END 767:
HMS Endurance
Scotia Sea
Geophysics
December 1976 - January 1977

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CRUISE REPORTS

of work undertaken on

HMS Endurance Cccember 1976 - January 1977

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1. Introduction

This report is a description of the scientific work carried out aboard HMS Endurance for the Antarctic Research Group of Birmingham University during her first work period, 9th December 1976 to 7th January 1977. This 'group is concerned with a geophysical and geochemical study of the earth's crust in the Scotia Sea region. The work undertaken this season involved two separate projects, these being:-

(i) Recovery of an automatic seismograph established on South Thule island in January 1976
(ii) Magnetometer survey during -passages within the Scotia Sea including 2 grid surveys in the Central and East Scotia Sea.

The seismograph was installed from HMS Endurance by Colin Brett, the group's seismologist, and designed to run automatically for 6 months recording the earthquake activity of the South Sandwich Island Arc. This data will supplement that obtained from our two other seiamograph stations, at South Georgia and Signy Island, to allow detailed study of the island-arc and the deep structure of the ocean crust to the west of it.

The magnetometer survey continues the detailed mapping of the Scotia Sea in which the group has been engaged for several years. All passage tracks, as well as the grid surveys, were laid off to complement and extend data coverage obtained in previous seasons.

2. Narrative

I joined HMS Endurance in Port Stanley on 6th December. The ship sailed at 1400 on the 10th, on passage to Elephant I. where the Joint services Expedition was to be landed. The track steamed was laid off to produce useful ocean sounding and magnetometer data with negligible increase in steaming times. The magnetometer sensor was streamed at 1600 and, after initial problems with the sensor cable connectors, the system was operational and watchkeeping started at 1720. At 1825 the cable connectors failed again and due to connector incompatibility the spare sensor loaned from the Institute of Oceanographic Sciences could not be used.

By 1200 on the 11th the connectors on the ship's equipment had been repaired and a compatible plug fitted on the spare sensor. A fault was then discovered in the inboard electronics unit, but this was rectified by fitting a replacement module from the extensive spares kit. Data collection recommenced at 1400 and continued until 1900 on the 12th, when the sensor was recovered, the ship having arrived at Elephant I.

The good weather experienced on the passage continued for the period of the landing of the Joint Services Expedition, all the stores and personnel being landed by midday on the 17th. The ship sailed at once to perform the first magnetometer survey on passage to South Georgia. After further troubles with cable

connectors data collection started at 1330. The record obtained had a high noise level which increased slowly and was finally diagnosed as another connector failure. The reserve I.O.S. sensor was streamed and only 40 minutes data was lost.

The magnetometer was run continuously until 1137 on the 21st with only a further 10 minutes data lost by failure of a set of contacts in the electronics unit, During this period the ship covered three of the four planned Worth-South survey lines and the passage tracks to the survey area were laid off to give the maximum scientific benefit in the time available.

Data collection ended when the ship was off the South Georgia coast in the Elsehul to Bay of Isles region, and aerial photography work for B.A.S. was progressed.

During the Christmas period, spent at Grytviken from 23rd December to 27th, the data collected in the first survey was processed and analysed in conjunction with previous work to permit the selection of desirable tracks to be covered on the return passage from S. Thule to Stanley.

The ship sailed from Grytviken on the morning of the 27th, and after conducting a flying programme in support of B.A.S. scientists in Royal Bay, the magnetometer was streamed at 1630. A very useful traverse was obtained as the ship steamed eastwards across the active ocean spreading ridge between South Georgia and the South Sandwich Islands. Readings were continued as the ship moved southward down the island arc, fixing the position of the islands by sat-nav and visual or radar bearings. Simultaneously aerial photography was progressed as opportunities occurred in the deteriorating weather.

On the afternoon of the 29th the ship reached South Thule Island in clear water, the reported pack-ice having been dispersed by a depression passing through the area. The magnetometer was recovered at 1300 and a landing made by Wasp helicopter between 1400 and 1500. All the instruments were recovered as planned, these being the "geostore" tape deck, seismometer, amplifier-modulator and radio receiver. The exhausted battery pack and radio aerial were left at the site. A collection of about 40 lb of rock samples was also made for geochemical analysis.

Inspection of the instruments on board ship revealed that they were all in good condition having withstood the rugged conditions well. Preliminary replay of the magnetic tape record at Birmingham confirms that the equipment operated for the first 12 weeks of its designed 28 week life-time. The record after the 12th week yields no data, but this will be checked with a higher quality replay system available in Edinburgh.

The magnetometer was streamed again after the landing at 1520 and ran continuously until 1930 on the 4th January, except for a six-hour period on the 3rd, when the ship was hove-to for main engine maintenance. Tracks during this period were laid off with regard to the results of the first survey, and the time available. Fortunately this allowed completion of the second survey as previously planned, and also further lines to support the information from the first survey. The final

part of the return track provided a crossing of the northern "Drake Passage" area in a very favourable direction, and this will be very useful in the interpretation of this complex area.

The ship arrived at Shag rock in the Falkland Islands in the early hours of the 5th January. The 5th and 6th were spent around East Falkland performing hydrographic survey work, the ship finally anchoring back in Port Stanley on the morning of the 7th. Throughout the periods of magnetometer survey logs were kept of 5-minute readings of the magnetometer and echo sounder. All sat-nav fixes and course or speed alterations were also logged to enable accurate track charts to be computed at Birmingham.

3. Cruise Statistics

Total time Stanley to Stanley	27 days	
Time on Passage or magnetometer survey	337½ hrs	(14 days)
Minimum time for direct passages	260 hrs	(11 days)
Total available magnetometer time	326 hrs	
Magnetometer downtime	20½ hrs	
Total time for landing on S. Thule	3 hrs	

4. Equipment Performance

Magnetometer:-

The Varian Magnetometer performed satisfactorily throughout the work period. Downtime of around 6% is higher than might be expected, but of the 20½ hrs lost, 19½ were lost in the first 24 hours of operation due to failure of the stern cable connectors. These connectors are usually the weak link in the system. Any electrical connector having to maintain a very high insulation impedence (50 Mo working in a salt laden atmosphere is liable to failure. This normally starts by mechanical strain on the connector loosening the seal enough to allow salt penetration. The connectors on Endurance are not, in my opinion, mechanically strong enough for their purpose, only one having a cable clamp. I would recommend the replacement of all connectors with a more rugged type, perhaps that made at Research Vessel Base, Barry, specifically for this purpose. Any connector should also be filled with a non-hardening potting compound (e.g. Vaseline) to further prevent salt penetration.

Even with these precautions, electrical failures will still occur at this connector and also at the sensor head. To prevent loss of data, and consequent wastage of ship time, a complete spare sensor and cable is highly desirable.

The inboard electronics developed only two faults during operation. The first was breakdown of the cycling contacts on the power supply. These contacts need periodic replacement yet no spares are supplied. A repair was effected by canibalising contacts from the slow cycle-rate unit.

The more serious defect was in the Phase lock timing module. One module had a component failure, possibly as a result of an input short circuit from a failed outboard connector. The

replacement unit from the extensive spares kit worked adequately but was very sensitive to tuning, especially at field strengths of about 31000 gammas. No cause for this could be isolated.

The provision of an accurate timing unit to actuate the event-mark pen on the chart roll at 5 minute intervals is a great convenience to both watch-keepers and data-processors.

Echo-Sounder & Satellite Navigator:-

Both these units naturally worked quite well with only occasional data-gaps. The Echo-Sounder watchkeeper completed a log of 5 minute depth values for our use, as well as the standard 10 minute log, for all periods when the magnetometer was streamed. Sat-nav watckkeepers generated frequent alert data to allow fix geometry to be determined,

5. Acknowledgements

I would like to thank Captain Wallis, the officers and crew of HMS Endurance, not only for their willing assistance and co-operation, but also for their hospitality.

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