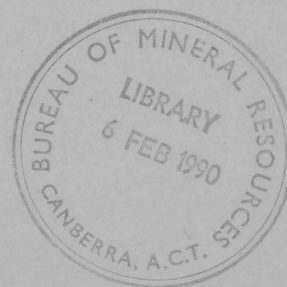
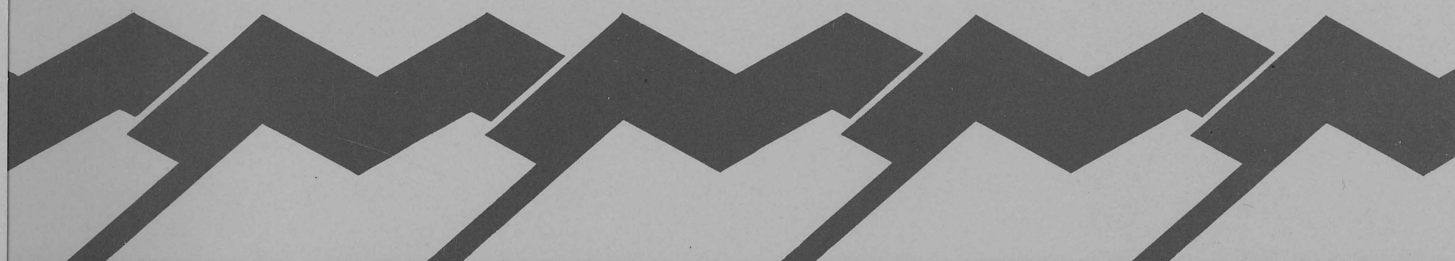


1990/4
C.4



Bureau of Mineral Resources, Geology & Geophysics

BMR PUBLICATIONS COMPACTUS
(LENDING SECTION)



R E C O R D

RECORD 1990/4

DEEP STRUCTURE OF THE GIPPSLAND AND BASS BASINS:
ONSHORE SEISMIC RECORDING

OPERATIONAL REPORT

by

C.D.N. Collins, J.P. Cull, J.B. Willcox,
J.B. Colwell, P.E. Williamson and M.G. Swift

1990/4
Copy 4

Information contained in this report has been obtained by the Bureau of Mineral Resources, Geology and Geophysics as part of the policy of the Government to assist in the exploration and development of mineral resources. It may not be published in any form or used in any way for any purpose or statement without the permission in writing of the Director.

RECORD 1990/4

DEEP STRUCTURE OF THE GIPPSLAND AND BASS BASINS:
ONSHORE SEISMIC RECORDING

OPERATIONAL REPORT

by

C.D.N. Collins, J.P. Cull, J.B. Willcox,
J.B. Colwell, P.E. Williamson and M.G. Swift



* R 9 0 0 0 4 0 1 *

CONTENTS

	Page
SUMMARY	1
1. Introduction	2
2. Geological Setting	2
3. Recording Equipment	3
3.1 Analogue Recorders	3
3.2 Digital Recorders	4
4. Energy Source	5
5. Location of Shots and Stations	5
5.1 Location of Shots	5
5.2 Location of Onshore Stations	6
6. Sonobuoys	6
7. Acknowledgements	7
8. References	7

APPENDIX

1. Onshore recording field personnel	7
--------------------------------------	---

TABLES

1. Onshore Refraction Stations	8
(a) Locations	8
(b) Recording Parameters	9
(c) Remarks	10
2. Sonobuoys	11
3. Traverse Statistics, Survey 82	11
4. Traverse Statistics, Survey 90	12
5. Clock Errors, Survey 82	13
6. Clock Errors, Survey 90	14
7. Digital Recorder Files	16
(a) Newmerella	16
(b) Marlo	17
(c) Deal Island, Survey 82	18
(d) Deal Island, Survey 90	19
(e) Stanley	20
8. Shot Statistics, Survey 82	21
(a) Line 82/001	21
(b) Line 82/002	23
(c) Line 82/003	24
(d) Line 82/101	25
(e) Line 82/102	25
(f) Line 82/201	26
(g) Line 82/202	26
9. Shot Statistics, Survey 90	28
(a) Line 90/002	28
(b) Line 90/004	30
(c) Line 90/005	31
(d) Line 90/007	31

	Page
(e) Line 90/009	32
(f) Line 90/011	33
(g) Line 90/013	33
(h) Line 90/015	35
(i) Line 90/017	36
(j) Line 90/019	37
(k) Line 90/021	39
(l) Line 90/023	40
(m) Line 90/025	40
(n) Line 90/027	41

FIGURES

1. Location map showing the general outline of the Otway, Bass and Gippsland basins.	44
1. Location of shot traverses and stations.	45

SUMMARY

Deep seismic reflection profiling in the Gippsland and Bass Basins was undertaken by the Bureau of Mineral Resources (BMR) in 1988 (Survey 82) and 1989 (Survey 90). Recording stations were deployed on land by BMR and the Department of Earth Sciences, Monash University, to record seismic arrivals from the routine air-gun shots during the reflection profiling. Long-offset wide-angle reflection and refraction data were obtained at these stations from traverses across both basins. Sonobuoys were deployed at intermediate positions along the traverses to provide wide-angle data from the central parts of the basins. The data from the land stations and sonobuoys will be used to derive velocities within the deeper sediments and basement of the basins, and the crustal structure associated with the basins and surrounding areas. This information will be used in conjunction with the deep reflection profiling to test and refine tectonic models of the development of these and similar sedimentary basins.

This report describes the operational aspects of the onshore recording, and lists various field parameters associated with the land stations. It also contains preliminary shot times and positions. Final shot parameters will be available after the marine navigation data is fully processed.

1. INTRODUCTION

In November/December 1988 and March/April 1989 the Bureau of Mineral Resources (BMR) undertook a regional seismic reflection survey of the Gippsland and Bass basins (Figure 1). During the two cruises of BMR's research vessel "Rig Seismic" (Survey 82 and Survey 90), BMR and the Department of Earth Sciences, Monash University, deployed seismic recorders on land to record long-offset wide-angle reflection and refraction data, using the airgun shots fired during the marine regional survey as the energy source.

The objective of the refraction study was to provide information which, when combined with the reflection profiling, would promote a better understanding of the tectonic history of these basins. This information includes the deep structure and velocities beneath the basins and their margins, the average total thickness of the basin sediments, variations in the crustal thickness, and the relationship between the crustal structure of Victoria and Tasmania.

Operational aspects of Surveys 82 and 90 are given by Willcox and Colwell (1989) and Williamson and Swift (1989). This report details the operational aspects of the onshore recording, and tabulates the field parameters and preliminary shot positions.

2. GEOLOGICAL SETTING

A summary of the geological setting of the Gippsland and Bass basins is given by Willcox and Colwell (1989) and Williamson and Swift (1989). More detailed overviews are given by Smith and Etheridge in Douglas and Ferguson (1988) and numerous references are listed by these authors. The Gippsland and Bass Basins, and the Otway Basin to the west (Figure 1), share a common history. They formed by Late Jurassic-Early Cretaceous rifting of the Palaeozoic Lachlan Fold Belt prior to the breakup of Antarctica and Australia. The Gippsland Basin and eastern Bass Basin may also have been influenced by the later opening of the Tasman Sea.

The rifting was associated with large rotational normal faults oriented WNW-ESE forming the margins of the central grabens of the Gippsland and Bass Basins. Etheridge and others (1985) have suggested that these normal faults are offset by orthogonal transfer faults which divide the basins into a series of half-grabens. The early syn-rift sediments associated with this extensional stage may be up to 3.5 km thick and comprise greywacke, sand, shale and minor coal of the Strzelecki Group within the Gippsland Basin and Otway Group within the Bass Basin.

Within the Gippsland Basin, up to 5 km of Late Cretaceous to Eocene fluvio-deltaic sands, shale and coal of the Latrobe Group were deposited during the late syn-rift and post-rift subsidence

phases, accompanied by initial volcanism. In the Eocene, widespread erosion and channeling occurred. A widespread marine transgression in the Early Oligocene resulted in the deposition of the calcareous shales and marls of the Lakes Entrance Formation which unconformably overlies the Latrobe Group in the main part of the basin. These were eroded along the margins of the basin during a fall in sea-level in the Early Oligocene. Following a rise in sea-level, renewed sedimentation in the Early Miocene provided a good regional seal over hydrocarbon reservoirs in the structural highs. The Lakes Entrance Formation was gradually replaced by the Gippsland Limestone during the Miocene, followed by calcarenites of Pliocene to Recent age.

Within the Bass Basin, sands, shale, coal and volcanics of the Eastern View Coal Measures (EVCN) were deposited during the Late Cretaceous to Late Eocene. The total thickness of the non-marine Otway and EVCN may reach 7 km. From the Late Eocene to Pliocene up to 3.5 km of marine sediments, including volcanics, of the Demon's Bluff Formation and Torquay Group were deposited.

The Gippsland Basin was subjected to NW-SE compressive stress from the Eocene onwards, resulting in the development of anticlinal structures and shear faults, probably related to the reactivation of the earlier normal and transfer faults. These structures now form the major hydrocarbon traps in the Gippsland Basin, particularly at the top of the Latrobe Group unconformity.

3. RECORDING EQUIPMENT

Two types of onshore seismic recording systems were used. Six BMR analogue recorders were run continuously during most of Surveys 82 and 90. Three Monash University digital recorders were operated during Survey 82 and one during Survey 90. The analogue recorders ran automatically, while the digital recorders were manned during the recording periods.

3.1 Analogue Recorders

The analogue recorders were four-channel FM tape recording systems developed by BMR (Finlayson and Collins, 1980). They had a maximum continuous recording period of 16 days when using 7200 foot (2195 m) tapes. They are powered by external 12 volt batteries, and to achieve the required duration five marine batteries of 90 amp-hours each were used for each recorder. The seismometer was a single vertical component Willmore Mk II seismometer with a natural frequency of 1.5 Hz.

During Survey 82 the output of the seismometer was filtered 0.01-20 Hz before amplification. Because of the predominantly low frequency background microseismic noise, as well as the low frequency instrument response, the maximum usable gain levels

were governed by the low end of the noise spectrum and not by the expected signal level. For Survey 90, a 6-100 Hz filter was designed to reduce the low frequency background noise before amplification. This allowed increased gain at the predominant frequencies of the signal, around 10-14 Hz.

The signal was amplified at two gain levels 24 dB apart and recorded on separate channels. Generally a high gain of 96 dB was used; actual gain levels are listed in Tables 1 and 7. A coded clock signal containing the days, hours, minutes and seconds was recorded on a third channel. Ten second pulses from the Omega Navigation facility in Gippsland were recorded on the fourth channel, as well as interpolated second pulses.

3.2 Digital Recorders

The digital recorders were developed at the Department of Earth Sciences, Monash University. They are based on a portable PC/AT (either Toshiba or Companion Computers) with an internal 20 megabyte hard disc and 12 bit Parameters analogue to digital board. The filters and amplifiers were the same as those used in the analogue recorders; the seismometers were Willmore Mk III vertical component seismometers with similar characteristics to the Willmore MK IIs used with the analogue recorders. Accurate timing was maintained by reference to Omega radio time signals. The CPU clock was set up using the radio signal as a reference, and initially during a recording period, and from time to time thereafter, the Omega signal was recorded superimposed on the seismic signal. In this way, initial timing errors and drift of the CPU clock could be calibrated.

The sampling interval used was either 10 or 20 msec. Blocks of 30000 samples (10 minutes at 20 msec sample interval) were written to disc as separate files. After writing to disc, the acquisition of the next block commenced, with the filename updating automatically. The average delay between the end of one block and the start of the next was 22 seconds. At the start of each of these data files, a header was written containing the total number of samples, the sample interval, and the start of digitizing time. Table 7 lists the data files recorded by the digital recorders; each file listed (eg. 1NEW.OUT, 2NEW.OUT, etc.) contains 30000 samples. During this survey, the longest semi-continuous recording period was 9 hr 30 m comprising 54 10-minute files. During this recording period, a total of 1.62 megabytes of data were collected; the total time devoted to writing the files to disc was 33 minutes. Data were transferred periodically from disc to magnetic tape cartridges via a Cipher 5400 tape streamer.

4. ENERGY SOURCE

The Texas Instruments air-gun array deployed by Rig Seismic comprised 20 individual guns, each of 160 cubic inch capacity, making up a tuned array of 3200 cubic inches (52.4 litres). The array was operated at 2000 psi and normally towed at a depth of 10 m. The firing rate was either 17.7, 18.2, 19.2, 19.4, 20.0 or 20.8 seconds, depending on the ship's speed and required shot spacing. The shot spacing was either 37.5 m, 50.0 or 55.0 m (Tables 3, 4). The shots were fired at the predetermined rate by the ship's Data Acquisition System. The time of firing of each shot was obtained in Universal Time by synchronising the Data Acquisition System clock with Omega radio time signals.

5. LOCATION OF SHOTS AND STATIONS.

Locations of the shot traverses, recording stations and sonobuoys are shown in Figure 2 and listed in Tables 1, 2, 8 and 9. The traverses were parallel to the inferred transfer faults or orthogonal to them. The land stations were located as far as possible in line with one or more traverses, but they also recorded arrivals with a range of azimuths from cross traverses. The positions of the shots and the sonobuoys are preliminary only as final reduction of all navigation information has yet to be finalised. Only initial and final positions for shots within each continuous series of shots is listed; approximate intermediate positions can be obtained by interpolation.

5.1 Location of Shots

The shots were all located along the reflection profiling traverses except for two traverses which were shot for refraction only without coincident reflection acquisition (Lines 82/201 and 82/202). A few shots at the beginning and end of each line were not included in the reflection acquisition but are listed in Tables 8 and 9 as they may provide potentially useful data from the land stations (See notes accompanying each table).

The shots were located by the ship's navigational systems. Three systems were used: Global Positioning System (GPS), dead reckoning updated by the Transit Satellite System, and radio navigation using Hifix shore stations. The positions listed in Tables 8 and 9 are preliminary only; final positions will be computed after reduction of all navigation systems, and should be primarily based on Hifix values.

5.2 Location of Onshore Stations

The shore stations were located to within 100 m by reference to 1:100,000 topographic maps. The two positions of the station on Deal Island were positioned relative to the lighthouse at the southern end of the island.

During Survey 82, analogue recorders operated in Victoria at Wilson's Promontory, Rosedale, Stradbroke, Seaspray, Corringale and 20 km north of Orbost on the Bonang Highway. These were operational for all lines in the Gippsland Basin, except lines 001 and 101 (Figure 2); Wilson's Promontory was operational during line 101. Lines 101 and 102 were repeats of lines 001 and 002 respectively, but with the ship sailing in the opposite direction. The recorders were also operating during most of the lines shot in the Boobyalla sub-basin of the Bass Basin (see Willcox and Colwell, 1989). Digital recorders operated at Newmerella, Marlo and Deal Island. They recorded lines 201 and 202, and Deal Island also recorded lines 002, 102, and part of 003.

During Survey 90, analogue recorders operated at four locations in Victoria during the Gippsland Basin lines: Wilson's Promontory, Stradbroke West, Toongabbie, and 20 km north of Orbost on the Bonang Highway (Table 1). A digital recorder was deployed on Deal Island during part of Line 002 and during Line 007. During the Bass Basin lines, six analogue recorders were operational at Wilson's Promontory, Stradbroke West, Toongabbie, Mirboo, Cape Liptrap, and Cape Paterson. A digital recorder was deployed at Stanley, northwest Tasmania and recorded line 025. Thus potentially all shots fired during Surveys 82 and 90 in the Gippsland and Bass Basins were recorded by one or more land stations.

6. SONOBUOYS

Seven sonobuoys were deployed in the Gippsland Basin and two in the Bass Basin (Table 2). All were REF-TEK-2 sonobuoys. Each sonobuoy was active from the moment of deployment, but the hydrophone remained at the surface for approximately 25 minutes before automatic deployment to 60 feet. This ensured that the sonobuoy would be clear of the towed seismic streamer before deployment of the hydrophone to full depth. The signal was received on board ship by a Yaesu VHF/UHF receiver and recorded on one channel of the seismic acquisition system. The positions of the sonobuoys can be obtained from the ship's navigation systems. Good first arrivals were observed on average to about 40 km, with a maximum distance at which signals were recorded of over 100 km.

7. ACKNOWLEDGEMENTS

This project, using land stations and marine air-gun shots to record long-range refraction profiles across Bass Strait, has had substantial support from Barry Drummond, Mike Etheridge, David Falvey and Gordon Lister. The digital station on Deal Island was deployed by helicopter supplied by Esso Australia, and their generous support is gratefully acknowledged. The Department of Lands, Conservation and Forests, Victoria, and many private property owners allowed the deployment of recording stations. The marine operations were undertaken by BMR Marine Division personnel on Surveys 82 and 90, and Henry Foreman (Master) and crew of the Rig Seismic. Guy Royce provided logistic support for the Monash field party. Kevin Seers and Franjo Somodji designed and built the filters used in the land stations during Survey 90. The figures were drawn by Jill Clarke.

8. REFERENCES

DOUGLAS J.G. & FERGUSON J.A. (Eds.), 1988 - Geology of Victoria. Victorian Division, Geological Society of Australia. pp 1-664.

FINLAYSON D.M. & COLLINS C.D.N., 1980 - A brief description of BMR portable seismic tape recording systems. Australian Society of Exploration Geophysicists Bulletin, 11, 75-77.

WILLCOX J.B. & COLWELL J.B., 1989 - Deep structure of the Gippsland and Bass basins (Project 9131.12), Operational Report for Cruise 1 (Survey 82). Bureau of Mineral Resources, Record 1989/1.

WILLIAMSON P.E., SWIFT M.G. & OTHERS, 1989 - Deep structure of the Gippsland and Bass basins (Project 9131.12B), Operational Report for Survey 90. Bureau of Mineral Resources, Record 1989/20.

APPENDIX 1. Onshore-recording field personnel

Clive Collins	BMR	Survey 82, 90
Glen Jennings	BMR	Survey 82
Chris Rochford	BMR	Survey 82
Jim Whatman	BMR	Survey 90
Ray Bracewell	BMR	Survey 90
Jim Cull	Monash University	Survey 82, 90
Jean Gray	Monash University	Survey 82
Zis Katelis	Monash University	Survey 82

TABLE 1. Onshore Refraction Stations

(a) Locations

No.	Location	Latitude	Longitude	Type	Tapes	Year
1	Bonang Hwy	37 34.58	148 32.94	A 20	1	88
				A 18	1	89
2	Toongabbie	38 03.44	146 35.02	A 20	2	89
3	Stradbroke	38 16.28	146 56.60	A 19	1	88
				A 17	2	89
4	Wilson's Prom	39 07.76	146 23.97	A 21	1	88
				A 21	2	89
5	Mirboo	38 27.98	146 12.15	A 16	1	89
6	Cape Liptrap	38 53.88	145 55.94	A 19	1	89
7	Cape Paterson	38 38.98	145 34.86	A 18	1	89
8	Deal Island	39 29.80	147 19.30	D	2	88
		39 28.38	147 19.32	D	1	89
9	Stanley, Tas	40 45.76	145 16.76	D	1	89
10	Rosedale	38 11.74	146 46.66	A 16	1	88
11	Seaspray	38 20.87	147 12.02	A 18	1	88
12	Corringle	37 48.02	148 28.32	A 17	1	89
13	Newmerella	37 44.43	148 25.20	D	1	88
14	Marlo	37 47.25	148 32.12	D	1	88

- Notes: i) Type A 20 = Analogue recorder, serial number 20
D = Digital recorder
ii) Stations were occupied during November/December 1988 and March/April 1989.
iii) The Tapes column lists the number of analogue tapes or digital tape-streamer cartridges recorded.

TABLE 1 (Continued). Onshore Refraction Stations

(b) Recording Parameters

Site No.	Gain dB	Filter Hz	Date On	Time On d h m	Error ms	Date Off	Time Off d h m	Error ms
1	96	.01-20	23/11	-	VNG	01/12	31 07 -	-
		6-100	16/03	16 14 52	002	30/03	30 12 28	553
2	96	6-100	16/03	16 19 32	001	30/03	30 17 34	-70
			30/03	30 17 36	000	09/04	40 14 21	-55
3	96	.01-20	23/11	-	VNG	06/12	-	624
		6-100	17/03	17 09 28	000	31/03	31 08 11	55
			31/03	31 08 40	000	11/04	42 11 31	38
4	96	.01-20	22/11	-	VNG	07/12	37 10 26	7
		6-100	17/03	17 14 47	000	31/03	31 13 48	-103
			31/03	31 14 21	000	10/04	41 16 25	-86
5	96	6-100	01/04	32 11 05	001	09/04	40 16 56	-47
6	96	6-100	31/03	31 17 35	000	10/04	41 12 39	40
7	96	6-100	01/04	32 08 17	000	10/04	41 09 18	425
8	-	1-100	23/11	23 15 27	-	28/11	28 10 20	68sec
	-	6-100	19/03	19 14 30	-	22/03	22 11 58	-
9	-	6-100	06/04	06 16 30	-	07/04	08 01 52	-
10	96	.01-20	23/11	-	VNG	06/12	36 13 13	-40
11	96	.01-20	10/11	10 18 00	000	06/12		1724
12	72	.01-20	09/11	09 18 00	000	05/12	35 14 18	110
13	-	1-100	24/11	24 10 50	-	26/11	26 11 33	-
14	-	1-100	23/11	23 15 30	-	26/11	26 10 16	-

- Notes:
- i) VNG in errors column indicates there was no Omega radio time signals when setting up. Clock was set as near as possible to VNG radio time signals. Recording was started on the dates shown; Omega signals were probably available on these dates. The second errors column lists the error in milliseconds relative to Omega time signals noted on the clock comparator of the analogue recorders.
 - ii) Digital recorders (Sites 8,9,13,14) used internal clocks. Precise timing relies on Omega signals recorded periodically on the seismic signal.
 - iii) Gain levels of digital recorders were varied, and are listed in Table 7.
 - iv) Days are from the date recorder set up, eg. 32 for Survey 90 is 1/4/89.

TABLE 1 (Continued). Onshore Refraction Stations

(c) Geological setting and Remarks

Station No.	Remarks
1	Ordovician meta-sediments. During Survey 82, site disturbed after 8 days and recorder switched off.
2	Boundary between Tertiary sediments and Ordovician meta-sediments.
3	Tertiary sediments. Set up initially for Survey 82 using VNG time signals. Power failure during Survey 82. Noise from nearby quarry may be a problem during Survey 90. May be on daylight program mode only for part of Survey 90.
4	Devonian granite. Set up initially for Survey 82 using VNG time signals. When calibrator switch off, seismic channel appears noisy (Survey 90).
5	Cretaceous sediments. Clock set to Daylight Saving Time (1 hour advanced).
6	Devonian sediments. Clock set to Daylight Saving Time (1 hour advanced).
7	Quaternary alluvium/Cretaceous sediments. Lower spool of tape drive jerky. Windy site.
8	Devonian granite. Digital station. Site during Survey 82 in lighthouse at southern end of island. Very noisy, including generator noise. New site selected further north for Survey 90. Also noisy and suspected amplifier fault.
9	Tertiary basalt. Digital station. Suspected intermittent amplifier fault.
10	Tertiary sediments. Set up initially using VNG time signals.
11	Quaternary sediments. Noisy site, in hay shed.
12	Quaternary sands. Tape drive problem shortly after set up; may not have recorded any shots.
13	Tertiary sediments. Digital station.
14	Quaternary sediments. Digital station.

TABLE 2. Sonobuoys

No.	Line	Time Deployed d h m s	Latitude d m	Longitude d m	Ship's course	Duration h m	Range km
(A) Gippsland Basin							
1	2	77:20:15:09.4	38 25.14	148 01.00	ESE	4 45	35.2
2	4	78:19:50:36.4	38 09.98	148 58.29	W	6 49	50.6
3	5	80:06:56:50.6	38 13.46	147 36.84	SW	4 43	35.0
4	7	81:11:57:53.2	38 55.86	147 38.81	NNE	5 42	42.3
5	7	81:18:00:36.4	38 34.08	147 54.19	NNE	8 39	64.3
6	9	82:20:27:53.2	38 26.93	148 25.00	SSW	5 36	41.6
7	15	85:23:50:18.2	38 31.77	147 29.83	NNE	6 00	44.5
(B) Bass Basin							
1	25	97:01:43:07.2	39 45.58	145 38.73	SSW	9 07	58.3
2	27	97:19:09:23.6	40 12.33	145 04.63	NNE	13 31	100.3

TABLE 3. Traverse Statistics, Survey 82.

Gippsland Basin, November/December 1988

Line No	Start (UT) d h m	Stop (UT) d h m	Start (Loc) d h m	Stop (Loc) d h m	Shot Rate
001	325 18 05	326 10 57	21 05 05	21 21 57	18.2
	326 17 08	327 00 06	22 04 08	22 11 06	18.2
101	327 06 50	327 18 26	22 17 50	23 05 26	18.2
201	328 23 19	329 13 20	24 10 19	25 00 20	20.0
	329 16 09	330 01 58	25 03 09	25 12 58	20.0
202	330 05 18	330 08 41	25 16 18	25 19 41	17.7
	330 08 51	330 09 52	25 19 51	25 20 52	19.4
	330 09 55	331 01 30	25 20 55	26 12 30	17.7
002	331 19 38	332 02 58	27 06 38	27 13 58	18.2
102	332 06 42	332 13 19	27 17 42	28 00 19	18.2
003	332 16 10	333 00 00	28 03 10	28 11 00	18.2
	333 10 13	333 17 20	28 21 13	29 04 20	18.2

1. Universal Time (UT) days are Julian days.
2. Local Time days are for November 1988.
3. Shot Rate is in seconds. The shot interval in metres is as follows: 18.2 s = 37.5 m, 20.0 s = 50.0 m, 17.7 s = 50.0 m, 19.4 s = 55.0 m.

TABLE 4. Traverse Statistics, Survey 90.

Gippsland and Bass Basins, March/April 1989

Line No	Start (UT) d h m	Stop (UT) d h m	Start (Loc) d h m	Stop (Loc) d h m	Shot Rate
002	77 14 03	77 22 58	19 01 03	19 08 58	18.2
	77 23 01	78 04 20	19 09 01	19 14 20	18.2
	78 04 23	78 08 28	19 14 23	19 18 28	18.2
004	78 18 40	79 08 36	20 04 40	20 18 36	18.2
	79 14 14	79 16 39	21 00 14	21 02 39	18.2
005	80 02 31	80 18 25	21 12 31	22 04 25	18.2
007	81 03 56	82 04 38	22 13 56	23 14 38	18.2
009	82 11 15	83 01 33	23 21 15	24 11 33	18.2
	83 01 33	83 02 11	24 11 33	24 12 11	19.2
011	83 17 04	84 02 29	25 03 04	25 12 29	18.2
013	84 13 50	84 23 59	25 23 50	26 09 59	18.2
	85 00 02	85 09 59	26 10 02	26 19 59	18.2
015	85 14 16	86 07 52	27 00 16	27 17 52	18.2
017	86 17 37	87 06 55	28 03 37	28 16 55	18.2
	88 19 46	89 07 06	30 05 46	30 17 06	18.2
019	89 20 46	89 21 02	31 06 46	31 07 02	18.2
	89 21 02	89 23 18	31 07 02	31 09 18	19.2
021	93 16 33	93 21 02	04 02 33	04 07 02	19.2
	93 21 02	94 05 54	04 07 02	04 15 54	18.2
023	94 11 45	94 21 57	04 21 45	05 07 57	18.2
025	96 06 31	96 08 50	06 16 31	06 18 50	20.8
	96 16 11	97 13 39	07 02 11	07 23 39	20.8
027	97 18 12	98 08 45	08 04 12	08 18 45	18.2
	98 12 57	98 18 22	08 22 57	09 04 22	18.2

1. Universal Time (UT) days are Julian days.
2. Local Time days are for March/April 1989. Eastern Australian Summer Time (Daylight Saving Time) ceased on 0 hrs, Sunday 19th March. Analogue stations set up before this time would remain one hour advanced until relocated.
3. Shot Rate is in seconds. The shot interval in metres is as follows: 18.2 s = 37.5 m, 19.2 s = 37.5 m, 20.8 s = 37.5 m.
4. Lines 002 - 023 are in Gippsland Basin.
Lines 025 - 027 are in Bass Basin.

TABLE 5. Clock Errors, Survey 82, November/December 1988.

Universal Time			Local Time			Error	Remarks
d	h	m	d	h	m	ms	
323	21	46	19	08	46	+002	
324	15	47	20	02	47	-030	
324	19	08	20	06	08	-042	
324	21	43	20	08	40	-050	
324	23	04	20	10	04	-055	
324	23	07	20	10	07	+001	Clock Corrected
325	16	49	21	03	49	-015	
325	20	10	21	07	10	-927	
325	20	16	21	07	16	+003	
326	11	12	21	22	12	-049	
327	06	37	22	17	37	-117	
327	06	48	22	17	48	-003	Clock Corrected
327	18	51	23	05	51	-045	
327	21	21	23	09	21	-054	
327	21	49	23	08	50	+001	Clock Corrected
328	16	07	24	03	07	-065	
328	16	09	24	03	09	000	Clock Corrected
328	21	14	24	08	14	-018	
328	22	32	24	09	32	-022	
328	23	08	24	10	08	+001	Clock Corrected
329	01	19	24	12	19	-007	
329	10	47	24	21	47	-040	
329	15	57	25	02	57	-058	
329	22	09	25	09	09	-080	
330	03	57	25	14	57	-100	
330	04	05	25	15	05	-101	
330	04	07	25	15	07	-001	Clock Corrected
330	08	11	25	19	12	-015	
330	09	53	25	20	53	-022	
330	11	00	25	10	00	-027	
330	18	52	26	05	52	-054	
331	00	28	26	11	28	-073	
331	15	09	27	02	09	-024	
331	15	13	27	02	13	+001	Clock Corrected
331	18	48	27	05	49	-012	
331	18	52	27	05	52	+002	Clock Corrected
332	19	06	28	06	06	-083	
332	20	39	28	07	39	-088	
333	02	16	28	13	16	-109	
333	02	18	28	13	19	+002	Clock Corrected
333	11	39	28	22	39	-031	
333	13	37	29	00	37	-038	
334	11	34	29	22	34	-116	
335	13	06	01	00	06	-207	
335	13	12	01	00	12	-001	Clock Corrected
336	19	00	02	06	00	-107	
336	19	04	02	06	04	-001	Clock Corrected
337	20	06	03	07	06	-089	

TABLE 6. Clock Errors, Survey 90, March/April 1989

Universal Time			Local Time			Error	Remarks
d	h	m	d	h	m	ms	
075	14	34	17	01	34	-033	E.A. Summer Time
075	14	39	17	01	39	-002	Clock corrected
076	06	23	17	17	23	+079	E.A. Summer Time
076	20	32	18	07	32	+048	E.A. Summer Time
077	13	37	19	00	37	+009	E.A. Summer Time
077	17	48	19	03	48	+001	E.A. Standard Time starts
078	00	32	19	10	33	-016	
078	16	07	20	02	07	-049	
079	01	20	20	11	20	-071	
079	15	59	21	02	00	-003	Error = -103?
080	19	19	22	05	19	-065	Error = -165?
080	19	26	22	05	26	-001	Clock corrected
081	03	58	22	13	58	-020	
081	07	37	22	17	37	-028	
Clock jumped, seems about 900 ms fast. Error reading +065.							
081	11	35	22	21	35	-003	Clock corrected shortly after jump.
081	14	11	23	00	11	-008	
081	16	30	23	02	30	-014	
081	19	11	23	05	11	-019	
081	21	05	23	07	05	-024	
082	14	32	24	01	32	-064	
082	21	09	24	07	09	-079	
083	16	46	25	02	46	-024	Error = -124?
083	20	21	25	06	21	-033	Error = -133?
084	01	24	25	11	24	-044	Error = -144?
084	07	41	25	17	41	-060	Error = -160?
084	07	45	25	17	45	-098	Clock corrected, Error = +998 or -198?
084	16	58	26	03	58	-067	
084	18	22	26	04	22	-071	Clock Fast, Error = +771?
084	18	33	26	04	33	000	Clock corrected
084	23	27	26	09	27	-012	
085	07	20	26	17	20		Clock 1835 ms fast
085	07	20	26	17	20	000	Clock corrected
085	10	40	26	20	40		Clock 3100 ms fast
085	10	40	26	20	40	000	Clock corrected
085	16	59	27	02	59	+091	Error = ?
085	18	07	27	04	07	+087	Clock 587 ms fast
085	18	09	27	04	09	-004	
085	20	05	27	06	05	-007	
085	21	20	27	07	20	-010	
086	00	50	27	10	50	-020	Clock looks exactly 1 sec fast
086	00	52	27	10	52	000	Retarded by 180 ms, not fully corrected because of interference with airguns.

TABLE 6 (Continued)

Universal Time			Local Time			Error	Remarks
d	h	m	d	h	m	ms	
Repairs to Clock							
086	16	29	28	02	29	-004	
086	20	31	28	06	31	-022	
086	23	45	28	09	45	-035	
087	16	23	29	02	23	-048	
088	18	37	30	04	37	-161	
088	18	43	30	04	43	-001	Clock corrected
089	00	59	30	10	59	-027	
089	18	18	31	04	18	+898	Clock slow 102 ms?
089	18	21	31	04	21	-002	Clock advanced 102 ms
089	20	29	31	06	29	-013	Clock slow 1 second
089	20	42	31	06	42	-003	Advanced 1 second
090	01	18	31	11	18	-023	
090	19	30	01	05	30	-001	1 second fast
This clock replaced by spare at 090 21 28							
090	21	30	01	07	30	-002	
091	17	10	02	03	10	-047	
092	02	05	02	12	05	-069	
092	02	06	02	12	06	-003	Clock corrected
092	07	34	02	17	34	-016	
092	19	17	03	05	18	-046	
093	07	39	03	17	39	-075	
093	07	40	03	17	40	000	Clock corrected
093	21	15	04	07	15	-034	
093	23	23	04	09	23	-138	Clock error jump?
094	00	56	04	10	56	-142	
094	07	43	04	17	43	-158	
094	17	06	05	03	06	-182	
094	21	06	05	07	06	-191	
095	01	48	05	11	48	+798	Error = -202?
095	22	56	06	08	57	+746	
095	23	02	06	09	02	+001	Clock corrected
096	03	17	06	13	17	-010	
096	11	52	06	21	52	-031	
096	19	17	07	05	17	-050	
096	22	45	07	08	45	-057	
097	05	58	07	15	58	-076	
097	10	02	07	20	02	+914	Error = -086?
097	16	22	08	02	22	+903	Error = -097?
097	16	23	08	02	23	-004	Clock corrected
097	23	44	08	09	44	-020	
098	17	02	09	03	02	-062	
098	18	55	09	04	55	-067	

Note: i) Clock used prior to 090 21 28 was subject to sudden jumps in time.

TABLE 7. Digital Recorder Files

(A) Newmerella

File Name ¹	Start Time ²			Remarks
	d	h	m	
1NEW.OUT - 12NEW.OUT	24	10	50	108 dB, Start Line 201
1NE2.OUT - 6NE2.OUT	24	13	01	
1NE3.OUT - 18NE3.OUT	24	14	13	
1NE4.OUT - 5NE4.OUT	24	17	24	
1NE5.OUT - 12NE5.OUT	24	18	21	
1NE6.OUT - 9NE6.OUT	24	20	30	
1NE7.OUT - 44NE7.OUT	24	22	48	114 dB. No source 25:00:20-
- 48NE7.OUT				25:03:09.
1NE8.OUT - 10NE8.OUT	25	07	23	
1NE9.OUT - 5NE9.OUT	25	09	15	108 dB
- 6NE9.OUT				102 dB
- 12NE9.OUT				96 dB
1NW1.OUT - 10NW1.OUT	25	11	30	102 dB, End Line 201
1NS1.OUT - 23NS1.OUT	25	16	20	102 dB, Start Line 202
- 24NS1.OUT				108 dB
1NS2.OUT - 8NS2.OUT	25	20	55	102 dB
- 9NS2.OUT				108 dB
1NS3.OUT - 6NS3.OUT	25	22	45	102 dB
- 7NS3.OUT				108 dB
- 54NS3.OUT				
1NS4.OUT - 14NS4.OUT	26	08	23	108 dB
- 15NS4.OUT				114 dB
- 19NS4.OUT				

1. All original files have pathname C:\DAS8\ which must be specified to access original data cartridges.

2. Times are Local Time (Eastern Australian Summer Time).

3. Total number of files = 248 (38,726,400 bytes).

TABLE 7 (Continued)

(B) Marlo

File Name ¹	Start Time ²			Remarks
	d	h	m	
1TES.OUT	23			1 minute test
1WPM.OUT	23	15	30	1 hr record, 938,022 bytes
1WQM.OUT	23	16	43	42 min rec., 703,685 bytes
1WRM.OUT - 6WRM.OUT	23	18	03	
1THA.OUT - 2THA.OUT	24	02	44	
1THB.OUT - 2THB.OUT	24	07	46	
1THC.OUT - 12THC.OUT	24	10	15	96 dB. Corrected Omega time
1THD.OUT - 12THD.OUT	24	12	23	1THD has Omega pips.
1THE.OUT - 9THE.OUT	24	14	31	
1THF.OUT - 12THF.OUT	24	16	43	
1THH.OUT - 18THH.OUT	24	18	56	Corrected Omega time
1THJ.OUT - 42THJ.OUT	24	22	10	
1FRA.OUT - 6FRA.OUT	25	05	31	Corrected Omega time
1FRB.OUT - 15FRB.OUT	25	06	58	
1FRC.OUT - 16FRC.OUT	25	09	39	Corrected Omega time
1FRD.OUT - 4FRD.OUT	25	12	29	End Line 201
1FRE.OUT - 12FRE.OUT	25	16	26	Start Line 202. Omega time.
1FRG.OUT - 19FRG.OUT	25	18	37	
1FRJ.OUT - 54FRJ.OUT	25	22	52	
1SAA.OUT - 10SAA.OUT	26	08	36	Corrected Omega time

1. All original files have pathname C:\SEIS\ which must be specified to access original data cartridges.

2. Times are Local Time (Eastern Australian Summer Time).

3. Total number of files = 270 (42,201,000 bytes).

TABLE 7 (Continued)

(C) Deal Island, Survey 82 (November 1988)

File Name ¹	Start Time ²			Remarks
	d	h	m	
1DWA.OUT - 5DWA.OUT	23	15	27	96dB
1TIM.OUT				Trial time.
1DTA.OUT - 12DTA.OUT	24	10	12	
1DTB.OUT - 24DTB.OUT	24	12	28	1DTB, 15DTB - time pips
1DTC.OUT - 30DTC.OUT	24	16	56	1DTC, 13DTC - time pips
1DTD.OUT - 27DTD.OUT	24	22	15	1DTD, 24DTD - time pips
1DFA.OUT - 30DFA.OUT	25	03	46	1DFA, 16DFA - time pips
1DFB.OUT - 23DFA.OUT	25	09	13	1DFB, 2DFB, 22DFB - time pips
1DFC.OUT - 30DFC.OUT	25	16	15	1DFC, 21DFC - time pips
1DFD.OUT - 30DFD.OUT	25	21	31	1DFD - time pips
1DSA.OUT - 30DSA.OUT	26	03	23	1DSA, 25DSA - time pips
1DSB.OUT - 23DSB.OUT	26	08	41	1DSB, 18DSB - time pips
1DKA.OUT - 30DKA.OUT	27	06	45	1DKA, 23DKA - time pips
1DKB.OUT - 11DKB.OUT	27	11	59	1DKB - time pips
1DKC.OUT - 30DKC.OUT	27	16	00	1DKC, 27DKC - time pips
1DKD.OUT - 17DKD.OUT	27	21	14	1DKD - time pips
1DMA.OUT - 30DMA.OUT	28	01	45	1-3DMA.OUT - time pips
1DMB.OUT - 20DMB.OUT	28	06	59	1DMB - time pips

1. All original files have pathname C:\SEIS\ which must be specified to access original data catridges.

2. Times are Local Time (Eastern Australian Summer Time). Note that times are 1 minute 8 seconds ahead of real time at the end of recording.

3. Total number of files = 403 (62,988,900 bytes)

TABLE 7 (Continued)

(D) Deal Island, Survey 90 (March 1989)

File Name ¹	Start Time ²			Remarks
	d	h	m	
1TES.OUT	20	14	07	
1DUM.OUT	20	14	18	
1EW1.OUT - 6EW1.OUT	20	14	30	
1EW2.OUT - 6EW2.OUT	20	15	36	
1OLD.OUT	20	16	53	
1TST.OUT	22	14	04	
1NS1.OUT - 5NS1.OUT	22	14	08	96-18 dB
1NS2.OUT - 8NS2.OUT	22	15	08	96-12 dB
1NS3.OUT - 6NS3.OUT	22	16	36	96-12 dB
1NS4.OUT - 5NS4.OUT	22	17	42	96-12 dB
1NS5.OUT - 12NS5.OUT	22	19	03	96-6 dB
1NS6.OUT - 34NS6.OUT	22	21	32	96-0 dB. 2 sec loss from
1NS7.OUT - 20NS7.OUT	23	04	07	96-0 dB start.
1NS8.OUT - 8NS8.OUT	23	07	42	96-0 dB
1NS9.OUT - 7NS9.OUT	23	09	11	96-0 dB
1N10.OUT - 9N10.OUT	23	10	28	
LOG.OUT	23			

1. All original files have pathname C:\TEMP\ which must be specified to access the original data cartridges.

2. Times are Local Time (Eastern Australian Time), March 1989.

3. Total number of files = 126 files (19,693,800 bytes).

TABLE 7 (Continued)

(E) Stanley, Tasmania

File Name ¹	Start Time ²			Remarks
	d	h	m	
1TUT.OUT	04	-	-	120-12 dB. Tests
1PS1.OUT - 6PS1.OUT	06	16	30	96 dB. Shot rate 20.8 s.
1PS2.OUT - 2PS2.OUT	06	17	48	96 dB. Delta t = 9.89 ms
1PS3.OUT - 18PS3.OUT	06	18	08	96 dB. Delta t = 9.89 ms
1PS4.OUT - 4PS4.OUT	06	20	15	Time set. Guns down 20:50
1PS5.OUT - 30PS5.OUT	07	02	36	Time set.
1PS6.OUT - 8PS6.OUT	07	08	01	Time set.
1PS7.OUT - 2PS7.OUT	07	09	30	
1PS8.OUT - 9PS8.OUT	07	09	54	
1PS9.OUT - 4PS9.OUT	07	11	36	Time set.
1P10.OUT - 20P10.OUT	07	12	24	90 dB.
1P11.OUT - 6P11.OUT	07	15	55	96 dB.
1P12.OUT - 12P12.OUT	07	17	08	90 dB.
1P13.OUT - 12P13.OUT	07	20	10	96 dB.
1P14.OUT - 21P14.OUT	07	22	22	96 dB.

1. All original files have pathname C:\TEMP\ which must be specified to access original data cartridges.

2. Times are Local Time (Eastern Australian Time), April 1989.
Error in time (Delta t) = -1.5 sec. CPU lost time.

3 Total number of files = 154 (24,070,200 bytes)

TABLE 8. Shot Statistics, Survey 82, November 1988.

(a) Line 82/001

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
205	18.2	325 14	11 21	1 38 17.3	39 35.449	148 14.802	1
0	0.0	325 16	11 21	3 14 40.0	39 29.500	148 15.999	
527	18.2	325 16	11 21	3 15 57.7	39 29.418	148 16.004	
531	18.2	325 16	11 21	3 17 10.5	39 29.344	148 16.022	
100	2.5	325 16	11 21	3 18 7.5	39 29.281	148 16.042	
101	18.2	325 16	11 21	3 18 25.7	39 29.256	148 16.057	1
193	18.2	325 16	11 21	3 46 20.1	39 27.506	148 16.797	
195	18.2	325 16	11 21	3 47 42.1	39 27.434	148 16.845	
197	18.2	325 16	11 21	3 48 18.5	39 27.401	148 16.870	
195	14.8	325 16	11 21	3 48 51.4	39 27.371	148 16.889	
196	18.1	325 16	11 21	3 49 9.6	39 27.356	148 16.898	
197	18.2	325 16	11 21	3 48 18.5	39 27.401	148 16.870	
195	14.8	325 16	11 21	3 48 51.4	39 27.371	148 16.889	
196	18.1	325 16	11 21	3 49 9.6	39 27.356	148 16.898	
197	3.0	325 16	11 21	3 49 48.9	39 27.325	148 16.914	
198	18.1	325 16	11 21	3 50 7.1	39 27.310	148 16.926	1
199	18.2	325 16	11 21	3 50 25.3	39 27.292	148 16.946	
221	18.2	325 16	11 21	3 57 5.7	39 26.939	148 17.231	
100	18.1	325 17	11 21	4 2 0.4	39 26.688	148 17.422	
101	18.2	325 17	11 21	4 2 18.6	39 26.670	148 17.438	
160	18.2	325 17	11 21	4 20 12.4	39 25.742	148 18.172	
101	18.1	325 17	11 21	4 21 6.4	39 25.695	148 18.207	
102	18.2	325 17	11 21	4 21 24.6	39 25.680	148 18.219	
104	18.2	325 17	11 21	4 22 1.0	39 25.649	148 18.243	
106	18.2	325 17	11 21	4 22 37.4	39 25.614	148 18.274	
109	18.2	325 17	11 21	4 23 32.0	39 25.559	148 18.326	1
110	18.2	325 17	11 21	4 24 8.4	39 25.523	148 18.360	
111	18.2	325 17	11 21	4 24 8.4	39 25.523	148 18.360	
112	18.2	325 17	11 21	4 24 26.6	39 25.507	148 18.369	
118	18.2	325 17	11 21	4 26 15.8	39 25.405	148 18.456	
123	18.2	325 17	11 21	4 28 5.0	39 25.306	148 18.541	
124	18.2	325 17	11 21	4 28 5.0	39 25.306	148 18.541	
149	18.2	325 17	11 21	4 35 40.0	39 24.882	148 18.882	
150	14.4	325 17	11 21	4 36 12.6	39 24.849	148 18.906	
151	18.1	325 17	11 21	4 36 30.8	39 24.830	148 18.923	
150	14.5	325 17	11 21	4 37 3.5	39 24.795	148 18.953	99
151	18.1	325 17	11 21	4 37 21.7	39 24.777	148 18.973	
152	18.2	325 17	11 21	4 37 39.9	39 24.759	148 18.993	
0	0.0	325 17	11 21	4 42 0.0	39 24.490	148 19.208	

TABLE 8(a) Continued)

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
224	18.2	325 17	11 21 4	59 30.3	39 23.338	148 19.904	
101	18.2	325 18	11 21 5	2 22.4	39 23.142	148 20.016	
295	18.2	325 19	11 21 6	1 13.2	39 19.316	148 22.127	
399	13.1	325 19	11 21 6	14 10.8	39 18.615	148 22.512	
400	18.1	325 19	11 21 6	14 29.0	39 18.597	148 22.525	
401	18.2	325 19	11 21 6	14 47.2	39 18.579	148 22.538	
407	18.2	325 19	11 21 6	16 36.4	39 18.468	148 22.599	
500	18.1	325 19	11 21 6	25 23.1	39 17.924	148 22.904	
501	18.2	325 19	11 21 6	25 41.3	39 17.905	148 22.915	
593	18.2	325 19	11 21 6	53 35.7	39 16.115	148 23.483	
700	18.1	325 19	11 21 6	58 7.6	39 15.852	148 24.036	
701	18.2	325 19	11 21 6	58 25.8	39 15.834	148 24.046	
712	18.2	325 20	11 21 7	1 46.0	39 15.643	148 24.167	
800	18.1	325 20	11 21 7	4 47.3	39 15.453	148 24.275	
801	18.2	325 20	11 21 7	5 5.5	39 15.434	148 24.284	
812	18.2	325 20	11 21 7	8 25.7	39 15.225	148 24.395	
900	18.1	325 20	11 21 7	12 11.4	39 15.006	148 24.514	
901	18.2	325 20	11 21 7	12 29.6	39 14.987	148 24.525	
968	18.2	325 20	11 21 7	32 49.0	39 13.770	148 25.204	
1049	6.5	325 20	11 21 7	39 47.5	39 13.317	148 25.444	
1050	18.1	325 20	11 21 7	40 5.7	39 13.298	148 25.456	
1051	18.2	325 20	11 21 7	40 23.9	39 13.280	148 25.466	
1241	18.2	325 21	11 21 8	38 1.9	39 9.711	148 27.431	
1300	18.1	325 21	11 21 8	41 28.3	39 9.506	148 27.550	
1302	18.2	325 21	11 21 8	42 22.9	39 9.451	148 27.578	
1303	18.2	325 21	11 21 8	42 22.9	39 9.451	148 27.578	
0	0.0	325 23	11 21 10	1 53.8	39 3.632	148 30.762	2
1582	18.2	325 23	11 21 10	7 0.7	39 3.339	148 30.965	
1583	18.2	325 23	11 21 10	7 37.1	39 3.297	148 30.991	
1700	18.1	325 23	11 21 10	16 8.1	39 2.750	148 31.317	
1701	18.2	325 23	11 21 10	16 26.3	39 2.730	148 31.326	
2916	18.2	326 5	11 21 16	25 17.5	38 40.035	148 43.914	
3000	18.1	326 5	11 21 16	28 12.5	38 39.854	148 44.016	
3001	18.2	326 5	11 21 16	28 30.7	38 39.835	148 44.028	
3093	18.2	326 5	11 21 16	56 25.1	38 38.062	148 44.989	
3099	18.0	326 5	11 21 16	59 52.1	38 37.837	148 45.116	
3101	18.2	326 6	11 21 17	0 28.5	38 37.798	148 45.136	
4079	18.2	326 10	11 21 21	57 8.1	38 19.341	148 55.316	
4199	10.9	326 15	11 22 2	25 28.1	38 27.935	148 52.104	
4200	18.1	326 15	11 22 2	25 46.3	38 27.927	148 52.080	

TABLE 8(a) (Continued)

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
4201	18.2	326 15	11 22 2	26 4.5	38 27.919	148 52.056	
4257	18.2	326 15	11 22 2	43 3.7	38 27.123	148 51.168	
4100	18.0	326 15	11 22 2	43 58.1	38 27.062	148 51.172	
4101	18.1	326 15	11 22 2	44 16.3	38 27.043	148 51.175	
4102	18.2	326 15	11 22 2	44 34.5	38 27.024	148 51.179	
4199	11.0	326 16	11 22 3	55 58.8	38 22.778	148 53.453	
4200	18.1	326 16	11 22 3	56 17.0	38 22.761	148 53.461	
4201	18.2	326 16	11 22 3	56 35.2	38 22.744	148 53.469	
4230	18.2	326 17	11 22 4	5 23.0	38 22.233	148 53.745	
4199	4.7	326 17	11 22 4	6 18.5	38 22.178	148 53.780	
4201	18.2	326 17	11 22 4	6 54.9	38 22.139	148 53.802	
0	0.0	326 21	11 22 8	8 49.2	38 7.051	149 2.117	3
0	0.0	326 23	11 22 10	33 26.7	37 58.500	149 7.985	4
5581	18.2	327 0	11 22 11	5 30.9	37 56.402	149 9.143	

TABLE 8(b) Line 82/002

100	18.1	331 16	11 27 3	58 29.9	38 10.183	148 45.408	
101	18.2	331 16	11 27 3	58 48.1	38 10.199	148 45.391	
353	18.2	331 18	11 27 5	15 14.5	38 14.813	148 39.708	
100	18.2	331 18	11 27 5	18 41.4	38 15.031	148 39.441	
102	18.2	331 18	11 27 5	18 59.6	38 15.051	148 39.418	
137	18.2	331 18	11 27 5	29 36.6	38 15.721	148 38.607	
100	18.1	331 18	11 27 5	32 55.7	38 15.938	148 38.391	
101	18.2	331 18	11 27 5	33 13.9	38 15.960	148 38.376	
103	18.2	331 18	11 27 5	33 50.3	38 16.002	148 38.347	
291	18.2	331 19	11 27 6	30 51.9	38 16.954	148 42.089	
100	18.1	331 19	11 27 6	31 57.5	38 16.907	148 42.154	
101	18.2	331 19	11 27 6	32 15.7	38 16.894	148 42.173	
100	15.0	331 19	11 27 6	33 40.0	38 16.835	148 42.258	
101	18.1	331 19	11 27 6	33 58.2	38 16.822	148 42.276	
102	18.2	331 19	11 27 6	34 16.4	38 16.809	148 42.292	
0	0.0	332 2	11 27 13	10 26.4	37 58.500	149 6.824	4
1523	18.2	332 2	11 27 13	45 18.6	37 56.903	149 9.005	
1537	6.9	332 2	11 27 13	50 30.6	37 56.769	149 9.391	
1538	18.1	332 2	11 27 13	50 48.8	37 56.778	149 9.418	
1539	18.2	332 2	11 27 13	51 7.0	37 56.777	149 9.443	
1562	18.2	332 2	11 27 13	58 5.6	37 56.693	149 10.028	
0	0.0	332 10	11 27 21	51 38.0	38 10.604	148 50.054	5
0	0.0	332 12	11 27 23	40 58.8	38 15.973	148 43.392	6

TABLE 8(c) Line 82/003

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
100	18.1	332 15	11 28 2	21 39.6	38 12.727	148 43.266	
101	18.2	332 15	11 28 2	21 57.8	38 12.735	148 43.290	
254	18.2	332 16	11 28 3	8 22.4	38 15.215	148 43.816	
99	2.5	332 16	11 28 3	9 1.3	38 15.252	148 43.796	
100	18.1	332 16	11 28 3	9 19.5	38 15.272	148 43.784	
103	18.2	332 16	11 28 3	10 32.3	38 15.346	148 43.745	
104	18.2	332 16	11 28 3	10 32.3	38 15.346	148 43.745	
0	0.0	332 16	11 28 3	20 43.8	38 15.973	148 43.388	6
0	0.0	332 17	11 28 4	2 14.3	38 18.476	148 41.950	7
456	18.2	332 17	11 28 4	57 18.7	38 21.650	148 40.075	
457	18.2	332 17	11 28 4	57 55.1	38 21.684	148 40.054	
500	18.1	332 18	11 28 5	1 43.1	38 21.879	148 39.904	
501	18.2	332 18	11 28 5	2 1.3	38 21.897	148 39.894	
0	0.0	332 21	11 28 8	14 3.8	38 33.368	148 33.005	8
1438	18.2	332 22	11 28 9	46 14.7	38 38.992	148 29.704	
5001	18.1	332 22	11 28 9	51 58.0	38 39.333	148 29.474	
5002	18.2	332 22	11 28 9	52 16.2	38 39.351	148 29.464	
5140	18.2	332 23	11 28 10	34 7.8	38 41.872	148 28.148	
99	18.2	332 23	11 28 10	34 26.0	38 41.891	148 28.438	
100	18.2	332 23	11 28 10	34 26.0	38 41.891	148 28.438	
101	18.2	332 23	11 28 10	34 44.2	38 41.910	148 28.728	
219	18.2	333 0	11 28 11	10 31.8	38 43.743	148 26.237	
221	18.1	333 0	11 28 11	12 18.5	38 43.740	148 26.069	
100	18.1	333 0	11 28 11	15 18.0	38 43.725	148 25.778	
101	18.2	333 0	11 28 11	15 54.5	38 43.721	148 25.716	
102	18.2	333 0	11 28 11	15 54.4	38 43.721	148 25.717	
111	18.2	333 0	11 28 11	18 38.2	38 43.684	148 25.429	
110	18.2	333 5	11 28 16	50 44.0	38 43.294	148 27.204	
112	18.2	333 5	11 28 16	51 20.4	38 43.329	148 27.183	
113	18.2	333 5	11 28 16	51 20.4	38 43.329	148 27.183	
114	18.2	333 5	11 28 16	51 38.6	38 43.347	148 27.173	
301	18.2	333 5	11 28 16	52 51.4	38 43.419	148 27.133	
302	18.2	333 5	11 28 16	53 9.6	38 43.438	148 27.123	
303	18.2	333 5	11 28 16	53 9.6	38 43.438	148 27.123	
375	18.2	333 6	11 28 17	15 0.0	38 44.725	148 26.375	
5999	10.6	333 10	11 28 21	9 30.8	38 40.841	148 28.652	
6000	18.1	333 10	11 28 21	9 49.0	38 40.861	148 28.640	
6001	18.2	333 10	11 28 21	10 7.2	38 40.881	148 28.629	
0	0.0	333 17	11 29 4	20 53.7	39 7.500	148 13.002	9
7437	18.2	333 17	11 29 4	25 42.4	39 7.783	148 12.838	

TABLE 8(d) Line 82/101

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
0	0.0	327 3	11 22 14	27 9.5	37 58.500	149 6.800	4
0	0.0	327 5	11 22 16	47 50.6	38 7.051	149 2.133	3
100	16.1	327 6	11 22 17	50 56.1	38 11.872	148 59.475	
101	18.1	327 6	11 22 17	51 14.3	38 11.891	148 59.464	
102	18.2	327 6	11 22 17	51 32.5	38 11.911	148 59.454	
2389	18.2	327 18	11 23 5	25 15.9	38 53.811	148 36.058	
2390	15.4	327 18	11 23 5	25 49.4	38 53.841	148 36.041	
2391	18.1	327 18	11 23 5	26 7.6	38 53.858	148 36.032	
2392	18.2	327 18	11 23 5	26 25.8	38 53.877	148 36.025	
2393	18.2	327 18	11 23 5	26 44.0	38 53.896	148 36.018	
2394	18.2	327 18	11 23 5	27 2.2	38 53.915	148 36.010	

TABLE 8(e) Line 82/102

100	15.4	332 5	11 27 16	38 58.6	37 56.034	149 10.189	
101	18.1	332 5	11 27 16	39 16.8	37 56.048	149 10.172	
102	18.2	332 5	11 27 16	39 35.0	37 56.062	149 10.156	
130	18.2	332 5	11 27 16	48 4.6	37 56.438	149 9.655	
117	18.2	332 6	11 27 17	42 28.8	37 58.906	149 6.238	
118	18.2	332 6	11 27 17	42 28.8	37 58.906	149 6.238	
122	18.2	332 6	11 27 17	43 41.6	37 58.963	149 6.160	
199	18.2	332 7	11 27 18	7 3.0	38 0.059	149 4.637	
100	18.2	332 7	11 27 18	7 21.2	38 0.073	149 4.619	
0	0.0	332 10	11 27 21	51 38.0	38 10.604	148 50.054	5
0	0.0	332 12	11 27 23	40 58.8	38 15.973	148 43.392	6
1320	18.2	332 13	11 28 0	17 25.2	38 17.836	148 41.039	
1322	18.2	332 13	11 28 0	19 14.7	38 17.880	148 40.854	
1323	18.2	332 13	11 28 0	19 14.7	38 17.880	148 40.854	
1324	18.2	332 13	11 28 0	19 32.9	38 17.888	148 40.828	

TABLE 8(f) Line 82/201

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
994	20.0	328 23	11 24 10	9 20.0	39 30.867	147 20.538	
995	20.0	328 23	11 24 10	9 20.0	39 30.867	147 20.538	
1013	20.0	328 23	11 24 10	15 20.0	39 30.989	147 19.840	
1014	20.0	328 23	11 24 10	16 11.5	39 30.996	147 19.739	
1021	20.0	328 23	11 24 10	18 31.5	39 30.991	147 19.458	
999	20.0	328 23	11 24 10	19 19.0	39 30.978	147 19.361	
0	0.0	329 1	11 24 12	8 9.4	39 25.000	147 22.502	10
0	0.0	329 19	11 25 6	56 23.0	38 18.000	148 10.490	11
0	0.0	330 1	11 25 12	54 0.0	37 51.075	148 21.502	99
5792	20.0	330 1	11 25 12	56 59.0	37 50.984	148 21.341	

TABLE 8(g) Line 82/202

115	17.7	330 5	11 25 16	14 11.7	37 50.360	148 17.369	
117	17.7	330 5	11 25 16	14 47.1	37 50.325	148 17.388	
1	17.7	330 5	11 25 16	20 28.7	37 49.967	148 17.382	
2	17.7	330 5	11 25 16	20 48.7	37 49.948	148 17.370	
4	17.7	330 5	11 25 16	21 28.7	37 49.912	148 17.341	
5	17.7	330 5	11 25 16	21 48.7	37 49.894	148 17.325	
42	17.7	330 5	11 25 16	32 43.6	37 50.004	148 16.397	
100	17.7	330 5	11 25 16	37 53.3	37 50.248	148 15.945	
185	17.7	330 6	11 25 17	2 57.8	37 52.278	148 14.853	
100	17.7	330 6	11 25 17	6 57.5	37 52.613	148 14.681	
189	17.7	330 6	11 25 17	33 12.8	37 50.588	148 17.199	
100	17.7	330 6	11 25 17	58 27.0	37 57.151	148 12.649	
255	17.7	330 7	11 25 18	44 10.5	38 1.019	148 10.425	
100	17.7	330 7	11 25 18	46 26.6	38 1.213	148 10.326	
101	17.7	330 7	11 25 18	46 26.6	38 1.213	148 10.326	
102	17.7	330 7	11 25 18	51 27.9	38 1.647	148 10.115	
103	17.7	330 7	11 25 18	51 27.9	38 1.647	148 10.115	
104	17.7	330 7	11 25 18	51 27.9	38 1.647	148 10.115	
105	17.7	330 7	11 25 18	59 1.4	38 2.301	148 9.781	
106	17.7	330 7	11 25 18	59 1.4	38 2.301	148 9.781	
107	17.7	330 7	11 25 18	59 1.4	38 2.301	148 9.781	
100	17.7	330 8	11 25 19	8 43.3	38 3.138	148 9.337	
206	17.7	330 8	11 25 19	39 59.5	38 6.726	148 14.024	
207	17.7	330 8	11 25 19	40 34.9	38 6.790	148 13.998	
208	17.7	330 8	11 25 19	40 34.9	38 6.790	148 13.998	
211	17.7	330 8	11 25 19	41 28.0	38 6.885	148 13.960	
-708	19.4	330 8	11 25 19	51 33.7	38 4.591	148 1.142	
-682	19.4	330 8	11 25 19	59 58.1	38 5.242	148 0.755	
100	19.4	330 9	11 25 20	34 29.6	37 50.554	148 17.215	

TABLE 8 (g) (Continued)

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
136	19.4	330 9	11 25 20	46 8.0	37 52.285	148 17.984	
1	19.4	330 9	11 25 20	50 43.2	37 53.266	148 18.324	
6	19.4	330 9	11 25 20	52 20.2	37 53.601	148 18.429	
5002	17.7	330 9	11 25 20	55 41.7	37 54.250	148 18.624	
0	0.0	330 9	11 25 20	59 0.0	38 12.653	148 4.411	99
0	0.0	330 12	11 25 23	21 10.5	38 24.500	147 58.494	14
0	0.0	331 0	11 26 11	43 51.7	39 24.000	147 15.977	15
8165	17.7	331 1	11 26 12	28 46.8	39 27.796	147 13.275	

- Notes: i) Most shot numbers listed in the Gun Logger printouts for each line are tabulated here. Some of these may not correspond to actual shots in the water, others may be shots fired in the water but not used for reflection profiling. These latter may be recorded by land stations and are useful for checking the correct identification of shots recorded on land, eg. by identifying the first or final shots to be fired, which are not necessarily the first or final shots in a reflection recording sequence.
- ii) The tables are condensed; where two or more shots are in sequence (ie. the shot numbers increment by 1 and the shot times by the specified shot rate), only the first and last shot in that sequence is listed. The intermediate shot numbers and times can be interpolated from these. Where shots are listed individually the shot number or time does not conform to the expected pattern. Note in some cases the shot times listed in the Navlog or Gun Logger printouts appear not to update and a repeat shot time occurs; the true shot time may in fact be correct.
- iii) The positions are preliminary only, and are derived from information in the Navlog and Gun Logger printouts for each line.
- iv) Minutes and seconds are common to both Julian and Local Time.
- v) Shot No. and Shot Rate = 0 indicates a Way Point at which no shot coincided.
- vi) Way Point 99 indicates the position at the start or end of the line where the cross-course error of the ship's course relative to the desired course becomes less than 0.050 nautical miles. This arises when the ship starts (or breaks off) a line at a point other than a Way Point, and is converging (or diverging) from the desired course beforehand (or afterwards). These positions should be used to plot the actual start and finish of the line.

TABLE 9. Shot Statistics, Survey 90, March-April 1989.

(a) Line 90/002

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
471	16.7	75 14	3 17 1	8 44.1	38 54.222	147 5.726	
472	16.7	75 14	3 17 1	8 44.1	38 54.222	147 5.726	
473	18.2	75 14	3 17 1	9 2.3	38 54.233	147 5.704	
657	18.2	75 15	3 17 2	4 51.1	38 55.428	147 1.242	
666	18.2	75 15	3 17 2	58 23.1	38 56.249	146 57.856	
99	18.1	75 16	3 17 3	1 17.9	38 56.331	146 57.354	
100	18.1	75 16	3 17 3	1 17.9	38 56.331	146 57.354	
101	18.2	75 16	3 17 3	1 36.1	38 56.339	146 57.324	
311	18.2	75 17	3 17 4	5 18.1	38 58.582	146 51.559	
400	99.0	76 13	3 18 0	0 50.7	38 56.324	146 57.816	
402	18.2	76 13	3 18 0	1 45.3	38 56.309	146 57.868	
403	18.2	76 13	3 18 0	1 45.3	38 56.309	146 57.868	
569	18.2	76 13	3 18 0	52 6.5	38 55.662	147 0.126	
570	18.2	76 13	3 18 0	52 42.9	38 55.654	147 0.152	
500	16.8	76 13	3 18 0	53 52.3	38 55.639	147 0.195	
501	16.8	76 13	3 18 0	53 52.3	38 55.639	147 0.195	
502	18.2	76 13	3 18 0	54 10.5	38 55.636	147 0.206	
503	18.2	76 13	3 18 0	54 28.7	38 55.632	147 0.218	
504	13.1	76 13	3 18 0	55 10.0	38 55.624	147 0.245	
505	13.1	76 13	3 18 0	55 28.2	38 55.620	147 0.257	
100	99.0	76 14	3 18 1	50 25.7	38 54.717	147 2.319	
100	99.0	76 15	3 18 2	7 16.1	38 54.328	147 2.558	
101	18.1	76 15	3 18 2	7 34.3	38 54.314	147 2.566	
102	18.2	76 15	3 18 2	7 52.5	38 54.301	147 2.575	
255	18.2	76 15	3 18 2	54 17.1	38 52.106	147 4.149	
256	3.0	76 15	3 18 2	54 56.4	38 51.965	147 4.177	
257	3.0	76 15	3 18 2	54 56.4	38 51.965	147 4.177	
258	18.1	76 15	3 18 2	55 14.6	38 51.913	147 4.235	
259	18.2	76 15	3 18 2	55 32.8	38 51.864	147 4.304	
1563	18.2	76 22	3 18 9	31 5.6	38 45.785	147 10.207	
3449	18.2	77 9	3 18 20	52 59.0	38 29.809	147 20.078	
3450	18.2	77 9	3 18 20	52 59.0	38 29.809	147 20.078	
4090	18.2	77 13	3 19 0	7 7.0	38 18.565	147 27.093	
4092	18.2	77 13	3 19 0	8 1.6	38 18.528	147 27.150	
4093	18.2	77 13	3 19 0	8 1.6	38 18.528	147 27.150	
4094	24.3	77 13	3 19 0	8 25.9	38 18.510	147 27.179	
4104	24.3	77 13	3 19 0	12 28.9	38 18.336	147 27.450	
100	99.0	77 13	3 19 0	18 1.6	38 18.097	147 27.822	

101 17.3 77 13 3 19 0 18 37.1 38 18.070 147 27.861
 TABLE 9(a) (Continued).

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
102	17.3	77 13	3 19 0	18 37.1	38 18.070	147 27.861	
103	18.2	77 13	3 19 0	18 55.3	38 18.056	147 27.882	
126	18.2	77 13	3 19 0	25 53.9	38 17.748	147 28.345	
102	2.9	77 13	3 19 0	26 33.2	38 17.719	147 28.386	
103	18.2	77 13	3 19 0	26 51.4	38 17.705	147 28.405	
104	18.2	77 13	3 19 0	26 51.4	38 17.705	147 28.405	
0	0.0	77 13	3 19 0	52 0.0	38 17.116	147 30.401	99
0	0.0	77 15	3 19 1	17 36.4	38 19.227	147 37.119	3
0	0.0	77 20	3 19 6	6 15.0	38 24.950	148 0.209	4
1913	18.2	77 22	3 19 8	35 35.2	38 27.970	148 12.021	
1914	18.2	77 22	3 19 8	36 11.6	38 27.982	148 12.071	
1915	18.2	77 22	3 19 8	36 11.6	38 27.982	148 12.071	
1984	18.2	77 22	3 19 8	57 7.4	38 28.396	148 13.784	
1986	18.2	77 22	3 19 8	58 2.0	38 28.416	148 13.862	
2000	99.0	77 23	3 19 9	1 18.7	38 28.484	148 14.139	
2001	18.2	77 23	3 19 9	1 36.9	38 28.490	148 14.164	
0	0.0	78 2	3 19 12	52 8.5	38 33.244	148 33.007	5
3008	18.2	78 4	3 19 14	7 4.3	38 34.848	148 39.025	
3010	18.2	78 4	3 19 14	7 40.7	38 34.867	148 39.073	
3024	18.2	78 4	3 19 14	11 55.5	38 34.970	148 39.404	
3026	18.2	78 4	3 19 14	12 50.1	38 34.989	148 39.479	
3027	18.2	78 4	3 19 14	12 50.1	38 34.989	148 39.479	
3050	18.2	78 4	3 19 14	19 48.7	38 35.131	148 40.035	
3052	18.2	78 4	3 19 14	20 43.3	38 35.148	148 40.110	
3100	99.0	78 4	3 19 14	23 6.7	38 35.194	148 40.298	
3101	18.1	78 4	3 19 14	23 24.9	38 35.201	148 40.321	
3102	18.2	78 4	3 19 14	23 43.1	38 35.207	148 40.345	
0	0.0	78 6	3 19 16	47 7.7	38 38.300	148 51.801	6
3917	18.2	78 8	3 19 18	30 56.1	38 39.864	149 0.131	
3946	18.2	78 8	3 19 18	39 43.9	0 0.000	0 0.000	
3948	7.1	78 9	3 19 19	34 43.5	0 0.000	0 0.000	
3949	7.1	78 9	3 19 19	34 43.5	0 0.000	0 0.000	
3952	18.2	78 9	3 19 19	35 56.3	0 0.000	0 0.000	
3953	18.2	78 9	3 19 19	35 56.3	0 0.000	0 0.000	
3970	18.2	78 9	3 19 19	41 5.7	0 0.000	0 0.000	
3973	18.2	78 9	3 19 19	42 18.5	0 0.000	0 0.000	
3974	18.2	78 9	3 19 19	42 18.5	0 0.000	0 0.000	
3984	18.2	78 9	3 19 19	45 20.5	0 0.000	0 0.000	
3985	18.2	78 9	3 19 19	45 56.9	0 0.000	0 0.000	
3986	18.2	78 9	3 19 19	45 56.9	0 0.000	0 0.000	

TABLE 9(b) Line 90/004

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
103	18.1	78 17	3 20 3	56 34.7	0 0.000	0 0.000	
103	18.2	78 17	3 20 3	56 52.9	0 0.000	0 0.000	
104	18.2	78 17	3 20 3	56 52.9	0 0.000	0 0.000	
226	18.2	78 18	3 20 4	33 53.3	0 0.000	0 0.000	
228	18.2	78 18	3 20 4	34 47.9	0 0.000	0 0.000	
229	18.2	78 18	3 20 4	34 47.9	0 0.000	0 0.000	
684	18.2	78 20	3 20 6	52 48.9	0 0.000	0 0.000	
685	18.2	78 20	3 20 6	53 25.3	0 0.000	0 0.000	
686	18.2	78 20	3 20 6	53 25.3	0 0.000	0 0.000	
843	18.2	78 21	3 20 7	41 2.7	0 0.000	0 0.000	
845	18.2	78 21	3 20 7	41 57.3	0 0.000	0 0.000	
846	18.2	78 21	3 20 7	41 57.3	0 0.000	0 0.000	
3072	18.2	79 8	3 20 18	57 10.5	0 0.000	0 0.000	
4004	18.2	79 14	3 21 0	4 42.2	0 0.000	0 0.000	
4005	18.2	79 14	3 21 0	5 0.4	0 0.000	0 0.000	
4006	18.2	79 14	3 21 0	5 0.4	0 0.000	0 0.000	
4011	18.2	79 14	3 21 0	6 31.4	0 0.000	0 0.000	
4012	18.2	79 14	3 21 0	7 7.8	0 0.000	0 0.000	
4013	18.2	79 14	3 21 0	7 7.8	0 0.000	0 0.000	
4021	18.2	79 14	3 21 0	9 33.4	0 0.000	0 0.000	
4022	18.2	79 14	3 21 0	10 9.8	0 0.000	0 0.000	
4023	18.2	79 14	3 21 0	10 9.8	0 0.000	0 0.000	
4028	18.2	79 14	3 21 0	11 40.8	0 0.000	0 0.000	
4029	18.2	79 14	3 21 0	12 17.2	0 0.000	0 0.000	
4030	18.2	79 14	3 21 0	12 17.2	0 0.000	0 0.000	
4032	18.2	79 14	3 21 0	12 53.6	0 0.000	0 0.000	
4034	18.2	79 14	3 21 0	13 48.2	0 0.000	0 0.000	
4035	18.2	79 14	3 21 0	13 48.2	0 0.000	0 0.000	
4511	18.2	79 16	3 21 2	38 11.4	0 0.000	0 0.000	
4600	18.1	80 2	3 21 12	8 35.4	38 9.465	148 0.500	
4601	18.1	80 2	3 21 12	8 35.4	38 9.465	148 0.500	
4602	18.2	80 2	3 21 12	8 53.6	38 9.471	148 0.474	
0	0.0	80 2	3 21 12	33 20.0	38 9.800	147 58.500	12
0	0.0	80 4	3 21 14	27 21.5	38 11.282	147 49.020	13
5483	18.2	80 6	3 21 16	36 7.8	38 13.064	147 38.662	
5484	18.2	80 6	3 21 16	36 44.2	38 13.076	147 38.614	
5485	18.2	80 6	3 21 16	36 44.2	38 13.076	147 38.614	
5487	18.2	80 6	3 21 16	37 38.8	38 13.092	147 38.546	
0	0.0	80 6	3 21 16	39 36.7	38 13.000	147 38.401	14

TABLE 9(c) Line 90/005

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
100	18.2	80 6	3 21 16	38 33.4	38 13.112	147 38.478	
101	18.2	80 6	3 21 16	38 33.4	38 13.112	147 38.478	
0	0.0	80 6	3 21 16	39 36.7	38 13.000	147 38.401	14
0	0.0	80 11	3 21 21	20 18.2	38 25.600	147 19.470	15
0	0.0	80 15	3 22 1	21 25.2	38 40.787	147 11.285	16
0	0.0	80 18	3 22 4	2 43.3	38 50.000	147 5.313	17
2429	18.2	80 18	3 22 4	24 43.0	38 51.333	147 4.656	

TABLE 9(d) Line 90/007

0	0.0	81 3	3 22 13	32 48.9	39 25.000	147 16.962	18
2432	12.8	81 3	3 22 13	56 42.1	39 23.994	147 18.433	
2433	12.8	81 3	3 22 13	56 42.1	39 23.994	147 18.433	
2434	18.2	81 3	3 22 13	57 0.3	39 23.981	147 18.449	
2542	18.2	81 4	3 22 14	29 45.9	39 22.207	147 19.916	
2543	18.2	81 4	3 22 14	30 22.3	39 22.171	147 19.942	
2544	18.2	81 4	3 22 14	30 22.3	39 22.171	147 19.942	
2545	18.2	81 4	3 22 14	30 58.7	39 22.134	147 19.968	
2546	18.2	81 4	3 22 14	30 58.7	39 22.134	147 19.968	
2547	18.2	81 4	3 22 14	31 16.9	39 22.116	147 19.981	
2560	18.2	81 4	3 22 14	35 13.5	39 21.862	147 20.194	
99	18.2	81 4	3 22 14	35 31.7	39 21.826	147 20.208	
100	18.2	81 4	3 22 14	35 31.7	39 21.826	147 20.208	
1214	18.2	81 10	3 22 20	13 26.5	39 1.999	147 34.324	
1215	18.2	81 10	3 22 20	13 45.7	39 1.980	147 34.335	
0	0.0	81 17	3 23 3	25 15.5	38 36.286	147 52.764	19
0	0.0	81 20	3 23 6	33 0.0	38 24.949	148 0.238	20
0	0.0	82 4	3 23 14	8 26.4	38 56.800	148 15.822	21
4854	18.2	82 4	3 23 14	37 35.5	37 55.872	148 17.745	

TABLE 9(e) Line 90/009

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
0	0.0	82 10	3 23 20	57 25.0	37 53.500	148 46.802	22
100	18.1	82 11	3 23 21	1 2.8	37 53.702	148 46.666	
101	18.2	82 11	3 23 21	1 21.0	37 53.720	148 46.653	
102	18.2	82 11	3 23 21	1 39.2	37 53.738	148 46.640	
103	18.2	82 11	3 23 21	1 39.2	37 53.738	148 46.640	
109	18.2	82 11	3 23 21	3 28.4	37 53.837	148 46.556	
110	18.2	82 11	3 23 21	4 4.8	37 53.869	148 46.528	
111	18.2	82 11	3 23 21	4 4.8	37 53.869	148 46.528	
112	18.2	82 11	3 23 21	4 23.0	37 53.886	148 46.515	
129	18.2	82 11	3 23 21	9 32.4	37 54.183	148 46.285	
130	18.2	82 11	3 23 21	10 8.8	37 54.212	148 46.254	
131	18.2	82 11	3 23 21	10 8.8	37 54.212	148 46.254	
132	18.2	82 11	3 23 21	10 27.0	37 54.227	148 46.237	
135	18.2	82 11	3 23 21	11 21.6	37 54.275	148 46.192	
136	18.2	82 11	3 23 21	11 58.0	37 54.308	148 46.165	
137	18.2	82 11	3 23 21	11 58.0	37 54.308	148 46.165	
138	18.2	82 11	3 23 21	12 16.2	37 54.326	148 46.155	
145	18.2	82 11	3 23 21	14 23.6	37 54.457	148 46.081	
146	18.2	82 11	3 23 21	15 0.0	37 54.498	148 46.063	
147	18.2	82 11	3 23 21	15 0.0	37 54.498	148 46.063	
148	18.2	82 11	3 23 21	15 18.2	37 54.517	148 46.051	
358	18.2	82 12	3 23 22	19 0.2	37 58.417	148 43.648	
99	18.2	82 12	3 23 22	19 18.4	37 58.435	148 43.638	
100	18.2	82 12	3 23 22	19 18.4	37 58.435	148 43.638	
0	0.0	82 15	3 24 1	42 46.3	38 10.510	148 35.849	23
0	0.0	82 16	3 24 2	56 57.1	38 14.946	148 33.626	24
1793	18.2	82 20	3 24 6	52 51.0	38 28.415	148 23.923	
99	18.2	82 20	3 24 6	53 9.2	38 28.432	148 23.914	
100	18.2	82 20	3 24 6	53 9.2	38 28.432	148 23.914	
101	18.2	82 20	3 24 6	53 45.6	38 28.466	148 23.900	
102	18.2	82 20	3 24 6	54 3.8	38 28.482	148 23.892	
103	18.2	82 20	3 24 6	54 3.8	38 28.482	148 23.892	
0	0.0	82 22	3 24 8	29 0.0	38 33.910	148 19.964	25
0	0.0	82 23	3 24 9	6 40.8	38 36.053	148 17.959	26
1019	18.2	83 1	3 24 11	31 55.0	38 44.635	148 13.065	
1020	18.2	83 1	3 24 11	32 31.4	38 44.672	148 13.048	
1021	18.2	83 1	3 24 11	32 31.4	38 44.672	148 13.048	
1022	19.2	83 1	3 24 11	32 50.6	38 44.691	148 13.039	
1138	19.2	83 2	3 24 12	9 57.8	38 46.881	148 11.818	
999	19.2	83 2	3 24 12	12 37.3	38 47.043	148 11.706	

TABLE 9(e) (Continued).

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
1000	19.2	83 2	3 24 12	12 37.3	38 47.043	148 11.706	
0	0.0	83 2	3 24 12	16 28.8	38 47.250	148 11.541	27
1002	19.2	83 2	3 24 12	16 36.0	38 47.256	148 11.535	
1003	10.9	83 2	3 24 12	16 36.0	38 47.256	148 11.535	
1195	19.2	83 10	3 24 20	4 31.5	38 28.728	148 27.609	
1196	19.2	83 10	3 24 20	4 31.5	38 28.728	148 27.609	
1234	19.2	83 10	3 24 20	16 41.1	38 28.066	148 28.275	

TABLE 9(f) Line 90/011

0	0.0	83 16	3 25 2	13 47.6	38 31.000	148 6.713	28
99	6.2	83 16	3 25 2	18 43.0	38 30.720	148 6.919	
100	6.2	83 16	3 25 2	18 43.0	38 30.720	148 6.919	
101	18.1	83 16	3 25 2	19 1.2	38 30.703	148 6.935	
102	18.2	83 16	3 25 2	19 19.4	38 30.687	148 6.950	
105	18.2	83 16	3 25 2	20 14.0	38 30.637	148 6.996	
106	18.2	83 16	3 25 2	20 50.4	38 30.602	148 7.027	
108	18.2	83 16	3 25 2	21 26.8	38 30.568	148 7.056	
109	18.2	83 16	3 25 2	21 26.8	38 30.568	148 7.056	
141	18.2	83 16	3 25 2	31 9.2	38 30.032	148 7.547	
200	17.4	83 16	3 25 2	41 27.0	38 29.454	148 8.070	
201	17.4	83 16	3 25 2	41 27.0	38 29.454	148 8.070	
202	18.2	83 16	3 25 2	41 45.2	38 29.438	148 8.085	
0	0.0	83 18	3 25 4	53 50.4	38 22.382	148 14.402	29
0	0.0	83 19	3 25 5	42 55.5	38 19.372	148 16.594	30
0	0.0	83 21	3 25 7	57 57.9	38 11.260	148 22.206	31
0	0.0	84 0	3 25 10	43 34.3	38 0.520	148 26.193	32
2189	18.2	84 2	3 25 12	44 28.6	37 53.088	148 30.189	

TABLE 9(g) Line 90/013

2190	1.9	84 7	3 25 17	33 52.4	0 0.000	0 0.000	
2191	18.2	84 7	3 25 17	34 10.6	0 0.000	0 0.000	
2192	18.2	84 7	3 25 17	34 28.8	0 0.000	0 0.000	
2193	18.2	84 7	3 25 17	34 28.8	0 0.000	0 0.000	
0	0.0	84 8	3 25 18	36 53.2	37 57.410	148 3.370	35
2540	18.2	84 9	3 25 19	19 44.2	38 0.006	148 1.915	
101	18.2	84 9	3 25 19	21 0.0	38 0.078	148 1.859	
143	18.2	84 9	3 25 19	33 44.4	38 0.819	148 1.312	
99	13.6	84 13	3 25 23	50 11.8	37 56.849	148 3.711	
100	13.6	84 13	3 25 23	50 11.8	37 56.849	148 3.711	
101	18.1	84 13	3 25 23	50 30.0	37 56.868	148 3.699	
102	18.2	84 13	3 25 23	50 48.2	37 56.887	148 3.687	

TABLE 9(g) (Continued)

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
0	0.0	84 18	3 26 4	38 4.1	38 14.106	148 53.717	36
0	0.0	84 23	3 26 9	7 56.8	38 31.260	147 47.871	37
2076	18.2	84 23	3 26 9	49 35.0	38 32.895	147 46.174	
2077	18.2	84 23	3 26 9	50 11.4	38 32.932	147 46.147	
2078	18.2	84 23	3 26 9	50 11.4	38 32.932	147 46.147	
2093	18.2	84 23	3 26 9	54 44.4	38 33.204	147 45.927	
2096	18.2	84 23	3 26 9	55 39.0	38 33.259	147 45.884	
2097	18.2	84 23	3 26 9	55 57.2	38 33.277	147 45.869	
2099	18.2	84 23	3 26 9	56 51.8	38 34.136	147 45.776	
2103	18.2	84 23	3 26 9	58 4.6	0 0.000	0 0.000	
2104	18.2	84 23	3 26 9	58 41.0	0 0.000	0 0.000	
2200	99.0	85 0	3 26 10	1 36.2	0 0.000	0 0.000	
2201	18.1	85 0	3 26 10	1 54.4	0 0.000	0 0.000	
2202	18.2	85 0	3 26 10	2 12.6	0 0.000	0 0.000	
0	0.0	0 0	3 26 11	0 0.0	38 38.530	147 42.206	38
2221	18.2	85 0	3 26 10	7 58.4	38 40.566	148 11.216	
2222	18.2	85 0	3 26 10	8 34.8	38 40.602	148 11.181	
2223	18.2	85 0	3 26 10	8 34.8	38 40.602	148 11.181	
2235	18.2	85 0	3 26 10	12 13.2	38 40.819	148 10.980	
2236	18.2	85 0	3 26 10	12 49.6	38 40.855	148 10.947	
3605	18.2	85 7	3 26 17	8 5.4	38 59.187	147 26.883	
3606	18.2	85 7	3 26 17	8 24.6	38 59.205	147 26.869	
3618	18.2	85 7	3 26 17	12 3.0	38 59.405	147 26.709	
3619	18.2	85 7	3 26 17	12 22.2	38 59.422	147 26.694	
3642	18.2	85 7	3 26 17	19 20.8	38 59.792	147 26.384	
3643	18.3	85 7	3 26 17	19 39.0	38 59.808	147 26.371	
3644	18.2	85 7	3 26 17	19 57.2	38 59.824	147 26.357	
3645	18.3	85 7	3 26 17	20 15.4	38 59.841	147 26.344	
3646	18.3	85 7	3 26 17	20 33.6	38 59.858	147 26.331	
3647	18.3	85 7	3 26 17	20 51.8	38 59.875	147 26.318	
3648	18.3	85 7	3 26 17	21 10.0	38 59.893	147 26.305	
3649	18.3	85 7	3 26 17	21 28.2	38 59.910	147 26.292	
3650	18.3	85 7	3 26 17	21 46.4	38 59.928	147 26.279	
3651	18.3	85 7	3 26 17	22 4.6	38 59.945	147 26.266	
3652	18.3	85 7	3 26 17	22 22.8	38 59.963	147 26.253	
3653	18.3	85 7	3 26 17	22 41.0	38 59.981	147 26.240	
3654	18.3	85 7	3 26 17	22 59.2	38 59.999	147 26.227	
3655	18.3	85 7	3 26 17	23 17.4	39 0.016	147 26.214	
3656	18.3	85 7	3 26 17	23 35.6	39 0.033	147 26.201	
3657	18.3	85 7	3 26 17	23 53.8	39 0.050	147 26.188	

TABLE 9(g) (Continued).

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
3658	18.3	85 7	3 26 17	24 12.0	39 0.067	147 26.174	
3659	18.3	85 7	3 26 17	24 30.2	39 0.085	147 26.160	
3660	18.3	85 7	3 26 17	24 48.4	39 0.102	147 26.146	
3661	18.3	85 7	3 26 17	25 6.6	39 0.119	147 26.132	
3662	18.3	85 7	3 26 17	25 24.8	39 0.136	147 26.119	
3663	18.3	85 7	3 26 17	25 43.0	39 0.152	147 26.106	
3664	18.3	85 7	3 26 17	26 1.2	39 0.169	147 26.093	
3665	18.3	85 7	3 26 17	26 19.4	39 0.186	147 26.080	
3666	18.2	85 7	3 26 17	26 37.6	39 0.202	147 26.067	
0	0.0	85 9	3 26 19	31 33.6	39 7.400	147 20.699	39
4139	18.2	85 9	3 26 19	50 6.2	39 8.486	147 19.894	
4140	18.2	85 9	3 26 19	50 25.4	39 8.504	147 19.879	
4141	18.2	85 9	3 26 19	50 44.6	39 8.522	147 19.864	
4167	18.2	85 9	3 26 19	58 37.8	39 8.980	147 19.498	
4168	18.2	85 9	3 26 19	58 57.0	39 8.998	147 19.483	
4214	18.2	85 10	3 26 20	12 54.2	39 9.830	147 18.814	

TABLE 9(h) Line 90/015

99	9.3	85 14	3 27 0	15 43.1	39 6.813	147 9.752	
101	18.2	85 14	3 27 0	16 19.5	39 6.779	147 9.771	
102	18.2	85 14	3 27 0	16 37.7	39 6.762	147 9.779	
103	18.2	85 14	3 27 0	16 37.7	39 6.762	147 9.779	
129	18.2	85 14	3 27 0	24 30.9	39 6.293	147 10.055	
130	18.2	85 14	3 27 0	24 50.1	39 6.273	147 10.068	
131	18.2	85 14	3 27 0	25 9.3	39 6.254	147 10.080	
0	0.0	85 14	3 27 0	26 2.9	39 6.200	147 10.115	40
135	18.2	85 14	3 27 0	26 22.1	39 6.180	147 10.128	
136	18.2	85 14	3 27 0	26 42.3	39 6.159	147 10.141	
155	18.2	85 14	3 27 0	32 28.1	39 5.814	147 10.360	
156	14.9	85 14	3 27 0	33 13.3	39 5.768	147 10.386	
157	18.2	85 14	3 27 0	33 31.5	39 5.750	147 10.395	
158	18.1	85 14	3 27 0	33 49.7	39 5.731	147 10.405	
159	18.1	85 14	3 27 0	34 7.9	39 5.713	147 10.415	
160	18.1	85 14	3 27 0	34 26.1	39 5.694	147 10.425	
161	18.1	85 14	3 27 0	34 44.3	39 5.676	147 10.436	
162	18.1	85 14	3 27 0	35 2.5	39 5.657	147 10.446	
163	18.1	85 14	3 27 0	35 20.7	39 5.639	147 10.455	
164	18.1	85 14	3 27 0	35 38.9	39 5.621	147 10.463	
165	18.1	85 14	3 27 0	35 57.1	39 5.603	147 10.471	
166	18.1	85 14	3 27 0	36 15.3	39 5.584	147 10.481	

TABLE 9(h) (Continued).

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
167	18.1	85 14	3 27 0	36 33.5	39 5.565	147 10.490	
168	18.1	85 14	3 27 0	36 51.7	39 5.546	147 10.500	
169	18.1	85 14	3 27 0	37 9.9	39 5.527	147 10.509	
170	18.2	85 14	3 27 0	37 28.1	39 5.508	147 10.519	
229	18.2	85 14	3 27 0	55 21.9	39 4.397	147 11.079	
99	18.2	85 14	3 27 0	55 40.1	39 4.380	147 11.090	
100	18.2	85 14	3 27 0	55 40.1	39 4.380	147 11.090	
0	0.0	85 16	3 27 2	28 25.2	38 58.578	147 14.263	41
1831	18.2	85 23	3 27 9	40 44.3	38 32.342	147 29.505	
1832	18.2	85 23	3 27 9	41 3.5	38 32.322	147 29.517	
0	0.0	86 3	3 27 13	17 39.1	38 19.227	147 37.102	42
0	0.0	86 4	3 27 14	18 21.0	38 15.500	147 39.180	43
0	0.0	86 7	3 27 17	23 5.8	38 5.000	147 47.998	44
3490	18.2	86 8	3 27 18	3 59.1	38 2.604	147 49.937	

TABLE 9(i) Line 90/017

100	99.0	86 16	3 28 2	37 35.7	38 21.094	147 22.066	
101	18.1	86 16	3 28 2	37 53.9	38 21.108	147 22.046	
102	18.2	86 16	3 28 2	38 12.1	38 21.122	147 22.026	
116	18.2	86 16	3 28 2	42 26.9	38 21.324	147 21.735	
102	18.2	86 16	3 28 2	44 15.8	38 21.404	147 21.617	
103	18.2	86 16	3 28 2	44 15.8	38 21.404	147 21.617	
0	0.0	86 17	3 28 3	22 8.0	38 23.083	147 19.400	45
381	18.2	86 18	3 28 4	8 35.4	38 24.846	147 22.763	
383	18.2	86 18	3 28 4	9 30.0	38 24.870	147 22.838	
384	18.2	86 18	3 28 4	9 30.0	38 24.870	147 22.838	
398	18.2	86 18	3 28 4	13 44.8	38 24.983	147 23.182	
399	18.2	86 18	3 28 4	14 3.1	38 24.992	147 23.207	
903	18.2	86 20	3 28 6	46 55.9	38 29.537	147 34.866	
905	18.2	86 20	3 28 6	47 32.3	38 29.554	147 34.911	
949	18.2	86 21	3 28 7	0 53.1	38 29.941	147 35.875	
950	18.2	86 21	3 28 7	1 29.5	38 29.961	147 35.919	
951	18.2	86 21	3 28 7	1 47.7	38 29.970	147 35.942	
952	18.2	86 21	3 28 7	1 47.7	38 29.970	147 35.942	
953	18.2	86 21	3 28 7	2 24.1	38 29.991	147 35.987	
954	18.2	86 21	3 28 7	2 24.1	38 29.991	147 35.987	
960	18.2	86 21	3 28 7	4 13.3	38 30.048	147 36.122	
961	18.2	86 21	3 28 7	4 49.7	38 30.066	147 36.167	
962	18.2	86 21	3 28 7	4 49.7	38 30.066	147 36.167	
966	18.2	86 21	3 28 7	6 2.5	38 30.101	147 36.257	

TABLE 9(i) (Continued).

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
967	18.2	86 21	3 28 7	6 38.9	38 30.117	147 36.302	
968	18.2	86 21	3 28 7	6 38.9	38 30.117	147 36.302	
0	0.0	86 21	3 28 7	19 23.5	38 30.479	147 37.265	46
0	0.0	87 0	3 28 10	42 45.0	38 36.310	147 52.768	47
2233	18.2	87 3	3 28 13	30 21.9	38 41.054	148 5.595	
2234	18.2	87 3	3 28 13	30 41.1	38 41.063	148 5.620	
2905	18.2	87 6	3 28 16	54 13.3	38 46.985	148 21.545	
3022	18.2	88 17	3 30 3	7 16.4	38 40.603	147 46.577	
3023	18.2	88 17	3 30 3	7 16.4	38 40.603	147 46.577	
3107	18.2	88 17	3 30 3	32 45.2	38 39.511	147 48.215	
131	18.2	88 19	3 30 5	28 36.8	38 37.790	147 56.799	
200	99.0	88 19	3 30 5	31 36.5	38 37.853	147 56.997	
201	18.2	88 19	3 30 5	31 54.7	38 37.861	147 57.020	
0	0.0	89 6	3 30 16	35 14.4	38 56.996	148 48.500	48
2535	18.2	89 7	3 30 17	19 53.5	38 58.121	148 45.424	

TABLE 9(j) Line 90/019

2621	18.2	89 20	3 31 6	14 17.4	39 5.554	148 1.017	
2622	18.2	89 20	3 31 6	14 17.4	39 5.554	148 1.017	
2624	18.2	89 20	3 31 6	14 53.8	39 5.517	148 1.036	
2626	18.2	89 20	3 31 6	15 48.4	39 5.461	148 1.064	
2627	18.2	89 20	3 31 6	15 48.4	39 5.461	148 1.064	
2643	18.2	89 20	3 31 6	20 39.6	39 5.167	148 1.246	
2644	18.2	89 20	3 31 6	20 56.8	39 5.150	148 1.256	
2653	18.2	89 20	3 31 6	23 40.6	39 4.980	148 1.366	
2654	18.2	89 20	3 31 6	24 17.0	39 4.942	148 1.388	
2658	18.2	89 20	3 31 6	25 29.8	39 4.867	148 1.430	
2660	18.2	89 20	3 31 6	26 6.2	39 4.828	148 1.453	
2661	18.2	89 20	3 31 6	26 42.6	39 4.790	148 1.477	
2663	18.2	89 20	3 31 6	27 19.0	39 4.752	148 1.499	
2666	18.2	89 20	3 31 6	28 31.8	39 4.677	148 1.540	
2667	18.2	89 20	3 31 6	29 8.2	39 4.640	148 1.559	
2669	18.2	89 20	3 31 6	29 44.6	39 4.603	148 1.581	
2670	18.2	89 20	3 31 6	30 21.0	39 4.567	148 1.602	
2672	18.2	89 20	3 31 6	30 57.4	39 4.532	148 1.623	
2673	18.2	89 20	3 31 6	31 33.8	39 4.495	148 1.643	
2675	18.2	89 20	3 31 6	32 10.2	39 4.458	148 1.662	
2676	18.2	89 20	3 31 6	32 46.6	39 4.421	148 1.681	
2678	18.2	89 20	3 31 6	33 23.0	39 4.384	148 1.699	
2681	18.2	89 20	3 31 6	34 54.0	39 4.292	148 1.750	

TABLE 9(j) (Continued).

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
2684	18.2	89 20	3 31 6	35 48.6	39 4.237	148 1.779	
2685	18.2	89 20	3 31 6	36 25.0	39 4.199	148 1.803	
2687	18.2	89 20	3 31 6	37 1.4	39 4.161	148 1.829	
91	18.1	89 20	3 31 6	41 7.3	39 3.910	148 1.973	
92	18.1	89 20	3 31 6	41 25.5	39 3.891	148 1.984	
93	18.2	89 20	3 31 6	41 43.7	39 3.872	148 1.994	
157	18.2	89 21	3 31 7	1 8.5	39 2.684	148 2.685	
159	18.2	89 21	3 31 7	2 3.1	39 2.635	148 2.716	
160	18.2	89 21	3 31 7	2 3.1	39 2.635	148 2.716	
161	19.2	89 21	3 31 7	2 22.3	39 2.618	148 2.725	
585	19.2	89 23	3 31 9	18 3.1	38 54.782	148 7.052	
592	19.2	89 23	3 31 9	20 40.6	38 54.645	148 7.172	
593	19.2	89 23	3 31 9	20 40.6	38 54.645	148 7.172	
617	19.2	89 23	3 31 9	28 21.4	38 54.371	148 7.703	
102	18.1	90 23	4 1 9	48 33.3	39 8.698	148 3.825	
103	18.2	90 23	4 1 9	48 51.5	39 8.691	148 3.838	
124	18.2	90 23	4 1 9	55 13.7	39 8.506	148 4.177	
100	18.1	91 21	4 2 7	51 8.6	39 8.040	147 59.642	
101	18.2	91 21	4 2 7	51 26.8	39 8.024	147 59.654	
106	18.2	91 21	4 2 7	52 57.8	39 7.940	147 59.695	
100	99.0	91 21	4 2 7	57 20.5	39 7.675	147 59.845	
101	19.2	91 21	4 2 7	57 58.9	39 7.636	147 59.863	
102	19.2	91 21	4 2 7	57 58.9	39 7.636	147 59.863	
203	19.2	91 22	4 2 8	30 18.1	39 5.893	148 0.863	
204	8.4	92 6	4 2 16	34 14.2	39 8.256	147 59.464	
205	8.4	92 6	4 2 16	34 14.2	39 8.256	147 59.464	
206	19.1	92 6	4 2 16	34 33.4	39 8.237	147 59.472	
207	19.2	92 6	4 2 16	34 52.6	39 8.218	147 59.481	
281	19.2	92 6	4 2 16	58 33.4	39 6.815	148 0.461	
283	18.9	92 15	4 3 1	18 1.6	39 6.341	148 0.482	
284	18.9	92 15	4 3 1	18 1.6	39 6.341	148 0.482	
285	19.1	92 15	4 3 1	18 20.8	39 6.323	148 0.494	
286	19.2	92 15	4 3 1	18 40.0	39 6.305	148 0.507	
319	19.2	92 15	4 3 1	29 13.6	39 5.759	148 0.827	
322	4.4	92 16	4 3 2	40 38.7	39 3.058	148 3.197	
323	19.1	92 16	4 3 2	40 57.9	39 3.063	148 3.213	
324	19.2	92 16	4 3 2	41 17.1	39 3.066	148 3.230	
345	19.2	92 16	4 3 2	48 0.3	39 3.177	148 3.594	
346	13.4	92 20	4 3 6	4 22.4	39 10.701	147 58.553	
347	13.4	92 20	4 3 6	4 22.4	39 10.701	147 58.553	

TABLE 9(j) (Continued)

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
348	19.1	92 20	4 3 6	4 41.6	39 10.689	147 58.532	
349	19.2	92 20	4 3 6	5 0.8	39 10.677	147 58.511	
360	19.2	92 20	4 3 6	8 32.0	39 10.526	147 58.334	
465	6.2	93 11	4 3 21	25 19.8	38 23.861	148 12.861	
466	6.2	93 11	4 3 21	25 19.8	38 23.861	148 12.861	
467	19.1	93 11	4 3 21	25 39.0	38 23.877	148 12.843	
468	19.2	93 11	4 3 21	25 58.2	38 23.893	148 12.826	
809	19.2	93 13	4 3 23	15 5.4	38 23.099	148 8.043	
811	19.2	93 14	4 4 0	9 26.7	38 20.015	148 10.650	
812	19.2	93 14	4 4 0	9 26.7	38 20.015	148 10.650	
813	19.1	93 14	4 4 0	9 45.9	38 19.996	148 10.663	
814	19.2	93 14	4 4 0	10 5.1	38 19.977	148 10.676	
827	19.2	93 14	4 4 0	14 14.7	38 19.733	148 10.872	
828	9.7	93 15	4 4 1	35 19.4	38 21.697	148 14.838	
829	9.7	93 15	4 4 1	35 19.4	38 21.697	148 14.838	
830	19.2	93 15	4 4 1	35 38.6	38 21.715	148 14.824	
846	19.2	93 15	4 4 1	40 45.8	38 21.999	148 14.585	
921	17.0	93 16	4 4 2	5 3.0	38 23.267	148 13.424	
922	19.2	93 16	4 4 2	5 22.2	38 23.286	148 13.410	
957	19.2	93 16	4 4 2	16 34.2	38 23.977	148 12.703	

TABLE 9(k) Line 90/021

99	8.2	93 16	4 4 2	33 18.2	38 24.803	148 12.076	
100	8.2	93 16	4 4 2	33 18.2	38 24.803	148 12.076	
101	19.2	93 16	4 4 2	33 37.4	38 24.820	148 12.061	
0	0.0	93 17	4 4 3	21 13.0	38 27.390	148 9.907	49
359	19.2	93 17	4 4 3	56 11.0	38 29.154	148 8.437	
99	19.2	93 17	4 4 3	56 30.2	38 29.171	148 8.424	
100	19.2	93 17	4 4 3	56 30.2	38 29.171	148 8.424	
0	0.0	93 19	4 4 5	48 0.0	38 35.000	148 3.483	50
677	19.2	93 21	4 4 7	1 8.6	38 39.237	148 1.099	
678	19.2	93 21	4 4 7	1 47.0	38 39.275	148 1.072	
679	19.2	93 21	4 4 7	1 47.0	38 39.275	148 1.072	
680	18.2	93 21	4 4 7	2 5.2	38 39.293	148 1.060	
859	18.2	93 21	4 4 7	56 23.0	38 42.647	147 59.203	
860	18.2	93 21	4 4 7	56 41.1	38 42.664	147 59.193	
0	0.0	93 22	4 4 8	58 3.9	38 46.394	147 57.081	51
0	0.0	94 5	4 4 15	13 33.6	39 8.800	147 42.815	52
2434	18.2	94 5	4 4 15	54 7.9	39 11.210	147 41.273	

TABLE 9(1) Line 90/023

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
100	18.2	94 11	4 4 21	26 59.6	39 5.691	148 0.961	
101	18.2	94 11	4 4 21	27 17.8	39 5.673	148 0.969	
102	18.2	94 11	4 4 21	27 17.8	39 5.673	148 0.969	
109	18.2	94 11	4 4 21	29 25.2	39 5.550	148 1.036	
110	18.2	94 11	4 4 21	30 1.6	39 5.515	148 1.060	
111	18.2	94 11	4 4 21	30 1.6	39 5.515	148 1.060	
114	18.2	94 11	4 4 21	30 56.2	39 5.463	148 1.092	
115	18.2	94 11	4 4 21	31 32.6	39 5.429	148 1.111	
116	18.2	94 11	4 4 21	31 32.6	39 5.429	148 1.111	
117	18.2	94 11	4 4 21	31 50.8	39 5.412	148 1.120	
119	18.2	94 11	4 4 21	32 27.2	39 5.377	148 1.139	
120	18.2	94 11	4 4 21	33 3.6	39 5.343	148 1.158	
121	18.2	94 11	4 4 21	33 3.6	39 5.343	148 1.158	
122	18.2	94 11	4 4 21	33 21.8	39 5.325	148 1.168	
129	18.2	94 11	4 4 21	35 29.2	39 5.209	148 1.234	
130	6.4	94 11	4 4 21	45 35.4	39 4.629	148 1.556	
131	6.4	94 11	4 4 21	45 35.4	39 4.629	148 1.556	
132	18.2	94 11	4 4 21	45 53.6	39 4.611	148 1.567	
142	18.2	94 11	4 4 21	48 55.6	39 4.432	148 1.669	
143	18.2	94 11	4 4 21	49 32.0	39 4.395	148 1.689	
144	18.2	94 11	4 4 21	49 32.0	39 4.395	148 1.689	
145	18.2	94 11	4 4 21	49 50.2	39 4.378	148 1.698	
146	18.2	94 11	4 4 21	50 26.6	39 4.341	148 1.719	
147	18.2	94 11	4 4 21	50 26.6	39 4.341	148 1.719	
148	18.2	94 11	4 4 21	50 44.8	39 4.323	148 1.729	
0	0.0	94 12	4 4 22	11 37.0	39 3.000	148 2.496	53
0	0.0	94 19	4 5 5	40 55.9	38 36.053	148 17.883	54
0	0.0	94 20	4 5 6	18 53.2	38 33.910	148 19.508	55
0	0.0	94 21	4 5 7	22 3.3	38 30.480	148 22.465	56
2159	18.2	94 22	4 5 8	0 45.0	38 28.178	148 24.181	

TABLE 9(m) Line 90/025

7100	99.0	95 22	4 6 8	58 23.7	39 8.074	146 28.827	
7101	18.2	95 22	4 6 8	59 0.1	39 8.086	146 28.777	
7102	18.2	95 22	4 6 8	59 0.1	39 8.086	146 28.777	
7109	18.2	95 23	4 6 9	1 7.5	39 8.131	146 28.603	
100	17.8	96 6	4 6 16	31 38.6	39 14.382	145 56.562	
101	17.8	96 6	4 6 16	31 38.6	39 14.382	145 56.562	
102	18.1	96 6	4 6 16	31 56.8	39 14.400	145 56.562	
103	18.2	96 6	4 6 16	32 15.0	39 14.418	145 56.560	
104	18.2	96 6	4 6 16	32 33.2	39 14.437	145 56.556	

TABLE 9(m) (Continued)

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
105	18.2	96 6	4 6 16	33 9.6	39 14.474	145 56.550	
106	18.2	96 6	4 6 16	33 9.6	39 14.474	145 56.550	
107	18.2	96 6	4 6 16	33 27.8	39 14.493	145 56.549	
109	18.2	96 6	4 6 16	34 4.2	39 14.530	145 56.546	
110	18.2	96 6	4 6 16	34 40.6	39 14.567	145 56.542	
111	18.2	96 6	4 6 16	34 40.6	39 14.567	145 56.542	
112	18.2	96 6	4 6 16	35 17.0	39 14.604	145 56.538	
113	18.2	96 6	4 6 16	35 17.0	39 14.604	145 56.538	
114	18.2	96 6	4 6 16	35 35.2	39 14.622	145 56.537	
115	20.8	96 6	4 6 16	35 56.0	39 14.642	145 56.535	
0	0.0	96 6	4 6 16	44 0.0	39 15.105	145 56.475	99
502	20.8	96 8	4 6 18	50 5.6	39 21.667	145 52.997	
503	20.8	96 8	4 6 18	50 47.2	39 21.702	145 52.975	
504	99.0	96 8	4 6 18	59 51.5	39 22.160	145 52.641	
505	20.8	96 9	4 6 19	0 12.3	39 22.177	145 52.629	
555	20.8	96 9	4 6 19	17 32.3	39 23.103	145 52.136	
0	0.0	96 15	4 7 1	25 0.0	39 13.010	145 57.788	99
699	11.8	96 16	4 7 2	7 4.7	39 14.944	145 56.238	
700	11.8	96 16	4 7 2	7 4.7	39 14.944	145 56.238	
701	20.7	96 16	4 7 2	7 25.5	39 14.963	145 56.235	
702	20.8	96 16	4 7 2	7 46.3	39 14.983	145 56.232	
710	20.8	96 16	4 7 2	10 32.7	39 15.142	145 56.197	
699	2.4	96 16	4 7 2	11 16.7	39 15.181	145 56.187	
700	2.4	96 16	4 7 2	11 16.7	39 15.181	145 56.187	
701	20.8	96 16	4 7 2	11 37.5	39 15.199	145 56.182	
4410	20.8	97 13	4 7 23	37 24.7	40 23.724	145 16.603	
0	0.0	97 13	4 7 23	41 0.0	40 23.941	145 16.485	99

TABLE 9(n) Line 90/027

101	16.7	97 17	4 8 3	43 39.2	40 17.306	145 1.096	
102	16.7	97 17	4 8 3	43 39.2	40 17.306	145 1.096	
103	18.1	97 17	4 8 3	43 57.4	40 17.289	145 1.108	
104	18.2	97 17	4 8 3	44 15.6	40 17.273	145 1.123	
168	18.2	97 18	4 8 4	3 40.4	40 16.164	145 1.999	
99	18.2	97 18	4 8 4	4 53.2	40 16.092	145 2.036	
100	18.2	97 18	4 8 4	4 53.2	40 16.092	145 2.036	
0	0.0	97 18	4 8 4	6 29.5	40 16.000	145 2.084	59
121	18.2	97 18	4 8 4	11 15.4	40 15.745	145 2.215	
100	3.9	97 18	4 8 4	12 32.0	40 15.678	145 2.259	

TABLE 9(n) (Continued)

Shot No.	Shot Rate s	Julian Time d h	Local Time mth d h	Time m s	Latitude deg min	Longitude deg min	Way pt.
101	3.9	97 18	4 8 4	12 32.0	40 15.678	145 2.259	
103	18.2	97 18	4 8 4	13 26.6	40 15.630	145 2.295	
104	18.2	97 18	4 8 4	13 26.6	40 15.630	145 2.295	
0	0.0	98 5	4 8 15	58 45.0	39 34.295	145 31.669	60
2975	18.2	98 8	4 8 18	44 18.8	39 24.519	145 38.360	
2977	18.2	98 8	4 8 18	45 13.4	39 24.465	145 38.395	
2999	1.8	98 8	4 8 18	57 26.0	39 23.738	145 38.894	
3000	1.8	98 8	4 8 18	57 26.0	39 23.738	145 38.894	
3001	18.2	98 8	4 8 18	57 44.2	39 23.721	145 38.907	
3020	18.2	98 9	4 8 19	3 30.0	39 23.384	145 39.143	
2999	4.0	98 12	4 8 22	57 25.3	39 25.184	145 37.915	
3000	4.0	98 12	4 8 22	57 25.3	39 25.184	145 37.915	
3001	18.2	98 12	4 8 22	57 43.5	39 25.166	145 37.927	
0	0.0	98 18	4 9 4	3 28.9	39 7.500	145 50.992	61
4071	18.2	98 18	4 9 4	22 17.5	39 6.415	145 50.738	
4088	3.6	98 18	4 9 4	28 5.8	39 6.139	145 51.016	
4089	3.6	98 18	4 9 4	28 5.8	39 6.139	145 51.016	
4090	18.1	98 18	4 9 4	28 24.0	39 6.122	145 51.030	
4091	18.2	98 18	4 9 4	28 42.2	39 6.104	145 51.045	
4107	18.2	98 18	4 9 4	33 33.4	39 5.834	145 51.262	

- Notes: i) Most shot numbers listed in the Gun Logger printouts for each line are tabulated here. Some of these may not correspond to actual shots in the water, others may be shots fired in the water but not used for reflection profiling. These latter may be recorded by land stations and are useful for checking the correct identification of shots recorded on land, eg. by identifying the first or final shots to be fired, which are not necessarily the first or final shots in a reflection recording sequence.
- ii) The tables are condensed; where two or more shots are in sequence (ie. the shot numbers increment by 1 and the shot times by the specified shot rate), only the first and last shot in that sequence is listed. The intermediate shot numbers and times can be interpolated from these. Where shots are listed individually the shot number or time does not conform to the expected pattern. Note in some cases the shot times listed in the Navlog or Gun Logger printouts appear not to update and a repeat shot time occurs; the true shot time may in fact be correct.

- iii) The positions are preliminary only, and are derived from information in the Navlog and Gun Logger print-outs for each line.
- iv) Minutes and seconds are common to both Julian and Local Time.
- v) Shot No. and Shot Rate = 0 indicates a Way Point at which no shot coincided.
- vi) Way Point 99 indicates the position at the start or end of the line where the cross-course error of the ship's course relative to the desired course becomes less than 0.050 nautical miles. This arises when the ship starts (or breaks off) a line at a point other than a Way Point, and is converging (or diverging) from the desired course beforehand (or afterwards). These positions should be used to plot the actual start and finish of the line.

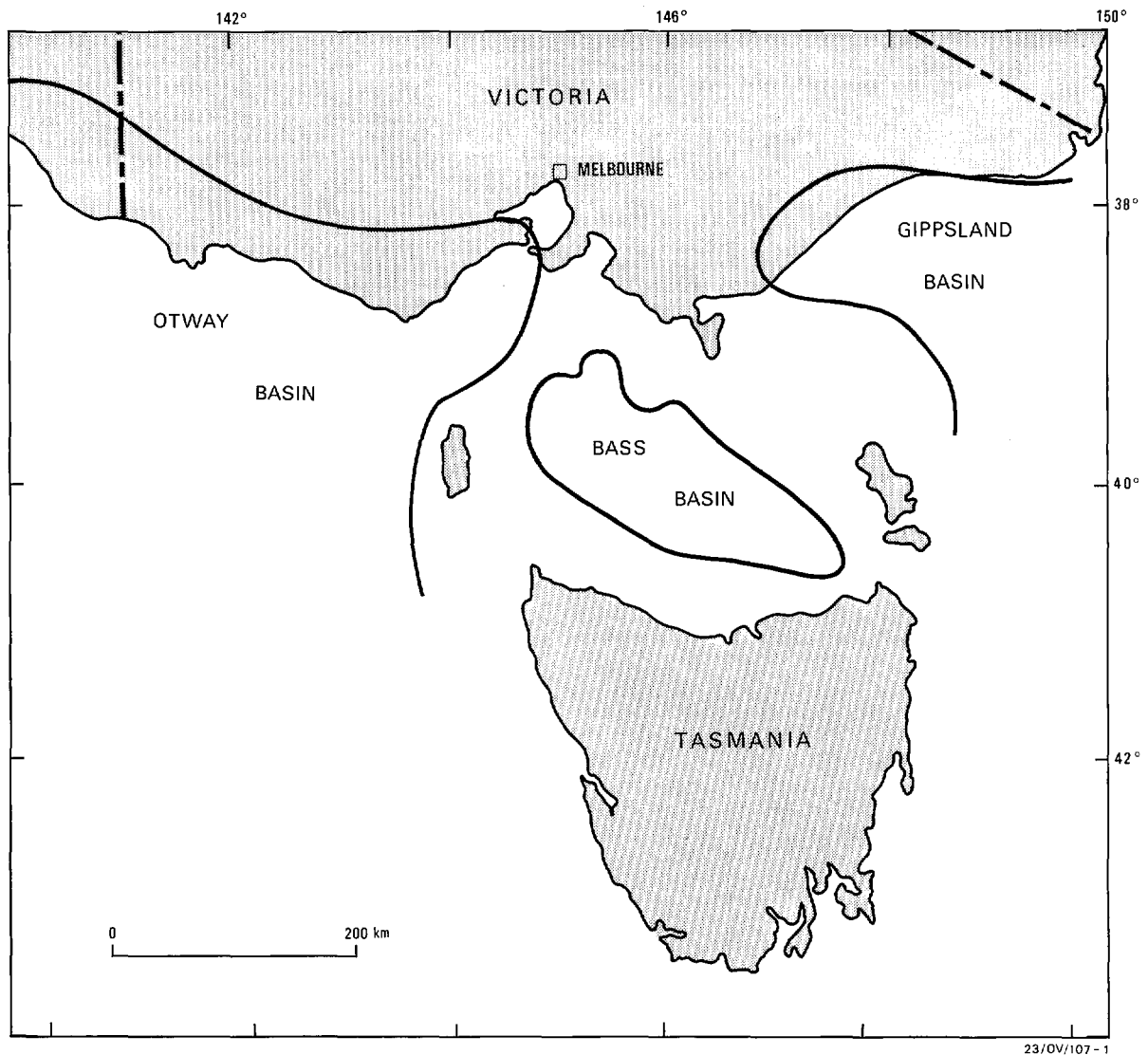


Figure 1. Location map showing the general outline of the Otway, Bass and Gippsland Basins.

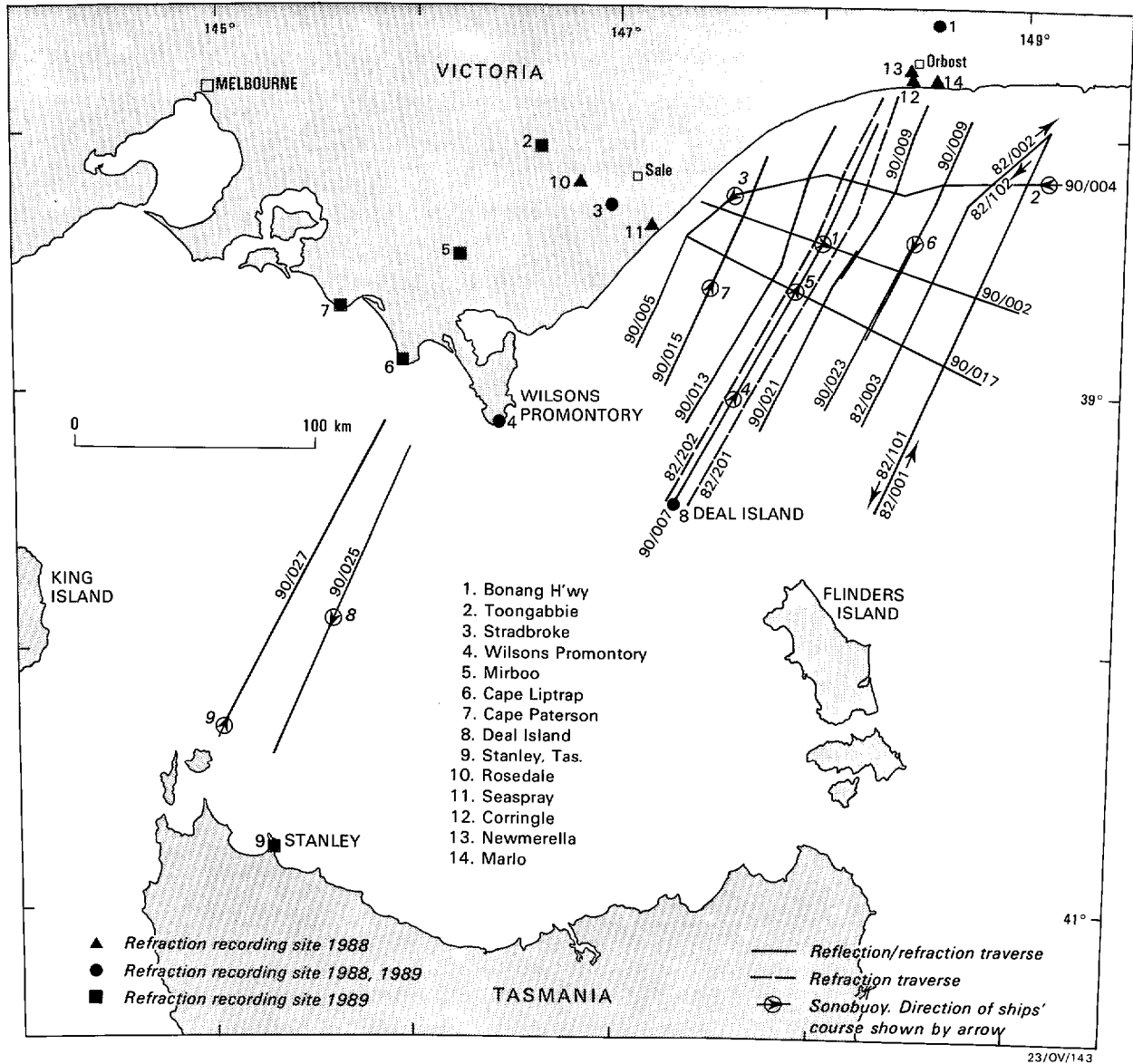


Figure 2. Location of shot traverses and stations.