Western Underground Gas Storage Pty. Ltd.

TXU

WELL COMPLETION REPORT

Iona Obs-1

PPL2
ONSHORE OTWAY BASIN, VICTORIA

VOLUME 1 OF 2
TEXT, TABLES, FIGURES & APPENDICES

September 1999

Copy 3 of 6

908918 002

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VOLUME 1 of 2

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FIGURES

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APPENDICES

VOLUME 2 of 2

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ENCLOSURES

1.0 INTRODUCTION

Iona Obs-1 was designed as an appraisal well of the Iona Gas-field. The location of the Iona field is shown on Figure 1.1. It was planned to complete the well and use the well-bore as an observation well for the purpose of monitoring reservoir pressure and gas/water contact movement during gas injection and withdrawal cycles. The well was also to be equipped to handle the disposal of produced water by re-injection into the Waarre Sandstone reservoir.

The well was targeted to the eastern-most edge of the field and was intended to be used to monitor water influx from the east adjacent to the northern bounding fault. The location of the well on the Iona site is shown on Figure 1.2. Iona Obs-1 was designed to be drilled as a deviated "S" shaped well dropping to vertical in the reservoir section to facilitate coring and logging in a vertical well bore. The maximum deviation in the well was 40.11 degrees.

The well was designed to be cased, completed and suspended with tubing to surface and a permanent well-head installed. A packer was to be set between the Waarre C1 and Waarre C2 sandstones to allow monitoring of the gas/water contact in the Waarre C1 and water disposal into the Waarre C2. There was no intention to inject gas or withdraw gas from the well-bore.

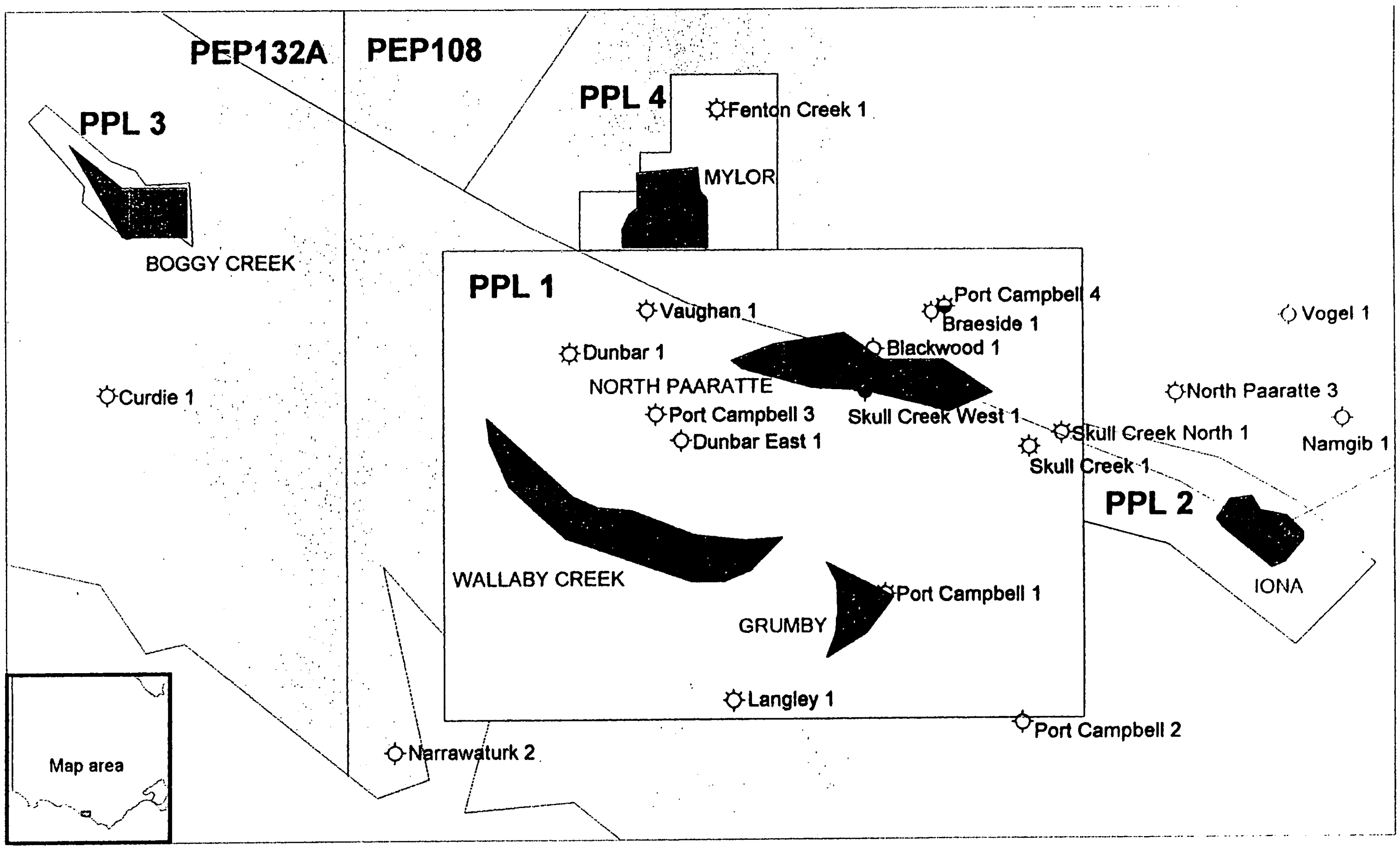
Unfortunately the Waarre C1 Sandstone objective was intersected low to prediction below the original field gas/water contact. The swept zone resulting from past production was not intersected. The location of the well was such that it was not possible to plug back and re drill the well into the Waarre C1 within the swept zone. The well was completed as a water disposal well and during withdrawal cycles it is planned to reinject produced water through perforations in the Waarre C2 Sandstone.

2.0 WELL HISTORY

2.1 LOCATION DATA

Basin:	Otway, onshore western Victoria
Lease:	PPL-2
Surface Coordinates:	5728559.7 metres North 677741.1 metres East
Surface Elevation:	Ground Level (GL): 132.5 metres AHD Kelly Bushing (KB): 137.5 metres AHD (Datum) (All depths relative to KB unless otherwise stated)
Bottom Hole Coordinates:	5728202.3 metres North 678217.1 metres East
Coordinate	Australian Map Grid 66, Zone 54, Central Meridian: 141 East

OTWAY BASIN - GAS FIELD LOCATION MAP



Produced by encom 1999

Figure 1.1

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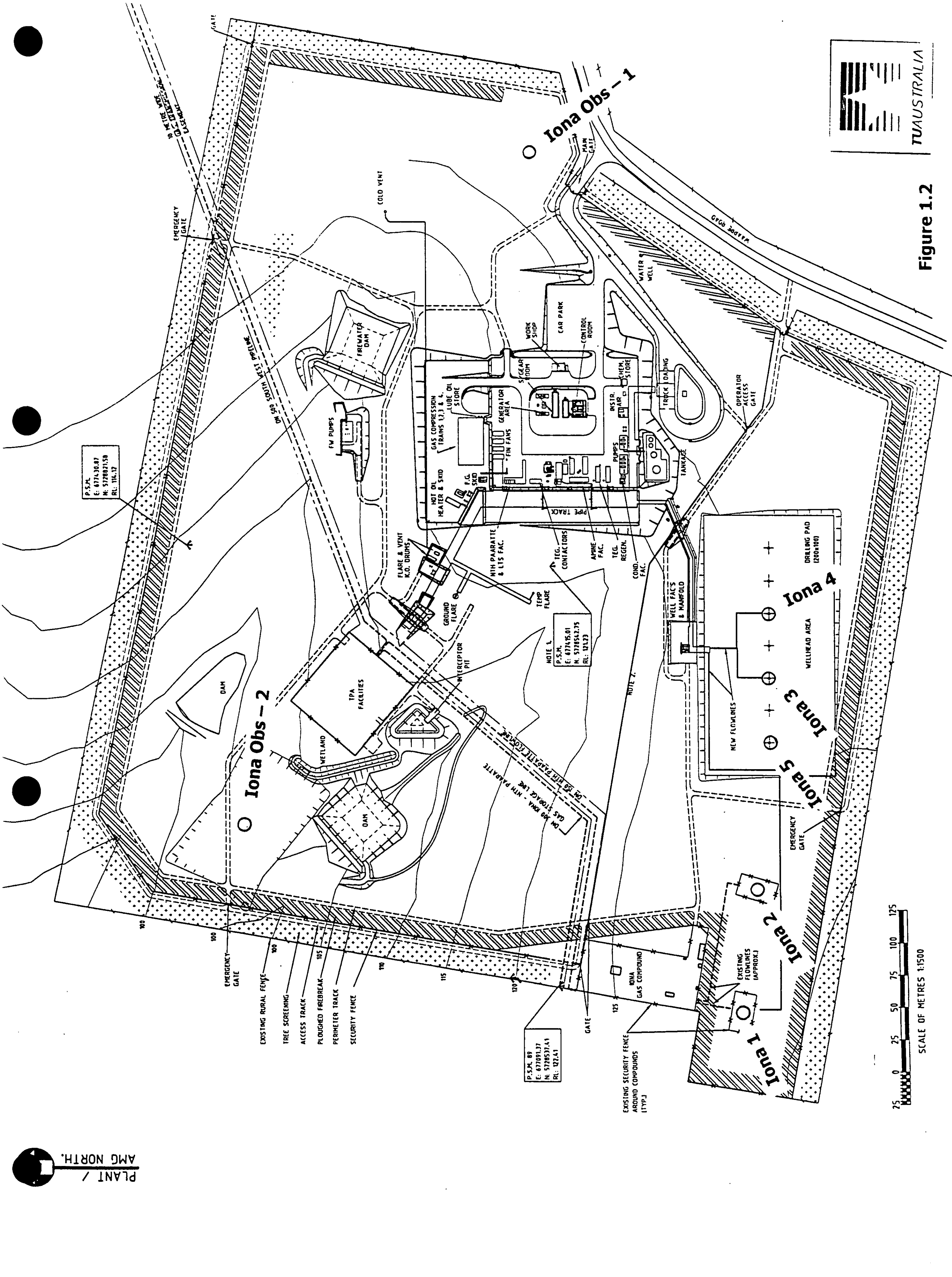

TUAUSTRALIA
Iona Obs – 1
Iona Obs – 2
Iona 1
Iona 2
Iona 3
Iona 4
Iona 5
MAIN GATE
CAR PARK
WORK SHOP
CONTROL ROOM
SWGEAR ROOM
GENERATOR AREA
LUBE OIL STORE
GAS COMPRESSION TRAINS 1,2,3 & 4.
FIN FANS
HOT OIL HEATER & SKID
F.G. SKID
PIPE TRACK
CHEM. STORE
INSTR. AIR
PUMPS
TANKAGE
TRUCK LOADING
WATER WELL
OPERATOR ACCESS GATE
FIREWATER DAM
FW PUMPS
COLD VENT
FLARE & VENT K.O. DRUMS
GROUND FLARE
TEMP FLARE
NTH PAARATTE & LTS FAC.
TEG. CONTACTORS
AMINE FAC.
TEG. REGEN.
COND. FAC.
WELL FAC'S & MANIFOLD
DRILLING PAD (200x100)
WELLHEAD AREA
NEW FLOWLINES
INTERCEPTOR PIT
TPA FACILITIES
WETLAND
DAM
DN 500 SOUTH WEST PIPELINE
DN 50 NTH PAARATTE FLOWLINE
DN 300 IONA - NTH PAARATTE GAS STORAGE LINE
EMERGENCY GATE
EXISTING RURAL FENCE
TREE SCREENING
ACCESS TRACK
PLOUGHED FIREBREAK
PERIMETER TRACK
SECURITY FENCE
GATE
IONA GAS COMPOUND
EXISTING FLOWLINES (APPROX.)
EXISTING SECURITY FENCE AROUND COMPOUNDS (TYP.)
P.S.M. 89
E: 677091.37
N: 5728531.41
RL: 122.41
NOTE 1.
P.S.M.
E: 677415.01
N: 5728542.75
RL: 121.23
NOTE 2.
P.S.M.
E: 677430.87
N: 5728821.50
RL: 114.12
SCALE OF METRES 1:1500
PLANT / AMG NORTH.

Figure 1.2

2.2 GENERAL DATA

Well Name:	Iona Obs-1
Classification:	Water disposal well for the Underground Gas Storage Project
Operator:	Western Underground Gas Storage Pty Ltd ("WUGS")
Property Owner:	Western Underground Gas Storage Pty Ltd
Nearest Town:	The coastal township of Port Campbell, approximately 7 km south of the Gas Field.
Nearest Well:	Iona-1 located approximately 0.6 km from surface location.
Final measured Depth:	Driller: 1568 m Logger: 1565 m
Final True Vertical Depth:	1403.7 mKB
Spud date:	01:00 hours February 5, 1999.
TD reached:	18:20 hours February 23, 1999.
Days to Drill:	18.72 days
Date well completed:	24:00 hours February 28, 1999
Rig Released:	24:00 hours February 28, 1999
Well Status:	Suspended Water Injection well

2.3 WELL SUMMARY

Table 2.1 Well Summary

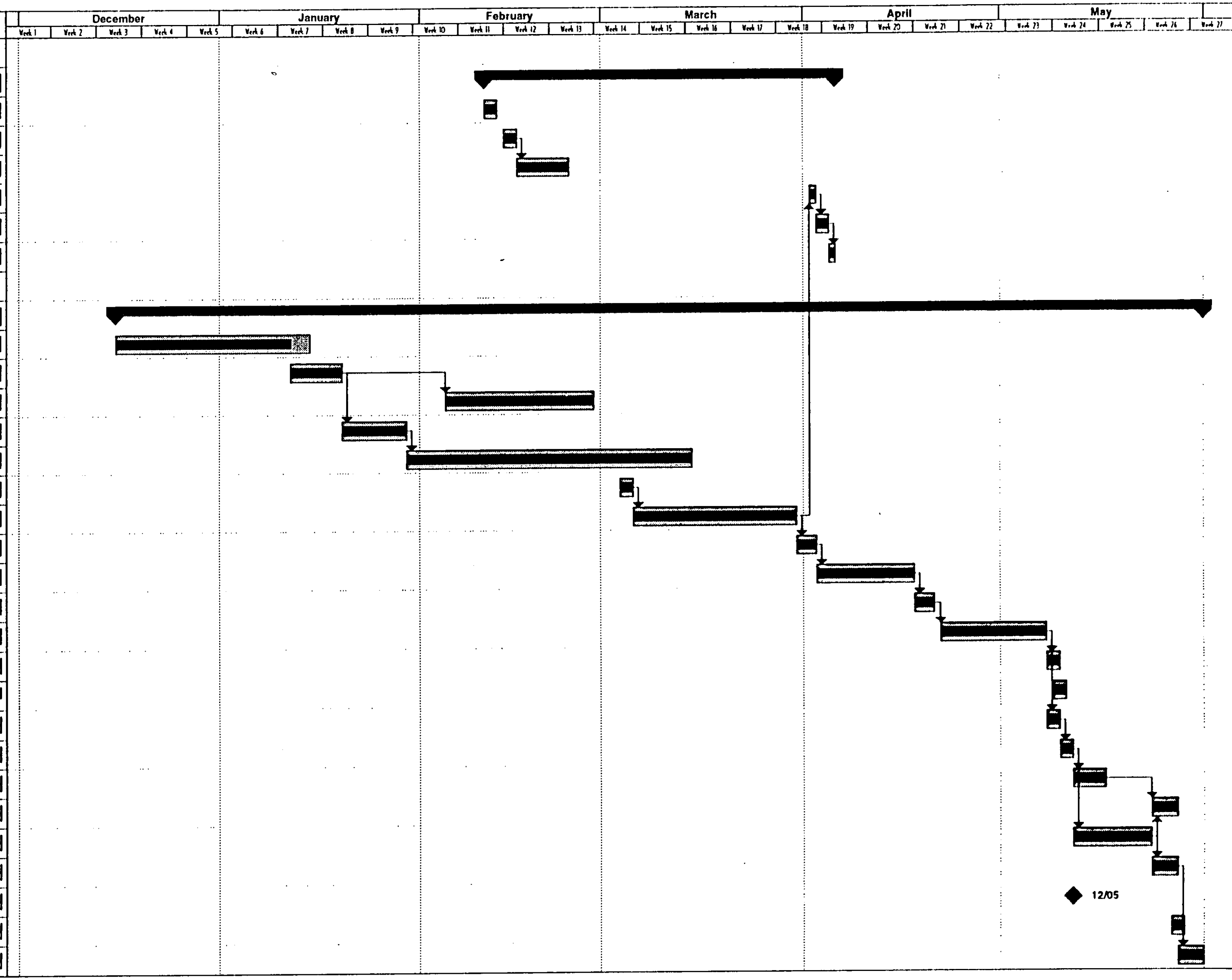
WELL NAME	Iona Obs-1		
DESIGNATION	Water Disposal Well		
BASIN	Otway		
OPERATIONS BASE	Kelly Down Consultants, St. Leonard's, Sydney		
FIELD OPERATIONS BASE	On site @ Iona , Waarre Rd, Port Campbell, Vic.		
DRILLING CONTRACTOR	OD&E		
RIG	Rig 30		
RT to GL	4.98 m		
GL to MSL	132.5 m		
TOTAL DEPTH (M DKB)	1568.0 m KB (driller depth)		
RIG MOBILISED	27 Feb 1999		
SPUD DATE	05 Feb 99 @ 0100 hrs		
8 ½" HOLE SECTION TD Depth/Time	743.5 m @ 0230 hrs 07 Feb 99		
6" HOLE SECTION TD Depth/Time	1568 m @ 1800 hrs 23 Feb 99		
SPUD TO TOTAL DEPTH TIME	18 Days 6.5 hrs		
COMPLETION INSTALLED	28 Feb 99 @ 2400 hrs		
SPUD TO WELL SUSPENDED	23 Days 12.5 hrs		
CASING STRINGS	13 3/8 "	Conductor	10 m
	7 "	Surface Casing	739 m
	4 ½ "	Production Casing	1567 m
FINAL WELL STATUS	Suspended with a single string 2 3/8" Vam Ace 13% Chrome completion, with a 4 ½" BWB Packer. Perforations - 1525 m to 1535 m		

2.4 OVERALL PROJECT TIMING

The overall project schedule and timing is shown on Figure 2.1 and shows the actual performance times for the major activities over the entire project, from site construction activity, through drilling and workover to completion, clean up and well handover.

WESTERN UNDERGROUND STORAGE - DEVELOPMENT DRILLING PROJECT. PHASE 1

ID	Task Name	Duration
1		
2	EXISTING WELLS (Provisional programme -TBA)	54d
3	CONDUCT GYRO SURVEY IONA 2	2d
4	MOBILISE WORKOVER RIG to IONA 1	2d
5	WORKOVER IONA 1 (Change Tubing)	8d
6	REPERFORATE IONA 2	1d
7	CONDUCT WELL TEST ON IONA 2	2d
8	CONDUCT WELL TEST ON IONA 1	1d
9		
10	NEW WELLS	167d
11	WELL PLANNING & LOCATION APPROVALS	30d
12	CONSTRUCT OBS-1 WELL SITE	8d
13	DRILL OBSERVATION 1 WELL & COMPLETE	23d
14	CONSTRUCT OBS-2 WELL SITE	10d
15	CONSTRUCT I/W DRILLING PAD	44d
16	MOVE RIG TO I/W DRILLING PAD & PREPARE TO SPUD	2d
17	DRILL I/W WELL IONA 4 (SLOT 3) COMPLETE & CLEAN UP	25d
18	REPOSITION RIG OVER IONA 3 (SLOT 5)	3d
19	DRILL I/W WELL IONA 3 (SLOT 5) COMPLETE & TEST	15d
20	RESPOSITION RIG OVER IONA 5 (SLOT 7)	3d
21	DRILL & COMPLETE I/W WELL IONA 5 & IONA-5 (ST1)	16d
22	TEST IONA 5 W. ESSO XMAS TREE . SUSPEND WELL W. XXN AND BP\	2d
23	INSTALL XMAS TREE ON IONA 4 . COMMISSION & HANDOVER	2d
24	CONSTRUCT NEW ACCESS ROAD TO OBS 2 (VIA WESTERN TRACK)	2d
25	MOVE RIG TO OBS-2 WELL SITE	2d
26	PREPARE & STORE SURPLUS PIPE STOCK ON I/W PAD	5d
27	PREP & STORE SURP. COPMPLETION STOCK IN DRILLING CONTAINER	4d
28	DRILL OBS-2 WELL & COMPLETE, & HANDOVER TO OPERATIONS	12d
29	DEMOBILISE RIG 30 FROM OBS 2 SITE	4d
30	HANDOVER IONA 3 TO OPERATIONS	1d
31	INSTALL XMAS TREE ON IONA 5 . COMMISSION & HANDOVER	2d
32	CONDUCT SITE CLEAN UP OPERATIONS	4d



Project: Western Underground Storage
Date: Wed 4/08/99

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress

Figure 2.1

Project Status

wugs_schedule280599 Page 1

KDC For WUGS

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2.5 CONTRACTORS

Table 2.2 Contractors

PROJECT MANAGERS	Kelly Down Consultants Pty Ltd
DRILLING	OD&E
LOCATION SURVEY	T. G Freeman
SITE CONSTRUCTION	Walter Mellis
WATER SUPPLY	Trucked in by Walter Mellis
FUEL SUPPLY	Supplied by Drilling Contractor
SUPPLY BASE	Max Nelson Storage yard – Cobden
CEMENTING	Halliburton
MUD SYSTEM - Drilling Fluids - Solids Control	 Baroid Via Drilling Contractor
MUD LOGGING	Halliburton
ELECTRIC LOGGING	Schlumberger
DRILLING TOOLS	Tasman Oil Tools
DIRECTIONAL DRILLING	Sperry/Halliburton
GYRO SERVICES	Gyrodata via Halliburton
MWD	Halliburton
CASING SERVICES	Premium Casing
CORING	Corepro
CASING & TUBING	Marubeni/Sumitomo
WELLHEADS - Drilling Spools - Xmas Trees - Miscellaneous Flanges/Xovers	 - Wood Group/Gearhart - Wood Group/Keamey Engineering - Gearhart & Baker Oil Tools
COMPLETION SERVICES - Slickline - Completion components - TCP perforating - Lubricator	 - Halliburton - Halliburton - Schumberger - Expertest
WELL TESTING	Halliburton
ENVIRONMENTAL - Waste Disposal	 Timboon Plumbing
FUEL SUPPLY	
RIG CAMP	Camp Cooriemungle
TRUCKING	Max Nelson Transport
CRANE SERVICES	Timboon Engineering
COMMUNICATIONS - Landlines - E Mail/Internet	 - Telstra - Big Pond

3.0 DRILLING DATA

3.1 WELL STATUS

The following figures illustrate the suspended condition of the wellhead, completion, and other pertinent data at the time of well handover from drilling to production. Figure 3.1 is the Wellhead Diagram, Figure 3.2 is the Completion Diagram and Figure 3.3 is the Handover Certificate.

3.2 OPERATIONAL SUMMARY

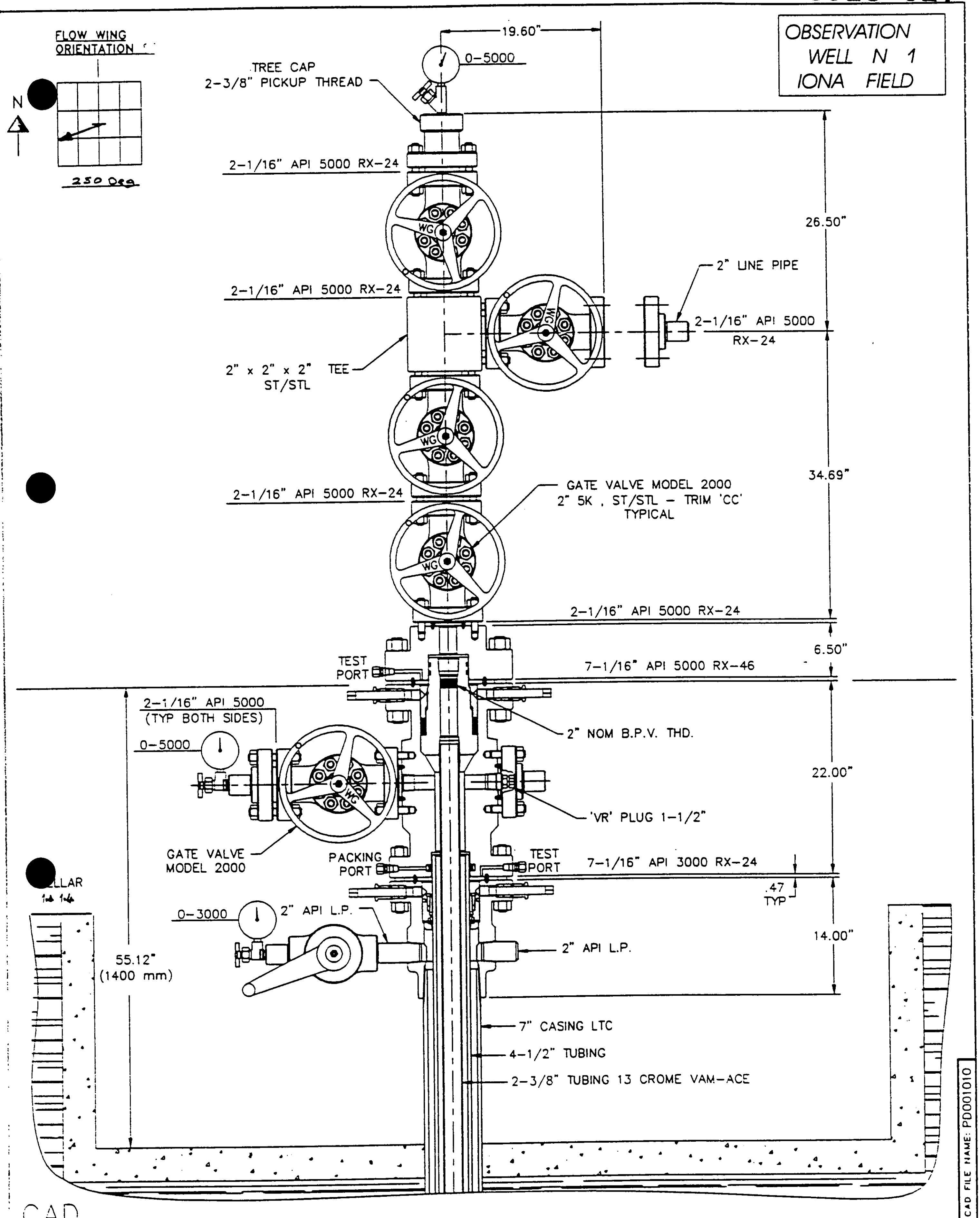
3.2.1 Logistics and Planning

Kelly Down Consultants ("KDC") managed the drilling and completion of the Iona Obs-1 well on behalf of WUGS as part of the project to drill and complete three injector/withdrawal wells, two observation wells, and the re-completion of the two existing wells.

Materials and logistics were managed out of the KDC Sydney offices with the input of the rig site team. Periodic visits to the well site by the materials and logistics coordinator ensured that inventory and service records were managed properly.

Mud and cement chemicals were supplied by Halliburton, from their Cheltenham facility. Directional drilling surveying and MWD equipment was provided by Halliburton from a number of locations mainly Perth and Darwin. The large distances and subsequent mobilisation times meant that it was often more economic to leave equipment on stand by in between jobs (such as casing running equipment) rather than truck equipment back and forth to the site.

The first site visit to assess lease building requirements took place on 21 December 1998. The Iona gas field site is set in a rural part of South West Victoria, approximately seven kilometers north of the township of Port Campbell. Two existing wells, Iona 1 and Iona 2, had commenced production at the site in 1992 and 1994 respectively. The new facilities for gas production/injection and processing were to be built on a large site encompassing the existing wells. The overall site area for the WUGS gas plant is approximately 0.5 km x 0.6 km square. All the new wells and the two existing have their surface locations within the security fence at the perimeter of the site.



CAD

WOOD GROUP

Wood Group Pressure Control
Mob. 0409-941693
Fax: (03) 9589-6127
Email: crossanorwgpc@ozemail.com.au

KELLY DOWN - WESTERN UNDERGROUND GAS STORAGE
WELLHEAD AND XMAS TREE OBSERVATION WELLS
CASING PROGRAM: 7" x 4-1/2" x 2-3/8"

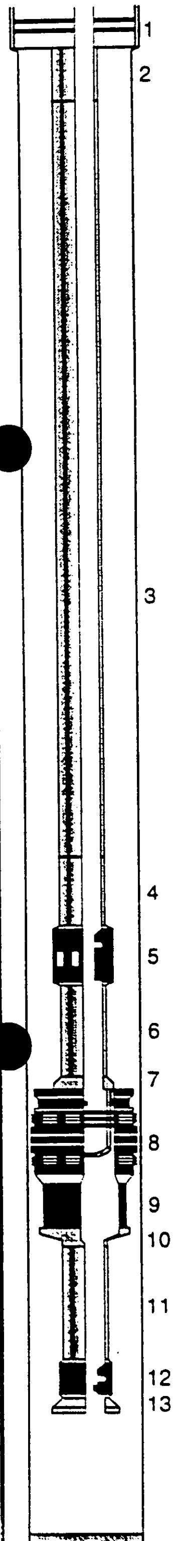
Drawn by:	Date:	Scale:	Drawing Number SHT 1 OF 1
R.C.	14-05-1999	N.T.S.	PD-001010

Figure 3.1

HALLIBURTON

Australian Completions

WELL : 4 1/2" Iona Observation Well #1
DATE : 26-February-99



Depth	Length	No.	DESCRIPTION	O.D.	I.D.	PART / No
0.00	-0.63		Difference			
-0.63	4.14		Elevation			
3.51	0.15	1	Woodgroup Tubing Hanger -		1.940	
3.66	0.61		Compression 15,000 Lbs			
4.27	1.09	2	Pup Jt - 2 3/8" Vam Ace 6.4 ppf 13 Cr	2.375	1.995	
5.36	2.49		Pup Jt - 2 3/8" Vam Ace 6.4 ppf 13 Cr			
7.85	1460.12	3	Tubing - 2 3/8" 4.6 ppf Vam Ace 13 Cr	2.375	1.995	
1467.97	1.28	4	Pup Jt - 2 3/8" Vam Ace 6.4 ppf 13 Cr	2.375	1.995	
1469.25	1.25	5	SSD - 2 3/8" Vam Ace P x P w/ 1.875 profile 9 Cr	3.250	1.875	621 XD 18701
			[Open Down - Flow area 2.770 sq in]			
			[Positioning Tool - 42 BO 116]			
1470.50	1.88	6	Pup Jt - 2 3/8" Vam Ace 6.4 ppf 13 Cr	2.375	1.995	
		7	Seal Assembly - consisting of :			
1472.38	0.26		J-slot locator Top- 2 3/8" Vam Ace B x 2 1/14 " 12 UN P			
1472.64	-0.60		Depth Correction			
1472.04	0.13		J-slot locator Bottom- 2 3/8" Vam Ace B x 2 1/14 " 12 UN	3.094	1.920	212 J 25503-B
1472.17	0.34		Seal Unit - RTR - 2 1/4" -12 UN B x P 13 Cr	2.573	1.920	812RTR 25501-F
1472.51	0.13		Mule Shoe Guide - 2 1/4" - 12 UN B 13 Cr	2.520	1.920	212 G 25502-F
1472.64	0.62	8	Packer - 4 1/2" BWB - 13 CR - 13.5 - 15.1 #	3.640	2.555	812 BWB 45103
1473.26	2.44	9	Millout Extension - 3 1/8" 10UNS-2 B x B 13 Cr	3.640	2.750	812 MOE 25502
1475.70	0.09	10	Crossover - 3 1/8" 10 UNS-2 P x 2 3/8" Vam Ace P 13 Cr	3.640	1.956	892 PPC 32008
1475.79	3.10	11	Pup Jt - 2 3/8" Vam Ace 6.4 ppf 13 Cr	2.375	1.995	
1478.89	0.34	12	XN' Nipple - 2 3/8" Vam Ace B x P 13 Cr	2.726	1.791	811 XN 18757
			[1.875" Packing Bore]			
1479.23	0.19	13	Wireline Reentry Guide - 2 3/8" Vam Ace B 13 Cr	3.530	1.994	812 M 1004
1479.42			End Of Tubing			
			Notes:			
			Tubing Pick Up Weight : 25,000. lb.			
			Land hanger with 15,000. lb compression.			

Figure 3.2

20/05/99

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TU AUSTRALIA

WESTERN UNDERGROUND GAS STORAGE

WELL HANDOVER & STATUS RECORD

Detail	Description	Distribution	
		Name	Company
Field / Country:	Iona / Australia	Gary Scott	WUGS
Well No:	Obs-1	Kurt Matheson	TU Australia
Well Surface Co-ordinates:	5728559 N: 677741.5 E	David Hesse	Woney/Bechtel
Well TD Co-ordinates:	5728201.53 N: 678215.17 W @ 1509.4 m MDRKB	Colin Stuart	KDC
Maximum Inclination:	40.1 deg @ 488 m MDRKB	Jim Slater	KDC
Well Drilled by :	OD&E Rig 30 - Drilling Management KDC ltd		
Rig Floor Elevations:	KB to GL: 4.98 m GL to MSL: 130 m		
Well TD/PBTD	TD: 1568 m MDRKB PBTD: 1551 m MDRKB		
Well Type:	Single Completion water disposal/observation		
Purpose of handover	Handing new well to Production Operations		
Handover from:	WUGS Drilling -		
Handover to:	Wugs Operations -		
HANDOVER DATE:	May 20 1999		

WELL STATUS (All depths MDRKB unless stated otherwise)

Item	Description	Status at handover	Pressure Status	Size/type/rating	Comments / Remarks
	Xmas Tree	Installed	Bled to Zero above BPV	2 1/16" 5.000 psi	Wood Group T Tree
1	Swab Valve	Closed	0 psi above/below	2 1/16"" API 5.000 psi	
2	Tree upper master valve	Closed	0 psi	2 1/16"" API 5.000 psi	
3	Tree lower master valve	Closed	0 psi above/below	2 1/16"" API 5.000 psi	
4	Flow wing valve	Closed	0 psi above/below	2 1/16"" API 5.000 psi	
5	Kill Wing Valve	Closed	0 psi above/below	2 1/16" API 5.000 psi	
6	Tree BPV	Not installed			
7	Tree cap	Installed			5.000 psi gauge installed
8	A annulus valve	Closed			5.000 psi gauge installed
9	A annulus valve outer	Not installed			
10	B annulus valve	Closed			5.000 psi gauge installed
11	Last rec.flow / FTHP	NA			Well completed below GWC.
12	Well fluid	Brine	0 psi		
13	A Annulus	8.6 ppg 3% KCL inhibited brine	0 psi	2 x 208 Litre drums inhibitor	COAT 2748 Baroid inhibiter
14	Wireline plugs installed?	No			
15	Perforated Interval	Open		1525 m to 1535 m	2 7/8" HSD guns 60 deg, 6 spf, 34gm
16	Injection Tubing	2 3/8" 4.6 ppf L80-13Cr VAM ACE		ID: 1.995" Drift: 1.901"	
17	Nipple Profile	XN @ 1479 m		ID: 1.791"	
18	Sliding Sleeve	2 3/8" SSD @ 1469 m		ID: 1.875"	
19	Production Packer	4 1/2" BWB @ 1473 m		ID: 2.555"	
20	Production Casing	4 1/2" 13.5 ppf N80 LTC		ID: 3.920" Drift: 3.795"	
21	Minimum restriction	XN nipple (1.791 ID) @ 1479 m			
22	Wellhead Type	7" x 4-1/2" x 2-3/8"	5.000 psi rated		Wood Group Slip & Seal Type

Remarks:

Well handed to WUGS Operations following completion of drilling program.
Tree cap installed on Xmas tree.
Steel Cellar installed, with ground level grating.
Handwheels locked with looped chain.(Lower Master)
Temporary protective steel cage installed around well.
Name Plate installed on cage.
Cellar drain installed.

Signatures:

Well accepted by : C. Stuart Signed: Date:

Well handed over by : Signed: L. Slater Date: 20/05/99

Figure 3.3

Well handover sheet_wugsobs1

3.2.2 Site Preparation

Site construction for Iona Obs-1 commenced in early January 1999. The lease area was on a flat paddock off the main plant access road. A construction contractor was appointed to lay down a 600 mm limestone/sandstone base for the drilling rig with an access road off the main site gate. Rig crew accommodation facilities were provided remote from the site at Camp Cooriemungle, approximately seven kilometers north of Iona. Site construction included the installation of a 1.8m x 1.8m x 1.8m deep cellar and 5m of 13-3/8" conductor pipe cemented in place.

Of particular concern throughout construction was adherence to the environmental management plan for the project, which stressed the minimisation of noise and dust levels. This necessitated the spraying of water, which had to be trucked into site from nearby water sources, as dam water on the WUGS site itself was reserved for gas plant construction requirements. A turkeys nest or small dam was eventually built to store trucked water for mud mixing. A water well was planned to be drilled on site by the gas plant construction group but this was delayed and as a result, water was trucked into the drilling site.

Drilling site construction took eight days and was ready for the target spud date February 5, 1999. A schematic of the overall site showing the location of Iona Obs-1 within the site boundary is shown on Figure 1.2 below.

3.2.3 Mobilisation

OD&E Rig 30 was mobilised from Sale in eastern Victoria on January 21, 1999 where it had been used to drill a well for Roma Petroleum NL. The rig contractor trucked the rig early to the site to perform some rig maintenance tasks.

Rig 30 is an Ideco H-725-D electric rig with four 600 kW generators powered by four CAT 3412 PCTA diesel engines. The generators were replaced with quiet generators for the duration of the project to meet noise guidelines provided in the environmental management plan.

The rig is a triple rig with a Dreco floor-mounted cantilever mast with a nominal hook gross load capacity of 510,000 lbs. The limiting performance factor of the rig was the mud pumps. Only two Gardner Denver PZ-8 (800 HP) pumps were provided by the drilling contractor.

3.2.4 Pre Spud

The Iona Obs-1 pre-spud was held at Camp Cooriemungle on February 3, 1999. All key management, service contractors and site personnel were present, together with gas plant site safety and environmental representatives from Bechtel (the gas plant construction managers). The drilling sites were all within the overall gas plant construction site boundary so it was agreed that a close interface between drilling and construction teams on site and in the planning offices was critical to project success.

A pre-spud manual highlighting key safety, technical, and environmental aspects was issued to all personnel. The critical well design and drilling procedures were outlined at the pre-spud meeting. Of particular concern was the need to avoid the build up of cuttings beds through sound drilling practices, such as pipe rotation, full circulation prior to pulling out of the hole ("POOH") and the maintenance of good mud properties.

3.2.5 8 ½" Hole Section

After a full safety briefing with the rig crews, Iona Obs-1 was spudded at 01:00 hrs on the February 5, 1999. An 8-½" hole was drilled using a KCL/PHPA/Polymer fresh water mud system. The PHPA was used to inhibit the reactive clays present within the Tertiary and Late Cretaceous claystones, i.e. in the Gellibrand Marl, Pember Mudstone and Paaratte Formation.

Drilling proceeded without incident to the kick off point at 135 m. Oriented drilling was necessary for 70 percent of each single until the desired build rate of 4° per 30 m had been achieved on an azimuth of 127.15 deg. Steerable drilling continued to 457 m, with orientation necessary 40 to 50 percent of the time. Drilling parameters were: Weight on bit ("WOB"), 5Klb WOB; Flow rate, 384 to 432 gpm; Standpipe pressure 1300 to 1600 psi; RPM, 50.

Rotary drilling continued to 499 m when some sliding was required to 514 m to correct a slight build and turn . Rotary drilling continued to 743.5 m, with only one pump from 688 m due to a hammer union failure on the discharge of mud pump #1. Inclination at 743.5 m was 36.9 deg on an azimuth of 126.6 degrees. After a wiper trip, a Gyrodata multishot was dropped in the drill string, as planned and recovered on the trip out.

The 7" casing was run and cemented back to surface without incident. A screw type 7-1/16" Wood Group casing head was run with the 7" casing. After waiting on cement for several hours, the wellhead adaptor was installed and the 7 1/16" blow out preventers ("BOP's") rigged up and tested.

3.2.6 6" Hole section

The objective of the 6" hole section was to directionally drill to the target (following a tangent section for 158 m out of the 7" shoe) and then to progressively drop angle to zero degrees inclination at the target in the Waarre Formation. The 7" casing was set in the Pebble Point Formation , thereby casing off the potentially troublesome mudstone at the top of the Pebble Point Formation, and also the freshwater sands of the overlying Dilwyn Formation. A maximum inclination of 40 degrees was achieved in the 8 ½" section. Due to the small hole size of 6", prevention of cuttings bed build up was again re-inforced prior to drilling out the shoe.

After drilling the shoe and two metres of new formation a leak off test ("LOT") was performed, with a leak off at 480 psi, or 13.2 ppg equivalent mud weight ("EMW"). Drilling ahead proceeded using a PDC bit in rotary mode at approx 40 m/hr. Once in the drop off section within the Paaratte Formation, difficulties were experienced in maintaining the correct trajectory. Both azimuth and drop rate by a depth of 1251 m were insufficient to guarantee hitting the target. This problem was believed to be caused by the PDC having a profile which was too aggressive, meaning the directional drillers could not maintain toolface, with the additional problem of the bottom hole assembly ("BHA") hanging up, or weight stacking. The BHA was therefore pulled to replace the PDC with a tri-cone bit.

After circulating bottoms up the BHA was pulled. At 923 m the string became stuck. No circulation was possible and the string could not be rotated or moved in either direction. Electric wireline was rigged up and the string backed off at 734 m. After running a fishing jar assembly and screwing into the fish at 734 m, jarring commenced with no success. A free point indicator was run which established the free point further down the hole below 741m, possibly above the 5 7/8" stabiliser at 918 m. The fishing string was recovered and a washpipe assembly run. The string was washed over to 774 m and a fishing string re-run. After backing off with a wireline string shot, partial recovery of the fish occurred with one joint of 3 ½" drill pipe and 3 x 4 3/4" drill collars ("DC's") recovered. The top of the fish was now at 771m. The fishing string was re-run and engaged the fish with a series 150 overshot and 4- ¾" grapple. The fish still could not be moved and so was backed off at 790 m. This run recovered the drilling jars and 1x 4-3/4" DC. Two further runs in the hole were made with different grapple sizes. The fish could still not be picked up mechanically so washpipe was re-run to 837 m. The string was backed off at 880 m and 5 x 4-3/4" DC's recovered. At this stage the remaining fish comprised 1x 4-¾" DC/ 1x 4- ¾" NM flex DC/ 1x 4 -¾" DWD assembly 1 x 4- ¾" NM flex DC/ 1x 4- ¾" Float sub/ 1 x 5-7/8" Stab/ 1x 4-¾" Mud Motor/6" bit. After a further two runs with an overshot, a rotary shoe assembly was run and successfully latched and recovered the fish.

After cleaning the hole, normal drilling resumed and the well was drilled successfully to the target core point at 1509 to 1527 m. The core point was picked within the overlying shale sequence, to obtain shale data relevant to the determination of injection pressure capacity. Coring within the shale was only partially successful with the core barrel jamming off after 18 m. Only 6 m (or 30 percent) being recovered at surface. A second core was cut from 1527 m to 1538 m when the core barrel again jammed. Approximately 6.8 m (or 62 percent) of core was recovered on core no 2.

Drilling 6" hole resumed to final total depth of 1568 m without incident. TD was reached at 1568 m, on February 23, 1999.

The hole was logged successfully by Schlumberger with three logging runs: Run#1 comprised a DSI/GR and Run #2 consisted of a HALS/PEX suite; Run #3 an offset checkshot survey, was then conducted.

Note: At the stuck point, across the 5 7/8" stabiliser, a sequence containing Volcanic pebbles was interpreted between 912 and 913 m from logs and cuttings samples.

3.2.7 4 ½" Production String

A 4 -½" 13.5 lb/ft N80 LTC production string was run to 1567 m and cemented in place with a 12.8 ppg lead slurry and 15.8 ppg class G tail. The top plug was bumped at 2500 psi, held pressure for 10 minutes, and the floats tested by bleeding back 1 bbl. After waiting on cement, the BOP's were lifted and the Wood Group slip and seal casing hanger installed. The tubing head was then landed and pressure tested to 3000 psi. The BOP's were then re-installed and tested in preparation for running the 2 3/8" completion.

3.2.8 Clean up and Perforate

A 4-½" casing scraper and 3-¾" junk mill was run on a dedicated 2-3/8" tubing work string to ensure the cased hole was clean and circulated to brine prior to running the completion. A three percent KCL brine was circulated at TD preceded by a clean up sweep. After POOH with the work string, a CBL/VDL confirmed good cement bond and isolation across the reservoir sands, and a top of cement at 781 m.

After installing a shooting nipple across the BOP's, the interval 1525 m to 1535 m in the C2 sands was perforated using 2-7/8" high shot density 60° phasing, 6 shots per foot, 34 gm charge guns, in an 8.4 ppg density brine.

3.2.9 Completion

A 4-½" Otis BWB packer and tailpipe assembly was run on electric line and after depth correlation was set at 1473 m using a Baker type explosive setting tool. The 2-3/8" 4.6 lb/ft L80 13% Chrome tubing was run with a J slot locater on the bottom, to the top of the packer. After circulating the well to inhibited brine, the tubing was spaced out and latched onto the packer. The tubing hanger was landed and locked down and annulus, tubing, and hanger seals tested. After recovery of the tubing landing joint, a back pressure valve ("BPV") was set in the tubing hanger, and the BOP nippled down.

A 2-1/16" bore Wood Group composite Xmas tree was installed on the tubing head spool and tested to 5000 psi and the BPV recovered from the well. The well was completed at 2400 hrs on February 28, 1999.

3.3 DAILY OPERATIONS

3.3.1 Daily Drilling Reports

The details of the daily activities during rig up and drilling operations for the Iona Obs-1 well are presented in the Daily Drilling reports in Appendix 1.

3.3.2 Time Depth curve

The daily cost estimates can be found in graphical format in the time depth curve in Figure 3.4.

3.3.3 Definitive Survey

A standard skid mounted measurements while drilling ("MWD") unit was provided by Sperry Sun/Halliburton and the azimuth and inclination of the well were continuously recorded. Gyro surveys were conducted by Gyrodata. The definitive survey for the well is presented in Appendix 2.

3.3.4 Directional Drilling

Iona Obs-1 was designed as a directional well drilled from within the main site boundary to a bottom hole location in the North West. Maximum hole angle for the well was designed to be 40 degrees, with a vertical drop off to the target to facilitate coring requirements. A directional plot showing a plan and section view is presented in Figure 3.5.

3.3.5 Iona Obs-1 Time Performance

Iona Obs-1 was spudded on February 5, 1999, with OD&E Rig 30. This was the first well to be drilled since the field's change of ownership and conversion to an underground gas storage project. Iona Obs-1 was designed as a directional well, with a surface location within the gas plant boundary and a bottom hole location under an adjacent property to the north east. The short time frame from project approval to spud of approximately six weeks allowed minimal time for well design, contracting and procurement and importantly offset well research. Due to some ownership changes over the years certain basic offset data on the two pre-existing wells, Iona 1 and Iona 2, was not available to the well planners.

As Iona Obs-1 was to be a high step out well with inclination in the 6" section up to 40 degrees, precautions were planned for the prevention of cuttings beds. However, despite this, a major lost time incident occurred while drilling in the 6" hole section. While drilling in the Paaratte Formation, previously unidentified Volcanic pebble beds became unstable causing a large volume of fines and pebbles to fall and build up on top of the bottom hole assembly ("BHA"). The BHA became mechanically stuck and the subsequent recovery operation took 7.58 days (82 hours). After recovering the stuck pipe, the well was drilled, cored, logged, cased and completed in eight days. The following charts illustrate the time performance.

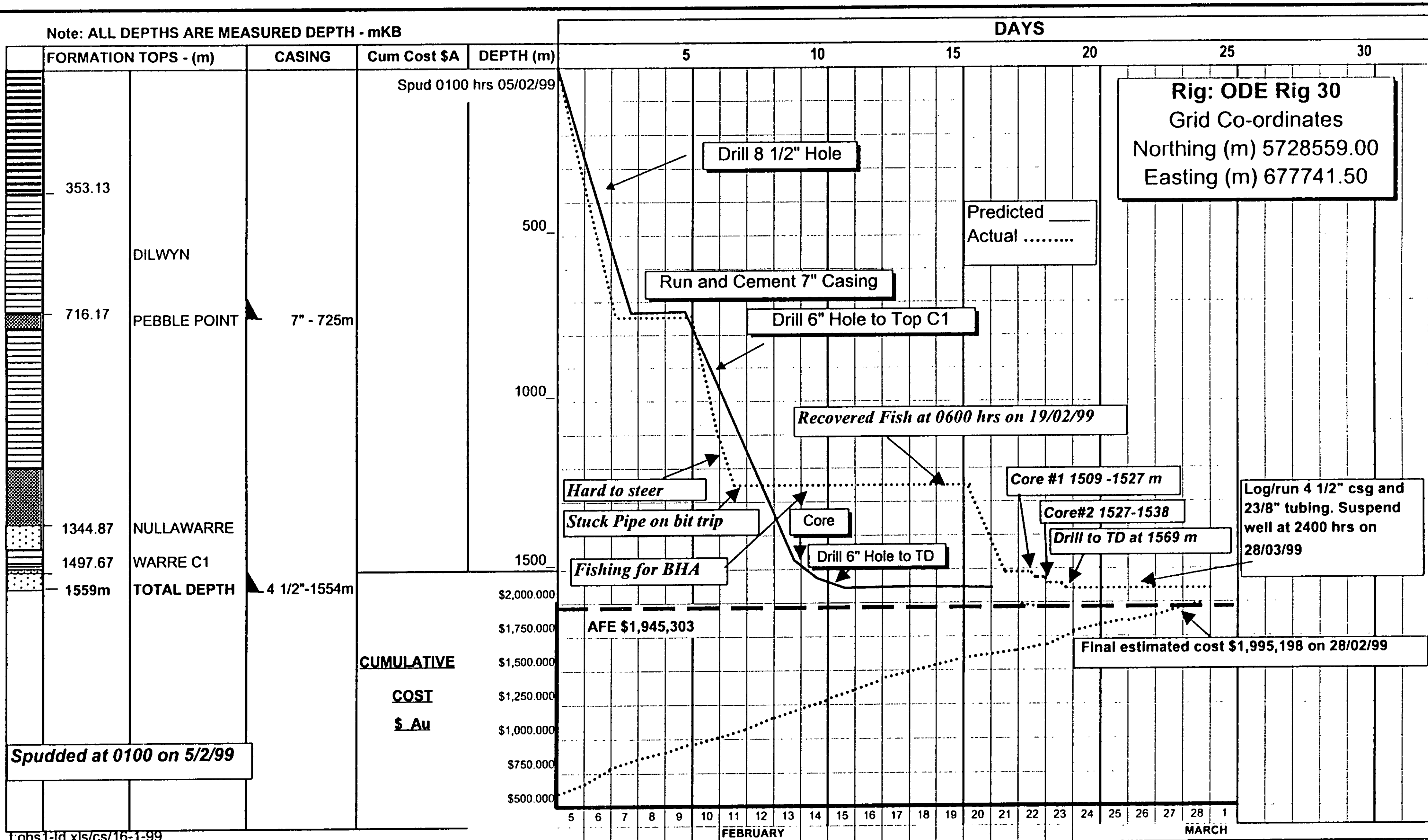
3.3.6 Time Analysis

Table 3.1 Time Summary

ACTIVITY	HOURS	DAYS
Rig move		
Rig up	1	0.04
Drilling	101.5	4.23
Bit Trip	45	1.88
Wiper trip	14	0.58
Survey	9.5	0.40
Circulate and condition	23.5	0.98
Change BHA	18.5	0.77
Casing & Cementing	35	1.46
Wellhead & BOP's	44.5	1.85
Coring	10.5	0.44
Logging	26	1.08
Wash & Ream	14	0.58
Fishing	182	7.58
Rig Repairs	6.5	0.27
Completion	41	1.71
Miscellaneous	2.5	
TOTAL	**575**	**23.96**

WUGS - WESTERN UNDERGROUND GAS STORAGE

Well: IONA OBS-1 | **Elev/KB: 132.5m/137.5m** | **Permit: PPL-2 Otway Basin**



3/08/1999

KDC FOR WUGS

Figure 3.4

908918 026

908918 027

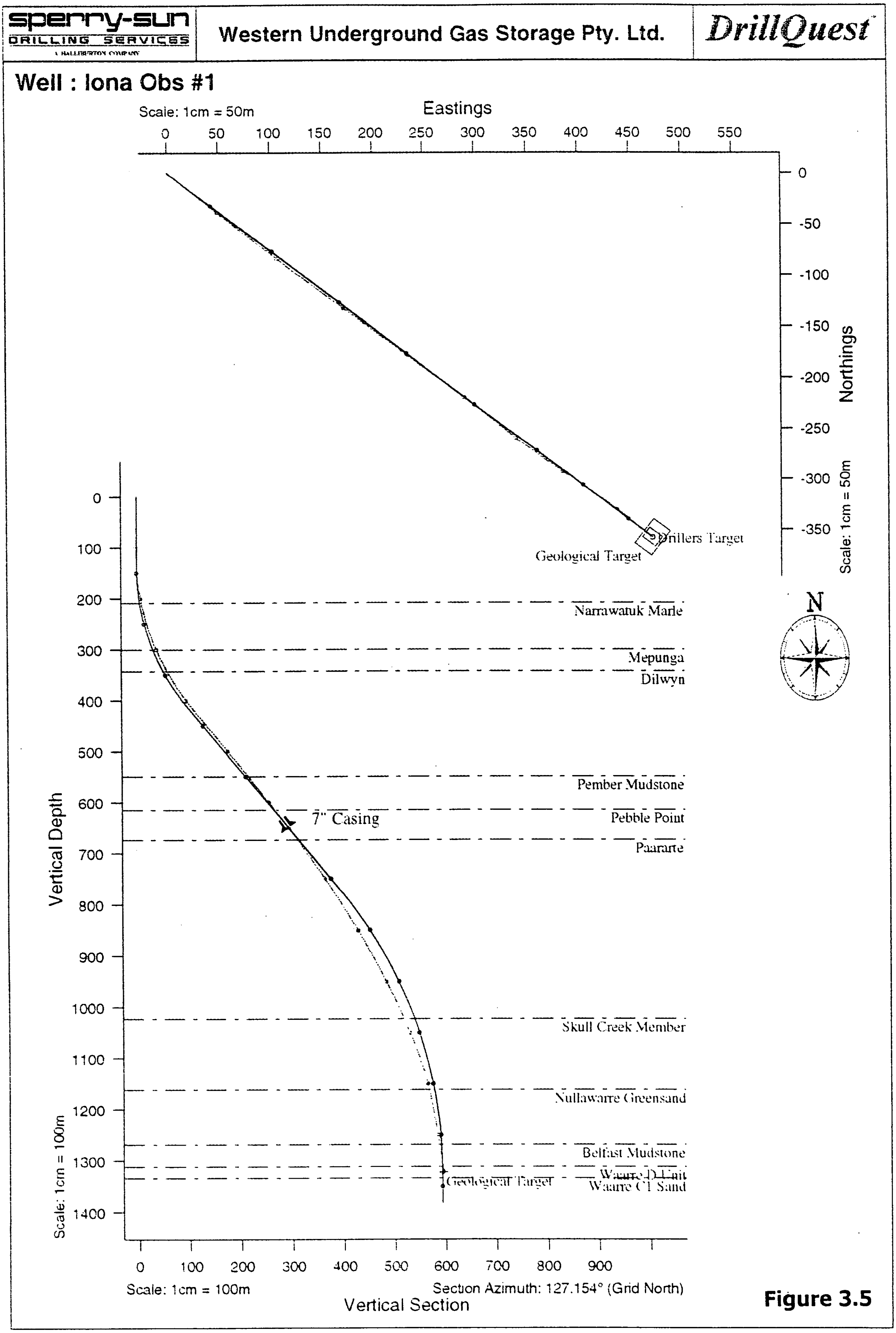


Figure 3.5

Figure 3.6 Time Performance Charts

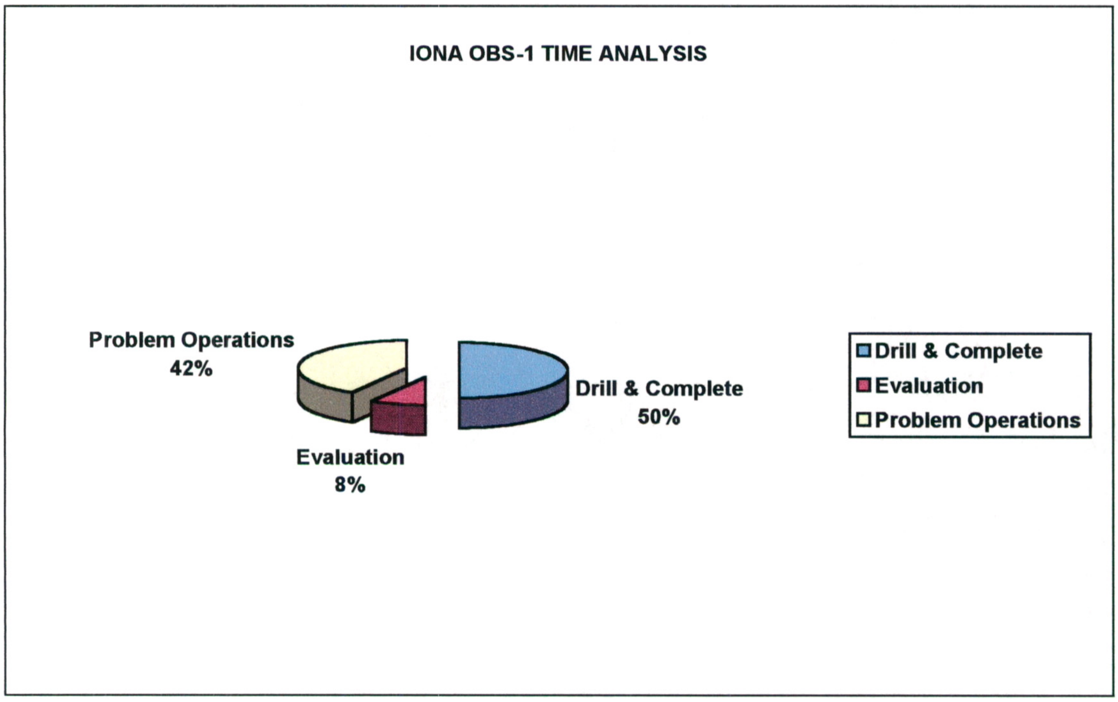


FIGURE 3.6a - OVERALL PERFORMANCE CHART

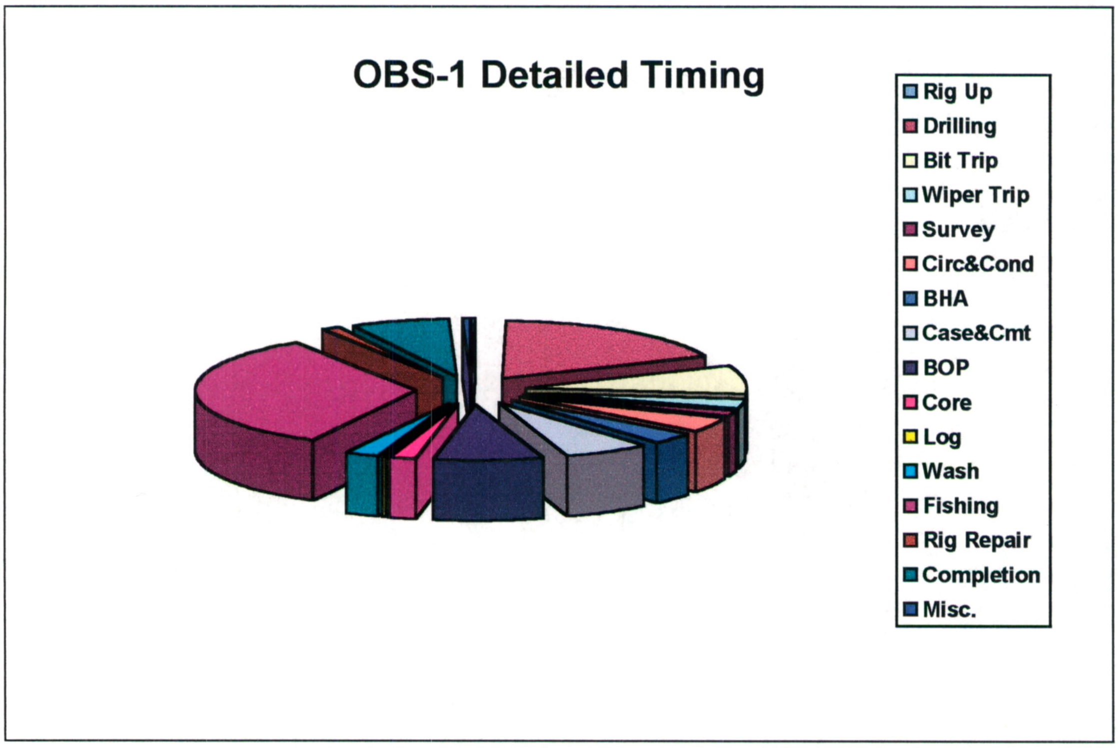


FIGURE 3.6b - DETAILED PERFORMANCE CHART

3.4 BHA SUMMARY

Table 3.2 presents the BHA's run in Iona Obs-1 well and Table 3.3 summarizes the Bit record.

Table 3.2 BHA Summary

Hole Size (ins)	BHA Description	Length (m)	Depth in (m)	Depth out (m)
	DRILLING ASSEMBLIES			
8 ½"	8 ½" Tricone Bit + 6 ¾" Motor + 7 ¾' SS + 6 ½" NMFS + 6½"NMDC + 6 ¾"DWDHOS + 6½"NMDC + 6½"X/O + 8x6 ½" Spiral DC + 6.25" Jar + 2x6 ½"Spiral DC + X/O.	134	10	743
8 ½"	8 ½" Tricone Bit + Bit Sub + 6½"NMX/O + 8 ¼"SS + 6½"NMDC + 7 ¾' SS + 6½"X/O + 8x6 ½" Spiral DC + 6.25" Jar + 2x6 ½"Spiral DC's + X/O.	118.5	743	743
6"	6" PDC Bit + 4 ¾" Motor + 5 7/8" SS + 4 ¾" FS + 4 ¾" NMFDC + 4 ¾" DWDHOS + 4 ¾" NMFDC + 12xDC + 4.75" Jar + 3xDC	179	743	1251
	FISHING ASSEMBLIES			
6"	4 ¾"PonyDC + Safety joint + 4 ¾" Bumper Sub + Z type Fishing Jar + 5x4 ¾" DC + 6x3 ½" HWDP			
6"	6"Rotary shoe + 5x5 ¾" Washpipe + DriveSub Safety Joint + 4 ¾" Bumper Sub = Z type Fishing Jar + 5x4 ¾" DC = 6x3 ½" HWDP			
6"	5 ¾" Overshot + 4 ¾" Bumper Sub + 4 ¾" Z Jar + 35x3 1/2" HWDP			
6"	6" Rotary Shoe + Drive Sub + 4 ¾" Bumper Sub + 4 ¾" Z Jar + Drain Sub + 35x3 ½" HWDP			
	DRILLING ASSEMBLIES			
6"	6" PDC Bit + 5 7/8" NBS + 4 ¾ " DC + 5 ¾" SS + 21 HWDP + 4.75" Jar + 15x3 ½ " HWDP { ***Clean out assembly post fish recovery*** }	353.7	1251	1251
6"	6" PDC Bit + 4 ¾" Motor + 5¾ " SS + 4 ¾" FS + 4 ¾" NMFDC + 4 ¾" DWDHOS + 4 ¾" NMFDC + 21xHWDP + 4.75" Jar + 15xHWDP	375.9	1251	1509
	CORING ASSEMBLIES			
6"	4 ¾" Corehead + 4 3/3" x18m Core Barrel + 21x 3 ½" HWDP + 4.75" Jar + 15x3 ½" HWDP	361.4	1509	1527
6"	4 ¾" Corehead + 4 3/3" x18m Core Barrel + 21x 3 ½" HWDP + 4.75" Jar + 15x3 ½" HWDP	361.4	1527	1538
	DRILLING ASSEMBLY			
6"	6" Tricone Bit + 5 7/8" NBS + 4 ¾ " DC + 5 ¾" SS + 21 HWDP + 4.75" Jar + 15x HWDP	353.7	1538	1568

BIT RECORD

The Table shown below provides details of the drill bits used to drill Iona Obs-1

BIT No.	Size (ins)	Make	Type	IADC Code	Serial No.	Jets 32nds	Depth Out (m)	Drilled (m)	Hrs	ROP (m/hr)	WOB 1000 (lbs)	RPM	Press (psi)	Pump (gpm)	MW (ppg)	Ver. Dev (deg)	Cutting Structure I	O	DC	LOC	B/S	G	ODC	POH	Remarks
1	8 ½"	HTC	GT-MGL	117	V00CS	13,13,13	743.5	733.5	35.5	20.6	5	120/200	1950	431	8.9	36	2	2	WT	A	E	1		TD	
2	6	BBL	457SRL	PDC	821355	4 x 10's	1251	507.5	38.5	13.2	15	60/250	1950	249	8.9	20	4	2	WT	S	X	1	CT	BHA	Stacking
3	6	HTC	STR-09	437	T09YE	11,11,11	1509	258	29.0	8.8	15/20	70/200	2400	216	9.1	2.4	2	2	ER	A	E	1	WT	CP	
4	6	Corepro	Corehead	CH	2087		1527	18	3.0	6.0	15/20	60	1150	129	9	2.4	2	2	WT	A	X	1	WT	CP	
4RR	6	Corepro	Corehead	CH	2087		1538	11	5.5	2.0	15/20	60	1150	129	9	2.4	2	2	WT	A	X	1	WT	CP	
3RR	6	HTC	STR-09	437	T09YE	11,11,11	1568	30	3.5	10.0	20	60	2400	216	9	2.4	3	3	ER	A	E	1	WT	TD	

DULL CHARACTERISTICS

BC	Broken Cone	ER	Erosion	PN	Plugged Nozzle
BT	Broken Teeth/Cutters	FC	Flat Crested Wear	RG	Rounded Gauge
BU	Balled Up	HC	Heat Checking	RO	Ring Out
CC	Cracked Cone	JD	Junk Damage	SD	Shirttail Damage
CD	Cone Dragged	LC	Lost Cone	SS	Self-Sharpening Wear
CI	Cone Interference	LN	Lost Nozzle	TR	Tracking
CR	Cored	LT	Lost Teeth/Cutters	WO	Wash Out in Bit
CT	Chipped Teeth/Cutters	OC	Off Centre Wear	WT	Worn Teeth/Cutters

REASON PULLED

FM	Formation Change	TW	Twist Off	LOG	Run Logs
HP	Hole Problems	WC	Weather Conditions	RIG	Rig Repair
HR	Hours on Bit	WO	Washout - Drillstring	CM	Condition Mud
FT	Footage	BHA	Change Bottomhole Assy	CP	Core Point
PP	Pump Pressure	DMF	Downhole Motor Failure	DP	Drill Plug
PR	Penetration Rate	DSF	Drillstring Failure	CSG	Casing Point
TD	Total Depth	DST	Drill Stem Test	MSC	Miscellaneous
TQ	Torque	DTF	Downhole tool failure		

Table 3.3

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3.5 CASING AND CEMENTING REPORT

3.5.1 8 1/2" Hole Section : 7" Surface Casing (Surface to 739 m RT)

Table 3.4 7" Surface Casing Tally

WELL NAME :	Iona Obs-1		DATE RUN :		8/02/99
ELEVATIONS :	R.T. :	4.98 m	M.S.L. : 132.5 m	T.D. :	744 m
STRING TYPE :	7" Surface		RKB TO TOP OF LAST SPOOL :		

SURFACE CASING & EQUIPMENT RECORD AS RUN FROM TOP TO BOTTOM

Size O.D. (ins)	Weight (lb/ft)	No. of Joints	Thread Type	Length (m)	From (m)	To (m)	Remarks
7"	26	1	LTC	6.13	-0.66	5.47	Landing Joint
7"	26	60	LTC	728.1	5.47	726.26	Intermed Jnts
		1		0.25	726.26	726.51	Float Collar
7'	26	1	LTC	12.08	726.51	738.59	Shoe Track Jnt
		1		0.40	738.59	738.99	Float Shoe
			Tally Total :	739.65	Casing Landed at :		739m

CASING SPOOL TYPE :	WG	SIZE :	7" x 4 ½" x 2 3/8"		
CENTRALISERS AT :	2 on shoe joint, 1ea on joints 2-7 and 1 per second joint to 41 m below KB.				
SCRATCHERS AT :	Nil.				

Table 3.5 Surface Casing cement details

DRILLING FLUID PRIOR TO CEMENTING :	9.1ppg Weighted KCL / PHPL
PREFLUSH, SPACER DETAILS :	30 bbl, 8.3 ppg Drill Water ahead of cement.

Class	No. SX	Additive	Function	Quantity of Additive (lbs / gal)	%	How Added Blend or Mix Water	Remarks
'G'	201	Aquagel CFR-3L NF-1	Gel Extender Friction Reducer Anti-Foam	465 lb 10.7 gal 2 gals	2.5 2gals/10 bbl 1	Blend Mix Water Mix Water	Lead Slurry.
'G'	144	CaCl	Accelerator	129 lbs	0.35	Mix Water	Tail Slurry -no losses
'G'	10	CaCl	Accelerator	10 lbs	1	Mix Water	Top up Job

Table 3.5 Surface Casing cement details cont.

THEORETICAL TOP OF CEMENT (m) :	Surface	AVERAGE SLURRY WEIGHT (ppg) :	Lead 12.8 Tail 15.8
DISPLACEMENT FLUID :	8.3 ppg Fresh water	DISPLACEMENT RATE (bbl/min) :	7.0 (Rig pumps)
PLUG BUMPED WITH (psi) :	Bumped – 2500	DISPLACEMENT VOLUME (bbl) :	Calculated 90.5 Actual 90.5
REMARKS :	Good returns – no cement to surface, hole oversize, floats held. Top job to support csg		

3.5.2 6" Hole Section : 4 1/2" Production Casing (Surface to 1568 m RT)

Table 3.6 4 1/2" Production Casing Tally

WELL NAME :	Iona Obs-1	DATE RUN :	8/02/99		
ELEVATIONS :	R.T. : 4.98 m	M.S.L. :	132.5 m	T.D. :	1568 m
STRING TYPE :	4 ½"	RKB TO TOP OF LAST SPOOL :			4.90m

SURFACE CASING & EQUIPMENT RECORD AS RUN FROM TOP TO BOTTOM

Size O.D. (ins)	Weight (lb/ft)	No. of Joints	Thread Type	Length (m)	From (m)	To (m)	Remarks
4 ½"	12.5	1	LTC	12.09	-3.23	8.86	Landing Joint
4 ½"	12.5	128	LTC	1545.30	8.86	1554.16	Intermed Jnts
		1		0.38	1554.16	1554.54	Float Collar
4 ½"	12.5	1	LTC	12.08	1554.54	1566.62	Shoe Track Jnt
		1		.38	1566.62	1567	Float Shoe
			Tally Total :	1570.23	Casing Landed at :		1567

CASING SPOOL TYPE :	WG	SIZE :	7" x 4 ½" x 2 3/8"		
CENTRALISERS AT :	2 on shoe joint, 1ea on joints 2-7 and 1 per second joint to joint 70.				
SCRATCHERS AT :	Nil.				

3.5.3 4½" Production Casing Cement Details

Table 3.7 Production Casing Cement Details

DRILLING FLUID PRIOR TO CEMENTING :	9.0ppg Weighted KCL / PHPL
PREFLUSH, SPACER DETAILS :	20 bbl, 8.5 ppg Mudflush.

Class	No. SX	Additive	Function	Quantity of Additive (lbs / gal)	%	How Added Blend or Mix Water	Remarks
'G'	106	Aquagel HR-7 NF-1	Gel Extender Retarder Anti-Foam	249 lb 149 lbs 2 gals	2.5 2gals/10 bbl 1	Blend Mix Water Mix Water	Lead Slurry.
'G'	101	Halad 413 L	Water loss control	28 gals		Mix Water	Tail Slurry –no losses

THEORETICAL TOP OF CEMENT (m) :	Surface	**AVERAGE SLURRY WEIGHT (ppg) :**	Lead 12.8 Tail 15.8
DISPLACEMENT FLUID :	8.3 ppg Fresh water	**DISPLACEMENT RATE (bbl/min) :**	5.0 (Rig pumps)
PLUG BUMPED WITH (psi) :	Bumped – 2500	**DISPLACEMENT VOLUME (bbl) :**	Calculated 77 Actual 77
REMARKS :	Good returns – no cement to surface, hole oversize, floats held. Top job to support csg		

3.6 DRILLING FLUID RECAP

The tables in this section outline the mud properties used in the various hole sections.

3.6.1 8 ½" Surface Hole Section : 10.1 to 743.5 m (05 to 07 Feb 1999)

The 8 ½ " hole section was drilled using freshwater with a KCL/EZ-MUD / Polymer mud system. EZ-MUD (PHPA) was used to stabilise the borehole wall and inhibit clay gumbo rings from forming. This proved effective and no downtime was lost due to dealing with gumbo. Some downhole seepage losses were seen across the Dilwyn sands, which were controlled with the addition of Barofibre. A centrifuge was run continuously in the section, in combination with the rig's linear motion shakers did an adequate job of solids removal. No hole problems occurred during running and cementing of the 7" casing.

Table 3.8 8 ½ " Hole Mud details and properties

8 ½ " Hole Section Details		
Bit Size	∅	8 1/2"
Depth	m	743.5
Casing Size	∅	7"
Depth	m	739
Drilled metres	m	733.4
Days		4

8 ½ " Hole Mud Details		
Volume used	bbls	761
Dilution rate	bbl/m	0.39
Consunption rate	bbl/m	0.89
Mud Cost/bbl	A$	31.82
Mud Cost/m	A$	33.02
Interval mud cost	A$	24,217

8 ½ " Hole Interval Mud Properties – KCL/Polymer					
Days		1	2	3	4
Date		04/02/99	05/02/99	06/02/99	07/02/99
Depth	M	10	308	702	743
Density	Ppg	8.3	8.6	8.9	9.1
Funnel viscosity	Sec/lt	28	45	44	45
Plastic Viscosity	Cps	1.0	10	12	14
Yield Point	Lbs/100ft^2		23	21	22
Gels 10" / 10'	Lbs/100ft^2		4/7	7/12	6/15
Filtrate API	Ml/30 min		9.2	9.8	10.6
Cake	32nd in		2/0	2/0	2/0
PH			7.5	8.3	8.7
Sand	%		Tr	1	1.5
Solids	%		0.64	2.04	2.84
MBT	Me/ml mud		6	12	15
Temperature	°C				

8½ " Hole Interval Mud products					
Mud Products	**Function**	**Unit Size**	**Unit Quantity**	**Total Cost US$**	**Cost % of Total**
ALDACIDE G	Biocide	25 l. Can	7	1,270.08	5.2
BARACOR 129	Sulfide Remover	25 Kg Sx	4	259.92	1.1
BARITE	Weighting agent	25 kg Sx	76	544.16	2.2
BAROFIBRE	Lost Circ. Material	25 LB bag	15	866.85	3.6
DEXTRID LT	Viscocifier	25 Kg bag	24	1500.96	6.2
EZ MUD	Shale stabiliser	5 Gal pail	38	3795.44	15.7
PAC-R	Filtration control	25 Kg bag	19	3606.77	14.9
Potassium Chloride	Shale inhibition	25 Kg bag	260	3380.00	14
Potassium Hydroxide	Shale inhibitor	20 Kg Pail	11	483.45	2
XCD Polymer	Viscosity & suspension			8509.68	35.1
			Total:	**24,217.31**	**100.00**

3.6.2 6" Production Hole Section : 743.5m to 1568 m (07 to 23 Feb 1999)

The same mud system used in the 8 ½ " section was carried over to the 6". The section was drilled using freshwater with a KCL/EZ-MUD / Polymer mud system.. EZ-MUD (PHPA) was used to stabilise the borehole wall and inhibit the shales of the Paaratte formation. The drillstring became mechanically stuck while POOH at 1251 m. Insufficient hole cleaning was the cause. No mud weight problems occurred prior to the stuck pipe . An increase in PV after recovering the fish was caused by pre-mix being accidentally discharged into the active system. This was overcome by dilution. Differential sticking was a concern at the well planning stage. This was avoided with close mud weight control and the addition of Baracarb while drilling the Paaratte and Waarre formations. Mud costs for the section were double those expected due to the 8 days lost while fishing. Mud properties for the drilling and coring phase are shown below.

Table 3.10 6" Hole Mud details and properties

6 " Hole Section Details		
Bit Size	∅	6"
Depth	m	1568
Casing Size	∅	4 ½ "
Depth	m	743.5
Drilled metres	m	824.5
Days (drilling/coring)		6

6 " Hole Mud Details		
Volume used	bbls	1110.0
Dilution rate	bbl/m	1.16
Consunption rate	bbl/m	1.87
Mud Cost/bbl	A$	50.80
Mud Cost/m	A$	68.37
Interval mud cost	A$	80,602

6 " Hole Interval Mud Properties – KCL/Polymer					
Days		**6**	**7**	**8**	**9**
Date		09/02/99	10/02/99	11/02/99	12/02/99
Depth	M	743	1110	1251	1251
Density	Ppg	8.9	8.9	8.9	9.4
Funnel viscosity	Sec/lt	52	48	55	57
Plastic Viscosity	Cps	12	12	19	12
Yield Point	$Lbs/100ft^2$	19	23	32	32
Gels 10" / 10'	$Lbs/100ft^2$	5/8	4/9	5/10	6/9
Filtrate API	Ml/30 min	4.8	4.5	5.0	4.2
Cake	32^{nd} in	2/0	1/0	1/0	½
PH		8.8	8.4	8.8	8.5
Sand	%	Tr	1	0.75	0.25
Solids	%	2.96	2.66	2.72	5.98
MBT	Me/ml mud	10	15	10	13
Temperature	°C				135

6 " Hole Interval Mud Properties – KCL/Polymer					
Days		**10**	**11**	**12**	**13**
Date		13/02/99	14/02/99	15/02/99	16/02/99
Depth	M	1251	1251	1251	1251
Density	Ppg	9.4	9.3	9.1	9.1
Funnel viscosity	Sec/lt	56	61	62	58
Plastic Viscosity	Cps	18	22	22	22
Yield Point	$Lbs/100ft^2$	28	33	20	18
Gels 10" / 10'	$Lbs/100ft^2$	5/10	6/11	5/89	4/6
Filtrate API	Ml/30 min	5	3.8	4.2	4
Cake	32^{nd} in	½	½	½	½
PH		8.5	9.2	8.5	8.5
Sand	%	0.25	0.25	0.25	Tr
Solids	%	5.99	6.02	2.66	2.66
MBT	Me/ml mud	10	10	9	9
Temperature	°C	121	121	121	121

6 " Hole Interval Mud Properties – KCL/Polymer					
Days		**14**	**15**	**16**	**17**
Date		17/02/99	18/02/99	19/02/99	20/02/99
Depth	M	1251	1251	1251	1428
Density	Ppg	9.2	9.0	9.0	9.0
Funnel viscosity	Sec/lt	68	72	76	131
Plastic Viscosity	Cps	23	23	23	33
Yield Point	$Lbs/100ft^2$	27	27	31	62
Gels 10" / 10'	$Lbs/100ft^2$	5/6	4/6	4/6	8/10
Filtrate API	Ml/30 min	4.6	5.0	4.0	3.4
Cake	32^{nd} in	½	½	½	½
PH		9.5	9.0	9.2	9.0
Sand	%	0.25	Tr	0.25	0.75
Solids	%	2.49	2.69	2.63	2.75
MBT	Me/ml mud	11	8	9	8
Temperature	°C	121	121	121	121

6 " Hole Interval Mud Properties – KCL/Polymer					
Days		**18**	**19**	**20**	
Date		21/02/99	22/02/99	23/02/99	
Depth	M	1509	1529	1568	
Density	Ppg	9.0	9.0	9.0	
Funnel viscosity	Sec/lt	125	84	126	
Plastic Viscosity	Cps	35	28	34	
Yield Point	$Lbs/100ft^2$	48	31	50	
Gels 10" / 10'	$Lbs/100ft^2$	6/8	4/5	6/6	
Filtrate API	Ml/30 min	3.6	4.7	3.3	
Cake	32^{nd} in	½	½	½	
PH		9.5	9.5	9.5	
Sand	%	2	0.25	0.75	
Solids	%	1.92	2.72	2.93	
MBT	Me/ml mud	12	12	11	
Temperature	°C	121	121	121	

Mud Products	Function	Unit Size	Unit Quantity	Total Cost US$	Cost % of Total
ALDACIDE G	Biocide	25 l. Can	17	3084.48	5.2
AQUAGEL	Gel -Cement mixwater	25 Kg bag	21	378.63	0.6
BARACARB 100	Lost Circ. Material	25 Kg bag	165	1961.85	3.3
BARACARB 25	Lost Circ. Material	25 Kg bag	137	1459.05	2.5
BARACARB 600	Lost Circ. Material	25 Kg bag	52	327.60	0.6
BARACIDE	Sulfide Remover	25 Kg can	6	1088.64	1.8
BARACOR 129	Lost Circ. Material	25 Kg can	23	1494.54	2.5
BARITE	Weighting agent	25 kg Sx	532	3809.12	6.5
BAROFIBRE	Lost Circ. Material	25 LB bag	5	288.95	0.5
Calcium Chloride	Salt	25 Kg bag	4	61.16	0.1
EZ- MUD	Shale stabiliser	5 gal pail	26	2596.88	4.4
EZ MUD DP	Shale stabiliser	25 kg bag	16	2807.04	4.8
PAC-L	Filtration control	25 Kg bag	76	14427.08	24.5
PAC-R	Filtration control	25 Kg bag	40	7593.20	12.9
Potassium Chloride	Shale inhibition	25 Kg bag	250	3250.0	5.5
Potassium Hydroxide	Shale inhibitor	20 Kg Pail	26	1142.70	1.9
TORQ TRIM	Friction reducer	20 Kg pail	4	3049.16	5.2
XCD Polymer	Viscosity & suspension	55 Gal drum	16	7564.16	12.8
Miscellaneous Iona Obs-1				2533.60	4.4
			Total:	**58917.84**	**100.00**

3.6.3 6" Completion Section : 1567 m (23 to 28 Feb 1999)

After reaching TD at 1568 m. the hole was logged and prepared for the 4 ½" production casing. This was run and installed without problems. A simple completion brine of 3% KCL was used. A Baraklean (detergent) pill was pumped to ensure hole was clean prior to running the completion. Prior to setting the completion a fresh volume of 3% KCL mixed with Coat 2748 corrosion inhibitor was circulated to the well.

Table 3.10 6 " Hole Interval Completion Section details

6 " Hole Interval Completion Section – Mud Costs					
Mud Products	**Function**	**Unit Size**	**Unit Quantity**	**Total Cost US$**	**Cost % of Total**
BARAKLEAN FL	Detergent	55 GAL drum	4	5807.8	88.9
KCL –TECH	Salt	25 Kg sack	50	701.50	10.7
Potassium Hydroxide	Increase pH	20 kg pail	1	43.95	0.7
			Total:	**6553.25**	**100.00**

3.7 COMPLETION SUMMARY

The details of the completion for Iona Obs-1 are shown in the completion status diagram. The completion primary function was to facilitate the monitoring of the gas water interface in the reservoir. This was to be achieved through pressure observations of the 2-3/8" tubing x 4-½" production casing annulus, and other logging methods, based on perforations positioned at the original gas water contact, at the base of the swept zone. The secondary function of the well was to facilitate produced water disposal down the tubing and into the aquifer.

Due to structural differences encountered in the well, from the original seismic prognosis, the reservoir sands were encountered below the original gas water contact. This meant the well could not be used for gas injection observations. Consequently the well was completed as a water disposal well only with perforations at 1525 m to 1535 m. The completion was run in two stages with a 4-½" BWB packer set on wireline with a Baker explosive setting tool. The packer was set at 1479 .4 m, some 45.6 m above the top perforation.

Completion times achieved were as follows:

Table 3.11 Completion Times

Activity	Hours
Run Scraper	13.0
Circulate Completion Brine	3.0
Repair BOP's	3.5
Test BOP's	2.5
Run Cement Bond Log	3.0
Perforate	3.0
Set Packer on wireline	3.0
Prepare to run completion	1.5
Run Tubing	11.0
Space-out/Land & test tubing	4.0
Nipple down BOP's, install Xmas Tree	7.5

The scraper run was slow due to the need to pick up a string of 2 3/8" tubing to RIH. The tubing running performance was slow due to careful handling procedures for 13% Chrome material. The connection to the packer using a Halliburton J slot sub was carried out without problems. The completion was handed over with the back pressure valve removed and the Xmas tree valves closed.

Figure 7 shows the comparative time performance for the completion:

OBS-1 COMPLETION TIME PERFORMANCE

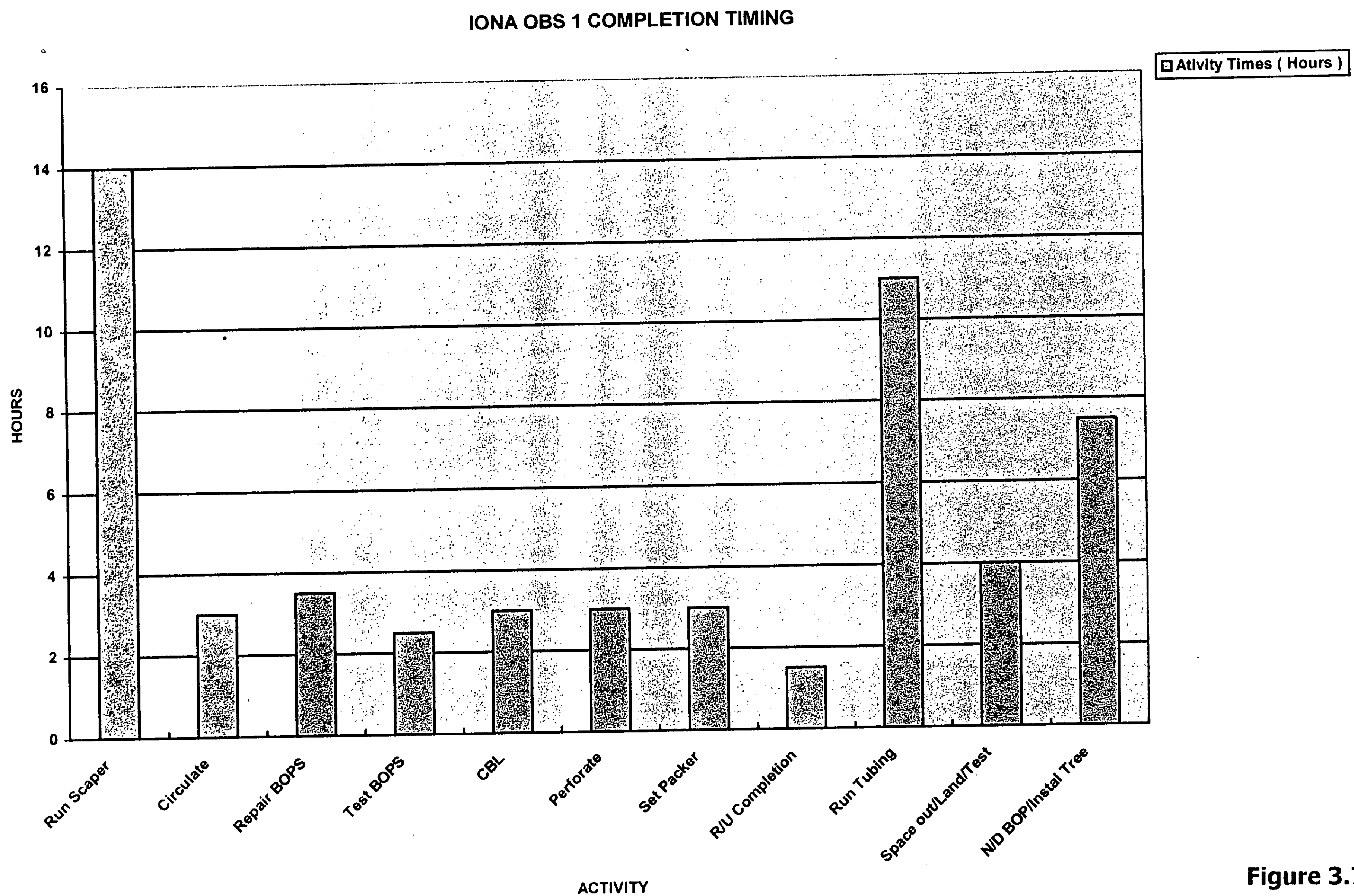


Figure 3.7

3.8 LESSONS LEARNED

Table 3.12 Incident Report No 1

Western Underground Gas Storage	INCIDENT REPORT/LESSON

Report No: 1	Date: 11 Feb 1999	Prepared By: Colin Stuart
Well: Iona Obs-1	Operator: WUGS	Rig: OD&E Rig 30

INCIDENT/LESSON
Stuck drill pipe while POOH, with bit 328 m off bottom

WELL DATA/OPERATIONS PRECEEDING INCIDENT/LESSON
The 6" hole had been drilled to 1251 m. Decided to POOH for bit change, as sliding with mud motor/PDC combination was not working. Bottoms up circulated once only. Hole tight while POOH. Pulled into tight spot with bit at 923 m, became mechanically stuck, no circulation, no rotation, no response to up or downward jarring. When tight hole was observed the drill pipe was not RIH and rotated to free blockage but continued to be pulled upwards.

EVALUATION OF INCIDENT (Cause, were procedures/orders followed?,
1. Insufficient circulation prior to POOH
2. Incorrect response by rig crew to pulling into tight hole
3. Volcanic pebbles not identified in geological prognosis was a contributing factor to cuttings build up/hole pack off.

REMEDIAL WORK CARRIED OUT
Fishing operations continued for 8 days. Fish was recovered with a combination of washover and rotary shoe fishing assembly.

RECOMMENDATIONS
1. Circulate hole clean prior to POOH. On directional wells above 30 deg inclination, circ a minimum of twice hole volume.
2. Conduct short trips, with frequent pipe rotation, when cuttings bed build up is expected
3. When a tight spot is encountered on POOH, stop and RIH with rotation and circulation to clean hole.
4. If management advice to rig staff is perceived to be critical, it must be reinforced in writing.
5. Allow substantially more planning time to assess and minimise risk of unscheduled events.

Table 3.13 Incident Report No 2

Western Underground Gas Storage	**INCIDENT REPORT/LESSON**

Report No: 2	**Date: 11 Feb 1999**	**Prepared By: Colin Stuart**
Well: Iona Obs-1	**Operator: WUGS**	**Rig: OD&E Rig 30**

INCIDENT/LESSON

Directional drilling assembly in 6" hole unable to slide to correct hole trajectory. PDC bit blamed by directional drillers.

WELL DATA/OPERATIONS PRECEEDING INCIDENT/LESSON

The 6" hole had been drilled to 1251 m with good progress in rotary mode and increasing difficulty in sliding mode. At 1251m no sliding was possible, due to the assembly hanging up , probably on the 5 7/8" OD stabiliser. As the trajectory required correcting to get back on target, the decision was taken to POOH and change the PDC for a tri-cone and put a smaller OD stabiliser behind the motor.

EVALUATION OF INCIDENT (Cause, were procedures/orders followed?)

Insufficient pipe rotation and circulation led to too much cuttings build up in the annulus.
The PDC selected was too aggressive for the BHA/motor being used.

REMEDIAL WORK CARRIED OUT

A tri-cone assembly with heavy weight drill pipe and a 5 ¾" string stabilser was run to finish the section after recovery of the BHA

RECOMMENDATIONS

1. Use a tri-cone bit to accomplish the directional build/turn in 6" hole.
2. Heavy weight drill pipe should be used in small hole sizes rather than drill collarts, to slicken up the BHA more and reduce the chances of hanging up.

Table 3.14 Incident Report No 3

Western Underground Gas Storage	**INCIDENT REPORT/LESSON**

Report No: 3	**Date: 08 Feb 1999**	**Prepared By: Colin Stuart**
Well: Iona Obs-1	**Operator: WUGS**	**Rig: OD&E Rig 30**

INCIDENT/LESSON

Insufficient rig pumping capacity and redundancy.

WELL DATA/OPERATIONS PRECEEDING INCIDENT/LESSON

While drilling the 8 ½" hole section a failed connection on the discharge line took on of the 2 mud pumps out of commission. The section was drilled the remaining 55 m on one mud pump.

EVALUATION OF INCIDENT (Cause, were procedures/orders followed?)

The rig's mud pump discharge pipe work was not in good working order prior to operations commencing

REMEDIAL WORK CARRIED OUT

Cracked union was weld repaired temporarily. Pipework and pump failures continued on a regular basis throughout the project.

RECOMMENDATIONS

Ensure contractor is maintaining rig in a proper condition and attempt to identify any maintenance critical items prior to contract commencing.

Table 3.15 Incident Report No 4

Western Underground Gas Storage	**INCIDENT REPORT/LESSON**

Report No: 4	**Date: Feb 1999**	**Prepared By: Colin Stuart**
Well: Iona Obs-1	**Operator: WUGS**	**Rig: OD&E Rig 30**

INCIDENT/LESSON

Site Construction critical to drilling project success

WELL DATA/OPERATIONS PRECEEDING INCIDENT/LESSON

At outset of project three drilling sites with connecting roads were identified in the construction work scope. Several discussions took place with the local site construction contractor to determine foundation design and materials.

EVALUATION OF INCIDENT (Cause, were procedures/orders followed?)

Proper design of rig site and access road foundation led to zero weather downtime.

REMEDIAL WORK CARRIED OUT

RECOMMENDATIONS

Listen carefully to local expertise, particularly with regard to local weather conditions.

4.0 FORMATION SAMPLING AND TESTING

4.1 CUTTINGS

Cuttings were collected at three metre intervals from surface to TD. Detailed cuttings descriptions are presented in Appendix 3.

4.2 CORES

4.2.1 Conventional Core

Two conventional cores were cut as follows:

Table 4.1 *Core Intervals*

Cores	Cut From (m)	Cut To (m)	Recovered From (m)	Recovered To (m)	Recovery %
Core No 1	1509	1527	1509.35	1515.55	34.4
Core No 2	1527	1538	1527.35	1534.28	63.0

Detailed core descriptions and core analysis data are presented in Appendix 4.

4.2.2 Sidewall Cores

No sidewall cores were acquired in Iona Obs-1.

4.3 TESTING

No drill stem tests or wireline formation tests were carried out in Iona Obs-1.

4.4 SAMPLE ANALYSIS

Two cuttings samples from the interval 1500-1515 MDKB and two core samples from 1509.35 MDKB and 1515 MDKB were submitted for palynological analysis to Biostrata Pty Ltd. The results of the palynological analysis are presented in Appendix 5. No geochemical analyses were carried out on samples from Iona Obs-1. For petrography by ACS Laboratories Pty Ltd, see Appendix 4.

4.5 LOGGING AND SURVEYS

4.5.1 Mud Logging

A standard Halliburton skid mounted unit for continuous recording of depth, penetration rate, mud gas, pump rate, and mud volume data as well as mud chromatographic analysis was operated from surface to total depth. Rate of penetration, total gas and chromatography were recorded and hand plotted on the Formation Evaluation Log (Mud Log) and are presented in Enclosure 1.

4.6 WIRELINE LOGGING

Wireline logging was carried out by Schlumberger Seaco using a standard truck mounted MAXIS unit. The logging suite consisted of two logging runs and a velocity check shot survey as follows.

Details of the log depth intervals for each log run are as follows. Unfortunately the maximum temperatures from the thermometers as presented on the log headers in the Enclosures were incorrectly recorded in the field and are consequently not presented:

Table 4.2 Details of Wireline Logs run

LOG	Logging Date	Depth Logger (mKB)	Depth Driller (mKB)	Top Log Interval	Bottom Log Interval	Max. Temp. Deg. C
RESISTIVITY CURVES HLLD, HLLS, RXOZ, SP, GR, Caliper: 1:200 & 1:500	24/02/99	1565	1680	10	1565	
DIPOLE SONIC: 1:200	24/02/99	1565	1680	10	1565	
NUCLEAR CURVES Neutron (TNPH), Density (RHOZ), Pe (PEFZ), GR, Caliper: 1:200 & 1:500	23/01/99	1565	1680	10	1565	
CBL–VDL–GR–CCL: 1:200	27/02/99	1553	1552	700	1553	
PRODUCTION PACKER SETTING: 1:200	27/02/99	1565	1680	1455	1510	
RESISTIVITY CURVES TVD INDEX-GR to Surface: 1:200 & 1:500	21/01/99			648	1406	
NUCLEAR CURVES TVD INDEX-GR to Surface: 1:200 & 1:500	21/01/99			600	1400	
OFFSET CHECKSHOT SURVEY	24/02/99	1568	1564	137.5	1537	

Each logging run is included at both 1:200 and 1:500 scale as an enclosure as shown in the following table. Enclosure 9 is a composite log with depths validated to the definitive survey and all curves environmentally corrected.

5.0 GEOLOGY

5.1 STRATIGRAPHY

The stratigraphic section penetrated in Iona Obs-1 is shown in Table 5.1. Formation tops were picked on the basis of cuttings descriptions, rate of penetration and wireline logs and by correlation to Iona-1 and Iona-2. Unless otherwise stated all depths are referenced to the Kelly Bushing MDKB. The composite well log showing Formation tops for each unit from the top Pebble Point Formation down is included as Enclosure 2. A detailed composite log for the reservoir section is included as Enclosure 3.

Table 5.1 Stratigraphic section Iona Obs-1

Stratigraphic Unit	Depth			Thickness
	MDKB (m)	TVDKB (m)	TVDSS (m)	(m)
Ground Level	4.98	4.98	-137.1	
Heytesbury and Nirranda Groups (undifferentiated)				360.7
Narrawaturk Marl				
Mepunga Formation	292.8	288.5	151.4	67.9
Wangerrip Group				424.8
Dilwyn Formation	360.7	349.3	212.2	264.6
Pember Mudstone	625.3	559.0	421.9	94.0
Pebble Point Formation	719.3	633.6	496.5	66.2
Sherbrook Group				782.7
Paaratte Formation	785.5	686.8	549.7	407.5
Skull Creek Member	1193.0	1038.1	901.0	144.5
Nullawarre Greensand	1337.5	1174.9	1037.8	96
Belfast Mudstone	1433.5	1269.3	1132.2	43.8
Flaxman Formation	1477.3	1312.9	1175.8	31
Top C1 sand	1508.3	1343.9	1206.8	3.7
Base C1 sand	1512.0	1347.6	1210.5	5
Top C2 sand	1517.0	1352.6	1215.5	20.9
Base C2 sand	1537.9	1373.5	1236.4	7.1
Top B sand	1545.0	1380.6	1243.1	12.8
Base B sand	1557.8	1393.3	1256.2	10.4
Total Depth (Driller)	1568.2	1403.7	1266.7	
Total Depth (Logger)	1565.0	1400.5	1263.4	

5.2 LITHOLOGY

Detailed descriptions of each interval sampled are included in Appendix 3 and a summary of each interval is included on the mudlog in Enclosure 1. The core petrography report is included in Appendix 4 and Core chip descriptions described on site are included in Appendix 6. The following is a summary of the lithological units observed in Iona Obs-1.

5.2.1 Heytesbury and Nirranda Groups

(Surface – 360.7 metres)

5.2.1.1 Port Campbell Limestone

No Port Campbell Limestone was recorded in the well.

5.2.1.2 Gellibrand Marl / Clifton Limestone/ Narrawaturk Marl

From the surface to 292.8 metres the lithology was predominantly marl and the contact between the Gellibrand Marl and the Narrawaturk Marl was difficult to determine. The predominant lithology observed was

Marl: medium greenish grey to brownish grey, very soft, sticky, occasionally silty, common to abundant fossil fragments, massive with trace pyrite and coaly fragments towards the base. The Cilfton Limestone could not be identified or was not present and the boundary between the Gellibrand Marl and the Narrawaturk Marl could not be positively identified on logs.

5.2.1.3 Mepunga Formation (292.8 – 360.7 m)

Sandstone: medium to dark brownish grey, fine to coarse, dominantly coarse, poorly sorted, subangular to subrounded, dominantly subrounded quartz, common iron oxide and limonite coating of grains, rare glauconite, trace pyrite, trace mica, nil to moderate calcareous cement, fair visual porosity.

5.2.2 Wangerrip Group (360.7 – 785.5 m)

5.2.2.1 Dilwyn Formation (360.7 – 625.3 m)

Sandstone: off white to translucent, fine to coarse, dominantly coarse, poorly to moderately sorted, subangular to subrounded, dominantly subrounded quartz, common brown and orange iron oxide stain, occasional pyrite, occasional glauconite, trace mica, good intergranular porosity, interbedded with

Claystone: medium to dark brownish grey, abundant silt, micromicaceous, massive, soft, dispersive.

5.2.2.2 Pember Mudstone (625.3 – 719.3 m)

Claystone: medium to dark brownish grey to grey, nil to moderately silty, trace to common glauconite, trace pyrite, micromicaceous, massive, soft, dispersive.

5.2.2.3 Pebble Point Formation (719.3 – 785.5 m)

Sandstone: light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grains, occasionally granule, dominantly coarse, sub angular to sub rounded occasionally rounded, common iron oxide and iron stained quartz, moderate sphericity, moderate to well sorted quartz, nil to common argillaceous matrix, trace to rare nodular pyrite, rare to minor skeletal fragments, friable to firm, good to excellent inferred porosity, interbedded with.

Claystone: medium to dark grey to brownish black in part, soft, dispersive, common to abundant quartz silt to fine sand, grading to arenaceous claystone, nil to trace carbonaceous specks, minor to common glauconite pellets oxidised in part, trace pyrite, trace to rare mica, slightly calcareous, massive, firm to moderately hard..

5.2.3 Sherbrook Group (785.5 – 1568.2 m)

5.2.3.1 Paaratte Formation (785.5 – 1193.0 m)

Sandstone: light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium occasionally coarse grains, sub angular to sub rounded occasionally rounded, moderate sphericity, poorly to moderately sorted quartz, nil to common multicoloured, orange, yellow, greyish blue hard lithic volcanic and siliceous grains, trace to rare nodular pyrite, nil to trace calcareous, moderate to good inferred porosity, interbedded with

Claystone: light to medium grey, soft to firm, dispersive, fissile, laminated, abundant argillaceous matrix, common to abundant very fine sand, common to abundant carbonaceous specks, common mica, trace pyrite, grading to Silty Claystone

Coal: trace to rare specks and laminae, black, soft to firm

5.2.3.2 Skull Creek Mudstone (1193.0 – 1337.5 m)

Siltstone: light to grey to brownish grey interbedded with greyish white laminations in part, soft to firm, dispersive, abundant argillaceous matrix, abundant very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite, grading to Clayey Siltstone, interbedded with minor to common

Sandstone: very light grey to white, soft, friable, very fine to fine, sub angular to sub rounded, poorly sorted, abundant clay matrix grading to argillaceous sandstone, rare mica, trace to rare pyrite, trace orange lithics, nil to poor visible porosity grading to

Sandstone: light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse to pebble grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity.

5.2.3.3 Nullawarre Greensand (1337.5 – 1433.5 m)

Sandstone: light brownish grey to dark yellowish green, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace foraminifera infilled with glauconite, trace to rare pyrite nodules, good inferred porosity.

5.2.3.4 Belfast Mudstone (1433.5 – 1477.3 m)

Claystone: medium to dark grey to greenish black to occasionally yellowish grey in part, soft to firm, dispersive, rare to minor quartz silt, minor to common , occasionally abundant disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite

5.2.3.5 Flaxmans Formation (1477.3 – 1508.3 m)

Claystone: medium to dark grey to greenish black to occasionally yellowish grey in part, soft to firm, dispersive, rare to minor quartz silt, minor to common , occasionally abundant disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite

Sandstone: light brownish grey to greyish brown to dark yellowish green in part, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace foraminifera infilled with glauconite, trace to rare pyrite nodules, good inferred porosity.

5.2.4 Waarre Formation

5.2.4.1 Unit C (1508.3 – 1545.0 m)

Sandstone: light brownish grey to very light grey, fine to coarse, dominantly medium, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, good to excellent visual porosity.

Claystone: medium to dark grey, soft to firm, dispersive, rare to minor carbonaceous laminations and specks, trace pyrite, trace resin

Coal: black, moderately hard, conchoidal fracture, vitreous.

5.2.4.2 Unit B (1545.0 – 1557.8 m)

Calcareous Sandstone: very light grey to white, fine to coarse occasionally very coarse, fair sphericity, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, 30 to 40 percent calcareous matrix, trace pyrite, common white to very light grey argillaceous matrix, trace carbonaceous fragments, grading to.

Sandstone: light brownish grey to very light grey, fine to coarse, dominantly medium, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, good visual porosity

Claystone: medium to dark grey, soft to firm, dispersive, rare to minor carbonaceous laminations and specks, trace pyrite, trace resin

5.2.4.3 Unit A (1557.0 – 1568.2 m TD)

Sandstone: light brownish grey to very light grey, fine to coarse, dominantly medium, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, good visual porosity

Claystone: medium to dark grey, soft to firm, dispersive, rare to minor carbonaceous laminations and specks, trace pyrite, trace resin

6.0 VELOCITY SURVEY

6.1 SEISMIC CALIBRATION AND RESULTS

A velocity, or checkshot survey, was carried out by Schlumberger as part of the open hole-logging program in Iona Obs-1. The source used for the survey was an airgun, with shots fired into a water filled pit dug at a surface location (E: 678210.2 N: 5728203.8 RL: 103.9m) over the Waarre C intersection in the well. The location of the pit directly above the Waarre C in the well was chosen to minimise any corrections due to seismic path distortion thereby permitting a direct tie into the 3D seismic data at the mapped Waarre C level.

A total of 18 levels were acquired in the survey. A single shot was used where a good first break was encountered on the records. Additional shots were fired at locations where the signal was poor.The data was then enhanced by stacking the shots together to obtain an acceptable first break on the record. Quality of the data obtained was generally good except for the records from near the surface casing shoe and at the sea level datum where casing and surface noises masked good records.

The data was processed by Schlumberger at their Melbourne processing centre. First breaks were picked from the edited data and corrections applied to obtain a set of time versus depth values below the seismic reference datum which was mean sea level.

6.2 DATA CORRECTIONS

The corrections applied consisted of the following:

6.2.1 Correction for Deviated Hole

The well was drilled as a deviated hole which was essentially vertical through the reservoir section, so the depths which were measured with reference to KB, were converted to true vertical depth. Conversion to true vertical depth were made using a combination of the single and multi-shot survey data obtained during the drilling of the well. A linear interpolation was used to correct the measured depth value to true vertical depth for checkshots recorded between surveyed points.

6.2.2 Correction for shot and geophone geometry

The travel path of the wave as it travels from the source point is not vertical. A correction was made to the travel time values of the checkshot data to account for the non-vertical path so as to obtain a corrected vertical time from source for each checkshot.

6.2.3 Correction for datum

The checkshot survey was acquired at a near surface location. The reference datum for the Iona 3D Seismic Survey is sea level. The travel time from the surface source to datum has to be subtracted from the corrected vertical time derived above to match the datum used in the seismic survey. The datum correction consists of two components:

A weathering or statics component, which is the delay in time as a result of the seismic wave travelling in the weathered zone near the surface. The weathered zone generally has a lower velocity than the sub-weathered zone.

An elevation component, which takes into account the elevation above the datum where the source is located and the sub-weathered velocity.

For ease of computation, the static and elevation correction is replaced by a term called the replacement velocity, which represents the average velocity of the energy from the source travelling to datum.

The nearest uphole that was recorded near the well location during the Iona 3D seismic survey is at intersection of lines 6710/2300 on the survey, which is approximately 700 metres away. This yielded a datum correction of 73 ms and a replacement velocity of 1465 m/s.

An average weathered layer thickness of 6 metres and subweathered zone velocity of 1650 m/s has been assumed for the location and this yields a replacement velocity of 1386 m/s per second which was used in the computations. The datum correction used in the Schlumberger Geogram equates to 73.5 milliseconds for an elevation of 101.9 metres (gun depth in the pit) above sea level. The datum estimation was carried out without the benefit of the uphole data over the bottom-hole location. The uphole survey over the bottom-hole location of the well was carried after the completion of the drilling program and the generation of the synthetic. The measured datum correction recorded in the downhole is 69.5 msec which is 4 msec less than the datum correction of 73.5 ms used in Schlumberger's Geogram computation.

The corrected checkshot data was used to calibrate the sonic logs processed from the DSI logging run in the well. A vertical impedance log was then derived from the calibrated sonic and the depth corrected density log recorded. Three Ricker wavelets of predominant frequencies of 25, 30 and 35 Hertz respectively were convolved with the impedance log to produce the synthetic seismograms. Further details of the calibration, checkshot corrections and synthetic seismogram generation can be found in the accompanying Schlumberger Well Seismic Edit and Geogram Report. (Appendix 7)

6.3 RESULTS

The derived synthetic seismogram matched the seismic data very well at the bottomhole location of the Iona Obs-1 well. The match at the shallower horizons is not as good but this is not unexpected because the well is deviated. The assumption of a vertical well path from the source becomes less valid as the lateral distance of the source to the detector for the shallower horizon increases. Enclosure 11 shows the synthetic seismogram spliced onto the seismic section through the well annotated with the tops encountered. The synthetic confirmed that the event mapped as the Top Waarre C was an accurate tie to the 3D seismic.

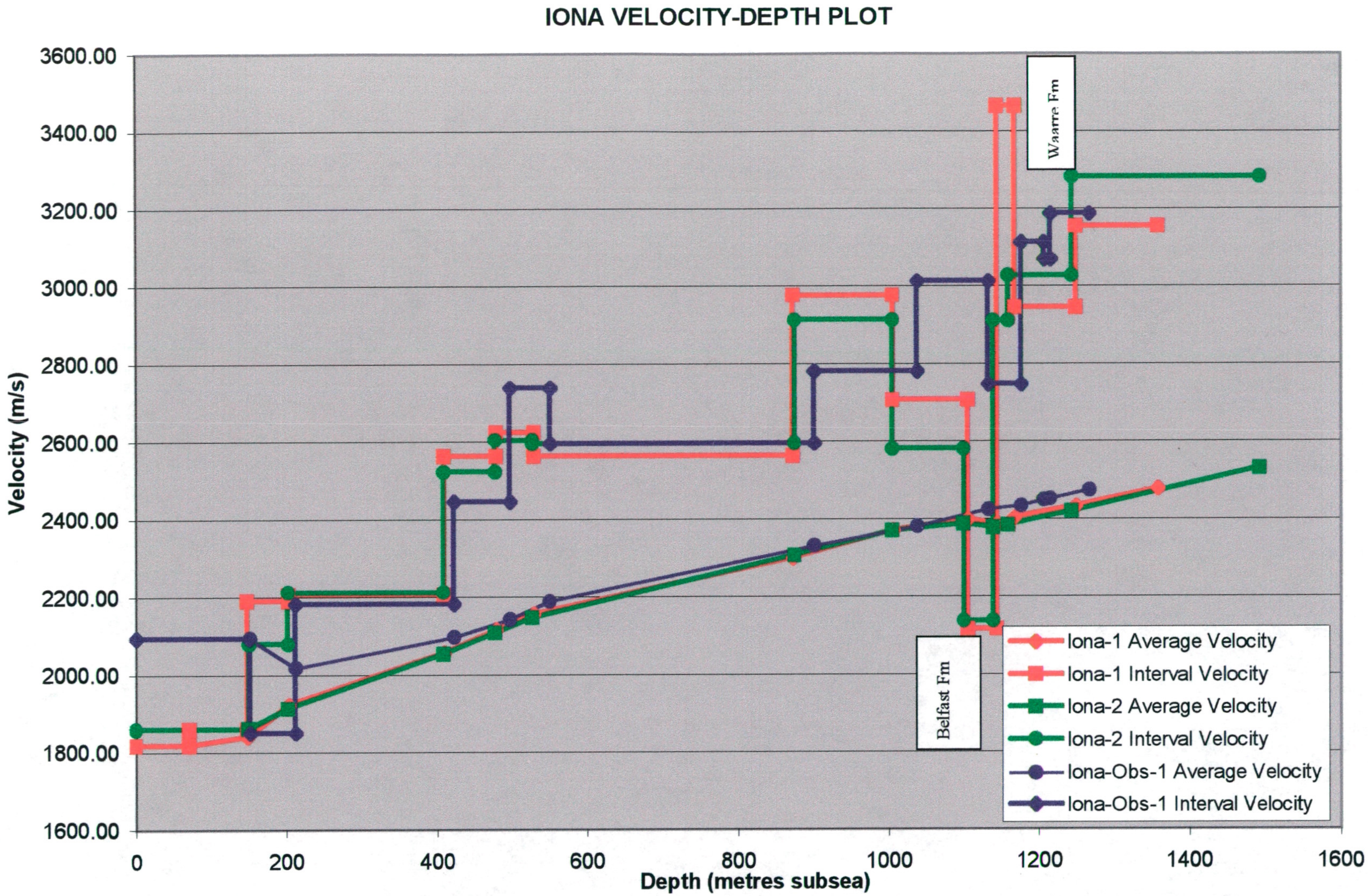
Despite the match of the seismogram, the depth prognosis for the Waarre C and most of the other horizons was shallower than they were encountered in the well.

Table 6.1 compares the Prognosed Depths and the Actual Well Depths for the main horizons encountered in the well. The original prognosis was made on the assumption that there was no velocity gradient over the field and that the velocities in Iona-1 and Iona-2 were representative of the total field area. The results of the well indicate this assumption to be incorrect and showed that a velocity gradient occurs between Iona -1 and 2 and Iona Obs-1. The average velocity to the top of the Waarre C horizon is greater over the Iona Obs-1 bottom hole location than that measured at Iona-1 and 2.

Table 6.1 Comparison of Prognosed and Actual Depths

Formation Tops	Original Prognosis(metres TVD subsea)	Actual Depth (metres TVD subsea)	Difference
Heytesbury Group	Surface	Surface	
Narrawaturk Marl	72	?	
Mepunga Formation	151	151	0
Dilwyn Formation	207	212	5
Pember Mudstone	413	422	9
Pebble Point Formation	487	496	9
Paaratte Formation	535	549	14
Skull Creek Member	886	901	15
Nullawarre Greensand	1032	1037	5
Belfast Mudstone	1119	1132	13
Waarre Formation D unit	1162	1175	13
Top C1 Sand	1184	1206	22
Base C1 Sand	1194		
Top C2 Sand	1196	1215	19
Base C2 Sand	1211	1236	25
Total Depth	1244		

Figure 6.1 is a plot that compares the measured average velocities and interval velocities from the Iona-1, -2 and Iona Obs-1 wells. The figure shows a higher average velocity to the top Waarre C at Iona-Obs-1. There is an increase in the average velocity for the shallower horizons in Iona-Obs-1 compared to the average velocity seen in Iona-1 and Iona-2. This increase contributed to an increase in depth of about 5 -15 metres in the shallower horizons from the predrill prognosis. At the Waarre C level, the error increased to 22 metres. This was mainly due to the increase in the interval velocity of the Belfast Formation compounded with the already high average velocity seen in the shallower section in the well. The interval velocity of the Belfast Formation is over 3000 metres per second in Iona Obs-1 compared to an interval velocity of 2700-2800 metres per second in Iona-1 and -2. The resulting average velocity to the top of the Waarre C unit is 2440 metres per second compared with 2400 metres per second at Iona-1 and Iona-2.



Comparison of Velocity Depth plots for Iona-1, 2 and Iona Obs-1 **Figure 6.1**

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7.0 PETROPHYSICS

7.1 DATABASE

Field logs were acquired by Schlumberger using the Platform Express equipment. Tool measurements included, nuclear, resistivity and sonic. Schlumberger carried out a number of post-logging services including:

- Borehole environment corrections;
- Shoulder bed corrections (except for Iona-1);
- Estimation of true formation resistivity, ***Rt*** (except for Iona-1);
- Conversion to true vertical depth, KB datum; and,
- Data re-sampling to a consistent 0.1 metre depth step.

The processed log data was supplied in LAS format. This data was loaded into the ***G-Pick*** software system for subsequent display and interpretation.

The ambient and overburden core data, including measurement of porosity, permeability and grain density were key punched and also loaded into the system. The core data matches log depth within an acceptable tolerance. A psuedo log, 'PHIO', was created by correcting the ambient core porosity to overburden conditions using the calibration provided by the limited core measurements at overburden pressures.

To evaluate the Waarre Formation a normalised gamma ray log, 'GRN', was calculated as the percentage deflection between the cleanest reservoir and the shale between Waarre B and C sandstones. This corrects for the distortion provided by KCl mud systems and different hole diameters and provides a log comparable with other Iona wells. Thereafter, a 'GRHB' log was calculated as the product of GRN times RHOB with the objective that this may better highlight the transition between reservoir and non-reservoir.

The photo-electric log is distorted due to the effect of barite in the mud system and the sonic log shows a significant gas effect. Both logs were rejected for quantitative analysis.

7.2 PETROPHYSICAL MODEL

The petrophysics were modelled using the ***FAST*** (***F***ormation ***A***nalysis using ***S***tatistical ***T***echniques) computer program which is typical of current log analysis technology based upon inverse, statistical algorithms.

The mineral model was constructed using Illite, Kaolinite, Quartz and Silt which is consistent with the core petrology. The logging tool responses for mineral endpoints were selected from chartbook tables. The clay minerals are defined as the dry clay endpoints and the bound water content is calculated dependent upon the salinity and temperature of the reservoir formation water. Wet clay endpoints are re-computed within the software. The endpoint parameters for the clay minerals expressed as GRHB were determined at first by conversion of average chartbook GR and RHOB and then by trial and error. The parameters for Silt were based on general empirical evidence that "shales" comprise clay minerals and silt with the latter a mixture of quartz, carbonates, micas and etcetera. The endpoints are generally taken to be between those of quartz and limestone but with an intermediate GR level. The hypothetical "shale" endpoint assumed ~67% wet clays and 33% silt. This provides a reasonable solution of the neutron log.

The Dual Water saturation equation was selected since this is the default for Schlumberger's ELAN software.
The cementation exponent, m^0, was calculated using the equation of Goode and Sen (1988) and this provides a dynamic solution at each data level dependent upon the porosity and CEC. This equation includes a small correction to m^* for the bound water layer in order that the cementation exponent is consistent with principles of the Dual Water equation.

The resistivity of formation water was accepted as 1.0 ohmm at 75 degrees F following analysis of all Iona wells.

7.3 LOG ANALYSIS RESULTS

The results of the log analysis are shown on the striplog and a description of the mnemonics is included as a facing page to the figure.

For the Waarre C sandstones there are 24.7 metres of porous reservoir with an average porosity of 25.7%. At this location no hydrocarbons of significance were intersected.

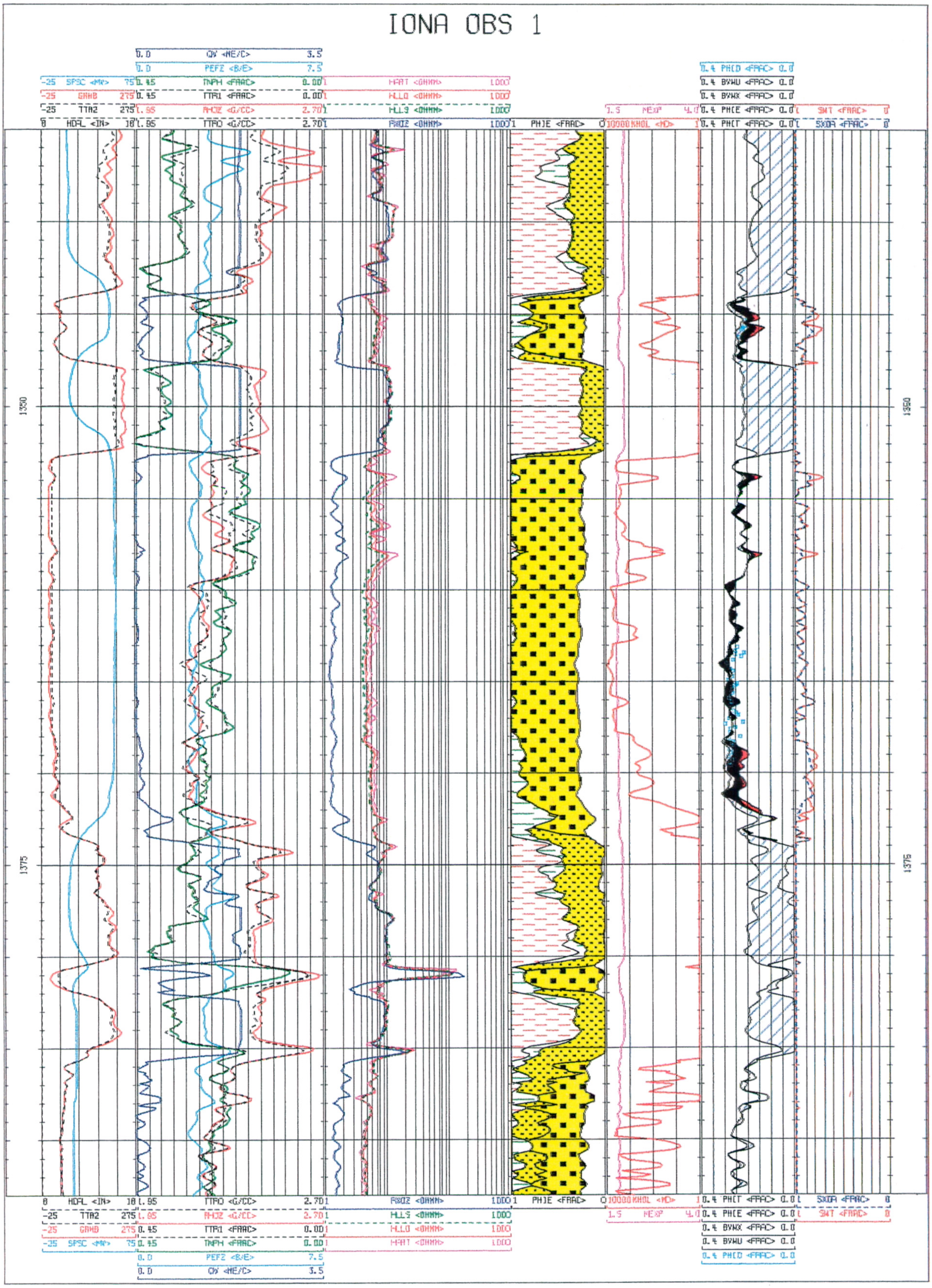

Figure 7.1

7.4 FAST – STRIPLOG DESCRIPTION

Track 1:

depth scale in metres TVD-KB

Track 2:

CALI / CALS / HCAL	caliper - short dash, black
TTR2	theoretical gamma ray/density - short dash, black
GRHB	gamma ray % deflection x density - solid line, red
SP	spontaneous potential - solid line, cyan

Track 3:

TTR0	theoretical density - short dash, black
RHOZ / RHOB	density - solid line, red
TTR1	theoretical neutron - short dash, black
TNPH / NPHI	neutron environment corrected - solid line, green
PEFZ / PEF / PEF	photoelectric environment corrected - solid line, cyan
Qv	cation exchange capacity per unit pore volume - solid line, dark blue

Track 4:

RXOZ / MSFL / RXO	micro-laterolog - solid line, dark blue
HLLS / SLLC / LLS	shallow laterolog environment corrected - short dash, green
HLLD / DLLC / LLD	deep laterolog environment corrected - solid line, red
HART / RT	true resistivity - solid line, magenta

Track 5:

wet Illite	pink clay pattern
wet Kaolinite	green mudstone pattern
Silt	siltstone pattern
Quartz	coarse sandstone pattern
Phie	effective porosity (white space to left of right margin)

Track 6:

KHOL	permeability from Goode & Sen equation - solid line, red; scale: 10 D to 1 mD
MEXP	cementation m^0 exponent calculated from ϕ_T and Qv - solid line, magenta

Track 7:

PHIO	core porosity (ambient data corrected to overburden) – cyan box symbols
PHIT	total porosity (bound water porosity plus effective porosity) - separation between curves indicates bulk volume of bound water or ϕ_{BW} - shown as diagonal blue hatch
PHIE	effective porosity -separation between curves indicates *residual hydrocarbons* coloured black
BVWX	bulk volume of water in the flushed zone - separation between curves indicates *moveable oil* coloured red
BVWU	bulk volume of water in the unflushed zone - separation between curves indicates *far water* (free water and capillary water) - shown as unfilled grid towards the right margin

Track 8:

SXO	water saturation in the flushed zone - short dash, dark blue
SWT	total water saturation in the unflushed zone total porosity - solid line, red

Track 9:

depth scale in metres TVD-KB

APPENDIX 1

Daily Drilling Reports by Kelly Down Pty. Ltd.

APPENDIX 1

Daily Drilling Reports by Kelly Down Pty. Ltd.

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	5-Feb-99
REPORT No:	1
D.F.S:	1.0
SHOE F.I.T:	

WELL NAME: Iona OBS-1 STATUS @ 2400 HRS: Drilling ahead @ 308m

DEPTH - 2400 HRS:	308 m	FORMATION:	Mepunga	KB - GL (m):	5.33
DEPTH - PREVIOUS:	10 m	HOLE SIZE:	8½"	SHOE DEPTH:	10m
24 HR PROGRESS:	298 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	Pre-spud				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.6	50l Aldacide
VISCOSITY	40	75g EZ MUD
pH	8.5	200kg PAC-R
PV / YP	9/14	275 lb XCD
GELS 0/10	3/5	3000 kg KCl
WL API / FC (cc)	11.8	80 kg KOH
SOLIDS %		
SAND %	tr	
CHLORIDES	22,500	
KCL (% WT)	4.00	
MBT (ppb)	10	
Pm Pm/Mf	.15/0.4	
TEMP (degC)	39	
HOLE VOL (bbls)	57	
SURFACE VOL (bbls	375	
HOLE LOSSES (bbls)	20	
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/16	8.5/8.6
SHAKER SCREENS	110/85/85	110/110/110

INVENTORY	
BARITE	720 sx
GEL	80 sx
CEMENT	sx
SALT	sx
KCL	865 sx
DRILLWATER	800 bbl
DIESEL FUEL	33,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	82	82
PRESSURE	1550	
GPM	431	
AV (DP - ft/min)	70.5	
AV (DC - ft/min)	352	
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	

BIT DATA		
BIT No.	1	
SIZE (ins)	8.1/2"	
TYPE	GT-MG1	
IADC CODE	117	
SERIAL No.	V00CS	
NOZZLES	13 13 13	
OUT (m)		
IN (m)	10	
DRILLED (m)	298	
HOURS	16.5	
CONDITION		
AVG ROP (m/hr)	18.00	
WOB (x1000 lbs)	5	
RPM	50/126	
JET VEL (ft/sec)	354	
HHP @ BIT	243.00	

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
32.12 / 32.12	0.2°	305
135.5 / 135.5	1.1°	124.4
155.2 / 155.17	4.6°	133.8
184.2 / 183.96	8.8°	127.1
212.6/211.87	12.3°	125
251/249.12	16°	129.4
280/276.69	20.2°	128.3

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	0.5
3. DRILLING	16.5
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	2
7. CIRC / COND	
8. CHANGE BHA	1.5
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	3
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	0.5
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 8.1/2" bit / 6.3/4" Motor / 7.3/4" String Stab / 6 .1/2" NM Float sub / 6.1/2" NM 6.3/4" DWD 650 / 6.1/2" NMDC / 6.1/2" XO / 8 x 6.1/2" DC / Jars / 2 x 6.1/2" DC / XO

BHA WEIGHT :	32,000 lbs	STRING WT.:	50,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	172,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	100 amps	DRAG UP :	1,000 lbs
TORQUE OFF BTM :	60 amps	DRAG DOWN :	1,000 lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	5-Feb-99
REPORT No:	1
D.F.S:	1.0

Iona OBS-1 STATUS @ 2400 HRS: Drilling ahead @ 308m

FROM	TO	HRS	24 HOUR SUMMARY
0:00	0:30	0.5	Picked up 6 3/4" motor, made up 8.1/16" NB straight blade stabilizer and 8.1/2" bit
0:30	1:00	0.5	Held pre-spud safety meeting.
1:00	3:00	2	Drilled 8.1/2" hole from 10m to 30m picking up 7.3/4" SS, NM float sub & NMDC.
3:00	3:30	0.5	Installed bails.
3:30	4:00	0.5	Set angle on motor to 1.5 degrees. RIH, held up at 16m.
4:00	4:30	0.5	Reamed out hole to 30m
4:30	5:00	0.5	Installed probe (18.5m from bit) Aligned motor with MWD.
5:00	9:30	4.5	Drilled 8 1/2" hole from 30m to135m.
9:30	10:00	0.5	Rigged up Drillers monitor for Sperry. Took survey.
10:00	0:00	14	Drilled directionally, sliding and rotating from 135m to 308m, reamed and took
			surveys on connections.
			NB: Pickett removed at 18:00hrs 4th. Nelsons Transport delivered Howco Pumper.
			Nelsons Transport delivered 2 loads 7"csg. Trailer load of miscelaneous equipment.
			Body truck w/ Howco chemicals and compressor. Howco pumper.
			Septic tanks cleaned today.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Fine

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
24	675-439	6.3/4" motor
24	2924	7.3/4" S.Stab
24	A-225	6.1/2" NM Float
22	C-462	6.1/2" NMDC
22	46728	6.3/4"DWD 650
22	49072	6.1/2" NMDC
20	D2302	Dailey D Jar

FORMATION TOPS : Gellibrand Marl: 0-290m Mepunga Sandstone: 290-321m Dilwyn Sandstone: 321m-

OPERATION TO 0600 HRS Tightened kelly connections and drilled ahead, building angle(34.9°@ 405m) to 414m.

PROGRAM - NEXT 24 HRS : *Continue to build angle to 40°, hold angle to casing point.*

TRANSPORTATION	
TRANSPORT-1	casing acc's
TRANSPORT-2	mud chemicals
TRANSPORT-3	
FORKLIFT	
WATER HAULER	trucking water
CRANE	

PERSONNEL	
CONTRACTOR	19
OPERATOR	2
SERVICE CO	12
TOTAL :	33

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

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TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	6-Feb-99
REPORT No:	2
D.F.S:	2.0
SHOE F.I.T:	

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: Drilling ahead @ 702m

DEPTH - 2400 HRS:	702 m	FORMATION:	Pember	KB - GL (m):	5.33
DEPTH - PREVIOUS:	308 m	HOLE SIZE:	8½"	SHOE DEPTH:	10m
24 HR PROGRESS:	394 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"

SAFETY MEETINGS: 2 x Toolbox meetings

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	75 l Aldacide
VISCOSITY	44	60g EZ MUD
pH	8.3	100kg PAC-R
PV / YP	12/21	385 lb XCD
GELS 0/10	7/12	625 kg KCl
WL API / FC (cc)	9.8	120 kg KOH
SOLIDS %	2.0	375 lb Barafibre
SAND %	1	75 kg Dextrid LT
CHLORIDES	25,000	
KCL (% WT)	4.60	
MBT (ppb)	12	
Pm Pm/Mf	0.2/0.43	
TEMP (degC)	44	
HOLE VOL (bbls)	147	
SURFACE VOL (bbls	236	
HOLE LOSSES (bbls)	73	
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/16	8.6/8.9
SHAKER SCREENS	110/85/85	110/110/110

INVENTORY	
BARITE	720 sx
GEL	80 sx
CEMENT	sx
SALT	sx
KCL	720 sx
DRILLWATER	860 bbl
DIESEL FUEL	28,500 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	82	82
PRESSURE	1950	
GPM	431	
AV (DP - ft/min)	70.5	
AV (DC - ft/min)	352	
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	

BIT DATA		
BIT No.	1	
SIZE (ins)	8.1/2"	
TYPE	GT-MG1	
IADC CODE	117	
SERIAL No.	V00CS	
NOZZLES	13 13 13	
OUT (m)		
IN (m)	10	
DRILLED (m)	692	
HOURS	35.5	
CONDITION		
AVG ROP (m/hr)	19.50	
WOB (x1000 lbs)	5	
RPM	50/126	
JET VEL (ft/sec)	354	
HHP @ BIT	243.00	

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
366.37/354.6	30.6	129
414.2/394.42	35.60	128
462.31/432.28	40.00	128.8
510.1/468.85	39.10	126.7
616.5/552.04	38.20	126.3
684.2/605.45	37.60	126.7
722.7/636.1	37.00	126.6

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.5

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	0.5
3. DRILLING	19
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	1
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	1.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	1.5
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	0.5
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 8.1/2" bit / 6.3/4" Motor / 7.3/4" String Stab / 6 .1/2" NM Float sub / 6.1/2" NM 6.3/4" DWD 650 / 6.1/2" NMDC / 6.1/2" XO / 8 x 6.1/2" DC / Jars / 2 x 6.1/2" DC / XO

BHA WEIGHT :	32,000 lbs	STRING WT.:	54,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	168,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	16,000 lbs
TORQUE OFF BTM :	100 amps	DRAG DOWN :	12,000 lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	6-Feb-99
REPORT No:	2
D.F.S:	2.0

Iona OBS-1 — STATUS @ 2400 HRS: Drilling ahead @ 702m

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	Drilled directionally, sliding and rotating from 308m to 317m.
0:30	1:00	0.5	Tightened kelly connections.
1:00	9:00	8	Drilled directionally, sliding and rotating from 317m to 465m, ream and surveyed each connection.
9:00	11:00	2	Drilled in rotary mode from 465m to 519m.
11:00	11:30	0.5	Rig Service.
11:30	20:30	9	Continued to drill conventionally from 519m to 688m with minor corrections.
20:30	22:00	1.5	Attempted to repair discharge line on MP#1, cracked hammer union.
22:00	0:00	2	Drilled 8 1/2" hole from 688m to 702m with one pump at 335 gpm.
			NB: Need P.O. to cover Timboon Engineering Crane Hire, $540 to move cement tanks to location. Also P.O. to cover Alan Gledhill for hire of low loader for same operation.
			73 bbl mud losses, healed with addition of barafibre.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Rain squalls

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
48	675-439	6.3/4" motor
48	2924	7.3/4" S.Stab
48	A-225	6.1/2" NM Float
46	C-462	6.1/2" NMDC
46	46728	6.3/4"DWD 650
46	49072	6.1/2" NMDC
44	D2302	Dailey D Jar

FORMATION TOPS : Gellibrand Marl: 0-290m Mepunga Sandstone: 290-321m
Dilwyn Sandstone: 321m-

OPERATION TO 0600 HRS: Drilled ahead to 743m, circulated bottoms-up, flow check and POOH

PROGRAM - NEXT 24 HRS : *Continue POOH, L/D motor &DWD. RIH to bottom, displace ann to vis mud, pump down Gyro multishot & POOH, L/D BHA.*

TRANSPORTATION	
TRANSPORT-1	Tubulars
TRANSPORT-2	Cement tanks
TRANSPORT-3	
FORKLIFT	Tubulars
WATER HAULER	trucking water
CRANE	Cement tanks

PERSONNEL	
CONTRACTOR	19
OPERATOR	2
SERVICE CO	14
TOTAL :	35

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 063

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	7-Feb-99
REPORT No:	3
D.F.S:	3.0
SHOE F.I.T:	

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: R/u to run 7" csg.

DEPTH - 2400 HRS:	744	m	FORMATION:	Pebble Point	KB - GL (m):	5.33
DEPTH - PREVIOUS:	702	m	HOLE SIZE:	8½"	SHOE DEPTH:	10m
24 HR PROGRESS:	42	m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	2 x Toolbox meetings					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.1	25 l Aldacide
VISCOSITY	45	30g EZ MUD
pH	8.7	0kg PAC-R
PV / YP	14/22	55 lb XCD
GELS 0/10	6/15	500 kg KCl
WL API / FC (cc)	10.6	0 kg KOH
SOLIDS %	2.9	0 lb Barafibre
SAND %	1.5	0 kg Dextrid LT
CHLORIDES	20,000	100kg Baracor
KCL (% WT)	4.20	
MBT (ppb)	15	
Pm Pm/Mf	0.1/0.4	
TEMP (degC)	25	
HOLE VOL (bbls)	151	
SURFACE VOL (bbls	220	
HOLE LOSSES (bbls)	9	
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/16	8.6/8.9
SHAKER SCREENS	110/85/85	110/110/110

INVENTORY	
BARITE	644 sx
GEL	80 sx
CEMENT	600 sx
SALT	sx
KCL	700 sx
DRILLWATER	840 bbl
DIESEL FUEL	17,500 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		140
PRESSURE		1350
GPM		335
AV (DP - ft/min)		55
AV (DC - ft/min)		274
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	

BIT DATA		
BIT No.	1	
SIZE (ins)	8.1/2"	
TYPE	GT-MG1	
IADC CODE	117	
SERIAL No.	V00CS	
NOZZLES	13 13 13	
OUT (m)		
IN (m)	10	
DRILLED (m)	692	
HOURS	35.5	
CONDITION	2 E I	
AVG ROP (m/hr)	19.50	
WOB (x1000 lbs)	5	
RPM	50/126	
JET VEL (ft/sec)	354	
HHP @ BIT	120.00	

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
366.37/354.6	30 6	129
414.2/394.42	35.60	128
462.31/432.28	40.00	128.8
510.1/468.85	39.10	126.7
616.5/552.04	38.20	126.3
684.2/605.45	37.60	126.7
722.7/636.1	37.00	126.6

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.5

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	2.5
4. BIT TRIP	3
5. WIPER TRIP	5
6. SURVEY	0.5
7. CIRC / COND	2.5
8. CHANGE BHA	6
9. CASE & CEMENT	2.5
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	1
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	1
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 8.1/2" bit /NM xo/8.1/4" Stab/ 6 .1/2" NM DC /7.3/4"S Stab/ 6.1/2"xo
8 x 6.1/2" DC / Jars / 2 x 6.1/2" DC /xo

BHA WEIGHT :	32,000 lbs	STRING WT.:	54,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	168,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	16,000 lbs
TORQUE OFF BTM :	100 amps	DRAG DOWN :	12,000 lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	7-Feb-99
REPORT No:	3
D.F.S:	3.0

Iona OBS-1 — STATUS @ 2400 HRS: R/u to run 7" csg.

FROM	TO		24 HOUR SUMMARY
0:00	2:30	2.5	Drill 8½" Hole 702m - 743.5m.
2:30	3:30	1	Circulate hole clean. Flow check. Pump slug.
3:30	6:30	3	POOH SLM pipe. Flow check at BHA.
6:30	9:00	2.5	JSA w/ crew. L/d, Service PDM and MWD. Clear catwalk.
9:00	10:00	1	P/u BHA and RIH. Wiper trip.
10:00	11:00	1	Rig service.
11:00	14:00	3	RIH. Wash and ream 720m - 743m. Took 25klbs at 720m.
14:00	15:30	1.5	Circulate clean.
15:30	17:00	1.5	Pump down Gyrodata multi-shot survey. Pump slug, orientate gyro.
17:00	21:30	4.5	POOH. L/D all BHA, recover survey barrel.
21:30	0:00	2.5	Held pre-job safety meeting. R/U to run 7" casing. Installed dump valve in 13.3/8 conductor.

NB: Site visit by A. Nadji DNRE.
Stoitze Transport body truck delivered mud chemicals ex Welshpool.
Gyro survey: bottom hole location + 0.79m North

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
51	675-439	6.3/4" motor
51	2924	7.3/4" S.Stab
51	A-225	6.1/2" NM Float
49	C-462	6.1/2" NMDC
49	46728	6.3/4"DWD 650
49	49072	6.1/2" NMDC
47	D2302	Dailey D Jar

FORMATION TOPS : Gellibrand Marl: 0-290m Mepunga Sandstone: 290-321m
Dilwyn Sandstone: 321m-614m Pember Mudstone 614-696m

OPERATION TO 0600 HRS Held pre-job meeting with new crew. M/U 7" shoetrack & RIH with 7" to 739m.

PROGRAM - NEXT 24 HRS : *Circulate and cement, WOC, install csg head, N/U & test BOPE*

TRANSPORTATION	
TRANSPORT-1	Chemicals
TRANSPORT-2	
TRANSPORT-3	
FORKLIFT	Tubulars
WATER HAULER	trucking water
CRANE	

PERSONNEL	
CONTRACTOR	19
OPERATOR	2
SERVICE CO	14
TOTAL :	35

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 065

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	8-Feb-99
REPORT No:	4
D.F.S:	4.0
SHOE F.I.T:	

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: N/U BOPE

DEPTH - 2400 HRS:	744 m	FORMATION:	Pebble Point	KB - GL (m):	5.33
DEPTH - PREVIOUS:	744 m	HOLE SIZE:	8½"	SHOE DEPTH:	739
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	2 x Toolbox meetings				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	25 l Aldacide
VISCOSITY	45	50g EZ MUD
pH	8.5	100kg PAC-R
PV / YP	13/20	165 lb XCD
GELS 0/10	7/15	1250 kg KCl
WL API / FC (cc)	9.6	20 kg KOH
SOLIDS %	3.8	0 lb Barafibre
SAND %	tr	0 kg Dextrid LT
CHLORIDES	21,000	50kg Baracor
KCL (% WT)	4.06	250kg Pac-L
MBT (ppb)	14	
Pm Pm/Mf	0.1/0.4	
TEMP (degC)		
HOLE VOL (bbls)	91	
SURFACE VOL (bbls	40	
HOLE LOSSES (bbls)		
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/85/85	110/110/110

INVENTORY	
BARITE	644 sx
GEL	80 sx
CEMENT	250 sx
SALT	sx
KCL	650 sx
DRILLWATER	880 bbl
DIESEL FUEL	23,500 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	

BIT DATA		
BIT No.		
SIZE (ins)		
TYPE		
IADC CODE		
SERIAL No.		
NOZZLES		
OUT (m)		
IN (m)		
DRILLED (m)		
HOURS		
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg	Azimuth
366.37/354.6	30.6	129
414.2/394.42	35.60	128
462.31/432.28	40.00	128.8
510.1/468.85	39.10	126.7
616.5/552.04	38.20	126.3
684.2/605.45	37.60	126.7
722.7/636.1	37.00	126.6

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	1.5
8. CHANGE BHA	
9. CASE & CEMENT	7.5
10. WELLHEAD	2
11. BOP'S	4
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	9
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.:

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	168,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	16,000 lbs
TORQUE OFF BTM :	100 amps	DRAG DOWN :	12,000 lbs

CONTINUED ../2

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	8-Feb-99
REPORT No:	4
D.F.S:	4.0

Iona OBS-1 STATUS @ 2400 HRS: N/U BOPE

FROM	TO	HRS	24 HOUR SUMMARY
0:00	6:00	6	Run 7" casing
6:00			Head up Howco. Circulate Casing volume x 1½. Hold pre-job meeting.
	7:30	1½	Pressure test lines 3500psi. Drop bottom plug and pump 30 bbls fresh water spacer.
7:30			Mix / pump lead cmt. 71 bbls 200sx "G"w/ 2.5% prehydrated gel / 2gals/10bbl CFR-3 @ 12.8ppg
	8:30	1	Followed by Tail. 29.5bbls / 137sx "G" w/1% CaCl @ 15.8ppg.
8:30	9:00	½	Drop top plug and displace w/ 90.5bbls fresh water. Bump plug w/ 2500psi hold 10 mins OK.
			CIP at 08:35hrs. Spacer to surface - no cement. Returns OK throughout.
9:00			Wait On Cement. Several attemts to slack off casing. R/D floor, flowline. Cut and lift conductor
			Clean mud pits. Changed out 3 1/2" pipe ram seals. Prepare BOPE for N/U. Held weekly
	18:00	9	Safety Meeting.
18:00			Slacked off casing string. Backed out Landing Joint. Laid out conductor & L/J. M/U 3k 7.1/16"
	20:00	2	casing head, 3,500 ftlbs.
20:00	0:00	4	Nippled up 3k x 5k 7.1/16" adapter & mud cross.
			NB: Site visit by A. Nadji DNRE. 7/2/99
			All points on Inspection Record #0140 rectified apart from #6. Books on site today.
			Recommendations: 1) Future cellars to be concrete, including base. 2) If surface conductor is
			adequately set, a Base plate can support 7" casing, alleviating WOC period.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : Gellibrand Marl: 0-290m Mepunga Sandstone: 290-321m
Dilwyn Sandstone: 321m-614m Pember Mudstone 614-696m

OPERATION TO 0600 HRS N/U double ram stack, annular & BOPE

PROGRAM - NEXT 24 HRS *Continue N/U BOPE, pressure test same, M/U sterable BHA*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
FORKLIFT	Tubulars
WATER HAULER	last 2 days = 19hrs
CRANE	

PERSONNEL	
CONTRACTOR	19
OPERATOR	2
SERVICE CO	13
TOTAL :	34

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA

WUGS Western Underground Storage Project

DATE:	9-Feb-99
REPORT No:	5
D.F.S:	5.0
SHOE F.I.T:	

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: RIH with steerable assembly

DEPTH - 2400 HRS:	744 m	FORMATION:		KB - GL (m):	5.33		
DEPTH - PREVIOUS:	744 m	HOLE SIZE:	6"	SHOE DEPTH:	739		
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"		
SAFETY MEETINGS:	2 x Weekly Safety Meeting						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	0 l Aldacide
VISCOSITY	52	0g EZ MUD
pH	8.8	0kg PAC-R
PV / YP	12/19	0 lb XCD
GELS 0/10	5/8	0 kg KCl
WL API / FC (cc)	4.8	20 kg KOH
SOLIDS %	3.0	0 lb Barafibre
SAND %	tr	0 kg Dextrid LT
CHLORIDES	18,000	0kg Baracor
KCL (% WT)	3.55	0kg Pac-L
MBT (ppb)	10	
Pm Pm/Mf	.15/.4	
TEMP (degC)		
HOLE VOL (bbls)	91	
SURFACE VOL (bbls	40	
HOLE LOSSES (bbls)		
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/85/85	110/110/110

INVENTORY	
BARITE	644 sx
GEL	80 sx
CEMENT	250 sx
SALT	sx
KCL	650 sx
DRILLWATER	850 bbl
DIESEL FUEL	18,500 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)		
IN (m)	744	
DRILLED (m)		
HOURS		
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	6
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	16.5
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	1.5
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" bit/ 4.3/4" Sperry Drill / 5.7/8" Sslab / 4.3/4" Float sub / 4.3/4" NM Flex DC
4.3/4" DWD Hang off collar / 4.3/4" NM Flex DC / 12 x 4.3/4" slick DC /
Drilling Jar / 3 x 4.3/4" DC

BHA WEIGHT :	20,000 lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA Iona OBS-1

STATUS @ 2400 HRS: RIH with steerable assembly

DATE:	9-Feb-99
REPORT No:	5
D.F.S:	5.0

FROM	TO		24 HOUR SUMMARY
0:00	12:00	12	Continue N/U BOPE, double ram, annular, choke and kill lines. Flush system and function.
12:00	13:00	1	M/U test string and set test plug. P.T. Blind rams 500/3000 psi OK. Test PR's, leak.
13:00			Test plug seals damaged, run cup tester, C/O 3.1/2" ram rubbers. P.Test choke manifold
			kill and choke line valves, PR's, casing head connection 500/3000psi. Annular 500/1000 psi
	16:30	3.5	Pull cup tester, run wear bushing. L/O test string.
16:30	18:30	2	M/U 6" Bit and 4 3/4" motor, function test same. P/U HOS (Hang off sub) bore too deep for
			probe. L/O.
18:30	20:00	1.5	Attempt to insert probe in back up HOS on catwalk. Centralizer / Bore ID incorrect. Reconfigure
20:00	21:00	1	P/U new probe / HOS assembly and align motor.
21:00	23:00	2	Continue RIH picking up 4.3/4" DC's and jars.
23:00	0:00	1	P/U kelly, function test MWD. Continue RIH.
			NB: Septic at rig pumped today. $120.00
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Hot

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : Pebble point 696-

OPERATION TO 0600 HRS: Continue RIH, drill out plugs, FC, shoetrack cement, shoe, rat hole & 2m formation. Circulate. Peform LOT. Drill 744-757m

PROGRAM - NEXT 24 HRS: *Drill ahead*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
FORKLIFT	
WATER HAULER	
CRANE	

PERSONNEL	
CONTRACTOR	19
OPERATOR	2
SERVICE CO	15
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 066

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	10-Feb-99
REPORT No:	6
D.F.S:	6.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: Drill 6" hole at 1110 m

DEPTH - 2400 HRS:	1,110 m	FORMATION:	Paaratte	KB - GL (m):	5.33
DEPTH - PREVIOUS:	744 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	366 m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	Pre-job, pre-tour .				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	25 l Aldacide
VISCOSITY	48	20g EZ MUD
pH	8.5	50kg PAC-R
PV / YP	12/23	160 lb XCD
GELS 0/10	4/9	750 kg KCl
WL API / FC (cc)	4.5	80 kg KOH
SOLIDS %	2.7	0 lb Barafibre
SAND %	1	0 kg Dextrid LT
CHLORIDES	23,000	0kg Baracor
KCL (% WT)	4.30	200kg Pac-L
MBT (ppb)	15	750kgBaracarb100
Pm Pm/Mf	.15/.7	
TEMP (degC)	39	
HOLE VOL (bbls)	123	
SURFACE VOL (bbls	398	
HOLE LOSSES (bbls)	26	
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	20	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/20	
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	644 sx
GEL	60 sx
CEMENT	250 sx
SALT	sx
KCL	620 sx
DRILLWATER	680 bbl
DIESEL FUEL	15,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	104	
PRESSURE	1950	
GPM	249	
AV (DP - ft/min)	102	
AV (DC - ft/min)	454	
SPR	40/60	40/60
SPR PRESS	480/600	460/600

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	6

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,110	
IN (m)	744	
DRILLED (m)	366	
HOURS	16	
CONDITION		
AVG ROP (m/hr)	23.00	
WOB (x1000 lbs)	5	
RPM	60/250	
JET VEL (ft/sec)	259	
HHP @ BIT	78.00	

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
793.23/693.08	36.4	126
851.25/740.5	34.50	127.1
938.1/813.15	31.40	129
996.2/862.78	30.70	127.6
1025.3/887.94	29.60	126.8
1054/913.06	28.30	125.2
1082.8/938.5	27.60	124.8

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	18
4. BIT TRIP	1
5. WIPER TRIP	
6. SURVEY	2.5
7. CIRC / COND	0.5
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	1.5
13. CORING	
14. LOGGING	
15. REAM / WASH	0.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" bit/ 4.3/4" Sperry Drill / 5.7/8" Sstab / 4.3/4" Float sub / 4.3/4" NM Flex DC 4.3/4" DWD Hang off collar / 4.3/4" NM Flex DC / 12 x 4.3/4" slick DC / Drilling Jar / 3 x 4.3/4" DC

BHA WEIGHT :	20,000 lbs	STRING WT.:	58,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	164,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	150 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	10,000 lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	10-Feb-99
REPORT No:	6
D.F.S:	6.0

Iona OBS-1 STATUS @ 2400 HRS: Drill 6" hole at 1110m.

FROM	TO	HRS	24 HOUR SUMMARY
0:00	1:00	1	Continue to RIH with 6" steerable assembly. Laid out 8 singles.
1:00	1:30	0.5	P/U kelly, wash from 707m, tag cement @ 720m.
1:30	3:30	2	Drill out FC @ 726m, shoetrack cement, shoe @ 739m, rathole and 2m formation to 746m.
3:30	4:00	0.5	Circulate to condition mud.
4:00			Peform LOT: Halliburton break circulation through annulus. P.T. lines 1000psi. Start pumping,
			communication to DP, leaking float. Restart test. Small volume pumped for pressure increase,
			verify communication DP x annulus,OK. Repeat test. Not conclusive due to small volume pumped.
	5:30	1.5	Estimate leak-off at 480psi. EMW = 13.2ppg
5:30	13:00	7.5	Rotary drill 6" hole with steerable assembly 746-959m.
13:00	15:30	2.5	Drill 6" hole in slide mode 959-969m.
15:30	22:00	6.5	Rotary drill 6" hole 969-1107m.
22:00	0:00	2	Drill 6" hole in slide mode 1107-1110m. (Problem encountered with weight stacking 20-25k,
			weight releasing onto PDC bit, stalling motor)
			NB: 15bbl loss at 1108m. Carbide at 1152m shows hole in gauge
			Core hand arrived 23:00 30-40k O/P after sliding
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Hot

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
21.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
27	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC
25	1400-252	Dailey Jar

FORMATION TOPS : Pebble point 696m. Paaratte 778m.

OPERATION TO 0600 HRS: Rotary drill 6" hole 1110-1124m, slide 1124-1127m, rotary 1127-1147m, slide 1147-1149m Rotary 1149-1183m

PROGRAM - NEXT 24 HRS: *Drill ahead with corrections / trip for bit and BHA change if unable to slide.*

TRANSPORTATION	
TRANSPORT-1	2.3/8" tubing
TRANSPORT-2	
TRANSPORT-3	
FORKLIFT	
WATER HAULER	6hr
CRANE	

PERSONNEL	
CONTRACTOR	19
OPERATOR	2
SERVICE CO	15
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 067

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — WUGS Western Underground Storage Project

DATE:	11-Feb-99
REPORT No:	7
D.F.S:	7.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: Schlumberger RIH with stringshot

DEPTH - 2400 HRS:	1,251 m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,110 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	141 m	ACCIDENTS:	nil	LAST CASING:	7"

SAFETY MEETINGS: Pre-job, pre-tour .

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	25 l Aldacide
VISCOSITY	57	20g EZ MUD
pH	8.8	75kg PAC-R
PV / YP	19/32	110 lb XCD
GELS 0/10	5/10	250 kg KCl
WL API / FC (cc)	5.0	80 kg KOH
SOLIDS %	2.7	125lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	22,000	50kg Baracor129
KCL (% WT)	3.90	200kg Pac-L
MBT (ppb)	10	675kgBaracarb100
Pm Pm/Mf	.16/.96	750kgBaracarb25
TEMP (degC)	42	300kgBaracarb600
HOLE VOL (bbls)	123	1650kg Barite
SURFACE VOL (bbls	455	55g Torq Trim
HOLE LOSSES (bbls)	26	
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	15	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/15	
SHAKER SCREENS:	110/175/175	110/110/110

INVENTORY	
BARITE	578 sx
GEL	68 sx
CEMENT	250 sx
SALT	sx
KCL	610 sx
DRILLWATER	480 bbl
DIESEL FUEL	16,200 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	104	
PRESSURE	1950	
GPM	249	
AV (DP - ft/min)	102	
AV (DC - ft/min)	454	
SPR	40/60	40/60
SPR PRESS	600/880	600/860

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	6

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)	13.20	
WOB (x1000 lbs)	5	
RPM	60/250	
JET VEL (ft/sec)	259	
HHP @ BIT	78.00	

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
1082.8/938.5	27.60	124.8
1140.45/990.19	25.00	124.4
1197.84/1042.56	23.00	125.7
1227/1069.51	21.90	124.9

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	12.5
4. BIT TRIP	1.5
5. WIPER TRIP	
6. SURVEY	1
7. CIRC / COND	2
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	6.5
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	0.5
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" bit/ 4.3/4" Sperry Drill / 5.7/8" Sstab / 4.3/4" Float sub / 4.3/4" NM Flex DC
4.3/4" DWD Hang off collar / 4.3/4" NM Flex DC / 12 x 4.3/4" slick DC /
Drilling Jar / 3 x 4.3/4" DC

BHA WEIGHT :	20,000 lbs	STRING WT.:	66,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	132,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	150 amps	DRAG UP :	24,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	14,000 lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	11-Feb-99
REPORT No:	7
D.F.S:	7.0

TUAUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: Schlumberger RIH with stringshot.

FROM	TO		24 HOUR SUMMARY
0:00			Continued to drill 6" hole with steerable assembly. Rotary drill 1110-1124m, slide 1124-1127m,
			rotary 1127-1147m, slide1147-1149m, rotary 1149-1194m. Attempted to slide at following depths
	11:30	11.5	1194, 1205, 1212, 1234m with little success. Drilled to 1238m.
11:30	12:00	0.5	Rig Service.
12:00	13:00	1	Drill ahead in rotary mode 1238-1251m.
13:00	13:30	0.5	Attempt to slide at 1251m. No progress due to weight stacking.
13:30	14:00	0.5	Work tight hole at 1238m.
14:00	15:00	1	Circulate and condition mud.
15:00	15:30	0.5	RIH to 1251m and attempt to slide. no progress.
15:30	16:30	1	Circulate bottoms up, flowcheck, pump pill.
16:30	17:30	1	POOH to 923m, tight hole, string stuck.
17:30			Work on stuck pipe, work string both ways, good up-jar action, poor down-jar action. No
			progress. R/U circulating sub, attempt to establish circulation, no success. Continue to work on
	20:30	3	on stuck pipe. R/D circ sub and hose.
20:30	0:00	3.5	R/U Schlumberger, change out head. R/U sheaves. 23:00 Safety meeting - Radio Silence.

NB: Howco slickline, Gyrodata, Timboon Eng, crane on site for Iona #2 Gyro.
Assemble lubricator and spot equipment. Prepare gyro. Open compound and prepare well.
Suspend operation until morning due to overcast conditions and inability to complete
operation in daylight.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Showers

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
51	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC
49	1400-252	Dailey Jar

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS Schlumberger RIH with stringshot and correlate, work three turns left hand torque to string, Stringshot @ 734m, back-off string. POOH with schlumberger & R/D. POOH with string. TOF 734m
M/U fishing assembly, P/U 5 x 4.3/4" DC & 6 x 3 1/2" hwdp

PROGRAM - NEXT 24 HRS *RIH, jar down, establish circ, free string, POOH*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
FORKLIFT	
WATER HAULER	6hr
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	15
TOTAL :	37

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 068

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	12-Feb-99
REPORT No:	8
D.F.S:	8.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: M/U 5.3/4" washover string.

DEPTH - 2400 HRS:	1,251	m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	7"

SAFETY MEETINGS: Baker Hughes Pre-job, pre-tour .

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.4	25 l Aldacide
VISCOSITY	57	0g EZ MUD
pH	8.5	0kg PAC-R
PV / YP	21/32	0 lb XCD
GELS 0/10	6/9	0 kg KCl
WL API / FC (cc)	4.2	20 kg KOH
SOLIDS %	6.0	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	18,500	0kg Baracor129
KCL (% vol)	4.40	0kg Pac-L
MBT (ppb)	13	0kgBaracarb100
Pm Pm/Mf	.2/.84	0kgBaracarb25
TEMP (degC)	27	250kgBaracarb600
HOLE VOL (bbls)	82	0kg Barite
SURFACE VOL (bbls	431	55g Torq Trim
HOLE LOSSES (bbls)	21	25kg CaCl2
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	418 sx
GEL	68 sx
CEMENT	250 sx
SALT	sx
KCL	610 sx
DRILLWATER	430 bbl
DIESEL FUEL	18,300 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	8

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)	13.20	
WOB (x1000 lbs)	5	
RPM	60/250	
JET VEL (ft/sec)	259	
HHP @ BIT	78.00	

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg	Azimuth
1082.8/938.5	27.60	124.8
1140.45/990.19	25.00	124.4
1197.84/1042.56	23.00	125.7
1227/1069.51	21.90	124.9

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	22
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	2
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 4.3/4" pony DC / safety joint / 4.3/4" Bumper sub / "Z" type fishing jar / 5 x 4.3/4" DC / 6 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	12-Feb-99
REPORT No:	8
D.F.S:	8.0

Iona OBS-1 — STATUS @ 2400 HRS: M/U 5.3/4" washover string

FROM	TO		24 HOUR SUMMARY
0:00			Schlumberger RIH with stringshot (4 strands) and correlate, work three turns left hand
	2:00	2	torque to string, stringshot at 734m, back-off string. Schlumberger POOH with SS & R/D.
2:00	4:00	2	POOH with 3.1/2" DP, T.OF. at 734m.
4:00			Received fishing tools, caliper same. Held pre-job safety meeting with Baker Hughes rep,
	8:00	4	M/U fishing assembly and RIH to 715m.
8:00	14:00	6	Wash down 715-734m, screw into fish and engage. Work down on stuck pipe, no progress.
14:00			R/U Schlumberger, run and establish free point. 779 & 760m stuck, 741m 5% free
	18:00	4	731m 50% free. R/D Schlumberger.
18:00	19:00	1	Back-off mechanically at 734m, circulate and condition mud to 9.4ppg.
19:00	21:00	2	POOH, L/D fishing assembly in one piece.
21:00	23:00	2	W.O. washover string ***
23:00	0:00	1	Offload and caliper 5 3/4" washover pipe and subs.

*** Washover equipment transport delayed due to road closure / accident

NB: Howco slickline, Gyrodata, Timboon Eng, crane on site for Iona #2 Gyro.
Slickline R/U, BOP's leaking, repair same. RIH with 3.19" gauge ring to 1264m.
RIH with Gyro, 150m station intervals in, 30m out. R/D

Fish in hole: 1 x DP/ 3 x 4.3/4" DC / Jars / 12 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 734m BOF: 923m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Overcast

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC
49	1400-252	Dailey Jar

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS: RIH with 6" rotary shoe, tooth type. Unable to pass through wear bushing, pull same and caliper, rerun. Run 6" scalloped shoe on 5 x 5.3/4" W/O pipe. W/O from 734-744m

PROGRAM - NEXT 24 HRS: *W/O string to below jars. Pull washpipe, run fishing string.*

TRANSPORTATION	
TRANSPORT-1	2 x Melbourne
TRANSPORT-2	
TRANSPORT-3	
FORKLIFT	
WATER HAULER	
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	18
TOTAL :	40

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 070

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — WUGS Western Underground Storage Project

DATE:	13-Feb-99
REPORT No:	9
D.F.S:	9.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: M/U 5.3/4" washover string.

DEPTH - 2400 HRS:	1,251	m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	7"

SAFETY MEETINGS: Schlumberger, Baker Hughes pre-job meetings.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.4	25 l Aldacide
VISCOSITY	56	15g EZ MUD
pH	8.5	100kg PAC-R
PV / YP	18/28	0 lb XCD
GELS 0/10	5/8	0 kg KCl
WL API / FC (cc)	5.0	40 kg KOH
SOLIDS %	6.0	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	18,000	50kg Baracor129
KCL (% vol)	3.88	100kg Pac-L
MBT (ppb)	10	0kgBaracarb100
Pm Pm/Mf	0.14/0.76	250kgBaracarb25
TEMP (degC)	37	250kgBaracarb600
HOLE VOL (bbls)	82	4500kg Barite
SURFACE VOL (bbls	286	55g Torq Trim
HOLE LOSSES (bbls)	18	0kg CaCl2
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	638 sx
GEL	67 sx
CEMENT	390 sx
SALT	sx
KCL	610 sx
DRILLWATER	800 bbl
DIESEL FUEL	18,300 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	1550	
GPM	311	
AV (DP - ft/min)	281	
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	9

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg	Azimuth
1082.8/938.5	27.60	124.8
1140.45/990.19	25.00	124.4
1197.84/1042.56	23.00	125.7
1227/1069.51	21.90	124.9

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	24
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" R.Shoe/ 5 x 5.3/4" WO pipe / D.sub-safety joint / 4.3/4" Bumper sub / "Z" type 5 x 4.3/4" DC / 6 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — Iona OBS-1

DATE:	13-Feb-99
REPORT No:	9
D.F.S:	9.0

STATUS @ 2400 HRS: M/U 5.3/4" washover string

FROM	TO		24 HOUR SUMMARY
0:00			M/U 6" tooth type rotary shoe to 5.3/4" W/O pipe, RIH, held up in wear bushing. Pull W/B and
			caliper. Rerun W/B and RIH with 6" scalloped shoe on 5 joints 5.3/4" W/O pipe. Slow trip speed
	5:00	5	due to mud backflowing through DP.
5:00			Break circulation, wash down from 724m, rotate over T.O.F. at 734m. Washover fish from 734-
	13:00	8	774m.
13:00	13:30	0.5	Circulate hole clean.
13:30	15:00	1.5	POOH
15:00	17:00	2	M/U 5.3/4" O/S dressed with 4.3/4" grapple, control and RIH.
17:00	17:30	0.5	P/U kelly, engage fish, work same, no progress.
17:30			Schlumberger R/U sheaves. Held pre-job Safety Meeting: Radio Silence. M/U 1.11/16" CCL
			and 6 strand stringshot. RIH and correlate. P/U string to 150k to secure grapple. S/O to 75k,
			work two lefthand turns into string, S/O to 65k. Schlumberger correlate stringshot to 789.5m, one
			joint below jars. Fire SS, no surface indication. Schlum POOH and redress S/S, RIH and correlate
	20:30	3	to 771m, top of jars. S/O to 60k. Fire S/S, torque released. POOH
20:30	21:00	0.5	Circulate hole clean just above fish. R/D Schlumberger.
21:00			POOH, pull 40k O/P to move string. Second connection below RT partially backed-out. L/O same
			Continue POOH, visual check on connections. Recover fish, 1 x 3.1/2" DP, 3 x 4.3/4" DC's.
	0:00	3	O/S and grapple in good condition.

Fish in hole: TOF @ 772m (D.Depth) Jars / 12 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 734m BOF: 923m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Overcast

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC
49	1400-252	Dailey Jar

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS: RIH with 6" scalloped rotary shoe, on 5 x 5.3/4"W/O pipe, checking connections. Slip Drill Line Wash down from 762m, wash over fish at 772m.

PROGRAM - NEXT 24 HRS: *W/O string. Pull washpipe, run fishing string.*

TRANSPORTATION	
TRANSPORT-1	2 x Melbourne
TRANSPORT-2	Septic
TRANSPORT-3	
FORKLIFT	
WATER HAULER	6hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	15
TOTAL :	37

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 071

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	14-Feb-99
REPORT No:	10
D.F.S:	10.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 **STATUS @ 2400 HRS:** RIH with overshot

DEPTH - 2400 HRS:	1,251 m	FORMATION:	Skull Creek	KB - GL (m):	5.33		
DEPTH - PREVIOUS:	1,251 m	HOLE SIZE:	6"	SHOE DEPTH:	739		
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"		
SAFETY MEETINGS:	Schlumberger, Baker Hughes pre-job meetings.						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.3	25 l Aldacide
VISCOSITY	61	0g EZ MUD
pH	9.2	0kg PAC-R
PV / YP	22/23	0 lb XCD
GELS 0/10	6/11	1000 kg KCl
WL API / FC (cc)	3.8	0 kg KOH
SOLIDS %	6.0	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	17,500	25kg Baracor129
KCL (% vol)	3.65	100kg Pac-L
MBT (ppb)	10	0kgBaracarb100
Pm Pm/Mf	0.14/0.68	930kgBaracarb25
TEMP (degC)	41	0kgBaracarb600
HOLE VOL (bbls)	82	950kg Barite
SURFACE VOL (bbls	314	g Torq Trim
HOLE LOSSES (bbls)	15	0kg CaCl2
MUD CO	Baroid	
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	1550	
GPM	311	
AV (DP - ft/min)	281	
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY		
BARITE	600	sx
GEL	67	sx
CEMENT	390	sx
SALT		sx
KCL	570	sx
DRILLWATER	810	bbl
DIESEL FUEL	16,000	lts

DRILLS / BOPS	
LAST BOP DRILL	14-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	10

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	24
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" R.Shoe/ 5 x 5.3/4" WO pipe / D.sub-safety joint / 4.3/4" Bumper sub / "Z" type
7 x 4.3/4" DC / 6 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	14-Feb-99
REPORT No:	10
D.F.S:	10.0

Iona OBS-1 **STATUS @ 2400 HRS:** RIH with overshot

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	Continue to recover fish. 1 x 3.1/2" DP, 3 x 4.3/4" DC's.
0:30	4:00	3.5	M/U & RIH with 5.3/4" Washover string, check each connection.
4:00	4:30	0.5	BOP drill. Slip 33' Drill Line. Rig Service.
4:30	11:00	6.5	RIH to 762m, wash to TOF at 771m. Wash over from 771-819m.
11:00	11:30	0.5	Circulate 'bottoms-up'.
11:30	13:30	2	POOH.
13:30	16:30	3	M/U 5.3/4" O/S dressed with 4.3/4" grapple and RIH to 772m and engage fish.
16:30			R/U Schlumberger, RIH with stringshot and correlate to 825m. Fire S/S, no back-off.
			POOH and redress stringshot. RIH and correlate to 816m. Fire S/S, partial detonation. Work
	18:30	2	L/H torque into string. Release fish.
18:30	21:30	3	POOH with fish. Recovered Dailey Jars and 1 x 4.3/4" DC, T.O.F. at 790m.
21:30	0:00	2.5	Dress 5.3/4" O/S with 4.5/8" grapple and RIH to 782m.

Fish in hole: TOF @ 790m (D.Depth) 11 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 734m BOF: 923m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Overcast

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS Wash 782-790m. Attempt to engage fish, no success. POOH, change grapple to 4.3/4" & RIH

PROGRAM - NEXT 24 HRS *Fishing*

TRANSPORTATION	
TRANSPORT-1	Nelsons (completion equip)
TRANSPORT-2	hotshot Baker Hughes Sale
TRANSPORT-3	30 x 3.1/2" HWDP
Transport -4	Baracarb & Barite
WATER HAULER	6hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	16
TOTAL :	38

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — WUGS Western Underground Storage Project

DATE:	15-Feb-99
REPORT No:	11
D.F.S:	11.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: POOH with fish

DEPTH - 2400 HRS:	1,251	m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	Schlumberger, Baker Hughes pre-job meetings.					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.1	50 l Aldacide
VISCOSITY	62	20g EZ MUD
pH	8.5	100kg PAC-R
PV / YP	22/20	165 lb XCD
GELS 0/10	5/8	750 kg KCl
WL API / FC (cc)	4.2	20 kg KOH
SOLIDS %	2.7	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	23,000	25kg Baracor129
KCL (% vol)	4.70	200kg Pac-L
MBT (ppb)	9	500kgBaracarb100
Pm Pm/Mf	0.12/0.2	500kgBaracarb25
TEMP (degC)	33	175kgBaracarb600
HOLE VOL (bbls)	82	950kg Barite
SURFACE VOL (bbls	456	g Torq Trim
HOLE LOSSES (bbls)	13	0kg CaCl2
MUD CO	Baroid	25Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	1550	
GPM	311	
AV (DP - ft/min)	281	
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	600 sx
GEL	67 sx
CEMENT	390 sx
SALT	sx
KCL	540 sx
DRILLWATER	460 bbl
DIESEL FUEL	16,400 lts

DRILLS / BOPS	
LAST BOP DRILL	14-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	11

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	24
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 5.3/4" O/S / 4.3/4" Bumper Sub / 4.3/4" type Z jars / 35 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: POOH with fish

DATE:	15-Feb-99
REPORT No:	11
D.F.S:	11.0

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Held pre-job Safety meeting with Baker Hughes Rep. Attempt to engage fish at 790m, no success
1:00	3:30	2.5	POOH and change out grapple to 4.3/4".
3:30	5:30	2	RIH to 782m.
5:30	6:00	0.5	P/U kelly, wash to 792m and engage fish.
6:00			Schlumberger hold pre-job Safety Meeting - Radio Silence - RIH with Stringshot. Mechanical
	8:00	2	back-off while working Left-hand torque into string. Release from fish. R/D Schlumberger
8:00	10:30	2.5	POOH.
10:30	14:00	3.5	Lay out Overshot, make up washover string.RIH picking up 36 x 3.1/2" HWDP to 780m.
14:00	16:00	2	Wash 780-790m and washover fish to 837m.
16:00	17:30	1.5	POH with W/O string.
17:30	19:30	2	M/U 5.3/4" O/S dressed with 4.3/4" grapple and RIH TO 780m.
19:30	20:00	0.5	P/U kelly, wash to 790m and engage fish.
20:00			Pre-job meeting - Radio Silence - Schlumberger RIH with stringshot, held up at TOF. POOH,
			RIH with 12 ft 1.11/16" weight bar and spang jars to 890m. POOH and rerun stringshot.
			Work two lefthand turns to string, lost torque. M/U string with 4.3/4 Righthand turns. Work 1 1/4
	23:30	3.5	lefthand turns to string. Fire stringshot. POOH with Schlumberger.
23:30	0:00	0.5	L/0 pup joints and POOH with fish.

Fish in hole: TOF @ 835m (D.Depth) 6 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 835m BOF: 923m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Cold

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS: Continue POOH, recover & L/D 5 x 4.3/4" DC's. M/U washover string & RIH

PROGRAM - NEXT 24 HRS: *Washover to 882m, POOH. RIH with O/S, recover 5 DC's*

TRANSPORTATION	
TRANSPORT-1	4" tubing
TRANSPORT-2	13.3/8" csg
TRANSPORT-3	
Transport -4	
WATER HAULER	
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	17
TOTAL :	39

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 072

DAILY DRILLING REPORT
RIG : OD & E 30
PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

WUGS Western Underground Storage Project

DATE:	16-Feb-99
REPORT No:	12
D.F.S:	12.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: RIH with washover string

DEPTH - 2400 HRS:	1,251	m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	7"

SAFETY MEETINGS: Schlumberger, Baker Hughes pre-job meetings.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.1	25 l Aldacide
VISCOSITY	58	5g EZ MUD
pH	8.5	0kg PAC-R
PV / YP	22/18	110 lb XCD
GELS 0/10	4/6	0 kg KCl
W. API / FC (cc)	4.0	20 kg KOH
SOLIDS %	1.7	0lb Barafibre
SAND %	TR	0 kg Dextrid LT
CHLORIDES	23,000	0kg Baracor129
KCL (% vol)	4.50	0kg Pac-L
MBT (ppb)	9	0kgBaracarb100
Pm Pm/Mf	0.12/0.2	0kgBaracarb25
TEMP (degC)		0kgBaracarb600
HOLE VOL (bbls)	82	0kg Barite
SURFACE VOL (bbls	478	55 g Torq Trim
HOLE LOSSES (bbls)	13	0kg CaCl2
MUD CO	Baroid	25Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	2000	
GPM	254	
AV (DP - ft/min)	229	
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	600 sx
GEL	67 sx
CEMENT	390 sx
SALT	sx
KCL	540 sx
DRILLWATER	810 bbl
DIESEL FUEL	14,000 lts

DRILLS / BOPS	
LAST BOP DRILL	14-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	11

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	24
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 5.3/4" O/S / 4.3/4" Bumper Sub / 4.3/4" type Z jars / 35 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT
RIG : OD & E 30
PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA Iona OBS-1

DATE:	16-Feb-99
REPORT No:	12
D.F.S:	12.0

STATUS @ 2400 HRS: RIH with washover string

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	POOH with fish.
1:00	2:30	1.5	B/O overshot, L/D 5 x 4.3/4" DC's.
2:30	6:00	3.5	M/U 5.3/4" washpipe assembly and RIH to 828m.
6:00	11:00	5	Wash 828 - 835m, washover 835 - 882m.
11:00	11:30	0.5	Circulate hole clean.
11:30	14:30	3	POOH with washpipe.
14:30	15:00	0.5	Pull wear bushing.
15:00	16:30	1.5	M/U 5.3/4" overshot dressed with 4.3/4" grapple and RIH.
16:30	17:00	0.5	Wash, engage fish at 835m.
17:00			Schlumberger hold pre-job Safety meeting. RIH with CCL / stringshot and correlate to 880m.
			Work 1.1/2 lefthand turns to string. Fire stringshot, good surface indication of back-off.
	19:30	2.5	Rotate string to left and release five collars from fish. POOH with Schlumberger and R/D.
19:30	21:00	1.5	POOH with fish.
21:00	21:30	0.5	B/O overshot, L/D 5 x 4.3/4" DC's. T.O.F at 880m
21:30	0:00	2.5	Run Wear bushing. C/O 6" rotary shoe, to tooth type and M/U 5.3/4" washpipe asembly, RIH

Fish in hole: TOF @ 880m (D.Depth) 1 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 880m BOF: 923m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Windy

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS: RIH, W/O string 880-896m, attempt connection, unable to pass 876m, re-work 880-896m
Continue wash over 896-911m

PROGRAM - NEXT 24 HRS: *Washover / mill stabilizer at 913m and string till free.*

TRANSPORTATION	
TRANSPORT-1	KCl
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	17
TOTAL :	39

PROGRAMME COSTS	
DAILY Aus$:	53,443
CUMULATIVE Aus$:	1,468,772
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 073

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — WUGS Western Underground Storage Project

DATE:	17-Feb-99
REPORT No:	13
D.F.S:	13.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 **STATUS @ 2400 HRS:** RIH with overshot.

DEPTH - 2400 HRS:	1,251	m
DEPTH - PREVIOUS:	1,251	m
24 HR PROGRESS:		m
SAFETY MEETINGS:		

FORMATION:	Skull Creek
HOLE SIZE:	6"
ACCIDENTS:	nil

KB - GL (m):	5.33
SHOE DEPTH:	739
LAST CASING:	7"

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.2	50 l Aldacide
VISCOSITY	68	0g EZ MUD
pH	9.5	200kg PAC-R
PV / YP	23/27	110 lb XCD
GELS 0/10	5/6	750 kg KCl
WL API / FC (cc)	4.6	20 kg KOH
SOLIDS %	2.5	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	26,000	50kg Baracor129
KCL (% vol)	3.69	100kg Pac-L
MBT (ppb)	11	500kgBaracarb100
Pm Pm/Mf	0.16/0.2	250kgBaracarb25
TEMP (degC)	37	0kgBaracarb600
HOLE VOL (bbls)	82	275kg Barite
SURFACE VOL (bbls	528	0 g Torq Trim
HOLE LOSSES (bbls)	13	0kg CaCl2
MUD CO	Baroid	50Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS:	110/175/175	110/110/110

INVENTORY	
BARITE	589 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	510 sx
DRILLWATER	700 bbl
DIESEL FUEL	14,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	2000	
GPM	254	
AV (DP - ft/min)	229	
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	14-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	13

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	24
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 5.3/4" O/S / 4.3/4" Bumper Sub / 4.3/4" type Z jars / 35 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — Iona OBS-1 **STATUS @ 2400 HRS:** RIH with overshot.

DATE:	17-Feb-99
REPORT No:	13
D.F.S:	13.0

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	RIH with washover string to 876m.
0:30	3:00	2.5	Wash to TOF at 880m, washover fish 880-896m.
3:00	4:30	1.5	Unable to make connection, held up 876m. L/O single, repeat wash-washover to 896m.
4:30	6:00	1.5	Washover 896-913m, top of 5.7/8" stabilizer blade.
6:00	14:00	8	Mill 15cm (6") of stabilizer blade.
14:00	14:30	0.5	Circulate hole clean.
14:30	16:30	2	POOH with washover assembly.
16:30	19:00	2.5	M/U 5.3/4" O/S with 4.3/4" grapple, RIH.
19:00			Engage fish, work string, grapple releasing. Engage fish, string in tension, lefthand rotation,
	20:00	1	minimal torque, gained 1,000lbs string weight.
20:00	22:00	2	POOH with fishing string.
22:00	23:30	1.5	No fish, L/O overshot. Lip guide partially backed-off, lip damaged and slightly "egg-shaped".
23:00	0:00	0.5	M/U new 5.3/4" O/S with 4.3/4" grapple.

Fish In hole: TOF @ 880m (D.Depth) 1 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 880m BOF: 923m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Wind & rain

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS RIH with overshot, wash, engage fish, verify with pump, p/u, o/s slipping off with 100k, grapple not engaged. POOH, inspect O/S, 6" penetration only. M/U 6" rotary shoe (4.3/4" ID) RIH on w/pipe

PROGRAM - NEXT 24 HRS *Clean top of fish with scalloped shoe, either continue with washover or POOH for O/S*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	17
TOTAL :	39

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 074

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — WUGS Western Underground Storage Project

DATE:	18-Feb-99
REPORT No:	14
D.F.S:	14.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: RIH with 6" shoe and drive sub.

DEPTH - 2400 HRS:	1,251 m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	50 l Aldacide
VISCOSITY	72	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	23/27	55 lb XCD
GELS 0/10	4/6	0 kg KCl
WL API / FC (cc)	5.0	20 kg KOH
SOLIDS %	1.7	0lb Barafibre
SAND %	tr	0 kg Dextrid LT
CHLORIDES	22,500	25kg Baracor129
KCL (% vol)	4.19	0kg Pac-L
MBT (ppb)	8	125kgBaracarb100
Pm Pm/Mf	0.16/0.42	125kgBaracarb25
TEMP (degC)	37	0kgBaracarb600
HOLE VOL (bbls)	82	475kg Barite
SURFACE VOL (bbls	528	0 g Torq Trim
HOLE LOSSES (bbls)	13	0kg CaCl2
MUD CO	Baroid	50Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	2	
SHAKER SCREENS:	110/175/175	110/110/110

INVENTORY	
BARITE	570 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	510 sx
DRILLWATER	760 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	2000	
GPM	254	
AV (DP - ft/min)	229	
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	18-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	14

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	24
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" R.Shoe/ Drive sub / 4.3/4" Bumper Sub / 4.3/4" type Z jars / drain sub / 35 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — Iona OBS-1

DATE:	18-Feb-99
REPORT No:	14
D.F.S:	14.0

STATUS @ 2400 HRS: RIH with 6" shoe and drive sub.

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Continue RIH with 5.3/4" O/S to 710m.
1:00	1:30	0.5	Held BOP drill, slipped 33' drill line, rig service.
1:30			Continue RIH with 5.3/4" O/S to 874m. Break circulation, wash over and attempt to engage
			fish. Set weight on string, P/U, O/S slipped off at 125k. Positive indication with pressure increase
	3:00	1.5	that fish entering O/S. Repeat with same result.
3:00	4:30	1.5	POOH.
4:30			L/O overshot. Indications that fish entered 6" into Lip Guide but not grapple. Suspect damage
	5:00	0.5	to top of fish.
5:00	7:30	2.5	M/U 6" rotary shoe, scalloped type shoe, dressed to ID of 5.7/8". RIH with washpipe to 875m.
7:30	10:30	3	Wash to 880m, dress-off TOF.
10:30	14:30	4	Continue to washover 886-917m. Tight spots at 890, 899, 902 and 906m.
14:30	15:00	0.5	Indications that fish moved 5m down hole. Circulate clean.
15:00	17:00	2	POOH.
17:00	20:00	3	M/U 5.3/4" O/S dressed with 4.3/4" grapple and RIH.
20:00	21:30	1.5	Wash to 885m (confirm fish movement) and attempt to engage fish. Space out kelly and
			rotate down over fish several times, no grapple engagement.
21:30	23:00	1.5	POOH with O/S.
23:00			B/O overshot and inspect. Indications that fish entered grapple, suspect fishing neck smaller
	0:00	1	than 4.3/4". L/O two joints washpipe to access drive sub.

Fish in hole: TOF @ 885m (D.Depth) 1 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 885m BOF: 928m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS M/U 6" scalloped shoe, drive sub and RIH, several attempts to screw into fish. Pull 110k to free string. POOH with FISH, recover fish

PROGRAM - NEXT 24 HRS *Inspect Fish, either clean-out trip or RIH with steerable assembly.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	17
TOTAL :	39

PROGRAMME COSTS	
DAILY Aus$:	53,487
CUMULATIVE Aus$:	1,527,183
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA WUGS Western Underground Storage Project

DATE:	19-Feb-99
REPORT No:	15
D.F.S:	15.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 | STATUS @ 2400 HRS: M/U 6" steerable assembly

DEPTH - 2400 HRS:	1,251	m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	50 l Aldacide
VISCOSITY	76	0g EZ MUD
pH	9.2	75kg PAC-R
PV / YP	23/31	55 lb XCD
GELS 0/10	4/6	0 kg KCl
WL API / FC (cc)	4.0	40 kg KOH
SOLIDS %	2.6	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	23,500	25kg Baracor129
KCL (% vol)	4.32	100kg Pac-L
MBT (ppb)	9	75kgBaracarb100
Pm Pm/Mf	0.22/0.68	550kgBaracarb25
TEMP (degC)	32	225kgBaracarb600
HOLE VOL (bbls)	82	1000kg Barite
SURFACE VOL (bbls	495	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	125Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	2	
SHAKER SCREENS:	110/175/175	110/110/110

INVENTORY	
BARITE	530 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	510 sx
DRILLWATER	770 bbl
DIESEL FUEL	16,500 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	2200	
GPM	306	
AV (DP - ft/min)	278	
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	18-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	15

BIT DATA		
BIT No.	2	3
SIZE (ins)	6"	6"
TYPE	457SRL	STR-O9
IADC CODE	O616	437
SERIAL No.	821355	TO9YE
NOZZLES	4 x 10	3 x 11
OUT (m)	1,251	
IN (m)	744	1,251
DRILLED (m)	507	
HOURS	38.5	
CONDITION	4,CT,A,X,1,BHA	
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	9
6. SURVEY	
7. CIRC / COND	2.5
8. CHANGE BHA	1
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	2
16. FISH / STUCK	9.5
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6"pdc / 5.7/8" NB stab / 4.3/4" DC / 5.3/4" Sstab / 21 HWDP / Jar/15 HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA Iona OBS-1 | STATUS @ 2400 HRS: M/U 6" steerable assembly

DATE:	19-Feb-99
REPORT No:	15
D.F.S:	15.0

FROM	TO	HRS	24 HOUR SUMMARY
0:00	2:00	2	M/U 6" scalloped type rotary shoe, drive sub assembly and RIH TO 886m.
2:00	3:00	1	Several attempts to engage fish, screw in, pull 110k to free string.
3:00	5:00	2	Flow check, pull into shoe, flow check. Continue POOH.
5:00			B/O shoe and drive sub, service break jars. Recover fish and L/O. Pull DWD probe.
	8:00	3	Service motor and L/O.
8:00	9:30	1.5	L/O washpipe and excess 4.3/4" DC's.
9:30	12:30	3	M/U wiper assembly and RIH to 872m.
12:30	14:30	2	Ream 872 - 950m interval. (precautionary)
14:30	15:00	0.5	RIH to 1248m, wash to 1251m.
15:00	16:30	1.5	Circulate, dump rat hole mud. Circulate and condition mud.
16:30	17:30	1	POOH to 959m.
17:30	18:30	1	Work string and circulate clean.
18:30	20:00	1.5	Pump pill and POOH to 353m with flow checks.
20:00	21:30	1.5	RIH with 6 stands excess pipe and L/O same.
21:30	23:00	1.5	Continue POOH and L/O wiper assembly.
23:00	0:00	1	
			P/U Sperry motor, C/O sleeve stab for slick protector, M/U bit.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Fine/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
	475-109	4.3/4"motor
	2993	5.3/4" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
	64085	4.3/4" HOS
	A-278	4.3/4"NMFDC
	1447-1026	Dailey Jars

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS Continue m/u steerable assembly, instal probe, allign motor, function motor, DWD. RIH, hole OK
Take checkshot. Drill from 1251-1275m. Sliding 10mph, rotary 20mph.

PROGRAM - NEXT 24 HRS *Drill to coring point, strap out, M/U core barrel*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 076

908918 077

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — WUGS Western Underground Storage Project

DATE:	20-Feb-99
REPORT No:	16
D.F.S:	16.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: Drill 6" hole at 1426m

DEPTH - 2400 HRS:	1,426 m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	175 m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	Toolbox				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	50 l Aldacide
VISCOSITY	131	0g EZ MUD
pH	9.0	100kg PAC-R
PV / YP	33/62	0 lb XCD
GELS 0/10	8/10	250 kg KCl
WL API / FC (cc)	3.4	40 kg KOH
SOLIDS %	1.7	0lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	21,500	25kg Baracor129
KCL (% vol)	4.17	200kg Pac-L
MBT (ppb)	8	250kgBaracarb100
Pm Pm/Mf	.18/.46	500kgBaracarb25
TEMP (degC)	42	100kgBaracarb600
HOLE VOL (bbls)	82	500kg Barite
SURFACE VOL (bbls	420	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	25Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/21	
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	95	
PRESSURE	2400	
GPM	227	
AV (DP - ft/min)	205	
AV (DC - ft/min)		
SPR	40 - 60	40 - 60
SPR PRESS	1100/1440	1080/1420

INVENTORY	
BARITE	510 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	500 sx
DRILLWATER	470 bbl
DIESEL FUEL	16,500 lts

DRILLS / BOPS	
LAST BOP DRILL	18-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	16

BIT DATA		
BIT No.	2	3
SIZE (ins)	6"	6"
TYPE	457SRL	STR-O9
IADC CODE	O616	437
SERIAL No.	821355	TO9YE
NOZZLES	4 x 10	3 x 11
OUT (m)	1,251	1,426
IN (m)	744	1,251
DRILLED (m)	507	175
HOURS	38.5	18
CONDITION	,4,CT,A,X,1,BHA	
AVG ROP (m/hr)		9.70
WOB (x1000 lbs)		5 to 10
RPM		70/200
JET VEL (ft/sec)		261
HHP @ BIT		72.7

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg	Azimuth
1259.1/1099.48	20.10	126.9
1288.2/1127.06	17.00	128.9
1317.2/1155.06	13.20	132.3
1345.5/1182.74	10.80	133.9
1374.6/1211.32	10.90	127.7
1403.6/1239.8	10.70	126

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	11.4

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	18
4. BIT TRIP	3
5. WIPER TRIP	
6. SURVEY	1.5
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	1.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" bit/ 4.3/4"Sperry Drill / 5.3/4"Sstab / 4.3/4" Float sub / 4.3/4" NM Flex DC
4.3/4" DWD HOS / 4.3/4" NM Flex DC / 21 x HWDP / Dailey Jar / 15 x HWDP

BHA WEIGHT :	25,000 lbs	STRING WT.:	63,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	138,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	8,000 lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: Drill 6" hole at 1426m.

DATE:	20-Feb-99
REPORT No:	16
D.F.S:	16.0

FROM	TO		24 HOUR SUMMARY
0:00	3:00	3	Align motor with DWD, RIH with HWDP, function test DWD, OK. RIH to 1241m.
3:00	3:30	0.5	P/U kelly and wash to 1251m.
3:30	0:00	20.5	Drill 6" hole in rotary mode with occasional corrections in slide mode. Ream each connection and survey. Take SCR's.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
20.5	475-109	4.3/4"motor
	2993	5.3/4" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
24	64085	4.3/4" HOS
	A-278	4.3/4"NMFDC
20.5	1447-1026	Dailey Jars

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast:

OPERATION TO 0600 HRS: Drill ahead 1426 - 1458m in rotary mode with occasional slide to correct inclination, azimuth.

PROGRAM - NEXT 24 HRS: *Drill to coring point, strap out, M/U core barrel*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	13
TOTAL :	35

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

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TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	21-Feb-99
REPORT No:	17
D.F.S:	17.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: L/O steerable assembly

DEPTH - 2400 HRS:	1,509 m	FORMATION:	Skull Creek	KB - GL (m):	5.33		
DEPTH - PREVIOUS:	1,426 m	HOLE SIZE:	6"	SHOE DEPTH:	739		
24 HR PROGRESS:	83 m	ACCIDENTS:	nil	LAST CASING:	7"		
SAFETY MEETINGS:	2 x Toolbox						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	25 l Aldacide
VISCOSITY	125	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	35/48	0 lb XCD
GELS 0/10	6/8	0 kg KCl
WL API / FC (cc)	3.6	20 kg KOH
SOLIDS %	1.9	0lb Barafibre
SAND %	2	0 kg Dextrid LT
CHLORIDES	18,500	50kg Baracor129
KCL (% vol)	4.10	0kg Pac-L
MBT (ppb)	12	250kgBaracarb100
Pm Pm/Mf	.28/.5	0kgBaracarb25
TEMP (degC)	41	0kgBaracarb600
HOLE VOL (bbls)		500kg Barite
SURFACE VOL (bbls	434	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	100Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	25kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	1	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/21	
SHAKER SCREENS:	110/175/175	110/110/110

INVENTORY	
BARITE	490 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	500 sx
DRILLWATER	670 bbl
DIESEL FUEL	16,250 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	90	
PRESSURE	2400	
GPM	216	
AV (DP - ft/min)	194	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

DRILLS / BOPS	
LAST BOP DRILL	21-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	17

BIT DATA		
BIT No.	2	3
SIZE (ins)	6"	6"
TYPE	457SRL	STR-O9
IADC CODE	O616	437
SERIAL No.	821355	TO9YE
NOZZLES	4 x 10	3 x 11
OUT (m)	1,251	1,509
IN (m)	744	1,251
DRILLED (m)	507	258
HOURS	38.5	29
CONDITION	,4,CT,A,X,1,BH	2,2ER,A,E,1,WT,CP
AVG ROP (m/hr)		8.90
WOB (x1000 lbs)		10 to 15
RPM		70/200
JET VEL (ft/sec)		261
HHP @ BIT		72.7

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg	Azimuth
1432.68/1268.49	8.10	131.3
1471.3/1306.92	3.30	98.4
1486.4/1322	2.40	84.2
1509.4/1344.98	2.40	84.2

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	10.9

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	11
4. BIT TRIP	4
5. WIPER TRIP	
6. SURVEY	1
7. CIRC / COND	7
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	1
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" bit/ 4.3/4"Sperry Drill / 5.3/4"Sstab / 4.3/4" Float sub / 4.3/4" NM Flex DC / 4.3/4" DWD HOS / 4.3/4" NM Flex DC / 21 x HWDP / Dailey Jar / 15 x HWDP

BHA WEIGHT :	25,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	21-Feb-99
REPORT No:	17
D.F.S:	17.0

Iona OBS-1 — STATUS @ 2400 HRS: L/O steerable assembly

FROM	TO		24 HOUR SUMMARY
0:00			Drill 6" hole with steerable assembly in rotary and slide mode 1426 - 1493m. Ream each
	10:30	10.5	connection, take surveys.
10:30	11:30	1	Circulate for samples.
11:30	12:00	0.5	Drill 6" hole 1493 - 1494m.
12:00	12:30	0.5	Circulate for samples.
12:30	13:00	0.5	Drill 6" hole 1494 - 1497m.
13:00	13:30	0.5	Circulate for samples.
13:30	14:00	0.5	Drill 6" hole 1497 - 1502m.
14:00	15:00	1	Circulate for samples.
15:00	15:30	0.5	Drill 1502 - 1504m
15:30	16:00	0.5	Circulate for samples.
16:00	16:30	0.5	Drill 1504 - 1509m.
16:30	17:00	0.5	Circulate for samples.
17:00	17:30	0.5	POOH to 1437m, pulling tight.
17:30	19:00	1.5	Circulate hole clean while reciprocating and rotating string.
19:00	19:30	0.5	Pull to 1410m, 25k O/P and swabbing.
19:30	20:00	0.5	Circulate clean.
20:00	20:30	0.5	POOH from 1410 - 1241m.
20:30	21:00	0.5	Precautionary circulation.
21:00	21:30	0.5	POOH 1241 - 918m, OK
21:30	22:00	0.5	Precautionary circulation.
22:00	24:00:00	2.0	Continue POOH to 228m (flow check at shoe)

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
40.5	475-109	4.3/4"motor
	2993	5.3/4" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
48	64085	4.3/4" HOS
	A-278	4.3/4"NMFDC
40.5	1447-1026	Dailey Jars

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast:

OPERATION TO 0600 HRS Service and L/O steerable assembly. Pre-job safety meeting, P/U 18m Core Barrel & RIH to shoe. Slip and cut Drill Line. Continue RIH.

PROGRAM - NEXT 24 HRS *RIH wash to bottom, circulate, drop ball and core 18m, POOH.*

TRANSPORTATION	
TRANSPORT-1	Sperry Sun
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	22-Feb-99
REPORT No:	18
D.F.S:	18.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: RIH with Core Barrel

DEPTH - 2400 HRS:	1,527 m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,509 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	18 m	ACCIDENTS:	nil	LAST CASING:	7"

SAFETY MEETINGS: Toolbox, Pre-coring Safety,

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	84	0g EZ MUD
pH	9.5	200kg PAC-R
PV / YP	28/31	0 lb XCD
GELS 0/10	4/5	1250 kg KCl
WL API / FC (cc)	4.7	40 kg KOH
SOLIDS %	2.7	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	22,000	25kg Baracor129
KCL (% vol)	2.98	250kg Pac-L
MBT (ppb)	12	250kgBaracarb100
Pm Pm/Mf	.22/.4	0kgBaracarb25
TEMP (degC)	41	0kgBaracarb600
HOLE VOL (bbls)		250kg Barite
SURFACE VOL (bbls	425	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	50kg Baracide

SOLIDS CONTROL UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	54	
PRESSURE	1150	
GPM	129	
AV (DP - ft/min)	117	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

INVENTORY	
BARITE	480 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	450 sx
DRILLWATER	470 bbl
DIESEL FUEL	16,500 lts

DRILLS / BOPS	
LAST BOP DRILL	21-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	18

BIT DATA		
BIT No.	3	4
SIZE (ins)	6"	6 x 2.9/16"
TYPE	STR-O9	CM366F
IADC CODE	437	
SERIAL No.	TO9YE	2087
NOZZLES	3 x 11	
OUT (m)	1,509	1,527
IN (m)	1,251	1,509
DRILLED (m)	258	18
HOURS	29	3
CONDITION	2ER,A,E,1,WT,CP	
AVG ROP (m/hr)	8.90	6.00
WOB (x1000 lbs)	10 to 15	5
RPM	70/200	60
JET VEL (ft/sec)	261	
HHP @ BIT	72.7	

SURVEYS DEPTHS MD/ (TVD)	Inc (deg	Azimuth
1432.68/1268.49	8.10	131.3
1471.3/1306.92	3.30	98.4
1486.4/1322	2.40	84.2
1509.4/1344.98	2.40	84.2

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	10.9

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	11
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	1.5
8. CHANGE BHA	1.5
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	5.5
14. LOGGING	
15. REAM / WASH	3
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	0.5
30. SLIP & CUT LINE	1
TOTAL	24

BHA.: 4.3/4 x 18m Core Barrel / 21 x HWDP / Dailey Jar / 15 x HWDP

BHA WEIGHT :	24,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	22-Feb-99
REPORT No:	18
D.F.S:	. 18.0

Iona OBS-1 — STATUS @ 2400 HRS: RIH with Core Barrel

FROM	TO		24 HOUR SUMMARY
0:00	1:30	1.5	Continue POOH. L/O steerable assembly. Recover DWD probe. Service motor.
1:30	3:00	1.5	Held pre-job Safety Meeting. M/U 4.3/4" x 2.9/16" x 18m Core Barrel assembly.
3:00	4:30	1.5	RIH to 735m.
4:30	5:30	1	Slip 33' and cut 103' Drill Line.
5:30	6:00	0.5	Rig Service.
6:00	7:30	1.5	RIH, held up at 1382m.
7:30	10:30	3	Break circulation, wash / ream 1382 - 1421m.
10:30	11:30	1	Continue RIH to 1488m, wash ream to 1509m.
11:30	12:00	0.5	Circulate 'bottoms-up'.
12:00	12:30	0.5	Drop ball, monitor and record pressures.
12:30	15:30	3	Cut core #1 1509 -1527m.
15:30	16:00	0.5	Circulate for samples.
16:00	19:30	3.5	POOH with flow checks.
19:30	21:00	1.5	Recover core #1, 6m = 30% recovery.
21:00	22:00	1	Dress Core Barrel.
22:00	0:00	2	RIH.

DOWNHOLE TOOLS Hours	Serial No.	Tool
49	1447-1026	Dailey Jars

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/warm

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast: 1432m
Waarre D :

OPERATION TO 0600 HRS: Continue RIH, wash 20m to bottom, circulate B's/U. Space-out. Drop ball. Cut core #2 1527 - 1538m
Little progress, suspect core jammed at 1537m. Flowcheck, POOH.

PROGRAM - NEXT 24 HRS: *POOH, recover core #2. L/O Core Barrel. RIH, drill to T.D.*

TRANSPORTATION	
TRANSPORT-1	washpipe/ tristate to Sale
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	23-Feb-99
REPORT No:	19
D.F.S:	19.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 | STATUS @ 2400 HRS: R/U Schlumberger

DEPTH - 2400 HRS:	1,568 m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,527 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	41 m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	Toolbox, Pre-coring Safety,				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	126	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	34/50	0 lb XCD
GELS 0/10	6/6	0 kg KCl
WL API / FC (cc)	3.3	40 kg KOH
SOLIDS %	2.9	0lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	18,500	50kg Baracor129
KCL (% vol)	3.79	200kg Pac-L
MBT (ppb)	11	0kgBaracarb100
Pm Pm/Mf	.2/.35	0kgBaracarb25
TEMP (degC)	42	0kgBaracarb600
HOLE VOL (bbls)	180	1600kg Barite
SURFACE VOL (bbls	470	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	50kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS:	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	54	
PRESSURE	1150	
GPM	129	
AV (DP - ft/min)	117	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

INVENTORY	
BARITE	416 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	450 sx
DRILLWATER	470 bbl
DIESEL FUEL	16,500 lts

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	19

BIT DATA		
BIT No.	4	RR3
SIZE (ins)	6 x 2.9/16"	6
TYPE	CM366F	STR-09
IADC CODE		437
SERIAL No.	2087	TO9YE
NOZZLES		3 x 11
OUT (m)	1,538	1,568
IN (m)	1,509	1,538
DRILLED (m)	29	30
HOURS	5.5	3.5
CONDITION		
AVG ROP (m/hr)	6.00	8.60
WOB (x1000 lbs)	5	
RPM	60	
JET VEL (ft/sec)	261	
HHP @ BIT	72.7	

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
1432.68/1268.49	8.10	131.3
1471.3/1306.92	3.30	98.4
1486.4/1322	2.40	84.2
1509.4/1344.98	2.40	84.2

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	11.1

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	3.5
4. BIT TRIP	10.5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	2
8. CHANGE BHA	1
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	5
14. LOGGING	0.5
15. REAM / WASH	1
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	0.5
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 4.3/4 x 18m Core Barrel / 21 x HWDP / Dailey Jar / 15 x HWDP

bit/5.7/8 NBstab/4.3/4" DC/5.3/4" Sstab/21 x HWDP Dailey Jar /15 x HWDP

BHA WEIGHT :	24,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ../2

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	23-Feb-99
REPORT No:	19
D.F.S:	19.0

Iona OBS-1 | STATUS @ 2400 HRS: R/U Schlumberger

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Continue RIH with Core Barrel to 1508m.
1:00	1:30	0.5	Wash / ream 1508 - 1527m.
1:30	2:00	0.5	Circulate hole at 260 gpm.
2:00	2:30	0.5	Space out and drop ball.
2:30	5:00	2.5	Cut core #2 1527 - 1538m. Little or no progress from 1537m, suspect core jammed.
5:00	7:00	2	Flow check. POOH to 707m.
7:00	7:30	0.5	Rig Service.
7:30	9:00	1.5	Continue POOH to surface.
9:00	11:00	2	Recover core #2. 6.8m recovery: = 62%. L/O Core barrel.
11:00	11:30	0.5	M/U 6" rotary assembly.
11:30	14:00	2.5	RIH to 1509m.
14:00	14:30	0.5	Wash / ream 1509 - 1538m.
14:30	18:00	3.5	Drill 6" hole 1538 - 1568m.
18:00	19:30	1.5	Circulate hole clean while reciprocating and rotating string. Drop Totco.
19:30	23:00	3.5	POOH, 25 - 30k O/P 1528 - 1490m interval. Wipe interval clean, OK. Continue POOH to shoe.
23:00	23:30	0.5	L/O bit, NB stab, DC and S.stab.
23:30	0:00	0.5	R/U Schlumberger.
			NB: #1 log shows Volcanic Tuff / Ash (Bentonitic) at 912 - 913m. (stabilizer in stuck string @
			918m) Cautionary note for future wells.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Fine/warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
58	1447-1026	Dailey Jars

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast: 1432m

Waarre D :

OPERATION TO 0600 HRS: R/U Schlumberger, #1 DSI/GR, Log down/up (Schlum TD: 1563m) L/O. M/U HALS/PEX

Hole took 3bbls in 4hrs of logging

PROGRAM - NEXT 24 HRS: *Complete logging, RIH, circ condition, POOH L/O drill string.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	18
TOTAL :	40

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 080

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — WUGS Western Underground Storage Project

DATE:	24-Feb-99
REPORT No:	20
D.F.S:	20.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: L/O drill string

DEPTH - 2400 HRS:	1,568 m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"

SAFETY MEETINGS: Weekly Safety Meeting, Schlumberger pre-job.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	137	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	38/44	0 lb XCD
GELS 0/10	6/6	0 kg KCl
WL API / FC (cc)	4.2	0 kg KOH
SOLIDS %	3.0	0lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	18,000	0kg Baracor129
KCL (% vol)	3.60	0kg Pac-L
MBT (ppb)	11	0kgBaracarb100
Pm Pm/Mf	.2/.35	0kgBaracarb25
TEMP (degC)	35	0kgBaracarb600
HOLE VOL (bbls)	180	1600kg Barite
SURFACE VOL (bbls	460	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	54	
PRESSURE	1150	
GPM	129	
AV (DP - ft/min)	117	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

INVENTORY	
BARITE	352 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	450 sx
DRILLWATER	780 bbl
DIESEL FUEL	12,000 lts

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	20

BIT DATA		
BIT No.	RR3	
SIZE (ins)	6	
TYPE	STR-09	
IADC CODE	437	
SERIAL No.	TO9YE	
NOZZLES	open	
OUT (m)		
IN (m)		
DRILLED (m)		
HOURS		
CONDITION	33ERAE1WTTD	
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	10.9

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	2
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	16.5
15. REAM / WASH	0.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: bit/bit sub/ 4.3/4" DC/ 21 x HWDP Dailey Jar / 15 x HWDP

BHA WEIGHT :	24,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: L/O drill string

DATE:	24-Feb-99
REPORT No:	20
D.F.S:	20.0

FROM	TO	HRS	24 HOUR SUMMARY
0:00	4:30	4.5	Schlumberger continue with log #1, DSI/GR, log down / up.
4:30	6:30	2	L/D DSI. Held safety meeting: Schlumberger on handling Radioactive Sources. M/U HALS/PEX
6:30	9:00	2.5	RIH, log #2 HALS/PEX
9:00	11:00	2	L/O HALS/PEX, M/U Siesmic tool.
11:00	16:00	5	RIH log #3 and take siesmic checkshots.
16:00	16:30	0.5	R/D Schlumberger. (hole taking 0.5 bbl/hr during logging)
16:30	19:00	2.5	M/U bit and DC. RIH to 1558m.
19:00	19:30	0.5	Wash 1558 - 1568m.
19:30	21:30	2	Circulate and condition mud while reciprocating and rotating string.
21:30	22:00	0.5	Pump slug and drop Totco.
21:30	0:00	2.5	POOH laying down tubulars.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Cloudy/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : From Logs: D sand: 1495-1508m C1 1508-1512m C2 1517-1536m

OPERATION TO 0600 HRS: Continue L/O tubulars. Break kelly connections at 660m. Continue L/O.

PROGRAM - NEXT 24 HRS: *Run and cement 4.1/2" csg.*

TRANSPORTATION	
TRANSPORT-1	backload Sperry equip. W.A.
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	6
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 081

908918 082

DAILY DRILLING REPORT

TUAUSTRALIA

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	18-Feb-99
REPORT No:	14
D.F.S:	14.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: RIH with 6" shoe and drive sub.

DEPTH - 2400 HRS:	1,251 m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	50 l Aldacide
VISCOSITY	72	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	23/27	55 lb XCD
GELS 0/10	4/6	0 kg KCl
WL API / FC (cc)	5.0	20 kg KOH
SOLIDS %	1.7	0lb Barafibre
SAND %	tr	0 kg Dextrid LT
CHLORIDES	22,500	25kg Baracor129
KCL (% vol)	4.19	0kg Pac-L
MBT (ppb)	8	125kgBaracarb100
Pm Pm/Mf	0.16/0.42	125kgBaracarb25
TEMP (degC)	37	0kgBaracarb600
HOLE VOL (bbls)	82	475kg Barite
SURFACE VOL (bbls	528	0 g Torq Trim
HOLE LOSSES (bbls)	13	0kg CaCl2
MUD CO	Baroid	50Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	2	
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	570 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	510 sx
DRILLWATER	760 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	2000	
GPM	254	
AV (DP - ft/min)	229	
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	18-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	14

BIT DATA		
BIT No.	2	
SIZE (ins)	6"	
TYPE	457SRL	
IADC CODE	O616	
SERIAL No.	821355	
NOZZLES	4 x 10	
OUT (m)	1,251	
IN (m)	744	
DRILLED (m)	507	
HOURS	38.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	24
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" R.Shoe/ Drive sub / 4.3/4" Bumper Sub / 4.3/4" type Z jars / drain sub / 35 x 3.1/2" HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

TUAUSTRALIA Iona OBS-1

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	18-Feb-99
REPORT No:	14
D.F.S:	14.0

STATUS @ 2400 HRS: RIH with 6" shoe and drive sub.

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Continue RIH with 5.3/4" O/S to 710m.
1:00	1:30	0.5	Held BOP drill, slipped 33' drill line, rig service.
1:30			Continue RIH with 5.3/4" O/S to 874m. Break circulation, wash over and attempt to engage
			fish. Set weight on string, P/U, O/S slipped off at 125k. Positive indication with pressure increase
	3:00	1.5	that fish entering O/S. Repeat with same result.
3:00	4:30	1.5	POOH.
4:30			L/O overshot. Indications that fish entered 6" into Lip Guide but not grapple. Suspect damage
	5:00	0.5	to top of fish.
5:00	7:30	2.5	M/U 6" rotary shoe, scalloped type shoe, dressed to ID of 5.7/8". RIH with washpipe to 875m.
7:30	10:30	3	Wash to 880m, dress-off TOF.
10:30	14:30	4	Continue to washover 886-917m. Tight spots at 890, 899, 902 and 906m.
14:30	15:00	0.5	Indications that fish moved 5m down hole. Circulate clean.
15:00	17:00	2	POOH.
17:00	20:00	3	M/U 5.3/4" O/S dressed with 4.3/4" grapple and RIH.
20:00	21:30	1.5	Wash to 885m (confirm fish movement) and attempt to engage fish. Space out kelly and
			rotate down over fish several times, no grapple engagement.
21:30	23:00	1.5	POOH with O/S.
23:00			B/O overshot and inspect. Indications that fish entered grapple, suspect fishing neck smaller
	0:00	1	than 4.3/4". L/O two joints washpipe to access drive sub.

Fish in hole: TOF @ 885m (D.Depth) 1 x 4.3/4" DC
4.3/4" NM flex DC / 4.3/4" DWD HOS / 4.3/4" NM flex DC
4.3/4" Float sub / 5.7/8" S.stab / 4.3/4" Sperry Drill / 6" bit.
TOF: 885m BOF: 928m.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
37.5	475-109	4.3/4"motor
	7089601	5.7/8" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
65	A-180	4.3/4" HOS
	A-278	4.3/4"NMFDC

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS: M/U 6" scalloped shoe, drive sub and RIH, several attempts to screw into fish. Pull 110k to free string. POOH with FISH, recover fish

PROGRAM - NEXT 24 HRS: *Inspect Fish, either clean-out trip or RIH with steerable assembly.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	17
TOTAL :	39

PROGRAMME COSTS	
DAILY Aus$:	53,487
CUMULATIVE Aus$:	1,527,183
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA WUGS Western Underground Storage Project

DATE:	19-Feb-99
REPORT No:	15
D.F.S:	15.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 STATUS @ 2400 HRS: M/U 6" steerable assembly

DEPTH - 2400 HRS:	1,251 m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	50 l Aldacide
VISCOSITY	76	0g EZ MUD
pH	9.2	75kg PAC-R
PV / YP	23/31	55 lb XCD
GELS 0/10	4/6	0 kg KCl
WL API / FC (cc)	4.0	40 kg KOH
SOLIDS %	2.6	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	23,500	25kg Baracor129
KCL (% vol)	4.32	100kg Pac-L
MBT (ppb)	9	75kgBaracarb100
Pm Pm/Mf	0.22/0.68	550kgBaracarb25
TEMP (degC)	32	225kgBaracarb600
HOLE VOL (bbls)	82	1000kg Barite
SURFACE VOL (bbls	495	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	125Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	2	
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	530 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	510 sx
DRILLWATER	770 bbl
DIESEL FUEL	16,500 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE	2200	
GPM	306	
AV (DP - ft/min)	278	
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	18-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	15

BIT DATA		
BIT No.	2	3
SIZE (ins)	6"	6"
TYPE	457SRL	STR-O9
IADC CODE	O616	437
SERIAL No.	821355	TO9YE
NOZZLES	4 x 10	3 x 11
OUT (m)	1,251	
IN (m)	744	1,251
DRILLED (m)	507	
HOURS	38.5	
CONDITION	,4,CT,A,X,1,BHA	
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.8/10

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	9
6. SURVEY	
7. CIRC / COND	2.5
8. CHANGE BHA	1
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	2
16. FISH / STUCK	9.5
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6"pdc / 5.7/8" NB stab / 4.3/4" DC / 5.3/4" Sstab / 21 HWDP / Jar/15 HWDP

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA Iona OBS-1 STATUS @ 2400 HRS: M/U 6" steerable assembly

DATE:	19-Feb-99
REPORT No:	15
D.F.S:	15.0

FROM	TO		24 HOUR SUMMARY
0:00	2:00	2	M/U 6" scalloped type rotary shoe, drive sub assembly and RIH TO 886m.
2:00	3:00	1	Several attempts to engage fish, screw in, pull 110k to free string.
3:00	5:00	2	Flow check, pull into shoe, flow check. Continue POOH.
5:00			B/O shoe and drive sub, service break jars. Recover fish and L/O. Pull DWD probe.
	8:00	3	Service motor and L/O.
8:00	9:30	1.5	L/O washpipe and excess 4.3/4" DC's.
9:30	12:30	3	M/U wiper assembly and RIH to 872m.
12:30	14:30	2	Ream 872 - 950m interval. (precautionary)
14:30	15:00	0.5	RIH to 1248m, wash to 1251m.
15:00	16:30	1.5	Circulate, dump rat hole mud. Circulate and condition mud.
16:30	17:30	1	POOH to 959m.
17:30	18:30	1	Work string and circulate clean.
18:30	20:00	1.5	Pump pill and POOH to 353m with flow checks.
20:00	21:30	1.5	RIH with 6 stands excess pipe and L/O same.
21:30	23:00	1.5	Continue POOH and L/O wiper assembly.
23:00	0:00	1	
			P/U Sperry motor, C/O sleeve stab for slick protector, M/U bit.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Fine/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
	475-109	4.3/4"motor
	2993	5.3/4" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
	64085	4.3/4" HOS
	A-278	4.3/4"NMFDC
	1447-1026	Dailey Jars

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m

OPERATION TO 0600 HRS Continue m/u steerable assembly, instal probe, allign motor, function motor, DWD. RIH, hole OK
Take checkshot. Drill from 1251-1275m. Sliding 10mph, rotary 20mph.

PROGRAM - NEXT 24 HRS *Drill to coring point, strap out, M/U core barrel*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

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908918 084

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	20-Feb-99
REPORT No:	16
D.F.S:	16.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: Drill 6" hole at 1426m

DEPTH - 2400 HRS:	1,426	m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,251	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	175	m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	Toolbox					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	50 l Aldacide
VISCOSITY	131	0g EZ MUD
pH	9.0	100kg PAC-R
PV / YP	33/62	0 lb XCD
GELS 0/10	8/10	250 kg KCl
WL API / FC (cc)	3.4	40 kg KOH
SOLIDS %	1.7	0lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	21,500	25kg Baracor129
KCL (% vol)	4.17	200kg Pac-L
MBT (ppb)	8	250kgBaracarb100
Pm Pm/Mf	.18/.46	500kgBaracarb25
TEMP (degC)	42	100kgBaracarb600
HOLE VOL (bbls)	82	500kg Barite
SURFACE VOL (bbls	420	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	25Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/21	
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	510 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	500 sx
DRILLWATER	470 bbl
DIESEL FUEL	16,500 lts

PUMPS	No. 1	No. 2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	95	
PRESSURE	2400	
GPM	227	
AV (DP - ft/min)	205	
AV (DC - ft/min)		
SPR	40 - 60	40 - 60
SPR PRESS	1100/1440	1080/1420

DRILLS / BOPS	
LAST BOP DRILL	18-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	16

BIT DATA		
BIT No.	2	3
SIZE (ins)	6"	6"
TYPE	457SRL	STR-O9
IADC CODE	O616	437
SERIAL No.	821355	TO9YE
NOZZLES	4 x 10	3 x 11
OUT (m)	1,251	1,426
IN (m)	744	1,251
DRILLED (m)	507	175
HOURS	38.5	18
CONDITION	,4,CT,A,X,1,BHA	
AVG ROP (m/hr)		9.70
WOB (x1000 lbs)		5 to 10
RPM		70/200
JET VEL (ft/sec)		261
HHP @ BIT		72.7

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
1259.1/1099.48	20.10	126.9
1288.2/1127.06	17.00	128.9
1317.2/1155.06	13.20	132.3
1345.5/1182.74	10.80	133.9
1374.6/1211.32	10.90	127.7
1403.6/1239.8	10.70	126

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	11.4

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	18
4. BIT TRIP	3
5. WIPER TRIP	
6. SURVEY	1.5
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	1.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" bit/ 4.3/4"Sperry Drill / 5.3/4"Sstab / 4.3/4" Float sub / 4.3/4" NM Flex DC
4.3/4" DWD HOS / 4.3/4" NM Flex DC / 21 x HWDP / Dailey Jar / 15 x HWDP

BHA WEIGHT :	25,000 lbs	STRING WT.:	63,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	138,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	8,000 lbs

CONTINUED ../2

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	20-Feb-99
REPORT No:	16
D.F.S:	16.0

Iona OBS-1

STATUS @ 2400 HRS: Drill 6" hole at 1426m.

FROM	TO	HRS	24 HOUR SUMMARY
0:00	3:00	3	Align motor with DWD, RIH with HWDP, function test DWD, OK. RIH to 1241m.
3:00	3:30	0.5	P/U kelly and wash to 1251m,
3:30	0:00	20.5	Drill 6" hole in rotary mode with occasional corrections in slide mode. Ream each connection and survey. Take SCR's.

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
20.5	475-109	4.3/4"motor
	2993	5.3/4" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
24	64085	4.3/4" HOS
	A-278	4.3/4"NMFDC
20.5	1447-1026	Dailey Jars

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast:

OPERATION TO 0600 HRS Drill ahead 1426 - 1458m in rotary mode with occasional slide to correct inclination, azimuth.

PROGRAM - NEXT 24 HRS *Drill to coring point, strap out, M/U core barrel*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	13
TOTAL :	35

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — WUGS Western Underground Storage Project

DATE:	21-Feb-99
REPORT No:	17
D.F.S:	17.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: L/O steerable assembly

DEPTH - 2400 HRS:	1,509	m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,426	m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	83	m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	2 x Toolbox					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	25 l Aldacide
VISCOSITY	125	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	35/48	0 lb XCD
GELS 0/10	6/8	0 kg KCl
WL API / FC (cc)	3.6	20 kg KOH
SOLIDS %	1.9	0lb Barafibre
SAND %	2	0 kg Dextrid LT
CHLORIDES	18,500	50kg Baracor129
KCL (% vol)	4.10	0kg Pac-L
MBT (ppb)	12	250kgBaracarb100
Pm Pm/Mf	.28/.5	0kgBaracarb25
TEMP (degC)	41	0kgBaracarb600
HOLE VOL (bbls)		500kg Barite
SURFACE VOL (bbls	434	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	100Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	25kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	1	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/21	
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	490 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	500 sx
DRILLWATER	670 bbl
DIESEL FUEL	16,250 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	90	
PRESSURE	2400	
GPM	216	
AV (DP - ft/min)	194	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

DRILLS / BOPS	
LAST BOP DRILL	21-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	17

BIT DATA		
BIT No.	2	3
SIZE (ins)	6"	6"
TYPE	457SRL	STR-O9
IADC CODE	O616	437
SERIAL No.	821355	TO9YE
NOZZLES	4 x 10	3 x 11
OUT (m)	1,251	1,509
IN (m)	744	1,251
DRILLED (m)	507	258
HOURS	38.5	29
CONDITION	.4,CT,A,X,1,BH	2,2ER,A,E,1,WT,CP
AVG ROP (m/hr)		8.90
WOB (x1000 lbs)		10 to 15
RPM		70/200
JET VEL (ft/sec)		261
HHP @ BIT		72.7

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg	Azimuth
1432.68/1268.49	8.10	131.3
1471.3/1306.92	3.30	98.4
1486.4/1322	2.40	84.2
1509.4/1344.98	2.40	84.2

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	10.9

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	11
4. BIT TRIP	4
5. WIPER TRIP	
6. SURVEY	1
7. CIRC / COND	7
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	1
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 6" bit/ 4.3/4"Sperry Drill / 5.3/4"Sstab / 4.3/4" Float sub / 4.3/4" NM Flex DC
4.3/4" DWD HOS / 4.3/4" NM Flex DC / 21 x HWDP / Dailey Jar / 15 x HWDP

BHA WEIGHT :	25,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: L/O steerable assembly

DATE:	21-Feb-99
REPORT No:	17
D.F.S:	17.0

FROM	TO	HRS	24 HOUR SUMMARY
0:00			Drill 6" hole with steerable assembly in rotary and slide mode 1426 - 1493m. Ream each
	10:30	10.5	connection, take surveys.
10:30	11:30	1	Circulate for samples.
11:30	12:00	0.5	Drill 6" hole 1493 - 1494m.
12:00	12:30	0.5	Circulate for samples.
12:30	13:00	0.5	Drill 6" hole 1494 - 1497m.
13:00	13:30	0.5	Circulate for samples.
13:30	14:00	0.5	Drill 6" hole 1497 - 1502m.
14:00	15:00	1	Circulate for samples.
15:00	15:30	0.5	Drill 1502 - 1504m
15:30	16:00	0.5	Circulate for samples.
16:00	16:30	0.5	Drill 1504 - 1509m.
16:30	17:00	0.5	Circulate for samples.
17:00	17:30	0.5	POOH to 1437m, pulling tight.
17:30	19:00	1.5	Circulate hole clean while reciprocating and rotating string.
19:00	19:30	0.5	Pull to 1410m, 25k O/P and swabbing.
19:30	20:00	0.5	Circulate clean.
20:00	20:30	0.5	POOH from 1410 - 1241m.
20:30	21:00	0.5	Precautionary circulation.
21:00	21:30	0.5	POOH 1241 - 918m, OK
21:30	22:00	0.5	Precautionary circulation.
22:00	24:00:00	2.0	Continue POOH to 228m (flow check at shoe)

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
40.5	475-109	4.3/4"motor
	2993	5.3/4" stab
	2949	4.3/4" float
	a-191	4.3/4"NMDC
48	64085	4.3/4" HOS
	A-278	4.3/4"NMFDC
40.5	1447-1026	Dailey Jars

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast:

OPERATION TO 0600 HRS: Service and L/O steerable assembly. Pre-job safety meeting, P/U 18m Core Barrel & RIH to shoe. Slip and cut Drill Line. Continue RIH.

PROGRAM - NEXT 24 HRS: *RIH wash to bottom, circulate, drop ball and core 18m, POOH.*

TRANSPORTATION	
TRANSPORT-1	Sperry Sun
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10 hrs
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 085

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

WUGS Western Underground Storage Project

DATE:	22-Feb-99
REPORT No:	18
D.F.S:	18.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 STATUS @ 2400 HRS: RIH with Core Barrel

DEPTH - 2400 HRS:	1,527 m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,509 m	HOLE SIZE:	6"	SHOE DEPTH:	739
24 HR PROGRESS:	18 m	ACCIDENTS:	nil	LAST CASING:	7"
SAFETY MEETINGS:	Toolbox, Pre-coring Safety,				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	84	0g EZ MUD
pH	9.5	200kg PAC-R
PV / YP	28/31	0 lb XCD
GELS 0/10	4/5	1250 kg KCl
WL API / FC (cc)	4.7	40 kg KOH
SOLIDS %	2.7	0lb Barafibre
SAND %	0.25	0 kg Dextrid LT
CHLORIDES	22,000	25kg Baracor129
KCL (% vol)	2.98	250kg Pac-L
MBT (ppb)	12	250kgBaracarb100
Pm Pm/Mf	.22/.4	0kgBaracarb25
TEMP (degC)	41	0kgBaracarb600
HOLE VOL (bbls)		250kg Barite
SURFACE VOL (bbls	425	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	50kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS:	110/175/175	110/110/110

INVENTORY	
BARITE	480 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	450 sx
DRILLWATER	470 bbl
DIESEL FUEL	16,500 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	54	
PRESSURE	1150	
GPM	129	
AV (DP - ft/min)	117	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

DRILLS / BOPS	
LAST BOP DRILL	21-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	18

BIT DATA		
BIT No.	3	4
SIZE (ins)	6"	6 x 2.9/16""
TYPE	STR-O9	CM366F
IADC CODE	437	
SERIAL No.	TO9YE	2087
NOZZLES	3 x 11	
OUT (m)	1,509	1,527
IN (m)	1,251	1,509
DRILLED (m)	258	18
HOURS	29	3
CONDITION	2ER,A,E,1,WT,CP	
AVG ROP (m/hr)	8.90	6.00
WOB (x1000 lbs)	10 to 15	5
RPM	70/200	60
JET VEL (ft/sec)	261	
HHP @ BIT	72.7	

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		
1432.68/1268.49	8.10	131.3
1471.3/1306.92	3.30	98.4
1486.4/1322	2.40	84.2
1509.4/1344.98	2.40	84.2

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	10.9

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	11
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	1.5
8. CHANGE BHA	1.5
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	5.5
14. LOGGING	
15. REAM / WASH	3
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	0.5
30. SLIP & CUT LINE	1
TOTAL	24

BHA.: 4.3/4 x 18m Core Barrel / 21 x HWDP / Dailey Jar / 15 x HWDP

BHA WEIGHT :	24,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA Iona OBS-1 STATUS @ 2400 HRS: RIH with Core Barrel

DATE:	22-Feb-99
REPORT No:	18
D.F.S:	. 18.0

FROM	TO		24 HOUR SUMMARY
0:00	1:30	1.5	Continue POOH. L/O steerable assembly. Recover DWD probe. Service motor.
1:30	3:00	1.5	Held pre-job Safety Meeting. M/U 4.3/4" x 2.9/16" x 18m Core Barrel assembly.
3:00	4:30	1.5	RIH to 735m.
4:30	5:30	1	Slip 33' and cut 103' Drill Line.
5:30	6:00	0.5	Rig Service.
6:00	7:30	1.5	RIH, held up at 1382m.
7:30	10:30	3	Break circulation, wash / ream 1382 - 1421m.
10:30	11:30	1	Continue RIH to 1488m, wash ream to 1509m.
11:30	12:00	0.5	Circulate 'bottoms-up'.
12:00	12:30	0.5	Drop ball, monitor and record pressures.
12:30	15:30	3	Cut core #1 1509 -1527m.
15:30	16:00	0.5	Circulate for samples.
16:00	19:30	3.5	POOH with flow checks.
19:30	21:00	1.5	Recover core #1, 6m = 30% recovery.
21:00	22:00	1	Dress Core Barrel.
22:00	0:00	2	RIH.

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
49	1447-1026	Dailey Jars

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Fine/warm

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast: 1432m
Waarre D :

OPERATION TO 0600 HRS: Continue RIH, wash 20m to bottom, circulate B's/U. Space-out. Drop ball. Cut core #2 1527 - 1538m
Little progress, suspect core jammed at 1537m. Flowcheck, POOH.

PROGRAM - NEXT 24 HRS: *POOH, recover core #2. L/O Core Barrel. RIH, drill to T.D.*

TRANSPORTATION	
TRANSPORT-1	washpipe/ tristate to Sale
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 086

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

WUGS Western Underground Storage Project

DATE:	23-Feb-99
REPORT No:	19
D.F.S:	19.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1

STATUS @ 2400 HRS: R/U Schlumberger

DEPTH - 2400 HRS:	1,568	m	FORMATION:	Waarre		KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,527	m	HOLE SIZE:	6"		SHOE DEPTH:	739
24 HR PROGRESS:	41	m	ACCIDENTS:	nil		LAST CASING:	7"

SAFETY MEETINGS: Toolbox, Pre-coring Safety,

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	126	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	34/50	0 lb XCD
GELS 0/10	6/6	0 kg KCl
WL API / FC (cc)	3.3	40 kg KOH
SOLIDS %	2.9	0lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	18,500	50kg Baracor129
KCL (% vol)	3.79	200kg Pac-L
MBT (ppb)	11	0kgBaracarb100
Pm Pm/Mf	2/.35	0kgBaracarb25
TEMP (degC)	42	0kgBaracarb600
HOLE VOL (bbls)	180	1600kg Barite
SURFACE VOL (bbls	470	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	Ed Perkins	50kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	54	
PRESSURE	1150	
GPM	129	
AV (DP - ft/min)	117	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

INVENTORY	
BARITE	416 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	450 sx
DRILLWATER	470 bbl
DIESEL FUEL	16,500 lts

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	19

BIT DATA		
BIT No.	4	RR3
SIZE (ins)	6 x 2.9/16""	6
TYPE	CM366F	STR-09
IADC CODE		437
SERIAL No.	2087	TO9YE
NOZZLES		3 x 11
OUT (m)	1,538	1,568
IN (m)	1,509	1,538
DRILLED (m)	29	30
HOURS	5.5	3.5
CONDITION		
AVG ROP (m/hr)	6.00	8.60
WOB (x1000 lbs)	5	
RPM	60	
JET VEL (ft/sec)	261	
HHP @ BIT	72.7	

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg	Azimuth
1432.68/1268.49	8.10	131.3
1471.3/1306.92	3.30	98.4
1486.4/1322	2.40	84.2
1509.4/1344.98	2.40	84.2

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	11.1

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	3.5
4. BIT TRIP	10.5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	2
8. CHANGE BHA	1
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	5
14. LOGGING	0.5
15. REAM / WASH	1
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	0.5
30. SLIP & CUT LINE	
TOTAL	24

BHA.: 4.3/4 x 18m Core Barrel / 21 x HWDP / Dailey Jar / 15 x HWDP

bit/5.7/8 NBstab/4.3/4" DC/5.3/4" Sstab/21 x HWDP Dailey Jar /15 x HWDP

BHA WEIGHT :	24,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ./2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA Iona OBS-1

STATUS @ 2400 HRS: R/U Schlumberger

DATE:	23-Feb-99
REPORT No:	19
D.F.S:	19.0

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Continue RIH with Core Barrel to 1508m.
1:00	1:30	0.5	Wash / ream 1508 - 1527m.
1:30	2:00	0.5	Circulate hole at 260 gpm.
2:00	2:30	0.5	Space out and drop ball.
2:30	5:00	2.5	Cut core #2 1527 - 1538m. Little or no progress from 1537m, suspect core jammed.
5:00	7:00	2	Flow check. POOH to 707m.
7:00	7:30	0.5	Rig Service.
7:30	9:00	1.5	Continue POOH to surface.
9:00	11:00	2	Recover core #2. 6.8m recovery: = 62%. L/O Core barrel.
11:00	11:30	0.5	M/U 6" rotary assembly.
11:30	14:00	2.5	RIH to 1509m.
14:00	14:30	0.5	Wash / ream 1509 - 1538m.
14:30	18:00	3.5	Drill 6" hole 1538 - 1568m.
18:00	19:30	1.5	Circulate hole clean while reciprocating and rotating string. Drop Totco.
19:30	23:00	3.5	POOH, 25 - 30k O/P 1528 - 1490m interval. Wipe interval clean, OK. Continue POOH to shoe.
23:00	23:30	0.5	L/O bit, NB stab, DC and S.stab.
23:30	0:00	0.5	R/U Schlumberger.

NB: #1 log shows Volcanic Tuff / Ash (Bentonitic) at 912 - 913m. (stabilizer in stuck string @ 918m) Cautionary note for future wells.

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
58	1447-1026	Dailey Jars

Incidents in last 24 Hours Y/N

(If yes see separate report)

- Weather : Fine/warm

FORMATION TOPS : Pebble point 696m. Paaratte 778m. Skull Creek: 1197m Nullawarre: 1344m Belfast: 1432m

Waarre D :

OPERATION TO 0600 HRS: R/U Schlumberger, #1 DSI/GR, Log down/up (Schlum TD: 1563m) L/O. M/U HALS/PEX

Hole took 3bbls in 4hrs of logging

PROGRAM - NEXT 24 HRS: *Complete logging, RIH, circ condition, POOH L/O drill string.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	10
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	18
TOTAL :	40

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 087

908918 088

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	24-Feb-99
REPORT No:	20
D.F.S:	20.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 **STATUS @ 2400 HRS:** L/O drill string

DEPTH - 2400 HRS:	1,568 m	FORMATION:	Waarre	KB - GL (m):	5.33	
DEPTH - PREVIOUS:	m	HOLE SIZE:	6"	SHOE DEPTH:	739	
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	7"	

SAFETY MEETINGS: Weekly Safety Meeting, Schlumberger pre-job.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	137	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	38/44	0 lb XCD
GELS 0/10	6/6	0 kg KCl
WL API / FC (cc)	4.2	0 kg KOH
SOLIDS %	3.0	0lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	18,000	0kg Baracor129
KCL (% vol)	3.60	0kg Pac-L
MBT (ppb)	11	0kgBaracarb100
Pm Pm/Mf	.2/.35	0kgBaracarb25
TEMP (degC)	35	0kgBaracarb600
HOLE VOL (bbls)	180	1600kg Barite
SURFACE VOL (bbls	460	0 g Torq Trim
HOLE LOSSES (bbls)	14	0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	352 sx
GEL	67 sx
CEMENT	367 sx
SALT	sx
KCL	450 sx
DRILLWATER	780 bbl
DIESEL FUEL	12,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM	54	
PRESSURE	1150	
GPM	129	
AV (DP - ft/min)	117	
AV (DC - ft/min)		
SPR	20 - 40	20 - 40
SPR PRESS	700/1020	680/1020

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	20

BIT DATA		
BIT No.	RR3	
SIZE (ins)	6	
TYPE	STR-09	
IADC CODE	437	
SERIAL No.	TO9YE	
NOZZLES	open	
OUT (m)		
IN (m)		
DRILLED (m)		
HOURS		
CONDITION	33ERAE1WTTD	
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	10.9

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	2
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	16.5
15. REAM / WASH	0.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.:

bit/bit sub/ 4.3/4" DC/ 21 x HWDP Dailey Jar / 15 x HWDP

BHA WEIGHT :	24,000 lbs	STRING WT.:	68,000 lbs
DP RATING :	297000 lbs - 'G' Grade	MARGIN :	133,000 lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	140 amps	DRAG UP :	22,000 lbs
TORQUE OFF BTM :	120 amps	DRAG DOWN :	11,000 lbs

CONTINUED ../2

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	24-Feb-99
REPORT No:	20
D.F.S:	20.0

Iona OBS-1 **STATUS @ 2400 HRS:** L/O drill string

FROM	TO	HRS	24 HOUR SUMMARY
0:00	4:30	4.5	Schlumberger continue with log #1, DSI/GR, log down / up.
4:30	6:30	2	L/D DSI. Held safety meeting: Schlumberger on handling Radioactive Sources. M/U HALS/PEX
6:30	9:00	2.5	RIH, log #2 HALS/PEX
9:00	11:00	2	L/O HALS/PEX, M/U Siesmic tool.
11:00	16:00	5	RIH log #3 and take siesmic checkshots.
16:00	16:30	0.5	R/D Schlumberger. (hole taking 0.5 bbl/hr during logging)
16:30	19:00	2.5	M/U bit and DC. RIH to 1558m.
19:00	19:30	0.5	Wash 1558 - 1568m.
19:30	21:30	2	Circulate and condition mud while reciprocating and rotating string.
21:30	22:00	0.5	Pump slug and drop Totco.
21:30	0:00	2.5	POOH laying down tubulars.

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

Incidents in last 24 Hours Y/N

(If yes see separate report)

- Weather : Cloudy/cool

FORMATION TOPS : From Logs: D sand: 1495-1508m C1 1508-1512m C2 1517-1536m

OPERATION TO 0600 HRS Continue L/O tubulars. Break kelly connections at 660m. Continue L/O.

PROGRAM - NEXT 24 HRS *Run and cement 4.1/2" csg.*

TRANSPORTATION	
TRANSPORT-1	backload Sperry equip. W.A.
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	6
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	14
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — WUGS Western Underground Storage Project

DATE:	25-Feb-99
REPORT No:	21
D.F.S:	21.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: R/D cementing equip

DEPTH - 2400 HRS:	1,568 m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:	6"	SHOE DEPTH:	1,567
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	4.1/2"

SAFETY MEETINGS: 2 x pre-casing / cement meetings

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	134	0g EZ MUD
pH	9.5	0kg PAC-R
PV / YP	37/42	0 lb XCD
GELS 0/10	6/6	0 kg KCl
WL API / FC (cc)	4.4	0 kg KOH
SOLIDS %	3.0	0lb Barafibre
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	18,000	0kg Baracor129
KCL (% vol)	3.40	0kg Pac-L
MBT (ppb)	11	0kgBaracarb100
Pm Pm/Mf	0.18/0.4	0kgBaracarb25
TEMP (degC)	31	0kgBaracarb600
HOLE VOL (bbls)	77	0kg Barite
SURFACE VOL (bbls	571	0 g Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	G.Lange	25kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS	110/175/175	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	352 sx
GEL	59 sx
CEMENT	147 sx
SALT	sx
KCL	450 sx
DRILLWATER	780 bbl
DIESEL FUEL	12,000 lts

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	21

BIT DATA		
BIT No.		
SIZE (ins)		
TYPE		
IADC CODE		
SERIAL No.		
NOZZLES		
OUT (m)		
IN (m)		
DRILLED (m)		
HOURS		
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	6
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	2
8. CHANGE BHA	1.5
9. CASE & CEMENT	14.5
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19. SIDETRACK	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.:

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: R/D cementing equip.

DATE:	25-Feb-99
REPORT No:	21
D.F.S:	21.0

FROM	TO		24 HOUR SUMMARY
0:00	2:30	2.5	Continue L/O tubulars to 625m.
2:30	4:00	1.5	Flush, and break all kelly connections.
4:00	7:30	3.5	Continue POOH, L/O all tubulars.
7:30	10:30	3	R/U and retreive wear bushing. R/U stabbing board and Premium casing equip.
10:30	18:00	7.5	M/U I jnt shoetrack and RIH to 1558m, filling string every five joints.
18:00	19:00	1	R/U circulating swage and lines, wash down to 1568m.
19:00	20:30	1.5	Increase flowrate gradually to 5bpm, circulate and condition mud / hole.
20:30	21:00	0.5	R/U Halliburton cement head and lines. Hold pre-job Safety / Contingency meeting.
21:00			Howco, pump 10bbls Mudfush, pressure test lines 5000 psi , leaking, replace and retest, OK.
			Pump 10bbls Mudflush, drop bottom plug and load Top plug. Mix and pump 39 bbls lead slurry
			at 12.8ppg, classG, 2.5% PHGel, followed by 20 bbls tail, 15.8ppg, class G with Halad 413L.
			Release Top plug and displace cement with 77 bbl water. Differential pressure prior to bump,
			1050 psi. Bump plug to 2500 psi, held OK for 10 mins. Bleed back 1 bbl water, floats holding.
	23:30	2.5	Shoe @ 1567m, FC @ 1554m.
23:30	0:00	0.5	R/D surface lines.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Cloudy/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : From Logs: D sand: 1495-1508m C1 1508-1512m C2 1517-1536m

OPERATION TO 0600 HRS: Continue R/D cementing equip. Lift BOP stack & hang-off. Install hanger & land with 35k. Energise primary seal. Rough cut casing. L/O landing joint. Land BOP & remove bell nipple. P/U BOP, final cut and prep casing stub.

PROGRAM - NEXT 24 HRS: *Remove adapter spool. Install tbg spool, test 'P' seal N/U BOPE, C/O rams for 2.3/8" and test BOP.*

TRANSPORTATION	
TRANSPORT-1	2 3/8" tubing
TRANSPORT-2	Baker hot-shot Sale
TRANSPORT-3	
Transport -4	
WATER HAULER	6
CRANE	

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	8
TOTAL :	31

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

908918 089

908918 090

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — WUGS Western Underground Storage Project

DATE:	26-Feb-99
REPORT No:	22
D.F.S:	22.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: Continue RIH with scraper on 2.3/8" tbg

DEPTH - 2400 HRS:	1,568	m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:		m	HOLE SIZE:	6"	SHOE DEPTH:	1,567
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	4.1/2"
SAFETY MEETINGS:						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.4	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		0 kg KCl
WL API / FC (cc)		0 kg KOH
SOLIDS %		0lb Barafibre
SAND %		0 kg Dextrid LT
CHLORIDES	17,500	0kg Baracor129
KCL (% vol)		0kg Pac-L
MBT (ppb)		0kgBaracarb100
Pm Pm/Mf		0kgBaracarb25
TEMP (degC)		0kgBaracarb600
HOLE VOL (bbls)	77	0kg Barite
SURFACE VOL (bbls)		0 g Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	G.Lange	25kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS:	110/175/175	110/110/110

INVENTORY	
BARITE	352 sx
GEL	59 sx
CEMENT	147 sx
SALT	sx
KCL	450 sx
DRILLWATER	610 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	9-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	22

BIT DATA		
BIT No.		
SIZE (ins)		
TYPE		
IADC CODE		
SERIAL No.		
NOZZLES		
OUT (m)		
IN (m)		
DRILLED (m)		
HOURS		
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	16
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	8
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.:

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: Continue RIH with scraper on 2.3/8" tbg

DATE:	26-Feb-99
REPORT No:	22
D.F.S:	22.0

FROM	TO		24 HOUR SUMMARY
0:00			L/D cementing equipment. Lift BOP and hang-off. Install casing hanger and land with 35k.
			Energise primary seal. Rough cut casing. L/O landing joint. Land BOP and remove bell nipple,
			P/U BOP, final cut and prep casing stub. N/D mud cross. Install upper tubing head assembly.
			Energize 'P' seal, injecting plastic to 3000 psi. P.T. flange connection to 3000psi. N/U BOPE.
	16:00	16	Kill and choke lines. Change PR to 2.3/8". Perform full function test. OK.
16:00			R/U Premium and equipment to run 2.3/8" tubing. S.L.M. tubing. M/U 3.3/4" MM junk mill,
	0:00	8	4.1/2" casing scraper and RIH P/U 2.3/8" EUE tubing.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Cloudy/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : From Logs: D sand: 1495-1508m C1 1508-1512m C2 1517-1536m

OPERATION TO 0600 HRS Contnue RIH with 4.1/2" scraper to HUD of 1551m. P/U off bottom, pump 10bbl caustic followed by 10bbl Baraklean FL, displace with 3% KCl brine. Pressure test 2.3/8" rams, leaking. Open doors to inspect.

PROGRAM - NEXT 24 HRS *P.T. BOPE. POOH L/O 2.3/8" tbg work string. Schlumberger Run CBL, R/U shooting nipple, perforate*

TRANSPORTATION	
TRANSPORT-1	Baroid Chemicals
TRANSPORT-2	Local delivery
TRANSPORT-3	
Transport -4	
WATER HAULER	6
CRANE	

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	10
TOTAL :	33

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

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DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA — WUGS Western Underground Storage Project

DATE:	27-Feb-99
REPORT No:	23
D.F.S:	23.0
SHOE F.I.T:	13.2

WELL NAME: Iona OBS-1 STATUS @ 2400 HRS: Continue N/D Shooting nipple

DEPTH - 2400 HRS:	1,568 m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:	6"	SHOE DEPTH:	1,567
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	4.1/2"
SAFETY MEETINGS:					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.4	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		0 kg KCl
WL API / FC (cc)		0 kg KOH
SOLIDS %		0lb Barafibre
SAND %		0 kg Dextrid LT
CHLORIDES	17,500	0kg Baracor129
KCL (% vol)		0kg Pac-L
MBT (ppb)		0kgBaracarb100
Pm Pm/Mf		0kgBaracarb25
TEMP (degC)		0kgBaracarb600
HOLE VOL (bbls)	77	0kg Barite
SURFACE VOL (bbls)		0 g Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	G.Lange	25kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS	110/175/175	110/110/110

INVENTORY	
BARITE	1,152 sx
GEL	59 sx
CEMENT	147 sx
SALT	sx
KCL	450 sx
DRILLWATER	610 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	27-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	23

BIT DATA		
BIT No.		
SIZE (ins)		
TYPE		
IADC CODE		
SERIAL No.		
NOZZLES		
OUT (m)		
IN (m)		
DRILLED (m)		
HOURS		
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	6
12. L.O.T.	
13. CORING	
14. LOGGING	9
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	9
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.:

BHA WEIGHT :	lbs	STRING WT.:	lbs
DP RATING :	lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TUAUSTRALIA Iona OBS-1 STATUS @ 2400 HRS: Continue RIH with scraper on 2.3/8" tbg

DATE:	27-Feb-99
REPORT No:	22
D.F.S:	22.0

FROM	TO	HRS	24 HOUR SUMMARY
0:00	1:30	1.5	Continue RIH with 3 3/4" J. Mill and 4 1/2" scraper, P/U 2 3/8" tbg workstring. Tag HUD @ 1551 m
1:30			R/U lines to tubing, pump 5 bbl 3% KCL brine. Hols sfatey meeting/mixing caustic. Halliburton
			mix and pump 10 bbls caustic/saline solution followed by 10 bbl Bara-Klean FL/saline solution.
	4:30	3	Rig pump fluids for 10 min contact time, displacing well to 3% KCL brine, R/D Halliburton.
4:30			Hold pre-test safety meeting, R/U halliburton test lines to tbg head wing. P/T lines 300/3000 psi.
	6:00	1.5	OK. Attempt to test 2.3/8" PR's,leaking. P.T. annular 150/1500psi OK.
6:00	8:00	2	Remove 2.3/8" rams, ram face slightly burred, repair same and N/U.
8:00	10:00	2	P.T. BOPE against rams.Choke manifold, kill and choke line valves, 200/2000 psi. OK.
10:00	14:30	4.5	POOH, L/D 2 3/8" EUE work string, junk mill and scraper.
14:30	15:00	0.5	P.T. blind rams,200/2000 psi, OK.
15:00	18:00	3	R/U Sclumberger, run CBL-VDL-GR-CCL. Good isolation across sands, TOC: 781m.
18:00			N/D Bell nipple, N/U Schlumberger shooting nipple. P.T. 500 psi, OK.Held pre-perf safety
			meeting, go on Radio-Silence.Schlumber RIH, correlate to open hole logs/CBL. Perforate
			1525-1535 m interval with 2.7/8" HSD gun, 60 deg phasing, 6 spf, 34 J charges. Observe well, ok
	21:00	3	after initial bubbling, static. POOH slowly to avoid swabbing. All charges fired.
21:00			M/U 4.1/2" Otis BWB packer/tailpipe assembly. RIH, correlate and set packer. Center packer @
	23:30	2.5	1473m. Re-entry guide @ 1479.39m. POOH and R/D Schlumberger.
23:30		0.5	R/D Schlumberger shooting nipple. Well static

Incidents in last 24 Hours Y/N
(If yes see separate report)

- Weather : Cloudy/cool

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : From Logs: D sand: 1495-1508m C1 1508-1512m C2 1517-1536m

OPERATION TO 0600 HRS N/U Bell nipple. R/U Premium equip. Pre-job meeting. M/U J-slot locator / SSD assembly and RIH P/U 2 3/8" Vam Ace 13% Cr L-80 tubing.

PROGRAM - NEXT 24 HRS *Cont RIH. Circ to inhibited brine, space out, land out, set BPV. N/D BOPE N/U BOPE. N/U Xmas tree & test Retreive BPV*

TRANSPORTATION	
TRANSPORT-1	Baroid Chemicals
TRANSPORT-2	Local deliveryx2
TRANSPORT-3	Sperry Sun equip
Transport -4	
WATER HAULER	6
CRANE	

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	13
TOTAL :	36

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — WUGS Western Underground Storage Project

DATE:	28-Feb-99
REPORT No:	24
D.F.S:	24.0
SHOE F.I.T:	

WELL NAME: Iona OBS-1 — STATUS @ 2400 HRS: Well completed

DEPTH - 2400 HRS:	1,568	m	FORMATION:	Waarre	KB - GL (m):	5.33	
DEPTH - PREVIOUS:		m	HOLE SIZE:		SHOE DEPTH:	1,567	
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	4.1/2"	

SAFETY MEETINGS: pre-tubing safety meeting.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.4	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		175 kg KCl Tech
WL API / FC (cc)		20 kg KOH
SOLIDS %		220g Bara-klean FL
SAND %		0 kg Dextrid LT
CHLORIDES	17,500	0kg Baracor129
KCL (% vol)		0kg Pac-L
MBT (ppb)		0kgBaracarb100
Pm Pm/Mf		0kgBaracarb25
TEMP (degC)		0kgBaracarb600
HOLE VOL (bbls)		0kg Barite
SURFACE VOL (bbls)		0 g Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	0Kg EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE		
SHAKER SCREENS:		

INVENTORY	
BARITE	1,152 sx
GEL	59 sx
CEMENT	147 sx
SALT	sx
KCL	450 sx
DRILLWATER	610 bbl
DIESEL FUEL	10,000 lts

PUMPS @	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	5.1/2"	5.1/2"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	23-Feb-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	27-Feb-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	24

BIT DATA		
BIT No.		
SIZE (ins)		
TYPE		
IADC CODE		
SERIAL No.		
NOZZLES		
OUT (m)		
IN (m)		
DRILLED (m)		
HOURS		
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)		
RPM		
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	24
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	
25. ABANDON / SUSP	
26. RIG DOWN	
27. W.O. CEMENT	
28. DRILL CEMENT	
29. RIG SERVICE	
30. SLIP & CUT LINE	
TOTAL	24

BHA.:

BHA WEIGHT :	lbs		STRING WT.:	lbs	
DP RATING :	lbs - 'G' Grade		MARGIN :	lbs @ 75%	
DP RATING :	lbs - 'S' Grade		MARGIN :	lbs @ 75%	
TORQUE ON BTM :	amps		DRAG UP :	lbs	
TORQUE OFF BTM :	amps		DRAG DOWN :	lbs	

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA — Iona OBS-1 — STATUS @ 2400 HRS: Well completed

DATE:	28-Feb-99
REPORT No:	24
D.F.S:	24.0

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	N/U Bell nipple, flowline.
0:30	1:30	1	R/U Premium equipment. Held pre-job plan / safety meeting.
1:30			M/U J-slot locator assembly and RIH with 2.3/8" Vam Ace , 4.6ppf, 13% Cr L80 tubing to top of
	11:30	10	packer. (153 joints run, 5 joints rejected)
11:30	12:30	1	R/U circulating swage and displace well to 3% KCl inhibited brine with 0.5% Coat 2748m.
12:30			Space-out, M/U tubing hanger, landing joint, latch packer pull 5k tension,. Land hanger with 15k
	15:30	3	compression. (String wt: P/U 25k, S/O 20k) Run lock down bolts.
15:30	16:30	1	R/U Halliburton to 4.1/2" x 2.3/8" annulus. Test lines 2000 psi. Test annulus 2000psi, 15 mins.OK
16:30	21:30	5	L/O landing joint, run and set BPV. N/D BOPE.
21:30	0:00	2.5	N/U Wood Group 2.1/16" 5k Xmas Tree. Pressure test seal pocket and flange to 5000 psi, OK.
			Pressure test, Swab, Upper Master and Flow wing valve to 5000psi, OK. All test 10 mins.
			Pull BPV and secure well.
			Well Completed 24:00 28/02/99.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : From Logs: D sand: 1495-1508m C1 1508-1512m C2 1517-1536m

OPERATION TO 0600 HRS Rig Down

PROGRAM - NEXT 24 HRS :

TRANSPORTATION	
TRANSPORT-1	Backload HWDP, Tasman, Baker
TRANSPORT-2	Local delivery x 2
TRANSPORT-3	
Transport -4	
WATER HAULER	6
CRANE	

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	10
TOTAL :	33

PROGRAMME COSTS	
DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :	Westman/Zurakowski

END OF REPORT

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APPENDIX 2

Definitive Survey by Sperry Sun/Gyrodata

Sperry-Sun Drilling Services

Survey Report for Iona Obs #1

Definitive Survey Report

Surveyed: 23 February, 1999

Western Underground Gas Storage Pty. Ltd. **Iona Obs #1**

Iona

Measured Depth (m)	Incl.	Azim.	Sub-Sea Depth (m)	Vertical Depth (m)	Local Coordinates Northings (m)	Local Coordinates Eastings (m)	Global Coordinates Northings (m)	Global Coordinates Eastings (m)	Dogleg Rate (°/30m)	Vertical Section (m)	Comment
Iona Obs #1 : Definitive 8½" Gyro											
0 00	0 000	0 000	-137.50	0.00	0.00 N	0.00 E	5728559.00 N	677741.50 E		0.00	
104 80	0.250	24.410	-32.70	104.80	0.21 N	0.09 E	5728559.21 N	677741.59 E	0.072	-0.05	
114 60	0 110	37.000	-22.90	114.60	0.24 N	0.11 E	5728559.24 N	677741.61 E	0.443	-0.06	
143 30	2.700	131.980	5.79	143.29	0.20 S	0.63 E	5728558.80 N	677742.13 E	2.835	0.62	
172 30	7.430	129 880	34.67	172.17	1.86 S	2.58 E	5728557.14 N	677744.08 E	4.896	3.17	
200 70	11 230	125 190	62.69	200.19	4.63 S	6.25 E	5728554.37 N	677747.75 E	4.090	7.77	
209 81	12 041	125 930	71.61	209.11	5.70 S	7.74 E	5728553.30 N	677749.24 E	2.715	9.61	Narrawatuk Marle
229 40	13.790	127 230	90.70	228.20	8.31 S	11.25 E	5728550.69 N	677752.75 E	2.715	13.99	
258 40	17.240	129.300	118.64	256.14	13.12 S	17.33 E	5728545.88 N	677758.83 E	3.614	21.74	
287 40	21 620	128.020	145.98	283.48	19.14 S	24.87 E	5728539.86 N	677766.37 E	4.552	31.38	
306 00	23 652	128 737	163.15	300.65	23.58 S	30.48 E	5728535.42 N	677771.98 E	3.308	38.54	Mepunga
316 40	24 790	129 090	172.64	310.14	26.26 S	33.80 E	5728532.74 N	677775.30 E	3.308	42.80	
344 80	27.970	129.380	198.07	335.57	34.25 S	43.57 E	5728524.75 N	677785.07 E	3.362	55.41	
353 00	29.149	129.170	205.28	342.78	36.73 S	46.61 E	5728522.27 N	677788.11 E	4.328	59.33	Dilwyn
373 80	32.140	128.700	223.17	360.67	43.39 S	54.86 E	5728515.61 N	677796.36 E	4.328	69.92	
402.30	34.760	126.940	246.95	384.45	53.01 S	67.27 E	5728505.99 N	677808.77 E	2.941	85.63	
431.00	37.430	126.830	270.14	407.64	63.16 S	80.79 E	5728495.84 N	677822.29 E	2.792	102.54	
460.10	39.760	128.670	292.88	430.38	74.28 S	95.14 E	5728484.72 N	677836.64 E	2.677	120.69	
488 60	40 110	129.780	314.73	452.23	85.85 S	109.31 E	5728473.15 N	677850.81 E	0.836	138.97	
517 60	38 830	126.010	337.12	474.62	97.17 S	123.84 E	5728461.83 N	677865.34 E	2.810	157.39	

Continued...

Sperry-Sun Drilling Services

Survey Report for Iona Obs #1

Definitive Survey Report

Surveyed: 23 February, 1999

Western Underground Gas Storage Pty. Ltd. **Iona Obs #1**

Iona

Measured Depth (m)	Incl.	Azim.	Sub-Sea Depth (m)	Vertical Depth (m)	Local Coordinates Northings (m)	Local Coordinates Eastings (m)	Global Coordinates Northings (m)	Global Coordinates Eastings (m)	Dogleg Rate (°/30m)	Vertical Section (m)	Comment
546 60	38 620	125 990	359 75	497 25	107.83 S	138.52 E	5728451.17 N	677880.02 E	0.218	175.53	
575 60	38 330	126 380	382.45	519.95	118.49 S	153.08 E	5728440.51 N	677894.58 E	0.391	193.57	
604 60	38 110	126 330	405.23	542.73	129.12 S	167.53 E	5728429.88 N	677909.03 E	0.230	211.51	
614.00	38 045	126 417	412.63	550.13	132.56 S	172.20 E	5728426.44 N	677913.70 E	0.269	217.31	Pember Mudstone
633 60	37 910	126 600	428.08	565.58	139.74 S	181.90 E	5728419.26 N	677923.40 E	0.269	229.37	
662 60	37 520	126 610	451.02	588.52	150.31 S	196.14 E	5728408.69 N	677937.64 E	0.403	247.11	
691 60	37.390	126.810	474.05	611.55	160.86 S	210.28 E	5728398.14 N	677951.78 E	0.184	264.74	
696 00	37.348	126.790	477.54	615.04	162.45 S	212.41 E	5728396.55 N	677953.91 E	0.301	267.41	Pebble Point
720 60	37.110	126.680	497.13	634.63	171.36 S	224.34 E	5728387.64 N	677965.84 E	0.301	282.30	
730 30	36 950	126.590	504.87	642.37	174.84 S	229.03 E	5728384.16 N	677970.53 E	0.522	288.14	

Iona Obs #1 : Definitive MWD Survey

Measured Depth (m)	Incl.	Azim.	Sub-Sea Depth (m)	Vertical Depth (m)	Local Coordinates Northings (m)	Local Coordinates Eastings (m)	Global Coordinates Northings (m)	Global Coordinates Eastings (m)	Dogleg Rate (°/30m)	Vertical Section (m)	Comment
739 00	36 587	126.596	511.84	649.34	177.95 S	233.21 E	5728381.05 N	677974.71 E	1.253	293.34	7" Casing
745 86	36 300	126 600	517.36	654.86	180.38 S	236.48 E	5728378.62 N	677977.98 E	1.253	297.42	
769 00	36 140	126 041	536.03	673.53	188.48 S	247.50 E	5728370.52 N	677989.00 E	0.476	311.09	Paararte
774 82	36 100	125.900	540.73	678.23	190.49 S	250.27 E	5728368.51 N	677991.77 E	0.476	314.52	
793 23	36.400	126 400	555.58	693.08	196.91 S	259.06 E	5728362.09 N	678000.56 E	0.686	325.41	
822 23	34 900	126.400	579.14	716.64	206.94 S	272.67 E	5728352.06 N	678014.17 E	1.552	342.31	
851.25	34.500	127.100	603.00	740.50	216.83 S	285.91 E	5728342.17 N	678027.41 E	0.584	358.83	
879.67	33.600	128.500	626.55	764.05	226.58 S	298.48 E	5728332.42 N	678039.98 E	1.260	374.74	
899 17	33.500	129.200	642.80	780.30	233.34 S	306.87 E	5728325.66 N	678048.37 E	0.615	385.51	
938.10	31 400	129.000	675.65	813.15	246.51 S	323.08 E	5728312.49 N	678064.58 E	1.620	406.38	

Continued...

Sperry-Sun Drilling Services

Survey Report for Iona Obs #1

Definitive Survey Report

Surveyed: 23 February, 1999

Western Underground Gas Storage Pty. Ltd.
Iona

Iona Obs #1

Measured Depth (m)	Incl.	Azim.	Sub-Sea Depth (m)	Vertical Depth (m)	Local Coordinates Northings (m)	Local Coordinates Eastings (m)	Global Coordinates Northings (m)	Global Coordinates Eastings (m)	Dogleg Rate (°/30m)	Vertical Section (m)	Comment
967.10	31.600	129.100	700.38	837.88	256.06 S	334.85 E	5728302.94 N	678076.35 E	0.214	421.53	
996.20	30.700	127.600	725.28	862.78	265.40 S	346.65 E	5728293.60 N	678088.15 E	1.225	436.58	
1025.30	29.600	126.800	750.44	887.94	274.24 S	358.29 E	5728284.76 N	678099.79 E	1.207	451.19	
1054.00	28.300	125.200	775.56	913.06	282.40 S	369.53 E	5728276.60 N	678111.03 E	1.582	465.08	
1082.80	27.600	124.800	801.00	938.50	290.15 S	380.58 E	5728268.85 N	678122.08 E	0.755	478.57	
1111.92	26.200	124.500	826.97	964.47	297.64 S	391.42 E	5728261.36 N	678132.92 E	1.449	491.73	
1140.45	25.000	124.400	852.69	990.19	304.61 S	401.59 E	5728254.39 N	678143.09 E	1.263	504.04	
1168.97	24.300	124.800	878.61	1016.11	311.37 S	411.38 E	5728247.63 N	678152.88 E	0.757	515.93	
1176.00	23.983	125.011	885.03	1022.53	313.01 S	413.74 E	5728245.99 N	678155.24 E	1.402	518.80	Skull Creek Member
1197.84	23.000	125.700	905.06	1042.56	318.05 S	420.84 E	5728240.95 N	678162.34 E	1.402	527.50	
1227.00	21.900	124.900	932.01	1069.51	324.48 S	429.92 E	5728234.52 N	678171.42 E	1.174	538.63	
1259.10	20.100	126.900	961.98	1099.48	331.22 S	439.25 E	5728227.78 N	678180.75 E	1.810	550.13	
1288.20	17.000	128.900	989.56	1127.06	336.90 S	446.56 E	5728222.10 N	678188.06 E	3.262	559.38	
1317.20	13.200	132.300	1017.56	1155.06	341.79 S	452.31 E	5728217.21 N	678193.81 E	4.035	566.92	
1324.00	12.623	132.630	1024.18	1161.68	342.81 S	453.43 E	5728216.19 N	678194.93 E	2.568	568.43	Nullawarre Greensand
1345.50	10.800	133.900	1045.24	1182.74	345.80 S	456.61 E	5728213.20 N	678198.11 E	2.568	572.77	
1374.60	10.900	127.700	1073.82	1211.32	349.37 S	460.75 E	5728209.63 N	678202.25 E	1.207	578.23	
1403.60	10.700	126.000	1102.30	1239.80	352.63 S	465.10 E	5728206.37 N	678206.60 E	0.389	583.67	
1432.61	8.106	131.283	1130.92	1268.42	355.57 S	468.81 E	5728203.43 N	678210.31 E	2.824	588.40	Belfast Mudstone
1432.68	8.100	131.300	1130.99	1268.49	355.57 S	468.82 E	5728203.43 N	678210.32 E	2.824	588.41	
1471.30	3.300	98.400	1169.42	1306.92	357.53 S	471.97 E	5728201.47 N	678213.47 E	4.366	592.10	
1475.67	3.023	95.168	1173.78	1311.28	357.56 S	472.21 E	5728201.44 N	678213.71 E	2.260	592.31	Waarre D Unit
1486.40	2.400	84.200	1184.50	1322.00	357.56 S	472.71 E	5728201.44 N	678214.21 E	2.260	592.71	
1497.67	2.400	84.200	1195.76	1333.26	357.52 S	473.18 E	5728201.48 N	678214.68 E	0.000	593.06	Waarre C1 Sand
1509.40	2.400	84.200	1207.48	1344.98	357.47 S	473.67 E	5728201.53 N	678215.17 E	0.000	593.42	Extrapolation to TD

Continued...

Sperry-Sun Drilling Services

Survey Report for Iona Obs #1
Definitive Survey Report
Surveyed: 23 February, 1999

Western Underground Gas Storage Pty. Ltd.
Iona

Iona Obs #1

All data is in metres unless otherwise stated. Directions and coordinates are relative to Grid North.
Vertical depths are relative to RTE. Northings and Eastings are relative to Well.

Coordinate System is UTM Zone 54S on Australian Datum 1984, Meters.
Grid Convergence at Surface is -1.273°. Magnetic Convergence at Surface is -12.207° (15-Feb-99)

The Dogleg Severity is in Degrees per 30m.
Vertical Section is from Well and calculated along an Azimuth of 127.150° (Grid).

Based upon Minimum Curvature type calculations, at a Measured Depth of 1509.40m.,
The Bottom Hole Displacement is 593.42m., in the Direction of 127.041° (Grid).

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APPENDIX 3

Cuttings Descriptions

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well:** **Iona Obs-1** **Permit:** **PPL-2**
		6" Hole Section (744 –1565.17 mRT)
747	80	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grains, sub angular to sub rounded occasionally rounded, moderate sphericity, moderate to well sorted quartz, trace to rare nodular pyrite, rare to minor skeletal fragments, good to excellent inferred. no shows.
	20	**CLAYSTONE:** medium to dark grey to brownish black in part, soft, dispersive, common to abundant quartz silt to fine sand, grading to arenaceous claystone, nil to trace carbonaceous specks, minor to common glauconite pellets oxidised in part, trace pyrite, trace to rare mica, slightly calcareous.
		Note up to 80 percent of sample is cement
750	60	**SANDSTONE:** as above
	40	**CLAYSTONE:** as above
		Note: claystone is dispersive and washing out and percentage is unrepresentative, up to 80 percent of sample is cement
753	60	**SANDSTONE:** as above
	40	**CLAYSTONE:** as above
		Note: claystone is dispersive and washing out and percentage is unrepresentative, up to 80 percent of sample is cement
756	80	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly fine to medium occasionally coarse grains, sub angular to sub rounded occasionally rounded, moderate sphericity, moderate to well sorted quartz, trace to rare nodular pyrite, excellent inferred porosity. no shows.
	20	**CLAYSTONE:** as above
759	80	**SANDSTONE:** as above
	20	**CLAYSTONE:** as above
762		Missed sample
765	90	**SANDSTONE:** as above, very fine to medium, trace coarse
	10	**CLAYSTONE:** as above
768		Missed sample
771	70	**SANDSTONE:** as above, very fine to medium, trace coarse
	30	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, trace to rare mica
774		Missed sample

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well: Iona Obs-1 Permit: PPL-2**
		6" Hole Section (744 –1565.17 mRT)
777	60	**SANDSTONE:** as above, very fine to medium, trace coarse
	40	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, trace to rare mica
780		Missed sample Note: change to 6 m sample interval
783		Missed sample
786	70	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium occasionally coarse grains, sub angular to sub rounded occasionally rounded, moderate sphericity, poorly to moderately sorted quartz, trace to rare multicoloured, orange, yellow, greyish blue hard lithic volcanic? and siliceous grains, trace to rare nodular pyrite, nil to trace calcareous, moderate to good inferred porosity. no fluorescence.
	30	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, trace to rare mica
792	90	**SANDSTONE:** as above.
	10	**CLAYSTONE:** as above
801	90	**SANDSTONE:** as above, trace coal fragments.
	10	**CLAYSTONE:** as above
807	100	**SANDSTONE:** as above, rare to minor lithics, trace coal fragments.
813	100	**SANDSTONE:** as above, rare to minor lithics, trace coal fragments.
819	90	**SANDSTONE:** as above, predominantly medium to coarse
	10	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt to fine sand, trace to rare mica
825	90	**SANDSTONE:** as above, predominantly medium to coarse
	10	**CLAYSTONE:** as above
831	100	**SANDSTONE:** as above
837	90	**SANDSTONE:** as above, predominantly medium to coarse
	10	**CLAYSTONE:** as above
843	90	**SANDSTONE:** as above
	10	**SILTSTONE:** light to medium grey, soft to firm, dispersive, fissile, laminated, abundant argillaceous matrix, common to abundant very fine sand, common to abundant carbonaceous specks, common mica, trace pyrite, grading to Silty Claystone

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well:** Iona Obs-1 **Permit:** PPL-2
		6" Hole Section (744 –1565.17 mRT)
849	90	SANDSTONE: as above, abundant multicoloured acid volcanic? lithics
	10	SILTSTONE: as above
855	80	SANDSTONE: light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium occasionally coarse grains, sub angular to sub rounded occasionally rounded, moderate sphericity, poorly to moderately sorted quartz, abundant multicoloured, orange, yellow, greyish blue hard lithic volcanic? and siliceous grains, trace to rare nodular pyrite, nil to trace calcareous, moderate to good inferred porosity. No fluorescence.
	20	SILTSTONE: light to medium grey, soft to firm, dispersive, fissile, laminated, abundant argillaceous matrix, common to abundant very fine sand, common to abundant carbonaceous specks, common mica, trace pyrite, grading to Silty Claystone
		Note: up to 30 percent lithics. Drill rate of >100 m/hr affecting sample quality
861	70	SANDSTONE: as above
	30	SILTSTONE: as above
867	80	SANDSTONE: as above
	20	SILTSTONE: as above
873	80	SANDSTONE: as above, common lithics
	20	SILTSTONE: as above
879	90	SANDSTONE: as above
	10	SILTSTONE: as above
885	100	SANDSTONE: as above, common lithics
891	100	SANDSTONE: as above
897	100	SANDSTONE: as above
903	100	SANDSTONE: as above
909	100	SANDSTONE: as above
915	100	SANDSTONE: light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grading to very coarse grains, angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare multicoloured, orange, yellow, greyish blue hard lithic volcanic? and siliceous grains, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence.
921	90	SANDSTONE: as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
	10	**SILTSTONE:** as above
927	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
933	80	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse, angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare multicoloured, orange, yellow, greyish blue hard lithic volcanic? and siliceous grains, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence,
	20	**SILTSTONE:** light to medium grey, soft to firm, dispersive, fissile, laminated, abundant argillaceous matrix, common to abundant very fine sand, common to abundant carbonaceous specks, common mica, trace pyrite, grading to Silty Claystone
939	80	**SANDSTONE:** as above, predominantly fine to coarse
	20	**SILTSTONE:** as above
945	70	**SANDSTONE:** as above, predominantly fine to coarse
	30	**SILTSTONE:** as above, trace to rare coaly fragments
951	90	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grading to very coarse grains occasional pebbly, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. no fluorescence.
	10	**SILTSTONE:** as above, trace to rare coaly fragments
957	80	**SANDSTONE:** as above
	20	**SILTSTONE:** as above
960	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
963	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
966	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
969	100	**SANDSTONE:** as above
972	100	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
975	100	**SANDSTONE:** as above
978	80	**SANDSTONE:** as above
	20	**SILTSTONE:** as above, trace to rare coaly fragments
981	90	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grading to very coarse grains occasionally pebbly, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence.
	10	**SILTSTONE:** light to medium grey, soft to firm, dispersive, fissile, laminated, abundant argillaceous matrix, common to abundant very fine sand, common to abundant carbonaceous specks, common mica, trace pyrite, grading to Silty Claystone
984	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above,
987	70	**SANDSTONE:** as above
	30	**SILTSTONE:** as above,
990		Missed sample
993	80	**SANDSTONE:** as above
	20	**SILTSTONE:** light to medium grey to white, soft to firm, dispersive, abundant argillaceous matrix, common to abundant very fine sand, common to abundant carbonaceous specks, common mica, trace pyrite, trace glauconite
996		Missed sample
999	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
1002	70	**SANDSTONE:** as above
	30	**SILTSTONE:** as above
1005		Sample unreliable – pumping out leak in flowline into cellar
1008	100	**SANDSTONE:** as above, predominantly fine to coarse
1011	100	**SANDSTONE:** as above, predominantly fine to coarse, well sorted
1014	90	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
	10	**SILTSTONE:** as above
1017	40	**SANDSTONE:** as above
	60	**SILTSTONE:** as above
1020	40	**SANDSTONE:** as above
	60	**SILTSTONE:** as above
1023	60	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence
	40	**SILTSTONE:** light to medium grey to brownish grey, soft to firm, dispersive, abundant argillaceous matrix, common to abundant very fine sand, common to abundant carbonaceous specks and laminae, minor mica, trace pyrite, trace glauconite
1026	50	**SANDSTONE:** as above
	50	**SILTSTONE:** as above
1029	50	**SANDSTONE:** as above
	50	**SILTSTONE:** as above
1032	90	**SANDSTONE:** as above, predominantly medium to coarse, well sorted
	10	**SILTSTONE:** as above
1035	100	**SANDSTONE:** as above, predominantly medium to coarse, well sorted
1038	100	**SANDSTONE:** as above
1041	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
1044	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
1047	100	**SANDSTONE:** as above
1050	100	**SANDSTONE:** as above, predominantly medium to coarse occasionally pebbly
1053	100	**SANDSTONE:** as above
1056		Missed sample

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1059	100	**SANDSTONE:** as above
1062		Missed sample
1065	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above
1068	80	**SANDSTONE:** as above
	20	**SILTSTONE:** as above
1071	90	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence
	10	**SILTSTONE:** light to medium grey to brownish grey, soft to firm, dispersive, abundant argillaceous matrix, common to abundant very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite, trace glauconite
1074	80	**SANDSTONE:** as above
	20	**SILTSTONE:** as above
1077	70	**SANDSTONE:** as above, predominantly fine to medium
	30	**SILTSTONE:** as above
1080	70	**SANDSTONE:** as above
	30	**SILTSTONE:** as above
1083	80	**SANDSTONE:** as above
	20	**SILTSTONE:** as above
1086	70	**SANDSTONE:** as above
	30	**SILTSTONE:** as above
1089	80	**SANDSTONE:** as above
	20	**SILTSTONE:** as above
1092	80	**SANDSTONE:** as above
	20	**SILTSTONE:** as above
1095	90	**SANDSTONE:** as above
	10	**SILTSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1098	80	SANDSTONE: as above
	20	SILTSTONE: as above
1101	60	SANDSTONE: as above
	40	SILTSTONE: as above
1104	70	SANDSTONE: as above
	30	SILTSTONE: as above
1107	90	SANDSTONE: light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse to pebble grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence
	10	SILTSTONE: light to medium grey to brownish grey, soft to firm, dispersive, abundant argillaceous matrix, common to abundant very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite, trace glauconite
1110	80	SANDSTONE: as above
	20	SILTY CLAYSTONE: light to medium grey to brownish grey, soft to firm, dispersive, abundant quartz silt, common to abundant coal specks and laminae, minor mica, trace pyrite
1113	40	SANDSTONE: as above
	60	SILTY CLAYSTONE: as above
1116	40	SANDSTONE: as above
	60	SILTY CLAYSTONE: as above
	tr	DOLOMITE: orange to reddish brown, hard, blocky
1119	40	SANDSTONE: as above
	55	SILTY CLAYSTONE: as above
	5	DOLOMITE: as above
1122	40	SANDSTONE: as above
	60	SILTY CLAYSTONE: as above
	tr	DOLOMITE: as above
1125	60	SANDSTONE: as above
	40	SILTY CLAYSTONE: as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
	tr	**DOLOMITE:** as above
1128	70	**SANDSTONE:** as above
	30	**SILTY CLAYSTONE:** as above
1131	40	**SANDSTONE:** as above
	60	**SILTY CLAYSTONE:** as above
	tr	**DOLOMITE:** as above
1134	60	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse to pebble grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence
	40	**SILTY CLAYSTONE:** light to medium grey to brownish grey, soft to firm, dispersive, abundant quartz silt, common to abundant coal specks and laminae, minor mica, trace pyrite
1137	30	**SANDSTONE:** as above
	70	**SILTY CLAYSTONE:** as above
1140	60	**SANDSTONE:** as above
	40	**SILTY CLAYSTONE:** as above
1143	50	**SANDSTONE:** as above
	50	**SILTY CLAYSTONE:** as above
1146	70	**SANDSTONE:** as above
	30	**SILTY CLAYSTONE:** as above
1149	50	**SANDSTONE:** as above
	50	**SILTY CLAYSTONE:** as above
1152	50	**SANDSTONE:** as above
	50	**SILTY CLAYSTONE:** as above
1155		Missed sample
1158	70	**SANDSTONE:** as above
	30	**SILTY CLAYSTONE:** as above
1161	70	**SANDSTONE:** as above
	30	**SILTY CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1164	70	**SANDSTONE:** as above
	30	**SILTY CLAYSTONE:** as above
1167	70	**SANDSTONE:** as above, predominantly medium to coarse
	30	**SILTY CLAYSTONE:** light to grey to brownish grey to white in part, soft to firm, dispersive, abundant quartz silt, minor very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite
1170	30	**SANDSTONE:** as above, predominantly medium to coarse
	70	**SILTY CLAYSTONE:** as above
1173	70	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse to pebble grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. No fluorescence
	30	**SILTY CLAYSTONE:** light to grey to brownish grey to white in part, soft to firm, dispersive, abundant quartz silt, minor very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite, grading to Clayey Siltstone
1176	30	**SANDSTONE:** as above, predominantly medium to coarse
	70	**SILTY CLAYSTONE:** as above
1179	80	**SANDSTONE:** as above, predominantly medium to coarse
	20	**SILTY CLAYSTONE:** as above
1182	70	**SANDSTONE:** as above, predominantly medium to coarse
	30	**SILTY CLAYSTONE:** as above
1185	20	**SANDSTONE:** as above, predominantly medium to coarse
	80	**SILTY CLAYSTONE:** as above
1188	30	**SANDSTONE:** as above, predominantly medium to coarse
	70	**SILTY CLAYSTONE:** as above
1191	50	**SANDSTONE:** as above, predominantly medium to coarse
	50	**SILTY CLAYSTONE:** as above
1194	40	**SANDSTONE:** as above
	60	**SILTY CLAYSTONE:** as above
1197	20	**SANDSTONE:** as above
	80	**SILTY CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1200	90	**SILTSTONE:** light to grey to brownish grey inter-bedded with greyish white laminations in part, soft to firm, dispersive, abundant argillaceous matrix, abundant very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite, grading to Clayey Siltstone
	10	**SANDSTONE:** as above
1203	90	**SILTSTONE:** as above
	10	**SANDSTONE:** as above
1206	50	**SILTSTONE:** light to grey to brownish grey interbedded with greyish white laminations in part, soft to firm, dispersive, abundant argillaceous matrix, abundant very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite, grading to Clayey Siltstone
	40	**SANDSTONE (1):** very light grey to white, soft, friable, very fine to fine, sub angular to sub rounded, poorly sorted, abundant clay matrix grading to argillaceous sandstone, rare mica, trace to rare pyrite, trace orange lithics, nil to poor visible porosity
	10	**SANDSTONE(2):** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse to pebble grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity.
1209	70	**SILTSTONE:** as above
	20	**SANDSTONE(1):** as above
	10	**SANDSTONE(2):** as above
1212	60	**SILTSTONE:** as above
	20	**SANDSTONE(1):** as above, trace glauconite
	20	**SANDSTONE(2):** as above
1215	70	**SILTSTONE:** as above
	20	**SANDSTONE(1):** as above
	10	**SANDSTONE(2):** as above
1218	70	**SILTSTONE:** as above
	20	**SANDSTONE(1):** as above
	10	**SANDSTONE(2):** as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1221	80	**SILTSTONE:** as above
	20	**SANDSTONE(1):** as above
	tr	**SANDSTONE(2):** as above
1224	60	**SILTSTONE:** as above
	40	**SANDSTONE(1):** as above
	tr	**SANDSTONE(2):** as above
1227	70	**SILTSTONE:** as above
	30	**SANDSTONE(1):** as above
1230	70	**SILTSTONE:** light to grey to brownish grey inter-bedded with greyish white laminations in part, soft to firm, dispersive, abundant argillaceous matrix, abundant very fine sand, common to abundant coal specks and laminae, minor mica, trace pyrite, grading to Clayey Siltstone
	30	**SANDSTONE (1):** very light grey to white, soft, friable, very fine to fine, sub angular to sub rounded, poorly sorted, abundant clay matrix grading to argillaceous sandstone, rare mica, trace to rare pyrite, trace orange lithics, nil to poor visible porosity
1233	50	**SILTSTONE:** as above
	50	**SANDSTONE (1):** as above, trace medium to coarse
1236	50	**SILTSTONE:** as above
	50	**SANDSTONE (1):** as above, trace medium to coarse
1239	70	**SILTSTONE:** as above
	30	**SANDSTONE (1):** as above
1242	70	**SILTSTONE:** as above
	30	**SANDSTONE (1):** as above
1245	40	**SILTSTONE:** as above
	60	**SANDSTONE(2):** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to coarse occasional very coarse to pebble grains, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity.
1248	40	**SILTSTONE:** as above
	60	**SANDSTONE(2):** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1251	50	**SILTSTONE:** as above
	50	**SANDSTONE(2):** as above
		Note: Drill string stuck on pulling out of hole on 11/2/99. Recommenced drilling on 20/2/99
1254	70	**SILTSTONE:** as above, grading to Silty Claystone
	30	**SANDSTONE(2):** as above
1257	70	**SILTSTONE:** as above, grading to Silty Claystone
	30	**SANDSTONE(2):** as above
1260	60	**SILTSTONE:** as above, grading to Silty Claystone
	40	**SANDSTONE(2):** as above
1263	70	**CLAYSTONE:** light grey to brownish grey inter-bedded with greyish white laminations in part, soft, dispersive, abundant quartz silt, minor very fine sand, common to abundant coal specks and laminae, minor mica, rare disseminated and nodular pyrite, grading to Silty Claystone in part
	30	**SANDSTONE:** light grey to light brownish grey to white, clear to translucent grains, unconsolidated to friable, predominantly fine to medium occasional coarse, predominantly angular to sub rounded occasionally rounded, poor to moderate sphericity, moderately sorted, trace to rare pyrite cement, moderate to good inferred porosity. No shows.
1266	80	**CLAYSTONE:** as above, common to abundant very fine to fine sand
	20	**SANDSTONE:** as above
1269	90	**CLAYSTONE:** as above, trace glauconite
	10	**SANDSTONE:** as above
1272	90	**CLAYSTONE:** as above, common to abundant very fine to fine sand
	10	**SANDSTONE:** as above
1275	90	**CLAYSTONE:** as above, common to abundant very fine to fine sand
	10	**SANDSTONE:** as above
1278	100	**CLAYSTONE:** as above, minor to common very fine to fine sand
	tr	**SANDSTONE:** as above
1281	90	**CLAYSTONE:** as above, minor to common very fine to fine sand
	10	**SANDSTONE:** as above
1284	100	**CLAYSTONE:** as above, minor to common very fine to fine sand

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well:** Iona Obs-1 **Permit:** PPL-2
		6" Hole Section (744 –1565.17 mRT)
	tr	**SANDSTONE:** as above
1287	100	**CLAYSTONE:** as above, grading to Silty Claystone
	tr	**SANDSTONE:** as above
1290	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1293	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1296	90	**SANDY CLAYSTONE:** light grey to brownish grey inter-bedded with greyish white laminations in part, soft, dispersive, abundant quartz silt, abundant very fine sand, common to abundant coal specks and laminae, minor mica, rare disseminated and nodular pyrite, grading to Silty Claystone in part
	10	**SANDSTONE:** as above
1299	90	**SANDY CLAYSTONE:** light grey to brownish grey inter-bedded with greyish white laminations in part, soft, dispersive, abundant quartz silt, abundant very fine sand, common to abundant coal specks and laminae, minor mica, rare disseminated and nodular pyrite, grading to Silty Claystone in part
	10	**SANDSTONE:** as above
1302	100	**SANDY CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1305	100	**SANDY CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1308	100	**CLAYSTONE:** light grey to brownish grey inter-bedded with greyish white laminations in part, soft, dispersive, abundant quartz silt, minor very fine sand, common to abundant coal specks and laminae, minor mica, rare disseminated and nodular pyrite, grading to Silty Claystone in part
	tr	**SANDSTONE:** as above
1311	90	**CLAYSTONE:** as above
	10	**CALCARENITE:** very light grey to yellowish grey, hard, crystalline, dolomitic in part, abundant argillaceous matrix, minor very fine sand, minor coal specks, minor glauconite, rare to minor pyrite cement
	tr	**SANDSTONE:** as above
1314	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
	tr	**CALCARENITE:** as above
1317	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
	tr	**CALCARENITE:** as above
1320	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1323	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1326	100	**CLAYSTONE:** as above
1329	100	**CLAYSTONE:** as above
1332	100	**CLAYSTONE:** light grey to brownish grey inter-bedded with greyish white laminations in part, soft, dispersive, abundant quartz silt, minor very fine sand, common to abundant coal specks and laminae, minor mica, rare disseminated and nodular pyrite, grading to Silty Claystone in part
1335	100	**CLAYSTONE:** as above
1338	100	**CLAYSTONE:** as above
1341	100	**CLAYSTONE:** light brown to moderate yellowish green, soft, dispersive, abundant quartz silt, common very fine to fine sand, minor to common glauconite, minor coal specks, rare mica, rare nodular pyrite, grading to Silty Claystone in part
1344	30	**CLAYSTONE:** moderate yellowish green to light brown, soft, dispersive, abundant quartz silt, common very fine to fine sand, minor to common glauconite, minor coal specks, rare mica, rare nodular pyrite, grading to Silty Claystone in part
	70	**SANDSTONE:** light brownish grey to dark yellowish green, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace foraminifera infilled with glauconite, trace to rare pyrite nodules, good inferred porosity. No shows.
1347	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1350	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well:** **Iona Obs-1** **Permit:** **PPL-2**
		6" Hole Section (744 –1565.17 mRT)
1353	40	CLAYSTONE: as above
	60	SANDSTONE: as above, grains commonly orange stained
1356	30	CLAYSTONE: as above
	70	SANDSTONE: as above, predominantly fine to medium
1359	90	SANDSTONE: as above
	10	CLAYSTONE: as above
1362	90	SANDSTONE: as above
	10	CLAYSTONE: as above
1365	60	SANDSTONE: as above
	40	CLAYSTONE: as above
1368	80	SANDSTONE: as above
	20	CLAYSTONE: as above
1371	80	SANDSTONE: light brownish grey to greyish brown to dark yellowish green in part, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace foraminifera infilled with glauconite, trace to rare pyrite nodules, good inferred porosity. No shows.
	20	CLAYSTONE: moderate yellowish green to light brown, soft, dispersive, abundant quartz silt, common very fine to fine sand, minor to common glauconite, minor coal specks, rare mica, rare nodular pyrite, grading to Silty Claystone in part
1374	90	SANDSTONE: as above
	10	CLAYSTONE: as above
1377	90	SANDSTONE: as above
	10	CLAYSTONE: as above
1380	100	SANDSTONE: as above
	tr	CLAYSTONE: as above
1383	100	SANDSTONE: as above
	tr	CLAYSTONE: as above
1386	100	SANDSTONE: as above
	tr	CLAYSTONE: as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1389	100	<u>**SANDSTONE:**</u> as above
	tr	<u>**CLAYSTONE:**</u> as above
1392		Missed sample
1395	100	<u>**SANDSTONE:**</u> as above, predominantly medium to coarse
	tr	<u>**CLAYSTONE:**</u> as above
1398	100	<u>**SANDSTONE:**</u> as above
	tr	<u>**CLAYSTONE:**</u> as above
1401	100	<u>**SANDSTONE:**</u> as above
	tr	<u>**CLAYSTONE:**</u> as above
1404	90	<u>**SANDSTONE:**</u> as above
	10	<u>**CLAYSTONE:**</u> as above
1407	90	<u>**SANDSTONE:**</u> light brownish grey to greyish brown to dark yellowish green in part, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace foraminifera infilled with glauconite, trace to rare pyrite nodules, good inferred porosity. No shows.
	10	<u>**CLAYSTONE:**</u> moderate yellowish green to light brown, soft, dispersive, abundant quartz silt, common very fine to fine sand, minor to common glauconite, minor coal specks, rare mica, rare nodular pyrite, grading to Silty Claystone in part
1410	90	<u>**SANDSTONE:**</u> as above
	10	<u>**CLAYSTONE:**</u> as above
1413	90	<u>**SANDSTONE:**</u> as above
	10	<u>**CLAYSTONE:**</u> as above
1416	90	<u>**SANDSTONE:**</u> as above
	10	<u>**CLAYSTONE:**</u> as above
1419	70	<u>**SANDSTONE:**</u> as above, predominantly fine to medium, grading to Clayey Sandstone in part
	30	<u>**CLAYSTONE:**</u> as above, grading to very light grey
1422	70	<u>**SANDSTONE:**</u> as above
	30	<u>**CLAYSTONE:**</u> as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well: Iona Obs-1 Permit: PPL-2**
		6" Hole Section (744 –1565.17 mRT)
1425	70	**SANDSTONE:** as above, predominantly very fine to medium, poorly to moderately sorted
	30	**CLAYSTONE:** as above
1428	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1431	60	**SANDSTONE:** as above
	40	**CLAYSTONE:** as above
1434	60	**SANDSTONE:** as above
	40	**CLAYSTONE:** as above
1437	50	**SANDSTONE:** as above
	50	**CLAYSTONE:** dark grey to greenish black, soft, dispersive, minor quartz silt, minor to common disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite, grading to Silty Claystone in part
1440	60	**CLAYSTONE:** medium to dark grey to greenish black, soft, dispersive, rare to minor quartz silt, minor to common disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite
	40	**SANDSTONE:** light brownish grey to greyish brown to dark yellowish green in part, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace foraminifera infilled with glauconite, trace to rare pyrite nodules, good inferred porosity. No shows.
1443	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1446	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1449	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1452	100	**CLAYSTONE:** medium light grey to dark greenish grey, soft, very dispersive, rare to minor quartz silt, minor to common disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite
	tr	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1455	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1458	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1461	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1464	100	**CLAYSTONE:** as above
1467	100	**CLAYSTONE:** as above, common to abundant nodular glauconite
1470	100	**CLAYSTONE:** as above
1473	100	**CLAYSTONE:** as above
1476	100	**CLAYSTONE:** as above
1479	100	**CLAYSTONE:** as above
1482	100	**CLAYSTONE:** medium light grey to dark greenish grey, soft, very dispersive, rare to minor quartz silt, minor to common disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite
1485	100	**CLAYSTONE:** as above
1488	90	**CLAYSTONE:** medium light grey to dark greenish grey, soft, very dispersive, rare to minor quartz silt, minor to common disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite
	10	**SANDSTONE:** light brownish grey to greyish brown to dark yellowish green in part, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse to pebble, predominantly angular to sub rounded, occasionally rounded and polished pebble grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace to rare pyrite nodules, good inferred porosity. No shows.
1491	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1493	90	**CLAYSTONE:** as above
Spot sample	10	**SANDSTONE:** as above
1494	100	**CLAYSTONE:** as above, grading to greyish yellow in part
	tr	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1495 Spot sample	90 10	**CLAYSTONE:** as above **SANDSTONE:** as above
1497	60 40	**CLAYSTONE:** as above **SANDSTONE:** as above, minor to common pebble grains
1498 Spot sample	70 30	**CLAYSTONE:** as above **SANDSTONE:** as above
1499 Spot sample	100 tr	**CLAYSTONE:** as above **SANDSTONE:** as above
1500	90 10	**CLAYSTONE:** as above **SANDSTONE:** as above
1501 Spot sample	100 tr	**CLAYSTONE:** medium light grey to dark greenish grey, soft, very dispersive, rare to minor quartz silt, minor to common disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite **SANDSTONE:** light brownish grey to greyish brown to dark yellowish green in part, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly fine to medium occasionally coarse to pebble, predominantly angular to sub rounded, occasionally rounded and polished pebble grains, poor to moderate sphericity, moderately sorted, common to abundant glauconite grains, rare skeletal fragments, trace to rare pyrite nodules, good inferred porosity. No shows.
1502 Spot sample	100	**CLAYSTONE:** as above
1503	100 tr	**CLAYSTONE:** as above **SANDSTONE:** as above
1504	100	**CLAYSTONE:** as above
1505	100	**CLAYSTONE:** as above
1506	100	**CLAYSTONE:** as above
1507	100	**CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1508	90	CLAYSTONE: as above
	10	SANDSTONE: as above
	tr	SILTY CLAYSTONE: light grey to light brownish grey , soft, common to abundant silt, common coaly specks, trace to rare mica
	tr	COAL: black, moderately hard, conchoidal fracture, vitreous
1509.35	80	CLAYSTONE: as above
B.U.	20	SANDSTONE: as above
	tr	SILTY CLAYSTONE: as above
	tr	COAL: as above
1510	75	CLAYSTONE: as above
	10	SANDSTONE: as above
	10	SILTY CLAYSTONE: as above
	5	COAL: as above
1511	70	SANDSTONE: light brownish grey to very light grey, fine to coarse, dominantly medium, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite
	25	CLAYSTONE: medium to dark grey, soft to firm, dispersive, rare to minor carbonaceous laminations and specks, trace pyrite, trace resin
	5	COAL: black, moderately hard, conchoidal fracture, vitreous
1512	90	SANDSTONE: as above
	10	CLAYSTONE: as above
	tr	COAL: as above
1513	90	SANDSTONE: as above
	10	CLAYSTONE: as above
	tr	COAL: as above
1514	60	SANDSTONE: as above
	40	CLAYSTONE: as above
1515	60	SANDSTONE: as above
	40	CLAYSTONE: as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona Obs-1 Permit: PPL-2
		6" Hole Section (744 –1565.17 mRT)
1516	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1517	60	**SANDSTONE:** as above
	40	**CLAYSTONE:** as above
1518	80	**SANDSTONE:** as above
	20	**CLAYSTONE:** as above
1519	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1520	80	**SANDSTONE:** as above
	20	**CLAYSTONE:** as above
1521	90	**SANDSTONE:** as above
	10	**CLAYSTONE:** as above
1522	100	**SANDSTONE:** as above
	tr	**CLAYSTONE:** as above
1523	70	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite
	30	**CLAYSTONE:** medium to dark grey, soft to firm, dispersive, rare to minor carbonaceous laminations and specks, trace pyrite, trace resin
1524	80	**SANDSTONE:** as above
	20	**CLAYSTONE:** as above
1525	100	**SANDSTONE:** as above
	tr	**CLAYSTONE:** as above
1526	90	**SANDSTONE:** as above
	10	**CLAYSTONE:** as above
1527	100	**SANDSTONE:** as above
	tr	**CLAYSTONE:** as above
1530 - 1533		No sample – too little across shakers See core chip descriptions
1536	80	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well: Iona Obs-1 Permit: PPL-2**
		6" Hole Section (744 –1565.17 mRT)
	20	**CLAYSTONE:** as above
1539	80	**SANDSTONE:** as above
	20	**CLAYSTONE:** as above
1542	30	**SANDSTONE:** as above
	70	**CLAYSTONE:** as above
1545	20	**CALCAREOUS SANDSTONE:** very light grey to white, fine to coarse occasionally very coarse, fair sphericity, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, 30 to 40 percent calcareous matrix, trace pyrite, common white to very light grey argillaceous matrix, trace carbonaceous fragments.
	80	**CLAYSTONE:** as above, grading to Silty Claystone
		Note: cavings of glauconitic Claystone – 20 percent
1548	40	**CALCAREOUS SANDSTONE:** as above
	60	**CLAYSTONE:** as above
1551	60	**CALCAREOUS SANDSTONE:** as above
	40	**CLAYSTONE:** as above
1554	90	**CALCAREOUS SANDSTONE:** very light grey to white, fine to coarse occasionally very coarse, fair sphericity, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, 30 to 40 percent calcareous matrix, trace pyrite, common white to very light grey argillaceous matrix, trace carbonaceous fragments.
	10	**CLAYSTONE:** medium to dark grey, soft to firm, dispersive, rare to minor carbonaceous laminations and specks, trace pyrite, trace resin
1557	70	**CALCAREOUS SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1560	40	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite
	30	**CALCAREOUS SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1563	50	**SANDSTONE:** as above
	10	**CALCAREOUS SANDSTONE:** as above
	40	**CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well: Iona Obs-1 Permit: PPL-2**
		6" Hole Section (744 –1565.17 mRT)
1566	Tr	**SANDSTONE:** as above
	Tr	**CALCAREOUS SANDSTONE:** as above
	100	**CLAYSTONE:** as above
1568.17	Tr	**SANDSTONE:** as above
TD	Tr	**CALCAREOUS SANDSTONE:** as above
	100	**CLAYSTONE:** as above

TD 1568.17 mRT reached at 18:20 hrs 23 February 1999

APPENDIX 4

Core Descriptions and Core Analysis by ACS Laboratories Pty. Ltd.

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ACS
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DETAILED CORE DESCRIPTION and
SEDIMENTOLOGICAL INTERPRETATION

of

IONA OBS-1

for

WESTERN UNDERGROUND GAS STORAGE PTY LTD

by

ACS LABORATORIES PTY LTD

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15 April 1999

ACS LABORATORIES PTY. LTD.

Western Underground Gas Storage Pty Ltd
C/- Texas Utilities Australia
Level 49, Rialto South Tower
525 Collins Street
MELBOURNE VIC 3000

Attention: Andy Whittle

FINAL REPORT: 0414-01

CLIENT REFERENCE:	Letter of Transmittal No. UGS 0000451 dated 17 March, 1999
MATERIAL:	Conventional Core
LOCALITY:	Iona OBS-1
WORK REQUIRED:	Detailed Core Description and Sedimentological Interpretation

Please direct technical enquiries regarding this work to the signatories below under whose supervision the work was carried out.

G. Kraishan

GHAZI KRAISHAN
Sedimentologist and Petrologist

DETAILED CORE DESCRIPTION
and
SEDIMENTOLOGICAL INTERPRETATION

of

IONA OBS-1

A final report prepared

for

WESTERN UNDERGROUND GAS STORAGE PTY LTD

by

Dr. GHAZI KRAISHAN

April 1999

This report is divided into two parts:

Part A presents an executive summary (Chapter 1), introduces this investigation (Chapter 2), summarises the methodology (Chapter 3), presents results (Chapter 4) and summarises the major findings (Chapter 5). Representative photos of different lithofacies are presented at the end of this part.

Part B presents the logging data sheets (comprising lithologic logs: Appendices I and II).

CONTENTS

PART A

PART B

APPENDICES

1. EXECUTIVE SUMMARY

- Western Underground Gas Storage Pty Ltd requested a sedimentological core study of Iona OBS-1. This was undertaken using a detailed log description and sedimentological interpretation.

- Iona OBS-1 core spans an interval between 1509.34 m to 1534.30 m. This interval comprises a succession of interbedded mudstone, siltstone and sandstone. The sandstones of Iona OBS-1 are very fine- to very coarse (sometimes pebbly) and poor to moderately well sorted.

- The Waarre Formation is generally interpreted to be the product of deposition in a mixture of braided and meandering fluvial settings. Detailed core description revealed that Iona OBS-1 sandstones contain numerous facies and include small scale to large scale cross stratified sandstone, horizontal continuous to discontinuous small scale cross laminated to ripple laminated sandstone, and interbedded laminated mudstone and rippled thinly bedded to lensen sandstones (heterolithics). The lower part of the studied section is believed to have been deposited in braided fluvial environments whilst the upper part represents meandering point bar and floodplain (overbank) deposits.

- Detailed core description revealed that Iona OBS-1 sediments are deposited within a mixture of braided and meandering fluvial settings. The core interval was a product of bed-load dominated sandstone with minor mixed-load and suspended-load river systems. Four lithofacies or lithofacies associations have been identified in the studied core interval of Iona OBS-1. These sandstone facies are believed to have been deposited in environments ranging from braided mid-channel bars to meandering floodplain. The lower part of the core interval represents a prograding thick stacked, braided fluvial channel deposit. This is overlain by thin heterolithic mudstone interbedded with thin starved, rippled sand lenses. This facies is believed to have been deposited in a changing depositional environment of meandering floodplain, marking a maximum flooding surface. The upper part of the mudstone of the meandering floodplain is truncated by medium to very coarse-grained fining upwards sandstone making a thin isolated ribbon of meandering point bar deposits.

- The ichnofacies assemblages are of extremely low diversity and are represented by one assemblage of *Planolites*. This monospecific assemblage belongs to the *Cruziana* ichnofacies. The trace fossils are restricted to the interbedded mudstone and thin sandstone facies (heterolithic facies). They are consistent with the depositional model presented above and reflect reducing to anoxic conditions which might have developed in a restricting setting of meandering fluvial floodplain deposits.

- Reservoir potential of Iona OBS-1 Waarre Formation ranges from poor to excellent. Reservoir quality is excellent in the medium to very coarse-grained, clean large scale trough cross stratification sands, good in the fine to medium-grained, horizontal to small scale cross laminated sands of the mid-channel bars and poor in the heterolithics overbank (floodplain) facies.

2. INTRODUCTION

Western Underground Gas Storage Pty Ltd requested a sedimentological core study of Iona OBS-1. Two cores, (almost 13 metres in length) comprising mostly subequal quantities of sandstone and mudstone (shale), were analysed, described and interpreted sedimentologically. A summary of the main aims of this investigation is presented below:-

- Describe the sedimentological lithofacies and ichnofacies.
- Provide facies scheme and identify the main depositional surfaces.
- Postulate the depositional environments.

3. METHODS

The sedimentary sequence of the Upper Cretaceous Waarre Formation was studied and logged from the Iona OBS-1 well. The colour, texture, bedding thicknesses, grain composition, trace fossils assemblage and primary sedimentary structures were used to identify different facies. The Frey and Pemberton (1984) and Pemberton (1992) ichnofacies assemblage scheme was used to describe and classify the trace fossils recognised during log description. The Miall classification of lithofacies (Miall, 1978) was used with some modification to characterise the core interval. The modified lithofacies scheme used in this study is presented in Table 1. The integration of lithology, primary sedimentary structures and trace fossil assemblages were used in combination to assess the interpretation of depositional environment for different sedimentary sequences in Iona OBS-1. The depositional facies interpretation is based on the work of Reading (1996) and Galloway and Hobday (1983). The core interval was logged in a scale of 1:25 cm. Detailed graphic core description, grain size, sedimentary structures, degree and type of bioturbation, bedding contacts, probable depositional environment and selected photographs of the Waarre Formation from Iona OBS-1 core interval are presented in Appendices I and II and Plates 1 - 3.

TABLE 1. Lithofacies scheme and depositional facies used for the core description of the Waarre Formation from Iona OBS-1. Lithofacies modified from Miall (1978) and depositional facies from Reading (1996).

Lithofacies

S	**Sandstone:**	
	Sc	Erosional scoured
	Sg	Normal grading
	Sl	Horizontal lamination
	Sp	Pebbly sandstone
	Sr	Ripple scale cross stratification
	St	Large scale cross stratification
	Sx	Small scale cross stratification
H	**Interbedded sandstone and mudstone:**	
	Hc1	Sand lensed mud
	Hc2	Sand streak mud
F	**Mudstone:**	
	Fb	Bioturbated
	Fl	Laminated
C	**Coal:**	

Depositional Facies

MCB	Mid-Channel Bar
BF	Barforms
PB	Point Bar
FB	Floodplain

4. RESULTS

This section summarises the results of the sedimentary study. The Waarre Formation from Iona OBS-1 has been subdivided into four lithostratigraphic facies deposited probably in four depositional environments (Table 1). The Iona OBS-1 interval comprises an interbedded sequence of shale and fine- to very coarse-grained sandstone. A detailed lithological description, depositional lithofacies and ichnofacies are presented in Appendix II on the graphic logs.

4.1 *Sedimentological Study*

The Waarre Formation sediments studied from Iona OBS-1 are dominated by nearly subequal quantities of relatively clean, fine to very coarse grained sandstone (sometimes pebbly) interbedded with mudstone. A number of lithofacies were recognised in the studied core interval including: sandstone, interbedded sandstone and shale. Table 2 summarises these lithofacies and their characteristics, thicknesses and possible depositional environments. Bedding laminations are marked by subtle changes in grain size and/or colour. Sedimentological studies revealed that the Waarre Formation sediments were deposited in braided to meandering river systems with possible tidal influence. The general depositional setting of the sediments studied therefore, has been interpreted to be fluvial.

The following section is a detailed description of the four lithofacies recognised during the core logging.

4.1.1 Horizontal to small scale cross laminated sandstone

This facies represents the lowermost part of the cored interval. It is dominantly composed of sandstone sets. The sands range in size from fine to medium-grained and moderately to well sorted. The upper and lower contacts are generally sharp. The thickness of each set ranges in thickness from 0.30 m to 2.0 m. The dominant sedimentary structure is low angle to small scale continuous to discontinuous cross to wavy laminations (Plate 1.A). Some sandstone units contain few rip-up clasts. The unit also contains local shale partings in millimetre scale. Current ripple lamination to wavy ripple lamination is common especially in the upper part of this facies. Local sand beds show trough cross stratification at their upper part . The facies contains thin coalified wood and plant materials with a thickness of less than 5 cm.

The absence of trace fossils indicates a moderate to high energy environment. The predominance of low angle of small cross lamination and the presence of current to wavy ripple marks suggests that this facies was produced by lateral and vertical accretion of low-relief unattached barforms. Given the preceding details, it is believed that this facies represents a low sinuosity braided sandy bedload river.

4.1.2 Stacked fining upward sandstones

This facies consists mainly of grey to creamy, sandstones and pebbly sandstones (Plate 1.B). The sandstones are typically medium to very-coarse grained, becoming finer upwards. The sandstone units commonly occur in thick stacked sets, ranging between 20 cm to 1.5 m beds. The facies is highly variable and contains a scoured or erosional base pebble sandstone, overlain by trough cross stratified sandstone, ripple to cross stratified sandstone and horizontal laminated sandstone. The basal parts of contacts are sharp and irregular, commonly exhibiting evidence of winnowing or scoured surfaces. The dominant sedimentary structures are large-scale cross stratification with inclinations up to 30° (Plate 1.B), interpreted as trough and planar tabular cross stratification. The cross stratification grades up to thin bedded, ripple and small scale cross lamination. The facies also contains rip-up clasts and pebble imbrications. These imbrications are characterised by uni-directional flow current. The top of this unit is sharp and locally gradational. The facies is dominated by physical sedimentary structures and is devoid of trace fossils. Plant debris or coalified wood or plant materials are present throughout of this facies (Plate 2.A).

The overall setting of this facies is interpreted as having been produced by low sinuosity braided, coarse-grained bedload, channelised uni-directional flow, fluvial river system. This is indicated by the combination of sedimentary structures, the lack of trace fossils and the associated facies. Planar to tabular and trough cross stratification, mudstone rip-up clasts and pebble imbrications all indicate sediment transport by traction currents. The sediments of this facies were deposited by mid-channel bars or longitudinal bars.

TABLE 2. Detailed description of the Waarre Formation lithofacies from Iona OBS-1, with thicknesses, probable depositional environments and reservoir potential.

Facies	Description	Thickness (m)	Depositional Environments	Reservoir Potential
S (Sandstone)				
St Dune scale cross stratification	Coarse to very coarse-grained, poorly sorted, clean sandstone. Sedimentary structures are dominated by large scale planar to trough cross stratification. No evidence of bioturbation. Associated with Sg, Sc, Sp and Sg.	0.20 to 0.50	High energy mid-channel bar	Excellent
Sg Normal grading	Fine to very coarse-grained, massive. No clear evidence of bioturbation. Lower contact is sharp with local evidence of scoured, and the upper contact is gradational. Associated with Sp and St.	0.10 to 1.5	High energy mid-channel bar	Excellent
Sr Ripple scale cross stratification	Fine to medium-grained, wavy to small scale ripple cross stratified sandstone. No bioturbation. Upper and lower contacts are sharp. Associated with Sx and Sl.	0.01 to 0.50	Moderate to high energy point bar High energy mid-channel bar Moderate to high energy barforms	Good
Sl Horizontal lamination	Fine to medium-grained, wavy, horizontal continuous to discontinuous laminated sandstone. Shale parting and rip-up clasts are present at the top of a few layers. Associated with Sx, and Sr.	0.01 to 1.5	Moderate to high energy point bar to mid-channel bar Moderate to high energy barforms	Good
Sx Small scale cross stratification	Fine to coarse-grained, small scale cross stratified sandstone. Thin to cross laminations are also present. This facies is characterised by a low angle of cross bedding and is associated with Sl, Sr, and St. No clear evidence of bioturbation.	0.2 to 0.50	Moderate to high energy point bar Moderate to high energy barforms	Good
Sc Erosional scoured	Medium to coarse, massive sandstone. Associated with scoured surfaces of all facies.	N/P	High energy mid-channel bar	Good to very good

TABLE 2. Detailed description of the Waarre Formation lithofacies from Iona OBS-1, with thicknesses, probable depositional environments and reservoir potential. (*continued*)

Facies	Description	Thickness (m)	Depositional Environments	Reservoir Potential
H (Interbedded sandstone and mudstone)				
Hc1 Sand lensed mud or Fl, Fb, F/Sr and F/Sl	Interbedded sand lenses with mudstone. The mudstone is horizontally laminated with moderate plant fossils. Mudstone is slightly bioturbated. Sandstone beds show current ripple cross stratification and continuous to discontinuous horizontal lamination. Sandstones are present as lens beds within the mud part. The amounts of sand beds are less than 20%	~ 4.5	Low energy floodplain	Very Poor
Hc2 Sand streak mud or F/Sl and F/Sr F/Sb	Dominantly thin laminated to small scale cross laminated mudstone with very thin beds of very fine-grained sandstone. Bioturbation is minor.	~ 4.5	Low energy floodplain	Very Poor
F (Mudstone)				
Fl Laminated	Thinly laminated silt to mudstone. Trace bioturbation. Associated with Fl.	Few cms	Low energy floodplain	Very Poor
Fb Bioturbated	Minor bioturbated silt to mudstone.	Few cms	Low energy floodplain	Very Poor
C (Coal)				
C Coal	Black thin bedded, lamainated.	Few cms	Low energy within the floodplain	Very poor

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4.1.3 Interbedded very fine-grained lenticular sandstone and mudstone (heterolithic)

This facies is characterised by interbedded very fine-grained lenticular laminated to wavy rippled sandstone with thinly laminated mudstone (Plate 2.B). The total thickness of this facies is 4.5 m. The sandstones are creamy, very fine to fine-grained and moderately to well sorted. The sands are typically developed as thin laminae, lenses and starved ripples (Plate 2.B), rarely greater than 1 cm in thickness. Primary sedimentary structures are common to abundant and dominated by laminations which are wavy and regular to irregular, with organic rich shale partings at millimetre scale. Some laminations are gently curved and represent ripple to cross lamination.

The mudstone (shale) facies commonly consists of black, thinly bedded (~ 10 cm to 20 cm) with variable fissility and dominates the heterolithic part of this facies. Sedimentary structures within the mudstone are dominated by wavy to horizontal lamination (Plate 2.B). The thickness of individual mudstone layers ranges from less than 5 cm to 20 cm. The facies contains numerous pyrite nodules. Incipient sideritisation has developed in a few of the mud beds, especially the lower part of the facies (Plate 3.A). This facies contains abundant plant debris (Plate 3.A) and plant fossils. The lower part of this facies contains thin coal beds ranging in thickness from a few millimetres up to 20 cm. There is evidence of subaerial emergence indicated by local and small scale syneresis or mudcracks.

The relative degree of bioturbation is characteristically extremely low and represented by low density assemblages. The trace fossils are dominated by small scale, horizontal *Planolites* (Plates 2.B and 3.A).

The style of laminations in this facies with the common occurrence of organic matter, then coal beds and plant debris, low intensity of bioturbation all lead to the conclusion that this facies was deposited on an alluvial floodplain environment. This facies was deposited on top of a braided river plain as a product of either major flood on the fluvial plain or channel migration. This facies represents a meandering suspended-load deposit.

4.1.4 Thin ribbon of stacked fining upwards sandstone

This facies is thin stacked fining upwards from basal erosional pebbly sandstone to very fine to fine-grained laminated to small scale ripple laminated sandstone sets (Plate 3.B). Pebbles are dominant at the bottom of each set (Plate 3.B) and represent scoured surfaces. The small scale to ripple laminated sandstone facies contains rip-up clasts or shale partings in a centimetre scale. The lower and upper contacts of the stacked sandstone facies are scoured. It also contains thin coal beds less than 5 cm in thickness. The thickness of each sand set is ranging from 20 cm to 50 cm. This is interbedded with laminated mudstone and thin massive bioturbated mudstone.

The isolated stacked fining upwards sandstone facies within the floodplain deposits are representing a ribbon sandbody within overbank deposits. The sands of this facies were deposited as a thin channel point bar representing a mixed-load deposit.

4.2 *Interpretation*

4.2.1 Vertical Facies Succession

The sediments of the Waarre Formation of Iona OBS-1 comprise a vertical facies succession that is dominated by interbedded fine to very coarse-grained sandstone with thinly laminated mudstone. The lowermost part comprises a horizontally to small scale cross laminated sandstone that has been deposited by vertical to lateral accretion of barforms. The flow velocity would have been moderate and less than for the overlaying mid-channel bar facies. The dominance of uni-directional cross bedding, and pebble imbrications of the following facies suggest high energy and low sinuosity braided channel deposits prograding basinward.

The interbedding of mudstone and thinly laminated sandstone suggests a low energy of sedimentation and may reflect major flood and changes in the sedimentation rate. This section of the core interval is interpreted to indicate a sudden change in sedimentary environment, from a braided system to a meandering fluvial system. Unfortunately the contact between the mid-channel bar facies and the interbedded mudstone and thinly laminated sandstone is not cored. The base of the mudstone facies, however, is marked by very thin lag deposit, suggesting a possible erosional surface. The lower part of the mudstone facies is dominated by heterolithic interbedded mudstone and thinly laminated sandstone that could have been deposited in a meandering floodplain with possible tidal influence (Fig. 1). The mudstone (shale) facies is slightly bioturbated. The monospecific ichnofacies assemblage of this facies suggests a restricted reducing to anoxic setting. This is evidenced by the presence of numerous pyrite nodules and local siderite nodules and bands.

The upper part of the cored interval of the Waarre Formation of Iona OBS-1 is mainly fine to very coarse-grained and dominated by horizontal to small scale cross lamination and ripple cross stratification. The bottom of this sandstone facies locally contains mud and rip-up clasts, which may have resulted from both the erosion of channel sides associated with the lateral migration of channels, and the reworking of sediments deposited by the weaker currents during periods of floodplain. The upper and lower contacts are scoured. This facies is interpreted to be deposited in a meandering point bar deposit.

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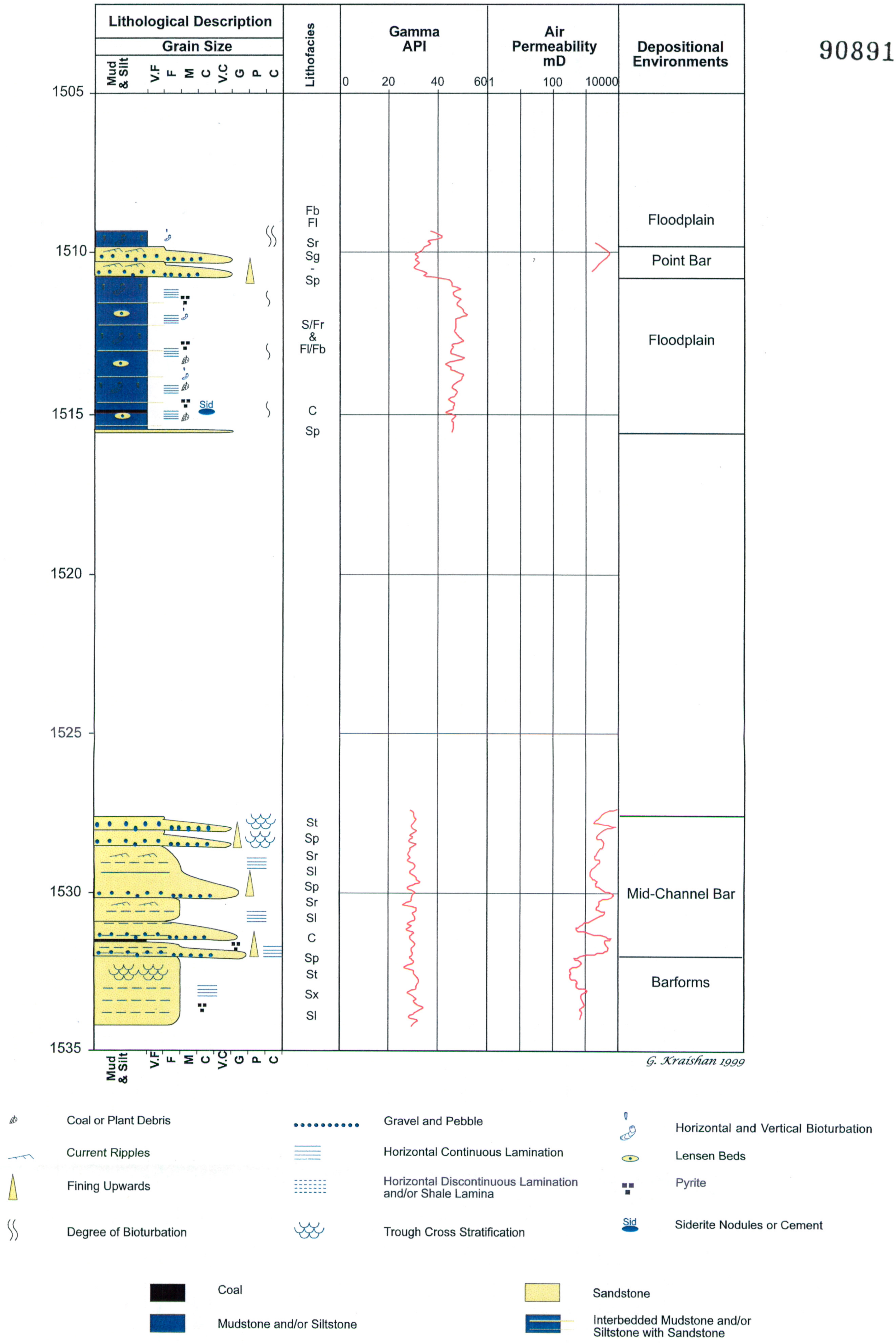

Figure 1: A generalised core description of Waarre Formation of Iona OBS-1 showing main lithofacies and probable depositional environments.

5. SUMMARY AND CONCLUSIONS

The sandstones of the Waarre Formation of Iona OBS-1 are very fine- to very coarse (sometimes pebbly) and poorly to moderately well sorted. Detailed core description revealed that the sandstones are deposited within a mixture of braided and meandering fluvial settings. The core interval was a product of bedload dominated sandstone with minor mixed-load and suspended-load river systems. Four lithofacies or lithofacies associations have been identified in the studied core interval of Iona OBS-1. These sandstone facies are believed to have been deposited in environments ranging from braided mid-channel bars to meandering floodplain.

The ichnofacies assemblages are of low diversity and combine elements of the *Cruziana* ichnofacies. The trace fossils are mainly *Planolites* and reflect a reducing or anoxic setting that could be associated with floodplains.

Reservoir potential of Iona OBS-1 sandstones ranges from poor to excellent. Reservoir quality is excellent in the medium to very coarse-grained, clean large scale trough cross stratification sands of the mid-channel bar and good in the very fine to medium-grained, small scale cross laminated sands of the barforms, and fair to poor in the heterolithics.

6. REFERENCES

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PLATES

CORE PHOTOGRAPHS

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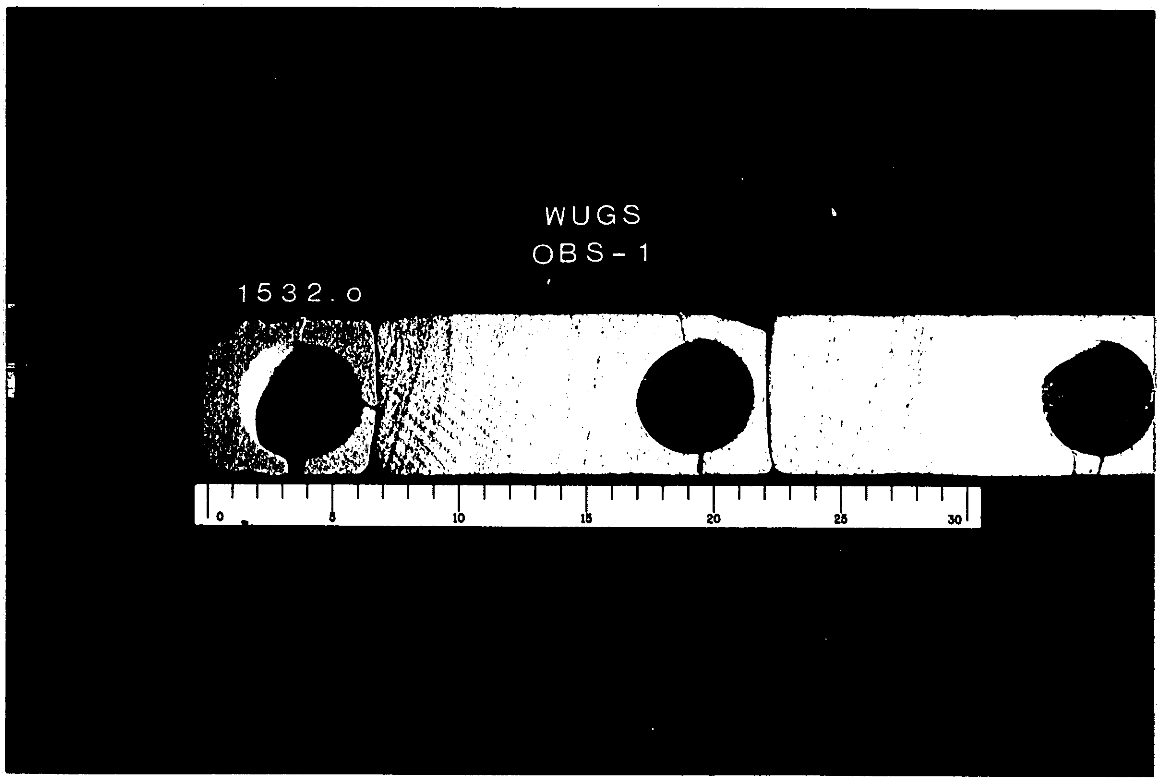


Plate 1A: Core # 2 (1532.00 m): Core photograph of thinly laminated to cross laminated fine to medium-grained sandstone (Sl). Note that there is no bioturbation. The possible depositional environment of this interval is braided fluvial barforms. Scale bar = 30 cm. *(Please note that the left hand side of all photos represents the top of the core).*

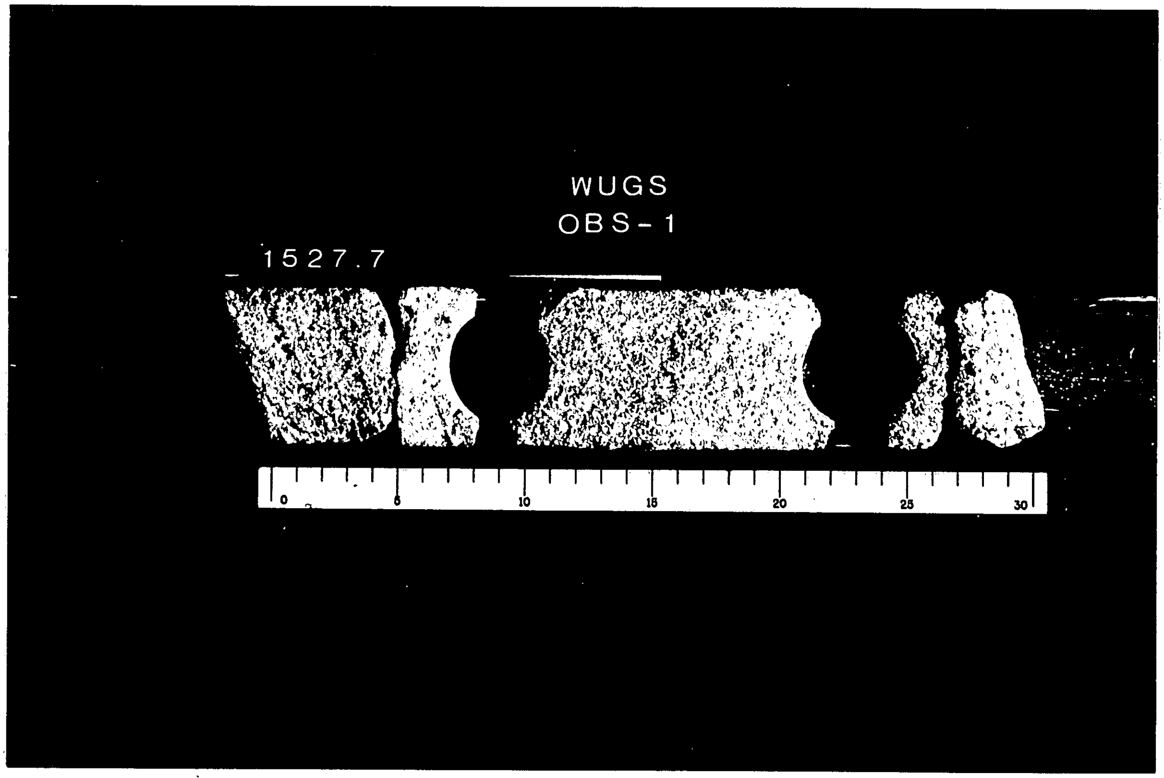


Plate 1B: Core # 2 (1527.70 m): Core photograph of thick stacked sets of trough cross stratified sandstone. The basal parts of contacts are sharp and irregular, commonly exhibiting evidence of scour. Note that the cross stratification grades up to thin bedded, ripple and small scale cross lamination. Scale bar = 30 cm.

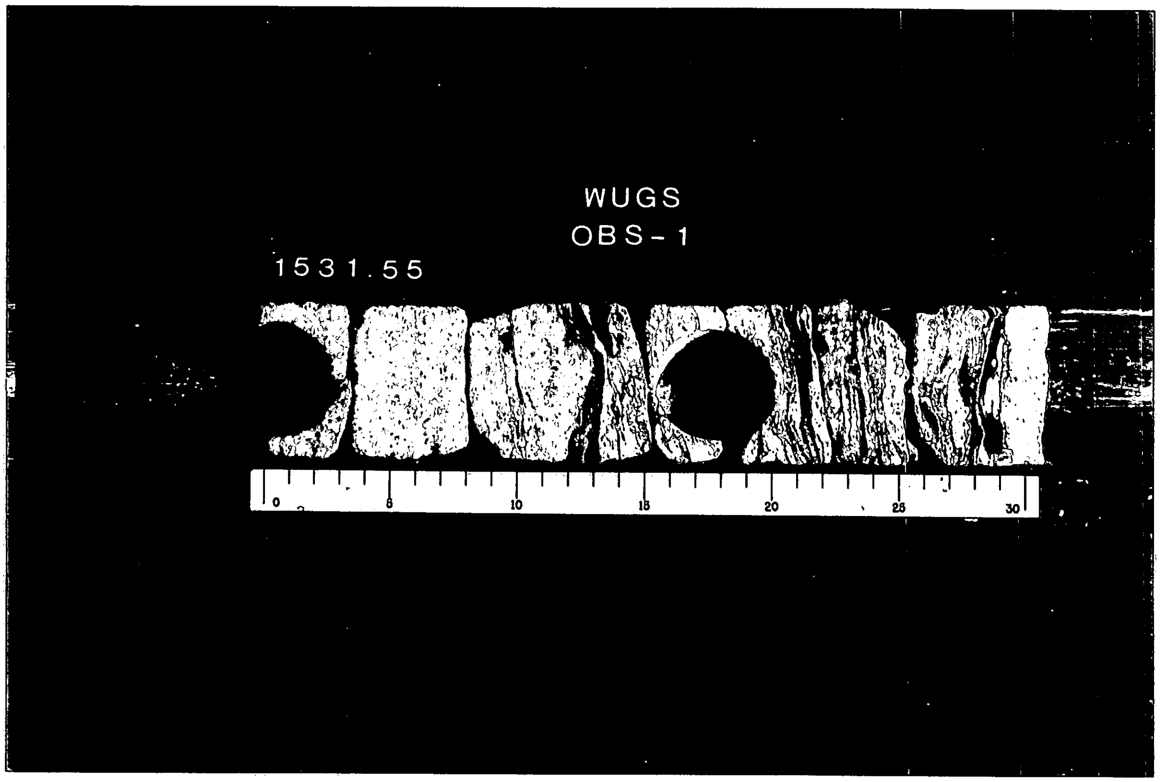


Plate 2A: Core # 2 (1531.55 m): Core photograph of pebbly sandstone (Sp) facies followed by large scale cross stratified sandstone (St), laminated sandstone and small scale cross stratified pebbly sandstone (Sl to Sc facies) with numerous thin coal laminae and plant debie. The probable depositional environment for this facies is braided mid-channel bar. Scale bar = 30 cm.

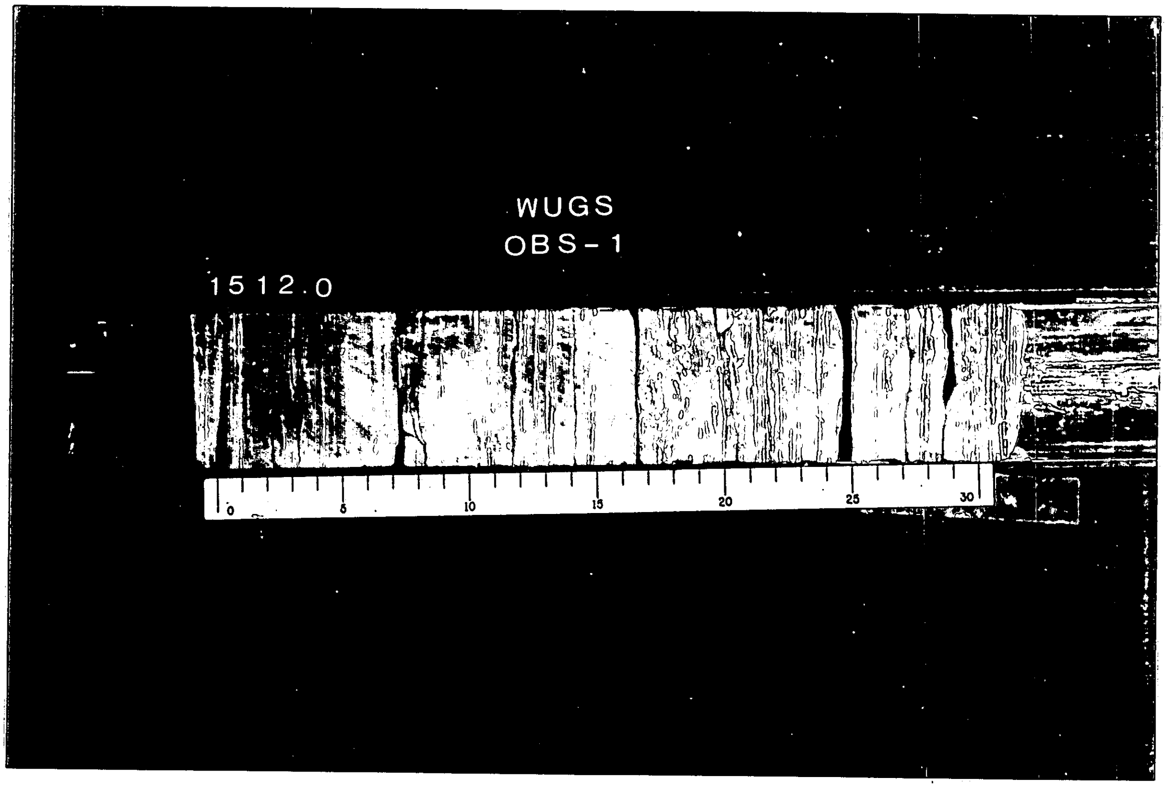


Plate 2B: Core # 1 (1512.00 m): Core photograph of interbedded thinly laminated mudstone (Fl) and very fine to fine-grained laminated to rippled sandstone facies(Sl to Sr). The trace fossil assemblages are dominated by *Planolites*. This interval was interpreted to reflect a meandering floodplain. Scale bar = 30 cm.

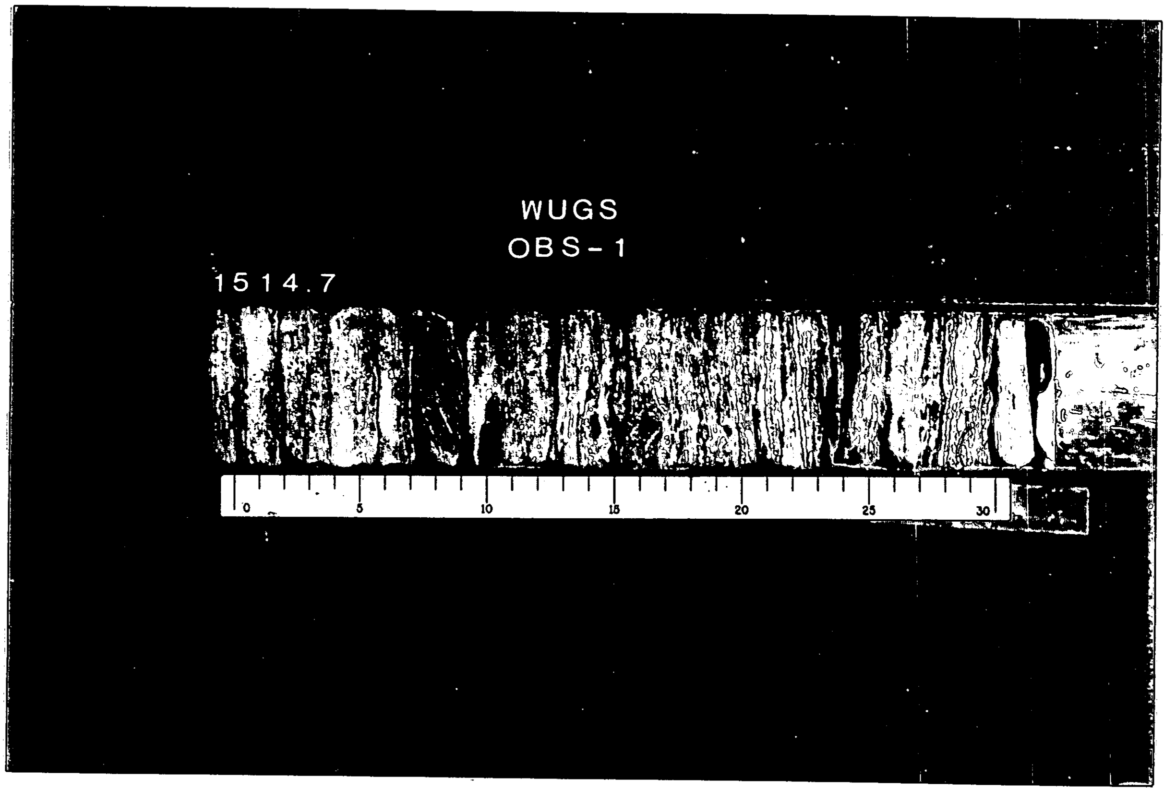


Plate 3A: Core # 1 (1514.70 m): Core photograph of interbedded thinly laminated mudstone (Fl) and very fine to fine-grained laminated to rippled sandstone (Sl to Sr) facies. The sands are typically developed as thin laminae, lenses and starved ripples, rarely greater than 1cm in thickness. Bioturbation is minor with possible *Planolites*. Pyrite and siderite nodules are common in this interval. Scale bar = 30cm.

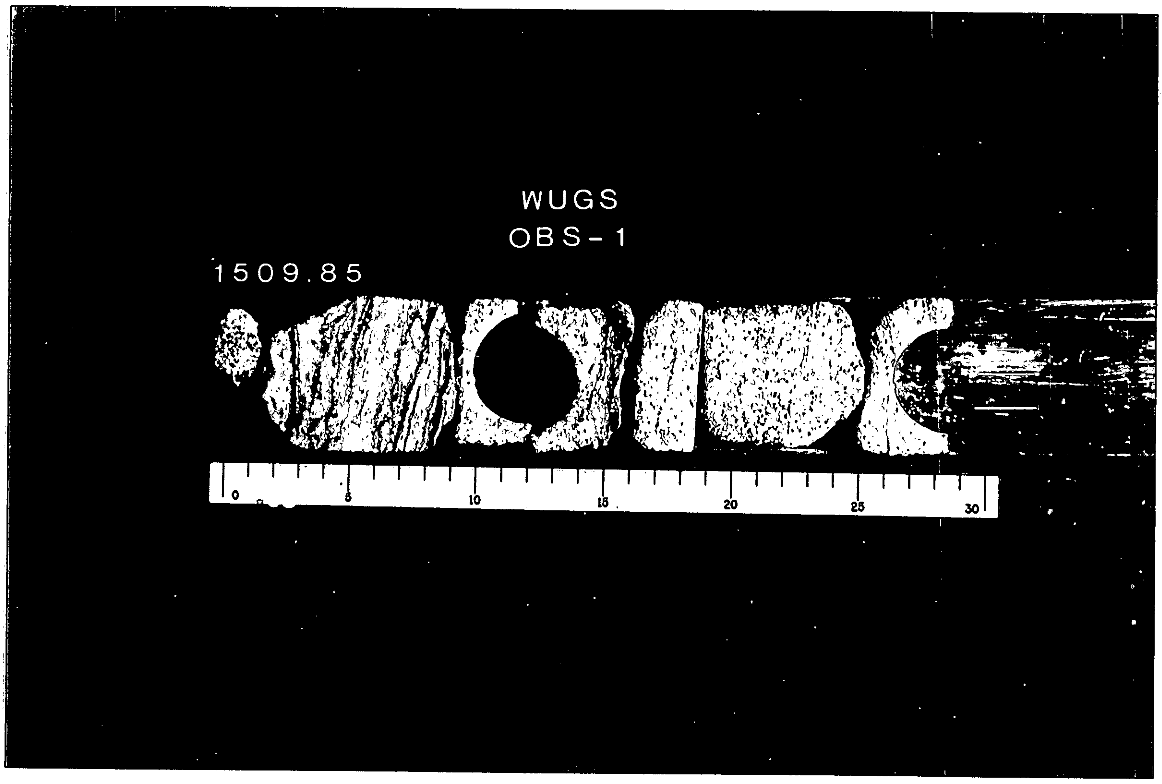


Plate 3B: Core # 1 (1509.85 m): Core photograph of a thin ribbon of stacked fining upwards sandstone. The upper part is laminated to cross laminated very fine to medium-grained sandstone (Sl) and the lower part is coarse to very coarse-grained (sometimes pebbly). The possible depositional environment of this interval is meandering point bar. Scale bar = 30 cm.

APPENDIX I

SYMBOL INDEX

APPENDIX I
SYMBOL INDEX

Trough Cross Stratification	Small scale Cross Stratification
Current Ripples	Coal or Plant Debris
Fining Upwards	Sand Lenses
Gravel and Pebble	Horizontal Bioturbation
Horizontal Continuous Lamination	Pyrite
Horizontal Discontinuous Lamination and/or Shale Lamina	Siderite Nodules or Cement

Sid

BIOTURBATION DEGREE

Trace	Common
Minor	Abundant

LITHOLOGY

- Coal
- Sandstone
- Mudstone and/or Siltstone
- Interbedded Mudstone and/or Siltstone with Sandstone

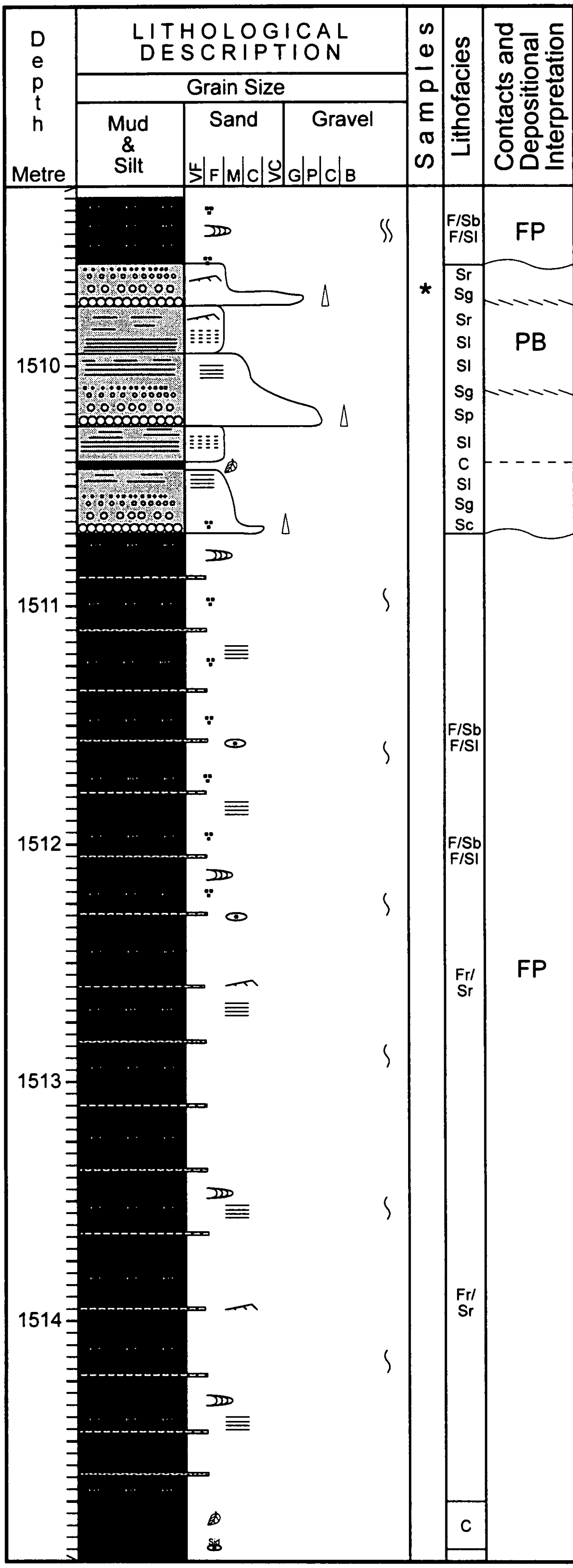
CONTACTS

- Sharp
- Scoured
- Gradational
- Uncertain

APPENDIX II

LITHOSTRATIGRAPHIC LOGS

Well : Iona OBS-1	Page 1 of 3
Waarre Formation	1509 -1515



Comments

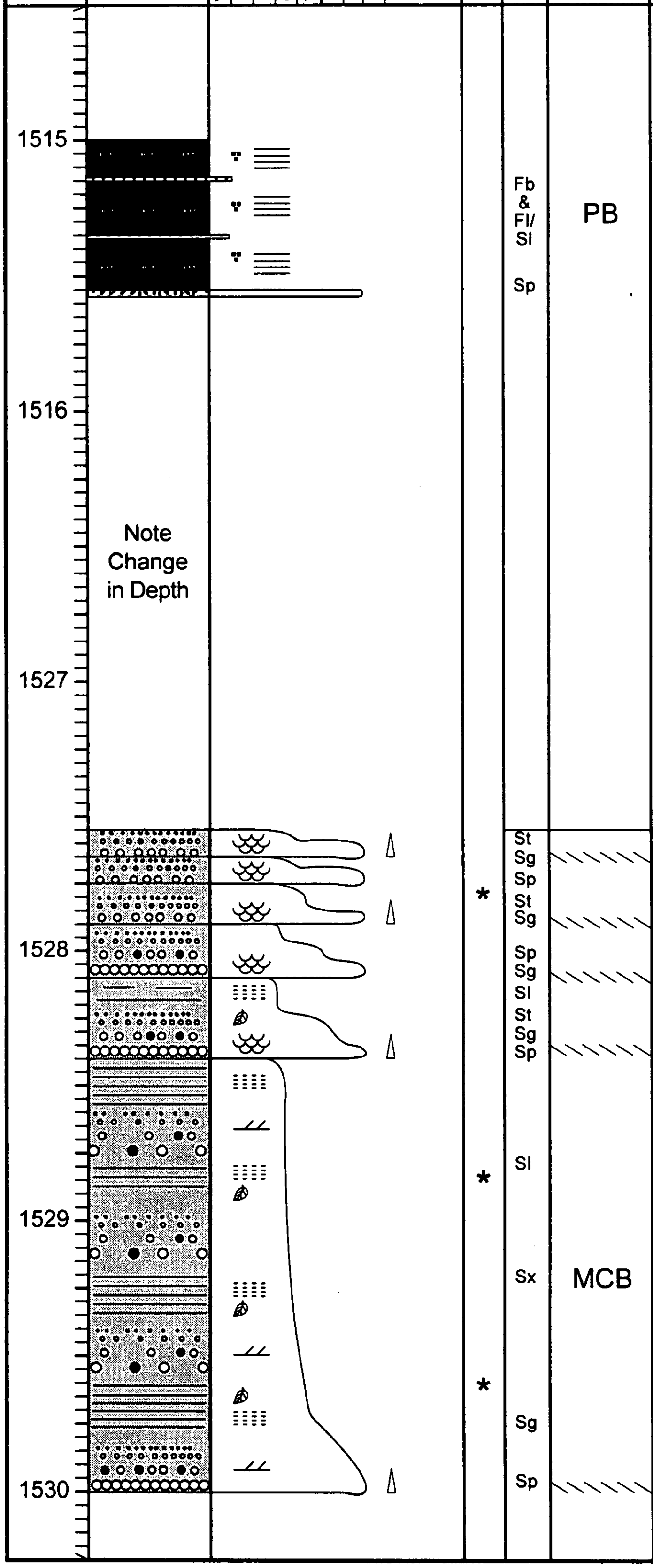
1509.30 - 1509.57m Mudstone.
Dark grey to black, massive, locally bioturbated mudstone. Bioturbation is mainly horizontal (*Planolites*). Numerous pyrite nodules.

1509.57 to 1510.70 m Sandstone.
Light grey to creamy, poorly sorted, fine to very coarse-grained sandstone with pebble at the bottom of each set. Gradational fining upwards to form horizontal continuous laminated fine sandstone. Ripple marks are common at the top of each set. Local coalified bed is developed in centimetres scale. Pebbles are dominantly quartz grains with few siltstone and/or mudstone clasts and coalified materials. Upper and lower contacts are scoured.

1510.70 - 1515.50 m Interbedded Mudstone and thin bedded sandstone.
Mudstone:
Dark grey to black, laminated, locally bioturbated mudstone. Bioturbation is mainly horizontal (*Planolites*). Numerous pyrite nodules. Mudstone is predominately laminated with few sunrise structures. Coalified materials are common and developed to a 20 cm bed at the bottom of the interval. Few siderite nodules and thin beds are developed around the coal bed. Upper and lower contacts are sharp.

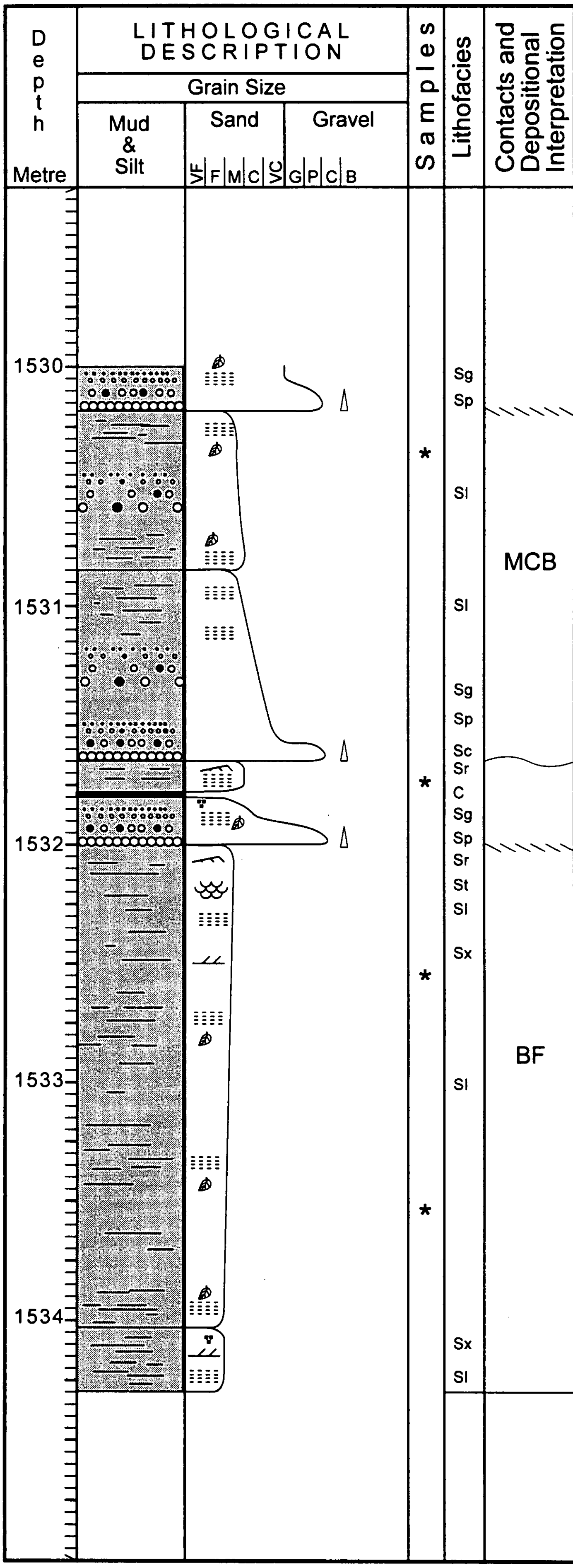
Sandstone:
Very fine to fine-grained sandstone is developed as thin to lensen beds ranging in thickness from a few millimetres to less than 1 cm. The dominant sedimentary structures in thin sandstone beds are lamination to small scale ripple cross lamination. The bulk sandstone content is less than 20%.

Depth Metre	LITHOLOGICAL DESCRIPTION — Grain Size: Mud & Silt; Sand (VF, F, M, C, VC); Gravel (G, P, C, B)	Samples	Lithofacies	Contacts and Depositional Interpretation	Well: Iona OBS-1 / Waarre Formation / Comments	Page 2 of 3 — 1527 - 1530, 1515 - 1516



1527.55 to 1532.00 Sandstone.
Grey to creamy, medium to very coarse-grained sandstone, with pebble to cobble grain size at the base of each sandstone set. The pebbles are mainly quartz grains and large siltstone to mudstone clasts. Dominant sedimentary structures are large scale cross stratification. Sandstone sets are grading upwards to form medium grained-, laminated to small scale cross laminated sandstone. Sandstone beds contain shale partings in centimetres scale. They also contain coalified materials and thin coal bed. Sandstone sets are stacked and form fining upward beds ranging in thickness from 20 cm up to 1.5 m. Contacts between sand sets are gradational with no clear evidence of erosion or scoured surfaces. There is no bioturbation.

Iona OBS-1	Page 3 of 3
Waarre Formation	1530 - 1534.30 m



Comments

1532 to 1534.30 m Sandstone.
Grey to creamy, moderately to well sorted, fine to medium-grained-sandstone. The dominant sedimentary structures are lamination to small scale cross lamination grades to small scale trough cross stratification at the upper part. Laminations are continuous to discontinues and occasionally wavy, developed to wavy ripples. The interval contains shale partings at centimetres scale with coalified materials and thin coal beds. The upper and lower contacts of this interval are sharp. No bioturbation.

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PETROLOGY and RESERVOIR QUALITY

of

IONA OBS-1

for

WESTERN UNDERGROUND GAS STORAGE PTY LTD

by

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CONTENTS

PART A

PART B

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15 April, 1999

Western Underground Gas Storage Pty Ltd
c/- Texas Utilities Australia
Level 49, Rialto South Tower
525 Collins Street
MELBOURNE VIC 3000

Attention: Andy Whittle

FINAL REPORT: 0415-01

CLIENT REFERENCE:	Letter of Transmittal No. UGS 0000451 dated 17 March, 1999
MATERIAL:	8 off-cut Core Samples
LOCALITY:	Iona OBS-1
WORK REQUIRED:	Petrology and Reservoir Quality

Please direct technical enquiries regarding this work to the signatories below under whose supervision the work was carried out.

G. Kraishan.
GHAZI KRAISHAN
Sedimentologist and Petrologist

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PETROLOGY and RESERVOIR QUALITY

of

IONA OBS-1 CORE SAMPLES

A final report prepared for

WESTERN UNDERGROUND GAS STORAGE PTY LTD

by

DR GHAZI KRAISHAN

April 1999

This report is divided into two parts:

Part A presents an executive summary (Chapter 1), introduces this investigation (Chapter 2), presents the methods of investigations (Chapter 3), summarises the main results (Chapter 4) and presents an integrated model which discusses sediment provenance, environment of deposition and reservoir character (Chapter 5). Photomicrographs referenced in the text are located at the end of Part A.

Part B presents detailed thin section descriptions (Appendix 1) and XRD traces (Appendix 2). Representative photomicrographs are provided with each description (Appendix 1).

1. EXECUTIVE SUMMARY

Western Underground Gas Storage Pty Ltd submitted eight (8) core samples collected from Iona OBS-1 well for petrographic analysis including detailed thin section description, X-ray diffraction and scanning electron microscopy. The main objectives of this study were to: undertake thin section descriptions including sediment classification, description of texture and composition, verify clay types, texture, grain size, shape, pore throat shape, clay matrix and pore bridging/grain coating clay identification using scanning electron microscope (SEM). SEM was used specifically to examine the morphology of the clay minerals. Particular attention was paid to observing:

- migration and/or mushing of fine clay crystallites in the pore space
- corrosion and/or dissolution of framework grains or authigenic phases
- change of habit of existing phases by collapse or swelling

Finally, the study aimed to present the sediment provenance, style and extent of diagenetic modification and reservoir potential.

The studied samples have similar mineralogy. Framework composition is dominated by monocrystalline quartz with minor to trace polycrystalline quartz, metamorphic and sedimentary rock fragments. Quartz grains are angular to rounded and exhibit strong to slightly undulose extinction with few coarse grains showing straight undulose extinction. Feldspar was absent in most of the samples. Micaceous schist metaquartzite and chert are the main lithic fragments but siltstone and mudstone also occur in trace to rare amounts. Muscovite is minor and altered in the studied samples. It is either disseminated or concentrated in very thin lamellae parallel to the bedding planes. The heavy mineral suite includes tourmaline, zircon and opaque grains. Detrital matrix is present in trace amounts in most of the samples. Dispersed organic matter is minor in the samples and comprises coalified wood and plant materials. These sandstones are classified as quartz arenite and sublithicarenite.

Routine core analysis (RCA) results show that Iona OBS-1 sandstone samples have high porosity and permeability, and excellent reservoir quality. RCA shows that ambient porosity for the studied samples ranges from 22.1% to 29.7% and air permeability ranges from 379 mD to 3842 mD. Petrographical studies revealed that visual porosity of the studied samples is very high ranging from 17% to 21.6% with an average of 19%, most of which is primary intergranular porosity. Highly altered ductile lithic fragments and authigenic clay masses contain considerable amounts of microporosity. Macroporosity is well developed and moderately effected by subsequent diagenetic modifications. The framework grains show mainly suture to concavo-convex contacts with local stylolites, suggesting that the effect of the compaction process in destroying the reservoir quality was not too severe. It seems likely that compaction and precipitation of authigenic minerals have moderate effect on the reservoir quality in the Iona OBS-1 core samples. Porosity reduction has occurred predominantly where the ductile lithic fragments are abundant. Compaction has reduced the intergranular primary porosity by up to 52% of the original intergranular porosity. Cementation of authigenic minerals has further contributed to the porosity loss and reduced around 14% of the original intergranular porosity.

SEM observations reveal that the samples contain moderate authigenic clay minerals with very high visual porosity. The pores are well developed and slightly filled with authigenic clays. The pores are very large and range in size from 50 microns up to a few hundred of microns. Pore throats are much smaller with an average size of less than 10 micron. Microporosity is well developed between kaolinite booklets and accounts for as much as 50% of the kaolinite masses. The macro-pores are well interconnected suggesting very high permeability and excellent reservoir quality. Authigenic clays comprise kaolinite and trace to minor mica (illite). Kaolinite occurs as pseudohexagonal booklets filling some of the pore spaces and locally restricting the pore throat and the intergranular primary pores. Authigenic illite occurs as a product of metamorphic micaceous schist and mica alteration. It has also developed around kaolinite booklets suggesting an intermediate stage of lithic grains and mica alteration. Smectite or illite/smectite mixed layer were not detected in any of the samples.

Based on the integration of detailed petrographic description with RCA, this study concludes that the reservoir potential of the studied samples is excellent. Visual porosity is very high. Precipitation of authigenic minerals and mechanical compaction have minor effect on reducing the primary intergranular porosity. Since the samples have a very low ratio of microporosity to total porosity, the effective porosity is relatively very high. Fines migration and invasion of fines from the wellbore into the formation should be minimal in the samples studied. Given that the cement of the studied samples is predominantly composed of authigenic clays, dissolution of this cement is unlikely. Kaolinite exhibits well crystallined texture implying that corrosion or changing in habit is unlikely to occur during fluid extractions. Since smectite or illite/smectite mixed layer were not detected, swelling is unlikely to occur within the samples.

2. INTRODUCTION

Western Underground Gas Storage Pty Ltd submitted eight (8) core samples from Iona OBS-1 well for a petrographic study involving detailed thin section description. Detailed thin section description and SEM studies were carried out on all samples. The following is a summary of the aims of this study:

- undertake thin section descriptions to include sediment classification, description of texture and composition.

- verify clay types, texture, grain size, shape, pore throat shape, clay matrix and pore bridging/grain coating clay identification using scanning electron microscope (SEM). SEM was used specifically to examine whether any damage effects could have occurred, in particular the morphology of the clay minerals. Particular attention was paid to observing:

    a) migration and/or mushing of fine clay crystallites in the pore space

b) corrosion and/or dissolution of framework grains or authigenic phases

c) change of habit of existing phases by collapse or swelling

- presentation of a sediment provenance, style and extent of diagenetic modification and reservoir potential.

3. METHODS

Samples were supplied as off-cuts of core materials. Thin sections were cut perpendicular to the bedding plane. All samples were impregnated with blue-stained araldite prior to thin section preparation in order to facilitate porosity recognition. The modal composition for all samples was determined using standard techniques (Zuffa, 1985; Pettijohn et al. 1987) and by counting 500 points per thin section.

All thin sections were stained with Alizarin Red-S and potassium ferricyanide to aid different carbonate assemblages identification (Dickson, 1965) and were stained with sodium cobaltinitrite to differentiate potassium feldspar from plagioclase (Lainz et al. 1964). Classification of clastic rocks was based on the relative proportion of detrital quartz, feldspar and rock fragments (Folk, 1974). Other detrital components, such as mica and heavy minerals, as well as all authigenic phases, are not included in the common sandstone classification.

The type of porosity is reported according to the classification of Schmidt and McDonald (1979). Furthermore, the point count data was compared to the routine core analysis (RCA) data to evaluate the effect of diagenetic modifications on reservoir quality.

X-ray Diffraction (XRD) analyses were carried out on all samples. Whole-rock samples were X-rayed for their bulk mineralogy. The samples were crushed in an agate swing mill prior to sub-samples being micronised in a McCrone mill using agate grinding elements and ethanol as a fluid. The samples were then oven-dried at less than 60°C to prevent collapse of clay structures.

Portions of the swing mill powdered samples were dispersed in water to extract the fine fraction containing an enhanced clay fraction. The pipetted fraction was allowed to dry slowly to produce an orientated thin film which was used to identify the clays present in the samples. Two X-ray runs for the clay fraction (< 2 µm) were made: 1) air dried at room temperature, and 2) after exposing the samples to ethylene glycol vapour overnight at 60°.

X-ray analyses for both whole-rock as a randomly orientated powder and orientated clay fraction samples were carried out on a *Philips PW 1840* vertical X-ray Diffractometer system with a *Philips PW 1729* high voltage generator using monochromic Cobalt K_α radiation, at the following setting: cobalt anode X-ray tube energised at 40kV and 40mA (Fe filtered), scan speed 0.02° 2θ/sec or 1.0° 2θ/min for the randomly oriented bulk samples and a scan speed 0.05° 2θ/sec or 2.0° 2θ/min for the oriented clay fraction and 0.2 mm receiving slit. The instrument was fitted with an automatic divergence slit. Whole-rock samples were scanned between 3° - 75° 2θ, whilst the oriented clay samples were scanned between 3° - 40° 2θ. Time constant was 1.0 sec.

Mineral identification of both whole-rock samples and clay fraction was checked by comparison with Joint Committee on Powder Diffraction Standards (JCPDS) files using Traces™ software. The identification of clay was based on the position of the main peaks (001, 002, 003 etc.) for each mineral.

A scanning electron microscope equipped with an energy-dispersive X-ray system (SEM-EDS) was used to study all samples after a detailed petrographic study. Samples were examined as fracture mounts. SEM was used specifically to examine the morphology of the clay minerals and the distribution and size of the pore throat.

A summary of all techniques used in this study is presented in Table 1.

TABLE 1: Summary of sample details and core analyses of Iona OBS-1 core samples.

Sample	Depth	PETROLOGICAL ANALYSIS					CORE ANALYSIS		
No.	(m)	MA	PM	SEM	XRD	Clay	ϕ	K	g/cm³
1	1509.67	*	*	*	*	*	*	*	*
9	1527.77	*	*	*	*	*	*	*	*
16	1528.84	*	*	*	*	*	*	*	*
21	1529.60	*	*	*	*	*	*	*	*
26	1530.35	*	*	*	*	*	*	*	*
33	1531.74	*	*	*	*	*	*	*	*
39	1532.52	*	*	*	*	*	*	*	*
45	1533.52	*	*	*	*	*	*	*	*

MA = modal analysis, PM = photomicrography, SEM = Scanning electron microscope, XRD = bulk mineralogy, Clay = < 2 μm clay mineralogy, ϕ = core porosity, K = air permeability, g/cm^3 = grain density.

4. RESULTS

A summary of the main lithological characteristics of the two core samples of Iona OBS-1 is given in Table 2. Grain size analysis and degree of sorting are presented in Table 3. The modal analysis of detrital, authigenic and porosity components are shown in Tables 4 and 5. Detailed petrographic description of each sample is given in Appendix I. Bulk and less than 2 µm clay fraction mineralogy are presented in Tables 6 and 7, and Appendix II. Routine core analysis (RCA) results are summarised in Table 8. Photomicrographs referenced in the text below are presented at the end of Part A. Representative thin section and SEM photomicrographs of each sample are also given with the relevant thin section description in Appendix I.

4.1 Lithology

The Iona OBS-1 sandstone samples are composed mostly of quartz with trace to minor amounts of lithic fragments and almost no feldspar. The presence of trace to minor amounts of depositional matrix in all of the samples strongly suggests a moderate to high energy sedimentation. The average grain composition of the studied samples is $Q_{98.1}$ $F_{0.0}$ $R_{1.9}$. The Iona OBS-1 sandstones are classified as quartz arenite and sublitharenite (Fig. 1).

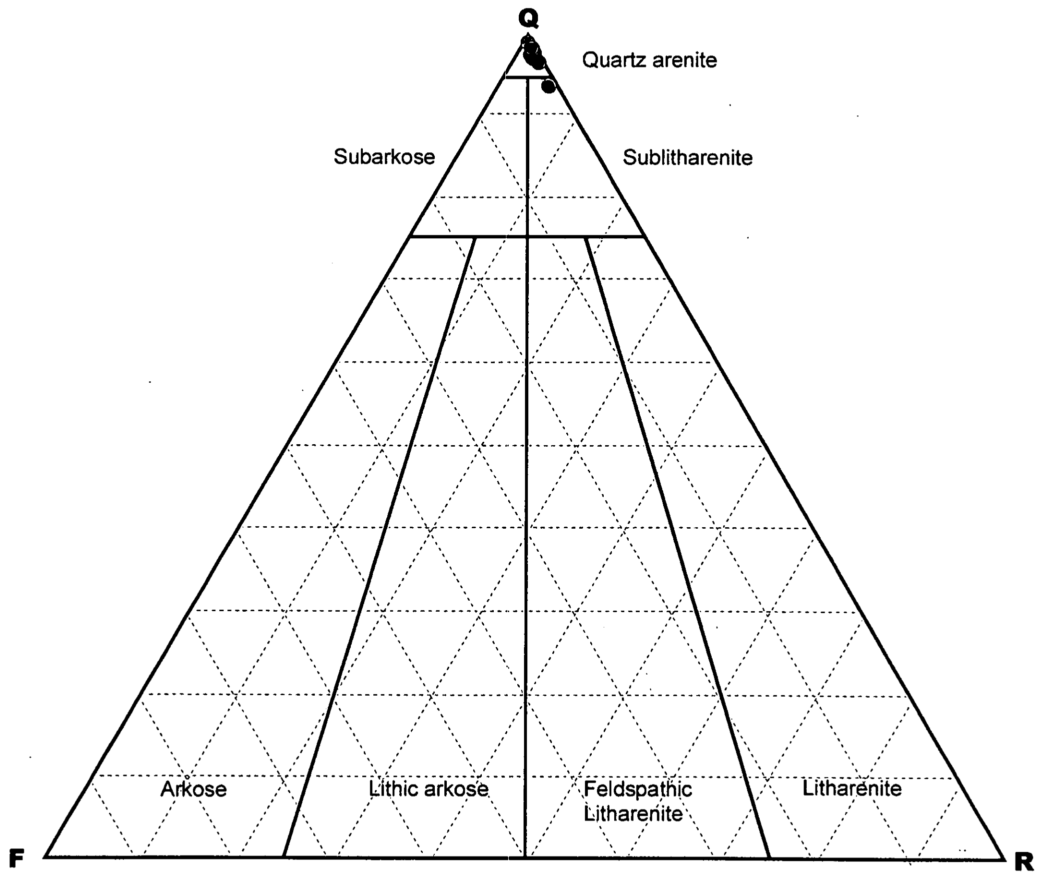

Figure 1: QFR ternary diagram showing the present-day framework grain composition of the Iona OBS-1 sands. Iona OBS-1 sands are classified as quartz arenite and sublitharenite (n = 8 samples), (after Folk, 1974).

TABLE 2: Summary of lithological descriptions of Iona OBS-1 core samples.

Sample No.	Depth (m)	Lithology	Brief Description
1	1509.67	Quartz Arenite	Grey to creamy, grain supported, small scale to ripple cross stratification, poorly to moderately sorted, coarse-grained sandstone. Quartz grains are angular to subrounded. Minor authigenic minerals and very good visual porosity.
9	1527.77	Quartz Arenite	Grey to creamy, grain supported, large scale cross stratification, poorly sorted, very coarse-grained sandstone. Quartz grains are angular rounded. Minor authigenic minerals and very good visual porosity.
16	1528.84	Quartz Arenite	Grey to creamy, grain supported, small scale cross stratification, moderately to well sorted, medium-grained sandstone. Quartz grains are mainly angular to subrounded. Minor authigenic minerals and high visual porosity.
21	1529.60	Quartz Arenite	Grey to creamy, grain supported, small scale cross stratification, moderately to well sorted, medium-grained sandstone. Quartz grains are mainly angular to subrounded. Minor authigenic minerals and high visual porosity.
26	1530.35	Quartz Arenite	Grey to creamy, grain supported, horizontally laminated to small scale cross stratification, poorly sorted, medium-grained sandstone. Quartz grains are angular rounded. Minor authigenic minerals and very good visual porosity.
33	1531.74	Quartz Arenite	Grey, grain supported, small scale to wavy cross stratification, poorly sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Minor authigenic minerals and high visual porosity.
39	1532.52	Sublitharenite	Grey to creamy, grain supported, small scale cross stratification, well sorted, fine-grained sandstone. Quartz grains are mainly angular to subrounded. Minor authigenic minerals and good visual porosity.
45	1533.52	Quartz Arenite	Grey to creamy, grain supported, small scale cross stratification, moderately to well sorted, fine-grained sandstone. Quartz grains are mainly angular to rounded. Minor authigenic minerals and good visual porosity.

4.2 Texture

The samples show a wide range of grain size from fine to very coarse and sometimes pebbly (Table 3). Parallel grain alignment and laminations to large scale cross stratifications are common and occur in continuous to discontinuous thin streaks, best developed in the fine grain samples. The samples are characterised by strongly homogeneous grain fabrics. All samples are grain-supported. The degree of sorting is, in general, poor to well.

Detrital grains range typically from angular to rounded. All samples underwent moderate compaction leading to a predominance of point and suture grain contacts between detrital grains (Plate 1). Ductile deformation during early burial is evident by the presence of squeezed lithic grains and detrital depositional matrix (Plate 2) and some mica flakes (Plate 3) as well as by the presence of stylolite (Plate 4).

4.3 Composition

The framework component of all samples is dominated by monocrystalline quartz (60.4% - 74.0%, Table 4) with an average of 69.6% ± 5.6 (Table 5). Table 5 summarises the range, average and standard deviation of the main components of the Iona OBS-1 sandstone samples. Monocrystalline quartz commonly displays strong to slightly undulose extinction and rarely contains vacuoles and trains of vacuoles. Mineral inclusions in quartz grains are rare and comprise acicular rutile or prismatic tourmaline. Polycrystalline quartz grains are present in minor to trace amounts (0.4% - 2.8%, Table 4) with an average of 1.4% ± 0.8 (Table 5). Polycrystalline quartz grains predominantly occur as equant to subequant rounded coarse grains and display strong undulose extinction.

Only one sample (# 45, 1533.52 m) contains traces of feldspar (Table 4). Lithic grains are also trace to minor components (0.2% - 4.2%) and comprise micaceous metamorphic schist, metaquartzite, rounded sedimentary chert and rare siltstone and claystone. Muscovite is present in trace to minor amounts (0.2% - 1.6%, Table 4) with an average of 0.7% (Table 5), most of which is derived from the disintegration of the micaceous schist rock fragments. Brown and blue tourmaline and zircon are found as accessory minerals in many samples. Clay depositional matrix constitutes a trace to minor component (0.2% - 1.6%, Table 4) with an average of 0.6% Table 5.

Authigenic phases are dominated by kaolinite (1% - 7.2%, Plate 5) with an average of 3.5% ± 2.2, quartz overgrowths (1% - 2.6%, Plate 6) with an average of 1.8% ± 0.7, and traces of siderite (0% - 0.4%, Table 4). Pyrite is present in trace amounts (0.2% - 0.6%) and occurs as spheroidal aggregates of discrete, equigranular microcrysts; less than one μm in size. The framboidal pyrite is associated with the argillaceous and organic materials.

4.4 XRD Bulk Mineralogy

The X-ray diffraction results of the whole-rock samples are summarised in Table 6. The studied samples are dominated by quartz, minor amounts of kaolinite and traces of mica and sylvite. The relative abundance of each mineral was assessed by comparison of the main peak heights. The identification of the minerals was based on Joint Committee on Powder Diffraction Standards files (JCPDS) using Traces™ software. It is believed that kaolinite and mica originated as alteration products of the micaceous metamorphic schist. Sylvite (KCl) is introduced to the samples artificially during drilling process (drilling mud).

TABLE 3: Summary of the grain size analysis and degree of sorting and angularity of Iona OBS-1 core samples.

Sample No.	Depth (m)	MGS (mm)	MGS (Phi)	MxGS (mm)	Sorting Degree	Roundness
1	1509.67	0.60	0.7	2.8	Poor to Moderate	Angular to Subangular
9	1527.77	1.30	-0.4	6.0	Poor	Angular to Rounded
16	1528.84	0.40	1.3	2.3	Moderate	Angular to Subangular
21	1529.60	0.45	1.2	2.0	Moderate	Angular to Subangular
26	1530.35	0.40	1.3	2.0	Moderate	Angular to Rounded
33	1531.74	0.55	0.9	3.0	Poor	Angular to Rounded
39	1532.52	0.20	2.3	0.7	Well	Angular to Subangular
45	1533.52	0.20	2.3	0.7	Moderate to Well	Angular to Rounded

MGS = average grain size, MxGS = maximum grain size.

4.5 XRD Clay Mineralogy

The clay fraction < 2 μm mineralogy of the samples studied from Iona OBS-1 well is presented in Table 7 and Appendix II. XRD patterns of the < 2 μm size fraction show that minor amounts of clay minerals have been recognised in the studied samples and are dominated by kaolinite with traces of mica (illite). The main peak of kaolinite occurs at 12.4° 2 theta (7.14 Å). Glycolation of the samples produced no detectable change of peak positions for both kaolinite and mica (illite).

TABLE 4: Composition of Iona OBS-1 core samples. All values are in per cent based on 500 point counts.

Sample No. Depth (m)	1 1509.67	9 1527.77	16 1528.84	21 1529.6	26 1530.35	33 1531.74	39 1532.52	45 1533.52
Quartz (Mono)	72.0	74.0	62.2	73.6	73.4	74.0	60.4	66.8
Quartz (Poly)	1.2	1.0	0.4	0.8	0.6	2.8	1.8	2.2
K feldspar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Plagioclase	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sedimentary Rock Fragments	0.4	0.0	0.2	1.0	0.2	0.2	2.2	0.8
Metamorphic Rock Fragments	0.2	0.2	0.2	1.0	0.8	0.4	2.0	0.8
Volcanic Rock Fragments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mica	1.2	0.4	0.8	0.4	Tr	0.2	1.6	0.4
Detrital Depositional Matrix	1.6	0.6	1.0	0.4	0.2	0.4	0.2	0.4
Siderite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Quartz Cement	2.2	2.6	2.6	2.0	1.2	1.0	1.0	2.0
Kaolinite	2.6	1.0	5.0	2.6	2.0	1.8	7.2	5.4
Pyrite	0.4	0.2	0.4	Tr	0.6	0.2	0.2	Tr
Organic Matter	1.2	0.4	9.4	Tr	Tr	1.8	1.8	0.8
Accessory Minerals	Tr	0.0	0.0	0.0	0.0	0.2	Tr	0.0
Primary Porosity	15.2	16.4	15.8	16.4	18.8	16.2	20.2	19.0
Secondary Porosity	1.8	3.2	2.0	1.8	2.2	0.8	1.4	0.8

TABLE 5: Summary of the modal analysis of Iona OBS-1 core samples.

	Average	Min	Max	STDEV
Quartz (Mono)	69.6	60.4	74.0	5.6
Quartz (Poly)	1.4	0.4	2.8	0.8
K feldspar	0.0	0.0	0.2	0.1
Plagioclase	0.0	0.0	0.0	0.0
Sedimentary Rock Fragments	0.6	0.0	2.2	0.7
Metamorphic Rock Fragments	0.7	0.2	2.0	0.6
Volcanic Rock Fragments	0.0	0.0	0.0	0.0
Mica	0.7	0.2	1.6	0.5
Detrital Depositional Matrix	0.6	0.2	1.6	0.5
Siderite	0.1	0.0	0.4	0.1
Quartz Cement	1.8	1.0	2.6	0.7
Kaolinite	3.5	1.0	7.2	2.2
Pyrite	0.3	0.2	0.6	0.2
Organic Matter	2.6	0.4	9.4	3.4
Accessory Minerals	0.0	0.0	0.2	0.1
Primary Porosity	17.3	15.2	20.2	1.8
Secondary Porosity	1.8	0.8	3.2	0.8

Min = minimum, Max = maximum STDEV = standard deviation.

TABLE 6: Qualitative bulk XRD results from selected core samples from Iona OBS-1.

Sample No. Depth (m)	#1 1509.67	#9 1527.77	#16 1528.84	#21 1529.60	#26 1530.35	#33 1531.74	#39 1532.52	#45 1533.52
Quartz	A	A	A	A	A	A	A	A
Kaolinite	M	M	M	M	M	M	A	M
Mica	m	T	T	T	T	T	m	T
Sylvite KCl	m	m	m	m	m	m	m	m

A = abundant (nominally more than 40 wt%), M = major (nominally > 10%), m = minor (nominally > 1%, < 10%), T = trace (nominally < 1%).

TABLE 7: Qualitative clay XRD results from selected core samples from Iona OBS-1 well.

Sample No. Depth (m)	#1 1509.67	#9 1527.77	#16 1528.84	#21 1529.60	#26 1530.35	#33 1531.74	#39 1532.52	#45 1533.52
Kaolinite	M	M	M	M	M	M	A	M
Mica (illite)	m	T	T	T	T	T	m	T

4.6 Scanning Electron Microscopy (SEM)

The samples comprise a fine to very coarse-grained, poorly to well sorted sandstone with a clay mineral assemblage dominated by kaolinite. A few intergranular areas are filled with well crystallined kaolinite (Plate 5). Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and book-like species and occupies much of the intergranular pore space. Individual crystals range in size from less than 5 μm to greater than 10 μm. Authigenic kaolinite is associated with altered lithic fragments and altered mica flakes (Plate 6), suggesting a direct relationship between both components. Moderate microporosity is present in the kaolinite cemented areas. Fines migration and invasion of fines from the wellbore into the formation should be minimal in the samples studied. Given that the cement of the studied samples is predominantly composed of authigenic clays, dissolution of this cement is unlikely. Kaolinite exhibits well crystallined texture implying that corrosion or changing in habit is unlikely to occur during fluid extractions. Since smectite or illite/smectite mixed layer were not detected, swelling is unlikely to occur within the samples.

SEM has also shown that quartz overgrowths are present in minor to trace amounts. They occur as small crystals filling and coating some of the pore spaces (Plate 7) and are also found associated with kaolinite pseudohexagonal booklets. The quartz overgrowths have partly filled the primary pores and slightly restricted the size of the pore throats. SEM photomicrographs indicate that most of the quartz overgrowths occur as grain coating around detrital quartz grains (Plate 7).

Based on SEM observations, most samples of Iona OBS-1 have considerable amounts of porosity. The pores are large and interconnected in 3-D, most of which are more than 50 μm and occasionally more than 100 μm (Plate 8). The distribution of the pore throat is regular with very good interconnection implying very good permeability (Fig.2). The pores are well interconnected in a 3-D network giving very good permeability (Plate 9). Fine, and a few loose, kaolinite plates could possibly move to block additional pore throats during fluid migration. In the fine-grained samples, fines migration during fluid extraction may cause a reduction in permeability since the size of the fines is similar to, or smaller than, most of the pore throats.

SEM also revealed that because all the samples have high porosity mud invasion has occurred and fills some of the pore spaces (Plate 10). It also coats many of the detrital and authigenic grains. Drilling mud invasion is evident by the presence of sylvite (KCl) of the bulk XRD.

Figure 2 is an overview providing detailed texture, reservoir properties of eight selected samples for SEM studies.

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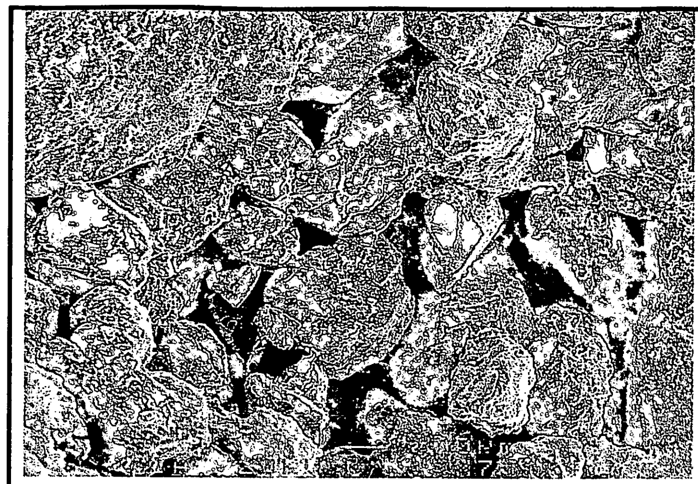
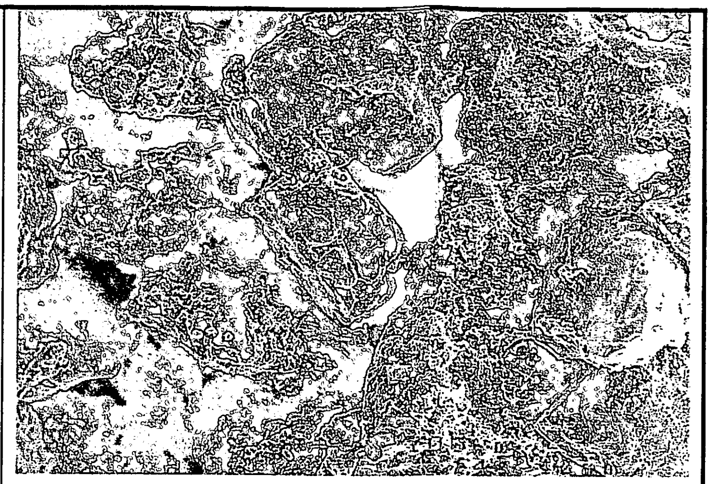
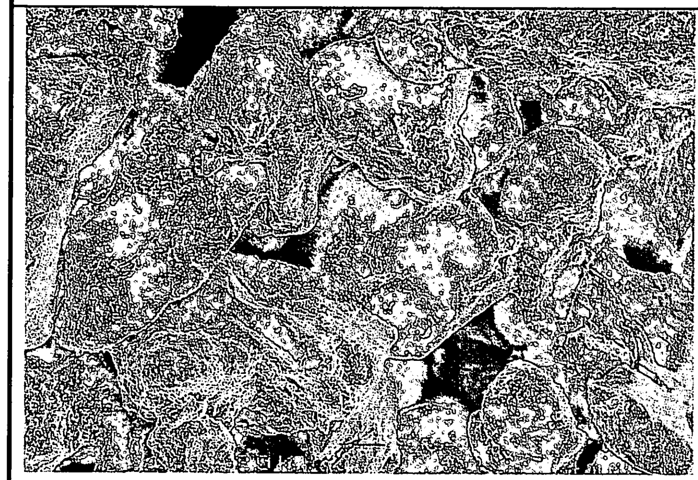


Sample # 1, 1509.67 m $\phi = 22.1\%$, K = 1948 mD
Scale bar = 100 μm

Sample # 9, 1527.77 m $\phi = 22.6\%$, K = 1828 mD
Scale bar = 100 μm

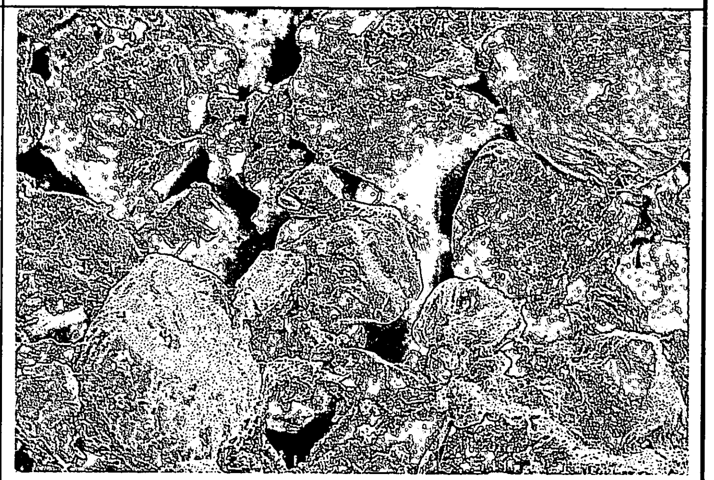


Sample # 16, 1528.84 m $\phi = 27.4\%$, K = 1871 mD
Scale bar = 100 μm

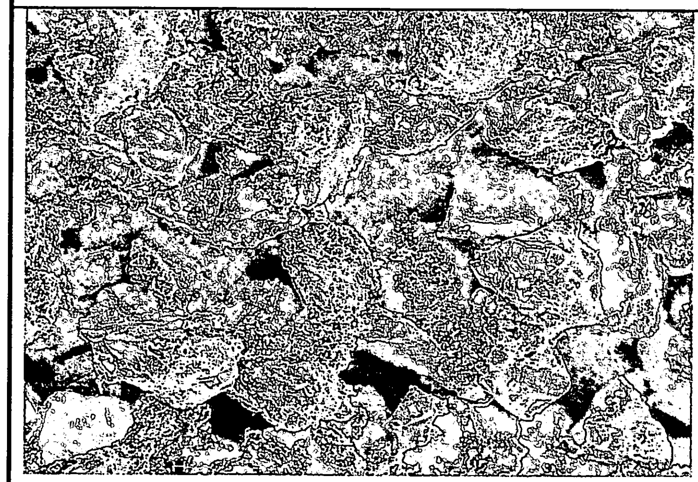


Sample # 21, 1529.60 m $\phi = 26.8\%$, K = 2291 mD
Scale bar = 100 μm

Sample # 26, 1530.35 m $\phi = 29.6\%$, K = 2601 mD
Scale bar = 100 μm



Sample # 33, 1531.74 m $\phi = 23.1\%$, K = 3842 mD
Scale bar = 100 μm



Sample # 39, 1532.52 m $\phi = 29.2\%$, K = 379 mD
Scale bar = 100 μm

Sample # 45, 1533.52 m $\phi = 29.7\%$, K = 957 mD
Scale bar = 100 μm

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Petrologist: Ghazi Kraishan
Iona OBS-1 Reservoir Quality Study,
Submitted to:
Western Underground Gas Storage Pty Ltd
April 1999

Figure 2. Overview of textural characteristics and reservoir parameters of selected core samples from Iona OBS-1.

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4.7 Diagenesis

Only the major diagenetic events are summarised below and the reader is referred to the thin section descriptions in Appendix I for a detailed discussion. As far as possible, diagenetic processes are discussed in chronological order. The following gives the relative timing of authigenic minerals and other diagenetic modifications observed during petrographic study.

- Early compaction has affected both samples and has resulted in closer packing of grains and well-developed parallel alignment of elongated detrital grains.
- Framboidal pyrite could have occurred during the early sulphate reduction.
- Traces of siderite could have occurred at the end of the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin. Feldspar, however, is almost absent from most samples.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.

4.8 Reservoir Quality

The results from routine core analysis (RCA) show that ambient porosity for the studied samples ranges from 22.1% to 29.7% and air permeability ranges from 379 mD to 3842 mD. Iona OBS-1 sandstones are clean and have very good to excellent reservoir characteristics.

Petrographic observations reveal that porosity is very high and presents mainly as primary pores as well as microporosity. Visible porosity dominantly occurs as primary intergranular porosity (Plate 11) and has been locally occluded by both compactional and cementation processes. Secondary pores are less dominant and comprise enlarged and elongated pores (Plate 12) providing good interconnection between intergranular primary pores and increasing the overall porosity. Secondary porosity resulting from fracturing is also present (Plate 13). Microporosity is well developed within the authigenic clays. Patches of authigenic coarsely crystallined kaolinite contains abundant microporosity (Plate 14).

Reservoir quality of Iona OBS-1 sandstones is excellent. The porosity of all samples is good to high and depends upon a combination of original lithology, texture and diagenesis involving compaction. Original lithology (grain composition) exerts one of the major controls on the reservoir quality as indicated by the good relationship between total quartz content and air permeability (Fig. 3). Most of the samples are clean quartz arenite with minor to trace detrital depositional matrix. The samples were selected from three different lithofacies. These are the meandering point bar

(PB), braided mid-channel bar (MCB) and from braided barforms (BF) facies. No samples have been collected from the floodplain (FP) facies (for more details see Sedimentology Report 0414-01 of Iona OBS-1).

TABLE 8: Routine core analysis (RCA) results for the Iona OBS-1 core samples selected for petrographic study.

Sample No.	Depth (m)	Porosity %	Permeability mD	Grain Density g/cm^3
1	1509.67	22.1	1948	2.64
9	1527.77	22.6	1828	2.65
16	1528.84	27.4	1871	2.63
21	1529.60	26.8	2291	2.64
26	1530.35	29.6	2601	2.64
33	1531.74	23.1	3842	2.65
39	1532.52	29.2	379	2.65
45	1533.52	29.7	957	2.65

The textural control on the reservoir quality is clear and is indicated by the relationship between grain size on one side and permeability and porosity on the other side (Figs 4 and 5).

Compaction is moderate and is evident by concavo-convex, suture grain contacts, rearrangements of the grains as well as by squeezed ductile deformation of lithic fragments, bent mica flakes and the presence of stylolites (Plates 1, 2, 3, and 4). Compaction processes have contributed to the porosity loss and destroyed up to 52% of the intergranular porosity. The intergranular volume (IGV) versus total cement diagram of Houseknecht (1987, 1989), modified by Ehrenberg (1989, 1990), was used to evaluate the effect of compaction processes on reservoir quality. The original porosity of the samples was assumed to be 40%. The grain size analyses show that Iona OBS-1 sandstones are in general, poor to well sorted and display a unimodal grain-size distribution.

The IGV and total cement mean value data are shown in Table 9. The IGV versus total cement diagram (Fig. 6) of Iona OBS-1 sandstones shows that both compaction and cementation processes have played significant roles in destroying the original intergranular porosity. The mean values of the IGV and total cement are 22.8% and 5.6% respectively, Table 9. This means that around 43% of the intergranular porosity has been lost by compaction processes, whereas cementation has removed 14% of the intergranular porosity. Both processes in combination have destroyed, on average, 43% of the intergranular porosity. Therefore the remaining intergranular primary porosity, on average, is slightly higher than 17%.

Precipitation of authigenic minerals has also had a minor effect on the reservoir quality. There is a relatively good inverse relationship between total cement and air permeability (Fig. 7) implying that cementation has had a minor effect on reducing the air permeability and reservoir quality. Among the main authigenic minerals, kaolinite has developed as pore filling authigenic mineral reducing the pore spaces, pore connectivity and air permeability. Authigenic kaolinite has been developed by either direct precipitation or as an alteration product of mica (muscovite) and what was probably feldspar especially in the samples rich in ductile lithic fragments. There is also a relatively good inverse relationship between pore filling authigenic kaolinite and air permeability (Fig. 8).

TABLE 9. The effect of mechanical compaction and cementation processes on the primary intergranular porosity of the Iona OBS-1 sandstones.

Sample No.	Depth (m)	Total Cement (%)	IGV (%)	PDTC[1] (%)	PDMC[2] (%)
1	1509.67	5.2	20.4	13.0	49.0
9	1527.77	3.8	20.2	9.5	49.5
16	1528.84	8.0	23.8	20.0	40.5
21	1529.60	4.6	21.0	11.5	47.5
26	1530.35	3.8	22.6	9.5	43.5
33	1531.74	3.0	19.2	7.5	52.0
39	1532.52	8.4	28.6	21.0	28.5
45	1533.52	7.8	26.8	19.5	33.0
	Average	5.6	22.8	13.9	42.9

1 PDTC = Porosity Destroyed by Total Cement
2 PDMC = Porosity Destroyed by Mechanical Compaction

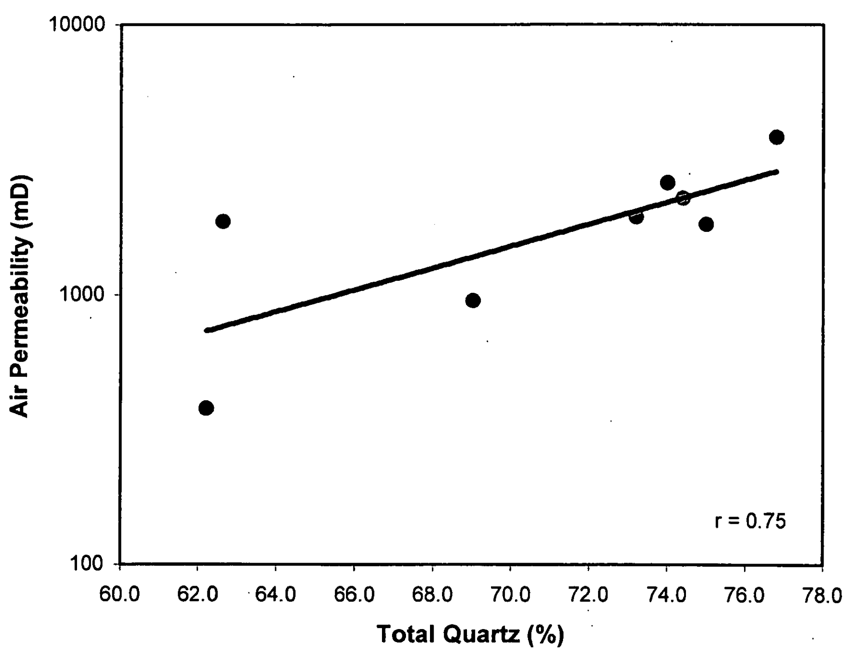

Figure 3: A cross plot between total quartz content and air permeability. Note the relatively high correlation coefficient r = 0.75 between both components.

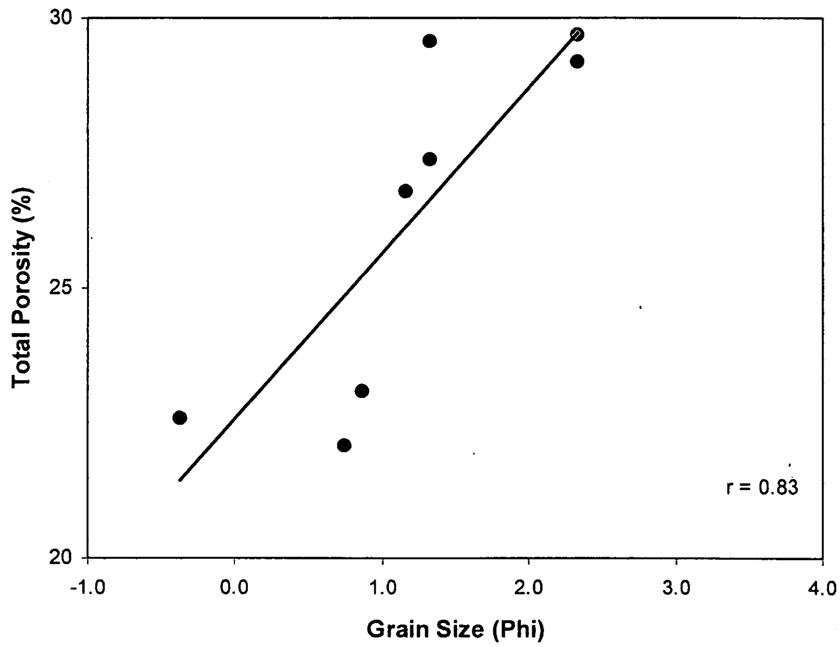

Figure 4: Relation between rock grain size and total porosity (core porosity). The relatively high correlation coefficient r = 0.83 between both components suggests a major control of textural variety on the reservoir quality

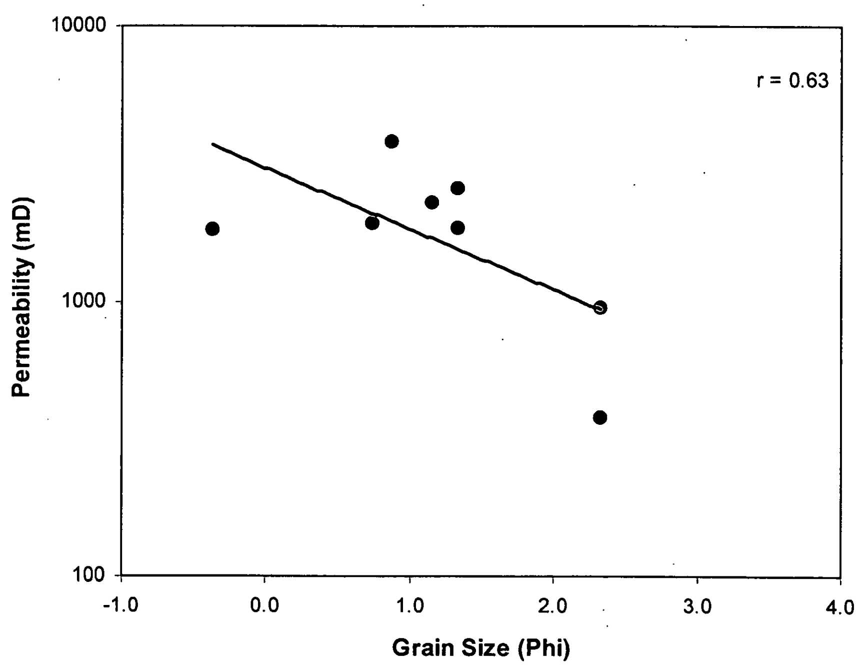

Figure 5: Relation between rock grain size and air permeability. The relatively good correlation coefficient r = 0.63 between both components suggests a major control of textural variety on the reservoir quality

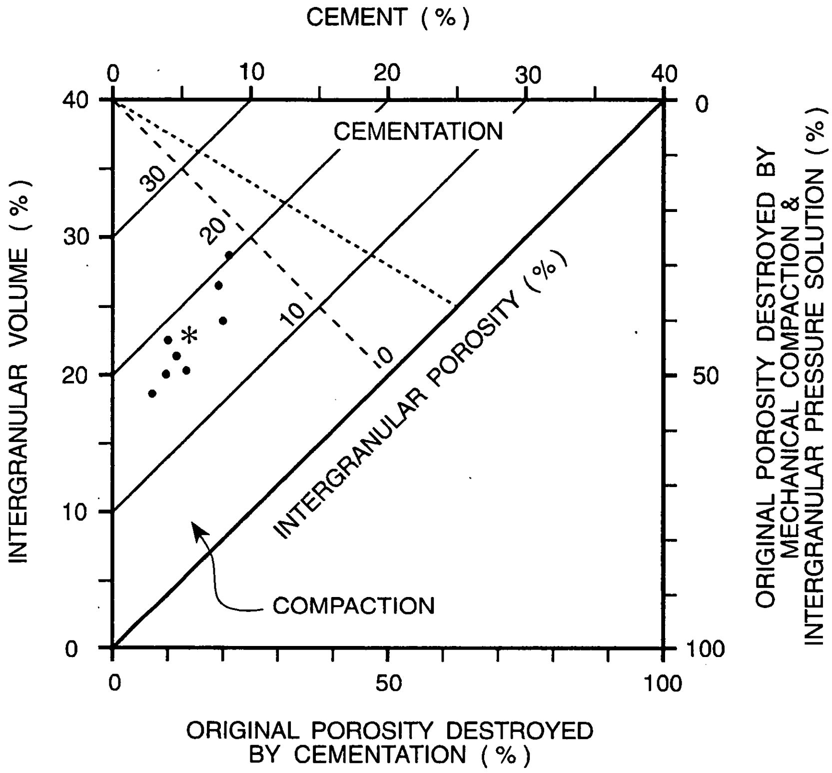

Figure 6. Intergranular volume vs total cement diagram for Iona OBS-1 sandstone samples to evaluate the relative importance of compaction and cementation process to porosity reduction (after Houseknecht (1987, 1989) and modified by Ehrenberg (1989, 1990). * denotes the average.

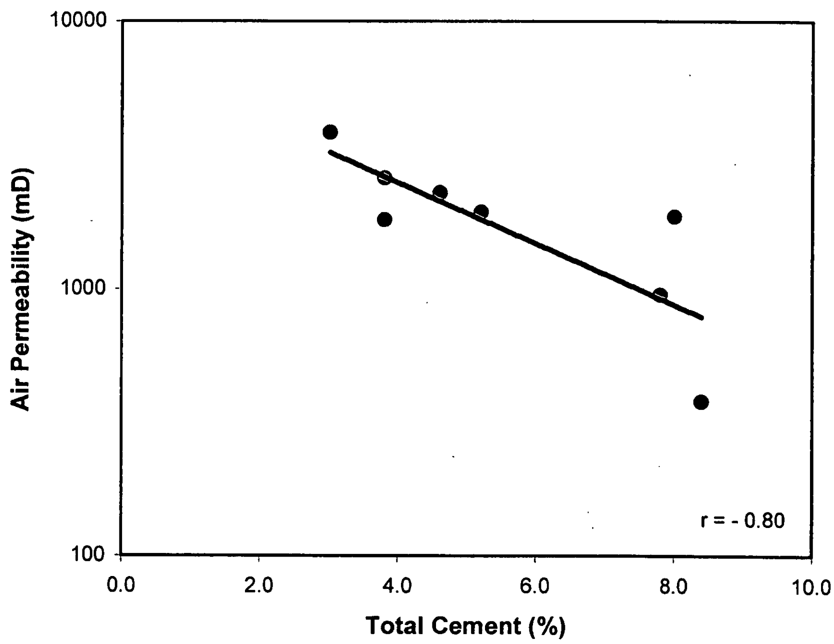

Figure 7: A cross plot between total cement and air permeability. The relatively good inverse correlation coefficient r = - 0.80 between both components suggests a minor control of authigenic minerals on reservoir quality in Iona OBS-1 core samples.

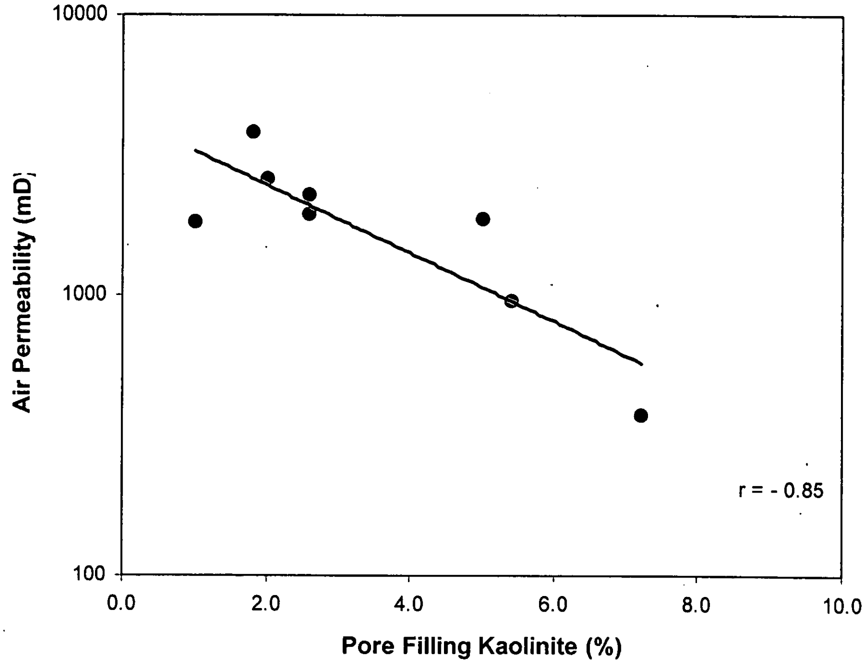

Figure 8: A cross plot between kaolinite and air permeability. The relatively high inverse correlation coefficient r = - 0.85 between both components suggests a major control of authigenic kaolinite on reservoir quality in Iona OBS-1 core samples.

5. SUMMARY AND CONCLUSIONS

5.1 Sediment Provenance

All samples exhibit similar sediment provenance. Angular to rounded monocrystalline quartz grains suggest predominance of metamorphic and sedimentary source terrains. The amount of lithic fragments is relatively low and sediment provenance can be vaguely estimated. The presence of a high proportion of micaceous schist and rounded sedimentary chert, is interpreted to reflect contribution from both metamorphic source and an older sedimentary source, i.e. a recycled cratonic region.

5.2 Environment of Deposition

Sandstones of Iona OBS-1 were probably deposited by moderate to high energy sedimentation that could be a braided stream system. This is evident by the presence of abundant large scale cross-stratifications, the texture of the studied samples, the degree of sorting, the relatively clean nature of these sandstones and the lack of trace fossils within the sandstone intervals. Sedimentary structures within the sandstones interval suggest that depositional environments are mainly fluvial.

5.3 Reservoir Potential

Given the detailed petrographic analysis, it seems most likely that compaction and precipitation of authigenic mineral and the presence of ductile rock fragments have made a minor impact on the reservoir quality of the Iona OBS-1 sandstones. Compaction has effected the reservoir quality to some degree, where ductile rock fragments are dominant. Contacts between framework grains contain concavo-convex and suture contacts, indicating however, that compaction has had a severe effect in reducing the reservoir quality. Cementation of authigenic clay minerals has further contributed to the porosity loss. Authigenic clays and altered ductile rock fragments contain considerable amounts of microporosity between their grains.

The measured ambient porosity for the studied samples ranges from 21.1% to 29.7% and air permeability ranges from 379 mD to 3842 mD. SEM revealed that the pores are well developed and partially reduced by compaction and precipitation of authigenic minerals. The pores are large ranging in size from 50 microns up to several hundred microns. The pore throats are much smaller with an average of 10 microns. Microporosity is well developed between kaolinite booklets and accounts for as much as 50% of the kaolinite masses. The macro-pores are well interconnected suggesting very high permeability and excellent reservoir quality. Authigenic clays comprise predominantly kaolinite and trace mica (illite). Kaolinite occurs as pseudohexagonal booklets filling some of the pore spaces and locally restricting the pore throat and the intergranular primary pores. Fines migration and invasion of fines from the wellbore into the formation should be minimal in the samples studied due to the amount and size of kaolinite crystals. Dissolution of the matrix cement is unlikely. Kaolinite exhibits crystalline texture implying that corrosion or changing in habit is unlikely to occur during fluid extractions.

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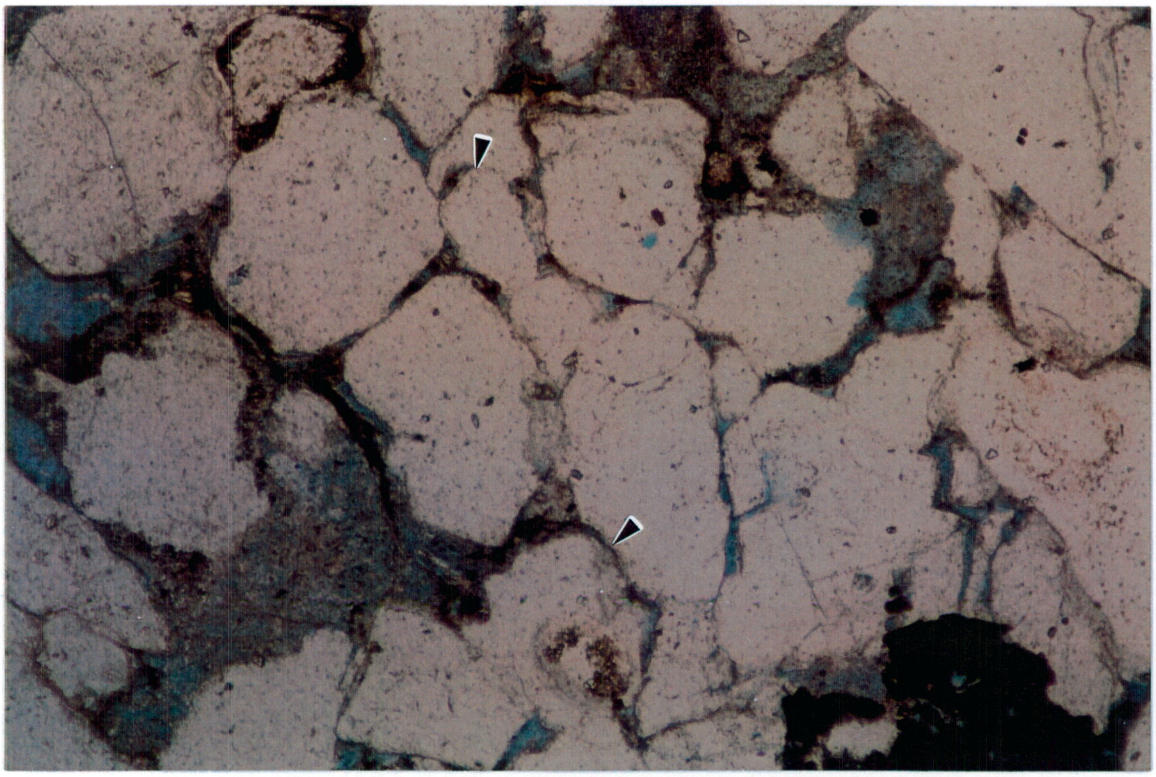

Plate 1: (Sample # 16, 1528.84 m): Thin section photomicrograph of quartz arenite comprising moderately sorted, angular to subrounded medium-grained sandstone. Note the concavo-convex and suture contacts between grains (arrows), indicating mechanical compaction. Also note squeezed ductile lithic fragments. Plane polarised light. Scale bar = 200 μm.

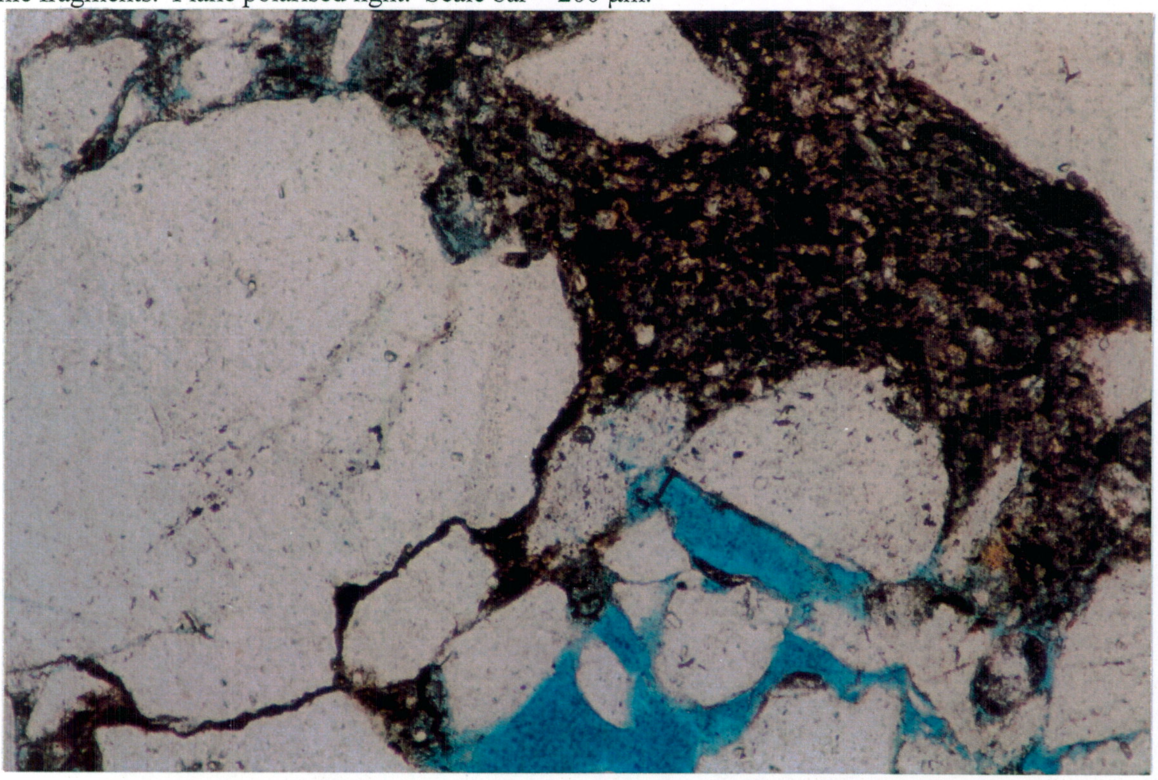

Plate 2: (Sample # 1, 1509.67 m): Thin section photomicrograph of quartz arenite showing severe effects of compaction as indicated by the squeezed detrital depositional matrix. Plane polarised light. Scale bar = 200 μm.

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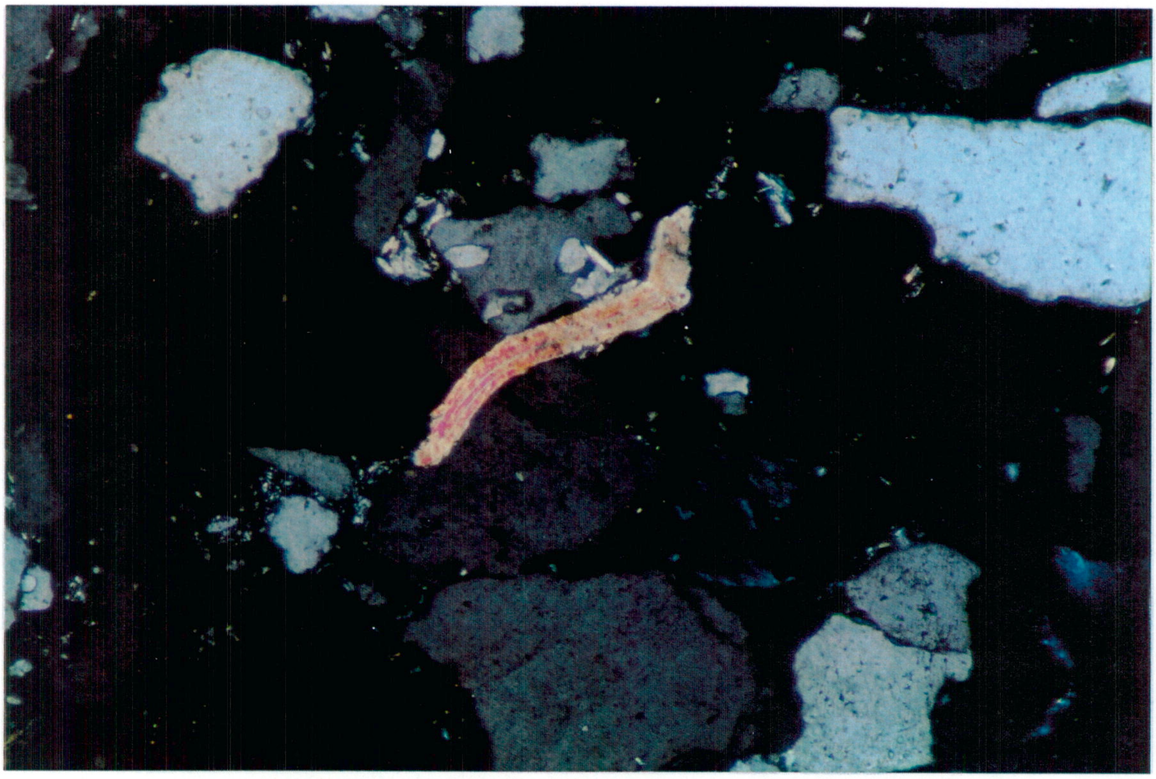

Plate 3: (Sample # 16, 1528.84 m): Thin section photomicrograph of quartz arenite comprising moderately sorted, angular to subrounded medium-grained sandstone. The effect of mechanical compaction in reducing the reservoir quality was moderate and is indicated by the presence of bent mica flakes. Crossed polars. Scale bar = 200 μm.

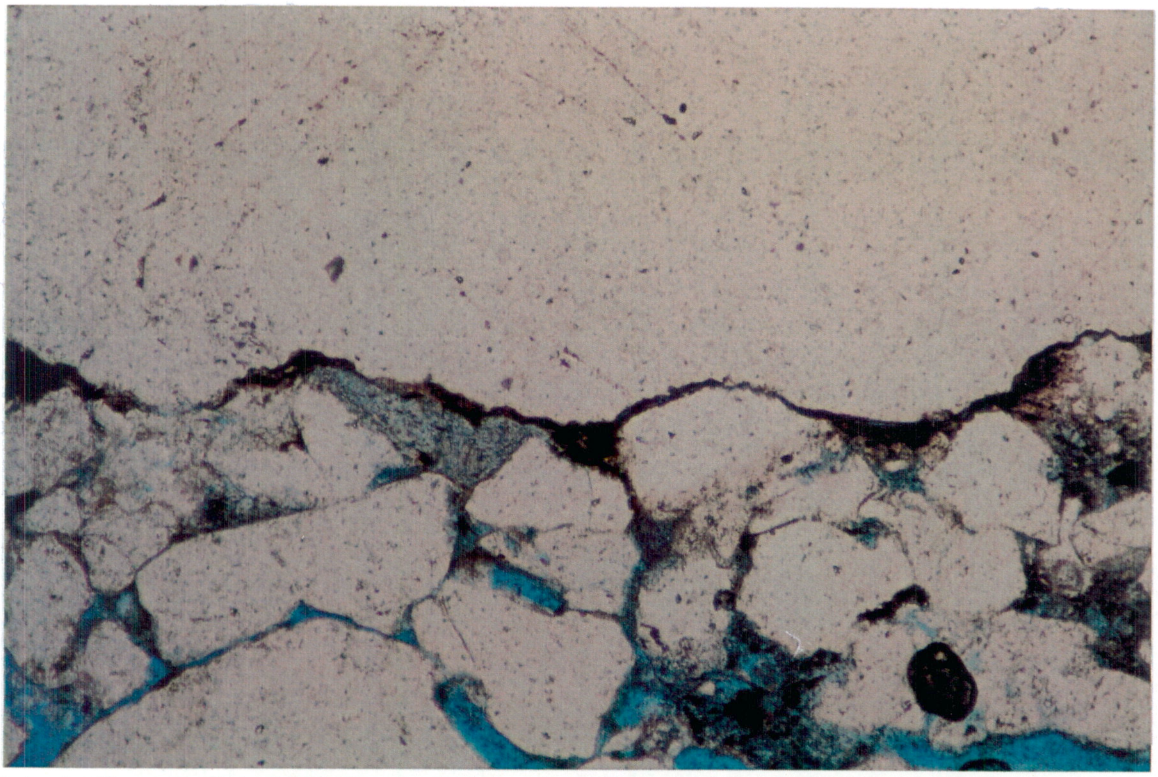

Plate 4: (Sample # 1, 1509.67 m): Thin section photomicrograph showing low amplitude stylolite. Stylolites occur predominantly around thin matrix lamina and around mica flakes. The presence of low amplitude stylolites suggest a moderate effect of intergranular pressure solution. Plane polarised light. Scale bar = 200 μm.

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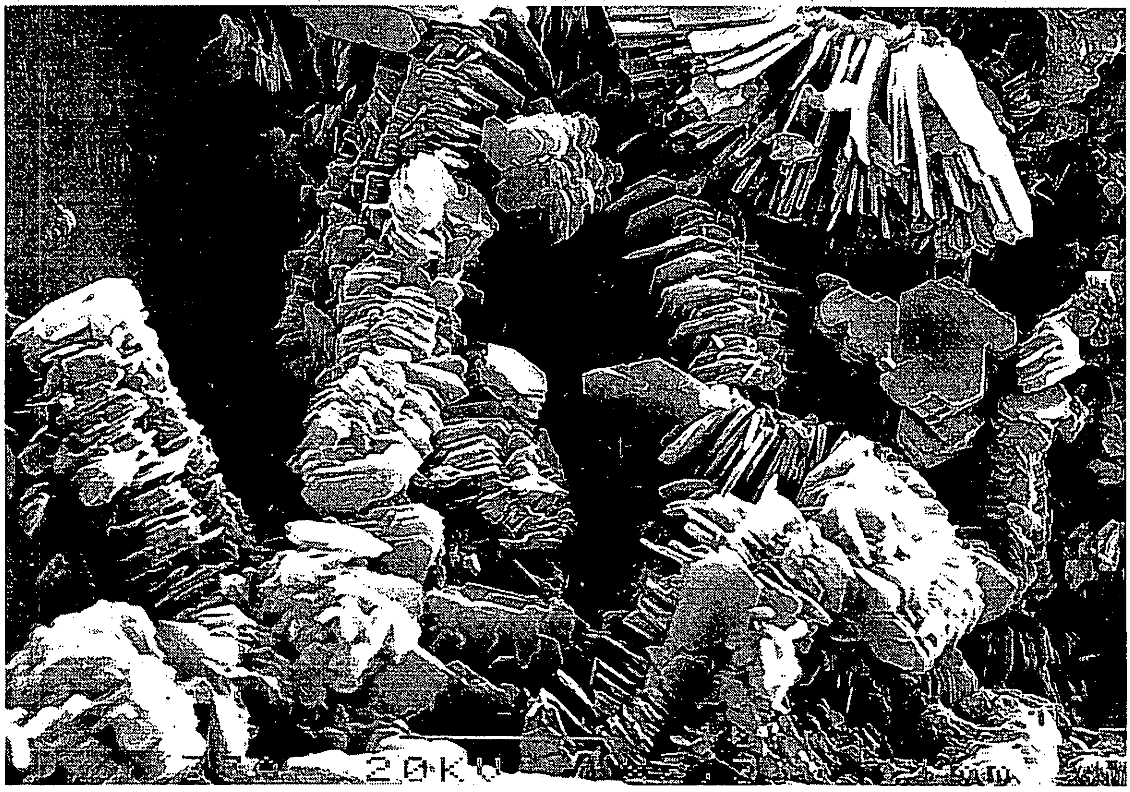

Plate 5: (Sample # 33, 1531.74 m): SEM photomicrograph showing authigenic kaolinite crystals which occur as randomly oriented pseudohexagonal, vermiform and book-like species and occupy some of the intergranular pore space and slightly restrict the pore throats. Scale bar = 10 μm.

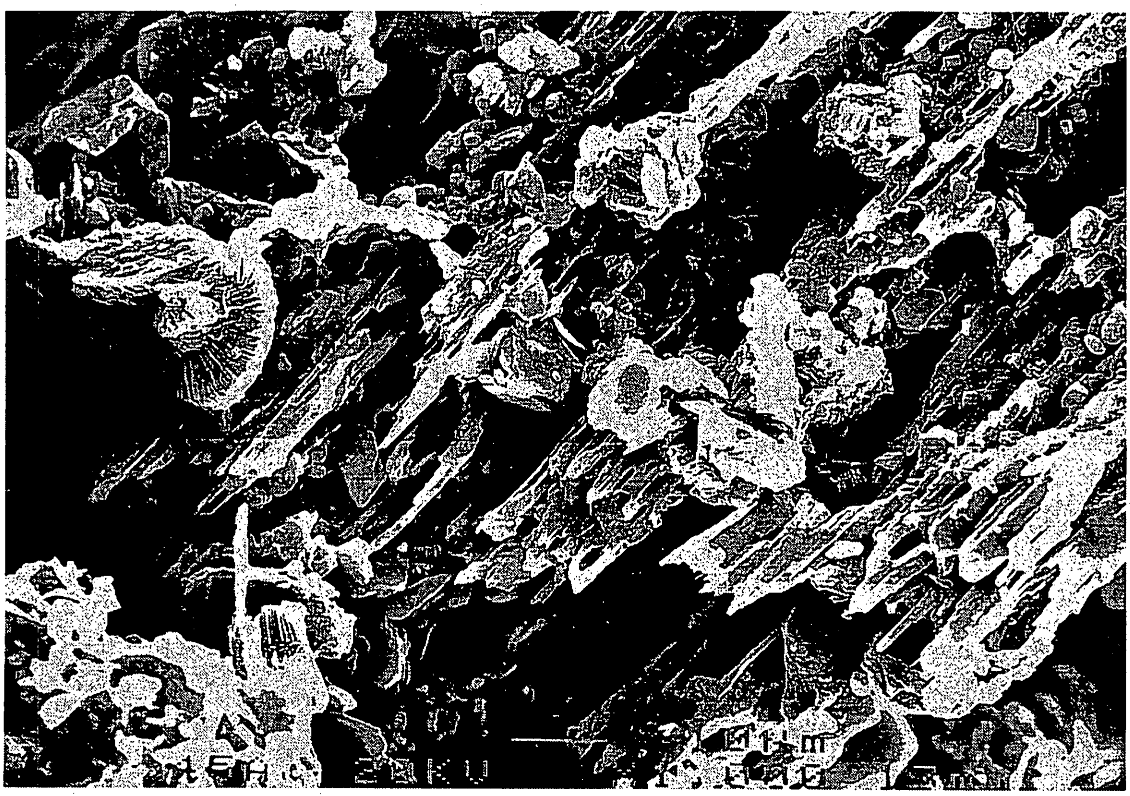

Plate 6: (Sample # 45, 1533.52 m): SEM photomicrograph showing authigenic kaolinite around highly altered ductile lithic fragment or mica flake suggesting a direct relationship between kaolinite and lithic fragments and mica. Scale bar = 10 μm.

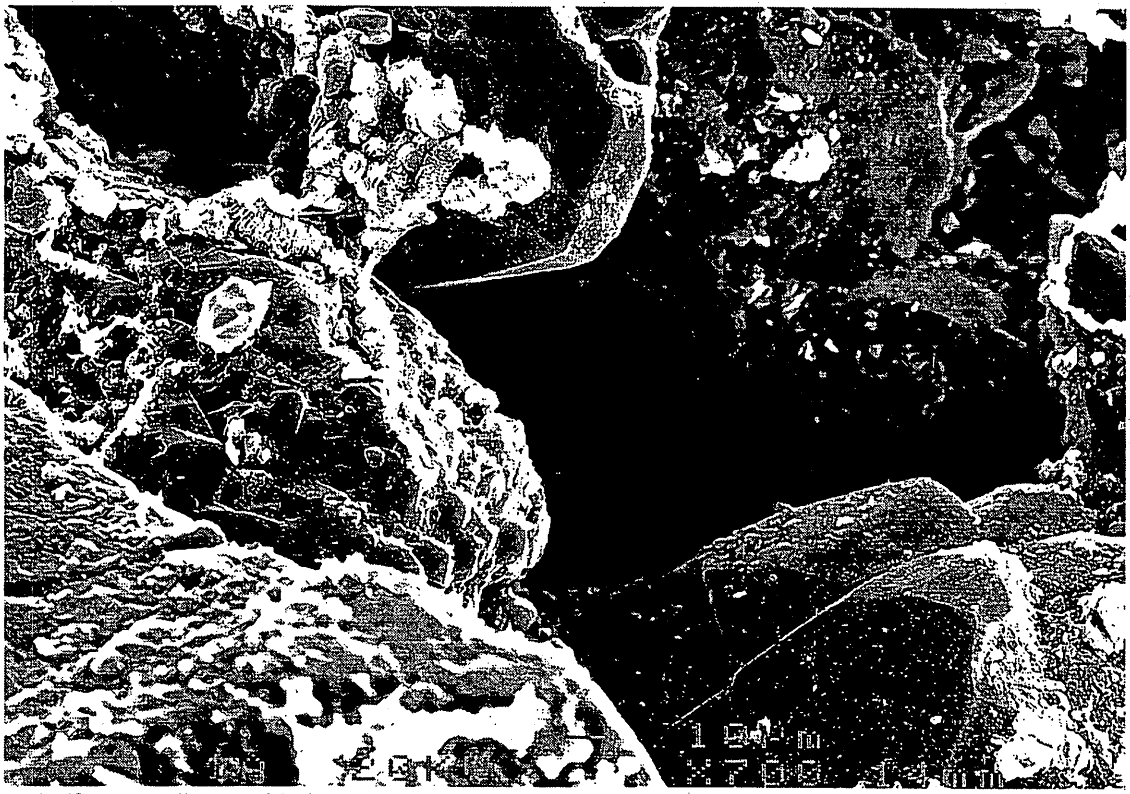

Plate 7: (Sample # 1, 1509.67 m): SEM photomicrograph showing minor quartz overgrowths which occur as thin crystals filling some of the pore space and coating few detrital quartz grains. Note that quartz cements have developed around the cleaner part of the sample. Scale bar = 10 μm.

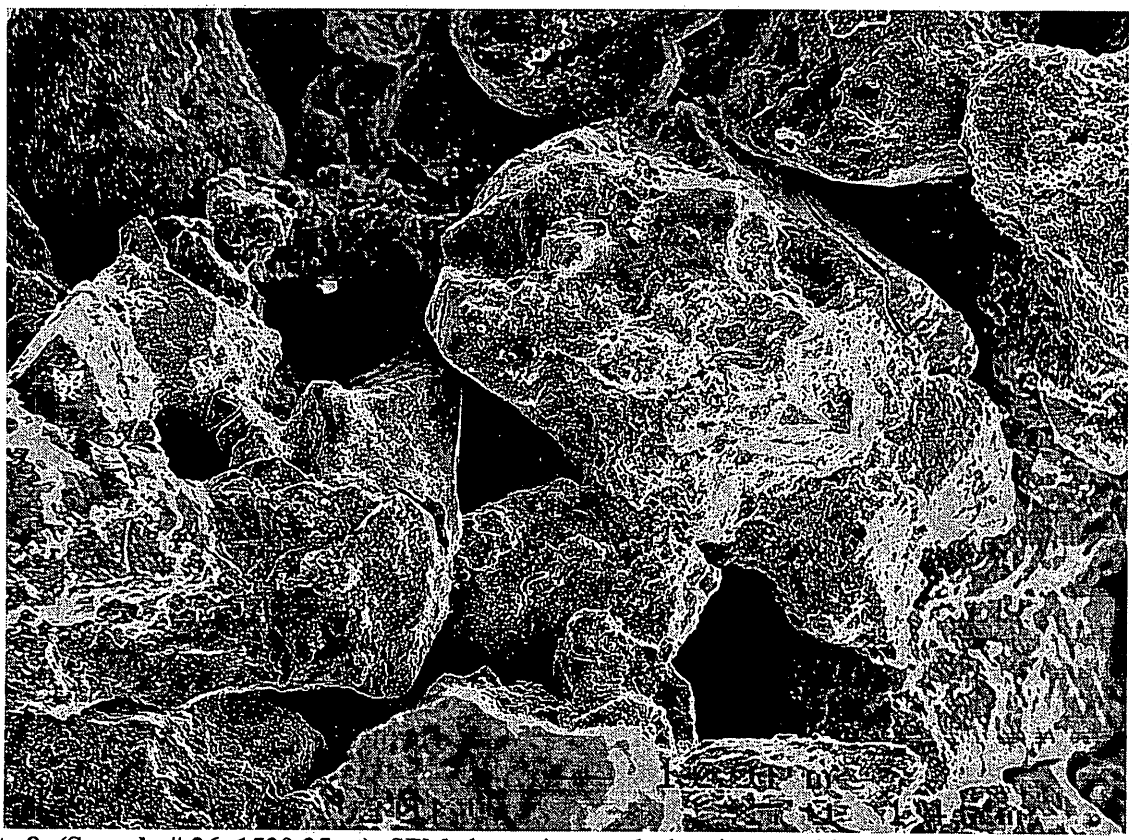

Plate 8: (Sample # 26, 1530.35 m) SEM photomicrograph showing considerable amounts of porosity. The pore throats are small and well interconnected in 3-D. The distribution of the pore throat is regular with good interconnection implying very good permeability. Scale bar = 100 μm.

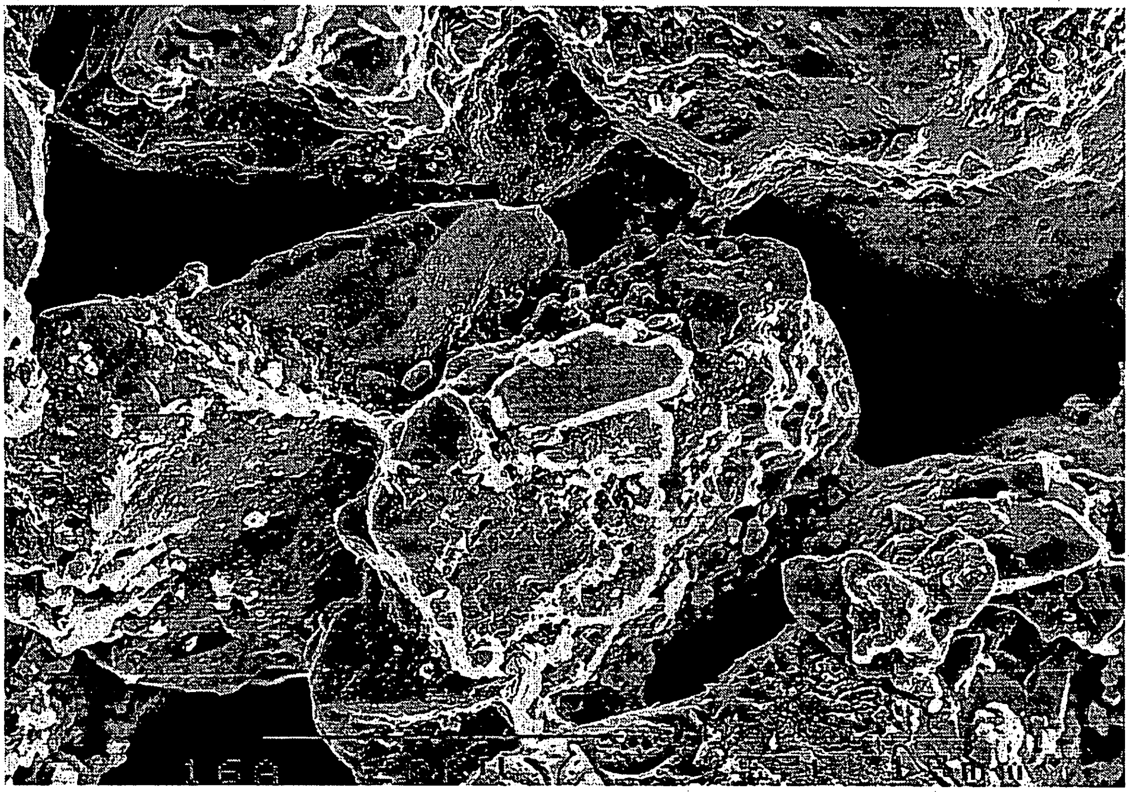

Plate 9: (Sample # 16, 1528.84 m): SEM photomicrograph showing small pore throats interconnected in 3-D, most of which are less than 10 μm. Fines migration during fluid extraction is unlikely to cause any reduction in permeability. Note drilling mud filling and bridging the pore spaces. Scale bar = 100 μm.

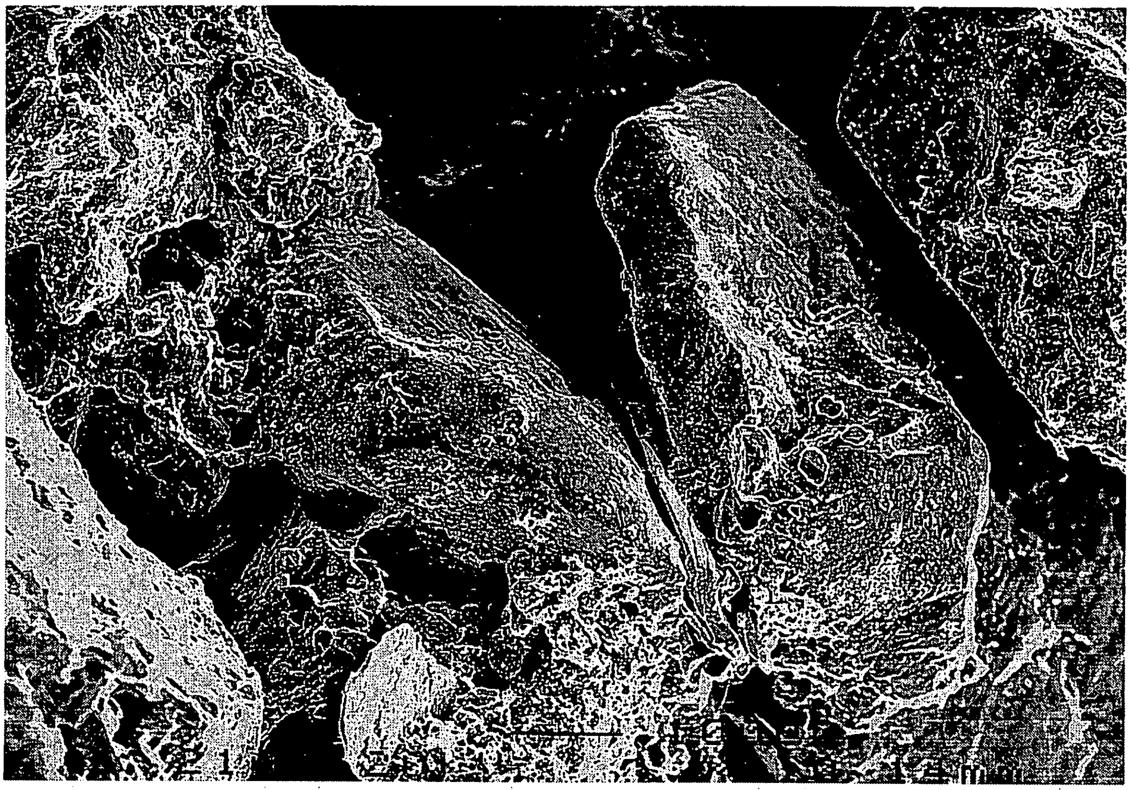

Plate 10: (Sample # 21, 1529.60 m): SEM photomicrograph showing minor amounts of drilling mud (sylvite) filling few of the pore spaces and coating detrital and authigenic minerals. Identification of drilling mud was determined by XRD and petrography. Scale bar = 100 μm.

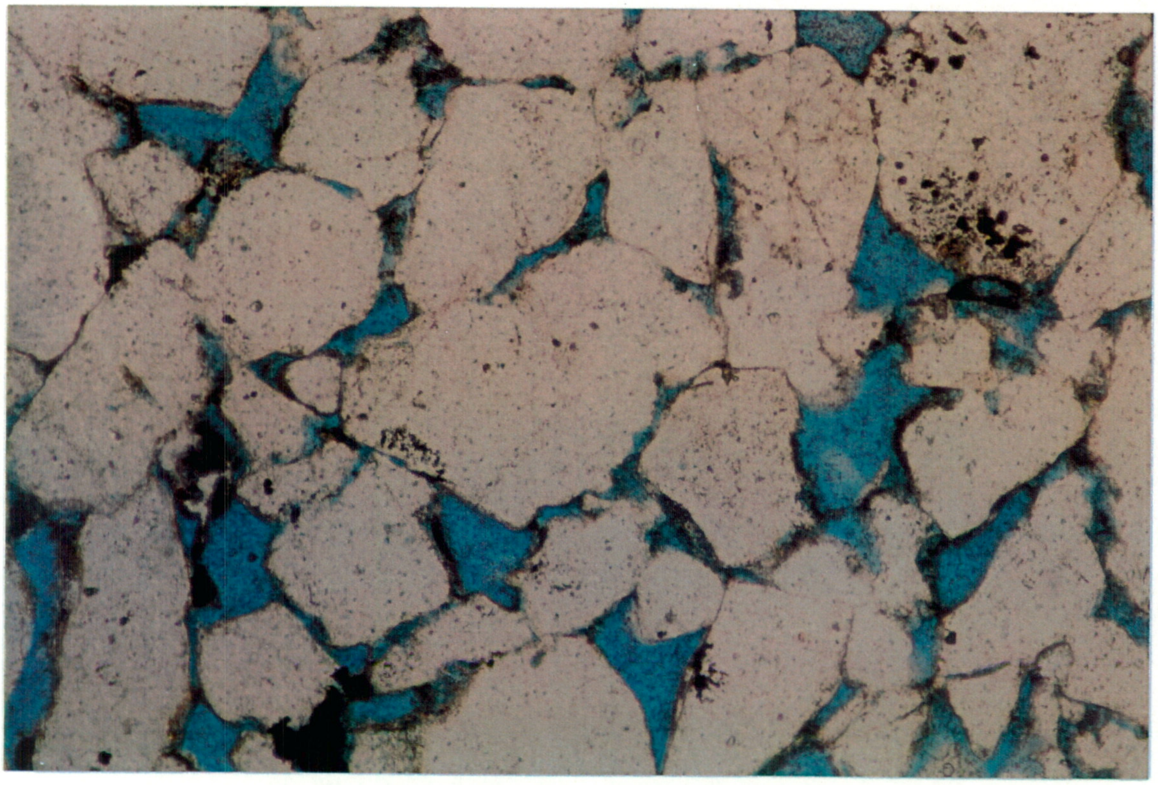

Plate 11: (Sample # 26, 1530.35 m): Thin section photomicrograph of quartz arenite comprising moderately sorted, angular to subrounded medium-grained sandstone with abundant visual porosity. Visual porosity occurs mostly as large triangles suggesting a primary intergranular origin. Plane polarised light. Scale bar = 200 µm.

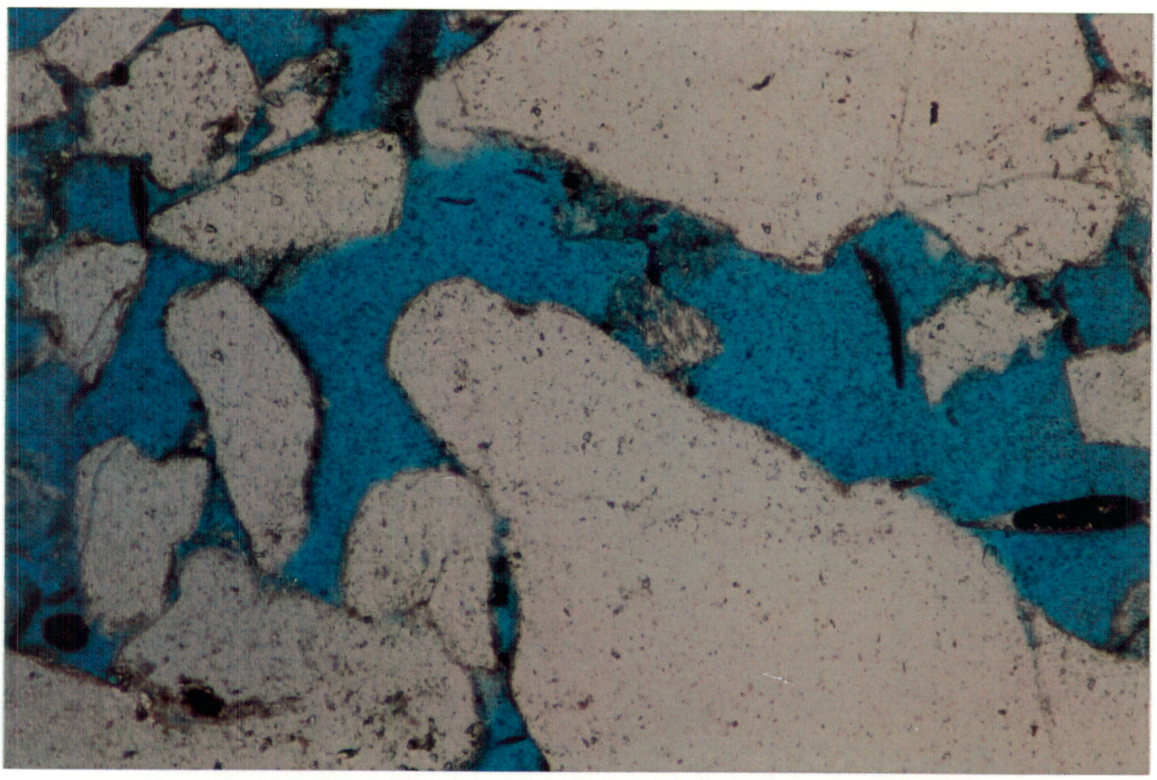

Plate 12: (Sample # 9, 1527. 77 m): Thin section photomicrograph of quartz arenite comprising poorly sorted, angular to rounded very coarse-grained sandstone with minor secondary porosity. Secondary porosity occurs as large and elongated pores providing good interconnection between the intergranular primary pores and increasing the overall porosity and permeability. Plane polarised light. Scale bar = 200 µm.

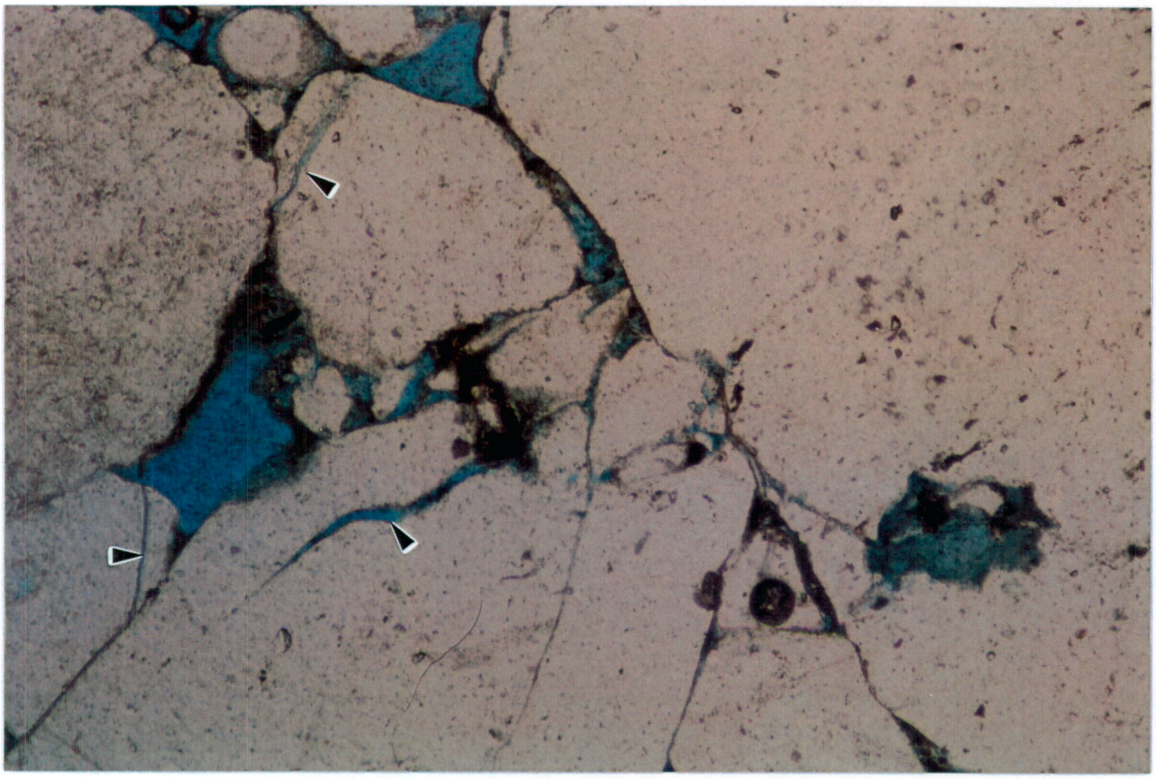

Plate 13: (Sample # 1, 1509.67 m): Thin section photomicrograph showing minor amounts of secondary porosity which resulted from fracturing (arrows). Plane polarised light. Scale bar = 200 μm.

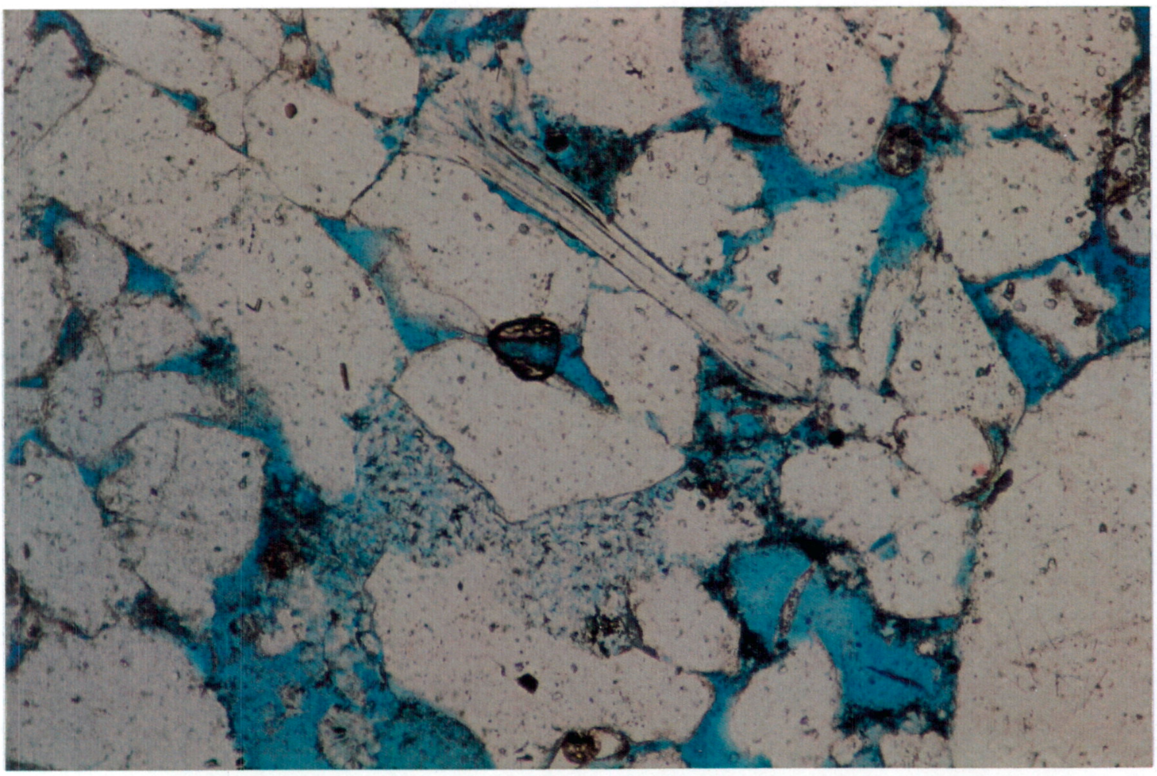

Plate 14: (Sample # 45, 1533.52 m): Thin section photomicrograph showing minor amounts of kaolinite pore filling. Kaolinite has been developed mostly as an alteration product of ductile lithic fragments and mica flakes. Microporosity has developed between kaolinite crystals. Plane polarised light. Scale bar = 200 μm.

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APPENDIX I

THIN SECTION DESCRIPTIONS

SAMPLE: **NO. 1 (1509.67 m)**

Lithology: Quartz Arenite

Texture: The sample cut is grey to creamy, grain supported, small scale to ripple cross stratification, poorly to moderately sorted, coarse-grained sandstone. Quartz grains are angular to subrounded. Minor authigenic minerals and very good visual porosity.

Composition: The sample is dominated by monocrystalline quartz (72%) with traces of minor polycrystalline quartz grains (1.2%), lithic fragments (0.6%) and mica (1.2%). Detrital matrix is also present in minor amounts. It comprises organic-rich silty sandstone. Dispersed organic matter or coalified wood and plant derbies are present in minor amounts (1.2%). Authigenic minerals comprise authigenic kaolinite (2.6%), quartz (2.2%) and traces of pyrite (0.4%). There are good amounts of visible porosity (17%) in the sample.

Quartz is mainly monocrystalline and displays slightly to strong undulose extinction with few grains having straight undulose extinction. Many of the quartz grains contain needle-like minerals, probably tourmaline and/or rutile. Lithic fragments are predominantly low grade metamorphic mica schist and traces of rounded sedimentary chert. Mica is mainly muscovite and occurs as disseminated flakes.

Kaolinite is the dominant authigenic mineral and forms randomly oriented booklets that fill some of the spaces between detrital grains. Individual crystals are pseudohexagonal and range in size from less than 5 μm up to 10 μm. Quartz cement is another authigenic mineral and occurs as euhedral to subhedral syntaxial overgrowths. Other authigenic components are trace to rare. Framboidal pyrite occurs as a cement and replacive authigenic mineral and replaces muscovite flakes.

Porosity is scattered throughout the sample (17%), usually as triangular pores between detrital and authigenic minerals (Plate 15). Secondary porosity is less common than the primary pores (1.8%). It includes enlarged pores and elongated pores providing moderate connections between the larger pores. There is minor microporosity between kaolinite booklets.

XRD: The sample is dominated by quartz, major kaolinite and minor mica and sylvite (drilling mud) (Table 6, and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and mica (illite), (Table 7 and Appendix II).

SEM: Authigenic clays have partly filled the primary pores and locally restricted the size of the pore throats (Plate 16). The pores are well interconnected in a 3-D network giving good permeability (Plate 17). The clay minerals are predominantly of authigenic origin. A few intergranular areas are filled with well crystallined kaolinite. Kaolinite occurs as hexagonal platelets forming short booklets. Moderate microporosity is present in the kaolinite cemented areas.

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Early compaction has affected this sample and has resulted in closer packing of grains and well-developed parallel alignment of elongated detrital grains.
- Framboidal pyrite could have occurred early during the early sulphate reduction.
- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and local illite. Feldspar, however, is almost absent in this sample.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.
- Minor corrosion and grain dissolution has developed as oversized grain dissolution pores and intragranular porosity.

Env. Deposition: The poor to moderately sorting and rounding nature in this very coarse-grained sandstone indicates deposition in a high energy environment. The moderate grain alignment indicates deposition by traction currents, thus the environment of deposition may have been braided fluvial.

Res. Potential: Reservoir potential of this sample is very good (17%). Visible pores are partly filled with quartz and kaolinite cements. Compaction has contributed by up to 49% of the porosity loss while cementation has occluded around 13% of the original intergranular porosity. The sample has very good reservoir characteristics.

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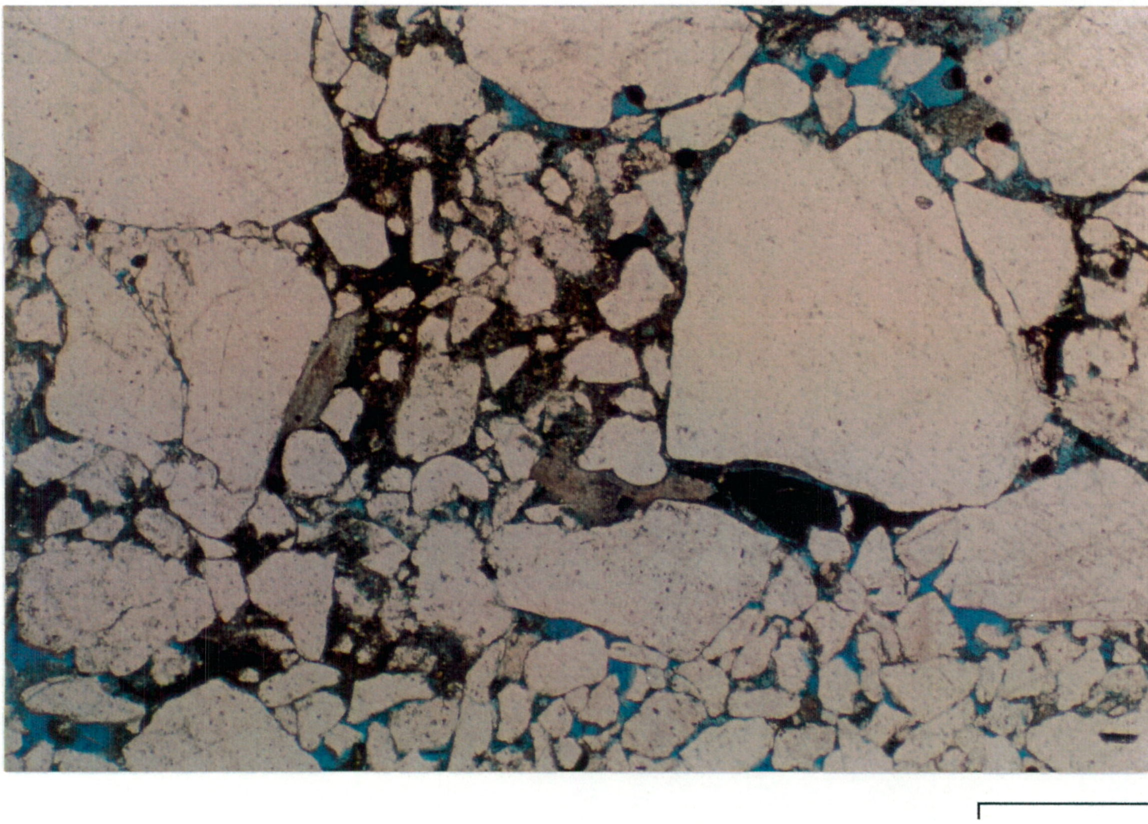

Plate 15A: Sample # 1 (1509.67 m): Thin section photomicrograph showing general view of coarse-grained, poor to moderately sorted quartz arenite with good amounts of primary intergranular porosity (blue). Plane polarised light. Scale bar = 500 µm.

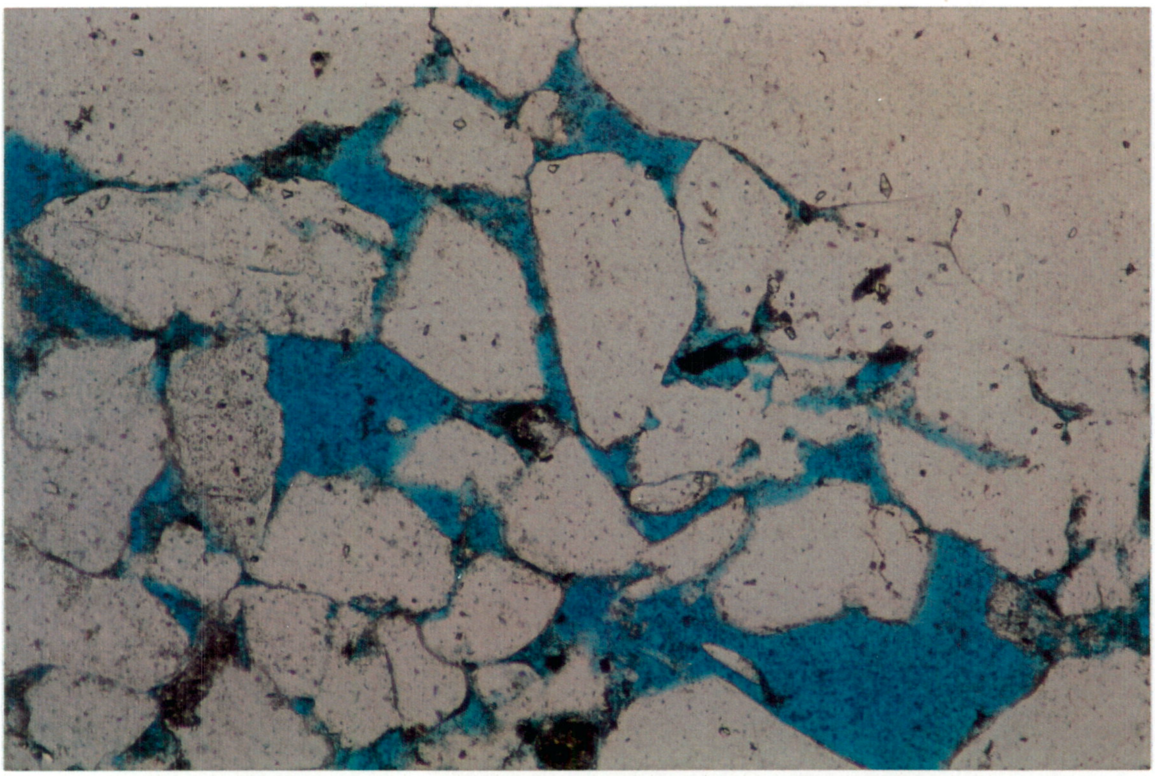

Plate 15B: Sample # 1 (1509.67 m): Thin section photomicrograph showing both types of porosity. Primary intergranular porosity is more common. Plane polarised light. Scale bar = 200 µm.

Plate 16: Sample # 1 (1509.67 m): SEM photomicrograph showing abundant kaolinite cement. Kaolinite occurs as pore filling around highly altered lithic fragments and mica flakes. Kaolinite occurs as hexagonal platelets forming short booklets. Note microporosity between kaolinite cemented areas. Scale bar = 10 μm.

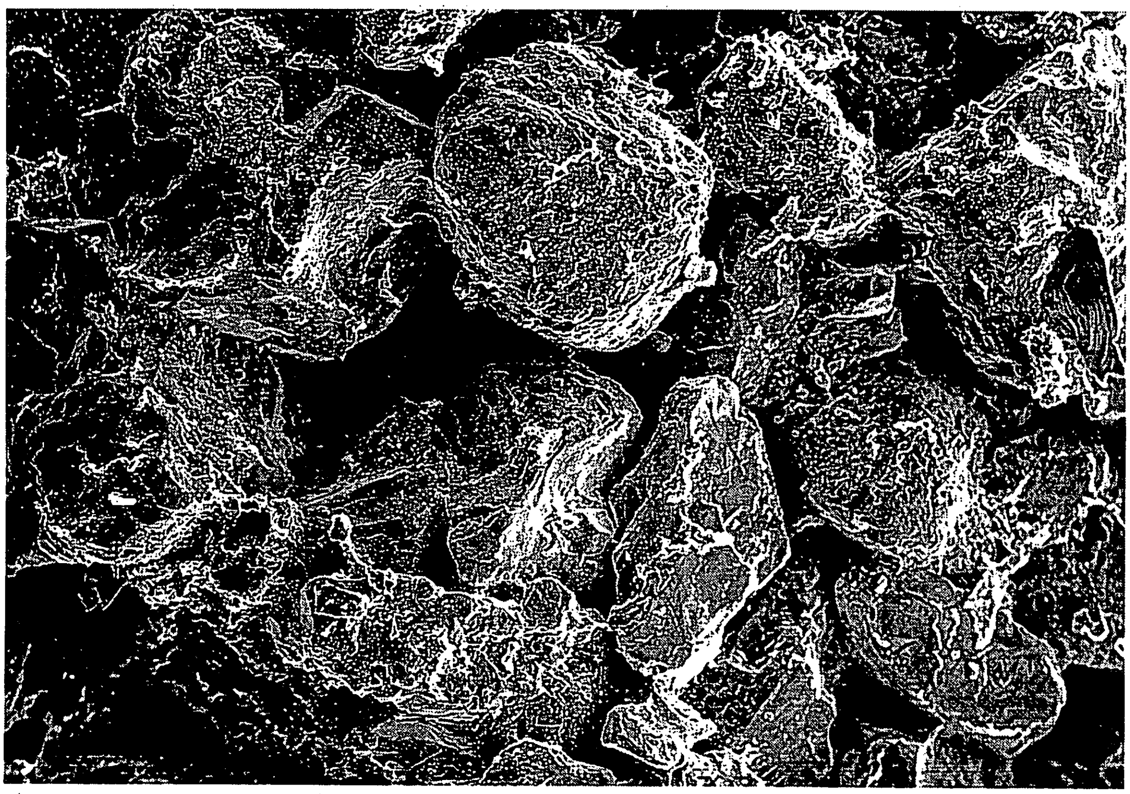

Plate 17: Sample # 1 (1509.67 m): SEM photomicrograph showing considerable amounts of visual porosity. The pores are well connected implying very good permeability. Note that drilling mud fills some of the pores and pore throats. Scale bar = 100 μm.

SAMPLE: **NO. 9 (1527.77 m)**

Lithology: Quartz Arenite

Texture: The sample depicts a grey to creamy, grain supported, large scale cross stratification, poorly sorted, very coarse-grained sandstone. Quartz grains are angular to rounded. Minor authigenic minerals and very good visual porosity. Porosity is patchily distributed and comprises mainly primary intergranular pores.

Composition: Monocrystalline quartz is the dominant framework component (74%) with trace amounts of polycrystalline quartz grains (1%) and metamorphic lithic grains (0.2%). Depositional matrix and organic matter are trace components in this sample comprising 0.6% and 0.4% respectively. Authigenic minerals are minor and dominated by quartz (2.6%) and authigenic kaolinite (1.0%) with traces of pyrite (0.2%). There are very good amounts of visual porosity (19.6%).

Monocrystalline quartz grains show strong undulose extinction. Straight undulose extinction is less common. Many of the monocrystalline grains contain fluid and igneous inclusions. Polycrystalline quartz occurs predominantly as equant to sub equant grains. Authigenic quartz is present as euhedral to subhedral syntaxial overgrowths. The size of the individual overgrowth, in general, is less than 100 μm. 'Dust' rims, euhedral faces and the contrast in the nature of inclusions between the authigenic overgrowths and the detrital quartz grains were used to distinguish detrital and authigenic quartz (Plate 18). The 'dust' rims consist of yellowish brown cryptocrystalline detrital clays. Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and face-to-face, book-like species and occupies much of the intergranular pore space.

Porosity, in general, is more abundant than in the previous sample. Porosity is scattered throughout the sample, usually as triangular pores between detrital and authigenic minerals (Plate 18). This suggests that the porosity is largely intergranular primary.

XRD: Quartz is the dominant component with major kaolinite, minor sylvite (drilling mud) and traces of mica (illite), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and traces of mica (illite), (Table 7 and Appendix II).

SEM: The pores in these poorly sorted quartz arenite grains are slightly filled authigenic clays. Authigenic clays have partly filled the primary pores and restricted the size of the pore throats (Plate 19). The pores, however, are still well interconnected in a 3-D network giving good permeability (Plate 19). The clay minerals are predominantly of authigenic origin. A few intergranular areas are filled with crystalline kaolinite (Plate 20).

Kaolinite occurs as hexagonal platelets forming short booklets. Moderate microporosity is present in the kaolinite cemented areas (Plate 20).

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Early compaction has affected this sample and has resulted in closer packing of grains and well-developed parallel alignment of elongated detrital grains.
- Framboidal pyrite could have occurred probably during the early sulphate reduction. It also occurs as replacive authigenic mineral, replacing mica and organic matter.
- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and illite. Feldspar, however, is almost absent in this sample.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.
- A phase of grain dissolution affected this sample and resulted in minor corrosion and grain dissolution which has developed dissolution pores and intragranular porosity.

Env. Deposition: The unit was deposited in high energy environments that could be braided fluvial.

Res. Potential: The sample shows a good reservoir potential with good porosity (19.6%). Primary pores are partly filled with authigenic quartz and clays which have also blocked some pore throats. Compaction rather than cementation, was the main agent responsible for reducing the intergranular primary porosity.

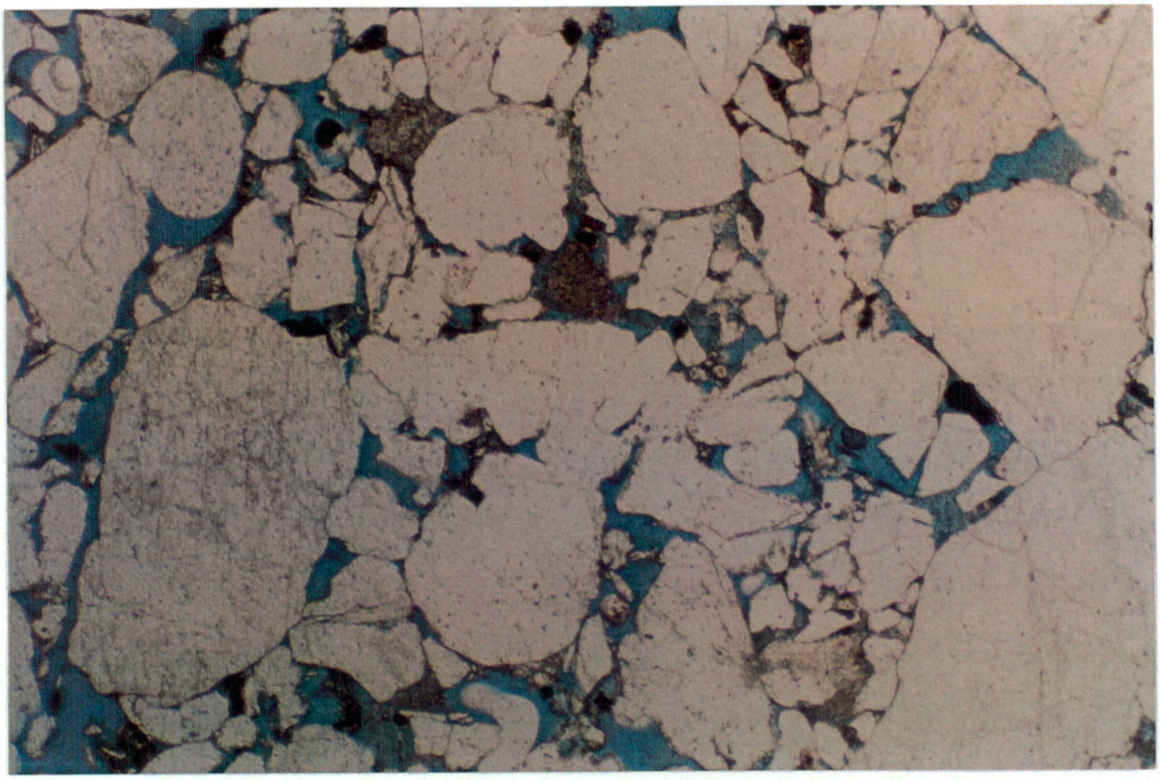

Plate: 18A: Sample # 9 (1527.77 m): Thin section photomicrograph general view of poorly sorted very coarse-grained sandstone (quartz arenite) showing abundant intergranular primary porosity (blue). Authigenic minerals (quartz and kaolinite) are minor. Plane polarised light. Scale bar = 500 μm.

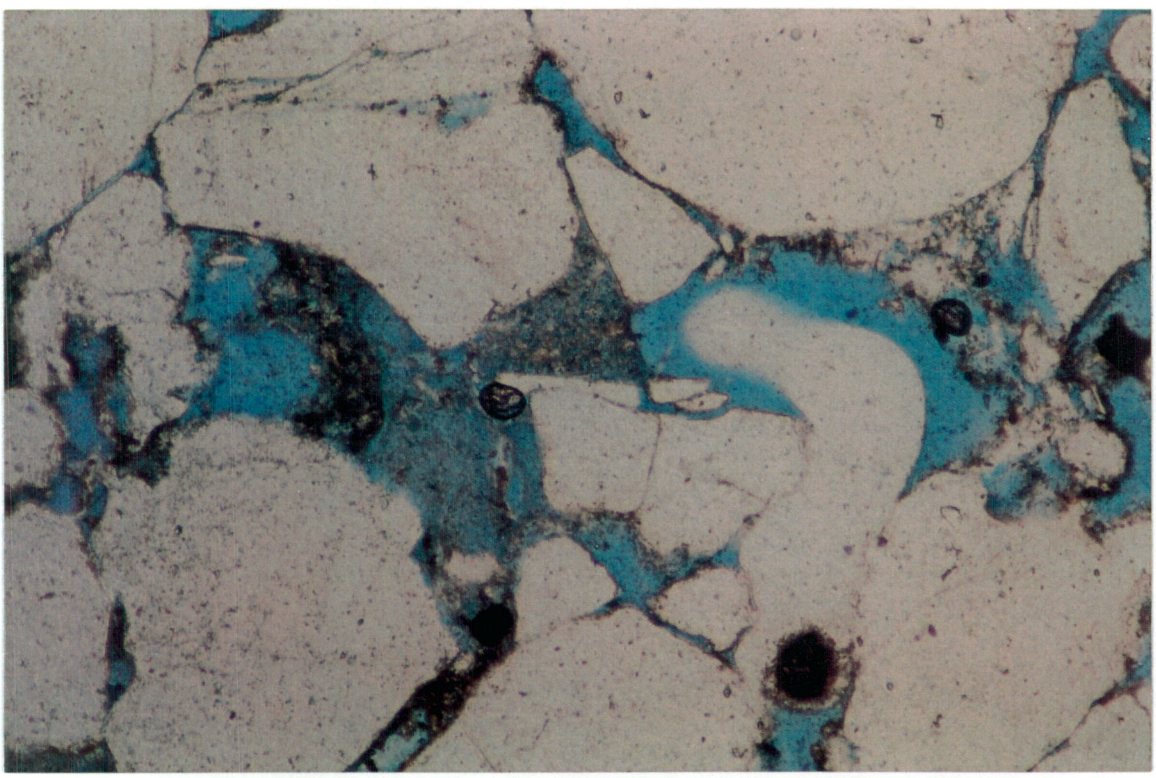

Plate: 18B: Sample # 9 (1527.77 m): Enlarged view of the sample showing minor amounts of drilling mud filling the pore spaces and coating detrital and authigenic grains. Scale bar = 200 μm.

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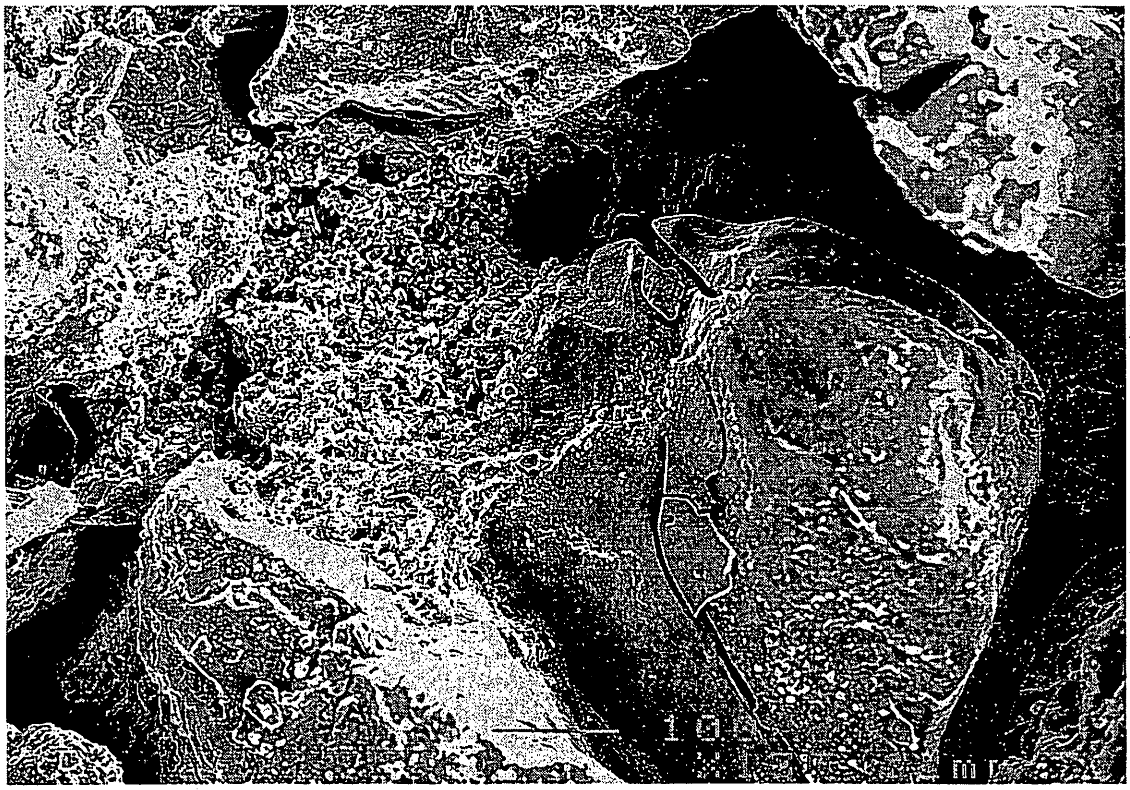

Plate: 19: Sample # 9 (1527.77 m): SEM photomicrograph showing minor authigenic kaolinite filling few of the pore spaces and slightly restricting the reservoir quality. Although kaolinite cement fills some of the pore spaces the pores are still interconnected giving high permeability. Note the presence of fracture porosity. Scale bar = 100 μm.

Plate: 20: Sample # 9 (1527.77 m): SEM photomicrograph showing kaolinite booklets filling the pore spaces. Kaolinite crystals occurs as pseudohexagonal and book-like crystals developed face to face. Scale bar = 10 μm.

SAMPLE: **NO. 16 (1528.84 m)**

Lithology: Quartz Arenite

Texture: Grey to creamy, grain supported, small scale cross stratification, moderately to well sorted, medium-grained sandstone. Quartz grains are mainly angular to subrounded. Minor authigenic minerals and high visual porosity.

Composition: The dominant framework component is monocrystalline quartz (62.2%). Polycrystalline quartz grains (0.4%) and lithic fragments (0.4%) are present in trace amounts. Coalified wood and plant debries are common (9.4%). Detrital depositional matrix is a trace component (1%). Authigenic minerals comprise authigenic kaolinite (5%), quartz (2.6%) and traces of pyrite (0.4%). There are good amounts of visible porosity (17.8%).

Monocrystalline quartz displays strongly undulose extinction with some of the quartz grains containing fluid, igneous inclusions or needle-like minerals and biotite.

Kaolinite is the main authigenic component in this sample. Quartz cement is another authigenic component. Kaolinite forms randomly oriented booklets that fill the spaces between framework grains. It is scattered throughout the sample, usually around altered muscovite and metamorphic rock fragments. Authigenic quartz is present as euhedral to subhedral syntaxial overgrowths.

There is good porosity (17.8%) evident in this sample, mostly as scattered primary pores between detrital and authigenic minerals (Plate 21). Microporosity is also evident between kaolinite crystals.

XRD: The sample is dominated by quartz, with major kaolinite, minor sylvite (drilling mud) and traces of mica (illite), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite with traces of mica (illite), (Table 7 and Appendix II).

SEM: SEM photomicrographs indicate that most of the quartz overgrowths occur as thin grain coating around detrital quartz grains. The pores, however, are still interconnected in a 3-D network giving good permeability (Plate 22). A few intergranular areas are filled with crystalline fine kaolinite crystals. Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and book-like species and occupies some of the intergranular pore space (Plate 23). The fine detritus in a few of the pores may move during fluid extraction but, because of the pore throat size, is unlikely to cause a significant reduction in permeability (Plate 23).

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Early compaction has affected this sample and has resulted in closer packing of grains and well-developed parallel alignment of elongated detrital grains.
- Framboidal pyrite could have occurred early during the early sulphate reduction.
- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and illite. Feldspar, however, is almost absent in this sample.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.
- A phase of grain dissolution affected the sample as indicated by the minor corrosion and grain dissolution (Plate 21) which has developed as oversized grain dissolution pores and intragranular porosity.

Env. Deposition: The medium grain size, moderate sorting and moderate roundness of detrital grains in the sandstone indicates a moderate to high energy environment of deposition. Deposition may have occurred in a braided fluvial environment.

Res. Potential: The reservoir potential of this sample is good. Visible porosity is good in the sample (17.8%) with primary porosity being more common than secondary porosity. The primary pores have been partly reduced in size by the deposition of authigenic clays. These clays have also locally restricted the size of the pore throats. The pores are well interconnected giving a good permeability. Inter-crystalline microporosity is present in the kaolinite cemented areas.

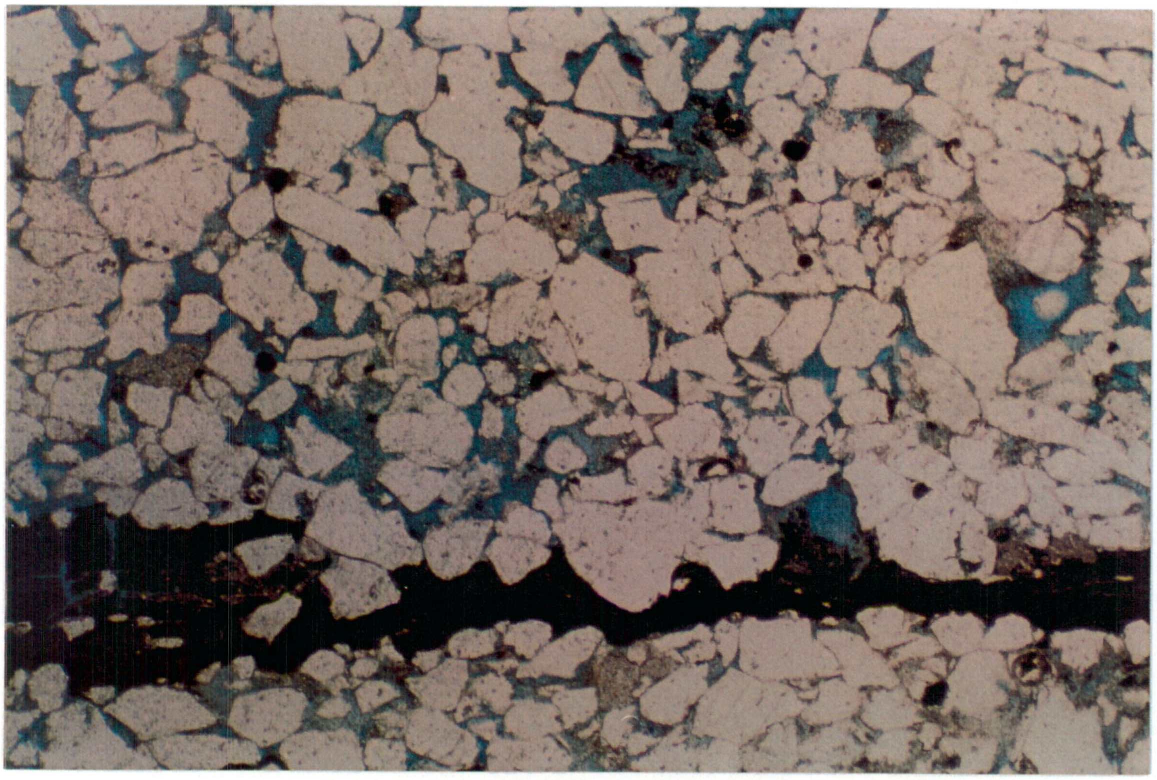

Plate 21A: Sample # 16 (1528.84 m): Thin section photomicrograph of quartz arenite comprising moderately sorted, angular to subrounded medium-grained sandstone with a patch of intergranular porosity (blue) and thin laminae of coalified plant. Plane polarised light. Scale bar = 500 μm.

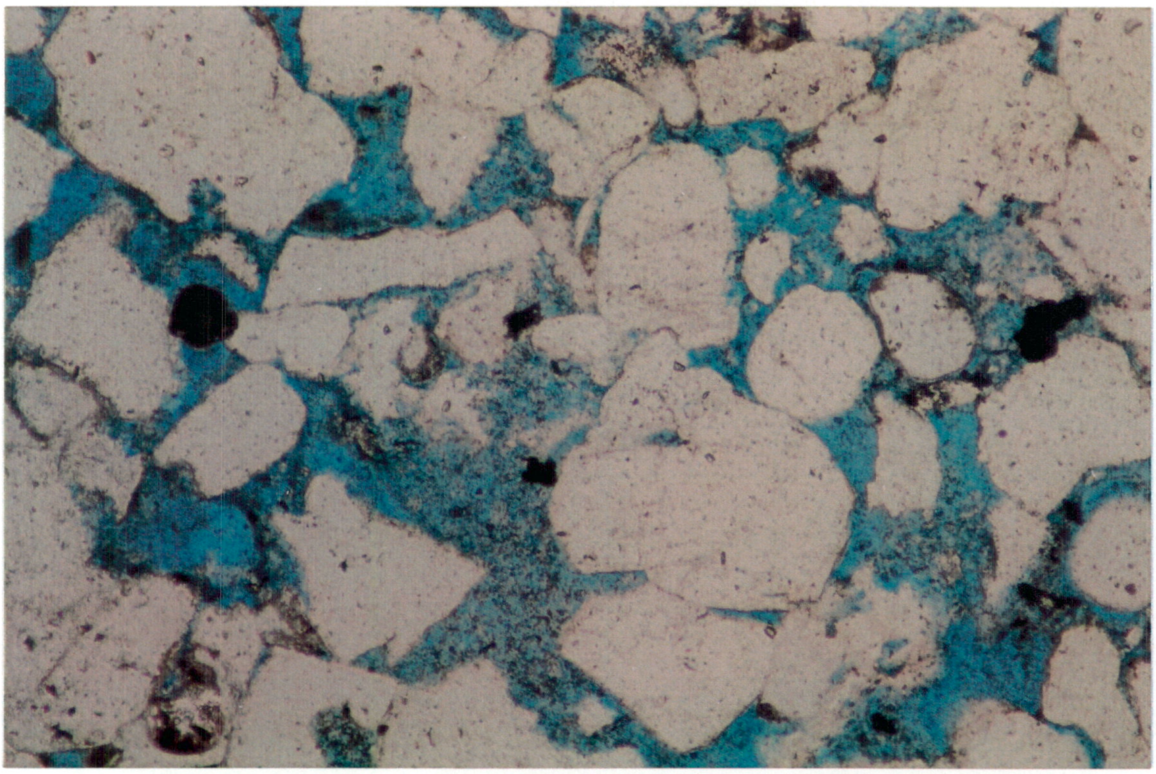

Plate 21B: Sample # 16 (1528.84 m): Enlarged view of 21A showing minor amounts of authigenic kaolinite filling some of the pore spaces. Plane polarised light. Scale bar = 200 μm.

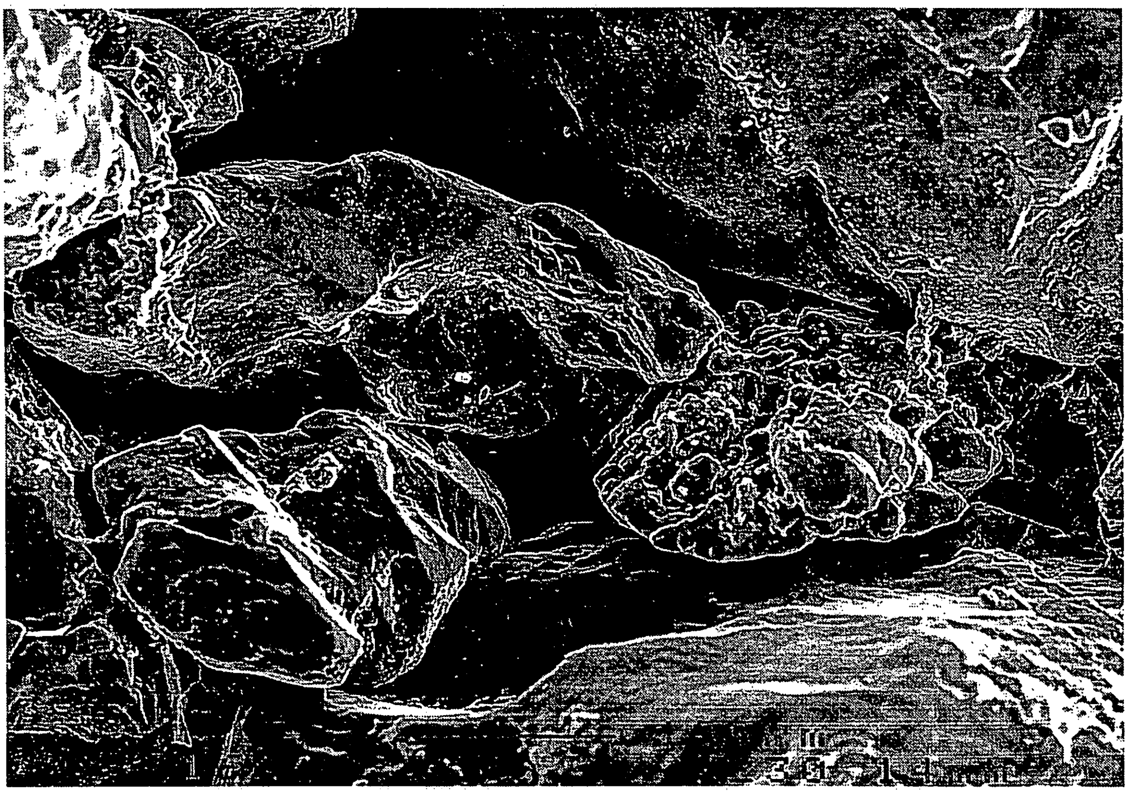

Plate 22: Sample # 16 (1528.84 m): SEM photomicrograph showing trace to minor amounts of quartz overgrowths which occur as thin grain coating around detrital quartz grains. The pores, however, are still interconnected in a 3-D network giving good permeability. Scale bar = 10 µm.

Plate 23: Sample # 16 (1528.84 m): SEM photomicrograph showing of kaolinite booklets filling some of the pore spaces. Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and book-like species and occupies some of the intergranular pore space. The fine detritus are unlikely to cause a significant reduction in permeability. Scale bar = 10 µm.

SAMPLE: **NO. 21 (1529.60 m)**

Lithology: Quartz Arenite

Texture: Grey to creamy, grain supported, small scale cross stratification, moderately to well sorted, medium-grained sandstone. Quartz grains are mainly angular to subrounded. Minor authigenic minerals and high visual porosity. Visible porosity is patchily distributed and comprises mainly primary intergranular pores and minor secondary grain dissolution.

Composition: The framework component of the sample is dominated by monocrystalline quartz (73.6%) and trace polycrystalline quartz (0.8%) Lithic fragments are minor components (2%). Authigenic minerals comprise kaolinite (2.6%), quartz (2%) and traces of pyrite. There are good amounts of visible porosity (18.2%).

Monocrystalline quartz occurs normally as subangular to rounded grains and displays strongly undulose extinction with many grains containing fluid and igneous inclusions. Lithic fragments predominantly comprise equal quantities of metamorphic mica schist and rounded sedimentary chert.

Kaolinite is scattered throughout. Authigenic quartz is present as euhedral to subhedral overgrowths. The size of the individual overgrowth, in general, is less than 100 μm.

The amount of visual porosity (Plate 24) in this sample is relatively high (18.2%). Secondary porosity is minor (1.8%). There is minor microporosity between kaolinite booklets. The main agent controlling the reservoir quality in this sample is the mechanical compaction.

XRD: XRD results show that quartz is the dominant component with major kaolinite, minor sylvite (drilling mud) and traces of mica (illite), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and traces of mica (illite) (Table 7 and Appendix II).

SEM: SEM photomicrographs indicate that pores are large and very well interconnected in a 3-D network giving very good permeability (Plate 25). Authigenic clays have partly filled the primary pores and locally restricted the size of the pore throats. A few intergranular areas are filled with crystalline kaolinite (Plate 26). Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and book-like species and occupy few of the intergranular pore spaces (Plate 26). Moderate microporosity is present in the kaolinite cemented areas.

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Minor early compaction, as suggested by the slight concavo-convex contacts between framework grains.
- Framboidal pyrite could have occurred early during the early sulphate reduction.
- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and illite. Feldspar, however, is almost absent in this sample.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.
- Minor corrosion and grain dissolution has developed as oversized grain dissolution pores and intragranular porosity.

Env. Deposition: The sorting and moderate rounding in this medium-grained sandstone suggests deposition in a moderate to high energy environment. Possible environments include braided fluvial mid-channel bar.

Res. Potential: Visible porosity is moderate (18.2%) and the pores are well interconnected in a 3-D network giving a high permeability. The reservoir quality is excellent.

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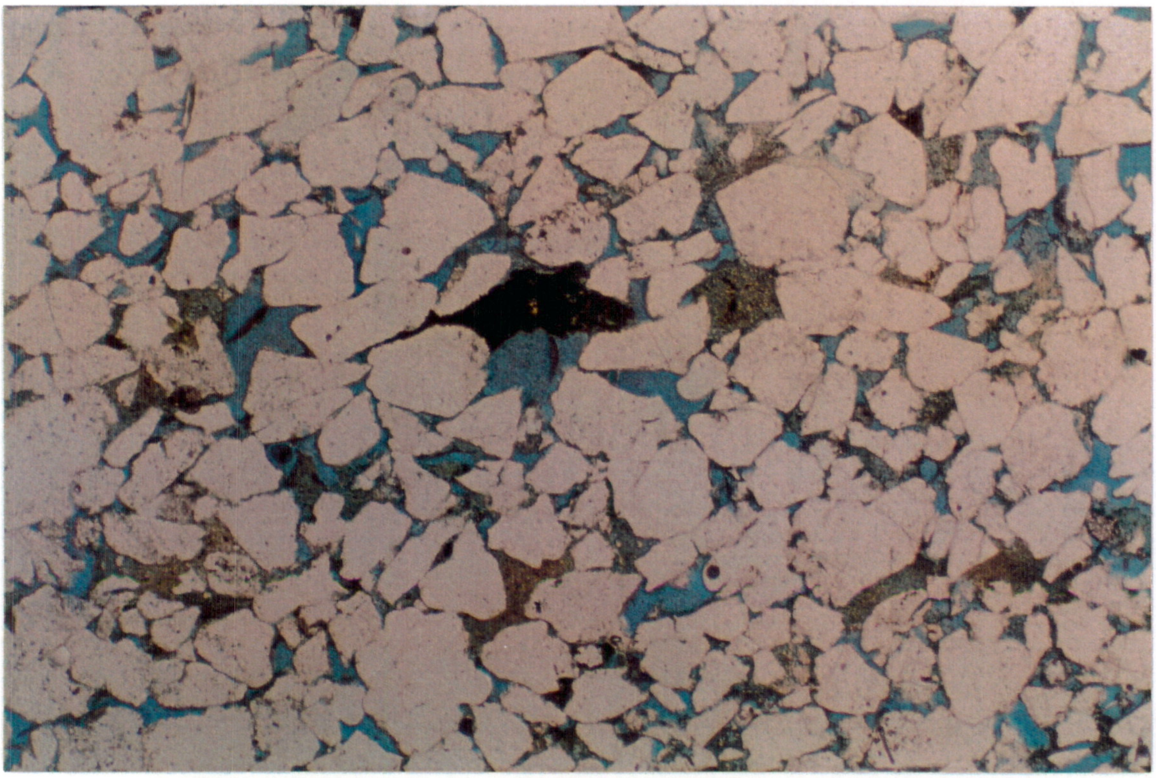

Plate 24A: Sample # 21 (1529.60 m): Thin section photomicrograph showing generalised view of moderately sorted, angular to subrounded medium-grained sandstone with considerable amounts of intergranular porosity. The yellow materials are drilling mud (sylvite) and stained yellow staining. Plane polarised light. Scale bar = 500 μm.

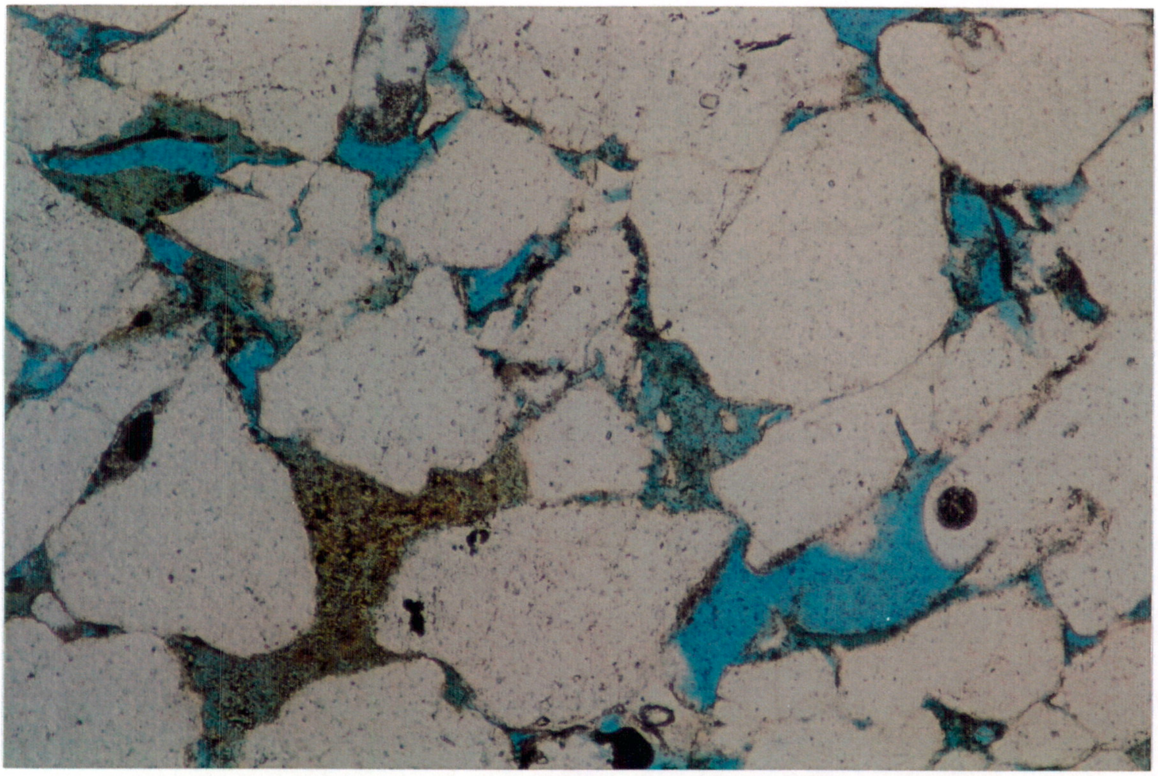

Plate 24B: Sample # 21 (1529.60 m): Enlarged view of Plate 24A. The sample is clean quartz arenite with minor amounts of drilling mud (yellow materials). Plane polarised light. Scale bar = 200 μm.

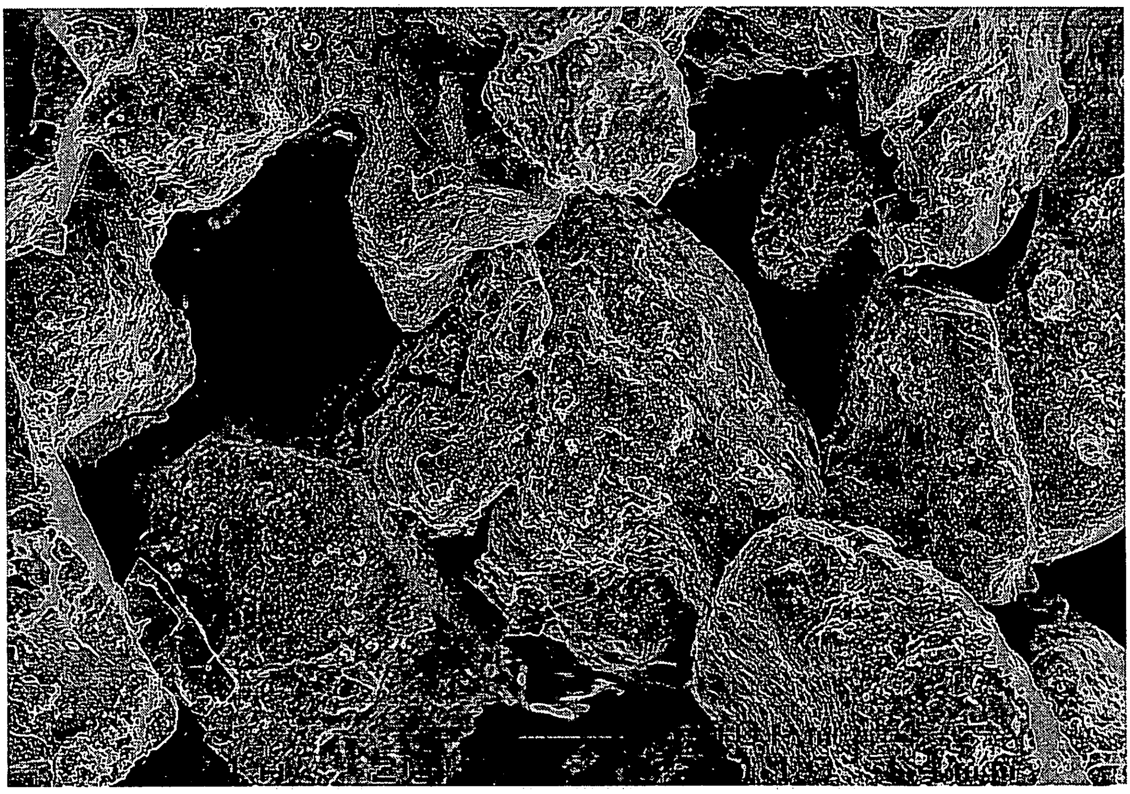

Plate 25: Sample # 21 (1529.60 m): SEM photomicrograph indicates that pores are large and very well interconnected in a 3-D network giving very good permeability. Scale bar = 100 μm.

Plate 26: Sample # 21 (1529.60 m): SEM photomicrograph showing authigenic kaolinite around altered ductile lithic grains and mica flakes. Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and book-like species and occupies few of the intergranular pore spaces. Scale bar = 10 μm.

SAMPLE: **NO. 26 (1530.35 m)**

Lithology: Quartz Arenite

Texture: The sample consists of grey to creamy, grain supported, horizontally laminated to small scale cross stratification, poorly sorted, medium-grained sandstone. Quartz grains are angular rounded. Minor authigenic minerals and very good visual porosity.

Composition: Monocrystalline quartz is the main framework component and constitutes 73.4% of the sample. Polycrystalline quartz grains are trace (0.6%). Lithic fragments are present also in trace amounts (1%) and dominated by metamorphic micaceous schist (0.8%) and rounded sedimentary chert (0.2%). Mica is trace and detrital depositional matrix is trace to rare (0.2%). Authigenic minerals comprise authigenic kaolinite (2%), quartz (1.2%), and traces of pyrite (0.6%). Visible porosity is present in high amounts in the sample (21.0%).

Monocrystalline quartz shows strongly undulose extinction. Few quartz grains contain fluid, igneous inclusions and needle-like minerals (tourmaline).

Porosity is high in this sample (Plate 27). It occurs as both intergranular primary and secondary in origin. Secondary porosity is less common and originated by partial dissolution of mica and ductile rock fragments. A relative proportion of microporosity is present between the clay minerals.

XRD: Quartz is the dominant component of this sample with major kaolinite, minor sylvite (drilling mud) and traces of mica (illite), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and traces of mica (illite), (Table 7 and Appendix II).

SEM: The moderately to well sorted medium-grained quartz in this sample contains small amounts of anhedral to subhedral quartz overgrowths (Plate 28). Authigenic clays are more common and locally restrict the size of the pore throats (Plates 28 and 29). SEM photomicrographs show that a few intergranular areas are filled with crystalline kaolinite (Plate 29). The fine detritus in a few of the pores may move during fluid extraction but, because of the pore throat size, is unlikely to cause a significant reduction in permeability (Plate 29).

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Minor early compaction, as suggested by the slight concavo-convex contacts between framework grains.

- Framboidal pyrite could have occurred early in the diagenetic history during the early sulphate reduction.

- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and illite. Feldspar, however, is almost absent in this sample.

- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.

- Minor corrosion and grain dissolution has developed as oversized grain dissolution pores and intragranular porosity.

Env. Deposition: The probable depositional environment of this sample is braided fluvial.

Res. Potential: The sample has a very good reservoir quality (21%). Visible porosity is partly filled with kaolinite and quartz cements which have locally blocked the pore throats. Reservoir quality apparently has been affected by mechanical compaction rather than precipitation of authigenic minerals.

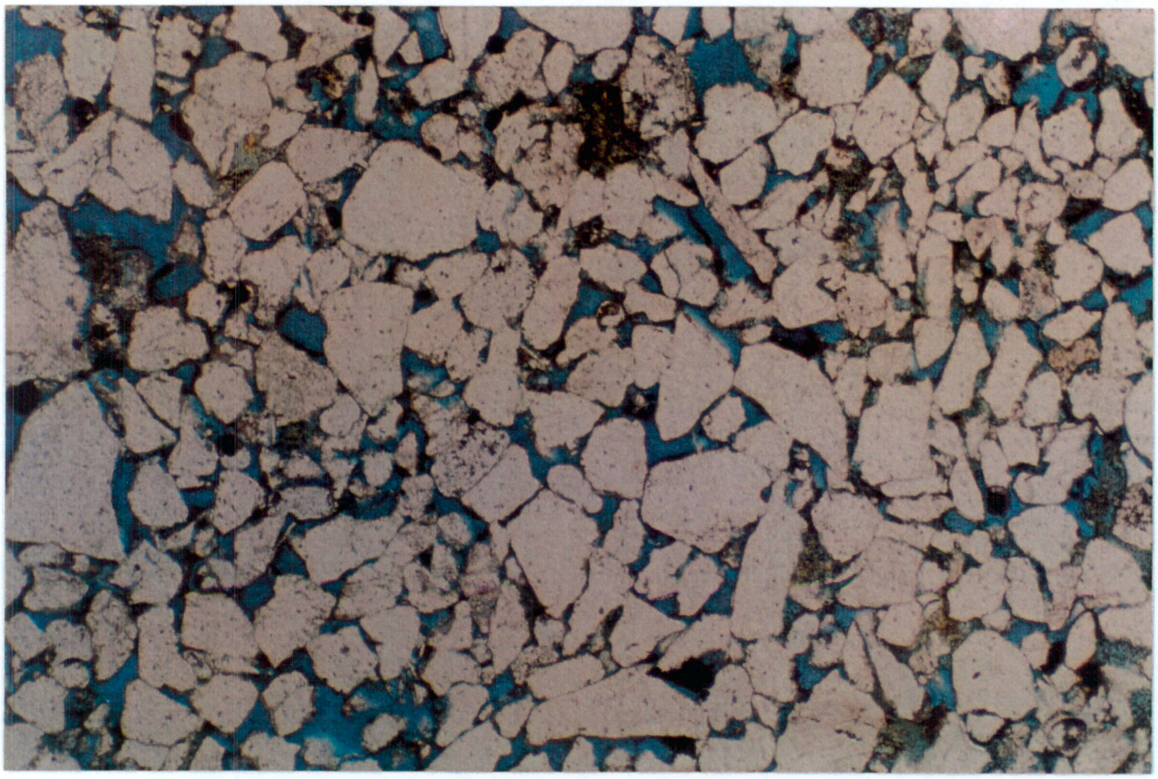

Plate 27A: Sample # 26 (1530.35 m) Thin section photomicrograph showing general view of quartz arenite comprising moderately sorted, angular to rounded medium-grained sandstone with high visual porosity. Note the presence of drilling mud coating almost all grains and filling some of the pores. Plane polarised light. Scale bar = 500 μm.

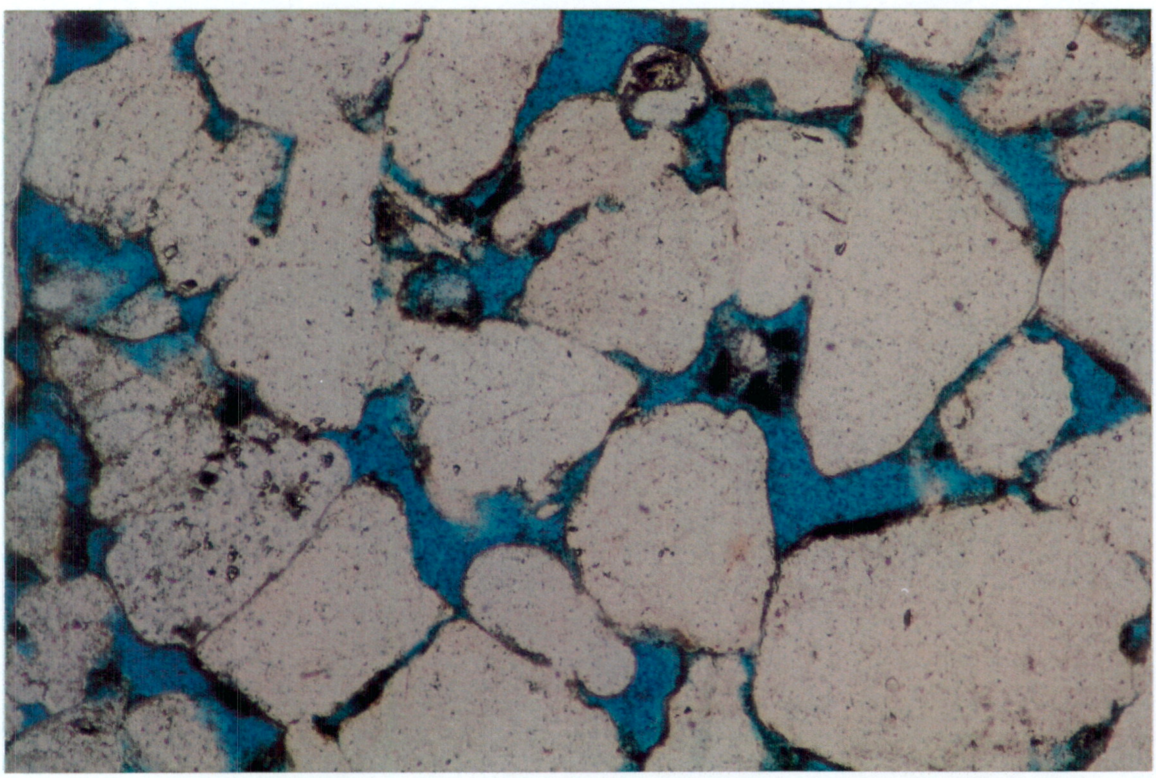

Plate 27B: Sample # 26 (1530.35 m) Enlarged view of Plate 27A. Plane polarised light. Scale bar = 200 μm.

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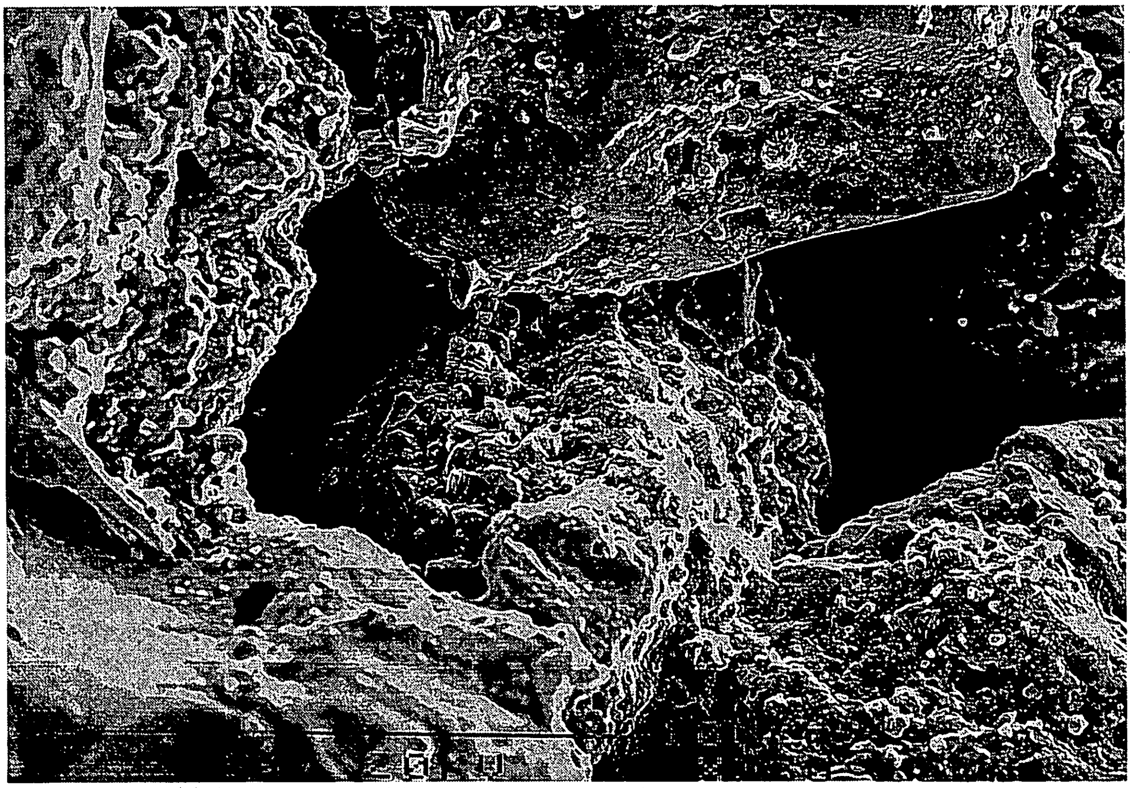

Plate 28: Sample # 26 (1530.35 m) SEM photomicrograph showing traces of anhedral to subhedral quartz overgrowths blocking some of the pore throats. A few pores are filled with fine kaolinite crystals. The pores are large and well connected in 3-D network giving good permeability. Scale bar = 100 μm.

Plate 29: Sample # 26 (1530.35 m) SEM photomicrograph shows minor authigenic clays restricting the size of the pore throats. Intergranular areas are filled with well crystallined kaolinite causing a minor reduction in primary porosity but have inter-crystalline microporosity. Scale bar = 10 μm.

SAMPLE: **NO. 33 (1531.74 m)**

Lithology: Quartz Arenite

Texture: The sample is a grey, grain supported, small scale to wavy cross stratification, poorly sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Minor authigenic minerals and high visual porosity.

Composition: The sample is dominated by monocrystalline quartz (74%). Polycrystalline quartz is minor (2.8%). Lithic fragments is a trace component (0.2%). Detrital depositional matrix, mica and organic matter are trace components. Accessory minerals are mainly tourmaline and zircon. Authigenic minerals are minor and comprise kaolinite (1.8%) and quartz (1%) and traces of pyrite (0.2%). There are good amounts of visible porosity (17%).

Monocrystalline quartz displays strongly undulose extinction with many grains containing fluid and igneous inclusions.

Porosity is scattered throughout the sample, usually as triangular pores between detrital and authigenic minerals (Plate 30). This suggests that the porosity is largely intergranular primary. Secondary porosity is less common than in the primary pores (Plate 30). It includes enlarged and elongated pores providing moderate connections between the larger pores. There is minor microporosity between kaolinite booklets. Secondary porosity was formed by minor dissolution of ductile rock fragments and micas.

XRD: The sample is dominated by quartz, major kaolinite, minor sylvite (drilling mud) and traces of mica (illite), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite (dickite) and traces of mica (illite), (Table 7 and Appendix II).

SEM: Pores and pore throat are large and present in significant amounts. They are well connected in 3-D network giving high permeability (Plate 31). Authigenic clays are minor and partially restrict the size of the pore throats. SEM photomicrographs show that a few intergranular areas are filled with well crystallined kaolinite (Plate 32). This kaolinite has also caused a minor reduction in primary porosity and has inter-crystalline microporosity.

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Minor early compaction, as suggested by the slight concavo-convex contacts between framework grains.

- Framboidal pyrite could have occurred early in the diagenetic history during the early sulphate reduction.

- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and illite. Feldspar, however, is almost absent in this sample.

- After kaolin, precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.

- Minor corrosion and grain dissolution has developed as oversized grain dissolution pores and intragranular porosity.

Env. Deposition: The unit was deposited in high energy environments that could be braided fluvial.

Res. Potential: The sample shows a good reservoir potential with high porosity (17%). Primary pores are partly filled with quartz and kaolinite cements which have locally blocked some pore throats. Fines migration should be minimal in this sample and it should retain a relatively high permeability. The porosity is interconnected in a 3-D network giving good permeability in all directions.

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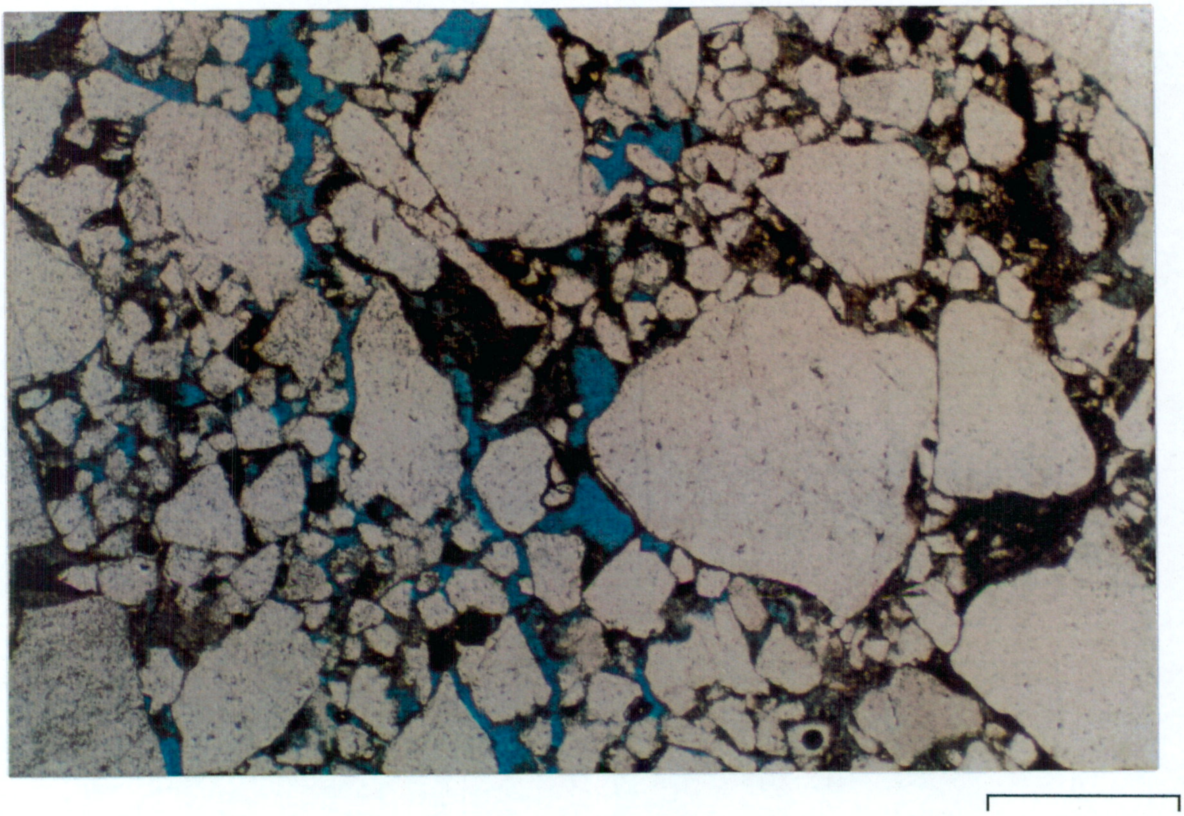

Plate 30A: Sample # 33 (1531.74 m): Thin section photomicrograph showing general view of quartz arenite with significant amounts of visible porosity. Drilling mud is filling much of the pore spaces. Note the triangular shape of the visible porosity suggesting primary intergranular origin. Plane polarised light. Scale bar = 500 μm.

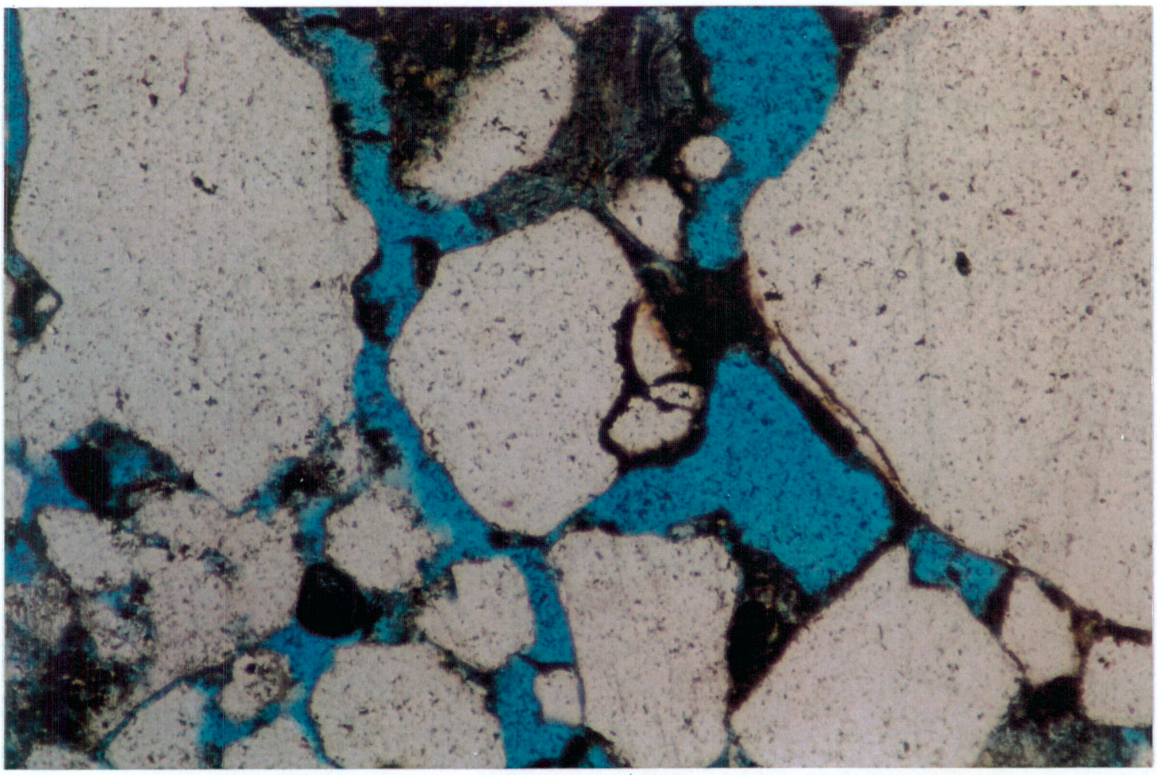

Plate 30B: Sample # 33 (1531.74 m): Thin section photomicrograph showing drilling mud filling and bridging the pore spaces. Plane polarised light. Scale bar = 200 μm.

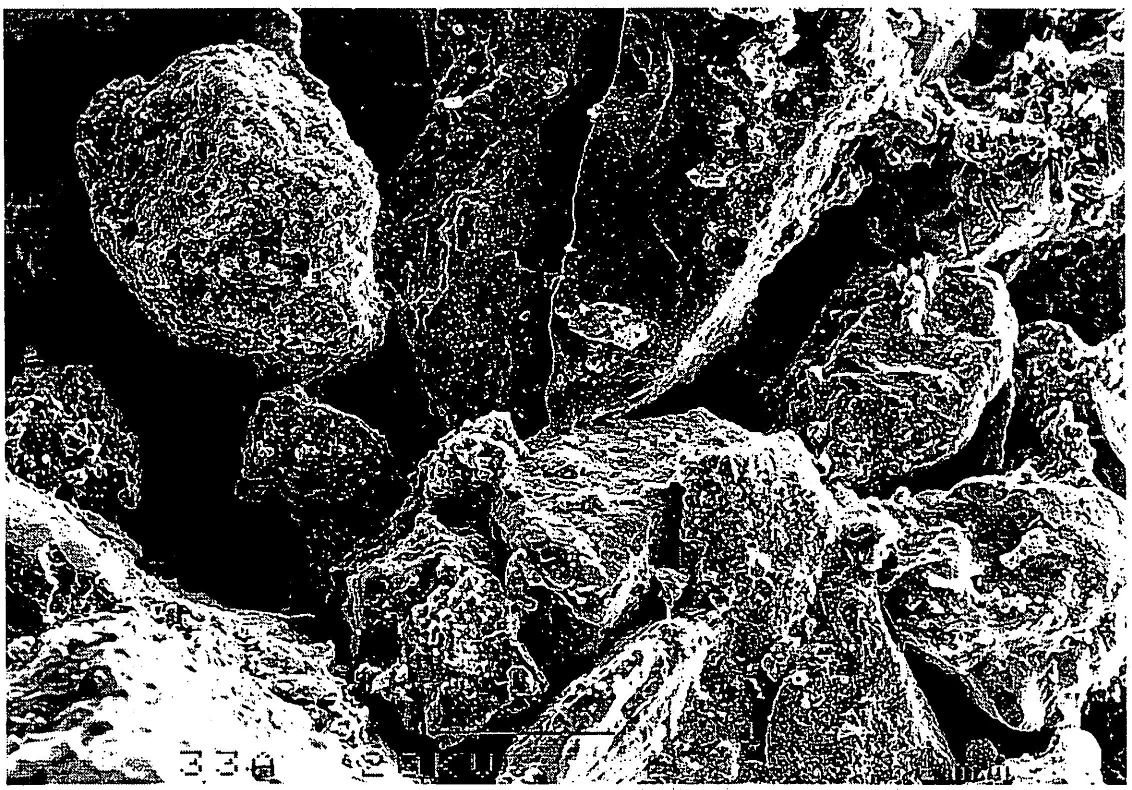

Plate 31: Sample # 33 (1531.74 m): SEM photomicrograph showing traces of anhedral to subhedral quartz overgrowths. Pores and pore throat are large and present in significant amounts. They are well connected in 3-D network giving high permeability. Scale bar = 100 µm.

Plate 32: Sample # 33 (1531.74 m): SEM photomicrograph showing pore filling authigenic kaolinite which occurs as book-like to pseudohexagonal crystals causing minor reduction of the pore spaces and partially restrict the size of the pore throats. Scale bar = 10 µm.

SAMPLE: **NO. 39 (1532.52 m)**

Lithology: Sublitharenite

Texture: The sample is grey to creamy, grain supported, small scale cross stratification, well sorted, fine-grained sandstone. Quartz grains are mainly angular to subrounded. Minor authigenic minerals and good visual porosity.

Composition: Monocrystalline quartz is the dominant framework component of this sample (60.4%). Polycrystalline quartz grains (1.8%), lithic fragments (4.2%) organic matter (1.8%) and mica (1.6%) are minor components. Detrital depositional matrix is trace (0.2%). Authigenic minerals comprise kaolinite (7.2%), quartz (1%) and traces of pyrite (0.2%). There are high amounts of visible porosity (21.6%) in the sample (Plate 33).

Monocrystalline quartz grains exhibit subrounded to rounded grains and display strongly undulose extinction with many grains containing fluid and igneous inclusions. Lithic fragments comprise low grade metamorphic micaceous schist.

Authigenic kaolinite is the dominant authigenic component. Authigenic quartz is much less dominant and fills some of the pore spaces (Plate 33).

There is a high visual porosity (when the thin section is held to the light, Plate 33). Porosity mainly occurs as triangular pores between detrital and authigenic minerals. This suggests that the porosity is largely intergranular primary. Secondary porosity is much less common than in the primary pores. It includes enlarged and elongated pores providing moderate connections between the larger pores. Secondary porosity was formed by minor dissolution of ductile rock fragments. There is minor microporosity between kaolinite booklets.

XRD: The sample is dominated by quartz, abundant kaolinite and minor sylvite (drilling mud) and mica (illite), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and minor mica (illite), (Table 7 and Appendix II).

SEM: The well sorted fine-grained quartz in this sample contains minor amounts of authigenic kaolinite and anhedral to subhedral quartz overgrowths (Plate 34). Authigenic clays are moderate and restrict locally the size of the pore throats (Plates 34 and 35). The pores are well connected providing good permeability.

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Minor early compaction, as suggested by the slight concavo-convex contacts between framework grains.
- Framboidal pyrite could have occurred early in the diagenetic history during the early sulphate reduction.
- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and illite. Feldspar, however, is almost absent in this sample.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.
- Minor corrosion and grain dissolution has developed as oversized grain dissolution pores and intragranular porosity.

Env. Deposition: The fine grain size indicates a moderate to high energy environment of deposition. The probable depositional environment could be braided fluvial bar sands.

Res. Potential: The visible porosity is high and consists predominantly of primary pores. The pores are well interconnected providing good porosity and permeability. Reservoir potential of this sample is very good with porosity 21.6%.

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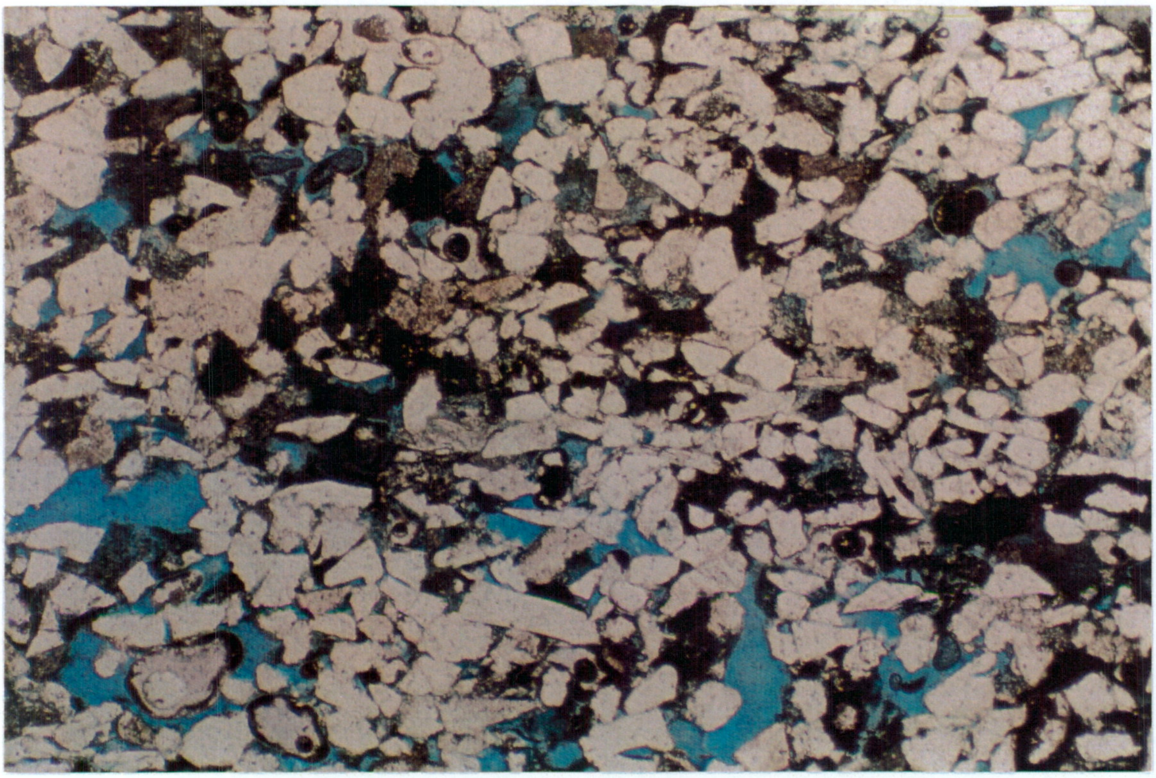

Plate 33A: Sample # 39 (1532.52 m): Thin section photomicrograph showing general view of sublitharenite comprising well sorted, angular to subrounded fine-grained sandstone. Note the presence of ductile lithic fragments in thin laminae parallel to the bedding plane. Plane polarised light. Scale bar = 500 μm.

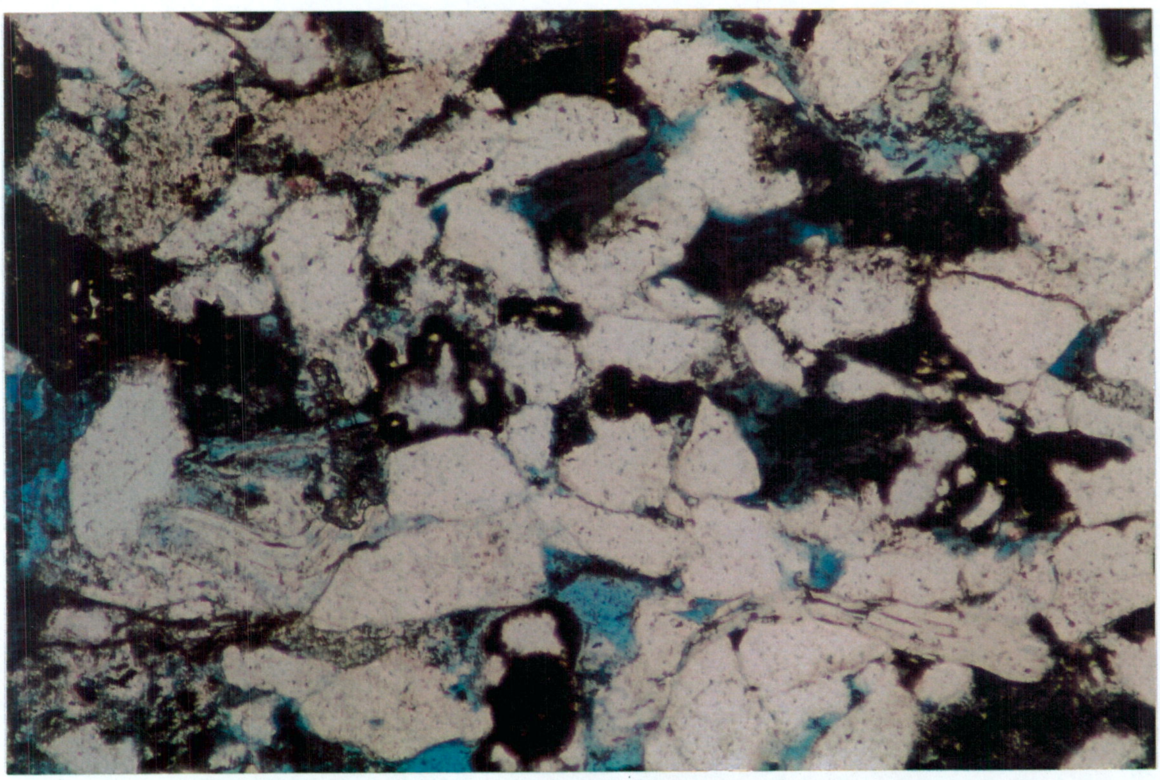

Plate 33B: Sample # 39 (1532.52 m): Enlarged view of the sample. Note microporosity between altered lithic fragments and mica flakes. Plane polarised light. Scale bar = 200 μm.

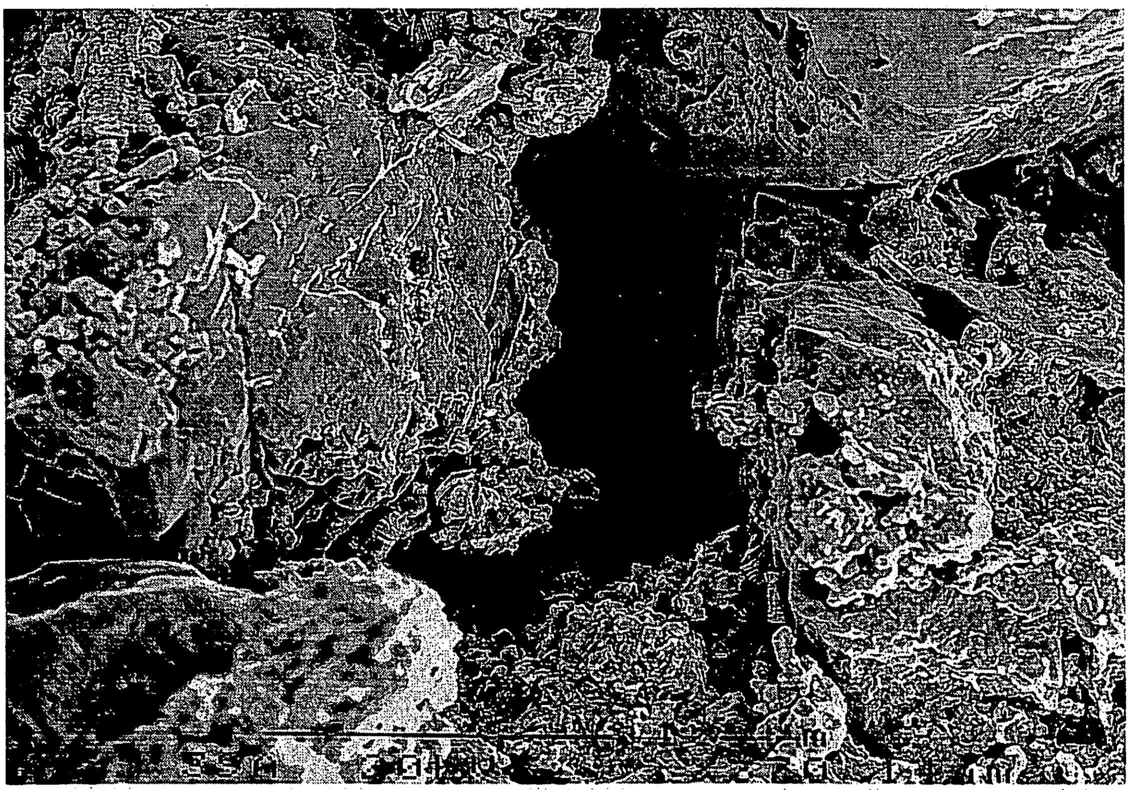

Plate 34: Sample # 39 (1532.52 m): SEM photomicrograph showing minor amounts of authigenic kaolinite and anhedral to subhedral quartz overgrowths. The pores are well connected providing good permeability. Scale bar = 100 μm.

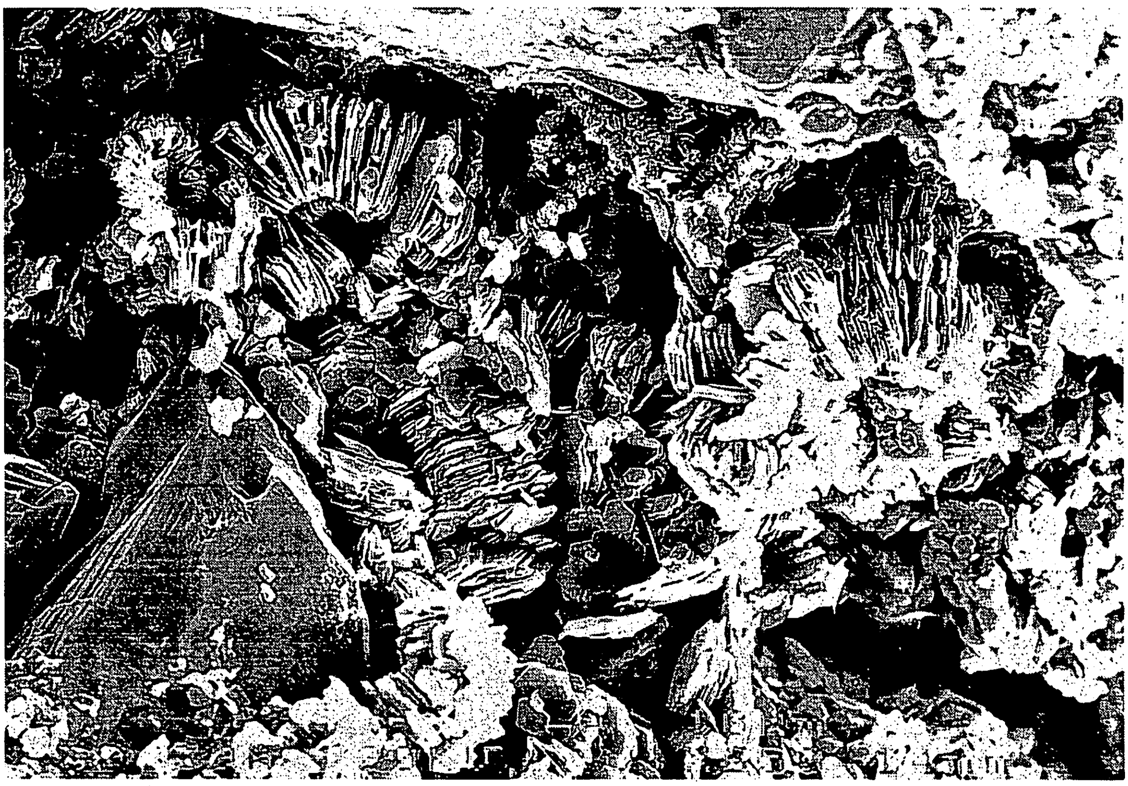

Plate 35: Sample # 39 (1532.52 m): SEM photomicrograph showing pore filling authigenic kaolinite. Authigenic kaolinite occurs as pseudohexagonal book-like crystals filling some of the pore spaces and locally restricting the reservoir quality. Scale bar = 10 μm.

SAMPLE: **NO. 45 (1533.52 m)**

Lithology: Quartz Arenite

Texture: The sample consists of grey to creamy, grain supported, small scale cross stratification, moderately to well sorted, fine-grained sandstone. Quartz grains are mainly angular to rounded. Minor authigenic minerals and good visual porosity.

Composition: The framework components of this sample are dominated by monocrystalline quartz (66.8%), minor polycrystalline quartz (2.2%) with traces of feldspar (0.2%), lithic fragments (1.6%), detrital depositional matrix (0.4%), organic matter (0.4%) and mica (0.4%). Authigenic minerals are dominated by kaolinite (5.4%) quartz (2%) and traces of siderite (0.4%) and pyrite. There are good amounts of visible porosity in this sample (19.8%).

Monocrystalline quartz exhibits strong undulose extinction with few grains showing straight undulose extinction. Detrital matrix is present in trace amounts and mainly comprises organic-rich siltstone to very fine sandstone (Plate 36). Mica is mainly muscovite and occurs as either disseminated or concentrated in very thin lamellae parallel to the bedding plane.

Authigenic components are dominated by kaolinite, quartz overgrowth with minor to trace amounts of siderite and pyrite.

Visible porosity is good (Plate 36) most of which is primary in origin.

XRD: Quartz are dominant with major kaolinite, minor sylvite (drilling mud) and traces of mica (illite), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and trace amounts of mica (illite), (Table 7 and Appendix II).

SEM: The pores are partially filled with subhedral to euhedral quartz overgrowths. The pores and pore throat are well connected giving a very good permeability (Plate 37). SEM photomicrographs show that authigenic clays are present and partially fill the intergranular porosity. Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and book-like species and occupies some of the intergranular pore space (Plate 38). The pores are well interconnected in a 3-D network giving good permeability (Plates 37 and 38) and reservoir quality.

Diagenesis: The diagenesis of this sample can be summarised as follows:

- Minor early compaction, as suggested by the slight concavo-convex contacts between framework grains.
- Alteration and dissolution of feldspar could have been responsible for the formation of kaolin and illite. Feldspar, however, is almost absent in this sample.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin as many kaolin booklets are engulfed by quartz overgrowths.
- Minor corrosion and grain dissolution has developed as oversized grain dissolution pores and intragranular porosity.

Env. Deposition: The fine sand size detrital grains in this sample range from angular to rounded and moderately to well sorted. These features suggest deposition in a moderate to high energy environment with at least periodic low energy conditions when fine detritus could settle out from suspension. The environment of deposition was most probably braided fluvial bar.

Res. Potential: The sample shows a good reservoir potential with high visible porosity (19.8%). The porosity is well interconnected in a 3-D network giving a good permeability and reservoir quality.

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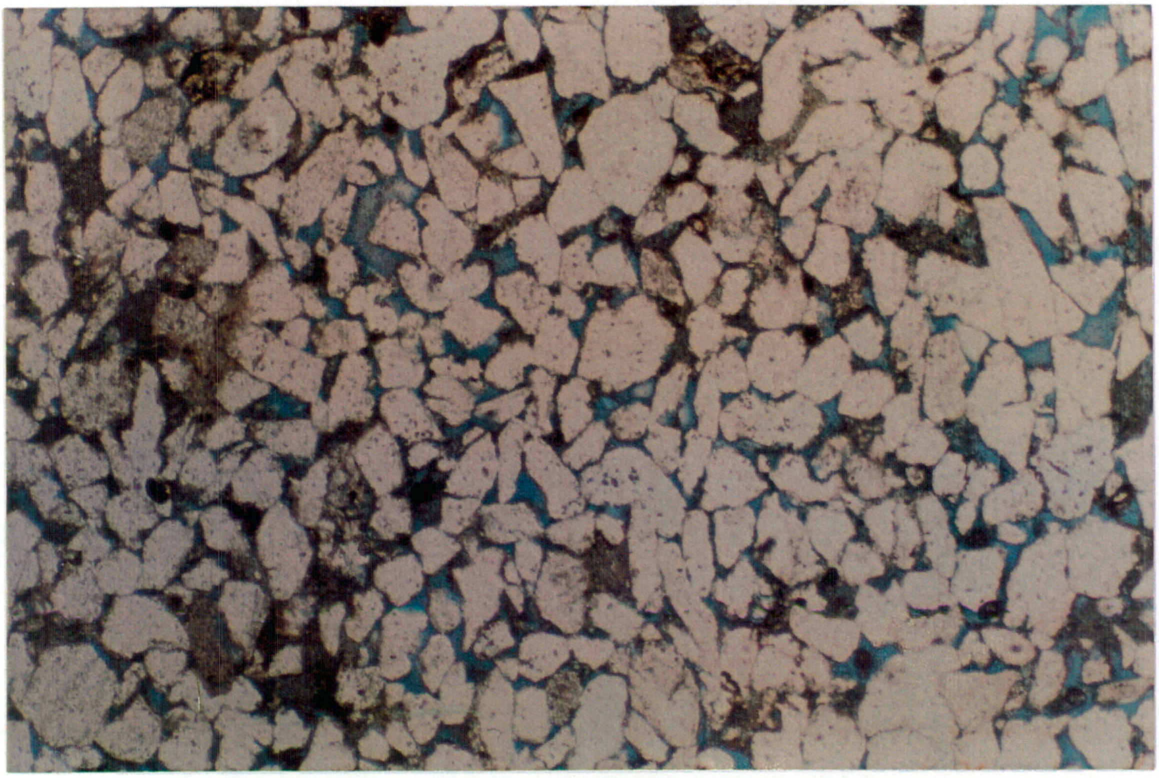

Plate 36A: Sample # 45 (1533.52 m): Thin section photomicrograph showing quartz arenite. High visible porosity and excellent reservoir quality with trace to minor amounts of ductile lithic grains and authigenic clays. Plane polarised light. Scale bar = 500 μm.

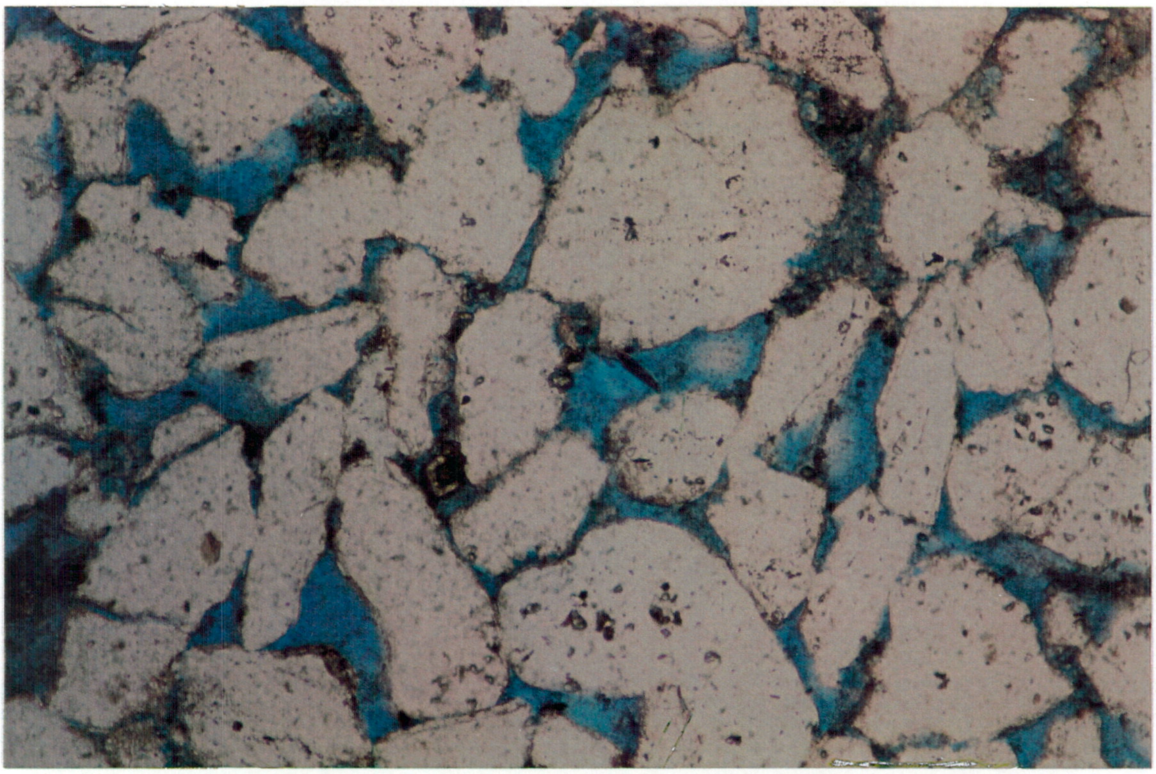

Plate 36B: Sample # 45 (1533.52 m): Enlarged view of the Plate 36A showing high visible porosity. Note the presence of zoned siderite cement. This sample has good reservoir characteristics. Plane polarised light. Scale bar = 200 μm.

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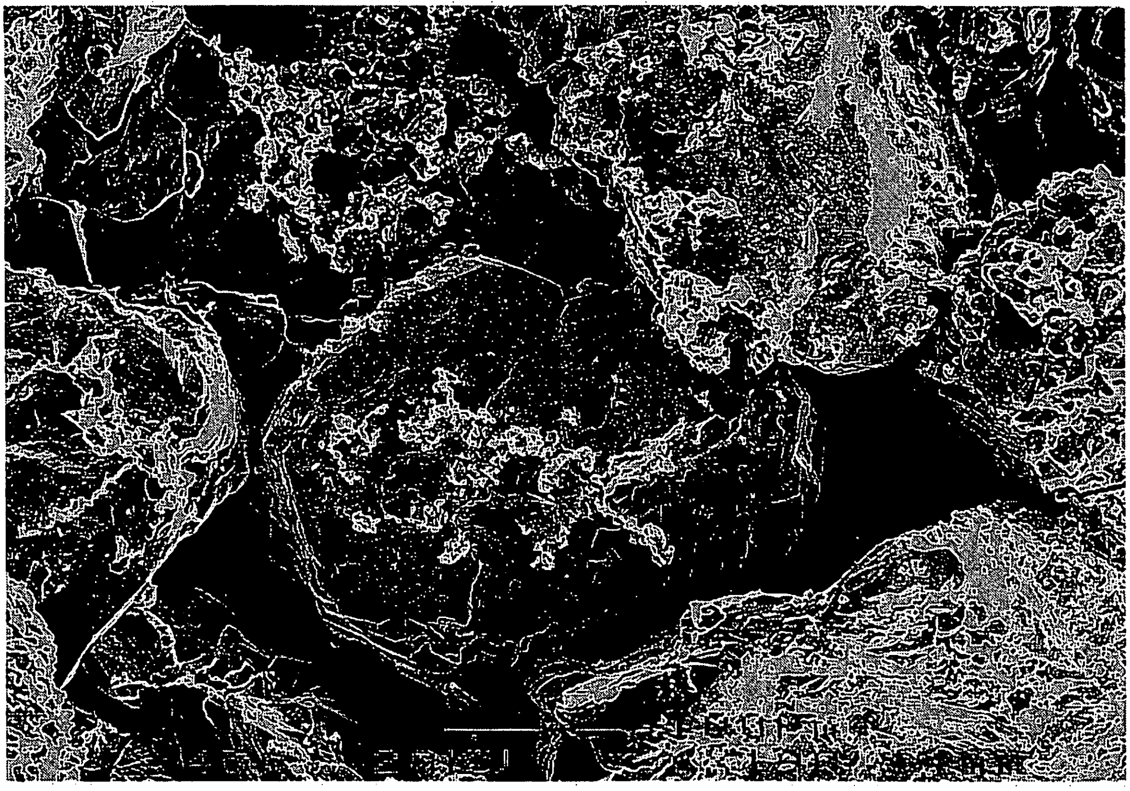


Plate 37: Sample # 45 (1533.52 m): SEM photomicrograph showing that the pores are partially filled with subhedral to euhedral quartz overgrowths. The pores and pore throat are well connected giving a very good permeability. Scale bar = 100 μm.

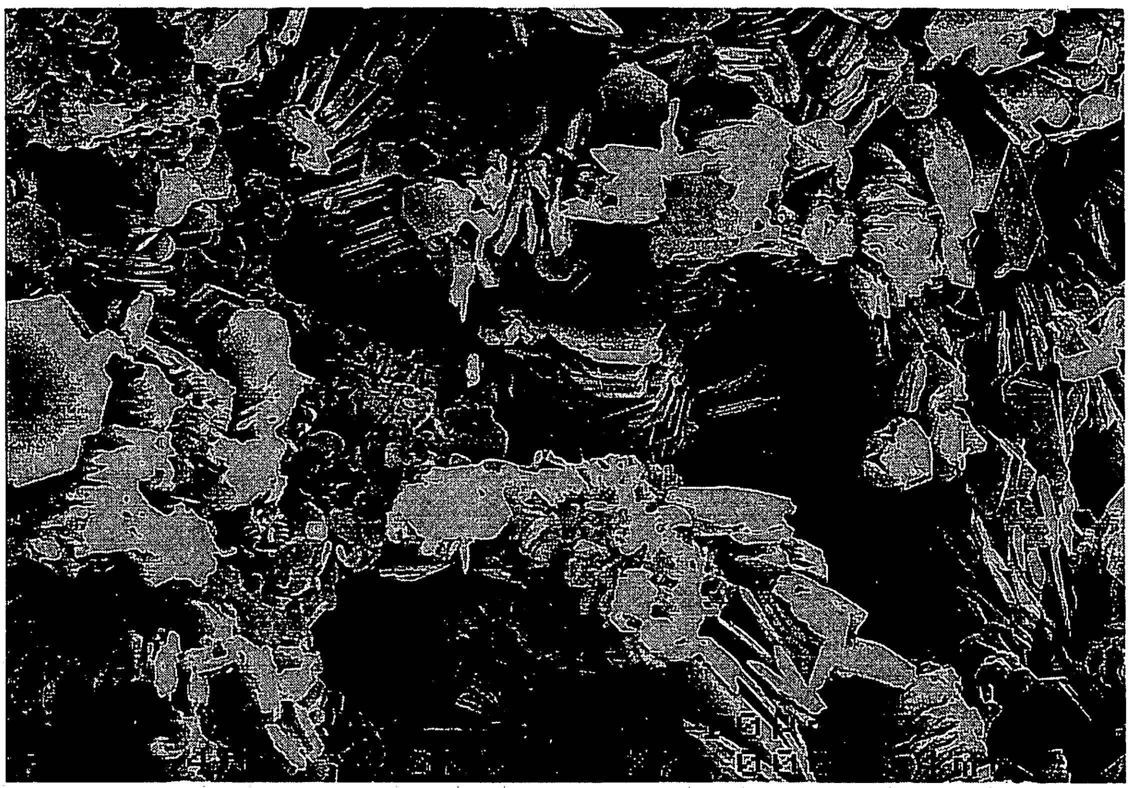
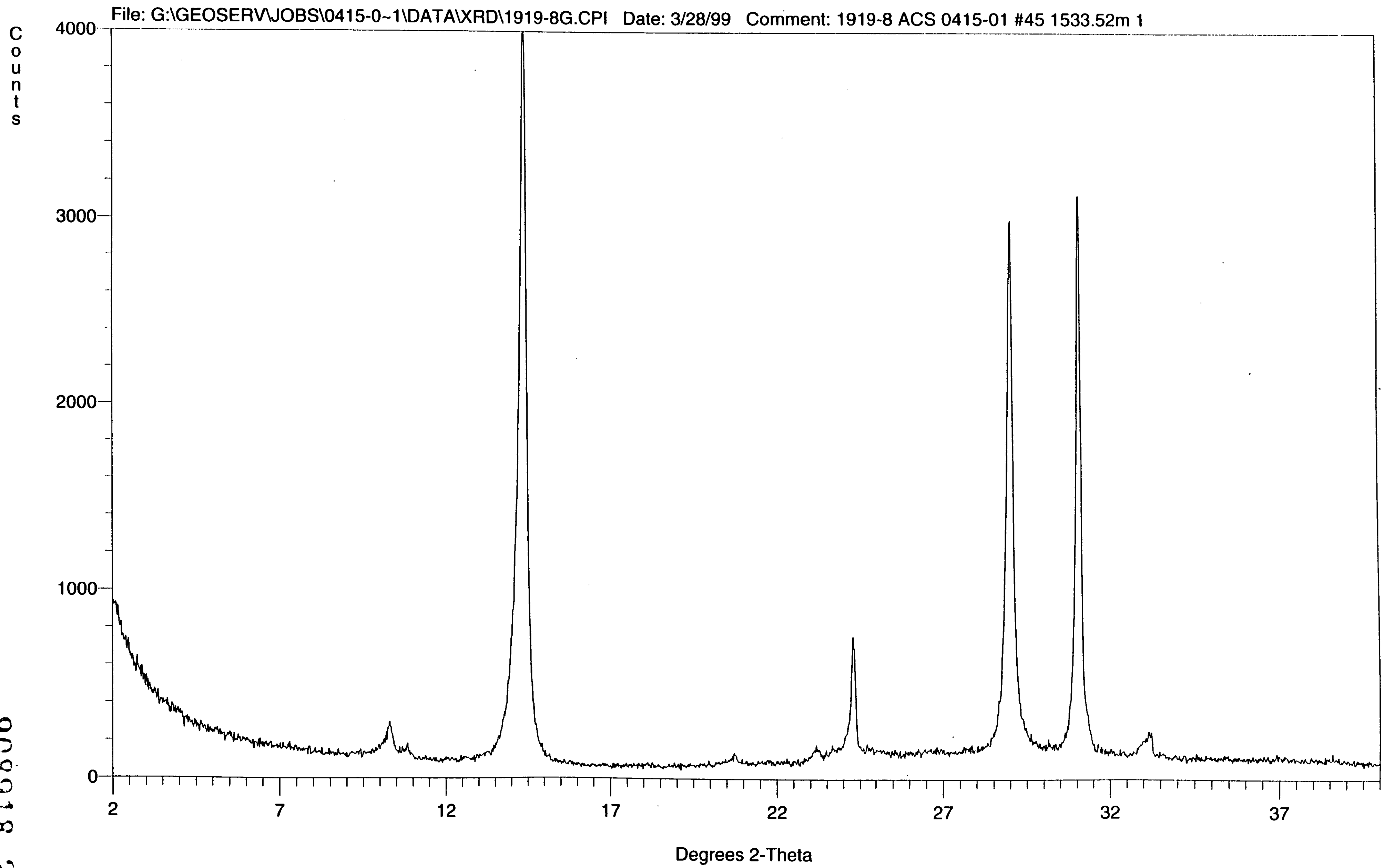


Plate 38: Sample # 45 (1533.52 m): SEM photomicrograph showing authigenic kaolinite booklets filling some of the intergranular porosity. Authigenic kaolinite occurs as randomly oriented pseudohexagonal, vermiform and book-like species and occupies some of the intergranular pore space. Scale bar = 10 μm.

APPENDIX II

XRD TRACES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Degrees 2-Theta

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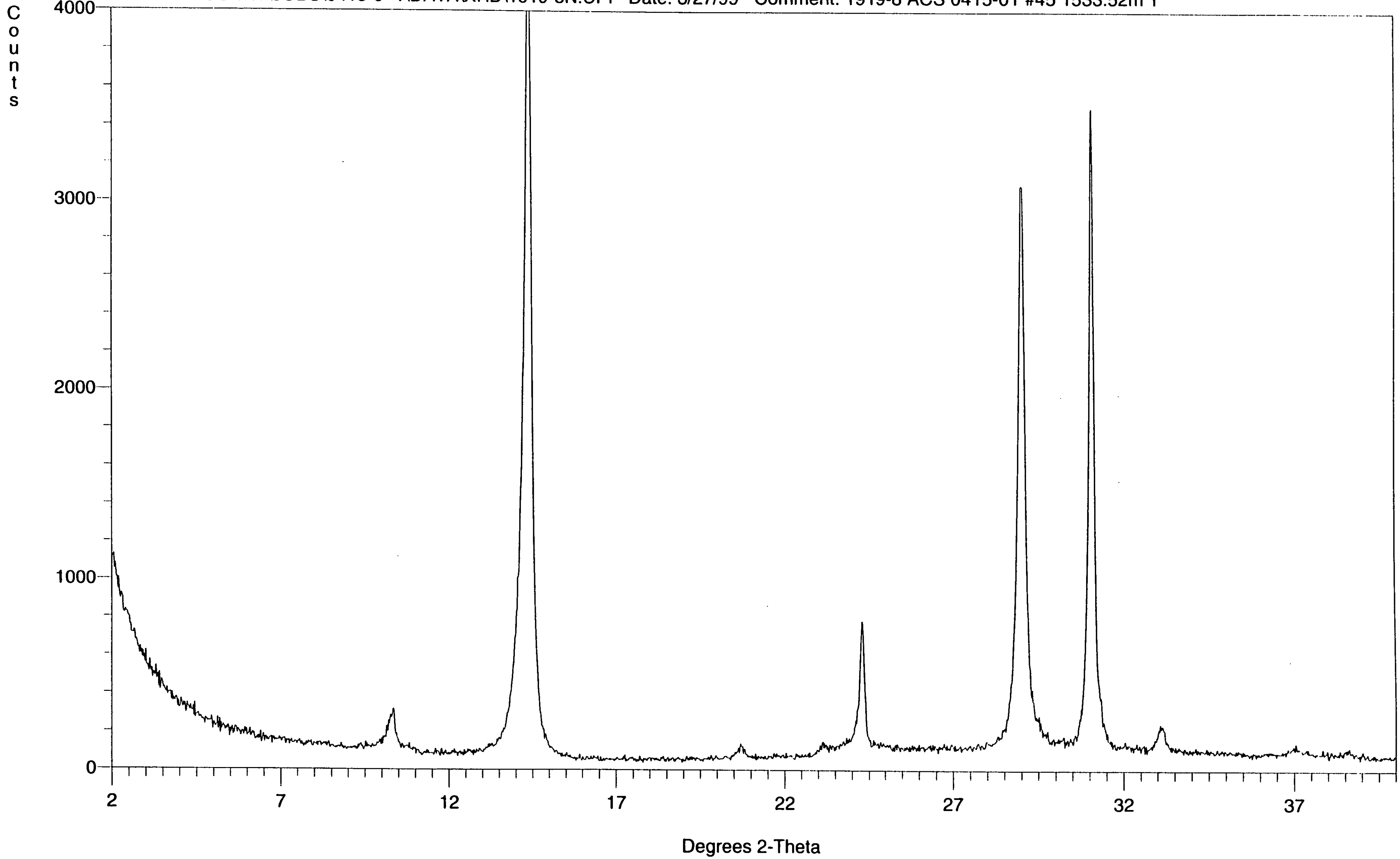

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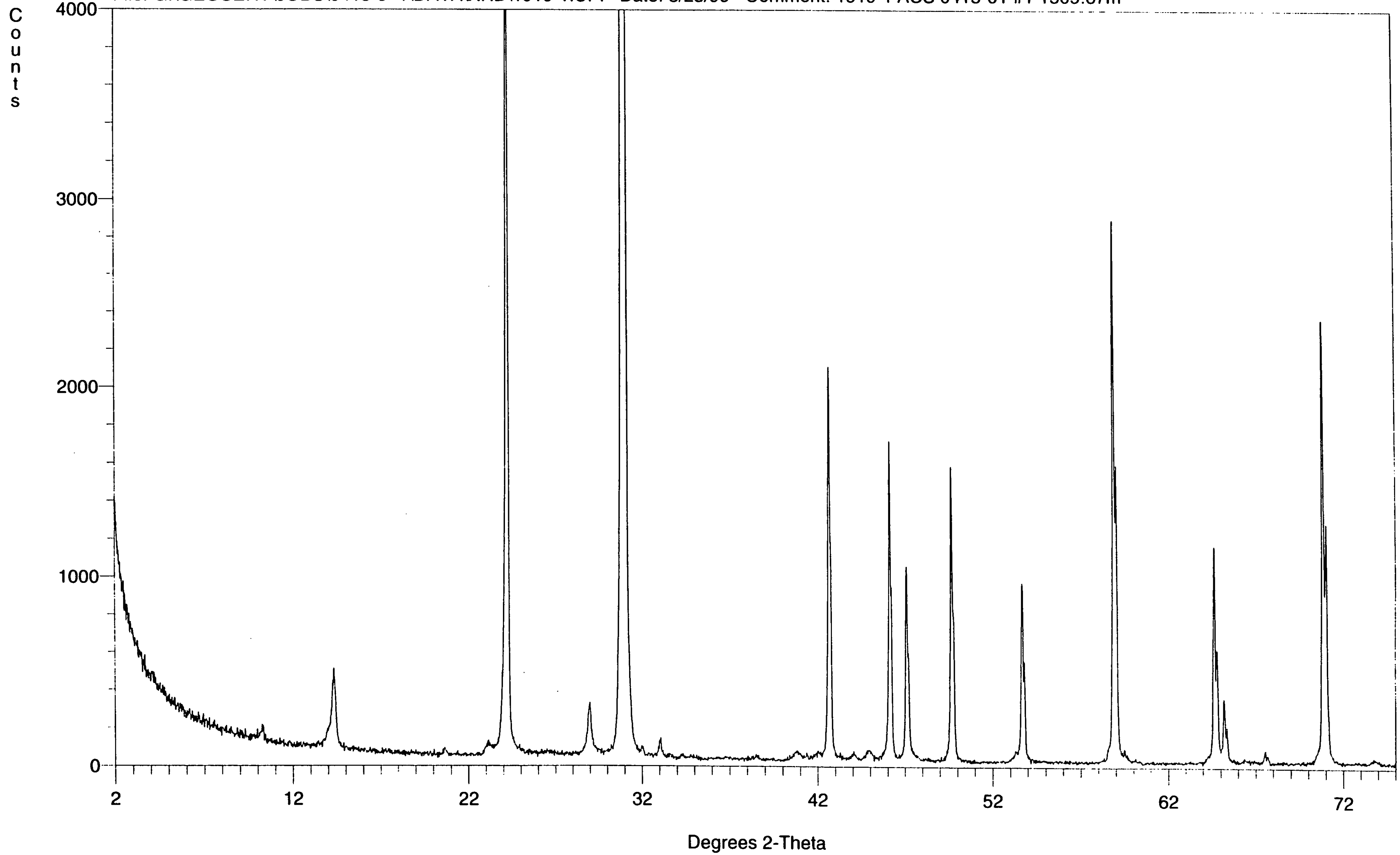

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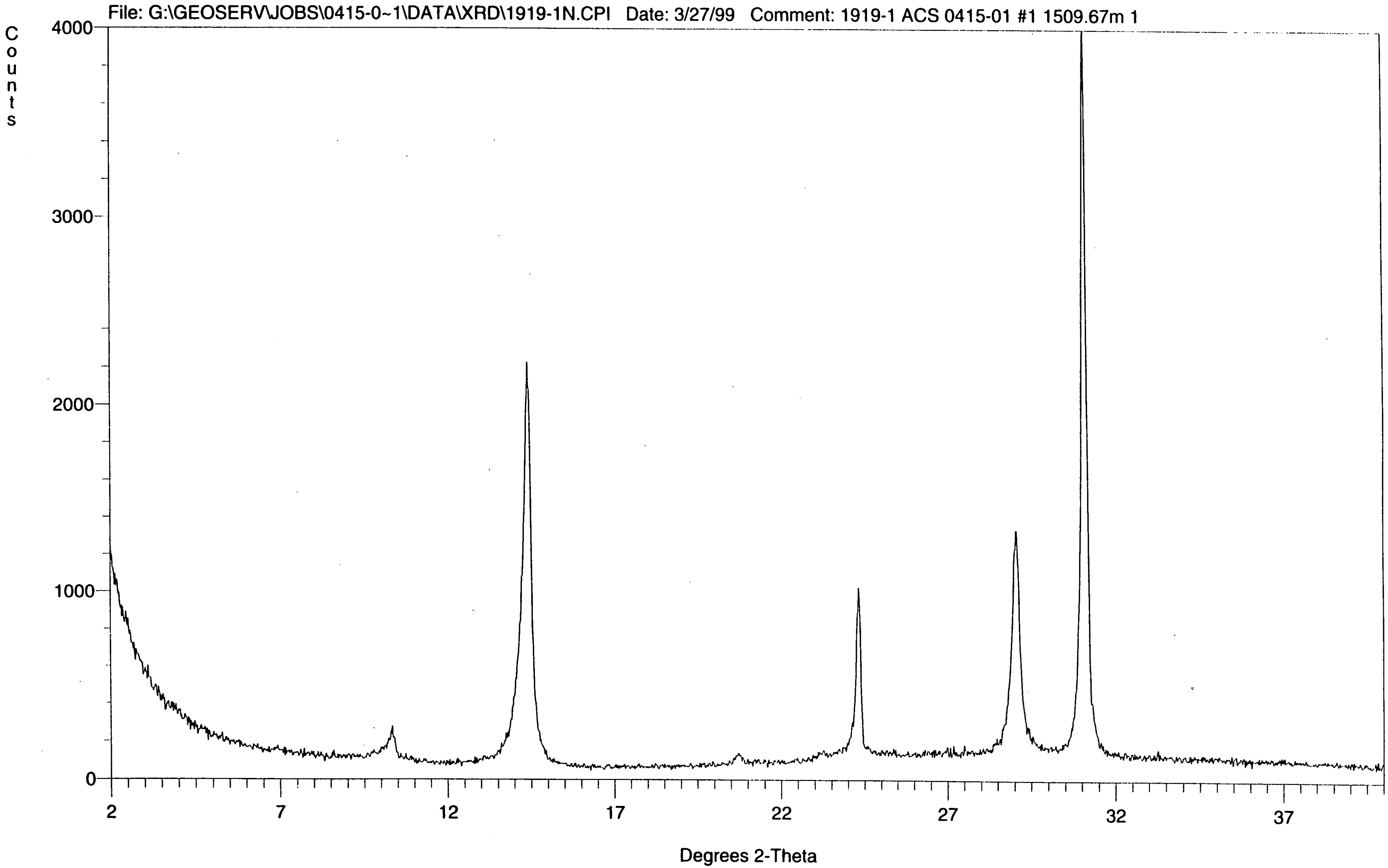
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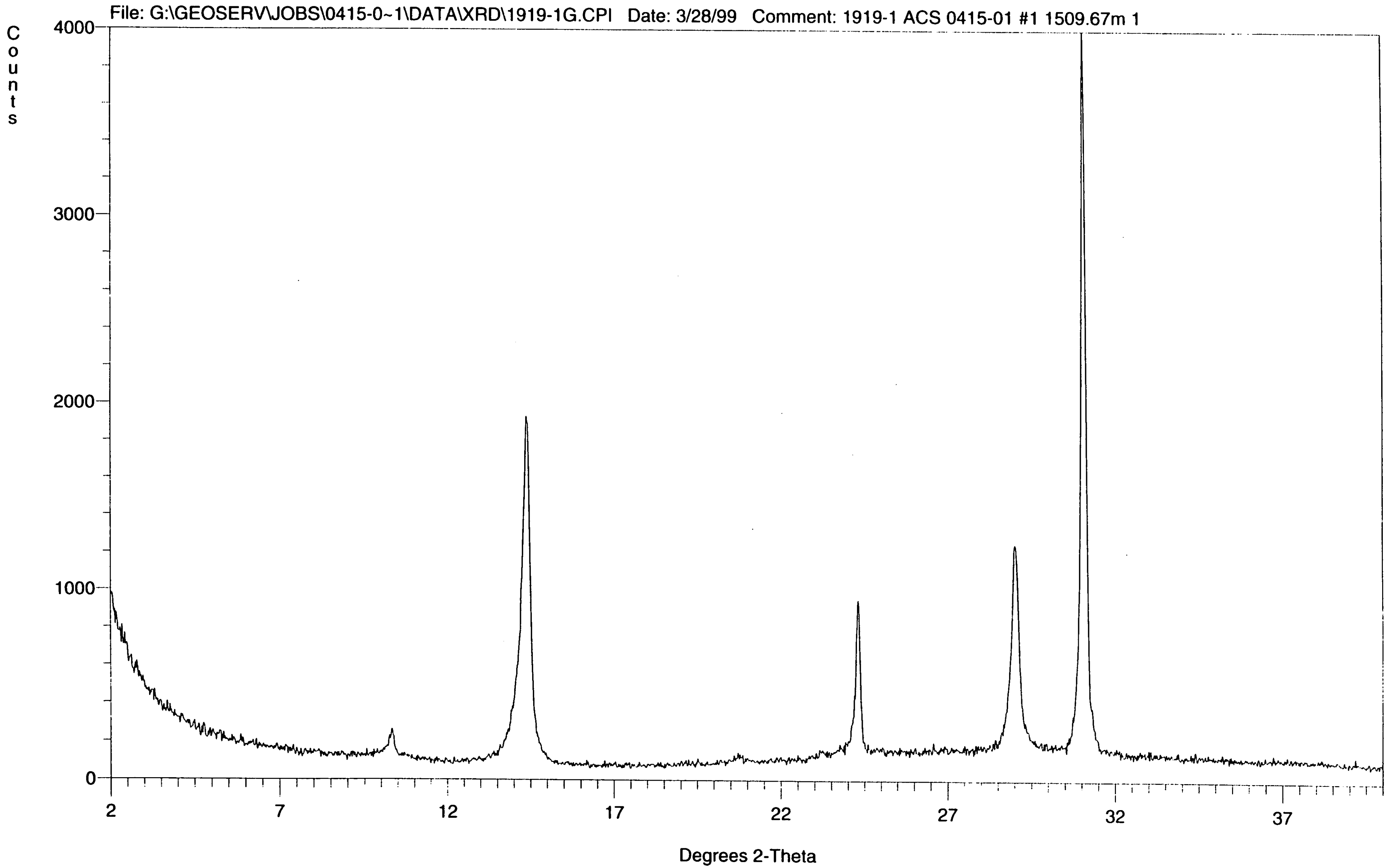
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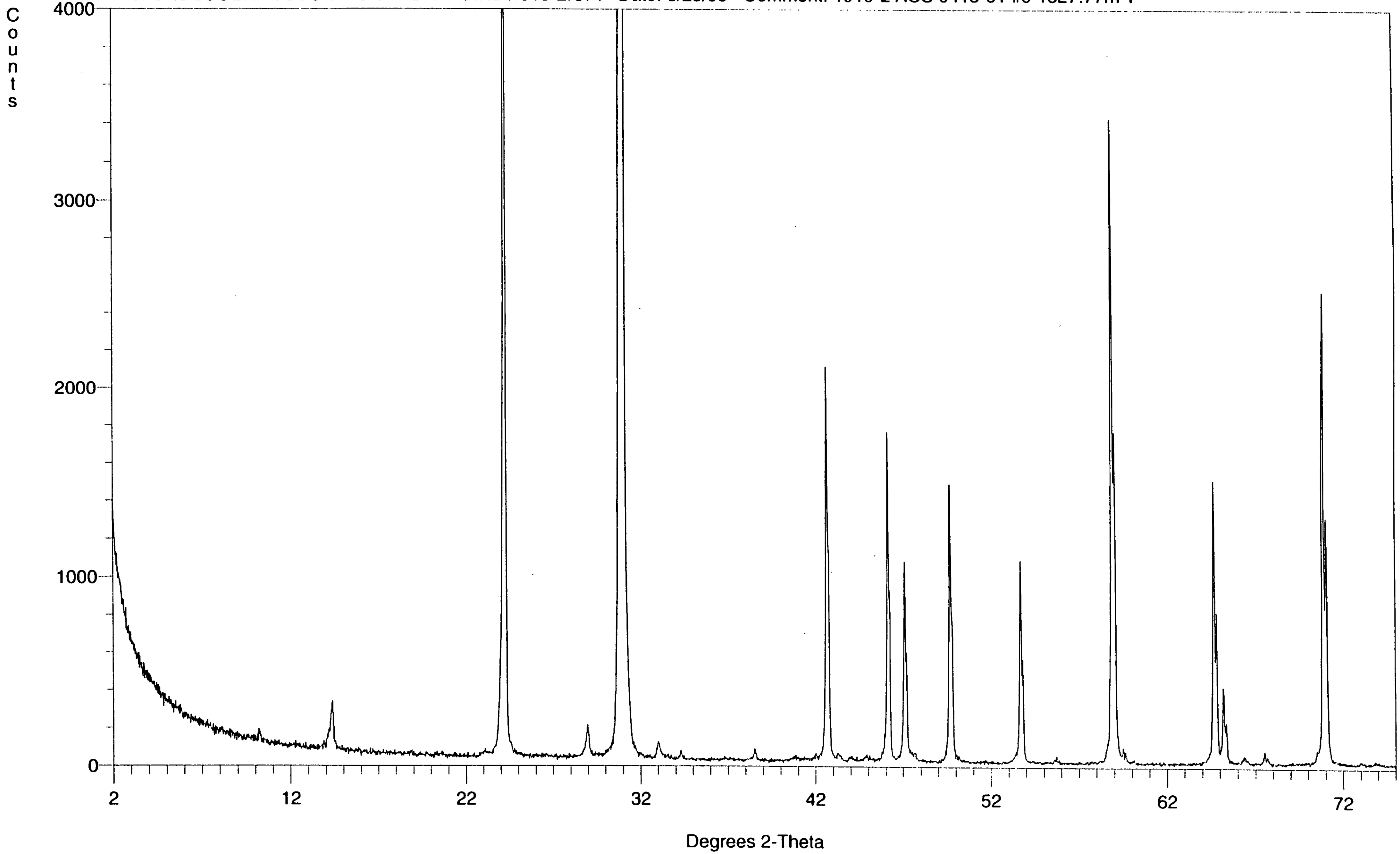

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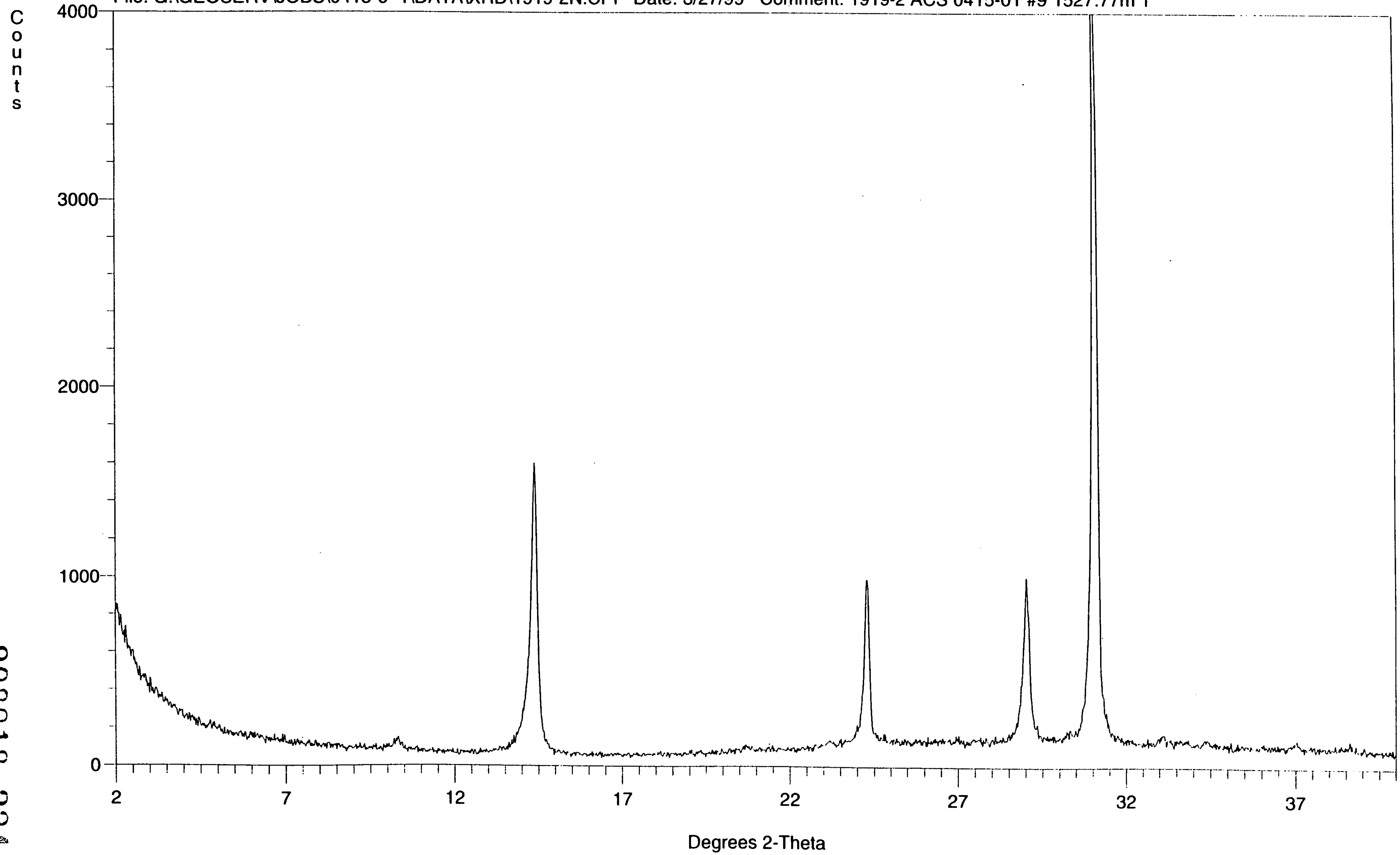

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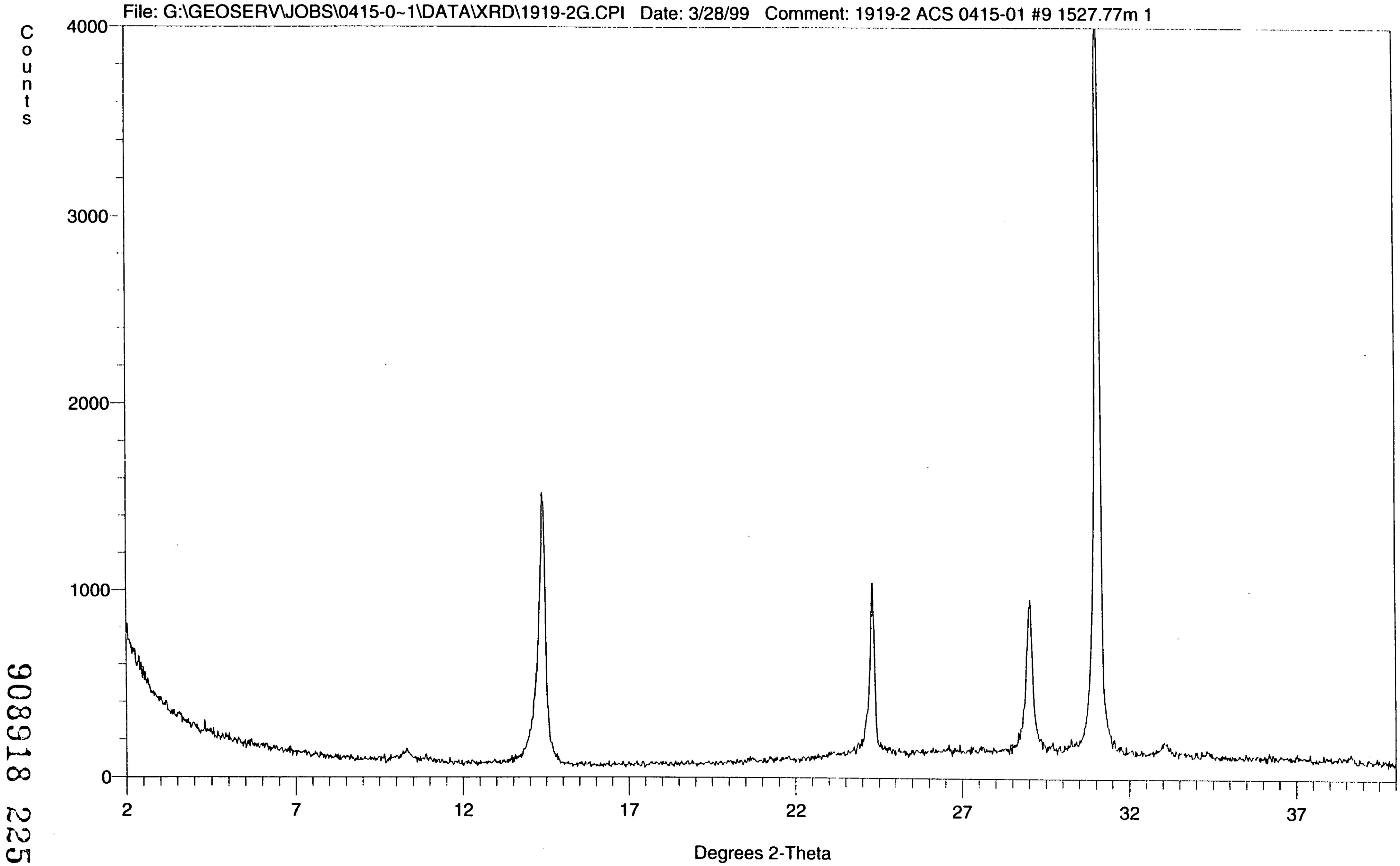
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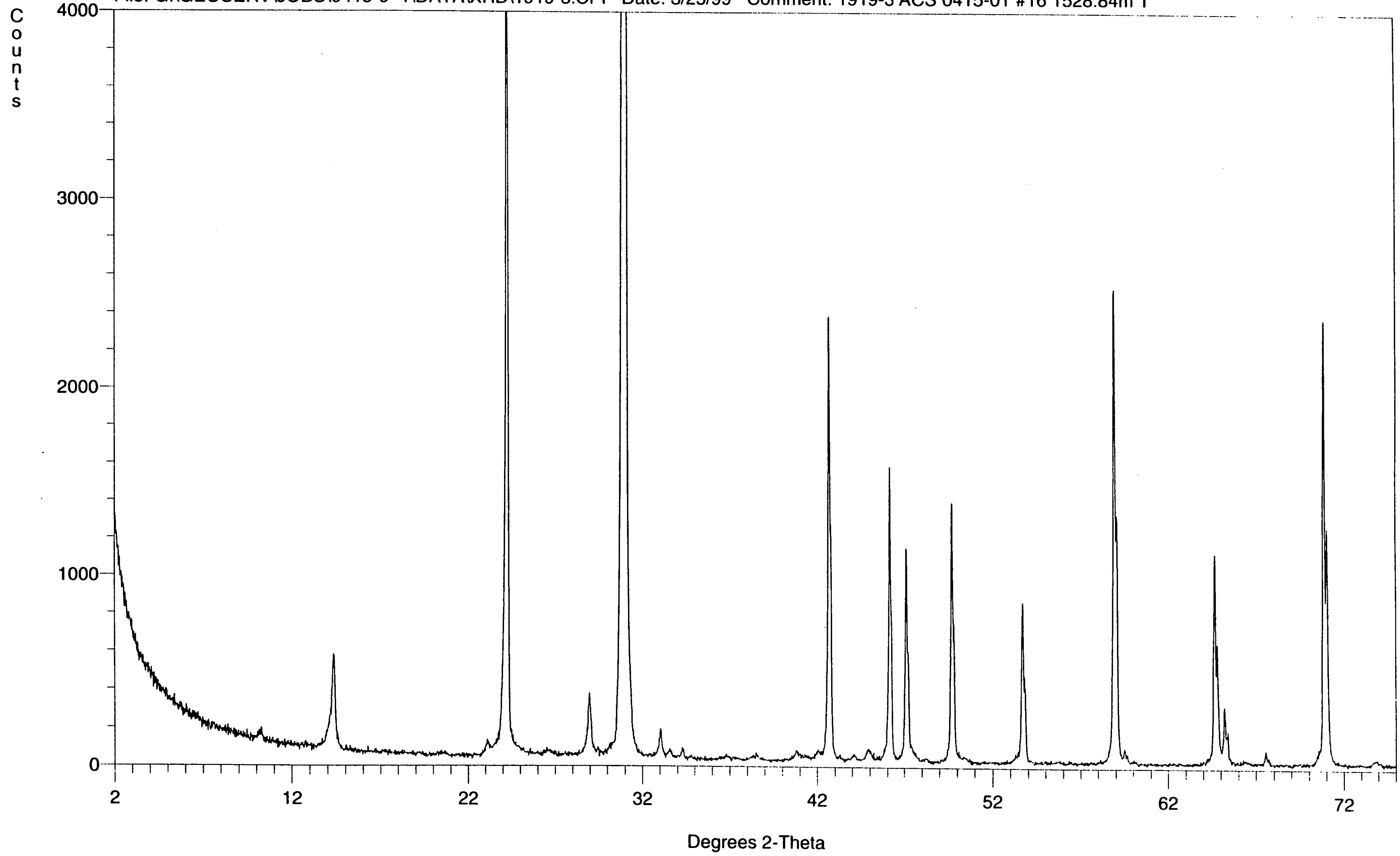

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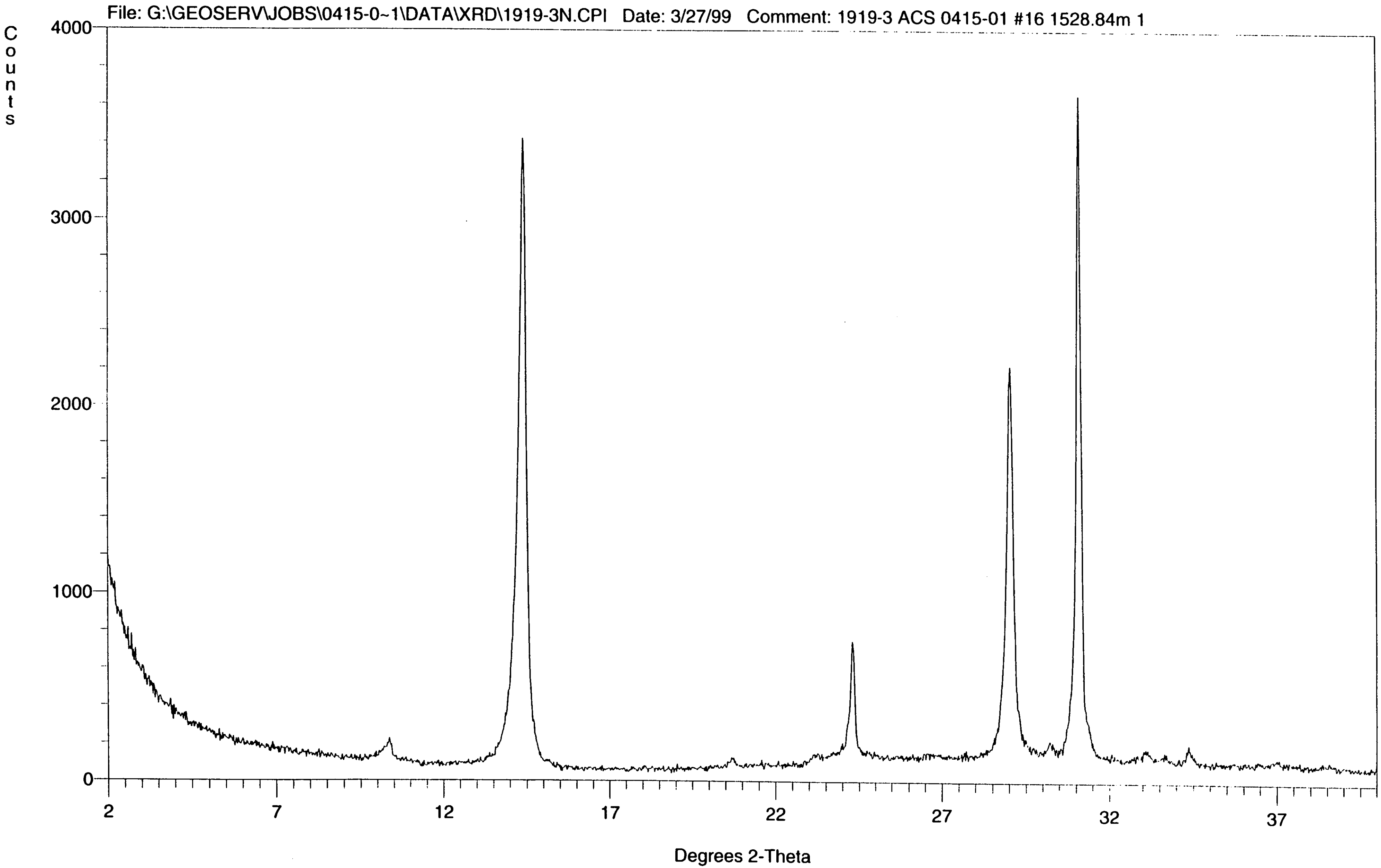
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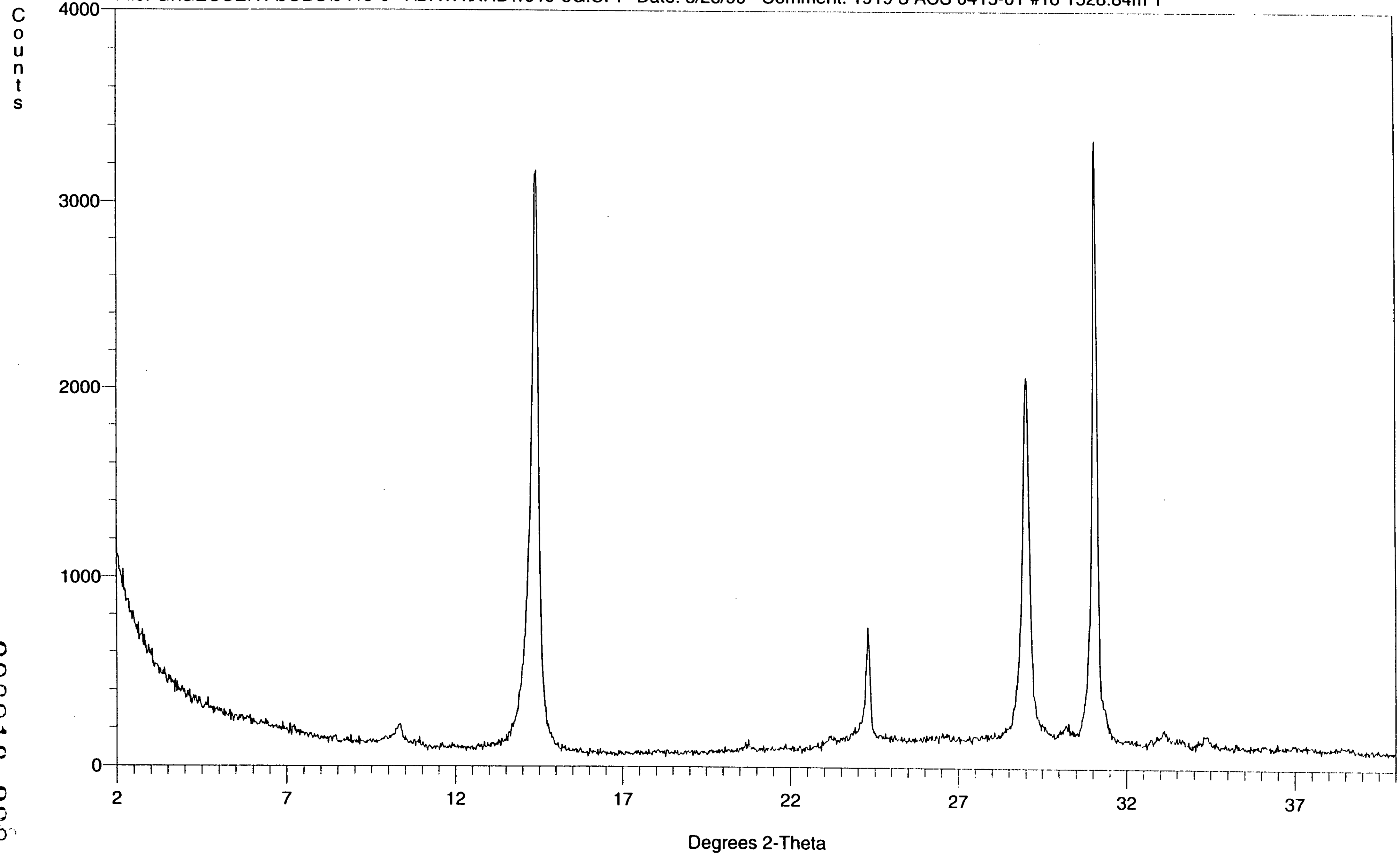

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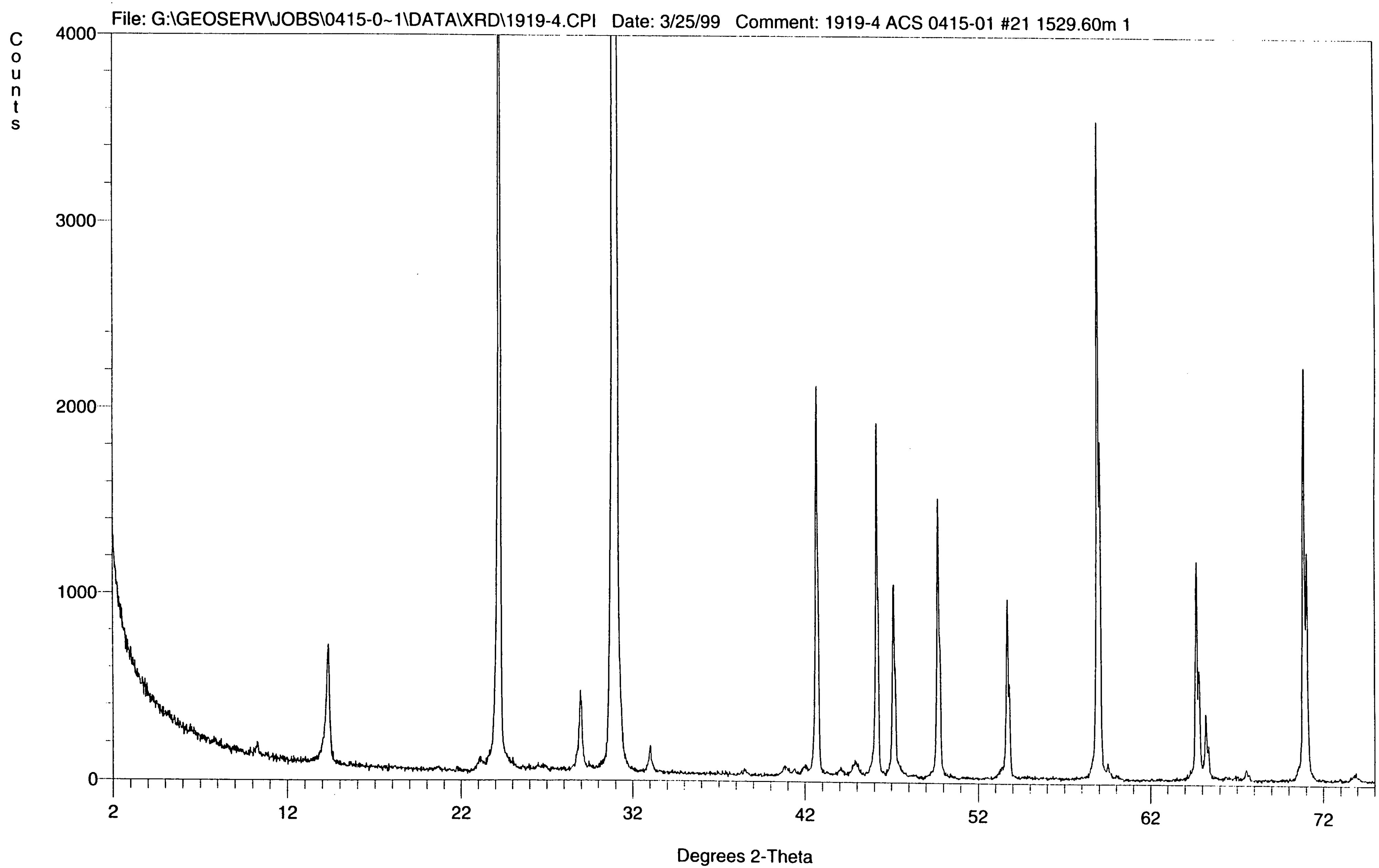
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Degrees 2-Theta

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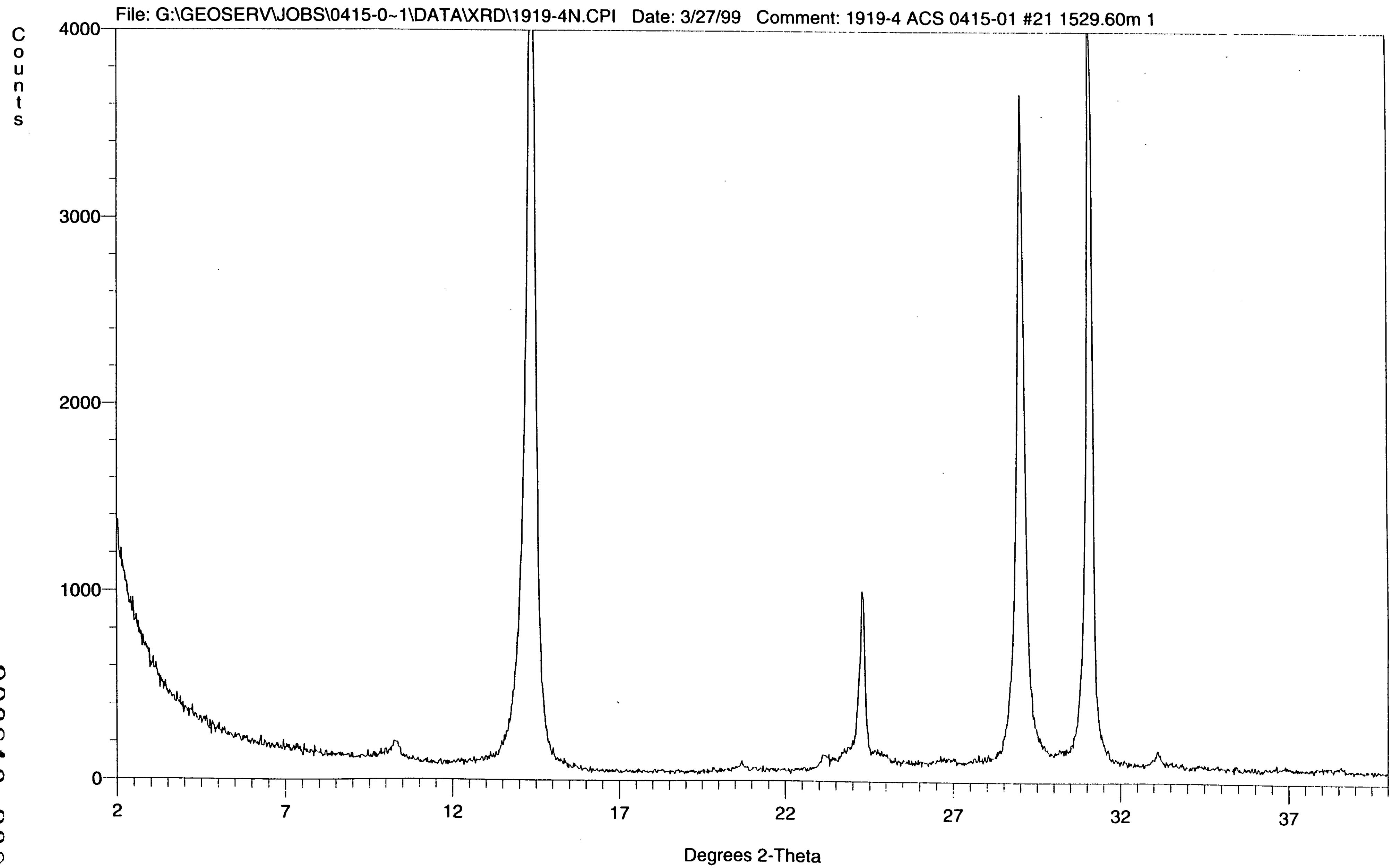
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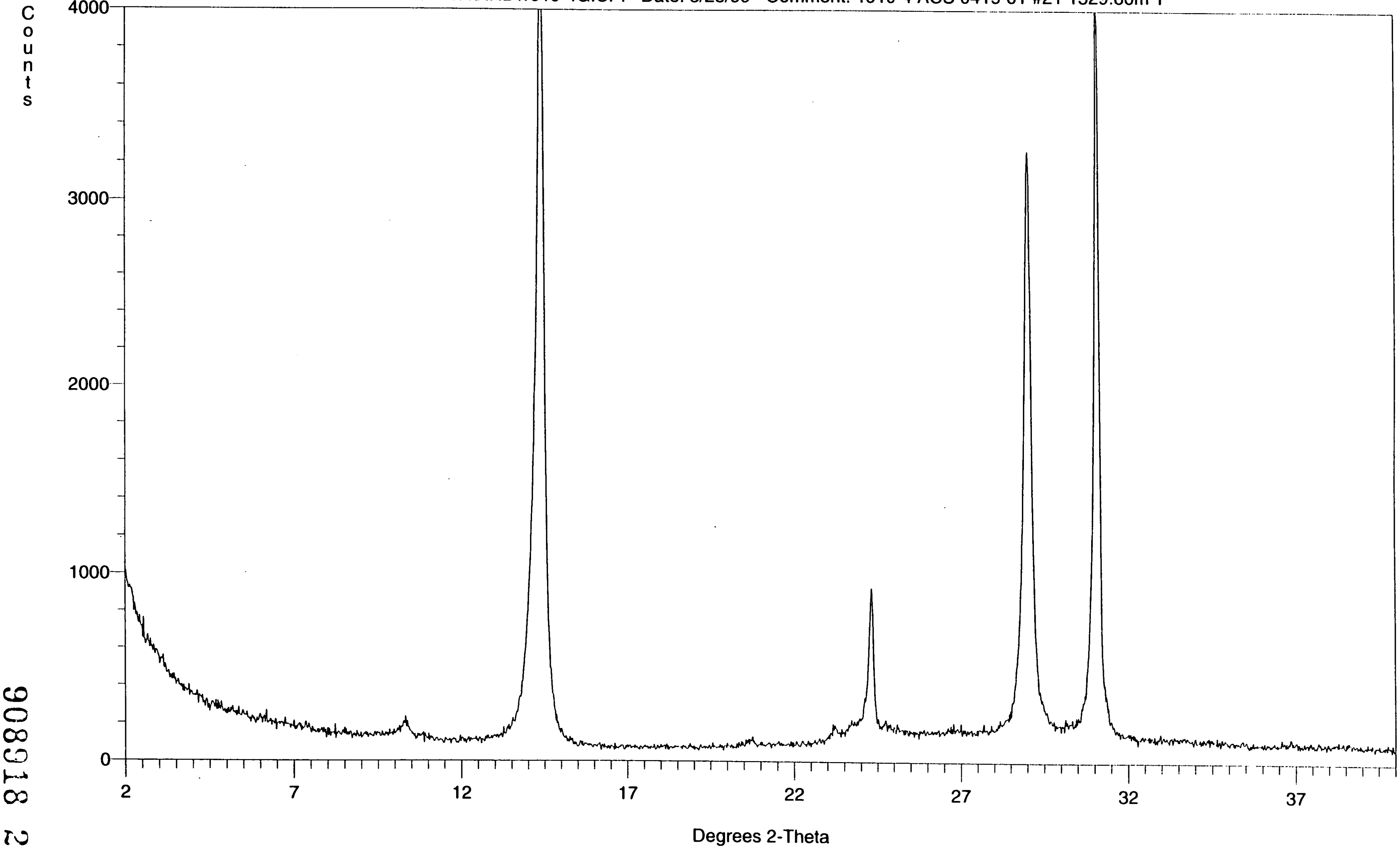

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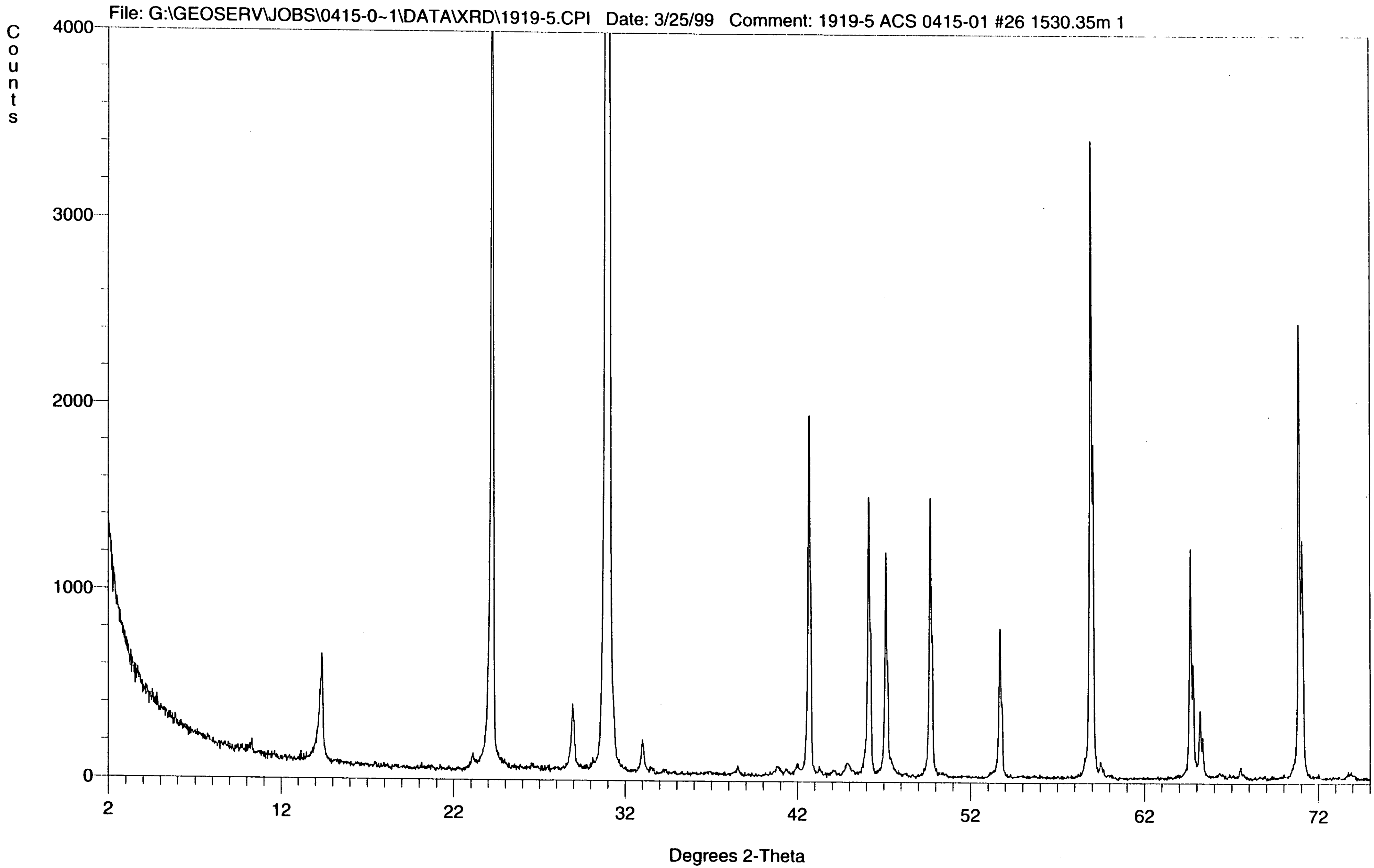
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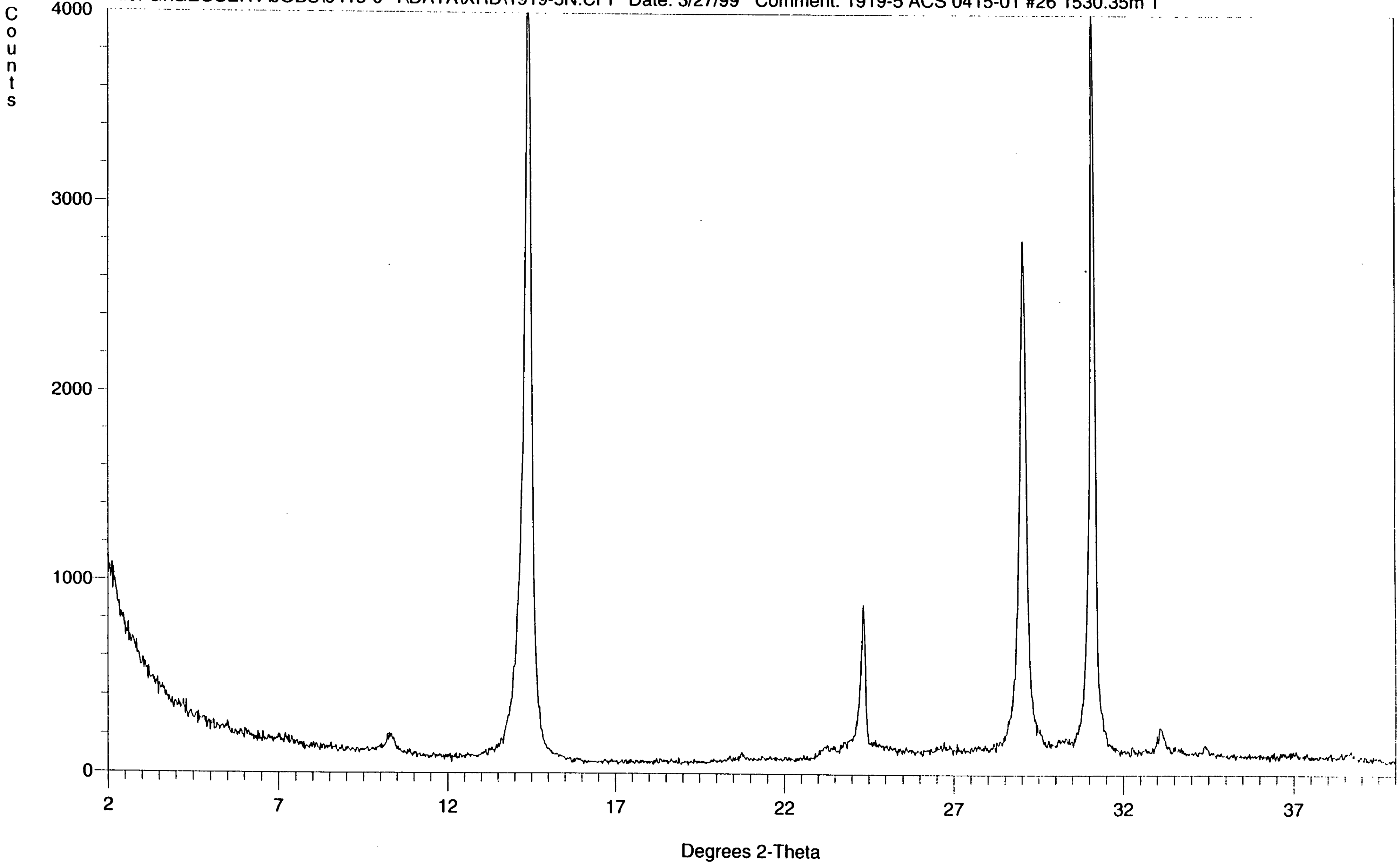

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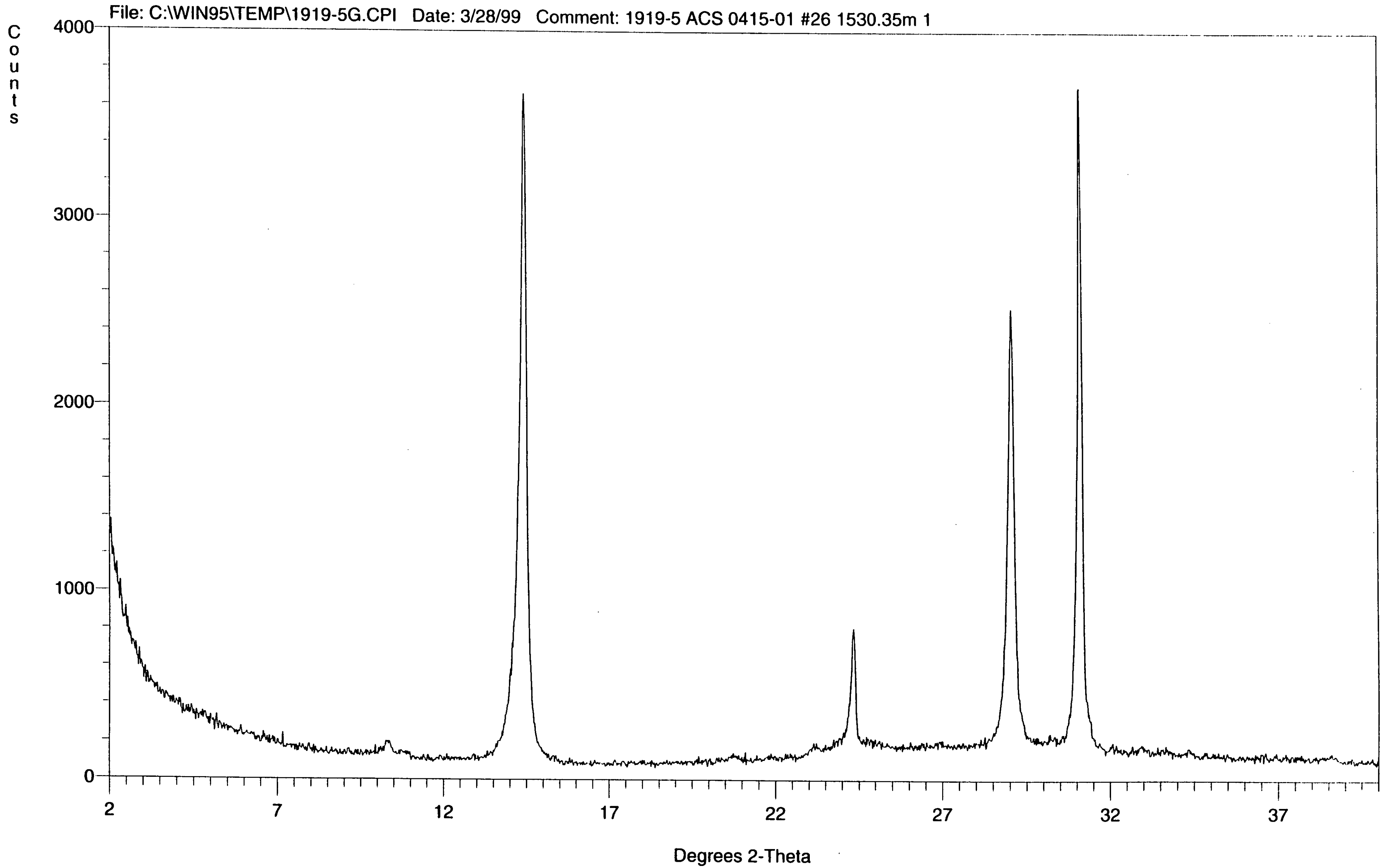
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2000
1000
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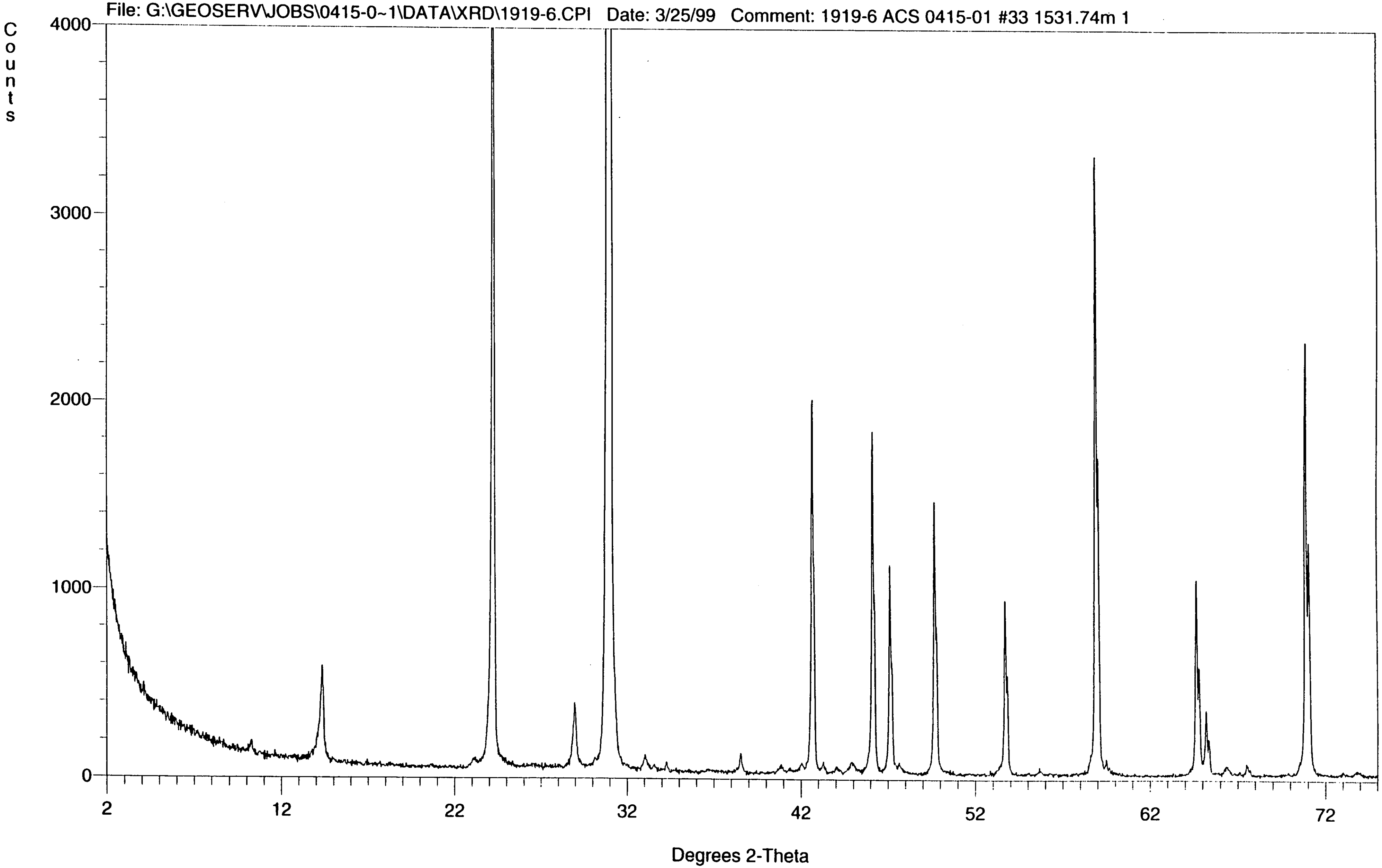
2
7
12
17
22
27
32
37
Degrees 2-Theta

908918 234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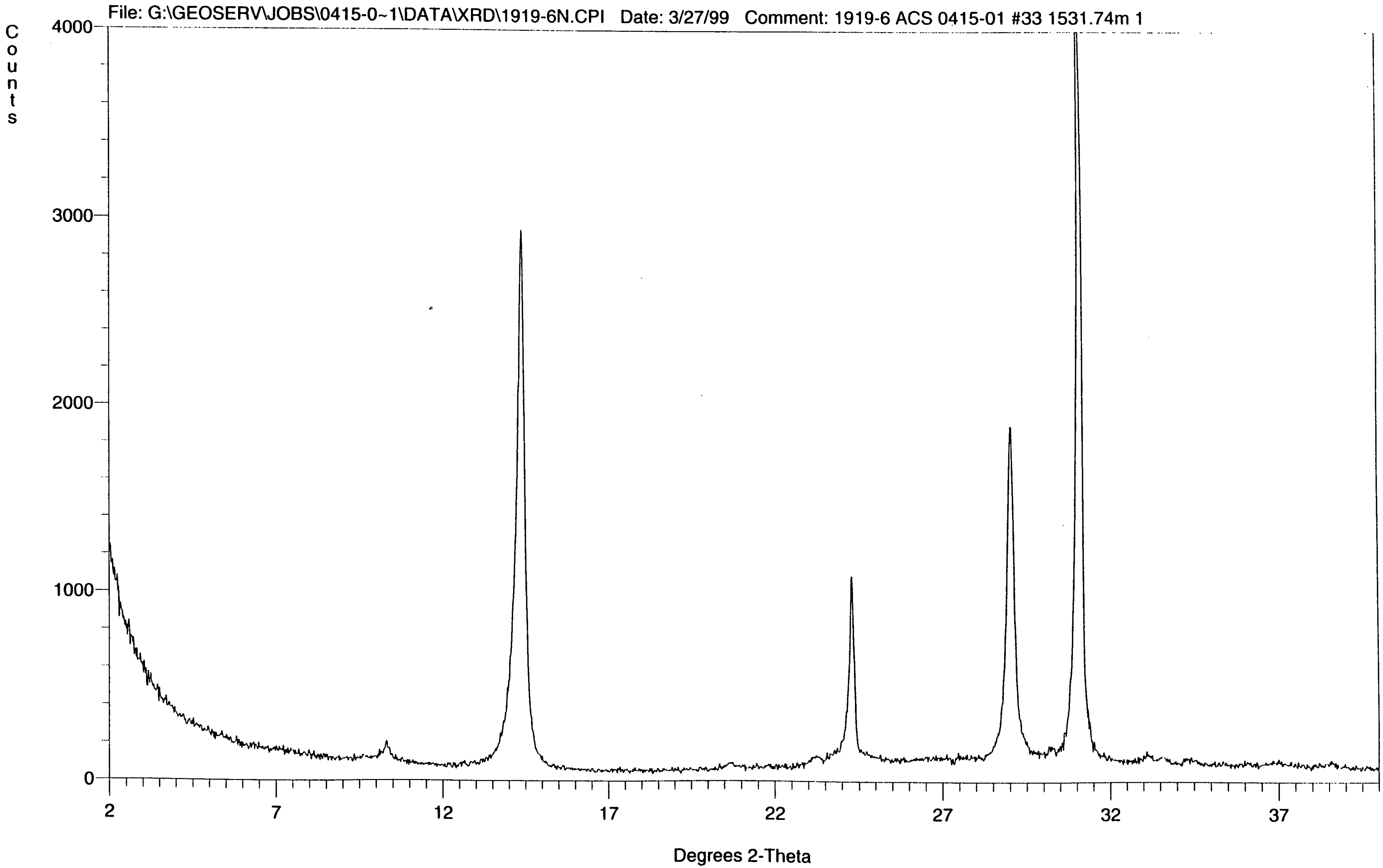
Degrees 2-Theta

908918 235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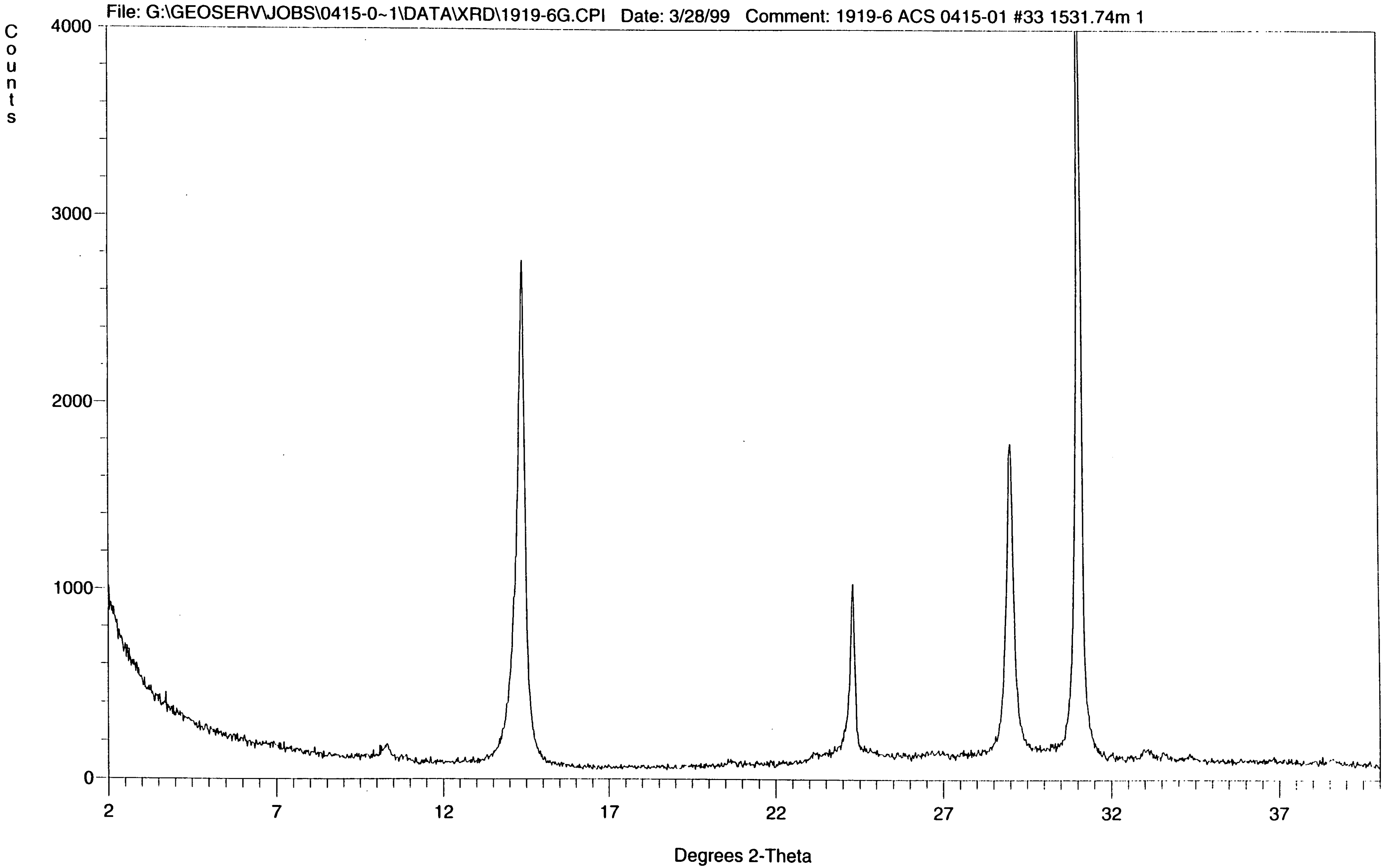
Degrees 2-Theta

908918 236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2
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12
17
22
27
32
37
Degrees 2-Theta

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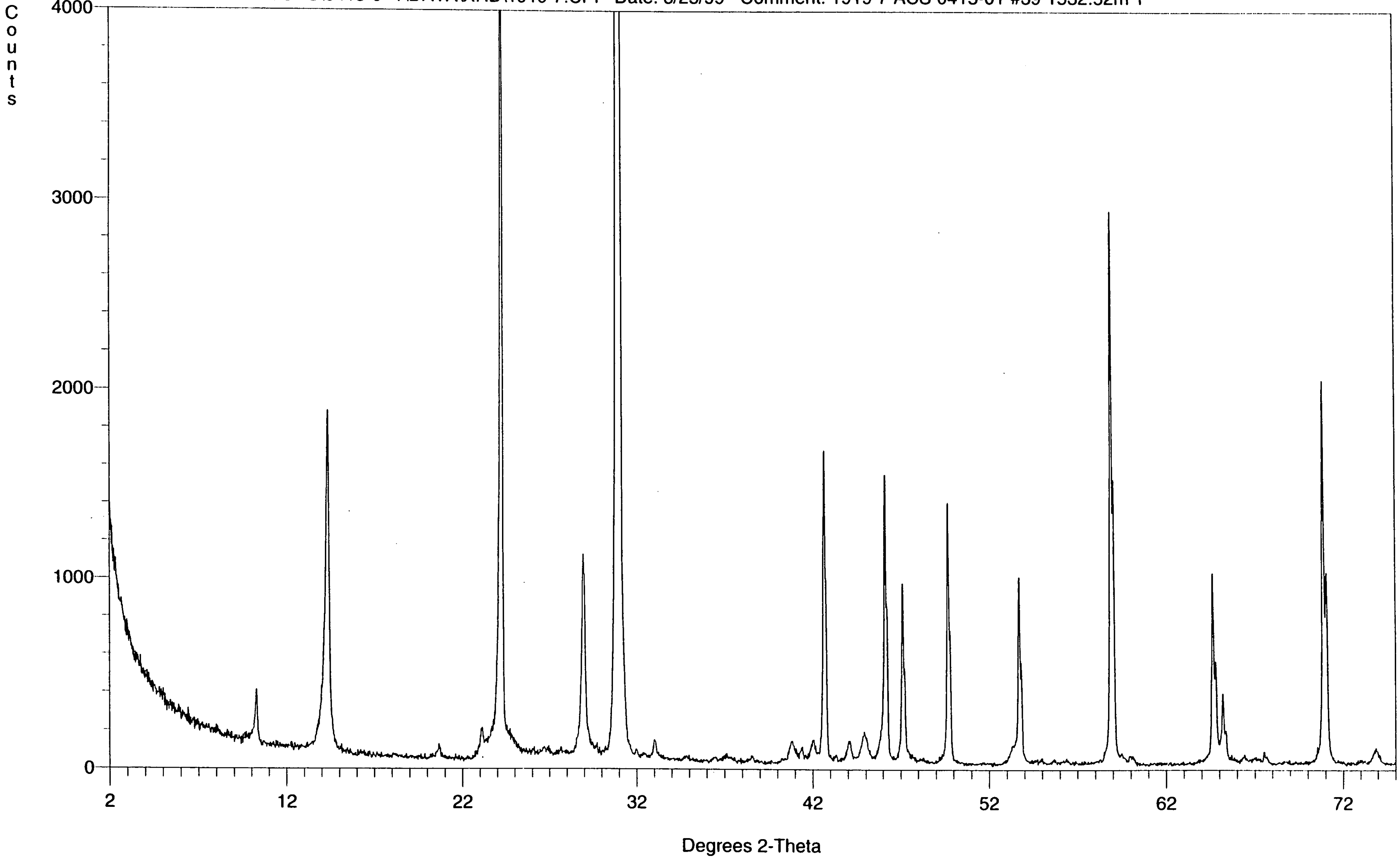

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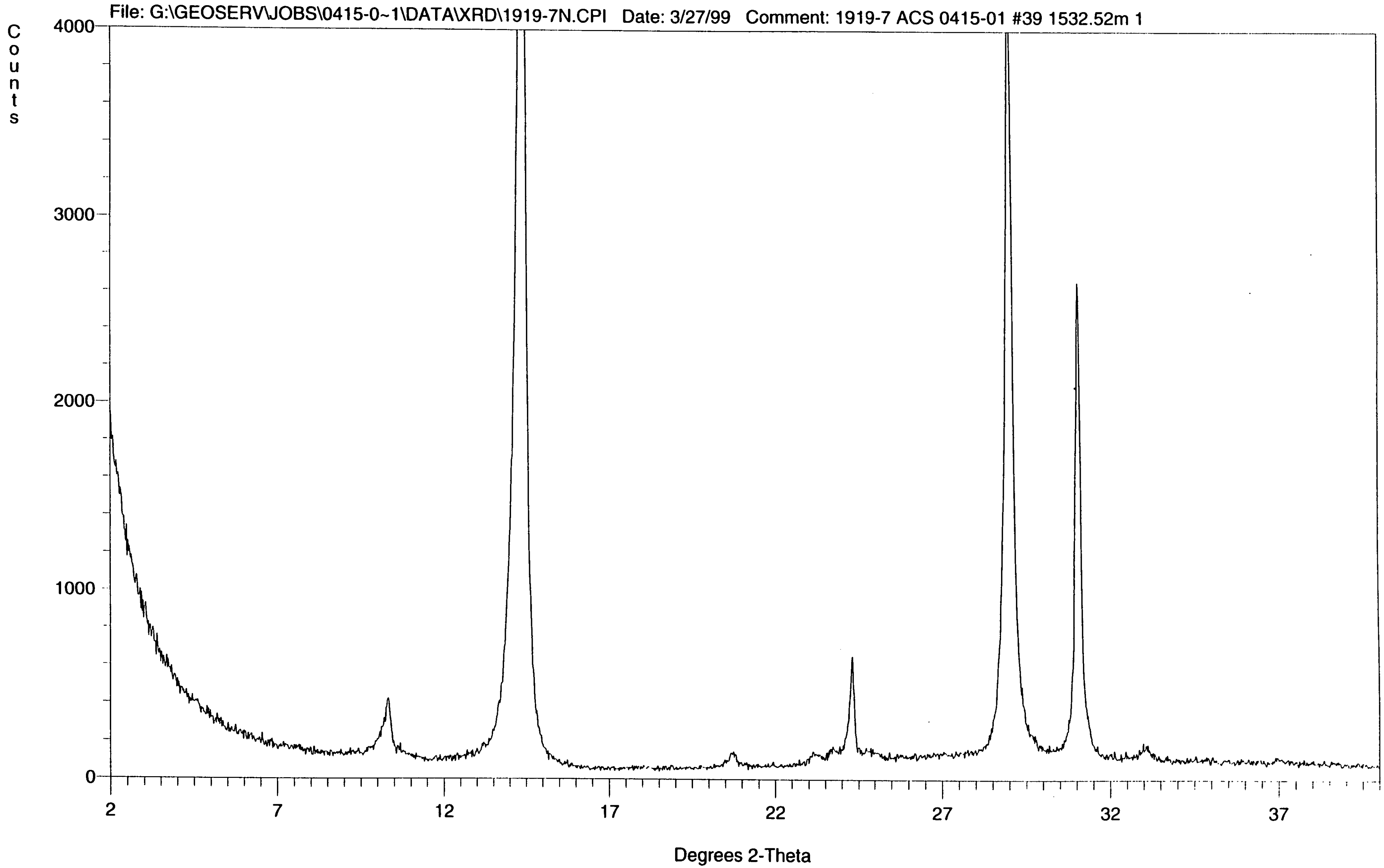
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0
2
7
12
17
22
27
32
37
Degrees 2-Theta

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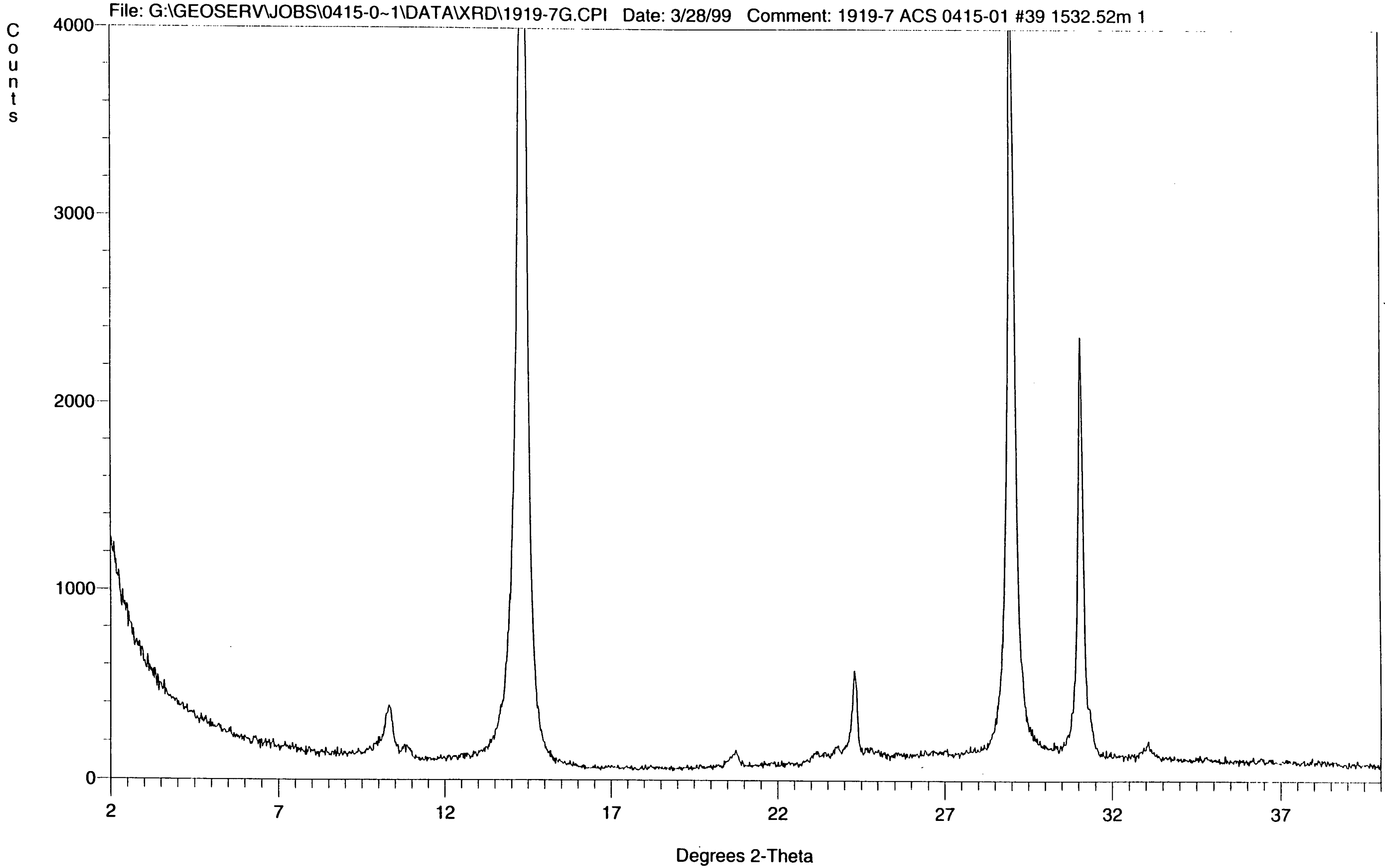
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Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

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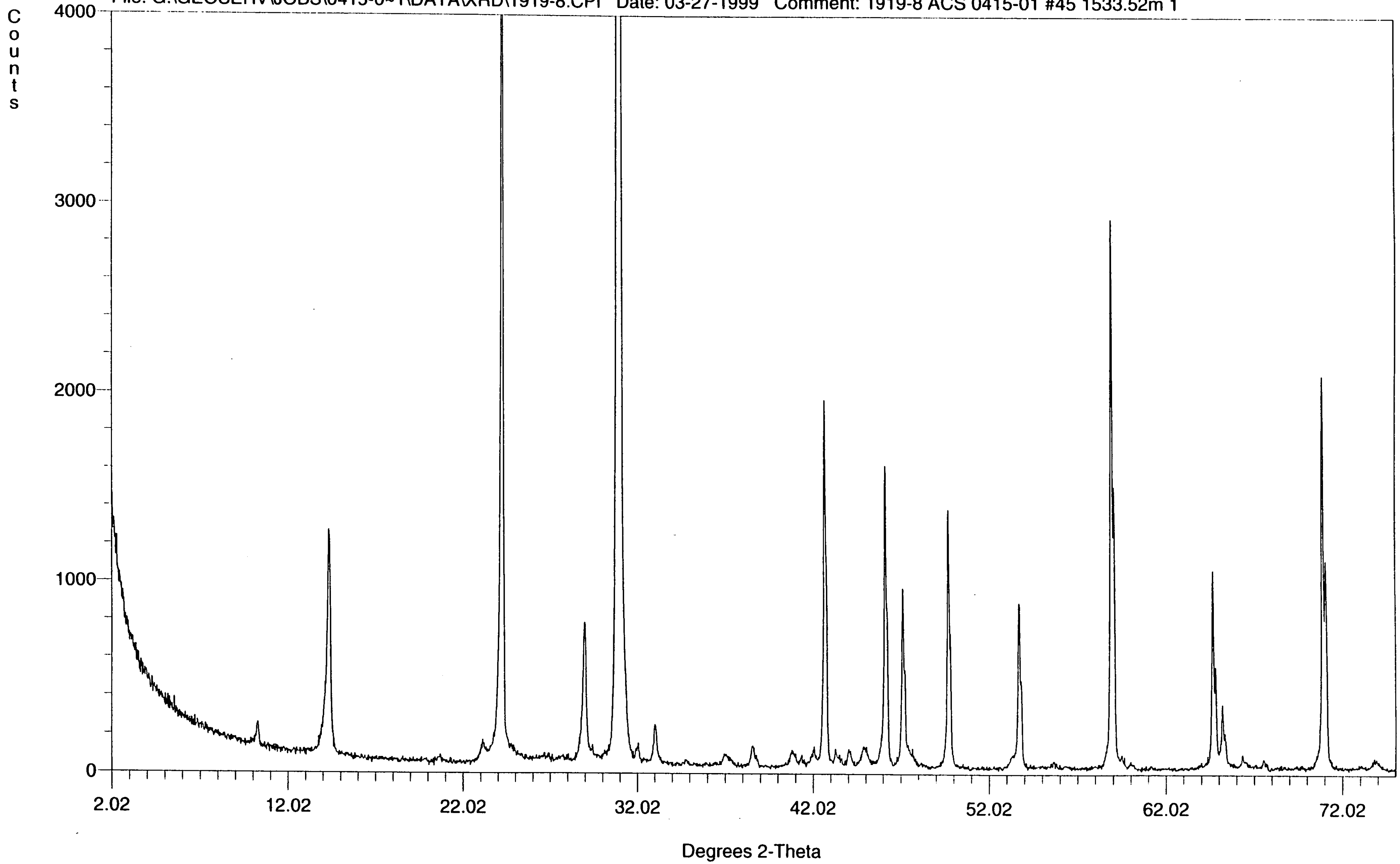

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ACS

LABORATORIES

PTY. LTD.

ROUTINE CORE ANALYSIS FINAL REPORT

of

IONA OBS-1

for

WESTERN UNDERGROUND GAS STORAGE PTY LIMITED

by

ACS LABORATORIES PTY LTD

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16 June 1999

ACS
LABORATORIES
PTY. LTD.

Western Underground Gas Storage Pty Limited
Level 49, Rialto South Tower
525 Collins Street
MELBOURNE VIC 3000

Attention: Mr. Andy Whittle

FINAL REPORT: 0298-02 - IONA OBS-1

CLIENT REFERENCE: Facsimile dated 11 March, 1999

MATERIAL: 2 5/8" diameter Whole Core

LOCALITY: PPL-2

WORK REQUIRED: Routine Core Analysis

Please direct technical inquiries regarding this work to the signatory below under whose supervision the work was conducted.

PETER CROZIER
Operations Manager

Head Office: P.O. Box 396, Chermside South, Qld. 4032, Australia
Telephone: 61 7 3350 3999 Facsimile: 61 7 3359 0222
Email: acs.bris@acslabs.com.au
ACS Laboratories Pty. Ltd.
ACN: 008 273 005

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CHAPTER 1

LOGISTICS AND INTRODUCTION

1. LOGISTICS and INTRODUCTION

LOGISTICS

Two cores from Iona OBS-1 well arrived at ACS Laboratories, Brisbane, on the 25th February, 1999.

Core No.	Depth Interval (m)	No. m
1	1509.35m - 1515.55m	6.20 m
2	1527.35m - 1534.28m	6.93 m
	Total	13.13 m

INTRODUCTION

On arrival, the core was removed from the aluminium liner, cleaned of drilling mud, oriented and marked up with orientation lines and depths prior to sampling. A core analysis study was initiated as per discussions with Western Underground Gas Storage Pty Limited.

The following report includes tabular data of permeability to gas, helium injection porosity and grain density. Data presented graphically includes a core log plot of the above and porosity versus permeability plots.

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CHAPTER 2

STUDY AIMS

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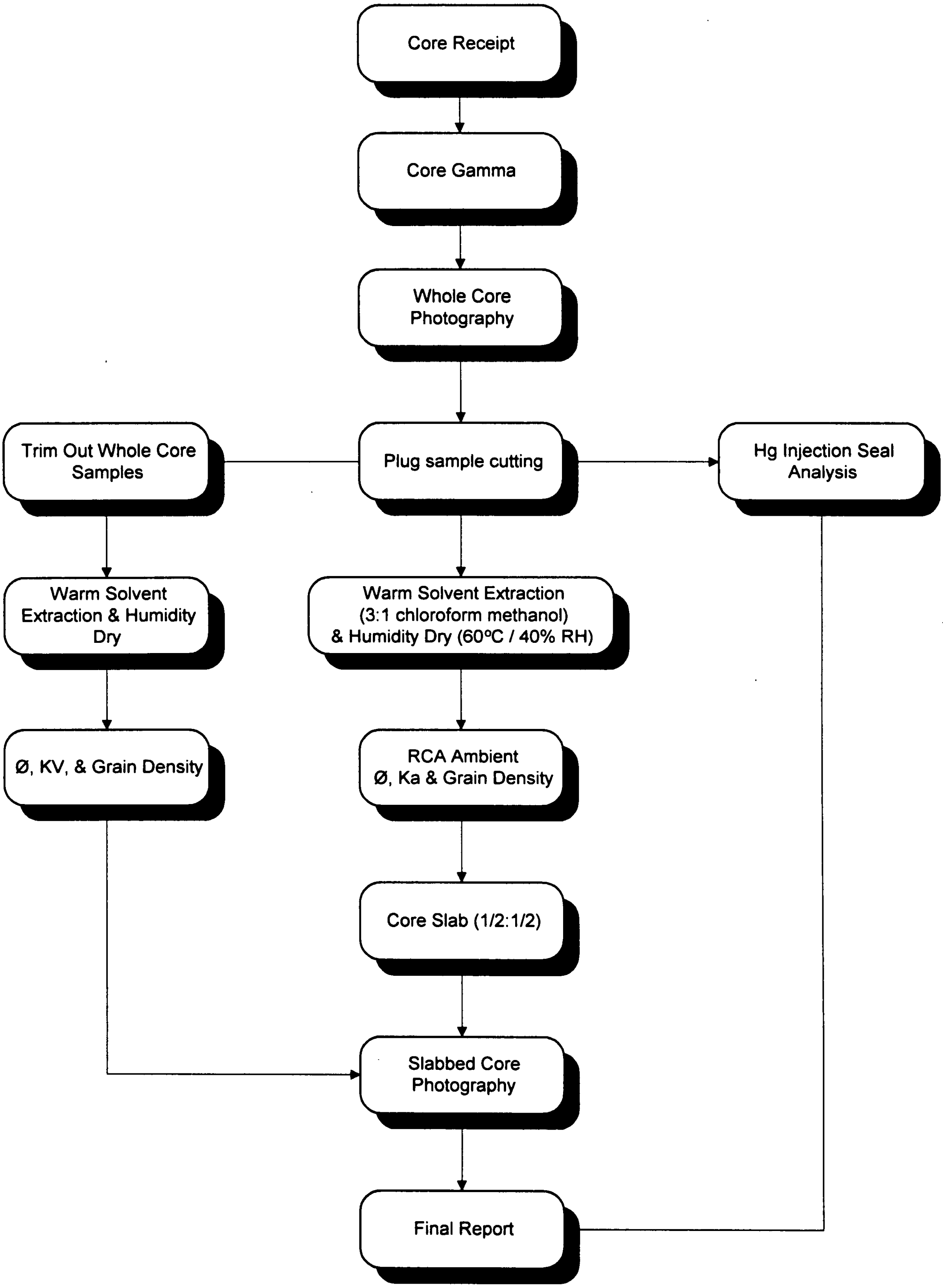
2. STUDY AIMS

The analyses were performed with the following aims:

1. To provide depth correlation through the provision of a continuous core gamma log over the cored interval.
2. To provide porosity, permeability to air and density data across the core.
3. To investigate the directional control on permeability by provision of vertical permeability data.
4. To investigate the seal capacity of the cap rock.

IONA OBS-1 - STUDY OUTLINE



CHAPTER 3

SAMPLING

3. SAMPLING

3.1 Routine Core Analysis Samples

A suite of 1½" diameter horizontal plug samples were cut at approximately 15 cm intervals throughout the core.

Due to the friable nature of the core, plugs were drilled from frozen core using liquid nitrogen. The liquid nitrogen freezes the core ahead of the cutting face of the bit, lubricates the bit and removes the cutting fines from the hole. The plug samples were trimmed to right cylinders while frozen. The majority of the samples were mounted in lead sleeves with screen ends, to maintain their integrity during analysis.

Vertical whole core samples were cut from at approximately 1 metre intervals throughout the core. Due to the diameter of the core, it was decided to use whole core sections for vertical permeability in an effort to minimise the destruction of the core.

The off-cuts of all plug samples were retained, labelled and bagged for possible future analysis.

3.2 Mercury Injection Seal Analysis Samples

Three thumbnail size chips were taken in the mudstone sections at the top of the core for Mercury Injection Seal Analysis.

3.3 Core Slabbing

On completion of the sampling, the core was slabbed longitudinally into two halves. On half was sent to the Department of Natural Resources and Environment, Weeribee, Victoria. The other half is currently stored with ACS Laboratories, Brisbane.

CHAPTER 4

SAMPLE PREPARATION

4. SAMPLE PREPARATION

4.1 Sample Extraction

After sampling, the samples were cleaned of hydrocarbons using a soxhlet extraction method. An azeotrope of 3:1 Chloroform Methanol was the solvent used. When the solvent in the extractor was no longer discoloured, the samples were removed and checked under ultra-violet light to ensure all hydrocarbons had been removed. When a sample of the solvent from the extractor chamber tested negative to Silver Nitrate ($AgNO_3$) induced salt precipitation, the samples were removed and placed in an oven to dry.

4.2 Sample Drying

After cleaning, all samples were humidity dried to a constant weight at 60°C and 40% relative humidity. Once dried, the plugs were stored in individual airtight vials and allowed to cool to room temperature before analysis.

CHAPTER 5

TEST PROCEDURES

5. TEST PROCEDURES

5.1 Continuous Core Gamma

The core was laid out according to depth markings, and a continuous core gamma trace produced by passing the core beneath a gamma radiation detector. The detector is protected from extraneous radiation by a lead tunnel. The detector signal is amplified and digitised to produce a gamma trace for comparison with the down hole log.

5.2 Porosity

Porosity was determined in two stages. Initially each sample was placed in a sealed matrix cup. Helium held at 100 psi reference pressure was then introduced to the cup. From the resultant pressure drop the unknown grain volume was determined from Boyle's Law.

$$P_1 V_1 = P_2 V_2$$

$$\Rightarrow P_1 Vr = P_2 (Vr + Vc + Vl - Vg)$$

where

P_1 = *initial pressure (psig)*
Vr = *reference cell volume (cm^3)*
Vc = *matrix cup volume (cm^3)*
Vl = *line volume (cm^3)*
Vg = *grain volume (cm^3)*
P_2 = *final pressure (psig)*

The samples were then placed into individual thick walled rubber sleeves and the assembly loaded into a hydrostatic cell. With an ambient pressure (400 psi) applied to the sample, helium held at 100 psi reference pressure was released into the samples pore volume. The resultant pressure drop was used to determine pore volume at ambient.

$$Vb = Vp + Vg$$

$$\textit{Ambient Porosity \%} = \frac{Vp}{Vb} x\,100$$

where

Vp = *ambient pore volume (cm^3)*
Vb = *ambient bulk volume (cm^3)*
Vg = *grain volume (cm^3)*

5.3 Permeability

The plugs are placed in a hydrostatic cell at a confining pressure of 400 psi. This pressure is used to prevent bypassing of air around the sample when the measurement is made.

During the measurement a known air pressure is applied to the upstream face of the sample, creating a flow of air through the sample. Permeability for each sample is then calculated using Darcy's Law through knowledge of the upstream pressure and flow rate during the test, the viscosity of air and the plug dimensions.

$$Ka = \frac{2000.BP.\mu.q.L}{(P_1^2 - P_2^2).A}$$

where

Ka = *air permeability (milliDarcy's)*
BP = *barometric pressure (atmospheres)*
μ = *gas viscosity (cP)*
q = *flow rate (cm^3/s)*
L = *sample length (cm)*
P_1 = *upstream pressure (atmospheres)*
P_2 = *downstream pressure (atmospheres)*
A = *sample cross sectional area (cm^2)*

5.4 Apparent Grain Density

The apparent grain density is determined by dividing the weight of the plug by the grain volume determined from the helium injection porosity measurement.

$$\rho = \frac{Wt}{Vg}$$

where

ρ = *grain density (g/cm^3)*
Wt = *weight of sample (g)*
Vg = *grain volume (cm^3)*

5.5 Mercury Injection Seal Analysis

Samples of sufficient volume to fill the sample chamber (circa 2 cm^3) were utilised for capillary pressure determinations by the mercury injection technique. The mercury injection apparatus used is a semi-automatic Micromeritics Autopore 9200 which can operate up to a pressure of 40,000 psia, and can measure intrusions as small as 0.0001 cm^3 per gram of sample.

The Micromeritics Autopore records mercury intrusion by measuring the capacitance change between the capillary of mercury contained in the penetrometer and an outer metal sheath as mercury invades the samples. For pressures up to 24 psia, air pressure is used. Hydraulic oil is used to achieve the higher pressures. No volume corrections for pressure effects were made, since below 24 psia they are negligible, whilst for higher pressures the penetrometer experiences equal external and internal pressures, and mercury compression is offset of penetrometer compression.

All samples were dried in a humidity oven and placed into calibrated glass penetrometers. These consist of a sample chamber and attached precision bore capillary. Once the samples were placed into the penetrometer a vacuum was applied until less than 50 micrometres of mercury had been achieved. Mercury was then introduced into the penetrometer and the run commenced along pre-defined pressure points on a logarithmic scale. After equilibration at each pressure point a capacitance reading was taken which was then converted into an equivalent intrusion volume.

Pore throat diameter for intrusion pressure can be calculated as such:

$$D = \frac{4\,T\cos\theta\,C}{P_C}$$

where	D	=	*pore throat diameter (microns)*
	T	=	*interfacial tension (dynes/cm)*
	θ	=	*contact angle (degrees)*
	Pc	=	*capillary pressure (psi)*
	C	=	*conversion constant*
		=	145×10^{-3}

5.6 Core Photography

Two sets of core photographs of Iona OBS-1 were produced. The first set were of the whole core, prior to sampling. One set of these prints was forwarded to Western Underground Gas Storage to give them a 'quick look' at the core. The second set of photographs were taken after sampling and slabbing of the core. Three sets of these photographs were forwarded to Western Underground Gas Storage on the 27th May 1999.

In both instances, photographs were taken of the core in a 5 metre format, under white light only, and on conventional professional film. The film was then digitally scanned, edited and printed.

CHAPTER 6

DISCUSSION

6. DISCUSSION

Due to the friable nature of the core, twenty-two (22) of the forty-eight (48) plug samples required mounting in lead sleeves with mesh screens placed at the end to maintain their integrity during analysis. Two of the samples required mounting in epoxy resin to enable them to be analysed.

The values quoted for the mercury injection seal analysis break through pressures are our interpretation of the results. As is often the case, there is more than one way to interpet these results. The values quoted in the report are for an ambient mercury/air system and need to be converted to the relevant fluid systems at reservoir conditions.

The traditional interpretation from the capillary pressure graph is to extrapolate back from the plateau part of the plot where mercury intrusion is obvious (see plot). Injection prior to this part is unclear whether it is real or intrusion in surface imperfections, pores or micro-fractures. The alternative interpretations are to extrapolate back from the tangent to the curve at the extreme point of inflection, or to derive a point where the data deviates away from the vertical. The values of breakthrough pressure derived from the pore throat plots show where obvious penetration occurs. These values show good agreement with the capillary pressure derived values.

CHAPTER 7

SAMPLE DISTRIBUTION AND STORAGE

7. SAMPLE DISTRIBUTION and STORAGE

Sample Description	Date Despatched	To whom	Via
Government 1/2 slab section of core	12/5/99	Department of Natural Resources & Environment, Werribee, Victoria	Discount Freight Express

The following items are currently held in storage with ACS Laboratories Pty. Ltd. - Brisbane:

- ◊ Company ½ slabbed section of Core
- ◊ Plug Samples
- ◊ Plug sample off-cuts
- ◊ Whole core sections

APPENDIX I

AMBIENT TEST RESULTS

CORE ANALYSIS FINAL REPORT

Client	: Western Underground Gas Storage Pty Limited	Date	: 01/03/99
Well	: Iona OBS-1	File	: 0298-02
Field	: Iona	Location	: PPL2
Core Int.	: 1509.35m - 1515.55m	ACS Lab.	: Brisbane
Core Int.	: 1527.35m - 1534.28m	Analysts	: pnc

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
1	1509.67	H	22.1	2.64	1948	Slv
2	1509.97	H	22.1	2.64	5289	Slv
3	1510.12	H	23.2	2.64	4629	Slv
4	1510.20	H	23.3	2.64	3717	Slv
5	1510.56	H	25.0	2.61	1566	Slv
6	1527.35	H	28.1	2.65	9239	Mtd
7	1527.48	H	25.8	2.65	3265	Slv
8	1527.65	H	26.5	2.65	2350	Slv
9	1527.77	H	22.6	2.65	1828	Slv
10	1527.92	H	26.4	2.65	8452	Mtd
11	1528.03	H	24.0	2.64	3584	Slv
12	1528.23	H	27.4	2.64	2236	Slv
13	1528.36	H	30.2	2.64	3320	
14	1528.54	H	29.5	2.64	3480	
15	1528.69	H	28.7	2.65	2280	
16	1528.84	H	27.4	2.63	1872	Slv, Carb lams
17	1528.98	H	28.4	2.65	2731	Slv, lams
18	1529.14	H	27.9	2.64	1890	
19	1529.34	H	29.7	2.63	1426	
20	1529.49	H	25.7	2.64	1594	
21	1529.60	H	26.8	2.64	2291	
22	1529.74	H	27.8	2.63	2101	
23	1529.86	H	27.8	2.64	3464	Slv
24	1530.03	H	28.1	2.64	7271	Slv
25	1530.22	H	28.7	2.64	2602	Slv
26	1530.35	H	29.6	2.64	2601	Slv
27	1530.49	H	28.4	2.64	2152	Slv
28	1530.65	H	28.5	2.64	3748	Slv
29	1530.97	H	27.6	2.64	854	
30	1531.11	H	26.1	2.64	544	

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
31	1531.25	H	25.2	2.65	1312	
32	1531.40	H	29.2	2.64	5802	Slv
33	1531.56	H	23.1	2.65	3842	Slv
34	1531.74	H	30.8	2.57	4899	Slv, C
35	1531.89	H	26.7	2.64	2735	Slv, Carb lams
36	1532.03	H	28.8	2.64	519	
37	1532.19	H	28.6	2.64	775	
38	1532.36	H	24.5	2.60	355	
39	1532.52	H	29.2	2.65	379	
40	1532.66	H	27.4	2.65	354	
41	1532.81	H	28.4	2.68	590	
42	1532.95	H	27.5	2.70	527	Pyr
43	1533.09	H	28.9	2.66	1176	
44	1533.26	H	28.8	2.64	755	
45	1533.52	H	29.7	2.65	957	
46	1533.65	H	27.7	2.67	697	
47	1533.80	H	29.2	2.66	765	
48	1533.97	H	28.9	2.67	682	

Note:
Slv - *Samples sleeved in lead with end screens* *(friable)*
Mtd - *Samples mounted in epoxy resin* *(undergauged)*

CORE ANALYSIS FINAL REPORT

Client	: Western Underground Gas Storage Pty Limited	Date	:	01/03/99
Well	: Iona OBS-1	File	:	0298-02
Field	: Iona	Location	:	PPL2
Core Int.	: 1509.35m - 1515.55m	ACS Lab.	:	Brisbane
Core Int.	: 1527.35m - 1534.28m	Analysts	:	pnc

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
1	1509.52	V	10.0	2.57	0.01	
2	1512.13	V				Failed
3	1527.42	V	29.5	2.64	3461	
4	1528.46	V	28.6	2.64	249	
5	1529.95	V	29.8	2.64	744	
6	1530.57	V	27.7	2.63	322	
7	1531.32	V	27.6	2.63	472	
8	1532.43	V	27.8	2.64	235	
9	1533.73	V	29.6	2.67	266	

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APPENDIX II

MERCURY INJECTION SEAL ANALYSIS RESULTS

CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1509.00 m

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
1.79	0.0	0.0	118
2.44	0.0	0.0	86.9
2.89	0.8	0.8	73.4
3.45	0.4	1.3	61.4
4.10	0.0	1.3	51.7
4.87	0.0	1.3	43.5
5.83	0.8	2.1	36.4
6.92	0.0	2.1	30.6
8.29	0.0	2.1	25.6
9.91	0.4	2.5	21.4
11.9	0.4	3.0	17.9
14.1	0.0	3.0	15.0
16.9	1.3	4.2	12.6
20.2	0.0	4.2	10.5
24.1	0.0	4.2	8.80
28.8	1.3	5.5	7.36
34.0	0.0	5.5	6.24
40.6	0.0	5.5	5.23
48.5	0.4	5.9	4.37
57.8	0.0	5.9	3.67
69.0	0.4	6.4	3.07
82.3	0.0	6.4	2.58
99.4	0.0	6.4	2.13
118	0.0	6.4	1.80
142	0.0	6.4	1.49
170	0.0	6.4	1.25

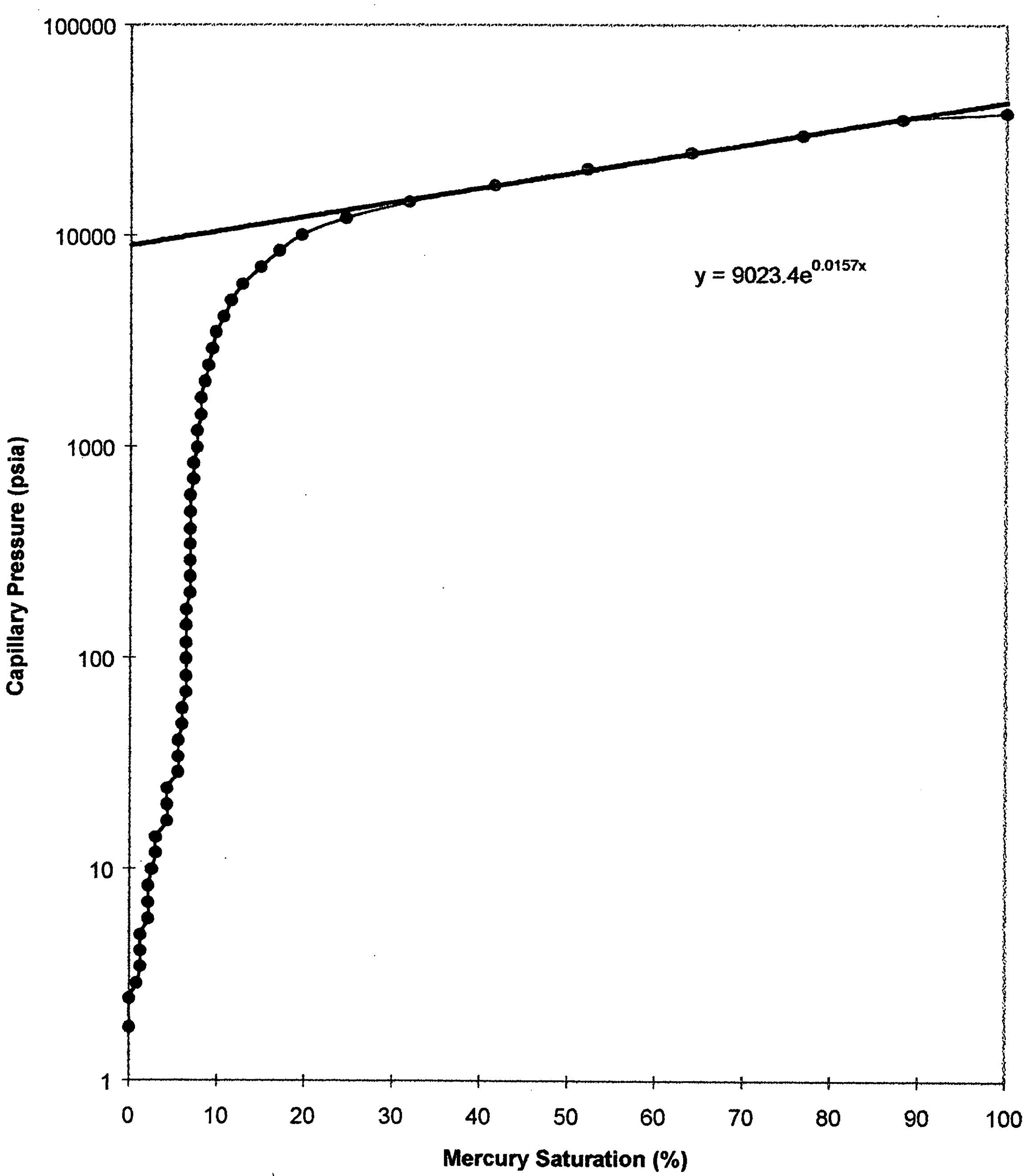
Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
203	0.4	6.8	1.04
243	0.0	6.8	0.873
289	0.0	6.8	0.733
345	0.0	6.8	0.614
409	0.0	6.8	0.518
492	0.0	6.8	0.431
590	0.0	6.8	0.360
705	0.4	7.2	0.301
840	0.0	7.2	0.252
999	0.4	7.6	0.212
1192	0.0	7.6	0.178
1427	0.4	8.1	0.149
1707	0.0	8.1	0.124
2042	0.4	8.5	0.104
2444	0.4	8.9	0.0867
2918	0.4	9.3	0.0726
3505	0.4	9.7	0.0605
4150	0.8	10.6	0.0511
4953	0.8	11.4	0.0428
5926	1.3	12.7	0.0358
7115	2.1	14.8	0.0298
8515	2.1	16.9	0.0249
10154	2.5	19.5	0.0209
12183	5.1	24.6	0.0174
14542	7.2	31.8	0.0146
17415	9.7	41.5	0.0122
20830	10.6	52.1	0.0102
24911	11.9	64.0	0.0085
29840	12.7	76.7	0.0071
35611	11.4	88.1	0.0060
38243	11.9	100.0	0.0055

CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1509.00 m



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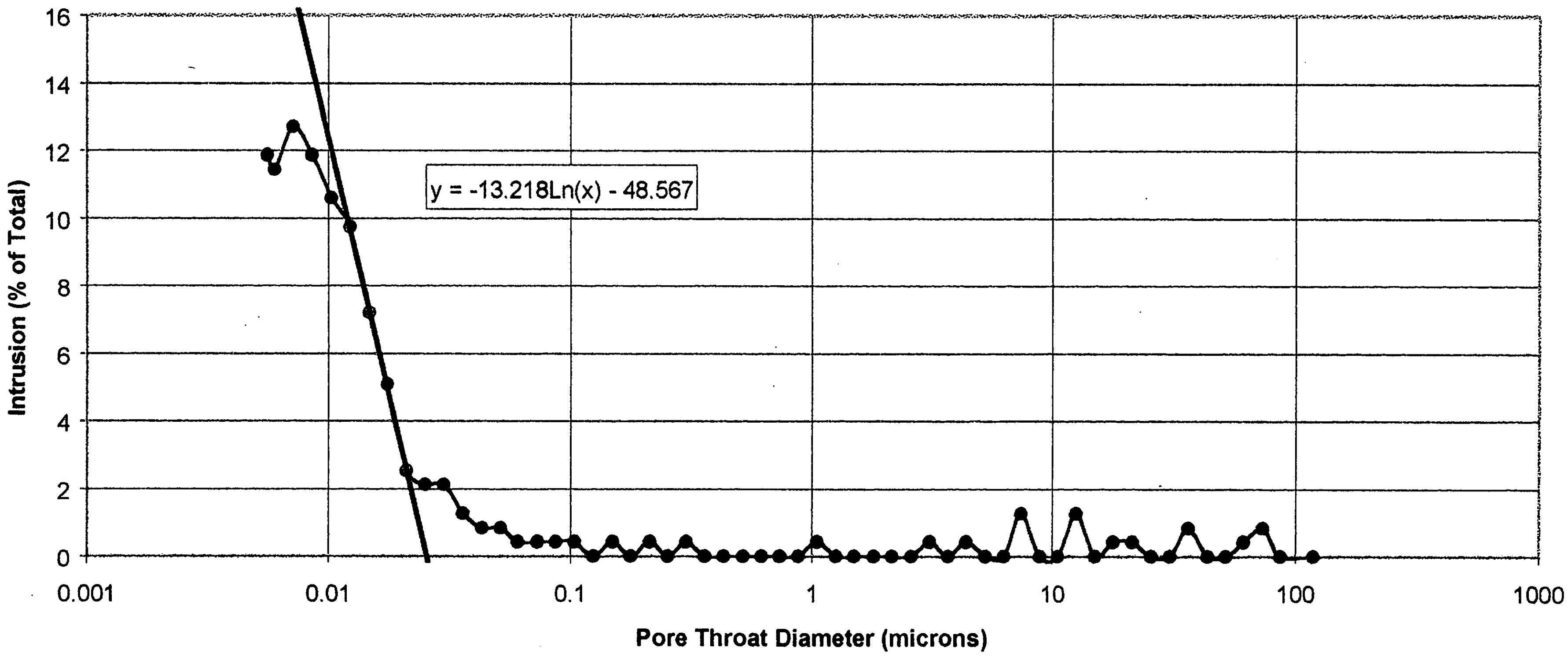
CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1509.00 m



CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1512.00 m

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
1.85	0.0	0.0	115
2.41	0.0	0.0	88.0
2.90	1.4	1.4	73.1
3.44	0.0	1.4	61.6
4.10	0.0	1.4	51.7
4.90	0.5	1.8	43.3
5.82	0.0	1.8	36.4
6.96	1.4	3.2	30.5
8.32	0.5	3.7	25.5
9.91	0.0	3.7	21.4
11.8	0.5	4.1	17.9
14.1	0.9	5.1	15.0
16.9	0.9	6.0	12.6
20.2	0.0	6.0	10.5
24.1	0.0	6.0	8.79
28.8	1.4	7.4	7.36
34.3	0.5	7.8	6.19
40.6	0.0	7.8	5.22
48.5	0.0	7.8	4.37
57.8	0.5	8.3	3.67
68.8	0.0	8.3	3.08
83.4	0.0	8.3	2.54
99.8	0.0	8.3	2.12
118	0.5	8.8	1.79
142	0.0	8.8	1.49
170	0.0	8.8	1.25

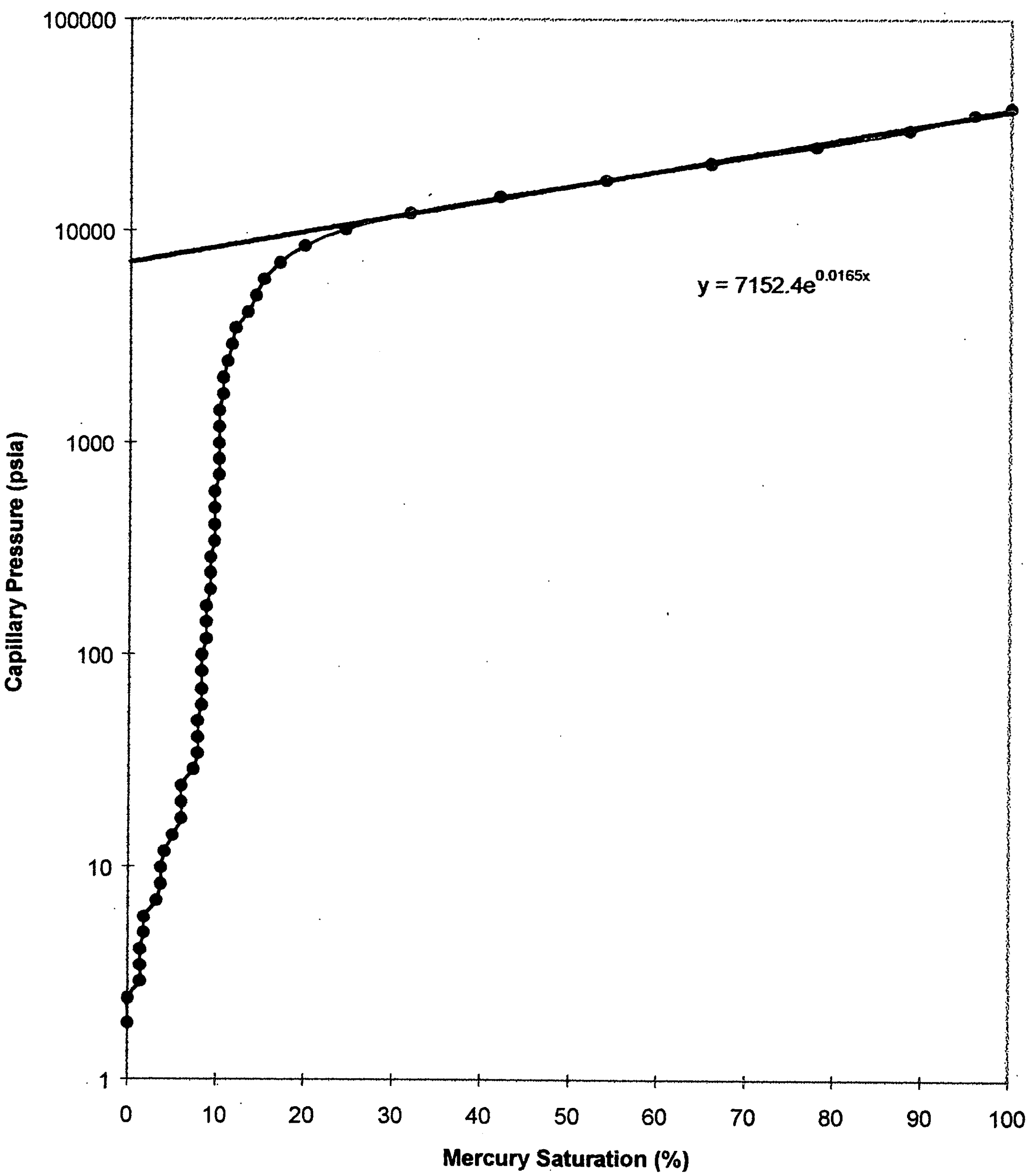
Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
203	0.5	9.2	1.04
243	0.0	9.2	0.873
288	0.0	9.2	0.737
344	0.5	9.7	0.617
412	0.0	9.7	0.515
490	0.0	9.7	0.432
587	0.0	9.7	0.361
705	0.5	10.1	0.301
838	0.0	10.1	0.253
996	0.0	10.1	0.213
1190	0.0	10.1	0.178
1424	0.0	10.1	0.149
1706	0.5	10.6	0.124
2040	0.0	10.6	0.104
2435	0.5	11.1	0.0871
2914	0.5	11.5	0.0727
3499	0.5	12.0	0.0606
4147	1.4	13.4	0.0511
4954	0.9	14.3	0.0428
5938	0.9	15.2	0.0357
7096	1.8	17.1	0.0299
8525	2.8	19.8	0.0249
10161	4.6	24.4	0.0209
12170	7.4	31.8	0.0174
14560	10.1	41.9	0.0146
17434	12.0	53.9	0.0122
20889	12.0	65.9	0.0101
24989	12.0	77.9	0.0085
29892	10.6	88.5	0.0071
35721	7.4	95.9	0.0059
38400	4.1	100.0	0.0055

CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1512.00 m

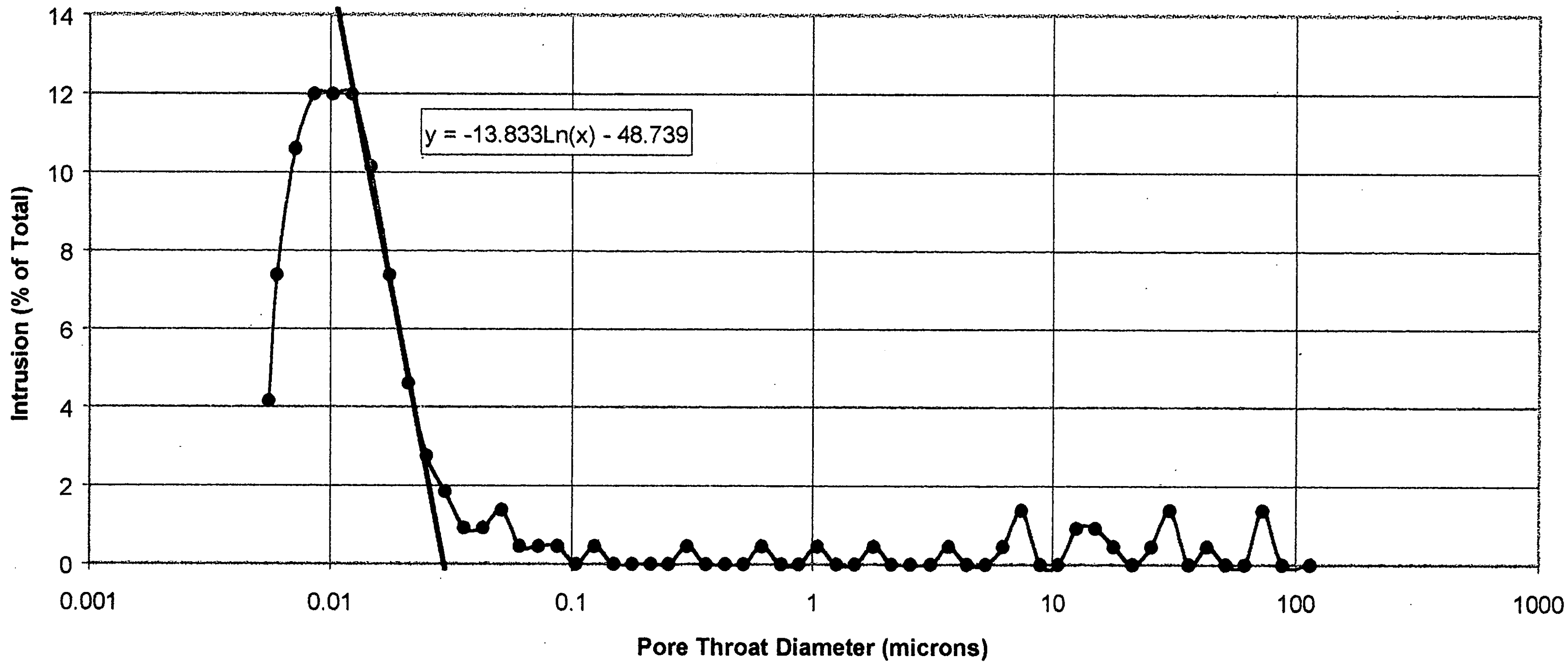


CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1512.00 m



CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1515.00 m

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
1.79	0.0	0.0	118
2.44	0.0	0.0	86.9
2.89	0.0	0.0	73.4
3.45	0.0	0.0	61.4
4.10	0.5	0.5	51.7
4.87	0.5	0.9	43.5
5.83	0.0	0.9	36.4
6.92	0.9	1.8	30.6
8.29	0.0	1.8	25.6
9.91	0.0	1.8	21.4
11.9	0.0	1.8	17.9
14.1	1.4	3.2	15.0
16.9	0.0	3.2	12.6
20.2	0.5	3.6	10.5
24.1	1.4	5.0	8.80
28.8	0.0	5.0	7.36
34.0	0.0	5.0	6.24
40.6	0.0	5.0	5.23
48.5	0.0	5.0	4.37
57.8	0.5	5.4	3.67
69.0	0.0	5.4	3.07
82.3	0.0	5.4	2.58
99.4	0.0	5.4	2.13
118	0.5	5.9	1.80
142	0.0	5.9	1.49
170	0.0	5.9	1.25

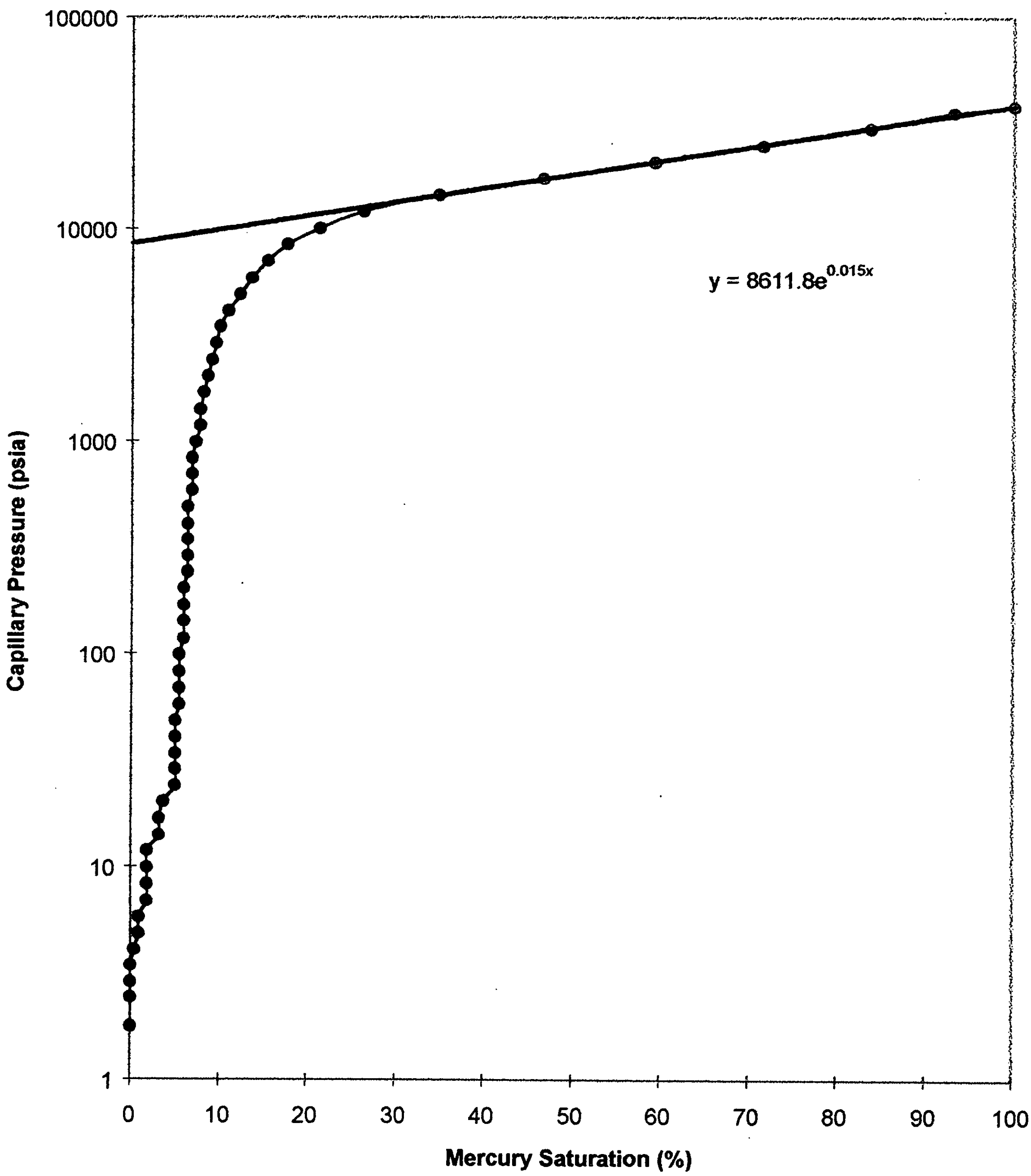
Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
203	0.0	5.9	1.04
243	0.5	6.3	0.873
289	0.0	6.3	0.733
345	0.0	6.3	0.614
409	0.0	6.3	0.518
492	0.0	6.3	0.431
590	0.5	6.8	0.360
705	0.0	6.8	0.301
840	0.0	6.8	0.252
999	0.5	7.2	0.212
1192	0.5	7.7	0.178
1427	0.0	7.7	0.149
1707	0.5	8.1	0.124
2042	0.5	8.6	0.104
2444	0.5	9.0	0.0867
2918	0.5	9.5	0.0726
3505	0.5	10.0	0.0605
4150	0.9	10.9	0.0511
4953	1.4	12.2	0.0428
5926	1.4	13.6	0.0358
7115	1.8	15.4	0.0298
8515	2.3	17.6	0.0249
10154	3.6	21.3	0.0209
12183	5.0	26.2	0.0174
14542	8.6	34.8	0.0146
17415	11.8	46.6	0.0122
20830	12.7	59.3	0.0102
24911	12.2	71.5	0.0085
29840	12.2	83.7	0.0071
35611	9.5	93.2	0.0060
38243	6.8	100.0	0.0055

CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1515.00 m

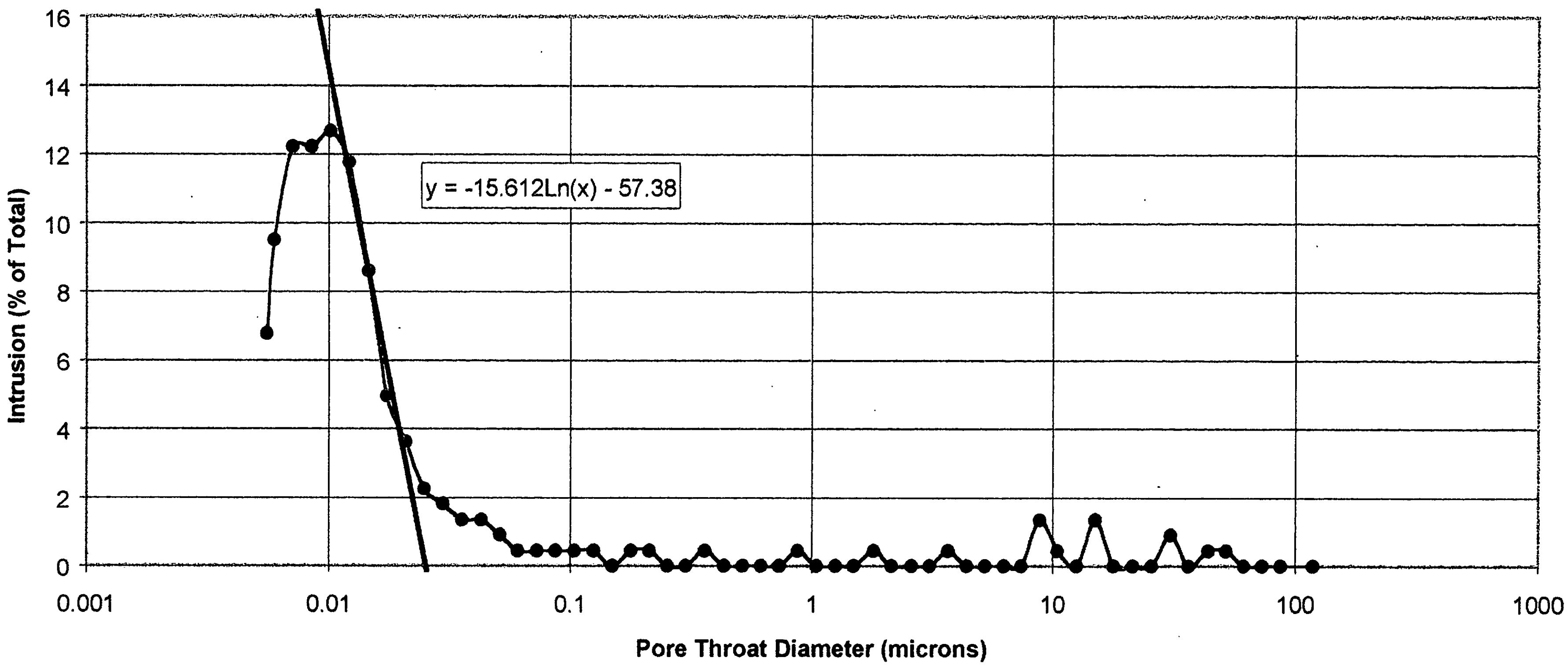


CAPILLARY PRESSURE

Client: Western Underground Gas Storage Pty Limited
Well: Iona-OBS-1

Test Method: Air/Mercury Capillary Pressure Drainage

Depth: 1515.00 m



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APPENDIX III

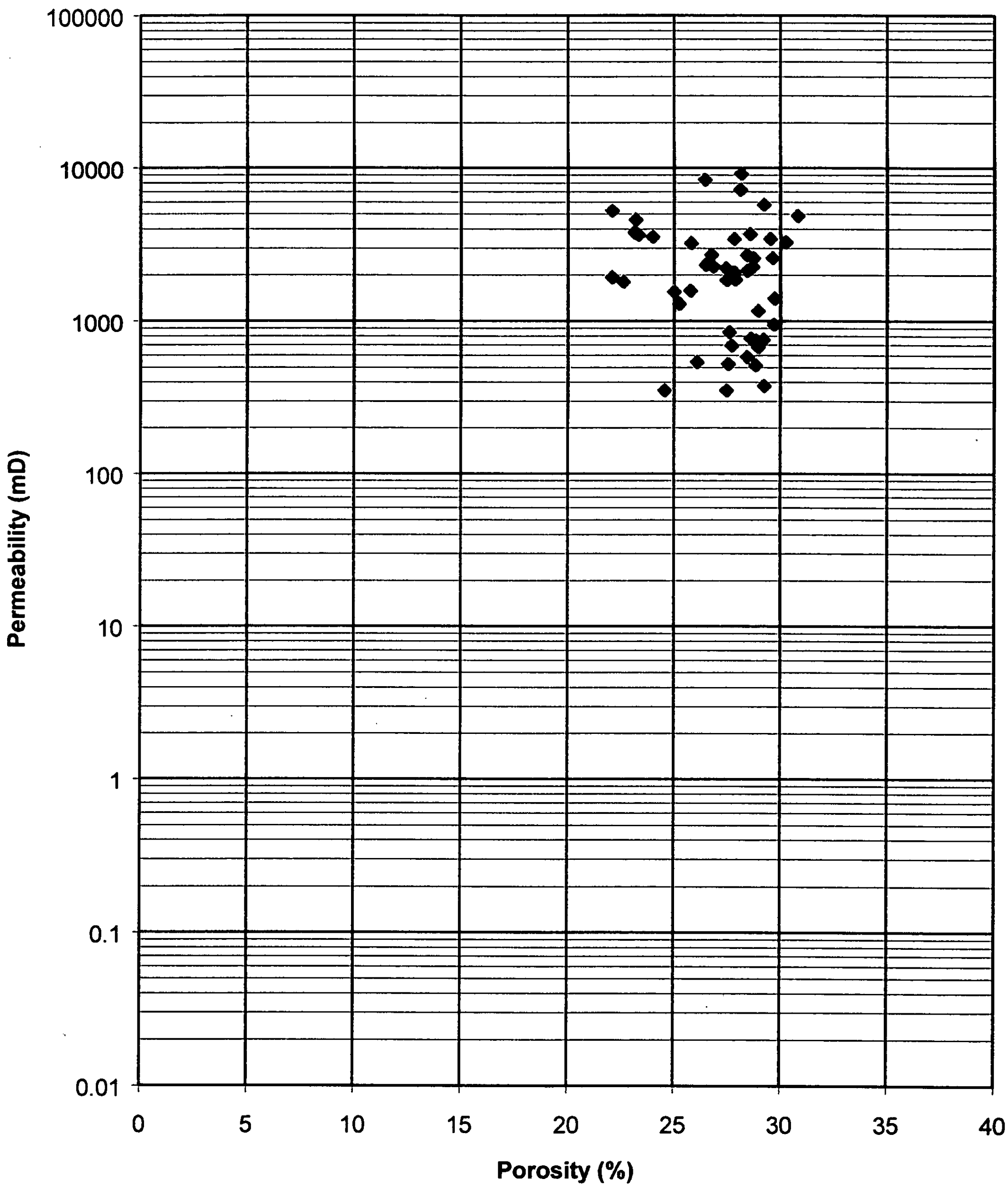
POROSITY vs PERMEABILITY PLOT

TUAUSTRALIA

POROSITY vs PERMEABILITY
Ambient

ACS LABORATORIES PTY. LTD.

Client: Western Underground Gas Storage Pty Limited
Well: Iona OBS-1
Depth: 1509.35m - 1534.28m



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APPENDIX IV

CORE LOG PLOT

This is Page Number **908918_283X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued fold-out with page number:

908918_283Y

and is enclosed within the document PE908918 at this page.

CORE PLOT

Scale 1:200

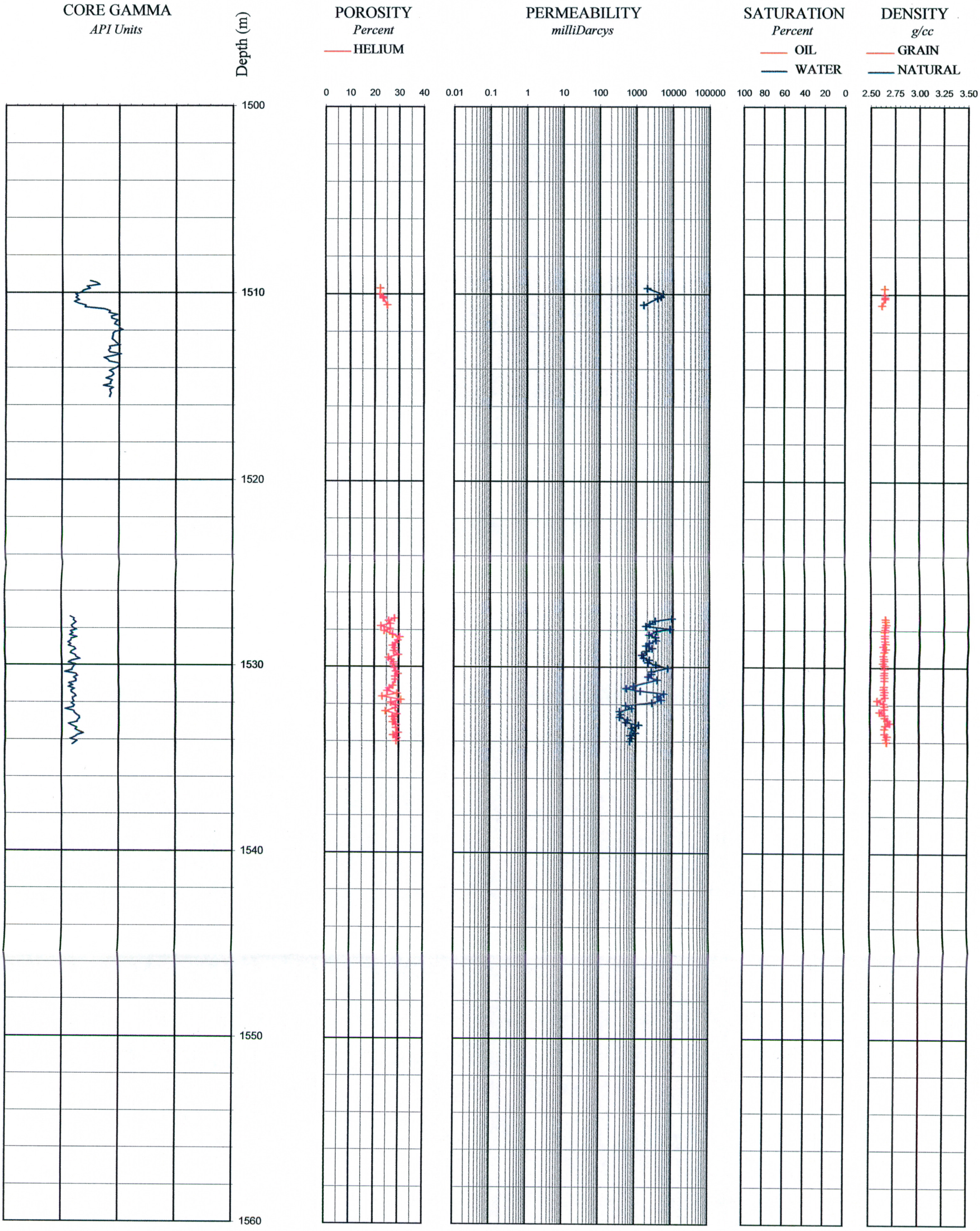
908918 283Y

ACS LABORATORIES PTY. LTD.

TUAUSTRALIA

Client: Western Underground Gas Storage Pty Limited
Well: Iona OBS-1
File No.: 0298-02

Core Int: 1509.35m - 1515.55m
Core Int: 1527.35m - 1534.28m



ACS Laboratories Pty. Ltd.
ACN: 008 273 005

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APPENDIX 5

Palynological analysis report by Biodata Pty. Ltd.

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BIOSTRATA PTY LTD
A.C.N. 053 800 945

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RECEIVED
-8 APR 1999

6 April 1999

Reference: GL99/08

A.P. Whittle
Western Underground Gas Storage Pty Ltd
C/- Texas Utilities Australia
Level 49, Rialto South Tower
525 Collins Street
Melbourne Vic 3000

Dear Andy

Enclosed are original hard copies of the provisional and final reports on the four palynological samples analysed from WUGS Iona Observation Well No.1, and the invoice for the work.

Please don't hesitate to contact me if you require either clarification of anything in the reports, or have comments that could improve the reports to better meet your needs.

Yours sincerely

Alan

Alan D. Partridge

Palynological analysis of four core and cuttings samples from WUGS Iona Observation Well No. 1, Otway Basin.

by

Alan D. Partridge

Biostrata Pty Ltd
A.C.N. 053 800 945

Biostrata Report 1999/2

6 April 1999

Palynological analysis of four core and cuttings samples from WUGS Iona Observation Well No. 1, Otway Basin

by

Alan D. Partridge

Summary

Two cuttings and two core samples were analysed for palynomorphs from WUGS Iona Observation Well No.1 over the interval 1500–1515m MDKB. The top two cuttings between 1500–1506m contained caved assemblages with material from both the Belfast Mudstone and Flaxman Formation and are considered to be no older than the *K. polypes* Subzone of the *P. infusorioides* microplankton Zone found in the Flaxman Formation. The two core samples between 1509.35–1515m gave good yields of moderately well preserved assemblages assigned to the *H. trinalis* Subzone of the *P. mawsonii* spore-pollen Zone and are considered to belong to the lower part of Unit C of the Waarre Formation.

Introduction

This palynological study was initiated to investigate the age of the stratigraphic section found at the top of the Waarre Formation in the first observation well for the gas storage project on the Iona Gas Field in the Otway Basin. The samples were sent by courier directly to Laola Pty Ltd in Perth for palynological processing on the 25 March 1999. The completed palynological slides were received by the author on Thursday 1 April 1999 and a Provisional Palynological Report submitted by facsimile the next day.

An average of 14 grams was processed for each sample and all gave moderate to high residue yields. Palynomorph concentrations on the slides varied from moderate to high, and preservation from poor to good.

The sample and zone data is summarised in Tables 1 & 2 and species identified are listed on Table 3. Zone and age determinations are based on the Mesozoic spore-pollen and microplankton zonation framework proposed by Helby *et al.* (1987), modified by the addition of local subzones applicable to the Otway Basin (Figure 1). Author citations for spore-pollen species can be sourced from Dettmann (1963), Dettmann & Playford (1969), Helby *et al.* (1987), and Stover & Partridge (1973), and for dinoflagellates from the index of Lentin & Williams (1993). Species names followed by "ms" are unpublished manuscript names.

Discussion of Assemblages

The cuttings samples between 1500–1506m contain the key microplankton index species *Valensiella griphus* and *Kiokansium polypes*, the overlap in ranges of these two species being diagnostic of the *K. polypes* Subzone of the *P. infusorioides* Zone (Figure 1). The former species has so far been found only in the Flaxman Formation, while the latter species ranges no higher than the Flaxman Formation, based on recent palynological studies of other more detailed sampled wells in the Otway Basin (eg. Partridge, 1994b, 1996, 1997b). The presence of *Isabelidinium evexus* ms in the deeper cuttings is consistent with a position low in the subzone. Also present in the assemblages are the zone index species *Odontochitina porifera, Isabelidinium cretaceum* and *Nelsoniella aceras*, which are each diagnostic of younger zones, and therefore indicative of material caved from the overlying Belfast and Skull Creek Mudstones. The associated spore-pollen assemblages are consistent with the *G. ancorus* Subzone of the *P. mawsonii* Zone based on presence of eponymous species in the deeper cuttings, and rare presence of *Rugulatisporites admirabilis* ms and frequent presence of *Coptospora pileolus* ms in both samples.

The two core samples between 1509.35–1515m contain diverse spore-pollen assemblages (30+ species) and can be confidently assigned to the *H. trinalis* Subzone of the *P. mawsonii* Zone based on presence of the eponymous species (Figure 1). Other key species presence are *Phyllocladidites mawsonii* in both samples, *Clavifera triplex* in the top sample, and *Appendicisporites distocarinatus*, *Rugulatisporites admirabilis* ms and *Coptospora pileolus* ms in the bottom sample. The assemblages are also assigned to broad *P. infusorioides* microplankton Zone based on the total microplankton assemblages. Even though the microplankton diversity is low in the two core samples (<10 species), the conspicuous absence of *Cribroperidinium edwardsii* indicates the assemblages are younger than the *C. edwardsii* Acme Subzone.

Because all four samples contain frequent to abundant marine microplankton (14% to 24% of total MP and SP count) the shales from which they come are considered to be marine, and diagnostic of inner to outer neritic environments. Although the environments of the shales do not necessary confirm similar environments of deposition for the associated sandstones, it is highly likely that they too may have been deposited in a marine environment.

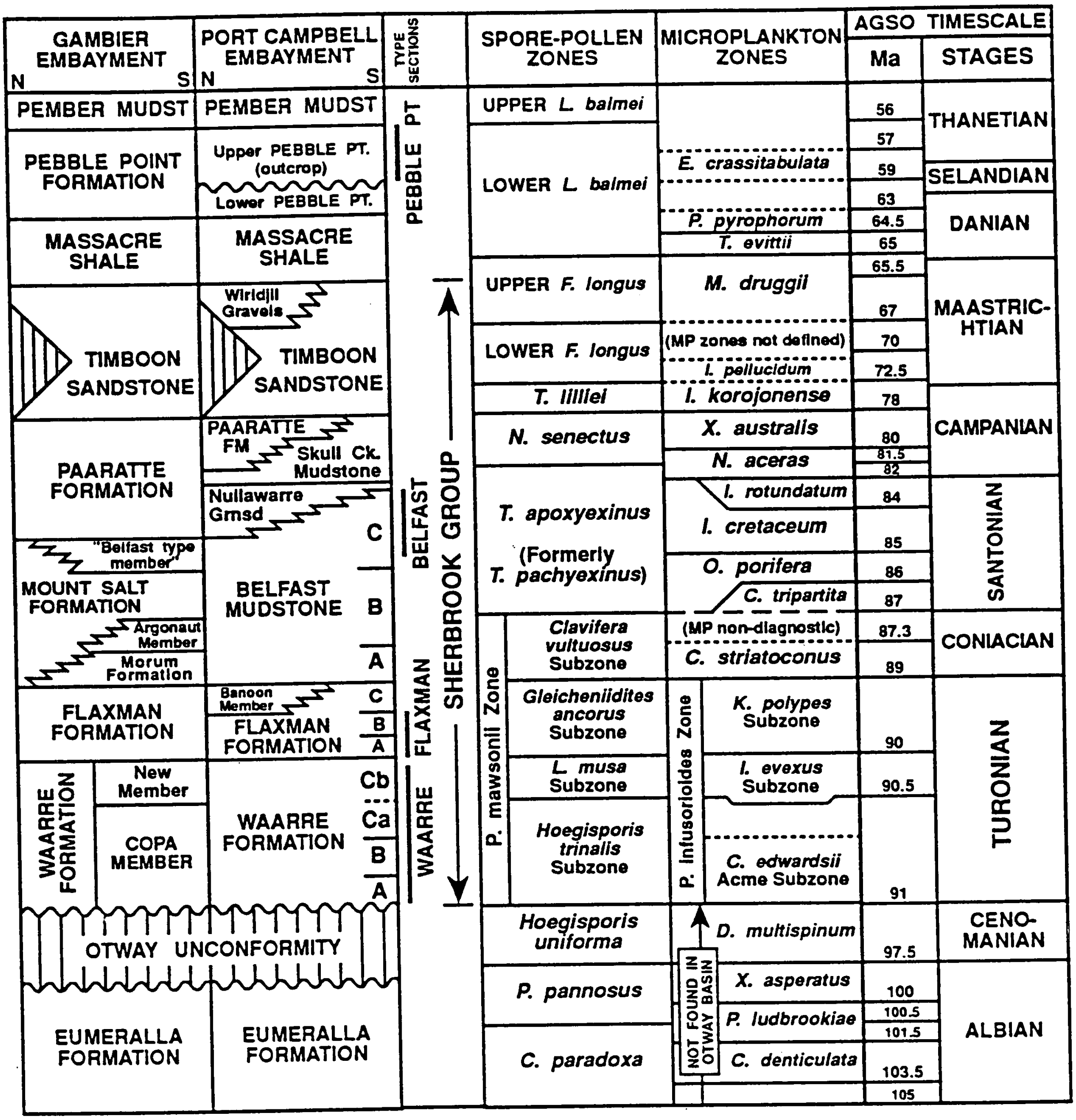

Figure 1. Revised Sherbrook Group stratigraphy, palynological biostratigraphy and proposed correlation to international stages and AGSO chronometric timescale (Young & Laurie, 1996).

Prepared by Alan D. Partridge — January 1999 version.

Discussion of Stratigraphic Assignments

The two cuttings samples contain assemblages that are most diagnostic of Flaxman Formation (= Waarre Unit D of Buffin, 1989). No species restricted to and diagnostic of the Waarre Unit C were recorded in the cuttings assemblages. There nevertheless remains the possibility that the cuttings assemblages are so heavily contaminated that the caved palynomorphs mask any older zone, but this considered unlikely based on overall assemblage composition.

The deeper two core samples contain assemblages considered characteristic of the Waarre Formation. Because these assemblages contain the key index species *Hoegisporis trinalis* (whose LAD is diagnostic of the top of the *H. trinalis* Subzone), but lack the key dinoflagellate species *Cribroperidinium edwardsii* (whose LAD is diagnostic of the top of the *C. edwardsii* Acme Subzone), the samples are interpreted to be from the lower part of Waarre Unit C or Unit Ca of Partridge (1997a).

Zones/Subzones	Iona–1 Depths & Samples MDKB	Iona–2 Depths & Samples MDKB	Iona OBS–1 Depths & Samples MDKB
I. cretaceum	1254.0m SWC	1281.0m SWC-25	Not sampled
O. porifera	Not sampled	1290.0m SWC-24 1292.5–95m Cuttings	Not sampled
C. striatoconus	1276.5m SWC-20	Not sampled	Not sampled
K. polypes	1287.0m SWC-18 1297.0m SWC-17	1303.5m SWC-23 1312.5–95m Cuttings 1315.0m SWC-22	1500m Cuttings 1506m Cuttings
I. evexus	Not sampled?	Not sampled?	Not sampled?
Upper *H. trinalis*	Not sampled	1332.5–35m Cuttings	1509.35m Core-1 1515.0m Core-1
Lower *H. trinalis* and *C. edwardsii* Acme	1347.5m SWC-10	1347.5–50m Cuttings 1353.0m SWC-21 1371.0m SWC-18	Not sampled

Figure 2: Comparison with palynological samples analysed in Iona–1 and 2.

Missing from the Iona OBS–1 sequence are assemblages typical of the *L. musa* spore-pollen Subzone and *I. evexus* microplankton Subzone found in the upper part of the Waarre Unit C (= Unit Cb of Partridge, 1997a) in other wells in the Port Campbell Embayment. Checking the available palynological data in Iona–1 (Morgan, 1988) and Iona–2 (Partridge, 1994a) suggest that both those wells also lack clear palynological evidence for presence of the *I. evexus* Subzone diagnostic of Waarre Unit Cb (Figure 2). It is therefore concluded that this latter unit is either represented essentially by the sandstones at the top of the Waarre Formation in the three wells, or is missing from the Iona Field. One way to check this hypothesis would be by additional study of Iona-1, as this well contains a conventional core and sidewall cores over the critical interval that have not yet been analysed for palynology. The additional samples recommended for analysis in core-1 are the carbonaceous parting at 1307.70–1307.75m; the thin coal at 1310.4–1310.6m, and two samples from the top and base of the 2 metre claystone bed between 1312.6–1314.6m. The additional sidewall cores that may be worth analysing (depending on their lithologies) are SWC 16 at 1301m, SWC 15 at 1318m, SWC 14 at 1321m, SWC 13 at 1324, and SWC 12 at 1328m.

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Table 1: Interpretative Palynological Data — WUGS Iona OBS–1.

Sample Type	Depth (Metres)	Spore-Pollen Zone (Microplankton Zone)	*CR	Comments
Cuttings	1500	*P. mawsonii* Zone and (*K. polypes* Subzone of *P. infusorioides* Zone)	D3 D3	Microplankton 24% and *Amosopollis cruciformis* 11% of total SP + MP count. LADs for *Kiokansium polypes* and *Valensiella griphus* confirms an age no younger than Flaxman Formation.
Cuttings	1506	*P. mawsonii* Zone and (*K. polypes* Subzone of *P. infusorioides* Zone)	D3 D3	Microplankton 51% and *Amosopollis cruciformis* 6% of total SP + MP count. FAD for *V. griphus* confirms an age no older than Flaxman Formation.
Core 1	1509.35	*H. trinalis* Subzone of *P. mawsonii* Zone and (*P. infusorioides* Zone)	A2 A5	Microplankton 16% and *Amosopollis cruciformis* 7% of total SP + MP count. LAD for *Hoegisporis trinalis* confirms an age no younger than Waarre Unit Cb.
Core 1	1515	*H. trinalis* Subzone of *P. mawsonii* Zone and (*P. infusorioides* Zone)	A1 A5	Microplankton 24% and *Amosopollis cruciformis* 11% of total SP + MP count. LAD of *Appendicisporites distocarinatus*.

LAD = Last Appearance Datum
FAD = First Appearance Datum

***Confidence Ratings used in STRATDAT data base.**

Alpha codes: Linked to sample type		**Numeric codes:** Linked to fossil assemblage		
A	Core	**1**	**Excellent confidence:**	High diversity assemblage recorded with key zone species.
B	Sidewall core	**2**	**Good confidence:**	Moderately diverse assemblage recorded with key zone species.
C	Coal cuttings	**3**	**Fair confidence:**	Low diversity assemblage recorded with key zone species.
D	Ditch cuttings	**4**	**Poor confidence:**	Moderate to high diversity assemblage recorded without key zone species.
E	Junk basket	**5**	**Very low confidence:**	Low diversity assemblage recorded without key zone species.
F	Miscellaneous/unknown			
G	Outcrop			

Table 2: Basic Palynomorph Data — WUGS Iona OBS–1.

SAMPLE TYPE	DEPTH (Metres)	Sample Wt (g)	Residue Yield	Palynomorph Concentration	Palynomorph Preservation
Cuttings	1500	13.6	Moderate	Moderate	Poor-fair
Cuttings	1506	15.0	High	Low – Moderate	Poor-fair
Core 1	1509.35	13.2	High	High	Poor-good
Core 1	1515	14.5	High	High	Poor-good

Table 3: Species distribution list for WUGS Iona OBS–1.

SPECIES	Cuttings 1500m	Cuttings 1506m	Core 1 1509.35m	Core 1 1515m
SPORES				
Aequitriradites spinulosus		X		
Antulisporites varigranulatus				X
Appendicisporites distocarinatus				X
Appendicisporites spp.	X		X	
Araucariacites australis	>2%	>2%	8%	9%
Australopollis obscurus	>1%		<1%	
Baculatisporites spp.	>2%	>5%		<1%
Balmeisporites holodictyus		~4%		
Ceratosporites equalis				X
Cicatricosisporites pseudotripartitus				X
Cicatricosisporites spp.	>1%		<1%	
Clavifera triplex	>2%	X	X	
Cononatispora perforata		X		
Coptospora pileolus ms	>2%	X		X
Cupressacites sp.	>1%		<2%	2%
Cyathidites spp. (large)	>5%	>6%	X	X
Cyathidites spp.)small)	13%	11%	8%	9%
Dictyophyllidites spp.	>3%	>4%	6%	2%
Dilwynites echinatus ms			X	X
Dilwynites granulatus	>1%	>2%	5%	3%
Dilwynites pusillus ms	>4%	>8%	7%	10%
Dulhuntyispora spp. **RW**	RW			
Foraminisporis asymmetricus				X
Foveogleicheniidites confossus			X	
Gleicheniidites ancorus ms		X		
Gleicheniidites spp.	X	>2%	3%	7%
Herkosporites elliottii			<1%	
Herkosporites proxistriatus			X	X
Hoegisporis trinalis ms			X	X
Laevigatosporites musa ms				2%
Laevigatosporites ovatus	>2%	X	<1%	<1%
Latrobosporites amplus	X			
Latrobosporites ohaiensis	X			
Leptolepidites verrucosus				X
Liliacidites spp.				X
Microbaculatispora spp. **RW**			RW	
Microcachryidites antarticus	14%	>4%	11%	8%
Murospora florida		cf		
Ornamentifera wellmanii	>1%	X		
Peromonolites sp.			<1%	X
Perotrilites majus		X	<1%	
Phyllocladidites eunuchus ms				X
Phyllocladidites mawsonii	2%	X	<2%	2%
Pilosisporites notensis **RW**	RW			
Plicatipollenites sp. **RW**	RW			
Podocarpidites spp.	25%	39%	33%	17%
Proteacidites spp.	>3%	X		
Protohaploxypinus spp. **RW**	RW			
Retitriletes austroclavatidites		X	X	
Retitriletes facetus			X	
Retitriletes spp.	>1%	>2%	X	<1%
Rugulatisporites admirabilis ms	X	X		X
Rugulatisporites mallatus			X	
Stereisporites antiquisporites				<1%
Trichotomosulcites subgranulatus	>3%	>2%	8%	14%
Tricolp(or)ates spp.	>2%		2%	<1%

Table 3: Species distribution list for WUGS Iona OBS-1 Cont...

SPECIES	Cuttings 1500m	Cuttings 1506m	Core 1 1509.35m	Core 1 1515m
Triporoletes reticulatus				<1%
Triporopollenites spp.				X
Vitreisporites signatus			<1%	
Total Spore-pollen count:	**94**	**46**	**127**	**125**
MICROPLANKTON				
Amosopollis cruciformis	48%	12%	>40%	>50%
Apteodinium sp.	X	X	X	X
Callaoisphaeridium asymmetricum				X
Chatangiella victoriensis	CV			
Cleistosphaeridium ancoriferum		X		
Cyclonephelium compactum	X			
Cyclonephelium distinctum			X	
Cyclonephelium spp.	7%			20%
Exochosphaeridium sp.	X			
Heterosphaeridium conjunctum	X			
Heterosphaeridium heteracanthum	X	X	X	X
Heterosphaeridium spp.	20%	25%	<5%	15%
Isabelidinium cretaceum	CV	>6%CV		
Isabelidinium evexus ms		X		
Kallosphaeridium sp.			X	
Kiokansium polypes	X	>6%	X	X
Nelsoniella aceras	CV			
Nummus sp.			X	X
Odontochitina costata	X	X	X	
Odontochitina porifera	>3%			
Oligosphaeridium complex	X			
Oligosphaeridium pulcherrimum		X		
Palaeohystrichosphaera infusorioides	>3%			X
Spiniferites spp.		2%	X	
Trithyrodinium spp.		X		
Valensiella griphus	X	8%		
Total Microplankton Count:	**29**	**48**	**25**	**20**
MP as % MP+SP Count:	**24%**	**51%**	**16%**	**14%**
A. cruciformis as % Total Count:	**11%**	**6%**	**7%**	**7%**
TOTAL Count:	**123**	**94**	**152**	**145**
OTHER				
Fungal fruiting bodies			X	X
Fungal spores & hyphae		C	C	C
Botryococcus sp.	X			

ABBREVIATIONS

A = Abundant
C = Common
F = Few or frequent
X = Present
RW = Reworked
CV = Caved
cf = Compared with

FACSIMILE

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2 April 1999

Our ref: PR99/04

To: Andy Whittle

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Level 49 Rialto South Tower
525 Collins Street
Melbourne 3000

Fax: (03) 9620 3109

PROVISIONAL REPORT WUGS Iona Observation Well No. 1

Sample	Depth Metres	Spore-Pollen Zone (Microplankton Zone)	Comments and Key Species Present
Cuttings	1500	*P. mawsonii* Zone and (*K. polypes* Subzone of *P. infusorioides* Zone)	Microplankton 24% and *Amosopollis cruciformis* 11% of total SP + MP count. LADs for *Kiokansium polypes* and *Valensiella griphus* confirms an age no younger than Flaxman Formation.
Cuttings	1506	*P. mawsonii* Zone and (*K. polypes* Subzone of *P. infusorioides* Zone)	Microplankton 51% and *Amosopollis cruciformis* 6% of total SP + MP count. FAD for *V. griphus* confirms an age no older than Flaxman Formation.
Core-1	1509.35	*H. trinalis* Subzone of *P. mawsonii* Zone and (*P. infusorioides* Zone)	Microplankton 16% and *Amosopollis cruciformis* 7% of total SP + MP count. LAD for *Hoegisporis trinalis* confirms an age no younger lower part of Waarre Unit C.
Core-1	1515	*H. trinalis* Subzone of *P. mawsonii* Zone and (*P. infusorioides* Zone)	Microplankton 24% and *Amosopollis cruciformis* 11% of total SP + MP count. LAD of *Appendicisporites distocarinatus*.

Discussion: The two shallower cuttings samples contain key index species diagnostic of Flaxman Formation (also called Unit D of Waarre), mixed with other species diagnostic of and caved from overlying Belfast and Skull Creek Mudstones. No species restricted to and diagnostic of the Waarre Unit C were recorded in the cuttings assemblages. It may be possible however that the cuttings assemblages are so heavily contaminated by caved palynomorphs that the latter mask any older ages, but this is considered unlikely based on overall assemblage composition.

The two core samples contain assemblages considered characteristic of the Waarre Formation. These assemblages contain the key index species *Hoegisporis trinalis*, but lack the key dinoflagellate species *Cribroperidinium edwardsii* and therefore are interpreted to lie above the acme of that species found in Waarre Unit B (see attached Figure–1). The assemblages also lack key spore-pollen and microplankton found in the *I. evexus* MP Subzone and *L. musa* SP Subzone found in some wells in the uppermost Unit Cb of the Waarre. The two core samples are therefore equated with Unit Ca of the Waarre Formation.

The assemblages from Iona OBS–1 have also been compared to assemblages recorded by Partridge (1994; *Biostrata Report 1994/4*) from the Iona–2 well. The assemblages from the two new cuttings samples correlated to assemblages recovered from SWCs at 1303.4m and 1315m MDKB in Iona–2, while the two new core samples correlated to the cuttings at 1332.5–1335m MDKB in Iona–2.

Deeper samples in Iona–2 such as cuttings at 1347.5–1350m MDKB and the SWC at 1353m MDKB, are considered to contain older assemblages as they contain multiple specimens of the dinoflagellate *Cribroperidinium edwardsii* and therefore are referred to *C. edwardsii* Acme Subzone.

It should be noted that some of the zone assignments given in my original Iona–2 report need to be revised because that report predates the new spore-pollen and microplankton subzones shown on accompanying Figure–1. The necessary corrections will be discussed in the final report.

Analysis and report prepared by:

Alan Partridge

Alan D. Partridge

FACSIMILIE

To: Andy Whittle

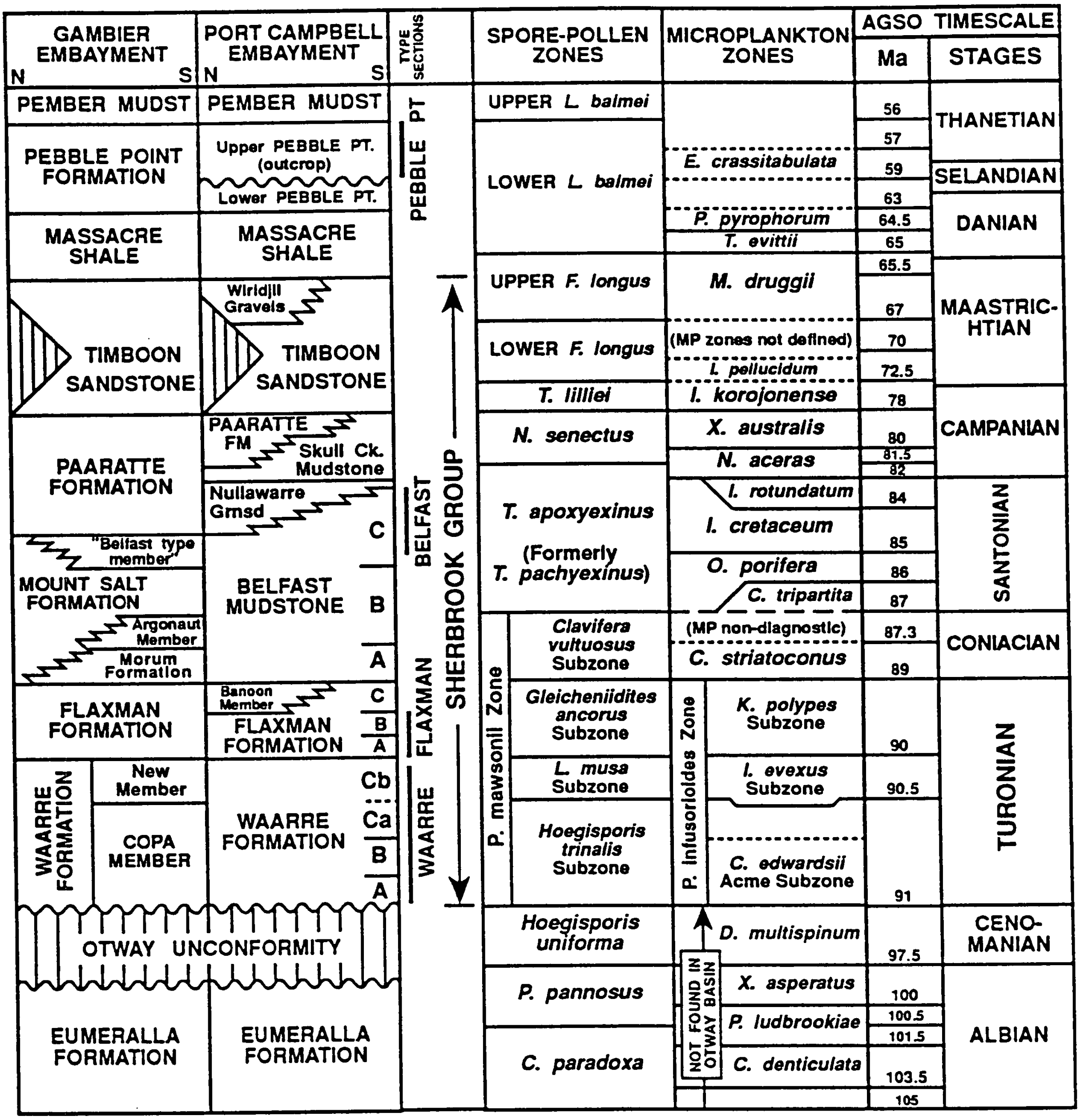

Figure 1. Revised Sherbrook Group stratigraphy, palynological biostratigraphy and proposed correlation to international stages and AGSO chronometric timescale (Young & Laurie, 1996).

Prepared by Alan D. Partridge — January 1999 version.

APPENDIX 6

Core chip descriptions

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Core Chip Description** **Well:** **Iona Obs-1** **Permit:** **PPL-2**
		6" Section (Core#1 (1509.35 – 1515.55 mRT) Core#2 (1527.35 – 1534.28 mRT)
1509.35 Core#1	100	**CLAYSTONE:** medium to dark grey, firm, moderately well bedded, minor to common carbonaceous laminations and leaf fossil fragments, rare to minor micro micaceous, trace pyrite, trace resin
1515.14 Core#1	100	**CLAYSTONE:** medium to dark grey, firm, moderately well bedded, minor to common carbonaceous laminations and leaf fossil fragments, rare to minor micro micaceous, trace pyrite, trace resin
1515.55 Core#1	100	**ARGILLACEOUS SANDSTONE:** medium grey to medium dark grey, fine sand to very coarse, minor quartz pebble grains, dominantly medium to coarse, very poorly sorted, angular to sub rounded, moderate to good sphericity, abundant clay matrix, trace to rare pyrite cement, poor visible porosity, No shows
1527.35 Core#2	100	**SANDSTONE:** light to medium dark grey, fine to coarse, dominantly medium, well sorted, angular to sub rounded, moderate to good sphericity, rare to minor clay matrix, trace to rare pyrite cement, trace black lithic grains, excellent visible porosity, No shows
1533.88 Core#2	100	**SANDSTONE:** light to medium dark grey, fine to coarse, dominantly fine to medium, well sorted, angular to sub rounded, moderate to good sphericity, rare to minor clay matrix, trace to rare pyrite cement, trace black lithic grains, excellent visible porosity, No shows
1534.28 Core#2	100	**SANDSTONE:** light to medium dark grey, fine to coarse, dominantly fine to medium, well sorted, angular to sub rounded, moderate to good sphericity, rare to minor clay matrix, trace to rare pyrite cement, trace black lithic grains, excellent visible porosity, No shows

APPENDIX 7

Western Underground Gas Storage Iona Obs-1 Report – Well Seismic Edit and Geogram. Schlumberger GeoQuest

Schlumberger

GeoQuest

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WESTERN UNDERGROUND GAS STORAGE

IONA OBS-1

REPORT

WELL SEISMIC EDIT

AND GEOGRAM

FIELD	:	IONA
COUNTRY	:	AUSTRALIA
WELL HEAD POSITION	: :	5728559.0 N 677741.5 E
LOCATION	:	VICTORIA
DATE OF VSP SURVEY	:	24-FEB-1999
REFERENCE NO.	:	561285

March 1999

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IONA OBS-1 Borehole Seismic

IONA OBS-1 Borehole Seismic

List of Figures

List of Enclosures

Summary of Geophysical Listings

IONA OBS-1 Borehole Seismic

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Introduction

Checkshot data was acquired with the Seismic Acquisition Tiool (SAT-A) in the IONA OBS-1 deviated onshore well on the 24th of February 1999. The IONA OBS-1 well is operated by **WESTERN UNDERGROUND GAS STORAGE**. A SM4 was used as the downhole geophone and the air gun (200 cu. in) was used as the source.

Processing of the data consisted of loading the raw data, editing bad shots, picking transit times, stacking and then applying corrections to Seismic Reference Depth (SRD) which in this case is at Mean Sea Level (MSL).

CONVENTION.

In the plots, each processing step is displayed according to the *SEG normal* polarity convention (1976) whereby an upgoing compressional wave, reflected by an increase of acoustic impedance with depth, is displayed as a white trough.

Data Acquisition

Table 1. Survey Parameters

Elevation of KB	137.5m above MSL
Elevation of DF	137.2 m above MSL
Elevation of GL	132.5 m above MSL
Level Interval	150.9-1235.9 VD MSL
Energy Source	Air gun
Source Offset	590 m
Source Depth	105.9 m above MSL
Reference Sensor	Reference hydrophone
Hydrophone Offset	590 m
Hydrophone Depth	106.4 m above MSL
Source & Hyd. Azimuth	127 Degrees
Tool Type	200 cu. in. air gun
Tool Combination	Stand Alone
Number of Axis	3
Geophone Type	SM-4
Sampling Rate	1.0 ms
Recording Time	3.0 s
Acquisition Unit	MAXIS 500
Recording Format	DLIS

WELL SEISMIC EDIT

Each shot of the raw geophone data was evaluated and edited as necessary.

The good shots at each level were stacked, using a median stacking technique, to increase the signal to noise ratio of the data. The transit time of each trace was re-computed after stacking. Stacked X,Y,Z components are displayed in Plot 1.

Data Quality

The overall quality of the data is good. The traces above level 719.3 mKB are noisy due to poor casing coupling.

Transit Time Measurement

The transit time measured, Delta t, corresponds to a difference between arrivals recorded by surface and downhole sensors. The reference time (zero time) is the physical recording of the source signal by accelerometers (fire pulse) on the gun or sensors positioned near the source (reference hydrophone and surface geophone). In this case, the reference hydrophone was used as the reference. First break picking algorithms were used on both the reference hydrophone and the downhole geophone.

Correction to Datum

Seismic Reference Datum (SRD) is at Mean Sea Level (MSL).

The source was positioned in the pit at 590 m, 127 degrees from the wellhead. Source elevation is 105.9 m above MSL. The surface velocity (1386.4 m/s) from the gun to MSL was supplied by the client.

Geophysical Airgun Report

The Geophysical Airgun Report listing contains all downhole seismic measurements obtained by analyzing stacked shots.

The level number, corresponding KB and SRD depth, observed (non-vertical) transit times and corrected (vertical) transit times from the source and from SRD are listed. Also included are average velocities between SRD and geophone together with level separation and corresponding transit times and finally interval velocities between levels. Vertical transit times have been corrected for the effects of geometry. The interval velocities listed are those computed from corrected (i.e. vertical) transit times.

Sonic Calibration Processing

Sonic Calibration

The aim of the sonic calibration is to reconcile seismic (checkshot) times and integrated sonic times for any given depth in a well. In the presence of checkshot data with scatter, the calibration always adjusts the sonic integrated times to match smoothed checkshot times.

A *drift* curve is determined by comparing an integrated sonic log transit time and vertical check shot times. The term drift is defined as the seismic time (from check shots) minus the sonic time (from integration of edited sonic). Commonly the word drift is used to identify the difference between sonic and seismic measurements either between two or more levels or over different zones in a well.

For a negative drift, $\frac{\Delta Drift}{\Delta Depth} < 0$ the sonic time is greater than the seismic time over a certain section of the log.

For a positive drift, $\frac{\Delta Drift}{\Delta Depth} > 0$ the sonic time is less than the seismic time over a certain section of the log.

The drift curve, between two levels, is then an indication of the error on the integrated sonic or an indication of the amount of correction required on the sonic to have the TTI of the corrected sonic match the check shot times.

Two methods of correction to the sonic log are used.

1. Uniform or block shift. This method applies a uniform correction to all the sonic values over the interval. This uniform correction is applied in the case of positive drift and is the average correction represented by the drift curve gradient expressed in µsec/ft .

2. ΔT Minimum. In the case of negative drift a second method is used, called ΔT minimum. This applies a differential correction to the sonic log, where it is assumed that the greatest amount of transit time error is caused by the lower velocity sections of the log. Over a given interval the method will correct only Δt values which are higher than a threshold, the Δt_{min} . Values of Δt which are lower than the threshold are not corrected. The correction is a reduction of the excess of Δt over Δt_{min}, $\Delta t - \Delta t_{min}$.

$\Delta t - \Delta t_{min}$ is reduced through multiplication by a reduction coefficient which remains constant over the interval. This reduction coefficient, named G, can be defined as:

$$G = 1 + \frac{Drift}{\int (\Delta t - \Delta t_{\min})dz}$$

Where *Drift* is the drift over the interval to be corrected and the value $\int (\Delta t - \Delta t_{min})dz$ is the time difference between the integrals of the two curves Δt and Δt_{min} only over the intervals where $\Delta t > \Delta t_{min}$.

Hence the corrected sonic: $\Delta t = G(\Delta t - \Delta t_{min}) + \Delta t_{min}$.

Open Hole Logs

The following table summarizes the availability of the sonic and density logs.

Log	Type	Interval
Sonic	Sonic data (STC processing result)	698.1-1540.4 mKB
Density	Density data	666-1570.6 mKB

DTCO curve after STC processing was used as a sonic curve. Both sonic and density have been depth matched and edited of bad hole effects.

The gamma ray, deep resistivity and caliper logs have been included as correlation curves where they were available.

Sonic Calibration Output

Drift Computation Report

The Drift Computation Report contains the basic comparison of raw seismic and edited sonic integrated times at checkshot levels.
The level number, measured depth and vertical depth for all levels, vertical checkshot times adjusted to SRD and corresponding integrated sonic times are compiled in the listing. The drift between two adjacent checkshot levels is listed in milliseconds and the corrections to be applied to the sonic log in µsec/ m are also listed for all intervals between two adjacent levels .

Sonic Adjustment Parameter Report

This listing shows the depth of selected knees from KB and SRD together with the measured drift. The amount of sonic adjustment and the type of correction (block shift or Delta T Minimum) plus the corresponding reduction factor G if applicable are all printed out.

Drift Curve Plot

The Drift Computation Report and Sonic Adjustment Report are graphically summarized on the Drift Curve Plot. The raw and selected (smoothed) drift curves, position of knees, and corresponding drift at all checkshots and knees are all indicated on the Drift Curve Plot.

Raw and Drift Corrected Sonic Plot

The effect of the shifts listed in the Sonic Adjustment Parameter Report on the edited sonic log and the results of sonic adjustment for drift are graphically displayed on the Raw and Corrected Sonic Plot.

Velocity Report

The interval velocities between two adjacent checkshot levels computed from corrected (adjusted) sonic log are listed in the Velocity Report. The residual errors between checkshots and integrated sonic times after calibration (adjustment) are also listed in the Velocity Report for every checkshot level.

Time and Velocity vs. Depth Plot

Four velocities - Average, Interval, Continuous and Root Mean Square together with Time vs. Depth curve are computed for all checkshot levels. The results are plotted as a function of depth on the Time and Velocity vs. Depth Plot.

Interval velocities (v_{int}) are those computed between two adjacent checkshot levels from corrected sonic logs and listed in the Velocity Report. Interval velocity is defined as

$$v_{int} = z_n - z_{n-1} \text{ over } t_n - t_{n-1}$$

where z_n is the depth of nth layer and t_n its corresponding integrated sonic time.

Average velocities (v_{ave}) are computed by dividing SRD depth of checkshots and their corresponding integrated sonic times from corrected sonic log.

$$v_{ave} = \frac{\sum v_n t_n}{\sum t_n}$$

The continuous velocity curve is an inverse of sonic log displayed not as slowness in µsec/ ft but as velocity in meters/second.

Root Mean Square Velocity (v_{rms}) is computed from calibrated sonic logs by

$$v_{rms} = \sqrt{\frac{\sum v_n^2 t_n}{\sum t_n}}$$

where v_n is an interval velocity over some specific time increment Delta t_n of calibrated sonic log.

The Time vs. Depth Curve is the result of integration of the calibrated sonic log and is plotted as one way time (OWT) against depth.

Time Converted Velocity Report

This listing is obtained from the calibrated sonic log. Average, RMS and Interval velocities are computed at one millisecond intervals one way time (OWT). The results are listed against two way time (TWT) together with corresponding measured (KB) and seismic datum (SRD) depths. Interval velocities are between two adjacent computations (two milliseconds TWT apart) whereas average and RMS are from SRD.

Sonic Calibration Results

Plot 2 is a display of the sonic calibration output in 22" format. 11" drift corrected sonic log in 1:200 scale also included as attachment.

Top of the sonic log was chosen as the start of the drift computation.

The calculated drift was small and well defined exhibiting very little scatter. The drift curve as expected increases steadily to a cumulative value of 5.74 msec at TD.

Knees are selected from the raw drift curve and lithological boundaries marked by the well logs. The depths of the knees define the zones for the adjustment.
The selected drift at the knees, defines the amount of time adjustment to the sonic log in each zone.

Geogram Processing

GEOGRAM plots 3, 4 and 5 were generated using 25, 35 and 45 Hz zero phase Ricker wavelets (the sonic log used to generate the Geograms was calibrated using first break transit-times). All GEOGRAM presentations include both normal and reverse polarity on a time scale of 25 cm/sec.

GEOGRAM processing produces synthetic seismic traces based on reflection coefficients generated form sonic and density measurements in the well-bore. The steps in the processing chain are described below.

Depth to Time Conversion

Open hole logs are recorded from the bottom to top with a depth index. These data are converted to a two-way time index and flipped to read form the top to bottom in order to match the seismic section.

Primary Reflection Coefficients

Sonic and density data are averaged over chosen time intervals (normally 2 or 4 milliseconds). Reflection coefficients are then computed using:

$$R = \frac{\rho_2 v_2 - \rho_1 v_1}{\rho_2 v_2 + \rho_1 v_1}$$

where:

ρ_1 = density of the layer above the reflection interface
ρ_2 = density of the layer below the reflection interface
v_1 = compressional wave velocity of the layer above the reflection interface
v_2 = compressional wave velocity of the layer below the reflection interface

This computation is done for each time interval to generate a set of primary reflection coefficients without transmission losses.

Primaries with Transmission Loss

Transmission loss on two-way attenuation coefficients is computed using:

$$A_n = (1 - R_1^2).(1 - R_2^2).(1 - R_3^2)...(1 - R_n^2)$$

A set of primary reflection coefficients with transmission loss is generated using:

$$Primary_n = R_n . A_{n-1}$$

Primaries plus Multiples

Multiples are computed from these input reflection coefficients using the transform technique from the top of the well to obtain the impulse response of the earth. The transform outputs primaries plus multiples.

Multiples Only

By subtracting previously calculated primaries form the above result we obtain multiples only.

Wavelet

A theoretical wavelet is chosen to use for convolution with the reflection coefficients previously generated. Choices available include:

Klauder wavelet
Ricker zero phase wavelet
Ricker minimum phase wavelet
Butterworth wavelet
User defined wavelet

Time variant Butterworth filtering can be applied after convolution.

Polarity Convention

Throughout this report the following polarity convention is used. An increase in acoustic impedance gives a positive reflection coefficient, is written to tape as a negative number and is displayed as a white trough under normal polarity. This is displayed in figure 1.

Convolution

The standard procedure of convolving the wavelet with reflection coefficients is performed; the output is the synthetic seismogram.

Geograms were generated with zero phase Ricker wavelets with central frequencies of 25 Hz, 30 Hz and 45 Hz. They are displayed in Plots 3, 4 and 5.

A Summary of Geophysical Listings

Five geophysical data listings are appended to this report. Following is a brief description of the format of each listing.

A1 Geophysical Airgun Report

1. Level number: the level number starting from the top level (includes any imposed shots).

2. Measured depth from KB: *dkb*, the depth in meters from Kelly bushing.

3. Vertical depth form SRD: *dsrd*, the depth in meters from seismic reference datum.

4. Observed travel time HYD to GEO: *tim0*, the transit time picked form the stacked data by subtracting the surface sensor first break time from the downhole sensor first break time.

5. Vertical travel time SRC to GEO: *timv*, is corrected for source to hydrophone distance and for source offset.

6. Vertical travel time SRD to GEO: *shtm*, is *timv* corrected for the vertical distance between source and datum.

7. Average velocity SRD to GEO: the average seismic velocity from datum to the corresponding checkshot level, $\frac{\text{dsrd}}{\text{shtm}}$.

8. Delta depth between shots: Δ*depth*, the vertical distance between each level.

9. Delta time between shots: Δ*time*, the difference in vertical travel time (*shtm*),between each level.

10. Interval velocity between shots: the average seismic velocity between each level, $\frac{\Delta depth}{\Delta\ time}$.

A2 Drift Computation Report

1. Level number: the level number starting from the top level (includes any imposed shots).

2. Vertical depth from KB: the depth in meters from Kelly bushing

3. Vertical depth from SRD: the depth in meters from seismic reference datum.

4. Vertical travel time SRD to GEO: the calculated vertical travel time from datum to downhole geophone (see column 7, Geophysical Airgun Report).

5. Integrated raw sonic time: the raw sonic log is integrated from top to bottom and listed at each level. An initial value at the top of the sonic log is set equal to the checkshot time at that level. This may be an imposed shot if a shot was not taken at the top of the sonic.

6. Computed drift at level: the checkshot time minus the integrated raw sonic time.

7. Computed blk-shft correction: the drift gradient between any two checkshot levels

$$\frac{\Delta drift}{\Delta depth}$$

A3 Sonic Adjustment Parameter Report

1. Knee number: the knee number starting from the highest knee. (The first knees listed will generally be at SRD and the top of sonic. The drift imposed at these knees will normally be zero.)

2. Vertical depth from KB: the depth in meters from Kelly bushing

3. Vertical depth from SRD: the depth in meters from seismic reference datum.

4. Drift at knee: the value of drift imposed at each knee.

5. Blockshift used: the change in drift divided by the change in depth between any two levels.

6. Delta-T minimum used: see section 4 of report for an explanation of $\Delta\ t_{min}$.

7. reduction factor: see section 4 of report.

8. Equivalent blockshift: the gradient of the imposed drift curve.

A4 Velocity Report

1. Level number: the level number starting from the top level (includes any imposed shots).

2. Vertical depth from KB: the depth in meters form Kelly bushing.

3. Vertical depth from SRD: the depth in meters from seismic reference datum.

4. Vertical travel time SRD to GEOPH: the vertical travel time from SRD to downhole geophone (see column 7, Geophysical Airgun Report)

5. Integrated adjusted sonic time: the adjusted sonic log is integrated from top to bottom. An initial value at the top of the sonic is set equal the checkshot time at that level. (the adjusted sonic log is the drift corrected sonic log.)

6. Drift=shot time-raw sonic: the check shot time minus the raw integrated sonic time.

7. Residual=shot time-adj sonic: the check shot time minus the adjusted integrated sonic time. This is the difference between calculated drift and the imposed drift.

8. Adjusted interval velocity: the interval velocity calculated from the integrated adjusted sonic time at each level.

A5 Time Converted Velocity Report

The data in this listing has been re-sampled in time.

1. Two way travel time from SRD: this is the index for the data in this listing. The first value is at SRD (0 milliseconds) and the sampling rate is 2 milliseconds.

2. Measured depth from KB: the depth from KB at each corresponding value of two way time.

3. Vertical depth from SRD: the vertical depth from SRD at each corresponding value of two way time.

4. Average velocity SRD to GEO: the vertical depth from SRD divided by half the two way time.

5. RMS velocity: the root mean square velocity from datum to the corresponding value of two way time.

$$v_{rms} = \sqrt{\frac{\sum v_i^2 t_i}{\sum t_i}}$$

where v_i is the velocity between each 2 millisecond interval.

6. First normal moveout: the correction time in milliseconds to be applied to the two way travel time for a specified moveout distance (default = 1000 M).

$$\Delta t = \sqrt{t^2 + (\frac{x}{v_{rms}})^2} - t$$

where:

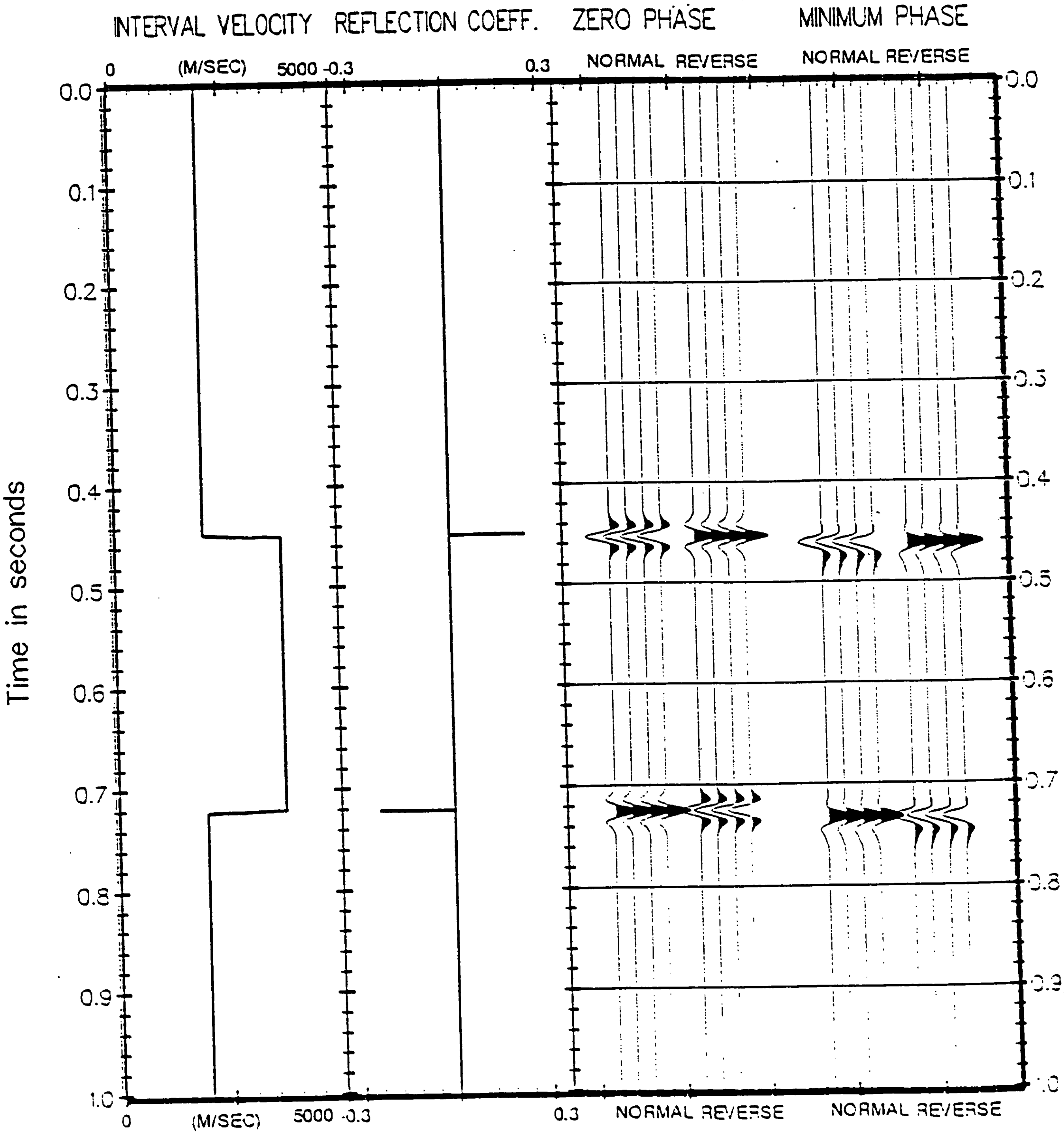
Δt = normal moveout (secs)
X = moveout distance (meters)
t = two way time (secs)
v_{rms} = rms velocity (meters / sec)

7. Second normal moveout: the correction time in milliseconds to be applied to the two way travel tome for a specified moveout distance (default = 1500 M).

8. Third normal moveout: the correction time in milliseconds to be applied to the two way travel time for a specified moveout distance (default = 2000 M)

9. Interval velocity: the velocity between each sampled depth. Typically, the sampling rate is 2 milliseconds two way time, (1 miles one way time) therefore the interval velocity will be equal to the depth increment divided by 0.002. It is equivalent to column 9 from the Velocity Report.

SCHLUMBERGER (SEG-1976) WAVELET POLARITY CONVENTION



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*                  *
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*                  *
*   SCHLUMBERGER   *
*                  *
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GEOPHYSICAL AIRGUN REPORT

COMPANY : WESTERN UNDERGROUND GAS STORAGE

WELL : IONA OBS-1

FIELD : IONA

STATE : VICTORIA

COUNTRY : AURTRALIA

REFERENCE: 561285

LOGGED : 24-FEB-1999

LONG DEFINITIONS

GLOBAL

KB - Elevation of the KELLY-BUSHING Above MSL or MWL
SRD - Elevation of the Seismic Reference Datum Above MSL or MWL
EKB - Elevation of Kelly Bushing
VELHYD - VELOCITY OF THE MEDIUM BETWEEN THE SOURCE AND THE HYDROPHONE
VELSUR - VELOCITY OF THE MEDIUM BETWEEN THE SOURCE AND THE SRD

MATRIX

GUNELZ - SOURCE ELEVATION ABOVE SRD (ONE FOR THE WHOLE JOB; OR ONE PER SHOT)
GUNEWZ - SOURCE DISTANCE FROM THE BOREHOLE AXIS IN EW DIRECTION (CF. GUNELZ)
GUNNSZ - SOURCE DISTANCE FROM THE BOREHOLE AXIS IN NS DIRECTION (CF. GUNELZ)
HYDELZ - HYDROPHONE ELEVATION ABOVE SRD (CF. GUNELZ)
HYDEWZ - HYDROPHONE DISTANCE FROM THE BOREH AXIS IN EW DIRECTION (CF GUNELZ)
HYDNSZ - HYDROPHONE DISTANCE FROM THE BOREH AXIS IN NS DIRECTION (CF GUNELZ)
TRTHYD - TRAVEL TIME FROM THE HYDROPHONE TO THE SOURCE
TRTSRD - TRAVEL TIME FROM THE SOURCE TO THE SRD
DEVWEL - DEVIATED WELL DATA PER SHOT : MEAS. DEPTH, VERT. DEPTH, EW, NS

SAMPLED

SHOT.GSH - Shot number
DKB.GSH Measured Depth from Kelly-Bushing
DSRD.GSH - Depth from SRD
TIMO.GSH - Tie In Memorized Output
TIMV.GSH - Vertical Travel Time from the Source to the Geophone
SHTM.GSH - Shot time (WST)
AVGV.GSH - Average Seismic Velocity
DELZ.GSH - Depth Interval between Successive Shots
DELT.GSH - Travel Time Interval between Successive Shots
INTV.GSH - Internal Velocity, Average

(GLOBAL PARAMETERS)			(VALUE)	
ELEV OF KB AB. MSL (WST)	KB	:	137.500	M
ELEV OF SRD AB. MSL(WST)	SRD	:	0	M
Elevation of Kelly Bushi	EKB	:	137.500	M
VEL SOURCE-HYDRO(WST)	VELHYD	:	1524.00	M/S
VEL SOURCE-SRD (WST)	VELSUR	:	1386.40	M/S

(MATRIX PARAMETERS)

908918 320

	SOURCE ELV M	SOURCE EW M	SOURCE NS M	HYDRO ELEV M	HYDRO EW M	HYDRO NS M
1	101.9	471.2	-355.1	102.4	471.2	-355.1

TRT HYD-SC MS	TRT SC-SRD MS
.33	-73.50

	MD @ KB M	VD @ KB M	VD @ SRD M	E-W COORD M	N-S COORD M
1	292.8	288.4	150.9	26.5	-20.4
2	360.2	348.9	211.4	49.6	-39.1
3	625.3	559.0	421.5	177.8	-136.7
4	700.0	618.2	480.7	214.4	-163.9
5	719.3	633.6	496.1	223.7	-170.9
6	785.5	686.8	549.3	255.4	-194.2
7	860.0	747.7	610.2	289.8	-219.8
8	960.0	831.8	694.3	332.0	-253.7
9	1060.0	918.4	780.9	371.8	-284.0
10	1160.0	1008.0	870.5	408.3	-309.2
11	1193.0	1038.1	900.6	419.3	-316.9
12	1337.5	1174.9	1037.4	455.4	-344.7
13	1433.5	1269.3	1131.8	468.9	-355.6
14	1477.3	1312.9	1175.4	472.3	-357.5
15	1508.3	1343.9	1206.4	473.6	-357.5
16	1517.0	1352.6	1215.1	474.0	-357.4
17	1537.9	1373.4	1235.9	474.9	-357.3

908918 321

LEVEL NUMBER	MEASUR DEPTH FROM KB M	VERTIC DEPTH FROM SRD M	OBSERV TRAVEL TIME HYD/GEO MS	VERTIC TRAVEL TIME SRC/GEO MS	VERTIC TRAVEL TIME SRD/GEO MS	AVERAGE VELOC SRD/GEO M/S	DELTA DEPTH BETWEEN SHOTS M	DELTA TIME BETWEEN SHOTS MS	INTERV VELOC BETWEEN SHOTS M/S
1	292.8	150.9	351.50	145.54	72.04	2095	60.5	32.80	1843
2	360.2	211.4	348.60	178.33	104.84	2017	210.1	96.37	2181
3	625.3	421.5	334.80	274.71	201.21	2095	59.2	22.58	2621
4	700.0	480.7	338.90	297.29	223.79	2148	15.4	7.91	1942
5	719.3	496.1	343.10	305.21	231.71	2141	53.2	21.14	2518
6	785.5	549.3	352.80	326.35	252.85	2173	60.9	22.49	2708
7	860.0	610.2	365.70	348.84	275.34	2216	84.1	34.52	2435
8	960.0	694.3	391.90	383.36	309.86	2241	86.5	32.20	2687
9	1060.0	780.9	419.20	415.57	342.07	2283	89.6	34.72	2581
10	1160.0	870.5	451.40	450.29	376.79	2310	30.2	10.29	2932
11	1193.0	900.6	461.20	460.58	387.08	2327	136.8	49.58	2759
12	1337.5	1037.4	509.90	510.16	436.66	2376	94.4	31.57	2990
13	1433.5	1131.8	541.40	541.73	468.23	2417	43.6	16.40	2659
14	1477.3	1175.4	557.80	558.13	484.63	2425	31.0	10.70	2895
15	1508.3	1206.4	568.50	568.83	495.33	2436	8.7	2.60	3344
16	1517.0	1215.1	571.10	571.43	497.93	2440	20.9	5.40	3868
17	1537.9	1235.9	576.50	576.83	503.33	2456			

908918 322

SCHLUMBERGER

DRIFT COMPUTATION REPORT

COMPANY : WESTERN UNDERGROUND GAS STORAGE

WELL : IONA OBS-1

FIELD : IONA

STATE : VICTORIA

COUNTRY : AURTRALIA

REFERENCE: 561285

LOGGED : 24-FEB-1999

ANALYST: YURI SOLOVYOV 18-MAR-99 09:13:40` PROGRAM: GDRIFT 007.E10

908918 323

LONG DEFINITIONS

GLOBAL

```
KB     - Elevation of the KELLY-BUSHING Above MSL or MWL
SRD    - Elevation of the Seismic Reference Datum Above MSL or MWL
EKB    - Elevation of Kelly Bushing
XSTART - TOP OF ZONE PROCESSED BY WST
XSTOP  - BOTTOM OF ZONE PROCESSED BY WST
UNFDEN - UNIFORM DENSITY VALUE
GAD001 - RAW SONIC CHANNEL NAME USED FOR WST SONIC ADJUSTMENT
```

ZONE

```
LOFDEN - LAYER OPTION FLAG FOR DENSITY : -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYDEN - USER SUPPLIED DENSITY DATA
```

SAMPLED

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SHOT   - Shot number
DKB    - Measured Depth from Kelly-Bushing
DSRD   - Depth from SRD
SHTM   - Shot time (WST)
RAWS     Raw Sonic (WST)
SHDR   - Drift at Shot or Knee
BLSH   - Block Shift between Shots or Knee
```

(GLOBAL PARAMETERS)			(VALUE)	
ELEV OF KB AB. MSL (WST)	KB	:	137.500	M
ELEV OF SRD AB. MSL(WST)	SRD	:	0	M
Elevation of Kelly Bushi	EKB	:	137.500	M
TOP OF ZONE PROCD (WST)	XSTART	:	0	M
BOT OF ZONE PROCD (WST)	XSTOP	:	0	M
UNIFORM DENSITY VALUE	UNFDEN	:	2.30000	G/C3
RAW SONIC CH NAME (WST)	GAD001	:	DT.ATT.003.TVD.FLP.*```````````````````	

(ZONED PARAMETERS)			(VALUE)		(LIMITS)		
LAYER OPTION FLAG DENS	LOFDEN	:	1.000000		30479.7	-	0
USER SUPPLIED DENSITY DA	LAYDEN	:	0	G/C3	0	-	0

908918 324

COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

LEVEL NUMBER	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	VERTICAL TRAVEL TIME SRD/GEO MS	INTEGRATED RAW SONIC TIME MS	COMPUTED DRIFT AT LEVEL MS	COMPUTED BLK-SHFT CORRECTION US/M
						0
1	292.8	150.9	72.04	72.04	0	
						0
2	360.2	211.4	104.84	104.84	0	
						0
3	625.3	421.5	201.21	201.21	0	
						0
4	700.0	480.7	223.79	223.79	0	
						0
5	718.6	495.6	231.44	231.44	0	
						127.64
6	719.3	496.1	231.71	231.64	.07	
						48.88
7	785.5	549.3	252.85	250.18	2.67	
						-9.91
8	860.0	610.2	275.34	273.28	2.07	
						20.99
9	960.0	694.3	309.86	306.03	3.83	
						3.92
10	1060.0	780.9	342.07	337.90	4.17	
						20.85
11	1160.0	870.5	376.79	370.75	6.04	
						-17.90
12	1193.0	900.6	387.08	381.58	5.50	
						4.84
13	1337.5	1037.4	436.66	430.50	6.16	
						5.65
14	1433.5	1131.8	468.23	461.53	6.69	
						13.44
15	1477.3	1175.4	484.63	477.35	7.28	
						27.21
16	1508.3	1206.4	495.33	487.20	8.12	
						-28.92
17	1517.0	1215.1	497.93	490.06	7.87	
						-52.82
18	1537.9	1235.9	503.33	496.56	6.77	
						0
19	1540.5	1238.5	504.13	497.36	6.77	

908918 325

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*   SCHLUMBERGER   *
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SONIC ADJUSTMENT PARAMETER REPORT

COMPANY : WESTERN UNDERGROUND GAS STOR

WELL : IONA OBS-1

FIELD : IONA

STATE : VICTORIA

COUNTRY : AURTRALIA

REFERENCE: 561285

LOGGED : 24-FEB-1999

ANALYST: YURI SOLOVYOV 18-MAR-99 10:41:10` PROGRAM: GADJST 008.E09

908918 326

LONG DEFINITIONS

GLOBAL

SRCDRF - ORIGIN OF ADJUSTMENT DATA
CONADJ - CONSTANT ADJUSTMENT TO AUTOMATIC DELTA-T MINIMUM = 7.5 US/F
UNERTH - UNIFORM EARTH VELOCITY (GTRFRM)

ZONE

ZDRIFT - USER DRIFT AT BOTTOM OF THE ZONE
ADJOPZ - TYPE OF ADJUSTMNENT IN THE DRIFT ZONE : 0=DELTA-T MIN, 1=BLOCKSHIFT
ADJUSZ - DELTA-T MINIMUM USED FOR ADJUSTMENT IN THE DRIFT ZONE
LOFVEL - LAYER OPTION FLAG FOR VELOCITY: -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYVEL - USER SUPPLIED VELOCITY DATA

SAMPLED

SHOT - Shot number
VDKB - Vertical Depth Relative to KB
DSRD - Depth from SRD
KNEE - Knee
BLSH - Block Shift between Shots or Knee
DTMI Value of Delta-T Minimum used
COEF - Delta-T MIN Coefficient used in the Drift Zone
DRGR - Gradient of Drift Curve

(GLOBAL PARAMETERS)		(VALUE)	
ORIG OF ADJ DATA (WST)	SRCDRF	: 2.00000	
CONS SONIC ADJST (WST)	CONADJ	: 24.6063	US/M
UNIFORM EARTH VELOCITY	UNERTH	: 2095.00	M/S

(ZONED PARAMETERS)		(VALUE)		(LIMITS)		
USER DRIFT ZONE (WST)	ZDRIFT	: 5.739999	MS	1373.40	-	1037.50
		4.900000		1037.50		827.500
		3.400000		827.500		633.000
		0		633.000		0
ADJUSMNT MODE (WST)	ADJOPZ	:-999.2500		30479.7	-	0
USER DELTA-T MIN (WST)	ADJUSZ	:-999.2500	US/M	30479.7	-	0
LAYER OPTION FLAG VELOC	LOFVEL	: 1.000000		30479.7	-	0
USER VELOC (WST)	LAYVEL	: 1942.000	M/S	633.000	-	618.200
		2621.000		618.200		559.000
		2181.000		559.000		348.900
		1843.000		348.900		288.400
		2095.000		288.400		0

908918 327

COMPANY : WESTERN UNDERGROUND GAS STOR   WELL : IONA OBS-1

KNEE NUMBER	VERTICAL DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	DRIFT AT KNEE MS	BLOCKSHIFT USED US/M	DELTA-T MINIMUM USED US/M	REDUCTION FACTOR G	EQUIVALENT BLOCKSHIFT US/M
				0			0
2	633.0	495.5	0				
				17.48			17.48
3	827.5	690.0	3.40				
				7.14			7.14
4	1037.5	900.0	4.90				
				2.50			2.50
5	1373.4	1235.9	5.74				

908918 328

SCHLUMBERGER

VELOCITY REPORT

COMPANY : WESTERN UNDERGROUND GAS STOR

WELL : IONA OBS-1

FIELD : IONA

STATE : VICTORIA

COUNTRY : AURTRALIA

REFERENCE: 561285

LOGGED : 24-FEB-1999

ANALYST: YURI SOLOVYOV 18-MAR-99 10:41:13` PROGRAM: GADJST 008.E09

LONG DEFINITIONS

GLOBAL

KB	- Elevation of the KELLY-BUSHING Above MSL or MWL
SRD	- Elevation of the Seismic Reference Datum Above MSL or MWL
EKB	- Elevation of Kelly Bushing
UNERTH	- UNIFORM EARTH VELOCITY (GTRFRM)

ZONE

LOFVEL	- LAYER OPTION FLAG FOR VELOCITY: -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYVEL	- USER SUPPLIED VELOCITY DATA

SAMPLED

SHOT	- Shot number
DKB	- Measured Depth from Kelly-Bushing
DSRD	- Depth from SRD
SHTM	- Shot time (WST)
ADJS	- Adjusted Sonic Travel Time
SHDR	- Drift at Shot or Knee
REST	- Residual Travel Time at Knee
INTV	- Internal Velocity, Average

(GLOBAL PARAMETERS)		(VALUE)	
ELEV OF KB AB. MSL (WST)	KB	: 137.500	M
ELEV OF SRD AB. MSL(WST)	SRD	: 0	M
Elevation of Kelly Bushi	EKB	: 137.500	M
UNIFORM EARTH VELOCITY	UNERTH	: 2095.00	M/S

(ZONED PARAMETERS)		(VALUE)		(LIMITS)	
LAYER OPTION FLAG VELOC	LOFVEL	: 1.000000		30479.7	- 0
USER VELOC (WST)	LAYVEL	: 1942.000	M/S	633.000	- 618.200
		2621.000		618.200	559.000
		2181.000		559.000	348.900
		1843.000		348.900	288.400
		2095.000		288.400	0

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COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

LEVEL NUMBER	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	VERTICAL TRAVEL TIME SRD/GEOPH MS	INTEGRATED ADJUSTED SONIC TIME MS	DRIFT = SHOT TIME - RAW SON MS	RESIDUAL = SHOT TIME - ADJ SON MS	ADJUSTED INTERVAL VELOCITY M/S
							2095
1	292.8	150.9	72.04	72.04	0	0	
							1843
2	360.2	211.4	104.84	104.83	0	0	
							2181
3	625.3	421.5	201.21	201.21	0	0	
							2620
4	700.0	480.7	223.79	223.80	0	-.01	
							1945
5	718.6	495.6	231.44	231.43	0	.01	
							2471
6	719.3	496.1	231.71	231.64	.07	.07	
							2735
7	785.5	549.3	252.85	251.11	2.67	1.74	
							2521
8	860.0	610.2	275.34	275.27	2.07	.07	
							2460
9	960.0	694.3	309.86	309.46	3.83	.41	
							2664
10	1060.0	780.9	342.07	341.94	4.17	.13	
							2676
11	1160.0	870.5	376.79	375.43	6.04	1.36	
							2732
12	1193.0	900.6	387.08	386.47	5.50	.61	
							2777
13	1337.5	1037.4	436.66	435.73	6.16	.93	
							3018
14	1433.5	1131.8	468.23	467.00	6.69	1.23	
							2739
15	1477.3	1175.4	484.63	482.92	7.28	1.70	
							3118
16	1508.3	1206.4	495.33	492.85	8.12	2.47	
							3027
17	1517.0	1215.1	497.93	495.73	7.87	2.20	
							3187
18	1537.9	1235.9	503.33	502.28	6.77	1.05	
							3351
19	1540.5	1238.5	504.13	503.05	6.77	1.08	

SCHLUMBERGER

TIME CONVERTED VELOCITY REPORT

COMPANY : WESTERN UNDERGROUND GAS STOR

WELL : IONA OBS-1

FIELD : IONA

STATE : VICTORIA

COUNTRY : AURTRALIA

REFERENCE: 561285

LOGGED : 24-FEB-1999

LONG DEFINITIONS

GLOBAL

KB	- Elevation of the KELLY-BUSHING Above MSL or MWL
SRD	- Elevation of the Seismic Reference Datum Above MSL or MWL
GL	- Elevation of Users Reference (Generally Ground Level) Above SRD
UNERTH	- UNIFORM EARTH VELOCITY (GTRFRM)
UNFDEN	- UNIFORM DENSITY VALUE

MATRIX

MVODIS	- MOVE-OUT DISTANCE FROM BOREHOLE

ZONE

LOFVEL	- LAYER OPTION FLAG FOR VELOCITY: -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYVEL	- USER SUPPLIED VELOCITY DATA
LOFDEN	- LAYER OPTION FLAG FOR DENSITY : -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYDEN	- USER SUPPLIED DENSITY DATA

SAMPLED

TWOT	- Two Way Travel Time (Relative to the Seismic Reference)
DKB	- Measured Depth from Kelly-Bushing
DSRD	- Depth from SRD
AVGV	- Average Seismic Velocity
RMSV	- Root Mean Square Velocity (Seismic)
MVOT	- Normal Move-Out
MVOT	- Normal Move-Out
MVOT	- Normal Move-Out
INTV	- Internal Velocity, Average

(GLOBAL PARAMETERS)			(VALUE)	
ELEV OF KB AB. MSL (WST)	KB	:	137.500	M
ELEV OF SRD AB. MSL(WST)	SRD	:	0	M
ELEV OF GL AB. SRD(WST)	GL	:	0	M
UNIFORM EARTH VELOCITY	UNERTH	:	2095.00	M/S
UNIFORM DENSITY VALUE	UNFDEN	:	2.30000	G/C3

(MATRIX PARAMETERS)

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	MVOUT DIST M
1	1000.0
2	1500.0
3	2000.0

(ZONED PARAMETERS)		(VALUE)		(LIMITS)		
LAYER OPTION FLAG VELOC	LOFVEL	: 1.000000		30479.7	-	0
USER VELOC (WST)	LAYVEL	: 1942.000	M/S	633.000	-	618.200
		2621.000		618.200		559.000
		2181.000		559.000		348.900
		1843.000		348.900		288.400
		2095.000		288.400		0
LAYER OPTION FLAG DENS	LOFDEN	:-1.000000		30479.7	-	0
USER SUPPLIED DENSITY DA	LAYDEN	: 0	G/C3	0	-	0

908918 334

COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

TWO-WAY TRAVEL TIME FROM SRD MS	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	AVERAGE VELOCITY SRD/GEO M/S	RMS VELOCITY M/S	FIRST NORMAL MOVEOUT MS	SECOND NORMAL MOVEOUT MS	THIRD NORMAL MOVEOUT MS	INTERVAL VELOCITY M/S
								2095
2.00	139.6	2.1	2095	2095	475.33	713.99	952.66	2095
4.00	141.7	4.2	2095	2095	473.34	712.00	950.66	2095
6.00	143.8	6.3	2095	2095	471.36	710.02	948.67	2095
8.00	145.9	8.4	2095	2095	469.39	708.04	946.69	2095
10.00	148.0	10.5	2095	2095	467.43	706.06	944.71	2095
12.00	150.1	12.6	2095	2095	465.48	704.09	942.73	2095
14.00	152.2	14.7	2095	2095	463.53	702.13	940.76	2095
16.00	154.3	16.8	2095	2095	461.60	700.17	938.79	2095
18.00	156.4	18.9	2095	2095	459.67	698.22	936.82	2095
20.00	158.5	21.0	2095	2095	457.75	696.27	934.86	2095
22.00	160.6	23.0	2095	2095	455.83	694.33	932.91	2095
24.00	162.7	25.1	2095	2095	453.93	692.39	930.96	2095
26.00	164.8	27.2	2095	2095	452.03	690.46	929.01	2095
28.00	166.9	29.3	2095	2095	450.15	688.54	927.06	2095
30.00	169.0	31.4	2095	2095	448.27	686.62	925.13	2095
32.00	171.1	33.5	2095	2095	446.40	684.71	923.19	2095
34.00	173.3	35.6	2095	2095	444.54	682.80	921.26	2095

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36.00	175.4	37.7	2095	2095	442.68	680.89	919.33	2095
38.00	177.5	39.8	2095	2095	440.84	679.00	917.41	2095
40.00	179.6	41.9	2095	2095	439.00	677.11	915.49	2095
42.00	181.8	44.0	2095	2095	437.17	675.22	913.58	2095
44.00	183.9	46.1	2095	2095	435.35	673.34	911.67	2095
46.00	186.0	48.2	2095	2095	433.54	671.47	909.76	2095
48.00	188.1	50.3	2095	2095	431.73	669.60	907.86	2095
50.00	190.2	52.4	2095	2095	429.94	667.73	905.96	2095
52.00	192.4	54.5	2095	2095	428.15	665.88	904.07	2095
54.00	194.5	56.6	2095	2095	426.37	664.02	902.18	2095
56.00	196.6	58.7	2095	2095	424.60	662.18	900.30	2095
58.00	198.7	60.8	2095	2095	422.84	660.34	898.41	2095
60.00	200.9	62.9	2095	2095	421.08	658.50	896.54	2095
62.00	203.0	64.9	2095	2095	419.34	656.67	894.67	2095
64.00	205.2	67.0	2095	2095	417.60	654.85	892.80	2095
66.00	207.3	69.1	2095	2095	415.87	653.03	890.93	2095
68.00	209.5	71.2	2095	2095	414.15	651.21	889.07	2095
70.00	211.6	73.3	2095	2095	412.43	649.40	887.22	2095
72.00	213.7	75.4	2095	2095	410.73	647.60	885.37	2095
74.00	215.9	77.5	2095	2095	409.03	645.80	883.52	2095
76.00	218.0	79.6	2095	2095	407.34	644.01	881.67	2095

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78.00	220.2	81.7	2095	2095	405.66	642.23	879.84	2095
80.00	222.3	83.8	2095	2095	403.98	640.45	878.00	2095
82.00	224.5	85.9	2095	2095	402.32	638.67	876.17	2095
84.00	226.6	88.0	2095	2095	400.66	636.90	874.34	2095
86.00	228.8	90.1	2095	2095	399.01	635.14	872.52	2095
88.00	230.9	92.2	2095	2095	397.37	633.38	870.70	2095
90.00	233.1	94.3	2095	2095	395.74	631.62	868.89	2095
92.00	235.3	96.4	2095	2095	394.11	629.88	867.08	2095
94.00	237.5	98.5	2095	2095	392.49	628.13	865.27	2095
96.00	239.6	100.6	2095	2095	390.89	626.40	863.47	2095
98.00	241.8	102.7	2095	2095	389.28	624.67	861.67	2095
100.00	244.0	104.8	2095	2095	387.69	622.94	859.88	2095
102.00	246.2	106.8	2095	2095	386.10	621.22	858.09	2095
104.00	248.3	108.9	2095	2095	384.53	619.50	856.30	2095
106.00	250.5	111.0	2095	2095	382.96	617.79	854.52	2095
108.00	252.7	113.1	2095	2095	381.39	616.09	852.74	2095
110.00	254.9	115.2	2095	2095	379.84	614.39	850.97	2095
112.00	257.0	117.3	2095	2095	378.29	612.70	849.20	2095
114.00	259.2	119.4	2095	2095	376.75	611.01	847.44	2095
116.00	261.4	121.5	2095	2095	375.22	609.33	845.68	2095

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118.00	263.7	123.6	2095	2095	373.70	607.65	843.92	2095
120.00	265.9	125.7	2095	2095	372.18	605.98	842.17	2095
122.00	268.1	127.8	2095	2095	370.67	604.31	840.42	2095
124.00	270.3	129.9	2095	2095	369.17	602.65	838.67	2095
126.00	272.6	132.0	2095	2095	367.68	600.99	836.93	2095
128.00	274.8	134.1	2095	2095	366.19	599.34	835.20	2095
130.00	277.0	136.2	2095	2095	364.71	597.70	833.46	2095
132.00	279.2	138.3	2095	2095	363.24	596.06	831.74	2095
134.00	281.4	140.4	2095	2095	361.78	594.42	830.01	2095
136.00	283.7	142.5	2095	2095	360.32	592.79	828.29	2095
138.00	285.9	144.6	2095	2095	358.88	591.17	826.58	2095
140.00	288.1	146.6	2095	2095	357.43	589.55	824.86	2095
142.00	290.4	148.7	2095	2095	356.00	587.94	823.16	2095
144.00	292.7	150.8	2095	2095	354.58	586.33	821.45	1848
146.00	294.7	152.7	2092	2092	353.85	585.80	821.19	1843
148.00	296.7	154.5	2088	2089	353.13	585.26	820.93	1843
150.00	298.7	156.4	2085	2086	352.40	584.71	820.63	1843
152.00	300.7	158.2	2082	2083	351.66	584.13	820.31	1843
154.00	302.7	160.1	2079	2080	350.91	583.54	819.96	1843
156.00	304.7	161.9	2076	2077	350.16	582.93	819.59	1843

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158.00	306.7	163.7	2073	2074	349.39	582.31	819.19	1843
160.00	308.7	165.6	2070	2071	348.62	581.66	818.77	1843
162.00	310.7	167.4	2067	2069	347.84	581.01	818.32	1843
164.00	312.7	169.3	2064	2066	347.06	580.34	817.85	1843
166.00	314.8	171.1	2062	2063	346.27	579.65	817.36	1843
168.00	316.8	173.0	2059	2061	345.47	578.95	816.85	1843
170.00	318.8	174.8	2057	2059	344.67	578.24	816.32	1843
172.00	320.9	176.6	2054	2056	343.86	577.52	815.78	1843
174.00	322.9	178.5	2052	2054	343.05	576.78	815.21	1843
176.00	325.0	180.3	2049	2052	342.23	576.03	814.62	1843
178.00	327.1	182.2	2047	2049	341.41	575.27	814.02	1843
180.00	329.1	184.0	2045	2047	340.59	574.50	813.40	1843
182.00	331.2	185.9	2042	2045	339.76	573.73	812.77	1843
184.00	333.2	187.7	2040	2043	338.93	572.94	812.12	1843
186.00	335.3	189.6	2038	2041	338.09	572.14	811.45	1843
188.00	337.3	191.4	2036	2039	337.26	571.33	810.77	1843
190.00	339.4	193.2	2034	2037	336.42	570.51	810.08	1843
192.00	341.5	195.1	2032	2035	335.57	569.69	809.37	1843
194.00	343.5	196.9	2030	2033	334.73	568.86	808.65	1843
196.00	345.6	198.8	2028	2031	333.88	568.02	807.92	1843

198.00	347.7	200.6	2026	2029	333.03	567.17	807.17	1843
200.00	349.9	202.5	2025	2028	332.18	566.31	806.41	1843
202.00	352.0	204.3	2023	2026	331.33	565.45	805.64	1843
204.00	354.1	206.1	2021	2024	330.47	564.58	804.86	1843
206.00	356.3	208.0	2019	2023	329.62	563.71	804.07	1843
208.00	358.4	209.8	2018	2021	328.76	562.83	803.27	1897
210.00	360.6	211.7	2016	2020	327.80	561.78	802.24	2180
212.00	363.1	213.9	2018	2021	326.23	559.77	799.90	2181
214.00	365.6	216.1	2019	2023	324.67	557.78	797.58	2180
216.00	368.1	218.3	2021	2024	323.13	555.80	795.28	2180
218.00	370.7	220.4	2022	2026	321.61	553.84	793.00	2181
220.00	373.2	222.6	2024	2027	320.09	551.90	790.74	2180
222.00	375.8	224.8	2025	2029	318.59	549.97	788.50	2180
224.00	378.4	227.0	2027	2030	317.11	548.06	786.28	2180
226.00	381.0	229.2	2028	2032	315.63	546.16	784.07	2180
228.00	383.6	231.3	2029	2033	314.17	544.28	781.88	2180
230.00	386.2	233.5	2031	2034	312.73	542.41	779.71	2180
232.00	388.8	235.7	2032	2036	311.29	540.56	777.55	2180
234.00	391.4	237.9	2033	2037	309.87	538.72	775.41	2181
236.00	394.1	240.1	2035	2038	308.46	536.89	773.29	2180
238.00	396.7	242.3	2036	2039	307.06	535.08	771.18	2180
240.00	399.3	244.4	2037	2041	305.68	533.28	769.08	

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COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

242.00	401.9	246.6	2038	2042	304.30	531.50	767.00	2181
244.00	404.6	248.8	2039	2043	302.94	529.72	764.94	2180
246.00	407.3	251.0	2040	2044	301.59	527.96	762.89	2180
248.00	410.0	253.2	2042	2045	300.24	526.21	760.85	2180
250.00	412.7	255.3	2043	2046	298.91	524.48	758.82	2180
252.00	415.4	257.5	2044	2047	297.59	522.75	756.81	2180
254.00	418.1	259.7	2045	2049	296.29	521.04	754.82	2181
256.00	420.8	261.9	2046	2050	294.99	519.34	752.83	2180
258.00	423.5	264.1	2047	2051	293.70	517.65	750.86	2180
260.00	426.2	266.2	2048	2052	292.42	515.97	748.90	2180
262.00	428.9	268.4	2049	2053	291.15	514.30	746.95	2180
264.00	431.6	270.6	2050	2054	289.90	512.65	745.02	2181
266.00	434.4	272.8	2051	2055	288.65	511.00	743.09	2180
268.00	437.2	275.0	2052	2056	287.41	509.36	741.18	2180
270.00	440.0	277.1	2053	2057	286.18	507.74	739.28	2180
272.00	442.8	279.3	2054	2058	284.96	506.12	737.39	2181
274.00	445.5	281.5	2055	2058	283.75	504.52	735.51	2180
276.00	448.3	283.7	2056	2059	282.55	502.92	733.64	2181
278.00	451.1	285.9	2057	2060	281.35	501.34	731.78	2180
280.00	453.9	288.0	2057	2061	280.17	499.76	729.93	2180
282.00	456.7	290.2	2058	2062	279.00	498.20	728.10	2181
284.00	459.5	292.4	2059	2063	277.83	496.64	726.27	2180
286.00	462.3	294.6	2060	2064	276.67	495.09	724.45	2180
288.00	465.2	296.8	2061	2065	275.52	493.55	722.64	2180

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COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

TWO-WAY TRAVEL TIME FROM SRD MS	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	AVERAGE VELOCITY SRD/GEO M/S	RMS VELOCITY M/S	FIRST NORMAL MOVEOUT MS	SECOND NORMAL MOVEOUT MS	THIRD NORMAL MOVEOUT MS	INTERVAL VELOCITY M/S
								2180
290.00	468.0	298.9	2062	2065	274.38	492.02	720.85	2181
292.00	470.9	301.1	2063	2066	273.25	490.50	719.06	2180
294.00	473.7	303.3	2063	2067	272.13	488.99	717.28	2180
296.00	476.5	305.5	2064	2068	271.01	487.49	715.51	2180
298.00	479.4	307.7	2065	2069	269.90	486.00	713.75	2181
300.00	482.2	309.8	2066	2069	268.80	484.51	712.00	2180
302.00	485.1	312.0	2066	2070	267.71	483.03	710.26	2180
304.00	487.9	314.2	2067	2071	266.63	481.56	708.52	2181
306.00	490.7	316.4	2068	2072	265.55	480.10	706.80	2181
308.00	493.6	318.6	2069	2072	264.48	478.65	705.08	2180
310.00	496.4	320.7	2069	2073	263.42	477.20	703.37	2181
312.00	499.2	322.9	2070	2074	262.36	475.77	701.68	2181
314.00	502.0	325.1	2071	2074	261.32	474.34	699.98	2180
316.00	504.9	327.3	2071	2075	260.28	472.92	698.30	2180
318.00	507.7	329.5	2072	2076	259.24	471.50	696.63	2181
320.00	510.5	331.7	2073	2076	258.22	470.10	694.96	2180
322.00	513.3	333.8	2073	2077	257.20	468.70	693.30	2181

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COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

324.00	516.2	336.0	2074	2078	256.19	467.31	691.65	2181
326.00	519.0	338.2	2075	2078	255.18	465.93	690.01	2180
328.00	521.8	340.4	2075	2079	254.19	464.55	688.37	2181
330.00	524.6	342.6	2076	2080	253.19	463.18	686.74	2180
332.00	527.4	344.7	2077	2080	252.21	461.82	685.12	2181
334.00	530.2	346.9	2077	2081	251.23	460.46	683.51	2180
336.00	532.9	349.1	2078	2081	250.26	459.12	681.90	2181
338.00	535.7	351.3	2079	2082	249.30	457.78	680.30	2180
340.00	538.5	353.5	2079	2083	248.34	456.44	678.71	2181
342.00	541.3	355.6	2080	2083	247.39	455.12	677.12	2181
344.00	544.1	357.8	2080	2084	246.44	453.79	675.55	2180
346.00	546.9	360.0	2081	2084	245.50	452.48	673.98	2180
348.00	549.7	362.2	2081	2085	244.57	451.17	672.41	2181
350.00	552.5	364.4	2082	2086	243.64	449.87	670.85	2181
352.00	555.3	366.5	2083	2086	242.72	448.58	669.30	2180
354.00	558.1	368.7	2083	2087	241.81	447.29	667.76	2181
356.00	560.8	370.9	2084	2087	240.90	446.01	666.22	2181
358.00	563.6	373.1	2084	2088	239.99	444.74	664.69	2180
360.00	566.4	375.3	2085	2088	239.10	443.47	663.17	2180
362.00	569.2	377.4	2085	2089	238.21	442.21	661.65	2181

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364.00	572.0	379.6	2086	2089	237.32	440.95	660.14	2180
366.00	574.8	381.8	2086	2090	236.44	439.70	658.63	2181
368.00	577.6	384.0	2087	2090	235.57	438.46	657.13	2181
370.00	580.3	386.2	2087	2091	234.70	437.22	655.64	2180
372.00	583.1	388.3	2088	2091	233.83	435.99	654.15	2181
374.00	585.9	390.5	2088	2092	232.98	434.77	652.67	2180
376.00	588.7	392.7	2089	2092	232.12	433.55	651.20	2180
378.00	591.4	394.9	2089	2093	231.28	432.33	649.73	2181
380.00	594.2	397.1	2090	2093	230.44	431.12	648.27	2181
382.00	597.0	399.2	2090	2094	229.60	429.92	646.81	2180
384.00	599.8	401.4	2091	2094	228.77	428.73	645.36	2181
386.00	602.5	403.6	2091	2095	227.94	427.54	643.91	2181
388.00	605.3	405.8	2092	2095	227.12	426.35	642.47	2180
390.00	608.1	408.0	2092	2095	226.31	425.17	641.04	2180
392.00	610.8	410.2	2093	2096	225.50	424.00	639.61	2181
394.00	613.6	412.3	2093	2096	224.69	422.83	638.19	2180
396.00	616.4	414.5	2093	2097	223.89	421.67	636.77	2181
398.00	619.1	416.7	2094	2097	223.10	420.51	635.36	2181
400.00	621.9	418.9	2094	2098	222.31	419.36	633.95	2180
402.00	624.7	421.1	2095	2098	221.52	418.21	632.55	2523

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404.00	627.9	423.6	2097	2100	220.41	416.51	630.37	2621
406.00	631.2	426.2	2099	2103	219.21	414.64	627.95	2621
408.00	634.5	428.8	2102	2106	218.02	412.80	625.56	2621
410.00	637.8	431.4	2105	2109	216.85	410.97	623.18	2621
412.00	641.2	434.1	2107	2112	215.69	409.16	620.83	2621
414.00	644.5	436.7	2110	2114	214.54	407.37	618.50	2621
416.00	647.8	439.3	2112	2117	213.40	405.59	616.19	2621
418.00	651.1	441.9	2114	2120	212.28	403.83	613.90	2621
420.00	654.4	444.5	2117	2123	211.16	402.08	611.63	2621
422.00	657.7	447.2	2119	2125	210.06	400.36	609.38	2621
424.00	661.0	449.8	2122	2128	208.97	398.64	607.15	2621
426.00	664.3	452.4	2124	2130	207.89	396.94	604.94	2621
428.00	667.6	455.0	2126	2133	206.82	395.26	602.74	2621
430.00	670.9	457.6	2129	2135	205.76	393.59	600.56	2621
432.00	674.2	460.3	2131	2138	204.71	391.94	598.41	2621
434.00	677.5	462.9	2133	2140	203.67	390.30	596.27	2621
436.00	680.8	465.5	2135	2143	202.65	388.67	594.14	2621
438.00	684.1	468.1	2138	2145	201.63	387.06	592.04	2621
440.00	687.4	470.7	2140	2148	200.62	385.47	589.95	2621
442.00	690.7	473.4	2142	2150	199.63	383.88	587.87	2621
444.00	694.0	476.0	2144	2152	198.64	382.31	585.82	2621

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COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

446.00	697.3	478.6	2146	2155	197.66	380.75	583.78	2475
448.00	700.4	481.1	2148	2156	196.81	379.42	582.05	1942
450.00	702.9	483.0	2147	2155	196.34	378.75	581.27	1942
452.00	705.3	485.0	2146	2154	195.87	378.08	580.49	1942
454.00	707.8	486.9	2145	2154	195.41	377.41	579.72	1942
456.00	710.2	488.9	2144	2153	194.94	376.74	578.94	1942
458.00	712.6	490.8	2143	2152	194.48	376.08	578.16	1942
460.00	715.1	492.7	2142	2151	194.02	375.41	577.38	1942
462.00	717.5	494.7	2141	2150	193.56	374.75	576.61	2270
464.00	720.4	496.9	2142	2151	192.89	373.71	575.29	2660
466.00	723.7	499.6	2144	2153	191.93	372.16	573.24	2676
468.00	727.1	502.3	2147	2156	190.97	370.60	571.18	2627
470.00	730.3	504.9	2149	2158	190.05	369.13	569.22	2649
472.00	733.6	507.6	2151	2160	189.13	367.63	567.24	2574
474.00	736.9	510.1	2152	2162	188.28	366.25	565.43	2598
476.00	740.1	512.7	2154	2164	187.41	364.85	563.57	2794
478.00	743.6	515.5	2157	2167	186.40	363.19	561.35	3066
480.00	747.4	518.6	2161	2172	185.17	361.14	558.56	3174
482.00	751.3	521.8	2165	2177	183.87	358.96	555.57	2951
484.00	755.0	524.7	2168	2180	182.77	357.13	553.10	2858
486.00	758.5	527.6	2171	2184	181.76	355.45	550.84	2824

908918 346

488.00	762.0	530.4	2174	2187	180.79	353.84	548.67	2806
490.00	765.5	533.2	2176	2190	179.84	352.27	546.55	2752
492.00	768.9	536.0	2179	2192	178.94	350.78	544.55	2659
494.00	772.2	538.6	2181	2194	178.11	349.42	542.74	2687
496.00	775.5	541.3	2183	2196	177.27	348.03	540.88	2526
498.00	778.7	543.8	2184	2198	176.55	346.85	539.33	2525
500.00	781.8	546.4	2185	2199	175.83	345.68	537.78	2646
502.00	785.1	549.0	2187	2201	175.04	344.38	536.03	2618
504.00	788.3	551.6	2189	2203	174.27	343.11	534.35	2437
506.00	791.3	554.1	2190	2204	173.63	342.06	532.97	2487
508.00	794.4	556.5	2191	2205	172.95	340.97	531.52	2676
510.00	797.7	559.2	2193	2207	172.17	339.66	529.77	2421
512.00	800.7	561.6	2194	2208	171.55	338.65	528.44	2390
514.00	803.6	564.0	2195	2209	170.95	337.67	527.16	2436
516.00	806.6	566.5	2196	2210	170.32	336.65	525.82	2494
518.00	809.7	569.0	2197	2211	169.67	335.58	524.40	2493
520.00	812.8	571.5	2198	2212	169.02	334.51	522.98	2484
522.00	815.8	573.9	2199	2213	168.39	333.46	521.59	2418
524.00	818.8	576.4	2200	2214	167.79	332.49	520.30	2573
526.00	822.0	578.9	2201	2216	167.11	331.36	518.79	2497
528.00	825.0	581.4	2202	2217	166.48	330.31	517.40	

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TWO-WAY TRAVEL TIME FROM SRD MS	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	AVERAGE VELOCITY SRD/GEO M/S	RMS VELOCITY M/S	FIRST NORMAL MOVEOUT MS	SECOND NORMAL MOVEOUT MS	THIRD NORMAL MOVEOUT MS	INTERVAL VELOCITY M/S
								2719
530.00	828.3	584.1	2204	2219	165.72	329.04	515.67	
								2422
532.00	831.3	586.6	2205	2220	165.14	328.08	514.41	
								2408
534.00	834.2	589.0	2206	2220	164.58	327.15	513.17	
								2558
536.00	837.3	591.5	2207	2222	163.93	326.06	511.72	
								2856
538.00	840.8	594.4	2210	2224	163.11	324.67	509.81	
								2456
540.00	843.8	596.8	2211	2225	162.53	323.70	508.52	
								2467
542.00	846.8	599.3	2211	2226	161.95	322.73	507.23	
								2749
544.00	850.1	602.1	2213	2228	161.21	321.48	505.52	
								2512
546.00	853.2	604.6	2215	2229	160.62	320.48	504.18	
								2428
548.00	856.1	607.0	2215	2230	160.07	319.57	502.96	
								2522
550.00	859.1	609.5	2216	2231	159.47	318.57	501.62	
								2494
552.00	862.1	612.0	2217	2232	158.90	317.60	500.32	
								2433
554.00	865.1	614.5	2218	2233	158.35	316.70	499.11	
								2502
556.00	868.1	617.0	2219	2234	157.78	315.73	497.82	
								2461
558.00	871.1	619.4	2220	2235	157.23	314.81	496.58	
								2515
560.00	874.1	621.9	2221	2236	156.66	313.85	495.28	
								2450
562.00	877.1	624.4	2222	2237	156.13	312.95	494.07	
								2771
564.00	880.4	627.2	2224	2239	155.43	311.75	492.42	
								2741

908918 348

566.00	883.7	629.9	2226	2241	154.76	310.59	490.83	2365
568.00	886.5	632.3	2226	2241	154.27	309.78	489.75	2344
570.00	889.3	634.6	2227	2242	153.80	308.99	488.70	2435
572.00	892.3	637.0	2227	2242	153.29	308.13	487.55	2409
574.00	895.1	639.4	2228	2243	152.80	307.29	486.43	2391
576.00	898.0	641.8	2229	2244	152.31	306.48	485.33	
								2452
578.00	900.9	644.3	2229	2244	151.80	305.61	484.17	2552
580.00	904.0	646.8	2230	2245	151.25	304.67	482.88	2675
582.00	907.1	649.5	2232	2247	150.64	303.62	481.44	2529
584.00	910.1	652.0	2233	2248	150.11	302.71	480.19	2497
586.00	913.1	654.5	2234	2249	149.60	301.82	479.00	2379
588.00	915.9	656.9	2234	2249	149.14	301.04	477.95	2343
590.00	918.7	659.3	2235	2250	148.69	300.30	476.95	2359
592.00	921.5	661.6	2235	2250	148.25	299.54	475.93	2262
594.00	924.2	663.9	2235	2250	147.84	298.86	475.03	2569
596.00	927.2	666.5	2236	2251	147.31	297.94	473.76	2272
598.00	929.9	668.7	2237	2251	146.91	297.26	472.85	2339
600.00	932.7	671.1	2237	2252	146.48	296.53	471.88	2358
602.00	935.5	673.4	2237	2252	146.04	295.79	470.88	2440
604.00	938.4	675.9	2238	2253	145.58	294.99	469.79	2511

908918 349

606.00	941.3	678.4	2239	2254	145.09	294.14	468.62	2408
608.00	944.1	680.8	2239	2254	144.64	293.37	467.58	2421
610.00	947.0	683.2	2240	2255	144.19	292.60	466.53	2487
612.00	949.9	685.7	2241	2256	143.72	291.78	465.41	2431
614.00	952.7	688.1	2241	2256	143.27	291.01	464.35	2520
616.00	955.7	690.6	2242	2257	142.79	290.17	463.20	2471
618.00	958.6	693.1	2243	2258	142.33	289.37	462.11	2699
620.00	961.8	695.8	2245	2259	141.78	288.40	460.75	2544
622.00	964.7	698.4	2246	2260	141.30	287.56	459.59	2618
624.00	967.8	701.0	2247	2262	140.79	286.66	458.34	2637
626.00	970.9	703.6	2248	2263	140.27	285.76	457.09	2713
628.00	974.1	706.3	2249	2264	139.73	284.80	455.74	2746
630.00	977.3	709.1	2251	2266	139.18	283.81	454.36	2560
632.00	980.3	711.6	2252	2267	138.71	282.99	453.21	2510
634.00	983.2	714.1	2253	2268	138.26	282.20	452.13	2533
636.00	986.1	716.7	2254	2269	137.80	281.40	451.02	2554
638.00	989.1	719.2	2255	2270	137.34	280.59	449.89	2554
640.00	992.1	721.8	2256	2271	136.89	279.78	448.77	2772
642.00	995.4	724.6	2257	2272	136.34	278.81	447.40	2536
644.00	998.3	727.1	2258	2273	135.90	278.03	446.31	2562

908918 350

646.00	1001.3	729.6	2259	2274	135.45	277.23	445.20	2609
648.00	1004.3	732.3	2260	2275	134.98	276.40	444.04	2598
650.00	1007.3	734.9	2261	2276	134.52	275.58	442.89	2528
652.00	1010.2	737.4	2262	2277	134.09	274.82	441.83	2550
654.00	1013.2	739.9	2263	2278	133.66	274.05	440.75	2675
656.00	1016.2	742.6	2264	2279	133.18	273.19	439.54	2735
658.00	1019.4	745.3	2265	2281	132.68	272.29	438.27	2630
660.00	1022.5	748.0	2267	2282	132.23	271.48	437.12	2694
662.00	1025.6	750.7	2268	2283	131.75	270.62	435.91	2807
664.00	1028.8	753.5	2270	2285	131.23	269.68	434.58	2691
666.00	1031.8	756.2	2271	2286	130.76	268.84	433.39	2740
668.00	1035.0	758.9	2272	2288	130.28	267.97	432.15	2563
670.00	1037.9	761.5	2273	2289	129.86	267.22	431.10	2531
672.00	1040.8	764.0	2274	2290	129.46	266.50	430.09	2867
674.00	1044.1	766.9	2276	2292	128.94	265.55	428.73	3076
676.00	1047.6	769.9	2278	2294	128.34	264.45	427.14	2723
678.00	1050.7	772.7	2279	2296	127.88	263.61	425.95	2907
680.00	1054.0	775.6	2281	2298	127.35	262.65	424.57	2722
682.00	1057.1	778.3	2282	2299	126.90	261.83	423.40	2665
684.00	1060.1	781.0	2284	2300	126.47	261.05	422.29	2641
686.00	1063.1	783.6	2285	2301	126.05	260.29	421.21	2682

908918 351

COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

688.00	1066.1	786.3	2286	2302	125.62	259.51	420.09	2548
690.00	1069.0	788.8	2286	2303	125.24	258.81	419.12	2965
692.00	1072.4	791.8	2288	2305	124.71	257.85	417.72	2729
694.00	1075.5	794.5	2290	2307	124.27	257.05	416.57	2748
696.00	1078.6	797.3	2291	2308	123.83	256.24	415.42	2643
698.00	1081.6	799.9	2292	2309	123.43	255.50	414.37	2668
700.00	1084.6	802.6	2293	2310	123.02	254.76	413.30	2636
702.00	1087.5	805.2	2294	2311	122.62	254.04	412.27	2604
704.00	1090.5	807.8	2295	2312	122.24	253.34	411.28	2577
706.00	1093.4	810.4	2296	2313	121.87	252.66	410.31	2612
708.00	1096.3	813.0	2297	2314	121.49	251.96	409.32	2712
710.00	1099.3	815.7	2298	2315	121.08	251.21	408.23	2658
712.00	1102.3	818.4	2299	2316	120.68	250.49	407.21	2587
714.00	1105.2	821.0	2300	2317	120.32	249.82	406.25	2647
716.00	1108.2	823.6	2301	2318	119.94	249.12	405.24	2527
718.00	1111.0	826.1	2301	2318	119.59	248.49	404.35	2544
720.00	1113.8	828.7	2302	2319	119.24	247.85	403.44	2665
722.00	1116.8	831.4	2303	2320	118.86	247.15	402.43	2677
724.00	1119.8	834.0	2304	2321	118.48	246.44	401.41	2784
726.00	1122.9	836.8	2305	2323	118.07	245.68	400.30	2713

908918 352

COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

728.00	1125.9	839.5	2306	2324	117.68	244.96	399.26	2581
730.00	1128.7	842.1	2307	2325	117.33	244.32	398.35	2879
732.00	1131.9	845.0	2309	2326	116.89	243.51	397.16	2712
734.00	1134.9	847.7	2310	2327	116.51	242.80	396.14	2700
736.00	1137.9	850.4	2311	2328	116.14	242.11	395.13	2718
738.00	1140.9	853.1	2312	2330	115.76	241.40	394.12	2696
740.00	1143.9	855.8	2313	2331	115.39	240.72	393.12	2756
742.00	1146.9	858.6	2314	2332	115.01	240.00	392.08	2668
744.00	1149.9	861.2	2315	2333	114.65	239.34	391.12	2618
746.00	1152.7	863.9	2316	2334	114.31	238.71	390.21	2618
748.00	1155.6	866.5	2317	2335	113.97	238.08	389.30	2757
750.00	1158.7	869.2	2318	2336	113.59	237.38	388.28	2729
752.00	1161.7	872.0	2319	2337	113.23	236.69	387.29	2692
754.00	1164.6	874.7	2320	2338	112.88	236.04	386.33	2719
756.00	1167.6	877.4	2321	2339	112.52	235.37	385.35	2618
758.00	1170.5	880.0	2322	2340	112.19	234.76	384.47	2637
760.00	1173.4	882.6	2323	2341	111.86	234.14	383.57	2853
762.00	1176.5	885.5	2324	2342	111.47	233.40	382.49	2708
764.00	1179.4	888.2	2325	2343	111.12	232.75	381.54	2673
766.00	1182.3	890.9	2326	2344	110.79	232.13	380.63	2667
768.00	1185.3	893.5	2327	2345	110.46	231.51	379.72	

908918 353

TWO-WAY TRAVEL TIME FROM SRD MS	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	AVERAGE VELOCITY SRD/GEO M/S	RMS VELOCITY M/S	FIRST NORMAL MOVEOUT MS	SECOND NORMAL MOVEOUT MS	THIRD NORMAL MOVEOUT MS	INTERVAL VELOCITY M/S
								2651
770.00	1188.2	896.2	2328	2346	110.13	230.90	378.83	
								3148
772.00	1191.6	899.3	2330	2348	109.67	230.01	377.52	
								2672
774.00	1194.5	902.0	2331	2349	109.34	229.40	376.62	
								2638
776.00	1197.4	904.6	2332	2350	109.03	228.81	375.76	
								2634
778.00	1200.2	907.3	2332	2351	108.71	228.22	374.90	
								2647
780.00	1203.1	909.9	2333	2351	108.40	227.63	374.04	
								2711
782.00	1206.0	912.6	2334	2352	108.07	227.01	373.13	
								2682
784.00	1208.9	915.3	2335	2353	107.75	226.40	372.24	
								2663
786.00	1211.8	918.0	2336	2354	107.44	225.81	371.38	
								2667
788.00	1214.7	920.6	2337	2355	107.12	225.22	370.51	
								2707
790.00	1217.6	923.4	2338	2356	106.80	224.62	369.62	
								2814
792.00	1220.7	926.2	2339	2357	106.46	223.96	368.65	
								2812
794.00	1223.7	929.0	2340	2359	106.11	223.31	367.68	
								2683
796.00	1226.6	931.7	2341	2359	105.80	222.72	366.82	
								2723
798.00	1229.5	934.4	2342	2360	105.49	222.12	365.94	
								2777
800.00	1232.5	937.2	2343	2362	105.16	221.50	365.01	
								2795
802.00	1235.5	940.0	2344	2363	104.83	220.87	364.08	
								2819
804.00	1238.5	942.8	2345	2364	104.49	220.23	363.13	
								2922

806.00	1241.7	945.7	2347	2365	104.14	219.54	362.11	2826
808.00	1244.7	948.5	2348	2367	103.80	218.91	361.17	2834
810.00	1247.7	951.4	2349	2368	103.47	218.27	360.23	2730
812.00	1250.7	954.1	2350	2369	103.17	217.69	359.37	2831
814.00	1253.7	956.9	2351	2370	102.84	217.07	358.43	2703
816.00	1256.6	959.6	2352	2371	102.55	216.50	357.60	2698
818.00	1259.5	962.3	2353	2372	102.25	215.95	356.77	2742
820.00	1262.4	965.1	2354	2373	101.95	215.37	355.92	2716
822.00	1265.2	967.8	2355	2374	101.66	214.81	355.09	2702
824.00	1268.1	970.5	2356	2375	101.37	214.26	354.27	2785
826.00	1271.0	973.3	2357	2376	101.07	213.67	353.39	2812
828.00	1274.0	976.1	2358	2377	100.76	213.08	352.51	2901
830.00	1277.0	979.0	2359	2378	100.43	212.44	351.56	2857
832.00	1280.1	981.8	2360	2380	100.11	211.83	350.64	2788
834.00	1283.0	984.6	2361	2381	99.81	211.26	349.79	2860
836.00	1286.0	987.5	2362	2382	99.50	210.65	348.88	2841
838.00	1289.0	990.3	2364	2383	99.19	210.06	347.99	2896
840.00	1292.0	993.2	2365	2384	98.87	209.45	347.07	2933
842.00	1295.0	996.2	2366	2386	98.55	208.82	346.13	2864
844.00	1298.0	999.0	2367	2387	98.24	208.23	345.24	2814

908918 355

846.00	1300.9	1001.8	2368	2388	97.95	207.66	344.38	2802
848.00	1303.8	1004.6	2369	2389	97.66	207.10	343.55	2794
850.00	1306.7	1007.4	2370	2390	97.37	206.55	342.72	2828
852.00	1309.6	1010.3	2371	2391	97.08	205.98	341.87	2822
854.00	1312.6	1013.1	2373	2393	96.79	205.42	341.03	2822
856.00	1315.5	1015.9	2374	2394	96.51	204.87	340.19	2864
858.00	1318.4	1018.8	2375	2395	96.21	204.30	339.33	2864
860.00	1321.4	1021.6	2376	2396	95.92	203.73	338.47	2825
862.00	1324.3	1024.5	2377	2397	95.64	203.18	337.65	2706
864.00	1327.0	1027.2	2378	2398	95.38	202.68	336.90	2644
866.00	1329.7	1029.8	2378	2398	95.14	202.21	336.20	2681
868.00	1332.5	1032.5	2379	2399	94.89	201.73	335.47	2852
870.00	1335.4	1035.3	2380	2400	94.61	201.18	334.64	2895
872.00	1338.3	1038.2	2381	2402	94.32	200.61	333.79	3252
874.00	1341.7	1041.5	2383	2404	93.95	199.89	332.69	2886
876.00	1344.6	1044.4	2384	2405	93.67	199.34	331.85	2854
878.00	1347.5	1047.2	2385	2406	93.39	198.80	331.03	2803
880.00	1350.4	1050.0	2386	2407	93.13	198.29	330.26	2962
882.00	1353.4	1053.0	2388	2409	92.83	197.71	329.38	3308
884.00	1356.8	1056.3	2390	2411	92.47	196.99	328.27	3086

908918 356

886.00	1359.9	1059.4	2391	2413	92.15	196.37	327.32	3315
888.00	1363.3	1062.7	2393	2415	91.79	195.65	326.21	2947
890.00	1366.3	1065.6	2395	2416	91.51	195.09	325.37	2816
892.00	1369.1	1068.5	2396	2417	91.25	194.59	324.61	2810
894.00	1372.0	1071.3	2397	2418	91.00	194.09	323.85	2872
896.00	1374.9	1074.1	2398	2419	90.73	193.58	323.07	2873
898.00	1377.9	1077.0	2399	2421	90.47	193.06	322.28	2879
900.00	1380.8	1079.9	2400	2422	90.21	192.55	321.50	2917
902.00	1383.8	1082.8	2401	2423	89.94	192.02	320.69	3025
904.00	1386.8	1085.8	2402	2424	89.65	191.45	319.83	3232
906.00	1390.1	1089.1	2404	2426	89.33	190.80	318.83	3295
908.00	1393.5	1092.4	2406	2429	88.99	190.13	317.79	3201
910.00	1396.7	1095.6	2408	2431	88.68	189.51	316.83	2967
912.00	1399.8	1098.5	2409	2432	88.41	188.98	316.02	3048
914.00	1402.9	1101.6	2410	2434	88.13	188.42	315.16	3051
916.00	1406.0	1104.6	2412	2435	87.85	187.87	314.31	2974
918.00	1409.0	1107.6	2413	2436	87.58	187.34	313.50	3031
920.00	1412.0	1110.6	2414	2438	87.31	186.80	312.67	3204
922.00	1415.3	1113.8	2416	2440	87.00	186.19	311.73	2983
924.00	1418.3	1116.8	2417	2441	86.74	185.68	310.94	2974

908918 357

926.00	1421.3	1119.8	2419	2442	86.48	185.16	310.15	3163
928.00	1424.5	1123.0	2420	2444	86.19	184.58	309.26	3058
930.00	1427.6	1126.0	2422	2446	85.92	184.05	308.43	2896
932.00	1430.6	1128.9	2423	2447	85.68	183.57	307.70	2840
934.00	1433.4	1131.7	2423	2448	85.46	183.12	307.00	2762
936.00	1436.2	1134.5	2424	2448	85.24	182.69	306.35	2848
938.00	1439.1	1137.4	2425	2449	85.01	182.24	305.66	2762
940.00	1441.9	1140.1	2426	2450	84.80	181.82	305.01	2680
942.00	1444.6	1142.8	2426	2450	84.60	181.43	304.41	2859
944.00	1447.4	1145.7	2427	2451	84.37	180.98	303.72	2922
946.00	1450.4	1148.6	2428	2452	84.14	180.51	302.99	2830
948.00	1453.2	1151.4	2429	2453	83.92	180.07	302.32	2687
950.00	1455.9	1154.1	2430	2454	83.72	179.68	301.73	2671
952.00	1458.6	1156.8	2430	2454	83.53	179.30	301.15	2647
954.00	1461.3	1159.4	2431	2455	83.34	178.93	300.58	2681
956.00	1464.0	1162.1	2431	2455	83.15	178.55	299.99	2653
958.00	1466.6	1164.8	2432	2456	82.96	178.18	299.42	2668
960.00	1469.3	1167.4	2432	2456	82.77	177.80	298.85	
								2696
962.00	1472.0	1170.1	2433	2457	82.58	177.42	298.26	2742
964.00	1474.8	1172.9	2433	2457	82.38	177.02	297.65	2719

908918 358

COMPANY : WESTERN UNDERGROUND GAS STOR WELL : IONA OBS-1

966.00	1477.5	1175.6	2434	2458	82.19	176.64	297.06	2974
968.00	1480.5	1178.6	2435	2459	81.96	176.17	296.34	2833
970.00	1483.3	1181.4	2436	2460	81.75	175.76	295.70	2936
972.00	1486.2	1184.3	2437	2461	81.52	175.31	295.00	3148
974.00	1489.4	1187.5	2438	2462	81.27	174.79	294.20	3140
976.00	1492.5	1190.6	2440	2464	81.01	174.28	293.40	3172
978.00	1495.7	1193.8	2441	2466	80.76	173.76	292.59	3287
980.00	1499.0	1197.1	2443	2468	80.48	173.21	291.72	3296
982.00	1502.3	1200.4	2445	2470	80.21	172.65	290.85	3311
984.00	1505.6	1203.7	2446	2472	79.93	172.10	289.98	3067
986.00	1508.7	1206.7	2448	2473	79.70	171.63	289.24	3007
988.00	1511.7	1209.8	2449	2474	79.47	171.18	288.54	3058
990.00	1514.7	1212.8	2450	2476	79.24	170.71	287.82	3056
992.00	1517.8	1215.9	2451	2477	79.01	170.25	287.10	3331
994.00	1521.1	1219.2	2453	2479	78.74	169.70	286.24	3250
996.00	1524.4	1222.4	2455	2481	78.49	169.19	285.42	3214
998.00	1527.6	1225.7	2456	2482	78.24	168.68	284.64	3179
1000.00	1530.8	1228.8	2458	2484	78.00	168.20	283.87	3132
1002.00	1533.9	1232.0	2459	2485	77.77	167.72	283.13	3042
1004.00	1537.0	1235.0	2460	2487	77.55	167.28	282.44	3188
1006.00	1540.2	1238.2	2462	2488	77.31	166.80	281.68	

908918 359

908918 360

PE605579

This is an enclosure indicator page.
The enclosure PE605579 is enclosed within the
container PE908918 at this location in this
document.

The enclosure PE605579 has the following characteristics:

ITEM_BARCODE = PE605579
CONTAINER_BARCODE = PE908918
NAME = Iona Obs-1 Synthetic Seismogram
BASIN = OTWAY
ONSHORE? = Y
DATA_TYPE = WELL
DATA_SUB_TYPE = SYNTH_SEISMOGRAM
DESCRIPTION = Iona Obs-1 Geogram Synthetic Seismogram, Seismic Calibration Log Appendix 7 Plot 1
REMARKS =
DATE_WRITTEN =
DATE_PROCESSED = 04-MAR-1999
DATE_RECEIVED =
RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
WELL_NAME = Iona Obs-1
CONTRACTOR = Western Underground Gas Storage Pty Ltd
AUTHOR =
ORIGINATOR = Western Underground Gas Storage Pty Ltd
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

908918 361

PE605580

This is an enclosure indicator page.
The enclosure PE605580 is enclosed within the container PE908918 at this location in this document.

The enclosure PE605580 has the following characteristics:

ITEM_BARCODE = PE605580
CONTAINER_BARCODE = PE908918
NAME = Iona Obs-1 Synthetic Seismogram
BASIN = OTWAY
ONSHORE? = Y
DATA_TYPE = WELL
DATA_SUB_TYPE = SYNTH_SEISMOGRAM
DESCRIPTION = Iona Obs-1 Geogram Synthetic Seismogram GEOGRAM with a 25Hz Zero Phase Ricker Wavelet Appendix 7 Plot 3
REMARKS =
DATE_WRITTEN =
DATE_PROCESSED =
DATE_RECEIVED =
RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
WELL_NAME = Iona Obs-1
CONTRACTOR = Western Underground Gas Storage Pty Ltd
AUTHOR =
ORIGINATOR = Western Underground Gas Storage Pty Ltd
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

908918 362

PE605581

This is an enclosure indicator page.
The enclosure PE605581 is enclosed within the container PE908918 at this location in this document.

The enclosure PE605581 has the following characteristics:

```
     ITEM_BARCODE = PE605581
CONTAINER_BARCODE = PE908918
             NAME = Iona Obs-1 Synthetic Seismogram
            BASIN = OTWAY
        ONSHORE? = Y
        DATA_TYPE = WELL
    DATA_SUB_TYPE = SYNTH_SEISMOGRAM
      DESCRIPTION = Iona Obs-1 Geogram Synthetic Seismogram
                    GEOGRAM with a 30Hz Zero Phase Ricker
                    Wavelet Appendix 7 Plot 4
          REMARKS =
     DATE_WRITTEN =
   DATE_PROCESSED =
    DATE_RECEIVED =
    RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
        WELL_NAME = Iona Obs-1
       CONTRACTOR = Western Underground Gas Storage Pty Ltd
           AUTHOR =
       ORIGINATOR = Western Underground Gas Storage Pty Ltd
        TOP_DEPTH =
     BOTTOM_DEPTH =
   ROW_CREATED_BY = DN07_SW
```

(Inserted by DNRE - Vic Govt Mines Dept)

908918 363

PE605582

This is an enclosure indicator page.
The enclosure PE605582 is enclosed within the container PE908918 at this location in this document.

The enclosure PE605582 has the following characteristics:

ITEM_BARCODE = PE605582
CONTAINER_BARCODE = PE908918
NAME = Iona Obs-1 Seismic Calibration Log
BASIN = OTWAY
ONSHORE? = Y
DATA_TYPE = WELL
DATA_SUB_TYPE = VELOCITY_CHART
DESCRIPTION = Iona Obs-1 Seismic Calibration Log, Adjusted Continuous Velocity Log, Stacked X, Y, Z components Appendix 7 Plot 2
REMARKS =
DATE_WRITTEN =
DATE_PROCESSED =
DATE_RECEIVED =
RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
WELL_NAME = Iona Obs-1
CONTRACTOR = Western Underground Gas Storage Pty Ltd
AUTHOR =
ORIGINATOR = Western Underground Gas Storage Pty Ltd
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

908918 364

PE605583

This is an enclosure indicator page.
The enclosure PE605583 is enclosed within the container PE908918 at this location in this document.

The enclosure PE605583 has the following characteristics:

```
     ITEM_BARCODE = PE605583
CONTAINER_BARCODE = PE908918
             NAME = Iona Obs-1 Synthetic Seismogram
            BASIN = OTWAY
        ONSHORE? = Y
        DATA_TYPE = WELL
    DATA_SUB_TYPE = SYNTH_SEISMOGRAM
      DESCRIPTION = Iona Obs-1 Geogram Synthetic Seismogram
                    GEOGRAM with a 35Hz Zero Phase Ricker
                    Wavelet Appendix 7 Plot 5
          REMARKS =
     DATE_WRITTEN =
   DATE_PROCESSED =
    DATE_RECEIVED =
    RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
        WELL_NAME = Iona Obs-1
       CONTRACTOR = Western Underground Gas Storage Pty Ltd
           AUTHOR =
       ORIGINATOR = Western Underground Gas Storage Pty Ltd
        TOP_DEPTH =
     BOTTOM_DEPTH =
   ROW_CREATED_BY = DN07_SW
```

(Inserted by DNRE - Vic Govt Mines Dept)

908918 365

PE605584

This is an enclosure indicator page.
The enclosure PE605584 is enclosed within the container PE908918 at this location in this document.

The enclosure PE605584 has the following characteristics:

ITEM_BARCODE =	PE605584
CONTAINER_BARCODE =	PE908918
NAME =	Iona Obs-1 Paper Print Field Log
BASIN =	OTWAY
ONSHORE? =	Y
DATA_TYPE =	WELL
DATA_SUB_TYPE =	SYNTH_SEISMOGRAM
DESCRIPTION =	Iona Obs-1 Drift Corrected Sonic Log Scale 1:200 Appendix 7 Log (Enclosure 1)
REMARKS =	
DATE_WRITTEN =	
DATE_PROCESSED =	
DATE_RECEIVED =	
RECEIVED_FROM =	Western Underground Gas Storage Pty Ltd
WELL_NAME =	Iona Obs-1
CONTRACTOR =	Western Underground Gas Storage Pty Ltd
AUTHOR =	
ORIGINATOR =	Western Underground Gas Storage Pty Ltd
TOP_DEPTH =	
BOTTOM_DEPTH =	
ROW_CREATED_BY =	DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

908918 366

PE908919

This is an enclosure indicator page.
The enclosure PE908919 is enclosed within the container PE908918 at this location in this document.

The enclosure PE908919 has the following characteristics:

ITEM_BARCODE = PE908919
CONTAINER_BARCODE = PE908918
NAME = Iona Obs-1 End Of Well Report
BASIN = OTWAY
ONSHORE? = Y
DATA_TYPE = WELL
DATA_SUB_TYPE = EOW_RPT
DESCRIPTION = Iona Obs-1 Directional End Of Well Report Attachment 8
REMARKS =
DATE_WRITTEN =
DATE_PROCESSED =
DATE_RECEIVED =
RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
WELL_NAME = Iona Obs-1
CONTRACTOR = Western Underground Gas Storage Pty Ltd
AUTHOR =
ORIGINATOR = Western Underground Gas Storage Pty Ltd
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)