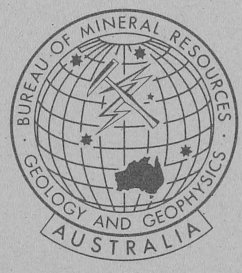

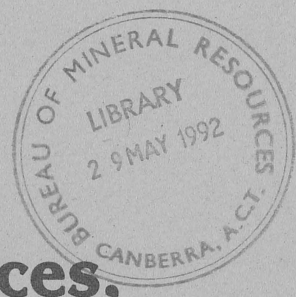

Bureau of Mineral Resources, Geology & Geophysics

R E C O R D

BMR Record 1992/10

EAST ARAFURA BASIN RECONNAISSANCE SURVEY OPERATIONAL REPORT

By

A M G Moore and D C Ramsay

Division of Marine Geosciences & Petroleum Geology

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EAST ARAFURA BASIN RECONNAISSANCE SURVEY OPERATIONAL REPORT

Project 121.31
(Survey 106)

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CONTENTS

SUMMARY

The East Arafura Seismic Reconnaissance Survey, research cruise 106 by the BMR's vessel *Rig Seismic,* took place in late November and December, 1991. The objective was to fill gaps in the seismic coverage of the eastern Arafura Basin, and to tie to other surveys, specifically the BMR's earlier survey 94, recorded in 1990. One well was tied, Arafura-1, the deepest well stratigraphically in the basin. The operation was very successful. A total of 3240 km of seismic reflection profile was acquired on thirteen lines, mainly 48-fold to a record length of eight seconds, but portions of three lines near the eastern edge of the Arafura Basin were recorded 32-fold to a length of 12 seconds. The weather was good, and the data was acquired to high standards and closely monitored. Preliminary results, based on shipboard monitor records, indicate that the Arafura Basin is truncated to the west under the base of the Money Shoal Basin, and also to the east and possibly the south, giving the eastern part of the basin a synclinal form. Refraction velocities at the top of the basin sequence are high, similar to those of the Cambro-Ordovician carbonates in the Arafura-1 and Goulburn-1 wells.

INTRODUCTION

The Arafura Basin (Fig. 1) is the most extensive of the basins underlying the shallow Arafura Sea, and contains a great thickness of Palaeozoic sediments. The west-northwest-trending Goulburn Graben (Bradshaw et al, 1990) within it contains up to 10 kilometres of Palaeozoic sediments. Exploration by a number of oil companies since 1971 (McLennan et al, 1990) has led to partial delineation of the basin sediments and structure, which has been recently reviewed (Petroconsultants, 1989). The eight exploration wells in the basin (Fig. 2) have all been sited on structural targets in the Goulburn Graben, and most of the modern seismic coverage is within it. The majority of the Cambrian and Permo-Triassic sequences remain untested, and extensive areas of the basin outside the graben are virtually unexplored.

In a recent study (Bradshaw et al, 1990), extensive redating of the Cambrian to Devonian sequences and analysis of the regional geology highlighted several important features. These include: late restructuring in the Goulburn Graben and variations in style along its length; Lower Palaeozoic stratigraphic intervals that are of equivalent age to the oil source rocks in the Amadeus and Canning basins; the continuation of the Palaeozoic section north of the graben to the Australian/Indonesian border; the existence of the lower Palaeozoic sequence to the northeast of the Wessel Islands; and the prevalence of relatively low geothermal gradients, thus raising the petroleum potential of the older sequences. This study led to the proposal (Moore et al, 1990) that BMR should acquire a framework of regional seismic traverses of the area.

The first results from Cruise 94 of the BMR's vessel R/V *Rig Seismic* (Napier et al, 1991) demonstrated that the area outside the Goulburn Graben is not as unprospective as previously assumed. Preliminary results indicated a very thick sedimentary sequence north of the graben, with a variety of hydrocarbon plays in what had been dismissed as an unstructured basin (Bradshaw et al, 1991).

It was proposed (Moore, 1991) that the *Rig Seismic* be used for one month in late 1991 to carry out reconnaissance of the eastern Arafura Basin. A total of nearly 2900 kilometres of seismic multifold coverage was expected to be acquired, together with magnetic and gravity data. The aims were to complete the framework of essential seismic reconnaissance in the sparsely-explored and little-known eastern part of the Arafura Basin, to investigate the Wessel Rise and possible northern extensions of the Walker Fault Zone, and to study the relationship of the Arafura Basin to the eastern McArthur Basin and the Carpentaria Basin.

The traverses are shown on Figure 2 as lines 1 to 13. Details of each line are given in Appendix 1 (a). The co-ordinates of the waypoints of the lines are listed in Appendix 1 (b). These are World Geodetic System (WGS) co-ordinates. The parameters of data collection

GEOLOGICAL SETTING

The Arafura Basin is a broad platform sequence situated on the northern margin of Australia, mostly beneath the shallow waters of the Arafura Sea. Structurally it consists of a northern and a southern platform separated by a mid-basin graben, the Goulburn Graben, perhaps analogous to the Fitzroy Graben in the Canning Basin. The Cambrian to Permo-Triassic Arafura Basin sequence is unconformably overlain by the mid-Jurassic to Recent Money Shoal Basin sequence and is underlain by Proterozoic sediments of the McArthur Basin. In the Goulburn Graben (formerly called Arafura Graben, or Money Shoal Graben, or Pre-Mesozoic Graben) there is a Palaeozoic sequence over 10 km in thickness. On the northern and southern 'platforms' there are respectively at least 5 and 3 seconds of seismic two-way time of basinal succession. A top-of-basement reflector is not visible.

BRIEF EXPLORATION HISTORY

The existence of a large Palaeozoic basin to the north of Australia was suspected for many years from the outcropping Cambrian sequence on Elcho Island (Wade, 1924; Plumb, 1965; Plumb et al, 1976) and aeromagnetic surveys (Balke & Burt, 1976). Oil exploration began in the early 1920s with the drilling of several shallow holes (<100 m) on Elcho Island in response to bitumen occurrences (Plumb, 1965). Offshore, Shell drilled Money Shoal-1 in 1971, which primarily tested a Mesozoic sequence. Tests of the Palaeozoic sequence of the Arafura Basin occurred between 1983 and 1986 with the drilling of Tasman-1, Torres-1, Arafura-1, Kulka-1 and Goulburn-1. All of these wells were sited offshore in the southern part of the basin along the Goulburn Graben. There were oil shows in most wells, and four source rock intervals were intersected. Arafura-1 was the most encouraging, encountering oil shows over a gross interval of 425 m in the Devonian and Ordovician, and recording total organic carbon (TOC) values of up to 8.65% in the Middle Cambrian.

Seismic surveys of regional significance and with good subsurface penetration on at least some lines include:

Wessel Marine Seismic Survey 1972, shot by Western Geophysical for Beaver Exploration, Line ID - WM and W.

M81A Seismic Survey 1981, by GSI for Esso, Line ID - M81.

Arafura Sea S81 Survey 1981, by GSI for Sion Resources, Line ID - S81.

AM81 Survey 1981, by GSI for Mincorp, Line ID - AM81.

DS81 Survey 1981, by Western Geophysical for Diamond Shamrock, Line ID - DS-81.

DS84 Survey 1984, by Western Geophysical for Diamond Shamrock, Line ID - DS-84.

Arafura Sea S81 Survey 1981, by GSI for Sion Resources, Line ID - S81.
AM81 Survey 1981, by GSI for Mincorp, Line ID - AM81.
DS81 Survey 1981, by Western Geophysical for Diamond Shamrock, Line ID - DS-81.
DS84 Survey 1984, by Western Geophysical for Diamond Shamrock, Line ID - DS-84.

Recent seismic surveys in the area include:
HA88A Seismic Survey by Halliburton for BHP, Line ID - HA88A, PSLA ID - 88/43.
HA88B Seismic Survey by Halliburton for BHP, Line ID - HA88B, PSLA ID - 89/1.
HA89A and HA89B, 1989, by Halliburton for BHP, Line ID - HA89A and HA89B,
BMR Survey 94, 1990, by R/V *Rig Seismic*, Line ID - BMR94

CRUISE OBJECTIVES

The objectives of cruise 106 were as follows:

- to fill gaps in the seismic coverage of the eastern part of the Arafura Basin and to tie it to seismic traverses in the central part of the basin,

- to investigate the relationship of the Arafura Basin to the Carpentaria Basin and the McArthur Basin,

- to investigate the Wessel Rise and the offshore extension of the Walker Fault Zone.

SYSTEMS PERFORMANCE

NON-SEISMIC SYSTEMS
The non-seismic data acquisition system (DAS) ran for the duration of the cruise with 3 breaks in data collection. One break was related to a fault in the disc drive connections and 4 hours and 27 minutes of data were lost. The cause of the second computer crash is unclear however 5 minutes of data were lost. Lastly, a power drop resulted in the loss of 21 minutes of data.

NAVIGATION
Positioning of the ship is derived from three systems: Navstar Global Positioning System with and without differential correction data (DGPS and GPS), and dead reckoning with updates from the U.S. Navy Navigation Satellite System (Transit satnavs). The 2 GPS systems use the same satellites however all onboard equipment is completely independent.

All ship positions are calculated in the WGS84 coordinate system.

Navstar Global Positioning System

The DGPS system consists of a Trimble 4000 series GPS receiver, a Racal satellite data demodulator and Racal supplied software running on a Compaq 386 PC. The Trimble receiver provides basic GPS data. Psuedo-range corrections are transmitted from a reference station operated by Racal via a geostationary satellite. The supplied software incorporates the data and corrections to provide DGPS positioning and provides the operator with a monitoring and control interface. The positioning data is in turn read by the DAS navigation computer. During this survey 2 identical systems were run using separate Trimble receivers and PCs. Reference stations in Darwin and Cairns provided differential corrections, with both systems being able to use either station. In addition, software was available to download Almanacs from the receivers and predict in advance DGPS satellite availability and quality.

GPS positions without corrections are also obtained from the onboard Magnavox T-Set receiver.

Both systems use the GPS coarse/acquisition code. This provides the T-Set system with positioning within 35 metres rms under optimum conditions. Racal estimate the error in DGPS to be 7.5 m at a distance of 900 km from the reference station with a horizontal dilution of precision of 1.5.

At present the system is still in the experimental stage with only 16 of the proposed 18 satellites in functioning orbit and the U.S. Department of Defence continues to test and reposition the satellites. Generally the DGPS provides positioning data to within 5m, however during survey 106 testing degraded the data quality noticeably, with more periods of poor data quality than usual and degraded speed and course data.

Dead Reckoning Systems

Dead Reckoning is provided by incorporating a gyro compass, dual axis sonar-doppler and Transit satnav receiver for periods when the other navigation systems prove inadequate.

The primary dead reckoning system of Sperry gyro-compass, Magnavox MX610D sonar-doppler and MX1107RS dual channel satnav receiver provides one of the best available positioning systems of this type. A lower grade system of Sperry gyro, Raytheon DSN450 sonar-doppler and MX1142 single channel satnav receiver is used as a backup. A SG-Brown gyro-compass is also available.

The sonar-dopplers were calibrated prior to the survey, however the calibration of the Raytheon sonar-doppler is still in doubt. The Magnavox calibration is good and during periods of bad DGPS data the Magnavox dead-reckoning system was used to provide the

bridge with reliable speed data; during these periods the position data of the DGPS was often accurate enough to tie the ship's position to but the speed and course data were too erratic for on-line navigation.

BATHYMETRY

Bathymetric data were obtained from a Raytheon echo-sounder operating at 12 kHz with a maximum output of 2 kW. The recorded data require a shift of 6 metres to relate to sea surface.

GRAVITY

Gravity data were obtained throughout the survey using a Bodenseewerk KSS-31 Marine Gravity meter with no problems.

MAGNETICS

Magnetics data were collected whenever possible during seismic acquisition using a Geometrics G801/803 marine proton precession magnetometer. With the exception of some brief periods noise levels were typically of the order of 2-3 nT, and some distinct anomalies were noted, including one at the Arafura-1 well site, generated by artefacts left at the well site.

SEISMIC SYSTEM

The seismic acquisition system described in Appendix 3 was essentially trouble-free during all periods of data collection, with the exception of some minor problems with the Phoenix, which controls the sampling and conversion of the data. The Phoenix is a 6000 series high level analogue data acquisition system containing the BMR-ESU designed IFP (instantaneous floating point amplifier), and controls the sampling and conversion of the data.

Channels 79 and 123 were dead for the duration of the survey.

During all periods of data acquisition the shot interval was controlled by speed data from the navigation computer. Shot point data were recorded by the navigation computer to provide tying of the seismic data to shotpoints during navigation processing. A Fjord Instruments programmable seismic cable was used, with depth control from Syntron DCL-3 birds. Three Syntron compass units were also installed on the seismic cable, providing additional information about cable location. Birds were positioned every 400 m along the cable.

PRELIMINARY RESULTS

The results of seismic data of the previous survey 94 processed to date, supplemented by hints on shipboard monitors during survey 106, indicate the presence of a thick Palaeozoic sub-basin, lying under the Mesozoic Money Shoal Basin to the north of the Goulburn Graben. The sub-basin is quite large in terms of areal extent: the boundaries are as yet unclear, however it would appear to cover at least 56,000 sq. kms within Australian territorial waters, and it extends northward into Indonesian territory.

The sediments contained within the sub-basin are thought to be of Early Palaeozoic age. Refraction velocities of about 5500 m/second are slightly slower than the interval velocities of the Cambro-Ordovician carbonates intersected in the Arafura-1 and Goulburn-1 wells. Shipboard monitors from the area north of NT/P42 clearly show westward truncation of the sub-basin (Fig. 3). It follows that it thickens and becomes younger toward the northeastern portion. The monitor records also indicate, less clearly, that the later Palaeozoic is eroded off around the eastern and southern edges of the Arafura Basin. It follows that the northeastern Arafura Basin has a general synclinal shape. The overlying Money Shoal Basin is very thin, generally less than 300 m, in the eastern Arafura Basin, deepening westward.

The quality of the seismic data recorded is expected to be very good compared to that previously available, and will facilitate the interpretation stage of the project. Further assessment of the area must await completion of the seismic processing.

ACKNOWLEDGEMENTS

We thank the Master, Bob Hardinge, and the crew of the R/V *Rig Seismic* for their co-operation in bringing the East Arafura Basin Reconnaissance Survey to a successful conclusion, noting especially their skill and knowledge in navigation of the shallow waters around the Wessel Islands and south of 11 degrees latitude.

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ILLUSTRATIONS

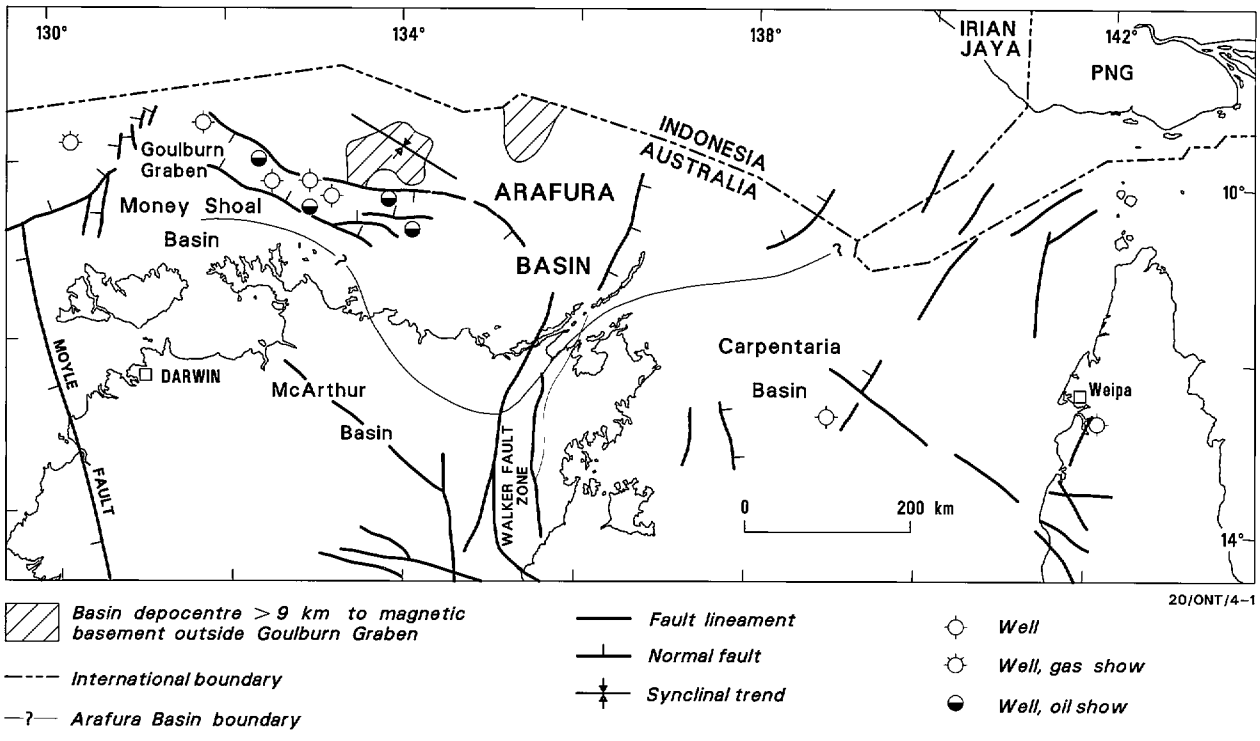

FIGURE 1 THE ARAFURA BASIN, SHOWING MAJOR FAULTS

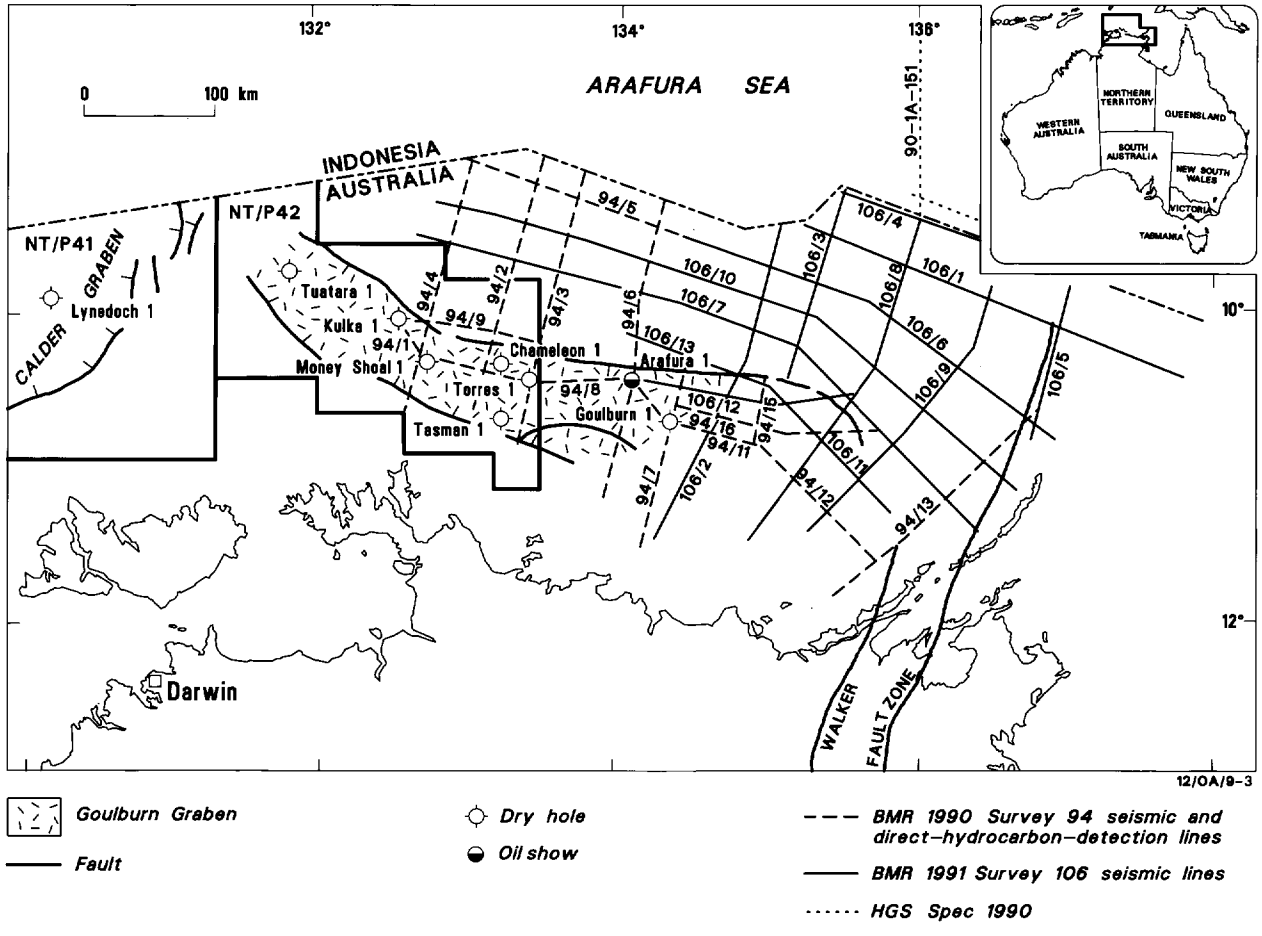

FIGURE 2 SURVEY LOCATION MAP SHOWING THE SEISMIC LINES OF BMR SURVEYS 94 AND 106, WITH WELLS, PERMITS AND THE GOULBURN GRABEN

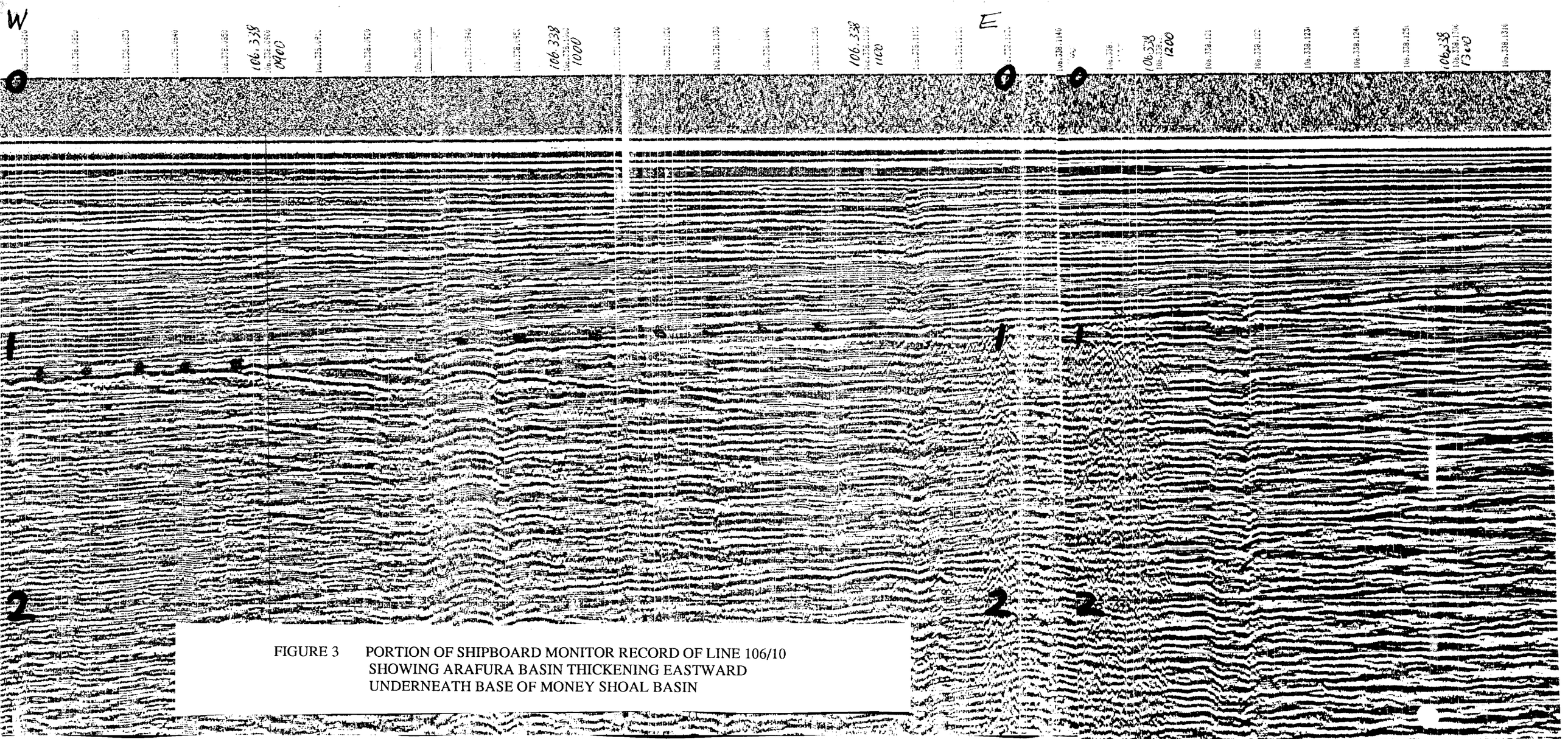

FIGURE 3 PORTION OF SHIPBOARD MONITOR RECORD OF LINE 106/10 SHOWING ARAFURA BASIN THICKENING EASTWARD UNDERNEATH BASE OF MONEY SHOAL BASIN

APPENDIX 1 (a)
DETAILED LINE SUMMARY

BMR Survey 106 - East Arafura

Line No. 106/01(a)

Date: 20 November 1991

Ship's Speed: 5 Knots

Heading: 291 degrees

Shot Spacing: 37.5 m

Shot Interval: 15.0 seconds

CDP Spacing: 6.25 m

Coverage: 32 fold

Seismic Source: 2 x 1500 c.i. Sleeve Air Guns

Source depth: 10 m

Seismic Cable:

Active Length: 2400 m
Group Length: 12.5 m
Number of Channels: 192
Leading Channel: 1
Near Offset: 179 m
Far Offset: 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms

Record Length: 12000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 129 km (69 Nautical miles) for part A

Number of good Shots 3428

Number of Field Tapes: 43

First good Shot: 212
Last good Shot: 3640

First good Tape: 106/002
Last good Tape: 106/43

Comments for Line 106/01 (a):

Offset at start of line, near=179, far=2567
SP 171 - SP 210 start of line tests
SP 211 - First good shot
SP 1047 - Offset changed, near=184, far=2572
SP 1370 - Offset changed, near=189, far=2577
SP 2949 - Offset changed, near=1179, far=2567
SP 2950 - 2993 Low air pressure (<1600 psi)
SP 3640 - Last good shot
SP 3645 - 3700 Tests
Loop carried out to check wear and tear on guns

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/05	325.0336	329.2251	10 4.367	136 51.039

Line No. 106/01 (b),(c)

Date: 21 November 1991

Ship's Speed: 4.5 Knots

Heading: 291 degrees

Shot Spacing: 25 m

Shot Interval: 10.8 seconds

CDP Spacing: 6.25 m

Coverage: 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns

Source depth: 10 m

Seismic Cable:

Active Length: 2400 m
Group Length: 12.5 m
Number of Channels: 192
Leading Channel: 1
Near Offset: 179 m
Far Offset: 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms

Record Length: 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 180 km (97.5 Nautical miles) for parts (b) & (c)

Number of good Shots 4241 (b), 3150 (c)

Number of Field Tapes: 69

First good Shot: 4004(b), 9124(c)
Last good Shot: 8245(b), 12104(c)

First good Tape: 106/046(b), 106/084(c)
Last good Tape: 106/086(b), 106/113(c)

Comments for Line 106/01 (b) & (c):

Line parameters changed between line 1 and 1(b)(c).
Offset at start of line, near=180, far=2567
SP 3900 - 4000 Tests
SP 4004 - First good shot
SP 4056 - 4063 Noise test
SP 4632 - Missed equiv of 2 shots to let compressors catch up.
SP 4160 - Offset changed, near=184, far=2572
SP 4682 - 2 Guns off, running with 18 (4,3,1,1 x 2)
SP 4927 - 2 guns off, running with 16 (4,3,1 x 2)
SP 5072 - 2 guns on, running with 18 (4,3,1,1 x 2)
SP 9124 - Offset changed, near=174, far=2562
SP 8245 - Last good shot
Loop for gun overhaul - start 1(c)
SP 9002 - Start tape drives
SP 9007 - 9114 Tests
SP 9124 - First good shot after loop
High feather angle for much of line
SP 10130 - Offset changed, near=179, far=2567
SP 12104 - Last good shot
SP 12110 - 12150 Tests
SP 12153 - Stop recording

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/09	325.1446	334.1515	9 53.288	136 22.445
106/08	325.2140	333.2108	9 41.837	135 53.762
106/03	326.0956	328.0026	9 29.031	135 24.210

BMR Survey 106 - East Arafura

Line No. 106/02

Date: 23 November 1991

Ship's Speed: 4.5 Knots

Heading: 193 degrees

Shot Spacing: 25.0 m

Shot Interval: 10.8 seconds

CDP Spacing: 6.25 m

Coverage: 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns

Source depth: 10 m

Seismic Cable:

Active Length: 2400 m
Group Length: 12.5 m
Number of Channels: 192
Leading Channel: 1
Near Offset: 179 m
Far Offset: 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms

Record Length: 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 108 km (58 Nautical miles)

Number of good Shots 4326

Number of Field Tapes: 40

First good Shot: 222
Last good Shot: 4548

First good Tape: 106/115
Last good Tape: 106/154

Comments for Line 106/02:

Offset at start of line, near=179, far=2567
SP 102 - SP 221 start of line tests
SP 222 - First good shot
Feathering angle consistantly high (>15 deg) for whole of line
SP 1030 - Offset changed, near=174, far=2562
SP 2910 - Offset changed, near=179, far=2567
SP 4548 - Last good shot
Tests
SP 4616 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/06	326.2035	331.2240	9 39.301	134 57.801
106/10	326.2341	340.0450	9 52.776	134 54.582
106/07	327.0233	332.2000	10 5.488	134 51.649

BMR Survey 106 - East Arafura

Line No. 106/202 **Date:** 10 December 1991

Ship's Speed: 4.4 Knots **Heading:** 206 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 174 m **Far Offset:** 2562 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 150 km (81 Nautical miles)

Number of good Shots 5060(a), 1083(b) **Number of Field Tapes:** 58

First good Shot: 171(a), 5558(b)
Last good Shot: 5230(a), 6640(b)

First good Tape: 106/1041(a), 106/1087(b)
Last good Tape: 106/1089(a), 106/1099(b)

Comments for Line 106/0202:

Offset at start of line, near=174, far=2562
SP 105 - SP 160 start of line tests
SP 171 - First good shot
SP 197 - Autofire
SP 616 - Offset changed, near=179, far=2567
SP 1412 - Offset changed, near=184, far=2572
SP 1670 - Offset changed, near=189, far=2577
SP 5230 - Last good shot
Loop
SP 5401 - Restart acquisition after loop
SP 5404 - 5540 Tests
SP 5558 - First good shot
SP 6640 - Last good shot
SP 6651 - SP 6691 Tests
SP 6698 - Acquisition stopped

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/13	344.1115	347.2315	10 24.630	134 45.564
106/12	344.1309	346.2254	10 32.325	134 41.759
94/16	334.1519	94.082.1400	10 41.068	134 37.452
94/11	334.1715	94.077.1265	10 48.994	134 33.550

BMR Survey 106 - East Arafura

Line No. 106/03 **Date:** 23 November 1991

Ship's Speed: 4.5 Knots **Heading:** 17 degrees

Shot Spacing: 25.0 m **Shot Interval:** 10.8 seconds

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 184 m **Far Offset:** 2571 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 149 km (81 Nautical miles)

Number of good Shots 5972 **Number of Field Tapes:** 57

First good Shot: 277 **First good Tape:** 106/157
Last good Shot: 6249 **Last good Tape:** 106/213

Comments for Line 106/03:

Offset at start of line, near=184, far=2571
SP 103 - SP 275 start of line tests
SP 277 - First good shot
SP 2230 - Offset changed, near=189, far=2576
SP 3020 - Offset changed, near=194, far=2581
SP 5445 - 5452 parity errors and may be missing shots on tape 106/205
SP 6249 - Last good shot
Tests
SP 6303 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/702	327.1354	336.0211	10 14.132	135 09.743
106/10	327.1716	340.0925	9 59.886	135 14.557
106/06(b)	327.2006	331.1750	9 47.712	135 18.217
106/01	328.0026	326.0956	9 28.909	135 24.038
106/04	328.0447	328.1027	9 10.127	135 29.883

BMR Survey 106 - East Arafura

Line No. 106/04 **Date:** 24 November 1991

Ship's Speed: 4.5 Knots **Heading:** 110 degrees

Shot Spacing: 25.0 m **Shot Interval:** 10.8 seconds

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 184 km (99 Nautical miles)

Number of good Shots 7358 **Number of Field Tapes:** 68

First good Shot: 265 **First good Tape:** 106/215
Last good Shot: 7623 **Last good Tape:** 106/282

Comments for Line 106/04:

Offset at start of line, near=179, far=2567
SP 105 - SP 143 start of line tests
SP 265 - First good shot
SP 3988 - Offset changed, near=174, far=2562
SP 7038 - Offset changed, near=179, far=2567
SP 7623 - Last good shot
Tests
SP 7689 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/03	328.1027	328.0447	9 10.161	135 29.866
106/08	328.1737	334.0155	9 21.153	136 00.427
106/09	329.0008	334.1015	9 31.470	136 28.967
106/05	329.0641	329.1741	9 41.707	136 67.517

BMR Survey 106 - East Arafura

Line No. 106/05 **Date:** 26 November 1991

Ship's Speed: 4.5 Knots **Heading:** 193 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 127 km (69 Nautical miles)

Number of good Shots 5092 **Number of Field Tapes:** 48

First good Shot: 174 **First good Tape:** 106/284
Last good Shot: 5266 **Last good Tape:** 106/331

Comments for Line 106/05:

Offset at start of line, near=179, far=2567
SP 101 - SP 170 start of line tests
SP 174 - First good shot on tape 106/284
SP 251 - 254 guns turned off for amplifier test
SP 5266 - Last good shot
Tests
SP 5318 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/04	329.1740	329.0641	9 41.504	136 56.473
106/01	329.2251	325.0336	10 04.435	136 51.052
106/06	330.0737	330.1548	10 42.890	136 41.902

BMR Survey 106 - East Arafura

Line No. 106/06 (a) **Date:** 26 November 1991

Ship's Speed: 5.0 Knots **Heading:** 307 degrees

Shot Spacing: 37.5 m by navigation with 0.25 knot window around 5.0 knots

CDP Spacing: 6.25 m **Coverage:** 32 fold

Seismic Source: 2 x 1500 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 12000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 83 km (45 Nautical miles)

Number of good Shots 2210 **Number of Field Tapes:** 27

First good Shot: 192 **First good Tape:** 106/333
Last good Shot: 2402 **Last good Tape:** 106/360

Comments for Line 106/06 (a):

Offset at start of line, near=179, far=2567
SP 106 - SP 140 start of line tests
SP 192 - First good shot on tape 106/333
SP 188 - Tape 106/332 only has chans 1-203, tape reached EOT marker
SP 277 - Tape 106/333 only has chans 1-55, tape reached EOT marker
SP 363 - Tape 106/334 only has chans 1-198, tape reached EOT marker
SP 520 - Offset changed, near=184, far=2572
SP 1842, 1843, 1844, 1849, 1850, 1851, 1852 - Autofires on tape 106/347
SP 2402 - Last good shot
Tests

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/05	330.1548	330.0737	10 42.993	136 41.865
94/013	330.1620	94.079.2128	10 41.349	136 39.712

BMR Survey 106 - East Arafura

Line No. 106/06 (b) &(c) **Date:** 27 November 1991

Ship's Speed: 4.5 Knots **Heading:** 307 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 184 m **Far Offset:** 2572 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 233 km (126 Nautical miles)

Number of good Shots 1201(b), 8243(c) **Number of Field Tapes:** 88

First good Shot: 2414(b), 3989(c) **First good Tape:** 360(b), 373(c)
Last good Shot: 3615(b), 12232(c) **Last good Tape:** 371(b), 448(c)

Comments for Line 106/06 (b) & (c):

Offset at start of line part, near=184, far=2572
SP 2403 - Change to 18 guns,8 sec record, 4.5 knots, 25 m shot distance
SP 2414 - first good shot on tape 106/360
SP 2908 or 2909 Autofire
SP 3615 - Last good shot
Loop to service guns
SP 3801 - Start acquisition
SP 3812 - 3900 tests
SP 3948 - First good shot
SP 3984 - 3988 noise test
SP 3989 - First good shot
SP 3910 - Offset changed, near=174, far=2561
SP 3964 - Offset changed, near=169, far=2557
SP 4040 - Offset changed, near=164, far=2552
SP 5426 - Offset changed, near=169, far=2557
SP 5866 - Offset changed, near=174, far=2562
SP 9350 - Offset changed, near=179, far=2567
SP 10840 -Transit navigation as DGPS ceased to be written to tape
SP 12232 - Last good shot
SP 12240 - 12286 Tests
SP 12306 - Suspend acquisition

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/09	330.2305	334.2150	10 21.217	136.12.416
106/08	331.1043	333.1620	10 2.336	136 46.853
106/03	331.1750	327.2006	9 47.739	135 18.279
106/02	331.2240	326.2035	9 39.154	134 58.105

BMR Survey 106 - East Arafura

Line No. 106/07 **Date:** 28 November 1991

Ship's Speed: 4.5 Knots **Heading:** 110 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 174 m **Far Offset:** 2562 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 117 km (63 Nautical miles)

Number of good Shots 4724 **Number of Field Tapes:** 44

First good Shot: 216 **First good Tape:** 106/451
Last good Shot: 4940 **Last good Tape:** 106/494

Comments for Line 106/07:

Offset at start of line, near=174, far=2562
SP 103 - SP 212 Start of line tests
SP 213 - First good shot on tape 106/451
SP 1930 - Offset changed, near=179, far=2567
SP 3844 - 3940 Gain and filter settings dropped out in 1 amp box
SP 4220 - Offset changed, near=174, far=2562
SP 4226 - Data collection errors to EOL
SP 4234 - Forced tape change 106/487 to 106/488
SP 4940 - Last good shot
Tests
SP 5004 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/02	332.2000	327.0233	10 5.446	134 51.610

BMR Survey 106 - East Arafura

Line No. 106/702 (or 7b) **Date:** 2 December 1991

Ship's Speed: 4.5 Knots **Heading:** 316 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 109 km (59 Nautical miles)

Number of good Shots 4347 **Number of Field Tapes:** 41

First good Shot: 200 **First good Tape:** 106/620
Last good Shot: 4546 **Last good Tape:** 106/660

Comments for Line 106/702:

Offset at start of line, near=179, far=2567
SP 103 - SP 159 start of line tests
SP 200 First good shot
SP 3073 - Offset changed(near=174, far=2562)
SP 4546 - Last good shot
Tests
SP 4643 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/09	335.1422	335.0638	10 52.408	135 47.512
94/014	335.1639	94.081.0345	10 45.204	135 40.291
106/12	335.2029	346.1247	10 32.699	135 27.799
106/08	335.2030	333.0825	10 32.644	135 27.774
106/03	336.0211	327.1354	10 14.097	135 09.763

BMR Survey 106 - East Arafura

Line No. 106/703 (a) & (b) **Date:** 3 December 1991

Ship's Speed: 4.5 Knots **Heading:** 284 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 195 km (107 Nautical miles)

Number of good Shots 3135(a), 5225(b) =8360 **Number of Field Tapes:** 41

First good Shot: 220 (a), 3765(b)
Last good Shot: 3355(a), 8990(b)

First good Tape: 106/663(a), 106/691(b)
Last good Tape: 106/691(a),106/742(b)

Comments for Line 106/703 (a) & (b):

Offset at start of line, near=179, far=2567
SP 103 - SP 200 start of line tests
SP 220 - First good shot
SP 2960 - Offset changed, near=174, far=2562
SP 3355 - Last good shot
Loop
End of loop offset changed , near 179, far 2567
SP 3765 - First good shot
SP 3973 - 3981 guns off for noise test
SP 5123 - 5130 Guns off for noise test
SP 5425 - Gun array down to 16 guns- compressors could not keep up
SP 5456 - Gun array back to 18 guns
SP 5502 - Gun array to 16 guns
SP 5587 - Gun array to 18 guns
SP 7630 - Offset changed, near=174, far=2562
SP 7995 - Offset changed, near=169, far=2557
SP 8266 - Offset changed, near=164, far=2552
SP 8990 - Last good shot
SP 9048 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
94/06	336.1936	94.071.2008	9 51.646	134 06.733
94/03	337.1115	94.062.0930	9 43.776	133 34.759
94/02	337.1515	94.060.2030	9 39.702	133 17.155
94/04	337.2040	n/a	9 33.478	132 52.996

BMR Survey 106 - East Arafura

Line No. 106/704 **Date:** 8 December 1991

Ship's Speed: 4.8 Knots **Heading:** 316 degrees

Shot Spacing: 37.5 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 32 fold

Seismic Source: 2 x 1500 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 12000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 85 km (46 Nautical miles)

Number of good Shots 2286 **Number of Field Tapes:** 30

First good Shot: 205 **First good Tape:** 106/925
Last good Shot: 2490 **Last good Tape:** 106/954

Comments for Line 106/704:

Offset at start of line, near=179, far=2567
SP 123 - SP 190 start of line tests
SP 205 - First good shot
SP 365 - Offset changed, near=184, far=2572
SP 545 - Offset changed, near=189, far=2577
SP 709 - 711 Bad block error
SP 1835 - Offset changed, near=184, far=2572
SP 1953 - Offset changed, near=179, far=2567
SP 2267 - Offset changed, near=174, far=2562
SP 2490 - Last good shot
SP 2491 - 2535 Tests
SP 9048 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
94/13	341.2243	94.079.1123	11 13.388	136 07.802
106/902	342.0440	342.1044	10 52.406	135 47.488
106/09	342.0445	335.0638	10 52.172	135 47.263

BMR Survey 106 - East Arafura

Line No. 106/08 **Date:** 29 November 1991

Ship's Speed: 4.5 Knots **Heading:** 32 & 16 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 174 m **Far Offset:** 2562 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 153 km (83 Nautical miles)

Number of good Shots: 6130 **Number of Field Tapes:** 55

First good Shot: 212 **First good Tape:** 106/496
Last good Shot: 6342 **Last good Tape:** 106/551

Comments for Line 106/08:

Offset at start of line, near=174, far=2562
SP 105 - SP 210 start of line tests
SP 212 - First good shot
SP 624 - 650 (approx) lost 1st 24 chans (no filters, maybe no amps)
SP 1382 - Gain 8
SP 1386 - Gain 16
SP 1460 - Gain 8
Sp 1465 - Gain 16
SP 1630 - Offset changed, near=179, far=2567
SP 3275 - Dogleg turn from 32 to 16 deg
SP 3367,3368 Autofires
SP 4490 - 4550 (approx) lost all chans in some of these shots
SP 4900 - 4906 lost 1st 24 chans (no filters or amps)
SP 5130 - Offset changed, near=184, far=2572
SP 6342 - Last good shot
No tests carried out - close to Indonesia/Australia boundary, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/07(02)	333.0825	335.2030	10 32.681	135 27.849
106/10	333.1217	340.1548	10 17.957	135 36.993
106/06	333.1620	331.1043	10 02.348	135 46.930
106/01	333.2108	325.2140	9 41.804	135 53.864
106/04	334.0155	328.1737	9 21.183	136 00.308

BMR Survey 106 - East Arafura

Line No. 106/802 **Date:** 12 December 1991

Ship's Speed: 4.5 Knots **Heading:** 32 & 16 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 133 km (72 Nautical miles)

Number of good Shots 5325 **Number of Field Tapes:** 49

First good Shot: 165 **First good Tape:** 106/1100
Last good Shot: 5489 **Last good Tape:** 106/1148

Comments for Line 106/802:

Offset at start of line, near=179, far=2567
SP 104 - SP 163 start of line tests
SP 165 - First good shot
High feather angle for last third of line
SP 5489 - Last good shot
SP 5404 - 5560 Tests
SP 5569 - Stop acquisition

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
94/12	345.2212	94.077.2112	11 6.059	135 6.370
106/11	346.0242	343.1912	10 48.846	135 17.446
94/14	346.0315	94.081.0902	10 46.720	135 18.821
106/702	346.0655	335.2030	10 32.727	135 27.817
106/12	436.0656	346.1247	10 32.727	135 27.817

BMR Survey 106 - East Arafura

Line No. 106/09 **Date:** 30 November 1991

Ship's Speed: 4.5 Knots **Heading:** 195 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 177 km (96 Nautical miles)
Number of good Shots 7095 **Number of Field Tapes:** 68

First good Shot: 185 **First good Tape:** 106/552
Last good Shot: 7279 **Last good Tape:** 106/619

Line No. 106/902 **Date:** 8 December 1991

Ship's Speed: 4.5 Knots **Heading:** 223 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 179 m **Far Offset:** 2567 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 87 km (47 Nautical miles)

Number of good Shots 4284 **Number of Field Tapes:** 37

First good Shot: 215 **First good Tape:** 106/957
Last good Shot: 4498 **Last good Tape:** 106/993

Comments for Line 106/902:

Offset at start of line, near=179, far=2567
SP 156 - SP 200 start of line tests
SP 215 - First good shot
SP 1750 - Offset changed, near=184, far=2572
SP 2054 - Offset changed, near=189, far=2577
SP 3000 - Last good shot
Loop
SP 3204 - Acquisition resarted
SP 3221 - 3285 Tests
SP 3297 - First good shot
SP 4489 - Last good shot
Tests

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/704	342.1044	342.0440	10 52.409	135 47.399
106/11	342.1503	342.1354	11 06.379	135 33.939
94/12	342.2320	94.078.0122	11 20.414	135 20.402

BMR Survey 106 - East Arafura

Line No. 106/010 **Date:** 4 December 1991

Ship's Speed: 4.5 Knots **Heading:** 107 & 144 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 164 m **Far Offset:** 2552 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 480 km (259 Nautical miles)

Number of good Shots 19240 **Number of Field Tapes:** 178

First good Shot: 172(a), 7787(b), 16790(c)
Last good Shot: 7471(a), 16435(b), 20083(c)

First good Tape: 106/743(a) , 106/812(b), 106/891(c)

Last good Tape: 106/809(a) , 106/890(c), 106/922(c)

Comments for Line 106/10:

Offset at start of line, near=164, far=2552
SP 102 - SP 149 start of line tests
SP 172 - First good shot
SP 2384 - Offset changed(near=169, far=2557)
SP 5254 - Offset changed(near=174, far=2562)
SP 6090 - Offset changed(near=179, far=2567)
SP 7099 - Offset changed(near=184, far=2572)
SP 7471 - Last good shot
Loop
SP 7703 - 7785 Tests
SP 7787 - First good shot
SP 8485 - Offset changed(near=184, far=2572)
SP 8633 - Offset changed(near=189, far=2577)
SP 9186 - Offset changed(near=194, far=2582)
SP 10930 - Offset changed(near=189, far=2577)
SP 11115 - Offset changed(near=184, far=2572)
SP 11670 - Offset changed(near=179, far=2567)
SP 11750 - Offset changed(near=174, far=2562)
SP 15150 - Offset changed(near=169, far=2557)
SP 16435 - Last good shot
Loop
Offset changed at start of line (loop)(near=184, far=2572)
SP 16608 - 16778 Tests
SP 16790 - First good shot
SP 19763 - 19769 Noise test
SP 20083 - Last good shot
SP 20085 - 20160 Tests
SP 20162- Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
94/04	338.0705	94.067.0550	9 16.275	132 56.911
94/02	338.1245	94.060.2340	9 23.622	133 21.610
94/03	338.1635	94.062.0121	9 28.669	133 38.696
94/06	338.2345	94.071.1700	9 37.917	133 09.842
106/02	340.0450	326.2341	9 52.787	134 54.564
106/03	340.0925	327.1716	9 59.865	135 14.460
106/08	340.1548	333.1217	10 17.908	135 36.982
106/09	341.0302	335.0232	10 38.149	135 59.161
94/13	341.0952	94.079.1600	10 58.702	136 22.352

BMR Survey 106 - East Arafura

Line No. 106/011 **Date:** 9 December 1991

Ship's Speed: 4.5 Knots **Heading:** 317 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 184 m **Far Offset:** 2572 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 123 km (67 Nautical miles)

Number of good Shots 4971 **Number of Field Tapes:** 47

First good Shot: 238 **First good Tape:** 106/994
Last good Shot: 5209 **Last good Tape:** 106/1040

Comments for Line 106/11:

Offset at start of line, near=184, far=2572
SP 121 - SP 235 start of line tests
SP 238 - First good shot
Chans 190 and 192 dead for whole line
Chans 188 and 189 noisy or dead for some of the line
SP 2384 - Offset changed(near=189, far=2577)
SP 5209 - Last good shot
SP 5211 - SP5267 Tests
SP 5268 - Tests finished, stop recording.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/902	343.1354	342.1503	11 06.347	135 33.961
106/802	343.1913	346.0242	10 48.884	135 17.411
94/14	343.1945	94.081.1200	10 47.102	135 15.743
106/12	343.2330	346.1759	10 34.543	135 03.913

BMR Survey 106 - East Arafura

Line No. 106/12 **Date:** 12 December 1991

Ship's Speed: 4.5 Knots **Heading:** 266 & 278 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 184 m **Far Offset:** 2572 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 165 km (89 Nautical miles)

Number of good Shots 6602 **Number of Field Tapes:** 62

First good Shot: 185 **First good Tape:** 106/1150
Last good Shot: 6787 **Last good Tape:** 106/1211

Comments for Line 106/12:

Offset at start of line, near=184, far=2572
SP 109 - SP 168 start of line tests
SP 185 - First good shot
SP 500 - 800 approx Another ship in area
SP 856 - Offset changed(near=189, far=2577)
SP 2480 - Changed direction from 266 deg to 278 deg
SP 2517 - Offset changed(near=184, far=2572)
SP 5420 - Offset changed(near=179, far=2567)
SP 5644 - Offset changed(near=174, far=2562)
SP 6641 - Arafura No1 well (mag anomaly from wellhead seen)
SP 6787 - Last good shot
SP 6790 - SP 6840 Tests

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
106/802	346.1247	346.0656	10 32.727	135 27.766
106/702	346.1247	335.2029	10 32.727	135 27.766
106/11	346.1759	343.2330	10 34.559	135 03.907
94/15	346.2008	94.082.0210	10 34.058	134 54.250
106/202	346.2254	344.1309	10 32.285	134 41.765
94/07	347.0313	94.074.0215	10 29.527	134 22.000
Arafura No1	347.0719	N/A	10 27.000	134 03.351

BMR Survey 106 - East Arafura

Line No. 106/13 **Date:** 13 December 1991

Ship's Speed: 4.5 Knots **Heading:** 110 degrees

Shot Spacing: 25.0 m by navigation with 0.25 knot window around 4.5 knots

CDP Spacing: 6.25 m **Coverage:** 48 fold

Seismic Source: 2 x 1350 c.i. Sleeve Air Guns **Source depth:** 10 m

Seismic Cable:

Active Length: 2400 m **Group Length:** 12.5 m
Number of Channels: 192 **Leading Channel:** 1
Near Offset: 169 m **Far Offset:** 2557 m
Nominal Cable Depth: 10 m

Sample Rate: 2 ms **Record Length:** 8000 ms

Field Tape Format: B.M.R. 16 BIT Floating Point SEG-Y Cartridges

Distance from Navigation Antenna to Source Centre: 83 m

Line Length: 113 km (61 Nautical miles)

Number of good Shots 4497 **Number of Field Tapes:** 42

First good Shot: 264 **First good Tape:** 106/1213
Last good Shot: 4760 **Last good Tape:** 106/1254

Comments for Line 106/13:

Offset at start of line, near=169, far=2557
SP 119 - SP 229 start of line tests
SP 264 - First good shot
SP 983 - Offset changed(near=174, far=2562)
SP 1250 - 1275 (approx) Another ship in area
SP 2075 - Offset changed(near=179, far=2567)
SP 3698 - Offset changed(near=174, far=2562)
SP 4760 - Last good shot
SP 4770 - 4830 Tests
SP 4831 - Suspend acquisition, project completed.

Line Intersects

Line #	Time (for this line)	Time (for other line)	Latitude (in Deg Min)	Longitude (in Deg Min)
94/06	347.1412	94.072.0622	10 10.642	134 6.134
94/07	347.1841	94.074.0509	10 17.450	134 25.345
106/202	347.2315	344.1115	10 24.613	134 45.606
94/15	348.0128	94.082.0340	10 28.030	134 55.252

APPENDIX 1(b)

EAST ARAFURA SEISMIC
CRUISE 106 WAY POINTS

Line number	Waypoint no.	Waypoint	Latitude	Longitude	line length SOL to EOL
106/001	WP2	SOL	S10 21.35	E137 34.954	295 km
	WP3	WP	S09 44.595	E136 00.0	
	WP4	EOL	S09 24.86	E135 12.97	
106/002	WP4	SOL	S09 24.86	E135 12.97	250 km
	WP5	EOL	S10 18.35	E134 48.649	
106/003	WP6	SOL	S10 24.59	E135 06.756	150 km
	WP7	EOL	S09 09.73	E135 30.0	
106/004	WP8	SOL	S09 09.73	E135 28.65	185 km
	WP9	WP	S09 21.00	E136 00.0	
	WP10	EOL	S09 42.70	E137 00.0	
106/005	WP11	SOL	S09 40.80	E136 58.0	126 km
	WP12	EOL	S10 45.135	E136 41.39	
106/006	WP13	SOL	S10 47.84	E136 48.33	312 km
	WP14	WP	S10 11.89	E136 00.0	
	WP15	WP	S09 53.45	E135 34.64	
	WP16	WP	S09 29.1	E134 25.0	
106/007	WP17	EOL	S09 56.18	E134 25.09	488 km
	WP18a	WP	S10 09.68	E135 03.77	
	WP18b	WP	S10 12.68	E135 08.53	
106/007-8	WP19	EOL/SOL	S10 32.73	E135 27.82	280 km
	WP19a	WP	S09 58.91	E135 49.09	
	WP20	EOL	S09 20.18	E136 00.55	
106/009	WP21	SOL	S09 30.82	E136 29.18	264 km
	WP22	WP	S10 20.18	E136 14.18	
106/009-7	WP23	EOL/SOL	S10 52.36	E135 47.45	
	WP24	EOL	S11 26.18	E136 20.18	
106/010	WP25	SOL	S11 09.82	E136 34.91	483 km
	WP26	WP	S10 01.09	E135 17.45	
	WP27	EOL	S09 43.09	E134 27.27	
106/011	WP28	SOL	S10 12.00	E134 04.91	126 km
	WP29	EOL	S10 28.90	E135 09.27	
106/007	WP30	SOL	S10 32.73	E135 27.82	
106/007-9	WP31	EOL/SOL	S10 52.36	E135 47.45	
	WP32	EOL	S11 26.6	S135 14.42	
106/011	WP33	SOL	S11 17.84	E135 44.74	
106/11-02	WP34	EOL/SOL	S10 18.35	E134 48.65	
106/02-13	WP35	EOL/SOL	S11 23.89	E134 16.34	
106/13-08	WP36	EOL/SOL	S11 29.32	E134 51.35	
106/08-12	WP37	EOL/SOL	S10 32.73	E135 27.82	168 km
	WP38		S10 34.86	E135 00.00	
106/12	WP39	EOL	S10 27.00	E134 03.373	ARAFURA-1 WELL (WGS CO-OR
106/13	WP40	SOL	S10 10.00	E134 04.32	112 km
106/13	WP41	EOL	S10 29.50	E134 59.40	

APPENDIX 2

SEISMIC RECORDING PARAMETERS

The following geometry and recording parameters were used for BMR *Rig Seismic* survey 106 in the east Arafura Basin region:

Streamer geometry

Fjord Instruments transformerless: 2400 m active length
192 seismic channels plus 5 WBs, 7 depth controllers/DTs, 3 compass units
Group interval 12.5 m
Nominal depth 10 m
Near offset nominally 185 m
Far offset nominally 2572.5 m

Energy Source

16 x 150 cu.in. HGS sleeve gun per array; 2 arrays of 9 guns each in 4, 3, 1, 1 groups normally used
Pressure 12.4 - 13.8 MPa (1800 - 2000 psi)
Gun depths 10 m nominal

Recording parameters

<u>All lines except 1(a), 6(a) and 704</u>

8 Hz - 128 Hz passband
2 ms demultiplexed
8 sec record length
48 fold at a nominal 4.5 knots (shot rate = 10.79 sec = 25 m)
Seismic data recorded in SEG -Y format, special floating point format: 4 bit binary exponent, 12 bit mantissa

<u>Lines 1(a), 6(a) and 704</u>

8 Hz - 128 Hz passband
2 ms demultiplexed
12 sec record length
32 fold at a nominal 5.0 knots (shot rate = 14.57 sec = 37.5 m)

APPENDIX 3

LIST OF GEOPHYSICAL EQUIPMENT

Seismic System

Streamer:

- 2400 m Fjord Instruments programmable analogue streamer configured as 192 x 12.5m groups with 20 hydrophones per group
- Syntron RCL-3 individually addressed cable levellers and compasses

Source Array:

- 52.4/73.4 litre (3200-4480 cubic inch), 32- element tuned Texas Instruments air-gun array; 16-18 elements (3200 cubic inch) equally divided into two strings in use at any one time
- Teledyne gun signature phones, gun depth sensors, and I/O SS-8 shot sensors
- 6 x Price a-300 compressors, each rated at 300 scfm @ 2000 psi

Recording:

- BMR designed and built seismic acquisition system based on Microvax II/III computers
- 192 channel digitally controlled preamp/filters
- bit accuracy
  - 12 bit floating point with 4 bit dynamic accuracy
  - 15 bit integer card
- Fujitsu cartridge tape drives
- 2 msec sampling
- streamer noise, amplifier tests and individual group QC
- recording oscillator and 4 seismic monitor QC

Bathymetric System

- Raytheon deep-sea echo sounder; 2 kW output at 12 kHz

Gravity Meter

- Bodenseewerk Geosystem KSS-31 marine gravity meter

Navigation Systems

DGPS System

- Trimble 4000 series GPS receivers, with Racal satellite data demodulator and software running on a Compaq 386 (all supplied by Racal)

GPS System

- Magnavox T-set GPS navigator

Prime transit System

- Magnavox MX1107RS dual channel satellite receiver
- Magnavox MX610D dual-axis sonardopplerspeedlog
- Sperry gyro-compass

Secondary Transit System - Magnavox MX1142 single channel satellite receiver
- Raytheon DSN450 dual-axis sonar dopplerspeed log
- Sperry gyro-compass

Data Acquisition System

- data acquisition system built around Hewlett- Packard 2117 F-Series minicomputer, with tape drives, disc drives, 12" and 36" plotters, line printers and interactive terminals

APPENDIX 4

CREW LIST

R. Hardinge	Master
L. Gillies	Mate
M. Gusterson	2nd Mate
B. Troke	Chief Engineer
T. Ireland	2nd Engineer
W. Hanson	Electrician
J. Baker	A.B.
J. Fraser	A.B.
M. Pitcher	A.B.
D. Brown	E.R.A.
H. Dekker	Chief Steward
W. Leary	Cook
S. Stavely	Steward
S. O'Rourke	Steward/Seaman
A. Moore	Co-Chief Scientist
D. Ramsay	Co-Chief Scientist
H. Miller	Systems Scientist
N. Alavi	Systems Scientist
C. Lawson	T.O. Science
J. Bedford	T.O. Science
F. Stradwick	T.O. Science
A. Hunter	T.O. Science
A. Warnes	T.O. Science
J. Reid	T.O. Science
J. Pittar	T.O. Electronics
M. Callaway	T.O. Electronics
U. Rieke	T.O. Electronics
J. Roberts	T.O. Mechanical
S. Milnes	T.O. Mechanical
R. Bodger	T.O. Mechanical
D. Sewter	T.O. Mechanical
J. Vickery	Technical Specialist (Mechanical)

APPENDIX 5

2400 m SEISMIC STREAMER

After experiencing difficulties with spatial aliassing in the processing of seismic data from cruise 94, one of the acquisition criteria for the present survey was a group length of not more than 12.5 m. Also, the maximum number of amplifiers available with the present system was limited to 192. Hence, the streamer configuration virtually chose itself: 2400 m, made up of 192 channels each of 12.5 metres. In addition, 5 water breaks (WBs) were positioned at intervals of 600 m, at the front of channels 1, 49, 97, 145 and 185; and 7 cable levelers with integral depth detectors (DTs) were placed at intervals of 400 m, at the front of channels 1, 33, 65, 97, 129, 161, plus at the front of the tail stretch section. Three stretch sections were used at the front of the cable, and one at the rear. Refer to Diagram 1.

Cable Balance

The cable used was last deployed in Bass Strait, where the water temperature was 15-20° C. It was reported to be slightly heavy. A rough calculation showed that for a water temperature of about 30° C, the buoyancy should be just about ideal without altering the ballasting. This turned out to be correct in practice, with most of the cable length being slightly positively buoyant, except for a couple of heavy points including the tail. The table shows typical wing angles for the 7 cable levelers; small negative angles are considered ideal - a slight downward force to counteract the natural positive buoyancy.

Table: TYPICAL BIRD WING ANGLES

BIRD	ANGLE
1	var
2	-11
3	
4	
5	03
6	-02
7	-03

The depth of the front of the cable is determined almost entirely by the length of the tow leader and by the speed of the ship through the water. Ideally, the wing angle on bird #1 should be close to zero, thus giving the bird maximum flexibility to cope with small differences in speed through the water, without resorting to changes in the tow leader length. A tow leader length of 60 to 70 m was found to be appropriate for this cable, at a

CABLE CONFIGURATION

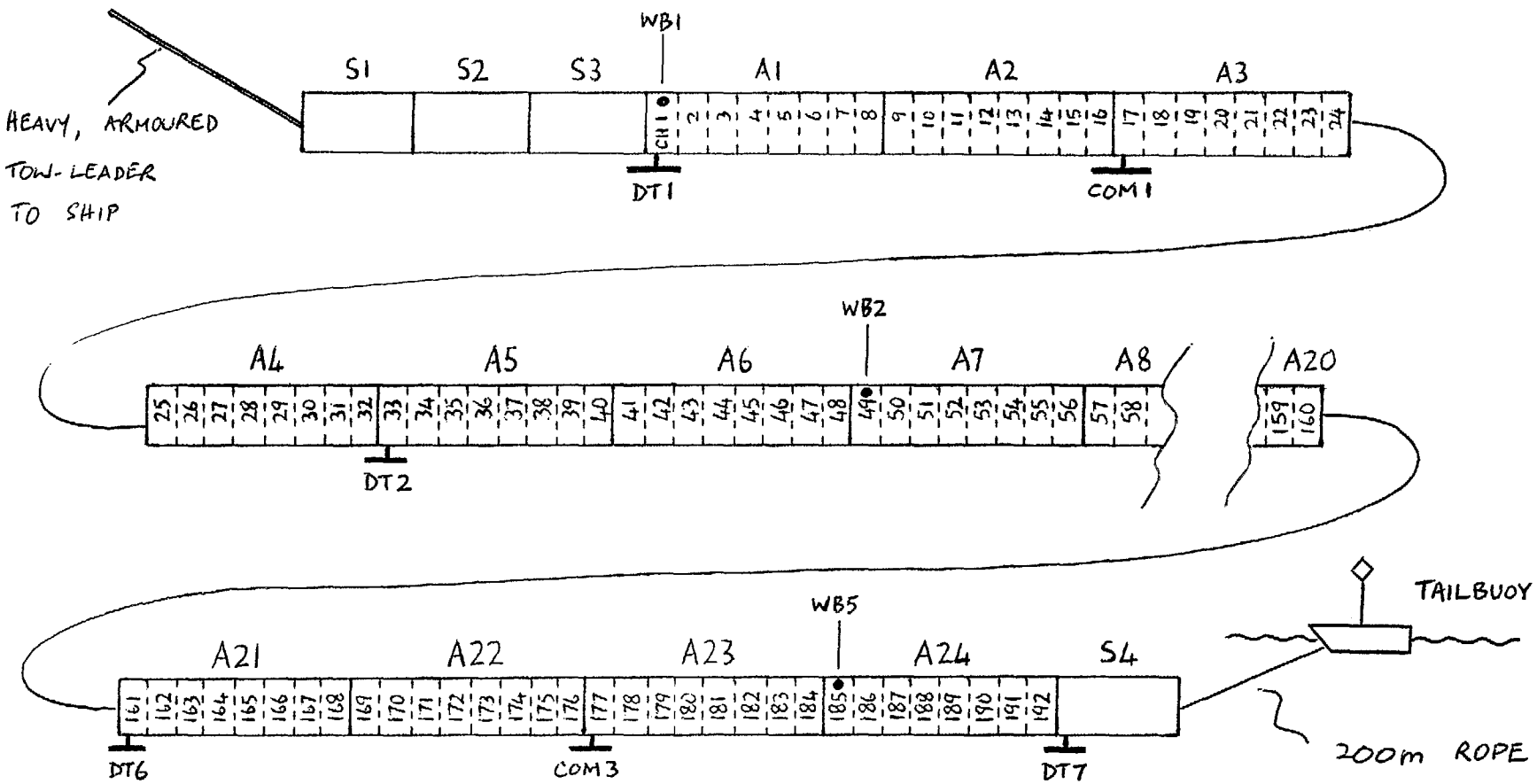

Diagram 1

speed through the water of 4.5 knots.

In the occasionally marginal to mostly excellent weather/sea conditions encountered on this cruise, the cable depth was observed to be at its desired depth of 10 m ± 0.3 m most of the time. This is a sure indication of a well ballasted and well controlled cable.

APPENDIX 6

NON-SEISMIC DATA CHANNELS

The following is a list of channel allocations for the non- seismic data for Survey 106.

The main data set is saved on magnetic tape every minute in blocks of 128 x 6 floating point words. This represents 128 data channels of 6 records per block.

1 Survey and day number (SS.DDD) from RTE clock
2 Acquisition GMT (.HHMMSS) from RTE clock
3 Acquisition GMT (.HHMMSS) from master clock
4 Latitude, best estimate (radians)
5 Longitude, best estimate (radians)
6 Speed, best estimate (knots)
7 Course, best estimate (degrees)
8 Magnetometer # 1 (nT)
9 Magnetometer # 2 (nT)
10 Depth from 3.5 kHz (metres)
11 Depth from 12 kHz (metres)
12 F/A Magnavox sonar doppler (4000 counts/nm)
13 P/S Magnavox sonar doppler (4000 counts/nm)
14 F/A Raytheon sonar doppler (193.5 counts/nm)
15 P/S Raytheon sonar doppler (193.5 counts/nm)
16 Paddle Log (7000 counts/nm)
18 S-G Brown gyro heading (degrees)
19 Robertson gyro heading (degrees)
20 Sperry gyro heading (degrees)
25 Racal dGPS #2 Time (hhmmss)
26 Racal dGPS #2 Latitude (radians)
27 Racal dGPS #2 Longitude (radians)
28 Racal dGPS #2 Height (m)
29 Racal dGPS #2 Speed (knots x 10)
30 Racal dGPS #2 Course (degrees x 10)
39 T-Set north std dev. (m)
40 T-Set east std dev. (m)
41 T-Set satellite numbers
42 T-Set time (GMT seconds)
43 T-Set DOP
44 T-Set latitude (radians)
45 T-Set longitude (radians)
46 T-Set height above geoid (m)

47 T-Set speed (knots x 10)
48 T-Set course (degrees x 10)
49 T-Set frequency bias
51 Latitude from Magnavox Sonar Doppler (radians)
52 Longitude " " " " (radians)
53 Speed " " " " (knots)
54 Course " " " " (degrees)
55 Latitude from Raytheon Sonar Doppler (radians)
56 Longitude " " " " (radians)
57 Speed " " " " (knots)
58 Course from Raytheon Sonar Doppler (degrees)
59 Latitude from Spare Log (radians)
60 Longitude " " " (radians)
61 Speed " " " (knots)
62 Course " " " (degrees)
67 GMT from Magnavox MX1107 (seconds)
68 Dead reckoned time from MX1107 (seconds)
69 MX1107 latitude (radians)
70 MX1107 longitude (radians)
71 MX1107 speed (knots)
72 MX1107 heading (degrees)
73 GMT from Magnavox MX1142 (seconds)
74 Dead reckoned time from MX1142 (seconds)
75 MX1142 latitude (radians)
76 MX1142 longitude (radians)
77 MX1142 speed (knots)
78 MX1142 heading (degrees)
79 Gravity (mGal x 100)
80 ACX (m/sec^2 x 10000)
81 ACY (m/sec^2 x 10000)
82 Sea state
83 AGRF magnetic anomaly #1
86 Shot time (HHMMSS)
87 Shot point number
88 Northerly set/drift (radians/10 seconds)
89 Easterly set/drift (radians/10 seconds)
110 Racal #1 dGPS time (GMT hhmmss)
111 Racal #1 dGPS latitude (radians)
112 Racal #1 dGPS longitude (radians)
113 Racal #1 dGPS height (m x 10)
114 Racal #1 dGPS course (degrees x 10)
115 Racal #1 dGPS speed (knots x 10)
116 Racal #1 dGPS number of satellites
117 Racal #1 dGPS PDOP (x 10)

118 Racal #1 dGPS HDOP (x 10)
119 Racal #1 dGPS 3-D position error (m)
120 Racal #1 dGPS 2-D position error (m)
121 Racal #1 dGPS differential quality
122 Racal #1 dGPS flag
123 Racal #2 dGPS HDOP
124 Racal #2 dGPS PDOP
125 Racal #2 dGPS number of satellites
126 Racal # 2 mode

Transit Satellite Fixes

The Transit satellite fix information from both the MX1107 and MX1142 are saved in blocks of 20 floating point words when the fix data becomes available. The data from each satnav is in a similar format, each being identified by the first word.

1 1107 or 1142
2 Day number (1107) or date (1142)
3 GMT
4 Latitude (radians)
5 Longitude (radians)
6 Used flag (0 = not used, 1 = used)
7 Elevation (degrees)
8 Iterations
9 Doppler counts
10 Distance from DR (nautical miles)
11 Direction from DR (degrees)
12 Satellite number
13 Antenna height (metres)
14 Doppler spread flags (1107 only)
. " " "
. " " "
20 " " "