P.O.L.

Sea Level Measurements In the Weddell Sea

As part of

HMS Endurance
January 5, 1998 – February 26, 1998

Cruise Report No. 29

1998

PROUDMAN
OCEANOGRAPHIC
LABORATORY

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G.W. Hargreaves and M.J. Smithson

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Sea Level Measurements in the Weddell Sea, as part of, HMS Endurance, January 5, 1998 – February 26, 1998

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ABSTRACT

The Weddell Sea is a major source of bottom water, the production of which is contributed to by tidal action. Tidal models are available but there is very little data available to verify the model.

Three Bottom Pressure Recorders were successfully deployed along the Ronne Ice Shelf to allow verification and modification of this tidal model.

Two new deep-sea Bottom Pressure recorders were deployed at similar depths across the Weddell Abyss for measuring coherent signals.

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CONTRACT

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The Library, Proudman Oceanographic Laboratory.

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BAS Personnel	
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	Adrian Jenkins
	Mark Johnson
	Andy Wood
Logistics	John Hall
SOC Personnel	Rob Bonner
	Ben Moat
AWI Personnel	Rebecca Woodgate
CRREL Personnel	Steve Ackley
	Elizabeth Hunke

HMS Endurance Personnel

Captain	Captain TJ Burton
Executive Officer	Lt Commander AJU Peters
Navigation Officer	Lt Commander FA Egeland
Charge Hydrographer	Lt Commander GR West
Buffer (Bosun)	Chief Petty Officer Furey

ACKNOWLEDGEMENTS

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OVERVIEW

The Weddell Sea is thought to be the most important source of bottom water in the Southern Ocean, accounting for about 80% of total production, and water modified by passage under the Filchner-Ronne Ice Shelf (FRIS) is a major constituent. Because there is no contact between the atmosphere and the ocean under the ice-shelf, sub ice-shelf circulation, mixing and heat

transport are forced by tidal action. An understanding of the tides and the interaction of the tides with the ice shelf are therefore important.

A tidal model of the Weddell Sea has been developed but there are few reliable observations to validate the model. An amphidromic point in the principal semidiurnal tides is seen in the model, centred on the Ronne Ice Shelf. The position of this amphidrome is sensitive to the model parameters, in particular the bottom friction coefficient, However, the available data, although indicating that such a feature may exist, is insufficient to fix its location. Thus the deployment of Bottom Pressure Recorders at either end of the ice shelf should help to pinpoint its position and fix some of the model parameters. In addition, the deployment of a third BPR off the Filchner Ice Shelf should enable an estimate of the tidal energy dissipated under FRIS to be made. These measurements will complement current meter, CTD and bathymetry measurements being made as part of the Ronne Polynya Experiment (ROPEX).

Two further BPRs, one at the southern end of the South Sandwich Islands, the other on the Weddell Sea shelf break, will form part of a continuing programme investigating large-scale coherence of sea-level signals in the Southern Ocean. In addition, the BPR on the shelf break will complement current meter measurements from nearby moorings and will give additional ground truth data for validation of the Weddell Sea tide model.

POL CRUISE OBJECTIVES

1) To deploy two Bottom Pressure Recorders in the deep ocean between the South Sandwich Islands and the Antarctic continental shelf.

2) To deploy three Bottom Pressure Recorders near the Filchner-Ronne Ice Shelf on the continental shelf.

BPR DEPLOYMENTS

Ship Preparation

Two POL personnel, Mike Smithson and Geoff Hargreaves, joined HMS Endurance at East Cove, Mare Harbour in the Falkland Islands on January 12, 1998. The equipment was unpacked from the transport container and loaded into the aft hold of the ship where it was safely stowed for use later. Two container laboratories where loaded onto the forecastle deck since the ship does not have any laboratory space. The ship departed East Cove on 14/1/98 at 08:00 hours, 24 hours later than planned due to a storm off the Falklands coast. It was feared that the storm might damage the container laboratories before reaching the Weddell Sea.

DEPLOYMENT OF POL (CH1) , 18/1/98

EVENTS

01.10 GMT	Arrive on station.
01.23 GMT	Released into the water.
02.16 GMT	On the seabed.

Total time on station: 1 hour 6 minutes.

POL 12 BPR (CH1) Deployment Summary

Acoustic conditions were good, but below 1500m the deck unit had difficulty picking out the transponder reply from the ship's echo sounder. The echo sounder was turned off and the BPR tracked to the seabed.

DEPLOYMENT OF POL 13 BPR (CH2), 20/1/98

EVENTS

21.00 GMT	Vessel on station.
21.06 GMT	Release into the water.
21.58 GMT	On the seabed.

Total time on station: 58 minutes.

POL 13 BPR (CH2) Deployment Summary

Acoustic conditions were good but as the ship drifted off station it became more difficult to receive consistent replies. This may have been because the hull of the ship was masking the transducer.

DEPLOYMENT OF POL 14 BPR (MS1), 1/2/98

EVENTS

19.18 GMT	Vessel on station.
19.21 GMT	Release into the water.
19.32 GMT	On the seabed.

Total time on station: 14 minutes

POL 14 BPR (MS1) Deployment Information

Since the deployment depth is so shallow, very good acoustic communication was achieved to the seabed.

DEPLOYMENT OF POL 15 BPR (MS3), 7/2/98

EVENTS

07.50 GMT	Vessel on station.
07.55 GMT	Released into the water.
08.05 GMT	On the seabed.

Total time on station: 15 minutes

POL 15 BPR (MS3) Deployment Information

The BPR was not monitored during its descent to the seabed due to the amount of time taken to get from the aft deck to the forecastle deck and receive permission from the bridge to deploy the overside transducer. When the acoustic release was interrogated, the BPR was already on the seabed.

DEPLOYMENT OF POL (MS2), 16 9/2/98

EVENTS

16.13 GMT	Vessel on station.
16.15 GMT	Released into the water.
16.22 GMT	On the seabed.

Total time on station: 9 minutes

Deployment of POL 16 BPR (MS2) Information

The BPR was monitored to the seabed, again with good acoustic communication.

CONCLUSION

With these deployments the POL cruise objectives were fully achieved.

APPENDIX 1 - BPR TECHNICAL INFORMATION

DEPLOYMENT OF POL 12 (CH1) INFORMATION

Location details	-	*Latitude*	*59°52.046' S*
		Longitude	*030°06.044' W*
		Depth	*2823m*
On station	-	01.10 GMT on 18/1/98	
Released into the water	-	01.23 GMT	
On seabed	-	02.16 GMT	

The deployment went well given that the Ships Company had not done anything like this before. Once the echo sounder was turned off, good acoustic reception was achieved although a high gain setting of 8 was needed to enable reception at the seabed.

Acoustic Information	-	TR 7000 Acoustics ID 08, Rx 13.5 kHz, Tx 12.0 kHz, Enable A, Disable B, Release C, Pinger D
Radio Beacon	-	Benthos 154.585 MHz Channel A
Logger	-	C1
Logger Information		
Sensor	-	DQ 68486
Timebase Channels		
1	-	Temperature
2	-	Pressure
Sensor Frequencies		
DQ 68486	-	Temperature - 171.709 kHz
	-	Pressure - 33.200 kHz

C1 timebase started at 14.15.00 GMT on 13/1/98. First scan at 14.30.00 GMT on 13/1/98

The first couple of scans will be bad since the EPROM already contained data.

Battery Voltages		
Logger	-	14.69 V
Burnwire	-	28.60 V
Logger Current	-	8.21 mA - powered up 1.64 mA - sleep

DEPLOYMENT OF POL 13 (CH2) INFORMATION

Location details	-	*Latitude 73°41.523' S* *Longitude 034°36.594' W* *Depth 2836m*
On station	-	21.00 GMT on 20/1/98
Released into the water	-	21.06 GMT
On seabed	-	21.58 GMT

The echo sounder was turned off without needing to ask and good acoustic reception was achieved although a high gain setting of 8 was needed to enable reception at the seabed.

Acoustic Information	-	TR 7000 Acoustics ID 02, Rx 11.0 kHz, Tx 12.0 kHz, Enable A Disable B, Release C, Pinger D
Radio Beacon	-	Benthos 154.585 MHz Channel A
Logger	-	C2
Logger Information		
Sensor	-	DQ 68482
Timebase Channels		
1	-	Temperature
2	-	Pressure
Sensor Frequencies		
DQ 68486	-	Temperature - 171.683 kHz
	-	Pressure - 33.260 kHz

C2 timebase started at 23.45.00 GMT on 12/1/98. First scan at 00.00.00 GMT on 13/1/98

The first couple of scans will be bad since the EPROM already contained data.

Battery Voltages		
Logger	-	14.7 V
Burnwire	-	28.4 V
Logger Current	-	9.10 mA - powered up 1.68 mA - sleep

DEPLOYMENT OF POL 14 (MS1) INFORMATION

Location details	-	*Latitude 74° 39.9' S* *Longitude 061° 00.4' W* *Depth 625m*
On station	-	19.18 GMT on 1/2/98
Released into the water	-	19.21 GMT
On seabed	-	19.32 GMT

Given the shallow depth of this deployment, there was very good communication with the acoustic release to the seabed.

Acoustic Information	-	XT 6000 Acoustics Rx 14.5 kHz, Tx 12.0 kHz, Release A
Radio Beacon	-	Novatek 160.725 MHz Channel C
Logger	-	M1
Logger Information		
Sensors	-	DQ 41077 Temp sensor I
Timebase Channels		
1	-	Temperature
2	-	Pressure
3	-	Temperature
Sensor Frequencies		
DQ 68486	-	Temperature - 170.062 kHz
	-	Pressure - 32.174 kHz
I	-	Temperature - 8.190 kHz

M1 timebase started at 22.15.00 GMT on 13/1/98. First scan at 22.30.00 GMT on 13/1/98

The first couple of scans will be bad since the EPROM already contained data.

Battery Voltages		
Logger	-	8.68 V
Burnwire	-	28.4 V
Temp Sensor	-	9.49 V

DEPLOYMENT OF POL 15 (MS3) INFORMATION

Location details	-	*Latitude 76°53.0' S* *Longitude 049°21.0' W* *Depth 376m*
On station	-	07.50 GMT on 7/2/98
Released into the water	-	07.55 GMT
On seabed	-	08.05 GMT

Given the shallow depth of this deployment, there was very good communication with the acoustic release at the seabed. The unit was not monitored to the seabed since there was a communication breakdown with the bridge and this delayed the deploying of the overside transducer. Once the transducer was deployed, the unit was already on the seabed.

Acoustic Information	-	XT 6000 Acoustics Rx 14.0 kHz, Tx 12.0 kHz, Release C
Radio Beacon	-	Novatek 160.725 MHz Channel C
Logger	-	M3
Logger Information		
Sensors	-	DQ 41097 Temp sensor QT 6
Timebase Channels		
1	-	Temperature
2	-	Pressure
3	-	Temperature
Sensor Frequencies		
DQ 68486	-	Temperature - 170.062 kHz
	-	Pressure - 32.174 kHz
QT 6	-	Temperature - 8.189 kHz

M3 timebase started at 20.15.00 GMT on 13/1/98. First scan at 20.30.00 GMT on 13/1/98

The first couple of scans will be bad since the EPROM already contained data.

Battery Voltages		
Logger	-	8.74 V
Burnwire	-	28.2 V
Temp Sensor	-	9.50 V

DEPLOYMENT OF POL 16 (MS2) INFORMATION

Location details	-	*Latitude 76°35.09' S* *Longitude 032°00.4' W* *Depth 389m*
On station	-	16.13 GMT on 9/2/98
Released into the water	-	16.15 GMT
On seabed	-	16.22 GMT

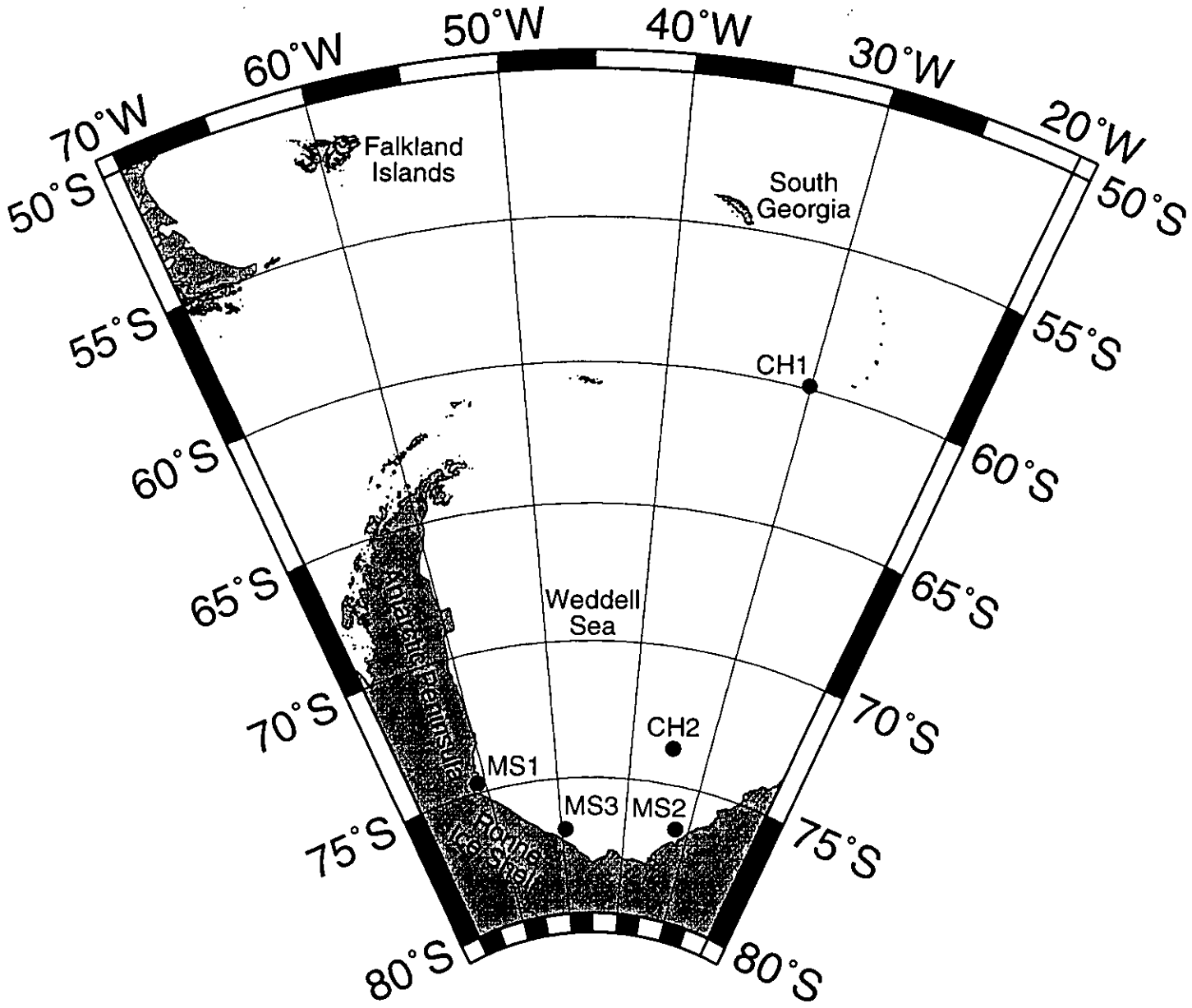
Given the shallow depth of this deployment, there was very good communication with the acoustic release to the seabed.

Acoustic Information	-	XT 6000 Acoustics Rx 11.0 kHz, Tx 12.0 kHz, Release A
Radio Beacon	-	Novatek 160.725 MHz Channel C
Logger	-	M2
Logger Information		
Sensors	-	DQ 41086 Temp sensor
Timebase Channels		
1	-	Temperature
2	-	Pressure
3	-	Temperature
Sensor Frequencies		
DQ 68486	-	Temperature - 170.062 kHz
	-	Pressure - 32.174 kHz

M2 timebase started at 18.30.00 GMT on 13/1/98. First scan at 18.45.00 GMT on 13/1/98

The first couple of scans will be bad since the EPROM already contained data.

Battery Voltages		
Logger	-	8.70 V
Burnwire	-	28.16 V
Temp Sensor	-	9.49 V


70°W
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80°S
Falkland Islands
South Georgia
CH1
Weddell Sea
Antarctic Peninsula
Ronne Ice Shelf
CH2
MS1
MS3
MS2

GLOSSARY

AWI	-	Alfred-Wegener Institute
BAS	-	British Antarctic Survey
BPR	-	Bottom Pressure Recorder
CTD	-	Conductivity, Temperature and Depth Profiler
CRREL	-	Cold Regions Research and Engineering Laboratory
EPROM	-	Erasable Programmable Memory
FRIS	-	Filchner-Ronne Ice Shelf
ROPEX	-	Ronne Polynya Experiment
SOC	-	Southampton Oceanography Centre