

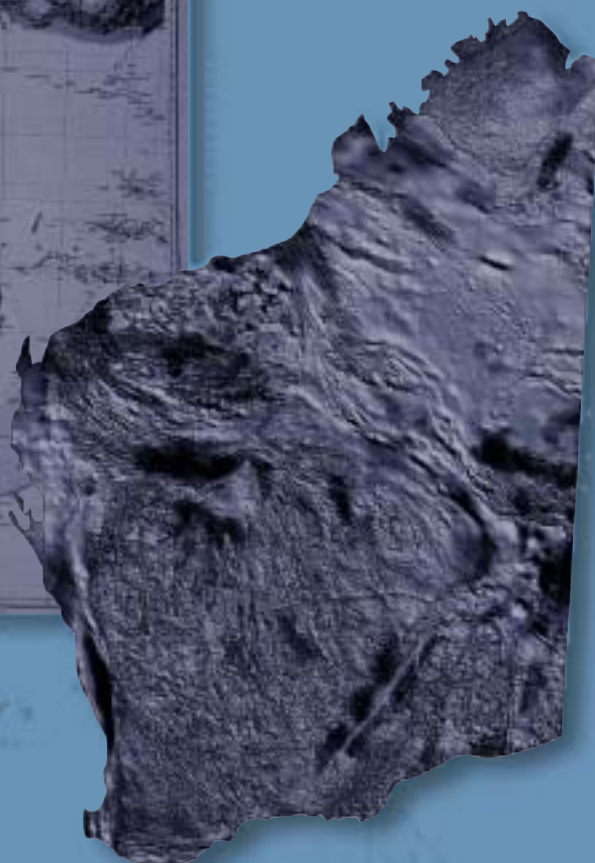
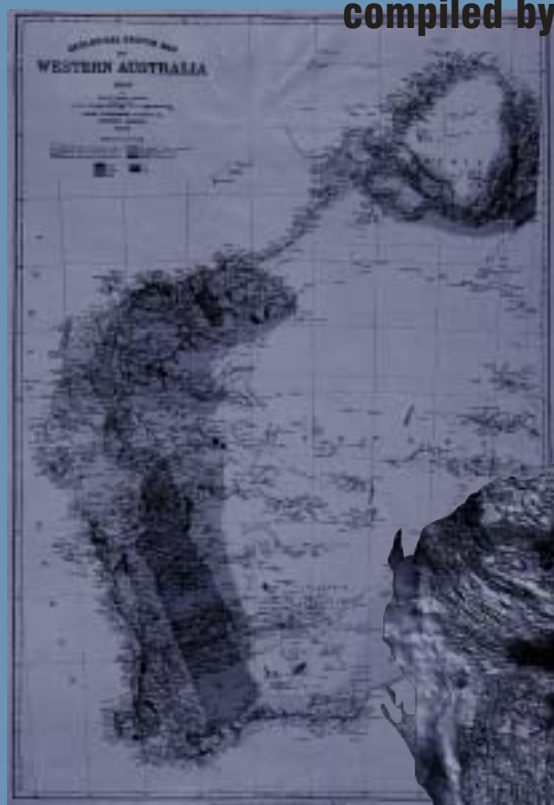


Department of
Mineral and Petroleum Resources

**RECORD
2002/7**

**GSWA BOOLOGOORO 1
WELL COMPLETION REPORT (BASIC DATA)
GASCOYNE PLATFORM
SOUTHERN CARNARVON BASIN
WESTERN AUSTRALIA**

compiled by A. J. Mory and M. Dixon



Geological Survey of Western Australia



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

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**compiled by
A. J. Mory and M. Dixon¹**

**with contributions from
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Perth 2002

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Contents

Abstract	1
Introduction	1
Well history	4
General data	4
Drilling data	4
Logging	4
Regional structural setting	4
Stratigraphy	4
Quaternary sediments	4
Trealla Limestone	4
Korojon Calcarenite	4
Toolonga Calcilutite	7
Unnamed Turonian unit	7
Winning Group	7
Gearle Siltstone	7
Windalia Radiolarite	7
Muderong Shale	8
Birdrong Sandstone	8
Gneudna Formation	8
Acknowledgements	8
References	9

Appendices

1. Operations report	10
2. Core photographs	16
3. Well index sheet	17

Plate

1. Booloogooro 1 composite well log

Figures

1. Location of petroleum and stratigraphic wells in the central Gascoyne Platform	2
2. Tectonic elements of the central Gascoyne Platform	3
3. Regional stratigraphy of the Gascoyne Platform	5
4. Booloogooro 1 stratigraphy	6

Tables

1. Summary of foraminiferal and radiolarian ages (supplied by D. W. Haig)	7
2. Summary of dinoflagellate and spore–pollen zones (supplied by J. Backhouse)	8

GSWA Booloogooro 1 well completion report (basic data), Gascoyne Platform, Southern Carnarvon Basin, Western Australia

compiled by
A. J. Mory and M. Dixon¹

with contributions from
J. Backhouse² and D. W. Haig¹

Abstract

GSWA Booloogooro 1 is a stratigraphic well drilled in 2001 at latitude 24°19'27.3"S and longitude 113°53'53.3"E on the Gascoyne Platform in the Southern Carnarvon Basin to a depth of 383.8 m. The interval from 51.4 m to total depth was continuously cored by diamond drilling with a recovery of 97%. It penetrated the following Cretaceous units below Quaternary alluvium and Miocene Trealla Limestone: Korojon Calcarenite, Toolonga Calcilutite, and Gearle Siltstone, before being terminated within the uppermost part of the Windalia Radiolarite. Information on the remainder of the Winning Group and the underlying Upper Devonian Gneudna Formation from the adjacent water bore is also presented.

KEYWORDS: Miocene, Cretaceous, Devonian, stratigraphy, diamond drilling.

Introduction

The Geological Survey of Western Australia (GSWA) Booloogooro 1 is a stratigraphic well located 66 km north-northeast of Carnarvon on Booloogooro Station. The well is situated 19 km due west of Booloogooro Homestead, which lies 70 km north of Carnarvon via the North West Coastal Highway (Fig. 1). The nearest petroleum wells are Grierson 1–3, 16 km to the northwest; Quobba 1, 45 km to the west; and Cape Cuvier 1, 50 km to the west-northwest (Fig. 2). To the east and south the nearest wells are Wandagee 1 and Barrabiddy 1, 72 km northeast, and Mooka 1, 120 km southeast. Booloogooro 1 was located after examining logs and cuttings from Water and Rivers Commission (WRC) bores drilled as part of their artesian bore refurbishment program (WRC website). The position of the hole in relation to geological structure is uncertain as the nearest seismic section (B72-01L) lies 20 km to the south. No signs of hydrocarbons were encountered in the well, and there are only minor indications of mineralization.

The primary objective of Booloogooro 1 was to continuously core the Cretaceous section to enhance the

understanding of the age and sedimentology of this section. Drilling was undertaken in collaboration with the University of Western Australia, as part of an Australian Research Council project on the Cretaceous. This joint project involved two other wells, Edaggee 1 and Yinni 1, 120 km and 215 km to the south-southeast, respectively (Mory and Dixon, 2002a,b). Booloogooro 1 was abandoned when the sticky carbonaceous clays in the Gearle Siltstone and caving from the basal part of the alluvium considerably slowed progress. The hole was not logged at the time of abandonment as the logs from the water bore 40 m to the north, which was logged during the WRC bore refurbishment program, are adequate to correlate this section. Information on the section below 383.8 m from this water bore has been incorporated into the present report.

This Record provides the basic data for Booloogooro 1 including the operations report (Appendix 1), core photographs (Appendix 2), a provisional well index sheet (Appendix 3), and a provisional composite well log (Plate 1). Additional analyses including petroleum and mineral geochemistry, and palynology, foraminifera, and nannofossil biostratigraphy will be supplied in an interpretive well completion report at a future date. Detailed images of the core are available on the University of Western Australia's Department of Geology and Geophysics website (see biostratigraphy group).

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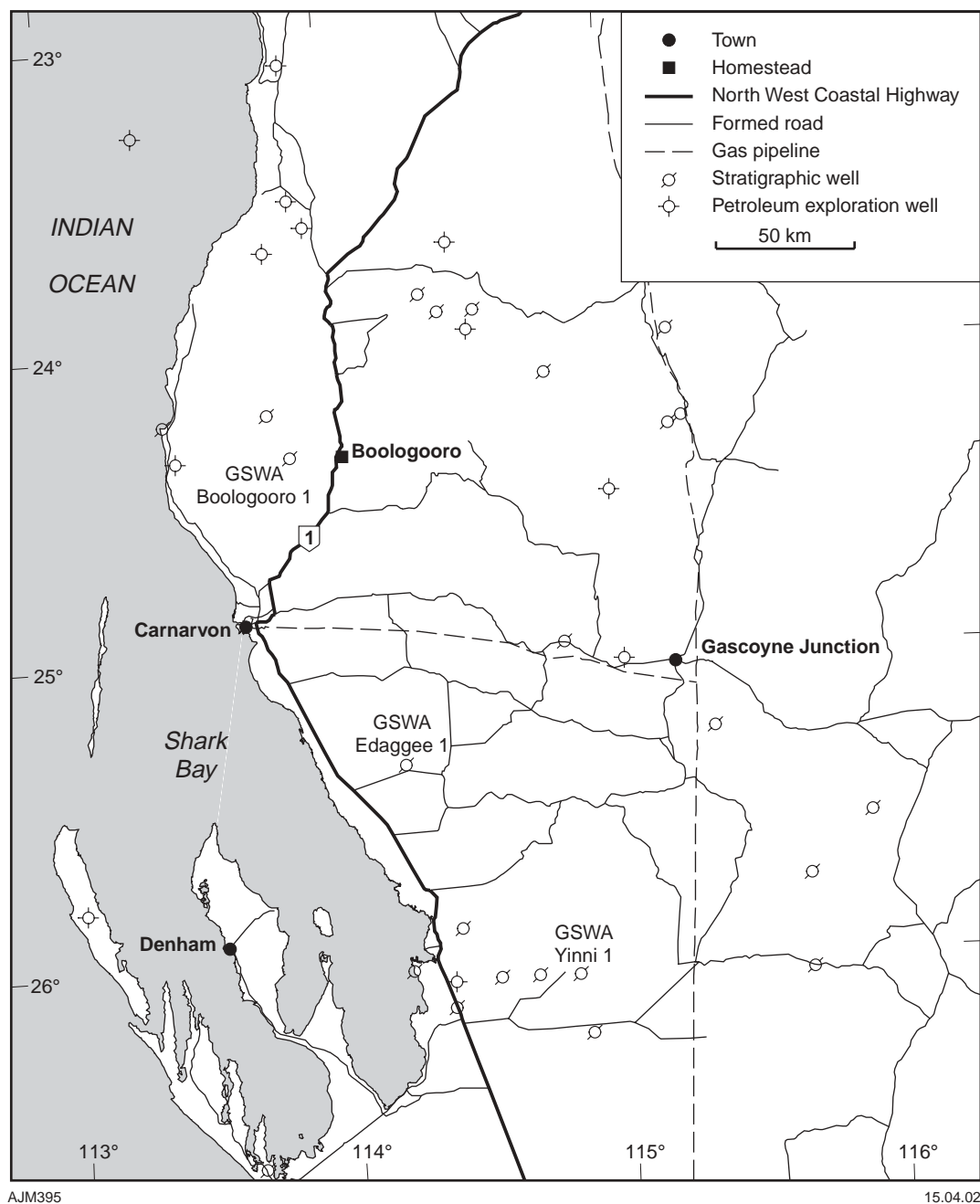


Figure 1. Location of petroleum and stratigraphic wells in the central part of the Gascoyne Platform

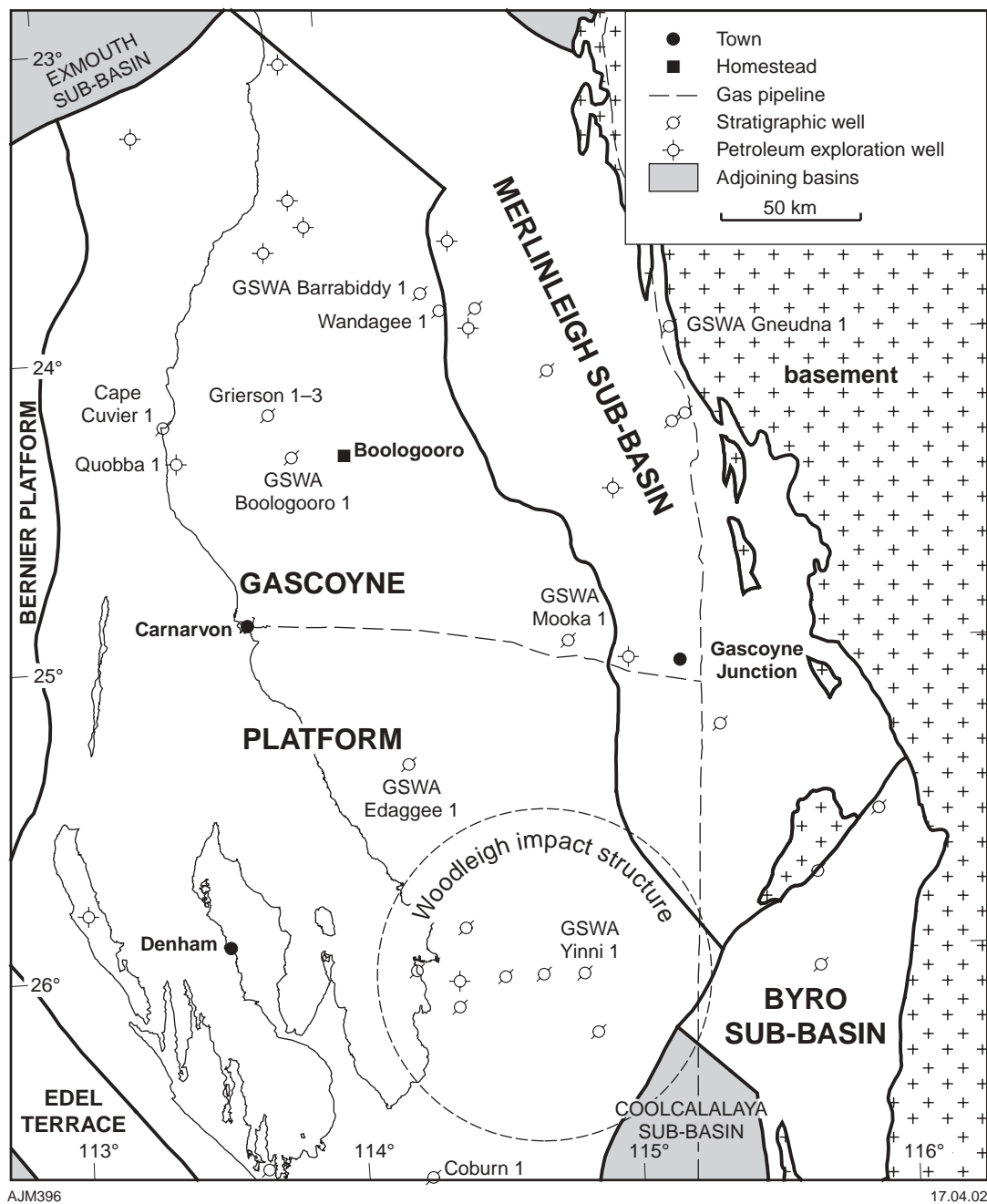


Figure 2. Tectonic elements of the central Gascoyne Platform showing location of petroleum and stratigraphic wells

Well history

General data

Permit:	Vacant
Location:	Latitude 24°19'27.3"S, Longitude 113°53'53.3"E. (GDA94) Northing 7306360, Easting 185200 (MGA Zone 50), determined from Global Positioning System (GPS)
Derivation of name:	Boologooro Station
Total depth (TD):	383.3 m (driller)
Date spudded:	20 May 2001
Reached TD:	25 May 2001
Logging:	Not logged
Date completed:	25 May 2001
Elevation:	7.5 m Australian Height Datum (AHD) from adjacent water bore
Drill floor:	Ground level
Status:	Abandoned

Drilling data

Drilling contractor:	Mt Magnet Drilling, 33 Paramount Drive, Wangara, W.A. 6065
Rig:	Hydco SD 1000
Rig datum:	Ground level
Hole size:	0–6 m 200 mm with a PVC conductor pipe to 1 m 6–168 m 117 mm with HWT casing (partially removed at end of drilling) 168–TD 96 mm open hole
Mud:	Mixture of KCl and polymer- based muds
Core recovery:	51.4 – 383.3 m (HQ) 63.5 mm diameter recovered 323.19 m (97%)
Hole deviation:	Not measured
Plugs:	None

Logging

The well was not logged: instead geophysical logs from the water bore, 40 m to the north, have been utilized and provide an excellent match to the cored section.

Regional structural setting

Boologooro 1 was drilled in the central part of the Gascoyne Platform within the Southern Carnarvon Basin (Hocking et al., 1994). The Gascoyne Platform is a

structurally high area containing up to 5000 m of faulted and folded Ordovician–Devonian strata (Iasky and Mory, 1999, fig. 4). It lies west of a major Permian depocentre incorporating the Merlinleigh, Byro, and Coolcalalaya Sub-basins to the east, and the Bernier Platform and Edel Terrace to the west (Fig. 2; Iasky and Mory, 1999; Hocking et al., 1987). The platform is covered by flat-lying Cretaceous and, in the south, Lower Jurassic strata (Iasky and Mory, 1999, fig. 4). The Wandagee and Ajana Ridges mark the raised eastern rim of the Gascoyne Platform.

As seismic control in the region is sparse and of poor quality (Iasky and Mory, 1999, fig. 1) the well was located primarily as a stratigraphic test on the basis of data from the adjacent artesian bore. Although the nearest seismic section (B72-01L) lies 20 km to the south it suggests Boologooro 1 was drilled over a broad syncline in the Palaeozoic section overlain by mostly flat lying Cretaceous strata. The unusually thin section of the Muderong Shale and Birdrong Sandstone in the adjacent water bore suggests a small fault at that level, or more likely, onlap onto a small anticline in the Early Cretaceous. Dips in the cored Cretaceous section were all less than 2°.

Stratigraphy

The northern Gascoyne Platform contains predominantly Ordovician–Carboniferous, and Cretaceous units (Fig. 3). The well was spudded into Quaternary sand below which the Miocene Trealla Limestone, Cretaceous Korojon Calcarene, Toolonga Calcilutite, an unnamed Turonian unit, Gearle Siltstone and upper part of the Windalia Radiolarite were intersected. Only the uppermost two units of the Winning Group were cored: data on the remainder of the group and underlying Gneudna Formation (Fig. 4) are from the adjacent water bore.

Quaternary sediments

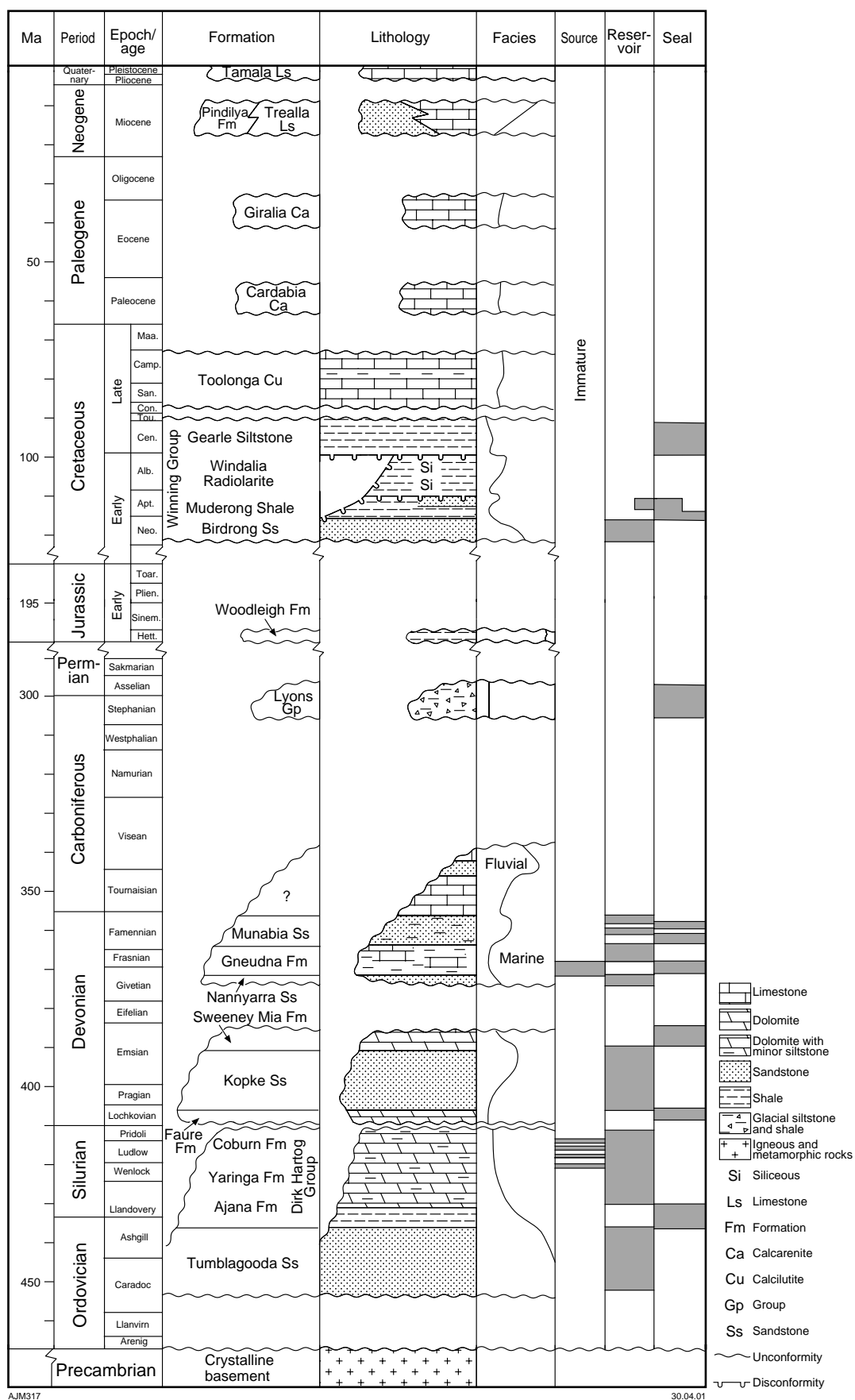
The uppermost section of Boologooro 1 (0–32 m) comprises red to brown, medium- to coarse-grained, loose sand and clay.

Trealla Limestone

Silty claystone and cavernous wackestone–packstone of the late early-Miocene Trealla Limestone was intersected between 32 and 38 m. There were no returns to 51.4 m and the contact with the Korojon Calcarene is tentatively placed at 49 m based on the wireline logs from the adjacent water bore.

Korojon Calcarene

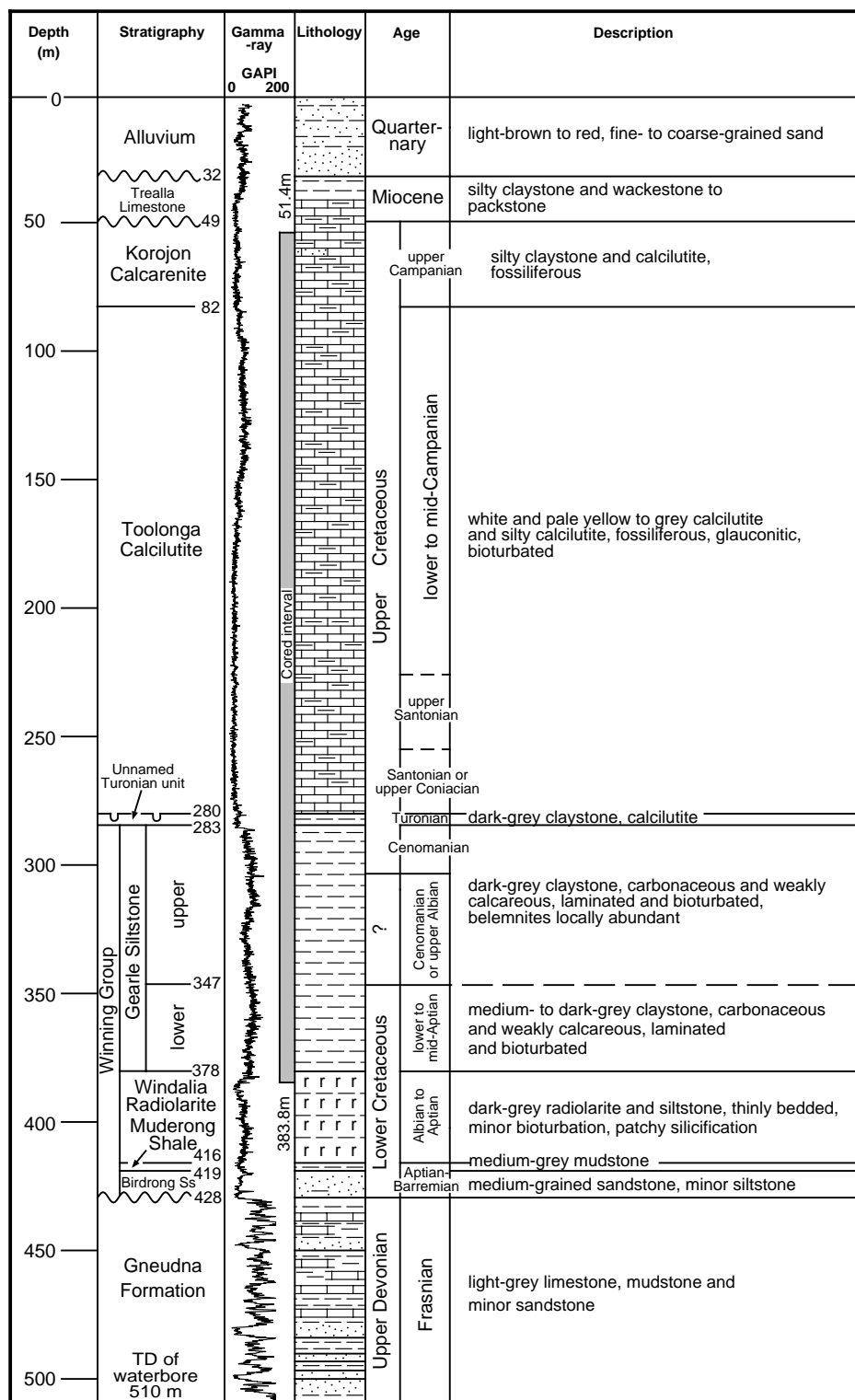
The Upper Cretaceous Korojon Calcarene is represented by pale-green and grey calcilutite with minor bioclastic sandy calcilutite and clay. *Inoceramus* fragments and medium-scale burrows are common whereas other



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Figure 3. Regional stratigraphy of the Gascoyne Platform (after Hocking et al., 1987; Iasky and Mory, 1999)



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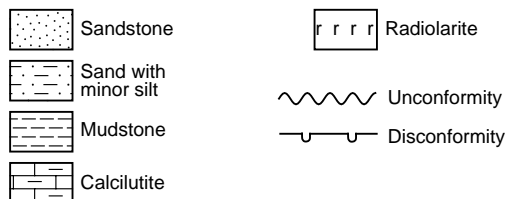


Figure 4. Boologooro 1 stratigraphy

bivalves and rare gastropods occur locally. Five subtle, gradational cycles are present, distinguished by changes in colour and fossil assemblages (53.5 – 58.6 m, 58.6 – 64.8 m, 64.8 – 69.5 m, 69.5 – 73.2 m, 73.2 – 80.6 m). The cycles fit within a broad overall trend of upward lightening of colours and the replacement of *Inoceramus* fragments with small bivalves. Phosphatic and barite nodules are disseminated through the unit, with concentrations at erosional surfaces between cycles and at the base of the unit. Abundant late Campanian foraminifera indicate deposition in mid-neritic water depths (Table 1).

Toolonga Calcilutite

The Upper Cretaceous Toolonga Calcilutite is present over the interval 82.1 – 280.05 m and consists of fossiliferous, greenish-grey to white calcilutite, and minor clay. Planktonic foraminifera and *Inoceramus* prisms are abundant in the calcareous samples. Considerable decametre-scale variability exists within the unit, defined by such characteristics as colour, scale and extent of bioturbation, *Inoceramus* abundance, and the presence of small molluscs. The lower contact with the Gearle Siltstone (Winning Group) is a regional discontinuity. Foraminifera and dinoflagellates indicate a Coniacian–Campanian age (Tables 1 and 2). Deposition was in an open-marine carbonate-dominated environment with foraminifera indicating a fluctuating mid- to outer neritic (water depths of 50–150 m) environment (Table 1).

Unnamed Turonian unit

An unnamed unit of Turonian age (based on foraminifera, Table 2) is present between 280.05 and 283.25 m, and consists of bioturbated carbonaceous calcilutite. Decimetre-scale cyclicity is evident from fluctuations in carbonaceous matter. The upper contact with the Toolonga Calcilutite is placed at a thin dark-grey laminated claystone. A similar, 0.4 m-thick claystone also occurs at the base of the unit. Deposition was in a quiet marine environment at outer neritic water depths (100–200 m).

Winning Group

Booloogooro 1 intersected only the Gearle Siltstone and the upper part of the Windalia Radiolarite. Data on the remaining units of the group are from cuttings and logs from the adjacent water bore. All formations within the group are separated by minor breaks that are well documented in Barrabiddy 1 and 1A (Mory and Yasin, 1999), Coburn 1 (Yasin and Mory, 1999), Edaggee 1 (Mory and Dixon, 2002a), and Yinni 1 (Mory and Dixon, 2002b).

Gearle Siltstone

The Gearle Siltstone was encountered over the interval 283.25 – 378.0 m and consists of medium to dark-grey, laminated pyritic mudstone and siltstone with belemnites and minor small-scale burrows. Below 340 m, the Gearle Siltstone is a relatively uniform dark-grey calcareous claystone with interbeds of radiolarite-rich siltstone becoming more common towards 378 m. Above 340 m, the unit is a greenish-grey slightly calcareous siltstone, grading up into a non-calcareous grey claystone which becomes increasingly calcareous and bioturbated. Rare barite nodules are present near the top of the unit. Foraminifera indicate the unit contains a significant break at about 347 m, which is indistinguishable in the core. Foraminifera indicate that the upper unit between 283.25 and 304 m is Cenomanian, and between 304 to 347.1 m is Cenomanian or late Albian. The foraminifera indicate that the lower unit (347.1 – 378.0 m) is early to mid-Albian (Table 2). Dinoflagellates from the same intervals suggest similar ages (Table 2). Foraminifera indicate deposition at outer neritic water depths (100–200 m).

Windalia Radiolarite

The Windalia Radiolarite (378.0 – 383.8 m) is characterized by distinctly siliceous radiolarian-rich dark-grey to black siltstone. In the adjacent water bore the base of the unit is placed at the top of a high gamma interval at 416 m. Foraminifera from the top of the unit indicate a latest Aptian – earliest Albian age (Table 1) whereas the *D. davidii* dinoflagellate zone of late Aptian age is present

Table 1. Summary of foraminiferal and radiolarian ages (by D. W. Haig)

Depth (m)	Sample type	Foraminiferal yield	Radiolarian yield	Age	Water depth
35–40	cuttings	high	–	late early-Miocene	inner neritic
54–82	core	high	–	late Campanian	mid-neritic
83–226	core	high	–	early to mid-Campanian	mid- to outer neritic
227–255	core	high	–	late Santonian	mid- to outer neritic
256–280	core	high	–	Santonian or late Coniacian	mid- to outer neritic
281–283	core	high	–	Turonian	outer neritic
284–304	core	high	–	mid-Cenomanian	mid- to outer neritic
305–347	core	variable	–	Cenomanian or upper Albian	mid-neritic
348–378	core	high	variable	early to mid-Albian	mid- to outer neritic
378–382	core	high	high	latest Aptian to earliest Albian	mid-neritic

Table 2. Summary of dinoflagellate and spore-pollen zones (by J. Backhouse)

Depth (m)	Sample type	GSWA no.	Microfossil yield	Preservation	Zone	Sub-zone	Age
80.85	core	177325	low	good	<i>I. korojonense</i>	–	Campanian
85.20	core	177329	low	good	<i>X. australis</i>	upper	Campanian
155.20	core	177398	low	good	<i>X. australis</i>	lower	Campanian
226.05	core	177469	low	good	<i>N. aceras</i>	–	Santonian–Campanian
275.90	core	177519	moderate	good	<i>C. striatoconus</i>	–	Coniacian–Santonian
283.90	core	177527	moderate	good	? <i>P. infusorioides</i>	–	?Turonian
295.15	core	177539	moderate	excellent	<i>D. multispinum</i>	–	Cenomanian
310.10	core	177554	high	good	<i>E. ludbrookiae</i>	–	late Albian
325.05	core	177569	high	good	<i>E. ludbrookiae</i>	–	late Albian
333.05	core	177577	high	good	<i>E. ludbrookiae</i>	–	late Albian
347.10	core	177591	high	good	<i>E. ludbrookiae</i>	–	late Albian
355.02	core	177599	high	good	<i>E. ludbrookiae</i>	–	late Albian
365.05	core	177607	high	good	<i>C. denticulata</i>	–	mid-Albian
375.10	core	177616	high	good	<i>C. denticulata</i>	–	mid-Albian
378.55	core	177620	high	good	<i>D. davidii</i>	–	late Aptian
380.60	core	177621	high	good	<i>D. davidii</i>	–	late Aptian
382.00	core	177622	high	good	<i>D. davidii</i>	–	late Aptian
387–390	cuttings	176833	high	good	<i>D. davidii</i>	–	late Aptian
399–402	cuttings	176834	high	good	<i>D. davidii</i>	–	late Aptian
411–414	cuttings	176835	high	good	<i>D. davidii</i>	–	late Aptian
423–426	cuttings	176836	high	good	<i>M. australis/O. operculata</i>	–	Barremian – early Aptian
460–463	cuttings	176814	high	good	<i>optivus–triangulatus</i>	–	late Givetian – early Frasnian
481–484	cuttings	176812	high	good	<i>optivus–triangulatus</i>	–	late Givetian – early Frasnian
507–510	cuttings	176813	high	good	<i>optivus–triangulatus</i>	–	late Givetian – early Frasnian

in cuttings samples throughout the unit. The foraminifera indicate deposition at mid-neritic water depths (~50 m).

Muderong Shale

The Muderong Shale (416 – 418.5 m in water bore) consists of a light- to medium-grey mudstone. Palynomorphs from cuttings samples in the underlying unit are inferred to be caved from this unit and belong to the Barremian – early Aptian *M. australis* and *O. operculata* Zones (Table 2). The basal mudstone interval was deposited in a low-energy, shallow marine environment.

Birdrong Sandstone

The interval 418.5 – 428 m in the water bore is assigned to the Birdrong Sandstone and consists of grey, fine- to medium-grained sandstone with minor siltstone. The unit overlies an erosional surface (Breakup Unconformity) cut into Upper Devonian strata. Palynomorphs of the *M. australis* Zone indicate a Barremian – early Aptian age (Table 2) but are probably caved from the overlying Muderong Shale. Most of the unit was deposited in a high-energy, nearshore marine environment.

Gneudna Formation

The interval 428–510 m in the water bore is placed within the Gneudna Formation on the basis of carbonate and shale yielding palynomorphs from the *optivus–triangularis* Zone of late Givetian – early Frasnian age (Table 2). This age is consistent with other wells that have intersected this unit such as Barrabiddy 1A (Mory and Yasin, 1999) and Gneudna 1 (Mory, 1996), and is the same unit below the Cretaceous in the nearby Grierson wells, Quobba 1 and Cape Cuvier 1. The section at Boollogooro is somewhat unusual, as there appear to be several sandstone intervals within the formation (Plate 1).

Acknowledgements

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Appendix 1

Operations report

Introduction

GSWA Booloogooro 1 is a vertical stratigraphic corehole located utilizing cuttings and log data from artesian bores, in an area of poor seismic control, within the Gascoyne Platform, Southern Carnarvon Basin. The well lies about 66 km north-northeast of Carnarvon, and 19 km west of the Booloogooro Homestead, at latitude 24°19'27.3"S, longitude 113°53'53.3"E, and an elevation of about 7.5 m AHD. The main operational objective was to continuously core the Cretaceous section for palaeontological studies.

Booloogooro 1 was drilled by Mt Magnet Drilling, from 19 to 25 May 2001 using a Hydco SD1000 rig mounted on a 8 × 4 Man diesel prime mover. The well was not geophysically logged as those available for the artesian bore 40 m to the north were considered a good match to the cored section. A summary of the stratigraphy, casing used, cores cut, and logs run in the artesian bore, are given in the well index sheet (Appendix 3).

Well history

Booloogooro 1 was spudded at 0800 hours on 19 May 2001 with a 200 mm HW roller bit to 6 m. After the surface conductor casing was installed drilling continued to 51.4 m with a 150 mm HQ core bit. Because only clay was evident above the Trealla Limestone, HWT casing was not cemented into place. However, overnight the casing slipped to 52.9 m in the soft claystone and had to be suspended from the surface casing. HQ3 coring commenced at 52.9 m and continued to 383.8 m with interruptions due to sand caving from the uppermost 32 m from this section and minor rig repairs when the wireline cable slipped off the drum. The caving was controlled by advancing the HWT casing to 90 m after coring reached 176.9 m, and again to 168 m after coring reached 191.9 m. Later a swelling agent was applied outside the top of the casing to inhibit caving and to divert returns to within the casing. Coring was terminated at 383.8 m at 1730 hours on 25 May in the upper part of the Windalia Radiolarite because progress was slow due to continued caving from the alluvium at the top of the hole and also from soft claystone in the Gearle Siltstone. During abandonment on the morning of 26 May, the HWT casing parted at 84 m. The remaining 106 m of HWT casing could not be retrieved, as a fishing tool was not available. The well was not plugged as it did not reach the main aquifer (Birdrong Sandstone) and there were no indications of hydrocarbons.

Operations

Water supply

Water was obtained from the artesian bore 40 m to the north.

Drilling fluids

Polymer muds were used for drilling based on tests on cuttings samples from the water bore 40 m to the north (Baroid Industrial Drilling Products, 2001).

Drilling operations

The drilling operations were carried out in single 12-hour shifts commencing at about 0530 hours and finishing around 1730 hours. One driller and two offsiders operated the rig.

Booloogooro 1 was drilled by HQ continuous wireline coring from 51.4 to 384.0 m.

Two plastic tanks were used for mixing mud. Two interconnected mud pits were used for storing and recycling the returning mud from the annulus of the hole.

Drilling operations are outlined in chronological order in Table 1.1 and the drilling rate is summarized in Figure 1.1.

Sample collection and handling

Cuttings samples were collected to 50 m from the returning mud at the wellhead using a bucket and amalgamated to make a 3 m composite sample. Unwashed cuttings (up to 0.6 kg) were collected in cloth bags and dried.

Core length was measured using a steel tape and the percentage recovery was calculated for each run (Table 1.2).

A 1:100 graphic sedimentological core log was recorded for Booloogooro 1 at the well site and has been placed on S-series file S20734 V2 at the Geological Survey of Western Australia.

Casing

The casing strings used in Booloogooro 1 are shown in Table 1.3. The casing was seated at 51.4 m in the Korojon Calcarene but slipped to 52.9 m in the soft formation. The casing later had to be advanced to 90.3 m and again to 168 m to contain running sand, in both cases being suspended from the surface casing. The strings were not cemented as there was no sign of loose sand in the alluvium, and neither hydrocarbons nor an artesian flow was expected because the well was not planned to reach the Birdrong Sandstone. During abandonment the HWT casing parted at 84 m and 102 m of casing could not be retrieved, as a fishing tool was not available on site.

Table 1.1. Chronological summary of drilling operations

<i>Date</i>	<i>Start</i>	<i>Finish</i>	<i>Activity</i>
18 May 2001	1300	1445	Mobilize rig from Carnarvon to Boollogooro
	1445	1730	Set up rig
19 May 2001	0530	0800	Set up rig
	0800	1000	Spud well and set surface conductor casing at 6 m
	1000	1200	HQ clore to 51.4 m (lost circulation in Trealla Limestone)
	1200	1230	Set HWT casing to 51.4 m
	1230	1245	Commence HQ3 coring from 51.4 to 52.9 m
	1245	1315	Advance casing to 52.9 m as still in soft ground
	1315	1600	HQ3 coring from 52.9 to 72.0 m
	1600	1745	Rewind wireline cable after it comes off drum
20 May 2001	0530	0630	Repairs to rig, modify core catcher
	0630	0800	HQ3 coring from 72.0 to 87.0 m
	0800	0900	Repairs to core catcher
	0900	1300	HQ3 coring from 87.0 to 120.0 m
	1300	1330	Repairs to core catcher
	1330	1500	HQ3 coring from 120.0 to 129.0 m
21 May 2001	0600	0630	Flush hole
	0630	1230	HQ3 coring from 129.0 to 176.9 m
	1230	1330	Advance HWT casing to 90.3 m to contain running sand
	1330	1500	HQ3 coring from 176.9 to 191.9 m
	1500	1800	Pull HQ string and advance HWT casing to 168 m to contain running sand (suspend from surface casing)
22 May 2001	0600	0730	Ream out sand at base of hole
	0730	1700	HQ3 coring from 191.9 to 269.9 m
23 May 2001	0600	1045	HQ3 coring from 269.9 to 287.9 m
	1045	1400	Break to pick up new offsider
	1400	1700	HQ3 coring from 287.9 to 293.9 m
	1700	1745	Flush hole and pull rods up to base of casing
24 May 2001	0600	0700	Ream out 3 m caved sand, and add bentonite and swelling agent outside HWT casing to inhibit sand caving into hole and divert returns to within casing
	0700	1700	HQ3 coring from 293.9 to 344.9 m
	1700	1730	Flush hole and pull rods up to base of casing
25 May 2001	0530	0630	Ream out 3 m caved sand
	0630	1430	HQ3 coring from 344.9 to 380.9 m
	1430	1700	Attempt to retrieve end of last core run
	1700	1730	HQ3 coring from 380.9 to 383.8 m
	1730	1830	Remove HQ3 drill string
26 May 2001	0600	0800	Pull HWT casing (parted at 84 m)
	0800	1100	Pack up
	1100	1300	Mobilize rig to Carnarvon

Table 1.2. Core recovery from Boologooro 1

<i>From (m)</i>	<i>To (m)</i>	<i>Metres drilled</i>	<i>Metres recovered</i>	<i>Recovery rate (%)</i>	<i>Remarks</i>
51.4	52.9	1.5	1.47	99	
52.9	54.0	1.1	0.98	89	
54.0	57.0	3.0	3.05	102	
57.0	60.0	3.0	2.24	75	
60.0	63.0	3.0	2.97	99	
63.0	66.0	3.0	2.97	99	
66.0	69.0	3.0	2.98	99	
69.0	72.0	3.0	1.73	58	
72.0	75.0	3.0	2.24	75	
75.0	78.0	3.0	3.02	101	
78.0	80.9	2.9	2.99	103	
80.9	82.1	1.2	1.15	96	
82.1	84.0	1.9	1.96	103	
84.0	87.0	3.0	3.02	101	
87.0	90.0	3.0	1.88	63	
90.0	93.0	3.0	3.01	100	
93.0	96.0	3.0	3.05	101	
96.0	99.0	3.0	3.13	104	
99.0	102.0	3.0	3.04	101	
102.0	105.0	3.0	3.05	102	
105.0	108.0	3.0	3.05	102	
108.0	110.3	2.3	2.26	98	
110.3	113.3	3.0	2.70	90	
113.3	114.0	0.7	0.99	141	
114.0	117.0	3.0	3.02	101	
117.0	120.0	3.0	3.12	104	
120.0	123.0	3.0	2.98	99	
123.0	126.0	3.0	2.85	95	
126.0	129.0	3.0	3.03	101	
129.0	132.0	3.0	3.10	103	
132.0	135.0	3.0	3.04	101	
135.0	138.0	3.0	3.04	101	
138.0	141.0	3.0	3.02	101	
141.0	144.0	3.0	2.96	99	
144.0	147.0	3.0	2.57	86	
147.0	149.7	2.7	3.14	116	
149.7	152.9	3.2	3.02	94	
152.9	156.0	3.1	2.65	85	
156.0	158.7	2.7	3.12	116	
158.7	161.9	3.2	2.98	93	
161.9	165.0	3.1	3.19	103	
165.0	168.0	3.0	2.95	98	
168.0	171.0	3.0	3.14	105	
171.0	174.0	3.0	3.02	101	
174.0	176.9	2.9	2.86	99	
176.9	179.9	3.0	2.95	98	
179.9	182.9	3.0	3.12	104	
182.9	185.9	3.0	2.99	100	
185.9	188.9	3.0	2.96	99	
188.9	191.9	3.0	2.93	98	
191.9	193.5	1.6	1.45	91	
193.5	194.9	1.4	0.74	53	
194.9	197.3	2.4	3.12	130	
197.3	200.4	3.1	3.11	100	
200.4	203.5	3.1	3.09	100	
203.5	206.6	3.1	3.11	100	
206.6	209.7	3.1	3.12	101	
209.7	212.8	3.1	3.06	99	
212.8	215.9	3.1	3.11	100	
215.9	218.9	3.0	3.09	103	
218.9	221.9	3.0	2.96	99	
221.9	224.9	3.0	3.06	102	
224.9	227.9	3.0	3.00	100	
227.9	230.9	3.0	3.01	100	
230.9	233.9	3.0	2.98	99	
233.9	236.9	3.0	3.05	102	
236.9	239.9	3.0	3.04	101	

Table 1.2. (continued)

<i>From (m)</i>	<i>To (m)</i>	<i>Metres drilled</i>	<i>Metres recovered</i>	<i>Recovery rate (%)</i>	<i>Remarks</i>
239.9	242.9	3.0	3.00	100	
242.9	245.9	3.0	3.02	101	
245.9	248.9	3.0	2.94	98	
248.9	251.9	3.0	2.67	89	0.3 m core loss
251.9	254.9	3.0	2.94	98	
254.9	257.9	3.0	3.01	100	
257.9	260.9	3.0	3.01	100	
260.9	263.9	3.0	2.99	100	
263.9	266.9	3.0	3.00	100	
266.9	269.9	3.0	2.97	99	
269.9	272.9	3.0	2.94	98	
272.9	274.0	1.1	1.05	95	
274.0	275.9	1.9	2.05	108	
275.9	278.9	3.0	3.02	101	
278.9	281.9	3.0	3.00	100	
281.9	283.2	1.3	1.30	100	
283.2	284.0	0.8	0.84	105	
284.0	284.9	0.9	0.89	99	
284.9	286.3	1.4	1.43	102	
286.3	287.9	1.6	1.60	100	10 cm very soft band on top of core
287.9	289.6	1.7	1.60	94	
289.6	290.9	1.5	0.36	24	0.7 m core loss from 287.9 to 292.5 m
290.9	292.5	1.6	1.87	117	
292.5	292.6	0.1	0.10	100	Short run to pick up core
292.6	293.9	1.5	1.31	87	
293.9	295.3	1.4	0.25	18	Core broken up
295.3	296.9	1.6	2.75	172	
296.9	298.1	1.2	1.28	107	
298.1	299.9	1.8	1.83	102	
299.9	302.9	3.0	3.09	103	
302.9	305.9	3.0	2.98	99	
305.9	311.9	3.0	3.03	101	
311.9	314.9	3.0	3.03	101	
314.9	317.9	3.0	3.00	100	
317.9	320.9	3.0	3.02	101	
320.9	323.9	3.0	3.05	102	
323.9	326.9	3.0	3.04	101	
326.9	329.9	3.0	2.98	99	
329.9	332.0	2.1	2.20	105	
332.0	335.1	3.1	3.10	100	
335.1	338.3	3.2	3.14	98	
338.3	341.4	3.1	3.10	100	
341.4	343.6	2.2	2.30	105	
343.6	344.9	1.3	1.43	110	
344.9	346.5	1.6	1.55	97	
346.5	347.9	1.4	1.54	110	
347.9	350.9	3.0	3.05	102	
350.9	352.1	1.2	1.25	104	
352.1	353.9	1.8	1.81	100	
353.9	356.9	3.0	3.04	101	
356.9	359.7	2.8	2.87	103	
359.7	362.8	2.1	2.05	98	
362.8	364.9	2.1	1.52	72	
364.9	366.5	1.6	2.25	141	
366.5	368.9	2.4	2.32	97	
368.9	371.9	3.0	2.95	98	
371.9	374.6	2.7	2.82	104	
374.6	376.0	1.4	1.34	96	
376.0	377.9	1.9	1.96	103	
377.9	380.9	3.0	2.75	92	
380.9	383.8	2.9	1.83	63	
Totals		331.9	323.19	97	

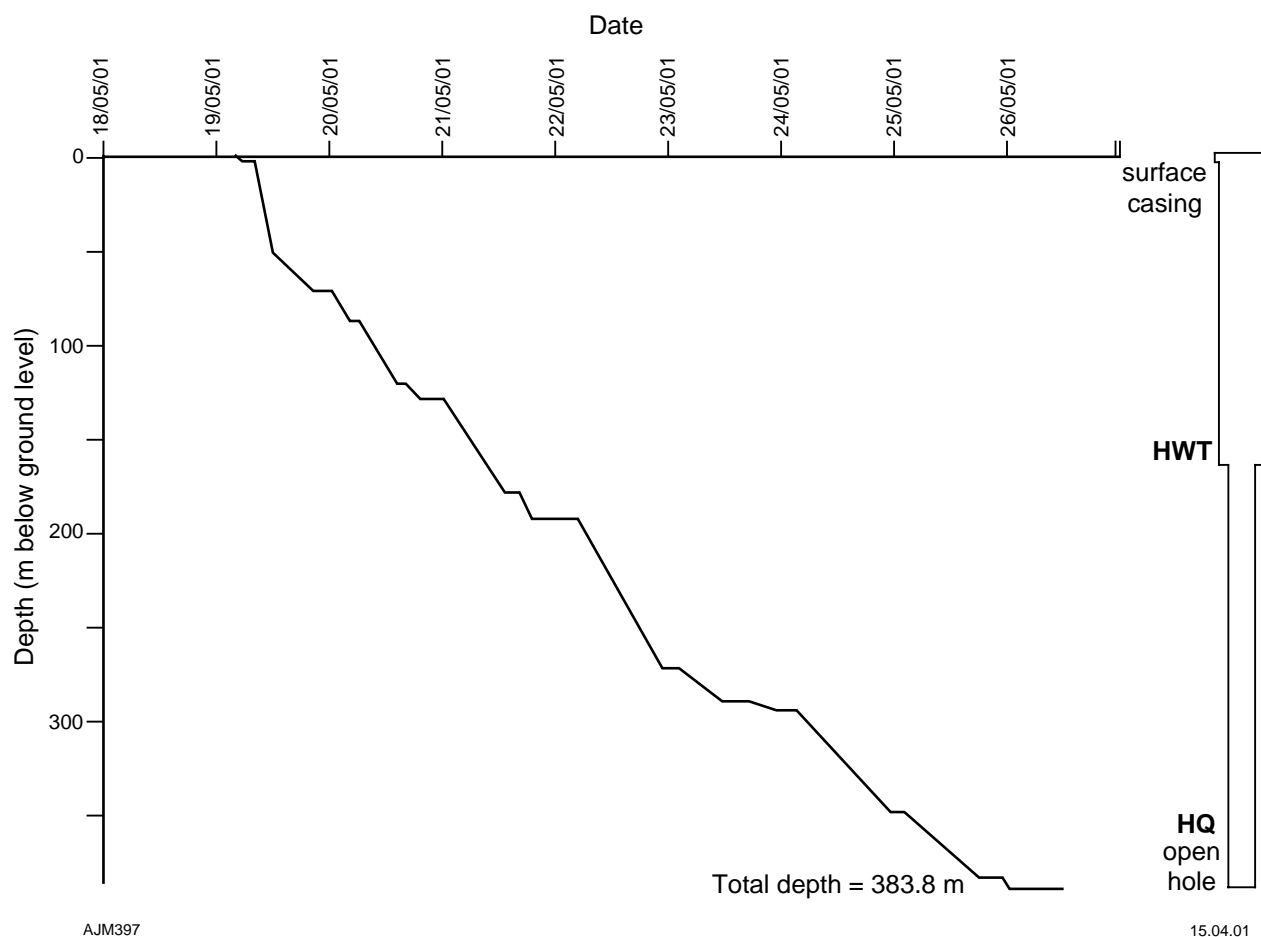


Figure 1.1. Time versus depth curve for Boologooro 1

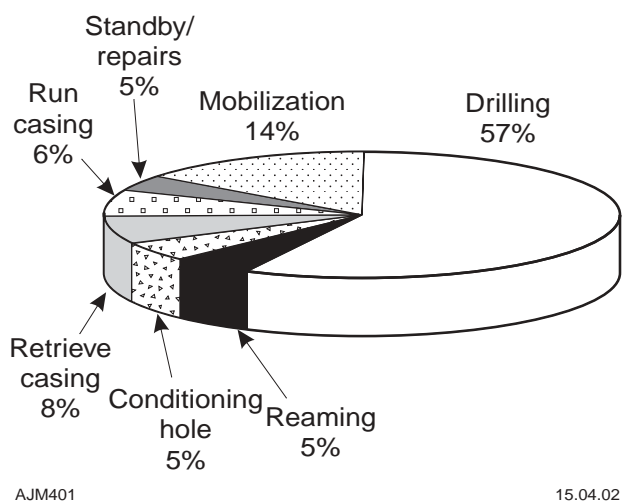


Figure 1.2. Breakdown of operation time for Boologooro 1

Table 1.3. Casing strings used in Booloogooro 1

<i>Casing</i>	<i>Outer diameter (mm)</i>	<i>Inner diameter (mm)</i>	<i>Depth interval (m)</i>
PVC	140	134	0–6
HWT	114.3	101.6	0–168

Orientation surveys

No orientation surveys were run.

Geophysical logging

No geophysical logging was undertaken but those from the adjacent water bore run by Geophysical Logging Technologies and Surtron for the Waters and Rivers Commission artesian bore refurbishment program were used instead.

Operation time analysis

The relative duration of the operational activities for Booloogooro 1 is shown in Figure 1.2.

Well completion

Booloogooro 1 was completed on 26 May 2001 with all free casing and drill strings pulled out. Drilling terminated in the Windalia Radiolarite, which unexpectedly produced a flow of water for two hours. As the flow completely abated overnight, it was not necessary to plug the hole. The top of the hole was covered with a capped steel pipe cemented over the PW casing. The well name and the total depth are recorded at the site.

Reference

BAROID INDUSTRIAL DRILLING PRODUCTS, 2001, Drilling fluids proposal for Mt Magnet Drilling, Carnarvon Basin: Western Australia Geological Survey, Statutory petroleum exploration report, S20734 V2 A1 (unpublished).

Appendix 2

Core photographs

(see Core photo library on this disk)

Appendix 3

Preliminary well index sheet

ORGANIZATION: Geological Survey of Western Australia and University of Western Australia WELL: GSWA Booloogooro 1 SPUDDED: 19 May 2001 COMPLETED: 28 May 2001 TD: 383.3 m STATUS: Abandoned			Statutory Petroleum Exploration Report No.: S 20734 V2 TYPE: Stratigraphic		
BASIN: Carnarvon Basin SUB-BASIN: Gascoyne Platform ELEVATION (GL): 7.5 m AHD LATITUDE: 24°19'27.3"S; LONGITUDE: 113°53'53.3"E. (GDA94) NORTHING: 7306360 EASTING: 185200 (MGA Zone 50)					
FORMATION	TOPS (m)		LITHOLOGICAL SUMMARY		
	DRILL	SUBSEA			
Alluvium	Surface	+7.5	Light-brown to red, fine- to coarse-grained sand Silty claystone and wackestone to packstone Silty claystone and calcilutite, fossiliferous White and pale-yellow to grey calcilutite and silty calcilutite, bioturbated, fossiliferous, glauconitic Dark-grey claystone, carbonaceous and weakly calcareous, pyritic, soft; pale-grey calcilutite, bioturbated Dark-grey claystone, carbonaceous and weakly calcareous, laminated and bioturbated, belemnites locally abundant Medium- to dark-grey claystone, carbonaceous and weakly calcareous, laminated and bioturbated Dark-grey radiolarite and siltstone, thinly bedded, minor bioturbation, patchy silicification Medium-grey mudstone Medium-grained sandstone, minor siltstone Light-grey limestone, mudstone and minor sandstone		
Trealla Limestone	32.0	34.5			
Korojon Calcarenite	749	41.5			
Toolonga Calcilutite	82.1	74.6			
Unnamed Turonian unit	280.05	272.55			
Upper Gearle Siltstone	283.25	275.75			
Lower Gearle Siltstone	347.1	339.6			
Windalia Radiolarite	378.0	370.5			
Muderong Shale ^(a)	416	408.5			
Birdrong Sandstone ^(a)	418.5	411.0			
Gneudna Formation ^(a)	428	420.5			
CORE	Continuously cored:		NQ: 51.4 – 383.8 m (98% recovery)		
LOGS	Gamma–density		2–510 m ^(a)		
	Gamma–neutron–neutron–calliper		2–510 m ^(a)		
CASING	HWT (OD 114 mm, ID 102 mm):		0–166 m (partially removed at completion)		

NOTE: (a) from water bore 40 m to north

Department of
Mineral and Petroleum Resources

JIM LIMERICK
DIRECTOR GENERAL

DIRECTOR GENERAL











Ecological Survey of Western Australia

GS WA B0010g0010 1






C : 4 W H I

Courtesy or Rig name
Latitude
Longitude
Permanent Datum
Elevation of DF
Elevation Log Zero
Log measured from
Drill measured from
Basin
Sub-Basin
Tenement-Concession
Geographic datum
On-Shore Flag
Date spudded
Date completed

Hydco SD 1000
24 19 27.3 S
113 53 53.3 E
MSL
7.50 M
7.50 M
DF
DF
Southern Carnarvon Basin
Gascoyne Platform
vacant
AGD84
yes
10 May 2001
25 May 2001

	Mudstone		Sandstone
	Calcareous mudstone		Gravelly sandstone
	Sandy mudstone		Radiolarite
			Calcilutite
			Sandy calcilutite

SYMBOL LEGEND

	Flatal laminations		<i>inoceramus</i> fragments
	Phosphate nodules		Bivalves
	Pyrite nodules		Coprolites
			Belemnites
			Burrow networks

GAMMA RAY (API-)		DEPTH M	LITHOLOGY	SEDIMENTARY STRUCTURES		RESISTIVITY (OHMM)		NEUTRON (API-)		DENSITY (G/CC)		STRATIGRAPHY AND DESCRIPTION		
0.0				200.0		0.2		500.0		0.0			500.0	
						GAMMA RAY (CPS)		500.0		1.96			2.96	
						LONG (OHMM)		500.0						
0.0		200.0		0.0		500.0		0.0		500.0		0 - 38.0 m cuttings		
0 - 32 m		ALLUVIUM		0 - 29		Sandy mud: light brown-red, rare pale-yellow claystone clasts, rare interbeds of pale-yellow chert sand		29 - 32		Quartz sand: pale brown-red, fine- to medium-grained, rare pale-yellow chert and claystone clasts				
32 - 49 m		TREALLA LIMESTONE		32 - 38		Silty claystone: pale yellow, leached		38 - 49		Wackestone to packstone: pale yellow, cavernous				
49 - 82.1 m		KOROJON CALCARENITE		51.4 - 384.0 m		core		49 - 55.4		Calclutite: white, cavernous, some caverns infilled with yellow to green quartz sand, sandy mud and mud				
55.4 - 58.6						Calclutite: very pale green, orange ferruginized mottles, rare medium-scale burrows		58.6 - 59.8		Sandy calclutite: very pale green, orange ferruginized mottles, composed 20% small disarticulated bivalves, rare gastropods				
59.8 - 64.8						Calclutite: light grey grading to medium grey, orange ferruginized mottles, common phosphatic nodules, rare medium-scale burrows, abundant small bivalves near top, common thin-shelled Inoceramus fragments near bottom, rare gastropods, phosphatic nodule disconformity horizon at base of interval		64.8 - 80.5		Calclutite: light grey, orange ferruginized mottles towards top, rare phosphatic nodules, rare medium-scale burrows, common Inoceramus fragments, rare metre-thick gradational interbeds of sandy calclutite (pale grey, orange ferruginized mottles, rare medium-scale burrows, abundant Inoceramus fragments, common bivalves)				
80.5 - 81.2						Calclutite: increasingly lighter green-grey, abundant phosphatic and barite nodules, common Inoceramus fragments		81.2 - 82.1		Clay: green-grey, calcareous				
82.1 - 280.05 m		TOOLONGA CALCILUTITE		82.1 - 120.2		Calclutite: green-grey, rare pyrite, common planar laminations, abundant small-scale burrows, rare interbeds of clay (green-grey, calcareous) towards the top		120.2 - 164.5		Calclutite: decimetre- to metre-scale gradationally or abruptly alternating, pale green to dark green-grey, rare phosphatic nodules towards top, common medium-scale burrows, rare small-scale burrows, rare bivalves, rare coprolite trails				
164.5 - 247.0						Silty calclutite: decimetre- to metre-scale gradationally or abruptly alternating, very pale green to light green-grey, rare pyrite, rare phosphatic nodules towards bottom, common medium-scale burrows, rare small-scale burrows; 164.5 - c.180 m, common Inoceramus fragments; c.180 - c.186 m, rare bivalves; 219 - 247.0 m, common Inoceramus fragments and rare bivalves		247.0 - 261.0		Silty calclutite: very pale green, rare phosphatic nodules, common medium-scale burrows, abundant Inoceramus fragments				
261.0 - 276.5						Silty calclutite grading to calcilutite: grading from mottled (bioturbated) pale green and light green to mottled (bioturbated) dark grey-green and green and light green, rare phosphatic nodules, abundant medium-scale burrows, common small-scale burrows		276.5 - 280.05		Calclutite: mottled dark grey-green to pale green (bioturbation), extremely abundant medium-scale burrows, abundant small-scale burrows, Inoceramus fragments and bivalves; sharp lower contact				
280.05 - 283.25 m		UNNAMED TURONIAN UNIT		280.05 - 280.2		Calclutite: pale grey, Claystone: dark grey, bioturbated		280.2 - 280.4		Claystone: dark grey, calcareous, carbonaceous, planar laminated				
280.4 - 282.5						Calclutite: alternating very pale green, pale grey and grey, common medium- and small-scale burrows		282.5 - 282.9		Calclutite: mottled grey and dark grey (bioturbation), carbonaceous, with interbeds and patches of claystone (black, calcareous, carbonaceous, planar laminated)				
282.9 - 283.3						Claystone: black, calcareous, carbonaceous, planar laminated		283.25 - 347.1 m		UPPER GEARLE SILTSTONE				
306.5 - 318.0						Claystone: medium and dark grey, calcareous, carbonaceous, common phosphate and barite nodules, common medium-scale burrows towards top of interval, common small-scale burrows, rare belemnites		318.0 - 340.0		Siltstone: dark green-grey, slightly calcareous below 327 m, carbonaceous, rare pyrite, rare medium-scale and small-scale burrows, rare belemnites				
340.0 - 347.1						Claystone: dark grey, carbonaceous, extremely pyritic, rare belemnites		347.1 - 378.0 m		LOWER GEARLE SILTSTONE				
378.0 - 384						Decimetre- and metre-scale interbeds of radiolarite (light grey, variably silty, variably calcareous, porous) and siltstone (grey, calcareous, carbonaceous, laminations deformed by patchy silicification), rare pyrite, carbonate veinlets, medium- and small-scale burrows, rare belemnites		384 - 416		WINDALLIA RADIOLARITE				
384 - 416						Interbedded radiolarite and mudstone		416 - 418.5 m		MUDERONG SHALE				
416 - 418.5 m						Mudstone: light to medium-grey		418.5 - 428 m		BIRDONG SANDSTONE				
418.5 - 428 m						Sandstone: grey, fine- to medium-grained, minor siltstone		428 - 510 m		GNEUDNA FORMATION				
428 - 510 m						Grey shale, limestone and sandstone (lithologies depicted on log based mainly on gamma-ray log)		510 - 500 m						
500 - 510 m														
GAMMA RAY (API-)		DEPTH M	LITHOLOGY	SEDIMENTARY STRUCTURES		RESISTIVITY (OHMM)		NEUTRON (API-)		DENSITY (G/CC)		STRATIGRAPHY AND DESCRIPTION		
0.0				200.0		0.2		500.0		0.0			500.0	
						GAMMA RAY (CPS)		500.0		1.96			2.96	
						LONG (OHMM)		500.0						
0.0		200.0		0.0		500.0		0.0		500.0				