Relocate transducers farther aft.
4. Drive both existing transducers at once.
5. Use a towed transducer.

There are problems associated with all of these options, not least that of cost in view of the uncertain future of marine geophysics aboard Bransfield beyond the next one or two seasons. Options 1, 2 and 3 are all expensive, particularly since no suitable cofferdam exists abaft the present transducer site until the motor generator room is reached, which would anyway be too noisy. A towed transducer is not really practicable; it is very vulnerable to loss and damage by ice and Bransfield spends a significant part of her season in areas where ice of sufficient size is common. At night in particular, such ice would be extremely difficult to see in time to be avoided. To adopt option 4, is to some extent to avoid the main problem, since again only a small signal to noise gain is to be expected.

It may be that, unless longer-term plans for marine science aboard Bransfield are favourable, we shall have to continue with the present arrangement. The provision by MSES of spare receiver and transmitter units clearly improves the reliability of the present machine, having made very swift repair possible this season on two occasions. Perhaps a towed fish should not be carried next season, and the remaining 10.2 kHz transmitter also converted to 9.6 kHz. In view of the hydrographic use of the sounder when no geophysicists are aboard, it would not be useful to move the receiver to the lab., despite other advantages of doing so. It seems possible that in future seasons conditions will not be quite so hostile as they were this time, but there is little doubt that echo sounding will continue to be something of a trial.

B. Magnetometer

The new Varian V75 magnetometer with Servoscribe chart recorder gave little trouble all season, although one magnetometer bottle was lost in ice. A bottle having a fully faired nose would probably have survived better, but the loss was really attributable to a misjudgment on our part as to the conditions which the existing bottle would tolerate. There was a tendency for circuit boards to vibrate loose and the magnetometer alarm was frequently (once every hour?) triggered by the 5-minute time marks supplied to the chart recorder.

C. Clock Unit and Fix Box

The clock unit kept good time, but the power failure feature had the somewhat pointless effect of resetting the clock to zero, which presumably should not happen. The fix box would have been more useful if more than one fix interval and pulse length had been available simultaneously; we tended to want 5 minutes for the magnetometer and 30 minutes for reflection profiles. The latter was obtained from the Accutron clock but, being gated by the EPC writing switch, was mostly only 4 seconds long, so will sometimes not appear on playback.

D. Satellite Navigation

The single channel Redifon set on the Bridge again worked well throughout the cruise. There was the usual progressive failure of sections of the display, and at one stage the thermal printer would print on only the first position of any line, a fault traced to a failed Zener diode on the upper tray (this component sits directly above a voltage-droppi ng resistor on the lower tray, and appears to have been very hot)

The lab. receiver, a Magnavox 702 set with both teletype and thermal printer (Silent 700) also performed fairly well. The teletype mains frequency control needed occasional adjustment and the Silent 700 writing head required an occasional 'decoke'. The main problem concerned the poor quality of doppler data acquisition on the low (150 MHz) channel. Receiver board changes failed to eliminate this fault, which it was therefore tempting to ascribe to shadowing of the incoming signal by the ship itself. It is not clear, however, why only the low channel was affected (high channel data acquisition was as good as by the Redifon receiver, whose aerial is optimally located), and there was no obvious correlation between the position of the ship relative to a particular orbit and those parts of the satellite signal which were not well received. Also, the effect appeared to become worse through the season. It would be advisable to re-examine the performance of the equipment on its return to Barry, in case the antenna preamplifier (for example) is at fault.

E. Reflection Profiler

This was made up of:

1. Reavell VHP36 compressor, electrically driven

2 large, 1 small, Bolt airguns with firing boxes

2 x 2 channel Geomecanique streamerson partitioned diesel driven winch drum,

1 Fortune 24 channel amplifier-filter set

1 12 channel tape amplifer

1 Bell Howell "Datatape 4020" 1" tape deck

3 Kemo filters

2 EPC flatbed dry paper recorders.

The reflection profiling system was very little used (about 4½days) essentially because we were unable to reach our first-choice survey area, as described in the narrative. Its use next season is likely to be much greater, so it is worth discussing its shortcomings in some detail.

The compressor was new, and potentially a great improvement on that carried last year, being electrically driven and having more than twice the free air capacity (it fired a 300 cu. inch gun at 1600 psi every 12 seconds). Its behaviour, however, was not entirely predictable, and the strong shipboard impression is that its control system is unnecessarily complicated. It stopped several times and would not restart automatically, or even manually sometimes. This happened more often during the first few hours than later, and its incidence was reduced after the leads from the pilot unloading valve, which had been shorted by sea water, had been renewed. It was difficult for the lab. watchkeeper to detect that the compressor had stopped, which could lead to gun failure by flooding, since firing would continue after the air supply had been exhausted.

The compressor cabin is slightly dented forward, presumably du e tocargo handling, and has let in seawater. It is extremely vulnerable to such damage, and open to salt water spray, and should probably be strengthened and proofed before next season.

Greater difficulty than usual was experienced in starting the streamer winch motor, and the brake pressure could not be maintained without repeated pumping. It is hoped that the separate drive unit, for which a bed has already been prepared and which should be available next season, will be an improvement. Earlier in the season the drive chain around the drum circumference was damaged during cargo handling, but the repair by the ship's engineers was perfectly effective. The winch stands in a similar position to the compressor container on the port side, and the more serious prospect, of damage to the streamer itself during cargo handling, suggests that additional protection of some kind would be advisable. It would have been useful also to have had some wind proofing around the operator's cab.

The hydrophone streamer itself suffered quite extensively, even though the season was short. The inboard spring section of the outboard (port) streamer split while being unwound from the drum for the first time. It was repaired but immediately split again in three more places. The problem is that the streamer is wound onto the drum under tension so that the inner sections are progressively compressed by the outer. These inner sections take up the shape of the available space, which is often anythingbut round, particularly if the section is not well filled (I have noticed a tendency for spring sections to be thin, which may be because some oil is pressed out from them when on the drum). The odd shapes introduce unequal stresses on the section when it is later unwound, particularly if it has been to some extent 'jammed' into a gap in a lower layer, or at the edge of the drum. This problem is exaggerated in cold weather, when the tubing becomes brittle.

There is much to be said for winding on the inner sections very slowly and carefully, and padding any irregularities, particularly the streamer nose and section joints. Above all, in cold weather it appears essential to have a winch cover in good condition, which can be replaced and a heater inserted beneath it for two days or so before the next planned use of the streamer. This was done (using a 3kW fan heater) for the second profiling period and the improved flexibility of the streamer was obvious.

During the first profiling period one tail buoy was lost when the rope parted. The second was lost early on during the second period, apparently by some kind of failure of the short wire strop at the end of the last streamer section. It seems reasonable to suggest that the drag produced by these new, larger buoys is too great for the present system, particularly in the rough seas and at the higher towing speeds to which they are unavoidably subjected. aboard Bransfield. Such large buoys are in any case not necessaryfor two- (or even six-) channel arrays.

There is little doubt that the after buoy contributes to the towing noise seen on the hydrophones, and makes it difficult to sink them to the required depth. Penetration is usually improved by going more slowly, but this is not always possible aboard Bransfield, because there is a minimum shaft horsepower which her engines will provide without risking damage. With a strong following wind it may be impossible to make less than 7 or 8 knots through the water (as off South Georgia this season). If a buoy is to remain an obligatory part of the hydrophone array, therefore, it may be worthwhile to insert a spring section after the active sections in an effort to reduce this noise. A cheaper alternative might be to make tow ropes longer, and of nylon.

The inboard signal processing and recording units were used essentially as last year, with one exception. Only the record cards for channels 8 to 13 were inserted, and the tape was written to in both directions. In a season in which profiler use is heavy, this will effect considerable saving on tape costs.

The need for a 30 minute fix signal of greater length has already been mentioned, under "C".

Only one air gun was used, with a 300 cu inch chamber. With the waveshape kit inserted, it would not recock above 1300psi. A reduced amplitude firing pulse produced by one of the Bolt firing boxes was probably responsible for the gun failing to fire on two occasions.

F. Disposable sonobuoys.

Six buoys had been requested for use in our first priority survey area in the western Weddell Sea where knowledge of the velocity structure of the thick sedimentary sequence would have been useful. As it was, one was tried out north of South Georgia, more to give us experience with the system than in the expectation of acquiring useful data. Because limited time was available, the buoy was launched in a Force 5-6 NW wind and a prominent residual SW swell, which probably reduced the range considerably. That particular buoy had first been unpacked 80 days before, to try to reduce its sensitivity, which may also have degraded its battery somewhat. The use of crystals in the Eddystone receiver appeared advantageous.

5. Personal and Acknowledgements

As mentioned earlier, we are grateful to the entire ship's company for their acceptance of the discomforts of geophysics and (particularly the senior deck and engineering staff) for their willing help and advice, and to BAS wintering personnel (and others) who helped with lab. and bridge watchkeeping.

A. Senior ship's staff

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B, BAS WATCHKEEPING UNION

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T. ESCOT	S. JONES	W. RODGERS	
W. FREELAND	G. LEATHERS	M. SMITH	

APOLOGIES TO ANYONE FORGOTTEN.

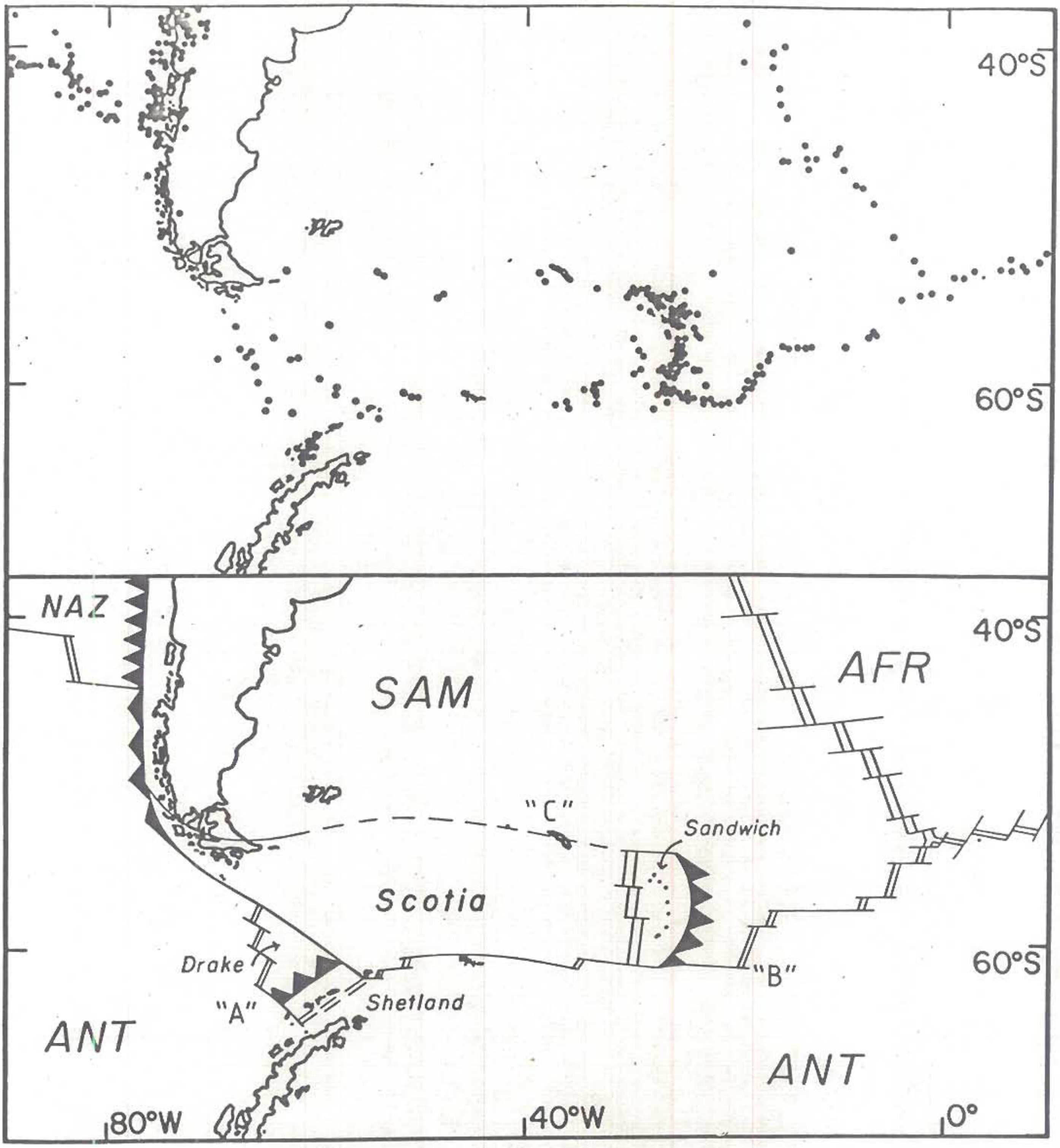
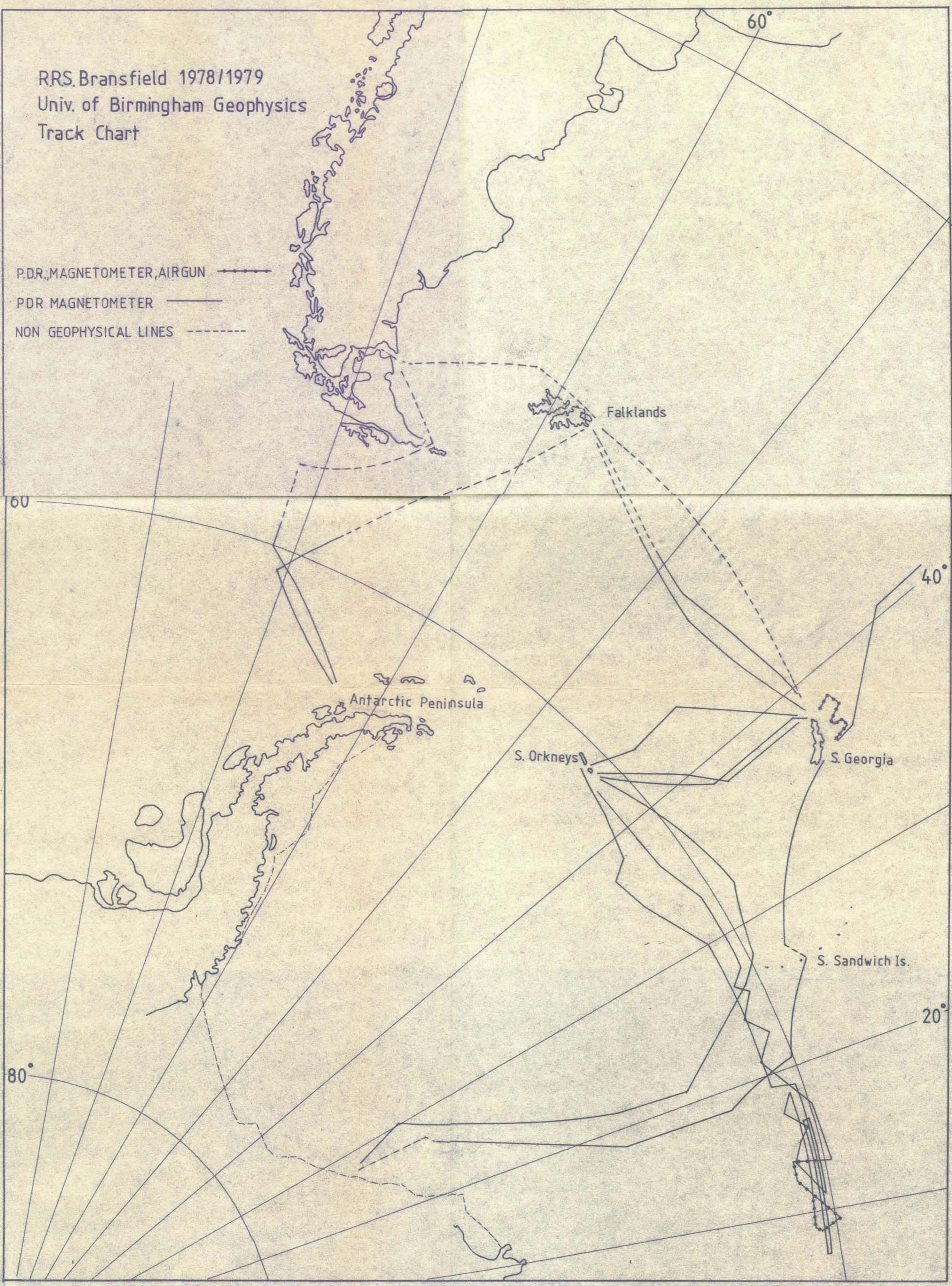


Figure 1.

For explanation see contents page and main text.

FIGURE 2



R.R.S. Bransfield 1978/1979
Univ. of Birmingham Geophysics
Track Chart
P.D.R., MAGNETOMETER, AIRGUN
PDR MAGNETOMETER
NON GEOPHYSICAL LINES
60°
Falklands
60
40°
Antarctic Peninsula
S. Orkneys
S. Georgia
S. Sandwich Is.
20°
80°