908903 001
(page 1/457)

Western Underground
Gas Storage Pty. Ltd.

TXU

WELL COMPLETION REPORT

Iona-4

PPL2
ONSHORE OTWAY BASIN, VICTORIA

VOLUME 1 OF 3
TEXT, TABLES, FIGURES & APPENDICES 1-7

October 1999

Copy 3 of 6

908903 002

Western Underground
Gas Storage Pty. Ltd.

TXU

WELL COMPLETION REPORT

Iona-4

PPL2
ONSHORE OTWAY BASIN, VICTORIA

VOLUME 1 OF 3
TEXT, TABLES, FIGURES & APPENDICES 1-7

October 1999

Copy 3 of 6

908903 003

Western Underground Gas Storage Pty Ltd

PPL 2
ONSHORE OTWAY BASIN, VICTORIA

WELL COMPLETION REPORT

Iona-4

October 1999

VOLUME 1

CONTENTS

908903 006

FIGURES

TABLES

TABLES (continued)

APPENDICES

ENCLOSURES

Enclosure 1. Formation Evaluation Log (mudlog) by Halliburton

Enclosure 2. Well Composite Log by PetroVal Australasia Pty Ltd

Enclosure 3. Well Composite Log - Reservoir Section by PetroVal Australasia Pty Ltd

Enclosure 4a. Field Logs - DSI – GR 1:200
Enclosure 4b. Field Logs - DSI – GR 1:500

Enclosure 5a. Field Logs - PEX – HALS Resistivity 1:200
Enclosure 5b. Field Logs - PEX – HALS Resistivity 1:500
Enclosure 5c. Field Logs - PEX – HALS Nuclear 1:200
Enclosure 5d. Field Logs - PEX – HALS Nuclear 1:500

Enclosure 6. Field Logs - Check Shot Survey

Enclosure 7a. Field Logs - CCL – GR 1:200
Enclosure 7b. Field Logs - CCL – GR 1:250

Enclosure 8. Field Logs - Perforation Record

Enclosure 9. Composite Well logs measured depth 1:200 – Validated Log Data Set Platform Express and DSI-GR

Enclosure 10. Composite Well logs True Vertical depth 1:200 – Validated Log Data Set Platform Express and DSI-GR

Enclosure 11 Synthetic seismogram spliced onto the seismic section through Iona-4

1.0 INTRODUCTION

Iona-4 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 as a Production well for gas withdrawal and injection cycle from the Waarre Sandstone reservoir.

The well was drilled as a directional well to target the top Waarre Sandstone reservoir near the crest of the structure approximately 125 metres to the south west of Iona-1 at the Waarre level. The surface location of the well on the Iona site is shown on Figure 1.2. Iona-4 was designed to be drilled as a build and hold directional well which intersected the reservoir section at an angle of just on 50 degrees dropping to 48.8 degrees at total depth. The well was also designed to facilitate coring of both the overlying Belfast Mudstone seal section and a significant portion of the Waarre Sandstone reservoir section to provide detailed reservoir core analysis data.

The well was cased, completed and suspended with tubing to surface and a permanent well-head installed. The well was perforated in the Waarre C1 sandstone reservoir from 1454 to 1467 MDKB. The well intersected the current gas/water contact at 1486.4 MDKB in a clean sand in the Waarre C2 reservoir therefor clearly establishing the current gas/water field contact at 1185.0 mTVDSS (based on the validated logs in Enclosure 3). The well was completed as a gas producer and an initial flow and clean up test on 30 March, 1999 flowed gas for a period of two hours at a rate of 49.3 to 51.3 mmscf/day through a 84/64" choke. A second completion/cleanup test on 11 May, 1999 flowed gas for a period of 1.5 hours at a rate of between 27.66 to 28.30 mmscf/day through a 1" choke.

2.0 WELL HISTORY

2.1 LOCATION DATA

Basin:	Otway, onshore western Victoria
Lease:	PPL-2
Surface Coordinates:	5728374.1 metres North (Termed Slot 3) 677379.4 metres East
Surface Elevation:	Ground Level (GL): 130.0 metres AHD Kelly Bushing (KB): 135.0 metres AHD (Datum) (All depths relative to KB unless otherwise stated)
Bottom Hole Coordinates:	5728319.7 metres North 676880.3 metres East
Coordinate System:	Australian Map Grid 66, Zone 54, Central Meridian: 141 East

OTWAY BASIN - GAS FIELD LOCATION MAP

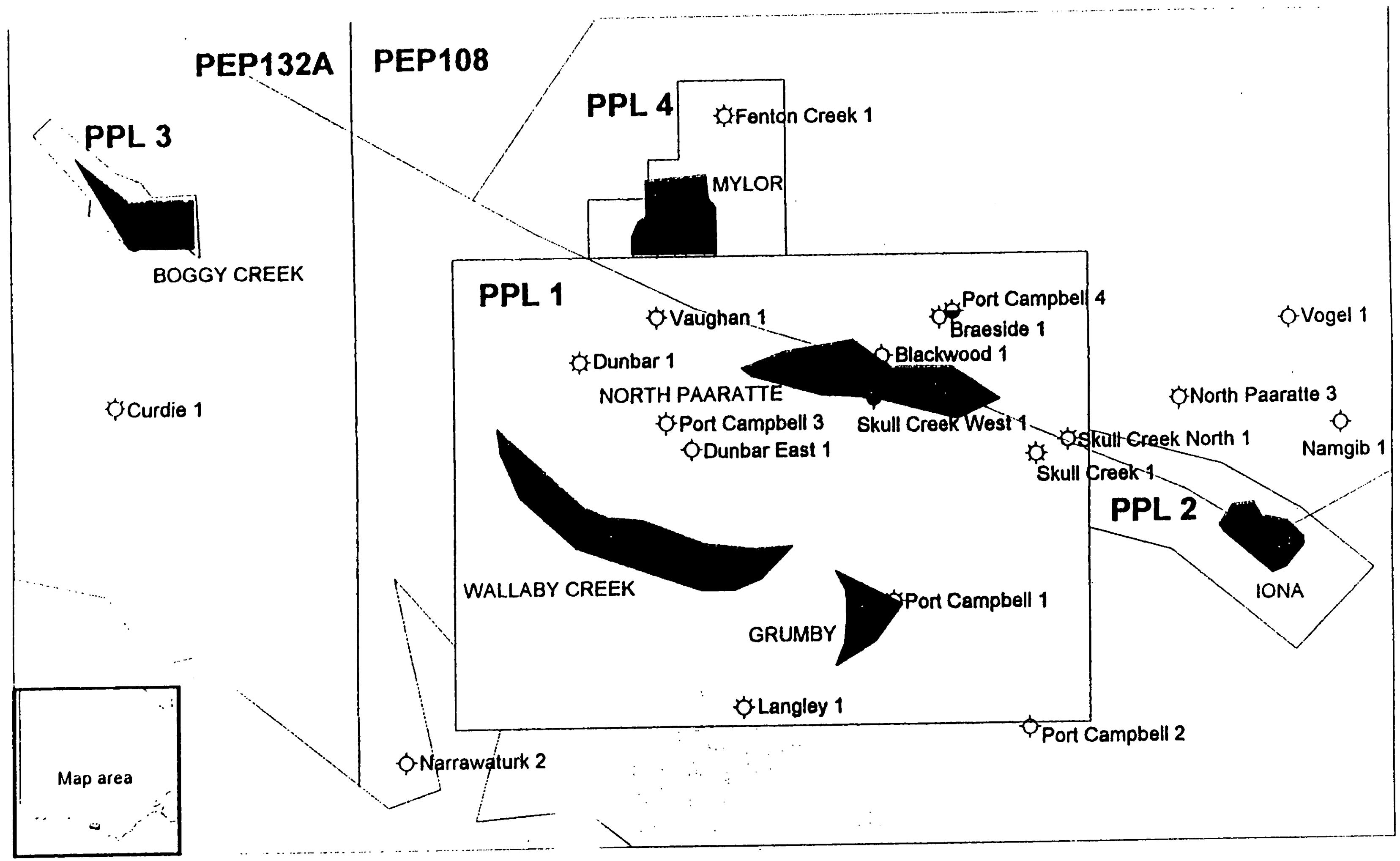
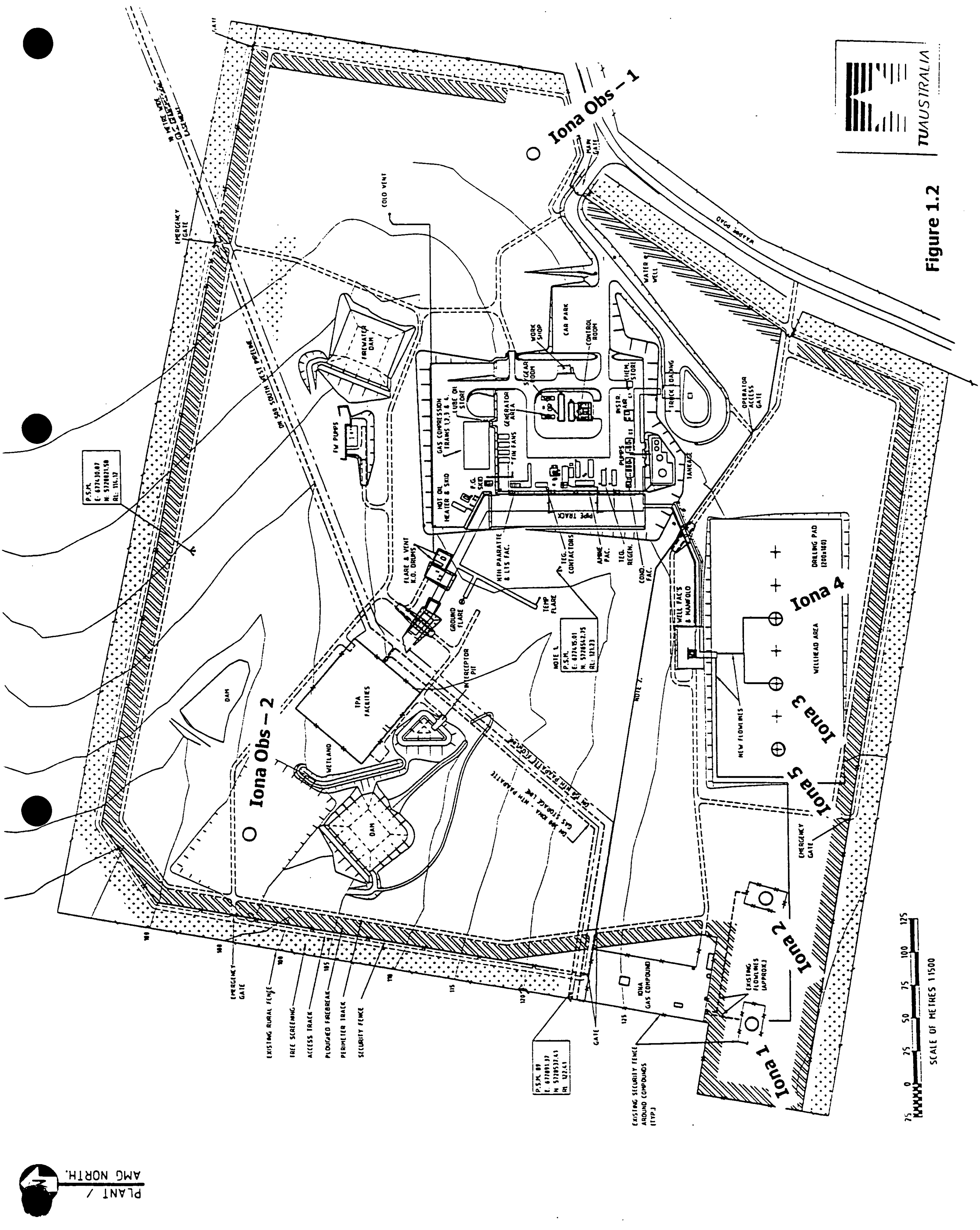


Figure 1.1

908903 010



Iona Obs – 1
Iona Obs – 2
Iona 1
Iona 2
Iona 3
Iona 4
Iona 5
TUAUSTRALIA
GAS COMPRESSION TRAINS 1,2,3 & 4
CAR PARK
CONTROL ROOM
WORK SHOP
FIREWATER DAM
DAM
WETLAND
TPA FACILITIES
WELLHEAD AREA
DRILLING PAD
NEW FLOWLINES
PIPE TRACK
GROUND FLARE
EMERGENCY GATE
EXISTING RURAL FENCE
TREE SCREENING
ACCESS TRACK
PLOUGHED FIREBREAK
PERIMETER TRACK
SECURITY FENCE
SCALE OF METRES 1:1500
PLANT / AMG NORTH.

Figure 1.2

2.2 GENERAL DATA

Well Name:	Iona - 4
Classification:	Gas Injection/Withdrawal 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 0.4 km from surface location.
Final measured Depth:	Driller: 1560.0 m Logger: 1554.4 m
Final True Vertical Depth:	1368.0 mKB
Spud date:	21:30 hours March 6, 1999.
TD reached:	22:45 hours March 22, 1999.
Days to Drill:	16.05 days
Date well completed:	09:00 hours March 30, 1999
Rig Released:	18:00 hours March 30, 1999
Well Status:	Suspended Gas Injection/Withdrawal well

2.3 WELL SUMMARY

Table 2.1 Well Summary

WELL NAME	Iona –4		
DESIGNATION	Gas Injection/Withdrawal Well		
BASIN	Otway		
OPERATIONS BASE	Kelly Down Consultants, St. Leonard's, Sydney		
FIELD OPERATIONS BASE	On site at Iona , Waarre Rd, Port Campbell, Vic.		
DRILLING CONTRACTOR	OD&E		
RIG	Rig 30		
RT to GL	4.98 m		
GL to MSL	130.0 m		
TOTAL DEPTH (M DKB)	1560.0 m KB (driller)		
RIG MOBILISED	27 Feb 1999		
SPUD DATE	06 Mar 99 @ 21:00 hrs		
17.5" HOLE SECTION TD Depth/Time	639.0 m @ 14:30 hrs 08 March 99		
12.25" HOLE SECTION TD Depth/Time	1560 m @ 22:45 hrs 22 Mar 99		
SPUD TO TOTAL DEPTH TIME	16 Days 1.25 hrs		
COMPLETION INSTALLED	30 March 99 @ 09:00 hrs		
SPUD TO WELL SUSPENDED	23 Days 20.5 hrs		
CASING STRINGS	20 "	Conductor	10 m
	13.375"	Surface Casing	504 m
	9.635 "	Production Casing	1557 m
FINAL WELL STATUS	A 5 ½" x 9 5/8" single packer completion was run simultaneously with 7" TCP guns. The completion was installed without incident and a 5 ½" Wood group Xmas tree installed and tested. Perforations – 1454 m to 1467 m		

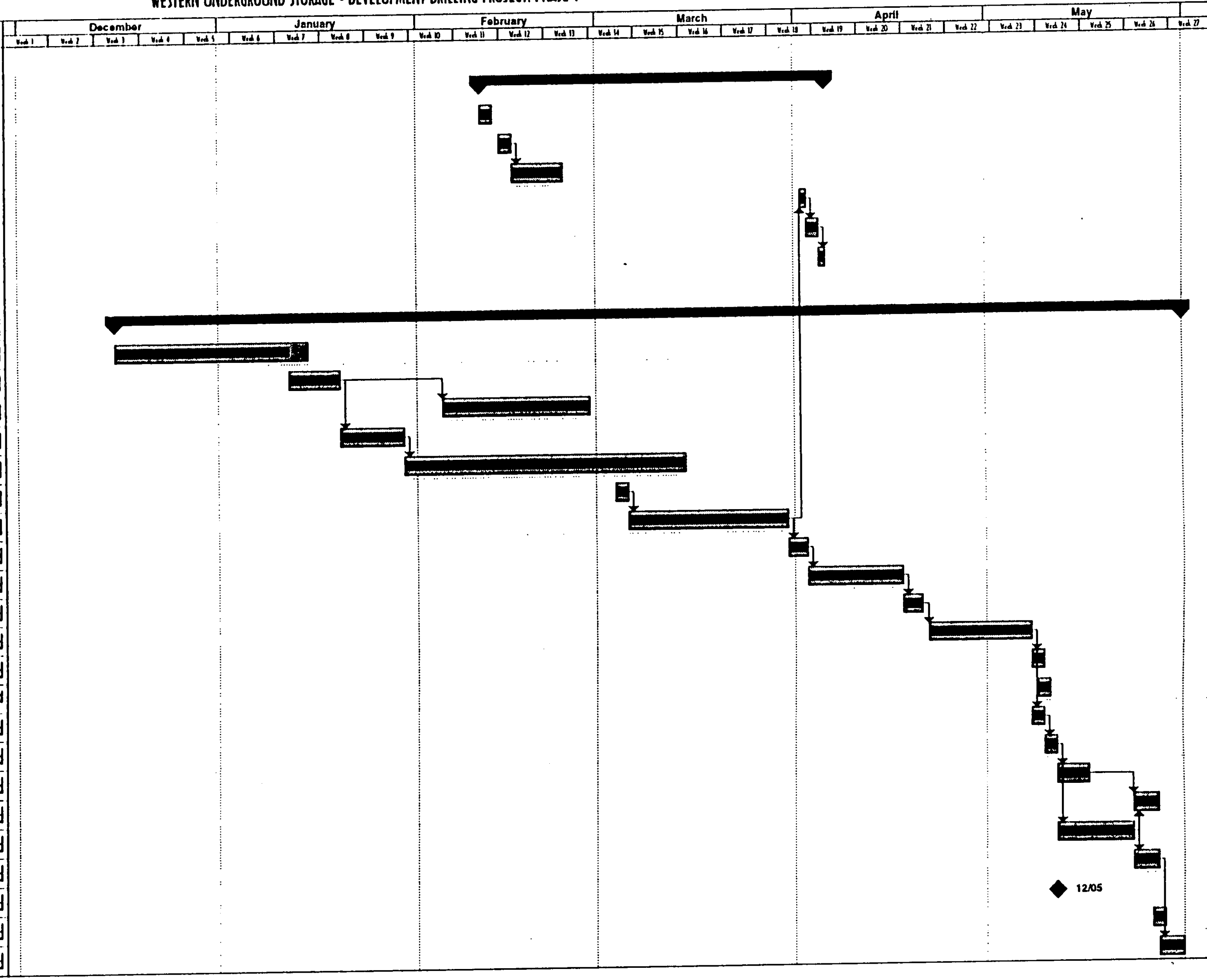
2.4 OVERALL PROJECT TIMING

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 hand-over.

908903 014

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 4/06/99

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

wugs_schedule280599 Page 1

Project Status

Figure 2.1

KDC For WUGS

2.5 CONTRACTORS

Table 2.2 Contractors

PROJECT MANAGERS	Kelly Down Consultants Pty Ltd
DRILLING	OD&E
LOCATION SURVEY	T. G Freeman and Associates
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 hand-over from drilling to production. Figure 3.1 is the Wellhead Diagram, Figure 3.2 is the Completion Diagram and Figure 3.3 is the Hand-over Certificate.

3.2 OPERATIONAL SUMMARY

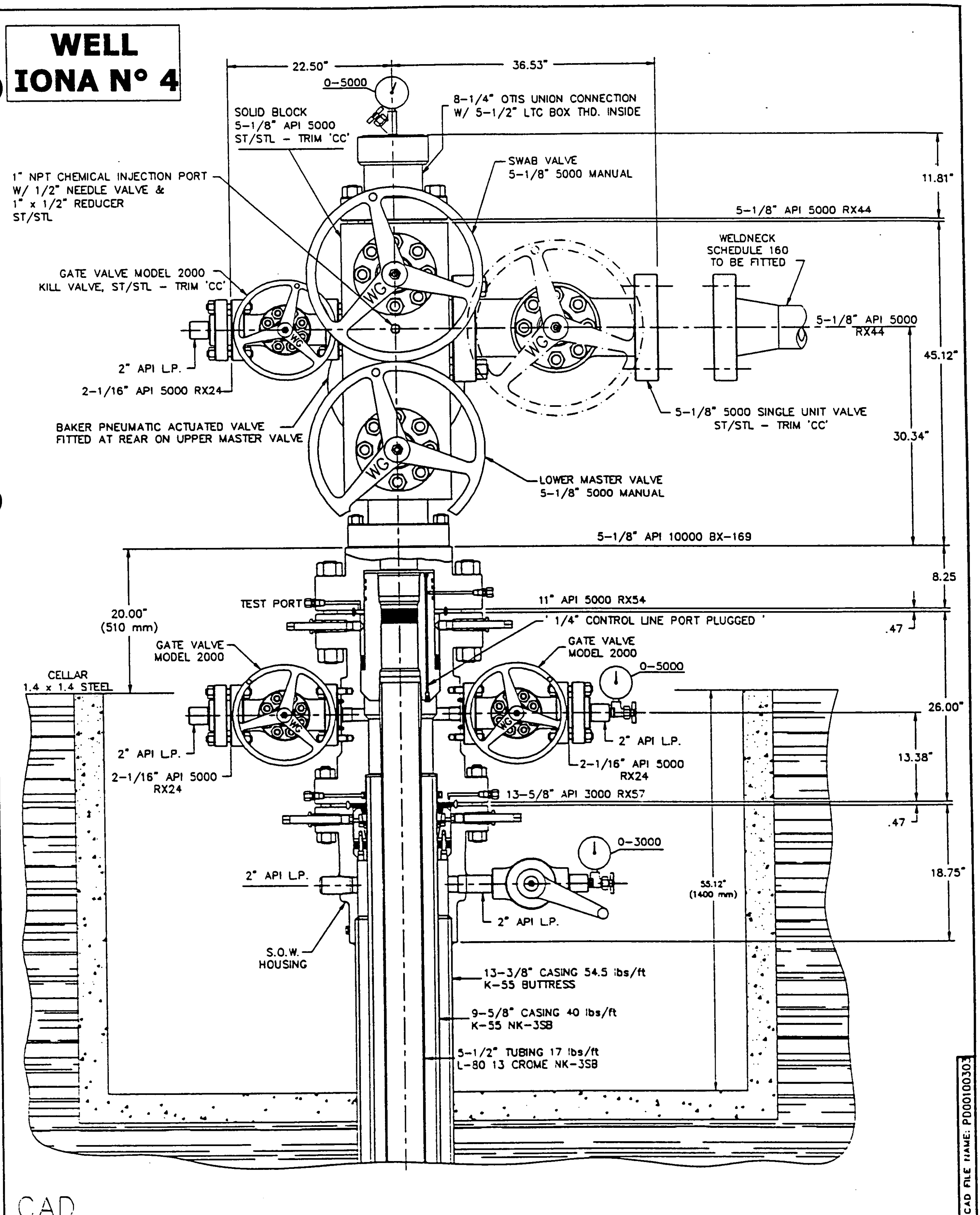
3.2.1 Logistics and Planning

Kelly Down Consultants ("KDC") managed the drilling and completion of the Iona-4 well on behalf of WUGS as part of the project to drill and complete three injection/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 wells have their surface locations within the security fence at the perimeter of the site.



WG
WOOD GROUP

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

WESTERN UNDERGROUND
IONA GAS INJECTION WELL N° 4
CASING PROGRAM: 13-3/8" x 9-5/8" x 5-1/2"

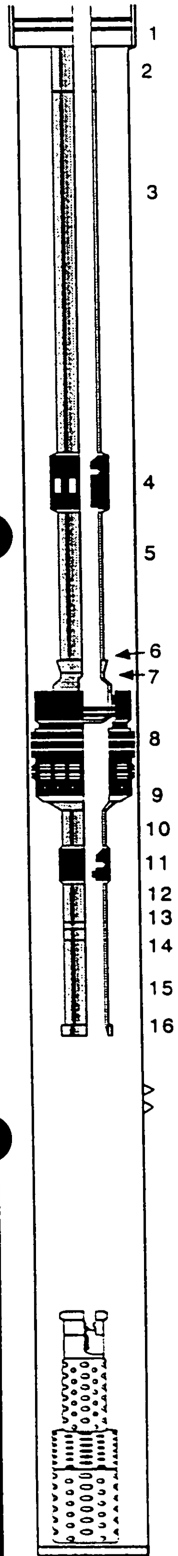
Drawn by:	Date:	Scale:	Drawing Number SHT 1 OF 1
R.C.	04-05-1999	N.T.S.	PD-001003-03

Figure 3.1

HALLIBURTON

Australian Completions

WELL : Western Underground Gas Storage; Iona 4
DATE : 29-March-99



Depth	Length(m)	No.	DESCRIPTION	O.D.	I.D.	PART / No
	0.600		Difference			
0.60	4.430		Elevation MDRKB			
5.03	0.240	1	Woodgroup Tubing Hanger	5.500	4.950	
5.27	0.000		Compression			
5.27	7.650	2	Pup Joint - 13 Cr 80 - 5 1/2" 17 ppf NK3-SB	5.500	4.892	
12.92	1402.230	3	Tubing -13 Cr - 5 1/2" 17 ppf NK3-SB	5.500	4.892	
1415.15	1.400	4	SSD - 5 1/2" NK3-SB B x P 9 Cr	6.560	4.562	621 XD 45603
			[Open Down - Flow Area 16.35 sq in]			
			[Positioning Tool - 42 BO 153]			
1416.55	2.410	5	Pup Joint - 13 Cr 80 - 5 1/2" 17 ppf NK3-SB	5.500	4.892	
1418.96	0.340	6	CrossOver - 5 1/2" NK3-SB B x 4 1/2" EUE P 9 Cr	6.020	3.958	MSO-7867-4
1419.30	0.260	7	Ratch Latch w/ RTR Seals - 4 1/2" EUE B 9 Cr	5.630	3.938	212 OO 7326
1419.56	2.460	8	Packer - 9 5/8" HVT 40 # LTC B 9 Cr	8.530	3.880	812HVT95382
1422.02	0.260	9	Crossover - 5" LTC P x 4 1/2" LTC Pin 9 Cr	5.020	3.830	MSO 7867-5
1422.28	2.960	10	10' Pup Jt - 4 1/2" 11.6 ppf K55 w/LTC BxP	4.500	3.958	
1425.24	0.410	11	'XN' Nipple - 4 1/2" LTC B x P 9 Cr	5.023	3.725	11XN 38160-A
1425.65	2.960	12	10' Pup Joint - 4 1/2" K55 w/LTC Box x Pin	4.500	3.958	
1428.61	0.290	13	CrossOver - 4 1/2" LTC Box by 4 1/2"EUE Pin	5.000	3.958	
1428.90	0.240	14	Debris Sub - w/ 4/12" EUE Box x Pin	5.560	3.880	
1429.14	9.570	15	Tubing Joint - 4 1/2" w/EUE Box x Pin	4.500	3.958	
1438.71	0.650	16	Schlumberger SAXR Re-Entry Guide.	5.520	3.860	
1439.36			End of Tubing			
			Perforations at 1454 m to 1467 m			
			7" TCP 30 deg phasing - 12 spf 37 gm HMX charges			
			Top of fish at 1514.14 meters			
			Schlumberger TCP Assembly - left in hole;			
			consisting of 7" guns and 3 3/8 gun spacer.	3.375		
			Total TCP length left in hole: 29.86 meters	7.000		
			PBTD at 1544. meters			
			Pick-up weight : 75,000.lb.; Slack-off: 65,000.lb			
			15,000 lb compression on tubing			
			Ratch Latch pinned at 120,000. Lb			
			Completion fluid: 8.6 lb/gal inhibited 3% KCl brine.			

Figure 3.2

TU AUSTRALIA

WESTERN UNDERGROUND GAS STORAGE

WELL HANDOVER & STATUS RECORD

Detail	Description	Distribution Name	Distribution Company
Field / Country:	Iona / Australia	Gary Scott	WUGS
Well No:	Iona 4	Kurt Matheson	TU Australia
Well Surface Co-ordinates:	5728374.14 N: 677379.42 E	David Hesse	Worley/Bechtel
Well TD Co-ordinates:	5728316.74 N 6768880.38 E	Colin Stuart	KDC
Maximum Inclination:	48.8 deg @ 1362 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: 1560 m MDRKB PBTD: 1145 m MDRKB		
Well Type:	Single Completion Gas Well		
Purpose of handover	Handing new well to Production Operations		
Handover from:	WUGS Drilling -		
Handover to:	Wugs Operations -		
HANDOVER DATE:	May 14 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	5 1/2" 5,000 psi	Wood Group Block Tree
1	Swab Valve	Closed	0 psi above/below	5 1/8" API 5,000 psi	
2	Tree upper master valve	Open	0 psi	5 1/8" API 5,000 psi	
3	Upper master actuator	Lock out cap installed	Pneumatic, no air supply	100 psi air supply	Baker Oil Tools type 1705
4	Tree lower master valve	Closed	0 psi above/below	5 1/8" API 5,000 psi	
5	Flow wing valve	Closed	0 psi above/below	5 1/8" API 5,000 psi	
6	Kill Wing Valve	Closed	0 psi above/below	2 1/16" API 5,000 psi	
7	Tree BPV	Installed	1500 psi below BPV	5" nominal Type H	
8	Tree cap	Installed			6,000 psi gauge installed
9	A annulus valve	Closed			3,000 psi gauge installed
10	A annulus valve outer	Not installed			
11	B annulus valve	Closed			
12	Last rec.flow / FTHP	28.1MMSCFD @1390 PSIG 11/05	SITHP = 1500 psig		Est. rate during brine clean up
13	Well fluid	Gas to BPV	1500 psi below BPV		SI pressure below BPV 1500 psi
14	A Annulus	8.6 ppg 3% KCL inhibited brine	0 psi	2 x 208 Litre drums inhibitor	COAT 2748 Baroid inhibiter
15	Wireline plugs installed?	No			
16	Perforated Interval	Open		1365.5 m to 1377.5 m	7 " TCP 30 deg,12 spf. 37cm.hmx
17	Production Tubing	5 1/2" 13 Cr L80 17 ppf NK3SB		ID: 4.892" Drift: 4.767"	
18	Nipple Profile	XN @ 1425 m		ID: 3.725"	Part No. 11XN38160-A
19	Sliding Sleeve	5 1/2" SSD @ 1415 m		ID: 4.562"	Part No. 621 XD 45603
20	Production Packer	9 5/8" HVT 40# @ 1419 m		ID: 3.880"	Part No. 812HVT 35382
21	Production Casing	9 5/8" 40 ppf L80 NK3SB		ID: 8.835" Drift: 8.679"	
22	Minimum restriction	X/Over 5" x 4 1/2" @ 1419 m		ID: 3.830"	Packer to tailpipe X/O
23	Wellhead Type	13 3/8" x 9 5/8" x 5 1/2"	5,000 psi rated		Wood Group Slip & Seal Type

Remarks:

Well handed to WUGS Operations following completion of drilling and testing program.
Tree cap installed on Xmas tree.
Steel Cellar installed, with ground level grating.
Handwheel locked with looped chain. (Lower Master)
Temporary protective steel cage to be installed around well.
Warning sign posted on actuator lockout cap.
Name Plate installed on cage.
Cellar drain installed.
A 5 1/8" 5,000 psi to 6" SCH 160 Weld Neck flange, for flow wing valve outlet connection to flow line, has been left inside the stores (blue) container.

Signatures:

Well accepted by : C. Stuart Signed: Date:

Well handed over by Signed: Date: 14/05/99

Figure 3.3

3.2.2 Site Preparation

Site construction for Iona-4 commenced in early January 1999. The lease area was on a flat paddock off the main plant access road. Iona-4 was to be situated on a drilling pad specifically designed for the drilling of the injection/withdrawal wells. Uncertainty in the future field development plans necessitated provision for some flexibility in the slot configuration for the main pad. Consequently a 50 m spacing was selected as the optimum for phase one drilling. Bottom hole targets had been selected for the production/withdrawal wells by the subsurface team. The optimum slot to target profiles were selected which put the Iona-4 slot 50m west of the eastern edge of the main pad boundary.

A construction contractor was appointed to lay down a 600 mm limestone/sandstone base for the main pad 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 20 inch 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.

A schematic of the overall site showing the location of Iona-4 within the site boundary is shown on Figure 1.2.

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.

Iona-4 was drilled during March as the first of the new injection/withdrawal wells. The rig was moved from the Iona Obs-1 site to the Iona-4 site via Waarre road.

3.2.4 Pre Spud

The Iona-4 pre-spud meeting was held at the rig site on March 5, 1999. The rig move from the Iona Obs-1 location commenced on the March 5, 1999 and was completed by 21.30 hrs on March 6, 1999.

3.2.5 17 ½" Hole Section

After a full safety briefing with the rig crews, Iona-4 was spudded at 21:30 hrs on the March 6, 1999. The 17½" 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.

A vertical hole was drilled as per the well plan to 639 m. Several hard stringers were encountered drilling through the Gellibrand Marl. Tight spots were encountered on the trip out from TD, with a maximum overpull of 30 k lbs. The 13 3/8" casing was run to 504 m where it became stuck either due to differential pressure or possibly due to an excessively rugose well bore. After several attempts to work the string free and displacing the hole to brine to reduce the differential pressure, the casing was cemented in place.

3.2.6 12 1/4" Hole section

A leak off test was performed after drilling the shoe but this was considered invalid due to the mud system becoming contaminated by excess cement in the rat hole. After changing out the mud system, the test was repeated and an equivalent mud weight ("EMW") of 12 ppg was achieved. The section was drilled directionally to the core point at 1381m. Appendix 10 gives details of the bottom hole assembly ("BHA") performance.

The core barrel assembly proved too stiff for the hole and held up at the kick off point. The assembly was reamed to bottom from the kick off point and cored only 2 m after which no further progress could be made. The core was recovered with a 75 percent recovery and the corehead found to be 3/16" undergauge on POOH. Drilling continued to the next core point at 1448.5 m. Core No 2 was cut from 1448.5 m to 1455 m with a 93.2 percent recovery. Core No 3 was then cut from 1455 m to 1463.3 m, with an 89% recovery. Core No 4 was cut from 1463.3 m to 1470.6 m with an 87 percent recovery. The final core No 5 was then cut from 1470.6 m to1478.3 m, with 100 % recovery. The well was then drilled to TD at 1580 m.

Open hole logging was completed with the exception of a failed offset check-shot survey which was successfully re-run in cased hole.

3.2.7 9 5/8" Production String

A combination 9 5/8" string was run with 100 m of 40 lb/ft L80 13% Chrome NK3SB casing across the pay zone and L80 casing back to surface. The string was successfully cemented in place and the wiper plug bumped with a pressure of 2500 psi. A conventional slip and seal type wellhead was installed after dropping the casing slips and cutting the 9 5/8" casing. The tubing head was installed and tested to 2000 psi.

A cement bond log ("CBL") showed effective isolation across the reservoir sands had been achieved.

3.2.8 Clean up and Perforate

A 9 5/8 " casing scraper run ensured a clean setting position for the completion packer prior to circulating the well to brine and running the completion. A 3% KCL brine was circulated at TD preceded by a clean up sweep.

3.2.9 Completion

A 5 ½" x 9 5/8" single packer completion was run simultaneously with 7" TCP guns. The completion was installed without incident and a 5½ inch Wood group Xmas tree installed and tested. After rigging up surface test lines, the TCP guns were detonated by the drop bar method, and the well flowed to clean up. Test rate details can be found in the Halliburton Iona-4 test report in Appendix 8. An initial flow and clean up test on 30 March, 1999 flowed gas at for a period of two hours at a rate of between 49.3 – 51.3 mmscf/day through a 84/64" choke. A second completion/cleanup test on 11 May, 1999 flowed gas for a period of 1.5 hours at a rate of between 27.66 – 28.30 mmscf/day through a 1" choke.

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-4 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. An electronic multishot survey ("EMS") survey was dropped through drillpipe at TD. Gyro surveys were conducted by Gyrodata. The well was subsequently resurveyed on 6 June, 1999 and the definitive survey for the well is presented in Appendix 2.

3.3.4 Directional Drilling

Iona-4 was designed as a directional well. No angle problems were experienced and the well was drilled comfortably within the target area. A directional plot showing a plan and section view is presented in Figure 3.5.

3.3.5 Iona-4 Time Performance

Iona-4 was spudded at 21:30 hrs on March 6, 1999, with OD&E Rig 30. The rig was released at 18:00 hrs on March 30, 1999, after drilling, completion and testing in 23 days 20.5 hours. The following charts illustrate the time performance.

3.3.6 Time Analysis

Table 3.1 Time Summary

ACTIVITY	HOURS	DAYS
Rig move	116.0	4.83
Rig up	22.5	0.94
Drilling	131.5	5.48
Bit Trip	64.5	2.68
Wiper trip	48.5	2.02
Survey	10.5	0.44
Circulate and condition	24.5	1.02
Change BHA	16.5	0.69
Casing & Cementing	40.0	1.67
Wellhead & BOP's	50.0	2.08
Coring	21.5	0.90
Logging	15.0	0.63
Wash & Ream	34.0	1.42
Fishing	16.5	0.69
Rig Repairs	6.5	0.85
Completion	92.0	3.83
Miscellaneous	7.0	0.29
TOTAL	**731**	**30.45**

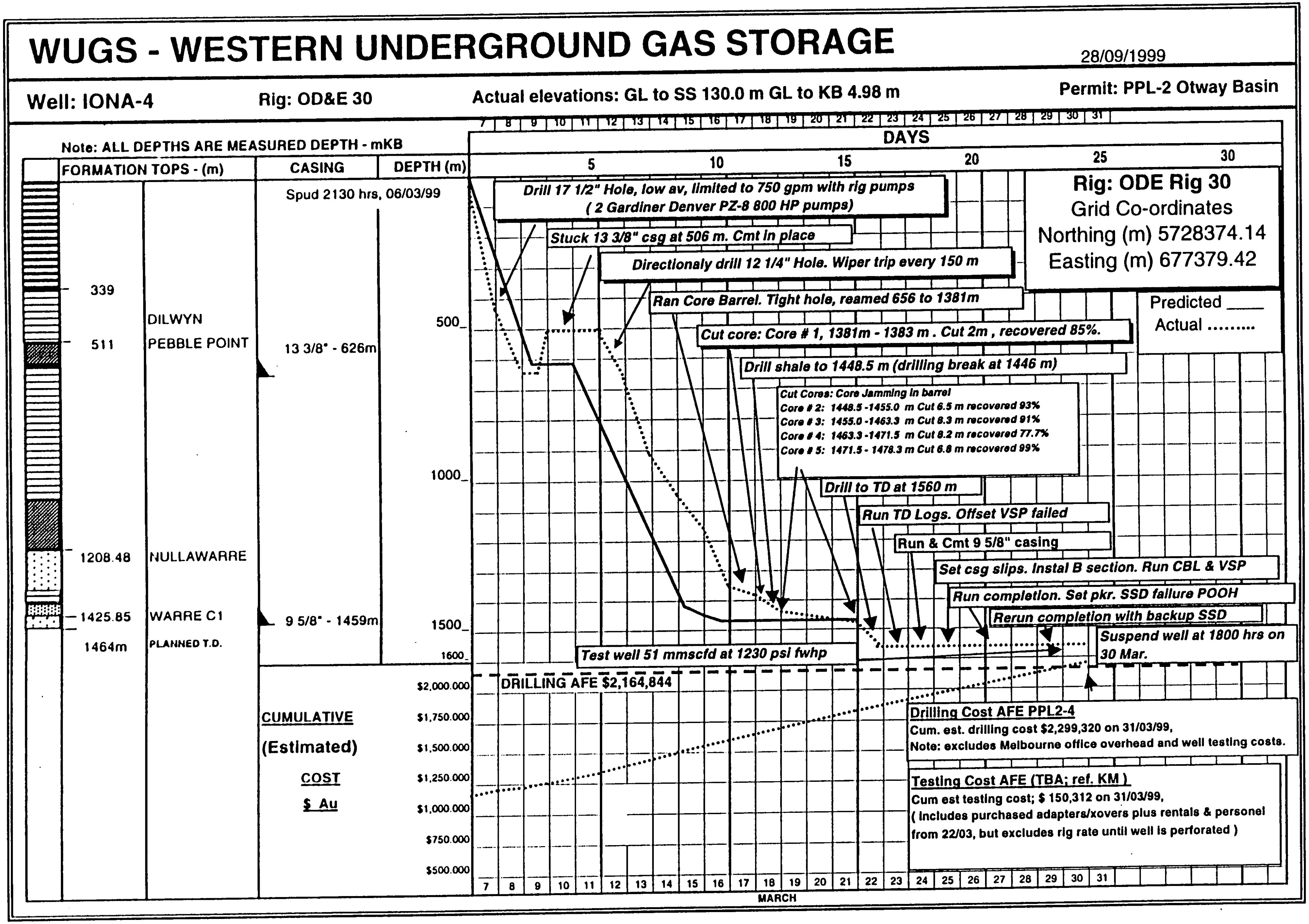

WUGS - WESTERN UNDERGROUND GAS STORAGE
28/09/1999
Well: IONA-4
Rig: OD&E 30
Actual elevations: GL to SS 130.0 m GL to KB 4.98 m
Permit: PPL-2 Otway Basin
Note: ALL DEPTHS ARE MEASURED DEPTH - mKB
FORMATION TOPS - (m)
CASING
DEPTH (m)
DAYS
339
511
1208.48
1425.85
1464m
DILWYN
PEBBLE POINT
NULLAWARRE
WARRE C1
PLANNED T.D.
Spud 2130 hrs, 06/03/99
13 3/8" - 626m
9 5/8" - 1459m
500
1000
1500
1600
Drill 17 1/2" Hole, low av, limited to 750 gpm with rig pumps
(2 Gardiner Denver PZ-8 800 HP pumps)
Stuck 13 3/8" csg at 506 m. Cmt in place
Directionaly drill 12 1/4" Hole. Wiper trip every 150 m
Ran Core Barrel. Tight hole, reamed 656 to 1381m
Cut core: Core # 1, 1381m - 1383 m . Cut 2m , recovered 85%.
Drill shale to 1448.5 m (drilling break at 1446 m)
Cut Cores: Core Jamming in barrel
Core # 2: 1448.5 -1455.0 m Cut 6.5 m recovered 93%
Core # 3: 1455.0 -1463.3 m Cut 8.3 m recovered 91%
Core # 4: 1463.3 -1471.5 m Cut 8.2 m recovered 77.7%
Core # 5: 1471.5 - 1478.3 m Cut 6.8 m recovered 99%
Drill to TD at 1560 m
Run TD Logs. Offset VSP failed
Run & Cmt 9 5/8" casing
Set csg slips. Instal B section. Run CBL & VSP
Run completion. Set pkr. SSD failure POOH
Rerun completion with backup SSD
Suspend well at 1800 hrs on 30 Mar.
Test well 51 mmscfd at 1230 psi fwhp
Rig: ODE Rig 30
Grid Co-ordinates
Northing (m) 5728374.14
Easting (m) 677379.42
Predicted ____
Actual ....
DRILLING AFE $2,164,844
CUMULATIVE
(Estimated)
COST
$ Au
$2,000.000
$1,750.000
$1,500.000
$1,250.000
$1,000.000
$750.000
$500.000
Drilling Cost AFE PPL2-4
Cum. est. drilling cost $2,299,320 on 31/03/99,
Note: excludes Melbourne office overhead and well testing costs.
Testing Cost AFE (TBA; ref. KM)
Cum est testing cost; $ 150,312 on 31/03/99,
(Includes purchased adapters/xovers plus rentals & personel
from 22/03, but excludes rig rate until well is perforated)
5
10
15
20
25
30
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
MARCH

Figure 3.4

Insert figure 3.4 here

FIGURE 3.4 – TIME DEPTH CURVE

sperry-sun DRILLING SERVICES

Western Underground Gas Storage Pty. Ltd.

DrillQuest

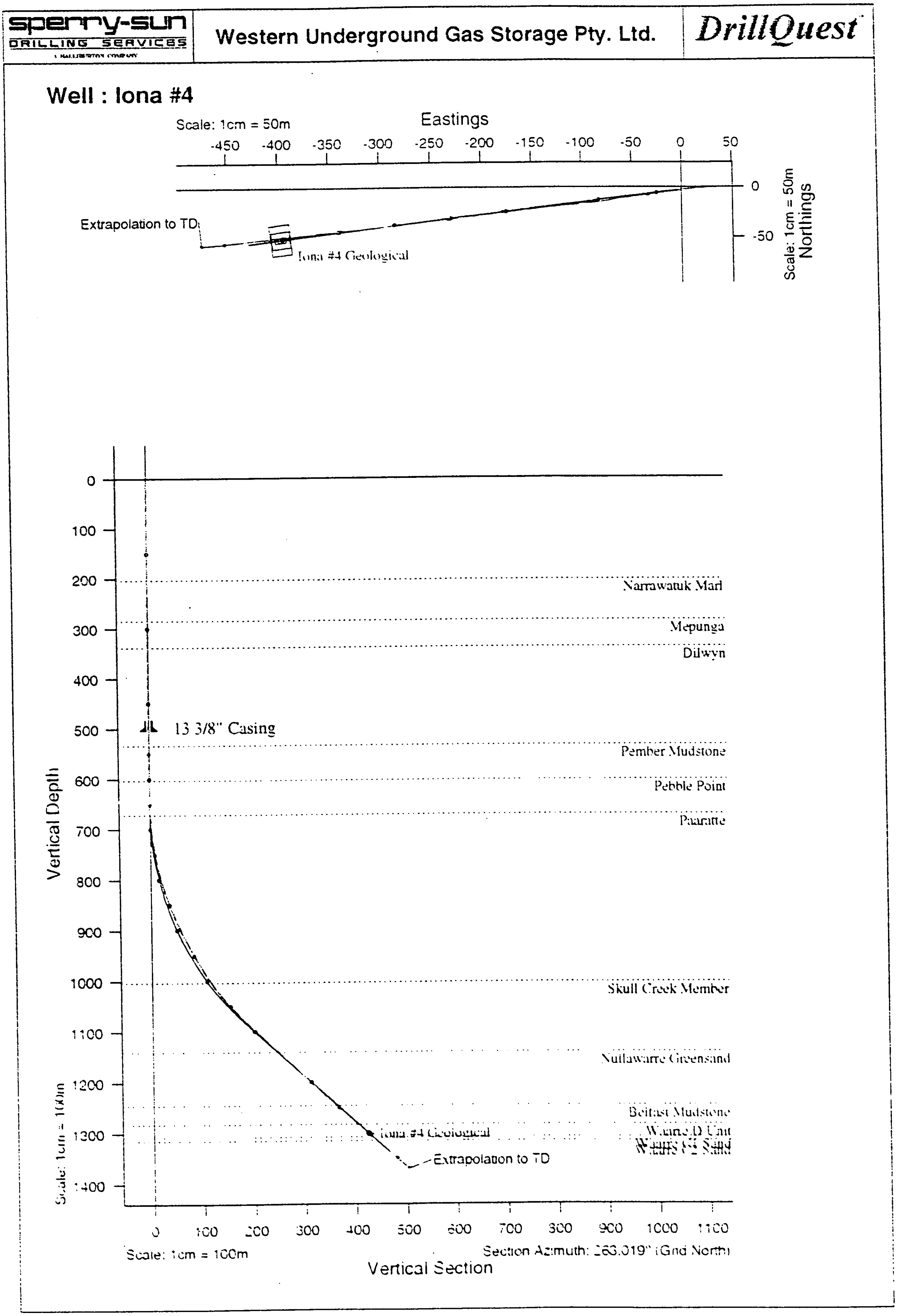


Figure 3.5

Figure 3.6 Time Performance Charts

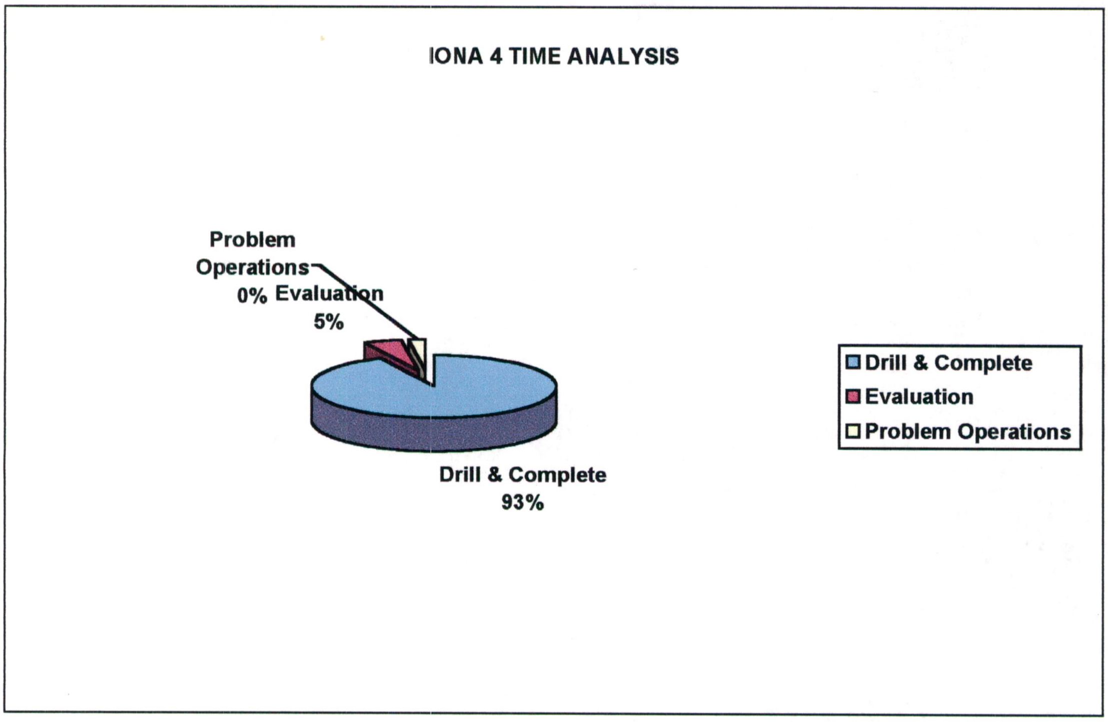


FIGURE 3.6a - OVERALL PERFORMANCE CHART

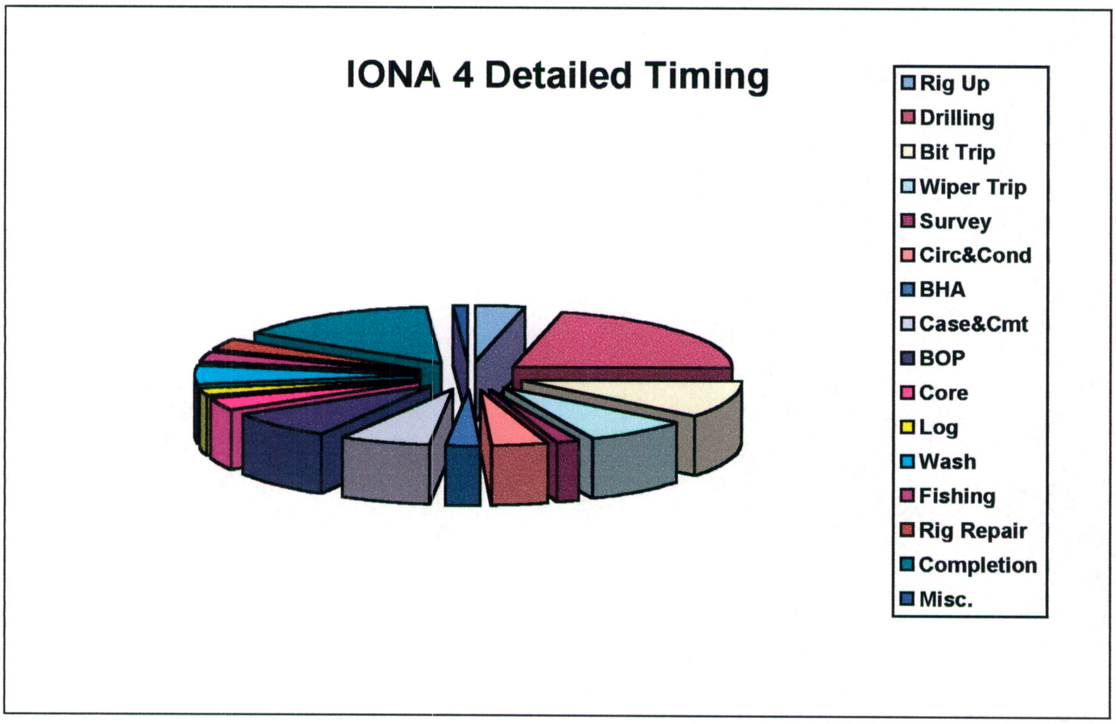


FIGURE 3.6b - DETAILED PERFORMANCE CHART

3.4 BHA AND BIT SUMMARIES

The BHA's and bit record are detailed in the Directional Drilling report in Appendix 10.

3.5 CASING AND CEMENTING REPORT

3.6.1 17 1/2" Hole Section:13 3/8" Surface Casing (Surface to 504 mRT)

Table 3.2 13 3/8" Surface Casing Tally

SURFACE CASING

WELL NAME :	Iona-4		**DATE RUN :**		09/03/99
ELEVATIONS :	**R.T. :**	4.98 m	**M.S.L. :** 130.5 m	**T.D. :**	629 m
STRING TYPE :	13 3/8" Surface k55		**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
13 3/8"	54.5	1	BTC	13.07	503.95	491.42	Shoe /Joint
13 3/8"	54.5	1	BTC	0.38	491.42	491.04	Float collar
13 3/8"	54.5	40	BTC	480.17	491.04	11.85	Joints csg
13 3/8"	54.5	1	BTC	12.07	11.85	-1.20	Landing jint
			Tally Total :	503.95	Casing Landed at :		m

CASING SPOOL TYPE :	WG	**SIZE :**	13 3/8" x 9 7/8" x 5 1/2"		
CENTRALISERS AT :	2 on shoe joint, 1 per second joint thereafter				
SCRATCHERS AT :	Cement basket at 120 m				

Table 3.3 Surface Casing Cement Details

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'	1224	Bentonite CFR-3L NF-1	Gel Extender Friction Reducer Anti-Foam	2874 lb 22 gal 10 gal	2.5 2gals/10 bbl 1	Blend Mix Water Mix Water	Lead Slurry.
'G'	393					Mix Water	Tail Slurry –no losses

SURFACE CASING CEMENT DETAILS

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) :**	6.2 (Rig pumps)
PLUG BUMPED WITH (psi) :	Bumped – 1500	**DISPLACEMENT VOLUME (bbl) :**	Calculated 249 Actual 248
REMARKS :	Good returns, floats held.		

3.6.2 12 1/4" Hole Section: 9 5/8" Production Casing (Surface to 1557 mRT)

Table 3.4 9 5/8" Production Casing Tally

PRODUCTION/MONITORING CASING

WELL NAME :	Iona-4	**DATE RUN :**			8/02/99
ELEVATIONS :	**R.T. :** 4.98 m	**M.S.L. :**	130.5 m	**T.D. :**	1560 m
STRING TYPE :	9 5/8" Production	**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
9 5/8"	40	2	NK3SB	23.09	1557	1545	Shoe
9 5/8"	40	3	NK3SB	35.17	1545	1510.6	13%cr Csg
9 5/8"	40	10	NK3SB	116.92	1510.58	1393.66	13% cr Csg
9 5/8"	40	118	NK3SB	1381.82	1393.66	4.85	9 5/8" Joints
Tally Total :					Casing Landed at :		1557

CASING SPOOL TYPE :	WG	**SIZE :**	13 3/8" x 9 5/8" x 5 1/2"		
CENTRALISERS AT :	One per joint for first 10 joints, every 2 joints to shoe.				
SCRATCHERS AT :	Nil.				

3.6.3 9 5/8" Production Casing Cement Details

Table 3.5 Production Casing Cement Details

DRILLING FLUID PRIOR TO CEMENTING :	9.2 ppg Weighted KCL / PHPL
PREFLUSH, SPACER DETAILS :	20 bbls water plus 20 bbl, 8.5 ppg Mudflush.

CLASS	No. SXS	ADDITIVE	FUNCTION	QUANTITY OF ADDITIVE (lbs / gal)	%	HOW ADDED BLEND OR MIX WATER	REMARKS
'G'	725	Econolite HR-6-L NF-1	Extender Retarder Anti-foam	398 gal 58 gal 52.5 gal	.55 gal/sx .08 gal/sx 0.5 lb/1bbl	Mix Water Mix Water Mix Water	Lead Slurry.
'G'	334	Halad 322LXP Gasstop	Water loss control Gas check	28 gal		Mix Water	Tail Slurry –no losses

THEORETICAL TOP OF CEMENT (m) :	Surface	**AVERAGE SLURRY WEIGHT (ppg) :**	Lead 12.5 Tail 15.8
DISPLACEMENT FLUID :	8.3 ppg Fresh water	**DISPLACEMENT RATE (bbl/min) :**	8.0 (Rig pumps)
PLUG BUMPED WITH (psi) :	Bumped – 2500	**DISPLACEMENT VOLUME (bbl) :**	Calculated 388 Actual 386
REMARKS :	Good returns, spacer at surface when plug bumped. TOC 450 from CBL		

3.6 DRILLING FLUID RECAP

The drilling fluid details are found in the drilling fluids recap in Appendix 9.

3.7 COMPLETION SUMMARY

The details of the completion for Iona-4 are shown in the completion status diagram. Completion times achieved were as follows:

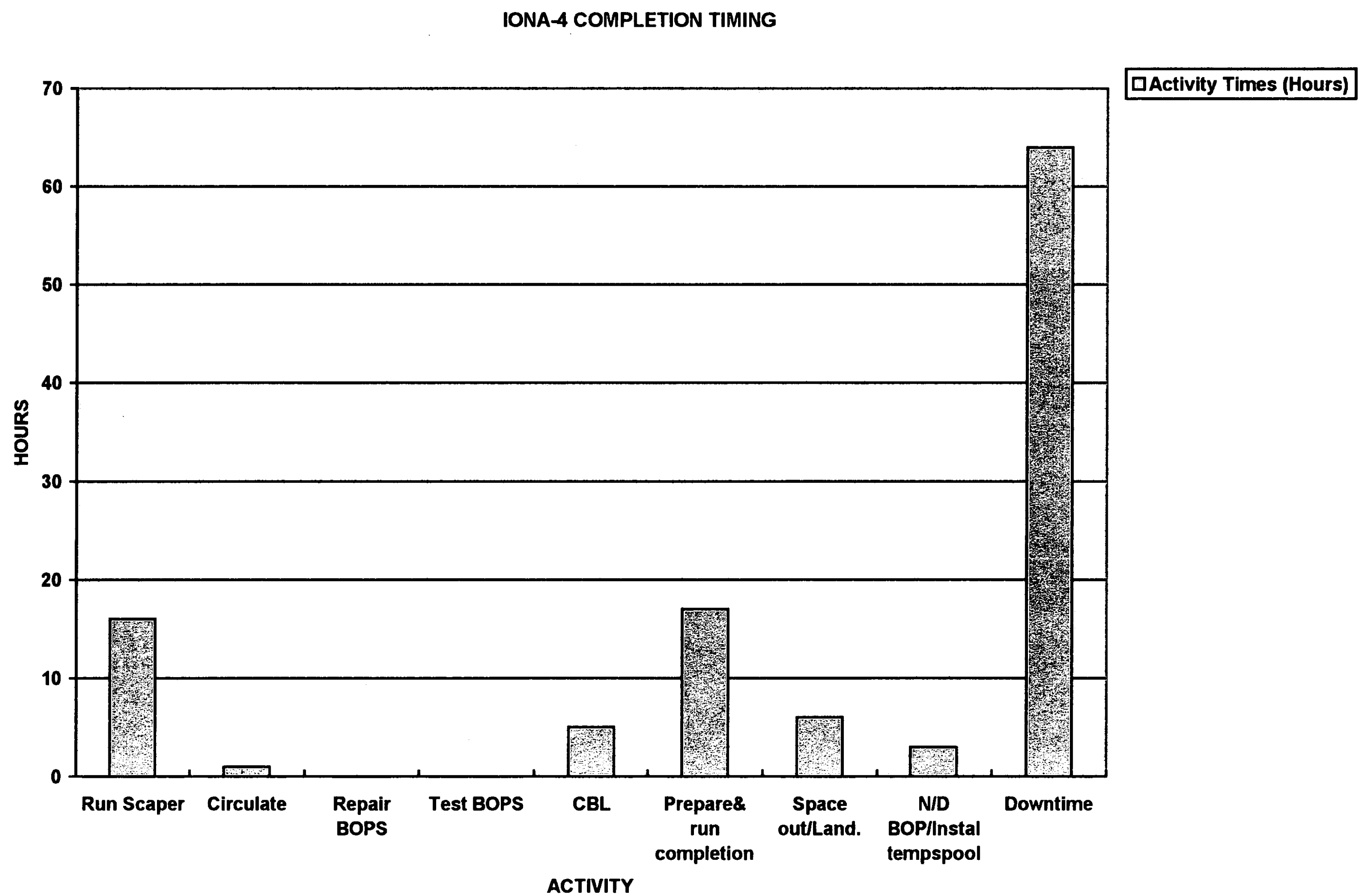
Table 3.6 Completion Times

Activity	Hours
Run Scraper	16.0
Circulate Completion Brine	1.0
Repair BOP's	0.0
Test BOP's	3.0
Run Cement Bond Log	5.0
Prepare TCP completion & Run Tubing	17.0
Spaceout/Land & test tubing	6.0
Nipple down BOP's, install temporary capping spool	3.0
Downtime due to failed SSD . Pull & rerun completion, suspend well	64.0

After running the completion string the wireline operated single side door ("SSD") could not be opened. The completion string was pulled, the SSD changed out and the completion re-run. The well was suspended with the tubing conveyed perforating ("TCP") guns intact, and the well left unperforated pending the scheduled delivery of the Xmas tree. The well was re-entered several weeks later on delivery of the Xmas tree and flow tested. The results of the flow test are presented in the Halliburton well test report (Appendix 8).

Figure 3.7 shows the comparative time performance for the completion:

Figure 3.7 Iona-4 Completion Time Performance



3.8 LESSONS LEARNED

Table 3.7 Incident Report No 1

Western Underground Gas Storage	**INCIDENT REPORT/LESSON**	
Report No: 1	**Date: 30 March 1999**	**Prepared By: Colin Stuart**
Well: Iona Iona-4	**Operator: WUGS**	**Rig: OD&E Rig 30**
INCIDENT/LESSON Equipment failure		
WELL DATA/OPERATIONS PRECEEDING INCIDENT/LESSON Running completion		
EVALUATION OF INCIDENT (Cause, were procedures/orders followed?), A total of 64 hours down--time lost due to a failure of the Single Side Door. After investigation, the conclusion is that operator error due to poor procedures caused the incorrect assembling of the type B SSD shifting tool. An investigation highlighted this fact which was passed on to the Halliburton slick-line division management.		
REMEDIAL WORK CARRIED OUT		
RECOMMENDATIONS		

4.0 FORMATION SAMPLING AND TESTING

4.1 CUTTINGS

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

4.2 CORES

4.2.1 Conventional Core

Five 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	1381.00	1383.00	1381.00	1382.50	75.00
Core No 2	1448.50	1455.00	1448.50	1454.56	93.23
Core No 3	1455.00	1463.30	1455.00	1462.30	89.04
Core No 4	1463.30	1470.6	1463.30	1469.75	87.26
Core No 5	1470.60	1478.30	1470.60	1478.50	100.00

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

4.2.2 Sidewall Cores

No sidewall cores were acquired in Iona-4.

4.3 TESTING

No drill stem tests or wireline formation tests were carried out in Iona-4. Results of the clean up and flow test of the well are presented in Appendix 8.

4.4 SAMPLE ANALYSIS

Routine core analysis, detailed core description and sedimentological interpretation, and Petrology and Reservoir quality reports on the conventional cores carried out by ACS Laboratories Pty Ltd are presented in Appendix 4.

Four core samples from submitted for palynological analysis to Biostrata Pty Ltd. The results of the palynological analysis are presented in Appendix 5.

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, weight on bit, total gas and chromatography were recorded and 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.

Table 4.2 Details of Wireline Logs run

LOG	Logging/ Processing 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	23/04/99 23/04/99	1554.4	1560	25	1554.4	54
DIPOLE SONIC: 1:200 & 1:500	23/04/99 23/04/99	1554.4	1560	25	1554.4	54
NUCLEAR CURVES Neutron (TNPH), Density (RHOZ), Pe (PEFZ), GR, Caliper: 1:200 & 1:500	23/04/99 23/04/99	1554.4	1560	25	1554.4	54
CBL – VDL – GR – CCL: 1:200	25/04/99 25/04/99	1547	1459	375	1547	62
GR-CCL, TCP CORRELATION: 1:200 & 1:500	27/04/99 27/04/99	1554.4	1459	1350	1426	
RESIST'Y CURVES TVD INDEX-GR to Surface: 1:200 & 1:500	23/04/99 16/04/99					
NUCLEAR CURVES TVD INDEX-GR to Surface: 1:200 & 1:500	23/04/99 15/04/99					
OFFSET CHECKSHOT SURVEY	25/04/99 25/04/99	1554.4	1459	134.8	1542	
GR-CCL 1:200	06/06/99 06/06/99	1452	1459	100	1510	

Each logging run is included at both 1:200 and 1:500 scale as an enclosure. 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-4 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 and based on the original field logs. The composite well log showing Formation tops for each unit from the top Pebble Point Formation down based on the original field logs is included as Enclosure 2. A detailed composite log for the reservoir section based on the definitive survey run on 6 June 1999, is included as Enclosure 3.

Table 5.1 Stratigraphic section Iona-4

Stratigraphic Unit	Depth			Thickness
	MDKB (m)	TVDKB (m)	TVDSS (m)	MDKB (m)
Ground Level	4.98	4.98	-130.0	
Heytesbury and Nirranda Groups (undifferentiated)				360.7
Narrawaturk Marl				
Mepunga Formation	285.0	285.0	150.0	54.0
Wangerrip Group				339.0
Dilwyn Formation	339.0	339.0	204.0	193.0
Pember Mudstone	532.0	532.0	398.0	87.0
Pebble Point Formation	619.0	619.0	484.0	52.0
Sherbrook Group				889.0
Paaratte Formation	671.0	671.0	536.0	372.8
Skull Creek Member	1043.8	1016.2	881.2	175.2
Nullawarre Greensand	1219.0	1142.1	1007.1	140.5
Belfast Mudstone	1359.5	1238.0	1105.0	57.7
Flaxman Formation	1417.2	1275.4	1141.0	35.8
Top C1 sand	1453.0	1298.4	1163.4	16.4
Base C1 sand	1469.4	1309.0	1174.0	1.0
Top C2 sand	1470.4	1309.6	1174.6	32.6
Base C2 sand	1503.0	1330.8	1195.8	6.0
Top B sand	1509.0	1334.6	1199.6	14.0
Base B sand	1523.0	1343.8	1208.8	37.0
Total Depth (Driller)	1560.0	1368.2	1233.2	
Total Depth (Logger)				

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-4.

5.2.1 Heytesbury and Nirranda Groups

(Surface – 339.0 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 285.0 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 (285.0 – 339.0 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 (339.0 – 671.0 m)

5.2.2.1 Dilwyn Formation (339.0 – 532.0 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 (5332.0 – 619.0 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 (619.0 – 671.0 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 (671.0 – 1560.0 m)

5.2.3.1 Paaratte Formation (671.0 – 1043.8 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 (1043.8 – 1219.0 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 (1219.0 – 1359.5 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 (1359.5 – 1417.2 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 (1417.2 – 1453.0 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 (1453.0 – 1509.0 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 (1509.0 – 1560.0 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

6.0 VELOCITY SURVEY

6.1 SEISMIC CALIBRATION AND RESULTS

A velocity (or check-shot survey) was performed by Schlumberger as part of the logging program in Iona-4. Attempts to get the sonde down the open-hole failed, so the check-shot survey was carried out after the well was cased. The source used for the survey was an airgun, with shots fired into a water-filled pit dug at an offset surface location (E: 676957.7 N: 5728322.5 RL: 121.77m) 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 19 levels were acquired in the survey. A single shot was used where a good first break was encountered on the record. Additional shots were fired at locations where the signal was poor. The data was then enhanced by stacking the data 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 at Schlumberger's Melbourne processing centre. First breaks were picked from the edited data and corrections were applied to obtain a set of time versus depth values below the seismic reference datum that 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 build and hold hole through the reservoir section, so the depths which were measured with reference to KB, were converted to true vertical depth. Conversion was made to true vertical depth 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 check-shots 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 check-shot data to account for the non-vertical path so as to obtain a corrected vertical time from source for each check-shot.

6.2.3 Correction for datum

The check-shot 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 that 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 5910 and 2330 on the survey, which is approximately 800 metres away. This yielded a datum correction of 76.6 msec and a replacement velocity of 1446 m/s.

An uphole survey (Uphole 7) was carried out over the reservoir location of Iona-4. The uphole yielded a datum correction from the surface of 87.11 msec, which was used in the generation of Schlumberger's Geogram

The corrected checkshot data was used to calibrate the sonic logs processed from the DSI-GR 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, check-shot corrections and synthetic seismogram generation can be found in the accompanying Schlumberger Well Seismic Edit and Geogram Report. (Appendix 7)

6.3 RESULTS

Enclosure 11 shows the synthetic seismogram spliced onto the seismic section through the well annotated with the tops encountered. The derived synthetic seismogram matched the seismic data very well at the bottom-hole location of the Iona-4 well. The synthetic confirmed that the event mapped as the Top Waarre C in the 3D seismic interpretation carried out prior to the drilling of the well to be correct. 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. Furthermore, the intersections of the shallow horizons is not as shown at the Waarre C intersection for which the synthetic is depicted.

The depth prognosis for the Waarre C and all horizons below the Belfast Formation was deeper than encountered in the well. The prognosed depths for the horizons above the Belfast is generally shallower than encountered.

Table 6.1 compares the Pre-drill Depth Prognosis and the Actual Well Depths for the main horizons encountered in the well based on the definitive GR-CCL and gyro surveys run in the well on 6 June, 1999. 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 & 2 and Iona-4.

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	68	?	
Mepunga Formation	145	148.2	3.2
Dilwyn Formation	201	202.2	1.2
Pember Mudstone	405	395.2	-9.8
Pebble Point Formation	474	482.2	8.2
Paaratte Formation	524	534.2	10.2
Skull Creek Member	871	879.8	8.8
Nullawarre Greensand	1005	1005.9	0.9
Belfast Mudstone	1107	1101.8	-5.2
Waarre Formation D unit	1143	1139.2	-3.8
Top C1 Sand	1166	1162.2	-3.8
Base C1 Sand	NP*	1172.8	
Top C2 Sand	1178	1173.5	-4.5
Base C2 Sand	NP	1194.6	
Top B Sand	NP	1198.5	
Base B Sand	NP	1207.6	
Total Depth	1196	1231.8	38.8
NP depth not prognosed*			

Figure 6.1 is a plot that compares the measured average velocities and interval velocities from the Iona-1, 2 and 4 wells. The figure shows a lower average velocity to the top Waarre C at Iona-4 compared to Iona-1 and 2.and this resulted in the well coming in shallower than prognosed. The lower average velocity to the top of the Waarre C is caused by the presence lower interval velocities within the Tertiary sections in the well.

The encountered depths for the horizons above the Belfast are generally deeper than prognosed despite the presence of slower interval velocities in the Tertiary section. This can be attributed to several reasons but is most likely due to a mispick in time. Another reason could be that because the well is deviated, the actual well path may not be the exact path used in the original prognosis.

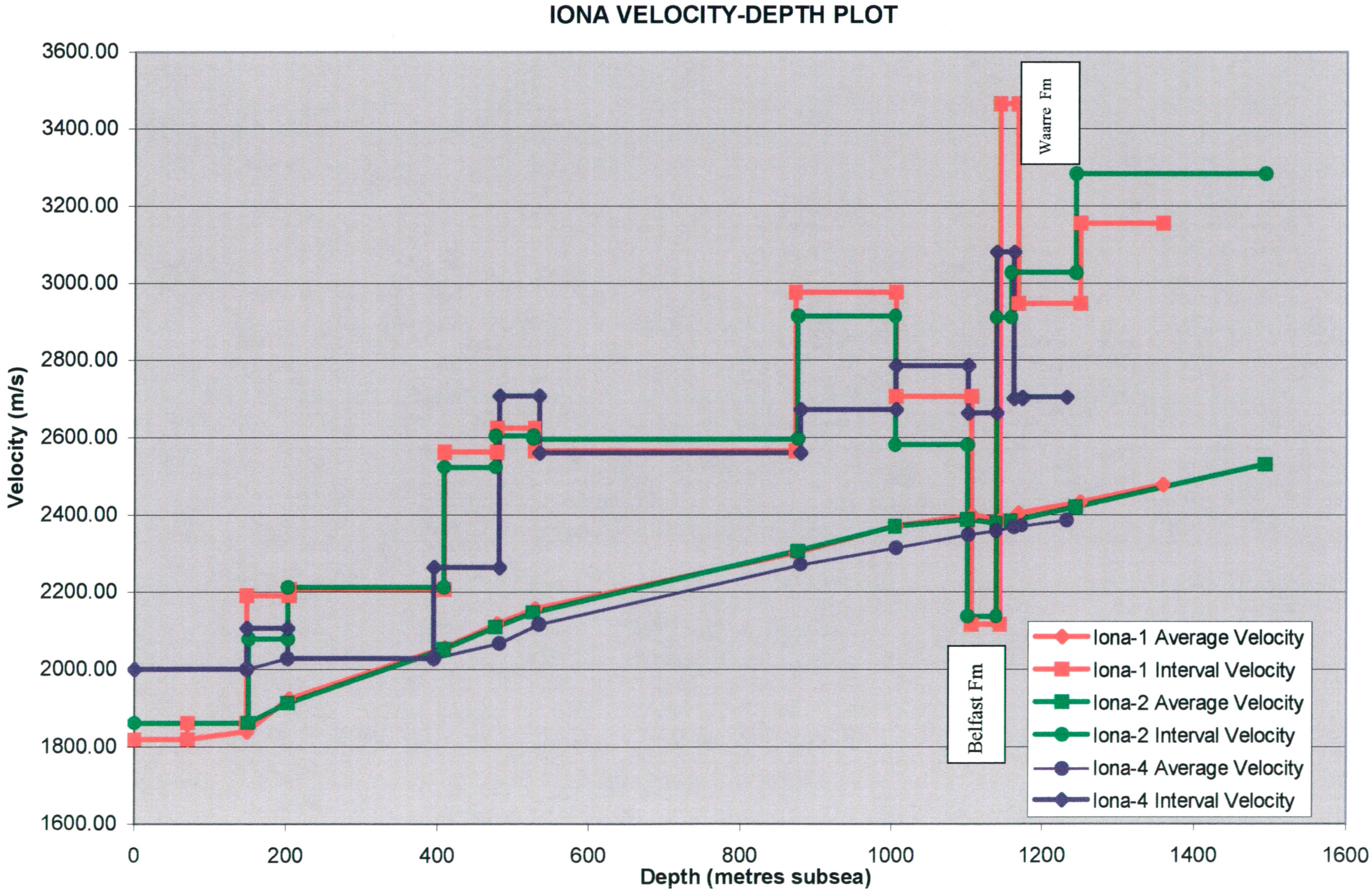


Figure 6.1: Comparison of Velocity Depth plots for Iona-1, 2 and 4

908903 044

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 on figure 7.1 and a description of the mnemonics is included below.

There has been production of 8.4 Bcf prior to field shutin at December 1997. The current gas/water contact is clearly identified in Iona-4 at 1,320.2 mTVD-KB (–1,185 metres subsea).

A summary of the petrophysics is tabulated as follows:

Table 7.1 Iona-4: Petrophysics Summary

Iona-4 : Petrophysics Summary			
Unit	*Thickness (metres)*	*Porosity %*	*Water Saturation %*
Flaxman	2.7	24.0	36.4
C - unswept	22.9	25.3	17.1
C - gross	31.6	25.2	-
B	4.2	23.5	28.2

908903 047

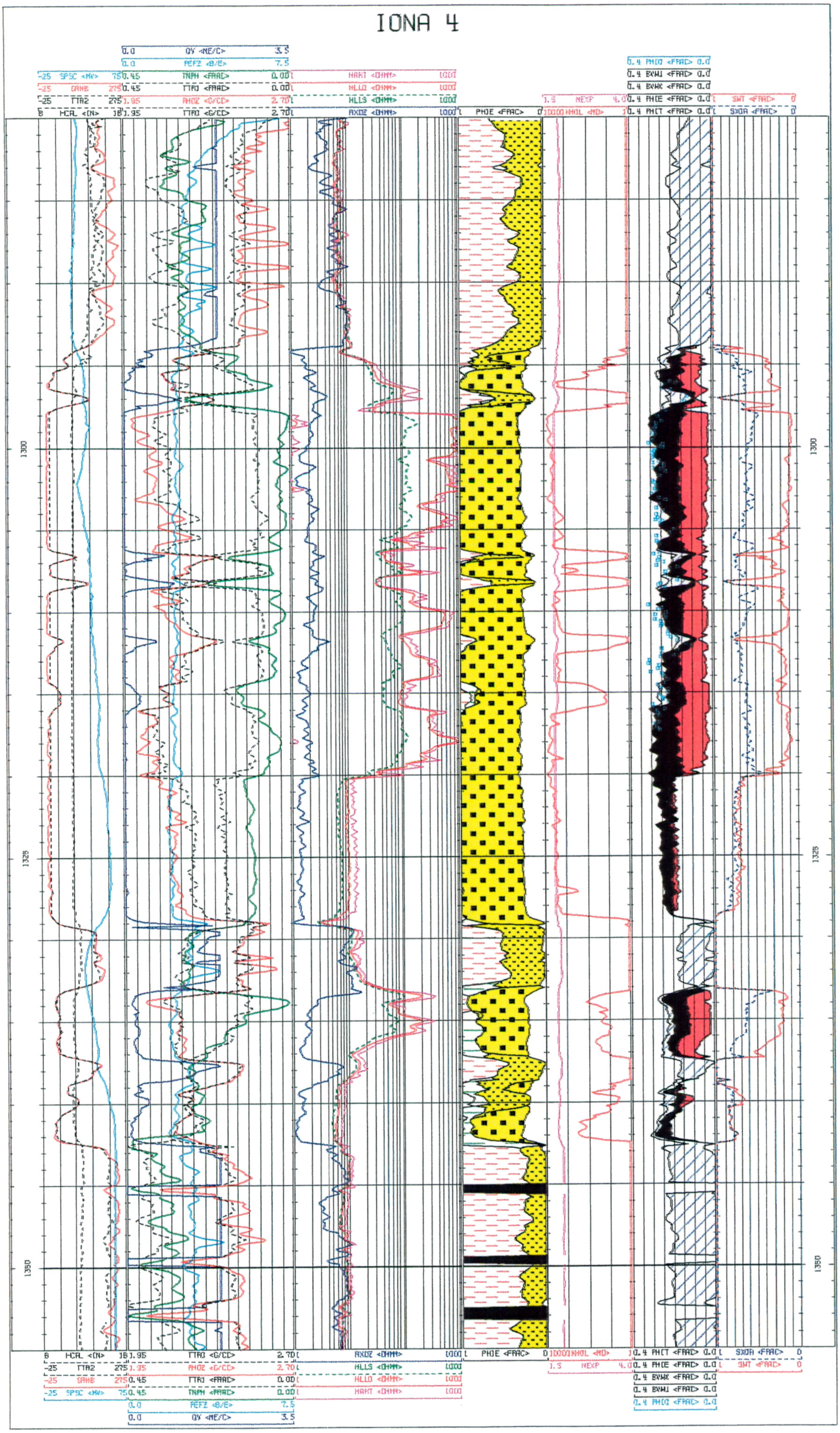


Figure 7.1

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:

TTRO	theoretical density – short dash, black
RHOZ / RHOB	density – solid line, red
TTRI	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)

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.

908903 050

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

WUGS Western Underground Storage Project

DATE:	1-Mar-99
REPORT No:	1
D.F.S:	
SHOE F.I.T:	

WELL NAME:	Iona 4		STATUS @ 2400 HRS:			
DEPTH - 2400 HRS:		m	FORMATION:	Waarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:		m	HOLE SIZE:		SHOE DEPTH:	
24 HR PROGRESS:		m	ACCIDENTS:	nil	LAST CASING:	
SAFETY MEETINGS:						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)		0 l Aldacide
VISCOSITY		0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		0 kg KCl Tech
WL API / FC (cc)		0 kg KOH
SOLIDS %		0g Bara-klean FL
SAND %		0 kg Dextrid LT
CHLORIDES		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	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	25

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	24
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	
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

908903 051

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

DATE:	1-Mar-9?
REPORT No:	1
D.F.S:	

WELL NAME: Iona 4

STATUS @ 2400 HRS:

FROM	TO		24 HOUR SUMMARY
0:00	0:00	24	Rig Down, prepare to move.
			R/d drill floor. L/d derrick. Pack junk box. Stack flare line and miscelaneous equipment.
			Earthmovers preparing #3 pad. Concentrating on east end of pad. Entire pad must be covered
			a reasonable thickness of gravel above the Geotech to protect against rain and move traffic.
			Anticipated completion date Thursday 4th March.
			Incidents in last 24 Hours Y/N
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Rig Down

PROGRAM - NEXT 24 HRS :

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

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	6
TOTAL :	**29**

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:	2-Mar-99
REPORT No:	2
D.F.S:	
SHOE F.I.T:	

WELL NAME: Iona 4

STATUS @ 2400 HRS:

DEPTH - 2400 HRS:	m	FORMATION:		KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH:	
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	
SAFETY MEETINGS:					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)		0 l Aldacide
VISCOSITY		0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		0 kg KCl Tech
WL API / FC (cc)		0 kg KOH
SOLIDS %		0g Bara-klean FL
SAND %		0 kg Dextrid LT
CHLORIDES		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:		

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	1,152 sx
GEL	59 sx
CEMENT	147 sx
SALT	sx
KCL	450 sx
DRILLWATER	610 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	25

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	24
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	
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

908903 053

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TG AUSTRALIA

DATE:	2-Mar-9[illegible]
REPORT No:	2
D.F.S:	

WELL NAME: Iona 4

STATUS @ 2400 HRS:

FROM	TO		24 HOUR SUMMARY
0:00	0:00	24	Rig Down, prepare to move.
			Unstring travelling block. Remove monkey board.
			Prepare BOP cross-over spools. Pack equipment. Clean lease.
			Move Howco cement unit, tanks and silos to holding area near l/w pad.
			Move mudlogging unit to holding area.
			Lease builder levelling and compacting gravel on slot #3.
			Anticipated pad completion date Thursday 4th March.
			Incidents in last 24 Hours Yes
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Rig Down

PROGRAM - NEXT 24 HRS :

TRANSPORTATION

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

PERSONNEL

CONTRACTOR	21
OPERATOR	2
SERVICE CO	6
TOTAL :	**29**

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:	3-Mar-99
REPORT No:	3
D.F.S:	
SHOE F.I.T:	

WELL NAME: Iona 4

STATUS @ 2400 HRS:

DEPTH - 2400 HRS:	m	FORMATION:		KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH:	
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	
SAFETY MEETINGS:					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)		0 l Aldacide
VISCOSITY		0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		0 kg KCl Tech
WL API / FC (cc)		0 kg KOH
SOLIDS %		0g Bara-klean FL
SAND %		0 kg Dextrid LT
CHLORIDES		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	6"	6"
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	26

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	24
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	
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

908903 055

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	3-Mar-99
REPORT No:	3
D.F.S:	

WELL NAME: Iona 4

STATUS @ 2400 HRS:

FROM	TO		24 HOUR SUMMARY
0:00	0:00	24	Rig Down, prepare to move.
			Change out pump liners to 6".
			Pull Electrical cables.
			Transfer and store mud to 400bbl frac tank.
			Clean Mud Tanks / disconnect lines
			Break derrick into sections.
			General Pack-up, rig camp, walkways etc.
			Lease builder levelling and compacting gravel on slot #3.
			Anticipated pad completion date Thursday 4th March.
			Incidents in last 24 Hours Yes
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Rig Down

PROGRAM - NEXT 24 HRS :

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

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	7
TOTAL :	**30**

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:	4-Mar-99
REPORT No:	4
D.F.S:	
SHOE F.I.T:	

WELL NAME: Iona 4

STATUS @ 2400 HRS:

DEPTH - 2400 HRS:		m	FORMATION:			KB - GL (m):	5.33
DEPTH - PREVIOUS:		m	HOLE SIZE:			SHOE DEPTH:	
24 HR PROGRESS:		m	ACCIDENTS:	nil		LAST CASING:	
SAFETY MEETINGS:							

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)		0 l Aldacide
VISCOSITY		0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		0 kg KCl Tech
WL API / FC (cc)		0 kg KOH
SOLIDS %		0g Bara-klean FL
SAND %		0 kg Dextrid LT
CHLORIDES		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:		

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	1,152 sx
GEL	59 sx
CEMENT	147 sx
SALT	sx
KCL	450 sx
DRILLWATER	610 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	27

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	24
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	
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

908903 057

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

DATE:	4-Mar-99
REPORT No:	4
D.F.S:	

WELL NAME: Iona 4

STATUS @ 2400 HRS:

FROM	TO		24 HOUR SUMMARY
0:00	0:00	24	Cranes and trucks arrived Iona OBS-1 location at 1600 hrs 3/02/99
			Laid down derrick in three sections, Moved pumps, loaded substructure/draworks to access mats
			Loaded rig and pump matting. Laid down poor-boy skid.
			Iona 4 site completed 1900 hrs 3/02/99.
			4/03/99: Spotted rig matting, substructure and draw-works. Moved and spotted mud pits, pumps,
			generators / SCR skids, derrick and A-frame pinned. Day tank-doghouse positioned.
			Move and R/U camp, run and connect cables. Camp powered-up at 1645 hrs.
			Position centrifuge, poor-boy.
			Incidents in last 24 Hours Yes
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Rig Down

PROGRAM - NEXT 24 HRS :

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

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	7
TOTAL :	**30**

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

END OF REPORT

908903 058

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	5-Mar-99
REPORT No:	5
D.F.S:	
SHOE F.I.T:	

WELL NAME:	Iona 4	STATUS @ 2400 HRS:	Continue R/U, catwalk, V-door, rig floor

DEPTH - 2400 HRS:	m	FORMATION:		KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH:	10m
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	20"
SAFETY MEETINGS:	pre-job (raise derrick)				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)		0 l Aldacide
VISCOSITY		0g EZ MUD
pH		0kg PAC-R
PV / YP		0 lb XCD
GELS 0/10		0 kg KCl Tech
WL API / FC (cc)		0 kg KOH
SOLIDS %		0g Bara-klean FL
SAND %		0 kg Dextrid LT
CHLORIDES		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:		

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	1,152 sx
GEL	59 sx
CEMENT	147 sx
SALT	sx
KCL	450 sx
DRILLWATER	610 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	28

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	19
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	
20. REP. SUBSURFACE	
21. REP. SURFACE	
22. WELL TEST	
23. W.O. WEATHER	
24. WAIT - OTHER	5
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

908903 059

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	5-Mar-99
REPORT No:	5
D.F.S:	

WELL NAME: Iona 4

STATUS @ 2400 HRS: Continue R/U, catwalk, V-door, rig floor

FROM	TO		24 HOUR SUMMARY
0:00			Lift derrick, pin "A" frame, string blocks, hoists and lines. Install monkey board, standpipe connection and kelly hose. Raise and pin derrick. Dress shakers. Halliburton, spot mix and water tank, "P" tanks and cement unit trailer. Spot diesel tank in bund. Transfer approx 300 bbl mud from OBS-1 site. Spot and start rig-up of new Halliburton Logging-Unit.
	19:00	19	Rig Camp established, water, sewerage plumbing connected. Communication operational.
19:00	0:00	5	Crews break for tour change.
			Incidents in last 24 Hours Yes
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : General R/U, dress floor, tongs, swivel.

PROGRAM - NEXT 24 HRS : *Continue R/U. M/U kelly, drill rat and mouse hole. N/U riser. Mix spud mud, prepare BHA. Spud Iona 4*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	8
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

908903 060

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	6-Mar-99
REPORT No:	6
D.F.S:	0.1
SHOE F.I.T:	

WELL NAME: Iona 4

STATUS @ 2400 HRS: Connection, P/U 8" Monel

DEPTH - 2400 HRS:	23 m	FORMATION:	Gellibrand Marl	KB - GL (m):	5.33
DEPTH - PREVIOUS:	7 m	HOLE SIZE:	17.1/2"	SHOE DEPTH:	10m
24 HR PROGRESS:	16 m	ACCIDENTS:	nil	LAST CASING:	20"
SAFETY MEETINGS:	pre-spud				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	0 l Aldacide
VISCOSITY	64	0g EZ MUD
pH	8.5	0kg PAC-R
PV / YP	20/18	4sx XCD
GELS 0/10	4/7	90 sx KCl
WL API / FC (cc)	6.5	0 kg KOH
SOLIDS %	3.2	0g Bara-klean FL
SAND %	0.75	0 kg Dextrid LT
CHLORIDES	22,000	0kg Baracor129
KCL ppb	14.40	0kg Pac-L
MBT (ppb)	12	0kgBaracarb100
Pm Pm/Mf	0.15/0.5	0kgBaracarb25
TEMP (degC)	27	0kgBaracarb600
HOLE VOL (bbls)	19	0kg Barite
SURFACE VOL (bbls)	382	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:	84/84/84	84/84/84

INVENTORY	
BARITE	1,152 sx
GEL	99 sx
CEMENT	1680+144 sx
SALT	sx
KCL	360 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	100	
PRESSURE	80	
GPM	285	
AV (DP - ft/min)	29	
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	29

BIT DATA		
BIT No.	1	
SIZE (ins)	17.1/2"	
TYPE	GTX-G1	
IADC CODE	115	
SERIAL No.	C83DR	
NOZZLES	22, 22, 18	
OUT (m)	23	
IN (m)	7	
DRILLED (m)	16	
HOURS	2.5	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)	0-5	
RPM	70	
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	21.5
3. DRILLING	2.5
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	
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.: 17.1/2" bit / NB Stab / 8" DC / 8" Monel

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

908903 061

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

DATE:	6-Mar-99
REPORT No:	6
D.F.S:	

WELL NAME: Iona 4

STATUS @ 2400 HRS: Connection, P/U 8" Monel

FROM	TO		24 HOUR SUMMARY
0:00			Continue general Rig Up. Pin "V-door". String survey and geolograph lines.
			P/U Swivel, spinner, kelly, subs and 12.1/4" bit, M/U. R/U floor tarpaulins. Run water line to
			Turkey's nest'. Modify (belled conductor) and connect 20" conductor / riser flow nipple.
			Caliper and prepare BHA. Drill (redrilled several times) mouse hole and rat hole, install socks.
			L/O 12.1/4" bit. M/U lower kellycock, install kelly bushing. M/U 17.1/2" bit, bitsub and xo.
	21:30	21.5	Hold Pre-spud / safety meeting.
21:30	0:00	2.5	Spud Iona 4. Drill 17.1/2" hole from 7m to 23m. (connection with 8" DC)
			NB: Change screens to 84 mesh on #1 shaker.
			Incidents in last 24 Hours Yes
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Drill 17.1/2" hole 23-27m. Clean out flowline / mud ring. P/U stab at 20m. Drill ahead 27 - 43m
Tighten kelly connections, drill ahead 43 - 70m, picking up 8" DC's.
Increasing flowrate gradually to 730 gpm.

PROGRAM - NEXT 24 HRS : *Drill 17.1/2" hole.*

TRANSPORTATION

TRANSPORT-1	Mellis, cart liquid mud, 20
TRANSPORT-2	Nelsons 3 x loads 13.3/8 csg
TRANSPORT-3	Nelson transfer mud products
Transport -4	Low loader / Howco unit
WATER HAULER	20
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

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	7-Mar-99
REPORT No:	7
D.F.S:	1.1
SHOE F.I.T:	

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill ahead @ 421m

DEPTH - 2400 HRS:	421 m	FORMATION:	Dilwyn	KB - GL (m):	5.33	
DEPTH - PREVIOUS:	23 m	HOLE SIZE:	17.1/2"	SHOE DEPTH:	10m	
24 HR PROGRESS:	398 m	ACCIDENTS:	nil	LAST CASING:	20"	
SAFETY MEETINGS:	TOOL BOX					

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	45	0g EZ MUD
pH	8.0	1sk PAC-R
PV / YP	10/17	17sx XCD
GELS 0/10	7/11	216 sx KCl
WL API / FC (cc)	7.5	1sk KOH
SOLIDS %	3.7	0g Bara-klean FL
SAND %	1	0 kg Dextrid LT
CHLORIDES	22,000	0kg Baracor129
KCL ppb	14.35	0kg Pac-L
MBT (ppb)	12.5	0kgBaracarb100
Pm Pm/Mf	.05/.35	0kgBaracarb25
TEMP (degC)	29	0kgBaracarb600
HOLE VOL (bbls)	392	0kg Barite
SURFACE VOL (bbls)	332	0 g Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	8sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	84/84/84	84/84/84

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	140	140
PRESSURE	1100	
GPM	798	
AV (DP - ft/min)	57	
AV (DC - ft/min)	81	
SPR		
SPR PRESS		

INVENTORY	
BARITE	1,152 sx
GEL	99 sx
CEMENT	1680+144 sx
SALT	sx
KCL	144 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	30

BIT DATA		
BIT No.	1	
SIZE (ins)	17.1/2"	
TYPE	GTX-G1	
IADC CODE	115	
SERIAL No.	C83DR	
NOZZLES	22, 22, 18	
OUT (m)	421	
IN (m)	7	
DRILLED (m)	16	
HOURS	23.5	
CONDITION		
AVG ROP (m/hr)	17.60	
WOB (x1000 lbs)	0 - 10	
RPM	70	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		
195	0.25	307
360	0.40	177

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	1
3. DRILLING	21
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	0.5
7. CIRC / COND	1
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	
20. REP. SUBSURFACE	
21. REP. SURFACE	0.5
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.: 17.1/2" bit / NB Stab / 8" DC / 8" Monel / 17.1/2" Stab / 4 x 8" DC / xo
6.1/2" Jars / xo / 30 x 5" HWDP

BHA WEIGHT :	lbs	STRING WT.:	65,000 lbs
DP RATING :	lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	2,000 lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	2,000 lbs

CONTINUED ../2

908903 063

TO AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	7-Mar-99
REPORT No:	7
D.F.S:	1.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill ahead @ 421m

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	Drill 17.1/2" hole 23 - 31m.
0:30	1:00	0.5	Riser / flowline plugged. Clean out mud ring from flow nipple.
1:00	3:00	2	Drill 17.1/2" hole 31 - 43m. P/U 17.1/2" stab during connection.
3:00	4:00	1	Tighten all kelly connections. Retrieve stuck drift from 8" DC in mousehole.
4:00	13:30	9.5	Drill ahead 43 -218m, gradually increasing flowrate to 798 gpm.
13:30	14:00	0.5	Circulate and run Single Shot Survey.
14:00	21:00	7	Drill ahead 218 - 383 m.
21:00	21:30	0.5	Circulate hole clean.
21:30	22:00	0.5	Run Single Shot Survey.
22:00	0:00	2	Drill ahead 383 - 421 m.

1 Truck. Amezdroz. Deliver jars and cement baskets.

Incidents in last 24 Hours Yes
(If yes see separate report)

- Weather : Clear / warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
21		Dailey jar
		Sperry Stab

FORMATION TOPS : Mepunga: 290m Dilwyn 339m

OPERATION TO 0600 HRS : Drill 17.1/2" hole 421 - 536m

PROGRAM - NEXT 24 HRS : *Drill 17.1/2" hole approx 20m into Pebble Point. Circ, survey, POOH. R/U for csg*

TRANSPORTATION	
TRANSPORT-1	Amezdroz - Jar
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	
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

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	8-Mar-99
REPORT No:	8
D.F.S:	2.1
SHOE F.I.T:	

WELL NAME: Iona 4

STATUS @ 2400 HRS: Circulate hole clean.

DEPTH - 2400 HRS:	639 m	FORMATION:	Pebble Point	KB - GL (m):	5.33
DEPTH - PREVIOUS:	421 m	HOLE SIZE:	17.1/2"	SHOE DEPTH:	10m
24 HR PROGRESS:	218 m	ACCIDENTS:	nil	LAST CASING:	20"
SAFETY MEETINGS:	Pre-Tour Safety Meeting				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.1	0 l Aldacide
VISCOSITY	46	0g EZ MUD
pH	8.3	2sx PAC-R
PV / YP	11/23	12sx XCD
GELS 0/10	10/17	122 sx KCl
WL API / FC (cc)	7.4	5sx KOH
SOLIDS %	4.3	0g Bara-klean FL
SAND %	1	0 kg Dextrid LT
CHLORIDES	21,000	0kg Baracor129
KCL ppb	14.10	0kg Pac-L
MBT (ppb)	11	0kgBaracarb100
Pm Pm/Mf	.05/.35	0kgBaracarb25
TEMP (degC)	38	0kgBaracarb600
HOLE VOL (bbls)	594	68sx Barite
SURFACE VOL (bbls)	344	0 g Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	7sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	84/84/84	84/84/84

INVENTORY	
BARITE	1,084 sx
GEL	99 sx
CEMENT	1680+144 sx
SALT	sx
KCL	22 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	140	140
PRESSURE	1200	
GPM	798	
AV (DP - ft/min)	57	
AV (DC - ft/min)	81	
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	31

BIT DATA		
BIT No.	1	
SIZE (ins)	17.1/2"	
TYPE	GTX-G1	
IADC CODE	115	
SERIAL No.	C83DR	
NOZZLES	22, 22, 18	
OUT (m)	639	
IN (m)	7	
DRILLED (m)	632	
HOURS	26.5	
CONDITION	1.2.I	
AVG ROP (m/hr)	23.90	
WOB (x1000 lbs)	0-20	
RPM	130	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg)	Azimuth
195	0.25	307
360	0.40	177
625	0.60	337

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	13
4. BIT TRIP	
5. WIPER TRIP	6
6. SURVEY	0.5
7. CIRC / COND	4
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	
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.: 17.1/2" bit / NB Stab / 8" DC / 8" Monel / 17.1/2" Stab / 4 x 8" DC / xo
6.1/2" Jars / xo / 30 x 5" HWDP

BHA WEIGHT :	lbs	STRING WT.:	65,000 lbs
DP RATING :	lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	2,000 lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	2,000 lbs

CONTINUED ../2

908903 065

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	8-Mar-99
REPORT No:	8
D.F.S:	2.1

TU AUSTRALIA

WELL NAME: Iona 4

STATUS @ 2400 HRS: Circulate hole clean.

FROM	TO		24 HOUR SUMMARY
0:00	10:00	10	Drill 17.1/2" hole 421 - 591 m. Reaming each connection.
10:00	10:30	0.5	Rig Service.
10:30	12:00	1.5	Drill 17.1/2" hole 591 - 620 m. Reaming each connection.
12:00	13:00	1	Circulate for samples.
13:00	14:30	1.5	Drill 17.1/2" hole 620 - 639 m. (6m into Pebble Point formation)
14:30	16:00	1.5	Circulate for sample, Pump 50 bbl sweep pill and circulate hole clean.
16:00	16:30	0.5	Run Single Shot Survey at 625m.
16:30			POOH, work through several tight spots, 514, 495, 457, 400, 381and 335m, 30k max overpull.
	20:00	3.5	Strap out: +0.4m
20:00	22:30	2.5	Check bit, RIH filling string to 618m.
22:30	23:00	0.5	Wash to bottom, no fill. .
23:00	0:00	1	Circulate hole clean, copious amounts of cuttings over shakers

Incidents in last 24 Hours NO
(If yes see separate report)
Reports forwarded to Town
Held meetings w/ crews to discuss incident prevention.

- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool
38		Dailey jar
48		Sperry Stab
48		8" Monel

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pebble Point 633m

OPERATION TO 0600 HRS : Circulate hole clean.Pump slug, POOH, L/D jars and stab. R/U to run 13.3/8" csg.

PROGRAM - NEXT 24 HRS : *Run and cement 13.3/8" csg.*

TRANSPORTATION	
TRANSPORT-1	Transfer Frac Tank
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	15
CRANE	transfer Frac Tank

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

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	9-Mar-99
REPORT No:	9
D.F.S:	3.1
SHOE F.I.T:	

WELL NAME: Iona 4 **STATUS @ 2400 HRS:** Pump KCl brine

DEPTH - 2400 HRS:	639 m	FORMATION:	Pebble Point	KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:	17.1/2"	SHOE DEPTH:	10m
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	20"
SAFETY MEETINGS:	2 x Pre-Tour Safety Meeting				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.1	0 l Aldacide
VISCOSITY	47	0g EZ MUD
pH	8.3	sx PAC-R
PV / YP	11/24	2sx XCD
GELS 0/10	10/17	22 sx KCl
WL API / FC (cc)	7.4	sx KOH
SOLIDS %	4.3	45sx KCl tech
SAND %	1	52sx Aquagel
CHLORIDES	21,000	10sx Kwikseal
KCL ppb	14.10	0kg Pac-L
MBT (ppb)	11	0kgBaracarb100
Pm Pm/Mf	.05/.35	0kgBaracarb25
TEMP (degC)		0kgBaracarb600
HOLE VOL (bbls)	625	sx Barite
SURFACE VOL (bbls)	344	4 dr Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	84/84/84	84/84/84

INVENTORY	
BARITE	1,084 sx
GEL	47 sx
CEMENT	1680+144 sx
SALT	sx
KCL	sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
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	32

BIT DATA		
BIT No.	1	
SIZE (ins)	17.1/2"	
TYPE	GTX-G1	
IADC CODE	115	
SERIAL No.	C83DR	
NOZZLES	22, 22, 18	
OUT (m)	639	
IN (m)	7	
DRILLED (m)	632	
HOURS	26.5	
CONDITION	1.2.I	
AVG ROP (m/hr)	23.90	
WOB (x1000 lbs)	0-20	
RPM	130	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		
195	0.25	307
360	0.40	177
625	0.60	337

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	3.5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	1.5
8. CHANGE BHA	
9. CASE & CEMENT	7.5
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	11.5
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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

DATE:	9-Mar-98
REPORT No:	9
D.F.S:	3.1

TO AUSTRALIA

WELL NAME: Iona 4

STATUS @ 2400 HRS: Pump KCl brine

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	Circulate hole clean at 639m. Pump slug.
0:30	4:00	3.5	POOH, hole good. L/D Jars, 17.1/2" stab, bitsub and bit.
4:00	6:00	2	R/U Premium and equip for 13.3/8" casing run. Hold pre-job Safety Meeting.
6:00			M/U one joint shoetrack, threadlock connections. RIH with 13.3/8" csg to 385m. Excessive P/U
	10:00	4	weights when moving string from slips.
10:00	11:00	1	R/U and circulate.
11:00	12:30	1.5	Continue RIH with 13.3/8" casing to 504m. Unable to move string after connection.
12:30			Work string. M/U circulating Head, mix and pump hi-vis sweep. Hole clean. Continue work string
			175k O/P. Mix and pump 50 bbl Torq Trim pill. Displace from casing. Pump 210 stks (14bbl)
			every 30 mins. Continue to work string.
	0:00	11.5	20:00 Transfer mud from pits to Frac Tank. Mix 300 bbl 3.5% KCl brine. Hold pre-job meeting.
			23:30 Start pumping KCl brine.
			Stretch calculations on 13.3/8" csg indicate stuck point +/- 390m.
			Shoe @ 504m, FC @ 491m. 42 joints 13.3/8" casing run.
			Incidents in last 24 Hours NO
			(If yes see separate report)
			Reports forwarded to Town
			Held meetings w/ crews to discuss incident prevention.
			- Weather : Clear / warm

DOWNHOLE TOOLS		
Hours	Serial No.	Tool

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m

OPERATION TO 0600 HRS : Continue displace annulus to KCl brine. Work string for 2.1/2 hrs, break circulation occasionally no progress, 03:30 displace annulus to mud. Circulate hole to condition while Halliburton prepare mix water & R/D Premium. R/D circ head, R/U cementing head. Pre-job meeting

PROGRAM - NEXT 24 HRS : *Cement casing, Top Job, WOC, cut conductor, csg, weld 13.3/8" SOW. Start N/U*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	20
CRANE	transfer Frac Tank

PERSONNEL	
CONTRACTOR	21
OPERATOR	2
SERVICE CO	14
TOTAL :	**37**

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:	10-Mar-99
REPORT No:	10
D.F.S:	4.1
SHOE F.I.T:	

WELL NAME:	Iona 4	STATUS @ 2400 HRS:	SOW, cooling down

DEPTH - 2400 HRS:	639 m	FORMATION:	Pebble Point	KB - GL (m):	5.33
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH:	504
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	pre- cementing, pre-tour, JSA - BOP N/U				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	0 l Aldacide
VISCOSITY	45	0g EZ MUD
pH	8.1	sx PAC-R
PV / YP	9/16	sx XCD
GELS 0/10	7/12	sx KCl
WL API / FC (cc)	7.6	sx KOH
SOLIDS %	3.4	sx KCl tech
SAND %	0.3	**27sx Aquagel**
CHLORIDES	18,500	sx Kwikseal
KCL ppb	11.00	0kg Pac-L
MBT (ppb)	7.5	0kgBaracarb100
Pm Pm/Mf	.02/.4	0kgBaracarb25
TEMP (degC)		0kgBaracarb600
HOLE VOL (bbls)	387	sx Barite
SURFACE VOL (bbls)	482	dr Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	8	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/8	
SHAKER SCREENS:	84/84/84	84/84/84

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR		
SPR PRESS		

INVENTORY	
BARITE	1,084 sx
GEL	20 sx
CEMENT	200+144 sx
SALT	sx
KCL	480 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	
NEXT BOP TEST	
DAYS SINCE LAST LTA	33

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)		
195	0.25	307
360	0.40	177
625	0.60	337

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	5.5
10. WELLHEAD	9
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	5
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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	4.5
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

TOAUSTRALIA

DATE: 10-Mar-99
REPORT No: 10
D.F.S: 4.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: SOW, Cooling down

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Pump and displace 244 bbls 3% KCl (8.4+ppg) brine into 17.1/2" x 13.3/8" annulus.
1:00	3:30	2.5	Attempt to free 13.3/8" casing string. Work string, 175k max O/P, no movement.
3:30	5:00	1.5	Displace brine from well with mud, dump returns. Circulate to condition hole.
5:00			R/D Premium casing equipment, circulating head, while Howco mix PH Gel mix water. R/U and
	6:30	1.5	load Cement Head. Hold pre-job planning / safety meeting.
6:30			Halliburton, pump 10 bbl water and pressure test lines 5000psi, OK. Pump 50 bbl water, drop
			bottom plug. Mix and pump 934 sx Class G cement, 12.8ppg slurry, 2.5% PH gel, 2gal/10bbl
			CFR-3L, followed by 393sx Clas G, 15.8ppg tail slurry, drop top plug, rig pumps displace with
			249 bbl mud @ 10bpm (contaminated lead slurry returns dumped) 600psi differential prior to
	10:30	4	bump. Pressure up to 1500psi and hold 15 mins, OK. Bleed off, floats holding.
10:30	15:00	4.5	WOC. R/D Halliburton, rough cut conductor.
15:00	0:00	9	S/O casing string. Rough cut 13.3/8" & L/O with conductor. Dress casing stub. Install and align
			13.5/8" 3M x 13.3/8" SOW csg head. Weld as per recommened procedure. Post heat and insulate
			Incidents in last 24 Hours NO
			(If yes see separate report)
			- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m

OPERATION TO 0600 HRS : Allow csg to cool. 03:00 Remove insulation, P.T. weld to 900psi 10mins, OK. Start N/U BOPE.

PROGRAM - NEXT 24 HRS : *N/U BOPE and pressure test, M/U clean out BHA, RIH, test casing 2000psi.*

TRANSPORTATION	
TRANSPORT-1	mud chemicals / centralisers
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	12
TOTAL :	**32**

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:	11-Mar-99
REPORT No:	11
D.F.S:	5.1
SHOE F.I.T:	

WELL NAME:	Iona 4		STATUS @ 2400 HRS:	Drill out plugs			
DEPTH - 2400 HRS:	639	m	FORMATION:	Pebble Point		KB - GL (m):	5.33
DEPTH - PREVIOUS:		m	HOLE SIZE:			SHOE DEPTH:	504
24 HR PROGRESS:		m	ACCIDENTS:	nil		LAST CASING:	13.3/8"
SAFETY MEETINGS:	2 x pre-tour						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	0 l Aldacide
VISCOSITY	45	0g EZ MUD
pH	8.1	sx PAC-R
PV / YP	9/16	sx XCD
GELS 0/10	7/12	sx KCl
WL API / FC (cc)	7.6	sx KOH
SOLIDS %	3.4	sx KCl tech
SAND %	0.3	27sx Aquagel
CHLORIDES	18,500	sx Kwikseal
KCL ppb	11.00	0kg Pac-L
MBT (ppb)	7.5	0kgBaracarb100
Pm Pm/Mf	.02/.4	0kgBaracarb25
TEMP (degC)		0kgBaracarb600
HOLE VOL (bbls)	387	sx Barite
SURFACE VOL (bbls)	482	dr Torq Trim
HOLE LOSSES (bbls)		0kg CaCl2
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	8	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/8	
SHAKER SCREENS:	84/84/84	84/84/84

INVENTORY	
BARITE	1,084 sx
GEL	20 sx
CEMENT	50+144 sx
SALT	sx
KCL	480 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
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	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	34

BIT DATA		
BIT No.	2	
SIZE (ins)	12.1/4"	
TYPE	Sec ERA-03	
IADC CODE	417M	
SERIAL No.	679091	
NOZZLES	3 x 24	
OUT (m)		
IN (m)	639	
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)		
195	0.25	307
360	0.40	177
625	0.60	337

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	4.5
6. SURVEY	
7. CIRC / COND	
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	3
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.COMPLETION	
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 / 8" DC / 8" NMDC / 4 x 8" DC / xo / xo / Jars / 30 x 5" HWDP

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

WELL NAME: Iona 4

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

STATUS @ 2400 HRS: Drill out plugs

DATE:	11-Mar-99
REPORT No:	11
D.F.S:	5.1

FROM	TO		24 HOUR SUMMARY
0:00	3:00	3	13.3/8" x 13.5/8" 3M SOW csg head, cooling down after welding.
3:00			Pressure test weld to 900psi, 10mins OK.
			Nipple up adapter spool, mud cross, double ram (TPR: 4.1/2" BPR: blind), annular, HCR,
	13:00	10	choke & kill lines. Connect hydraulic hoses, function test.
13:00			M/U test assembly, set test plug. P.T. Upper pipe rams, inner, outer kill and choke line valves,
			choke manifold valves, upper & lower kelly cock valves, 300psi low, 2000psi high, each 5 mins
			OK. Blind rams, 13.3/8" casing 300 / 1500 psi. Annular 300 / 1000psi, all OK. L/D test
	19:30	6.5	assembly, run and set wear bushing.
19:30	22:00	2.5	M/U 12.1/4" bit, slick assembly, P/U new jars, RIH
22:00	23:00	1	L/O 15 joints DP.
23:00	23:30	0.5	Continue RIH to 480m.
23:30	0:00	0.5	Wash from 480m, tag up cement / plugs at 490m.

Incidents in last 24 Hours NO
(If yes see separate report)

- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool
		Sperry Monel
	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m

OPERATION TO 0600 HRS : Drill plugs and FC at 490m, cement in shoetrack hard, and shoe at 504m, cement to 508m. Wash to 512m. Circulate hole clean, condition mud. Perform L.O.T. RIH, held up, wash down to 531m Continue RIH , wash to bottom.

PROGRAM - NEXT 24 HRS : *Clean out rathole, POOH, L/D 3 x 8" DC, P/U steerable assembly, RIH, drill ahead.*

TRANSPORTATION	
TRANSPORT-1	pup joints, xo's
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	8
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	13
TOTAL :	33

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:	12-Mar-99
REPORT No:	12
D.F.S:	6.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill 12.1/4" hole

DEPTH - 2400 HRS:	650	m	FORMATION:	Pebble Point	KB - GL (m):	5.33
DEPTH - PREVIOUS:	639	m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	11	m	ACCIDENTS:	nil	LAST CASING:	13.3/8"

SAFETY MEETINGS: 2 x pre-tour (Well Control response while tripping, ie xo's for different size pipe)

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.6	0 l Aldacide
VISCOSITY	56	0g EZ MUD
pH	8.2	6sx PAC-R
PV / YP	9/17	14sx XCD
GELS 0/10	6/8	20sx KCl
WL API / FC (cc)	9.2	sx KOH
SOLIDS %	1.6	sx KCl tech
SAND %	tr	sx Aquagel
CHLORIDES	24,000	10sx Kwikseal
KCL ppb	15.40	9sx Pac-L
MBT (ppb)		0kgBaracarb100
Pm Pm/Mf	.01/.35	0kgBaracarb25
TEMP (degC)	27	0kgBaracarb600
HOLE VOL (bbls)	365	40sx Barite
SURFACE VOL (bbls)	498	20sx Citric Acid
HOLE LOSSES (bbls)		7sx Bicarb
MUD CO	Baroid	4sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	10	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/10	
SHAKER SCREENS:	84/84/84	84/84/84

INVENTORY	
BARITE	1,044 sx
GEL	20 sx
CEMENT	50+144 sx
SALT	sx
KCL	775 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	100	100
PRESSURE	700	
GPM	570	
AV (DP - ft/min)	49	
AV (DC - ft/min)	162	
SPR	40/60	40/60
SPR PRESS	130/170	130/170

DRILLS / BOPS	
LAST BOP DRILL	12-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	35

BIT DATA		
BIT No.	2	
SIZE (ins)	12.1/4"	
TYPE	Sec ERA-03	
IADC CODE	417M	
SERIAL No.	679091	
NOZZLES	3 x 24	
OUT (m)	650	
IN (m)	639	
DRILLED (m)	11	
HOURS	1	
CONDITION		
AVG ROP (m/hr)		
WOB (x1000 lbs)	10	
RPM	50 + 33	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		
195	0.25	307
360	0.40	177
625	0.60	337

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	1.5
4. BIT TRIP	6.5
5. WIPER TRIP	3
6. SURVEY	
7. CIRC / COND	5
8. CHANGE BHA	3
9. CASE & CEMENT	2.5
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	2
13. CORING	
14. LOGGING	
15. REAM / WASH	0.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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 / 8" Sperry Motor / Stab 11.5" / Float sub / 8" DWD 1200 / 8" NMDC
xo / xo / 24 5" HWDP / Jars / 6 5" HWDP

BHA WEIGHT :	39,000 lbs	STRING WT.:	50,000 lbs
DP RATING :	4.1/2" 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

DATE:	12-Mar-9
REPORT No:	12
D.F.S:	6.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill 12.1/4" hole

FROM	TO		24 HOUR SUMMARY
0:00			Drill out FC at 491m, hard shoetrack cement, shoe at 504m, cement, contaminated cement to
	2:30	2.5	513m.
2:30	3:30	1	Circulate hole clean, some "clobbered mud" from rat hole.
3:30	4:30	1	L.O.T. With 8.7 ppg mud, leak-off at 175psi, EMW = 10.7ppg
4:30	5:00	0.5	Wash / ream 513-531m
5:00	6:00	1	RIH P/U singles to 629m, wash to 639m.
6:00	7:00	1	Circulate, dump rathole returns, PH 12.5
7:00	7:30	0.5	Pull back to casing shoe.
7:30	9:30	2	Build new mud to replace contaminated and dumped mud.
9:30	13:00	3.5	POOH, L/D 6 x 8" DC's.
13:00	16:00	3	M/U directional BHA, align motor - DWD. Motor set at 1.5°
16:00	19:30	3.5	RIH to 639m.
19:30	20:30	1	Displace well to new mud.
20:30	21:00	0.5	Pull back to casing shoe.
21:00	22:00	1	Repeat L.O.T. with new mud. MW 8.5ppg. Leak -off at 300psi, EMW = 12.0ppg.
22:00	22:30	0.5	RIH to 639m.
22:30	0:00	1.5	Drill 12.1/4" hole conventionally 639 - 650m. Take SCR's

Incidents in last 24 Hours NO

(If yes see separate report)

- Weather : Clear / warm

DOWNHOLE TOOLS

Hours	Serial No.	Tool
2.5	679091	8" motor
10	HOC 46807	DWD
	6849	Sperry Monel
7	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:

OPERATION TO 0600 HRS : Drill 12.1/4" hole to 659m conventionally. K.O. and drill in slide/rotary mode to 716m

PROGRAM - NEXT 24 HRS : *Drill directionally to 789m, wiper trip to 639m. Drill ahead*

TRANSPORTATION

TRANSPORT-1	mud chemicals
TRANSPORT-2	Coring equip
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL

CONTRACTOR	18
OPERATOR	2
SERVICE CO	13
TOTAL :	33

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:	13-Mar-99
REPORT No:	13
D.F.S:	7.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4 **STATUS @ 2400 HRS:** Drill 12.1/4" hole @ 906m

DEPTH - 2400 HRS:	906 m	FORMATION:	Paararte	KB - GL (m):	5.33
DEPTH - PREVIOUS:	650 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	256 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	2 x pre-tour				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.7	0 l Aldacide
VISCOSITY	51	0g EZ MUD
pH	8.5	sx PAC-R
PV / YP	12/24	**14sx XCD**
GELS 0/10	10/12	**63sx KCl**
WL API / FC (cc)	6.6	**4sx KOH**
SOLIDS %	1.7	sx KCl tech
SAND %	1.5	sx Aquagel
CHLORIDES	22,000	sx Kwikseal
KCL ppb	11.50	**8sx Pac-L**
MBT (ppb)	7.5	0kgBaracarb100
Pm Pm/Mf	.08/.35	0kgBaracarb25
TEMP (degC)	41	**4 can Baracor 129**
HOLE VOL (bbls)	477	sx Barite
SURFACE VOL (bbls)	315	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	110/84/84	110/84/84

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	134	134
PRESSURE	1300	
GPM	764	
AV (DP - ft/min)	66	
AV (DC - ft/min)	218	
SPR @ 887m	40/60	40/60
SPR PRESS	175/200	175/200

INVENTORY	
BARITE	1,044 sx
GEL	20 sx
CEMENT	50+144 sx
SALT	sx
KCL	712 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	13-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	36

BIT DATA		
BIT No.	2	
SIZE (ins)	12.1/4"	
TYPE	Sec ERA-03	
IADC CODE	417M	
SERIAL No.	679091	
NOZZLES	3 x 24	
OUT (m)	906	
IN (m)	639	
DRILLED (m)	267	
HOURS	19.5	
CONDITION		
AVG ROP (m/hr)	13.70	
WOB (x1000 lbs)	15	
RPM	200	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg)	Azimuth
677	2.60	274.5
706	5.40	272.4
763/762.4	11.40	263.9
820./817.6	16.90	262.6
848.57/844.7	20.10	262.6
877.08/871.2	22.50	216.1

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	18.5
4. BIT TRIP	
5. WIPER TRIP	1
6. SURVEY	1.5
7. CIRC / COND	1.5
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	
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.: bit / 8" Sperry Motor / Stab 11.5" / Float sub / 8" DWD 1200 / 8" NMDC
xo / xo / 24 5" HWDP / Jars / 6 5" HWDP

BHA WEIGHT :	39,000 lbs	STRING WT.:	92,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	100 amps	DRAG UP :	2,000 lbs
TORQUE OFF BTM :	140 amps	DRAG DOWN :	2,000 lbs

CONTINUED ../2

TOTAL AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	13-Mar-9?
REPORT No:	13
D.F.S:	7.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill 12.1/4" hole @ 906m.

FROM	TO		24 HOUR SUMMARY
0:00	11:00	11	Drill 12.1/4" hole in slide and rotary mode 650 - 783m. Survey and ream each connection.
11:00	12:00	1	Circulate hole clean, reciprocating and rotating string.
12:00	12:30	0.5	POOH 783 - 628m, OK.
12:30	13:00	0.5	Circulate hole clean, reciprocating and rotating string 628 - 640m.
13:00	13:30	0.5	RIH 628 - 783m.
13:30	21:00	7.5	Drill 12.1/4" hole in slide and rotary mode 783 - 887m. Survey and ream each connection.
21:00	21:30	0.5	C/O washed valve on pump #2.
21:30	22:30	1	Replace 3" 5k blind flange on discharge manifold pump #2.
22:30	0:00	1.5	Drill 12.1/4" hole in slide and rotary mode 887 - 906m. Survey and ream each connection.

Incidents in last 24 Hours NO

(If yes see separate report)

- Weather : Squally

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
24	679091	8" motor
34	HOC 46807	DWD
	6849	Sperry Monel
28.5	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:

OPERATION TO 0600 HRS : Drill 12.1/4" hole to 920m. Repair pump #1, #1 & #2 liner seals. Drill ahead to 935m. Crculate clean. POOH to rathole.Circulate hole clean, reciprocating and rotating string 628 - 640m. moderate amount of cuttings. RIH

PROGRAM - NEXT 24 HRS : *Drill 12.1/4" directional hole with precautionary wiper trips every 150m.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	20
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	14
TOTAL :	**34**

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:	14-Mar-99
REPORT No:	14
D.F.S:	8.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4 **STATUS @ 2400 HRS:** Drill 12.1/4" hole @ 1058m

DEPTH - 2400 HRS:	1,058 m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	906 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	152 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	2 x pre-tour				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.7	0 l Aldacide
VISCOSITY	53	0g EZ MUD
pH	8.5	sx PAC-R
PV / YP	11/28	**16sx XCD**
GELS 0/10	11/16	**100sx KCl**
WL API / FC (cc)	6.6	**5sx KOH**
SOLIDS %	1.8	sx KCl tech
SAND %	0.5	sx Aquagel
CHLORIDES	21,000	sx Kwikseal
KCL ppb	11.50	**9sx Pac-L**
MBT (ppb)	5	0kgBaracarb100
Pm Pm/Mf	.08/.4	0kgBaracarb25
TEMP (degC)	42	**3 can Baracor 129**
HOLE VOL (bbls)	538	sx Barite
SURFACE VOL (bbls)	485	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	**1sx EZ-Mud DP**
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	110/110/840	110/110/840

INVENTORY	
BARITE	1,044 sx
GEL	20 sx
CEMENT	50+144 sx
SALT	sx
KCL	612 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	140	140
PRESSURE	1500	
GPM	799	
AV (DP - ft/min)	70	
AV (DC - ft/min)	227	
SPR @ 1058m	40/60	40/60
SPR PRESS	200/250	200/250

DRILLS / BOPS	
LAST BOP DRILL	13-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	37

BIT DATA		
BIT No.	2	
SIZE (ins)	12.1/4"	
TYPE	Sec ERA-03	
IADC CODE	417M	
SERIAL No.	679091	
NOZZLES	3 x 24	
OUT (m)	906	
IN (m)	639	
DRILLED (m)	419	
HOURS	35.5	
CONDITION		
AVG ROP (m/hr)	11.80	
WOB (x1000 lbs)	15	
RPM	200	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		
848.57/844.7	20.10	262.6
877.08/871.2	22.50	216.1
905.6/897.3	25.20	261.9
924.61/914.4	26.30	262.1
953.07/939.7	28.20	260.3
981.56/964.6	30.20	260.8
1038.59/1012.	35.50	263.4

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	16
4. BIT TRIP	
5. WIPER TRIP	1
6. SURVEY	2
7. CIRC / COND	1.5
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	0.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
20. REP. SUBSURFACE	
21. REP. SURFACE	3
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 / 8" Sperry Motor / Stab 11.5" / Float sub / 8" DWD 1200 / 8" NMDC
xo / xo / 24 5" HWDP / Jars / 6 5" HWDP

BHA WEIGHT :	39,000 lbs	STRING WT.:	92,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	100 amps	DRAG UP :	2,000 lbs
TORQUE OFF BTM :	140 amps	DRAG DOWN :	2,000 lbs

CONTINUED ../2

908903 077

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TO AUSTRALIA

DATE:	14-Mar-9
REPORT No:	14
D.F.S:	8.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill 12.1/4" hole @ 1058m.

FROM	TO		24 HOUR SUMMARY
0:00	1:30	1.5	Drill 12.1/4" hole in slide and rotary mode 906 - 920m. Survey and ream on connections.
1:30	3:00	1.5	Repair pump #1, change out liner seals #1 & 2.
3:00	4:00	1	Drill 12.1/4" hole in slide and rotary mode 920 - 935m. Survey and ream on connections.
4:00	4:30	0.5	Circulate hole clean.
4:30	5:00	0.5	POOH 935 - 628m, 15k O/P at 785m.
5:00			Circulate hole clean while reciprocating and rotating string 628 - 640m, moderate amount of
	6:00	1	cuttings.
6:00	6:30	0.5	RIH 628 - 913m.
6:30	7:00	0.5	Wash / ream 913 - 963m.
7:00	11:00	4	Drill 12.1/4" hole in slide and rotary mode 935 - 963m. Survey and ream on connections.
11:00	12:00	1	Change out shaker screens from 84 to 110 mesh. (reduce mud sand content)
12:00	20:30	8.5	Drill 12.1/4" hole in slide and rotary mode 963 - 1041m. Survey and ream on connections.
20:30	21:00	0.5	Tighten leaking 5k flange on pump #2.
21:00	0:00	3	Drill 12.1/4" hole in slide and rotary mode 1041 - 1058m. Survey and ream on connections.

Incidents in last 24 Hours NO
(If yes see separate report)

- Weather : Squally

DOWNHOLE TOOLS

Hours	Serial No.	Tool
41.5	679091	8" motor
58	HOC 46807	DWD
	6849	Sperry Monel
46	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m

OPERATION TO 0600 HRS : Drill 12.1/4" hole to 1068m. 4" pipework between #1 & 2 pump leaking. R/U hose / 2" discharge and circulate while prep and weld leak. Drill ahead 1069 - 1075m. Pipework cracked. Circulate while repair.

PROGRAM - NEXT 24 HRS : *Drill 12.1/4" directional hole to approx 1140m, circ, pump Gyro survey. Pull back to shoe and retrieve barrel. RIH, circulate rathole, RIH & drill tangent section.*

TRANSPORTATION

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

PERSONNEL

CONTRACTOR	18
OPERATOR	2
SERVICE CO	16
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:	15-Mar-99
REPORT No:	15
D.F.S:	9.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4 **STATUS @ 2400 HRS:** RIH

DEPTH - 2400 HRS:	1,153 m	FORMATION:	Skull Creek	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,058 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	95 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	2 x pre-tour				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.7	0 l Aldacide
VISCOSITY	50	0g EZ MUD
pH	8.5	1sx PAC-R
PV / YP	10/28	2sx XCD
GELS 0/10	11/17	37sx KCl
WL API / FC (cc)	6.4	2sx KOH
SOLIDS %	1.7	2 sx Soda Ash
SAND %	0.25	sx Aquagel
CHLORIDES	22,000	sx Kwikseal
KCL ppb	11.50	2sx Pac-L
MBT (ppb)	5	0kgBaracarb100
Pm Pm/Mf	.08/.55	0kgBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)	583	60sx Barite
SURFACE VOL (bbls)	530	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	1sx EZ-Mud DP
MUD ENGINEER	G.Lange	0kg Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	110/110/110	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	140	140
PRESSURE	1650	
GPM	799	
AV (DP - ft/min)	70	
AV (DC - ft/min)	227	
SPR @ 1058m	40/60	40/60
SPR PRESS	200/250	200/250

INVENTORY	
BARITE	984 sx
GEL	20 sx
CEMENT	50+144 sx
SALT	sx
KCL	575 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	15-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	38

BIT DATA		
BIT No.	2	
SIZE (ins)	12.1/4"	
TYPE	Sec ERA-03	
IADC CODE	417M	
SERIAL No.	679091	
NOZZLES	3 x 24	
OUT (m)	1,153	
IN (m)	639	
DRILLED (m)	514	
HOURS	48.5	
CONDITION		
AVG ROP (m/hr)	10.60	
WOB (x1000 lbs)	15	
RPM	200	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg)	Azimuth
1038.59/1012.5	35.50	263.4
1067.09/1035.1	39.10	263.8
1095.64/1056.8	42.00	263.7
1124.14/1077.6	44.00	262.8

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	13
4. BIT TRIP	
5. WIPER TRIP	2
6. SURVEY	3.5
7. CIRC / COND	1
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	
20. REP. SUBSURFACE	
21. REP. SURFACE	4
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	0.5
TOTAL	**24**

BHA.: bit / 8" Sperry Motor / Stab 11.5" / Float sub / 8" DWD 1200 / 8" NMDC
xo / xo / 24 5" HWDP / Jars / 6 5" HWDP

BHA WEIGHT :	39,000 lbs	STRING WT.:	97,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	110 amps	DRAG UP :	13,000 lbs
TORQUE OFF BTM :	150 amps	DRAG DOWN :	7,000 lbs

CONTINUED ../2

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	15-Mar-9[illegible]
REPORT No:	15
D.F.S:	9.1

TOTAUSTRALIA

WELL NAME: Iona 4 **STATUS @ 2400 HRS:** RIH

FROM	TO		24 HOUR SUMMARY
0:00	1:30	1.5	Drill 12.1/4" hole in slide and rotary mode 1058 - 1069m. Ream & survey each connection
1:30			Washout on pump #2 pipework. R/U from 2" discharge #1 to string, circulate while weld and
	3:30	2	repair leak.
3:30	4:30	1	Drill 12.1/4" hole in slide and rotary mode 1069 - 1075m. Ream & survey each connection
4:30	6:30	2	Repair on #2 pump failed. Remove and cut pipework, re-weld while circulating.
6:30	18:00	11.5	Drill 12.1/4" hole in slide and rotary mode 1075 - 1153m. Ream & survey each connection
18:00	19:00	1	Pump LCM pill and circulate hole clean, significant amount of cuttings.
19:00	20:00	1	Pump Gyro / Drop system in two stages to baffle. Pump slug at slow rate.
20:00	21:30	1.5	POOH to 485m, 3 min slip time for Gyro. 20-25k O/P 1141-922m and 795m.
21:30	23:00	1.5	RIH with slickline O/S, latch Gyro barrel, POOH in 30m stages
23:00	23:30	0.5	Slip 33 feet Drill Line.
23:30	0:00	0.5	RIH filling string.

MD	Survey Type	TVD	N	E
613.5	Single Shot	613.49	N 0.14	E23.96
613.5	GYRO	613.5	S 1.19	E 25.33
			1.33	**1.37**
1129	MWD	1081.16	S 21.84	W 155.25
1129	GYRO	1079.8	S 22.70	W 157.29
		1.36	**0.86**	**2.04**

DOWNHOLE TOOLS

Hours	Serial No.	Tool
56.5	679091	8" motor
82	HOC 46807	DWD
	6849	Sperry Monel
61	1416-1128	Tasman Jars

Incidents in last 24 Hours NO

(If yes see separate report)

- Weather : Fine

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m

OPERATION TO 0600 HRS : RIH, wash to bottom, take SCR's, drill ahead in rotary mode with corrections, 1153 - 1193m

PROGRAM - NEXT 24 HRS : *Drill 12.1/4" tangent section with corrections to CP, approx 1382m, Strap out.*

TRANSPORTATION	
TRANSPORT-1	2 x 9.5/8" casing
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	16
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:	16-Mar-99
REPORT No:	16
D.F.S:	10.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Slide, to build angle

DEPTH - 2400 HRS:	1,356 m	FORMATION:	Nullawarre	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,153 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	203 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	2 x pre-tour, Weekly Safety Meeting				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.9	0 l Aldacide
VISCOSITY	50	0g EZ MUD
pH	8.5	4sx PAC-R
PV / YP	12/30	8sx XCD
GELS 0/10	11/19	120sx KCl
WL API / FC (cc)	6.4	4sx KOH
SOLIDS %	3.2	sx Soda Ash
SAND %	0.5	sx Aquagel
CHLORIDES	22,000	10sx Kwikseal M
KCL ppb	11.80	8sx Pac-L
MBT (ppb)	7.5	0kgBaracarb100
Pm Pm/Mf	.1/.7	0kgBaracarb25
TEMP (degC)	51	4can Baracor 129
HOLE VOL (bbls)	669	sx Barite
SURFACE VOL (bbls)	410	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	4sx EZ-Mud DP
MUD ENGINEER	G.Lange	1sk Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	110/110/110	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	140	140
PRESSURE	1650	
GPM	799	
AV (DP - ft/min)	70	
AV (DC - ft/min)	227	
SPR @ 1058m	40/60	40/60
SPR PRESS	200/250	200/250

INVENTORY	
BARITE	984 sx
GEL	20 sx
CEMENT	50+144 sx
SALT	sx
KCL	455 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	15-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	39

BIT DATA		
BIT No.	2	
SIZE (ins)	12.1/4"	
TYPE	Sec ERA-03	
IADC CODE	417M	
SERIAL No.	679091	
NOZZLES	3 x 24	
OUT (m)	1,356	
IN (m)	639	
DRILLED (m)	717	
HOURS	70	
CONDITION		
AVG ROP (m/hr)	10.20	
WOB (x1000 lbs)	20	
RPM	200	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		
1181.16/1115.8	47.30	262.5
1209.66/1135.1	47.60	263.1
1238.19/1154.4	46.90	264.1
1266.66/1173.9	46.80	263.3
1295.18/1193.5	46.30	262.9
1323.7/1213.3	45.70	263.9

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.3

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	21.5
4. BIT TRIP	
5. WIPER TRIP	1
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	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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 / 8" Sperry Motor / Stab 11.5" / Float sub / 8" DWD 1200 / 8" NMDC
xo / xo / 24 5" HWDP / Jars / 6 5" HWDP

BHA WEIGHT :	39,000 lbs	STRING WT.:	100,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	110 amps	DRAG UP :	20,000 lbs
TORQUE OFF BTM :	150 amps	DRAG DOWN :	15,000 lbs

CONTINUED ../2

908903 081

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

DATE:	16-Mar-9
REPORT No:	16
D.F.S:	10.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Slide, to build angle

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Continue RIH 798 - 1141m, wash to 1153m, take SCR's.
1:00	0:00	23	Drill 12.1/4" tangent section in rotary mode with corrections 1153 -1355m. Ream and survey at connections. (Difficulty maintaining angle from 1266m, sliding more frequently)
			Incidents in last 24 Hours YES (
			(If yes see separate report)
			- Weather : cloudy

DOWNHOLE TOOLS

Hours	Serial No.	Tool
79.5	679091	8" motor
106	HOC 46807	DWD
	6849	Sperry Monel
84	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m

OPERATION TO 0600 HRS : Drill 12.1/4" tangent section with corrections to CP, 1381m,

PROGRAM - NEXT 24 HRS : *Continue POOH, L/O steerable assembly, M/U 9.1/2" CB, P/U 8" DC's, RIH*

TRANSPORTATION	
TRANSPORT-1	1 x 9.5/8" casing
TRANSPORT-2	mud chemicals
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	17
OPERATOR	2
SERVICE CO	15
TOTAL :	**34**

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:	17-Mar-99
REPORT No:	17
D.F.S:	11.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Ream out hole with Core Barrel

DEPTH - 2400 HRS:	1,381 m	FORMATION:	Belfast	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,356 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	25 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"

SAFETY MEETINGS: 2 x pre-tour, Weekly Safety Meeting, Pit drill

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.0	0 l Aldacide
VISCOSITY	51	0g EZ MUD
pH	8.3	1sx PAC-R
PV / YP	11/27	1sx XCD
GELS 0/10	10/18	30sx KCl
WL API / FC (cc)	5.8	1sx KOH
SOLIDS %	3.7	sx Soda Ash
SAND %	0.3	sx Aquagel
CHLORIDES	22,000	sx Kwikseal M
KCL ppb	11.50	2sx Pac-L
MBT (ppb)	7.5	0kgBaracarb100
Pm Pm/Mf	.04/.67	0kgBaracarb25
TEMP (degC)	41	can Baracor 129
HOLE VOL (bbls)	712	80sx Barite
SURFACE VOL (bbls)	319	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	1sx EZ-Mud DP
MUD ENGINEER	G.Lange	sk Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	110/110/110	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	140	140
PRESSURE	1650	
GPM	799	
AV (DP - ft/min)	70	
AV (DC - ft/min)	227	
SPR @ 1327m	40/60	40/60
SPR PRESS	190/240	190/240

INVENTORY	
BARITE	904 sx
GEL	20 sx
CEMENT	50+144 sx
SALT	sx
KCL	425 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	17-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	40

BIT DATA		
BIT No.	2	3RR
SIZE (ins)	12.1/4"	12.1/4 x 5.1/4"
TYPE	Sec ERA-03	CM355F
IADC CODE	417M	
SERIAL No.	679091	774301
NOZZLES	3 x 24	
OUT (m)	1,381	
IN (m)	639	1,381
DRILLED (m)	742	
HOURS	76	
CONDITION	5,5WT,E,3,CP	
AVG ROP (m/hr)	9.80	
WOB (x1000 lbs)	20	
RPM	200	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		
1181.16/1115.8	47.30	262.5
1209.66/1135.1	47.60	263.1
1238.19/1154.4	46.90	264.1
1266.66/1173.9	46.80	263.3
1295.18/1193.5	46.30	262.9
1323.7/1213.3	45.70	263.9

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.3

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	6
4. BIT TRIP	8
5. WIPER TRIP	
6. SURVEY	0.5
7. CIRC / COND	2
8. CHANGE BHA	2.5
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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.: 12.1/4" CH / 9.1/2" CB /8"NMDC / 2 x 8" DC / 2 x xo's
24 x 5" HWDP / Jars / 6 x 5" HWDP

BHA WEIGHT :	47,000 lbs	STRING WT.:	85,000 lbs
DP RATING :	4.1/2" 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:	17-Mar-9_
REPORT No:	17
D.F.S:	11.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Reaming out hole with Core Barrel

FROM	TO		24 HOUR SUMMARY
0:00	6:30	6.5	Drill 12.1/4" tangent section 1356 - 1381m, slide to maintain angle, ream and survey.
6:30	7:30	1	Pump 40bbl LCM pill, circulate hole clean, substantial amount of cuttings.
7:30	9:30	2	POOH to 618m with flow checks.
9:30	10:30	1	Circulate rathole, reciprocating and rotating 618 - 630m interval.
10:30	14:30	4	POOH, service and L/D DWD and Motor.
14:30	17:00	2.5	M/U 13m x 9.1/2" CB, P/U 8" NMDC, 2 x 8" DC.
17:00	19:00	2	RIH, held up 656m.
19:00	0:00	5	P/U kelly and ream 656 - 830m. Using eight work singles off rack, L/O, run three stands.

Incidents in last 24 Hours YES (

(If yes see separate report)

- Weather : fine

DOWNHOLE TOOLS

Hours	Serial No.	Tool
87.5	679091	8" motor
119	HOC 46807	DWD
	6849	Sperry Monel
98.5	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m Skull Creek: 1029m Belfast: 1373m

OPERATION TO 0600 HRS : Continue ream out 12.1/4" hole with 9.1/2" CB 830 - 982m

PROGRAM - NEXT 24 HRS : *Ream to bottom, circulate ball, core #1*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	14
TOTAL :	**34**

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:	18-Mar-99
REPORT No:	18
D.F.S:	12.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Cut core #1 at 1382m.

DEPTH - 2400 HRS:	1,382 m	FORMATION:	Belfast	KB - GL (m):	5.33
DEPTH - PREVIOUS:	1,381 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	1 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"

SAFETY MEETINGS: 2 x pre-tour,

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.1	0 l Aldacide
VISCOSITY	55	0g EZ MUD
pH	8.5	2sx PAC-R
PV / YP	13/28	3sx XCD
GELS 0/10	10/18	40sx KCl
WL API / FC (cc)	5.9	3sx KOH
SOLIDS %	4.2	sx Soda Ash
SAND %	0.75	sx Aquagel
CHLORIDES	23,000	sx Kwikseal M
KCL ppb	12.00	1sx Pac-L
MBT (ppb)	8	0kgBaracarb100
Pm Pm/Mf	.08/.73	0kgBaracarb25
TEMP (degC)	40	1can Baracor 129
HOLE VOL (bbls)	702	24sx Barite
SURFACE VOL (bbls)	287	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	1sx EZ-Mud DP
MUD ENGINEER	G.Lange	sk Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	24	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/24	
SHAKER SCREENS:	110/110/110	110/110/110

INVENTORY	
BARITE	880 sx
GEL	20 sx
CEMENT	1100+144 sx
SALT	sx
KCL	385 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	116	
PRESSURE	450	
GPM	330	
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1327m		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	17-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	41

BIT DATA		
BIT No.	2	3RR
SIZE (ins)	12.1/4"	12.1/4 x 5.1/4"
TYPE	Sec ERA-03	CM355F
IADC CODE	417M	
SERIAL No.	679091	774301
NOZZLES	3 x 24	
OUT (m)	1,381	
IN (m)	639	1,381
DRILLED (m)	742	1
HOURS	76	1.5
CONDITION	5,5WT,E,3,CP	
AVG ROP (m/hr)	9.80	0.70
WOB (x1000 lbs)	20	15
RPM	200	70
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD / (TVD)		
1181.16/1115.8	47.30	262.5
1209.66/1135.1	47.60	263.1
1238.19/1154.4	46.90	264.1
1266.66/1173.9	46.80	263.3
1295.18/1193.5	46.30	262.9
1323.7/1213.3	45.70	263.9

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
B.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.3

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	0.5
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	1.5
14. LOGGING	
15. REAM / WASH	22
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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.: 12.1/4" CH / 9.1/2" CB /8"NMDC / 2 x 8" DC / 2 x xo's
24 x 5" HWDP / Jars / 6 x 5" HWDP

BHA WEIGHT :	47,000 lbs	STRING WT.:	110,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	200 amps	DRAG UP :	15,000 lbs
TORQUE OFF BTM :	200 amps	DRAG DOWN :	20,000 lbs

CONTINUED ../2

TOTAL AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	18-Mar-9[illegible]
REPORT No:	18
D.F.S:	12.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Cut core #1 at 1382m.

FROM	TO		24 HOUR SUMMARY
0:00	22:00	22	Continue to ream 12.1/4" hole with 9.1/2" Core Barrel 830 - 1381m.
22:00	22:30	0.5	Circulate on bottom, drop ball. Record string weights.
22:30	0:00	1.5	Start cutting core #1 1381 - 1382m, gradually increasing parameters to 25k, 80rpm, 330gpm.
			Incidents in last 24 Hours YES (
			(If yes see separate report)
			- Weather : fine

DOWNHOLE TOOLS		
Hours	Serial No.	Tool
33.5	928---	Corpro CB
	6849	Sperry Monel
122.5	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m Belfast: 1373m

OPERATION TO 0600 HRS : Cut core #1 1381 - 1383m, little to no progress in one hour. Break core. Pump slug, POOH

PROGRAM - NEXT 24 HRS : *Core #1 to 1393m. POOH, recover core #1. Either rerun CB or M/U rotary drilling assembly.*

TRANSPORTATION	
TRANSPORT-1	5.1/2" tubing
TRANSPORT-2	Howco chemicals
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	11
TOTAL :	31

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:	19-Mar-99
REPORT No:	19
D.F.S:	13.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill 12.1/4" hole at 1439m.

DEPTH - 2400 HRS:	1,439 m	FORMATION:	Belfast	KB - GL (m):	4.98
DEPTH - PREVIOUS:	1,382 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	57 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"

SAFETY MEETINGS: 2 x pre-tour, Core handling Procedure, Slip'n Cut DL

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.1	0 l Aldacide
VISCOSITY	52	0g EZ MUD
pH	8.5	4sx PAC-R
PV / YP	13/25	4sx XCD
GELS 0/10	9/17	70sx KCl
WL API / FC (cc)	6.2	5sx KOH
SOLIDS %	4.2	sx Soda Ash
SAND %	0.5	sx Aquagel
CHLORIDES	23,000	sx Kwikseal M
KCL ppb	12.00	2sx Pac-L
MBT (ppb)	8	0kgBaracarb100
Pm Pm/Mf	.06/.78	0kgBaracarb25
TEMP (degC)	49	1can Baracor 129
HOLE VOL (bbls)	730	sx Barite
SURFACE VOL (bbls)	359	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	2sx EZ-Mud DP
MUD ENGINEER	G.Lange	sk Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	13	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/15	
SHAKER SCREENS:	110/110/110	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	136	136
PRESSURE	1950	
GPM	776	
AV (DP - ft/min)	67	
AV (DC - ft/min)	221	
SPR @ 1383m	40/60	40/60
SPR PRESS	200/250	190/250

INVENTORY	
BARITE	880 sx
GEL	20 sx
CEMENT	1100+144 sx
SALT	sx
KCL	315 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	19-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	42

BIT DATA		
BIT No.	3RR	4
SIZE (ins)	12.1/4 x 5.1/4"	12.1/4"
TYPE	CM355F	ERAO3D
IADC CODE		417M
SERIAL No.	774301	681061
NOZZLES		3 x 18
OUT (m)	1,383	1,439
IN (m)	1,381	1,383
DRILLED (m)	2	56
HOURS	4.5	8.5
CONDITION	10% 1/16"	
AVG ROP (m/hr)	0.44	6.60
WOB (x1000 lbs)	25	25
RPM	70	100
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)	9.3

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	8.5
4. BIT TRIP	8
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	0.5
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	5
14. LOGGING	
15. REAM / WASH	0.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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.: 12.1/4" bit / NB Stab / 8"NMDC / 11.1/2" Stab / 2 x 8" DC / 2 x xo's
24 x 5" HWDP / Jars / 6 x 5" HWDP

BHA WEIGHT :	47,000 lbs	STRING WT.:	110,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	240 amps	DRAG UP :	15,000 lbs
TORQUE OFF BTM :	160 amps	DRAG DOWN :	14,000 lbs

CONTINUED ../2

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	19-Mar-9[illegible]
REPORT No:	19
D.F.S:	13.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Drill 12.1/4" hole at 1439m

FROM	TO		24 HOUR SUMMARY
0:00	3:30	3.5	Continue to cut core #1 1382 - 1383 m. ROP decreasing, no progress in last hour.
3:30	4:00	0.5	Mix and pump 20 bbl slug.
4:00	8:00	4	POOH, L/O six work singles (from reaming) Flow check at 505m, OK.
8:00	9:00	1	Recover 1.7m core (85% recovery) Inspect Core Head.
9:00	9:30	0.5	Rig Service.
9:30	10:00	0.5	Break and L/D Core Barrel.
10:00	13:00	3	M/U 12.1/4" bit, NB stab and stab at 30'. RIH filling pipe to 486m. BOP drill.
13:00	14:00	1	Slip 33ft and cut 98ft Drill Line,
14:00	15:00	1	Continue RIH, filling string to 1370m
15:00	15:30	0.5	Wash and ream 1370 - 1383m.
15:30	0:00	8.5	Drill 12 .14" hole from 1383 - 1439m (flowcheck @ 1425m -ve)
			- Weather : fine

DOWNHOLE TOOLS

Hours	Serial No.	Tool
41.5	928---	Corpro CB
	6849	Sperry Monel
134.5	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m Belfast: 1373m

OPERATION TO 0600 HRS : Drill 12.1/4" hole 1439 - 1448m. Flow check Drilling break 1447-1449m, -ve. Circulate, max gas 2.8%
F/C, POOH to rathole, circulate / reciprocate. Continue POOH.

PROGRAM - NEXT 24 HRS : *POOH, L/O stabs. P/U Core Barrel, RIH core 1448.5m to top of Waarre sands, POOH*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	4
SERVICE CO	10
TOTAL :	32

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

END OF REPORT

908903 088

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	20-Mar-99
REPORT No:	20
D.F.S:	14.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4 | **STATUS @ 2400 HRS:** Wash to 1445m

DEPTH - 2400 HRS:	1,455 m	FORMATION:	Waarre	KB - GL (m):	4.98
DEPTH - PREVIOUS:	1,439 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	16 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"

SAFETY MEETINGS: 1 x pre-tour, Core handling Procedure,

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.2	0 l Aldacide
VISCOSITY	52	0g EZ MUD
pH	8.5	2sx PAC-R
PV / YP	13/24	2sx XCD
GELS 0/10	9/20	35sx KCl
WL API / FC (cc)	6.1	3sx KOH
SOLIDS %	4.8	sx Soda Ash
SAND %	0.5	sx Aquagel
CHLORIDES	22,000	sx Kwikseal M
KCL ppb	12.00	1sx Pac-L
MBT (ppb)	10	0kgBaracarb100
Pm Pm/Mf	.12/.78	0kgBaracarb25
TEMP (degC)	40	1can Baracor 129
HOLE VOL (bbls)	735	51sx Barite
SURFACE VOL (bbls)	376	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	1sx EZ-Mud DP
MUD ENGINEER	G.Lange	sk Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	10	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/17	
SHAKER SCREENS:	110/110/110	110/110/110

INVENTORY	
BARITE	829 sx
GEL	20 sx
CEMENT	1100+144 sx
SALT	sx
KCL	280 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	70	70
PRESSURE	500	
GPM	399	
AV (DP - ft/min)	34	
AV (DC - ft/min)	114	
SPR @ 1448m	40/60	40/60
SPR PRESS	180/250	180/250

DRILLS / BOPS	
LAST BOP DRILL	20-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	43

BIT DATA		
BIT No.	4	5
SIZE (ins)	12.1/4"	12.1/4" x 5.1/4"
TYPE	ERAO3D	CM459EE
IADC CODE	417M	
SERIAL No.	681061	5163
NOZZLES	3 x 18	
OUT (m)	1,448	1,455
IN (m)	1,383	1,448.5
DRILLED (m)	65	7
HOURS	9.5	2.5
CONDITION	1,1,NO,I	1,1,NO,I
AVG ROP (m/hr)	6.80	2.80
WOB (x1000 lbs)	25	25
RPM	100	80
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
T.GAS (%)	2.55%
P.PRESS (ppg)	
ECD (ppg)	9.5

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	1
4. BIT TRIP	14.5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	2.5
8. CHANGE BHA	1.5
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	4.5
14. LOGGING	
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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.: 12.1/4" x 5.1/4" CH / 8"NMDC / 2 x 8" DC / 2 x xo's
24 x 5" HWDP / Jars / 6 x 5" HWDP

BHA WEIGHT :	47,000 lbs	STRING WT.:	100,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	200 amps	DRAG UP :	15,000 lbs
TORQUE OFF BTM :	160 amps	DRAG DOWN :	15,000 lbs

CONTINUED ../2

908903 089

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

DATE:	20-Mar-9
REPORT No:	20
D.F.S:	14.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Wash to 1455m

FROM	TO		24 HOUR SUMMARY
0:00	1:00	1	Drill 12.1/4" hole 1439 - 1448.5m. Flow check drilling break 1447 - 1448.5m, -ve
1:00	2:30	1.5	Circulate hole clean, max gas 2.8%. Flowcheck, slight loss. Pump slug.
2:30	4:30	2	POOH to 619m. OK.
4:30	5:00	0.5	Circulate and reciprocate rat hole interval 619 - 632m. Minimal cuttings.
5:00	7:00	2	Continue POOH with flowchecks. L/O Near Bit and String stabilizers.
7:00	8:30	1.5	M/U 13m x 9.1/2" Core Barrel.
8:30	12:00	3.5	RIH with Core Barrel to 1442m
12:00	12:30	0.5	Drop ball, record weights and torque readings.
12:30	15:00	2.5	Cut core #2 1448.5 - 1455m. No progress.
15:00	19:00	4	POOH with Core Barrel.
19:00	20:00	1	Hold Pre-job safety meeting. Recover 6.06m core #2 (93% recovery)
20:00	21:00	1	Service and redress Core Barrel.
21:00	0:00	3	RIH to 1442m.
			- Weather : fine

DOWNHOLE TOOLS

Hours	Serial No.	Tool
58.5	928—	Corpro CB
	6849	Sperry Monel
142.5	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m Belfast 1373m

OPERATION TO 0600 HRS : Wash to 1455m, circ B/U, 0.3% gas, Drop ball, core #3 1455 - 1463.3m (adding Baracarb)
No progress for 45mins, pump slug, POOH.

PROGRAM - NEXT 24 HRS : *Continue POOH, recover core #3, redress & RIH, cut core #4*

TRANSPORTATION

TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL

CONTRACTOR	18
OPERATOR	4
SERVICE CO	10
TOTAL :	**32**

PROGRAMME COSTS

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

END OF REPORT

908903 090

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	21-Mar-99
REPORT No:	21
D.F.S:	15.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Wash to 1471m with Core Barrel

DEPTH - 2400 HRS:	1,471	m	FORMATION:	Waarre	KB - GL (m):	4.98	
DEPTH - PREVIOUS:	1,455	m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504	
24 HR PROGRESS:	16	m	ACCIDENTS:	nil	LAST CASING:	13.3/8"	

SAFETY MEETINGS: 1 x pre-tour,

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.3	0 l Aldacide
VISCOSITY	49	0g EZ MUD
pH	8.5	sx PAC-R
PV / YP	12/21	sx XCD
GELS 0/10	8/19	sx KCl
WL API / FC (cc)	6.2	sx KOH
SOLIDS %	5.8	sx Soda Ash
SAND %	1.25	sx Aquagel
CHLORIDES	22,000	sx Kwikseal M
KCL ppb	12.75	sx Pac-L
MBT (ppb)	11	60sxBaracarb100
Pm Pm/Mf	.9/.72	60sxBaracarb25
TEMP (degC)	40	1can Baracor 129
HOLE VOL (bbls)	743	65sx Barite
SURFACE VOL (bbls)	344	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	sk Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER	10	
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/17	
SHAKER SCREENS:	110/110/110	110/110/110

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	80	
PRESSURE	280	
GPM	228	
AV (DP - ft/min)	20	
AV (DC - ft/min)	65	
SPR @ 1448m		
SPR PRESS		

INVENTORY	
BARITE	764 sx
GEL	20 sx
CEMENT	1100+144 sx
SALT	sx
KCL	280 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	20-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	44

BIT DATA		
BIT No.	5RR	5RR
SIZE (ins)	2.1/4" x 5.1/4	12.1/4" x 5.1/4"
TYPE	CM459EE	CM459EE
IADC CODE		
SERIAL No.	5163	5163
NOZZLES	core #3	core #4
OUT (m)	1,463.3	1,471.5
IN (m)	1,455.0	1,463.3
CORED (m)	8.3	8.2
HOURS	2	2
CONDITION	1,1,NO,I	1,1,NO,I
AVG ROP (m/hr)	4.20	4.00
WOB (x1000 lbs)	10	10
RPM	80	80
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
T.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.2

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	13
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	1
8. CHANGE BHA	
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	8
14. LOGGING	
15. REAM / WASH	1
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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	0.5
TOTAL	**24**

BHA.: 12.1/4" x 5.1/4" CH / 8"NMDC / 2 x 8" DC / 2 x xo's
24 x 5" HWDP / Jars / 6 x 5" HWDP

BHA WEIGHT :	47,000 lbs	STRING WT.:	105,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	200 amps	DRAG UP :	15,000 lbs
TORQUE OFF BTM :	160 amps	DRAG DOWN :	15,000 lbs

CONTINUED ../2

908903 091

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TO AUSTRALIA

DATE:	21-Mar-9
REPORT No:	21
D.F.S:	15.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Wash to 1471m with Core Barrel

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	Ream with Coring assembly, 1442-1455m, 3m fill.
0:30	1:00	0.5	Reciprocate string while completing 'bottoms-up'. 0.3% gas.
1:00	1:30	0.5	Drop ball, record weights, torque and circulating values.
1:30	3:30	2	Cut core #3, 1455 - 1463.3m. No progress last 40 mins, check samples, sand.
3:30	7:00	3.5	Pump slug, POOH with flowchecks.
7:00	9:00	2	Recover core #3, 7.55m (91% recovery) Service and dress Core Barrel.
9:00	9:30	0.5	Rig Service.
9:30	12:30	3	RIH to 1426m.
12:30	13:00	0.5	Wash to bottom, space-out, drop ball, record parameters.
13:00	15:00	2	Cut core #4, 1463.3 - 1471.5m.
15:00	18:00	3	Pump slug, POOH with flowchecks.
18:00	20:00	2	Recover core #4, 6.37m (77.7% recovery) Service and dress Core Barrel.
20:00	22:00	2	RIH to 477m.
22:00	22:30	0.5	Slip 33ft Drill Line.
22:30	0:00	1.5	RIH to 1461m.
			- Weather : squally rain

DOWNHOLE TOOLS

Hours	Serial No.	Tool
82.5	928---	Corpro CB
	6849	Sperry Monel
151.5	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m Belfast: 1373m

OPERATION TO 0600 HRS : Wash/ream to 1471m,(3m fill) Drop ball, core #5 1471.5 - 1478.3m. Pump slug, POOH, recover core

PROGRAM - NEXT 24 HRS : *L/D Core Barrel, M/U rotary drilling assembly, RIH, drill ahead.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	4
SERVICE CO	10
TOTAL :	**32**

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:	22-Mar-99
REPORT No:	22
D.F.S:	16.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Circulate hole clean at T.D.

DEPTH - 2400 HRS:	1,560 m	FORMATION:	Eumeralla	KB - GL (m):	4.98
DEPTH - PREVIOUS:	1,471 m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	504
24 HR PROGRESS:	89 m	ACCIDENTS:	nil	LAST CASING:	13.3/8"
SAFETY MEETINGS:	1 x pre-tour,				

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.2	0 l Aldacide
VISCOSITY	49	0g EZ MUD
pH	8.5	2sx PAC-R
PV / YP	11/19	5sx XCD
GELS 0/10	7/22	40sx KCl
WL API / FC (cc)	5.7	5sx KOH
SOLIDS %	5.2	sx Soda Ash
SAND %	0.5	sx Aquagel
CHLORIDES	23,500	10sx Kwikseal M
KCL ppb	12.25	2sx Pac-L
MBT (ppb)	11	65sxBaracarb100
Pm Pm/Mf	.07/.88	65sxBaracarb25
TEMP (degC)	49	2can Baracor 129
HOLE VOL (bbls)	784	sx Barite
SURFACE VOL (bbls)	402	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	2sx EZ-Mud DP
MUD ENGINEER	G.Lange	2sk Baracide

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

INVENTORY	
BARITE	764 sx
GEL	20 sx
CEMENT	1100+144 sx
SALT	sx
KCL	240 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM	136	136
PRESSURE	2050	
GPM	776	
AV (DP - ft/min)	67	
AV (DC - ft/min)	221	
SPR @ 1478m	40/60	40/60
SPR PRESS	150/220	150/220

DRILLS / BOPS	
LAST BOP DRILL	22-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	45

BIT DATA		
BIT No.	5RR	4RR
SIZE (ins)	12.1/4"x 5.1/4"	12.1/4"
TYPE	CM459EE	ERA-03D
IADC CODE		417M
SERIAL No.	5163	681061
NOZZLES	core #5	3 x 18
OUT (m)	1,478.3	1,560.0
IN (m)	1,471.5	1,478.0
DRILLED (m)	6.8	82.0
HOURS	2	9.5
CONDITION	1,1,NO,I	
AVG ROP (m/hr)	4.00	8.60
WOB (x1000 lbs)	10	25
RPM	80	90
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS MD/ (TVD)	Inc (deg)	Azimuth

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
T.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	9.4

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	9.5
4. BIT TRIP	6.5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	1
8. CHANGE BHA	1.5
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	2.5
14. LOGGING	
15. REAM / WASH	1.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
20. REP. SUBSURFACE	
21. REP. SURFACE	1
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.: 12.1/4" bit/ NB stab / 8"NMDC / 12.1/4" S Stab / 2 x 8" DC / 2 x xo's
24 x 5" HWDP / Jars / 6 x 5" HWDP

BHA WEIGHT :	47,000 lbs	STRING WT.:	105,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	210 amps	DRAG UP :	20,000 lbs
TORQUE OFF BTM :	170 amps	DRAG DOWN :	15,000 lbs

CONTINUED ../2

TO AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	22-Mar-
REPORT No:	22
D.F.S:	16.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Circulate hole clean.

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	Wash / Ream 1461 - 1471.5m with Core Barrel. 4m fill. Drop Ball.
0:30	1:30	1	Cut core #5 1471.5 - 1478.3m.
1:30	5:00	3.5	Flow check, pump slug. POOH with flow checks.
5:00	6:30	1.5	Recover core #5, 6.37m (113% recovery) Service and L/D Core Barrel.
6:30	7:00	0.5	Rig Service.
7:00	8:30	1.5	Make up Rotary drilling BHA.
8:30	11:30	3	RIH to 1445m, filling drill string.
11:30	12:30	1	Wash / Ream 1445 - 1478m. Take SCR's.
12:30	13:30	1	Repair Mud Pump #1 (2 x liner seals)
13:30	23:00	9.5	Drill 12.1/4" hole 1478 -1560m.
23:00	0:00	1	Pump 40 bbl LCM pill, circulate hole clean.
			- Weather : reasonable

DOWNHOLE TOOLS

Hours	Serial No.	Tool
89	928---	Corpro CB
	6849	Sperry Monel
164.5	1416-1128	Tasman Jars

FORMATION TOPS : Mepunga: 290m Dilwyn 339m Pember Muds: 534m Pebble Point 633m Paararte:672m
Skull Creek: 1029m Belfast: 1373m Top Waarre C1: 1466m

OPERATION TO 0600 HRS : Circulate hole clean, drop Single Shot, pump slug, POOH, 1520-1507 30k O/P, 1497-1476 50k O/P
P/U kelly, work string 40k max O/P, single out to 1440m, wiped all tight spots. Continue POOH

PROGRAM - NEXT 24 HRS : *POOH, L/O stabs, R/U Schlumberger, log*

TRANSPORTATION	
TRANSPORT-1	2 x 13.3/8" casing
TRANSPORT-2	3 x Testing Equipment
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	12
TOTAL :	**32**

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-Mar-99
REPORT No:	23
D.F.S:	17.1
SHOE F.I.T:	12.0ppg

WELL NAME:	Iona 4		STATUS @ 2400 HRS:	Wash ream to bottom @ 1467m			
DEPTH - 2400 HRS:	1,560	m	FORMATION:			KB - GL (m):	4.98
DEPTH - PREVIOUS:		m	HOLE SIZE:	12.1/4"		SHOE DEPTH:	504
24 HR PROGRESS:		m	ACCIDENTS:	nil		LAST CASING:	13.3/8"
SAFETY MEETINGS:	1 x pre-tour, pre-logging,						

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.2	0 l Aldacide
VISCOSITY	46	0g EZ MUD
pH	8.5	**1sx PAC-R**
PV / YP	11/16	**1sx XCD**
GELS 0/10	6/18	sx KCl
WL API / FC (cc)	6.2	sx KOH
SOLIDS %	5.2	sx Soda Ash
SAND %	0.75	sx Aquagel
CHLORIDES	23,500	sx Kwikseal M
KCL ppb	12.80	sx Pac-L
MBT (ppb)	12	**29sxBaracarb100**
Pm Pm/Mf	.08/1.0	**31sxBaracarb25**
TEMP (degC)	39	can Baracor 129
HOLE VOL (bbls)	787	**32sx Barite**
SURFACE VOL (bbls)	276	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	sk Baracide

SOLIDS CONTROL		
UNIT	GPM / HRS	UF / OF
DESILTER		
DESANDER		
MUDCLEANER		
CENTRIFUGE	70/7	
SHAKER SCREENS:	110/110/110	110/110/110

INVENTORY	
BARITE	732 sx
GEL	20 sx
CEMENT	1100+144 sx
SALT	sx
KCL	240 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	23-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	46

BIT DATA		
BIT No.	4RR	
SIZE (ins)	12.1/4"	
TYPE	ERA-03D	
IADC CODE	417M	
SERIAL No.	681061	
NOZZLES	3 x 18	
OUT (m)	1,560.0	
IN (m)	1,478.0	
DRILLED (m)	82.0	
HOURS	9.5	
CONDITION	1 E I	
AVG ROP (m/hr)	8.60	
WOB (x1000 lbs)	25	
RPM	90	
JET VEL (ft/sec)		
HHP @ BIT		

SURVEYS		
DEPTHS	Inc (deg)	Azimuth
MD/ (TVD)		
1555/1366.4	48.80	264.2

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	9
6. SURVEY	0.5
7. CIRC / COND	0.5
8. CHANGE BHA	1.5
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	6
15. REAM / WASH	0.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
20. REP. SUBSURFACE	
21. REP. SURFACE	6
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.: 12.1/4" bit/ NB stab / 8"NMDC / 12.1/4" S Stab / 2 x 8" DC / 2 x xo's
24 x 5" HWDP / Jars / 6 x 5" HWDP

BHA WEIGHT :	47,000 lbs	STRING WT.:	105,000 lbs
DP RATING :	4.1/2" lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	210 amps	DRAG UP :	20,000 lbs
TORQUE OFF BTM :	170 amps	DRAG DOWN :	15,000 lbs

CONTINUED ../2

908903 095

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

DATE:	23-Mar-9[illegible]
REPORT No:	23
D.F.S:	17.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Wash / ream to bottom @ 1467m

FROM	TO		24 HOUR SUMMARY
0:00	0:30	0.5	Continue circulating hole clean at T.D.
0:30	1:00	0.5	Drop Magnetic Single Shot, flow check.
1:00			Pump slug, POOH, 30k O/P 1520 -1507m, work and wipe same. 50k O/P to 1480m, tight, work
			string, P/U kelly, break circulation at slow rate, work and wipe interval. Kelly out singles to 1440m
	7:00	6	OK, continue POOH with flow checks. SLM (-0.75m). L/O stabs, recover MSS.
7:00			Hold pre-job Safety Meeting with Schlumberger. R/U PEX/HALS/DSI logging combo, log hole.
	13:00	6	Schlumberger TD: 1554m. POOH, L/D toolstring. (Hole taking 1 bbl/hr during logging)
13:00	19:00	6	M/U SAT string, RIH to shoe, unable to fire guns in VSP pit. Troubleshoot without success. R/D
19:00	20:30	1.5	M/U wiper BHA.
20:30	23:30	3	RIH filling string every ten stands, held up at 1455m.
23:30	0:00	0.5	P/U kelly, wash / ream to 1467m.
			Incidents last 24hr: **No**
			- Weather : reasonable

DOWNHOLE TOOLS

Hours	Serial No.	Tool
	6849	Sperry Monel
164.5	1416-1128	Tasman Jars

FORMATION TOPS : **From Logs:** Mepunga: 290m Dilwyn 339m Pember Muds: **532m** Pebble Point **602.5**m Paararte:**671m**
Skull Creek: **1043.8**m Nullawarre: **1219m** Belfast: **1359.5m** Top Waarre C1: **1453-1467m**

OPERATION TO 0600 HRS : Continue wash / ream to 1560m, Circulate hole clean. POOH 30k O/P from 1530m Pump out with low flowrate to 1450m (20/25k O/P) pump slug, POOH

PROGRAM - NEXT 24 HRS : *POOH, L/O stabs, pull wear bushing, R/U to & run 9.5/8" casing.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	4
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:	24-Mar-99
REPORT No:	24
D.F.S:	18.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Circ casing @ 1557m.

DEPTH - 2400 HRS:	1,560 m	FORMATION:		KB - GL (m):	4.98
DEPTH - PREVIOUS:	m	HOLE SIZE:	12.1/4"	SHOE DEPTH:	1,557
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	9.5/8"

SAFETY MEETINGS: 1 x pre-tour, pre-casing,

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	9.2	0 l Aldacide
VISCOSITY	46	0g EZ MUD
pH	8.5	sx PAC-R
PV / YP	11/16	sx XCD
GELS 0/10	6/18	sx KCl
WL API / FC (cc)	6.2	2sx KOH
SOLIDS %	5.2	sx Soda Ash
SAND %	0.75	sx Aquagel
CHLORIDES	23,500	sx Kwikseal M
KCL ppb	12.75	sx Pac-L
MBT (ppb)	12	20sxBaracarb100
Pm Pm/Mf	.08/.98	20sxBaracarb25
TEMP (degC)	39	can Baracor 129
HOLE VOL (bbls)	764	35sx Barite
SURFACE VOL (bbls)	210	sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	sk Baracide

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

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

INVENTORY	
BARITE	697 sx
GEL	20 sx
CEMENT	1660+144 sx
SALT	sx
KCL	240 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	23-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	47

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)		
1555/1366.4	48.80	264.2

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

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	4.5
5. WIPER TRIP	
6. SURVEY	
7. CIRC / COND	4
8. CHANGE BHA	
9. CASE & CEMENT	12
10. WELLHEAD	1
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	
15. REAM / WASH	2.5
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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.:	155,000 lbs
DP RATING :	lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	35,000 lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	35,000 lbs

CONTINUED ../2

TU AUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	24-Mar-9
REPORT No:	24
D.F.S:	18.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Circulate and reciprocate casing @ 1557m.

FROM	TO		24 HOUR SUMMARY
0:00	2:00	2	Continue wash / ream 1467 - 1560m, 9m of fill.
2:00	3:30	1.5	Circulate hole clean.
3:30	5:30	2	POOH, 30k O/P from 1520m. P/U kelly, single out to 1455m, wiping hole.
5:30	8:00	2.5	Flow check, pump slug, POOH. L/O near bit and string stabilizer.
8:00	9:00	1	R/U, pull wear bushing, R/D.
9:00	11:00	2	R/U to run 9.5/8" casing.
11:00	16:00	5	M/U shoetrack and RIH with 9.5/8" casing to 619m.
16:00	17:00	1	R/U circulating swage, circulate while racking 9.5/8" casing.
17:00	20:00	3	Continue RIH to 1240m.
20:00	21:30	1.5	R/U circulating swage, circulate while racking 9.5/8" casing.
21:30	23:30	2	Continue RIH with 9.5/8" casing to 1545m.
23:30	0:00	0.5	M/U circulating head, wash to 1557m. Work string.
			Incidents last 24hr: **No**
			- Weather : Windy, gusting to **Gale Force**.

DOWNHOLE TOOLS

Hours	Serial No.	Tool
	6849	Sperry Monel
168.5	1416-1128	Tasman Jars

FORMATION TOPS : **From Logs:** Mepunga: 290m Dilwyn 339m Pember Muds: **532m** Pebble Point **602.5m** Paararte: **671m** Skull Creek: **1043.8m** Nullawarre: **1219m** Belfast: **1359.5m** Top Waarre C1: **1453-1467m**

OPERATION TO 0600 HRS : Circulate hole clean, gradually increasing flowrate to 8bpm, no losses, reciprocate string. Hold pre-job, N/U Howco cmt head. Pump spacer, 276bbl lead, 127bbl tail, displace with 388 bbl water, 1500psi differential, bump to 2500psi, bleed off, floats holding

PROGRAM - NEXT 24 HRS : *N/D Howco, drop csg hanger, land, N/D stack, dress csg, install tbg spool, test, N/U BOPE and test*

TRANSPORTATION	
TRANSPORT-1	various testing
TRANSPORT-2	various completion
TRANSPORT-3	Howco chemicals
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	22
TOTAL :	**42**

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:	25-Mar-99
REPORT No:	25
D.F.S:	19.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4 | STATUS @ 2400 HRS: Checkshot survey.

DEPTH - 2400 HRS:	1,545 m	FORMATION:		KB - GL (m):	4.98
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH:	1,557
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	9.5/8"

SAFETY MEETINGS: PRE- Cementing / N/U BOP's

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)		0 l Aldacide
VISCOSITY		0g EZ MUD
pH		sx PAC-R
PV / YP		sx XCD
GELS 0/10		sx KCl
WL API / FC (cc)		sx KOH
SOLIDS %		sx Soda Ash
SAND %		sx Aquagel
CHLORIDES		sx Kwikseal M
KCL ppb		sx Pac-L
MBT (ppb)		0sxBaracarb100
Pm Pm/Mf		0sxBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)		sx Barite
SURFACE VOL (bbls)		sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	1can Baracide

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

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

INVENTORY	
BARITE	697 sx
GEL	20 sx
CEMENT	260+144 sx
SALT	sx
KCL	240 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	23-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	11-Mar-99
NEXT BOP TEST	26-Mar-99
DAYS SINCE LAST LTA	48

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)		
1555/1366.4	48.80	264.2

FORMATION DATA	
TRIP GAS (%)	
CONN.GAS (%)	
T.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	5.5
10. WELLHEAD	9.5
11. BOP'S	
12. L.O.T.	
13. CORING	
14. LOGGING	6
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	
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.:

BHA WEIGHT :	.5/8" STRING lbs	STRING WT.:	155,000 lbs
DP RATING :	lbs - 'G' Grade	MARGIN :	lbs @ 75%
DP RATING :	lbs - 'S' Grade	MARGIN :	lbs @ 75%
TORQUE ON BTM :	amps	DRAG UP :	35,000 lbs
TORQUE OFF BTM :	amps	DRAG DOWN :	35,000 lbs

CONTINUED ../2

908903 099

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	25-Mar-9
REPORT No:	25
D.F.S:	19.1

WELL NAME: Iona 4 **STATUS @ 2400 HRS:** Checkshot survey.

FROM	TO		24 HOUR SUMMARY
0:00	1:30	1.5	Circulate hole clean while reciprocating 9.5/8" casing at 1557m.
1:30			Hold pre-job safety / contingency meeting. N/D circulating swage, N/U cement head and
			adapters. Pressure test Lines 5000 psi, tighten adapter, test OK. Pump 20bbl water, 20bbl
			Mud Flush, release bottom plug. Mix and pump 276 bbls, 12.5ppg, Class G, with 0.55g/sk
			Econolite and 0.06g/sk HR-6L, Lead slurry. Followed by 127 bbls 15.8ppg, Class G, with
			2.8 g / 1 bbl mixwater of Halad 413L, Tail slurry. Release Top Plug. Halliburton displace with
			388 bbl water at 8bpm. Differential prior to bump, 1500si. Bump to 2500psi and hold 10mins.
	7:00	5.5	Bleed off pressure, floats holding. N/D cement head and lines.
7:00			Attempt drop casing hanger, held up bell nipple flange. N/D same. Drop casing hanger and
	9:00	2	set string with 30k.
9:00			N/D BOP adapter spool, reset hanger with 180k. Rough cut casing, L/O landing joint. Dress
	16:30	7.5	casing stub. Install B section, tubing spool. (13.5/8" 3M x 11" 5M WG-TCM)
16:30	21:30	5	R/U Schlumberger, run CBL/VDL/GR, good isolation across reservoir.
21:30	23:00	1.5	Schlumberger RIH with SAT. Guns firing OK, problem receiving signal. Troubleshoot console.
23:00	0:00	1	Schlumberger perform Checkshot survey.
			Concurrent Rig operations during logging: Energize 'P' Seal on tbg spool. Pressure test flange,
			P' Seal and casing hanger pack-off to 2000psi, OK. Change TPR to 5.1/2". Lay 9.5/8" flare line.
			Cleaned tanks in prep for brine mixing.
			Incidents last 24hr: **No**
			Test Separator, manifold, flare lines positioned and nippled up.
			Mudloggers released.
			- Weather : Overcast.

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS : **From Logs:**Mepunga: 290m Dilwyn 339m Pember Muds: **532m** Pebble Point **602.5m** Paararte:**671m** Skull Creek: **1043.8m** Nullawarre: **1219m** Belfast: **1359.5m** Top Waarre C1: **1453-1467m**

OPERATION TO 0600 HRS : Schlumberger continue Checkshot Survey, R/D. Power Failure. P.T. BOPE Run wear bushing. No test on annular.

PROGRAM - NEXT 24 HRS : *RIH with Bit and scraper, displace to brine. POOH L/D tubulars*

TRANSPORTATION	
TRANSPORT-1	Scraper
TRANSPORT-2	Completion
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	8

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	21
TOTAL :	**41**

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:	26-Mar-99
REPORT No:	26
D.F.S:	20.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4 — **STATUS @ 2400 HRS:** L/O packer assembly.

DEPTH - 2400 HRS:	1,544 m	FORMATION:		KB - GL (m):	4.98
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH:	1,557
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	9.5/8"

SAFETY MEETINGS: Safety briefing with rig crews re: Mismatching hammer unions.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.6	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		sx PAC-R
PV / YP		sx XCD
GELS 0/10		153sx KCl tech
WL API / FC (cc)		2 dr Coat-2748
SOLIDS %		sx Soda Ash
SAND %		sx Aquagel
CHLORIDES	25,000	sx Kwikseal M
KCL ppb		sx Pac-L
MBT (ppb)		0sxBaracarb100
Pm Pm/Mf		0sxBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)		sx Barite
SURFACE VOL (bbls)		sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	can Baracide

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

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

INVENTORY	
BARITE	697 sx
GEL	20 sx
CEMENT	260+144 sx
SALT	sx
KCL	240 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	23-Mar-99
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	26-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	49

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 (%)	
T.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	10.5
6. SURVEY	
7. CIRC / COND	1
8. CHANGE BHA	4
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	5.5
12. L.O.T.	
13. CORING	
14. LOGGING	1.5
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	1
20. REP. SUBSURFACE	
21. REP. SURFACE	0.5
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.:

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

TOUAUSTRALIA

DATE:	26-Mar-9
REPORT No:	26
D.F.S:	20.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: L/O packer assembly.

FROM	TO		24 HOUR SUMMARY
0:00	1:30	1.5	Schlumberger continue with Checkshot survey, R/D.
1:30	2:30	1	R/U test assembly, RIH, flush mud pumps and lines to choke manifold with water.
2:30	3:00	0.5	Rig Blackout.
3:00			Several attempts to pressure test annular at various closing pressures, no success.
			Pressure test Blind rams, inner, outer kill line valves, HCR, adapter and top tbg head flange to
	5:00	2	300psi low, 2500psi high, OK.
5:00	6:00	1	Install wear bushing. L/O test assembly.
6:00	7:30	1.5	RIH with stand of 8" DC's, L/O same.
7:30	8:30	1	M/U 8.1/2" bit, 9.5/8" scraper assembly.
8:30	11:30	3	RIH, work scraper over 1440 - 1470m interval, RIH to 1510m.
11:30	12:30	1	Wash to 1544m, displace well to 3% KCl brine, 8.6ppg.
12:30	13:00	0.5	Break all kelly connections.
13:00	20:30	7.5	POOH, L/D tubulars and BHA.
20:30	22:00	1.5	M/U assembly, pull wear bushing. L/O excess floor equipment.
22:00	23:00	1	L/O Swivel and kelly.
23:00	0:00	1	Hold pre-job safety meeting. R/U Premium equipment. M/U packer and ratch latch assembly. L/D
			Incidents last 24hr: **No**
			- Weather : Dark

DOWNHOLE TOOLS

Hours	Serial No.	Tool
170.5	1416-1128	Tasman Jars

FORMATION TOPS : **From Logs:** Mepunga: 290m Dilwyn 339m Pember Muds: **532m** Pebble Point **602.5m** Paararte: **671m**
Skull Creek: **1043.8m** Nullawarre: **1219m** Belfast: **1359.5m** Top Waarre C1: **1453-1467m**

OPERATION TO 0600 HRS : M/U Schlumberger 7" gun assembly, spacers, debris sub, nipples, xo's, pup joints, packer assembly, Sliding sleeve and one joint 5.1/2" tbg. (verify measurement from top shot to pip tag, 51.08m)
Prepare and strap 5.1/2" tbg.

PROGRAM - NEXT 24 HRS : *Run 5.1/2" completion, correlate, space-out, test tbg, set packer, land out. R/U test tree.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	2
SERVICE CO	21
TOTAL :	**41**

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:	27-Mar-99
REPORT No:	27
D.F.S:	21.1
SHOE F.I.T:	12.0ppg

WELL NAME: Iona 4 **STATUS @ 2400 HRS:** Flush test equipment.

DEPTH - 2400 HRS:	1,544 m	FORMATION:			KB - GL (m):	4.98
DEPTH - PREVIOUS:	m	HOLE SIZE:			SHOE DEPTH:	1,557
24 HR PROGRESS:	m	ACCIDENTS:	nil		LAST CASING:	9.5/8"

SAFETY MEETINGS: Safety briefing with rig crews, guns, completion, R/U test tree, coflex, slickline

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.6	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		sx PAC-R
PV / YP		sx XCD
GELS 0/10		32sx KCl tech
WL API / FC (cc)		dr Coat-2748
SOLIDS %		sx Soda Ash
SAND %		sx Aquagel
CHLORIDES	25,000	sx Kwikseal M
KCL ppb		sx Pac-L
MBT (ppb)		0sxBaracarb100
Pm Pm/Mf		0sxBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)		sx Barite
SURFACE VOL (bbls)		sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	can Baracide

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

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

INVENTORY	
BARITE	657 sx
GEL	20 sx
CEMENT	260+144 sx
SALT	sx
KCL	240 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	26-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	50

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 (%)	
T.GAS (%)	
P.PRESS (ppg)	
ECD (ppg)	

TIME ANALYSIS	
1. MOVE RIG	
2. RIG UP	
3. DRILLING	
4. BIT TRIP	
5. WIPER TRIP	10.5
6. SURVEY	
7. CIRC / COND	1
8. CHANGE BHA	4
9. CASE & CEMENT	
10. WELLHEAD	
11. BOP'S	5.5
12. L.O.T.	
13. CORING	
14. LOGGING	1.5
15. REAM / WASH	
16. FISH / STUCK	
17. LOSS CIRC	
18. KICK CONTROL	
19.COMPLETION	1
20. REP. SUBSURFACE	
21. REP. SURFACE	0.5
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.:

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

TOAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	27-Mar-9
REPORT No:	27
D.F.S:	21.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Fush Test equipment.

FROM	TO		24 HOUR SUMMARY
0:00			Hold Safety briefing with new crew. L/O packer, ratch-latch assembly. M/U Schlumberger 7" gun
			assembly, 3.3/8" spacers, nipples, debris sub, xo's, pup joints, packer assembly, sliding sleeve
			and one joint 5.1/2" tubing. Threadlock all EUE and LTC connections. Strap from R/A pip tag to
	4:30	4.5	Top shot: 51.08m. (drifted all pups and tbg joints)
4:30	6:00	1.5	Prepare and strap 5.1/2" tubing.
6:00	15:00	9	RIH picking up 117 joints of 5.1/2" NK3SB, 13CrL80, 17ppf, drifting each joint, fill every five.
15:00	17:30	2.5	R/U Schlumberger, correlate string and top shot position. R/D.
			Space out for correct packer setting depth.R/U circ swage and lines, P.T. 3000psi, OK. P.T. tubing
			1000psi, 10mins, OK. P/U to 2700psi, set packer and test tubing. Land tbg hanger with 15k
	21:00	3.5	compression. Screw in tie-down bolts.
21:00	23:00	2	R/U adapter. P/U temporary Test Tree, N/U same, kill and flow lines. P.T. tree, swab valve,
			flow wing actuator, adapter connection, tbg to 2000psi, 15mins, OK
23:00	0:00	1	R/U Coflexip Flowline from tree to production Manifold. Pump water through Tree, flowline,
			manifold, separator and flare lines..
			Incidents last 24hr: **No**
			- Weather : Horizontal Rain

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : P.T. Tree to flare lines, 1300psi, repair two leaks, test to Inlet separator and by-pass to 1500psi. Test to upstream choke valves, leaking. R/U slickline and test to 2000psi. RIH and pull plug from XN. P.T. annulus 2000psi 15mins, OK. Retest manifold, OK. RIH open SSD.

PROGRAM - NEXT 24 HRS : *Displ tbg to N2, close SSD, Drop bar, perforate and test.*

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

PERSONNEL	
CONTRACTOR	18
OPERATOR	4
SERVICE CO	19
TOTAL :	**41**

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:	28-Mar-99
REPORT No:	28
D.F.S:	22.1
SHOE F.I.T:	

WELL NAME: Iona 4

STATUS @ 2400 HRS: Fabricate Wireline brush

DEPTH - 2400 HRS:	1,544	m	FORMATION:			KB - GL (m):	4.98
DEPTH - PREVIOUS:		m	HOLE SIZE:			SHOE DEPTH:	1,557
24 HR PROGRESS:		m	ACCIDENTS:	nil		LAST CASING:	9.5/8"

SAFETY MEETINGS: Pre-tour and Weekly Safety Meeting, Pressure Testing.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.6	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		sx PAC-R
PV / YP		sx XCD
GELS 0/10		38sx KCl tech
WL API / FC (cc)		dr Coat-2748
SOLIDS %		sx Soda Ash
SAND %		sx Aquagel
CHLORIDES	25,000	sx Kwikseal M
KCL ppb	19.50	sx Pac-L
MBT (ppb)		0sxBaracarb100
Pm Pm/Mf		0sxBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)		sx Barite
SURFACE VOL (bbls)		sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	G.Lange	can Baracide

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

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

INVENTORY	
BARITE	657 sx
GEL	20 sx
CEMENT	260+144 sx
SALT	sx
KCL	240 sx
DRILLWATER	700 bbl
DIESEL FUEL	10,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	26-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	51

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 (%)	
T.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

908903 105

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

DATE:	28-Mar-
REPORT No:	28
D.F.S:	22.1

YU AUSTRALIA

WELL NAME: Iona 4

STATUS @ 2400 HRS: Fabricate Wireline brush

FROM	TO		24 HOUR SUMMARY
0:00			Pressure Test temporary tree through to both flare lines, 1300psi. Repair and retest two leaks.
			Test to Inlet Separator and By-pass valves, 1500psi OK. Test to Upstream choke valves, leaking.
	2:00	2	Retest several times to identify leaking valve. (3000psi)
2:00			Clocks back one hour. R/U Wireline lubricator and equipment. Pressure Test 2000psi OK.
	3:30	1.5	RIH with 3.813" GS pulling tool and retreive plug from XN at 1425m. POOH.
3:30	4:30	1	R/U lines to 5.1/2" x 9.5/8" annulus. Pressure test Packer and tubing hanger to 2000psi, OK.
4:30	5:30	1	Retest upstream choke valves, tree and coflexip line to 3000psi, OK. Test downstream, OK.
5:30	7:30	2	Wireline RIH with 4.562" BO shifting tool. Jar down to open SSD at 1415m, little progress.
7:30			Suspect SSD partially open. Pump Nitrogen down tubing displacing 23.5bbl of brine from
	11:00	4.5	annulus to Trip tank.
11:00			POOH with shifting tool, reconfigure tools to close sleeve, RIH, attempt to close SSD, no
			progress. POOH, M/U 4.1" LIB and RIH to xo at 1419m. POOH. RIH with 4.562" BO shifting tool.
			Attempt to close SSD, unable to locate keys in profile, Jar down, no progress. POOH. Inspect
	23:00	12	tool, some grease and scale, tool OK.
23:00	0:00	1	Fabricate brush, stem and 3/16" braided line.
			Incidents last 24hr: **No**
			- Weather : Horizontal Rain

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : RIH with brush, work 1407-1419m interval x 25. POOH (nitrogen at 483psi) RIH with shifting tool, unable to engage keys in profile. POOH. 04:00 N2 @ 450psi, fluid level @ 322m. RIH with shifting tool and Knuckle-joint, no progress

PROGRAM - NEXT 24 HRS : *If unable to close SSD, consider set plug R/D test tree, release hanger, release tbg from packer. POOH, L/O SSD, rerun tbg.*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12.00
CRANE	

PERSONNEL	
CONTRACTOR	18
OPERATOR	4
SERVICE CO	18
TOTAL :	**40**

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:	29-Mar-99
REPORT No:	29
D.F.S:	23.1
SHOE F.I.T:	12.0 ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Run 5 1/2" tubing.

DEPTH - 2400 HRS:	1,544 m	FORMATION:			KB - GL (m):	4.98
DEPTH - PREVIOUS:	m	HOLE SIZE:			SHOE DEPTH:	1,557
24 HR PROGRESS:	m	ACCIDENTS:	nil		LAST CASING:	9.5/8"

SAFETY MEETINGS: Pre-tour and Weekly Safety Meeting, Pressure Testing.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.6	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		sx PAC-R
PV / YP		sx XCD
GELS 0/10		38sx KCl tech
WL API / FC (cc)		dr Coat-2748
SOLIDS %		sx Soda Ash
SAND %		sx Aquagel
CHLORIDES	25,000	sx Kwikseal M
KCL ppb	19.50	sx Pac-L
MBT (ppb)		0sxBaracarb100
Pm Pm/Mf		0sxBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)		sx Barite
SURFACE VOL (bbls)		sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	Alan Searle	can Baracide

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

INVENTORY	
BARITE	657 sx
GEL	20 sx
CEMENT	260+144 sx
SALT	sx
KCL	200 sx
DRILLWATER	700 bbl
DIESEL FUEL	9,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	26-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	52

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 (%)	
T.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

908903 107

DAILY DILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TU AUSTRALIA

DATE:	29-Mar-9
REPORT No:	29
D.F.S:	23.1

WELL NAME: Iona 4

STATUS @ 2400 HRS: Fabricate Wireline brush

FROM	TO		24 HOUR SUMMARY
0:00	11:00	11	RIH with brush. POOH.Change tool. RIH attemted to close SSD. POOH.
			Attached knuckle above jars. RIH attemted to close SSD. POOH. RIH, attempted to set X-plug.
			Failed to set X-plug. POOH, rigged down wire line unit, lubricator & test tree.
11:00	12:00	1	Rigged up to pull tubing, pulled out of hanger, bk out of pkr. pulled landing joint, hanger
			& pup joint, laid out. Rigged up to reverse circulate back to shakers.
12:00	12:30	0.5	Reverse circulated out tubing capacity plus 20%.
12:30	18:00	5.5	Pulled out & laid down 5 1/2" tubing.
18:00	19:30	1.5	Cleaned & inspected tubing & tools. Changed out SSD.
19:30	20:00	0.5	Slipped 66' of drilling line.
20:00	0:00	4	Made up tools, run in with 5 1/2" tubing (48 joints in)
			Incidents last 24hr: No
			- Weather : Overcast no rain

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Continued to run 5 1/2" tubing, pick & make up landing joint, make up circulating swedge

PROGRAM - NEXT 24 HRS : *Displace with N2, Land completion,make up flow head test same. Test well, suspend & rig down to move.*

TRANSPORTATION

TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12.00
CRANE	

PERSONNEL

CONTRACTOR	20
OPERATOR	2
SERVICE CO	18
TOTAL :	**40**

PROGRAMME COSTS

DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :Westman/Lambert	

END OF REPORT

TUAUSTRALIA

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

WUGS Western Underground Storage Project

DATE:	30-Mar-99
REPORT No:	30
D.F.S:	23.1
SHOE F.I.T:	12.0 ppg

WELL NAME: Iona 4

STATUS @ 2400 HRS: Wait on gas to perculate up

DEPTH - 2400 HRS:	1,544 m	FORMATION:		KB - GL (m):	4.98
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH:	1,557
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING:	9.5/8"

SAFETY MEETINGS: Pre-tour and Weekly Safety Meeting, Pressure Testing.

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)	8.6	0 l Aldacide
VISCOSITY	28	0g EZ MUD
pH		sx PAC-R
PV / YP		sx XCD
GELS 0/10		38sx KCl tech
WL API / FC (cc)		dr Coat-2748
SOLIDS %		sx Soda Ash
SAND %		sx Aquagel
CHLORIDES	25,000	sx Kwikseal M
KCL ppb	19.50	sx Pac-L
MBT (ppb)		0sxBaracarb100
Pm Pm/Mf		0sxBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)		sx Barite
SURFACE VOL (bbls)		sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	Alan Searle	can Baracide

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

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

INVENTORY	
BARITE	657 sx
GEL	20 sx
CEMENT	260+144 sx
SALT	sx
KCL	200 sx
DRILLWATER	700 bbl
DIESEL FUEL	9,000 lts

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	26-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	52

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 (%)	
T.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

DATE:	30-Mar-
REPORT No:	30
D.F.S:	24.1

GFE AUSTRALIA

WELL NAME: Iona 4

STATUS @ 2400 HRS: Wait on gas to perculate up.

FROM	TO		24 HOUR SUMMARY
0:00	4:00	4	Continued to run 5 1/2" tbg, changed out one damaged jnt, made up pup jnt
			Hanger & landing jnt. Run in to 1413m.
4:00	6:00	2	Work tbg down to 1m above packer, broke off top flange, made up circulating
			swedge & T piece.
6:00	8:00	2	Displaced tbg to N2, returns to trip tank 25.3 bbls brine
8:00	8:30	0.5	Stabbed & latched into packer, landed completion, bled of N2.
8:30	9:00	0.5	Pressure tested annulas to 2000 psi.
9:00	12:00	3	Laid out circulating swedge, made up top flange & tree. Rigged up lubricator
			changed o ring in lubricator, rigged up coflex hose, tested all to 3000 psi.
12:00	15:00	3	Pressure tested tbg with N2 to 840 psi, rigged down test equipment
			prepared for well test.
15:00	19:00	4	Dropped bar (15:07) Flow tested well as per programe .
19:00	19:30	0.5	Shut well in bled off pressure.
19:30	20:30	1	Ran in with wire line set plug in EOT.
20:30	22:00	1.5	Bled off lubricator, laid down wire line tool,bled off tbg.
22:00	22:30	0.5	Laid down lubricator & wire line.
22:30	0:00	1.5	Pumped 75.5 bbls kcl brine to tbg to 2000 psi, bled off to flare pit, to 1450 psi no
			gas returns, shut in .
			Incidents last 24hr: **No**
			- Weather : Overcast, wind & rain.

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Displacing tubing with brine & flaring off gas.

PROGRAM - NEXT 24 HRS : *Suspend well, rig down & move Rig.*

TRANSPORTATION

TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12.00
CRANE	

PERSONNEL

CONTRACTOR	20
OPERATOR	2
SERVICE CO	18
TOTAL :	**40**

PROGRAMME COSTS

DAILY Aus$:	
CUMULATIVE Aus$:	
REPORTED TO :	Colin Stuart
REPORTED BY :Westman/Lambert	

END OF REPORT

DAILY DRILLING REPORT

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

TUAUSTRALIA — **WUGS** Western Underground Storage Project

DATE:	30-Mar-99
REPORT No:	31
D.F.S:	25.1
SHOE F.I.T:	12.0 ppg

WELL NAME:	Iona 4	STATUS @ 2400 HRS:		
DEPTH - 2400 HRS:	1,544 m	FORMATION:		KB - GL (m): 4.98
DEPTH - PREVIOUS:	m	HOLE SIZE:		SHOE DEPTH: 1,557
24 HR PROGRESS:	m	ACCIDENTS:	nil	LAST CASING: 9.5/8"
SAFETY MEETINGS:	Pre-tour Meetings.			

MUD PROPERTIES		ADDITIVES
DENSITY (ppg)		0 l Aldacide
VISCOSITY		0g EZ MUD
pH		sx PAC-R
PV / YP		sx XCD
GELS 0/10		38sx KCl tech
WL API / FC (cc)		dr Coat-2748
SOLIDS %		sx Soda Ash
SAND %		sx Aquagel
CHLORIDES		sx Kwikseal M
KCL ppb		sx Pac-L
MBT (ppb)		0sxBaracarb100
Pm Pm/Mf		0sxBaracarb25
TEMP (degC)		can Baracor 129
HOLE VOL (bbls)		sx Barite
SURFACE VOL (bbls)		sx Citric Acid
HOLE LOSSES (bbls)		sx Bicarb
MUD CO	Baroid	sx EZ-Mud DP
MUD ENGINEER	Alan Searle	can Baracide

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

INVENTORY	
BARITE	657 sx
GEL	20 sx
CEMENT	260+144 sx
SALT	sx
KCL	200 sx
DRILLWATER	100 bbl
DIESEL FUEL	8,000 lts

PUMPS	1	2
TYPE	PZ-8	PZ-8
STROKE	8"	8"
LINER	6"	6"
SPM		
PRESSURE		
GPM		
AV (DP - ft/min)		
AV (DC - ft/min)		
SPR @ 1478m		
SPR PRESS		

DRILLS / BOPS	
LAST BOP DRILL	
LAST FIRE DRILL	
LAST ABN.RIG DRILL	
LAST BOP TEST	26-Mar-99
NEXT BOP TEST	
DAYS SINCE LAST LTA	53

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 (%)	
T.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

908903 111

DAILY DRILLING REPORT

RIG : OD & E 30

PERMIT : PPL-2 OTWAY BASIN

TOTAL AUSTRALIA

DATE:	30-Mar-9
REPORT No:	31
D.F.S:	24.1

WELL NAME: Iona 4

STATUS @ 2400 HRS:

FROM	TO		24 HOUR SUMMARY
Midnight	3:00	3:00	Allow Kcl brine to lubricate into tubing. Bleed gas.
3:00	7:00	4:00	Pump 48bbls KCl brine to tbg. Bleed gas. Pump 59 bbls. Bleed gas to zero.
7:00	9:30	2:30	R/d test tree. L/d landing jt.
9:30	10:00	0:30	Top up tbg w/ brine. Install BPV.
10:00	15:30	5:30	N/d BOP. Dump and clean mud tanks.
15:30	18:00	2:30	Install wellhead bonnet. Pressure test 5000psi 15 mins OK. Secure wellhead..
			Rig released at 18:00 hrs.
			Incidents last 24hr: **Yes**
			See attached reports.
			Twisted knee..B.Hoskin
			Tugger chain hits face A.Stein
			- Weather : Clear and cold.

DOWNHOLE TOOLS

Hours	Serial No.	Tool

FORMATION TOPS :

OPERATION TO 0600 HRS : Prepare to move.

PROGRAM - NEXT 24 HRS : *Move rig to Slot #5*

TRANSPORTATION	
TRANSPORT-1	
TRANSPORT-2	
TRANSPORT-3	
Transport -4	
WATER HAULER	12.00
CRANE	

PERSONNEL	
CONTRACTOR	20
OPERATOR	2
SERVICE CO	18
TOTAL :	**40**

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

END OF REPORT

APPENDIX 2

Definitive Survey by Sperry Sun/Gyrodata

Sperry-Sun Drilling Services

Survey Report for Iona #4 - Gyro Re-survey

Your Ref: Definitive Gyro Re-survey (6th June 1999)

Western Underground Gas Storage Pty. Ltd.
Iona

Iona Drillpad

Measured Depth (m)	Incl.	Azim.	Vertical Depth (m)	Local Coordinates Northings (m)	Local Coordinates Eastings (m)	Geographic Coordinates Latitude	Geographic Coordinates Longitude	Global Coordinates Northings (m)	Global Coordinates Eastings (m)
0.00	0.000	0.000	0.00	0.00 N	25.00 E	38° 34' 30.9599" S	143° 02' 10.4437" E	5728374.14 N	677379.42 E
30.00	0.040	109.340	30.00	0.00 N	25.01 E	38° 34' 30.9600" S	143° 02' 10.4441" E	5728374.14 N	677379.43 E
60.00	0.110	101.950	60.00	0.01 S	25.05 E	38° 34' 30.9602" S	143° 02' 10.4457" E	5728374.13 N	677379.47 E
90.00	0.120	126.330	90.00	0.04 S	25.10 E	38° 34' 30.9610" S	143° 02' 10.4479" E	5728374.10 N	677379.52 E
120.00	0.130	112.200	120.00	0.07 S	25.16 E	38° 34' 30.9620" S	143° 02' 10.4503" E	5728374.07 N	677379.58 E
150.00	0.160	130.270	150.00	0.11 S	25.22 E	38° 34' 30.9632" S	143° 02' 10.4530" E	5728374.03 N	677379.64 E
180.00	0.120	125.000	180.00	0.15 S	25.28 E	38° 34' 30.9646" S	143° 02' 10.4554" E	5728373.99 N	677379.70 E
210.00	0.230	123.930	210.00	0.21 S	25.36 E	38° 34' 30.9663" S	143° 02' 10.4586" E	5728373.93 N	677379.78 E
240.00	0.230	135.810	240.00	0.28 S	25.45 E	38° 34' 30.9687" S	143° 02' 10.4624" E	5728373.86 N	677379.87 E
270.00	0.200	125.850	270.00	0.36 S	25.53 E	38° 34' 30.9710" S	143° 02' 10.4660" E	5728373.78 N	677379.95 E
300.00	0.160	126.980	300.00	0.41 S	25.61 E	38° 34' 30.9728" S	143° 02' 10.4692" E	5728373.73 N	677380.03 E
330.00	0.200	136.390	330.00	0.48 S	25.68 E	38° 34' 30.9748" S	143° 02' 10.4721" E	5728373.66 N	677380.10 E
360.00	0.110	141.470	360.00	0.54 S	25.73 E	38° 34' 30.9767" S	143° 02' 10.4744" E	5728373.60 N	677380.15 E
390.00	0.140	149.680	390.00	0.59 S	25.77 E	38° 34' 30.9784" S	143° 02' 10.4760" E	5728373.55 N	677380.19 E
420.00	0.200	165.380	420.00	0.67 S	25.80 E	38° 34' 30.9811" S	143° 02' 10.4773" E	5728373.47 N	677380.22 E
450.00	0.210	179.340	450.00	0.78 S	25.81 E	38° 34' 30.9845" S	143° 02' 10.4780" E	5728373.36 N	677380.23 E
480.00	0.250	169.650	480.00	0.90 S	25.83 E	38° 34' 30.9883" S	143° 02' 10.4786" E	5728373.24 N	677380.25 E
510.00	0.270	181.900	510.00	1.03 S	25.83 E	38° 34' 30.9927" S	143° 02' 10.4791" E	5728373.11 N	677380.25 E
540.00	0.100	202.180	540.00	1.13 S	25.82 E	38° 34' 30.9958" S	143° 02' 10.4787" E	5728373.01 N	677380.24 E
570.00	0.170	222.820	570.00	1.18 S	25.78 E	38° 34' 30.9977" S	143° 02' 10.4771" E	5728372.96 N	677380.20 E
600.00	0.190	226.280	600.00	1.25 S	25.72 E	38° 34' 30.9999" S	143° 02' 10.4744" E	5728372.89 N	677380.14 E
630.00	0.250	243.670	630.00	1.31 S	25.62 E	38° 34' 31.0020" S	143° 02' 10.4706" E	5728372.83 N	677380.04 E
660.00	0.610	272.620	660.00	1.34 S	25.40 E	38° 34' 31.0029" S	143° 02' 10.4616" E	5728372.80 N	677379.82 E
690.00	4.230	271.970	689.96	1.29 S	24.14 E	38° 34' 31.0023" S	143° 02' 10.4093" E	5728372.85 N	677378.56 E
720.00	6.640	272.310	719.83	1.18 S	21.30 E	38° 34' 31.0009" S	143° 02' 10.2919" E	5728372.96 N	677375.72 E

Continued...

908903 113

Sperry-Sun Drilling Services

Survey Report for Iona #4 - Gyro Re-survey
Your Ref: Definitive Gyro Re-survey (6th June 1999)

Western Underground Gas Storage Pty. Ltd.
Iona

Iona Drillpad

Measured Depth (m)	Incl.	Azim.	Vertical Depth (m)	Local Coordinates Northings (m)	Local Coordinates Eastings (m)	Geographic Coordinates Latitude	Geographic Coordinates Longitude	Global Coordinates Northings (m)	Global Coordinates Eastings (m)
750.00	10.020	267.060	749.51	1.25 S	16.96 E	38° 34' 31.0061" S	143° 02' 10.1127" E	5728372.89 N	677371.38 E
780.00	13.140	262.740	778.89	1.81 S	10.97 E	38° 34' 31.0287" S	143° 02' 09.8658" E	5728372.33 N	677365.39 E
810.00	16.180	262.730	807.91	2.77 S	3.44 E	38° 34' 31.0652" S	143° 02' 09.5556" E	5728371.37 N	677357.86 E
840.00	19.420	263.080	836.47	3.90 S	5.66 W	38° 34' 31.1084" S	143° 02' 09.1808" E	5728370.24 N	677348.76 E
870.00	22.160	262.880	864.52	5.20 S	16.23 W	38° 34' 31.1582" S	143° 02' 08.7456" E	5728368.94 N	677338.19 E
900.00	24.530	262.860	892.06	6.68 S	28.03 W	38° 34' 31.2145" S	143° 02' 08.2597" E	5728367.46 N	677326.39 E
930.00	26.960	262.310	919.08	8.36 S	40.95 W	38° 34' 31.2784" S	143° 02' 07.7276" E	5728365.78 N	677313.47 E
960.00	28.670	261.220	945.61	10.37 S	54.80 W	38° 34' 31.3535" S	143° 02' 07.1573" E	5728363.77 N	677299.62 E
990.00	31.300	261.670	971.59	12.60 S	69.62 W	38° 34' 31.4364" S	143° 02' 06.5471" E	5728361.54 N	677284.80 E
1020.00	33.970	263.950	996.86	14.61 S	85.67 W	38° 34' 31.5132" S	143° 02' 05.8860" E	5728359.53 N	677268.75 E
1050.00	37.130	264.900	1021.26	16.30 S	103.03 W	38° 34' 31.5804" S	143° 02' 05.1707" E	5728357.84 N	677251.39 E
1080.00	40.730	264.890	1044.60	17.98 S	121.80 W	38° 34' 31.6483" S	143° 02' 04.3968" E	5728356.16 N	677232.62 E
1110.00	43.240	264.420	1066.89	19.85 S	141.78 W	38° 34' 31.7233" S	143° 02' 03.5734" E	5728354.29 N	677212.64 E
1140.00	46.020	263.660	1088.24	22.04 S	162.74 W	38° 34' 31.8094" S	143° 02' 02.7097" E	5728352.10 N	677191.68 E
1170.00	46.760	263.880	1108.93	24.40 S	184.34 W	38° 34' 31.9013" S	143° 02' 01.8200" E	5728349.74 N	677170.08 E
1200.00	47.880	263.690	1129.27	26.79 S	206.26 W	38° 34' 31.9945" S	143° 02' 00.9167" E	5728347.35 N	677148.16 E
1230.00	47.250	264.450	1149.51	29.08 S	228.28 W	38° 34' 32.0845" S	143° 02' 00.0092" E	5728345.06 N	677126.14 E
1260.00	47.240	264.900	1169.88	31.12 S	250.21 W	38° 34' 32.1665" S	143° 01' 59.1052" E	5728343.02 N	677104.21 E
1290.00	46.750	262.410	1190.34	33.54 S	272.02 W	38° 34' 32.2607" S	143° 01' 58.2070" E	5728340.60 N	677082.40 E
1320.00	46.010	264.360	1211.04	36.05 S	293.59 W	38° 34' 32.3573" S	143° 01' 57.3183" E	5728338.09 N	677060.83 E
1350.00	47.000	264.260	1231.69	38.20 S	315.24 W	38° 34' 32.4428" S	143° 01' 56.4259" E	5728335.94 N	677039.18 E
1380.00	50.040	264.280	1251.56	40.45 S	337.60 W	38° 34' 32.5316" S	143° 01' 55.5044" E	5728333.69 N	677016.82 E
1410.00	50.270	264.470	1270.78	42.70 S	360.53 W	38° 34' 32.6213" S	143° 01' 54.5597" E	5728331.44 N	676993.89 E
1440.00	50.060	264.800	1290.00	44.86 S	383.46 W	38° 34' 32.7076" S	143° 01' 53.6143" E	5728329.28 N	676970.96 E
1470.00	49.590	264.290	1309.35	47.04 S	406.28 W	38° 34' 32.7946" S	143° 01' 52.6739" E	5728327.10 N	676948.14 E

Continued...

Sperry-Sun Drilling Services

Survey Report for Iona #4 - Gyro Re-survey
Your Ref: Definitive Gyro Re-survey (6th June 1999)

Iona Drillpad

Western Underground Gas Storage Pty. Ltd.
Iona

Measured Depth (m)	Incl.	Azim.	Vertical Depth (m)	Local Coordinates Northings (m)	Local Coordinates Eastings (m)	Geographic Coordinates Latitude	Geographic Coordinates Longitude	Global Coordinates Northings (m)	Global Coordinates Eastings (m)
1500.00	49.570	262.160	1328.80	49.73 S	428.96 W	38° 34' 32.8982" S	143° 01' 51.7397" E	5728324.41 N	676925.46 E
1510.00	49.500	264.230	1335.29	50.63 S	436.51 W	38° 34' 32.9328" S	143° 01' 51.4285" E	5728323.51 N	676917.91 E
1555.00	48.800	264.200	1364.73	54.06 S	470.38 W	38° 34' 33.0683" S	143° 01' 50.0329" E	5728320.08 N	676884.04 E
1560.00	48.800	264.200	1368.02	54.44 S	474.12 W	38° 34' 33.0833" S	143° 01' 49.8787" E	5728319.70 N	676880.30 E

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 Drillpad Slot #4.

Coordinate System is UTM Zone 54S on Australian Datum 1984, Meters.
Grid Convergence at Surface is -1.270°.

Based upon Minimum Curvature type calculations, at a Measured Depth of 1560.00m.,
The Bottom Hole Displacement is 502.08m., in the Direction of 263.775° (Grid).

Comments

Measured Depth (m)	Station Coordinates TVD (m)	Station Coordinates Northings (m)	Station Coordinates Eastings (m)	Comment
1555.00	1364.73	54.06 S	470.38 W	Previous Mag Single Shot
1560.00	1368.02	54.44 S	474.12 W	Extrapolated to TD

908903 115

Sperry-Sun Drilling Services

Survey Report for Iona #4 - Gyro Re-survey

Your Ref: Definitive Gyro Re-survey (6th June 1999)

Western Underground Gas Storage Pty. Ltd. | **Iona Drillpad**

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
0.00	0.000	0.000	-134.98	0.00	0.00 N	25.00 E	5728374.14 N	677379.42 E		0.00	
30.00	0.040	109.340	-104.98	30.00	0.00 N	25.01 E	5728374.14 N	677379.43 E	0.040	-0.01	
60.00	0.110	101.950	-74.98	60.00	0.01 S	25.05 E	5728374.13 N	677379.47 E	0.071	-0.05	
90.00	0.120	126.330	-44.98	90.00	0.04 S	25.10 E	5728374.10 N	677379.52 E	0.050	-0.10	
120.00	0.130	112.200	-14.98	120.00	0.07 S	25.16 E	5728374.07 N	677379.58 E	0.032	-0.15	
150.00	0.160	130.270	15.02	150.00	0.11 S	25.22 E	5728374.03 N	677379.64 E	0.054	-0.21	
180.00	0.120	125.000	45.02	180.00	0.15 S	25.28 E	5728373.99 N	677379.70 E	0.042	-0.26	
210.00	0.230	123.930	75.02	210.00	0.21 S	25.36 E	5728373.93 N	677379.78 E	0.110	-0.33	
240.00	0.230	135.810	105.02	240.00	0.28 S	25.45 E	5728373.86 N	677379.87 E	0.048	-0.41	
270.00	0.200	125.850	135.02	270.00	0.36 S	25.53 E	5728373.78 N	677379.95 E	0.048	-0.49	
300.00	0.160	126.980	165.02	300.00	0.41 S	25.61 E	5728373.73 N	677380.03 E	0.040	-0.56	
330.00	0.200	136.390	195.02	330.00	0.48 S	25.68 E	5728373.66 N	677380.10 E	0.050	-0.62	
360.00	0.110	141.470	225.02	360.00	0.54 S	25.73 E	5728373.60 N	677380.15 E	0.091	-0.67	
390.00	0.140	149.680	255.02	390.00	0.59 S	25.77 E	5728373.55 N	677380.19 E	0.035	-0.70	
420.00	0.200	165.380	285.02	420.00	0.67 S	25.80 E	5728373.47 N	677380.22 E	0.075	-0.72	
450.00	0.210	179.340	315.02	450.00	0.78 S	25.81 E	5728373.36 N	677380.23 E	0.051	-0.72	
480.00	0.250	169.650	345.02	480.00	0.90 S	25.83 E	5728373.24 N	677380.25 E	0.056	-0.72	
510.00	0.270	181.900	375.02	510.00	1.03 S	25.83 E	5728373.11 N	677380.25 E	0.059	-0.72	
540.00	0.100	202.180	405.02	540.00	1.13 S	25.82 E	5728373.01 N	677380.24 E	0.180	-0.70	
570.00	0.170	222.820	435.02	570.00	1.18 S	25.78 E	5728372.96 N	677380.20 E	0.084	-0.65	
600.00	0.190	226.280	465.02	600.00	1.25 S	25.72 E	5728372.89 N	677380.14 E	0.023	-0.58	
630.00	0.250	243.670	495.02	630.00	1.31 S	25.62 E	5728372.83 N	677380.04 E	0.089	-0.48	
660.00	0.610	272.620	525.02	660.00	1.34 S	25.40 E	5728372.80 N	677379.82 E	0.410	-0.26	
690.00	4.230	271.970	554.98	689.96	1.29 S	24.14 E	5728372.85 N	677378.56 E	3.620	1.00	
720.00	6.640	272.310	584.85	719.83	1.18 S	21.30 E	5728372.96 N	677375.72 E	2.410	3.81	

Continued...

Western Underground Gas Storage Pty. Ltd. — **Iona Drillpad**
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
750.00	10.020	267.060	614.53	749.51	1.25 S	16.96 E	5728372.89 N	677371.38 E	3.461	8.13	
780.00	13.140	262.740	643.91	778.89	1.81 S	10.97 E	5728372.33 N	677365.39 E	3.236	14.15	
810.00	16.180	262.730	672.93	807.91	2.77 S	3.44 E	5728371.37 N	677357.86 E	3.040	21.74	
840.00	19.420	263.080	701.49	836.47	3.90 S	5.66 W	5728370.24 N	677348.76 E	3.242	30.91	
870.00	22.160	262.880	729.54	864.52	5.20 S	16.23 W	5728368.94 N	677338.19 E	2.741	41.55	
900.00	24.530	262.860	757.08	892.06	6.68 S	28.03 W	5728367.46 N	677326.39 E	2.370	53.44	
930.00	26.960	262.310	784.10	919.08	8.36 S	40.95 W	5728365.78 N	677313.47 E	2.442	66.46	
960.00	28.670	261.220	810.63	945.61	10.37 S	54.80 W	5728363.77 N	677299.62 E	1.784	80.45	
990.00	31.300	261.670	836.61	971.59	12.60 S	69.62 W	5728361.54 N	677284.80 E	2.640	95.43	
1020.00	33.970	263.950	861.88	996.86	14.61 S	85.67 W	5728359.53 N	677268.75 E	2.939	111.61	
1050.00	37.130	264.900	886.28	1021.26	16.30 S	103.03 W	5728357.84 N	677251.39 E	3.208	129.04	
1080.00	40.730	264.890	909.62	1044.60	17.98 S	121.80 W	5728356.16 N	677232.62 E	3.600	147.89	
1110.00	43.240	264.420	931.91	1066.89	19.85 S	141.78 W	5728354.29 N	677212.64 E	2.530	167.95	
1140.00	46.020	263.660	953.26	1088.24	22.04 S	162.74 W	5728352.10 N	677191.68 E	2.831	189.03	
1170.00	46.760	263.880	973.95	1108.93	24.40 S	184.34 W	5728349.74 N	677170.08 E	0.757	210.75	
1200.00	47.880	263.690	994.29	1129.27	26.79 S	206.26 W	5728347.35 N	677148.16 E	1.129	232.80	
1230.00	47.250	264.450	1014.53	1149.51	29.08 S	228.28 W	5728345.06 N	677126.14 E	0.844	254.94	
1260.00	47.240	264.900	1034.90	1169.88	31.12 S	250.21 W	5728343.02 N	677104.21 E	0.331	276.97	
1290.00	46.750	262.410	1055.36	1190.34	33.54 S	272.02 W	5728340.60 N	677082.40 E	1.886	298.90	
1320.00	46.010	264.360	1076.06	1211.04	36.05 S	293.59 W	5728338.09 N	677060.83 E	1.594	320.62	
1350.00	47.000	264.260	1096.71	1231.69	38.20 S	315.24 W	5728335.94 N	677039.18 E	0.993	342.38	
1380.00	50.040	264.280	1116.58	1251.56	40.45 S	337.60 W	5728333.69 N	677016.82 E	3.040	364.85	
1410.00	50.270	264.470	1135.80	1270.78	42.70 S	360.53 W	5728331.44 N	676993.89 E	0.272	387.88	
1440.00	50.060	264.800	1155.02	1290.00	44.86 S	383.46 W	5728329.28 N	676970.96 E	0.329	410.92	
1470.00	49.590	264.290	1174.37	1309.35	47.04 S	406.28 W	5728327.10 N	676948.14 E	0.611	433.84	

Continued...

Sperry-Sun Drilling Services

Survey Report for Iona #4 - Gyro Re-survey
Your Ref: Definitive Gyro Re-survey (6th June 1999)

Western Underground Gas Storage Pty. Ltd. **Iona Drillpad**
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
1500.00	49.570	262.160	1193.82	1328.80	49.73 S	428.96 W	5728324.41 N	676925.46 E	1.622	456.67	
1510.00	49.500	264.230	1200.31	1335.29	50.63 S	436.51 W	5728323.51 N	676917.91 E	4.729	464.28	
1555.00	48.800	264.200	1229.75	1364.73	54.06 S	470.38 W	5728320.08 N	676884.04 E	0.467	498.32	Previous Mag Single Shot
1560.00	48.800	264.200	1233.04	1368.02	54.44 S	474.12 W	5728319.70 N	676880.30 E	0.000	502.08	Extrapolated to TD

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 Drillpad Slot #4.

Coordinate System is UTM Zone 54S on Australian Datum 1984, Meters.
Grid Convergence at Surface is -1.270°.

The Dogleg Severity is in Degrees per 30m.
Vertical Section is from Iona #4 Wellhead and calculated along an Azimuth of 263.775° (Grid).

Based upon Minimum Curvature type calculations, at a Measured Depth of 1560.00m.,
The Bottom Hole Displacement is 502.08m., in the Direction of 263.775° (Grid).

Continued...

908903 118

Sperry-Sun Drilling Services

Survey Report for Iona #4 - Gyro Re-survey
Your Ref: Definitive Gyro Re-survey (6th June 1999)

Western Underground Gas Storage Pty. Ltd. — **Iona Drillpad**
Iona

Comments

Measured Depth (m)	Station Coordinates TVD (m)	Northings (m)	Eastings (m)	Comment
1555.00	1364.73	54.06 S	470.38 W	Previous Mag Single Shot
1560.00	1368.02	54.44 S	474.12 W	Extrapolated to TD

908903 119

APPENDIX 3

Cuttings Descriptions

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		17.5" Hole Section (591 - 639 mRT)
591	90	**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 and ferruginised in part, trace pyrite, trace to rare mica, trace skeletal fragments, slightly calcareous.
	10	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated, loose, predominantly medium to coarse grains, sub angular to sub rounded occasionally rounded and polished with ferruginous staining, moderate sphericity, moderate to well sorted quartz, trace to rare nodular pyrite, rare to minor skeletal fragments, good inferred. No shows.
594	100	**CLAYSTONE:** as above grading to Arenaceous Claystone
	tr	**SANDSTONE:** as above
597	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
600	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
603	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
606		Missed sample
609	90	**SILTY CLAYSTONE GRADING TO ARENACEOUS CLAYSTONE:** medium to dark greenish grey to brownish grey in part, soft to firm, abundant quartz silt to fine sand, nil to trace carbonaceous specks, minor to common glauconite pellets oxidised and ferruginised in part, trace to minor nodular pyrite, trace to rare mica flakes, trace skeletal fragments, slightly calcareous.
	10	**SANDSTONE:** as above, occasional very coarse, trace lithics, brown volcanic? glass
612	50	**SILTY CLAYSTONE:** as above
	50	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated, loose, predominantly medium to coarse grains, sub angular to sub rounded occasionally rounded and polished with ferruginous staining, low to moderate sphericity, moderate to well sorted quartz, trace to rare nodular pyrite, good inferred porosity. No shows.

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		17.5" Hole Section (591 - 639 mRT)
615	30	**ARENACEOUS CLAYSTONE:** as above, grading to form to moderately hard
	70	**SANDSTONE:** as above
618	20	**ARENACEOUS CLAYSTONE:** as above
	80	**SANDSTONE:** as above
621	95	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated, loose, predominantly medium to coarse grains, sub angular to sub rounded occasionally rounded and polished with ferruginous staining, low to moderate sphericity, moderate to well sorted quartz, trace to rare nodular pyrite, good to excellent inferred porosity. No shows.
	5	**ARENACEOUS CLAYSTONE:** medium to dark greenish grey to brownish grey in part, firm to moderately hard, abundant quartz silt to fine sand, nil to trace carbonaceous specks, minor to common glauconite pellets oxidised and ferruginised in part, trace to minor nodular pyrite, trace to rare mica flakes, trace skeletal fragments, slightly calcareous.
624	100	**SANDSTONE:** as above.
	tr	**ARENACEOUS CLAYSTONE:** as above
627	100	**SANDSTONE:** as above.
	tr	**ARENACEOUS CLAYSTONE:** as above
630	100	**SANDSTONE:** as above.
	tr	**ARENACEOUS CLAYSTONE:** as above
633	30	**CLAYEY SANDSTONE:** light brownish to greenish grey, clear to translucent grains, moderately hard to hard, predominantly medium to coarse grains occasionally very coarse, angular to sub rounded occasionally rounded and polished with ferruginous staining, low to moderate sphericity, poorly to moderately sorted quartz, abundant quartz silt, abundant clay matrix, minor calcareous-dolomitic cement, trace to rare nodular pyrite, nil to poor inferred porosity.
	70	**SANDSTONE:** as above.
	tr	**ARENACEOUS CLAYSTONE:** as above
636	50	**CLAYEY SANDSTONE:** as above
	50	**SANDSTONE:** as above.
	tr	**ARENACEOUS CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		17.5" Hole Section (591 - 639 mRT)
639	50	**CLAYEY SANDSTONE:** as above
B.U.	50	**SANDSTONE:** as above.
	tr	**ARENACEOUS CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well: Iona - 4 Permit: PPL-2**
		12.25" Hole Section (693 – 1560 mRT)
642	60	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated, loose, predominantly medium to coarse grains, sub angular to sub rounded occasionally rounded and polished with ferruginous staining, low to moderate sphericity, moderate to well sorted quartz, trace to rare nodular pyrite, good to excellent inferred porosity. No shows.
	40	**ARENACEOUS CLAYSTONE:** medium to dark greenish grey to brownish grey in part, firm to moderately hard, abundant quartz silt to fine sand, nil to trace carbonaceous specks, minor to common glauconite pellets oxidised and ferruginised in part, trace to minor nodular pyrite, trace to rare mica flakes, trace skeletal fragments and forams, slightly calcareous, minor calcareous-dolomitic cement
645	70	**SANDSTONE:** as above.
	30	**ARENACEOUS CLAYSTONE:** as above
648	30	**SANDSTONE:** as above.
	70	**ARENACEOUS CLAYSTONE:** as above
651	60	**SANDSTONE:** as above.
	40	**ARENACEOUS CLAYSTONE:** as above
654	50	**SANDSTONE:** as above.
	50	**ARENACEOUS CLAYSTONE:** as above
657	40	**SANDSTONE:** as above, predominantly fine to medium.
	60	**ARENACEOUS CLAYSTONE:** as above
660	20	**SANDSTONE:** as above.
	80	**ARENACEOUS CLAYSTONE:** as above
663	20	**SANDSTONE:** as above.
	80	**ARENACEOUS CLAYSTONE:** as above
666	30	**SANDSTONE:** as above, predominantly medium to coarse occasional pebble.
	70	**ARENACEOUS CLAYSTONE:** as above
669	20	**SANDSTONE:** as above.
	80	**ARENACEOUS CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
672	20	**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.
	80	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, minor coal specks, trace to rare mica
675	20	**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.
	80	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, minor coal specks, trace to rare mica flakes
678	80	**SANDSTONE:** as above, up to 10 percent lithic volcanics
	20	**CLAYSTONE:** as above
681	90	**SANDSTONE:** as above, up to 5 percent lithic volcanics
	10	**CLAYSTONE:** as above
684	90	**SANDSTONE:** as above, up to 5 percent lithic volcanics
	10	**CLAYSTONE:** as above
687	100	**SANDSTONE:** as above predominantly medium to very coarse, trace to rare lithic volcanics
	tr	**CLAYSTONE:** as above
690	100	**SANDSTONE:** as above predominantly medium to very coarse, trace to rare lithic volcanics, rare coal specks
	tr	**CLAYSTONE:** as above
693		Missed sample
696	100	**SANDSTONE:** as above predominantly medium to very coarse, rare siliceous cement, trace to rare lithic volcanics, rare coal specks
699		Missed sample

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
702	100	<u>**SANDSTONE:**</u> as above, rare lithic volcanics
705		Missed sample
708	80	<u>**SANDSTONE:**</u> as above
	20	<u>**CLAYSTONE:**</u> as above
711	70	<u>**SANDSTONE:**</u> as above
	30	<u>**CLAYSTONE:**</u> as above
714	60	<u>**SANDSTONE:**</u> as above
	40	<u>**CLAYSTONE:**</u> as above
717		Missed sample
720	50	<u>**SANDSTONE:**</u> 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, rare to minor 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.
	50	<u>**CLAYSTONE:**</u> medium to light grey to brownish grey, very soft, dispersive, minor to common silt, minor pyritized coal specks, trace to rare mica flakes
723	50	<u>**SANDSTONE:**</u> as above
	50	<u>**CLAYSTONE:**</u> as above
726	50	<u>**SANDSTONE:**</u> as above
	50	<u>**CLAYSTONE:**</u> as above
729	70	<u>**SANDSTONE:**</u> as above, rare sub angular to sub rounded pebbles
	30	<u>**CLAYSTONE:**</u> as above
732	60	<u>**SANDSTONE:**</u> as above
	40	<u>**CLAYSTONE:**</u> as above
735	50	<u>**SANDSTONE:**</u> as above
	50	<u>**CLAYSTONE:**</u> as above
738		Missed sample

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
741	70	SANDSTONE: as above
	30	CLAYSTONE: as above
744	50	SANDSTONE: as above
	50	CLAYSTONE: as above
747	40	SANDSTONE: as above
	60	CLAYSTONE: as above
750	30	SANDSTONE: as above
	70	CLAYSTONE: as above
753	30	SANDSTONE: as above
	70	CLAYSTONE: as above,
		Note: rare to minor coal lumps and black chert pebbles (1-2cm) over shakers
756	20	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, rare to minor 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.
	80	CLAYSTONE: medium to light grey to brownish grey, very soft, dispersive, minor to common silt, minor pyritized coal specks, trace to rare clear, red-brown and black mica flakes
759	20	SANDSTONE: as above
	80	CLAYSTONE: as above
762	20	SANDSTONE: as above
	80	CLAYSTONE: as above
765	90	SANDSTONE: light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grains grading to gravel in part, sub angular to sub rounded occasionally rounded, moderate sphericity, moderately well sorted quartz, minor to common multicoloured, orange, yellow, greyish blue and black hard lithic volcanic? and siliceous pebbles, trace to rare nodular pyrite cement, nil to trace calcareous, moderate to good inferred porosity. No fluorescence.

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well: Iona - 4 Permit: PPL-2**
		12.25" Hole Section (693 – 1560 mRT)
	10	**CLAYSTONE:** as above Note: pebbles are sub angular to rounded and up to 2 cm in size
768	100 tr	**SANDSTONE:** as above, pebbles as above **CLAYSTONE:** as above
771	100 tr	**SANDSTONE:** as above, pebbles as above **CLAYSTONE:** as above
774	100 tr	**SANDSTONE:** as above, pebbles as above **CLAYSTONE:** as above
777	90 10	**SANDSTONE:** as above, pebbles as above **CLAYSTONE:** as above
780	70 30	**SANDSTONE:** as above, pebbles as above **CLAYSTONE:** as above
783	70 30	**SANDSTONE:** as above, pebbles as above **CLAYSTONE:** as above Note: B.U. sample, followed by wiper trip
786	80 20	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium occasionally coarse grains grading to gravel, sub angular to sub rounded occasionally rounded, moderate sphericity, moderately well sorted quartz, minor to common multicoloured, orange, yellow, greyish blue and black hard lithic volcanic? and siliceous pebbles, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence. **CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, minor pyritized coal specks, trace to rare clear, red-brown and black mica flakes Note: minor cavings from Pebble Point Formation
789	80 20	**SANDSTONE:** as above, pebbles as above **CLAYSTONE:** as above Note: minor cavings from Pebble Point Formation
792	60	**SANDSTONE:** as above, pebbles as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	40	**CLAYSTONE:** as above Note: minor cavings from Pebble Point Formation
795	70	**SANDSTONE:** as above, pebbles as above
	30	**CLAYSTONE:** as above
798	80	**SANDSTONE:** as above, pebbles as above predominantly rounded milky quartz with occasional coloured lithic
	20	**CLAYSTONE:** as above
801	80	**SANDSTONE:** as above, pebbles as above predominantly rounded milky quartz
	20	**CLAYSTONE:** as above
804	90	**SANDSTONE:** as above, pebbles as above predominantly rounded milky quartz
	10	**CLAYSTONE:** as above
807	70	**SANDSTONE:** as above, pebbles as above predominantly rounded milky quartz
	30	**CLAYSTONE:** as above
810	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
813	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
816	80	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to occasionally coarse grains grading to gravel, sub angular to sub rounded occasionally rounded, larger pebbles predominantly sub angular to sub rounded milky quartz, moderate sphericity, moderately well sorted quartz, trace multicoloured, orange, yellow, greyish blue and black hard lithic volcanic? and siliceous pebbles, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	20	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, minor pyritized coal specks, trace to rare clear, red-brown and black mica flakes
819	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
822	50	**SANDSTONE:** as above,

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	50	**CLAYSTONE:** as above
825	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
828	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
831	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
834	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
837	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above, grading to Silty Claystone in part
840	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
843	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above, firm to moderately hard in part
846	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
849	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
852	70	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to occasionally coarse grains grading to gravel, sub angular to sub rounded occasionally rounded, larger pebbles predominantly sub angular to sub rounded milky quartz, moderate sphericity, moderately well sorted quartz, trace multicoloured, orange, yellow, greyish blue and black hard lithic volcanic? and siliceous pebbles, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	30	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
855	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
858	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
861	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
864	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above, minor large coal fragments, black, moderately hard, pyritized, well bedded
867	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
870	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
873	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
876	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
879	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
882	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
885	100	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to occasionally coarse grains grading to gravel, sub angular to sub rounded occasionally rounded, larger pebbles predominantly sub angular to sub rounded milky quartz, moderate sphericity, moderately well sorted quartz, trace multicoloured, orange, yellow, greyish blue and black hard lithic volcanic? And siliceous pebbles, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	tr	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive,

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well:** Iona - 4 **Permit:** PPL-2
		12.25" Hole Section (693 – 1560 mRT)
		minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes
888	100	**SANDSTONE:** as above,
	tr	**CLAYSTONE:** as above
891		Missed sample
894	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
897	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
900	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
903	100	**SANDSTONE:** as above,
	tr	**CLAYSTONE:** as above
906	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
	tr	**COAL:** black, moderately hard, vitreous, blocky and conchoidal fracture, pyritized
909	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
912	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
915	30	**SANDSTONE:** as above,
	70	**CLAYSTONE:** as above
918	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
		COAL: black, moderately hard, vitreous, blocky and conchoidal fracture, pyritized
921	60	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to occasionally coarse grains grading to gravel, sub angular to sub rounded occasionally rounded, larger pebbles

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
		predominantly sub angular to sub rounded milky quartz, moderate sphericity, moderately well sorted quartz, trace multicoloured, orange, yellow, greyish blue and black hard lithic volcanic? and siliceous pebbles, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	40	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes
924	30	**SANDSTONE:** as above,
	70	**CLAYSTONE:** as above
927	30	**SANDSTONE:** as above,
	70	**CLAYSTONE:** as above
930	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
	tr	**COAL:** black, moderately hard, vitreous, blocky and conchoidal fracture, pyritized
933	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
936	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
939	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
942	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
945	90	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grains occasionally fine, sub angular to sub rounded, moderate sphericity, well sorted quartz, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	10	**CLAYSTONE:** as above
948	100	**SANDSTONE:** as above,
951	100	**SANDSTONE:** as above,
954	80	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains,

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
		unconsolidated to friable, predominantly medium to coarse grains minor pebble, sub angular to sub rounded, moderate sphericity, well sorted quartz, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	20	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes
957	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
960	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
963	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
966	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
969	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
972	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
975	50	**SANDSTONE:** as above, minor to common pebbles
	50	**CLAYSTONE:** as above
978	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
	tr	**COAL:** black, moderately hard, vitreous, blocky and conchoidal fracture, pyritized
981	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
984	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
987	80	**SANDSTONE:** as above,

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	20	**CLAYSTONE:** as above
990	80	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grains minor pebble, sub angular to sub rounded, moderate sphericity, well sorted quartz, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	20	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes
993	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
996	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
999	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
1002	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
1005	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
1008	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
1011	90	**SANDSTONE:** as above,
	10	**CLAYSTONE:** as above
	tr	**DOLOMITE:** dark grey to black, hard, blocky, trace pyrite
1014	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above
	tr	**DOLOMITE:** as above
1017	80	**SANDSTONE:** as above,
	20	**CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	tr	**DOLOMITE:** as above
1020	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
1023	50	**SANDSTONE:** light grey to light brownish grey, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grains minor pebble, sub angular to sub rounded, moderate sphericity, well sorted quartz, trace to rare nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	50	**CLAYSTONE:** medium to light grey to brownish grey, very soft, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes
1026	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
1029	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
1032	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above, grading to firm
	tr	**DOLOMITE:** dark grey to black, hard, blocky, trace pyrite, trace carbonaceous
1035	40	**SANDSTONE:** as above, grading to white, very fine to fine with abundant calcareous cement
	60	**CLAYSTONE:** as above, grading to firm
	tr	**DOLOMITE:** as above
1038	50	**SANDSTONE:** as above, grading to white, very fine to fine with abundant calcareous cement
	50	**CLAYSTONE:** as above, grading to firm
	tr	**DOLOMITE:** as above
1041	50	**SANDSTONE:** light grey to light brownish grey grading to white,, clear to translucent grains, unconsolidated to friable, predominantly medium to coarse grains minor pebble, sub angular to sub rounded, moderate sphericity, well sorted quartz, in part very fine to fine with abundant calcareous cement, trace to rare

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
		nodular pyrite cement, moderate to good inferred porosity. No fluorescence.
	50	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor coal specks, trace to rare pyrite, trace to rare mica flakes
1044	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
1047	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
1050	70	**SANDSTONE:** light grey to light brownish grey grading to white, clear to translucent grains, friable to sub blocky, predominantly fine to medium occasionally coarse grains to minor pebble, sub angular to sub rounded, moderate sphericity, well sorted quartz, in part very fine to fine with abundant calcareous cement, trace to rare nodular pyrite cement, poor to moderate inferred porosity. No fluorescence.
	30	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes
1053	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
1056	70	**SANDSTONE:** as above,
	30	**CLAYSTONE:** as above
1059	60	**SANDSTONE:** as above,
	40	**CLAYSTONE:** as above
1062	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
1065	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
1068	50	**SANDSTONE:** as above,
	50	**CLAYSTONE:** as above
1071	50	**SANDSTONE:** as above,

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	50	**CLAYSTONE:** as above, minor pyritized coal
1074	30	**SANDSTONE:** as above,
	70	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes, trace glauconite
1077	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
1080	40	**SANDSTONE:** as above,
	60	**CLAYSTONE:** as above
1083	80	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes, trace glauconite
	20	**SANDSTONE:** light grey to light brownish grey grading to white, clear to translucent grains, friable to sub blocky, predominantly very fine to medium occasionally coarse grains, sub angular to sub rounded, moderate sphericity, well sorted quartz, in part very fine to fine with abundant calcareous cement, trace to rare nodular pyrite cement, poor to moderate inferred porosity. No fluorescence.
1086	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1089	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1092	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above, occasional pebble
1095	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1098	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1101	60	**CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	40	**SANDSTONE:** as above
1104	60	**CLAYSTONE:** as above
	40	**SANDSTONE:** as above
1107	60	**CLAYSTONE:** as above
	40	**SANDSTONE:** as above
1110	60	**CLAYSTONE:** as above
	40	**SANDSTONE:** as above
1113	50	**CLAYSTONE:** as above
	50	**SANDSTONE:** as above
1116	50	**CLAYSTONE:** as above
	50	**SANDSTONE:** as above
1119	60	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, common to abundant very fine to fine sand grading to Sandy Claystone in part, minor pyritized coal specks, trace to rare mica flakes, trace glauconite
	40	**SANDSTONE:** light grey to light brownish grey grading to white, clear to translucent grains, friable to sub blocky to moderately hard in part, predominantly very fine to medium occasionally coarse to pebble grains, sub angular to sub rounded, moderate sphericity, well sorted quartz, in part up to 30 percent very fine to fine with abundant calcareous cement, minor siliceous cement, trace glauconite, trace to rare nodular pyrite cement, very poor to poor inferred porosity. No fluorescence.
1122	60	**CLAYSTONE:** as above
	40	**SANDSTONE:** as above
1125	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1128	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above, rare to minor pyrite
1131	60	**CLAYSTONE:** as above
	40	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
1134	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1137	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1140	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1143	70	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1146	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1149	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1152	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1155	90	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, rare very fine sand, minor pyritized coal specks, trace to rare mica flakes, trace glauconite
	10	**SANDSTONE:** light grey to light brownish grey grading to white, clear to translucent grains, friable to sub blocky to moderately hard in part, predominantly very fine to medium occasionally coarse to pebble grains, sub angular to sub rounded, moderate sphericity, well sorted quartz, in part up to 30 percent very fine to fine with abundant calcareous cement, minor siliceous cement, trace glauconite, trace to rare nodular pyrite cement, very poor to poor inferred porosity. No fluorescence.
1158	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1161	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1164	90	**CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	10	**SANDSTONE:** as above
1167	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1170	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1173	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
1176	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above, minor to common glauconite
1179	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above, minor glauconite
1182	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1185	90	**CLAYSTONE:** as above
	10	**SANDSTONE:** as above
		Note: minor cavings due to back reaming whilst going from sliding to rotary
1188	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1191	90	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, rare very fine sand, minor pyritized coal specks, trace to rare mica flakes, trace glauconite
	10	**SANDSTONE:** light grey to light brownish grey grading to white, clear to translucent grains, friable to sub blocky to moderately hard in part, predominantly very fine to medium occasionally coarse to pebble grains, sub angular to sub rounded, moderate sphericity, well sorted quartz, in part up to 30 percent very fine to fine with abundant calcareous cement, minor siliceous cement, trace glauconite, trace to rare nodular pyrite cement, very poor to poor inferred porosity. No fluorescence.
1194	100	**CLAYSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	tr	**SANDSTONE:** as above
1197	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1200	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1203	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1206	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1209	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1212	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above
1215	100	**CLAYSTONE:** as above, rare to minor glauconite
	tr	**SANDSTONE:** as above
1218	80	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, rare very fine sand, minor pyritized coal specks, trace to rare mica flakes, rare to minor glauconite
	20	**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, minor to common glauconite grains, rare skeletal fragments, trace foraminifera infilled with glauconite, trace to rare pyrite nodules, good inferred porosity. No shows.
1221	70	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, rare very fine sand, minor pyritized coal specks, trace to rare mica flakes, rare to minor glauconite
	30	**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,

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well:** **Iona - 4** **Permit:** **PPL-2**
		12.25" Hole Section (693 – 1560 mRT)
		occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common white argillaceous matrix, minor to common glauconite grains, rare skeletal fragments, rare to minor calcareous cement in part, trace to rare pyrite nodules, moderate inferred porosity. No shows.
1224	50	**SANDSTONE:** as above, common to abundant glauconite
	50	**CLAYSTONE:** as above
1227	60	**SANDSTONE:** as above
	40	**CLAYSTONE:** as above
1230	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1233	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1236	80	**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 white argillaceous matrix grading to Argillaceous Sandstone, common to abundant disseminated and nodular glauconite, rare to minor calcareous cement, trace to rare pyrite nodules, moderate inferred porosity. No shows.
	20	**CLAYSTONE:** as above
1239	90	**SANDSTONE:** as above
	10	**CLAYSTONE:** as above
1242	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1245	90	**SANDSTONE:** as above, predominantly fine grading to Argillaceous Sandstone
	10	**CLAYSTONE:** as above
1248	90	**SANDSTONE:** as above
	10	**CLAYSTONE:** as above
1251	90	**SANDSTONE:** light brownish grey to dark yellowish green, clear to translucent

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
		grains commonly coated with glauconite, unconsolidated to friable, predominantly very fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant white to yellowish green argillaceous matrix grading to Argillaceous Sandstone in part, common to abundant disseminated and nodular glauconite, rare to minor calcareous cement, trace to rare pyrite nodules, poor to moderate inferred porosity. No shows.
	10	**CLAYSTONE:** medium to light grey to brownish grey, soft to firm, dispersive, minor to common silt, rare very fine sand, minor pyritized coal specks, trace to rare mica flakes, rare to minor glauconite
1254	100	**SANDSTONE:** as above
	tr	**CLAYSTONE:** as above
1257	100	**SANDSTONE:** as above
1260	100	**SANDSTONE:** as above
1263	100	**SANDSTONE:** as above
1266	100	**SANDSTONE:** as above
1269	100	**SANDSTONE:** as above
1272	100	**SANDSTONE:** as above
1275	100	**SANDSTONE:** as above
1278	100	**SANDSTONE:** as above
1281	100	**SANDSTONE:** as above
1284	100	**SANDSTONE:** as above
1287	100	**SANDSTONE:** as above
1290	100	**SANDSTONE:** as above
1293	100	**SANDSTONE:** as above
1296	100	**SANDSTONE:** as above
1299	100	**SANDSTONE:** as above
1302	100	**SANDSTONE:** as above
1305	100	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
1308	100	**SANDSTONE:** as above
1311	100	**SANDSTONE:** light brownish grey to dark yellowish green, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly very fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant white to yellowish green argillaceous matrix grading to Argillaceous Sandstone in part, common to abundant disseminated and nodular glauconite, rare to minor calcareous cement, trace to rare pyrite nodules, poor to moderate inferred porosity. No shows.
1314	100	**SANDSTONE:** as above
1317	100	**SANDSTONE:** as above
1320	100	**SANDSTONE:** as above
1323	100	**SANDSTONE:** as above
1326	100	**SANDSTONE:** as above
1329	100	**SANDSTONE:** as above
1332	100	**SANDSTONE:** as above
1335	100	**SANDSTONE:** as above
1338	100	**SANDSTONE:** as above
1341	100	**SANDSTONE:** as above
1344	100	**SANDSTONE:** as above
1347	100	**SANDSTONE:** as above
1350	100	**SANDSTONE:** as above
1353	80	**SANDSTONE:** as above
	20	**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
1356	80	**SANDSTONE:** as above
	20	**CLAYSTONE:** as above
1359	80	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	20	**CLAYSTONE:** as above
1362	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
1365	50	**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
	50	**SANDSTONE:** light brownish grey to dark yellowish green, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly very fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant white to yellowish green argillaceous matrix grading to Argillaceous Sandstone in part, common to abundant disseminated and nodular glauconite, rare to minor calcareous cement, trace to rare pyrite nodules, poor to moderate inferred porosity. No shows.
1368	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1371	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1374	90	**CLAYSTONE:** as above, abundant glauconite
	10	**SANDSTONE:** as above
1377	90	**CLAYSTONE:** as above, abundant glauconite
	10	**SANDSTONE:** as above
1380	90	**CLAYSTONE:** as above, abundant glauconite
	10	**SANDSTONE:** as above
1381.5	90	**CLAYSTONE:** as above, abundant glauconite
B.U.	10	**SANDSTONE:** as above
1383		Core # 1 cut from 1381 – 1383, recovered 1.5 m
1386	70	**CLAYSTONE:** as above, abundant glauconite
	30	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Cuttings Description Sheet** **Well: Iona - 4 Permit: PPL-2**
		12.25" Hole Section (693 – 1560 mRT)
1389	70	**CLAYSTONE:** as above
	30	**SANDSTONE:** as above
1392	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1395	80	**CLAYSTONE:** as above
	20	**SANDSTONE:** as above
1398	70	**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
	30	**SANDSTONE:** light brownish grey to dark yellowish green, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly very fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant white to yellowish green argillaceous matrix grading to Argillaceous Sandstone in part, common to abundant disseminated and nodular glauconite, rare to minor calcareous cement, trace to rare pyrite nodules, poor to moderate inferred porosity. No shows.
1401	75	**CLAYSTONE:** as above
	25	**SANDSTONE:** as above
1404	85	**CLAYSTONE:** as above
	15	**SANDSTONE:** as above
1407	85	**CLAYSTONE:** as above
	15	**SANDSTONE:** as above
1410	95	**CLAYSTONE:** as above
	5	**SANDSTONE:** as above
1413	95	**CLAYSTONE:** as above
	5	**SANDSTONE:** as above
1416	100	**CLAYSTONE:** as above
	tr	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
1419	100	<u>**CLAYSTONE:**</u> as above
	tr	<u>**SANDSTONE:**</u> as above
1422	90	<u>**CLAYSTONE:**</u> as above
	10	<u>**SANDSTONE:**</u> as above
1425	95	<u>**CLAYSTONE:**</u> as above
	5	<u>**SANDSTONE:**</u> as above
1428	80	<u>**CLAYSTONE:**</u> as above
	20	<u>**SANDSTONE:**</u> as above
1431	80	<u>**CLAYSTONE:**</u> 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
	20	<u>**SANDSTONE:**</u> light brownish grey to dark yellowish green, clear to translucent grains commonly coated with glauconite, unconsolidated to friable, predominantly very fine to medium occasionally coarse, predominantly angular to sub rounded, occasionally rounded and polished grains, poor to moderate sphericity, moderately sorted, common to abundant white to yellowish green argillaceous matrix grading to <u>Argillaceous Sandstone</u> in part, common to abundant disseminated and nodular glauconite, rare to minor calcareous cement, trace to rare pyrite nodules, poor to moderate inferred porosity. No shows.
1434	90	<u>**CLAYSTONE:**</u> as above
	10	<u>**SANDSTONE:**</u> as above
1437	80	<u>**CLAYSTONE:**</u> as above
	20	<u>**SANDSTONE:**</u> as above
1440	80	<u>**CLAYSTONE:**</u> as above
	20	<u>**SANDSTONE:**</u> as above
1443	80	<u>**CLAYSTONE:**</u> as above
	20	<u>**SANDSTONE:**</u> as above
1446	50	<u>**SANDSTONE:**</u> light brownish grey to very light grey, fine to coarse, dominantly medium clear quartz, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, excellent porosity, No shows.

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	50	**CLAYSTONE:** as above
1448.5 B.U.	90 10	**SANDSTONE:** as above **CLAYSTONE:** as above
		Core # 2 cut from 1448.5 to 1454,56, recovered 6.06 m – 93.23 percent
		Core # 3 cut from 1455.0 to 1462.39, recovered 7.39 m – 89.04 percent
		Core # 4 cut from 1463.3 to 1469.67, recovered 6.37 m – 87.26 percent
		Core # 5 cut from 1470.6 to 1478.3, recovered 7.7 m – 100.00 percent
		From 1448.5 to 1478.3 m for lithology descriptions see core chip descriptions.
1479	100	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium clear quartz, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, excellent porosity, No shows. Note: Five to ten percent glauconitic claystone cavings
1482	100	**SANDSTONE:** as above
1485	100	**SANDSTONE:** as above
1488	100	**SANDSTONE:** as above
1491	100	**SANDSTONE:** as above
1494	100	**SANDSTONE:** as above
1497	100	**SANDSTONE:** as above
1500	100	**SANDSTONE:** as above
1503	100	**SANDSTONE:** as above
1506	100	**SANDSTONE:** as above
1509	90	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	10	**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. Up to10 to 20 percent dull yellow mineral fluorescence
1512	90	**SANDSTONE:** as above
	10	**CALCAREOUS SANDSTONE:** as above
1515	90	**SANDSTONE:** as above
	10	**CALCAREOUS SANDSTONE:** as above
1518	80	**SANDSTONE:** as above
	20	**CALCAREOUS SANDSTONE:** as above
1521	80	**SANDSTONE:** as above
	20	**CALCAREOUS SANDSTONE:** as above
1524	70	**SANDSTONE:** as above
	30	**CALCAREOUS SANDSTONE:** as above
1527	70	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium clear quartz, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, excellent porosity, No shows.
	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, 15 to 25 percent calcareous matrix, rare to minor glauconite nodules, trace pyrite, common white to very light grey argillaceous matrix, trace carbonaceous fragments.
	10	**COAL:** black, moderately hard to hard, conchoidal fracture, vitreous lustre, rare to minor resin
1530	80	**SANDSTONE:** as above
	20	**CALCAREOUS SANDSTONE:** as above
1533	70	**SANDSTONE:** as above
	30	**CALCAREOUS SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	tr	**COAL:** as above
1536	75	**SANDSTONE:** as above
	20	**CALCAREOUS SANDSTONE:** as above
	5	**COAL:** as above
1539	55	**SANDSTONE:** as above
	40	**CALCAREOUS SANDSTONE:** as above
	5	**COAL:** as above
1542	60	**SANDSTONE:** as above
	20	**CALCAREOUS SANDSTONE:** as above
	5	**COAL:** as above
	15	**CLAYSTONE:** dark grey to greyish black, firm, blocky, trace mica, rare to minor carbonaceous specks
1545	60	**SANDSTONE:** as above
	20	**CALCAREOUS SANDSTONE:** as above
	5	**COAL:** as above
	15	**CLAYSTONE:** as above
1548	70	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium clear quartz, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, excellent porosity, No shows.
	10	**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, 15 to 25 percent calcareous matrix, rare to minor glauconite nodules, trace pyrite, common white to very light grey argillaceous matrix, trace carbonaceous fragments.
	Tr	**COAL:** black, moderately hard to hard, conchoidal fracture, vitreous lustre, rare to minor resin
	20	**CLAYSTONE:** dark grey to greyish black, firm, blocky, trace mica, rare to minor carbonaceous specks
1551	80	**SANDSTONE:** as above

Depth (mRT)	Lithol. (%)	Western Underground Gas Storage Pty Ltd Cuttings Description Sheet Well: Iona - 4 Permit: PPL-2
		12.25" Hole Section (693 – 1560 mRT)
	Tr	**CALCAREOUS SANDSTONE:** as above
	Tr	**COAL:** as above
	20	**CLAYSTONE:** as above
1554	70	**SANDSTONE:** as above
	30	**CLAYSTONE:** as above
	Tr	**COAL:** as above
1557	80	**SANDSTONE:** as above
	20	**CLAYSTONE:** as above
	Tr	**COAL:** as above
1560	90	**SANDSTONE:** as above
	10	**CLAYSTONE:** as above, grading to light grey

TD 1560 mRT reached at 22:45 hrs 22 March 1999

APPENDIX 4

Core Descriptions and Core Analysis by ACS Laboratories Pty Ltd

908903 154

ACS
LABORATORIES
PTY. LTD.

DETAILED CORE DESCRIPTION AND SEDIMENTOLOGICAL INTERPRETATION

of

IONA-4

for

WESTERN UNDERGROUND GAS STORAGE PTY LIMITED

by

ACS LABORATORIES PTY LTD

ACS
LABORATORIES
PTY. LTD.

8 July, 1999

Western Underground Gas Storage Pty Limited
Level 49, Rialto South Tower
525 Collins Street
MELBOURNE VIC 3000

Attention: Andy Whittle

FINAL REPORT: 0417-01

CLIENT REFERENCE: Purchase Order No. UGS.0000476

MATERIAL: Conventional Core

LOCALITY: Iona-4

WORK REQUIRED: Detailed Core Description and Sedimentological Interpretation

Please direct technical enquiries regarding this work to the signatory below under whose supervision the work was carried out.

for

GHAZI KRAISHAN
Sedimentologist and Petrologist

ACS Laboratories Pty Ltd shall not be liable or responsible for any loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from any information or interpretation given in this report. In no case shall ACS Laboratories Pty Ltd be responsible for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report.

Brisbane Laboratory: P.O. Box 396, Chermside South Qld 4032, Australia
☎: 61 7 3350 1222 Facsimile: 3359 0666
E-mail: acs.bris@acslabs.com.au
ACS Laboratories Pty Ltd
ACN: 008 273 005

908903 156

DETAILED CORE DESCRIPTION
AND
SEDIMENTOLOGICAL INTERPRETATION

of

IONA-4

A final report prepared

for

WESTERN UNDERGROUND GAS STORAGE PTY LIMITED

by

Dr. GHAZI KRAISHAN

July 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 Limited requested a sedimentological core study of Iona-4. This was undertaken using a detailed log description and sedimentological interpretation.

Iona-4 core spans an interval between 1509.34 m to 1534.30 m. This interval comprises a succession of interbedded sandstone, siltstone and mudstone. The sandstones of Iona-4 are fine- to very coarse (sometimes pebbly) and poorly to well sorted. The silty mudstone is black, thinly laminated, slightly bioturbated and interbedded with thin sand laminae and lenses.

Detailed core description revealed that Iona-4 Waarre Formation sandstones contain numerous facies and include small 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 lensor sandstones. The studied section is believed to be deposited in a distal braided fluvial setting.

The core interval was a product of bed-load dominated sandstone with minor mixed-load and suspended-load river systems. Three lithofacies or lithofacies associations have been identified in the studied core interval of Iona-4. These sandstone facies are believed to be deposited in environments ranging from distal braided fluvial channel to meandering floodplain. The lower part of the core interval represents fine-grained, thinly laminated sandstone with thin coal and shale laminae that could be deposited in the upper flow regime or sheet flood deposits. This is overlain by thin to thick stacked, fining upward very coarse-grained to pebbly sandstone. The upper part of this facies comprises mudstone interbedded with thin starved, rippled sand lenses. This lithofacies was probably deposited as distal or transition between braided to low sinuosity fluvial channel deposits. The mudstone could be explained by the vertical accretion of the channel deposits in the distal part of the braided river system. The uppermost part of the core interval comprises a massive to thinly laminated, slightly bioturbated mudstone. This facies is believed to have been deposited in a changing depositional environment of meandering floodplain.

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. They reflect reducing to anoxic conditions which might have developed in a restricting setting of meandering fluvial floodplain deposits.

Reservoir potential of Iona-4 Waarre Formation ranges from poor to excellent. Reservoir quality is excellent in the fine to very coarse-grained, clean horizontal to small scale cross laminated sands of the braided channel and poor in the upper mudstone overbank (floodplain) facies which could represent a good local blanket (seal) for these lithofacies above.

2. INTRODUCTION

Western Underground Gas Storage Pty Limited requested a sedimentological core study of Iona-4. Five cores (almost 29 meters 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-4 well. The colour, texture, bedding thickness, 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-4. 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-4 core interval are presented in Appendices I and II and Plates 1 - 6.

TABLE 1. Lithofacies scheme and depositional facies used for the core description of the Waarre Formation from Iona-4. 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
Sx	Small scale cross stratification

F **Mudstone:**

Fb	Bioturbated
Fl	Laminated
Fm	Massive

C **Coal:**

Depositional Facies

BF or UFR	Barforms or Upper Flow Regime
FB	Floodplain
MCB	Mid-Channel Bar

4. RESULTS

This section summarises the results of the sedimentary study. The Waarre Formation from Iona-4 has been subdivided into four lithostratigraphic facies deposited probably in four depositional environments (Table 1). The Iona-4 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-4 are dominated by relatively clean, fine to very coarse-grained to pebbly sandstone interbedded with mudstone. A number of lithofacies were recognised in the studied core interval including: sandstone, interbedded sandstone and shale, and coal. Table 2 summarises these lithofacies and their characteristics, thickness and possible depositional environments. Bedding laminations are marked by subtle changes in grain size and/or colour. Sedimentological studies revealed that the cored interval of the Waarre Formation was deposited in braided fluvial river systems. Although the core interval has few thin coal beds, thin shale laminae and interbedded mudstone and sandstone, the depositional environment is still within the braided river system and could be part of the distal braided fluvial system with possible sinuosity. The upper part of the cored interval (Core #1) comprises massive to thinly laminated mudstone (shale) and reflects changes in depositional environment from braided to meandering river system.

The following section is a detailed description of the three lithofacies recognised during the core logging.

4.1.1 Fine-grained horizontally 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). 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 small cross laminations 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 or in the upper flow regime or sheet flood deposits.

4.1.2 Stacked fining upward sandstone

This facies consists mainly of creamy, sandstones and pebbly sandstones (Plate 2). 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 small scale 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 (Plate 3). The cross stratification grades up to thin bedded, ripple and small scale cross lamination (Plate 4). 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 5).

The upper part of this facies is characterised by interbedded very fine-grained lenticular laminated to wavy rippled sandstone with thinly laminated mudstone (Plate 4). 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 (Plates 3 and 4), 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) part commonly consists of black, thin bedded ranging in size between 10 cm to 20 cm with variable fissility. Sedimentary structures within the mudstone are dominated by wavy to horizontal lamination (Plates 3 and 4). The thickness of individual mudstone layers ranges from less than 5 cm to 20 cm. The facies contains numerous pyrite nodules. This facies contains abundant plant debris and plant fossils. The lower part of this facies contains thin coal beds ranging in thickness from a few millimetres up to 20 cm.

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 3 and 4).

The overall setting of this facies is interpreted as having been produced by low sinuosity braided fluvial river system with coarse-grained bedload, channelised uni-directional flow. This is indicated by the combination of sedimentary structures, the low diversity of trace fossils and the associated facies. Small scale 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. Mudstone at the top was deposited as a result of vertical accretion of the braided fluvial channel.

4.1.3 Thinly laminated, black, slightly bioturbated mudstone

This facies consists of black, massive to thinly laminated mudstone with variable fissility. Sedimentary structures within the mudstone are dominated by wavy to horizontal lamination (Plate 6). The thickness of this facies is 1.5 meters.

The relative degree of bioturbation is characteristically extremely low and represented by low density assemblages. The rare to trace fossils are dominated by small scale, horizontal *Planolites* (Plate 6). Depositional environment could be meandering floodplain.

4.2 Interpretation and Vertical Facies Succession

The sediments of the Waarre Formation of Iona-4 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 dominant facies is the mid-channel bar, with a total thickness of around 24 meters. The sand bodies range in thickness from 1 to 3 meters. Sands are stacked in thin fining upward cycles ranging in thickness from a few centimeters up to several 10's of centimeters. Thin mudstone and coal laminae are present in the top of some cycles (Plates 1, 3, 4 and 5). The lateral migration of channels is probably accompanied by fining upward successions. The facies contains thin coal laminae and thin coalified wood materials, criteria that indicate a local reducing environment which is not expected in a braided fluvial river system. High energy water is commonly oxidizing with traces to negligible vegetation. The presence of these coal laminae and coal beds may indicate a little to moderate water movement during flood stages where spare to moderate vegetation covers the active channels. The presence of mudstone at the top of this facies could be explained by vertical accretion of the braided fluvial channels where active channels shift on top of abandoned channel deposits.

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 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 lower part of the mudstone facies is dominated by mudstone 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.

TABLE 2. Detailed description of the Waarre Formation lithofacies from Iona-4, with thicknesses, probable depositional environments and reservoir potential.

Facies	Description	Thickness (m)	Depositional Environments	Reservoir Potential
S (Sandstone) 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
Sg Normal grading	Medium to very coarse-grained, massive. No clear evidence of bioturbation. The lower contact is sharp with local evidence of scouring. The upper contact is gradational. Associated with Sp and Sc.	0.10 to 1.5	High energy mid-channel bar	Excellent
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 0.60	High energy mid-channel bar Moderate to high energy barforms	Good
Sp Pebbly sandstone	Medium to very coarse-grained, massive. No clear evidence of bioturbation. The lower and upper contacts are sharp with local evidence of scouring. Associated with Sg and Sc.	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	High energy 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 barforms	Good
F (Mudstone) Fb Bioturbated	Minor bioturbated silt to mudstone.	10s cms	Low energy floodplain	Very poor
Fl Laminated	Thinly laminated silt to mudstone. Trace bioturbation. Associated with Fb and Fm.	10s cms	Low energy floodplain	Very poor
Fm Massive	Massive silt to mudstone. Trace bioturbation. Associated with Fl and Fb.	10s cms	Low energy floodplain	Very poor
C (Coal) C Coal	Black thin bedded, laminated.	Few cms	High energy mid-channel bar Low energy within the floodplain	Very poor Very poor

This is Page Number **908903_167X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued fold-out with page number:

908903_167Y

and is enclosed within the document PE908903 at this page.

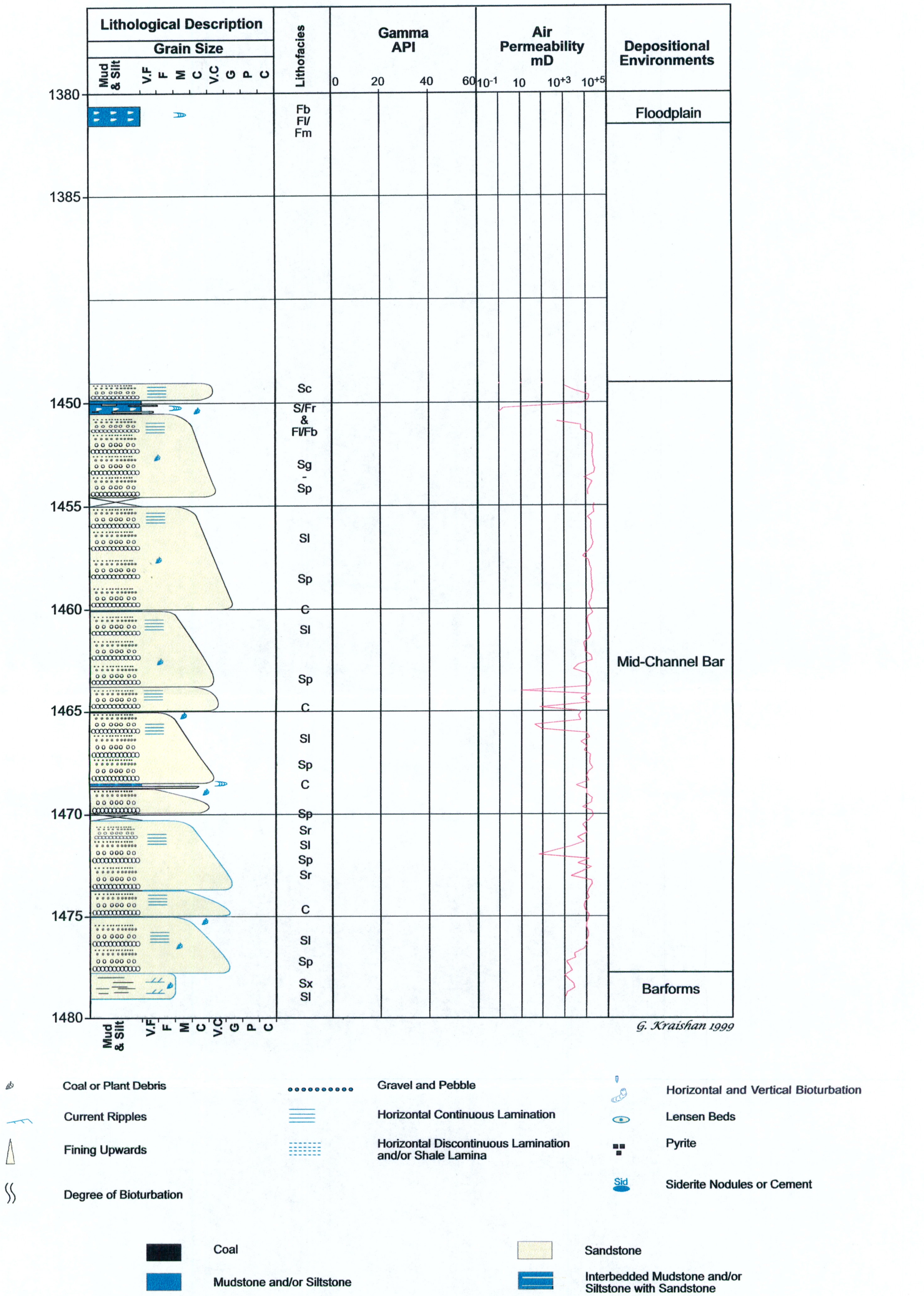


Figure 1: A generalised core description of Waarre Formation of Iona-4 showing main lithofacies and probable depositional environments.

908903 167Y

5. SUMMARY AND CONCLUSIONS

The sandstones of the Waarre Formation of Iona-4 are fine- to very coarse (sometimes pebbly) and poorly to moderately well sorted. Detailed core description revealed that the sandstones are deposited within braided fluvial settings. The core interval was a product of bedload dominated sandstone with minor mixed-load and suspended-load river systems. Three lithofacies or lithofacies associations have been identified in the studied core interval of Iona-4. 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-4 sandstones ranges from poor to excellent. Reservoir quality is excellent in the medium to very coarse-grained, clean small scale trough cross stratification sands of the mid-channel bar. Reservoir quality is good in the very fine to medium-grained, small scale cross laminated sands of the barforms, and poor in the upper part of the mid-channel bar and the floodplain deposits.

6. REFERENCES

Frey, R.W. and Pemberton, S.G., 1984—Trace fossils facies models. In: Walker, R.G. (ed.), *Facies Models* (2nd ed.). Geoscience Canada Reprint Series. 1: 189-207.

Galloway, W.E. and Hobday, D.K., 1983—*Terrigenous clastic depositional systems: application to petroleum, coal, and uranium exploration.* New York, Springer-Verlag, 423 p.

Miall, A.D.,1978—Lithofacies types and vertical profile in braided river deposits: a summary. In Miall, A.D., (ed.), *Fluvial Sedimentology. Can. Soc. Geol. Mem.,* 5 507-604.

Pemberton, S.G., (ed.) 1992—*Applications of ichnology to petroleum exploration: a core workshop.* Soc. Econ. Palaeontologists and Mineralogists, Core Workshop 17, Calgary Alberta, 429 p.

Reading, H.G., (ed.) 1996—*Sedimentary environments and facies.* 3rd ed. Blackwell Sci. Publ. Oxford, United Kingdom. 688 p.

PLATES

CORE PHOTOGRAPHS

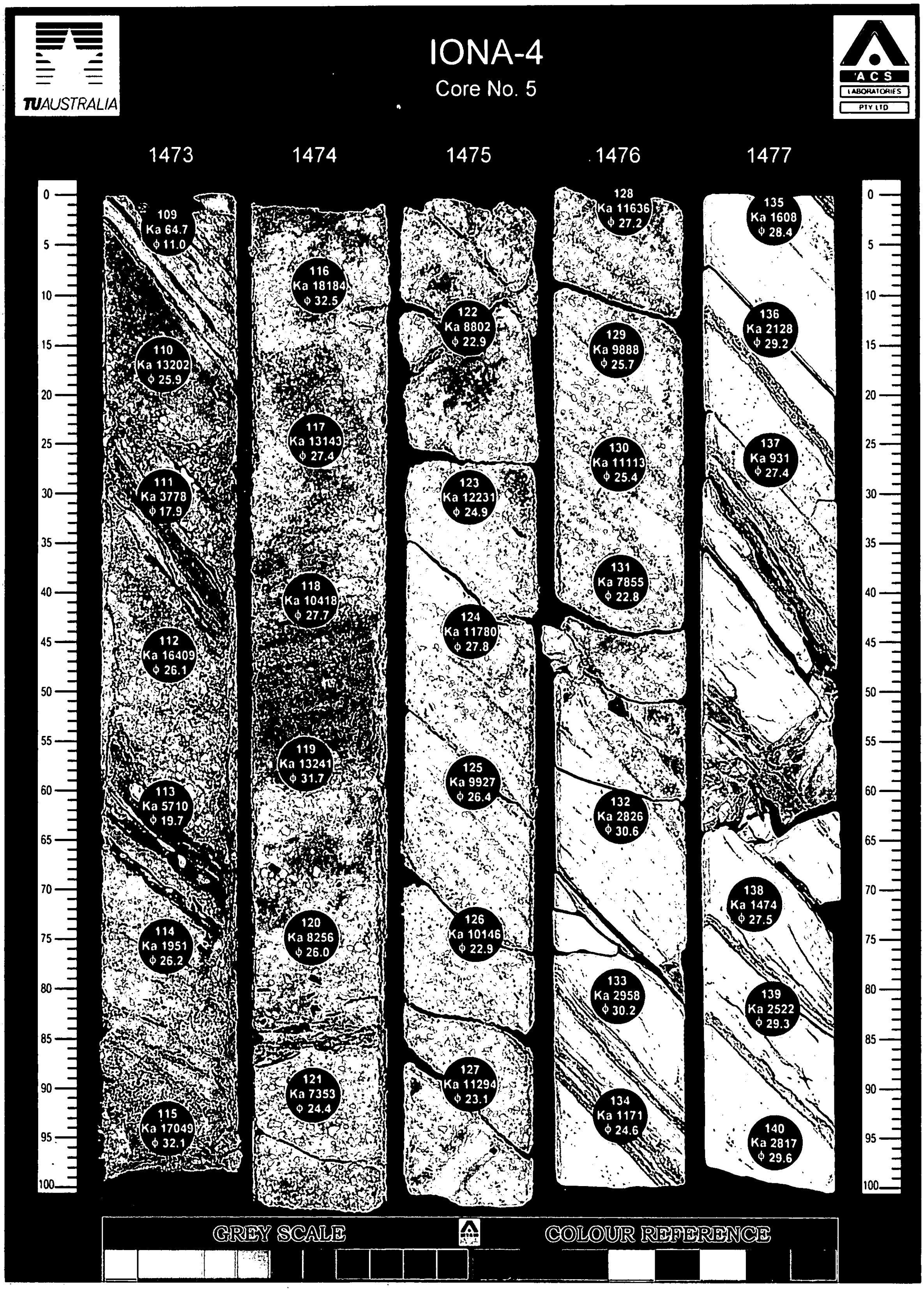


Plate 1: Core # 1 (1473.00 - 1478.00 m): Core photograph of thinly laminated to small cross to wavy laminated fine to medium-grained sandstone (Sl). Note that there is no bioturbation. The possible depositional environment of this interval is braided fluvial barforms.

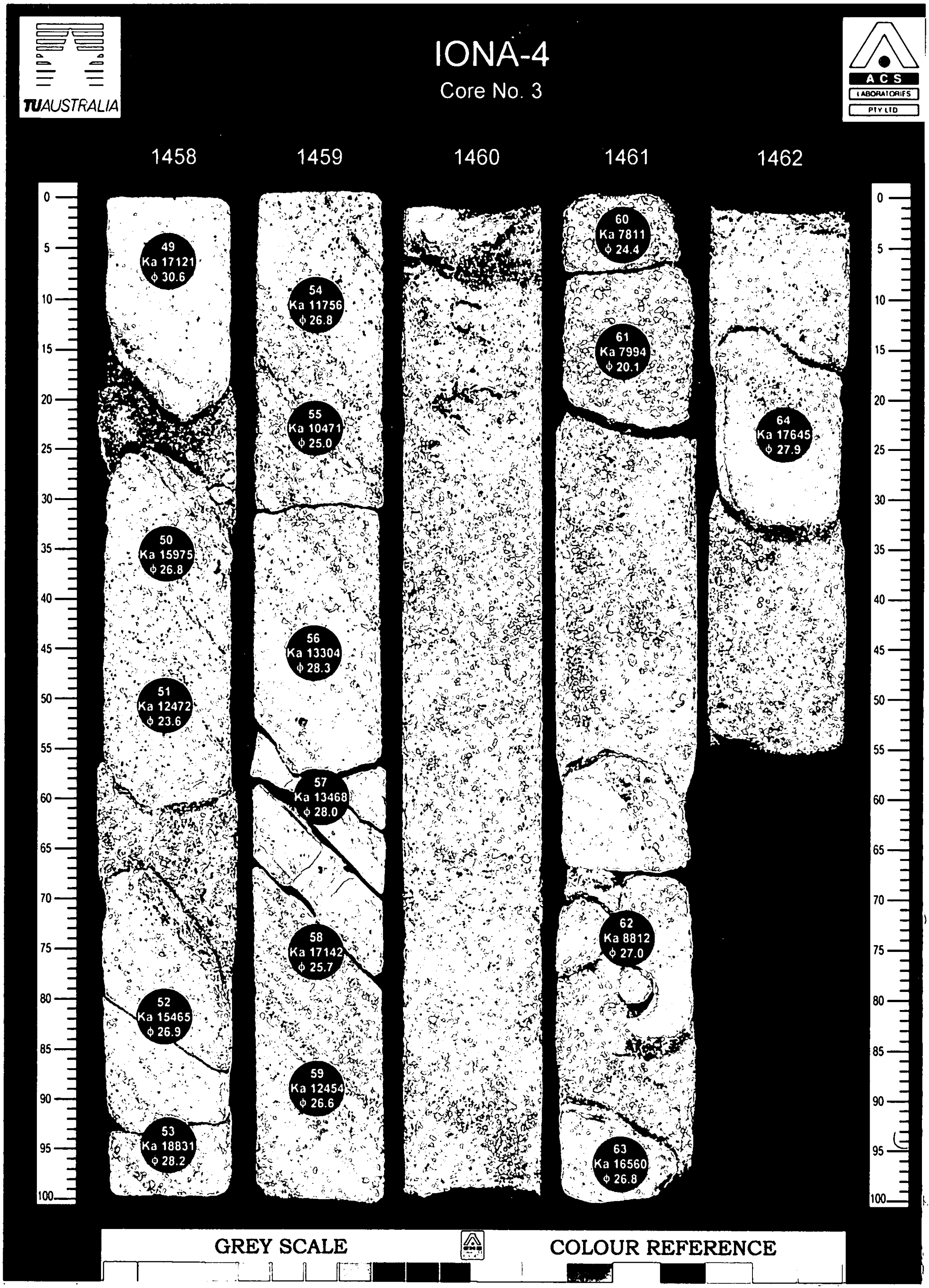


Plate 2: Core # 3 (1458.00 – 1462.55 m): Core photograph of thick stacked sets of creamy sandstones and pebbly sandstones. The sandstones are typically medium to very-coarse grained, becoming finer upwards. The basal parts of contacts are sharp and irregular, commonly exhibiting evidence of scour.

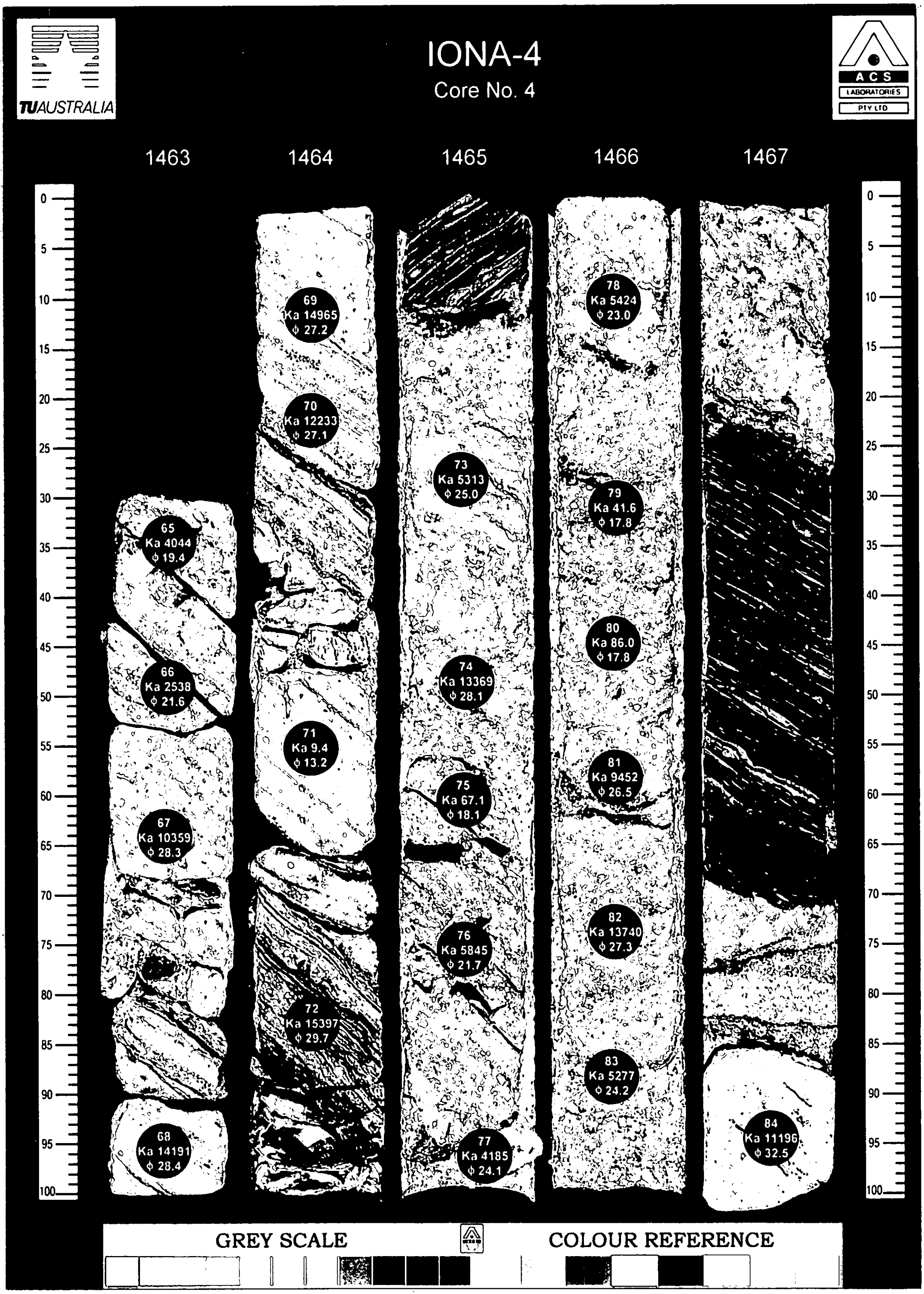


Plate 3: Core # 4 (1463.30 – 1468.00 m): Core photograph of pebbly sandstone (Sp) facies followed by small scale cross stratified to rippled sandstone (St and Sr) with numerous thin coal laminae and plant debris. Note the scoured or erosional base pebble sandstone. Note also the presence of mudstone on top of the channel deposit.

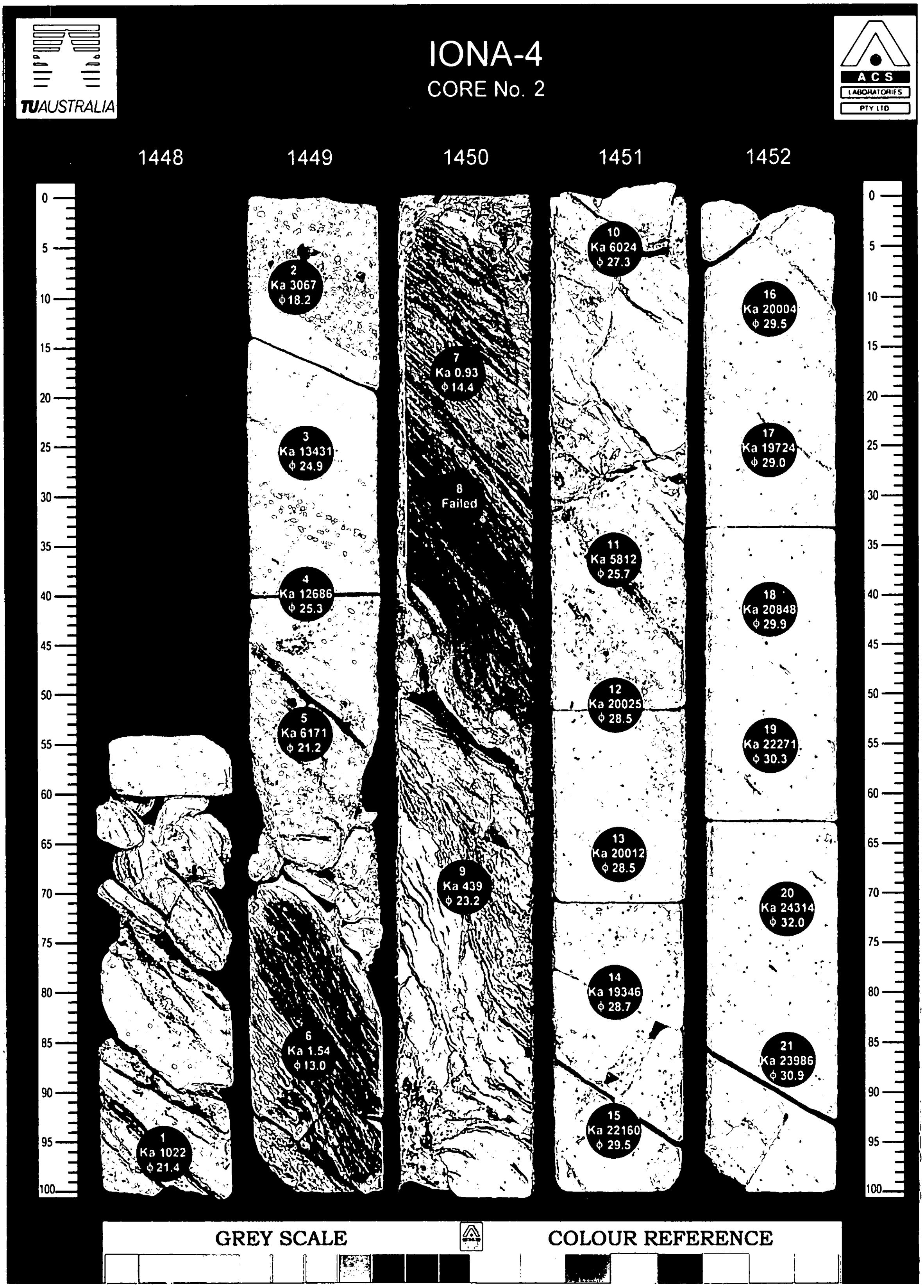


Plate 4: Core # 2 (1448.55 – 1453.00 m): Core photograph of interbedded thinly laminated mudstone (Fl) and very coarse small scale cross laminated to rippled sandstone facies (Sl to Sr). The trace fossil assemblages within the mudstone interval are dominated by *Planolites*.

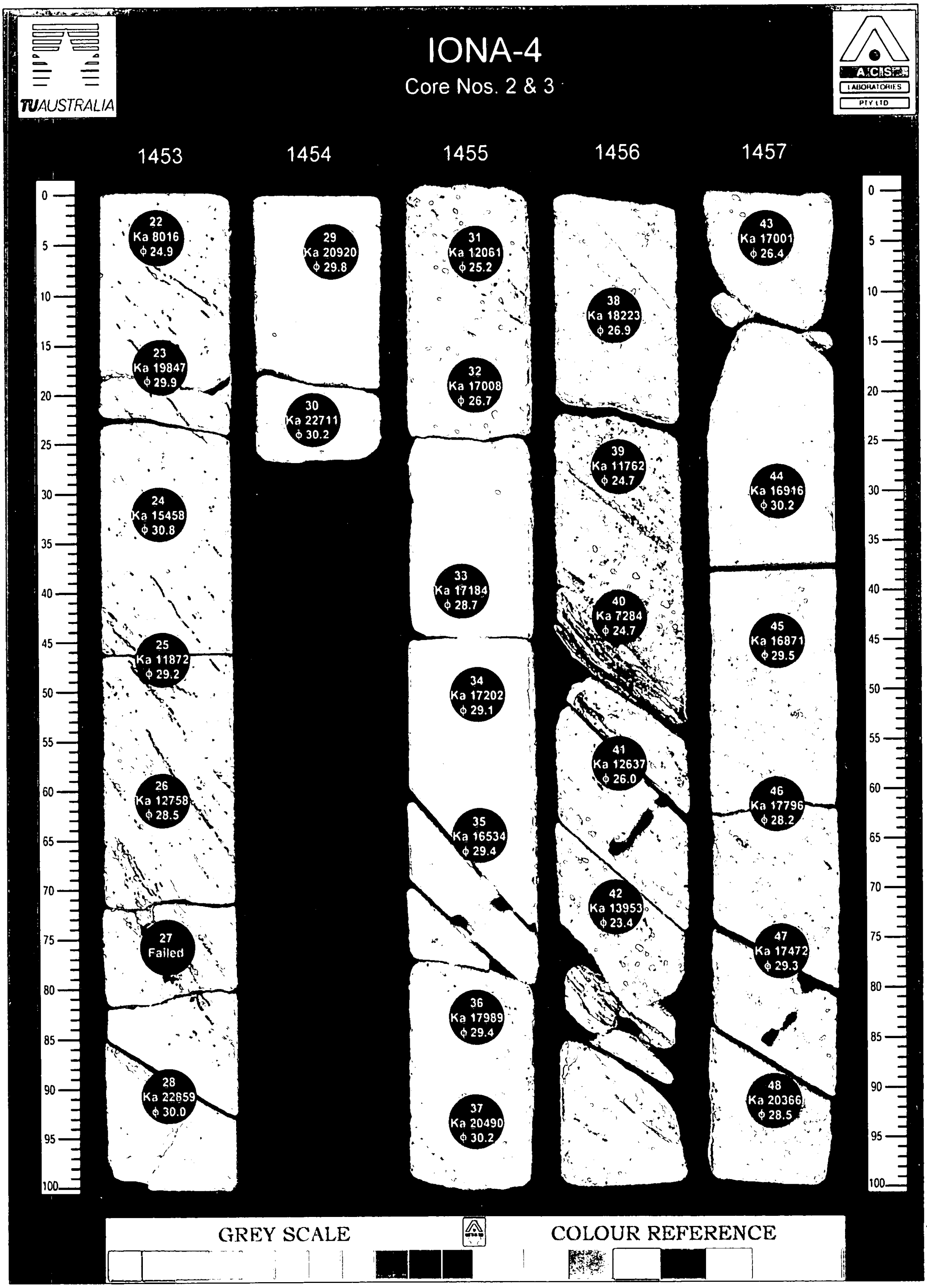


Plate 5: Cores # 2 and 3 (1453.00 – 1458.00 m): Core photograph of cross stratification grades up to thin bedded, ripple and small scale cross laminated sandstone which contains rip-up clasts and pebble imbrications. Note that the facies is dominated by physical sedimentary structures and is devoid of trace fossils with plant debris or coalified wood or plant materials present throughout this facies.

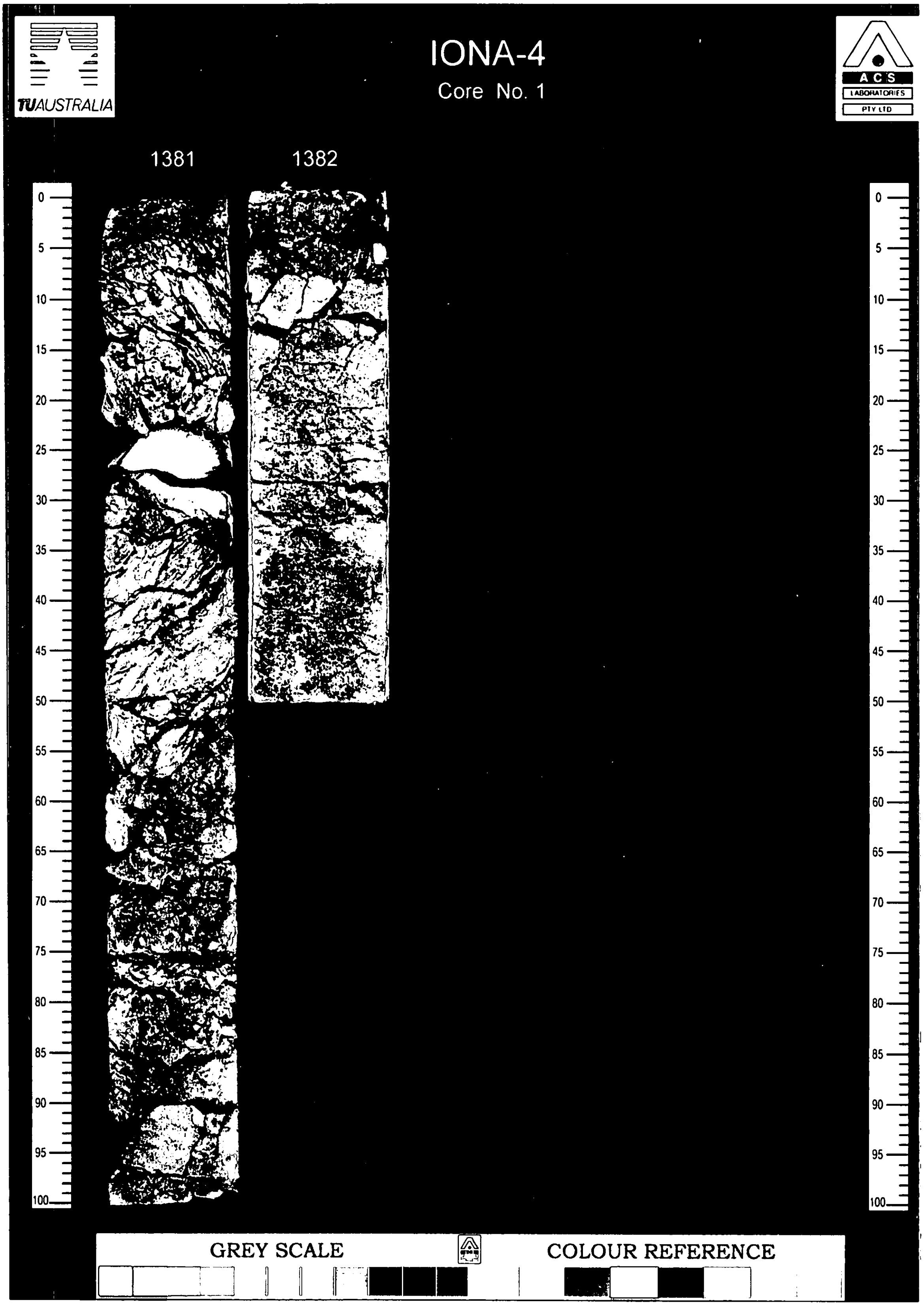


Plate 6: Core # 1 (1381.00 – 1382.50 m): Core photograph of the upper part of the cored interval. This part comprises massive to thinly laminated mudstone with rare to trace horizontal bioturbation. The possible depositional environment of this interval is meandering floodplain.

?

APPENDIX I

SYMBOL INDEX

APPENDIX I
SYMBOL INDEX

Current Ripples

Small scale Cross Stratification

Fining Upwards

Coal or Plant Debris

Gravel and Pebble

Sand Lenses

Horizontal Continuous Lamination

Horizontal Bioturbation

Horizontal Discontinuous Lamination and/or Shale Lamina

Pyrite

BIOTURBATION DEGREE

Trace

Common

Minor

Abundant

LITHOLOGY

Coal

Sandstone

Mudstone and/or Siltstone

Interbedded Mudstone and/or Siltstone with Sandstone

CONTACTS

Sharp

Scoured

Gradational

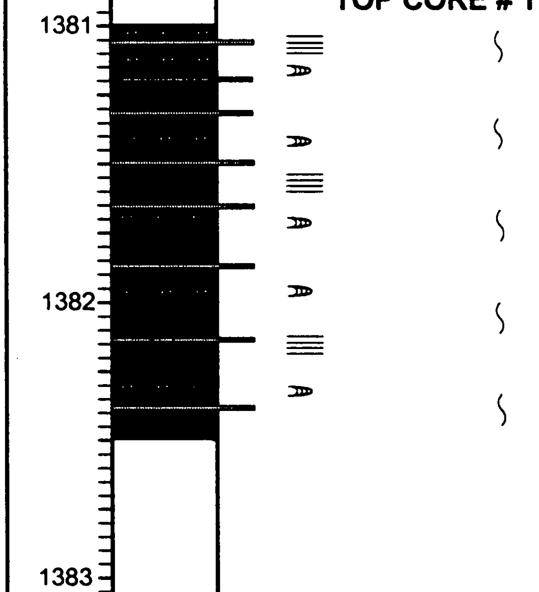
Uncertain

APPENDIX II

LITHOSTRATIGRAPHIC LOGS

Depth Metre	LITHOLOGICAL DESCRIPTION – Grain Size: Mud & Silt; Sand (VF, F, M, C, VC); G, P, C, B	Samples	Lithofacies	Contacts and Depositional Interpretation	Well : Iona-4	Page 1 of 7
					Waarre Formation	1381 - 1383
					Comments	

TOP CORE # 1



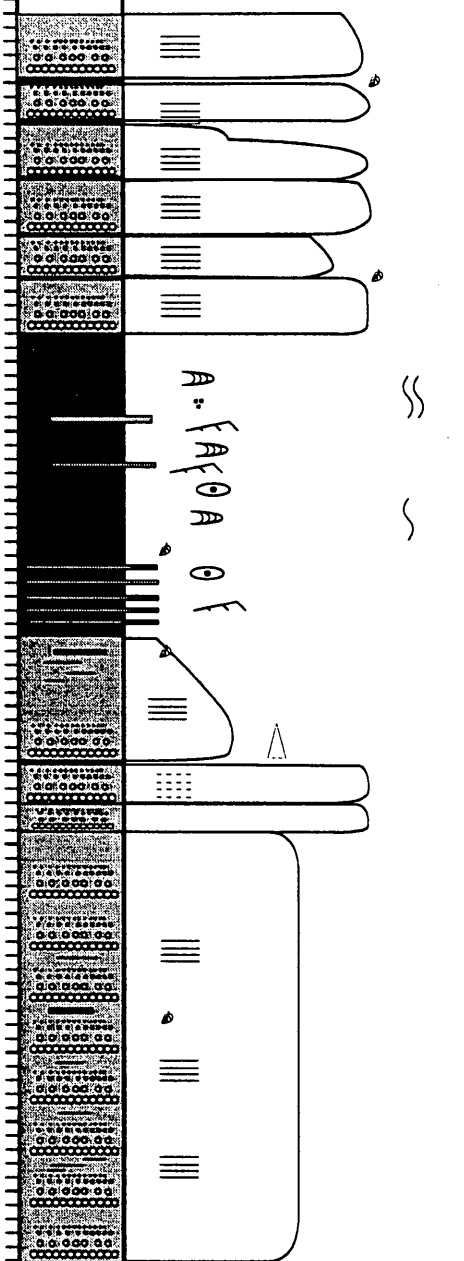
1381 - 1382.50
Mudstone (Shale)

Black, massive to thinly laminated, slightly bioturbated mudstone. Poor reservoir quality, good as a seal .

Depth Metre	LITHOLOGICAL DESCRIPTION — Grain Size: Mud & Silt; Sand (VF, F, M, C, VC); G, P, C, B	Samples	Lithofacies	Contacts and Depositional Interpretation	Well : Iona-4	Page 2 of 7
					Waarre Formation	1448 -1453
					Comments	

1448

TOP CORE # 2



1449

1450

1451

1452

1453

Samples: * * * * *

Lithofacies: Sp, C, Sl, Sp, C, Sc, Fb/Sl, Sr, Fb/Sl, C, Fl/Sl, Sp, Sl, Sp, Sl, Sp

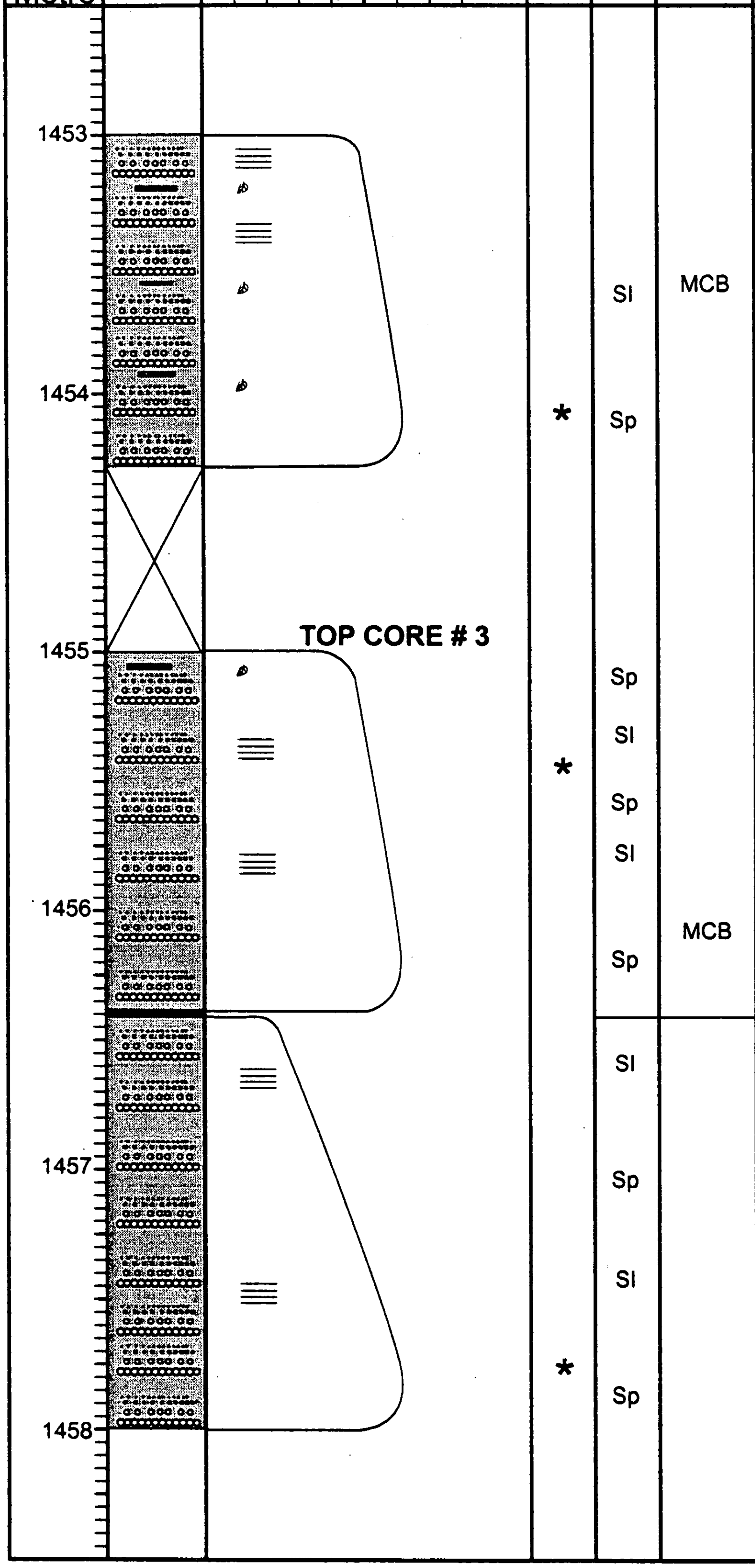
Contacts and Depositional Interpretation: MCB, MCB

1448.50 - 1453.00
Sandstone interbedded with thin mudstone (Shale) laminae

Sandstone: Creamy, coarse to pebble-grained, thinly laminated sandstone. Main sedimentary structures are thin continuous laminated to thin laminated occasionally wavy. Numerous mud drapes are present in some sandstone sets. Small scale cross laminations are present at the top. The interval contains few thin mud laminae with thin coal and coalified wood materials in centimetres scale. The sands are present in 10 to 150 cm fining upward sets. Each set comprises a pebble sandstone at the bottom and grades up to medium-grained sandstone. Some of the sandstone set has a scoured and irregular base, suggesting reworking and/or erosional surface.

Mudstone: Black, thinly laminated, slightly bioturbated. Bioturbation is mainly horizontal (*Planolites*). The mudstone contains thin lenses of very fine to fine-grained sandstone. It contains coalified wood materials and thin coal laminae.

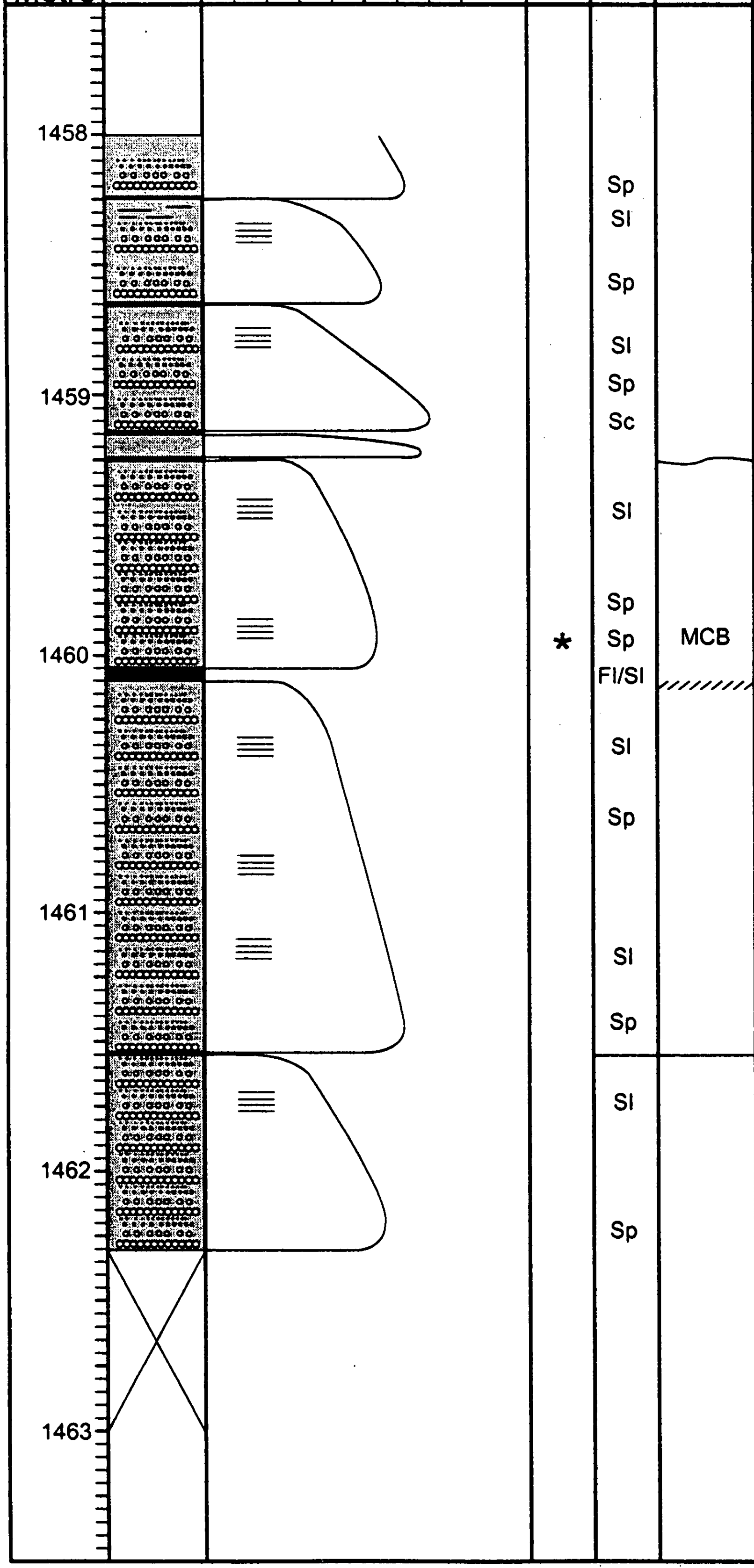
Depth Metre	LITHOLOGICAL DESCRIPTION — Grain Size: Mud & Silt; Sand VF F M C VC; G P C B	Samples	Lithofacies	Contacts and Depositional Interpretation	Well : Iona-4	Page 3 of 7
					Waarre Formation	1453 - 1458
					Comments	



1453.00 - 1458.00
Sandstone

Creamy, coarse to pebble-grained, thinly laminated sandstone. Main sedimentary structures are thin continuous laminated to thin laminated occasionally wavy. Small scale cross laminations are present at the top. The interval contains few thin mud laminae and coalified materials. Some sandstone sets contain shale parting in a centimetres scale. The sands are present in 10 to 150 cm fining upward sets. Each set comprises a pebble sandstone at the bottom and grades up to medium-grained sandstone. Some of the sandstone set has a scoured and irregular base, suggesting reworking and/or erosional surface.

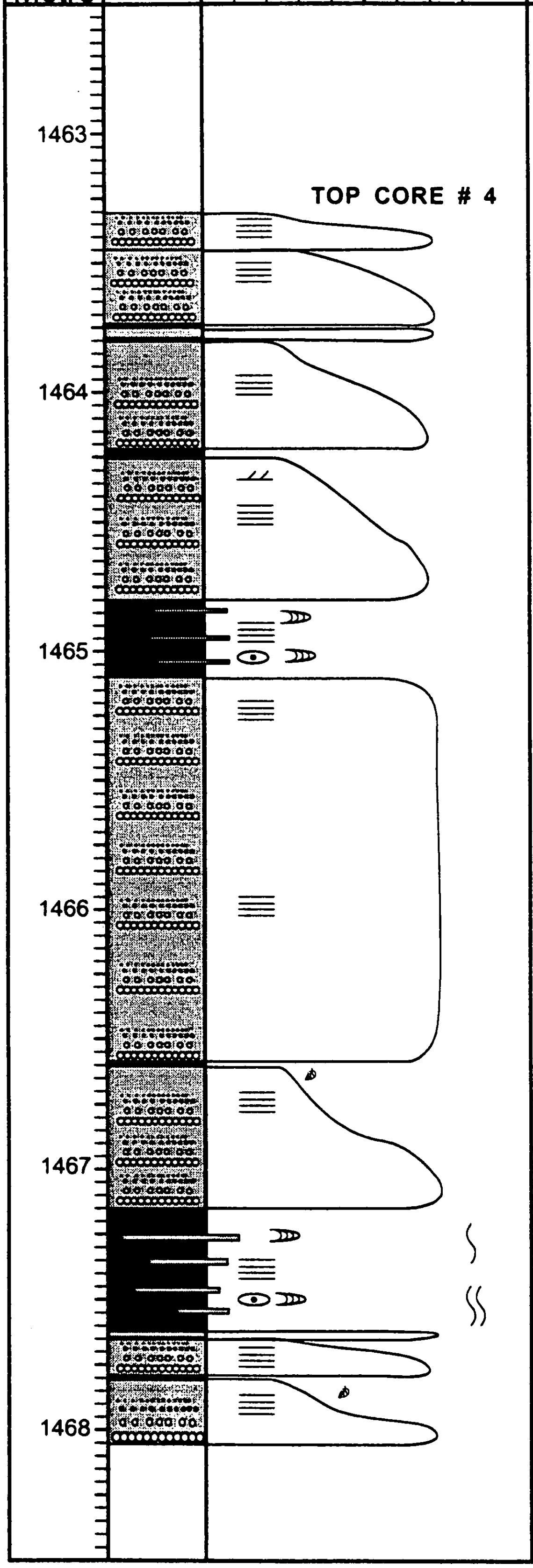
Depth Metre	LITHOLOGICAL DESCRIPTION Grain Size: Mud & Silt; Sand VF F M C VC; G P C B	Samples	Lithofacies	Contacts and Depositional Interpretation	Well : Iona-4	Page 4 of 7
					Waarre Formation	1458 - 1463
					Comments	



1458.30 - 1462.30
Sandstone

Creamy, coarse to pebble-grained, thinly laminated sandstone. Main sedimentary structures are thin continuous laminated to thin laminated occasionally wavy. Small scale cross laminations are present at the top. The interval contains few thin mud laminae. Some sandstone sets contain shale parting in a centimetres scale. The sands are present in 10 to 150 cm fining upward sets. Each set comprises a pebble sandstone at the bottom and grades up to medium-grained sandstone. Some of the sandstone set has a scoured and irregular base, suggesting reworking and/or erosional surface.

Depth Metre	LITHOLOGICAL DESCRIPTION: Grain Size — Mud & Silt; Sand: VF, F, M, C, VC; G, P, C, B	Samples	Lithofacies	Contacts and Depositional Interpretation	Well : Iona-4	Page 5 of 7
					Waarre Formation	1463 - 1468
					Comments	



Samples: *

Lithofacies: Sp, Sl, Sp, Sl, Sp, Sl, Sp, Sc, Fl/Sl, Sl, Sp, C, Sl, Sp, Sc, Fl/Sl, C, Sl, Sp

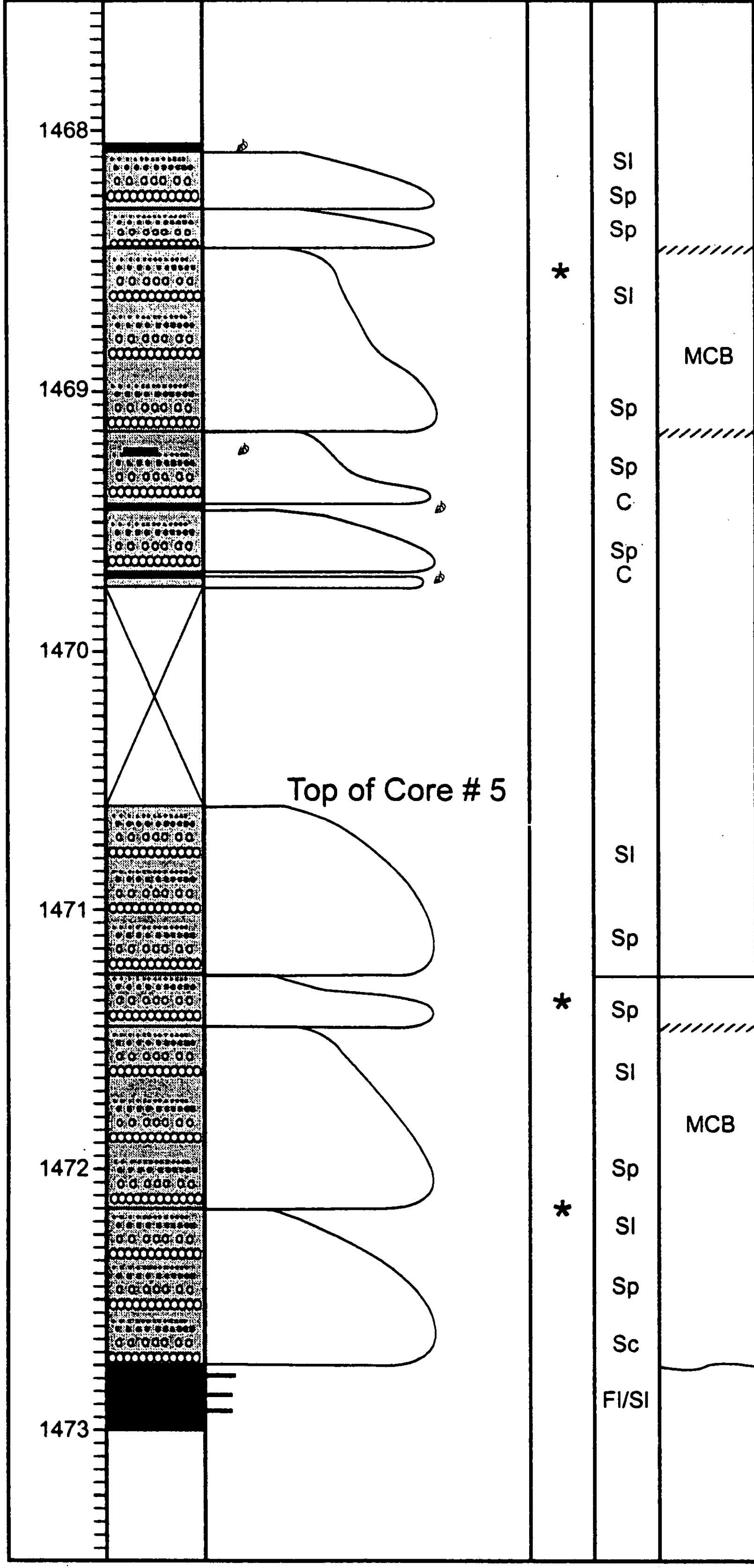
Contacts and Depositional Interpretation: MCB

1463.30 - 1468.00
Sandstone interbedded with thin mudstone (Shale) laminae

Sandstone: Creamy, coarse to pebble-grained, thinly laminated sandstone. Main sedimentary structures are thin continuous laminated to thin laminated occasionally wavy. Small scale cross laminations are present at the top. The interval contains few thin mud laminae with thin coal and coalified wood materials in centimetres scale. The sands are present in 10 to 150 cm fining upward sets. Each set comprises a pebble sandstone at the bottom and grades up to medium-grained sandstone. Some of the sandstone set has a scoured and irregular base, suggesting reworking and/or erosional surface.

Mudstone: Black, thinly laminated, slightly bioturbated. Bioturbation is mainly horizontal (*Planolites*). The mudstone contains thin lenses of very fine to fine-grained sandstone. It contains coalified wood materials and thin coal laminae.

Depth Metre	LITHOLOGICAL DESCRIPTION — Grain Size: Mud & Silt; Sand (VF, F, M, C, VC); G, P, C, B	Samples	Lithofacies	Contacts and Depositional Interpretation	Well : Iona-4	Page 6 of 7
					Waarre Formation	1468 - 1473
					Comments	

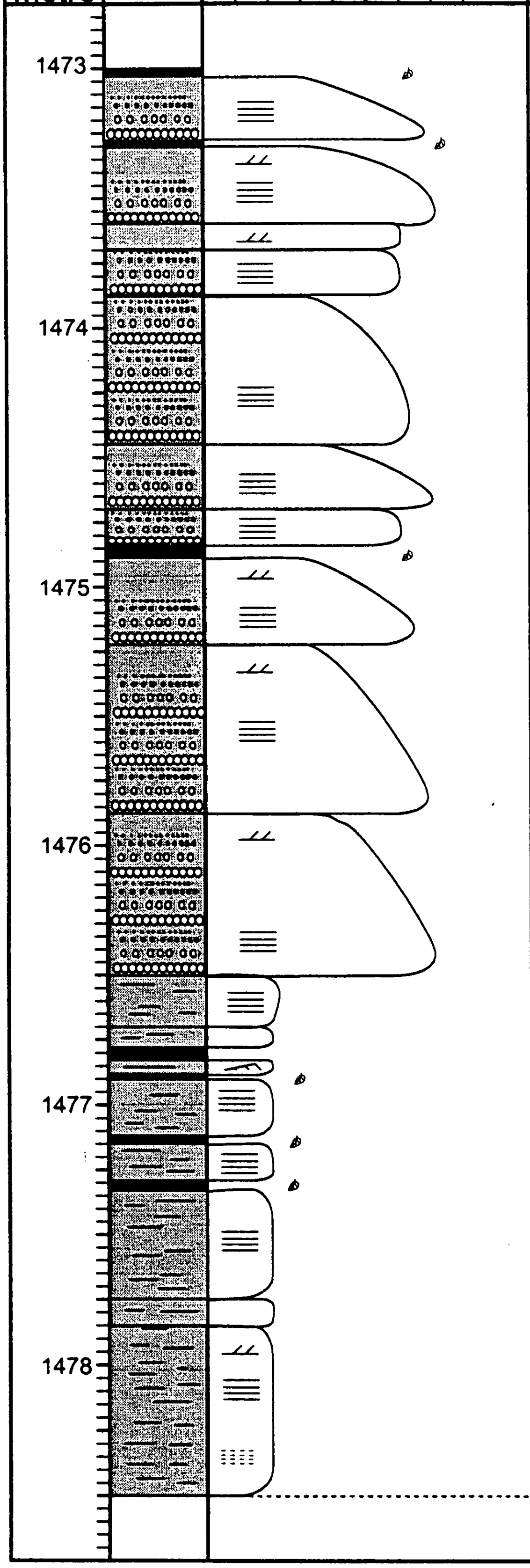


1468.00 - 1473.00
Sandstone interbedded with thin mudston (Shale) laminae.

Creamy, coarse to pebble-grained, thinly laminated sandstone. Main sedimentary structures are thin continuous laminated to thin laminated occasionally wavy. Small scale cross laminations are present at the top. The interval contains few thin mud laminae with thin coal and coalified wood materials in centimetres scale. The sands are present in 10 to 60 cm fining upward set. Each set comprises a pebble sandstone at the bottom and grades up to medium-grained sandstone. Some of the sandstone set has a scoured and irregular base, suggesting reworking and/or erosional surface.

908903 186

Depth Metre	Lithological Description: Grain Size — Mud & Silt; Sand (VF, F, M, C, VC); G, P, C, B	Samples	Lithofacies	Contacts and Depositional Interpretation	Well : Iona-4	Page 7 of 7
					Waarre Formation	1473 - 1478
					Comments	



Samples	Lithofacies	Contacts and Depositional Interpretation
	C, Sl, Sp	
	C, Sl, Sp	
	Sx, Sp, Sl, Sp, Sp, Sl, Sp, Sp, C	
*	Sp, Sl, Sp, Sp, Sl, Sp	MCB
*, *	Sl, Fl, Sr, Sl, C, Sl, Sx, Sl	BF to UFR

1473.00 - 1476.50 m
Sandstone

Creamy, coarse to pebble-grained, thinly laminated sandstone. Main sedimentary structures are thin continuous laminated to thin laminated occasionally wavy. Small scale cross laminations are present at the top. The interval contains few thin mud laminae with thin coal and coalified wood materials in centimetres scale. The sands are present in 10 to 60 cm fining upward set. Each set comprises a pebble sandstone at the bottom and grades up to medium-grained sandstone.

1476.50 - 1478.40 m
Sandstone

Creamy, fine to medium-grained, thinly laminated sandstone. Main sedimentary structures are thin continuous laminated to thin laminated occasionally wavy. Small scale cross laminations are present at the top. The interval contains few thin mud laminae with thin coal and coalified wood materials. Local single and couple mud drapes are present.

908903 187

ACS LABORATORIES PTY. LTD.

PETROLOGY and RESERVOIR QUALITY

of

IONA-4

for

WESTERN UNDERGROUND GAS STORAGE PTY LIMITED

by

ACS LABORATORIES PTY LTD

908903 188

9 July, 1999

ACS
LABORATORIES
PTY. LTD.

Western Underground Gas Storage Pty Limited
c/- Texas Utilities Australia
Level 49, Rialto South Tower
525 Collins Street
MELBOURNE VIC 3000

Attention: Andy Whittle

FINAL REPORT: 0418-01

CLIENT REFERENCE:	Purchase Order No. UGS 0000476
MATERIAL:	15 Core Sample Off-cuts
LOCALITY:	Iona-4
WORK REQUIRED:	Petrology and Reservoir Quality

Please direct technical enquiries regarding this work to the signatory below under whose supervision the work was carried out.

for
GHAZI KRAISHAN
Sedimentologist and Petrologist

ACS Laboratories Pty Ltd shall not be liable or responsible for any loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from any information or interpretation given in this report. In no case shall ACS Laboratories Pty Ltd be responsible for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report.

Brisbane Laboratory: P.O. Box 396, Chermside South Qld 4032, Australia
☎: 61 7 3350 1222 Facsimile: 3359 0666
E-mail: acs.bris@acslabs.com.au
ACS Laboratories Pty Ltd
ACN: 008 273 005

908903 189

PETROLOGY and RESERVOIR QUALITY

of

IONA-4 CORE SAMPLES

A final report prepared for

WESTERN UNDERGROUND GAS STORAGE PTY LIMITED

by

DR GHAZI KRAISHAN

June 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 I) and XRD traces (Appendix II). Representative photomicrographs are provided with each description (Appendix I).

CONTENTS

1. EXECUTIVE SUMMARY

Western Underground Gas Storage Pty Limited submitted 15 core samples collected from Iona-4 well for petrographic analysis including detailed thin section description, X-ray diffraction and environmental 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 an environmental scanning electron microscope (ESEM). ESEM 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 slightly to strong undulose extinction with few coarse grains showing straight undulose extinction. Feldspar is a minor components and comprises orthoclase and cross hatched twinning to 'tartan' twinning (microcline). Plagioclase was absent in all 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, subarkose, lithic arkose and sublithicarenite.

Routine core analysis (RCA) results show that Iona-4 sandstone samples have high porosity and permeability, and excellent reservoir quality. RCA shows that ambient porosity for the studied samples ranges from 21.6% to 30.6% and air permeability ranges from 2538 mD to 20920 mD. Petrographical studies revealed that visual porosity of the studied samples is very high ranging from 11.6% to 27.2% with an average of 22%, 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, 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-4 core samples. Porosity reduction has occurred predominantly where the ductile lithic fragments are abundant. Compaction has reduced the intergranular primary porosity by up to 65% of the original intergranular porosity. Cementation of authigenic minerals has further contributed to the porosity loss and reduced up to 24% of the original intergranular porosity.

ESEM observations reveal that the samples contain very high visual porosity with traces of authigenic clay minerals. The pores are well developed and range in size from 50 microns up to a few hundred microns. Pore throats are much smaller with an average size of less than 10 micron. The macro-pores are well interconnected suggesting very high permeability and excellent reservoir quality.

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 present in trace amounts and predominantly composed of authigenic clays, dissolution of this cement is unlikely. 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 Limited submitted fifteen core samples from Iona-4 well for a petrographic study involving detailed thin section description. Detailed thin section description and ESEM 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 environmental scanning electron microscope (ESEM). ESEM 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 image analysis using video camera.

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 ($< 2\ \mu m$) 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.

An environmental scanning electron microscope equipped with an energy-dispersive X-ray system (ESEM-EDS) was used to study 12 samples after a detailed petrographic study. Samples were examined as fracture mounts. As all the samples were extremely friable and saturated with fluids (wet) and contain drilling mud it was necessary to study them using the ESEM. ESEM was used specifically to examine the morphology of the clay minerals and the distribution and size of the pore throat. The quality of the ESEM is not as good as that expected from the standard SEM.

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-4 core samples.

Sample No.	Depth (m)	PETROLOGICAL ANALYSIS					CORE ANALYSIS		
		MA	PM	ESEM	XRD	Clay	ϕ	K	g/cm^3
3	1449.25	*	*	*	*	*	*	*	*
10	1451.06	*	*	*	*	*	*	*	*
13	1451.66	*	*	*	*	*	*	*	*
17	1452.25	*	*	*	*	*	*	*	*
29	1454.05	*	*	*	*	*	*	*	*
33	1455.40	*	*	*	*	*	*	*	*
47	1457.75	*	*	*	*	*	*	*	*
59	1459.89	*	*	*	*	*	*	*	*
66	1463.50	*	*	*	*	*	*	*	*
88	1468.54	*	*	*	*	*	*	*	*
98	1471.35	*	*	*	*	*	*	*	*
110	1473.17	*	*	*	*	*	*	*	*
124	1475.42	*	*	*	*	*	*	*	*
132	1476.65	*	*	*	*	*	*	*	*
140	1477.97	*	*	*	*	*	*	*	*

MA = modal analysis, PM = photomicrography, ESEM = Environmental 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-4 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 ESEM photomicrographs of each sample are also given with the relevant thin section description in Appendix I.

4.1 Lithology

The Iona-4 sandstone samples are composed mostly of quartz with minor amounts of feldspar and lithic fragments. 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 $Q_{90.1}\ F_{5.9}\ R_{4.0}$. The Iona-4 sandstones are classified as quartz arenite, subarkose, lithic arkose and sublitharenite (Fig. 1).

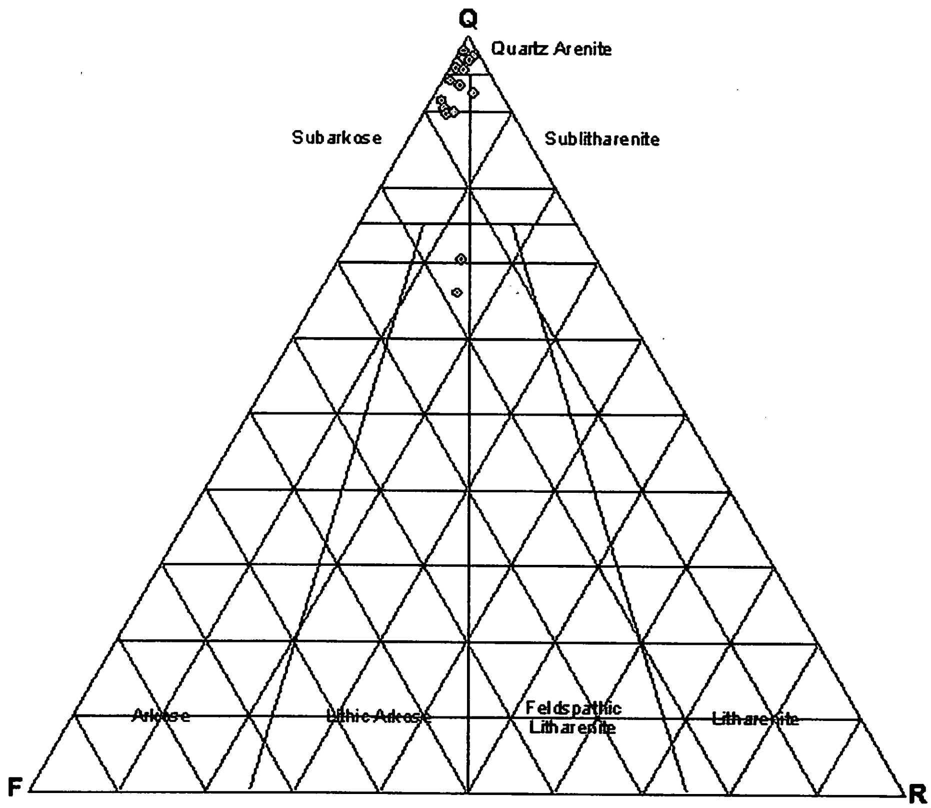


Figure 1: QFR ternary diagram showing the present-day framework grain composition of the Iona-4 sands. Iona-4 sands are classified as quartz arenite, subarkose, lithic arkose and sublitharenite (n = 15 samples), (after Folk, 1974).

TABLE 2: Summary of lithological descriptions of Iona-4 core samples.

Sample No.	Depth (m)	Lithology	Brief Description
3	1449.25	Quartz Arenite	Creamy, grain supported, small scale to ripple cross stratification, moderately to well sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Minor authigenic minerals and very good visual porosity.
10	1451.06	Quartz Arenite	Creamy, grain supported, small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are mainly angular to rounded. Trace authigenic minerals and high visual porosity.
13	1451.66	Subarkose	Creamy, grain supported, small scale cross stratification, well sorted, very coarse-grained sandstone. Quartz grains are subangular to rounded. Trace authigenic minerals and very good visual porosity.
17	1452.25	Quartz Arenite	Creamy, grain supported, horizontal to small scale cross stratification, well sorted, coarse-grained sandstone. Quartz grains are mainly subangular to rounded. Trace authigenic minerals and high visual porosity.
29	1454.05	Subarkose	Creamy, grain supported, horizontally laminated to small scale cross stratification, well sorted, coarse-grained sandstone. Quartz grains are subangular to rounded. Trace authigenic minerals and very good visual porosity.
33	1455.40	Subarkose	Creamy, grain supported, horizontal to small scale cross stratification, well sorted, medium-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.
47	1457.75	Subarkose	Creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are subangular to rounded. Trace authigenic minerals and high visual porosity.
59	1459.89	Subarkose	Creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.
66	1463.50	Subarkose	Creamy, grain supported, horizontal to small scale cross stratification, poorly sorted, very coarse-grained sandstone. Quartz grains are angular to subrounded. Minor authigenic minerals and high visual porosity.
88	1468.54	Quartz Arenite	Creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.
98	1471.35	Quartz Arenite	Creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, very coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.
110	1473.17	Quartz Arenite	Creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.
124	1475.42	Sublitharenite	Creamy, grain supported, horizontal to small scale cross stratification, poorly to moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.
132	1476.65	Lithic Arkose	Creamy, grain supported, horizontal to small scale cross stratification, well sorted, fine-grained sandstone. Quartz grains are mainly subangular to rounded. Minor authigenic minerals and good visual porosity.
140	1477.97	Lithic Arkose	Creamy, grain supported, well sorted, medium-grained sandstone. Quartz grains are mainly subangular 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 small scale cross stratifications are common and occur in continuous to discontinuous thin streaks that are 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).

4.3 Composition

The framework component of all samples is dominated by monocrystalline quartz (39.6% - 72.2%, Table 4) with an average of 63.8% ± 8.4 (Table 5). Table 5 summarises the range, average and standard deviation of the main components of the Iona-4 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 (0.2% - 4%, Table 4) with an average of 1.6% ± 0.9 (Table 5). Polycrystalline quartz grains predominantly occur as equant to subequant rounded coarse grains and display strong undulose extinction.

Feldspar is a minor component ranging from 0.6% to 11.8% and an average of 4.2% ± 3.3 (Table 5). Plagioclase is entirely absent in all studied samples. Lithic grains are also trace to minor components (0.6% - 11%) and comprise micaceous metamorphic schist, metaquartzite, rounded sedimentary chert and rare siltstone and claystone. Muscovite is present in trace to minor amounts (0% - 1.4%, Table 4) with an average of 0.3% (Table 5), most of which is derived from the disintegration of the micaceous schist rock fragments (Plate 4). Brown and blue tourmaline and zircon are found as accessory minerals in many samples. Clay depositional matrix constitutes a minor component (0% - 12.8%, Table 4) with an average of 1.3% Table 5. It comprises organic rich silty to very fine-grained sandstone and where abundant it occludes the intergranular porosity (Plate 5). Organic matter, coal and coalified wood particles are present in minor amounts (Plate 6).

Authigenic phases are dominated by kaolinite (0.2% - 7.8%) with an average of 2.2% ± 1.8 and traces of quartz overgrowths (0% - 0.4%) with an average of 0.1% ± 0.1. Pyrite is present in minor amounts (0.2% - 5.4%) and occurs as spheroidal aggregates of discrete, equigranular microcrysts; less than one µm in size (framboidal pyrite). The framboidal pyrite is associated with the argillaceous detrital matrix and organic materials. Pyrite also occurs as large cubes filling some of the pore spaces.

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 potassium feldspar with traces of pyrite and sylvite. One sample contains traces of ankerite. 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).

4.5 XRD Clay Mineralogy

The clay fraction < 2 μm mineralogy of the samples studied from Iona-4 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), chlorite, illite/smectite and smectite. 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). There was direct relation between the presence of smectitic clay and depositional matrix, suggesting that the detrital depositional matrix was originally composed of smectite. Since smectite is present in trace amounts, there was no effect on the glycolation methods on the smectite peaks.

TABLE 3: Summary of the grain size analysis and degree of sorting and angularity of Iona-4 core samples.

Sample No.	Depth (m)	MGS (mm)	MGS (Phi)	MxGS (mm)	Sorting Degree	Roundness
3	1449.25	0.80	2.70	0.32	Moderate to Well	Angular to Rounded
10	1451.06	0.75	3.00	0.42	Moderate	Angular to Rounded
13	1451.66	0.80	2.20	0.32	Well	Subangular to Rounded
17	1452.25	0.70	3.00	0.51	Well	Subangular to Rounded
29	1454.05	0.60	1.70	0.74	Well	Subangular to Rounded
33	1455.40	0.45	1.00	1.15	Well	Angular to Rounded
47	1457.75	0.90	3.60	0.15	Moderate	Subangular to Rounded
59	1459.89	0.80	3.00	0.32	Moderate	Angular to Rounded
66	1463.50	1.10	4.00	-0.14	Poor	Angular to Subrounded
88	1468.54	0.90	3.00	0.15	Moderate	Angular to Rounded
98	1471.35	1.10	4.00	-0.14	Moderate	Angular to Rounded
110	1473.17	0.75	3.80	0.42	Moderate	Angular to Rounded
124	1475.42	0.80	4.00	0.32	Poor to Moderate	Angular to Rounded
132	1476.65	0.20	0.60	2.32	Well	Subangular to Rounded
140	1477.97	0.40	0.80	1.32	Well	Subangular to Rounded

MGS = average grain size, MxGS = maximum grain size.

TABLE 4: Composition of Iona-4 core samples. All values are in per cent based on image analysis.

Sample No.	3	10	13	17	29	33	47	59
Depth (m)	1449.08	1451.06	1451.66	1452.25	1454.05	1455.4	1457.75	1459.89
Quartz (Mono)	69.2	71.8	63.0	68.2	64.6	63.8	65.0	62.4
Quartz (Poly)	1.2	0.2	1.2	1.0	1.2	0.8	2.0	4.0
K feldspar	0.6	1.8	5.2	3.0	5.0	4.4	3.8	5.4
Plagioclase	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sedimentary Rock Fragments	0.4	0.2	0.2	0.2	0.8	0.6	0.4	0.4
Metamorphic Rock Fragments	1.0	1.6	1.0	0.4	1.2	3.0	0.6	1.8
Volcanic Rock Fragments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mica	0.2	0.2	Tr	0.0	0.0	0.2	0.0	0.0
Depositional Matrix	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quartz Cement	0.4	0.2	Tr	0.2	0.0	0.0	0.0	0.0
Kaolinite	0.4	0.4	0.2	2.0	2.2	2.6	2.0	3.2
Pyrite	5.4	1.2	1.8	1.4	1.6	0.2	0.2	0.2
Organic Matter	Tr	0.6	Tr	0.0	0.0	0.0	Tr	Tr
Accessory	0.4	0.2	0.2	0.2	0.0	0.4	0.0	0.2
Visual Porosity	20.8	20.6	27.2	23.4	23.4	24.0	26.0	22.4

TABLE 4: Composition of Iona-4 core samples. All values are in per cent based on image analysis. (*Continued*)

Sample No.	66	88	98	110	124	132	140
Depth (m)	1463.5	1468.54	1471.35	1473.17	1475.42	1476.65	1477.97
Quartz (Mono)	64.8	67.8	72.2	68.6	65.0	39.6	50.8
Quartz (Poly)	1.0	1.6	1.8	1.8	2.6	1.6	1.4
K feldspar	2.4	2.4	1.8	1.2	2.6	11.4	11.8
Plagioclase	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sedimentary Rock Fragments	0.4	Tr	0.0	0.2	0.6	2.4	2.2
Metamorphic Rock Fragments	1.4	0.6	0.8	1.2	2.4	8.0	8.8
Volcanic Rock Fragments	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mica	0.4	0.0	0.0	Tr	0.4	1.2	1.4
Depositional Matrix	12.8	0.0	3.0	1.2	Tr	0.0	0.0
Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quartz Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kaolinite	1.4	2.4	1.6	2.4	2.2	7.8	2.6
Pyrite	1.2	2.0	1.6	0.4	1.2	1.8	0.6
Organic Matter	2.4	0.4	0.4	0.2	0.0	0.8	0.2
Accessory	0.2	0.0	0.0	Tr	Tr	0.6	0.4
Visual Porosity	11.6	22.8	16.8	22.8	23.0	24.8	19.8

TABLE 5: Summary of the modal analysis of Iona-4 core samples.

	Average	Min	Max	STDEV
Quartz (Mono)	63.8	39.6	72.2	8.4
Quartz (Poly)	1.6	0.2	4.0	0.9
K feldspar	4.2	0.6	11.8	3.3
Plagioclase	0.0	0.0	0.0	0.0
Sedimentary Rock Fragments	0.6	0.0	2.4	0.7
Metamorphic Rock Fragments	2.3	0.4	8.8	2.6
Volcanic Rock Fragments	0.0	0.0	0.0	0.0
Mica	0.3	0.0	1.4	0.5
Depositional Matrix	1.3	0.0	12.8	3.4
Carbonate	0.0	0.0	0.0	0.0
Quartz Cement	0.1	0.0	0.4	0.1
Kaolinite	2.2	0.2	7.8	1.8
Pyrite	1.4	0.2	5.4	1.3
Organic Matter	0.5	0.0	2.4	0.7
Accessory	0.2	0.0	0.6	0.2
Visual Porosity	22.0	11.6	27.2	3.8

Min = minimum, Max = maximum STDEV = standard deviation.

TABLE 6: Qualitative bulk XRD results from selected core samples from Iona-4.

Sample No.	Depth (m)	Quartz	Kaolinite	KCl	K-feldspar	Pyrite	Ankerite
3	1449.25	A		m		T	
10	1451.06	A	T		m	T	T
13	1451.66	A		T	T	T	
17	1452.25	A		T	m	T	
29	1454.05	A		T	m	T	
33	1455.40	A	T	m		T	
47	1457.75	A	T	m	T	T	
59	1459.89	A	T	T	T	T	
66	1463.50	A	T	T	m	T	
88	1468.54	A	T	T		T	
98	1471.35	A		T		T	
110	1473.17	A	T	T	T	T	
124	1475.42	A		T	T	T	
132	1476.65	A	T	T	m	T	
140	1477.97	A	T		m	T	

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-4 well.

Sample No.	Depth (m)	Kaolinite	Chlorite	Muscovite	Illite/Smectite	Smectite
3	1449.25	M		m		
10	1451.06	M		m		
13	1451.66	M		m		
17	1452.25	M		m		
29	1454.05	M	T	m		
33	1455.40	M	T	m		T
47	1457.75	M	T	m		T
59	1459.89	M	T	m		T
66	1463.50	M		m	T	
88	1468.54	M		m		
98	1471.35	M		m		
110	1473.17	M		m		
124	1475.42	M		m		T
132	1476.65	M		m		
140	1477.97	M		m		

A = abundant (nominally more than 40 wt%), M = major (nominally > 10%), m = minor (nominally > 1%, < 10%), T = trace (nominally < 1%).

4.6 Environmental Scanning Electron Microscopy (ESEM)

The samples comprise a fine to very coarse-grained, poorly to well sorted sandstone with traces of authigenic clay mineral assemblage. 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. Since smectite or illite/smectite mixed layer were not detected, swelling is unlikely to occur within the samples. ESEM has also shown that quartz overgrowths are entirely absent.

Based on ESEM observations, most samples of Iona-4 have considerable amounts of porosity. The pores are large, most of which are more than 50 μm and occasionally more than 100 μm (Plate 7). 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 8) and have triangular shape suggesting that most of the pores are of intergranular primary origin (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.

ESEM 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 ESEM studies.

This is Page Number **908903_204X**

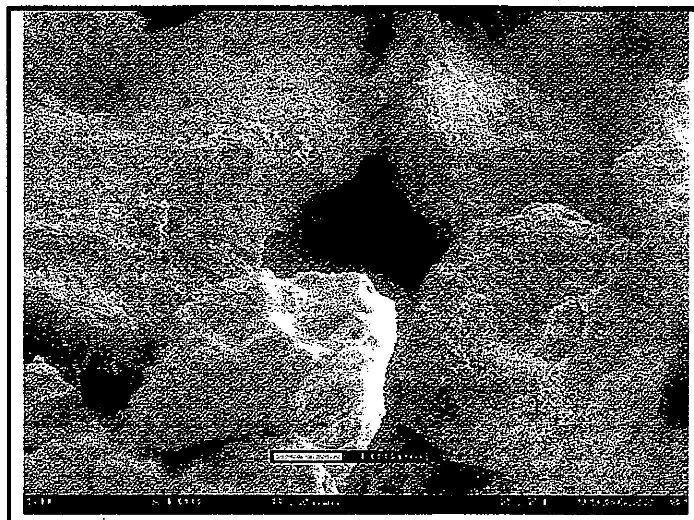
This is an enclosure indicator page.

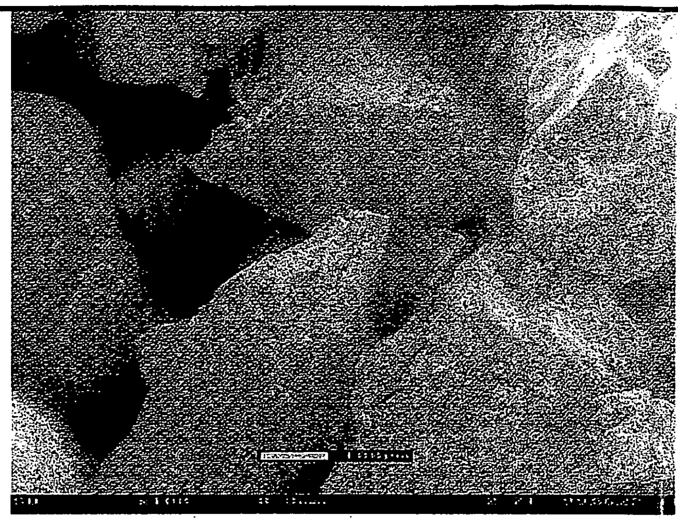
The page that follows this page is an uncatalogued fold-out with page number:

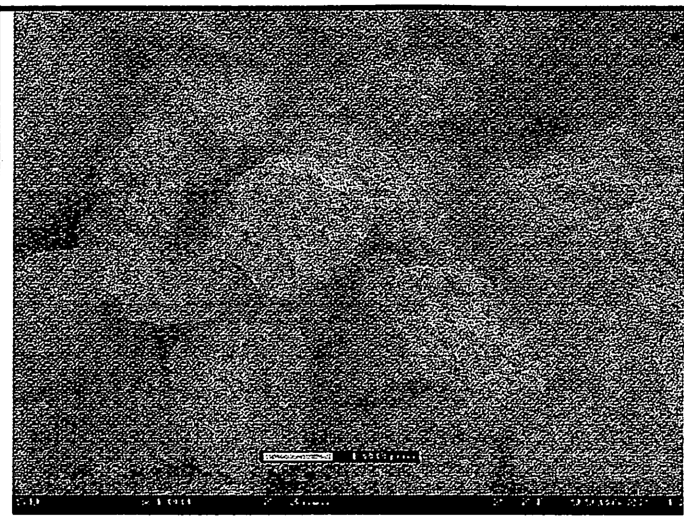
908903_204Y

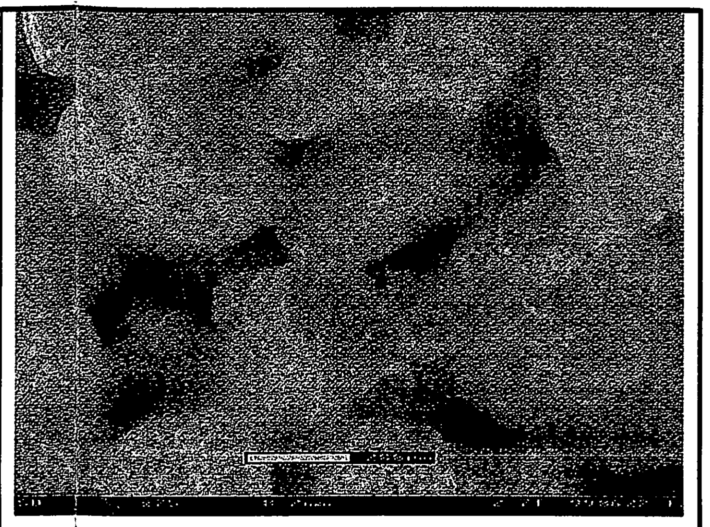
and is enclosed within the document PE908903 at this page.

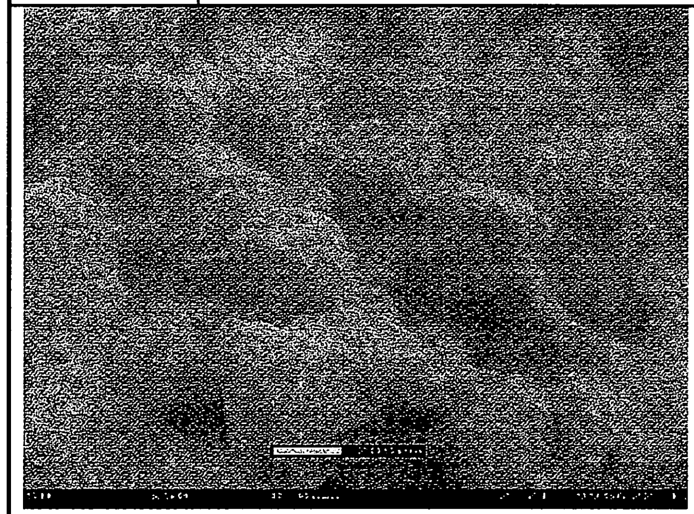
908903 204Y

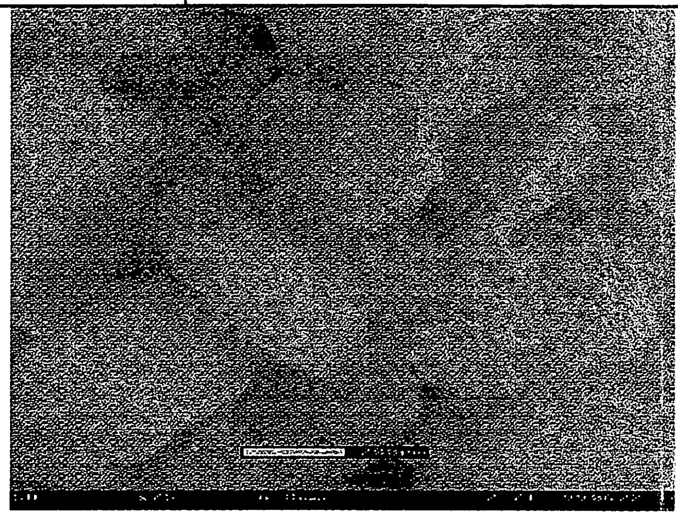

Sample # 3, 1449.25 m ϕ = 24.9%, K = 13431 mD
Scale bar = 100 μm

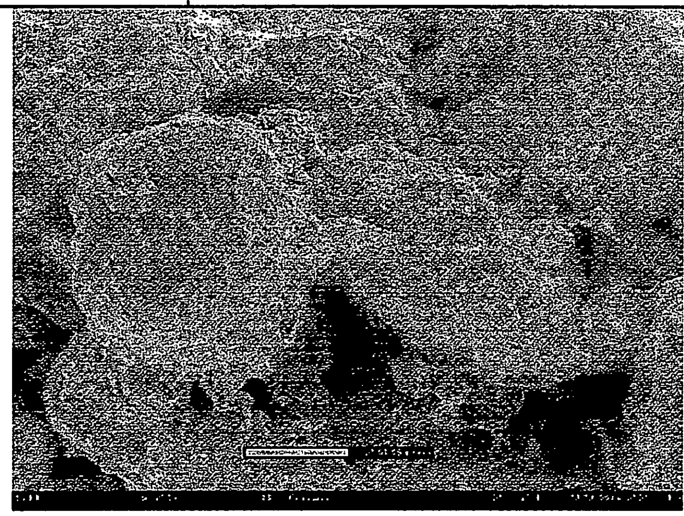

Sample # 10, 1451.06 m ϕ = 27.3%, K = 6024 mD
Scale bar = 100 μm


Sample # 13, 1451.66 m ϕ = 28.5%, K = 20012 mD
Scale bar = 100 μm

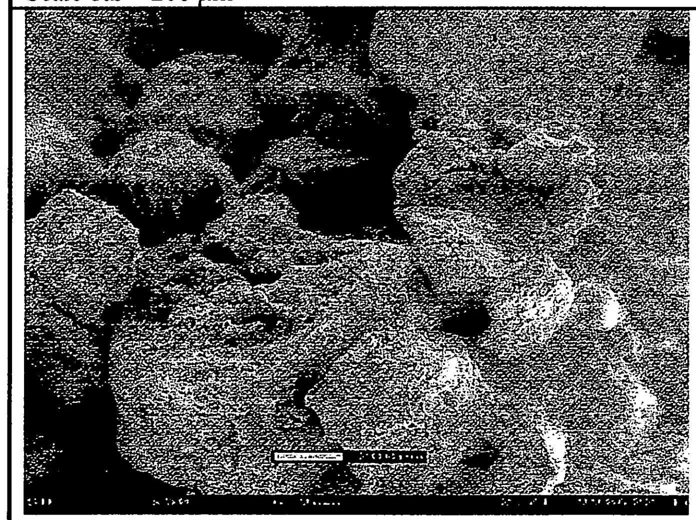

Sample # 33, 1455.40 m ϕ = 28.7%, K = 17184 mD
Scale bar = 200 μm

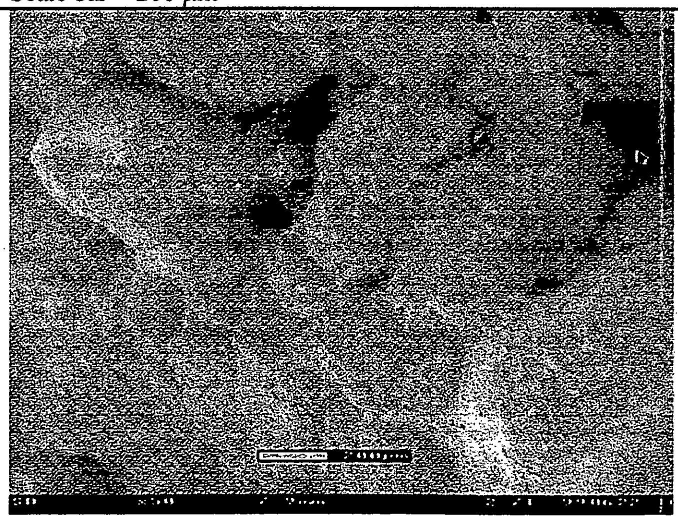

Sample # 47, 1457.75 m ϕ = 29.3%, K = 17472 mD
Scale bar = 200 μm

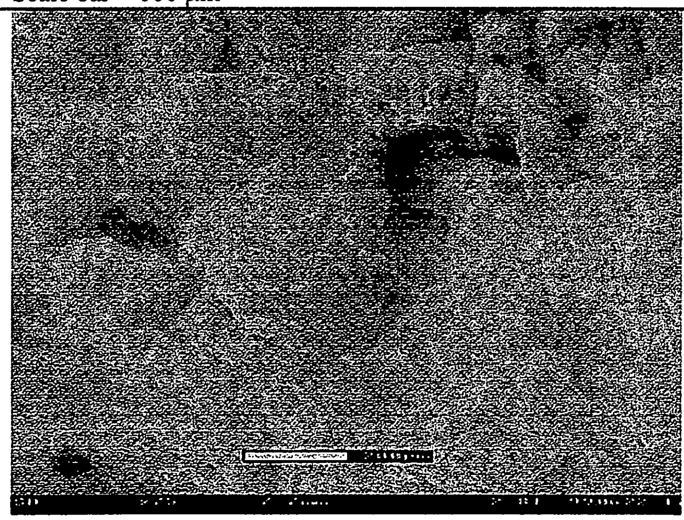

Sample # 59, 1459.89 m ϕ = 26.6%, K = 12454 mD
Scale bar = 200 μm


Sample # 66, 1463.50 m ϕ = 21.6%, K = 2538 mD
Scale bar = 100 μm


Sample # 88, 1468.54 m ϕ = 26.5%, K = 13325 mD
Scale bar = 200 μm


Sample # 98, 1471.35 m ϕ = 23.8%, K = 6218 mD
Scale bar = 200 μm


Sample # 110, 1473.17 m ϕ = 25.9%, K = 13202 mD
Scale bar = 200 μm


Sample # 132, 1476.65 m ϕ = 30.6%, K = 2826 mD
Scale bar = 200 μm

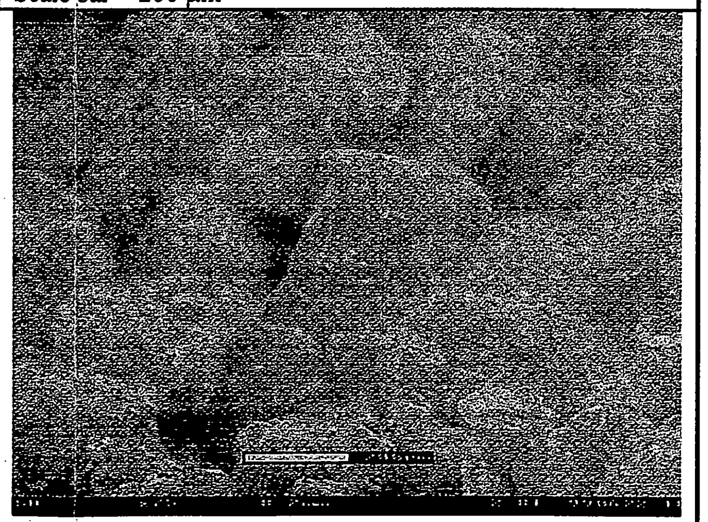

Sample # 140, 1477.97 m ϕ = 29.6%, K = 2817 mD
Scale bar = 200 μm

Figure 2. Overview of textural characteristics and reservoir parameters of selected core samples from Iona-4.

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.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.
- Later in the diagenetic history, large cubic crystalline pyrite has occurred as pore filling around thin coal beds, organic-rich detrital matrix and coalified wood materials.

4.8 Reservoir Quality

The results from routine core analysis (RCA) show that ambient porosity for the studied samples ranges from 21.6% to 30.6% and air permeability ranges from 2817 mD to 20920 mD. Iona-4 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). Secondary porosity has mostly resulted from partial to complete dissolution of potassium feldspar (Plate 14). Potassium feldspar displays some sieve and skeletal structures (Plate 14), suggesting partial dissolution to increase the visual porosity. There is a good relationship between total porosity and estimated visual porosity (Fig. 3).

The porosity of all samples is good to high and depends upon a combination of texture and diagenesis involving compaction. Most of the samples are clean quartz arenite with minor to trace detrital depositional matrix. The samples were selected from two different lithofacies. These are the braided mid-channel bar (MCB) and the braided barforms (BF) facies. No samples have been collected from the floodplain (FP) facies (for more details see Sedimentology Report 0414-01 of Iona-4).

TABLE 8: Routine core analysis (RCA) results for the Iona-4 core samples selected for petrographic study.

Sample No.	Depth (m)	Porosity %	Permeability mD	Grain Density g/cm^3
3	1449.25	24.9	13431	2.72
10	1451.06	27.3	6024	2.64
13	1451.66	28.5	20012	2.66
17	1452.25	29.0	19724	2.65
29	1454.05	29.8	20920	2.63
33	1455.40	28.7	17184	2.64
47	1457.75	29.3	17472	2.65
59	1459.89	26.6	12454	2.64
66	1463.50	21.6	2538	2.64
88	1468.54	26.5	13325	2.64
98	1471.35	23.8	6218	2.63
110	1473.17	25.9	13202	2.66
124	1475.42	27.8	11780	2.65
132	1476.65	30.6	2826	2.66
140	1477.97	29.6	2817	2.66

The textural control on the reservoir quality is clear and is indicated by the relationship between grain size and porosity (Fig. 4).

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 and 3). 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-4 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. 5) of Iona-4 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 25.6% and 3.7% respectively, Table 9. This means that around 36% of the intergranular porosity has been lost by compaction processes, whereas cementation has removed 9% of the intergranular porosity. Both processes in combination have destroyed, on average, 45% of the intergranular porosity. Therefore the remaining intergranular primary porosity, on average, is slightly higher than 22%.

Precipitation of authigenic minerals has much less effect on the reservoir quality.

TABLE 9. The effect of mechanical compaction and cementation processes on the primary intergranular porosity of the Iona-4 sandstones.

Sample No.	Depth (m)	Total Cement (%)	IGV (%)	PDTC[1] (%)	PDMC[2] (%)
3	1449.25	6.2	27.0	15.5	32.5
10	1451.06	1.8	22.4	4.5	44.0
13	1451.66	2.0	29.2	5.0	27.0
17	1452.25	3.6	27.0	9.0	32.5
29	1454.05	3.8	27.2	9.5	32.0
33	1455.40	2.8	26.8	7.0	33.0
47	1457.75	2.2	28.2	5.5	29.5
59	1459.89	3.4	25.8	8.5	35.5
66	1463.50	2.6	14.2	6.5	64.5
88	1468.54	4.4	27.2	11.0	32.0
98	1471.35	3.2	20.0	8.0	50.0
110	1473.17	2.8	25.6	7.0	36.0
124	1475.42	3.4	26.4	8.5	34.0
132	1476.65	9.6	34.4	24.0	14.0
140	1477.97	3.2	23.0	8.0	42.5
	Average	3.7	25.6	9.2	35.9

[1] PDTC = Porosity Destroyed by Total Cement
[2] PDMC = Porosity Destroyed by Mechanical Compaction

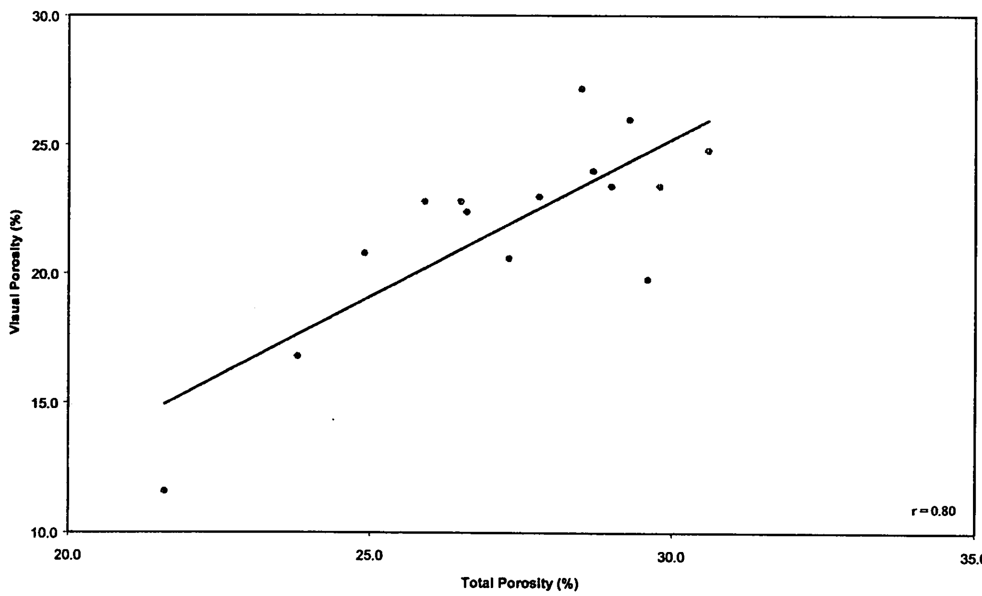


Figure 3: Relation between visual and total porosity (core porosity). The relatively high correlation coefficient r = 0.80 between both components suggests a major control of textural variety on the reservoir quality.

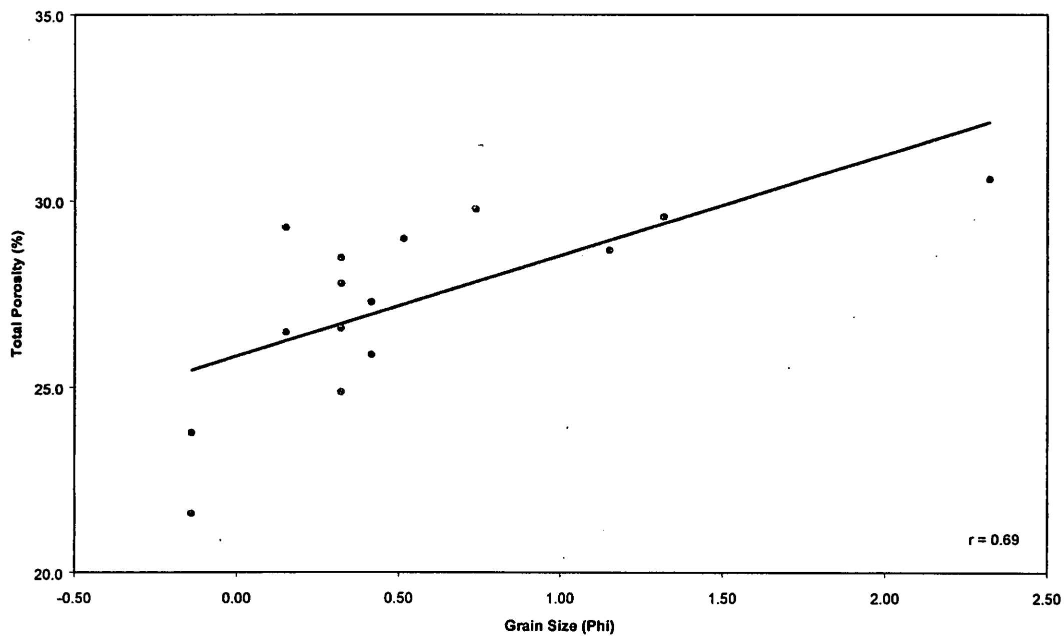


Figure 4: Relation between rock grain size and total porosity (core porosity). The relatively high correlation coefficient r = 0.69 between both components suggests a major control of textural variety on the reservoir quality

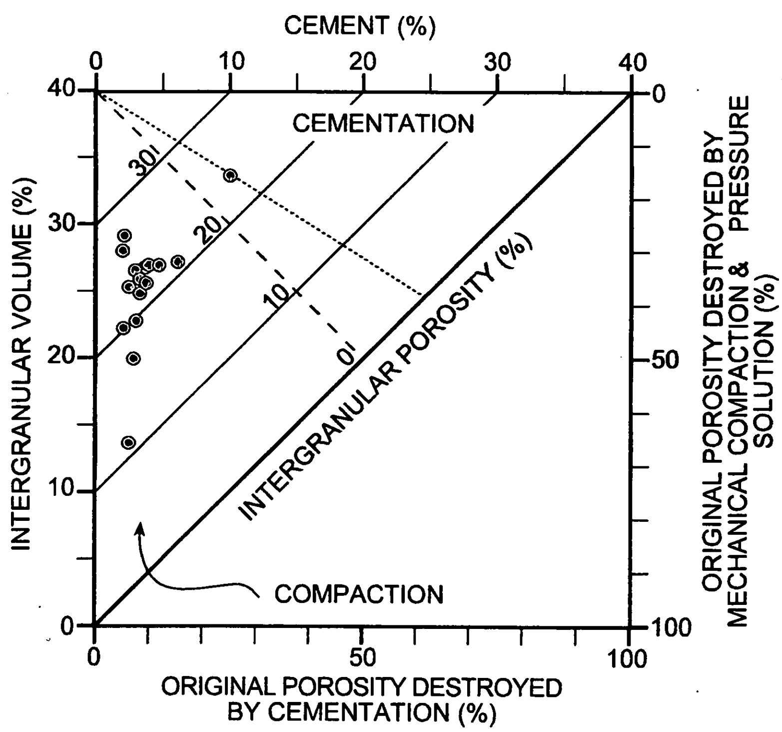


Figure 5. Intergranular volume vs total cement diagram for Iona-4 sandstone samples to evaluate the relative importance of compaction and cementation process to porosity reduction (after Houseknecht (1987, 1989) and modified by Ehrenberg (1989, 1990). * *denotes the average.*

5. SUMMARY AND CONCLUSIONS

5.1 Sediment Provenance

All samples exhibit similar sediment provenance. 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-4 were probably deposited by moderate to high energy sedimentation that could be a braided stream system. This is evident by the presence of coarse grained to pebbly imbrification, 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 the presence of ductile rock fragments have made a minor impact on the reservoir quality of the Iona-4 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 21.6% to 30.6% and air permeability ranges from 2817 mD to 20920 mD. ESEM revealed that the pores are well developed and partially reduced by compaction and much less by 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. Fines migration and invasion of fines from the wellbore into the formation should be minimal in the samples studied. Dissolution of the matrix cement is unlikely.

6. REFERENCES

Dickson, J. A. D., 1966—Carbonate identification and genesis as revealed by staining. *J. Sediment. Petrol.*, 36, 491-505.

Ehrenberg, S. N., 1989—Assessing the relative importance of compaction processes and cementation to reduction of porosity in sandstones: discussion; compaction and porosity evolution of Pliocene sandstones, Ventura basin, California: discussion. *Am. Assoc. Petrol. Geol. Bull.*, 73, 1274-1276.

Ehrenberg, S. N., 1990—Relationship between diagenesis and reservoir quality in sandstones of the Gran Formation, Haltenbanken, Mid-Norwegian continental shelf. *Am. Assoc. Petrol. Geol. Bull.*, 74, 1538-1558.

Folk, R. L., 1974—*Petrology of Sedimentary Rocks*. Austin, Texas, Hemphill Publishing Co., 182 p.

Houseknecht, D. W., 1987—Assessing the relative importance of compaction processes and cementation to reduction of porosity in sandstones. *Am. Assoc. Petrol. Geol. Bull.*, 71, 633-642.

Houseknecht, D. W., 1989—Assessing the relative importance of compaction processes and cementation to reduction of porosity in sandstones: reply. *Am. Assoc. Petrol. Geol. Bull.*, 73, 1277-1279.

Lainz, R. V., Stevens, R. E. and Norman, M. B., 1964—Staining of Plagioclase Feldspar and other Minerals with F. D. and C. Red No. 2. U.S. Geol. Survey Prof. Paper 501-B, 152-153.

Pettijohn, F. J., Potter, P. E. and Siever, R., 1987—*Sand and Sandstone*. New York, Springer-Verlag, 553 p.

Schmidt, V. and McDonald, D. A., 1979—Texture and recognition of secondary porosity in sandstones. In: Scholle, P. A. and Schluger, P. R. (eds.), *Aspects of Diagenesis*. Soc. Econ. Palaeontologists and Mineralogists, Spec. Pub., 26, 209-225.

Zuffa, G. G., 1985—Optical Analysis of Arenites: Influence of Methodology on Compositional Results. In: Zuffa, G. G., (ed.), *Provenance of Arenites*, North Atlantic Treaty Organization (NATO), Advanced Study Institute Series, V. C. D. Reidel Publishing Company, Dordrecht, 168-189.

ACS LABORATORIES PTY. LTD.

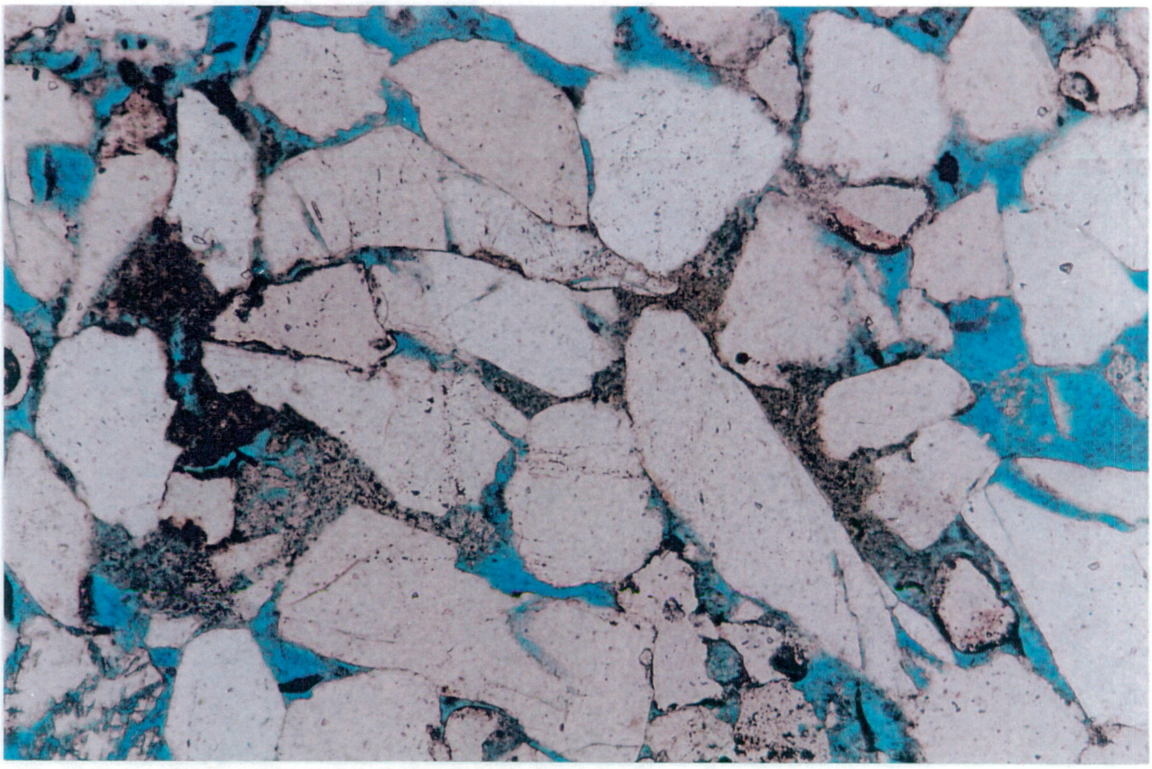


Plate 1: (Sample # 140, 1477.97 m): Thin section photomicrograph of lithic arkose comprising well sorted, angular to subrounded medium-grained sandstone. Note the concavo-convex and suture contacts between grains, indicating mechanical compaction. Also note squeezed ductile lithic fragments. Plane polarised light. Scale bar = 200 µm.

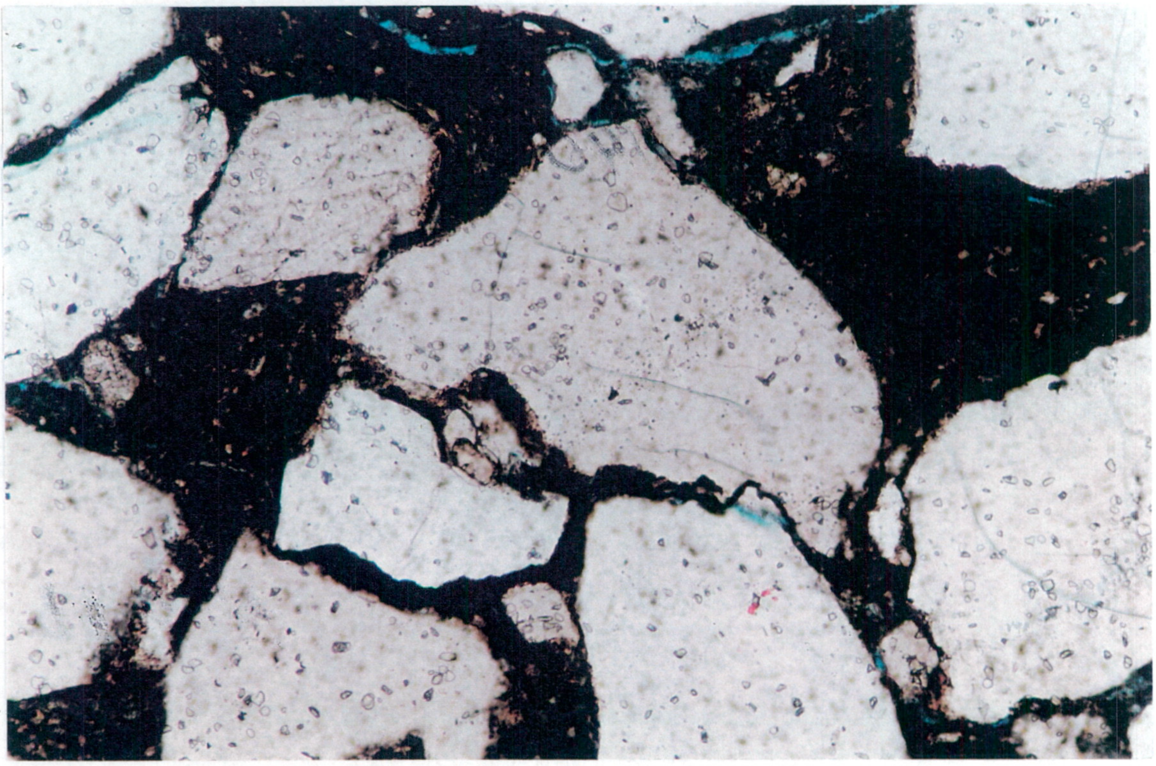


Plate 2: (Sample # 66, 1463.50 m): Thin section photomicrograph of subarkose showing severe effects of compaction as indicated by the squeezed detrital depositional matrix. Plane polarised light. Scale bar = 200 µm.

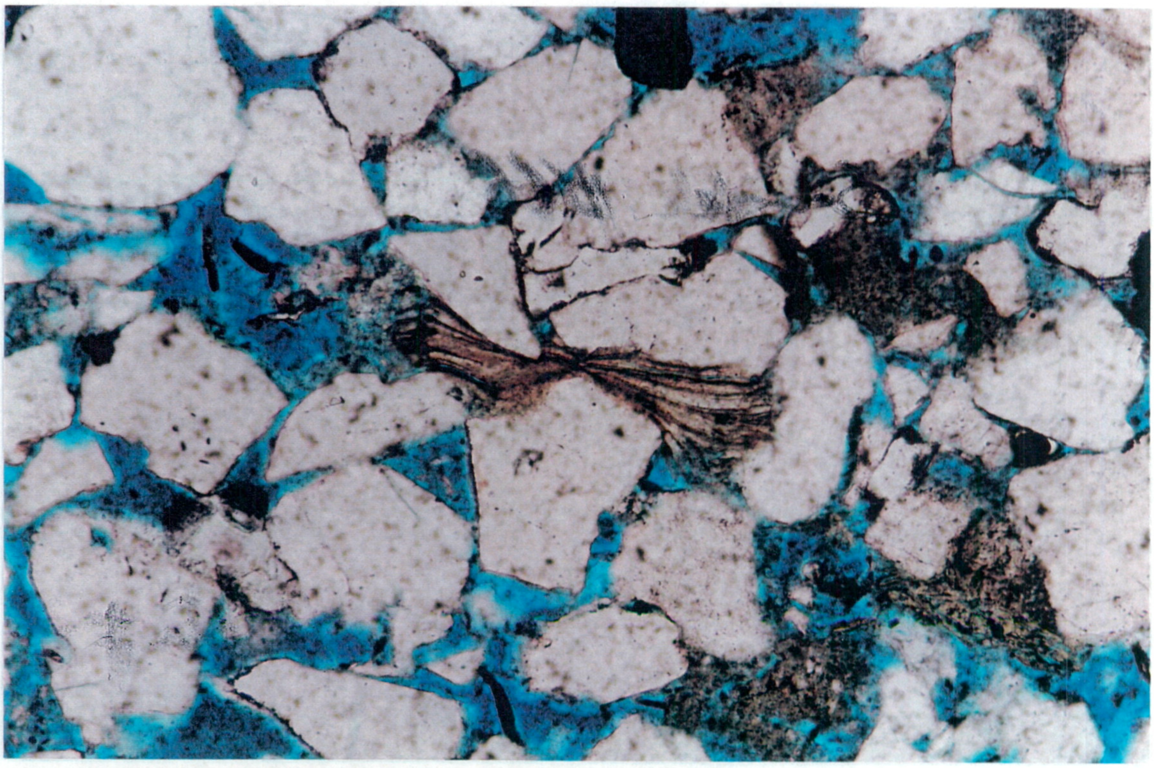


Plate 3: (Sample # 132, 1476.65 m): Thin section photomicrograph of lithic arkose comprising well sorted, subangular to rounded fine-grained sandstone. The effect of mechanical compaction in reducing the reservoir quality was moderate and is indicated by the presence of bent mica flakes. Plane polarised light. Scale bar = 200 µm.

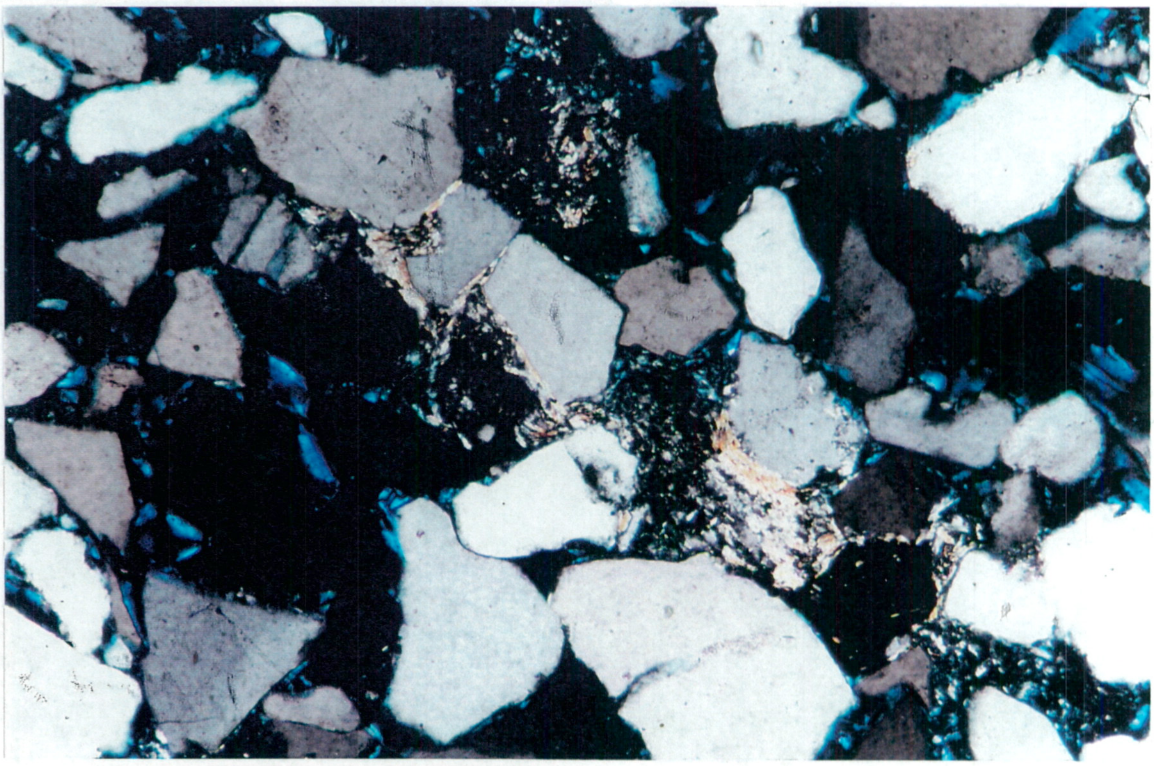


Plate 4: (Sample # 140, 1509.67 m): Thin section photomicrograph showing disintegrated metamorphic mica schist to produce muscovite. Note that mica flakes are squeezed between rigid quartz grains suggesting a moderate mechanical compaction. Crossed polars. Scale bar = 200 µm.

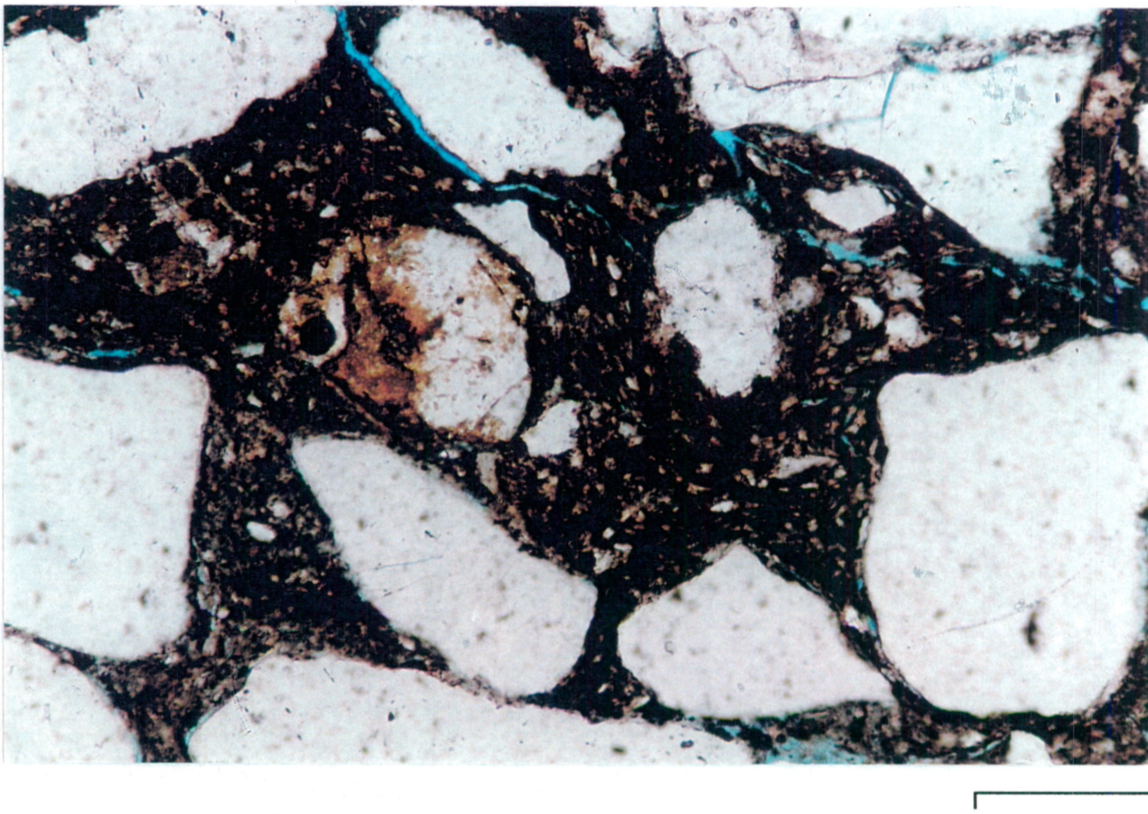


Plate 5: (Sample # 66, 1463.50 m): Thin section photomicrograph showing moderate amounts of detrital depositional matrix. It comprises organic rich silty to very fine-grained sandstone and where abundant it occludes the intergranular porosity. Plane polarised light. Scale bar = 200 μm.

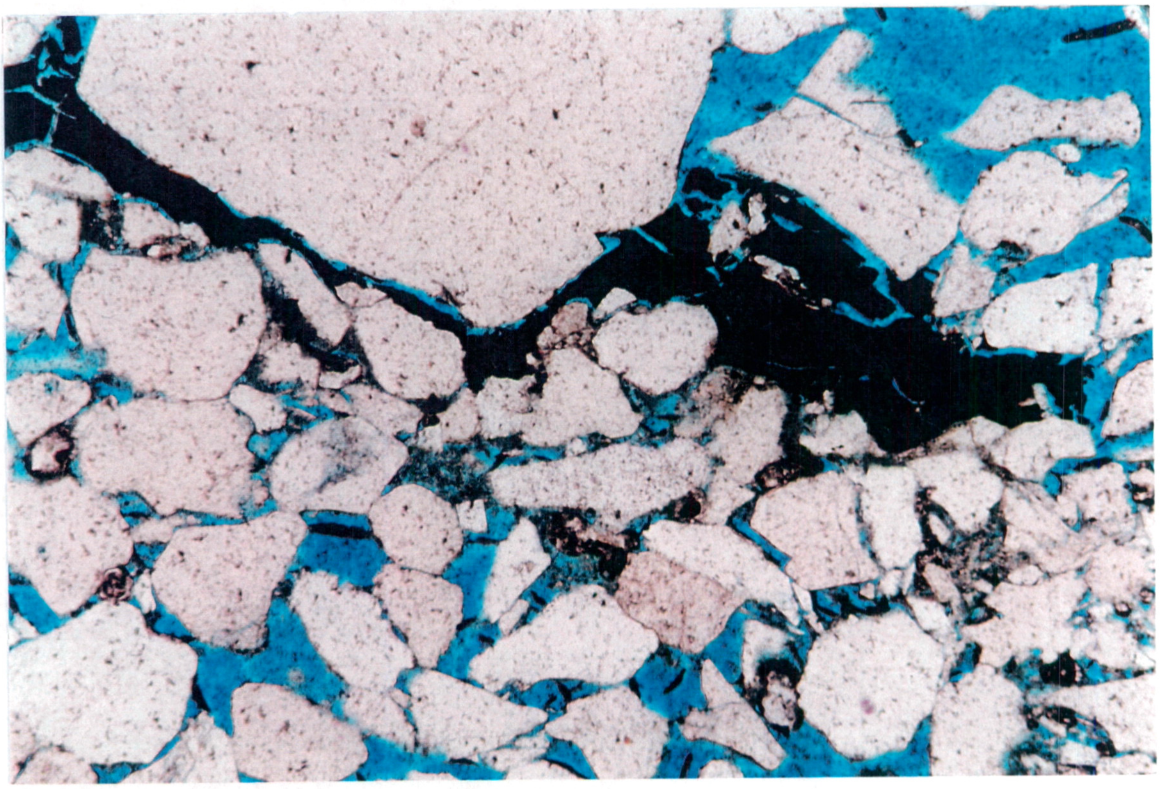


Plate 6: (Sample # 98, 1533.52 m): Thin section photomicrograph showing organic materials. Organic matter occurs as coal or coalified wood materials. Plane polarised light. Scale bar = 200 μm.

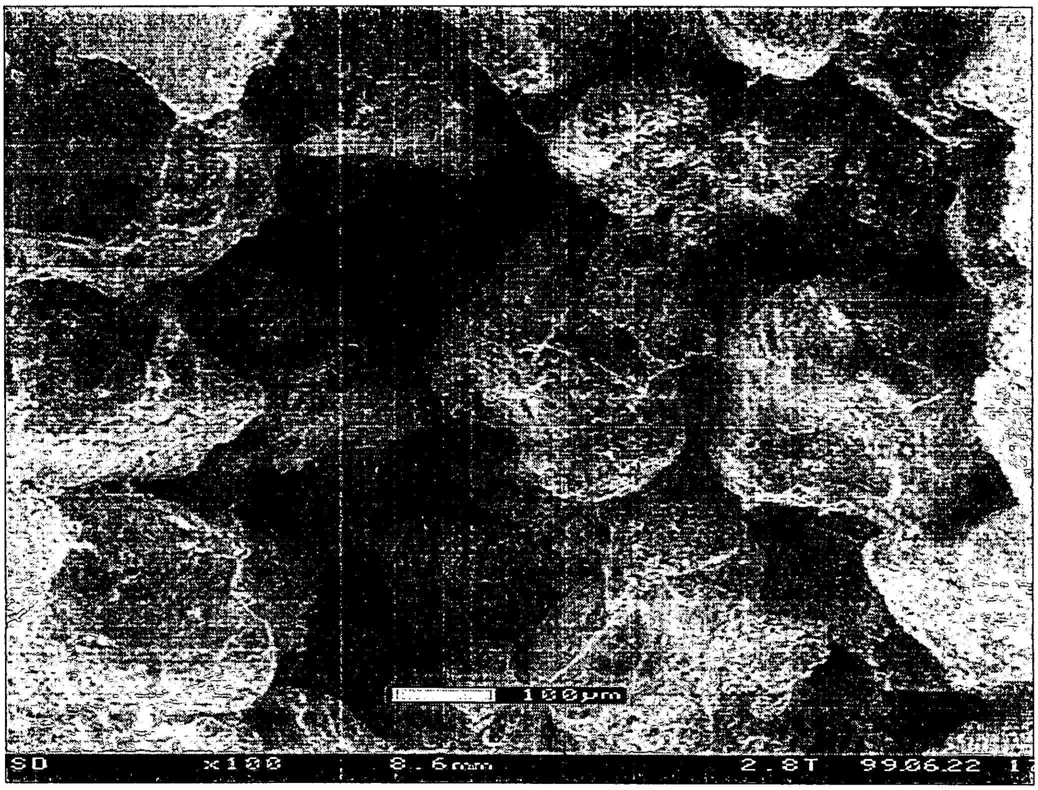


Plate 7: (Sample # 132, 1476.65 m): ESEM photomicrograph showing high visual porosity, large pore spaces and pore throat. The pores are well interconnected implying good to high permeability in 3-D and good reservoir quality. Scale bar = 100 µm.

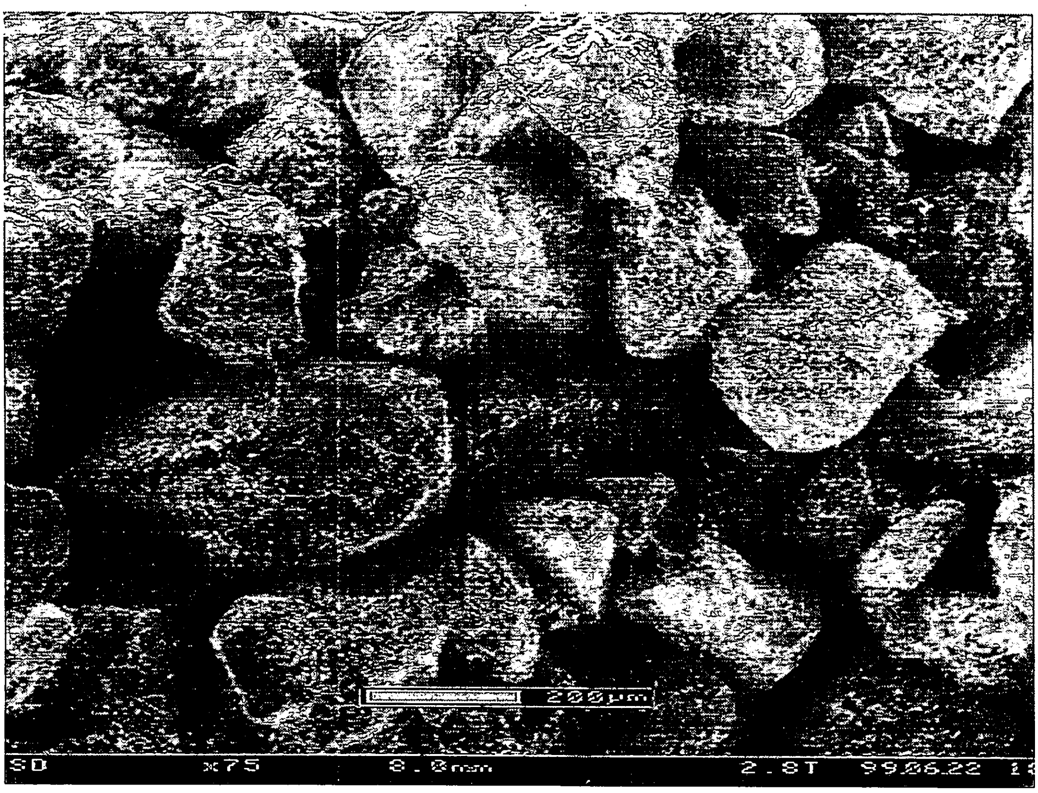


Plate 8: (Sample # 140, 1477.97 m): ESEM photomicrograph showing considerable amounts of porosity. The pore throats are small and well interconnected in 3-D. The distribution of the pore throat is regular with good interconnection implying very good permeability. Scale bar = 200 µm.

Plate 9: (Sample # 132, 1476.65 m): ESEM photomicrograph showing small pore throats interconnected in 3-D, most of which are less than 50 µm. Fines migration during fluid extraction is unlikely to cause any reduction in permeability. Scale bar = 100 µm.

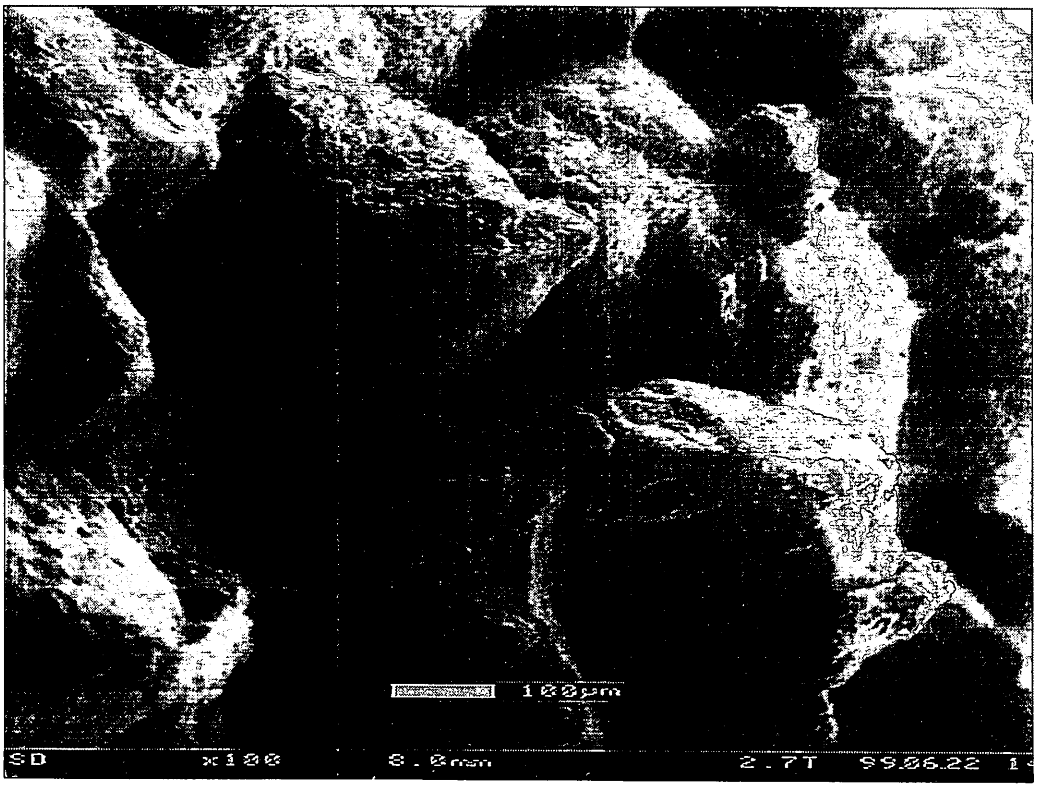


Plate 10: (Sample # 59, 1459.89 m): ESEM photomicrograph showing minor amounts of drilling mud (sylvite) filling few of the pore spaces and coating detrital and authigenic minerals. Identification of drilling mud was determined by XRD and petrography. Scale bar = 100 µm.

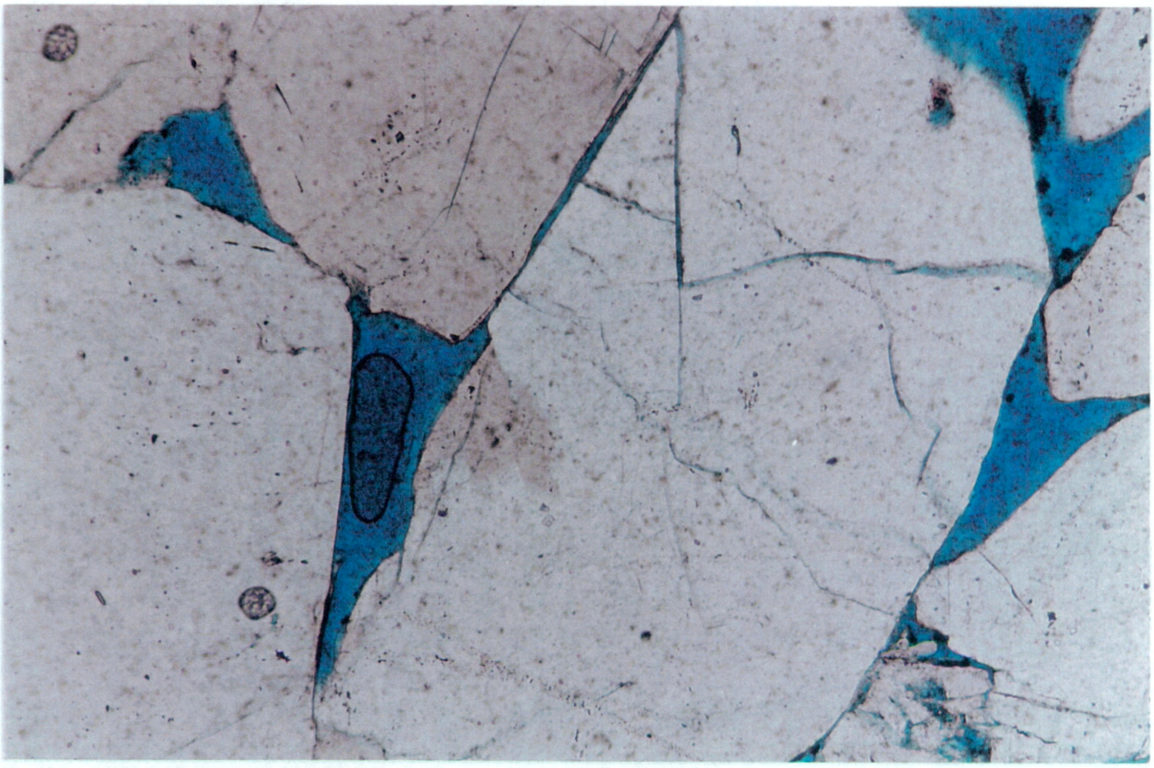


Plate 11: (Sample # 110, 1473.17 m): Thin section photomicrograph of quartz arenite comprising moderately sorted, angular to rounded coarse-grained sandstone with abundant visual porosity. Visual porosity occurs mostly as large triangles suggesting a primary intergranular origin. Plane polarised light. Scale bar = 200 μm.

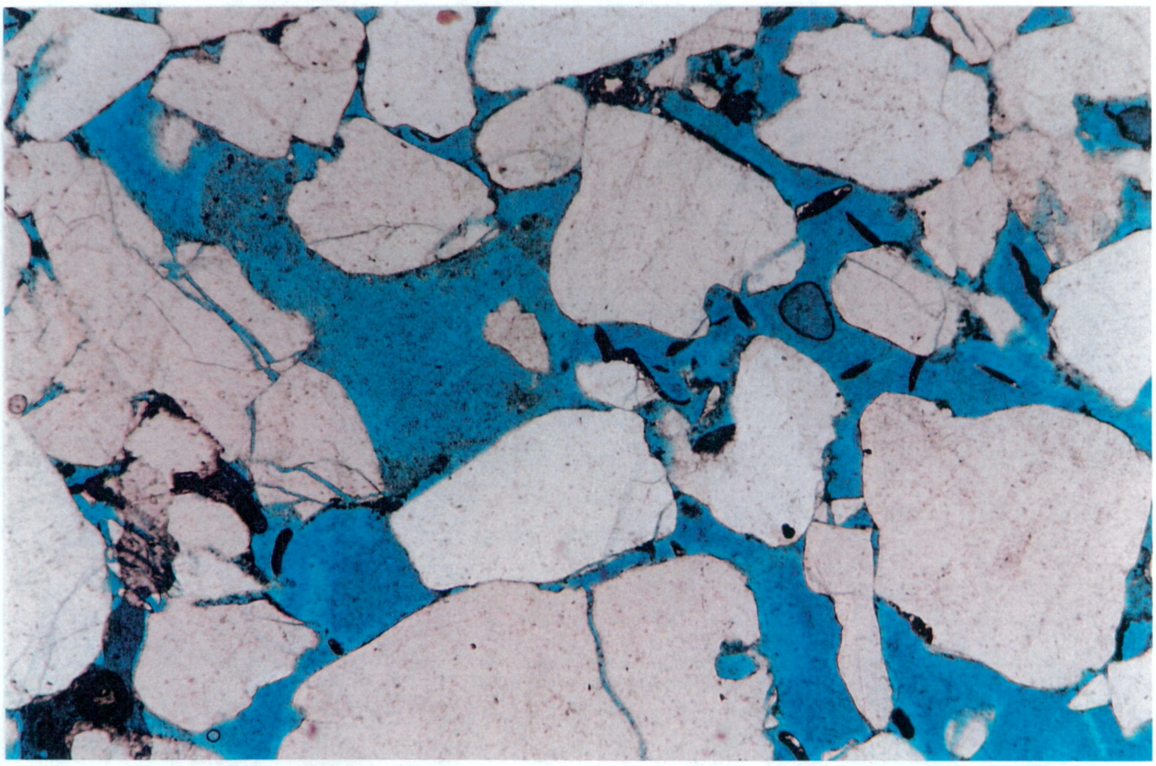


Plate 12: (Sample # 110, 1473.17 m): Thin section photomicrograph of quartz arenite comprising moderately sorted, angular to rounded coarse-grained sandstone with minor secondary porosity. Secondary porosity occurs as large and elongated pores providing good interconnection between the intergranular primary pores and increasing the overall porosity and permeability. Plane polarised light. Scale bar = 200 μm.

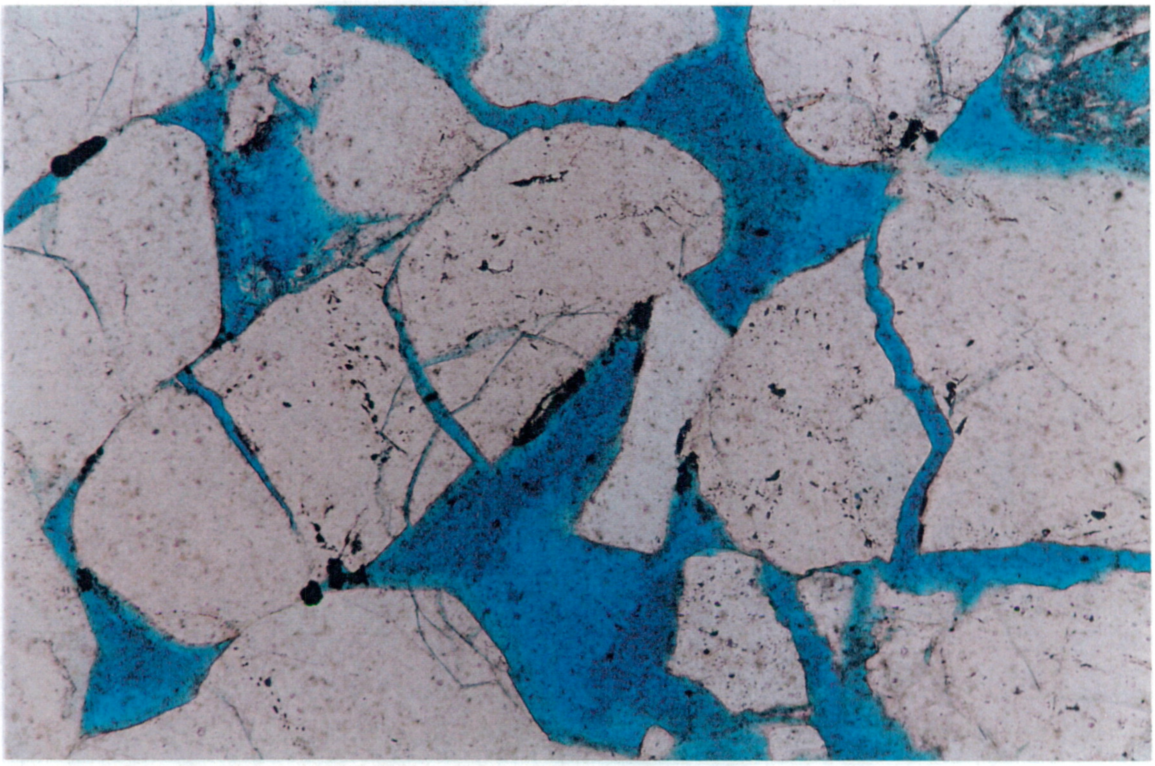


Plate 13: (Sample # 13, 1451.66 m): Thin section photomicrograph showing minor amounts of secondary porosity which resulted from fracturing. Plane polarised light. Scale bar = 200 μm.

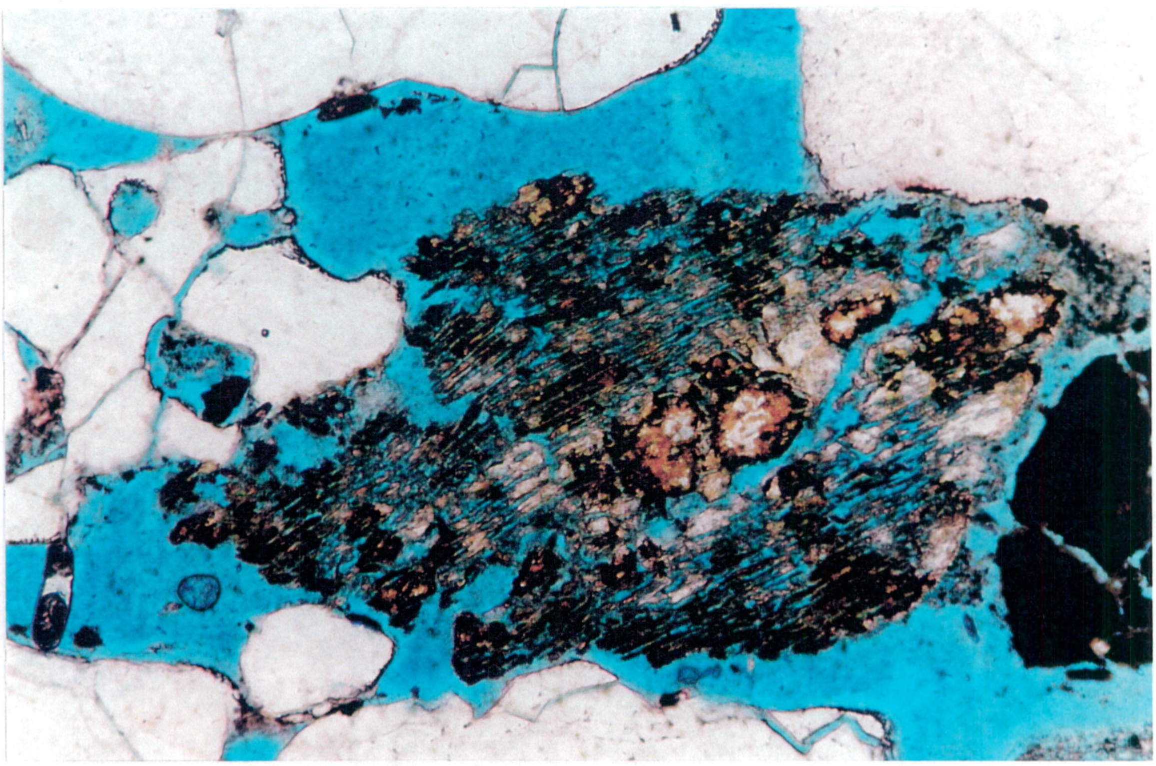


Plate 14: (Sample # 13, 1451.66 m): Thin section photomicrograph of subarkose showing minor secondary porosity as a result of partial to complete dissolution of potassium feldspar (yellow). Potassium feldspar displays sieve to skeletal structure providing good interconnection to pore spaces. Plane polarised light. Scale bar = 200 μm.

APPENDIX I

THIN SECTION DESCRIPTIONS

SAMPLE: **NO. 3 (1449.25 m)**

Lithology: Quartz Arenite

Texture: Creamy, grain supported, small scale to ripple cross stratification, moderately to well sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Minor authigenic minerals and very good 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 (69.2%) and trace polycrystalline quartz (1.2%). Traces of potassium feldspar are present (0.6%). Lithic fragments are also trace components (1.4%). Authigenic minerals comprise pyrite (5.4%) with traces of kaolinite (0.4%) and quartz (0.4%). There are good amounts of visible porosity (20.8%).

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.

The amount of visual porosity (Plate 15) in this sample is relatively high (20.8%) most of which is primary intergranular porosity. Secondary porosity is less common and resulted from partial dissolution of potassium feldspar and alteration of ductile lithic grains. 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 minor sylvite (drilling mud) and traces of pyrite (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and traces of mica (muscovite) (Table 7 and Appendix II).

ESEM: ESEM photomicrographs indicate that pores are large and very well interconnected in a 3-D network giving very good permeability (Plates 16 and 17).

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.
- Later in the diagenetic history, large cubic crystalline pyrite has occurred as pore filling around thin coal beds, organic-rich detrital matrix and coalified wood materials.

Env. Deposition: The sorting and moderate rounding in this coarse-grained sandstone suggests deposition in a moderate to high energy environment. Possible environments include braided fluvial mid-channel bar.

Res. Potential: Visible porosity is high (20.8%) and the pores are well interconnected in a 3-D network giving a high permeability. The reservoir quality is excellent.

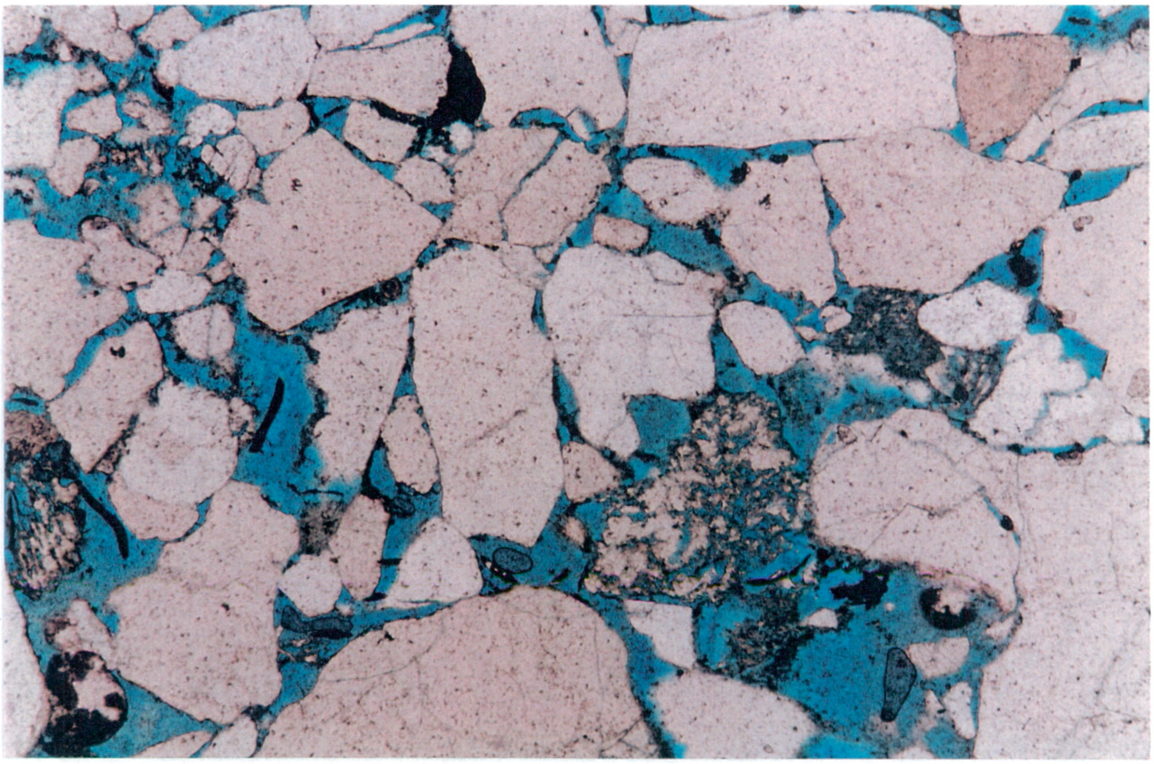


Plate 15A: Sample # 3 (1449.25 m): Thin section photomicrograph showing generalised view of moderately to well sorted, angular to rounded coarse-grained sandstone with considerable amounts of intergranular porosity. Plane polarised light. Scale bar = 500 μm.

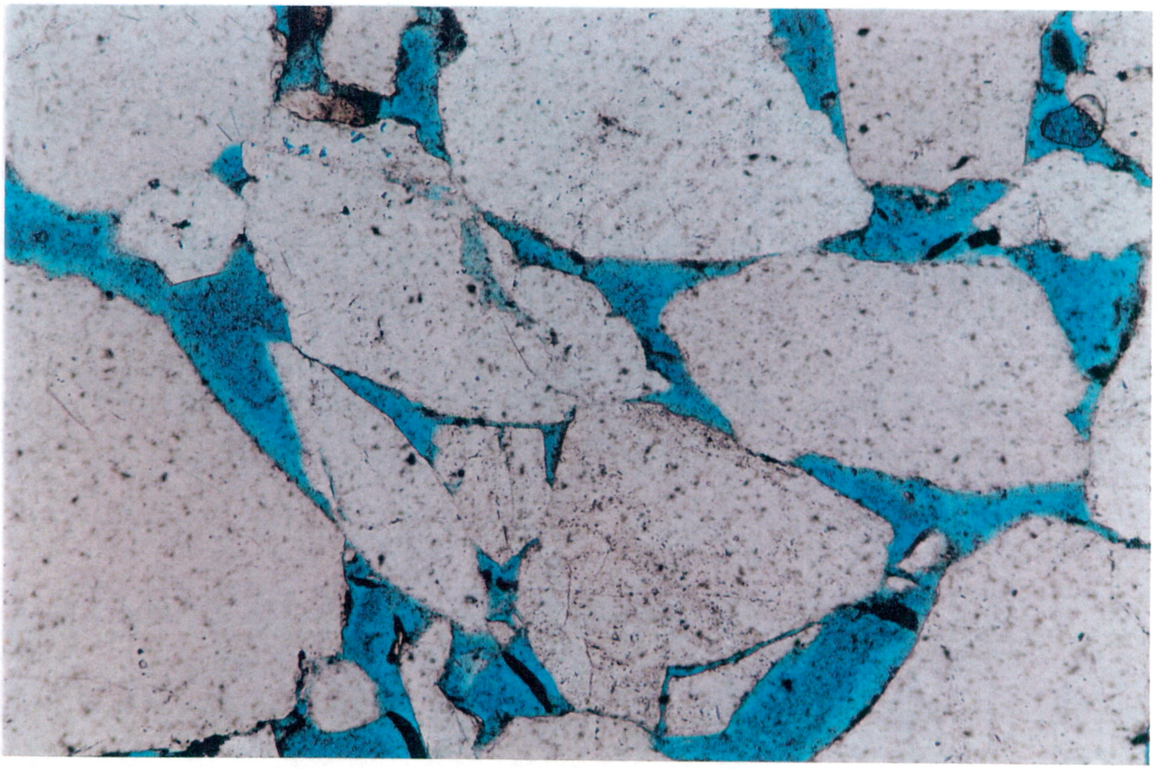


Plate 15B: Sample # 3 (1449.25 m): Thin section photomicrograph showing triangular pore spaces between authigenic and detrital grains, implying that most of the visual porosity in this sample is primary intergranular in origin. Plane polarised light. Scale bar = 200 μm.

Plate 16: Sample # 3 (1449.25 m): ESEM photomicrograph showing a general view of the sample. ESEM indicates that pores are large and very well interconnected in a 3-D network giving very good permeability. Scale bar = 100 µm.

Plate 17: Sample # 3 (1449.25 m): ESEM photomicrograph showing large pore space and pore throat. Both are well interconnected in 3-D giving high permeability. Scale bar = 100 µm.

SAMPLE: **NO. 10 (1451.06 m)**

Lithology: Quartz Arenite

Texture: The sample depicts a creamy, grain supported, small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are mainly angular to rounded. Trace authigenic minerals and high visual porosity. Porosity is patchily distributed and comprises mainly primary intergranular pores.

Composition: Monocrystalline quartz is the dominant framework component (71.8%) with trace amounts of polycrystalline quartz grains (0.2%) and metamorphic lithic grains (0.2%). Potassium feldspar is present in trace amounts (1.2%). Depositional matrix and organic matter are trace components in this sample comprising 1% and 0.6% respectively. Authigenic minerals are trace and dominated by pyrite (1.2%), authigenic kaolinite (0.4%) and quartz (0.2%). There are very good amounts of visual porosity (20.6%).

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.

Porosity is very high in this sample and scattered throughout, usually as triangular pores between detrital and authigenic minerals (Plate 18). This suggests that the porosity is largely intergranular primary. The sample also contains drilling mud (Plate 18) which has probably largely invaded the sample during drilling.

XRD: Quartz is the dominant component with minor potassium feldspar traces of kaolinite, pyrite and ankerite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and traces of mica (muscovite), (Table 7 and Appendix II).

ESEM: The pores in these moderately sorted quartz arenite grains are large and interconnected by relatively large pore throats (Plate 19). Authigenic clays could not be detected. The pores are well interconnected in a 3-D network giving good permeability (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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

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 (20.6%). Compaction rather than cementation, was the main agent responsible for reducing the intergranular primary porosity.

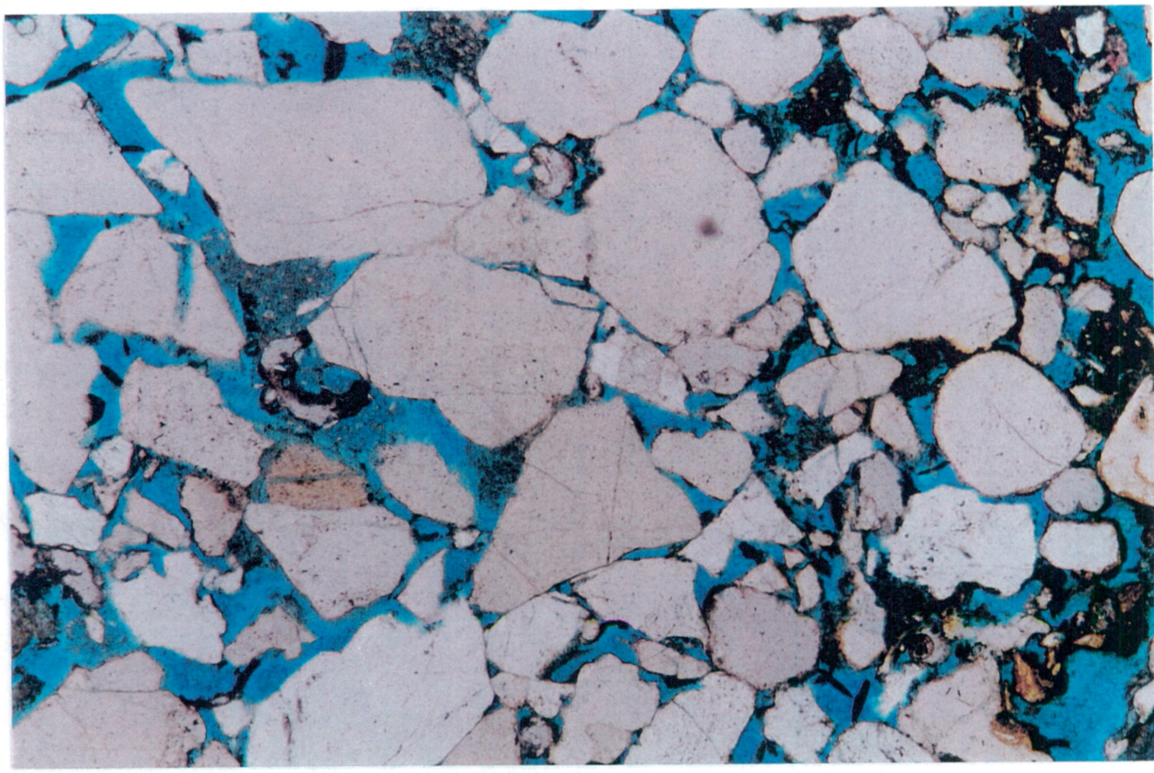


Plate 18A: Sample # 10 (1451.06 m): Thin section photomicrograph showing generalised view of moderately sorted, angular to subrounded coarse-grained sandstone with considerable amounts of intergranular porosity. The yellow materials are drilling mud (sylvite, yellow). Plane polarised light. Scale bar = 500 μm.

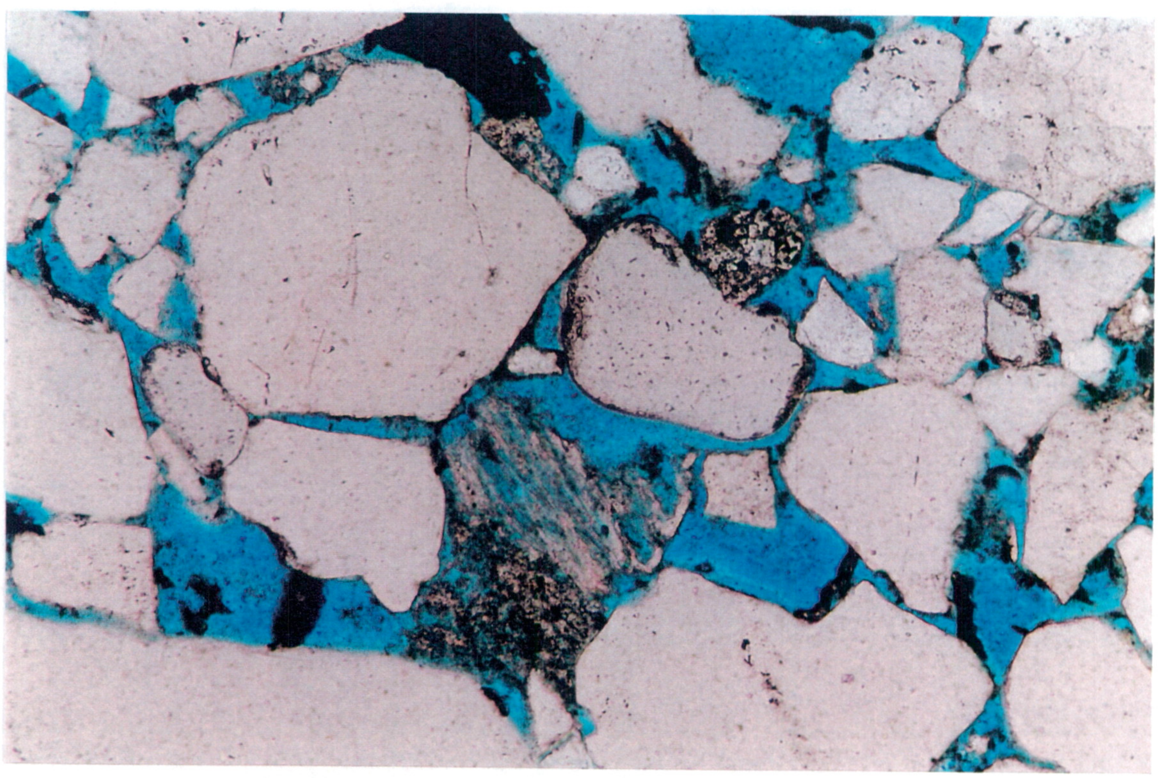


Plate 18B: Sample # 10 (1451.06 m): Thin section photomicrograph showing triangular pore and minor secondary porosity. Secondary porosity has resulted from partial to complete dissolution of feldspar. Plane polarised light. Scale bar = 200 μm.

ACS LABORATORIES PTY. LTD.

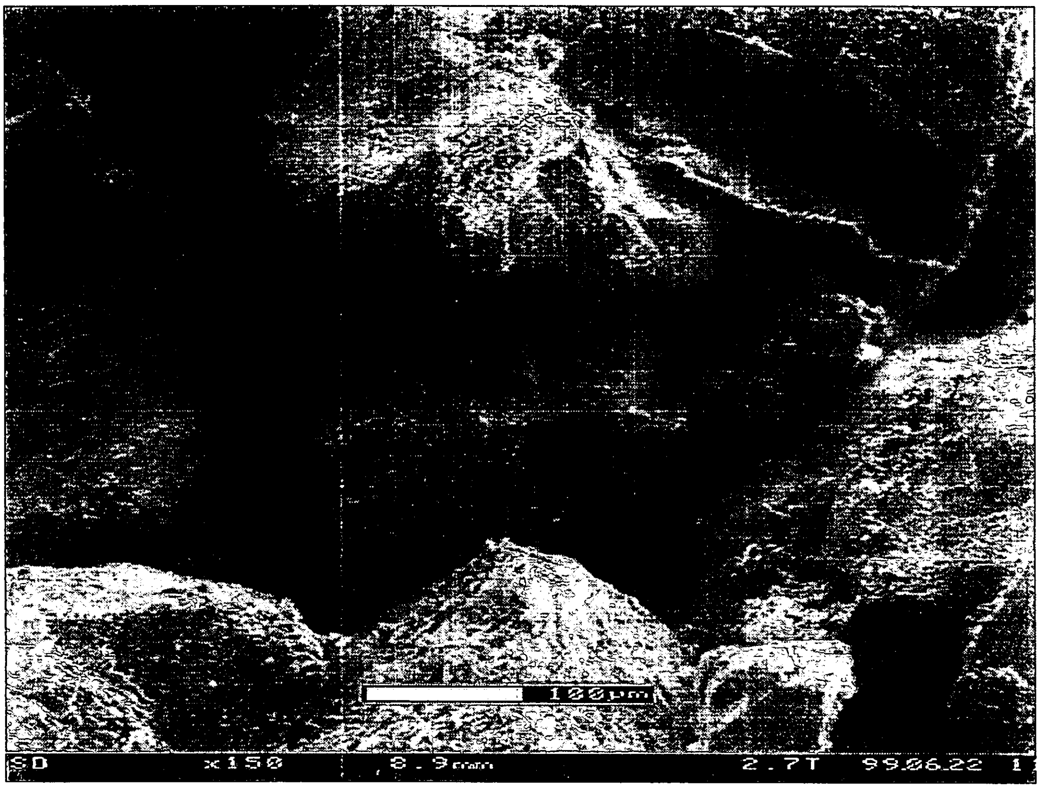


Plate: 19: Sample # 10 (1451.06 m): ESEM photomicrograph showing general view of the sample. Note the pores and pore throat are still interconnected giving high permeability. Scale bar = 100 µm.

Plate: 20: Sample # 10 (1451.06 m): ESEM photomicrograph showing large pore spaces. Note that the pore throat connecting the pore spaces giving very high porosity. Scale bar = 200 µm.

SAMPLE: **NO. 13 (1451.66 m)**

Lithology: Subarkose

Texture: Creamy, grain supported, small scale cross stratification, well sorted, coarse-grained sandstone. Quartz grains are subangular to rounded. Trace authigenic minerals and very good visual porosity.

Composition: The dominant framework component is monocrystalline quartz (63%). Polycrystalline quartz grains (1.2%) and lithic fragments (1.2%) are present in trace amounts. Potassium feldspar is present in minor amounts (5.2%). Mica is a trace component. Authigenic minerals comprise pyrite (1.2%) and traces of authigenic kaolinite (0.2%), and quartz (2.6%). There are very high amounts of visible porosity (27.2%).

Monocrystalline quartz displays strongly undulose extinction with some of the quartz grains containing fluid, igneous inclusions or needle-like minerals and biotite.

There is a very high amount of porosity (27.2%) evident in this sample, mostly as scattered primary pores between detrital and authigenic minerals (Plate 21).

XRD: The sample is dominated by quartz, with traces of sylvite (drilling mud), potassium feldspar and pyrite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite with traces of mica (muscovite), (Table 7 and Appendix II).

ESEM: ESEM photomicrographs indicate that this sample has a very high macro porosity. The pores are interconnected in a 3-D network giving good permeability (Plates 22 and 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 during the early sulphate reduction.

- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The coarse grain size, well 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 excellent. Visible porosity is very high in the sample (27.2%) with primary porosity being more common than secondary porosity. The primary pores have been partly reduced in size by mechanical compaction. The pores are well interconnected giving a good permeability.

ACS LABORATORIES PTY. LTD.

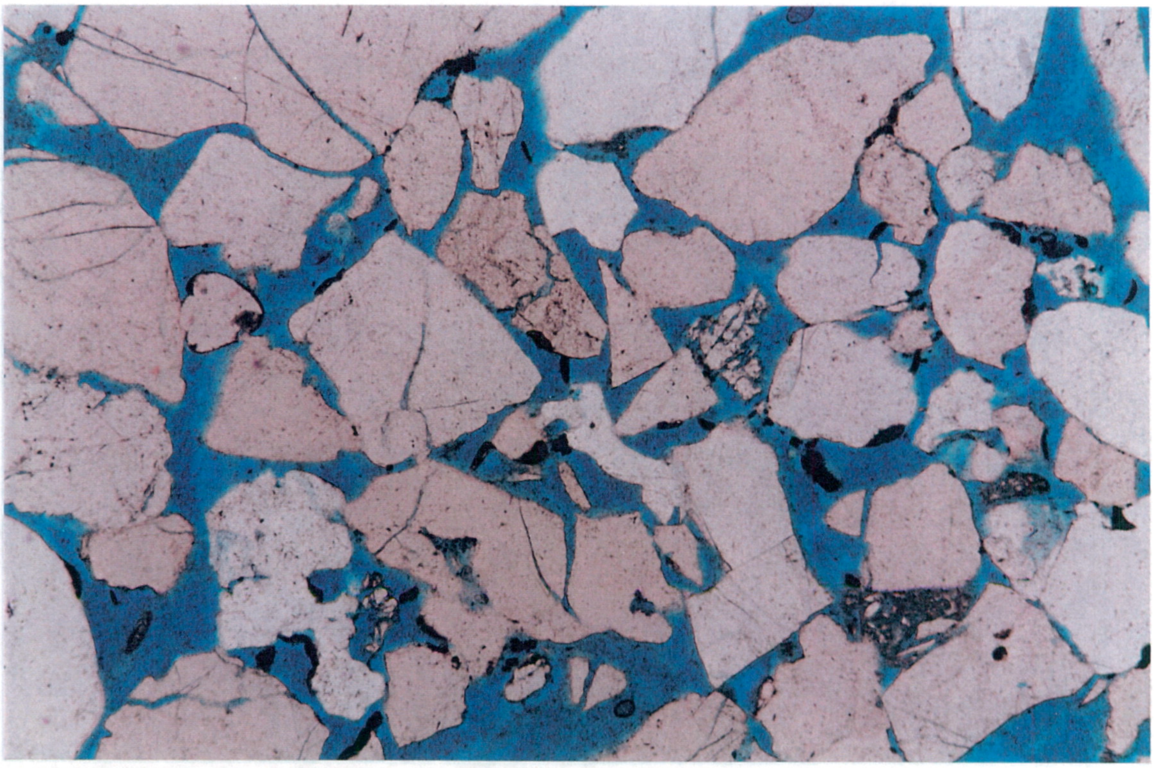


Plate 21A: Sample # 13 (1451.66 m): Thin section photomicrograph of subarkose comprising well sorted, subangular to rounded very coarse-grained sandstone with a very high proportion of intergranular porosity (blue). Plane polarised light. Scale bar = 500 μm.

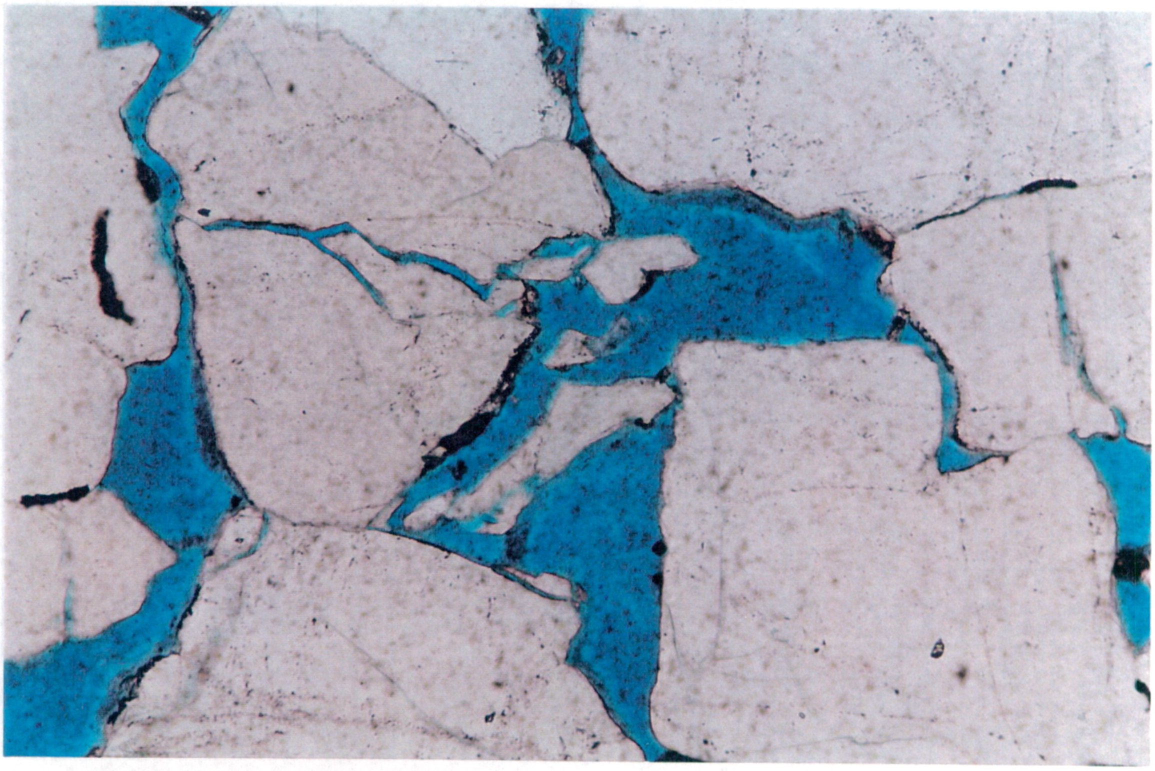


Plate 21B: Sample # 13 (1451.66 m): Thin section photomicrograph showing triangular primary intergranular porosity. The sample is subarkose with minor amounts of secondary porosity (fracture). Plane polarised light. Scale bar = 200 μm.

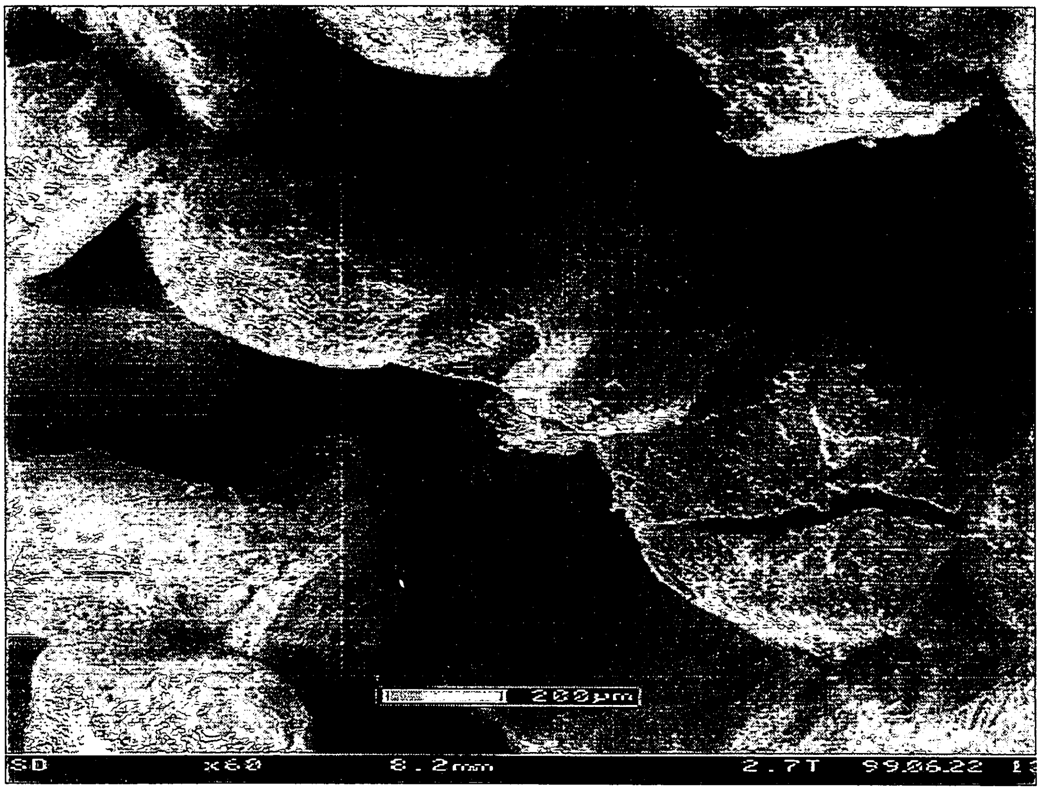


Plate 22: Sample # 13 (1451.66 m): ESEM photomicrograph showing general view of the sample. The sample contains large pores and pore throat with minor secondary porosity resulting from fracturing. The pores are interconnected in a 3-D network giving good permeability. Scale bar = 200 µm.

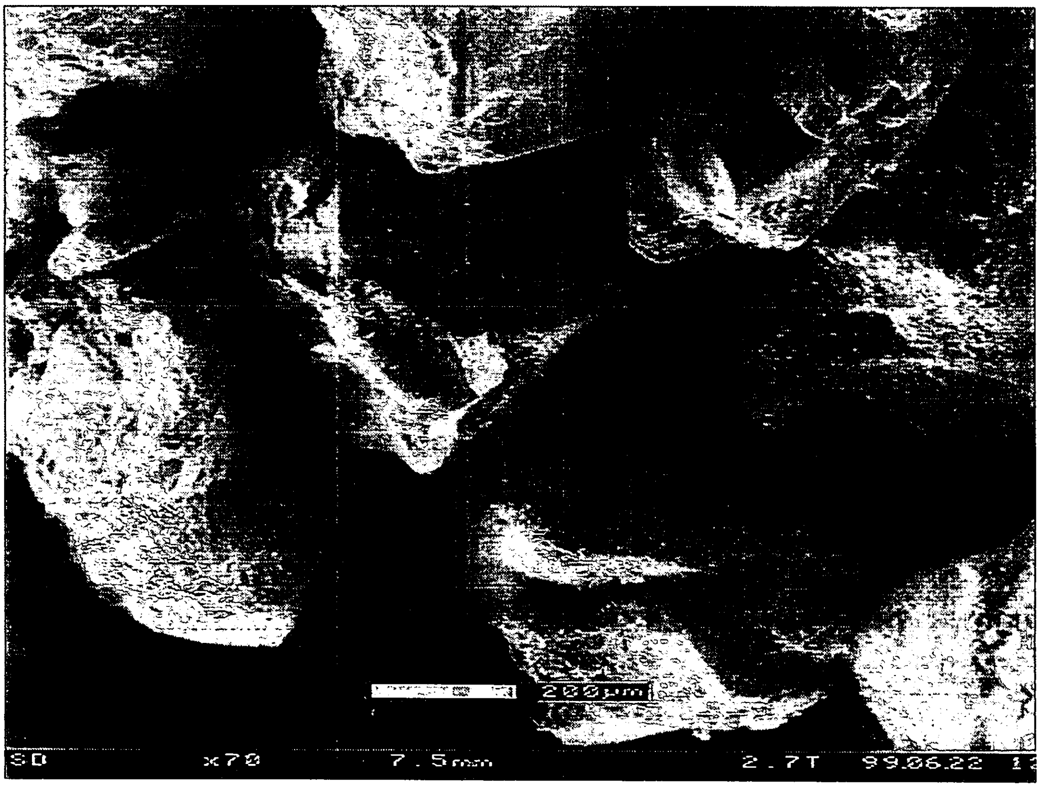


Plate 23: Sample # 13 (1451.66 m): ESEM photomicrograph showing very large pore spaces. The pore throats are well interconnected giving high permeability. Scale bar = 200 µm.

SAMPLE: **NO. 17 (1452.25 m)**

Lithology: Quartz Arenite

Texture: The sample cut is creamy, grain supported, horizontal to small scale cross stratification, well sorted, coarse-grained sandstone. Quartz grains are mainly subangular to rounded. Trace authigenic minerals and high visual porosity.

Composition: The sample is dominated by monocrystalline quartz (68.2%) with traces of minor polycrystalline quartz grains (1%), lithic fragments (0.6%). Potassium feldspar is a minor component (3%). Authigenic minerals comprise authigenic kaolinite (2%), pyrite (1.4%) and traces of quartz (0.2%). There are very good amounts of visible porosity (23.4%) 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.

Porosity is scattered throughout the sample (23.4%), usually as triangular pores between detrital and authigenic minerals (Plate 24). Secondary porosity is less common than the primary pores. It includes enlarged pores and elongated pores providing moderate connections between the larger pores.

XRD: The sample is dominated by quartz, minor potassium feldspar and traces of kaolinite and sylvite (drilling mud) (Table 6, and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and mica (muscovite), (Table 7 and Appendix II).

ESEM: No ESEM photos were taken for this sample. The sample is highly friable.

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.
- Later in the diagenetic history, large cubic crystalline pyrite has occurred as pore filling around thin coal beds, organic-rich detrital matrix and coalified wood materials.

Env. Deposition: The well sorting and moderate rounding nature in this 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 (23.4%). Compaction has contributed by up to 33% of the porosity loss while cementation has occluded around 9% of the original intergranular porosity. The sample has very good reservoir characteristics.

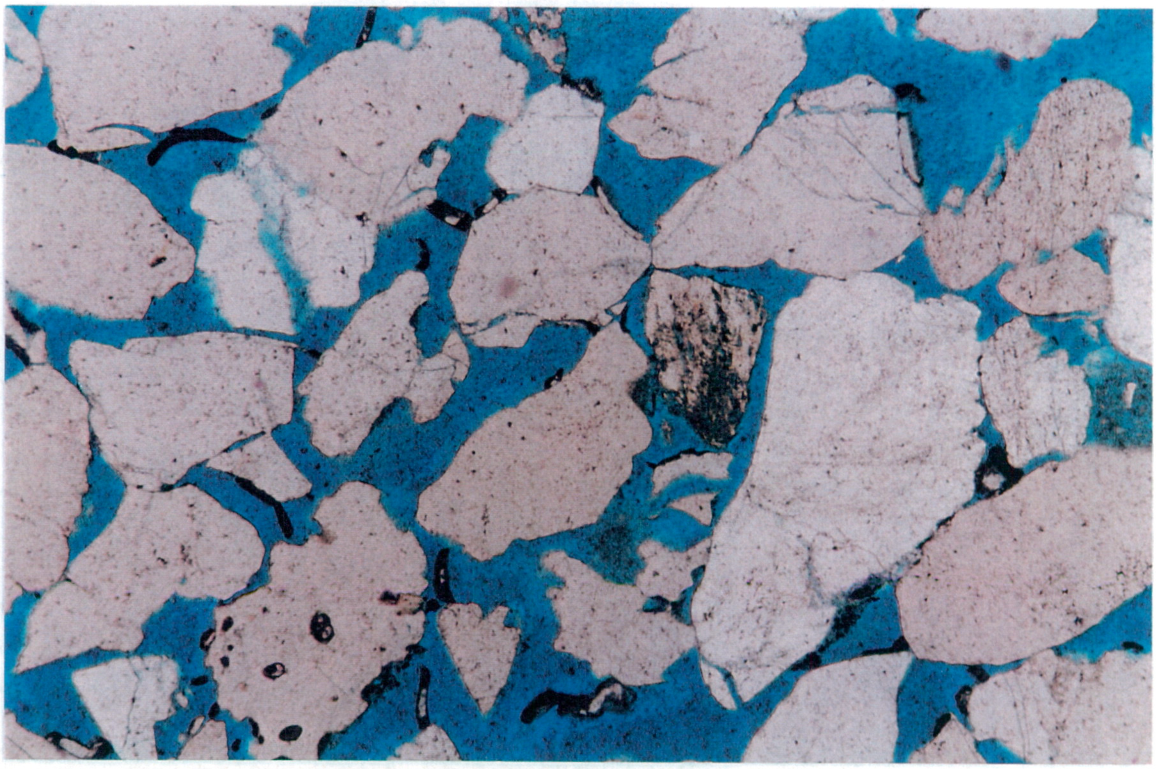


Plate 24A: Sample # 17 (1452.25 m): Thin section photomicrograph showing general view of coarse-grained, well sorted quartz arenite with good amounts of primary intergranular porosity (blue). Plane polarised light. Scale bar = 500 μm.

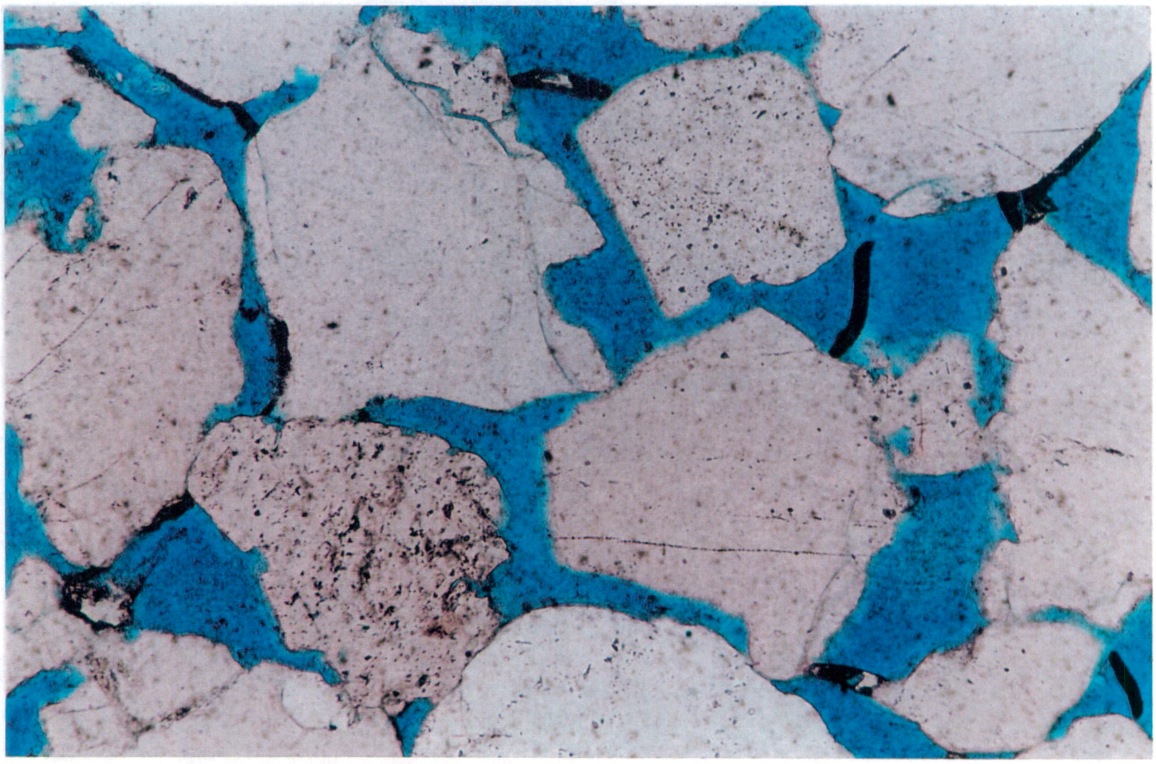


Plate 24B: Sample # 17 (1452.25 m): Thin section photomicrograph of quartz arenite with high amounts of visual porosity. Plane polarised light. Scale bar = 200 μm.

SAMPLE: **NO. 29 (1454.05 m)**

Lithology: Subarkose

Texture: The sample consists of creamy, grain supported, horizontally laminated to small scale cross stratification, well sorted, coarse-grained sandstone. Quartz grains are subangular rounded. Trace authigenic minerals and very good visual porosity.

Composition: Monocrystalline quartz is the main framework component and constitutes 64.6% of the sample. Polycrystalline quartz grains are trace (1.2%). Minor amounts of potassium feldspar are present (5%). Lithic fragments are present also in minor amounts (2%) and dominated by metamorphic micaceous schist (1.2%) and rounded sedimentary chert (0.8%). Authigenic minerals comprise authigenic kaolinite (2.2%) and pyrite (1.6%). Visible porosity is present in high amounts in the sample (23.4%).

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 25). It occurs as both intergranular primary and secondary in origin. Secondary porosity is less common and originated by partial dissolution of feldspar, mica and ductile rock fragments.

XRD: Quartz is the dominant component of this sample with minor potassium feldspar and traces of sylvite (drilling mud) and pyrite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite minor muscovite and traces of chlorite (Table 7 and Appendix II).

ESEM: No ESEM photos, the sample is highly friable.

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.

- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The probable depositional environment of this sample is braided fluvial.

Res. Potential: The sample has a very good reservoir quality (23.4%). Mechanical compaction rather than precipitation of authigenic minerals apparently have affected the reservoir quality in this sample.

ACS LABORATORIES PTY. LTD.

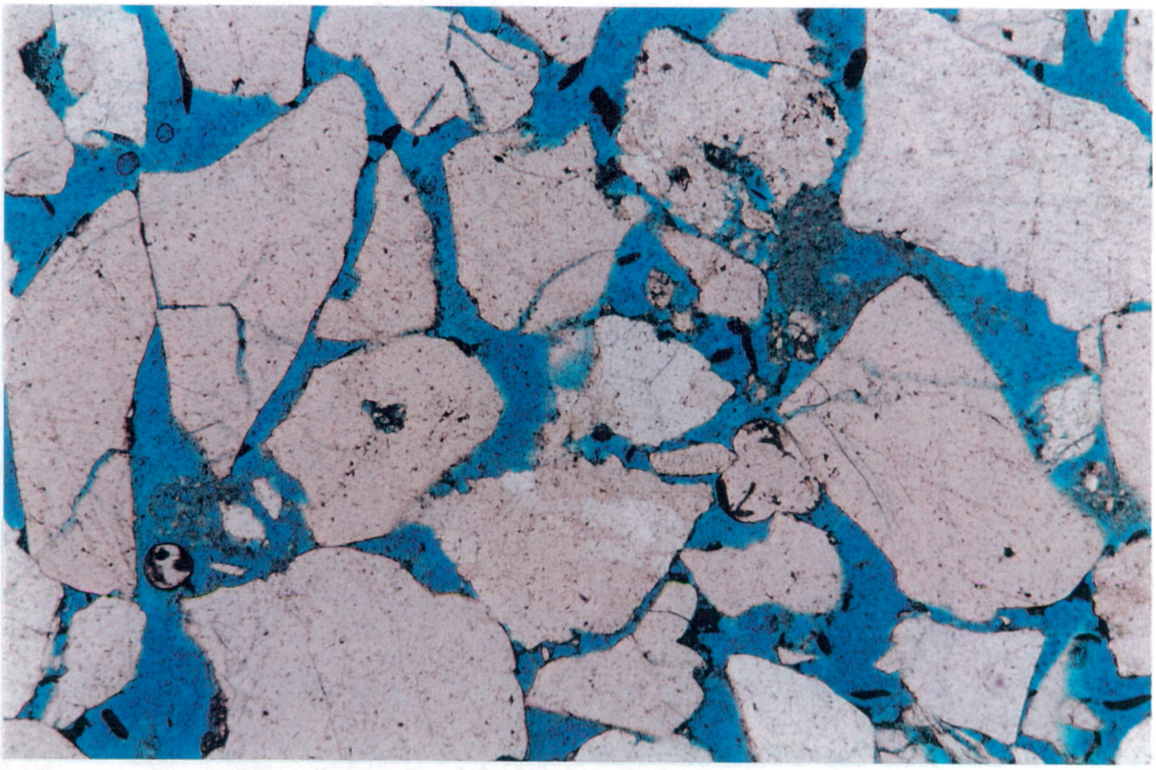


Plate 25A: Sample # 29 (1454.05 m): Thin section photomicrograph showing general view of subarkose comprising well sorted, subangular to rounded coarse-grained sandstone with high visual porosity. Plane polarised light. Scale bar = 500 μm.

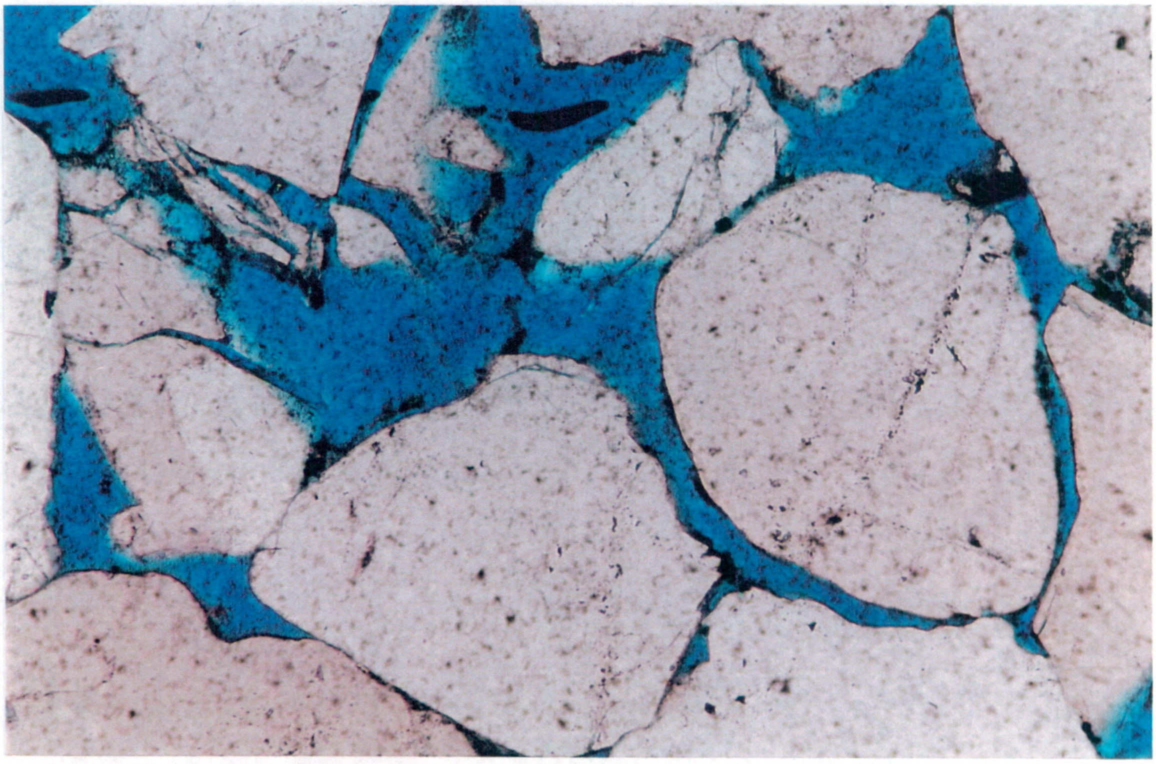


Plate 25B: Sample # 29 (1454.05 m): Thin section photomicrograph showing high triangular visual porosity, implying that most of it has originated as primary intergranular porosity. Plane polarised light. Scale bar = 200 μm.

SAMPLE: **NO. 33 (1455.40 m)**

Lithology: Subarkose

Texture: The sample is a creamy, grain supported, horizontal to small scale cross stratification, well sorted, medium-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.

Composition: The sample is dominated by monocrystalline quartz (63.8%). Polycrystalline quartz is trace (0.8%). Potassium feldspar (4.4%) and lithic fragments (3.6%) are present in minor amounts. Accessory minerals are mainly tourmaline and zircon. Authigenic minerals are minor and comprise kaolinite (2.6%) and traces of pyrite (0.2%). There are good amounts of visible porosity (24%).

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 26). This suggests that the porosity is largely intergranular primary. Secondary porosity is less common than in the primary pores (Plate 26). It includes enlarged and elongated pores providing moderate connections between the larger pores. Secondary porosity was formed by minor dissolution of potassium feldspar, ductile rock fragments and micas.

XRD: The sample is dominated by quartz, minor sylvite (drilling mud) and traces of kaolinite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite, and traces of mica (muscovite), chlorite and smectite (Table 7 and Appendix II).

ESEM: Pores and pore throat are large and present in significant amounts. They are well connected in 3-D network giving high permeability (Plates 27 and 28).

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 during the early sulphate reduction.

- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

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 (24%). 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.

ACS LABORATORIES PTY. LTD.

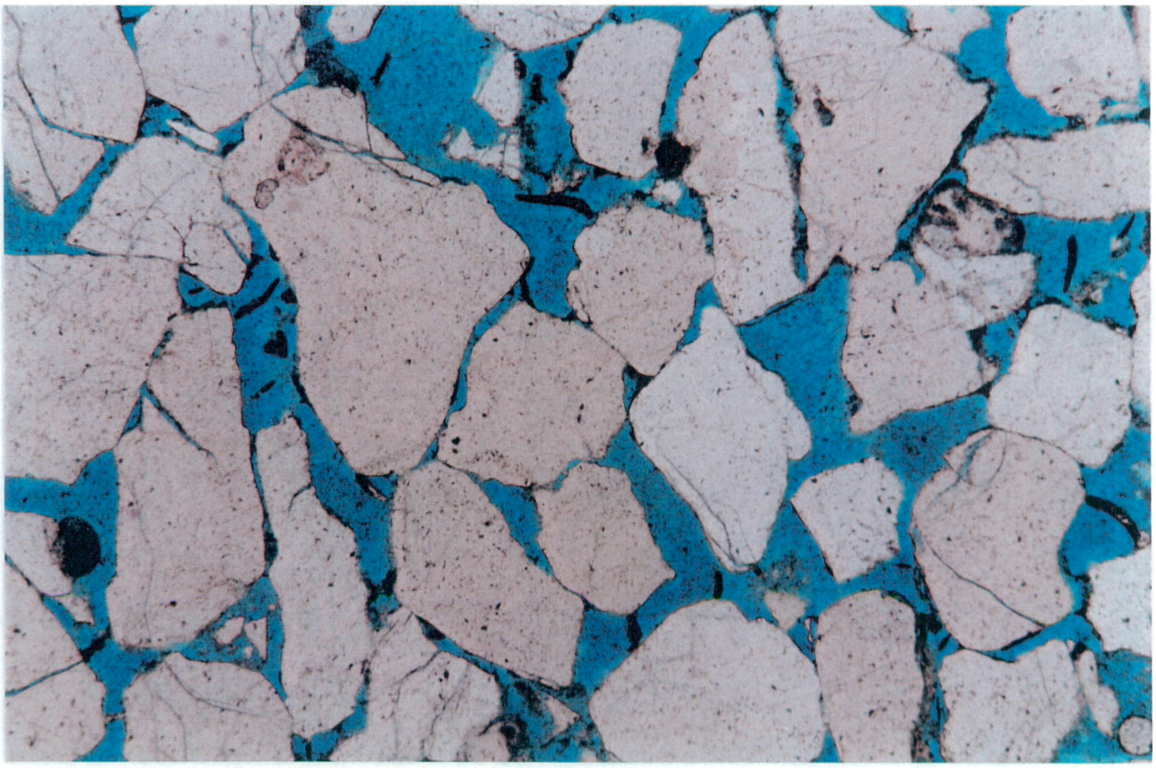


Plate 26A: Sample # 33 (1455.40 m): Thin section photomicrograph showing general view of subarkose with significant amounts of visible porosity. Note the triangular shape of the visible porosity suggesting primary intergranular origin. Note also the dissolution of potassium feldspar and secondary porosity. Plane polarised light. Scale bar = 500 μm.

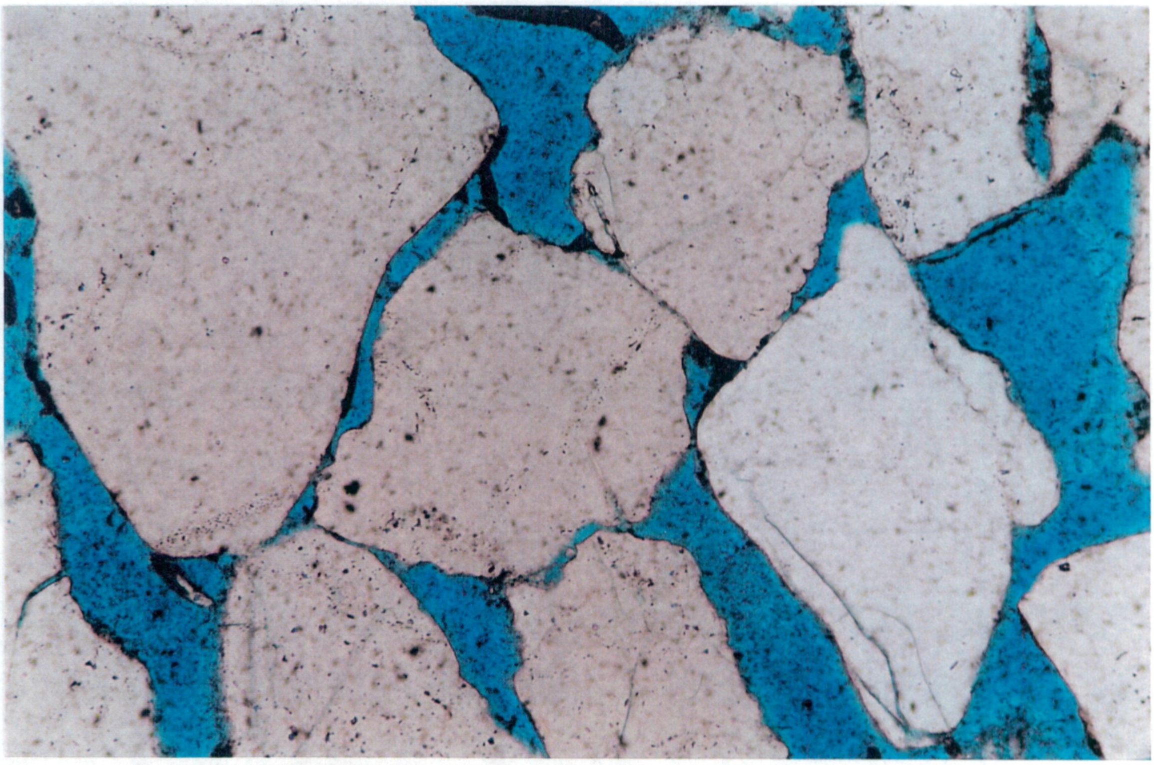


Plate 26B: Sample # 33 (1455.40 m): Enlarged view of Plate 26A. Plane polarised light. Scale bar = 200 μm.

Plate 27: Sample # 33 (1455.40 m): ESEM photomicrograph showing general view of the sample with high amounts if visual porosity. The pores are well interconnected giving high permeability in 3-D dimensions. Scale bar = 200 µm.

Plate 28: Sample # 33 (1455.40 m): ESEM photomicrograph showing large pore space > 300 µm. Scale bar = 100 µm.

SAMPLE: **NO. 47 (1457.75 m)**

Lithology: Subarkose

Texture: The sample is creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are subangular to rounded. Trace authigenic minerals and high visual porosity.

Composition: Monocrystalline quartz is the dominant framework component of this sample (65%). Polycrystalline quartz grains (2%) and potassium feldspar (3.8%) are minor components. Lithic fragments (1%) are present in trace amounts. Authigenic minerals comprise kaolinite (2%) and traces of pyrite (0.2%). There are high amounts of visible porosity (26%) in the sample (Plate 29).

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.

There is a high visual porosity (when the thin section is held to the light, Plate 29). 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 feldspar and ductile rock fragments.

XRD: The sample is dominated by quartz minor sylvite (drilling mud), and traces of potassium feldspar, kaolinite and pyrite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and minor mica (muscovite), and traces of chlorite and smectite, (Table 7 and Appendix II).

ESEM: The moderately sorted coarse-grained subarkose contains very high amounts of macro pores (Plate 30). The pores are well interconnected providing very high permeability and reservoir quality (Plate 31).

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The coarse 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 26%.

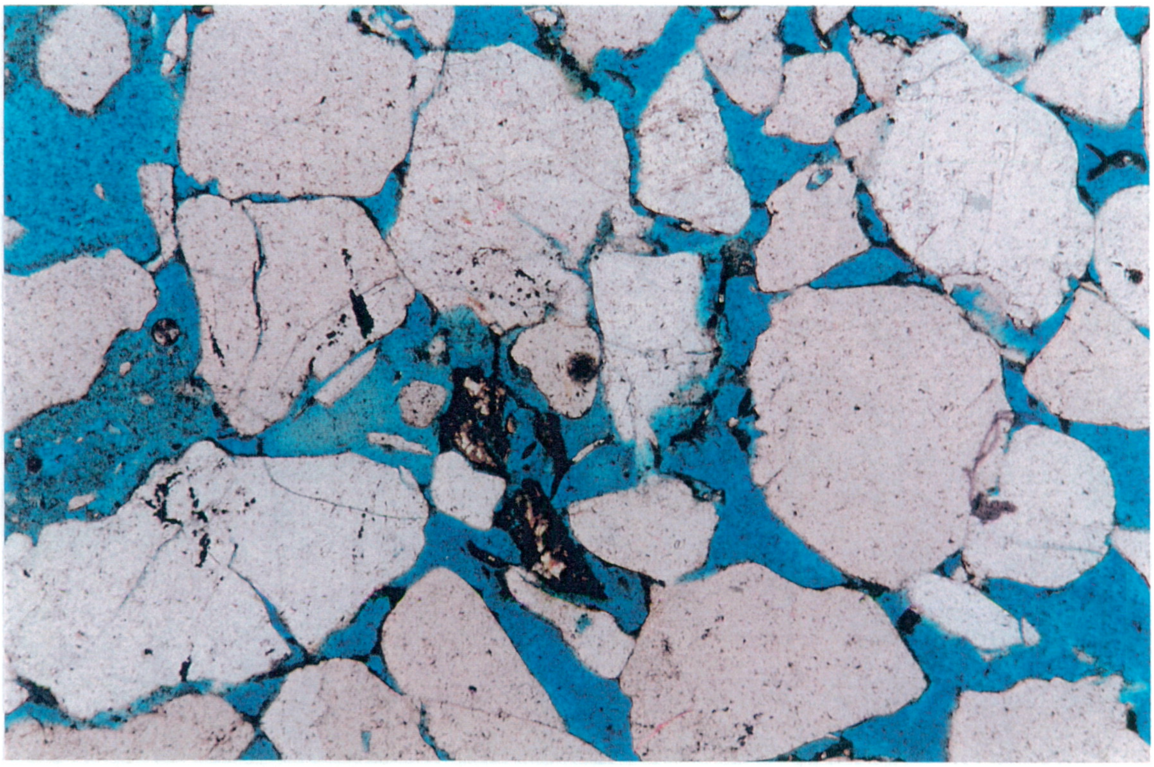


Plate 29A: Sample # 47 (1457.75 m): Thin section photomicrograph showing general view of subarkose comprising moderately sorted, subangular to rounded coarse-grained sandstone. Note the presence of drilling mud between detrital grains. Plane polarised light. Scale bar = 500 μm.

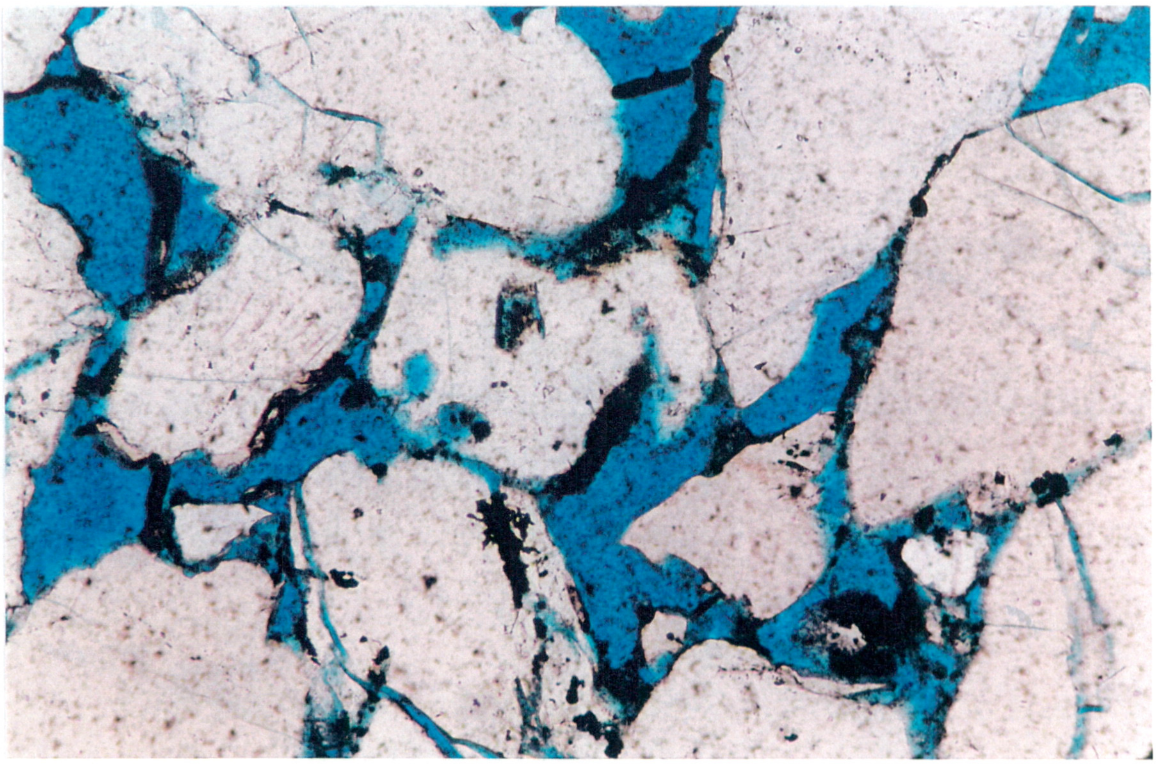


Plate 29B: Sample # 47 (1457.75 m): Thin section photomicrograph showing drilling mud (black) filling the pore spaces and lining the detrital grains. Plane polarised light. Scale bar = 200 μm.

ACS LABORATORIES PTY. LTD.

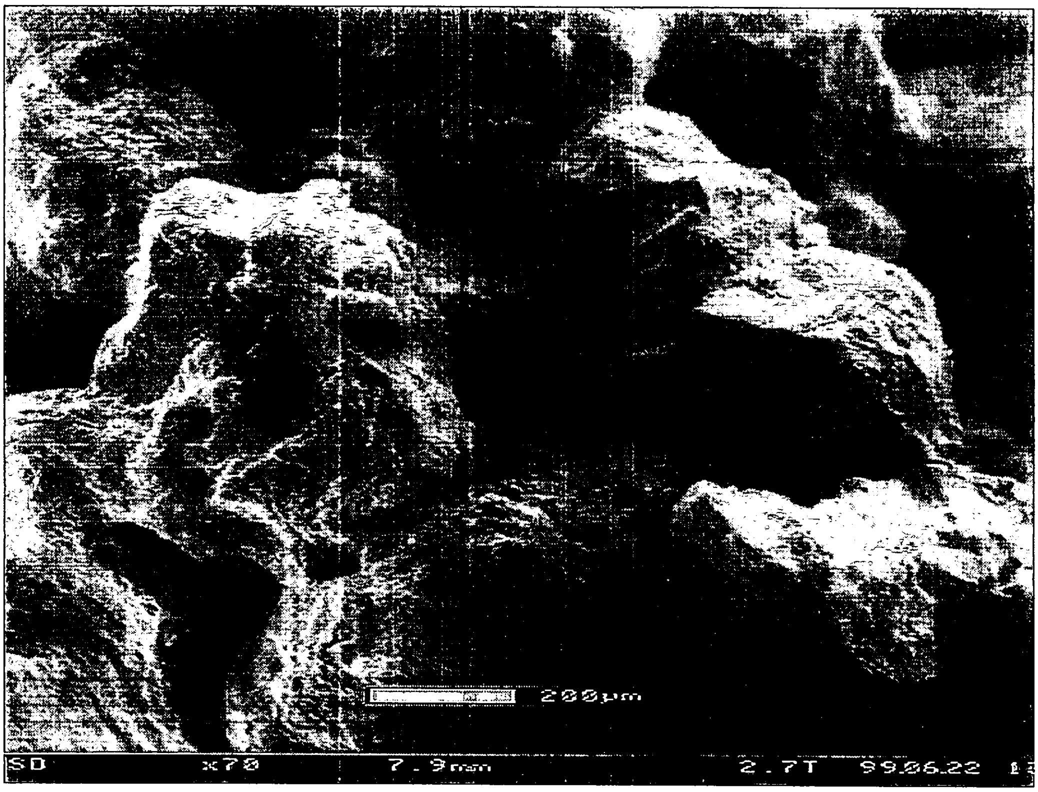


Plate 30: Sample # 47 (1457.75 m): ESEM photomicrograph showing general view of the sample. The sample contains high amounts of visual porosity. The pores are well connected providing good permeability. Scale bar = 200 µm.

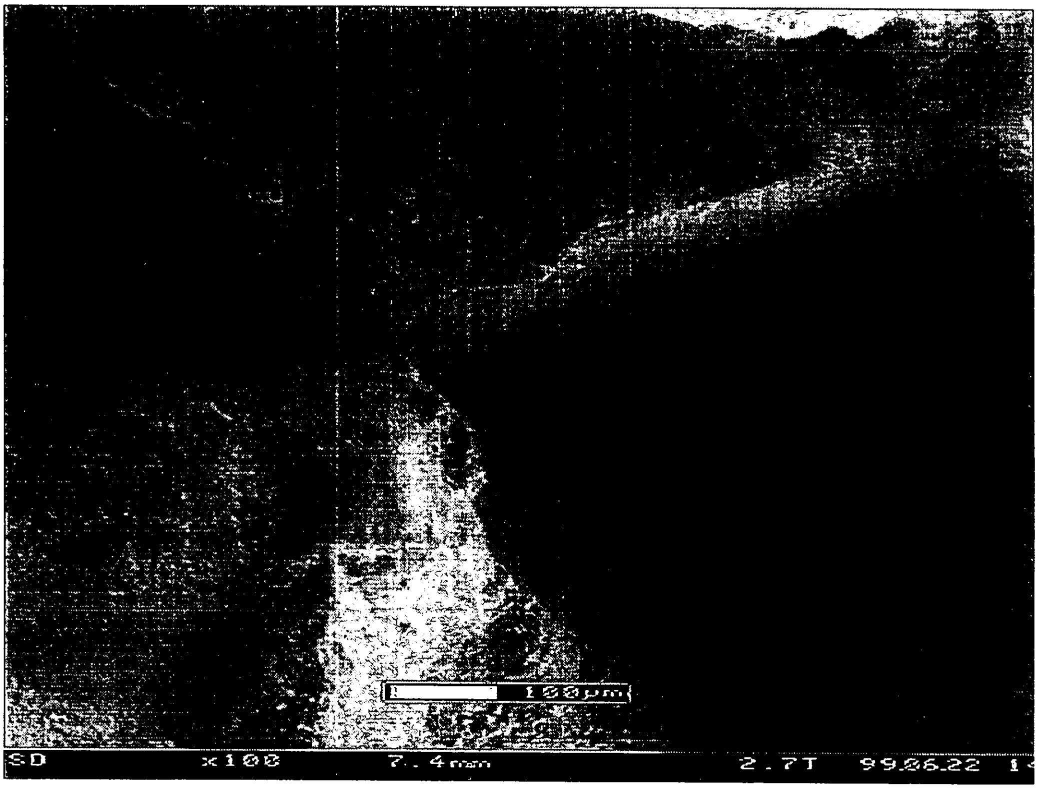


Plate 31: Sample # 47 (1457.75 m): ESEM photomicrograph showing large pore spaces. They are well interconnected giving high 3-D permeability. Scale bar = 100 µm.

SAMPLE: **NO. 59 (1459.89 m)**

Lithology: Subarkose

Texture: The sample consists of creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.

Composition: The framework components of this sample are dominated by monocrystalline quartz (62.4%), minor polycrystalline quartz (4%), feldspar (5.4%) and lithic fragments (2.2%). Authigenic minerals are dominated by kaolinite (3.2%) and traces of pyrite (0.2%). There are good amounts of visible porosity in this sample (22.4%).

Monocrystalline quartz exhibits strong undulose extinction with few grains showing straight undulose extinction.

Visible porosity is good (Plate 32) most of which is primary in origin.

XRD: Quartz are dominant with major kaolinite, and traces of potassium feldspar, sylvite (drilling mud), kaolinite and pyrite (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and minor amounts of mica (muscovite) and traces of chlorite and smectite, (Table 7 and Appendix II).

ESEM: The pores and pore throat are large and present in significant amounts (Plate 33). ESEM photomicrographs show that the pores are well interconnected in a 3-D network giving good permeability (Plates 33 and 34) and reservoir quality.

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The coarse sand size detrital grains in this sample range from angular to rounded and moderately sorted. These features suggest deposition in a moderate to high energy environment. The environment of deposition was most probably braided fluvial bar.

Res. Potential: The sample shows a good reservoir potential with high visible porosity (22.4%). The porosity is well interconnected in a 3-D network giving a good permeability and reservoir quality.

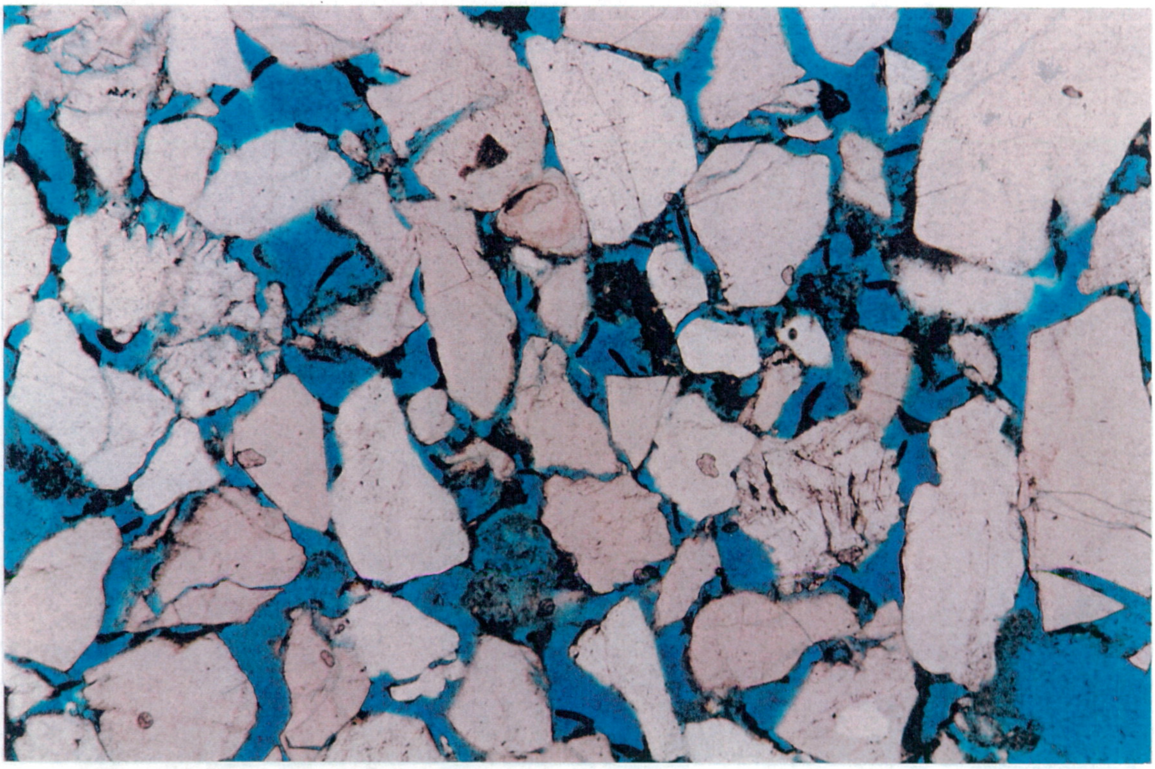


Plate 32A: Sample # 59 (1459.89 m): Thin section photomicrograph showing general view of subarkose. The sample comprises moderately sorted coarse–grained sandstone. High visible porosity and excellent reservoir quality with trace to minor amounts of drilling mud. Plane polarised light. Scale bar = 500 μm.

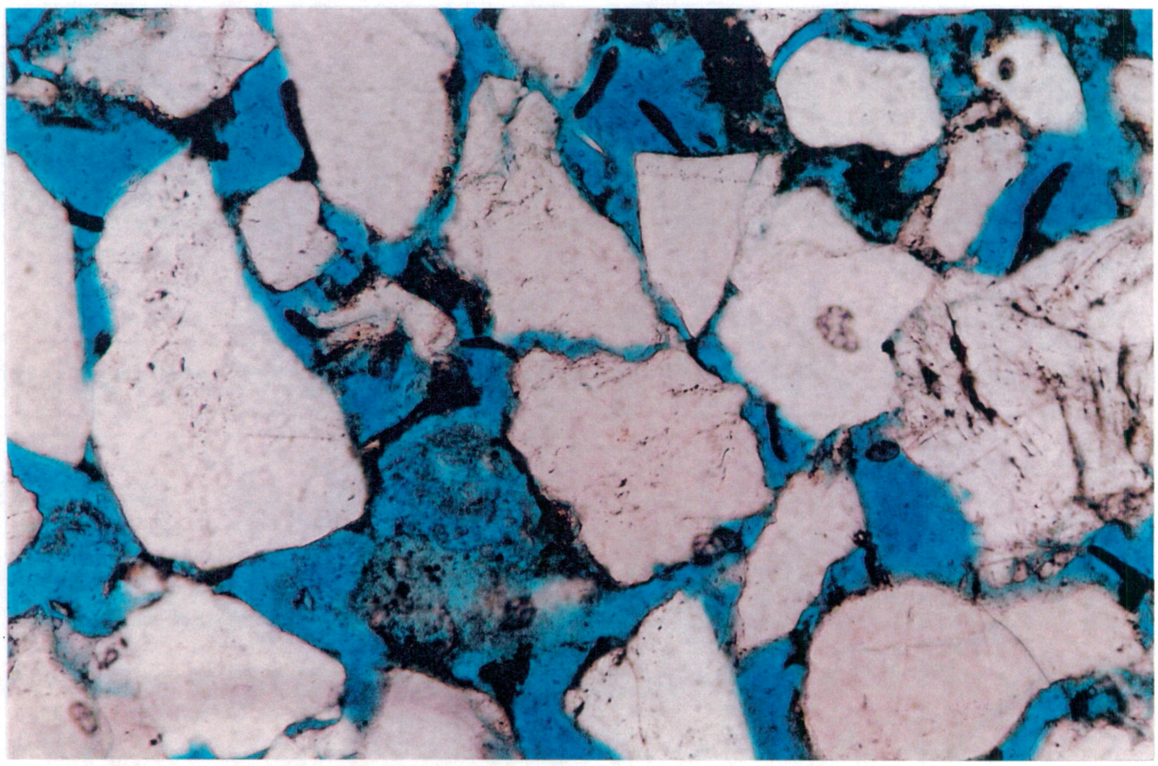


Plate 32B: Sample # 59 (1459.89 m): Enlarged view of Plate 32A. Plane polarised light. Scale bar = 200 μm.

ACS LABORATORIES PTY. LTD.

Plate 33: Sample # 59 (1459.89 m): ESEM photomicrograph showing general view of the sample. The pores are partially filled with drilling mud. The pores and pore throat are well connected giving a very good permeability. Scale bar = 100 μm.

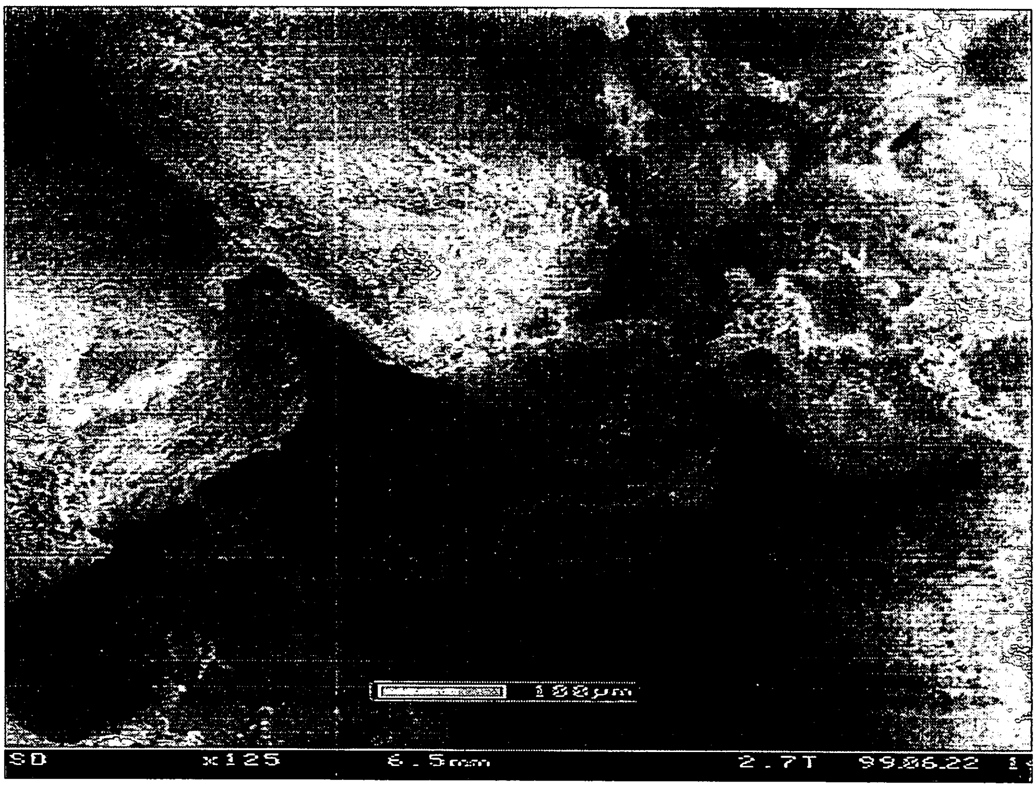


Plate 34: Sample # 59 (1459.89 m): ESEM photomicrograph showing well connected pore spaces and pore throat giving high permeability and reservoir quality. Scale bar = 100 μm.

SAMPLE: **NO. 66 (1463.50 m)**

Lithology: Subarkose

Texture: Creamy, grain supported, horizontal to small scale cross stratification, poorly sorted, very coarse-grained sandstone. Quartz grains are 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 (64.8%) and trace polycrystalline quartz (1%) Potassium feldspar (2.4%) and lithic fragments (1.8%) are minor components. Depositional matrix is present in significant amounts (12.8%) and comprises organic-rich silty to very fine-grained sandstone. Dispersed organic matter and coalified wood and coal thin laminae are present in minor amounts (2.4%). Mica (muscovite) is present as a trace component (0.4%). Authigenic minerals comprise kaolinite (1.4%) and traces of pyrite (1.2%). There are moderate amounts of visible porosity (11.6%).

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.

The amount of visual porosity (Plate 35) in this sample is moderate (11.6%). Secondary porosity is minor. The main agent controlling the reservoir quality in this sample is the mechanical compaction and the presence of detrital matrix.

XRD: XRD results show that quartz is the dominant component with minor potassium feldspar, and traces of sylvite (drilling mud), kaolinite and pyrite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and traces of illite/smectite mixed layer (Table 7 and Appendix II).

ESEM: ESEM photomicrographs indicate that pores are large and very well interconnected in a 3-D network giving very good permeability (Plates 36 and 37).

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The poor sorting and moderate rounding in this very coarse-grained sandstone suggests deposition in a moderate to high energy environment with at least periodic low energy conditions when fine detritus could settle out from suspension. Possible environments include braided fluvial mid-channel bar.

Res. Potential: Visible porosity is moderate (11.6%) and the pores are well interconnected in a 3-D network giving a moderate permeability. The reservoir quality is good.

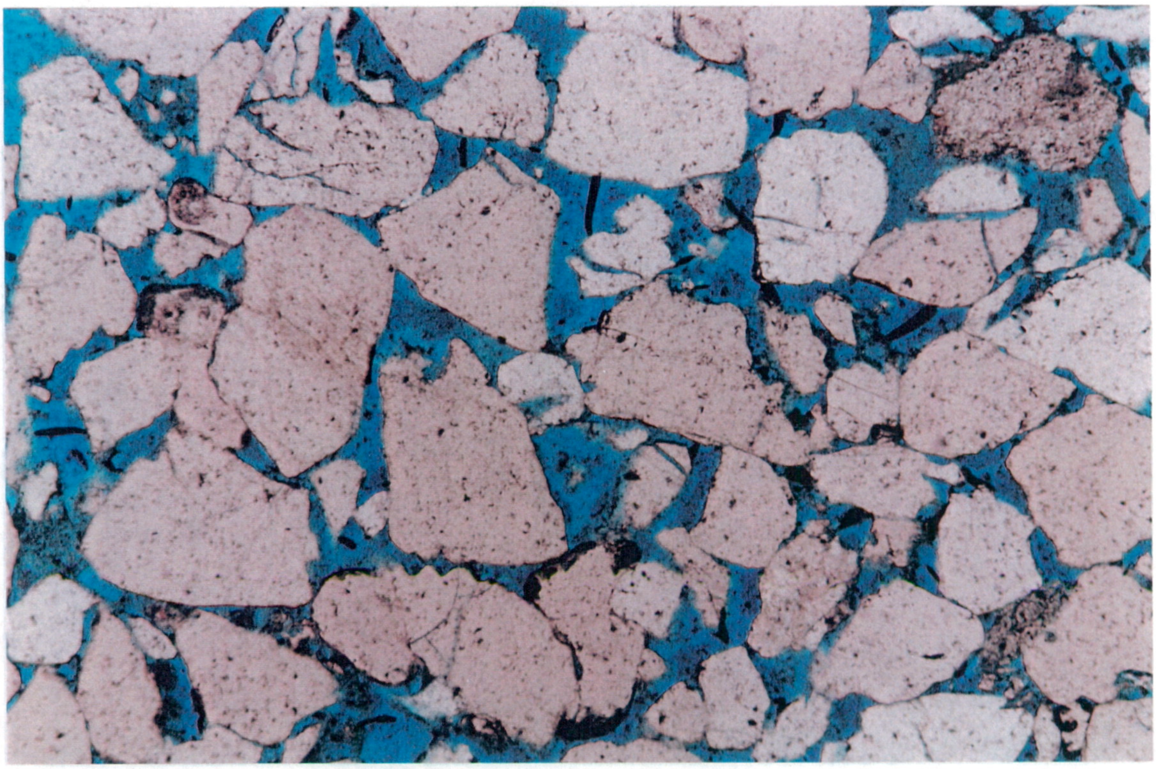


Plate 35A: Sample # 66 (1463.50 m): Thin section photomicrograph showing generalised view of poorly sorted, angular to subrounded very coarse-grained sandstone with considerable amounts of intergranular porosity. This photo represents the clean part of the sample. Plane polarised light. Scale bar = 500 μm.

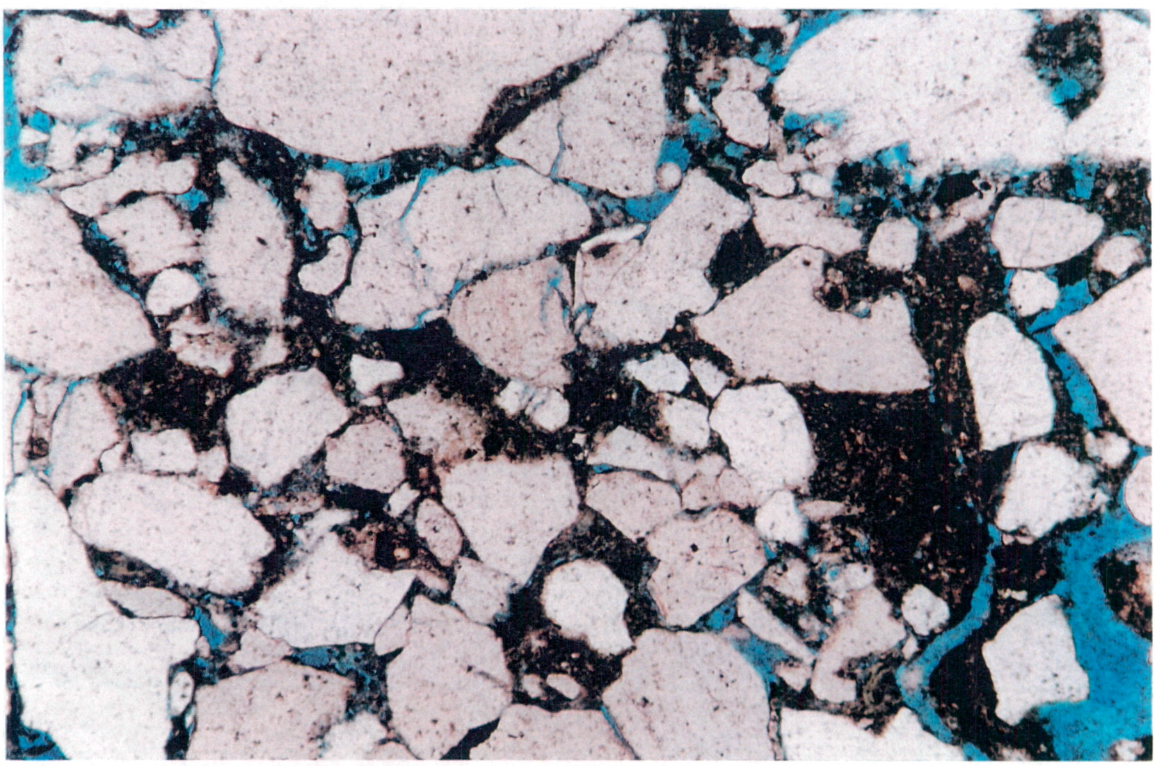


Plate 35B: Sample # 66 (1463.50 m): The dirty part of the sample with a high proportion of detrital depositional matrix. Note minor to moderate visual porosity. Plane polarised light. Scale bar = 500.

Plate 36: Sample # 66 (1463.50 m): ESEM photomicrograph indicates that pores are large and very well interconnected in a 3-D network giving very good permeability. Scale bar = 100 µm.

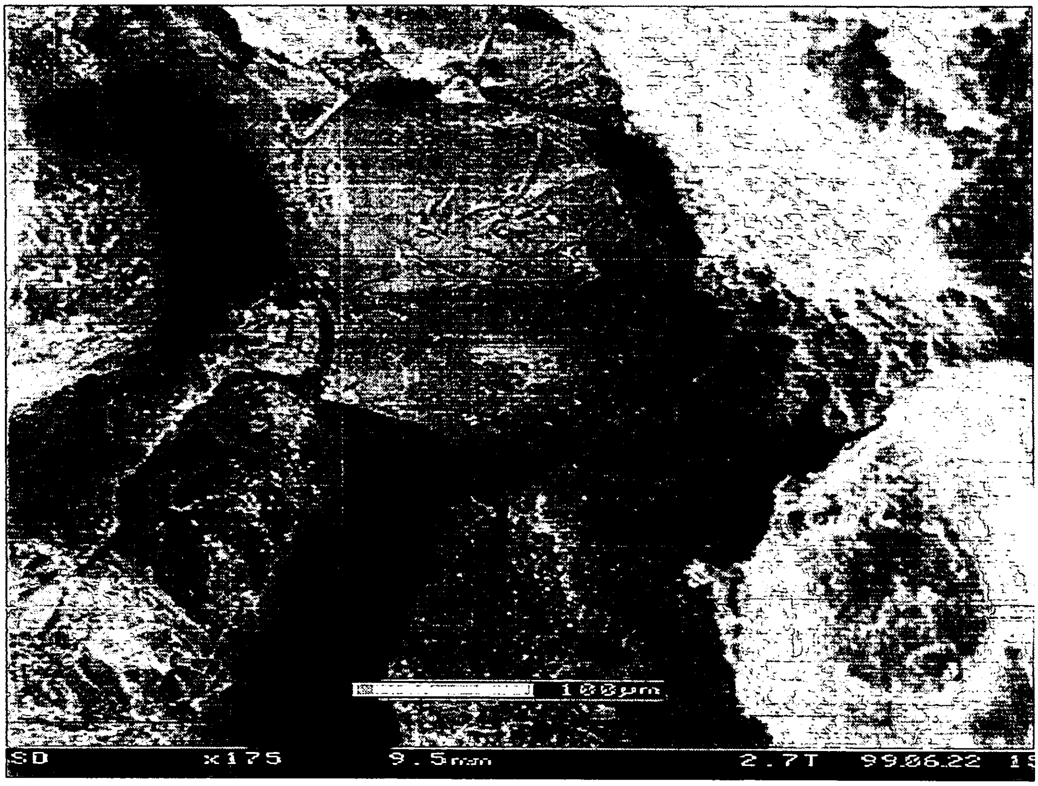


Plate 37: Sample # 66 (1463.50 m): ESEM photomicrograph showing large pore spaces. Permeability should be very high in this sample in 3-D. Note absence of quartz overgrowth and authigenic clays. Scale bar = 100 µm.

SAMPLE: **NO. 88 (1468.54 m)**

Lithology: Quartz Arenite

Texture: The sample depicts a creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity. Porosity is patchily distributed and comprises mainly primary intergranular pores.

Composition: Monocrystalline quartz is the dominant framework component (67.8%) with trace amounts of polycrystalline quartz grains (1.6%) and metamorphic lithic grains (0.6%). Potassium feldspar is minor (2.4%). Organic matter is a trace component in this sample comprising 0.4%. Authigenic minerals are minor and dominated by authigenic kaolinite (2.4%) and pyrite (2%). There are very good amounts of visual porosity (22.8%).

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.

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 38). This suggests that the porosity is largely intergranular primary.

XRD: Quartz is the dominant component with traces of kaolinite, sylvite (drilling mud) and pyrite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and minor of mica (muscovite), (Table 7 and Appendix II).

ESEM: The pores in this moderately sorted quartz arenite grains are present in high amounts. They are relatively large and interconnected in a 3-D network giving good permeability (Plates 39 and 40).

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 during the early sulphate reduction.

- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

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 (22.8%). Compaction rather than cementation, was the main agent responsible for reducing the intergranular primary porosity.

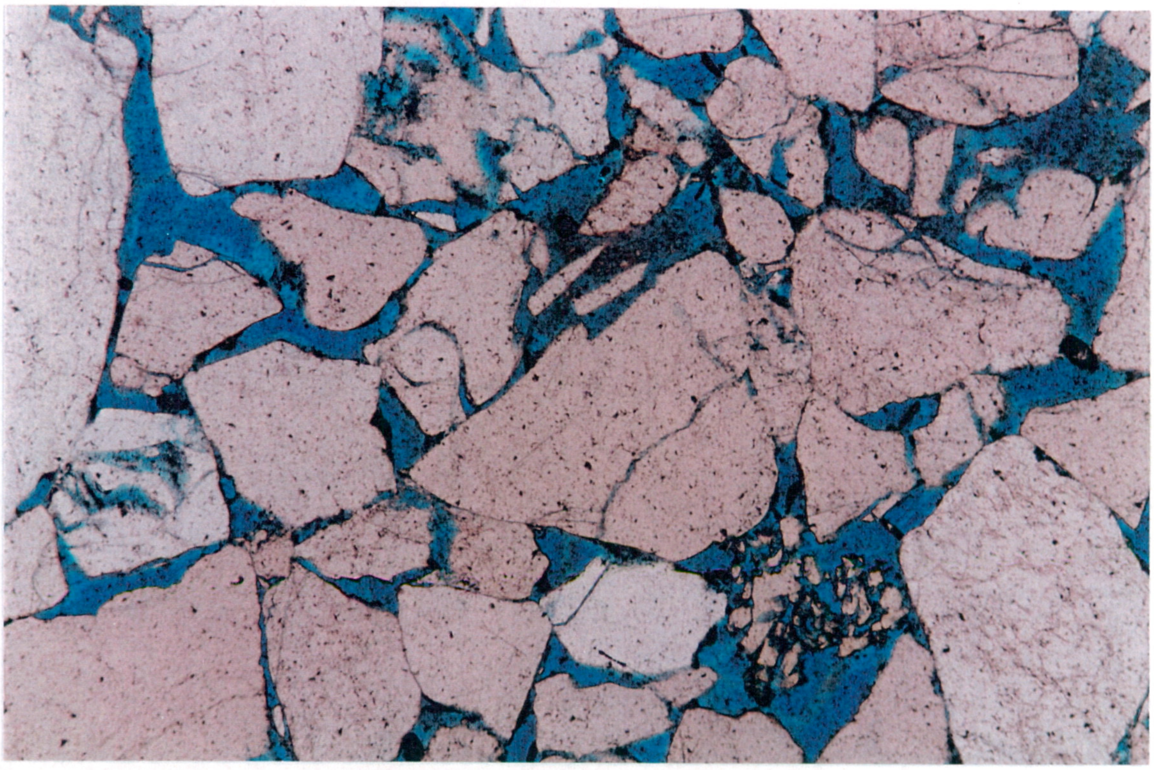


Plate 38A: Sample # 88 (1468.54 m): Thin section photomicrograph showing generalised view of moderately sorted, angular to rounded coarse-grained sandstone with considerable amounts of intergranular porosity. Plane polarised light. Scale bar = 500 μm.

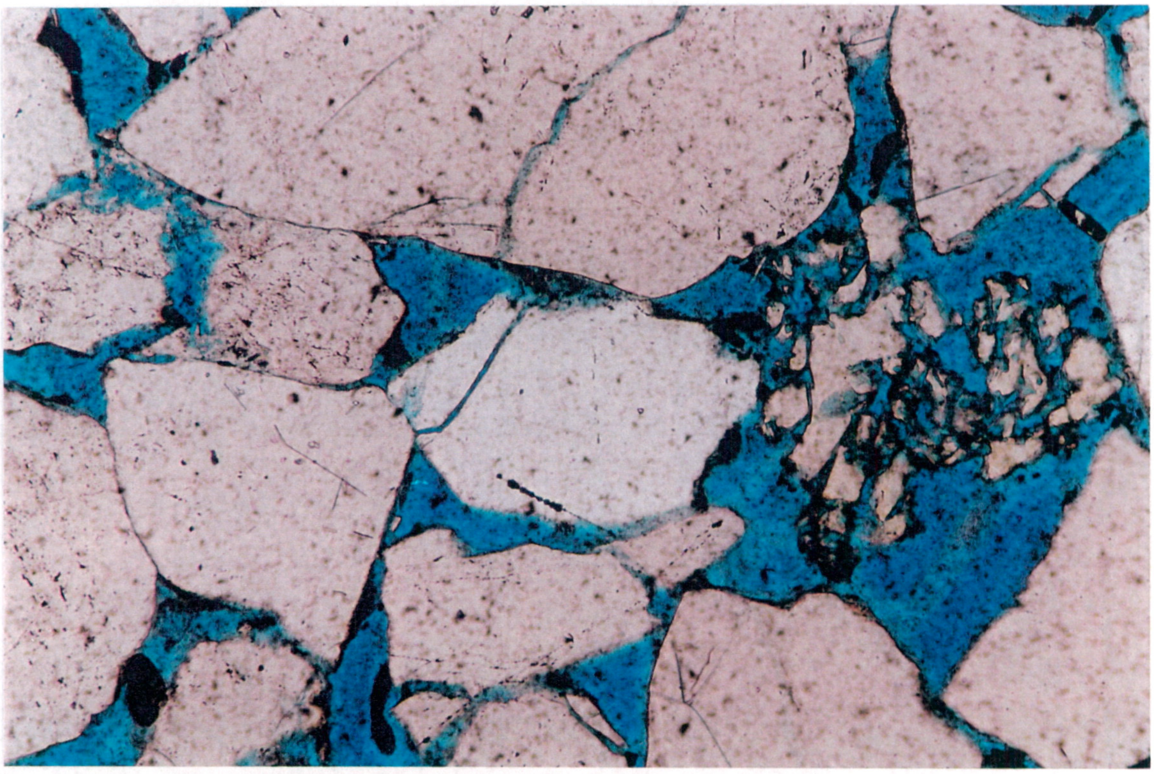


Plate 38B: Sample # 88 (1468.54 m): Enlarged view of Plate 38A. The sample is clean quartz arenite with minor amounts of secondary porosity resulting from fracturing and feldspar dissolution. Plane polarised light. Scale bar = 200 μm.

ACS LABORATORIES PTY. LTD.

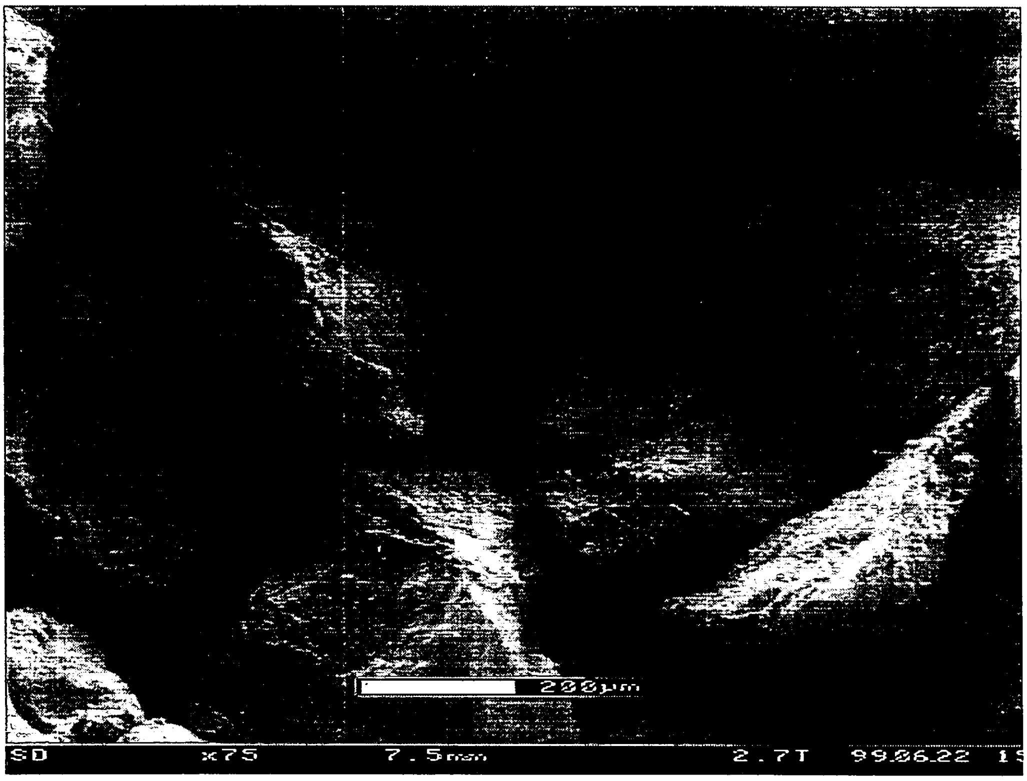


Plate: 39: Sample # 88 (1468.54 m): ESEM photomicrograph showing general view of the sample with high visual porosity. Note that both pore spaces and pore throat are well interconnected giving a high permeability in 3-D. Scale bar = 200 µm.

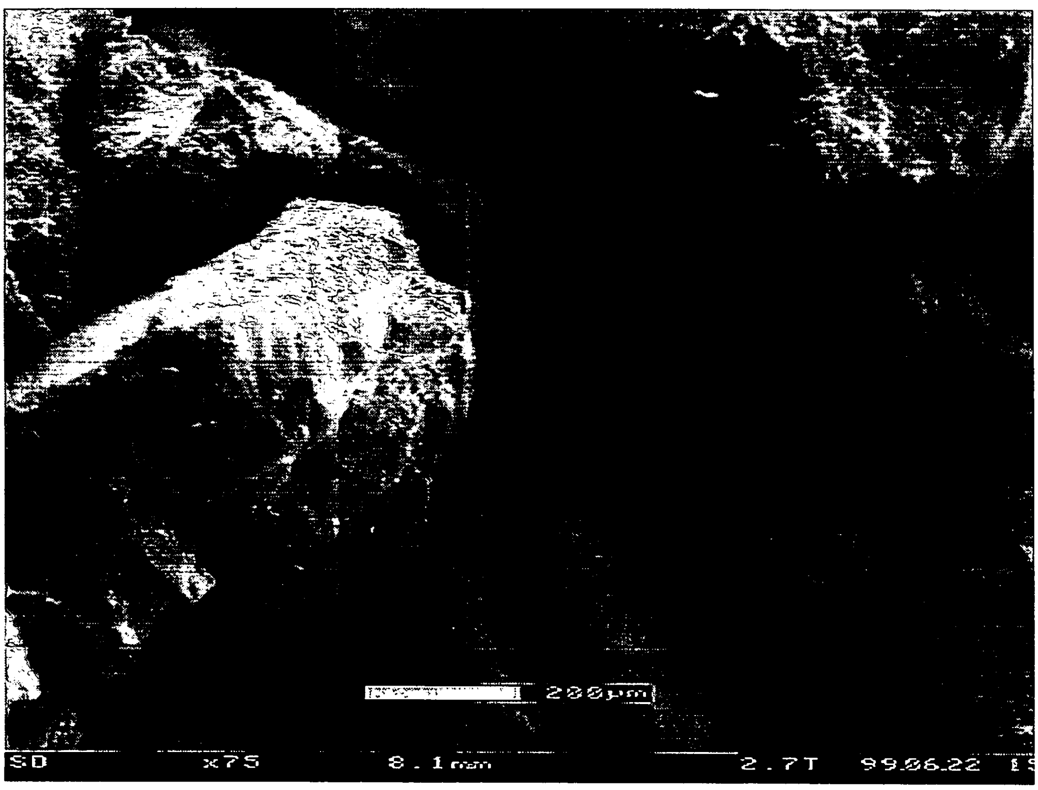


Plate: 40: Sample # 88 (1468.54 m): ESEM photomicrograph showing large pore spaces (> 300 µm). The pores are well interconnected with negligible amounts of authigenic clays. Scale bar = 200 µm.

SAMPLE: **NO. 98 (1471.35 m)**

Lithology: Quartz Arenite

Texture: Creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, very coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.

Composition: The dominant framework component is monocrystalline quartz (72.2%). Polycrystalline quartz grains (1.8%) and potassium feldspar (1.8%) are minor components. Lithic fragments (0.8%) are present in trace amounts. Coalified wood and plant debris are trace components (0.4%). Detrital depositional matrix is a minor component (3%). Authigenic minerals comprise authigenic kaolinite (1.6%) and traces of pyrite (0.4%). There are good amounts of visible porosity (16.8%).

Monocrystalline quartz displays strongly undulose extinction with some of the quartz grains containing fluid, igneous inclusions or needle-like minerals and biotite.

There is good porosity (16.8%) evident in this sample, mostly as scattered primary pores between detrital and authigenic minerals (Plate 41).

XRD: The sample is dominated by quartz, with traces of kaolinite and sylvite (drilling mud), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite with minor amounts of mica (muscovite), (Table 7 and Appendix II).

ESEM: ESEM photomicrographs indicate that this sample contains a high proportion of macro porosity (Plate 42). The pores are interconnected in a 3-D network giving good permeability (Plate 43). 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 43).

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 during the early sulphate reduction.

- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The very coarse 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 (16.8%) with primary porosity being more common than secondary porosity. Although the primary pores have been partly reduced in size by mechanical compaction, the pores are well interconnected giving a good permeability.

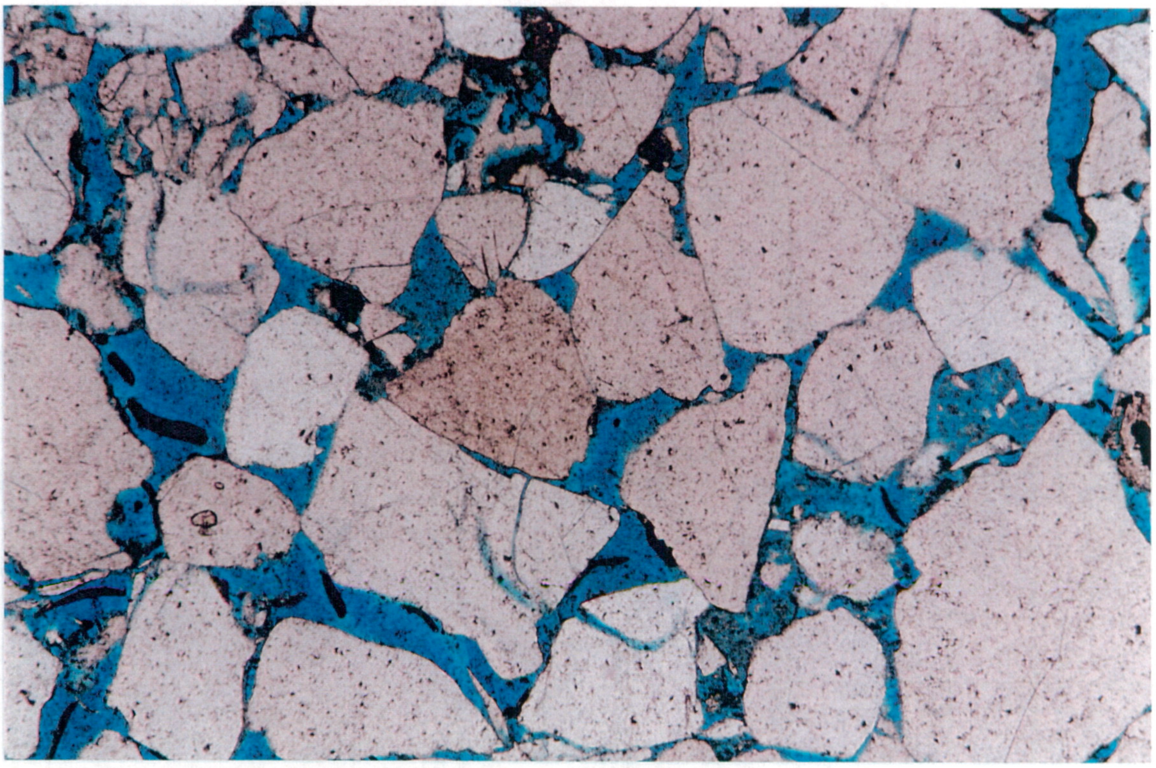


Plate 41A: Sample # 98 (1471.35 m): Thin section photomicrograph of quartz arenite comprising moderately sorted, angular to rounded very coarse-grained sandstone with a patch of intergranular porosity (blue). Plane polarised light. Scale bar = 500 μm.

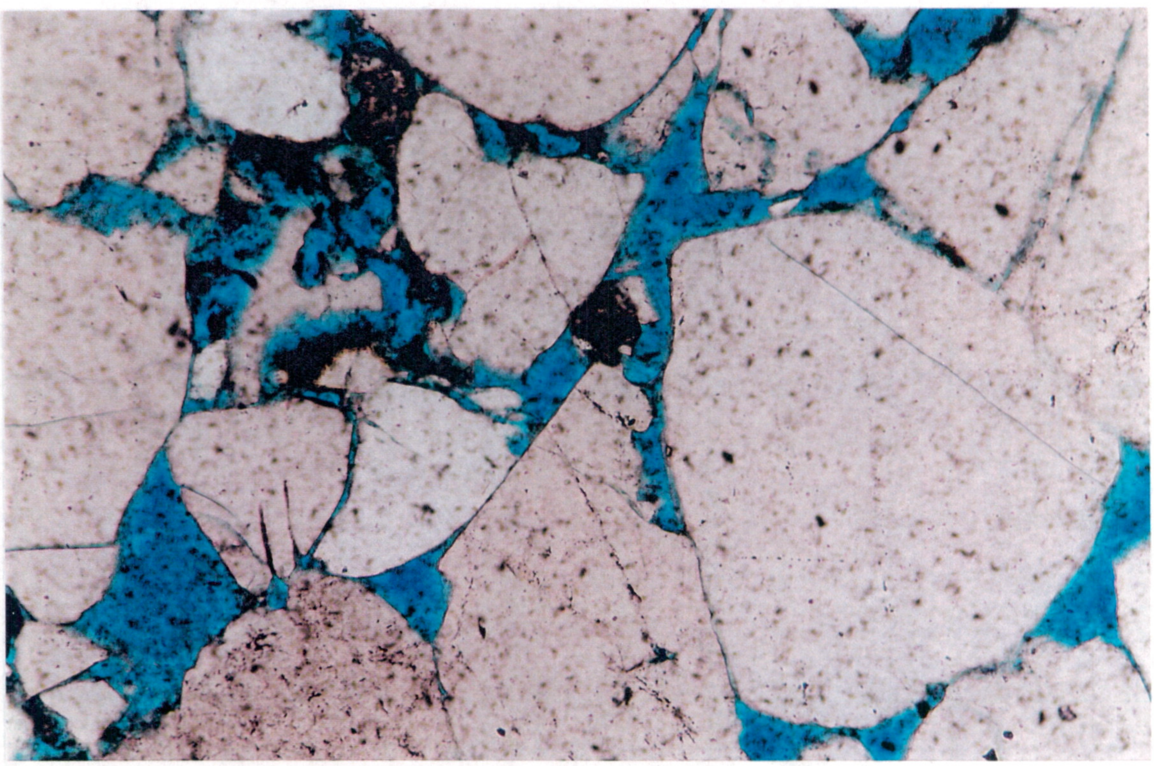


Plate 41B: Sample # 98 (1471.35 m): Enlarged view of Plate 42A. The sample is clean quartz arenite with minor amounts of drilling mud (black materials). Plane polarised light. Scale bar = 200 μm.

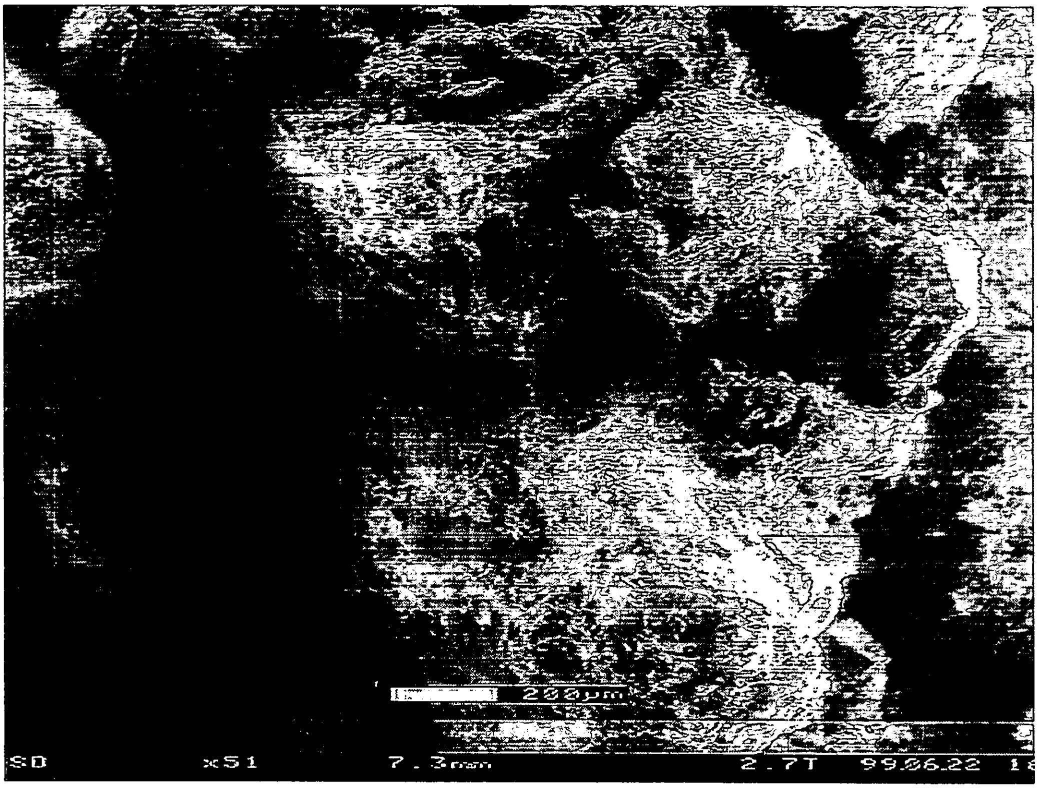


Plate 42: Sample # 98 (1471.35 m): ESEM photomicrograph showing general view of the sample. The sample contains a high proportion of visual porosity. The pores are large and interconnected implying good permeability. Scale bar = 200 µm.

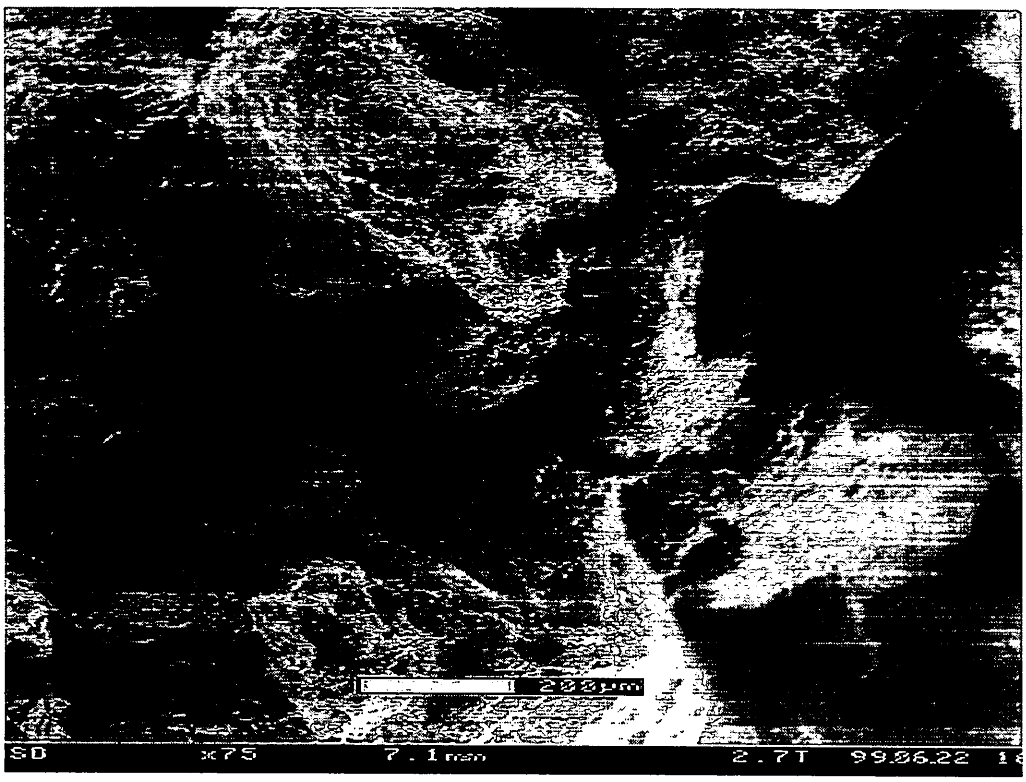


Plate 43: Sample # 98 (1471.35 m): ESEM photomicrograph showing large pore spaces and pore throat. The pores are well interconnected in 3-D suggesting good permeability. The fine detritus are unlikely to cause a significant reduction in permeability. Scale bar = 200 µm.

SAMPLE: **NO. 110 (1473.17 m)**

Lithology: Quartz Arenite

Texture: The sample cut is creamy, grain supported, horizontal to small scale cross stratification, moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.

Composition: The sample is dominated by monocrystalline quartz (68.6%) with minor polycrystalline quartz grains (1.8%), potassium feldspar (1.2%), lithic fragments (1.4%) and mica. Detrital matrix is also present in trace amounts. It comprises organic-rich silty sandstone. Dispersed organic matter or coalified wood and plant debris are present also in trace amounts (0.2%). Authigenic minerals comprise authigenic kaolinite (2.4%) and traces of pyrite (0.4%). There are good amounts of visible porosity (22.8%) 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.

Porosity is scattered throughout the sample (22.8%), usually as triangular pores between detrital and authigenic minerals (Plate 44). Secondary porosity is less common than the primary pores. It includes enlarged pores and elongated pores providing moderate connections between the larger pores.

XRD: The sample is dominated by quartz, and traces of potassium feldspar, kaolinite, sylvite (drilling mud) and pyrite, (Table 6, and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and minor mica (muscovite), (Table 7 and Appendix II).

ESEM: The pores are well interconnected in a 3-D network giving good permeability (Plates 45 and 46).

Diagenesis: The diagenesis of this sample can be summarised as follows:

- 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.

- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.

- After kaolin precipitation quartz cements (have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The poor to moderately sorted and rounded nature in this very coarse-grained sandstone indicate 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 (22.8%). Visible pores are partly filled with quartz and kaolinite cements. Compaction has contributed by up to 36% of the porosity loss while cementation has occluded around 7% of the original intergranular porosity. The sample has very good reservoir characteristics.

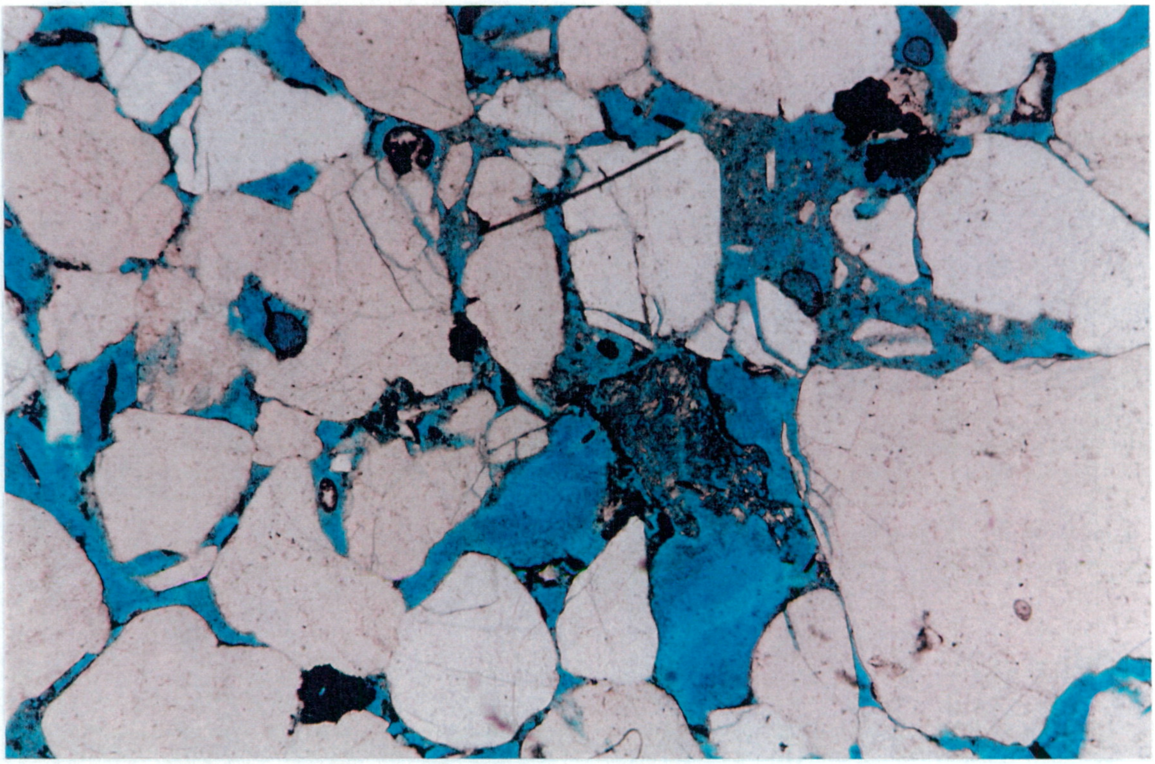


Plate 44A: Sample # 110 (1473.17 m): Thin section photomicrograph showing general view of coarse-grained, moderately sorted quartz arenite with good amounts of primary intergranular porosity (blue). Plane polarised light. Scale bar = 500 μm.

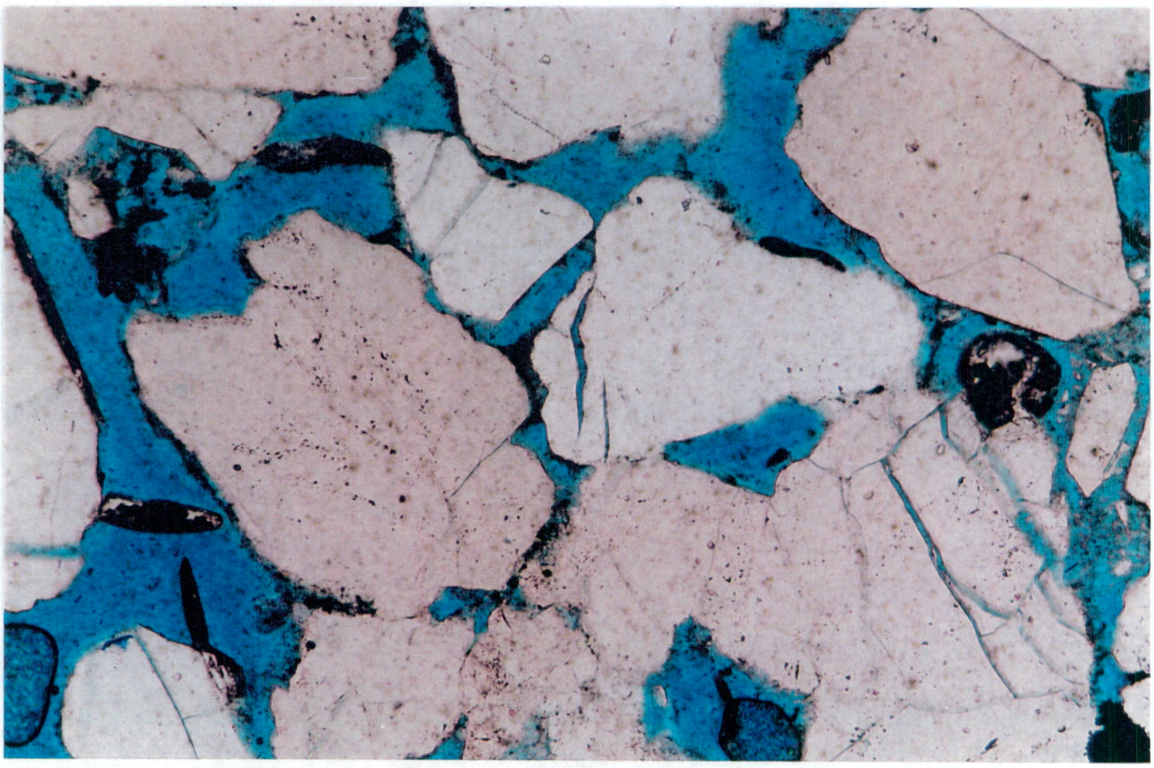


Plate 44B: Sample # 110 (1473.17 m): Enlarged view of Plate 44A. The sample is clean quartz arenite with minor amounts of drilling mud (black materials). Plane polarised light. Scale bar = 200 μm.

ACS LABORATORIES PTY. LTD.

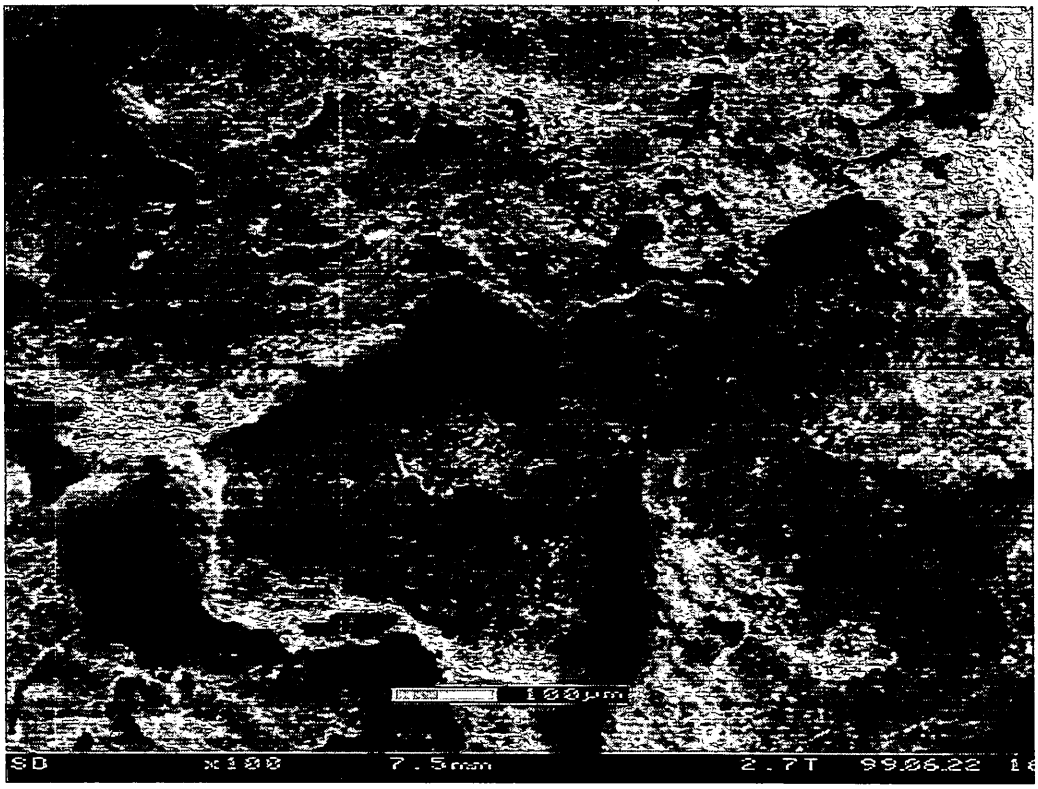


Plate 45: Sample # 110 (1473.17 m): ESEM photomicrograph showing general view of the sample with abundant pore spaces. The pore spaces are well interconnected indicating high permeability. Scale bar = 100 µm.

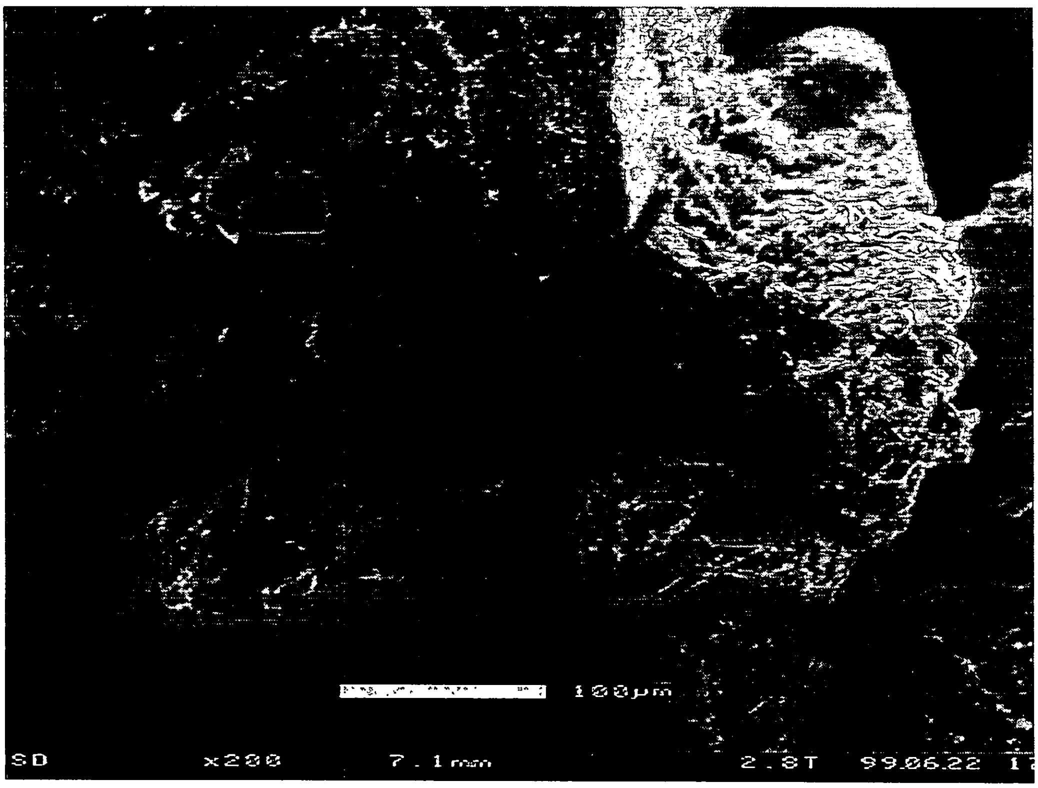


Plate 46: Sample # 110 (1473.17 m): ESEM photomicrograph showing considerable amounts of visual porosity. The pores are well connected implying very good permeability. Note the presence of fracturing of some of the quartz grains. Scale bar = 100 µm.

SAMPLE: **NO. 124 (1475.42 m)**

Lithology: Sublitharenite

Texture: The sample consists of creamy, grain supported, horizontal to small scale cross stratification, poorly to moderately sorted, coarse-grained sandstone. Quartz grains are angular to rounded. Trace authigenic minerals and high visual porosity.

Composition: Monocrystalline quartz is the main framework component and constitutes 65% of the sample. Polycrystalline quartz grains are minor (2.6%). Potassium feldspar and lithic fragments are present also in minor amounts 2.6% and 3% respectively. Lithic grains are dominated by metamorphic micaceous schist (2.4%) and rounded sedimentary chert (0.6%). Mica is trace and detrital depositional matrix is trace to rare (0.4%). Authigenic minerals comprise authigenic kaolinite (2.2%), and pyrite (1.2%). Visible porosity is present in high amounts in the sample (23%).

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 47). It occurs as both intergranular primary and secondary in origin. Secondary porosity is less common and originated by partial dissolution of feldspar, mica and ductile rock fragments.

XRD: Quartz is the dominant component of this sample with traces of potassium feldspar, sylvite (drilling mud) and pyrite, (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and minor amounts of mica (muscovite), (Table 7 and Appendix II).

ESEM: No ESEM photos, the sample was extremely friable.

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.

- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The probable depositional environment of this sample is braided fluvial.

Res. Potential: The sample has a very good reservoir quality (23%). Reservoir quality apparently has been affected by mechanical compaction rather than precipitation of authigenic minerals.

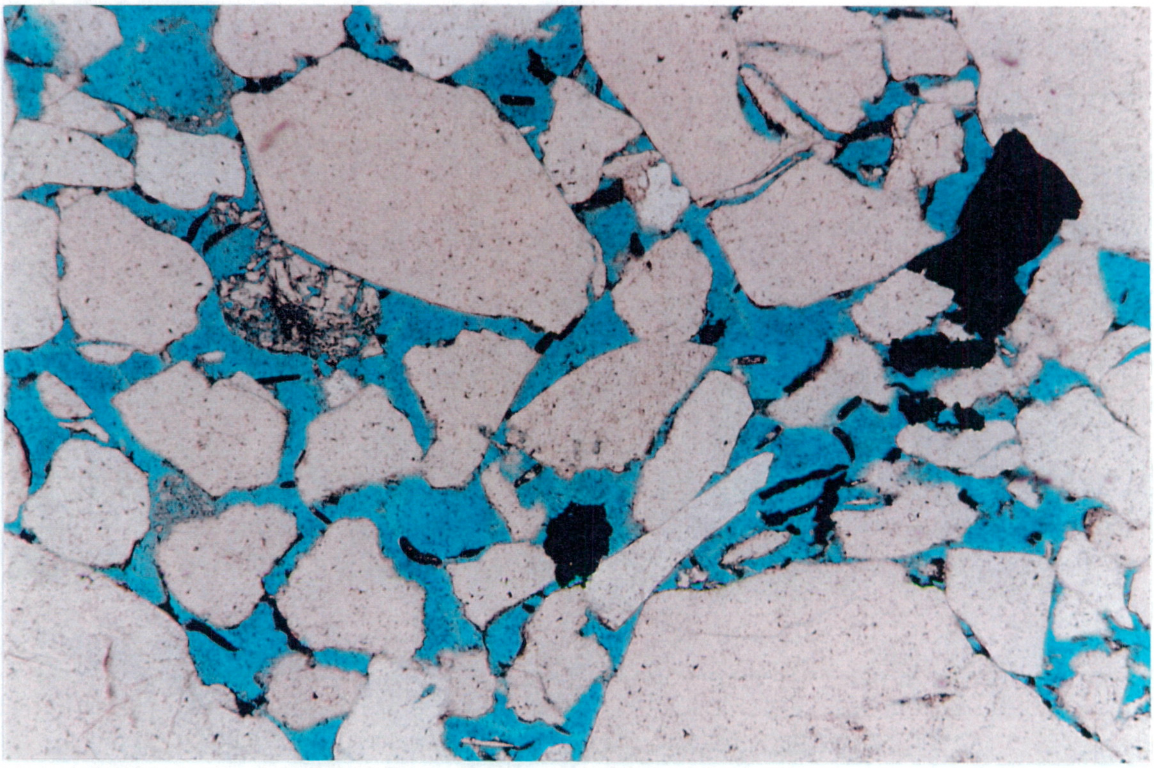


Plate 47A: Sample # 124 (1475.42 m): Thin section photomicrograph showing general view of sublitharenite comprising poorly to moderately sorted, angular to rounded coarse-grained sandstone with high visual porosity. Note the presence of coalified materials and cubic pyrite crystals. Plane polarised light. Scale bar = 500 μm.

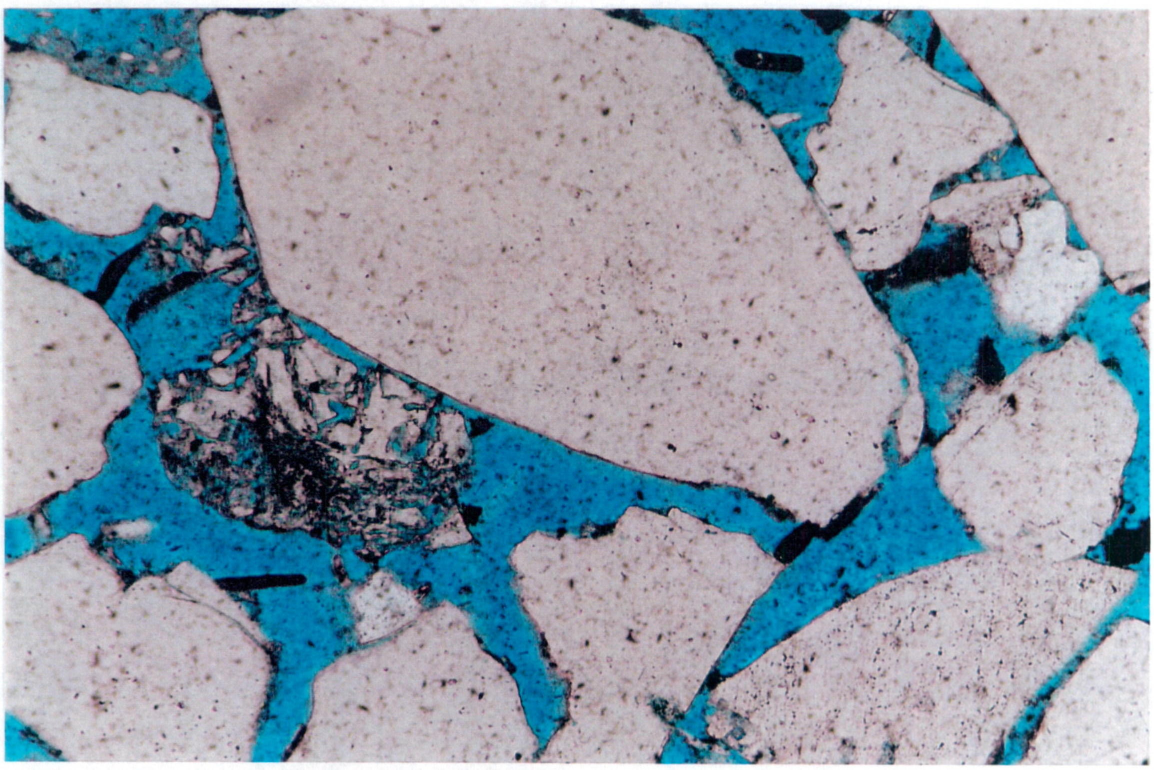


Plate 47B: Sample # 124 (1475.42 m): Enlarged view of Plate 47A. Plane polarised light. Scale bar = 200 μm.

SAMPLE: **NO. 132 (1476.65 m)**

Lithology: Lithic Arkose

Texture: The sample is a creamy, grain supported, horizontal to small scale cross stratification, well sorted, fine-grained sandstone. Quartz grains are mainly subangular to rounded. Minor authigenic minerals and good visual porosity.

Composition: The sample is dominated by monocrystalline quartz (39.6%). Polycrystalline quartz is trace (1.6%). Potassium feldspar is present in significant amounts (11.4%). Lithic fragments are also present in substantial amounts (10.4%) and comprise metamorphic mica schist and rounded sedimentary chert. Mica is mostly muscovite and has been greatly effected by mechanical compaction. Accessory minerals are mainly tourmaline and zircon. Authigenic minerals are minor and comprise kaolinite (7.8%) and pyrite (1.8%). There are good amounts of visible porosity (24.8%).

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 48). This suggests that the porosity is largely intergranular primary. Secondary porosity is less common than in the primary pores (Plate 48). It includes enlarged and elongated pores providing moderate connections between the larger pores. Secondary porosity was formed by minor dissolution of feldspar grains, ductile rock fragments and mica flakes.

XRD: The sample is dominated by quartz, minor potassium feldspar and traces of kaolinite, pyrite and sylvite (drilling mud), (Table 6 and Appendix II). The clay fraction (< 2 μm) is dominated by kaolinite and minor of mica (muscovite), (Table 7 and Appendix II).

ESEM: Pores and pore throat are large and present in significant amounts. They are well connected in 3-D network giving high permeability (Plates 49 and 50).

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 during the early sulphate reduction.

- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.
- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

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 (24.8%). 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.

ACS LABORATORIES PTY. LTD.

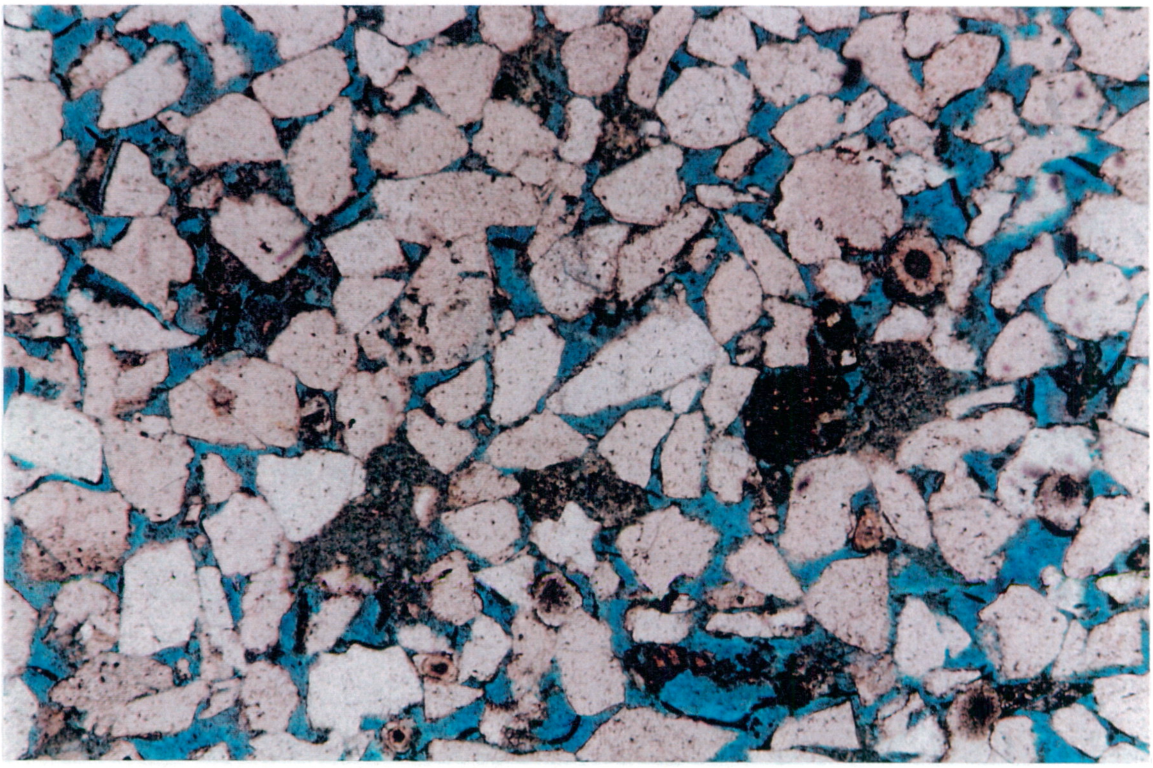


Plate 48A: Sample # 132 (1476.65 m): Thin section photomicrograph showing general view of lithic arkose with significant amounts of visible porosity. Feldspar and ductile lithic grains are abundant. Note the triangular shape of the visible porosity suggesting primary intergranular origin. Plane polarised light. Scale bar = 500 μm.

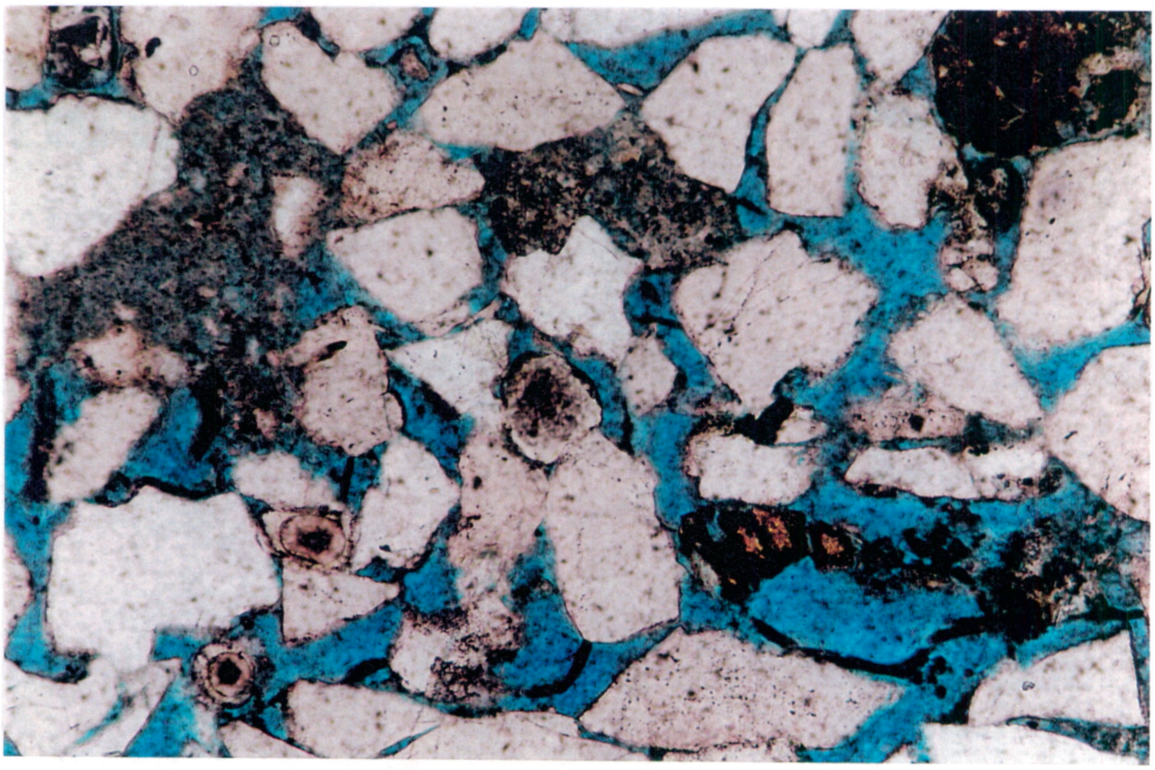


Plate 48B: Sample # 132 (1476.65 m): Enlarged view of Plate 48A. Note the presence of secondary porosity as feldspar dissolution (yellow). Plane polarised light. Scale bar = 200 μm.

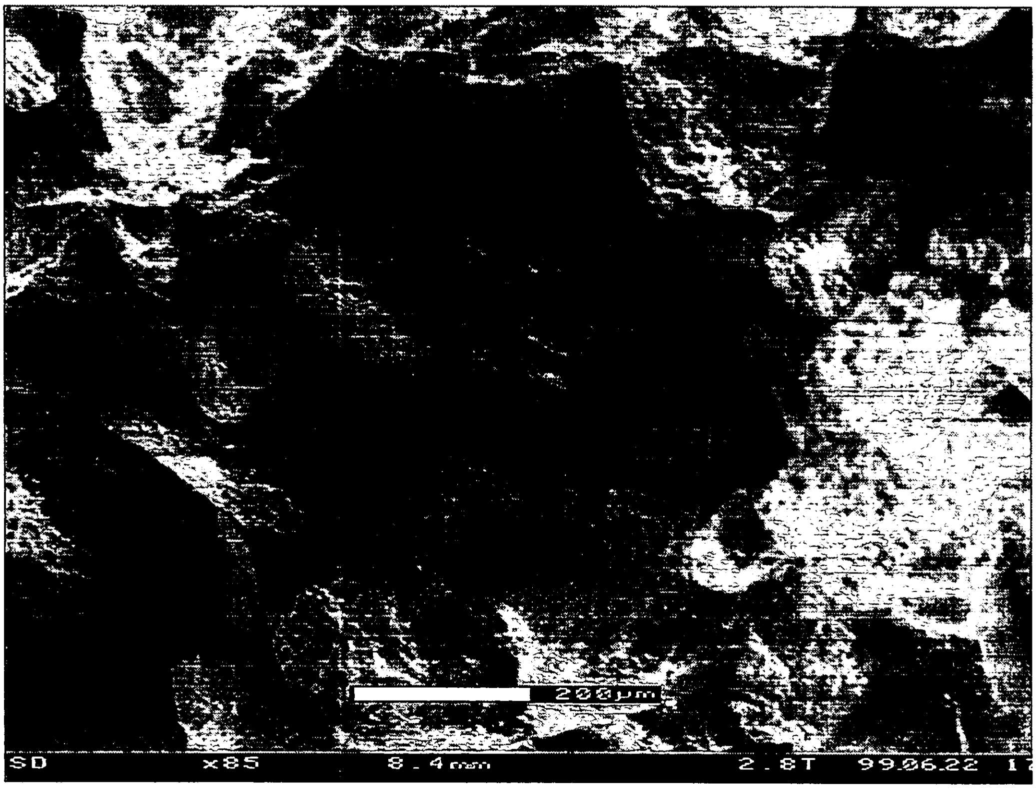


Plate 49: Sample # 132 (1476.65 m): ESEM photomicrograph showing general view of the sample with a high proportion of visual porosity. Scale bar = 200 µm.

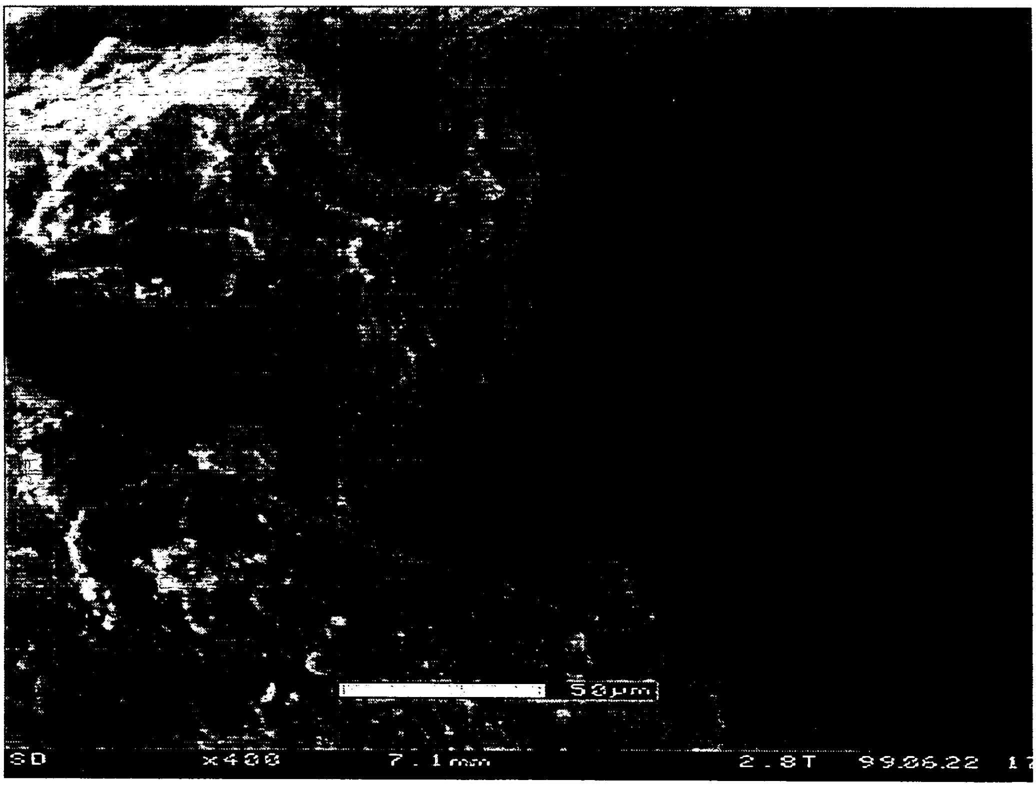


Plate 50: Sample # 132 (1476.65 m): ESEM photomicrograph showing pore spaces and pore throat. The pores are well interconnected indicating good permeability. Scale bar = 50 µm.

SAMPLE: **NO. 140 (1477.97 m)**

Lithology: Lithic Arkose

Texture: The sample consists of creamy, grain supported, well sorted, medium-grained sandstone. Quartz grains are mainly subangular to rounded. Minor authigenic minerals and good visual porosity.

Composition: The framework components of this sample are dominated by monocrystalline quartz (50.8%), trace polycrystalline quartz (1.2%) considerable amounts of feldspar (11.8%) and lithic fragments (11%). Organic matter (0.2%) and mica (1.4%) are trace components. Authigenic minerals are dominated by kaolinite (2.6%) and traces of pyrite (0.6%). 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. Mica is mainly muscovite and occurs as either disseminated or concentrated in very thin lamellae parallel to the bedding plane.

Visible porosity is good (Plate 51) most of which is primary in origin.

XRD: Quartz is dominant with, minor potassium feldspar and traces of kaolinite and pyrite, (Table 6 and Appendix II). The clay fraction ($< 2\ \mu m$) is dominated by kaolinite and minor amounts of mica (muscovite), (Table 7 and Appendix II).

ESEM: ESEM photomicrographs show that the pores and pore throat are well interconnected in a 3-D network giving good permeability (Plates 52 and 53) and reservoir quality.

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 during the early sulphate reduction.
- Alteration and dissolution of feldspar, ductile lithic fragments and mica could have been responsible for the formation of kaolin.

- After kaolin precipitation quartz cements have occurred as overgrowths. The quartz overgrowths postdated or at least formed simultaneously with the precipitation of kaolin.

Env. Deposition: The medium sand size detrital grains in this sample range from angular to rounded and 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.

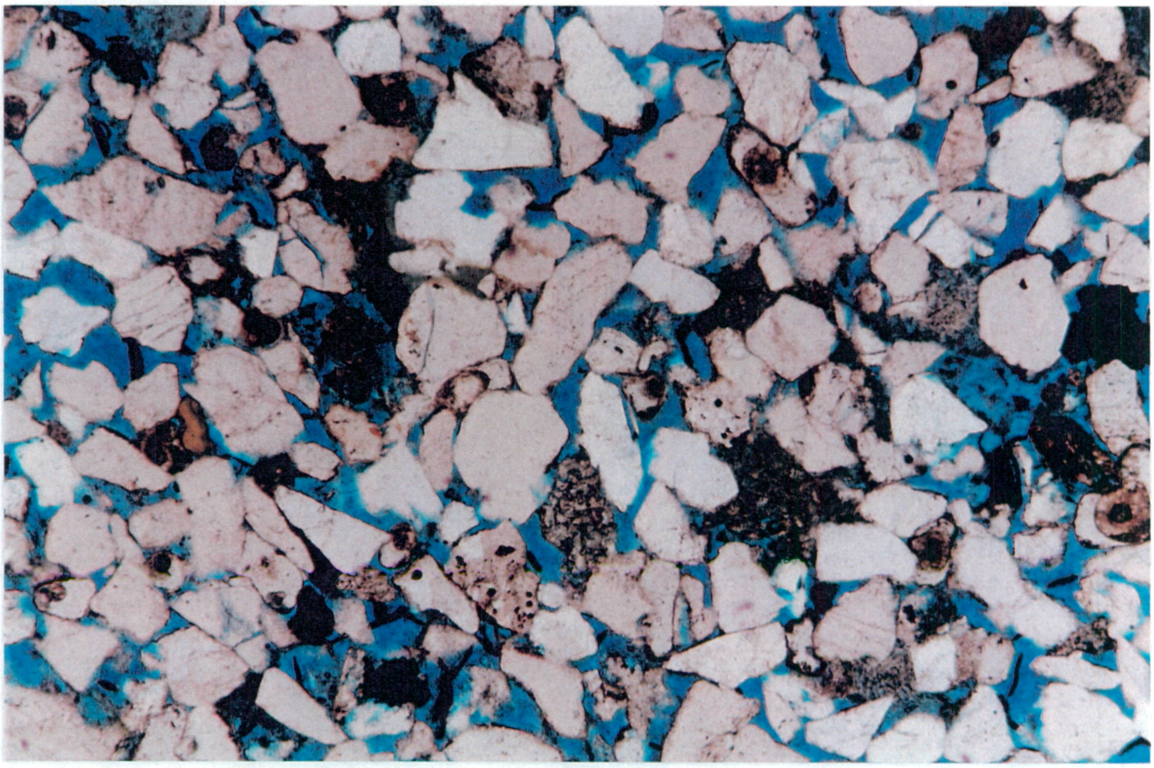


Plate 51A: Sample # 140 (1477.97 m): Thin section photomicrograph showing lithic arkose. High visible porosity and excellent reservoir quality with trace to minor amounts of ductile lithic grains and authigenic clays. Plane polarised light. Scale bar = 500 μm.

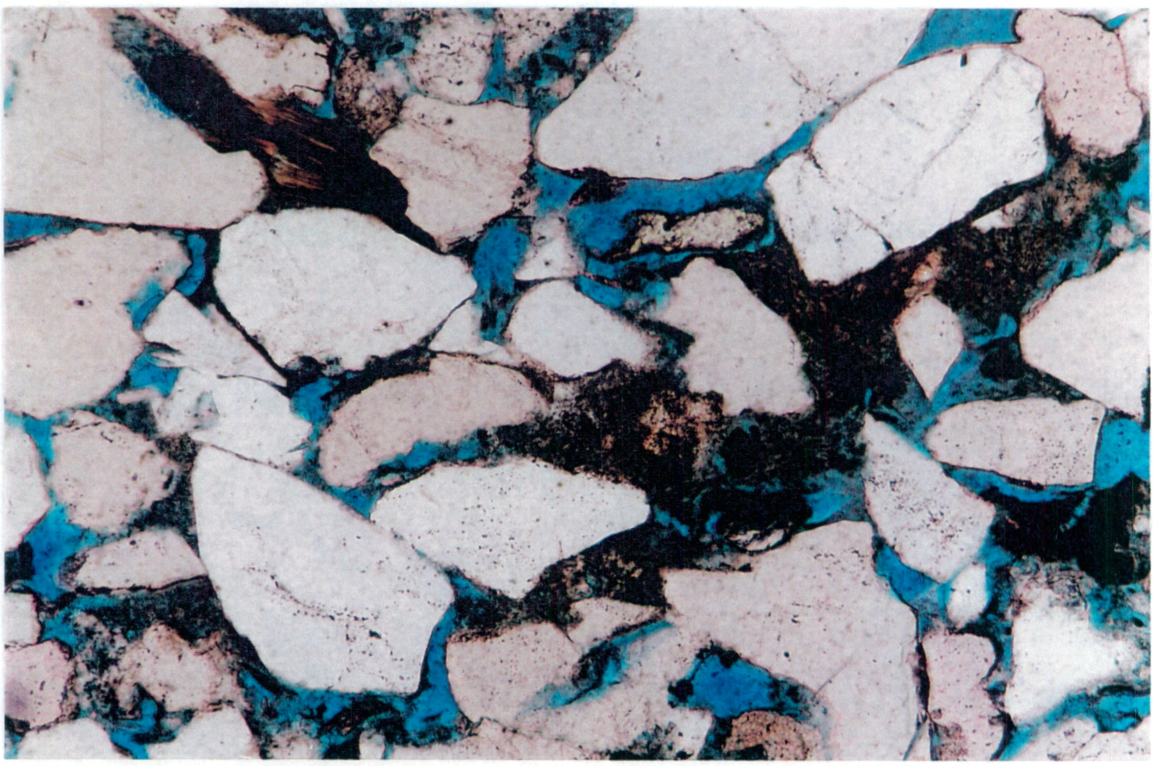


Plate 51B: Sample # 140 (1477.97 m): Enlarged view of Plate 51A. Note the effect of mechanical compaction in reducing the intergranular porosity. Plane polarised light. Scale bar = 200 μm.

Plate 52: Sample # 140 (1477.97 m): ESEM photomicrograph showing general view of the sample. Note 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.

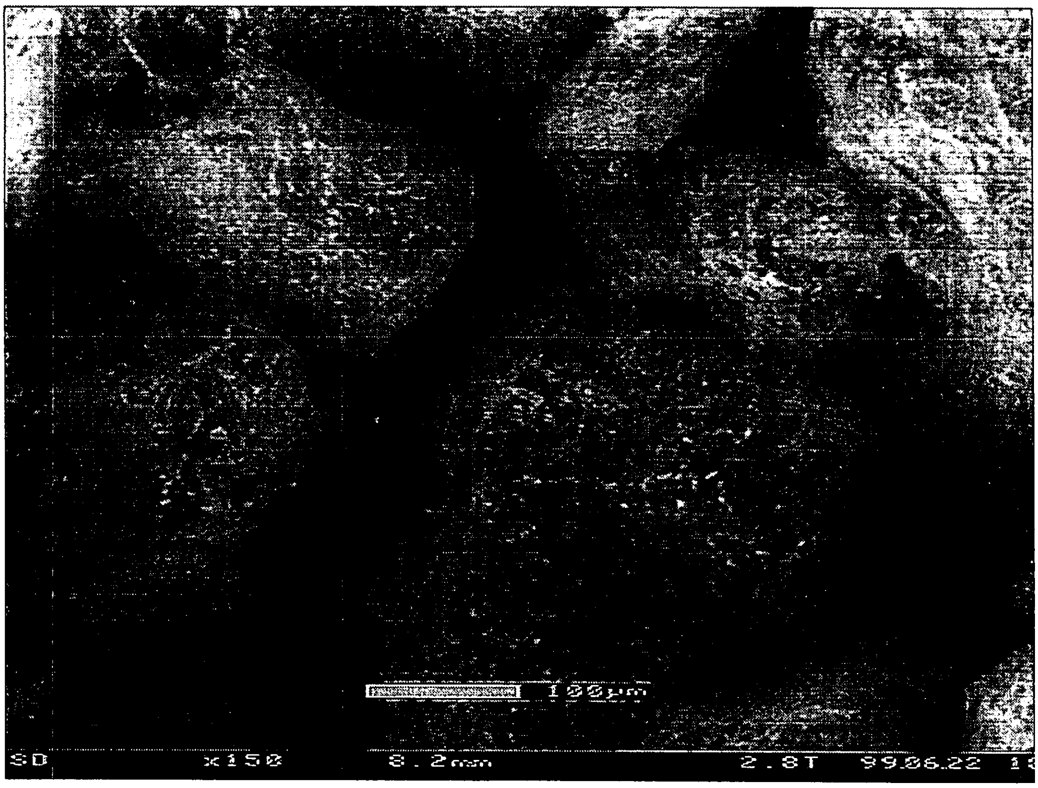
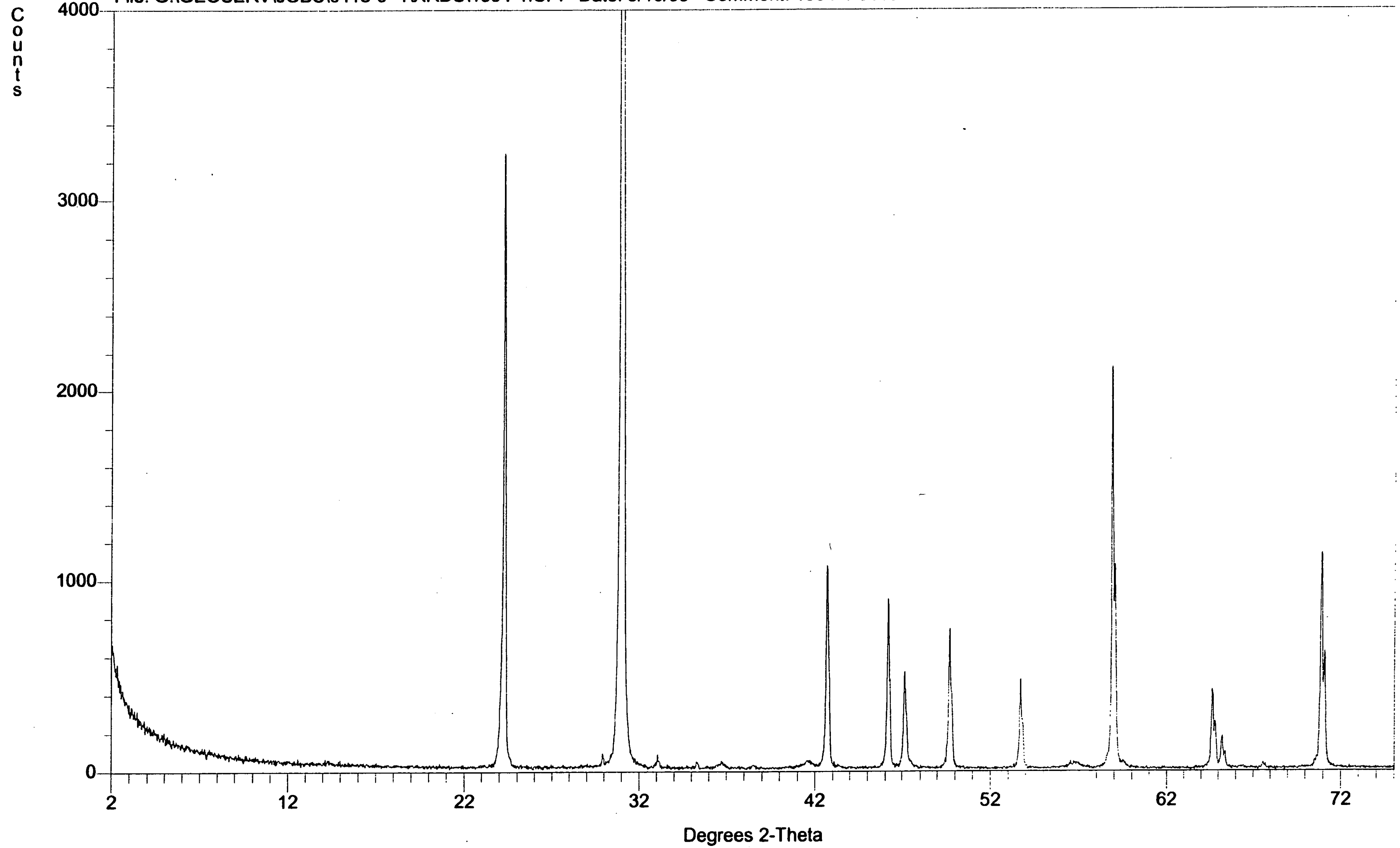


Plate 53: Sample # 140 (1477.97 m): ESEM photomicrograph showing large pore spaces and pore throat. They are well interconnected giving high permeability and reservoir quality. Scale bar = 100 μm.

APPENDIX II

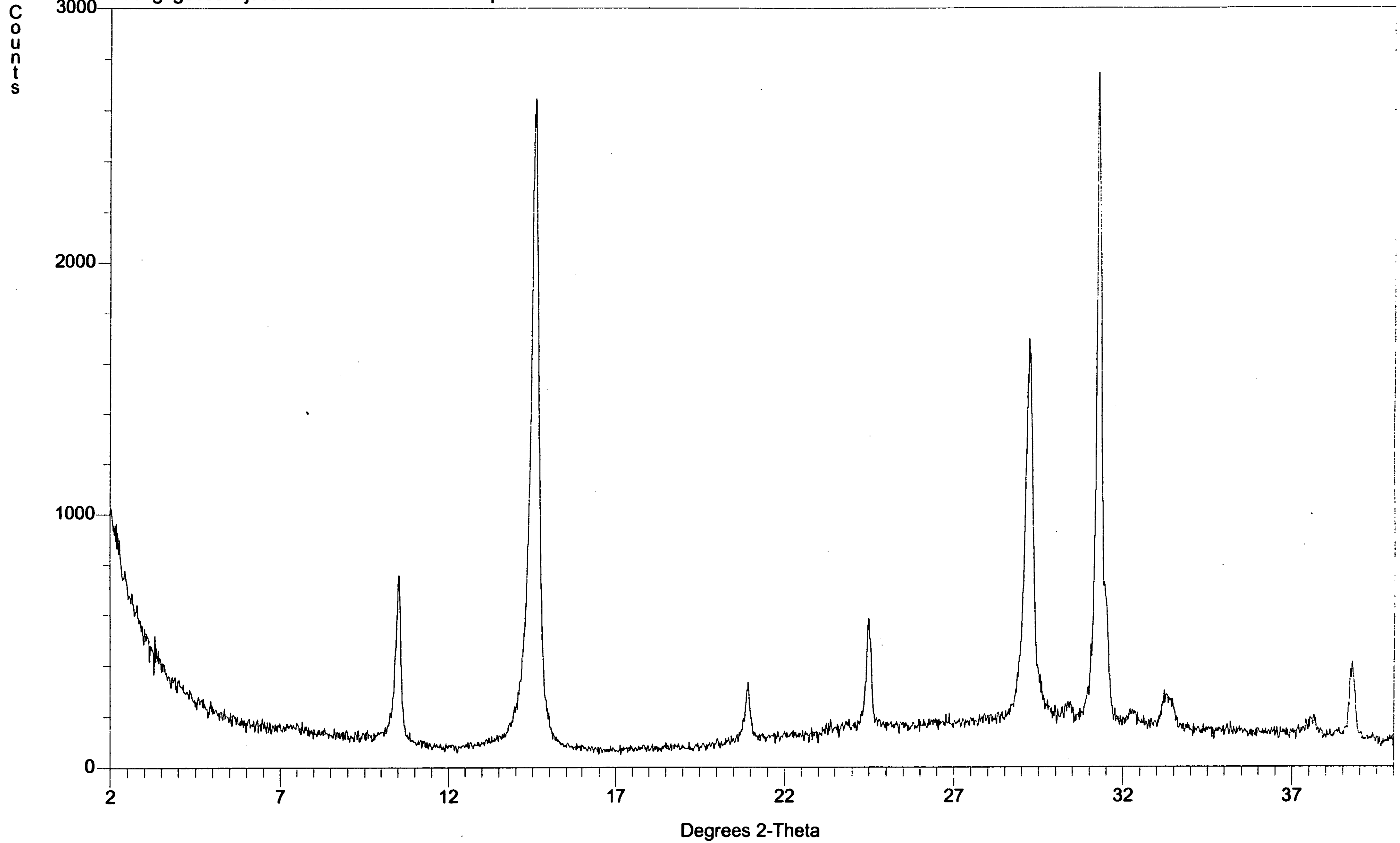
XRD TRACES

File: G:\GEOSERV\JOBS\0418-0~1\XRDS\1954-1.CPI   Date: 5/16/99   Comment: 1954-1 0418-01 Iona-4 #3 1



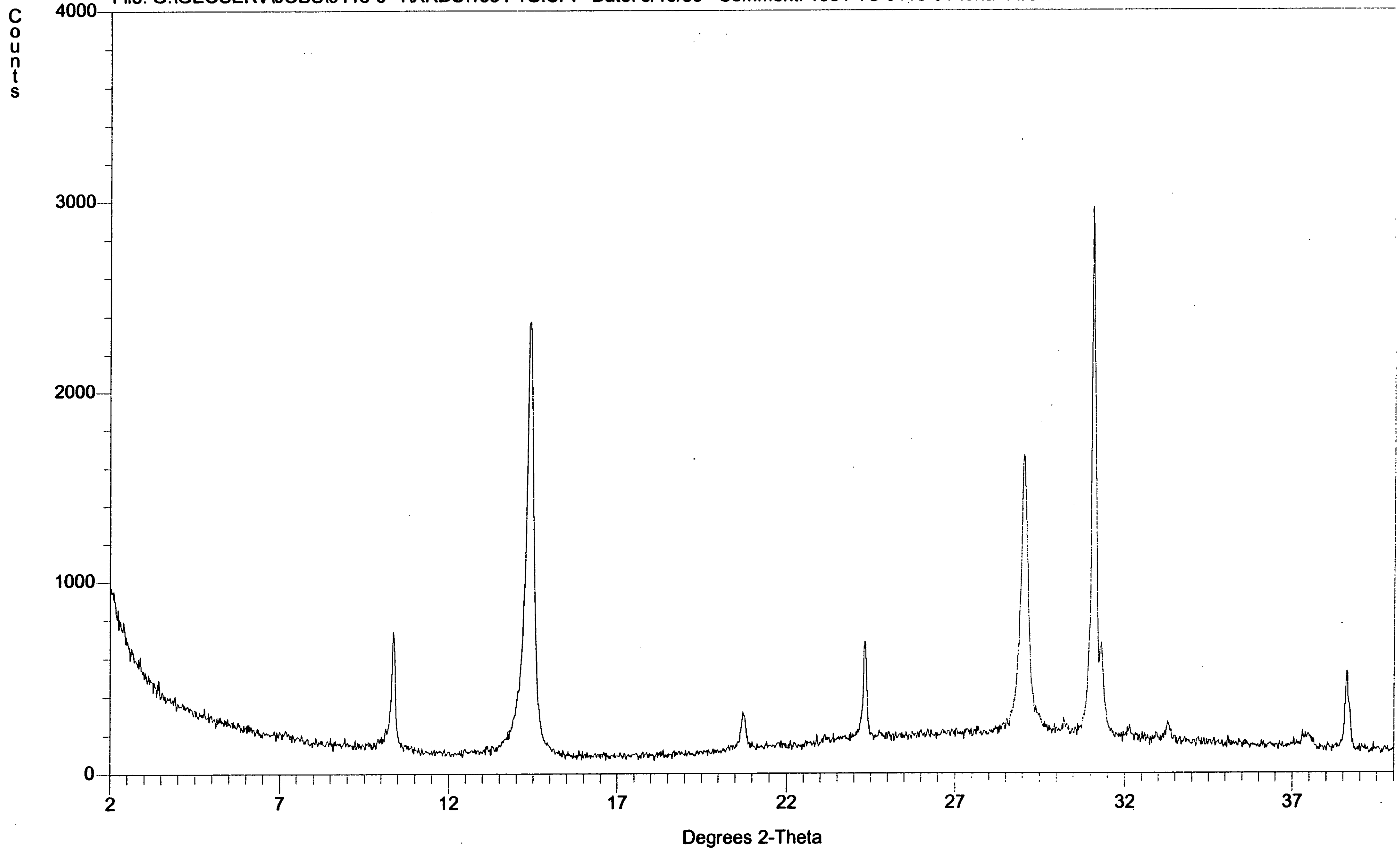
908903-277

File: g:\geoserv\jobs\0418-0~1\xrds\1954-1n.cpi   Date: 5/15/99   Comment: 1954-1N 0418-01 Iona-4 #3 1

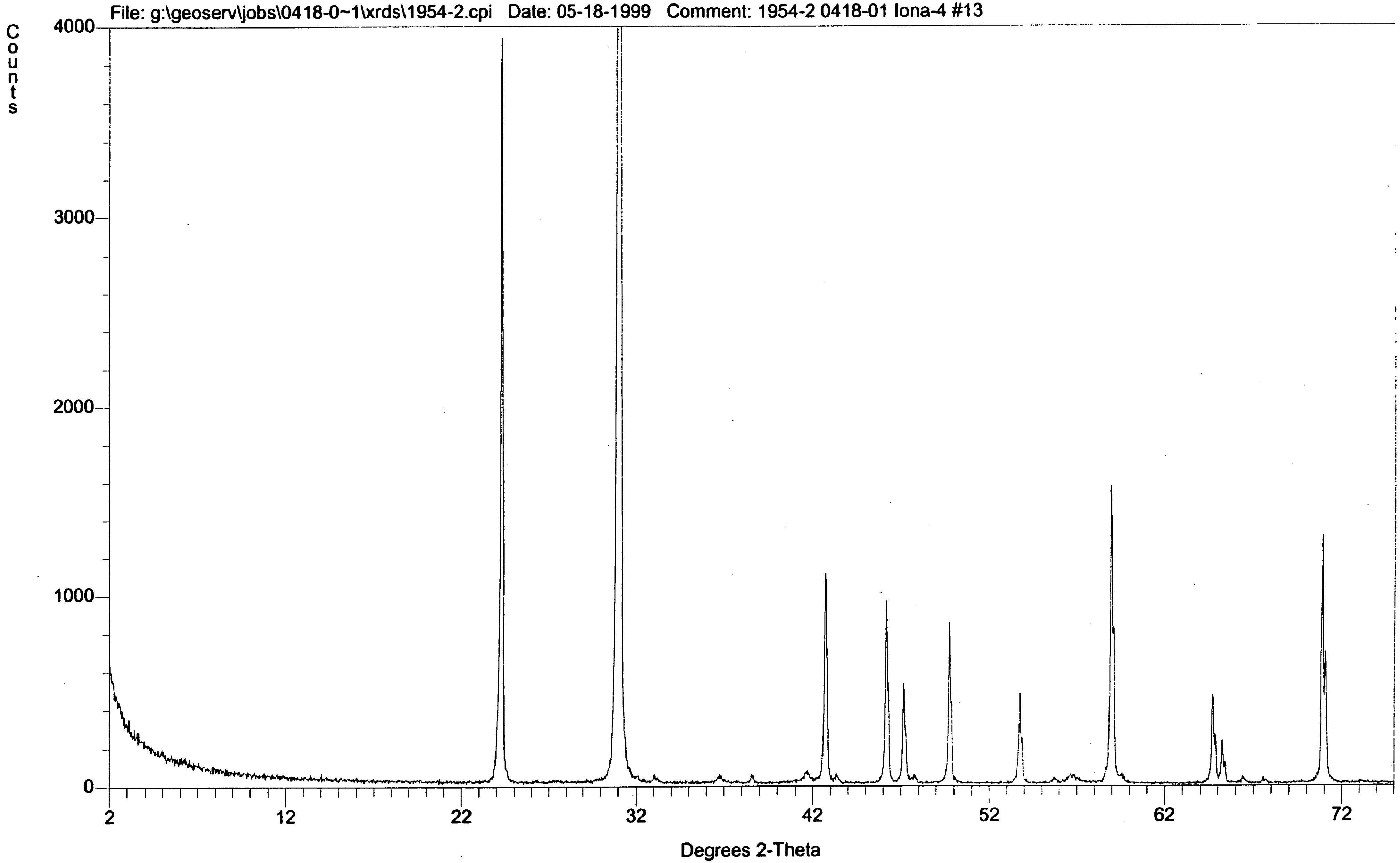


908903 278

File: G:\GEOSERV\JOBS\0418-0~1\XRDS\1954-1G.CPI Date: 5/15/99 Comment: 1954-1G 0418-01 Iona-4 #3 1

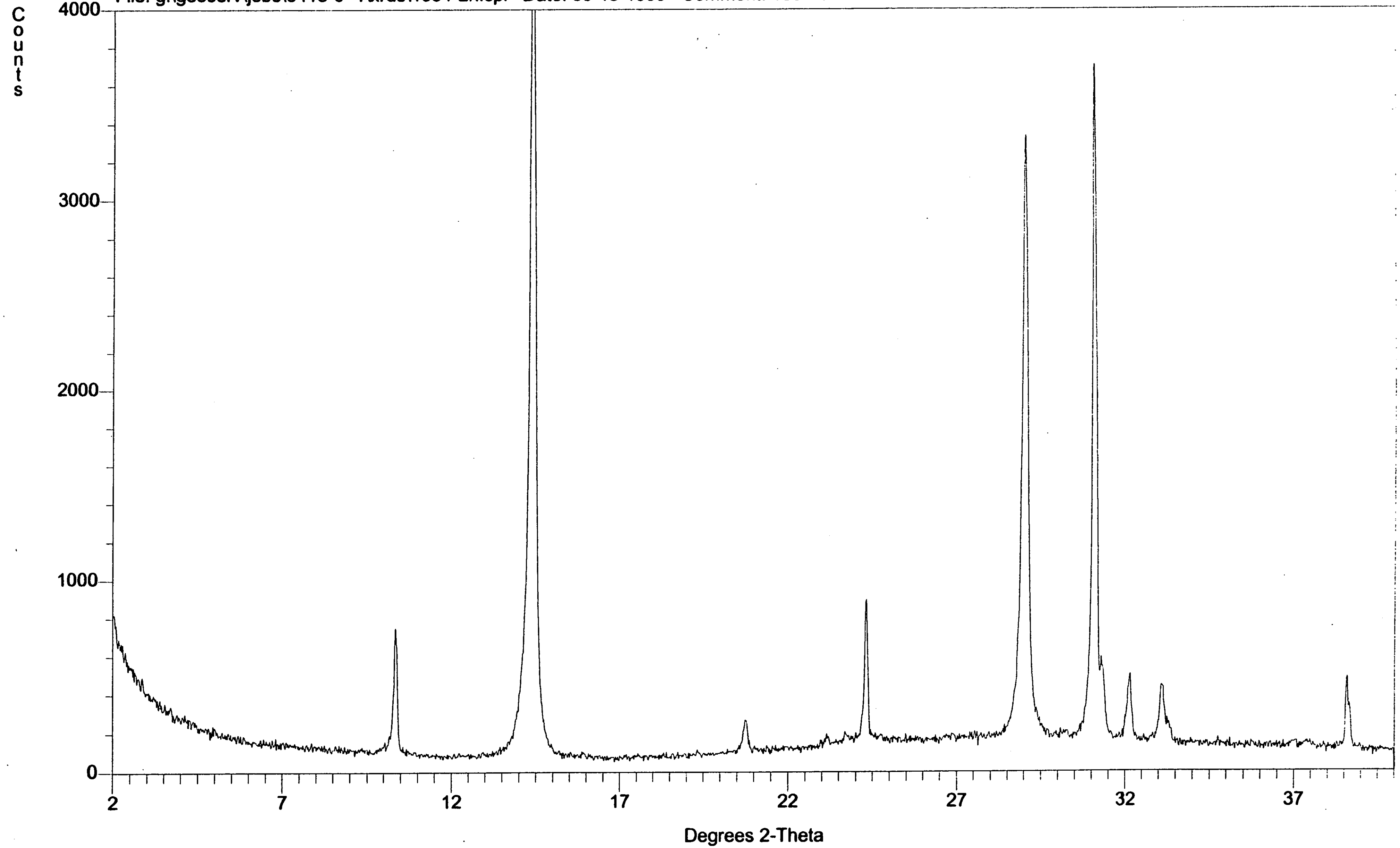


908903 280



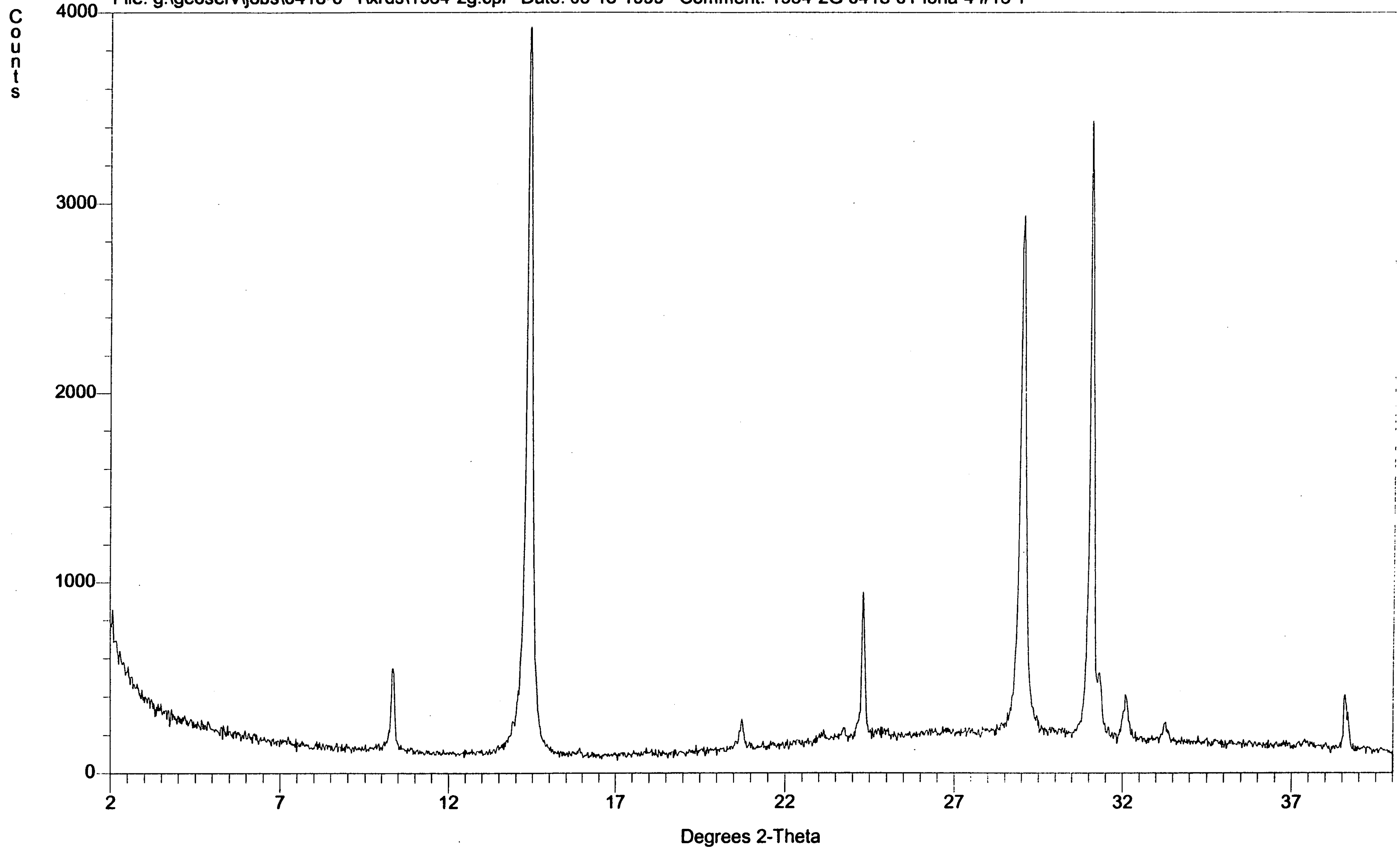
File: g:\geoserv\jobs\0418-0~1\xrds\1954-2.cpi Date: 05-18-1999 Comment: 1954-2 0418-01 Iona-4 #13
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta

File: g:\geoserv\jobs\0418-0~1\xrds\1954-2n.cpi   Date: 05-18-1999   Comment: 1954-2N 0418-01 Iona-4 #13 1

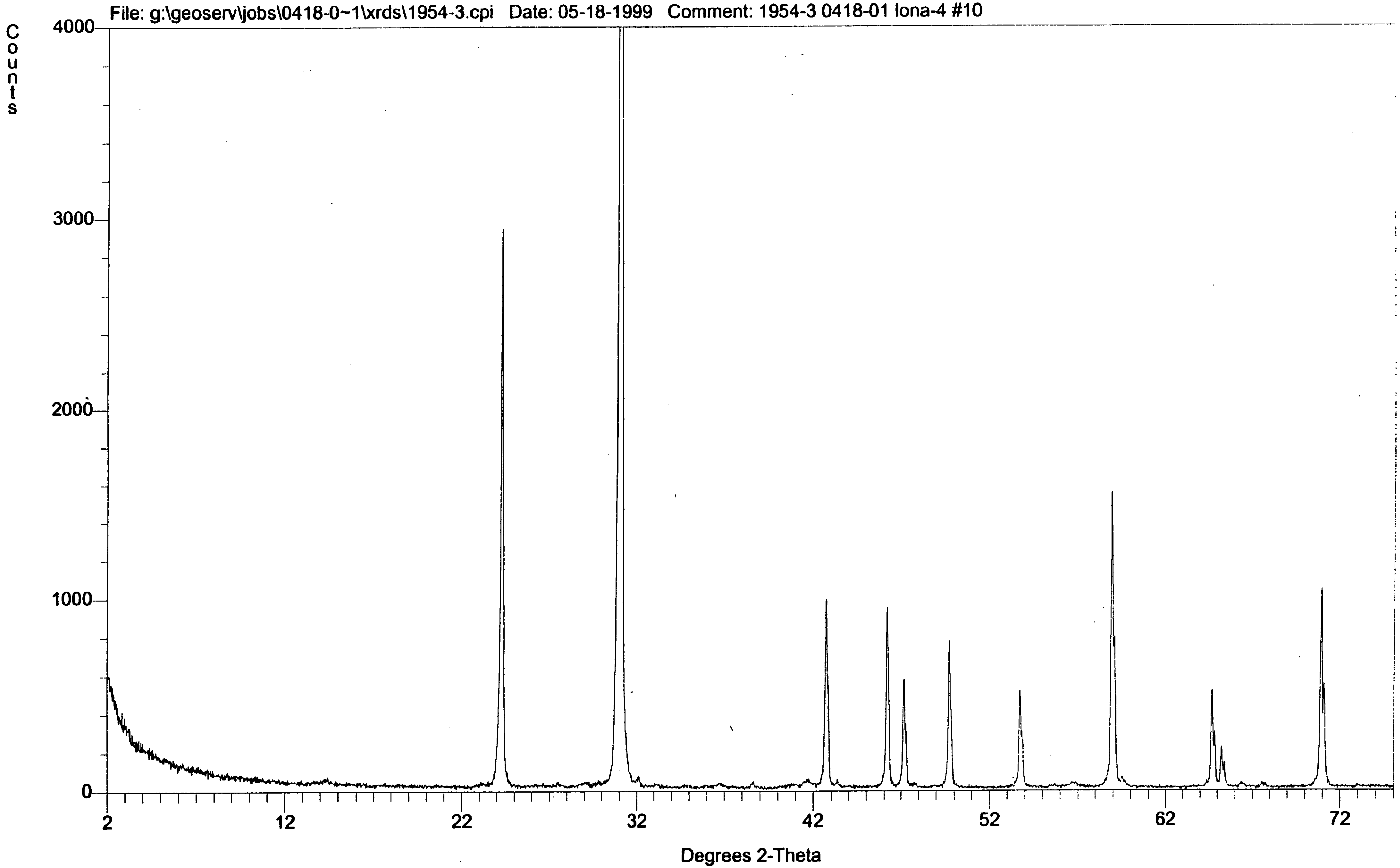


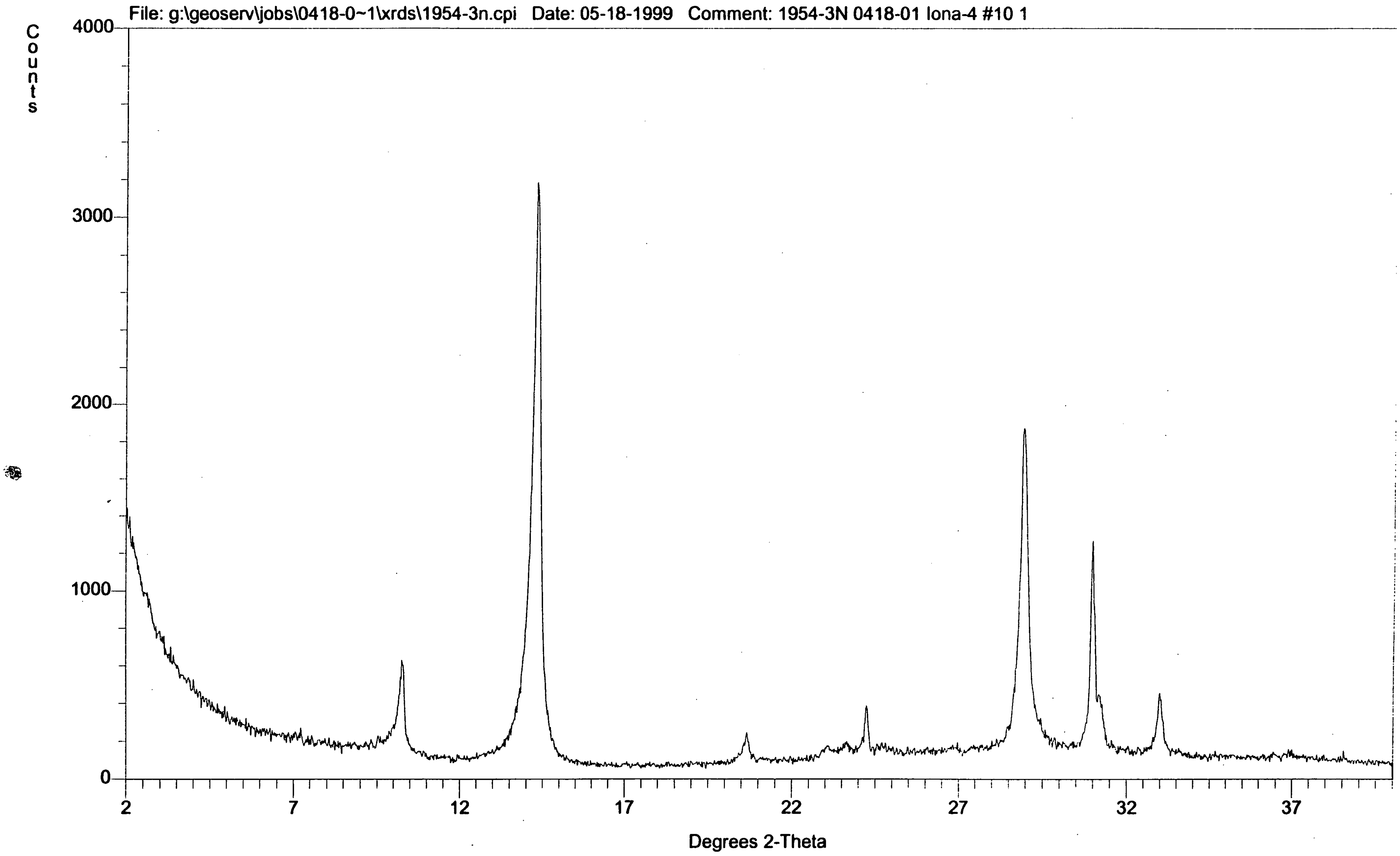
908903 281

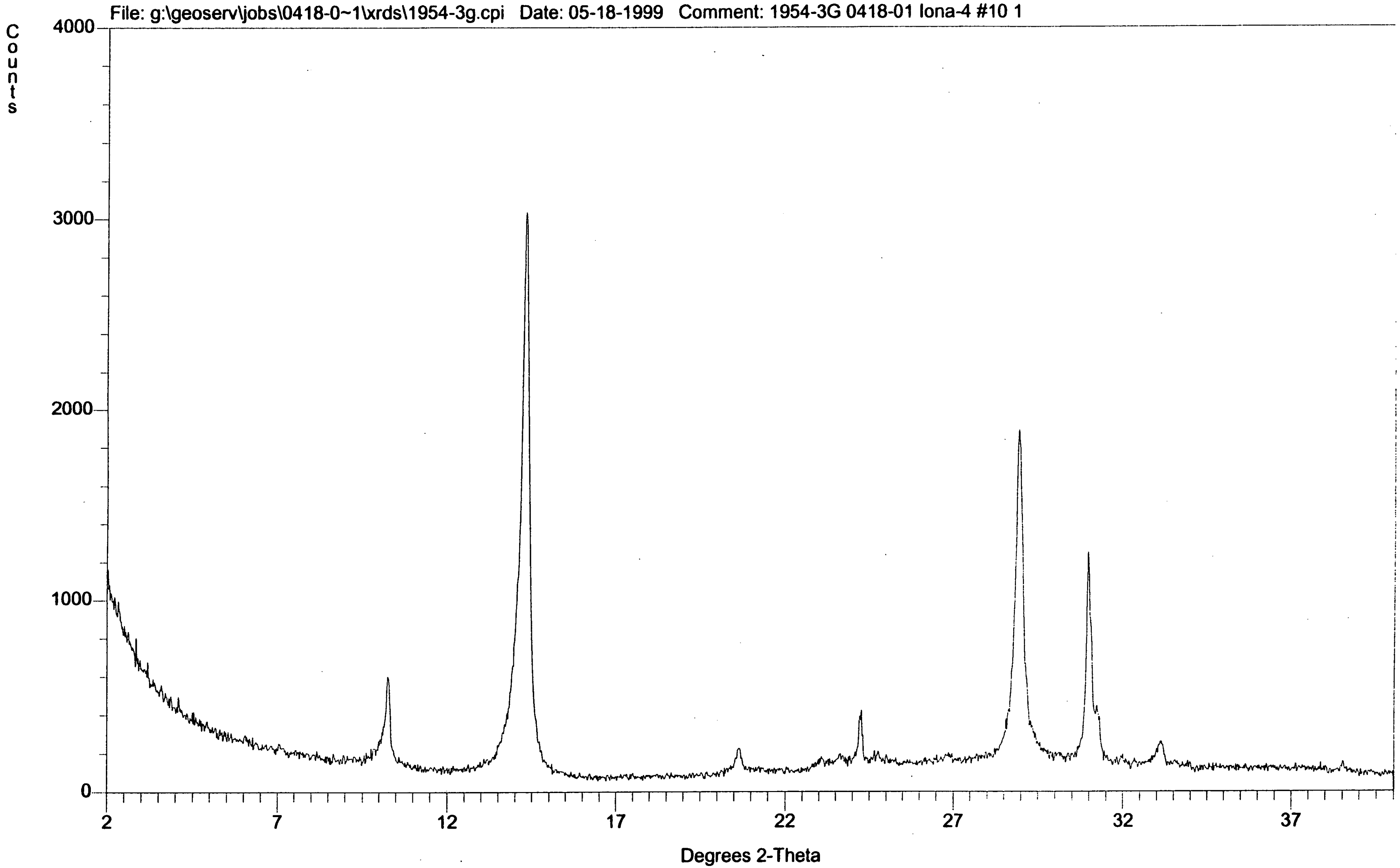
File: g:\geoserv\jobs\0418-0~1\xrds\1954-2g.cpi   Date: 05-18-1999   Comment: 1954-2G 0418-01 Iona-4 #13 1



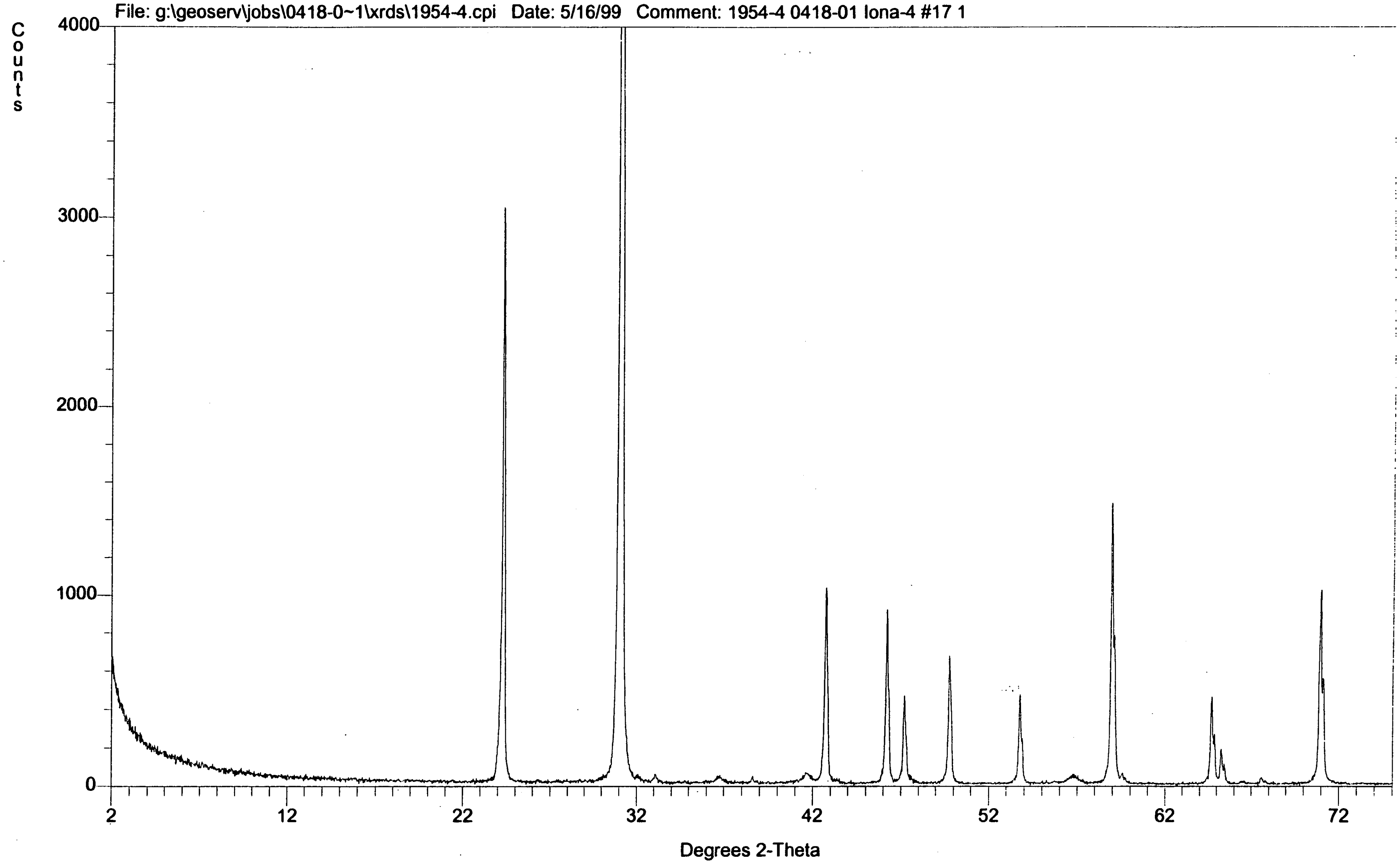
908903 282

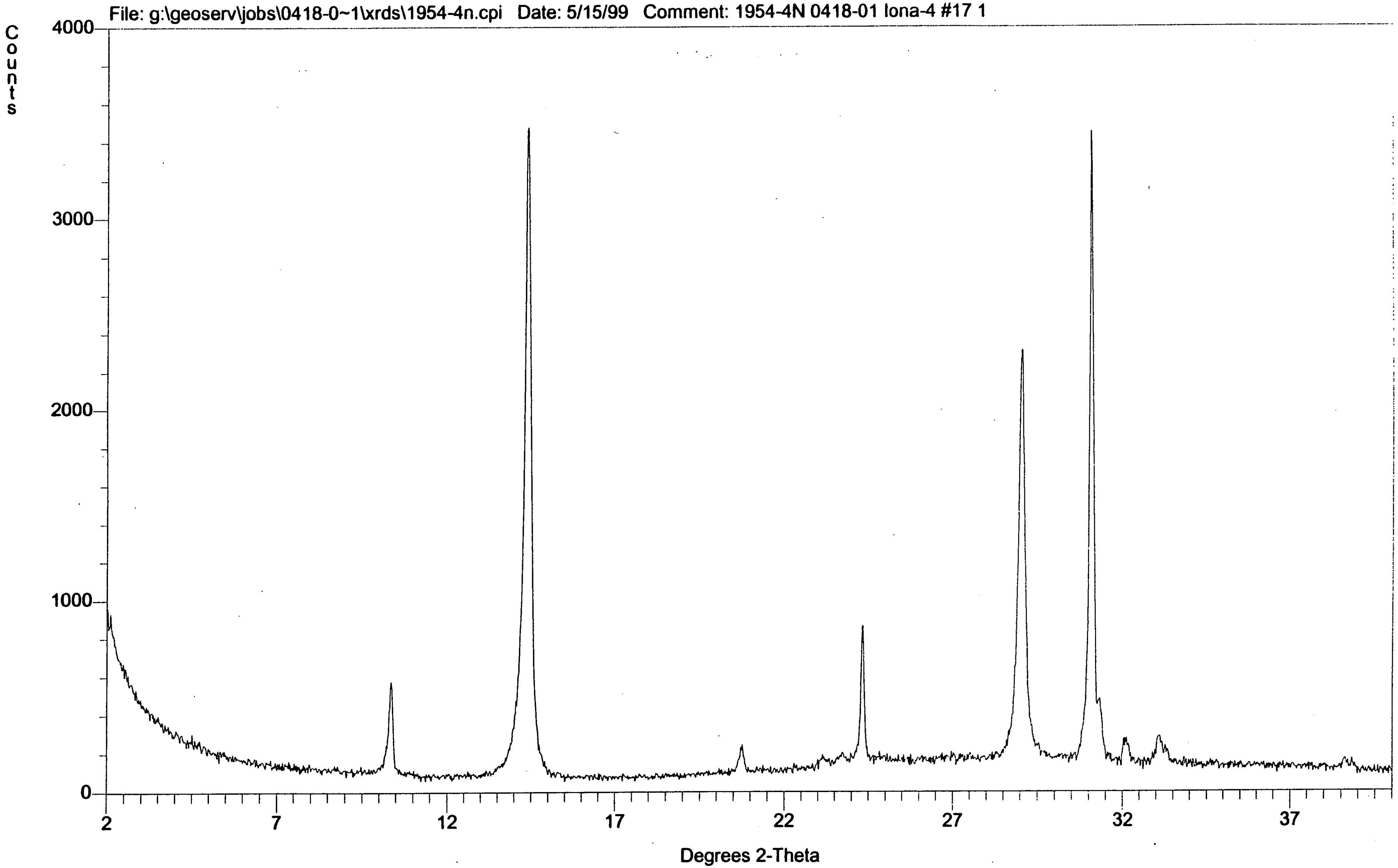

File: g:\geoserv\jobs\0418-0~1\xrds\1954-3.cpi Date: 05-18-1999 Comment: 1954-3 0418-01 Iona-4 #10
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta


File: g:\geoserv\jobs\0418-0~1\xrds\1954-3n.cpi Date: 05-18-1999 Comment: 1954-3N 0418-01 Iona-4 #10 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

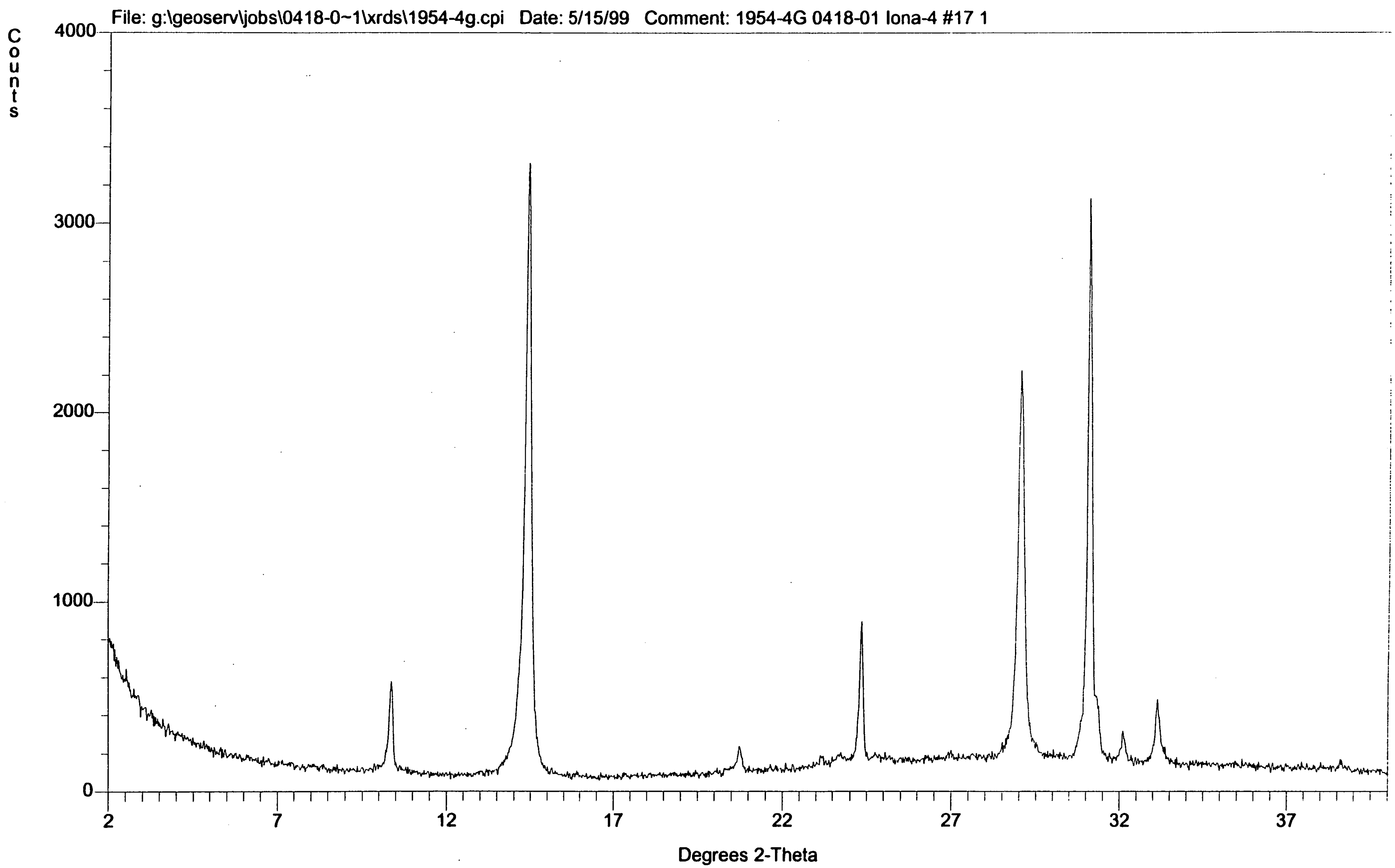

File: g:\geoserv\jobs\0418-0~1\xrds\1954-3g.cpi Date: 05-18-1999 Comment: 1954-3G 0418-01 Iona-4 #10 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

908903 285

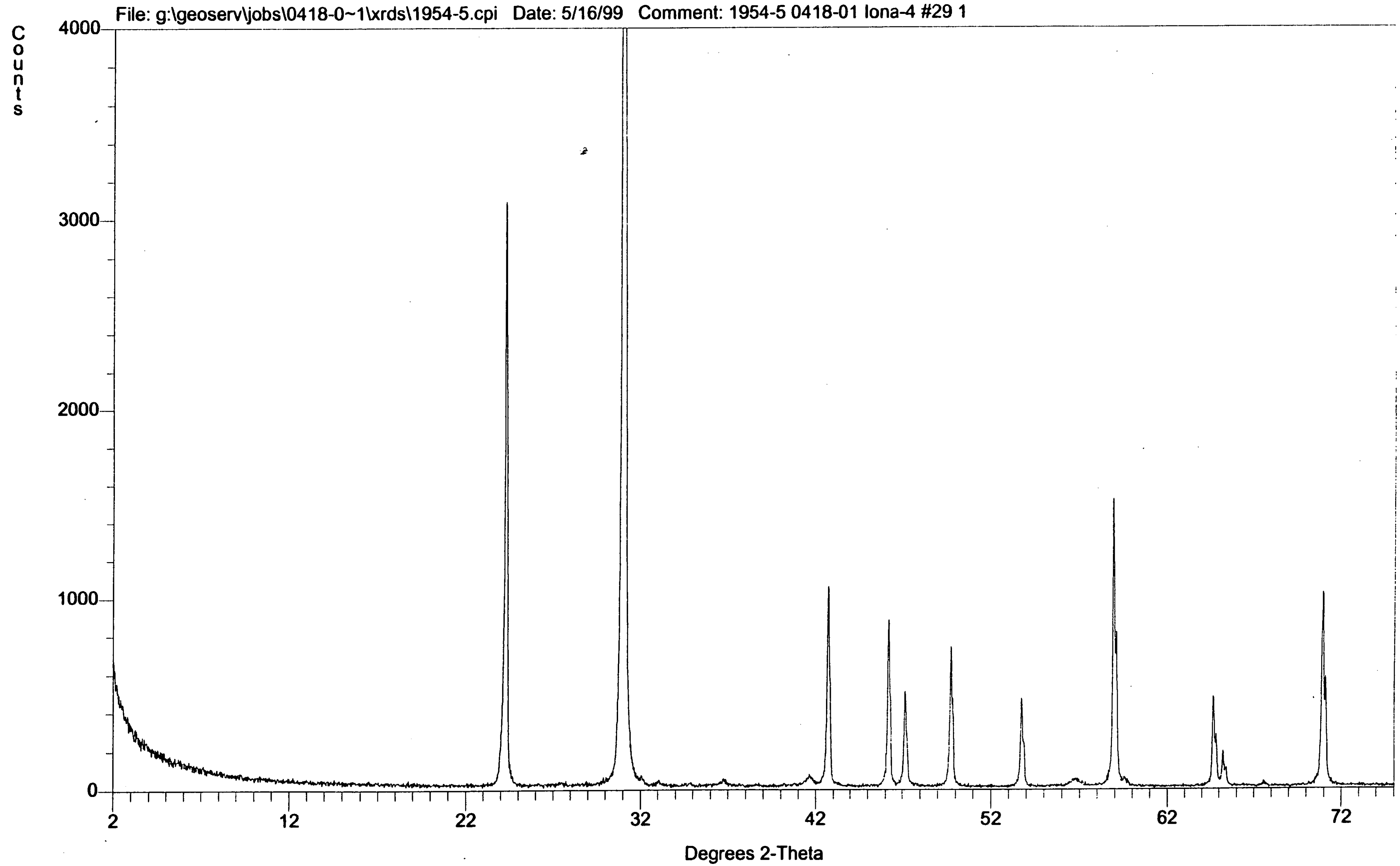

File: g:\geoserv\jobs\0418-0~1\xrds\1954-4.cpi Date: 5/16/99 Comment: 1954-4 0418-01 Iona-4 #17 1
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta

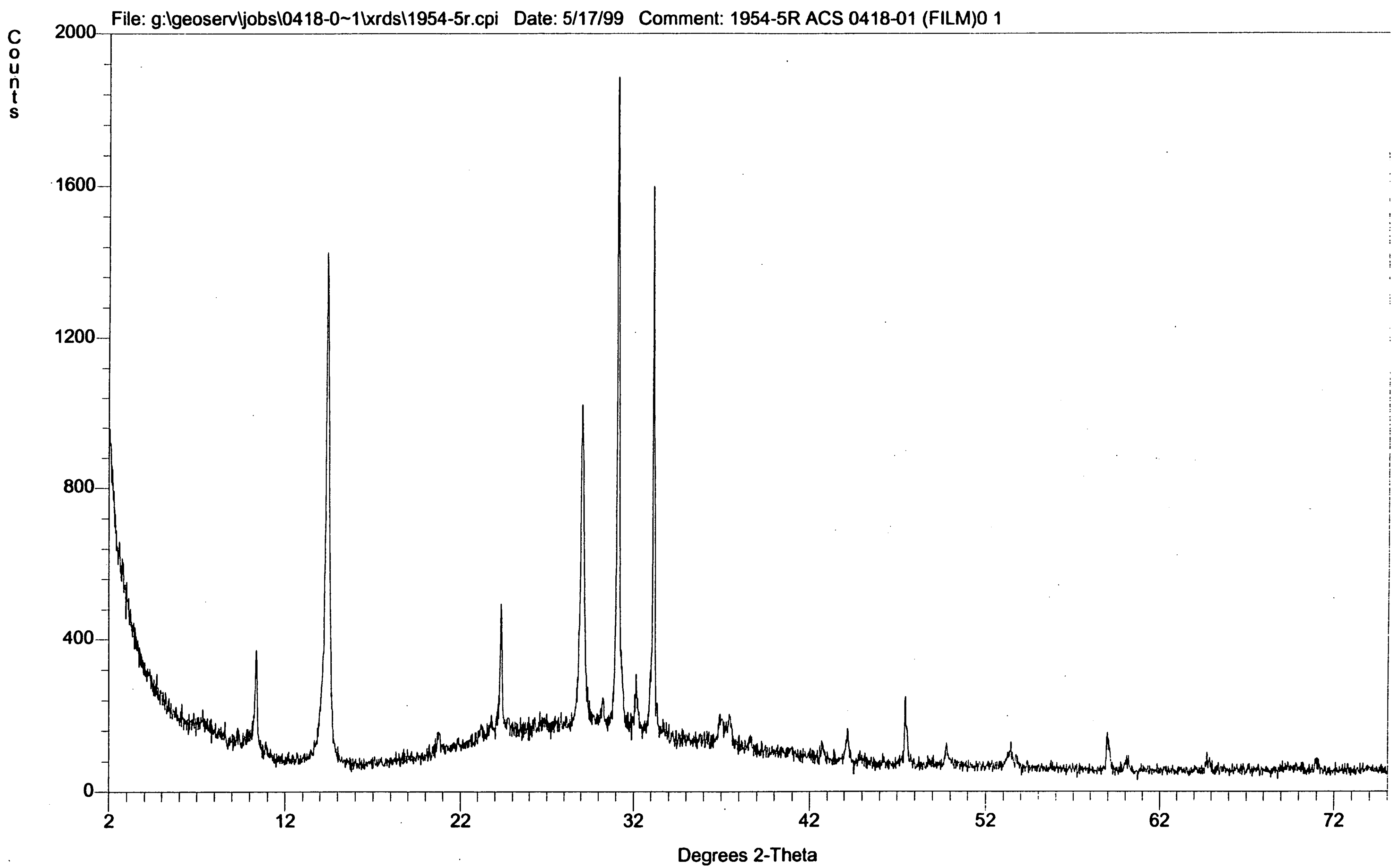

File: g:\geoserv\jobs\0418-0~1\xrds\1954-4n.cpi Date: 5/15/99 Comment: 1954-4N 0418-01 Iona-4 #17 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

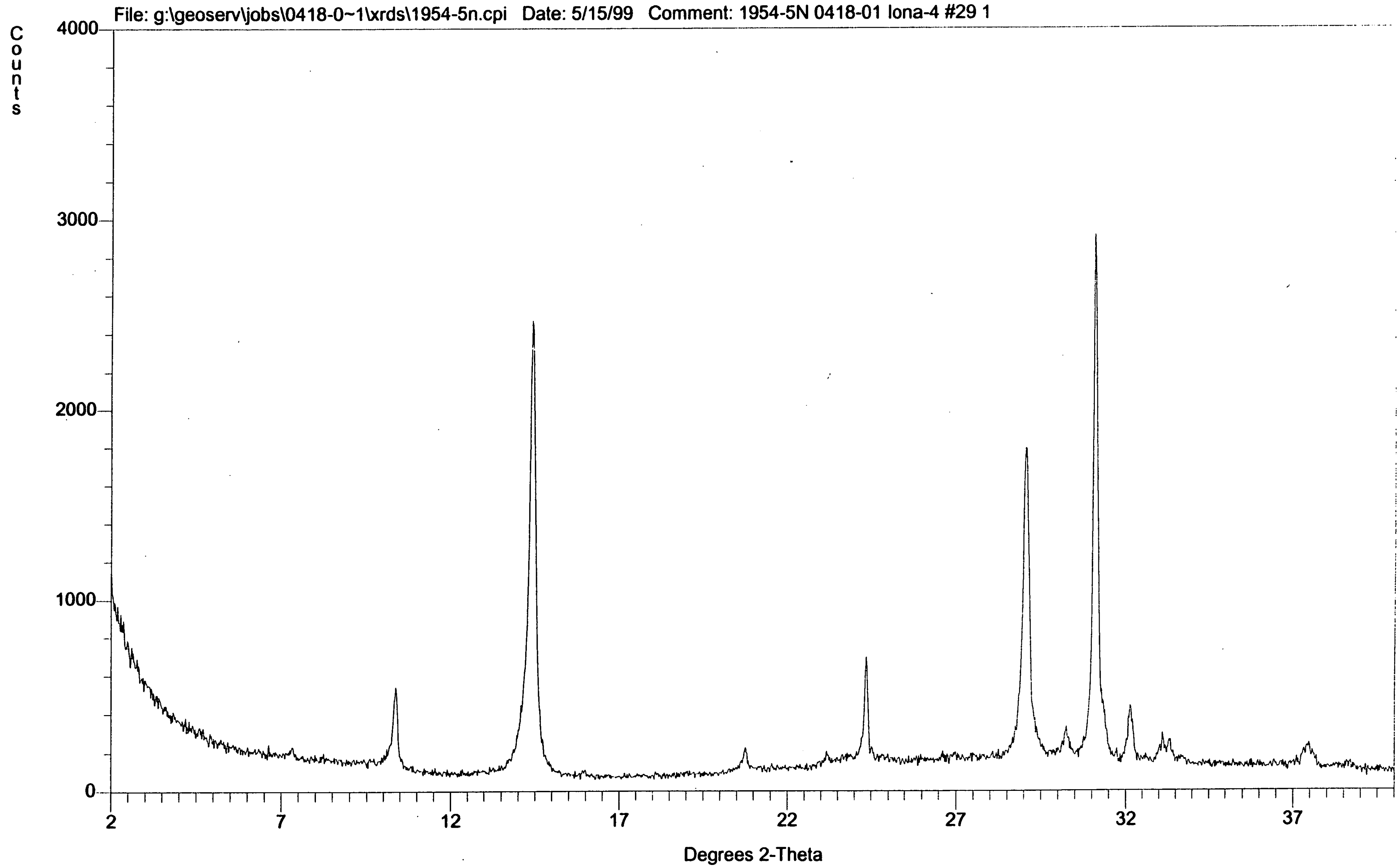
908903 287

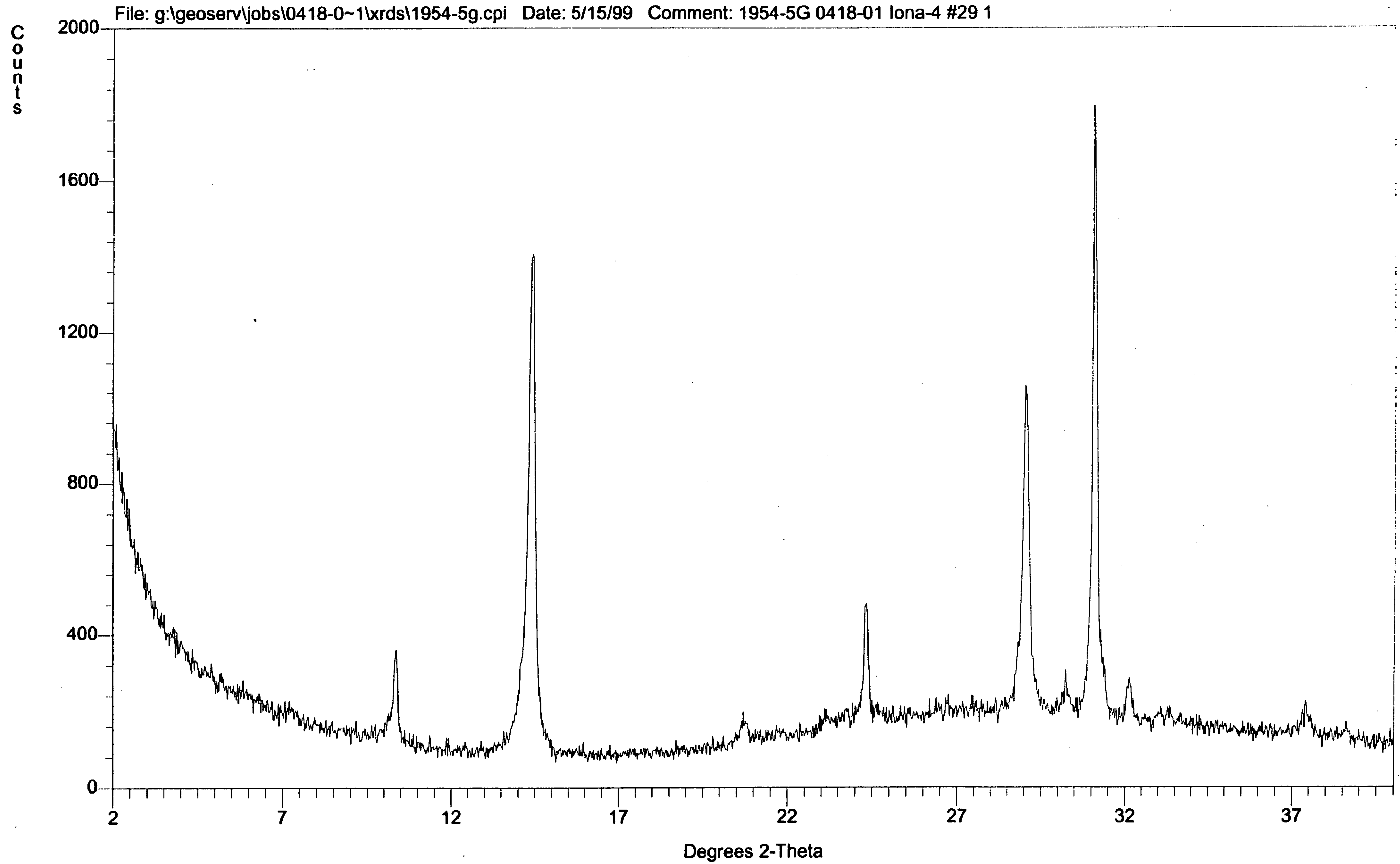

File: g:\geoserv\jobs\0418-0~1\xrds\1954-4g.cpi Date: 5/15/99 Comment: 1954-4G 0418-01 Iona-4 #17 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

908903 289

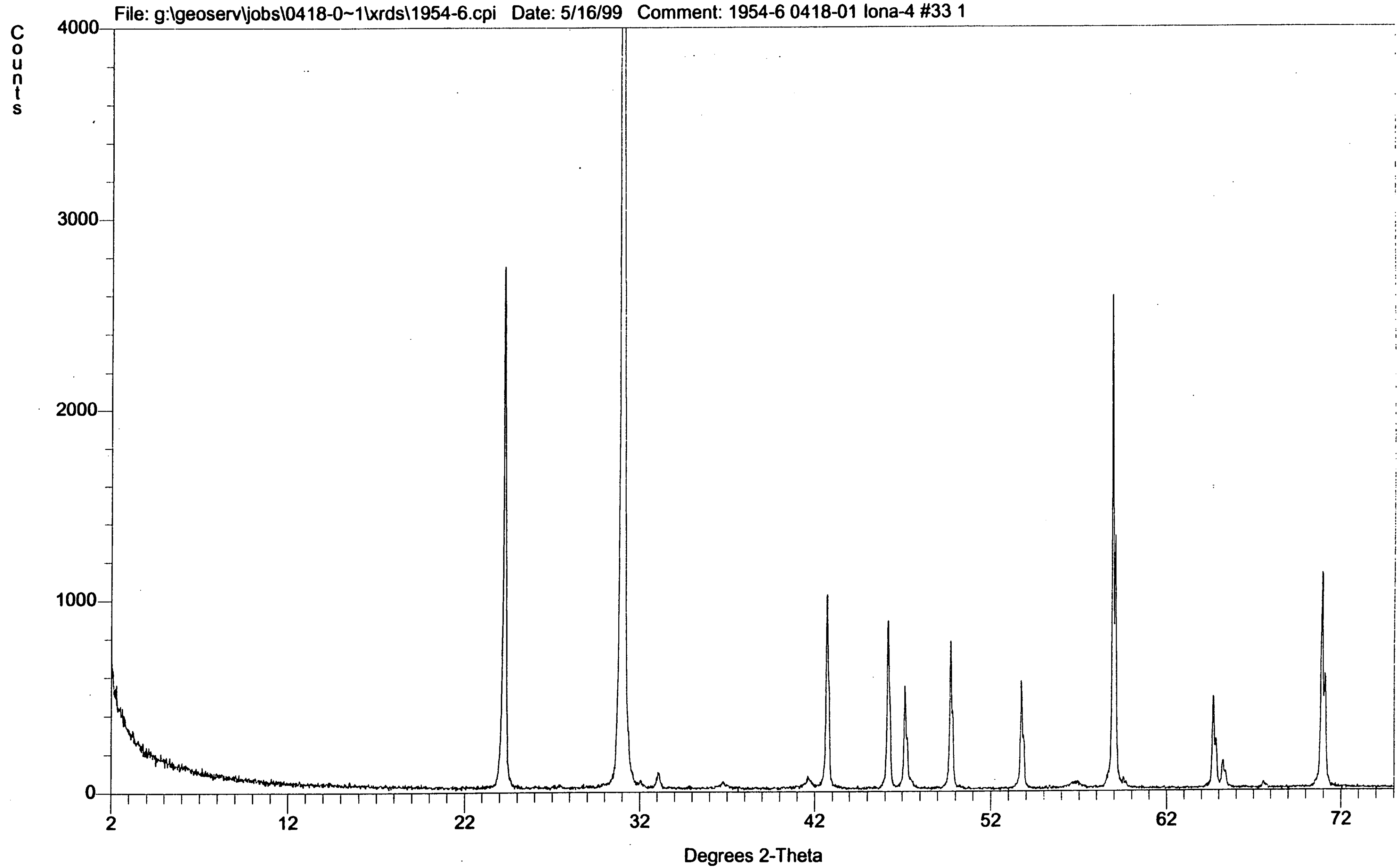

File: g:\geoserv\jobs\0418-0~1\xrds\1954-5.cpi Date: 5/16/99 Comment: 1954-5 0418-01 Iona-4 #29 1
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta


File: g:\geoserv\jobs\0418-0~1\xrds\1954-5r.cpi Date: 5/17/99 Comment: 1954-5R ACS 0418-01 (FILM)0 1
Counts
2000
1600
1200
800
400
0
2
12
22
32
42
52
62
72
Degrees 2-Theta


File: g:\geoserv\jobs\0418-0~1\xrds\1954-5n.cpi Date: 5/15/99 Comment: 1954-5N 0418-01 Iona-4 #29 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

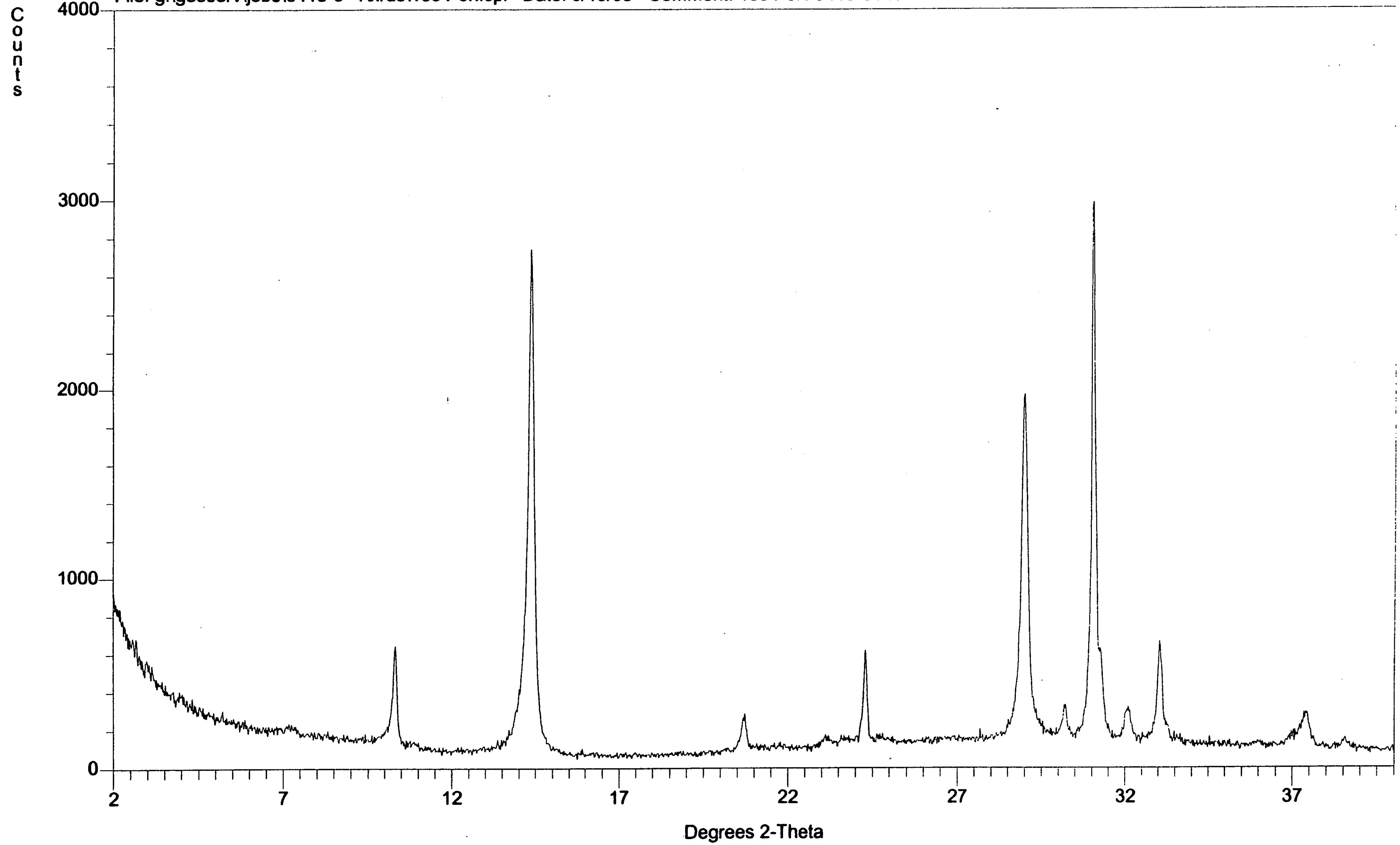

File: g:\geoserv\jobs\0418-0~1\xrds\1954-5g.cpi Date: 5/15/99 Comment: 1954-5G 0418-01 Iona-4 #29 1
Counts
2000
1600
1200
800
400
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

908903 292


File: g:\geoserv\jobs\0418-0~1\xrds\1954-6.cpi Date: 5/16/99 Comment: 1954-6 0418-01 Iona-4 #33 1
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta

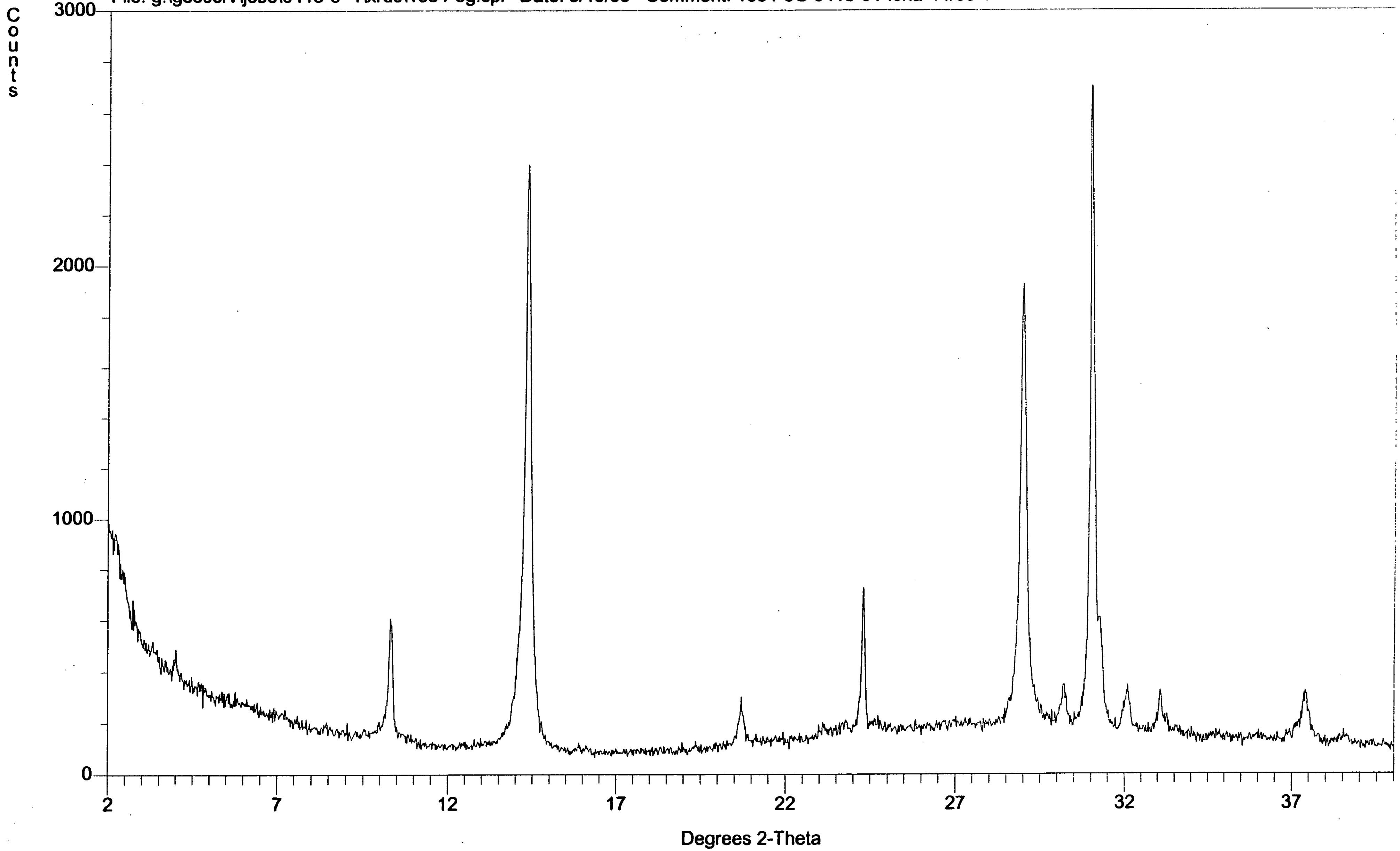
908903 293

File: g:\geoserv\jobs\0418-0~1\xrds\1954-6n.cpi Date: 5/15/99 Comment: 1954-6N 0418-01 Iona-4 #33 1



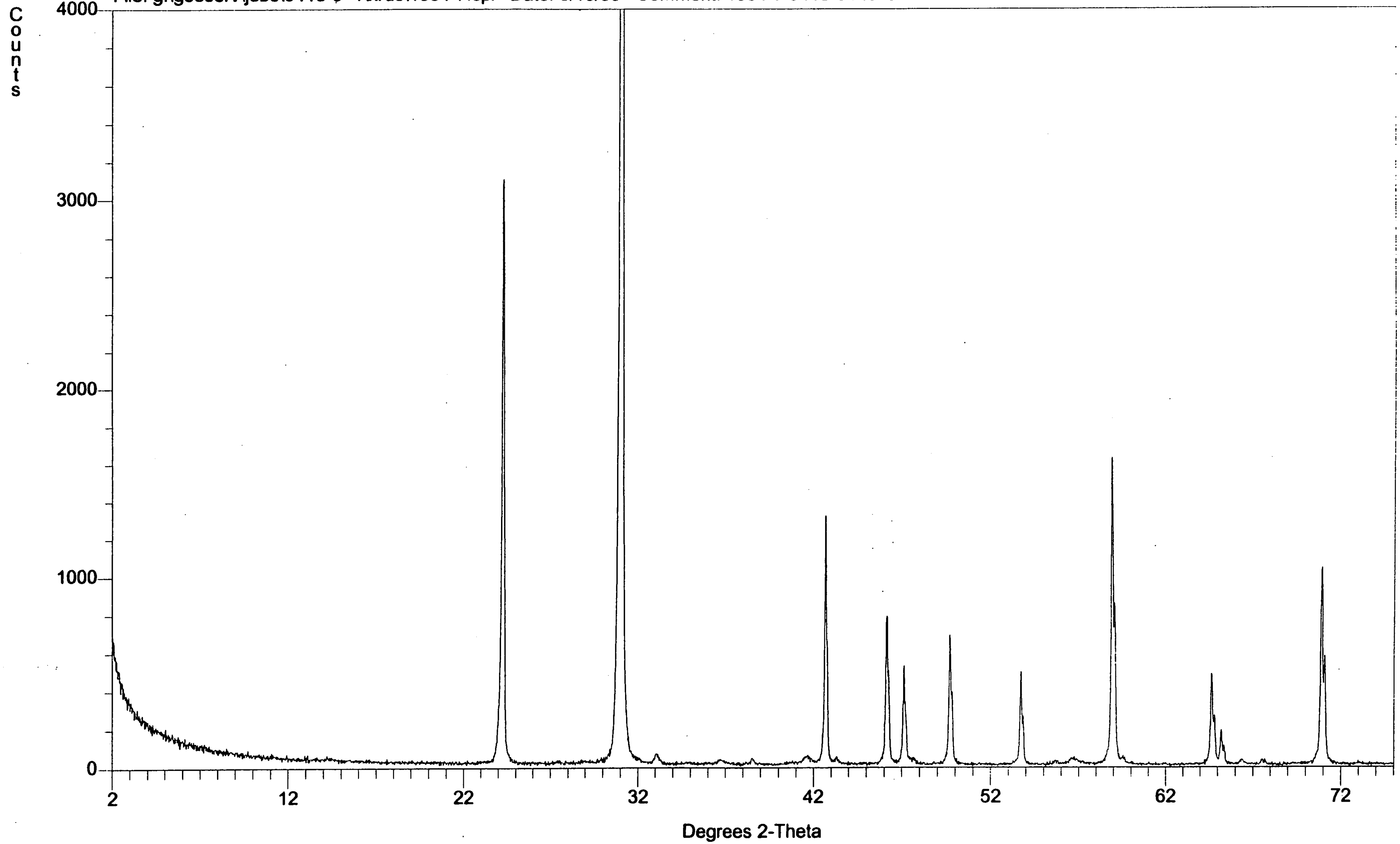
908903 294

File: g:\geoserv\jobs\0418-0~1\xrds\1954-6g.cpi Date: 5/15/99 Comment: 1954-6G 0418-01 Iona-4 #33 1



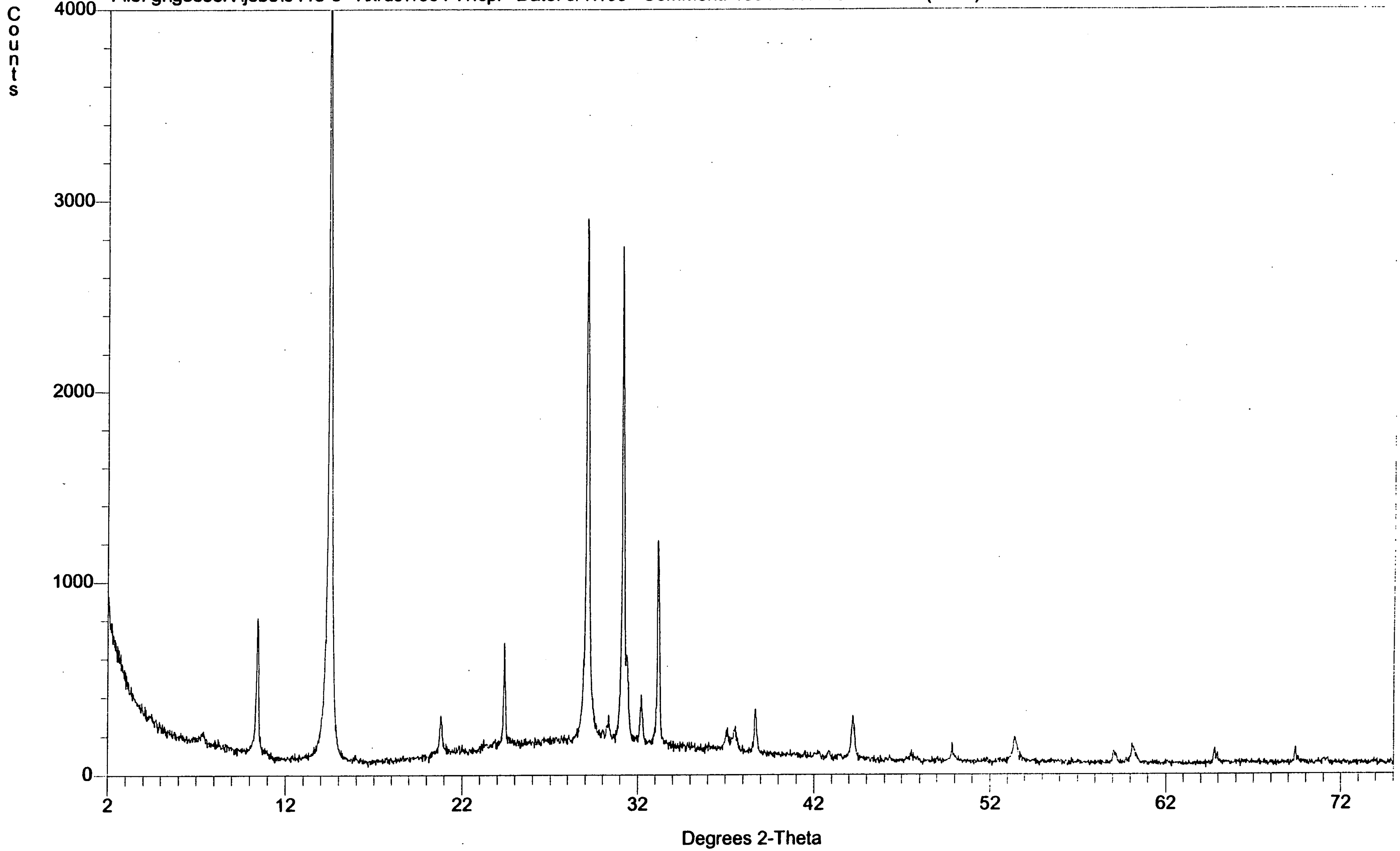
908903 295

File: g:\geoserv\jobs\0418-0~1\xrds\1954-7.cpi Date: 5/16/99 Comment: 1954-7 0418-01 Iona-4 #47 1

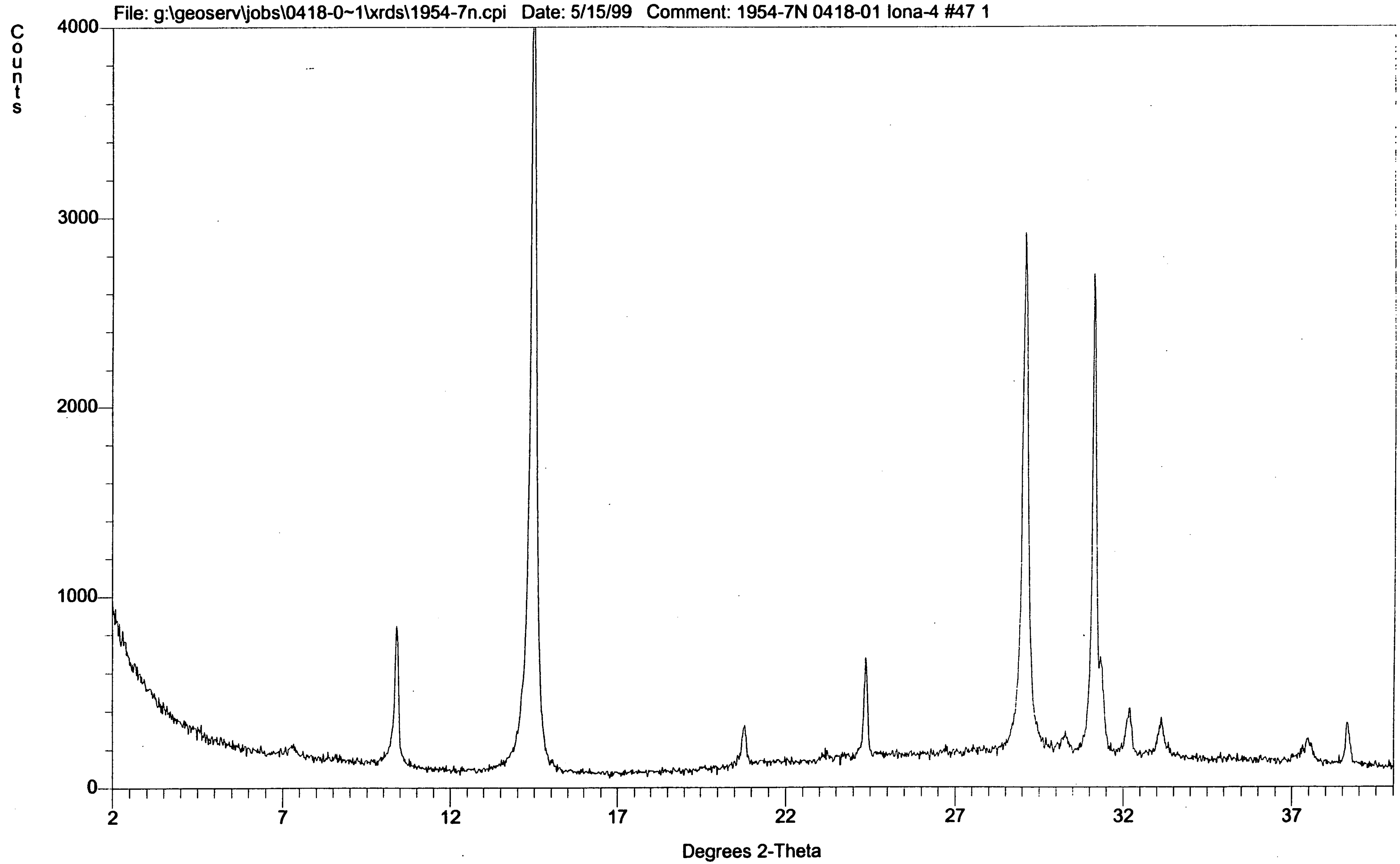


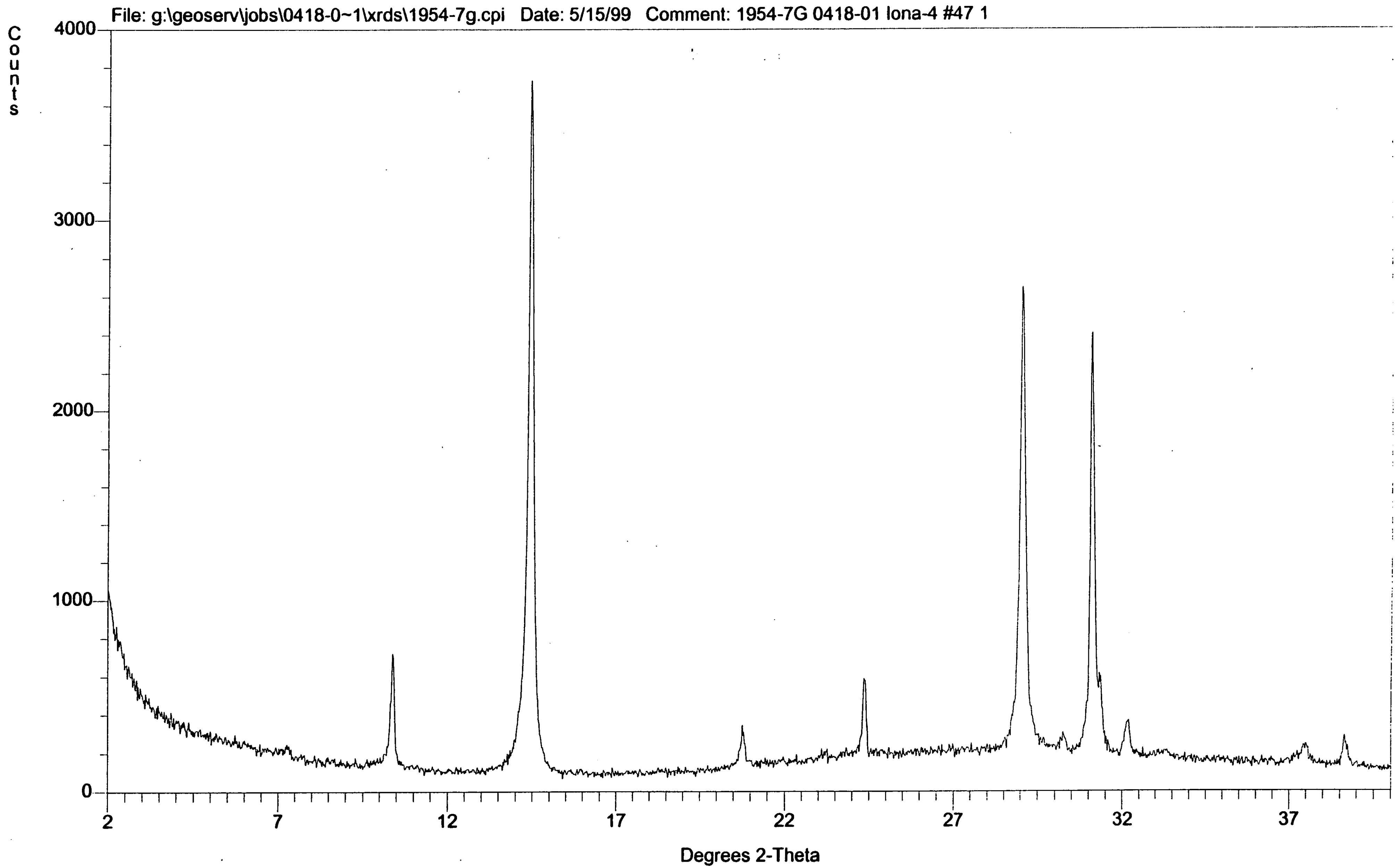
908903 296

File: g:\geoserv\jobs\0418-0~1\xrds\1954-7r.cpi   Date: 5/17/99   Comment: 1954-7R ACS 0418-01 (FILM)0 1

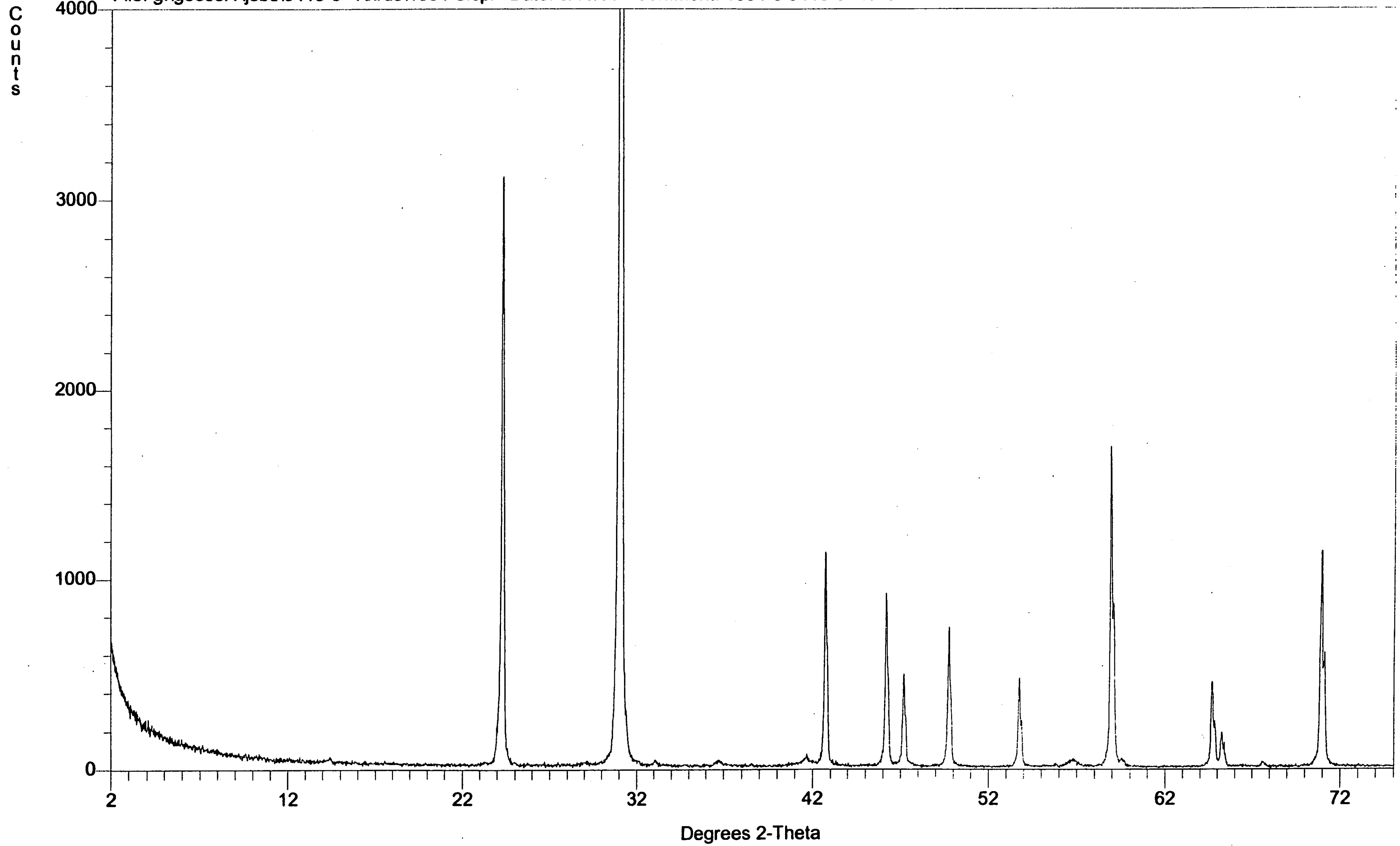


908903 297


File: g:\geoserv\jobs\0418-0~1\xrds\1954-7n.cpi Date: 5/15/99 Comment: 1954-7N 0418-01 Iona-4 #47 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

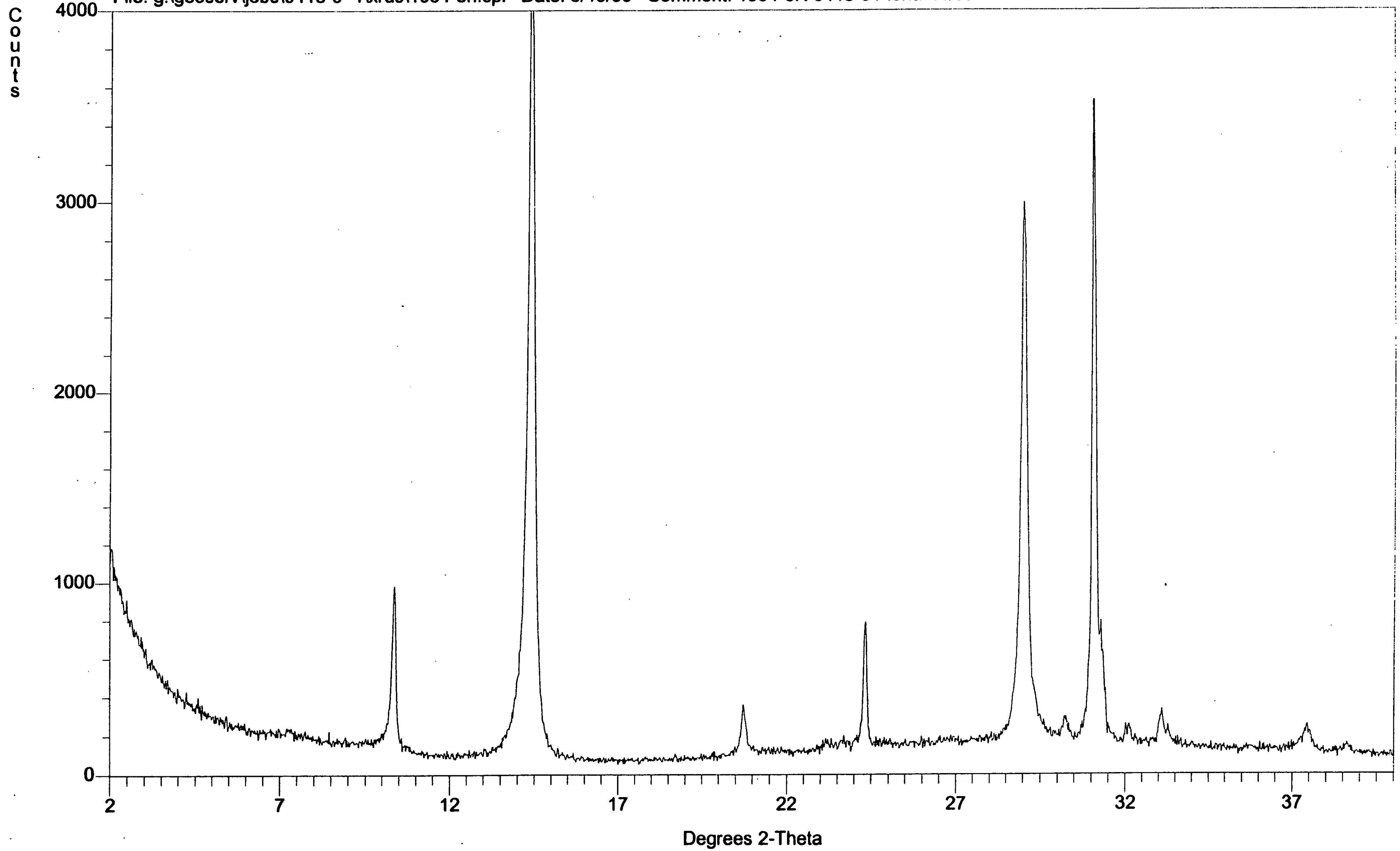

File: g:\geoserv\jobs\0418-0~1\xrds\1954-7g.cpi Date: 5/15/99 Comment: 1954-7G 0418-01 Iona-4 #47 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

File: g:\geoserv\jobs\0418-0~1\xrds\1954-8.cpi Date: 5/16/99 Comment: 1954-8 0418-01 Iona-4 #59 1



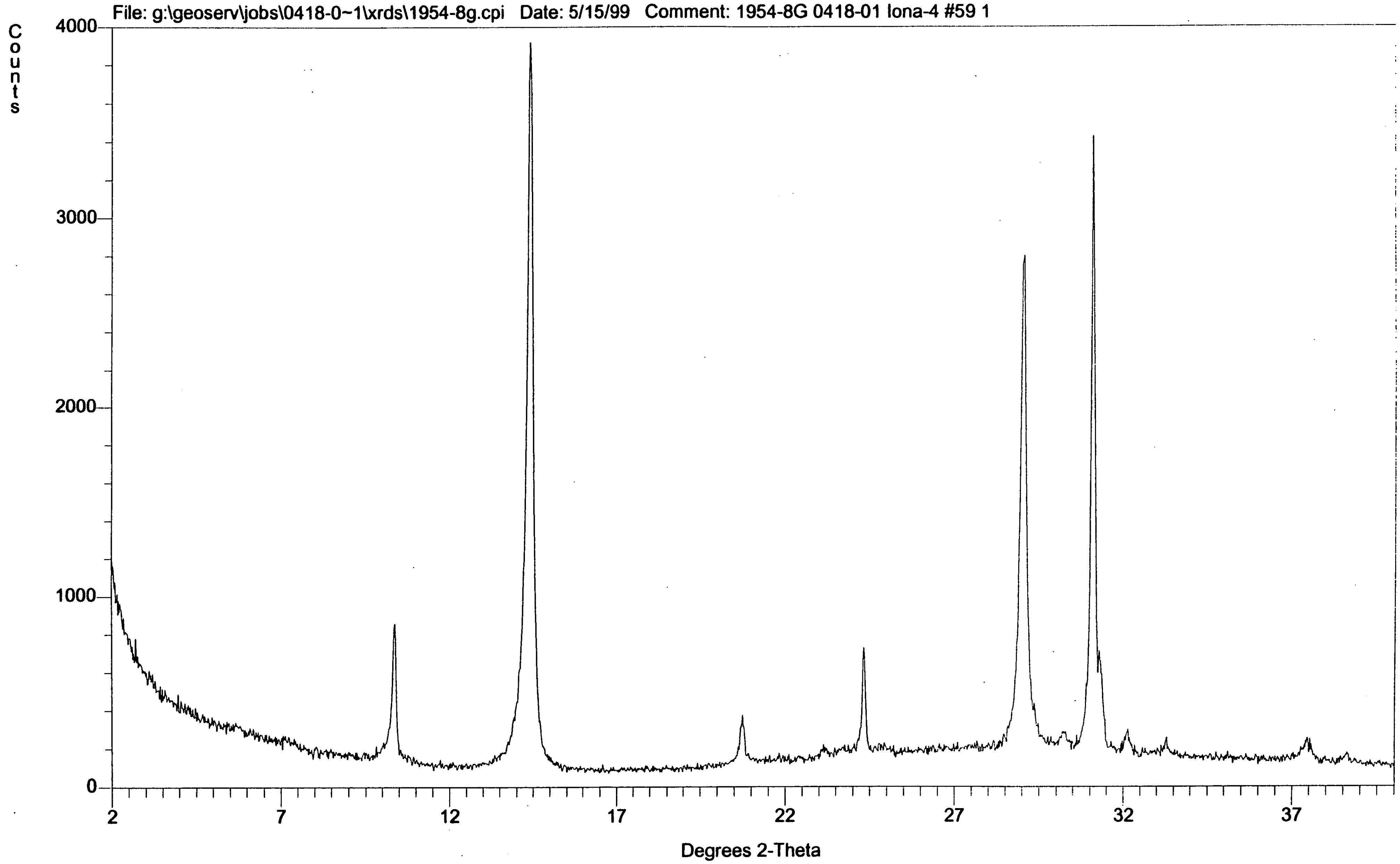
908903 300

File: g:\geoserv\jobs\0418-0~1\xrds\1954-8n.cpi Date: 5/15/99 Comment: 1954-8N 0418-01 Iona-4 #59 1



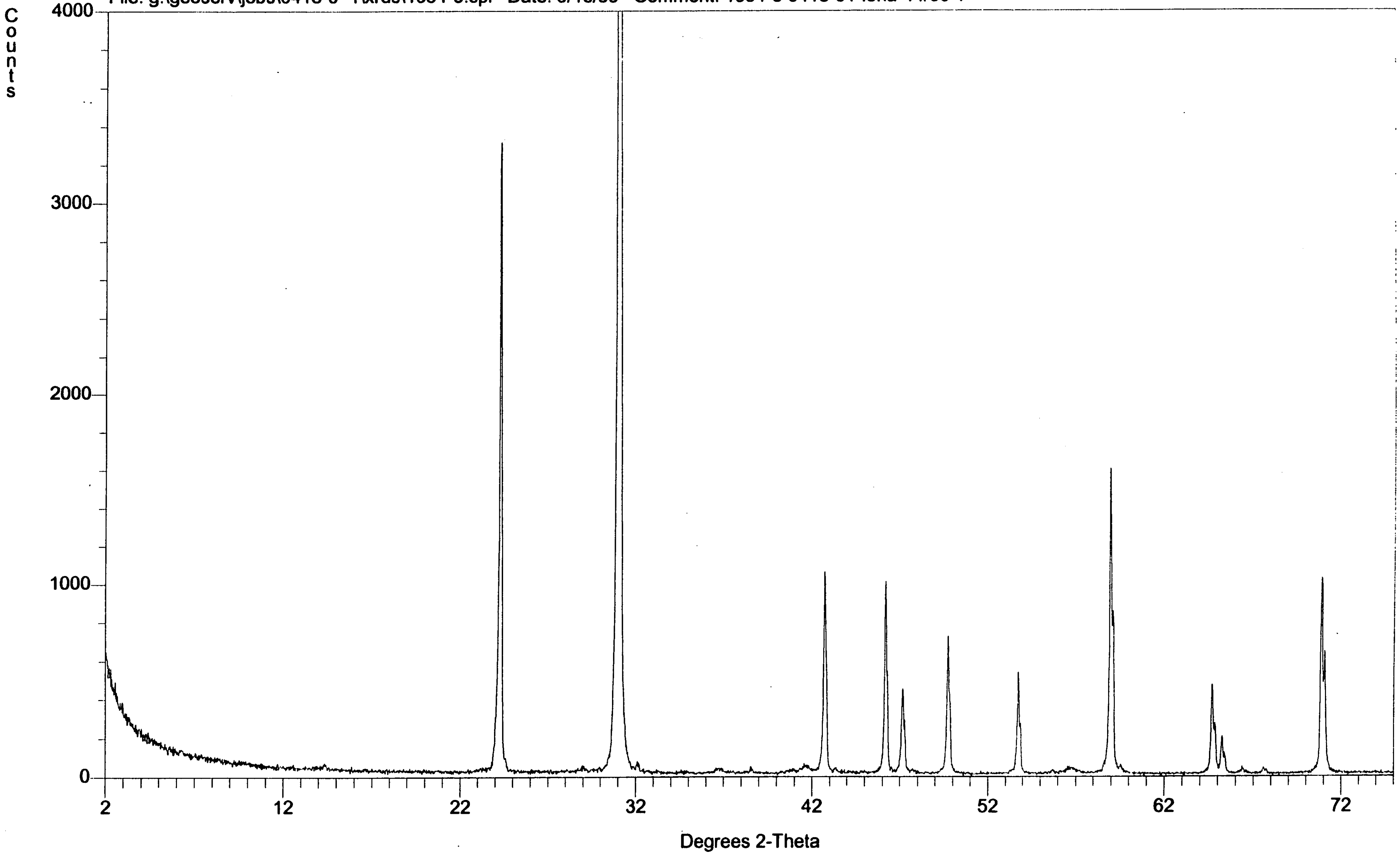
908903 301

908903 302



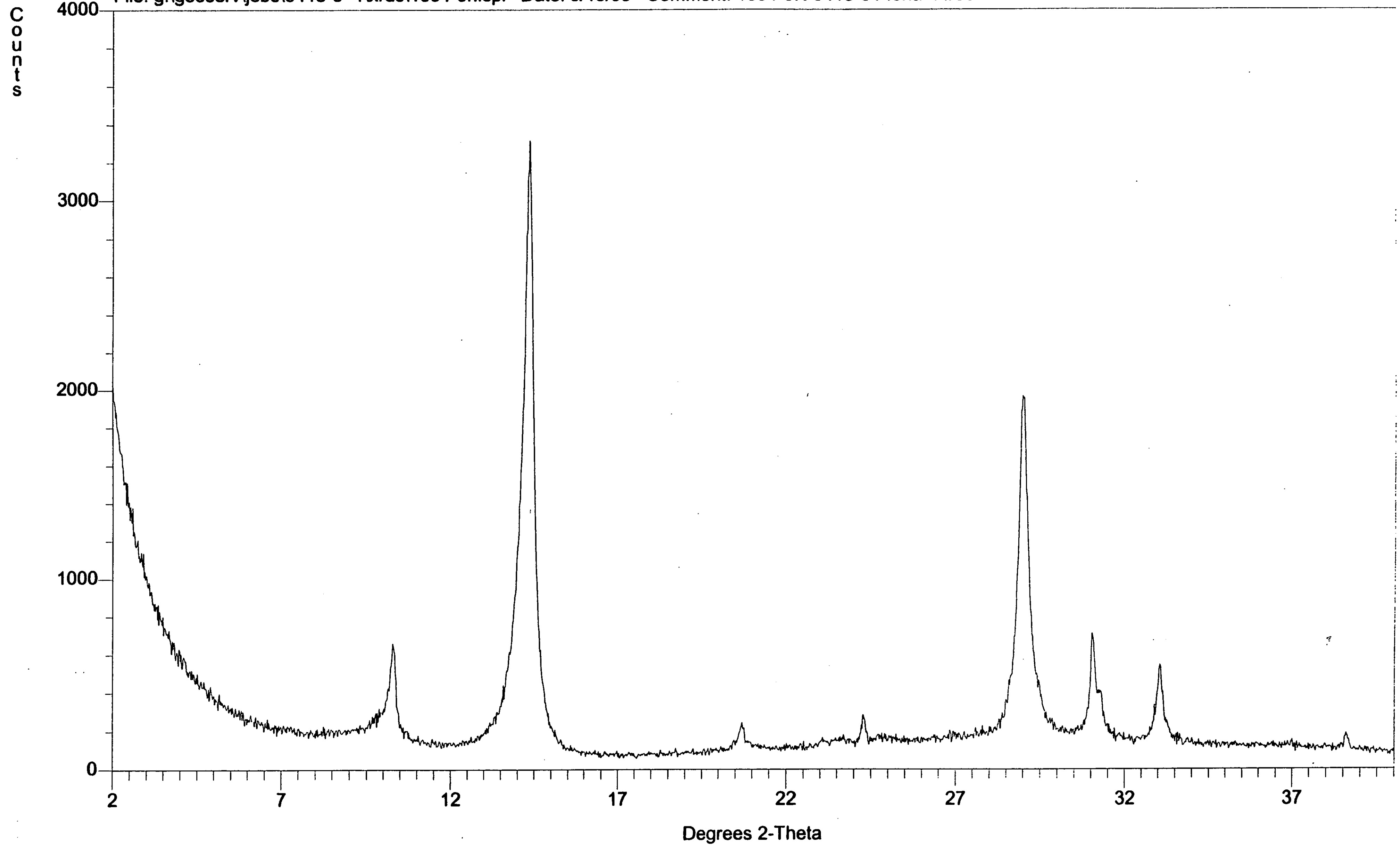
File: g:\geoserv\jobs\0418-0~1\xrds\1954-8g.cpi Date: 5/15/99 Comment: 1954-8G 0418-01 Iona-4 #59 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

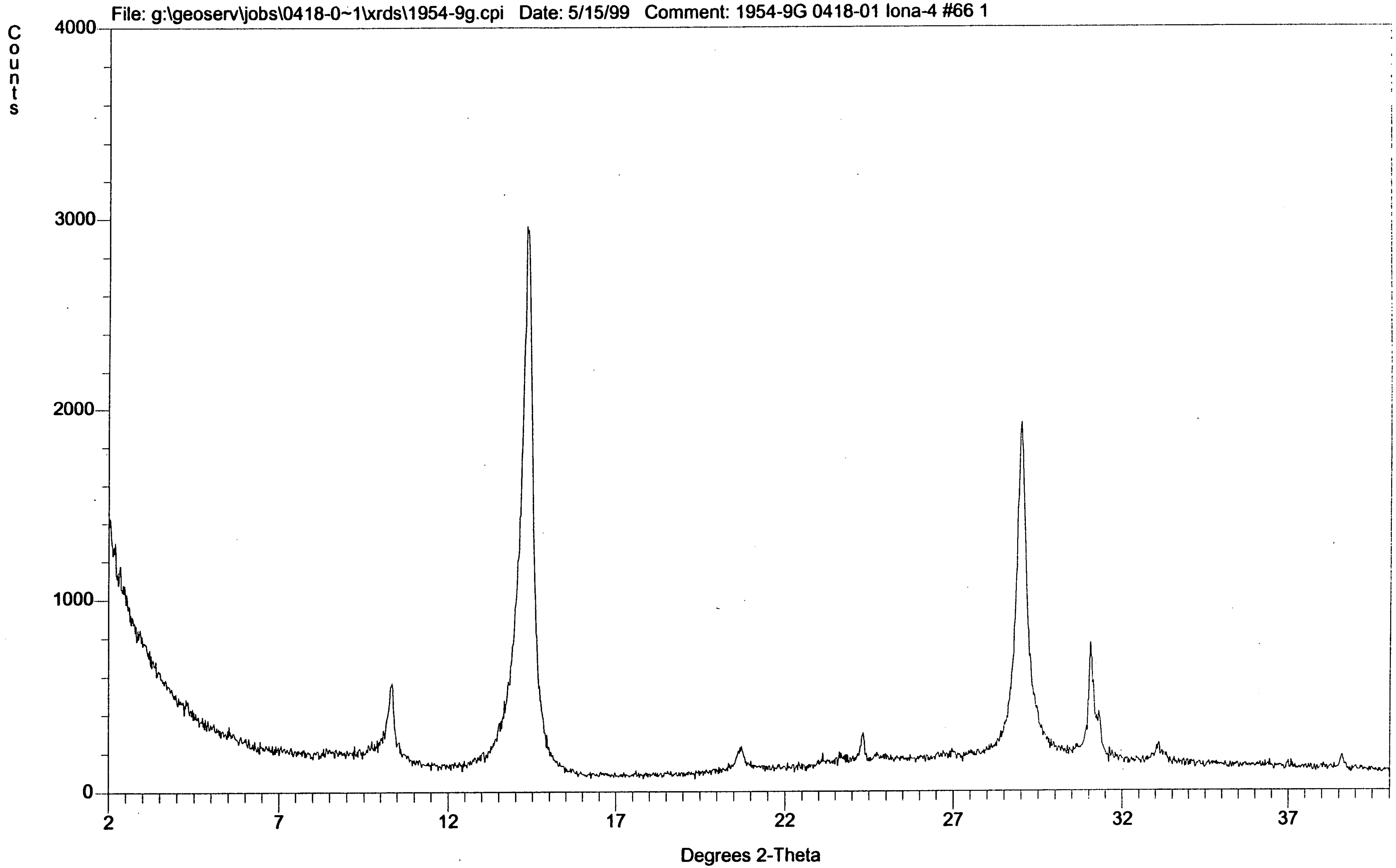
File: g:\geoserv\jobs\0418-0~1\xrds\1954-9.cpi   Date: 5/16/99   Comment: 1954-9 0418-01 Iona-4 #66 1

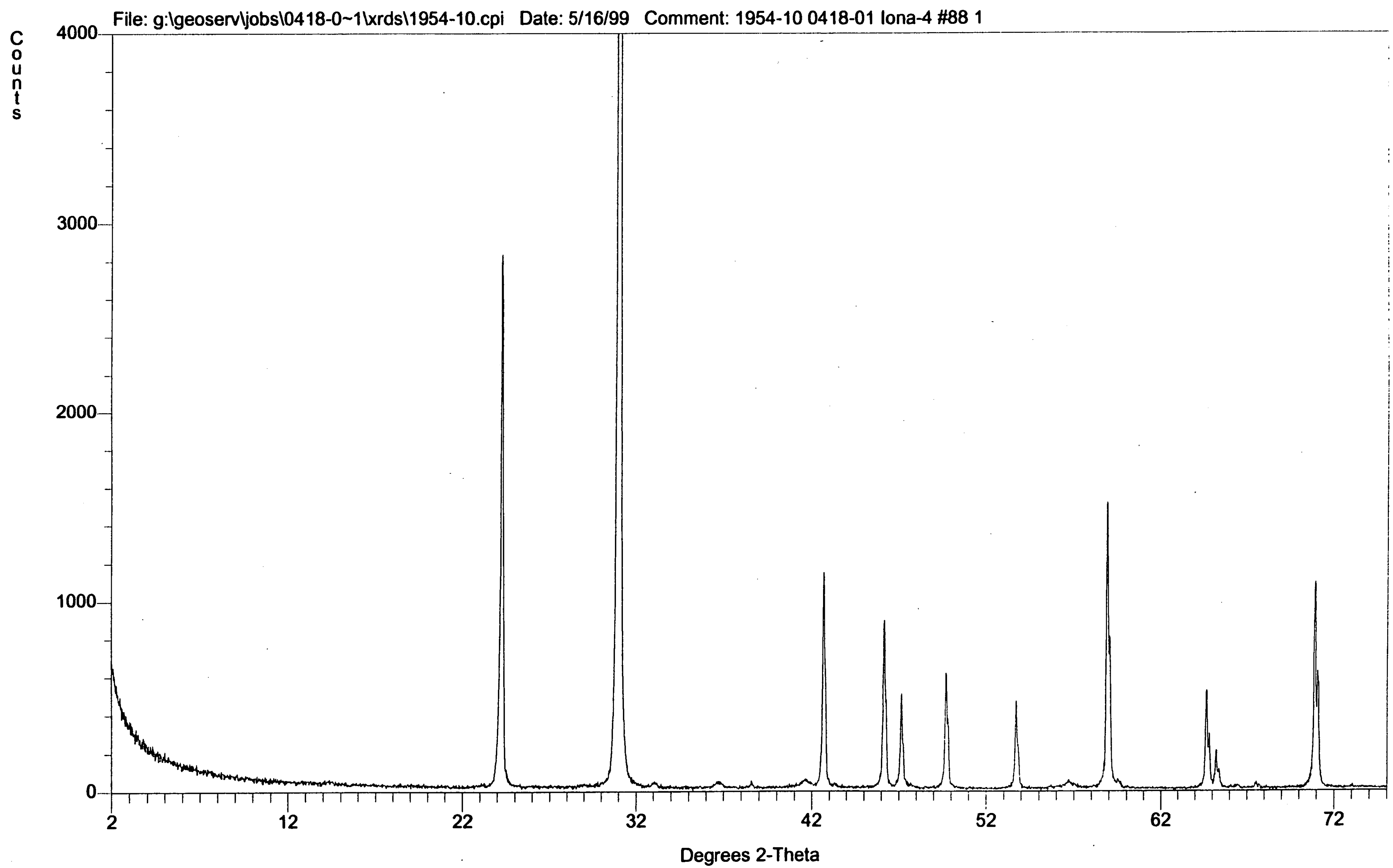


908903 303

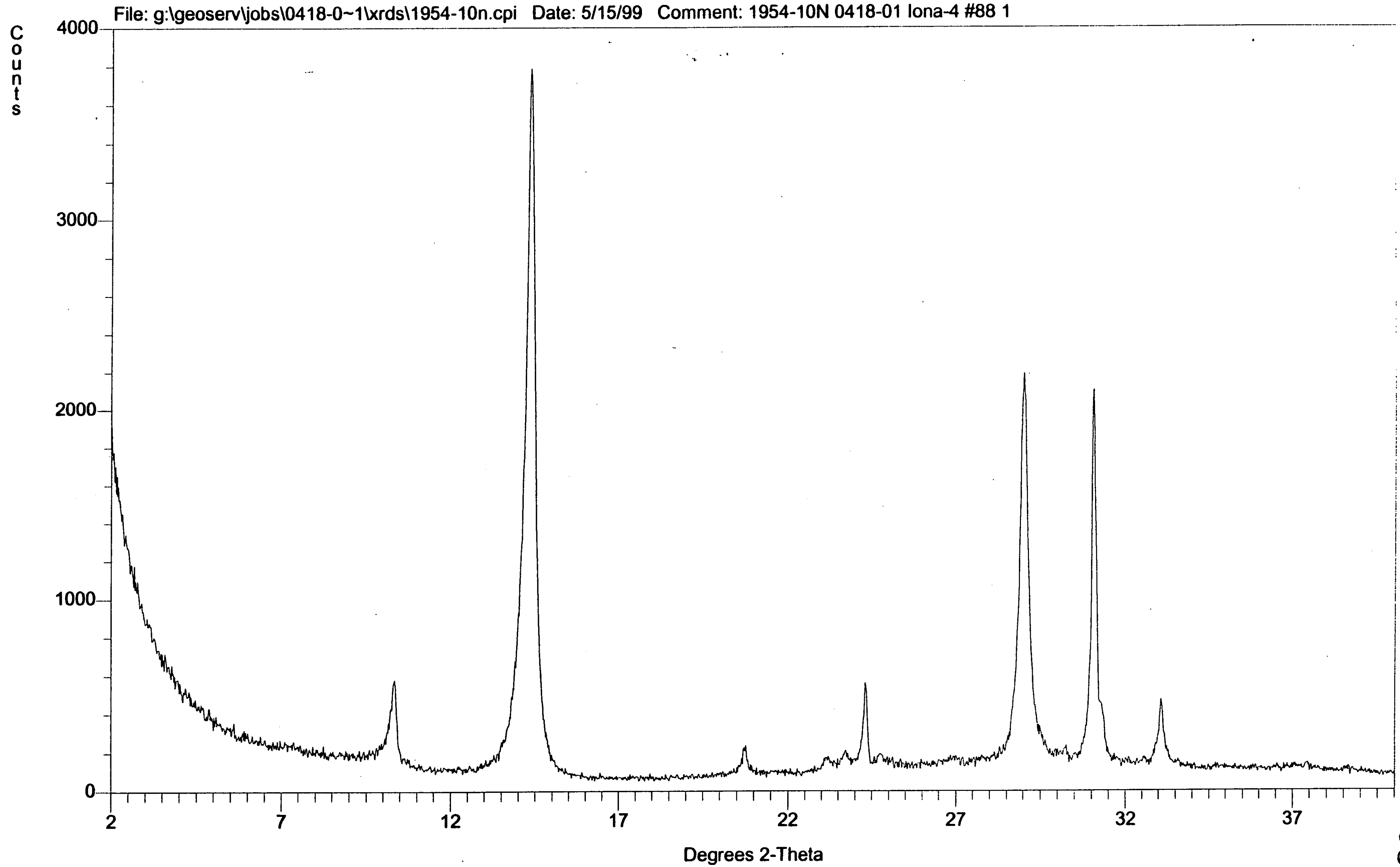
File: g:\geoserv\jobs\0418-0~1\xrds\1954-9n.cpi Date: 5/15/99 Comment: 1954-9N 0418-01 Iona-4 #66 1



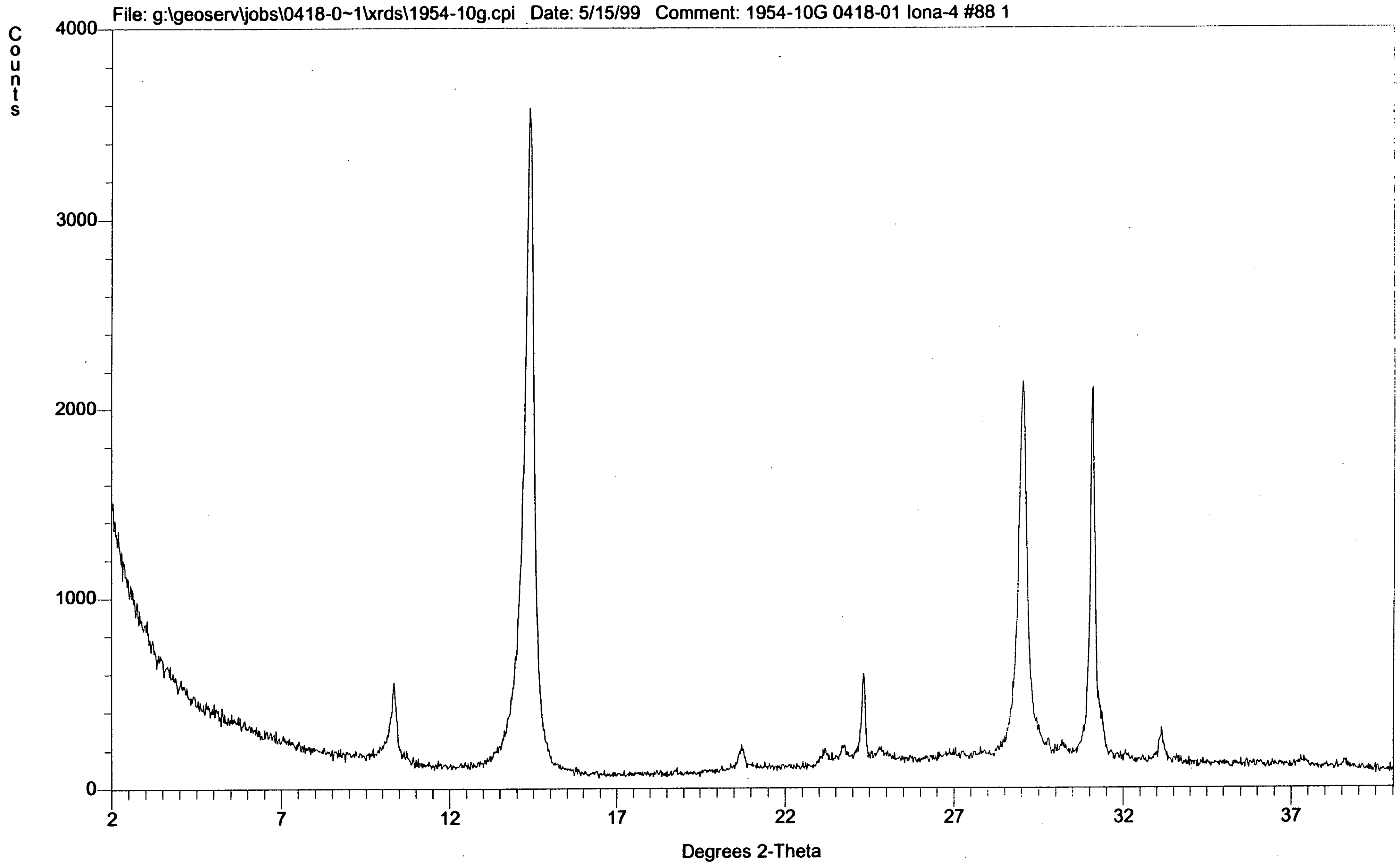

File: g:\geoserv\jobs\0418-0~1\xrds\1954-9g.cpi Date: 5/15/99 Comment: 1954-9G 0418-01 Iona-4 #66 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta


File: g:\geoserv\jobs\0418-0~1\xrds\1954-10.cpi Date: 5/16/99 Comment: 1954-10 0418-01 Iona-4 #88 1
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta

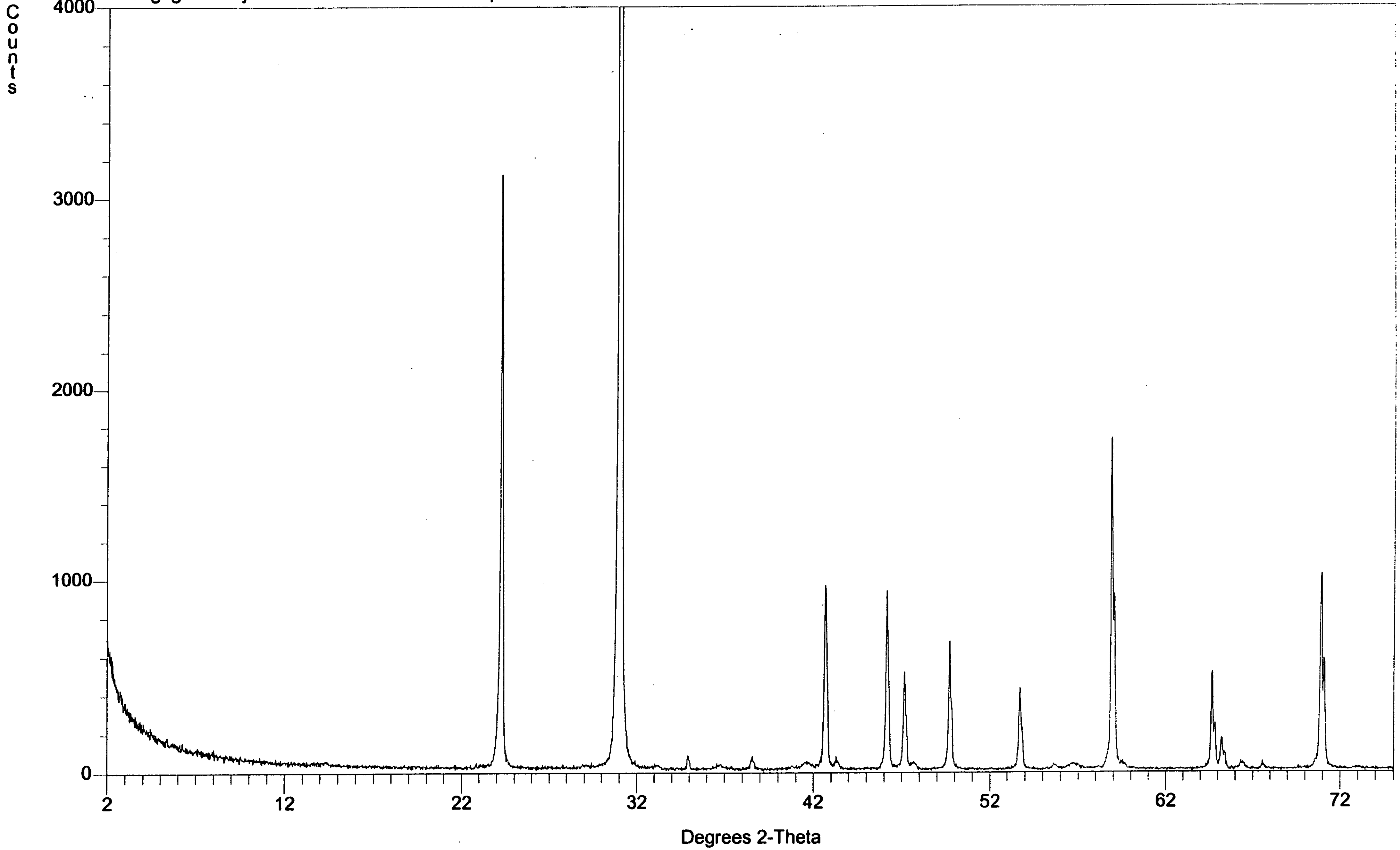
908903 306

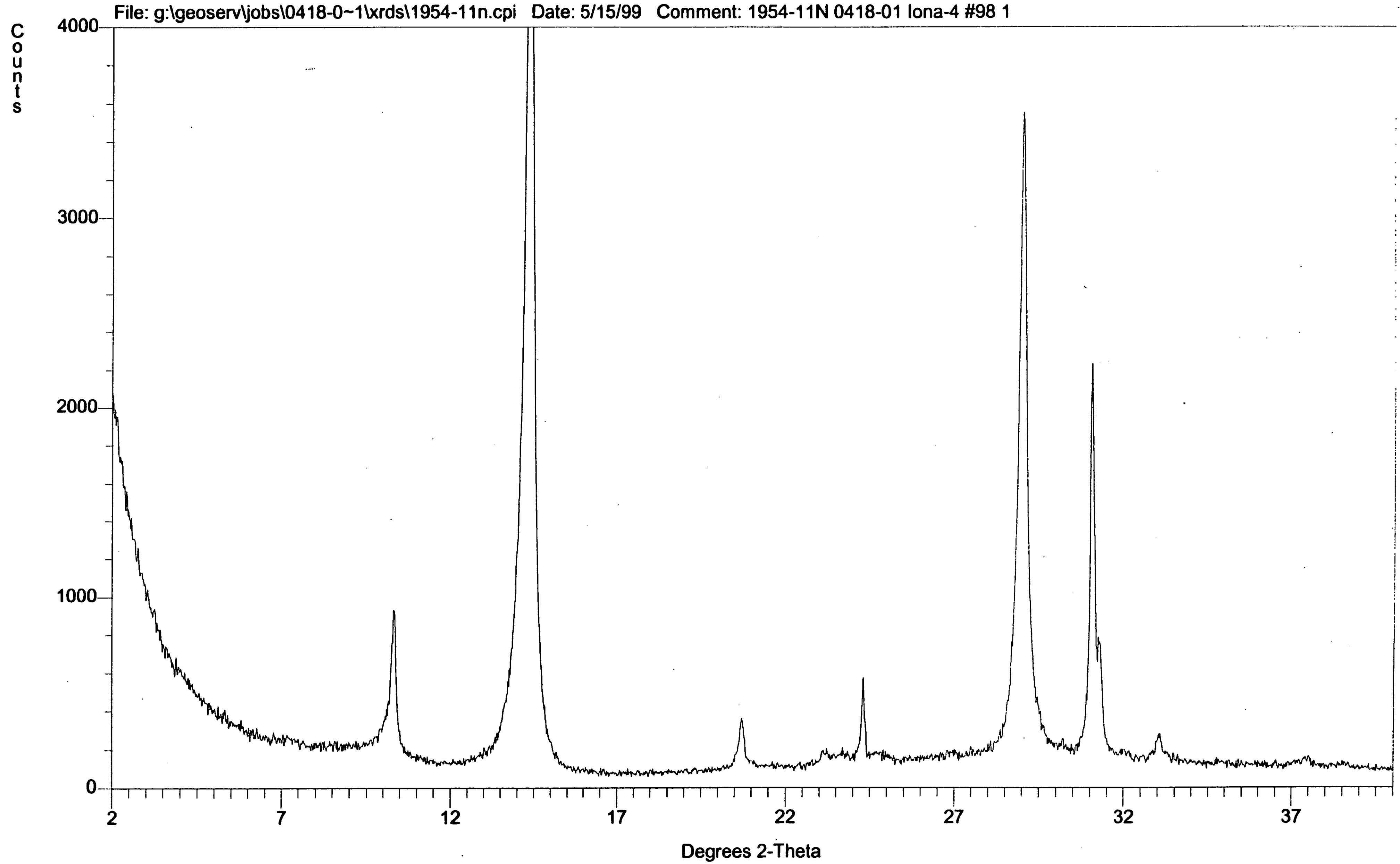

File: g:\geoserv\jobs\0418-0~1\xrds\1954-10n.cpi Date: 5/15/99 Comment: 1954-10N 0418-01 Iona-4 #88 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

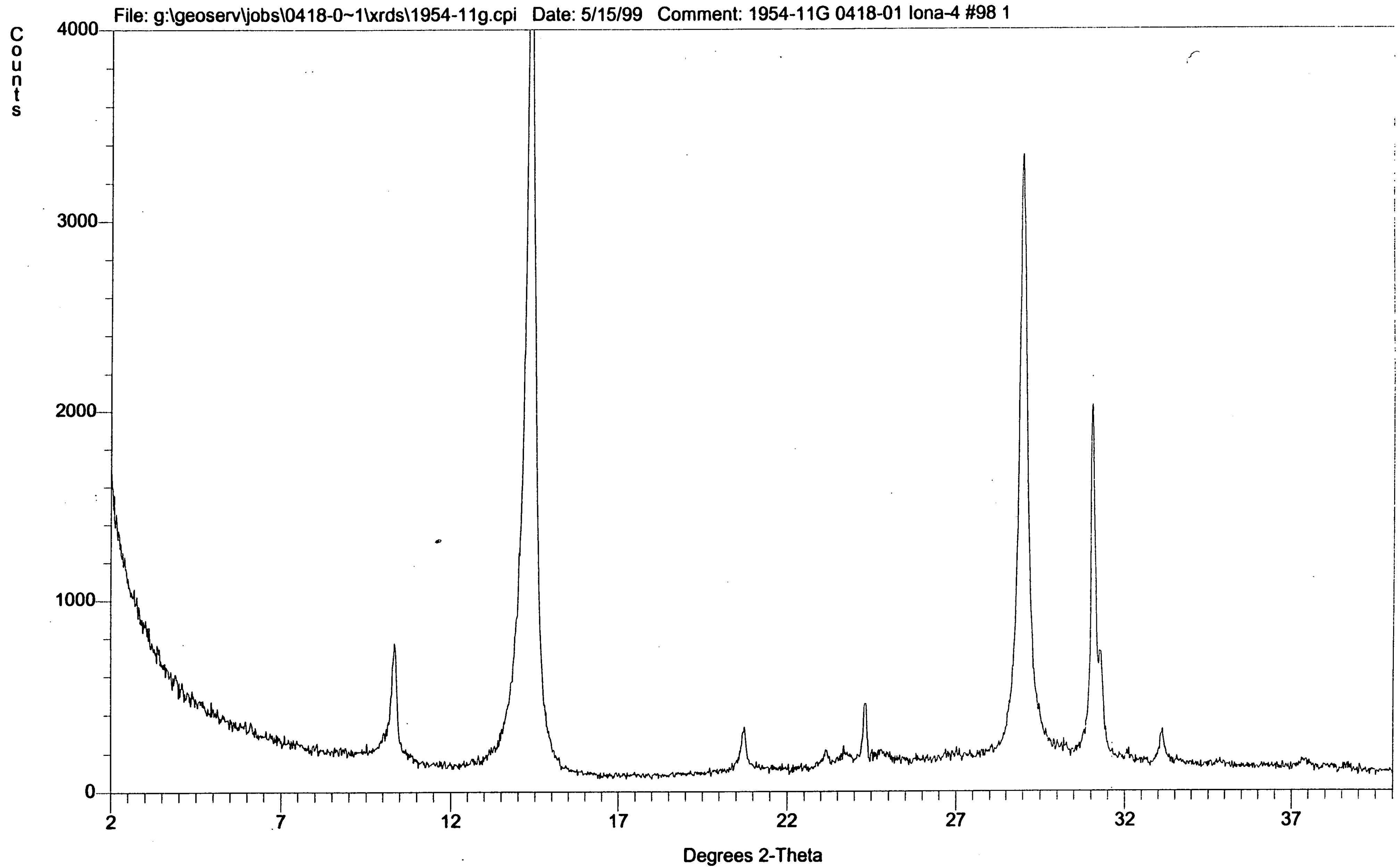
908903 307


File: g:\geoserv\jobs\0418-0~1\xrds\1954-10g.cpi Date: 5/15/99 Comment: 1954-10G 0418-01 Iona-4 #88 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

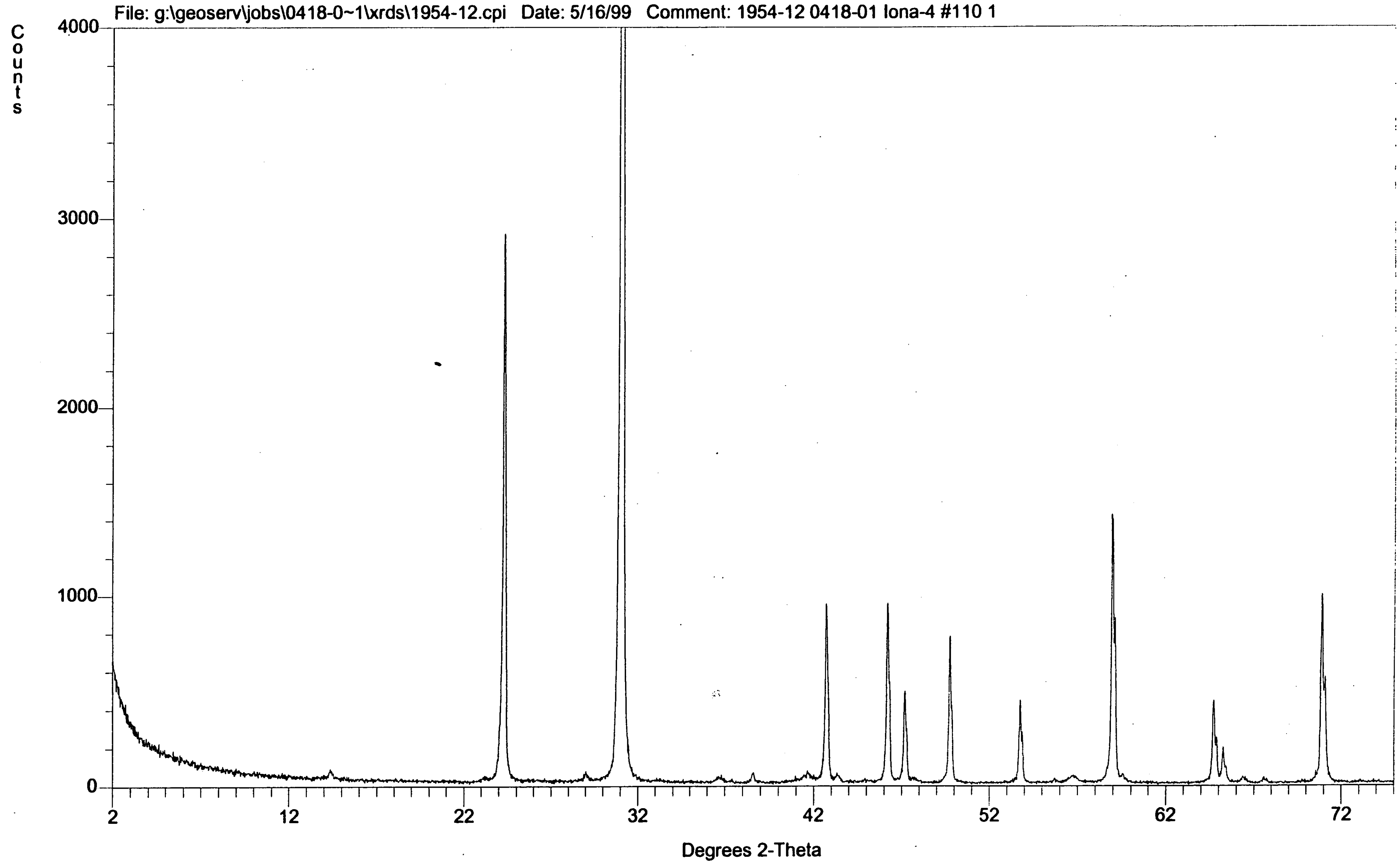
File: g:\geoserv\jobs\0418-0~1\xrds\1954-11.cpi   Date: 5/16/99   Comment: 1954-11 0418-01 Iona-4 #98 1




File: g:\geoserv\jobs\0418-0~1\xrds\1954-11n.cpi Date: 5/15/99 Comment: 1954-11N 0418-01 Iona-4 #98 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

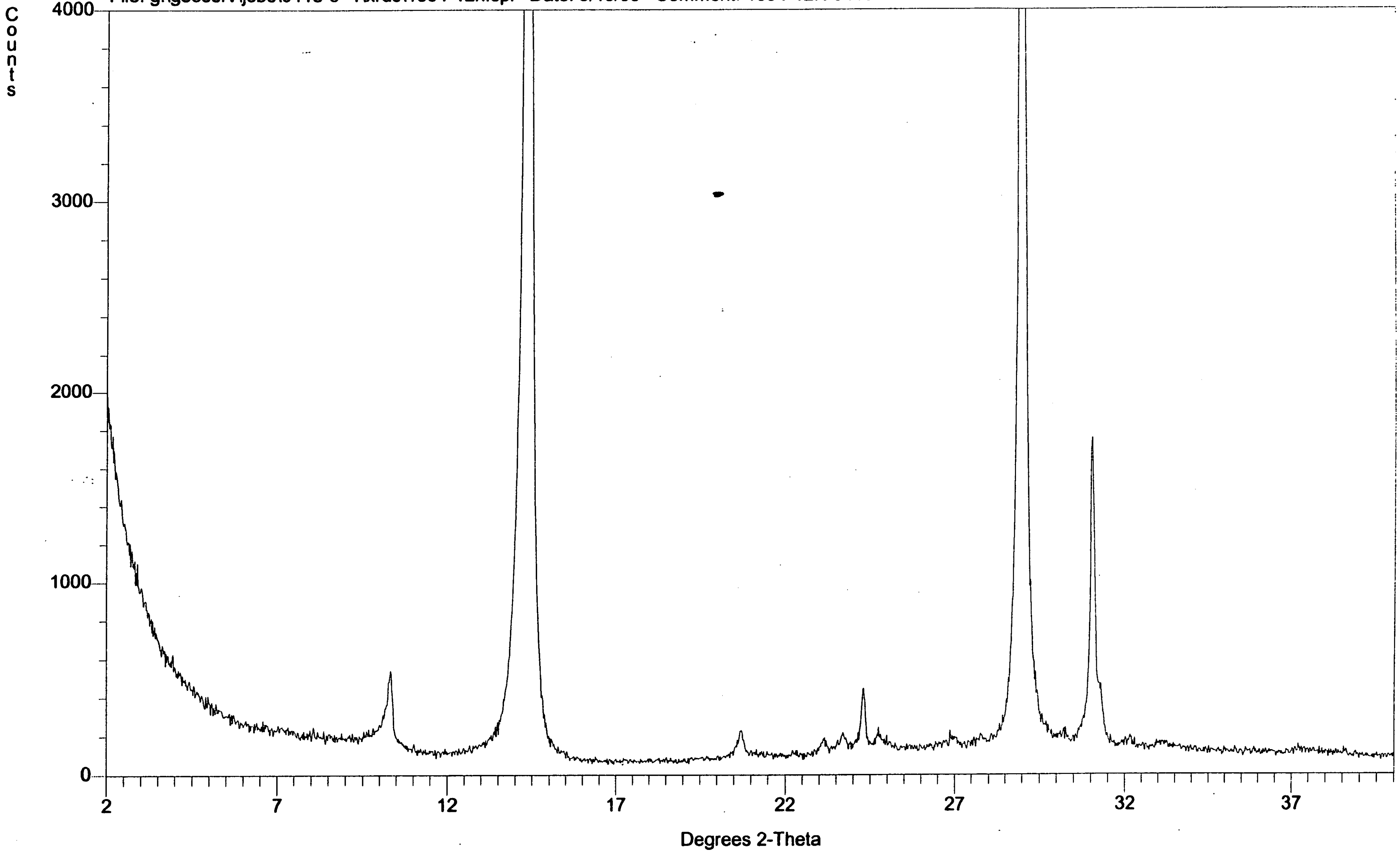

File: g:\geoserv\jobs\0418-0~1\xrds\1954-11g.cpi Date: 5/15/99 Comment: 1954-11G 0418-01 Iona-4 #98 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

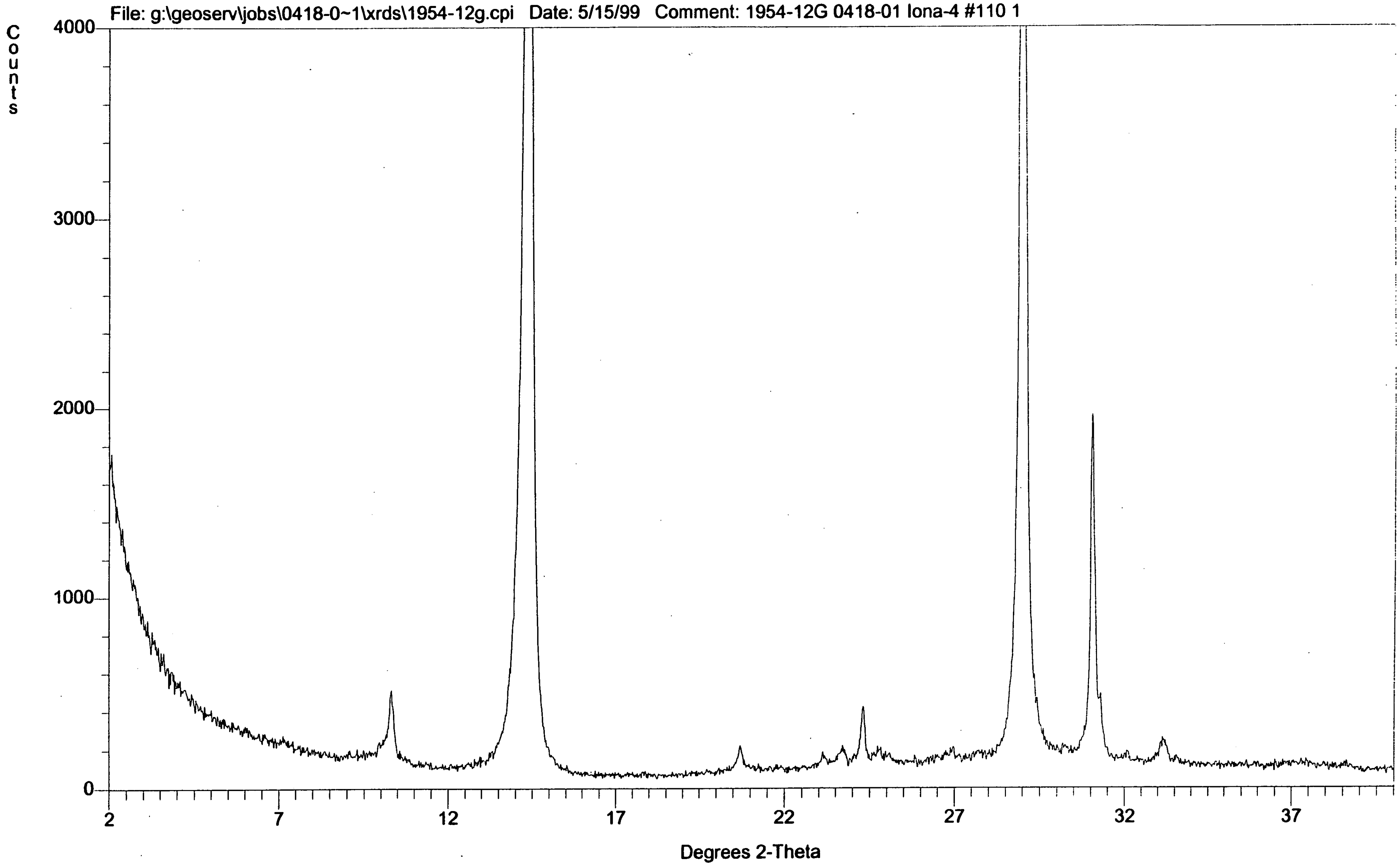
908903 311

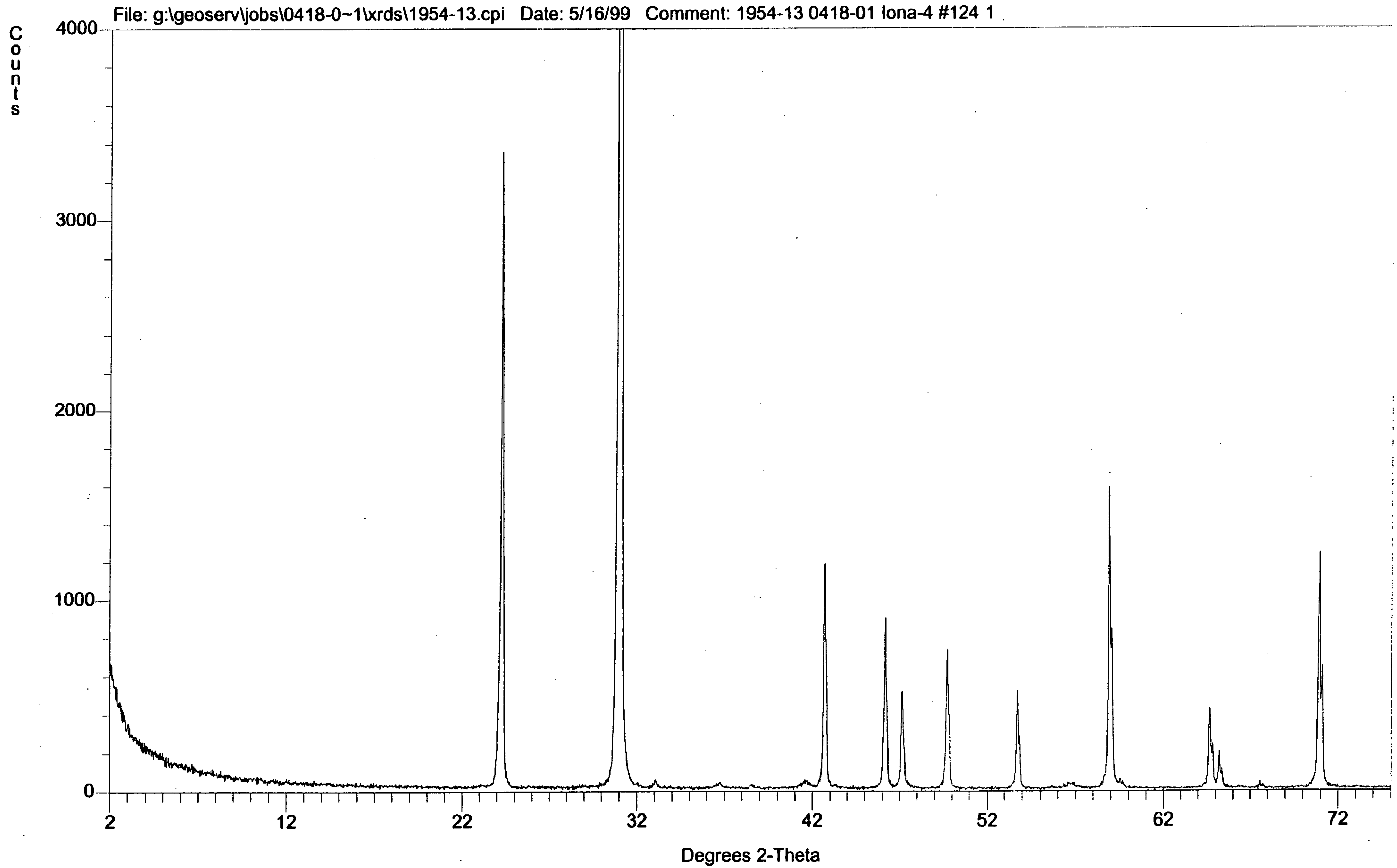

File: g:\geoserv\jobs\0418-0~1\xrds\1954-12.cpi Date: 5/16/99 Comment: 1954-12 0418-01 Iona-4 #110 1
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta

908903 312

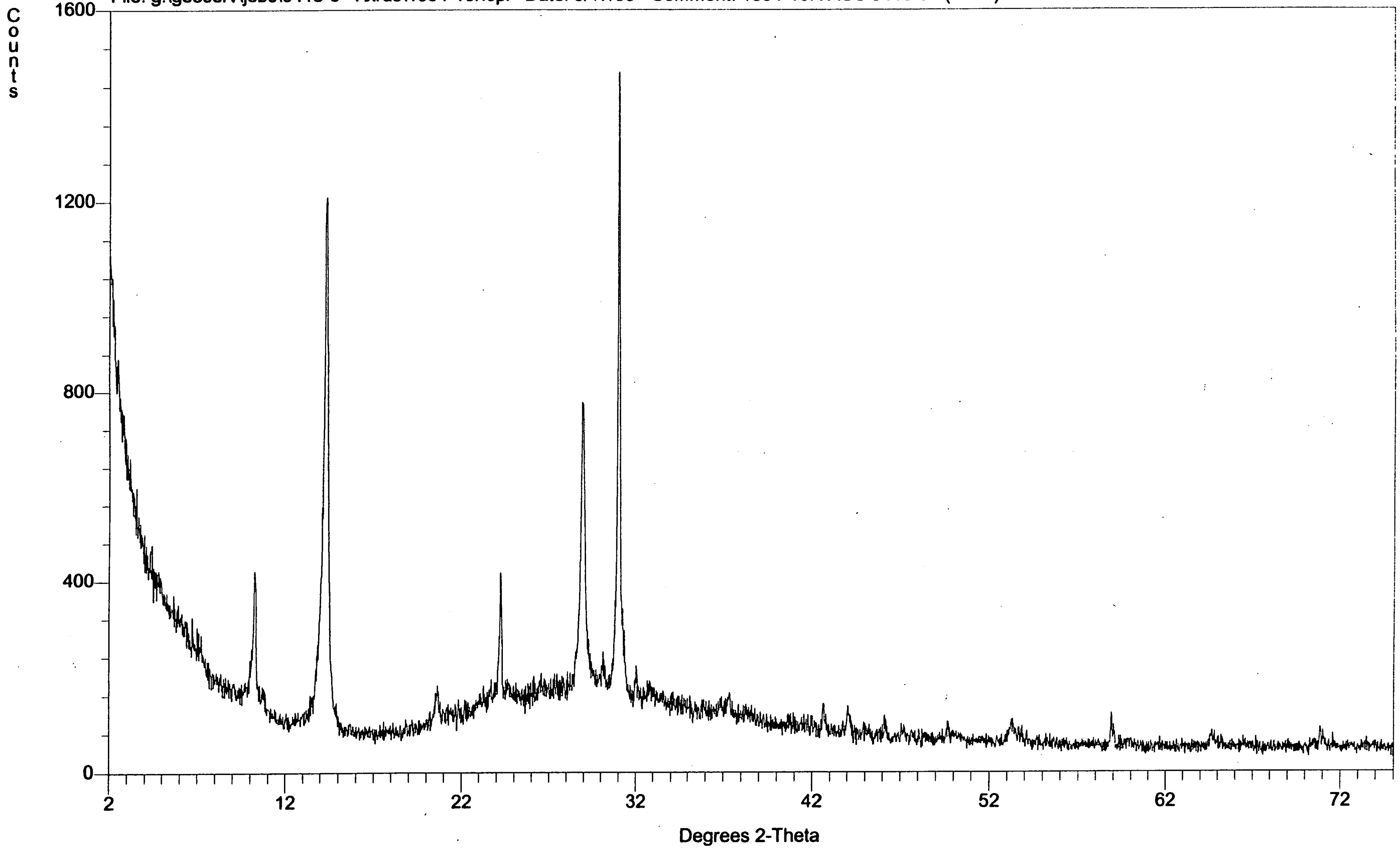
File: g:\geoserv\jobs\0418-0~1\xrds\1954-12n.cpi   Date: 5/15/99   Comment: 1954-12N 0418-01 Iona-4 #110 1



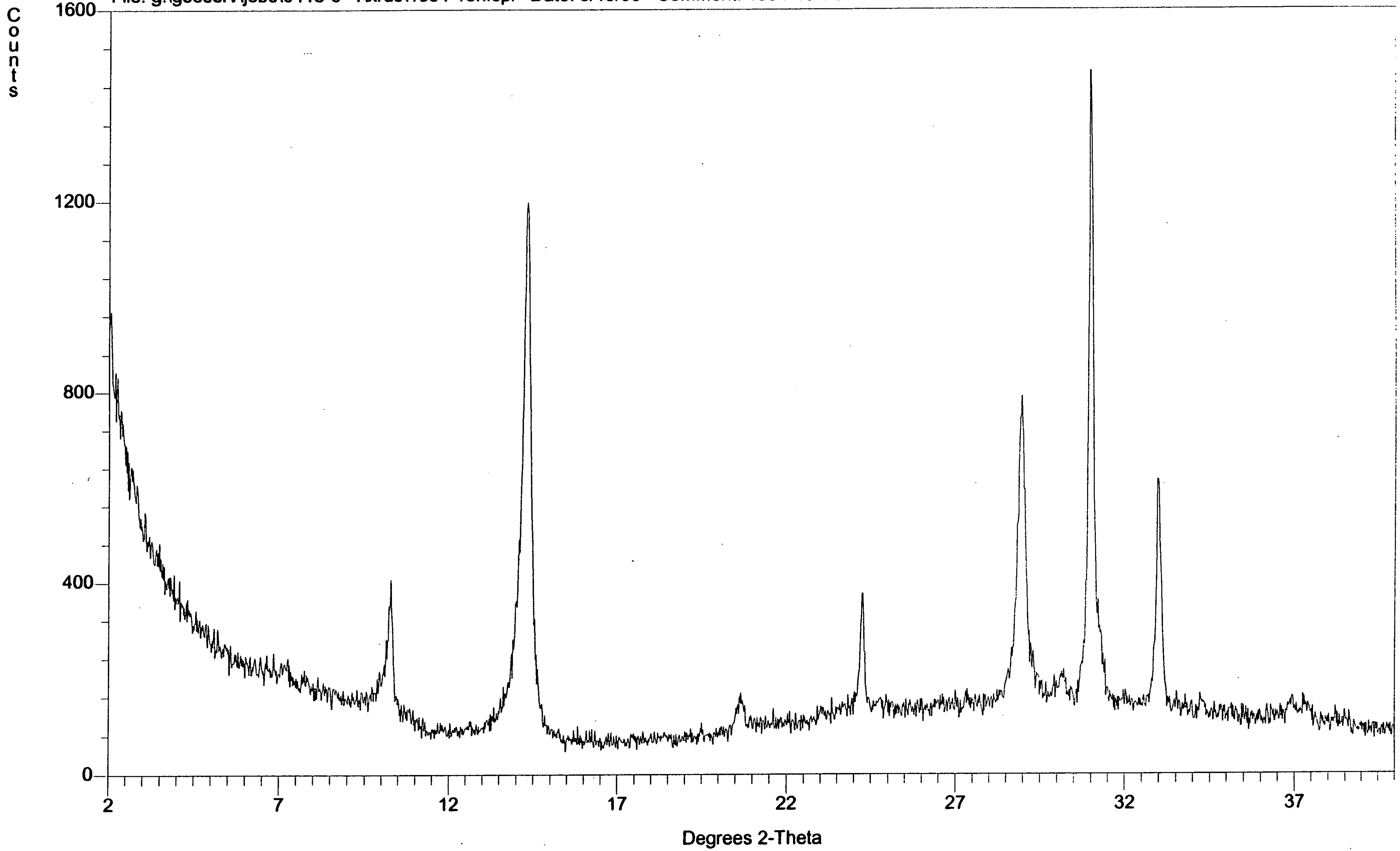

File: g:\geoserv\jobs\0418-0~1\xrds\1954-12g.cpi Date: 5/15/99 Comment: 1954-12G 0418-01 Iona-4 #110 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

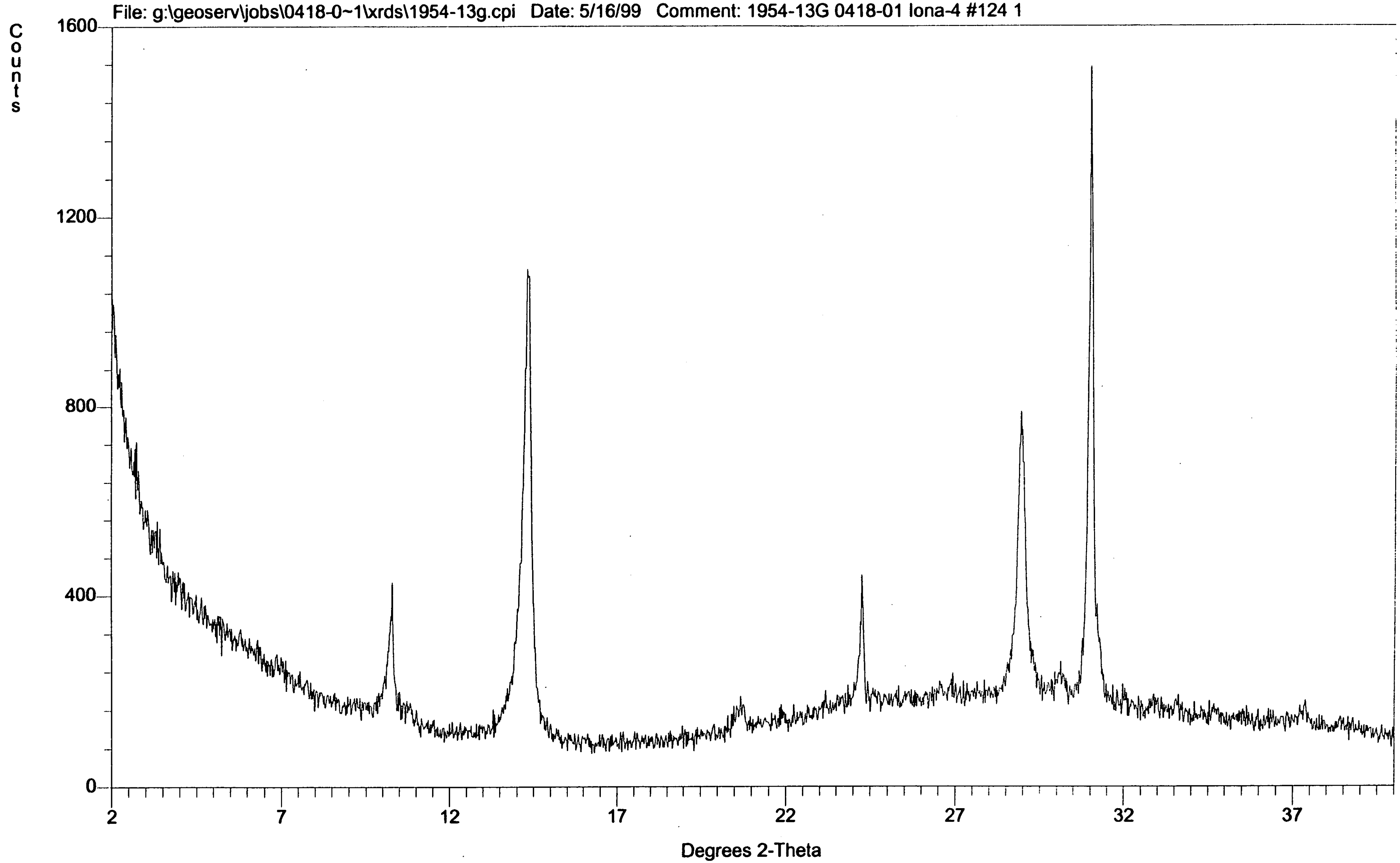

File: g:\geoserv\jobs\0418-0~1\xrds\1954-13.cpi Date: 5/16/99 Comment: 1954-13 0418-01 Iona-4 #124 1
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta

File: g:\geoserv\jobs\0418-0~1\xrds\1954-13r.cpi Date: 5/17/99 Comment: 1954-13R ACS 0418-01 (FILM)0 1

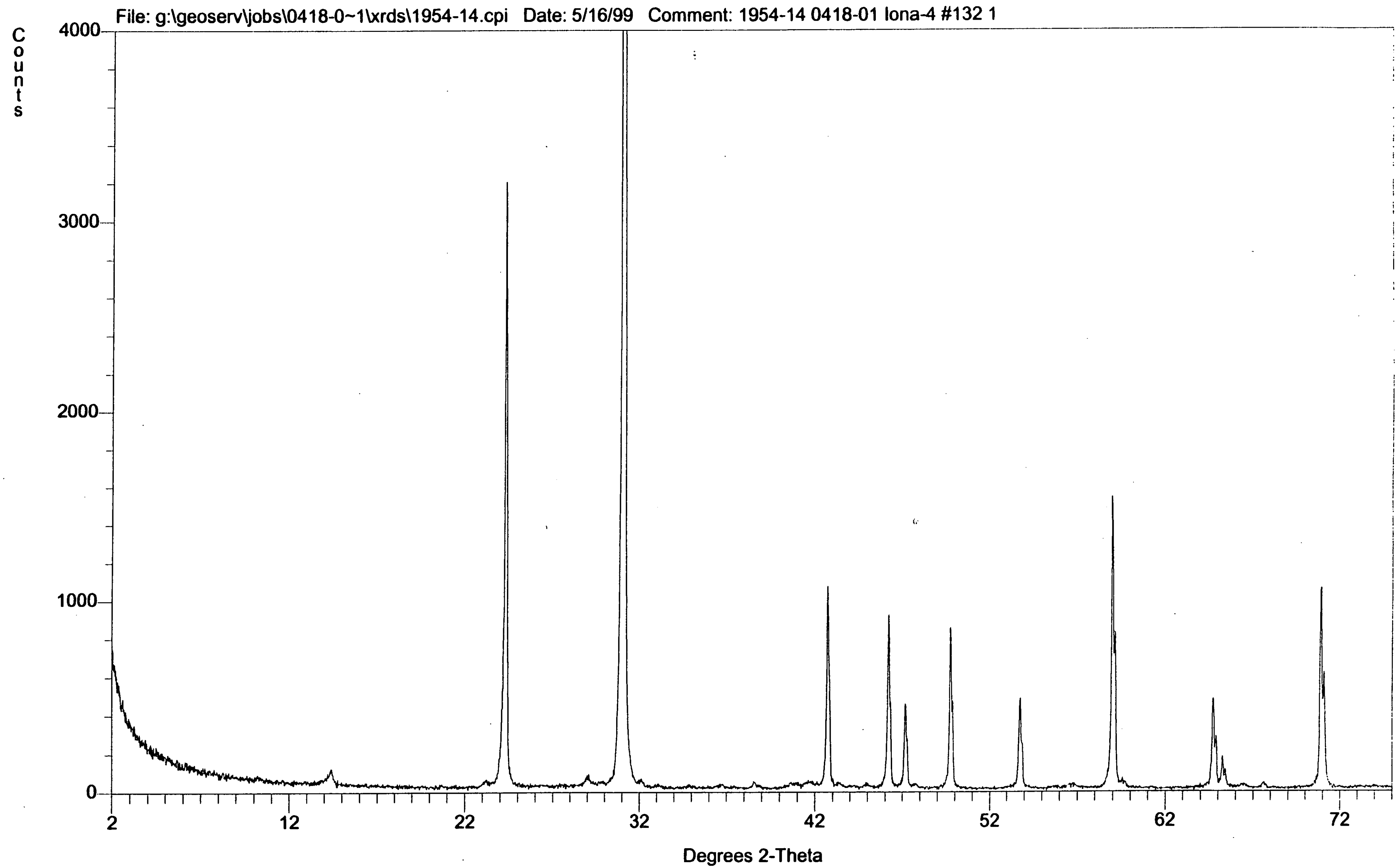


File: g:\geoserv\jobs\0418-0~1\xrds\1954-13n.cpi   Date: 5/15/99   Comment: 1954-13N 0418-01 Iona-4 #124 1



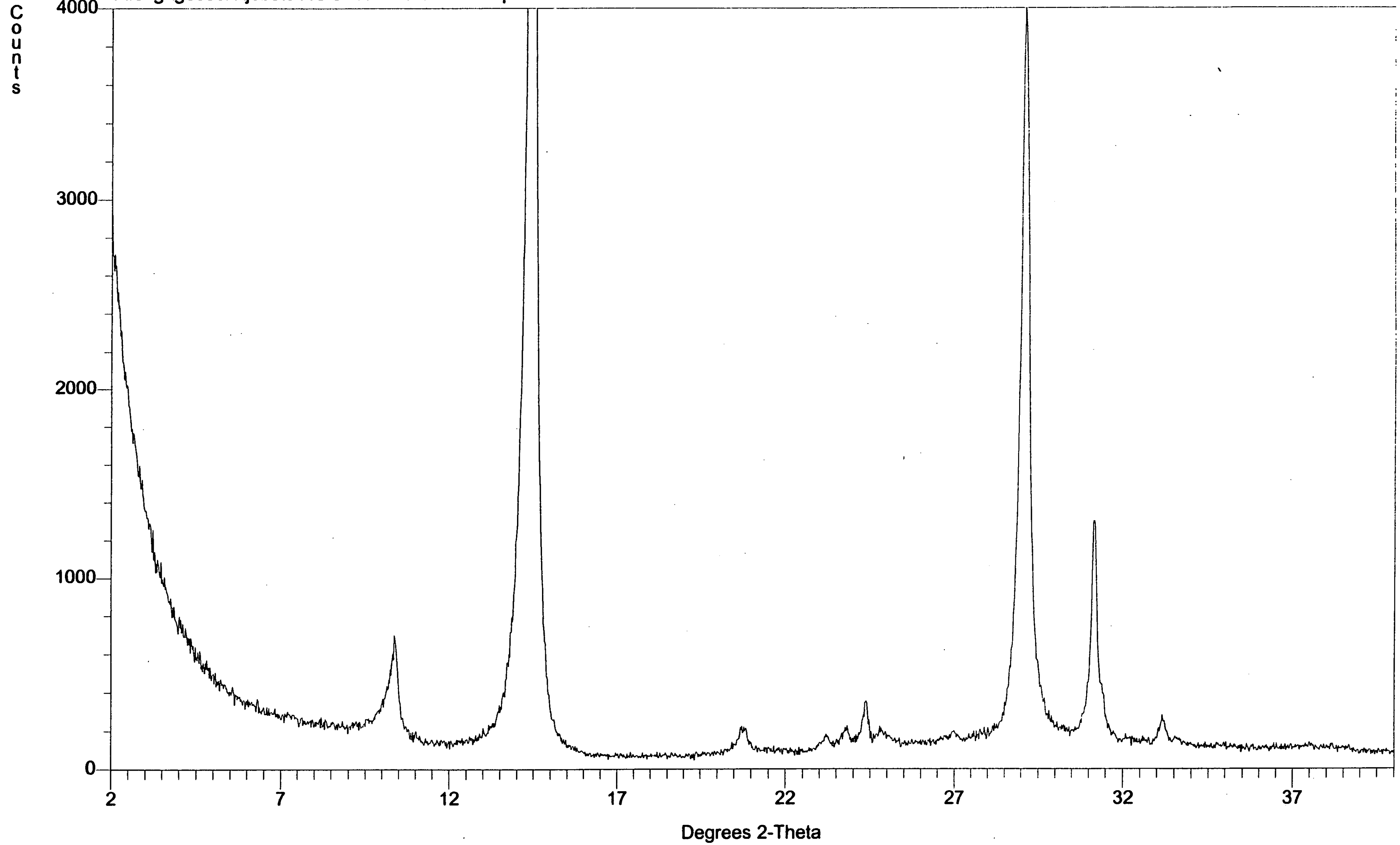

File: g:\geoserv\jobs\0418-0~1\xrds\1954-13g.cpi Date: 5/16/99 Comment: 1954-13G 0418-01 Iona-4 #124 1
Counts
1600
1200
800
400
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

908903 318


File: g:\geoserv\jobs\0418-0~1\xrds\1954-14.cpi Date: 5/16/99 Comment: 1954-14 0418-01 Iona-4 #132 1
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta

908903 319

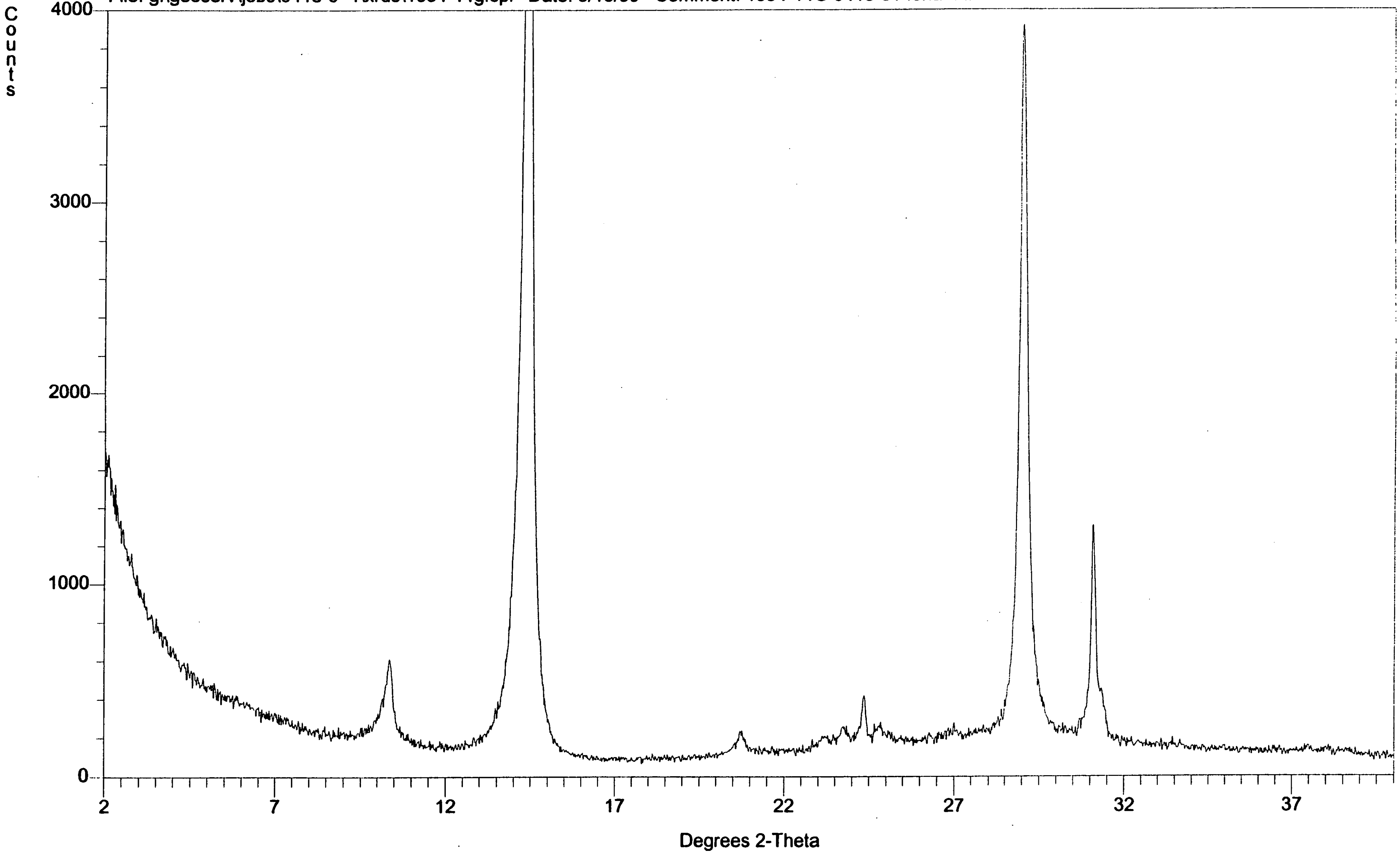
File: g:\geoserv\jobs\0418-0~1\xrds\1954-14n.cpi   Date: 5/15/99   Comment: 1954-14N 0418-01 Iona-4 #132 1

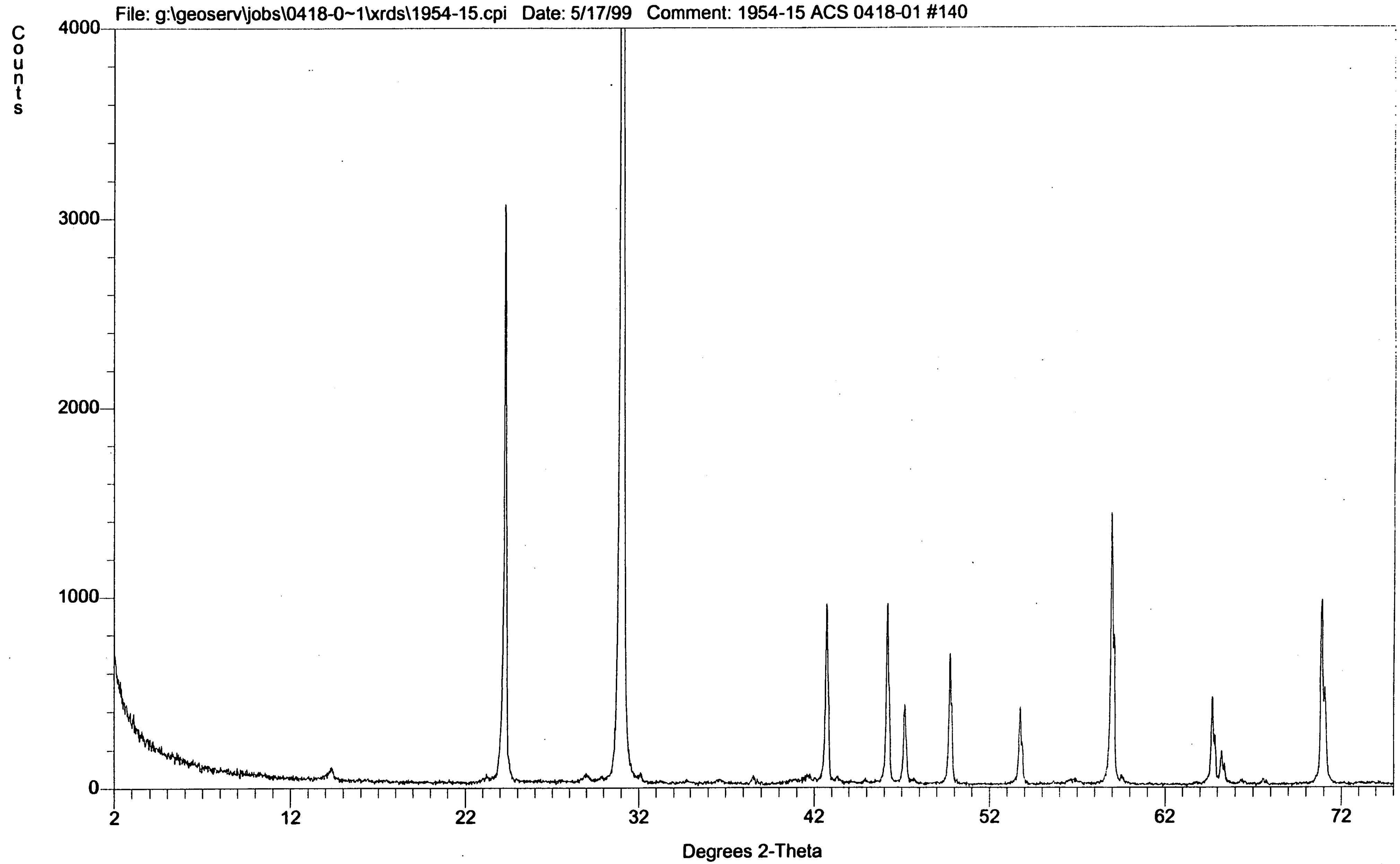


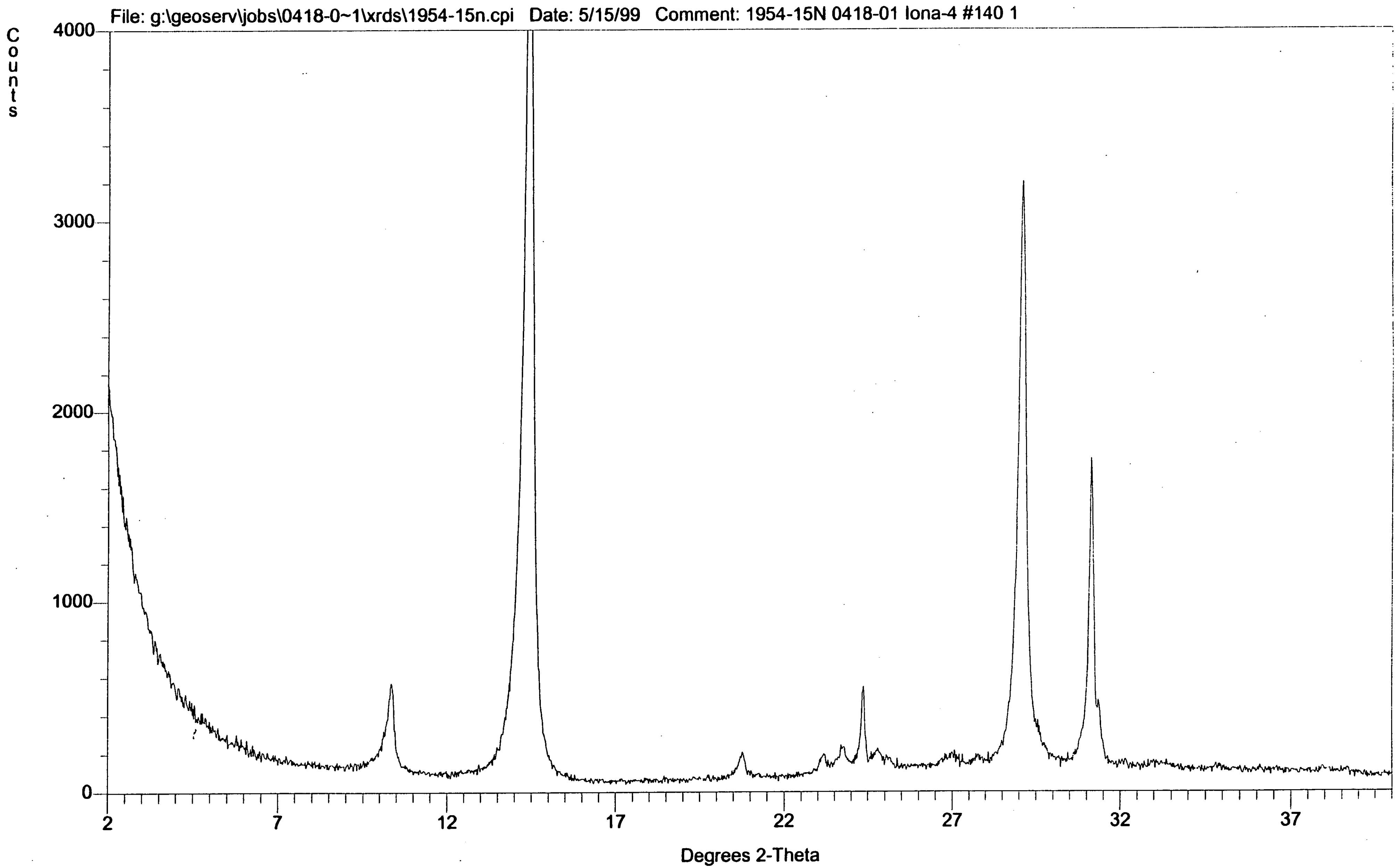
908903 320

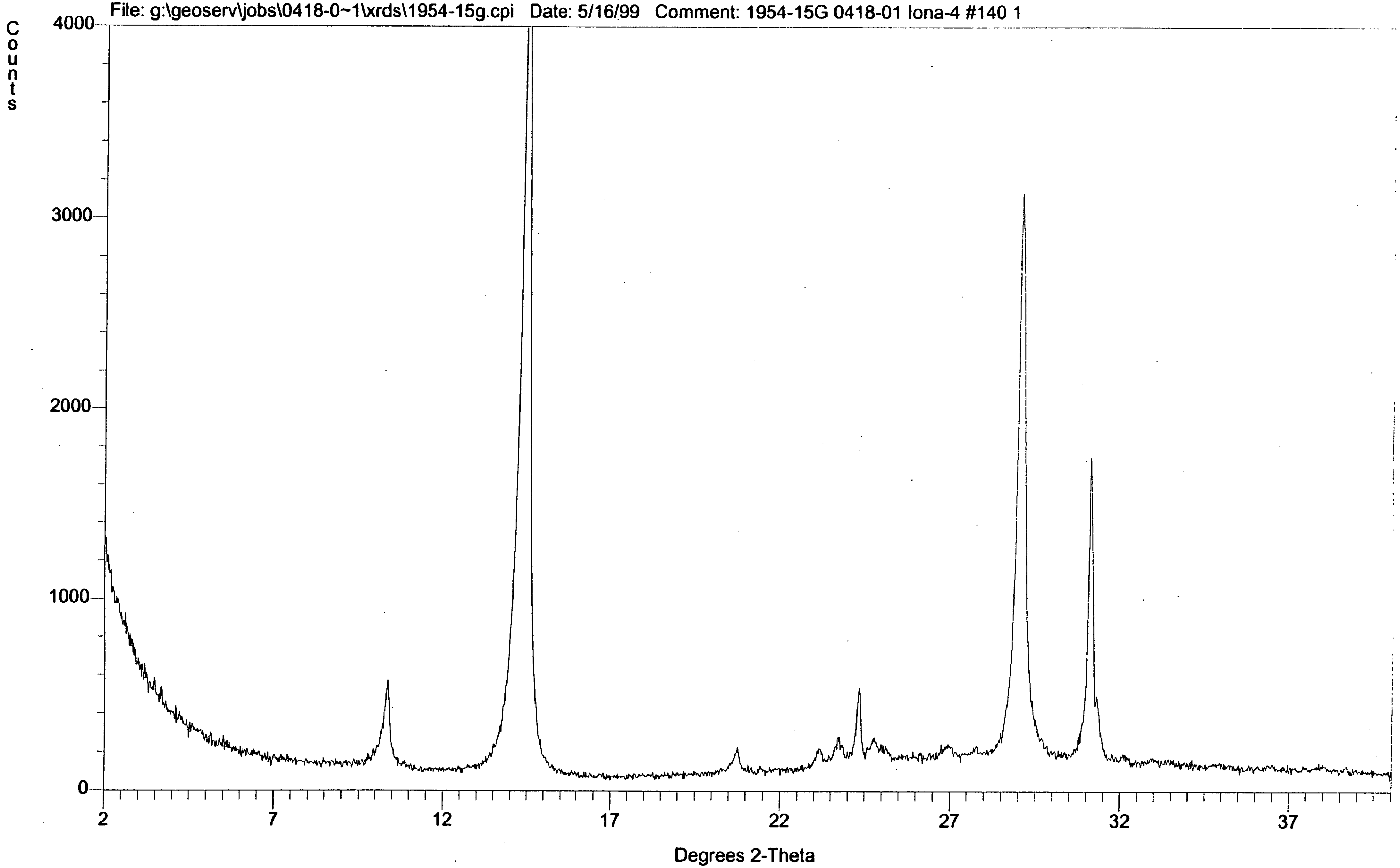
908903 321

File: g:\geoserv\jobs\0418-0~1\xrds\1954-14g.cpi Date: 5/16/99 Comment: 1954-14G 0418-01 Iona-4 #132 1




File: g:\geoserv\jobs\0418-0~1\xrds\1954-15.cpi Date: 5/17/99 Comment: 1954-15 ACS 0418-01 #140
Counts
4000
3000
2000
1000
0
2
12
22
32
42
52
62
72
Degrees 2-Theta


File: g:\geoserv\jobs\0418-0~1\xrds\1954-15n.cpi Date: 5/15/99 Comment: 1954-15N 0418-01 Iona-4 #140 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta


File: g:\geoserv\jobs\0418-0~1\xrds\1954-15g.cpi Date: 5/16/99 Comment: 1954-15G 0418-01 Iona-4 #140 1
Counts
4000
3000
2000
1000
0
2
7
12
17
22
27
32
37
Degrees 2-Theta

908903 325

ACS LABORATORIES PTY. LTD.

ROUTINE CORE ANALYSIS FINAL REPORT

of

IONA-4

for

WESTERN UNDERGROUND GAS STORAGE PTY LIMITED

by

ACS LABORATORIES PTY LTD

908903 326

ACS
LABORATORIES
PTY. LTD.

18 June 1999

Western Underground Gas Storage Pty Limited
Level 49, Rialto South Tower
525 Collins Street
MELBOURNE VIC 3000

Attention: Mr. Andy Whittle

FINAL REPORT: 0299-02 - IONA-4

CLIENT REFERENCE: Verbal

MATERIAL: 5¼" 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

ACS Laboratories Pty. Ltd. shall not be liable or responsible for any loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from any information or interpretation given in this report. In no case shall ACS Laboratories Pty. Ltd. be responsible for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report.

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

CONTENTS

CHAPTER 1

LOGISTICS and INTRODUCTION

1. LOGISTICS and INTRODUCTION

Five (5) cores from Iona-4 well arrived at ACS Laboratories, Brisbane, on the 24th March, 1999.

Core No.	Depth Interval	No. m
1	1381.00m - 1382.50m	1.50m
2	1448.55m - 1454.26m	5.71m
3	1455.00m - 1462.55m	7.55m
4	1463.30m - 1469.67m	6.37m
5	1470.60m - 1478.40m	7.80m
	Total	28.93m

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.

CHAPTER 2

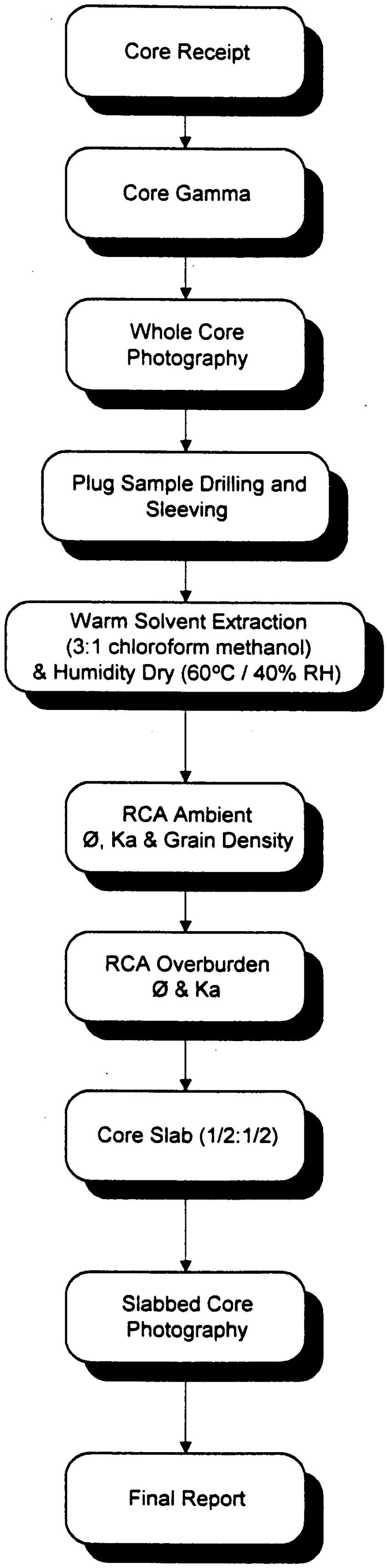
STUDY AIMS

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 effect on porosity and permeability due to overburden stress.

IONA -4 - 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 coarse grained 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 screened ends, to maintain their integrity during analysis.

Vertical plug samples were cut from the core at approximately 1 metre intervals normal to the bedding.

The off-cuts of all plug samples were retained, labelled and bagged for possible future analysis.

3.2 Core Slabbing

On completion of the sampling, the core was slabbed longitudinally into 1/3:2/3 sections. The core was slabbed frozen using liquid nitrogen as the blade lubricant. The 1/3 section was sent to the Department of Natural Resources and Environment, Weeribee, Victoria. The 2/3 section is currently stored with ACS Laboratories, Brisbane.

CHAPTER 4

SAMPLE PREPARATION

4. SAMPLE PREPARATION

4.1 Sample Extraction

After sampling, the plug 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 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 Helium Injection 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.

$$Vb = Vp + Vg$$

$$\text{Ambient Porosity \%} = \frac{Vp}{Vb} \times 100$$

where
- Vp = *ambient pore volume (cm^3)*
- Vb = *ambient bulk volume (cm^3)*
- Vg = *grain volume (cm^3)*

5.3 Air 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)*
	Vgt	=	*grain volume (cm^3)*

5.5 Overburden Porosity and Permeability

Porosity and permeability measurements were performed under simulated overburden pressure conditions on a selection of samples to obtain an ambient to reservoir pressure conversion factor for the data. The samples were selected to cover the range of porosity and permeability encountered in the reservoir.

To determine the porosity and permeability of the core plug at overburden pressure, the sample is placed in a heavy duty Hassler sleeve. The assembly is loaded into a thick walled hydrostatic cell capable of withstanding the simulated reservoir overburden stress.

After loading, the sample is subjected to the net overburden stress conditions and the porosity and permeability are determined as per the ambient procedures above. The overburden stress values of 1150 psi, 1400 psi, and 1650 psi used in these measurements were supplied by Western Underground Gas Storage.

5.6 Core Photography

Two (2) sets of core photographs of Iona-4 were produced. The first set were of the whole core, prior to sampling. One set of these prints was forwarded to Western Under Ground Gas Storage for a 'quick look' at the core. The second set of photographs were taken after sampling and slabbing of core was completed. Three sets of these photographs were forwarded to Western Underground Gas Storage Pty Limited.

In both cases, photographs were taken of the core in a 5 metre format, under white light only, on conventional professional film. The film negatives were then digitally scanned, edited and printed.

CHAPTER 6

DISCUSSION

6. DISCUSSION

It was not possible to remove the majority of the core from the aluminium inner barrels in the conventional way due the friable nature of the core, and the fact that it was held in the barrel by a mixture of the drilling mud and re-worked formation. The core was frozen while in the aluminum liner, and two slits were cut in the liner on opposing sides. The liner was prised apart to expose the core.

The majority of the samples required mounting in lead sleeves with end screens to maintain sample integrity during analysis. Two (2) samples failed during sampling.

CHAPTER 7

SAMPLE DISTRIBUTION AND STORAGE

7. SAMPLE DISTRIBUTION and STORAGE

Sample Description	Date Despatched	To whom	Via
Government 1/3 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 2/3 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	: 30/04/1999
Well	: Iona-4	File	: 0299-02
Field	: Iona	Location	: PPL2
Core 1	: 1381.00 - 1382.50m	ACS Lab.	: Brisbane
Core 2	: 1448.55 - 1454.26m	Analysts	: PNC IJM SW
Core 3	: 1455.00 - 1462.55m		
Core 4	: 1463.30 - 1469.67m		
Core 5	: 1470.60 - 1478.40m		

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
1	1448.97	H	21.4	2.58	1022	carb md lam, C
2	1449.08	H	18.2	2.64	3067	
3	1449.25	H	24.9	2.72	13431	Pyr
4	1449.40	H	25.3	2.64	12686	
5	1449.54	H	21.2	2.64	6171	
6	1449.86	H	13.0	2.58	1.54	carb md
7	1450.17	H	14.4	2.57	0.93	carb md
8	1450.30	H				Failed
9	1450.69	H	23.2	2.62	439	md lam, C
10	1451.05	H	27.3	2.64	6024	
11	1451.36	H	25.7	2.57	5812	carb md lam
12	1451.51	H	28.5	2.64	20025	
13	1451.66	H	28.5	2.66	20012	
14	1451.80	H	28.7	2.64	19346	
15	1451.95	H	29.5	2.64	22160	
16	1452.11	H	29.5	2.64	20004	
17	1452.25	H	29.0	2.65	19724	
18	1452.41	H	29.9	2.64	20848	
19	1452.55	H	30.3	2.64	22271	
20	1452.71	H	32.0	2.65	24314	
21	1452.87	H	30.9	2.64	23986	
22	1453.04	H	24.9	2.64	8016	
23	1453.17	H	29.9	2.64	19847	
24	1453.32	H	30.8	2.64	15458	
25	1453.47	H	29.2	2.61	11872	C lam
26	1453.61	H	28.5	2.64	12758	
27	1453.76	H				Failed
28	1453.92	H	30.0	2.69	22859	Pyr
29	1454.05	H	29.8	2.63	20920	
30	1454.22	H	30.2	2.64	22711	

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
31	1455.06	H	25.2	2.64	12061	
32	1455.20	H	26.7	2.64	17008	
33	1455.40	H	28.7	2.64	17184	
34	1455.50	H	29.1	2.64	17202	
35	1455.65	H	29.4	2.64	16534	
36	1455.84	H	29.4	2.64	17989	
37	1455.95	H	30.2	2.64	20490	
38	1456.12	H	26.9	2.64	18223	
39	1456.28	H	24.7	2.64	11762	
40	1456.43	H	24.7	2.65	7284	
41	1456.58	H	26.0	2.65	12637	
42	1456.73	H	23.4	2.65	13953	
43	1457.04	H	26.4	2.65	17001	
44	1457.30	H	30.2	2.65	16916	
45	1457.45	H	29.5	2.65	16871	
46	1457.62	H	28.2	2.66	17796	
47	1457.77	H	29.3	2.65	17472	
48	1457.92	H	28.5	2.65	20366	
49	1458.06	H	30.6	2.65	17121	
50	1458.36	H	26.8	2.65	15975	
51	1458.51	H	23.6	2.65	12472	
52	1458.83	H	26.9	2.65	15465	
53	1458.96	H	28.2	2.65	18831	
54	1459.10	H	26.8	2.64	11756	
55	1459.23	H	25.0	2.53	10471	C lam
56	1459.45	H	28.3	2.65	13304	
57	1459.60	H	28.0	2.64	13468	
58	1459.77	H	25.7	2.64	17142	
59	1459.90	H	26.6	2.64	12454	
60	1461.04	H	24.4	2.64	7811	
61	1461.15	H	20.1	2.64	7994	
62	1461.75	H	27.0	2.63	8812	
63	1461.97	H	26.8	2.63	16560	
64	1462.23	H	27.9	2.64	17645	
65	1463.35	H	19.4	2.83	4044	Pyr
66	1463.50	H	21.6	2.64	2538	
67	1463.65	H	28.3	2.63	10359	
68	1463.97	H	28.4	2.63	14191	
69	1464.11	H	27.2	2.64	14965	
70	1464.22	H	27.1	2.63	12233	
71	1464.55	H	13.2	2.65	9.4	
72	1464.83	H	29.7	2.64	15397	

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
73	1465.28	H	25.0	2.64	5313	
74	1465.50	H	28.1	2.64	13369	
75	1465.61	H	18.1	2.64	67.1	
76	1465.75	H	21.7	2.65	5845	
77	1465.95	H	24.1	2.59	4185	carb md lam, C
78	1466.10	H	23.0	2.64	5424	
79	1466.31	H	17.8	2.63	41.6	
80	1466.45	H	17.8	2.64	86.0	
81	1466.58	H	26.5	2.65	9452	
82	1466.74	H	27.3	2.63	13740	
83	1466.89	H	24.2	2.64	5277	
84	1467.95	H	32.5	2.63	11196	
85	1468.06	H	27.9	2.59	7513	C lam
86	1468.24	H	25.2	2.64	15720	
87	1468.44	H	23.5	2.64	13358	
88	1468.55	H	26.5	2.64	13325	
89	1468.70	H	27.6	2.64	19080	
90	1468.85	H	29.1	2.64	11244	
91	1469.10	H	27.5	2.64	10065	
92	1469.25	H	25.2	2.67	12845	
93	1469.39	H	21.8	2.64	3361	
94	1470.67	H	25.8	2.63	9973	
95	1470.85	H	28.0	2.65	10281	
96	1471.05	H	29.4	2.64	18601	
97	1471.20	H	24.1	2.64	16275	
98	1471.35	H	23.8	2.63	6218	
99	1471.50	H	26.6	2.65	18019	
100	1471.68	H	26.1	2.66	19577	
101	1471.82	H	26.6	2.66	12901	
102	1471.96	H	22.7	2.66	6407	
103	1472.10	H	22.7	2.65	9042	
104	1472.27	H	22.6	2.65	10003	
105	1472.40	H	18.5	2.65	3916	
106	1472.54	H	21.2	2.68	7868	
107	1472.70	H	17.8	2.65	1866	
108	1472.87	H	13.8	2.66	376	
109	1473.03	H	11.0	2.61	64.7	md lam
110	1473.16	H	25.9	2.66	13202	
111	1473.30	H	17.9	2.65	3778	
112	1473.46	H	26.1	2.68	16409	
113	1473.62	H	19.7	2.64	5710	

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
114	1473.75	H	26.2	2.65	1951	
115	1473.94	H	32.1	2.65	17049	
116	1474.08	H	32.5	2.65	18184	
117	1474.24	H	27.4	2.65	13143	
118	1474.40	H	27.7	2.62	10418	
119	1474.57	H	31.7	2.65	13241	
120	1474.75	H	26.0	2.65	8256	
121	1474.91	H	24.4	2.65	7353	
122	1475.13	H	22.9	2.65	8802	
123	1475.30	H	24.9	2.65	12231	
124	1475.43	H	27.8	2.65	11780	
125	1475.59	H	26.4	2.65	9927	
126	1475.74	H	22.9	2.65	10146	
127	1475.90	H	23.1	2.65	11294	
128	1476.03	H	27.2	2.64	11636	
129	1476.15	H	25.7	2.65	9888	
130	1476.27	H	25.4	2.65	11113	
131	1476.39	H	22.8	2.65	7855	
132	1476.63	H	30.6	2.66	2826	
133	1476.82	H	30.2	2.66	2958	
134	1476.94	H	24.6	2.48	1171	carb md & C lam
135	1477.02	H	28.4	2.65	1608	
136	1477.14	H	29.2	2.68	2128	
137	1477.27	H	27.4	2.64	931	
138	1477.72	H	27.5	2.65	1474	
139	1477.83	H	29.3	2.65	2522	
140	1477.97	H	29.6	2.66	2817	
141	1478.10	H	27.6	2.66	1274	
142	1478.25	H	27.1	2.66	1062	

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	:	30/04/1999
Well	: Iona-4	File	:	0299-02
Field	: Iona	Location	:	PPL2
Core 1	: 1381.00 - 1382.50m	ACS Lab.	:	Brisbane
Core 2	: 1448.55 - 1454.26m	Analysts	:	PNC IJM SW
Core 3	: 1455.00 - 1462.55m			
Core 4	: 1463.30 - 1469.67m			
Core 5	: 1470.60 - 1478.40m			

Sample Number	Depth	Dir	Porosity Percent	Grain Density	Permeability mD	Remarks
1	1449.93	V	13.7	2.56	25.4	md lam
2	1451.87	V	30.0	2.65	21474	
3	1452.95	V	28.3	2.65	3987	
4	1453.96	V	28.7	2.65	15594	
5	1455.72	V	30.4	2.65	15565	
6	1456.63	V	25.4	2.65	9643	
7	1457.83	V	29.6	2.65	15385	
8	1458.88	V	27.7	2.65	11425	
9	1459.68	V	28.9	2.64	9531	
10	1461.62	V	25.6	2.67	7860	
11	1463.40	V	22.5	2.72	3325	Pyr
12	1464.35	V	25.8	2.64	2609	
13	1465.73	V	16.2	2.64	111	
14	1472.97	V	13.1	2.61	13.5	md lam
15	1475.96	V	28.6	2.65	8085	
16	1477.20	V	27.8	2.60	153	C lam
17	1478.15	V	30.0	2.65	1904	

APPENDIX II

OVERBURDEN TEST RESULTS

OVERBURDEN CORE ANALYSIS FINAL REPORT

Client	: Western Underground Gas Storage Pty Limited			Date	: 15/4/99
Well	: Iona-4			File	: 0299-02
Core Int.	: Core No.1 1381.00m - 1382.50m	Overburden Pressure 1:	1150 psi	Location	: PPL2
Core Int.	: Core No.2 1448.55m - 1454.26m	Overburden Pressure 2:	1400 psi	Analysts	: PNC IJM SW
Core Int.	: Core No.3 1455.00m - 1462.55m	Overburden Pressure 3:	1650 psi		
Core Int.	: Core No.4 1463.30m - 1469.67m				
Core Int.	: Core No.5 1470.60m - 1478.40m				

Sample Number	Depth	Dir	Ambient Porosity	OB1 Porosity	OB2 Porosity	OB3 Porosity	Ambient Permeability	OB1 Permeability	OB2 Permeability	OB3 Permeability
2	1449.08	R	18.2	17.7	17.4	17.4	3067	2123	2043	1943
9	1450.69	R	23.2	22.2	21.9	21.8	439	226	174	151
13	1451.66	R	28.5	28.0	28.0	27.9	20012	18047	17935	17292
19	1452.55	R	30.3	29.7	29.6	29.5	22271	19838	19466	19082
25	1453.47	R	29.2	28.4	28.3	28.2	11872	9915	9724	9698
4V	1453.96	V	28.7	28.1	28.1	28.0	15594	13850	13597	12911
32	1455.20	R	26.7	26.0	25.9	25.9	17008	15109	14559	14515
39	1456.28	R	24.7	24.0	23.9	23.8	11762	9441	9219	9214
45	1457.45	R	29.5	29.0	28.9	28.9	16871	13779	13624	13543
51	1458.51	R	23.6	22.8	22.7	22.6	12472	10892	10646	10400
9V	1459.68	V	28.9	28.3	28.2	28.1	9531	7894	7618	7527
61	1461.15	R	20.1	19.3	19.1	19.0	7994	6699	6386	6074
68	1463.97	R	28.4	27.9	27.8	27.7	14191	13245	12772	12135
76	1465.75	R	21.7	21.2	21.1	21.0	5845	4917	4818	4795
80	1466.45	R	17.8	17.1	17.0	16.9	86.0	27.2	21.0	16.1
89	1468.70	R	27.6	27.0	26.9	26.9	19080	18296	17603	17433
96	1471.05	R	29.4	28.5	28.4	28.3	18601	18389	17849	17486

908903 352

Sample Number	Depth	Dir	Ambient Porosity	OB1 Porosity	OB2 Porosity	OB3 Porosity	Ambient Permeability	OB1 Permeability	OB2 Permeability	OB3 Permeability
102	1471.96	R	22.7	21.9	21.9	21.8	6407	5568	5369	5231
108	1472.87	R	13.8	13.0	12.9	12.8	376	269	244	235
115	1473.94	R	32.1	30.1	30.1	29.9	17049	7530	5245	4442
124	1475.43	R	27.8	27.3	27.3	27.2	11780	10388	10247	10210
126	1475.74	R	22.9	22.0	21.9	21.8	10046	7913	6863	6769
132	1476.63	R	30.6	29.9	29.7	29.7	2826	1729	1415	1332
16V	1477.20	V	27.8	27.2	27.1	27.0	153	51.2	43.9	
141	1478.10	R	27.6	27.0	27.0	27.0	1274	1197	1184	1172

APPENDIX III

POROSITY vs PERMEABILITY PLOT

APPENDIX IV

CORE LOG PLOT

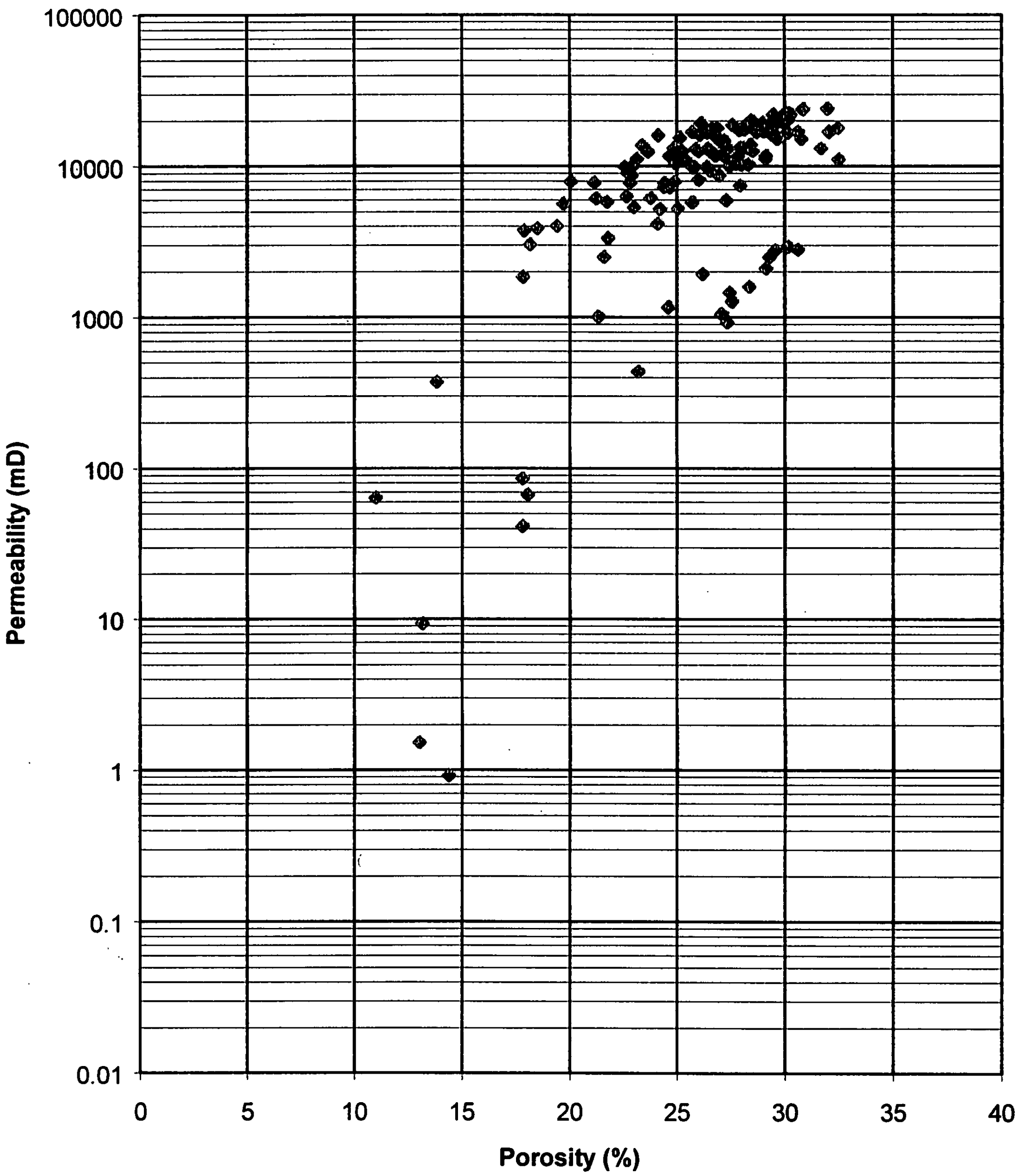
POROSITY vs PERMEABILITY
Ambient

ACS LABORATORIES PTY. LTD.

Client: Western Underground Gas Storage Pty Limited

Well: Iona-4

Depth: 1448.55m - 1478.40m



This is Page Number **908903_358X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued fold-out with page number:

908903_358Y

and is enclosed within the document PE908903 at this page.

TUAUSTRALIA

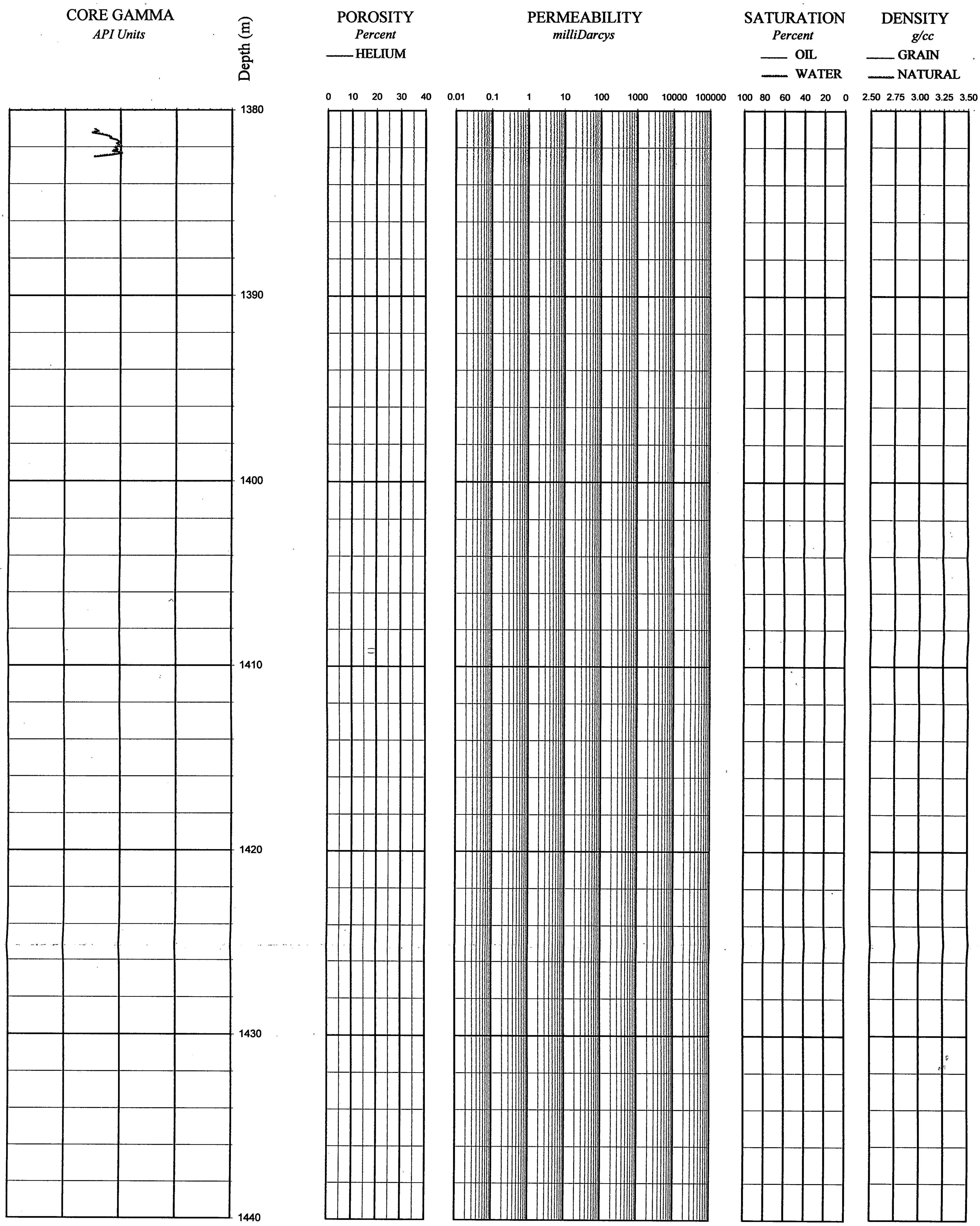
CORE PLOT

Scale 1:200

ACS LABORATORIES PTY. LTD.

Client: Western Underground Gas Storage Pty Limited
Well: Iona 4
File No.: 0299-02

Core 1: 1381.00m - 1382.50m



ACS Laboratories Pty. Ltd.
ACN: 008 273 005

908903 358Y

This is Page Number **908903_359X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued fold-out with page number:

908903_359Y

and is enclosed within the document PE908903 at this page.

CORE PLOT

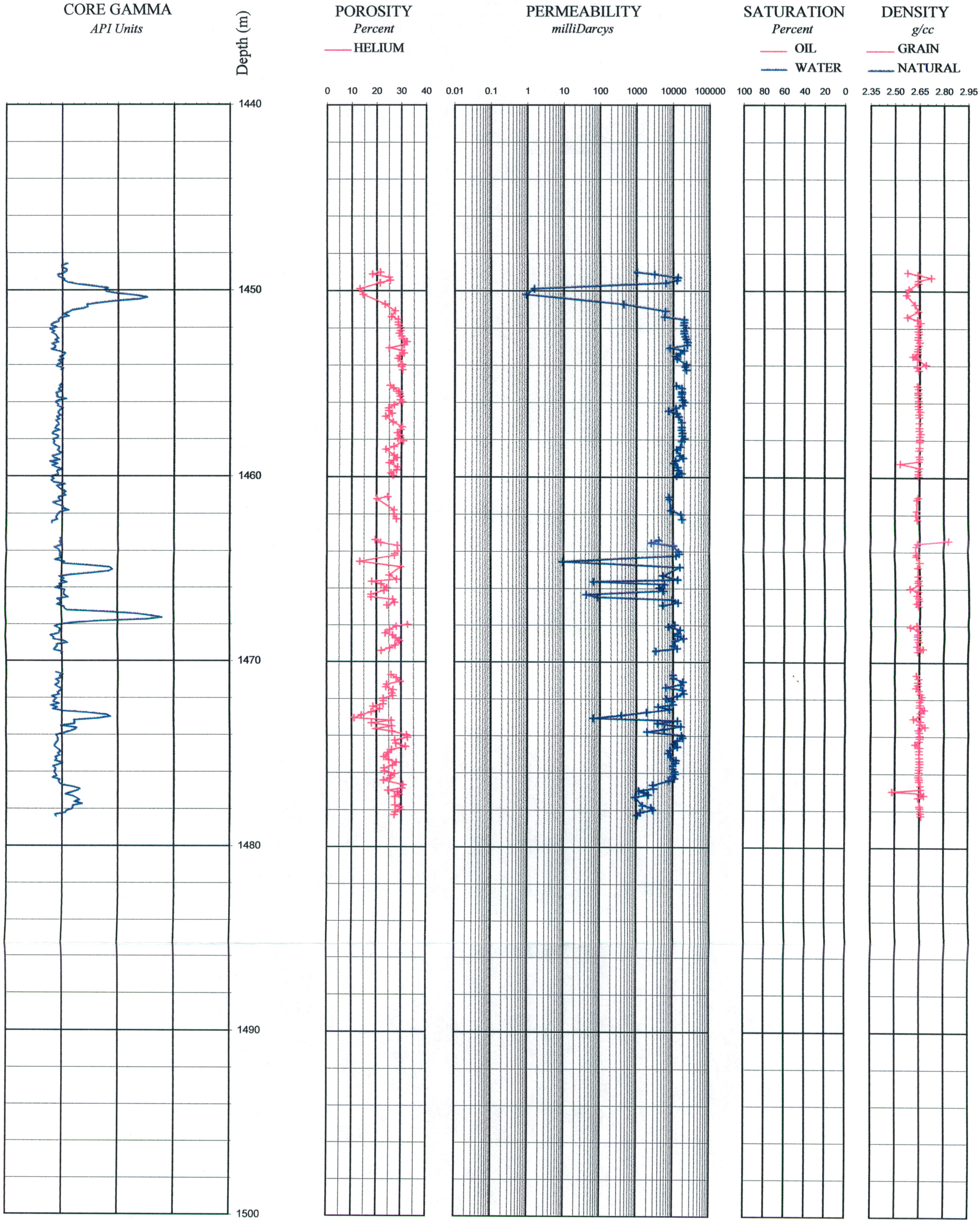
Scale 1:200

TUAUSTRALIA

ACS LABORATORIES PTY. LTD.

Client: Western Underground Gas Storage Pty Limited
Well: Iona-4
File No.: 0299-02

Core 2: 1448.55m - 1454.26m
Core 3: 1455.00m - 1462.55m
Core 4: 1463.30m - 1469.67m
Core 5: 1470.60m - 1478.40m



ACS Laboratories Pty. Ltd.
ACN: 008 273 005

908903 359Y

APPENDIX 5

Palynological analysis report by Biodata Pty Ltd

908903 361

Palynological analysis on four core samples from Iona–4 well, Otway Basin.

by

Alan D. Partridge

Biostrata Pty Ltd
A.C.N. 053 800 945

Biostrata Report 1999/10

1 October 1999

Palynological analysis on four core samples from Iona–4, Otway Basin.

by Alan D. Partridge

Summary

Four samples were examined from core–2 in the Iona–4 well, over a 1.5 metre interval between 1448.9 and 1450.4 mMDKB, to provide a palynological zone determination and age for the youngest sandstone identified in the Iona field. The top two samples consist of carbonaceous shaly layers from near the base of the sandstone, while the bottom two samples consist of carbonaceous siltstones to silty mudstones from the shale parting separating the youngest sandstone from the underlying and more widely distributed C1 sandstone.

All four samples gave good yields of moderately well preserved assemblages, that are similar in composition, and which can readily be assigned to the upper part of the *Hoegisporis trinalis* Subzone of the *P. mawsonii* spore-pollen Zone and the *Palaeohystrichophora infusorioides* microplankton Zone. The age of the samples is considered to be Turonian. Based on these results the interval clearly belongs to Unit C of the Waarre Formation, but does not represent the youngest part of Unit C as neither the *Isabelidinium evexus* microplankton Subzone nor *Laevigatosporites musa* spore-pollen Subzone were found.

All samples contained moderate diversity microplankton assemblages considered to be diagnostic of lower coastal plain to shallow neritic depositional environments.

Introduction

This palynological study was initiated to investigate the age of the youngest sandstone reservoir unit identified in the Iona Gas Field in the Otway Basin. This youngest sandstone is identified in Iona–4 and 5 wells based on a detailed electric log correlation of all wells in the field, part of which is reproduced in Figure 1. From lithology and electric log character the highest sandstone was interpreted to be a transgressive marine facies at the base of the Flaxman Formation, and this palynological study was instigated to provide independent support for this interpretation. Initially it was proposed to analyse cuttings samples from the Iona–5 well, which had intersected the thickest section of this youngest reservoir unit. However, as cavings from the Flaxman and younger formations were likely to mask the youngest zone at the top of the Waarre Formation the palynological analysis was switched to core–2 in the adjacent Iona–4 well, where the base of the youngest sandstone and the underlying shale interbed have been cored (Fig.2).

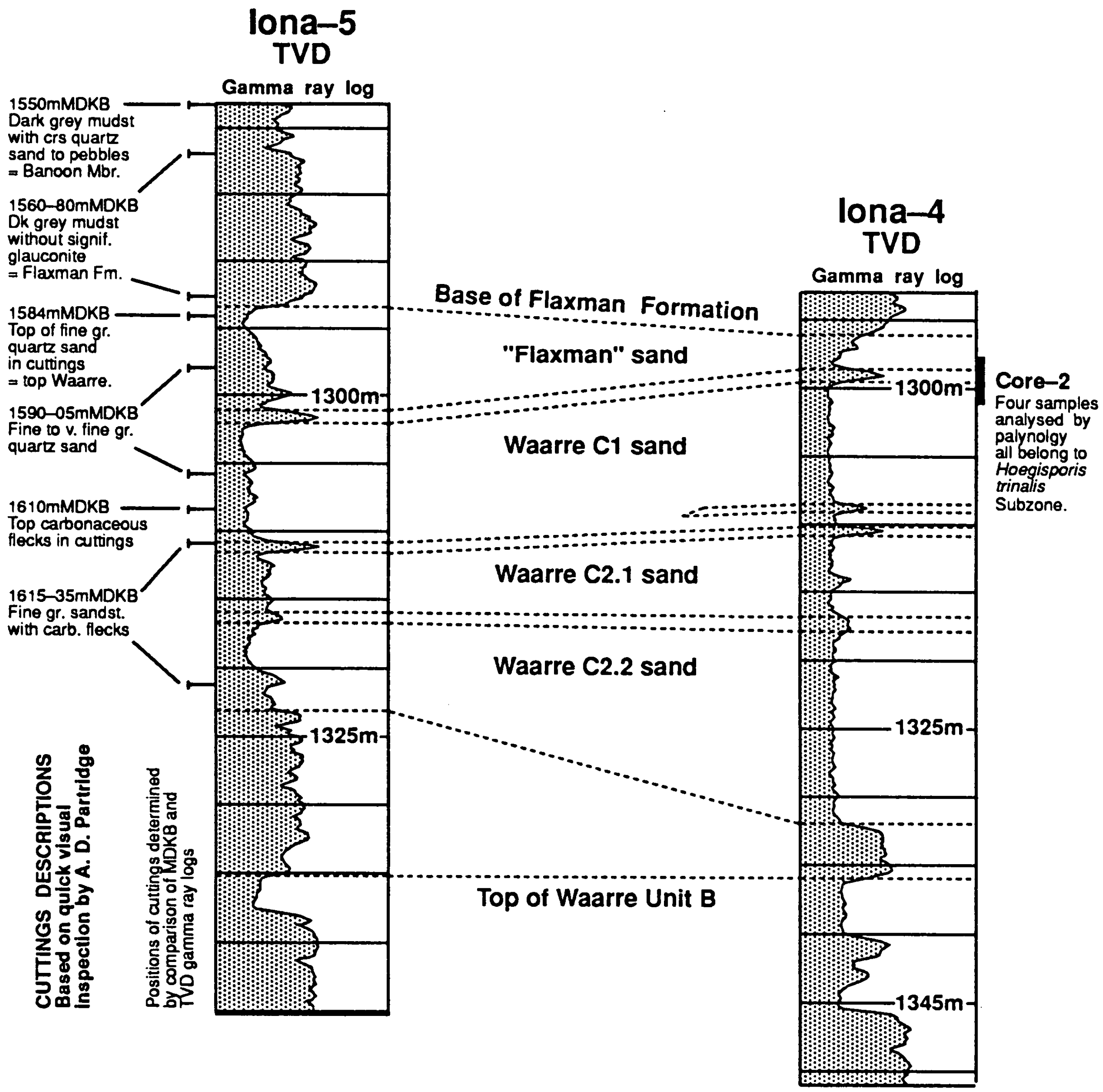


Figure 1. Log correlation between Iona–4 and Iona–5 production wells and naming of sands within Waarre Formation Unit C proposed by WUGS. Cuttings were inspected in Iona–5, but palynological analysis was only performed on samples from core–2 in Iona–4.

The four samples were received and sent by courier directly to Laola Pty Ltd in Perth for palynological processing on Wednesday15th September and returned to the author for examination on Thursday 23rd September. A provisional report on the samples was submitted on 30th September 1999.

An average of 18.9 grams was processed for each sample and all gave moderate to high residue yields, whilst palynomorph concentrations on the slides was mostly moderate, and preservation from fair to good.

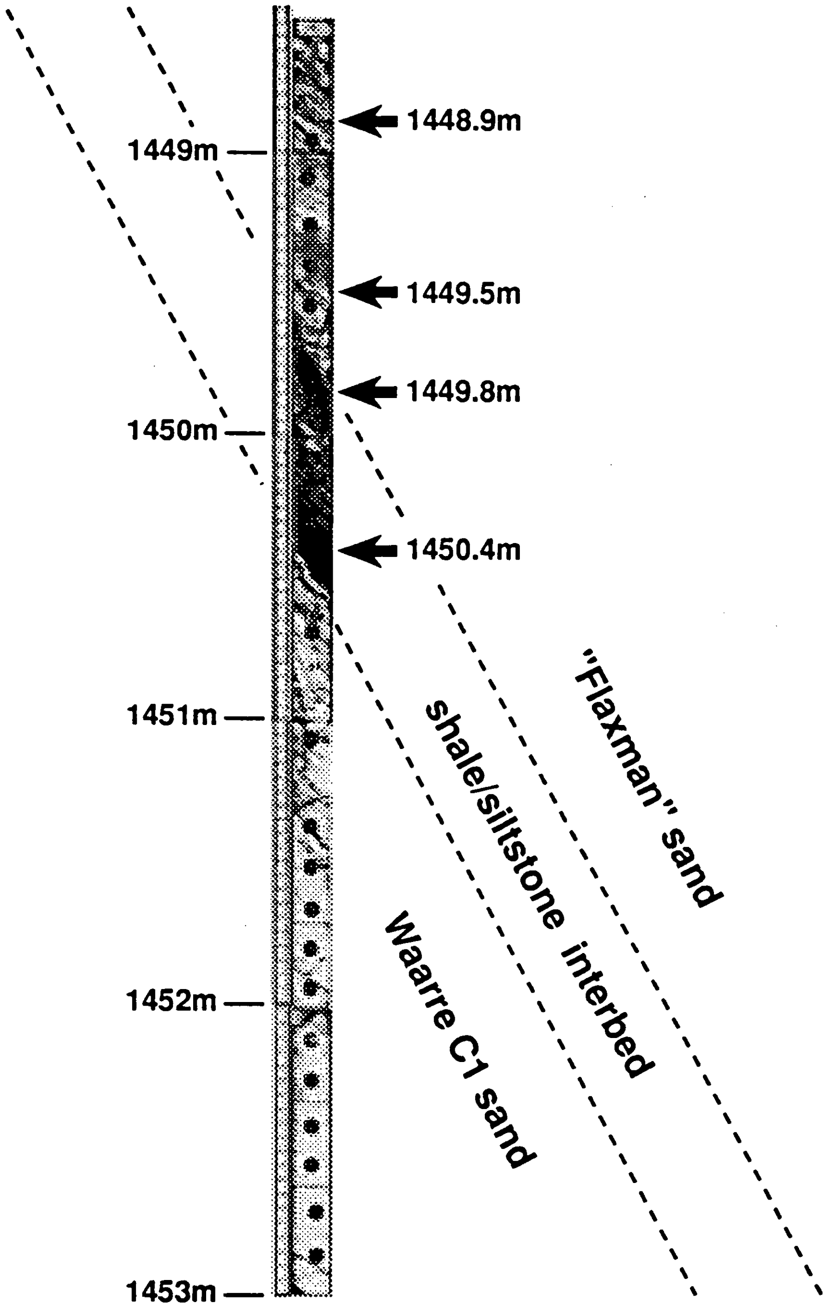


Figure 2. Scanned image of photograph of core–2 in Iona–4 showing interpreted stratigraphy and location of four palynological samples.

Details of zone assignments, confidence ratings and key comments are given in Table 1, basic sample and assemblage data in Tables 2 and 3, and the distribution of all spore-pollen and microplankton recorded in the samples provided in Table 4. 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

(Fig.3). 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 the microplankton from the index of Williams *et al.* (1998). Species names followed by "ms" are unpublished manuscript names.

Discussion of Assemblages

The four core samples contain diverse assemblages of spores and pollen (average 29+ species/samples), and low to moderate diversity assemblages of microplankton (average 8+ species /sample).

The spore-pollen can be confidently assigned to the *H. trinalis* Subzone of the *P. mawsonii* Zone based on the rare presence of the eponymous species *Hoegisporis trinalis* ms in all four samples. Other key species presence are the frequent occurrence of *Phyllocladidites mawsonii* (2% to 5%) in all samples, *Laevigatosporites musa* ms in three of the four samples (at >2%), while both *Verrucosisporites* (al. *Rugulatisporites*) *admirabilis* ms and *Tricolpites variverrucatus* ms were recorded from the top two samples. The accessory index species *Clavifera triplex* was only recorded in one sample, while the distinctive spore *Appendicisporites distocarinatus* was conspicuous by its absence from all samples. The assemblages are dominated by bisaccate gymnosperm pollen referred to *Podocarpidites* (average 32%) and smooth trilete spore referred to *Cyathidites* (average 8%), with secondary abundances of the gymnosperm pollen *Dilwynites* (average 8%), and the spore *Gleicheniidites circinidites* (average 6%). The gymnosperm pollen *Araucariacites australis* is conspicuously abundant in the sample at 1449.8m.

Although the microplankton assemblages are of low diversity, when the species recorded from all four samples are amalgamated into a single list the assemblage has a moderate diversity (16+ species), and a species composition which is consistent with the *Palaeohystrichophora infusorioides* Zone identified in the Waarre and Flaxman Formations in other wells in the Port Campbell Embayment. The assemblages are dominated by either the colonial algae *Amosopollis cruciformis*, or dinoflagellate cysts of *Heterosphaeridium*, with a secondary abundance of *Paralecaniella indentata* at 1449.5m (Table 4).

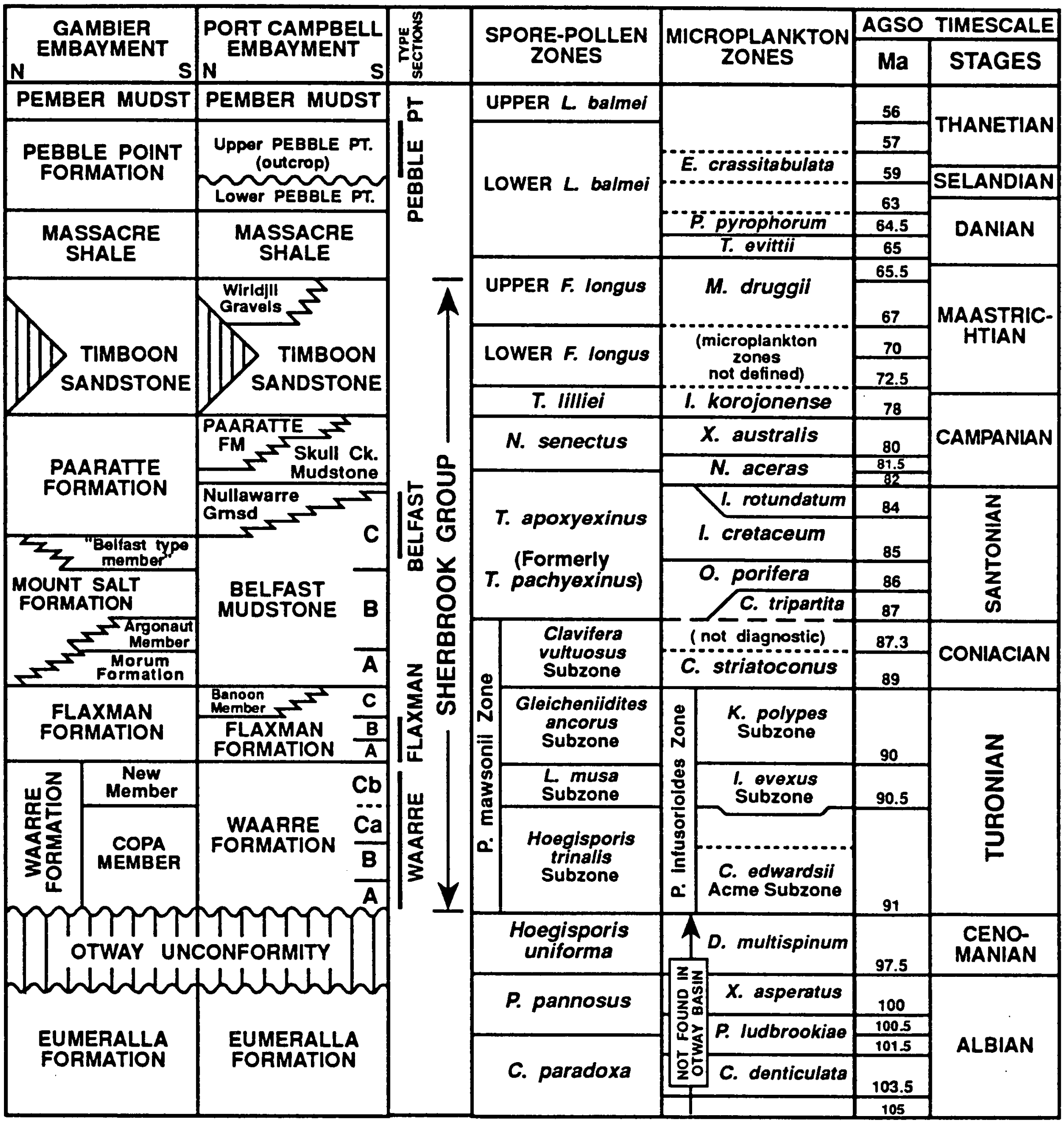


Figure 3. Revised Sherbrook Group stratigraphy, palynological biostratigraphy and proposed correlation to international stages and AGSO chronometric timescale (Young & Laurie, 1996).

Conspicuous by their absence in all four samples are the dinoflagellate species *Cribroperidinium edwardsii* and *Isabelidinium evexus* ms. The former has a characteristic acme in Units A and B of the Waarre, whilst the latter first appears in the uppermost part of Waarre Unit C (= Cb on Fig.3) and then ranges to the top of the Flaxman Formation. Based on the absence of these two species in four good assemblages the interval sampled is interpreted to fall into the gap between the *C. edwardsii* Acme Subzone and the *I. evexus* Subzone (Fig.3). This interpretation is supported by the spore-pollen assemblages as the presence of

Hoegisporis trinalis, but absence of *Appendicisporites distocarinatus* in all four samples is considered diagnostic of the same stratigraphic interval.

The moderate abundance of microplankton (18% to 28% of total MP and SP count) and the moderate diversity of the composite assemblage is considered diagnostic of a marine environment of deposition for all the samples. Although all recorded species are found in marine environments, the most abundant species is *Amosopollis cruciformis*, which also ranges into, and is known to be abundant in brackish and non-marine environments. Noteworthy secondary abundances are the species *Paralecaniella indentata* (29% of MP count at 1449.5m) and *Nummus* (2% in same sample). These two species have been observed in other basins to be most abundant in shallow water near-shore marine environments. Their co-occurrence with abundant *Amosopollis cruciformis* is interpreted to indicate either a nearshore shallow-water marine environment, or a paralic marine environment on the lower coastal plain only a few kilometres shoreward of the palaeoshoreline. The common alternative interpretation that the sandstones and shale/siltstone interbeds in the upper part of the Waarre Formation were deposited in predominantly fluviatile environments is difficult to reconcile with the observation that >90% of the microplankton species recorded from these samples are typical of normal marine environments.

Stratigraphy

Because all four samples contain similar assemblages, no age break is obvious between the top two samples from the supposed "Flaxman" sand, and the bottom two samples from the underlying shale/siltstone bed. As the assemblages are from the *H. trinalis* Subzone, but lie above the *Cribroperidinium edwardsii* Acme Zone they are considered to belong to the unit designated Waarre Ca (Fig.3; Partridge, 1997). As yet the youngest part of the Waarre Formation referred to as unit Cb, and characterised by the *Isabelidinium evexus* microplankton Subzone and *Laevigatosporites musa* spore-pollen Subzone, has not been identified in any of the palynological studies of the Iona Field (see fig.2 in Partridge, 1999).

Unit Cb of the Waarre is currently best documented in Langley-1, Vaughan-1, Fenton Creek-1 and Mylor-1, and is less well documented in Flaxmans-1 and Port Campbell-2. Usually it is only recorded from one or two samples, and its precise thickness and geographic distribution is poorly understood. The apparent absence of this unit from all wells analysed in the Iona Field suggests the presence of an erosional unconformity between the sandstone facies and the typical dark grey mudstones of the Flaxman Formation. In my opinion, the palynological results indicate that all of the sandstone reservoirs in the Iona Field should be assigned to the Waarre Formation.

References

DETTMANN, M.E., 1963. Upper Mesozoic microfloras from southeastern Australia. *Proceedings Royal Society Victoria, vol.77*, pt. 2, p.1–148.

DETTMANN, M.E. & PLAYFORD, G., 1969. Palynology of the Australian Cretaceous: a review. **In** *Stratigraphy and palaeontology. Essays in honour of Dorothy Hill*, K.S.W. Campbell, ed., A.N.U. Press Canberra, p.174-210.

HELBY, R., MORGAN, R. & PARTRIDGE, A.D., 1987. A palynological zonation of the Australian Mesozoic. *Memoir Association Australasian Palaeontologists 4*, p.1–94.

PARTRIDGE, A.D., 1997a. New Upper Cretaceous palynology of the Sherbrook Group, Otway Basin. In *Victorian Supplement, PESA News* April/May, p.9.

PARTRIDGE, A.D., 1999. Palynological analysis of four core and cuttings samples from WUGS Iona Observation Well No.1, Otway Basin. *Biostrata Report 1999/2*, p.1–8.

STOVER, L.E. & PARTRIDGE, A.D., 1973. Tertiary and late Cretaceous spores and pollen from the Gippsland Basin, southeastern Australia. *Proceedings Royal Society Victoria 85*, p.237–286.

WILLIAMS, G.L., LENTIN, J.K. & FENSOME, R.A., 1998. The Lentin and Williams index of fossil dinoflagellates 1998 edition. *American Association of Stratigraphic Palynologists, Contributions Series, no. 34*, p.1–817.

YOUNG, G.R. & LAURIE, G.C., editors, 1996. *An Australian Phanerozoic Timescale.* Oxford University Press, Melbourne, p.1-279.

Table 1: Interpretative data from Iona–4 well.

Sample	Depth Metres	Spore-Pollen Zone (Microplankton Zone)	CR*	Comments and Key Species Present
Core 2	1448.9	*H. trinalis* Subzone of *P. mawsonii* Zone (*P. infusorioides* Zone)	A1 A3	MP 21% with *Amosopollis cruciformis* dominant at 16% of total SP + MP count. *Hoegisporis trinalis* ms, *Laevigatosporites musa* ms and *Verrucosisporites admirabilis* ms are all present.
Core 2	1449.5	*H. trinalis* Subzone of *P. mawsonii* Zone (*P. infusorioides* Zone)	A1 A3	MP 28% with *A. cruciformis* dominant at 16% of total SP + MP count. *Palaeohystrichophora infusorioides*, *H. trinalis* ms, *L. musa* ms and *V. admirabilis* ms are all present.
Core 2	1449.8	*H. trinalis* Subzone of *P. mawsonii* Zone (*P. infusorioides* Zone)	A1 A3	MP 18% with *Heterosphaeridium* at 7% only slightly more abundant than *A. cruciformis* at 5%, in total count. *H. trinalis* ms present in SP assemblage dominated (>35%) by *Araucariacites australis* and *Dilwynites* pollen.
Core 2	1450.4	*H. trinalis* Subzone of *P. mawsonii* Zone (*P. infusorioides* Zone)	A1 A3	MP 21% with *A. cruciformis* dominant at 17% of total SP + MP count. *H. trinalis* ms and *L. musa* ms both present.

MP = microplankton
SP = spore–pollen

***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 sample data from Iona–4 well.

Sample Type	Depth metres	Lithology	Wt (g)
Core 2	1448.9	Carbonaceous medium grey shale with wavy bedding 3mm thick, interbedded with light grey medium–grained sandstone with rare pebbles (<5%) up to 5mm diameter.	14.0
Core 2	1449.5	Medium grey, medium to coarse-grained sandstone with carbonaceous partings.	27.8
Core 2	1449.8	Medium–dark grey, hard micaceous siltstone.	16.7
Core 2	1450.4	Medium to dark grey hard silty mudstone, irregularly laminated with lenticular discontinuous silty layers (<1mm thick up to 5mm long). Bedding plains with carbonaceous leaf impressions.	17.2

Table 3: Basic assemblage data from Iona–4 well.

Sample Type	Depth metres	Visual Yield	Palynomorph Concentration	Preservation	No. SP Spp.	No. MP Spp.
Core 2	1448.9	High	Moderate	Fair	27+	9+
Core 2	1449.5	Moderate	Moderate	Good	35+	10+
Core 2	1449.8	High	Moderate	Fair	31+	8+
Core 2	1450.4	High	Moderate	Fair	26+	6+
				Averages:	**29+**	**8+**

Table–4: Species distribution list for core samples from Iona–4.

Sample Type	Core 2	Core 2	Core 2	Core 2
Depth (m)	1448.9	1449.5	1449.8	1450.4
SPORES				
Araucariacites australis	6%	5%	20%	5%
Ariadnaesporites sp. (threads)	C	X	C	C
Asteropollis asteroides		X	1%	4%
Australopollis obscurus	1%			
Baculatisporites spp.		X	1%	1%
Biretisporites spectabilis		X		
Camarozonosporites heskermensis			X	
Ceratosporites equalis	X		X	
Cicatricosisporites spp.	1%	X	2%	
Cicatricosisporites australiensis			X	
Clavifera triplex		X		
Corollina torosa		X		
Cupressacites sp.	3%	2%	1%	
Cyathidites (large) >40µm		1%	X	1%
Cyathidites (small) <40µm	2%	11%	8%	9%
Densoisporites velatus	X			
Dictyophyllidites spp.	X	2%	1%	X
Dilwynites echinatus ms		X		X
Dilwynites granulatus	X	X	X	X
Dilwynites pusillus ms		3%	5%	1%
Dilwynites tuberculatus		X		
Dilwynites spp.	2%	5%	12%	7%
Foraminisporis asymmetricus			X	
Foveogleicheniidites confossus		X		
Gleicheniidites circinidites	10%	1%	3%	11%
Herkosporites elliottii	2%		1%	1%
Hoegisporis trinalis ms	X	X	X	X
Interulobites intraverrucatus		X		
Laevigatosporites musa ms	2%	2%		3%
Laevigatosporites ovatus	2%	1%	1%	2%
Liliacidites spp.	X		1%	
Marratisporites scabratus			1%	
Microcachryidites antarcticus	6%	6%	4%	6%
Osmundacidites wellmanii	1%	3%	1%	4%
Peromonolites spp.		2%		
Perotrilites jubatus	1%			
Phyllocladidites mawsonii	5%	5%	4%	2%
Plicatipollenites sp. **RW**		RW		
Podocarpidites spp.	42%	47%	21%	18%
Retitriletes spp.		1%		1%
Retitriletes austroclavatidites				X
Retitriletes eminulus		X		X
Rugulatisporites mallatus		X		

Table–4: Species distribution list for core samples from Iona–4 (cont.).

Sample Type	**Core 2**	**Core 2**	**Core 2**	**Core 2**
Depth (m)	**1448.9**	**1449.5**	**1449.8**	**1450.4**
Stereisporites antiquisporites	3%		2%	X
Trichotomosulcites subgranulatus	9%	5%	8%	19%
Tricolpites variabilis			X	
Tricolpates/Tricolporates spp.	1%		3%	5%
Tricolpites variverrucatus ms	X	X		
Triporoletes reticulatus			X	
Verrucosisporites admirabilis ms	X	X		
Vitreisporites signatus		X		
Total Spores:	**25%**	**23%**	**21%**	**33%**
Total Gymnosperms:	**73%**	**77%**	**75%**	**58%**
Total Angiosperms:	**2%**		**4%**	**9%**
MICROPLANKTON (Note: % wrt MP count)				
Amosopollis cruciformis	77%	56%	26%	81%
Cribroperidinium sp.		X		
Cyclonephelium distinctum	X	cf		
Cyclonephelium spp.	4%	2%		
Heterosphaeridium heteracanthum	4%	5%	33%	19%
Heterosphaeridium sp. nov.		X	X	
Hystrichodinium pulchrum			X	
Kiokansium polypes				X
Microdinium n.sp.			11%	
Nummus sp.	X	2%		X
Odontochitina costata	X			
Odontochitina operculata		X	4%	X
Palaeohystrichophora infusorioides		X		
Paralecaniella indentata	X	29%	7%	
Spiniferites spp.	X		4%	
Veryhachium sp.	4%			X
Microplankton as % of total SP & MP:	**21%**	**28%**	**18%**	**21%**
OTHER PALYNOMORPHS				
Microforaminifera liners			1%	
Fungal fruiting bodies	1%	1%		1%
Fungal spores & hyphae	4%	X	4%	6%

ABBREVIATIONS
X = Present
C = Common
RW = Reworked
cf = Compared with

APPENDIX 6

Core chip descriptions

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** Core Chip Description **Well:** Iona – 4 **Permit:** PPL-2
		12.25" Section (Cores # 1 to 5)
1381.0 Core#1	100	**CLAYSTONE:** medium grey to greyish black, firm, blocky, rare to minor quartz silt, trace medium to coarse quartz grains, minor to common disseminated and nodular glauconite, rare coal specks, rare mica, trace pyrite, trace calcareous, trace resin. Note: Claystone is sheared and slickensided from rotating in the core barrel
1382.14 Core#1	100	**CLAYSTONE:** as above
1448.5 Core#2	95 5	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium clear quartz, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, trace black lithics, good to excellent porosity, No shows. Interbedded with **COAL:** black, moderately hard, brittle, waxy to vitreous, laminated one to 2 mm thick
1455.84 Core#3	100	**SANDSTONE:** light brownish grey to very light grey, fine to very coarse, dominantly coarse clear quartz, moderately to well sorted, subangular to subrounded, firm to friable, predominantly loose and unconsolidated, trace pyrite, trace black lithics, excellent visible porosity, No shows.
1462.55 Core#3	100	**SANDSTONE:** light brownish grey to very light grey, very coarse to granule, dominantly granule clear and milky quartz, moderately to well sorted, subangular to subrounded, friable to predominantly loose and unconsolidated, trace pyrite, trace black lithics, excellent visible porosity, No shows.
1463.3 Core#4	100	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium to coarse clear quartz, moderately to well sorted, subangular to rounded, friable, trace pyrite, trace black lithics, good to excellent visible porosity, No shows.
1464.44 Core#4	100	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium clear quartz, moderately to well sorted, subangular to rounded, loose to friable, trace black carbonaceous laminations, trace pyrite, trace black lithics, good to excellent visible porosity, No shows.
1469.67 Core#4	100	**SANDSTONE:** light brownish grey to very light grey, fine to coarse, dominantly medium to coarse clear quartz, moderately to well sorted, subangular to rounded, loose to friable, trace pyrite, trace black lithics, good to excellent visible porosity,

Depth (mRT)	Lithol. (%)	**Western Underground Gas Storage Pty Ltd** **Core Chip Description** **Well:** **Iona – 4** **Permit:** **PPL-2**
		12.25" Section (Cores # 1 to 5)
		No shows.
1470.6 Core#5	100	**SANDSTONE:** light brownish grey to very light grey, medium to very coarse to granule, dominantly very coarse clear quartz, moderately to well sorted, subangular to subrounded, friable to predominantly loose and unconsolidated, trace pyrite, trace black lithics, excellent visible porosity, No shows.
1471.6 Core#5	100	**SANDSTONE:** light brownish grey to very light grey, medium to very coarse to granule occasional pebble to one centimetre, dominantly very coarse clear quartz, moderately to well sorted, subangular to subrounded, friable to predominantly loose and unconsolidated, trace pyrite, trace black lithics, excellent visible porosity, No shows.
1477.76 Core#5	100	**SANDSTONE:** very light grey to white, very fine to medium, dominantly medium clear quartz, poorly to moderately sorted, subangular to subrounded, firm to friable, abundant white argillaceous matrix grading to Argillaceous Sandstone, trace pyrite, trace black lithics, poor to moderate visible porosity, No shows.
1478.3 Core#5	95 5	**SANDSTONE:** very light grey to white, very fine to medium, dominantly medium clear quartz, poorly to moderately sorted, subangular to subrounded, firm to friable, abundant white argillaceous matrix grading to Argillaceous Sandstone, trace pyrite, trace black lithics, poor to moderate visible porosity, No shows. Interbedded with **CLAYSTONE:** dark grey to greyish black, firm, well bedded 4 to 5 mm beds, trace mica, rare to minor carbonaceous specks

APPENDIX 7

Western Underground Gas Storage Iona-4 Report
Well Seismic Edit and Geogram. Schlumberger GeoQuest

908903 377

Schlumberger
GeoQuest

WESTERN UNDERGROUND GAS STORAGE

IONA 4

REPORT

WELL SEISMIC EDIT AND GEOGRAM

FIELD	:	IONA
COUNTRY	:	AUSTRALIA
	:	
	:	
	:	
LOCATION	:	VICTORIA
DATE OF VSP SURVEY	:	25-MAR-1999
REFERENCE NO.	:	561286

August 1999

IONA 4 Borehole Seismic

IONA 4 Borehole Seismic

List of Figures

List of Enclosures

Summary of Geophysical Listings

Well Seismic Report
Drift & Sonic Adjustment
Time to Depth Report
Velocity Report

IONA 4 Borehole Seismic

Introduction

Checkshot data was acquired with the Seismic Acquisition Tiool (SAT-A) in the IONA3 deviated onshore well on the 25th of MARTH 1999. The IONA 4 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), correcting for TVD.

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	134.8 m above MSL
Elevation of DF	134.3 m above MSL
Elevation of GL	130 m above MSL
Level Interval	150.2-1221.4 VD MSL
Energy Source	Air gun
Source Offset	424.5 m
Source Depth	119.27 m above MSL
Reference Sensor	Reference hydrophone
Hydrophone Offset	424.5 m
Hydrophone Depth	119.77 m above MSL
Source & Hyd. Azimuth	263 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 first checkshot level at 134 mKB was excluded from processind due to poor signal in casing.
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 Z component is displayed in Plot 1.

Data Quality

The overall quality of the data is good.

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 424.5 m, 263 degrees from the wellhead. elevation is 119.27 m above MSL. The surface velocity (1492 m/s) from the gun to MSL was calculated using an uphole survey, supplied by the client (static shift to SRD=87.11 ms).

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	486-1564 mKB
Density	Density data	486-1564 mKB

Both sonic and density have been depth matched to definitive ECGR.
Density log was edited extended to the SRD level using constant value of 2.22 g/cc.

DT5 curve was used as sonic log. The quality of sonic log is good.

The gamma ray, deep resistivity and caliper logs have been included as correlation curves where they were available.

All logs were corrected for TVD.

Sonic Calibration Output

Zone Set Data

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.

Sonic Adjustment Data

The Drift & Sonic Adjustment 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

Drift Corrected Sonic Plot

The effect of the shifts listed in the Drift & Sonic Adjustment Report on the edited sonic log and the results of sonic adjustment for drift are graphically displayed on the Drift Corrected Sonic (Plot 5).

Velocity Report

The Average, RMS and interval velocities between two adjacent checkshot levels computed from corrected (adjusted) sonic log are listed in the Velocity Report with the sampling rate 2 ms.

Velosity Crossplot

Three velocities - Average, Interval, 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 Velosity Crossplot.

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.

$$v_{ave} = \frac{\sum v_n t_n}{\sum t_n}$$

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 two way time (TWT) against depth.

Time to Depth Report

This listing is obtained from the calibrated sonic log. The results are listed against two way time (TWT) together with corresponding seismic datum (SRD) depths.Sampling rate is 1 ms.

Sonic Calibration Results

Plot 4, Velosity Crosssplot is a display of the sonic calibration output in 34" format.

Top of the sonic log was chosen as the start of the drift comutation.

The calculated drift was small and well defined exhibiting very little scatter. The drift curve as expected increases steadily to a cumulative value of 12.2 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

Composite Display plots 2, 3 (Normal and Reversed Polarities correspondinly at scale 1 s : 25 cm) and 6 and 7 (normal and Reversed Polarities at scale 1s : 50 cm) were generated using 25, 30 and 35 Hz zero phase Ricker wavelets (the sonic log used to generate the Geograms was calibrated using first break transit-times).

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 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 35 Hz. They are displayed in Plots 2, 3 and 6,7.

A Summary of Geophysical Listings

Four geophysical data listings are appended to this report. Following is a brief description of the format of each listing.

Well Seismic Report

1. Level number: the level number starting from the top level (includes any imposed shots).

2. Vertical depth form SRD: *dsrd*, the depth in metres from seismic reference datum.

3. Measured depth from KB: *dkb*, the depth in metres from kelly bushing.

4. Observed travel time HYD to GEO: *tim*0, 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 SRD to GEO: *shtm*, is *timv* corrected for the vertical distance between source and datum.

6. Delta depth between shots: Δ*depth*, the vertical distance between each level.

7. Delta time between shots: Δ*time*, the difference in vertical travel time (*shtm*),between each level.

8. Interval velocity between shots: the average seismic velocity between each level, Δ*depth*/Δ*time*

9. Average velocity SRD to GEO: the average seismic velocity from datum to the corresponding checkshot level, $\frac{\text{dsrd}}{\text{shtm}}$.

Drift & Sonic Adjustment

Zone Set Data

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. Measured depth from KB: the depth in metres from kelly bushing

3. Vertical depth from SRD: the depth in metres from seismic reference datum.

4. Selected Drift at knee: the value of drift imposed at each knee.

5. Shift: the change in drift divided by the change in depth between any two levels.

6. Delta-T: see section 4 of report for an explanation of Δt_{min}.

7. Reuction factor G: see section 4 of report.

8. Selected Drift Gradient: the gradient of the imposed drift curve.

Sonic Adjustment Data

1. Measured depth from KB: the depth in metres from kelly bushing

2. Vertical depth from SRD: the depth in metres from seismic reference datum.

3. Vertical shot time SRD to GEO: the calculated vertical travel time from datum to downhole geophone.

4. Adjusted Sonic Time.

5. Computed drift at level: the checkshot time minus the integrated raw sonic time.

6. Residual Shot Time - Adjusted Sonic Time.

7. Adjusted Interval Velocity.

8. Adjusted RMS Velocity.

9. Adjusted Average Velocity.

Velocity Report

The data in this listing has been resampled 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 millisecs) and the sampling rate is 2 millisecs.

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.

$$v_{rms} = \sqrt{S_1{}^n v_i{}^2 t_i / S^n{}_1 t_i}$$

where v_i is the velocity between each 2 millisecs interval.

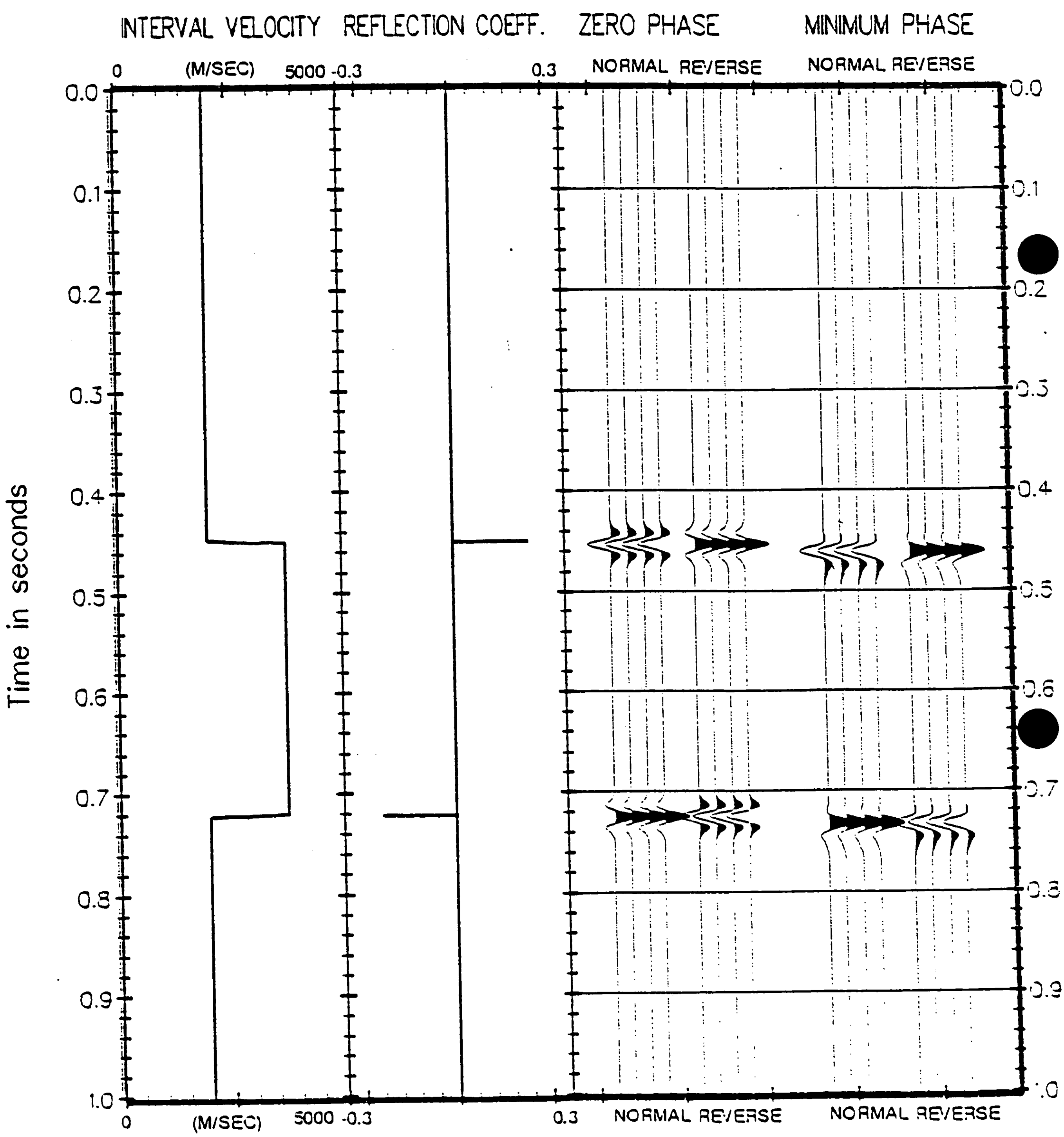
6. Interval velocity: the velocity between each sampled depth. Typically, the sampling rate is 2 millisecs two way time, (1 millisec one way time) therefore the interval velocity will be equal to the depth increment divided by 0.002. It is equivalent to column 9 from the Velocity Report.

Time to Depth

1. Two Way Sonic Time from SRD

2-11. Depth at Time 0-9 ms: moveout times every 1 ms

SCHLUMBERGER (SEG-1976) WAVELET POLARITY CONVENTION



TVD Computation Report

This is a report of the TVD Computation Module for the data described below.

Company/Well Information:

Company Name:	Western Underground Gas Storage
Field:	IONA
Well:	IONA #4

Input Parameters:

General Parameters

Top Depth:	0.000 m
Bottom Depth:	1559.966 m
Sample Rate:	-0.152 m

TVD Parameters

Method of Computation:	Minimum Curvature Method
Type of Input Data:	Log Inputs Only
Stations Input File:	./tvdcomp.dat
Station Data Output Sample Type?:	Continuous
Magnetic Decl. Corr.?:	No
Magnetic Declination:	0.000 deg

Tie Point Parameters

Measured Depth:	0.0 m
True Vertical Depth:	0.0 m
Azimuth:	0.0 deg
Deviation:	0.000 deg
North/South Drift:	0.0 m
East/West Drift:	0.0 m

Schlumberger

GEOGRAM+
Well Seismic Report

DATE 8/11/99

Client and Well Information

Country	AUSTRALIA
State	VICTORIA
Logging Date	
Company	Western Underground Gas Storage
Field	IONA
Well	IONA #4

Check Shot Data

LEVEL NUMBER	VERTICAL DEPTH FROM SRD m	MEASURED DEPTH FROM KB m	OBSERVED TRAVEL TIME owt s	Vertical Transit Time-SRD owt s	DELTA DEPTH m	DELTA TIME s	ACOUSTIC INTERVAL VELOCITY m/s	ACOUSTIC AVERAGE VELOCITY m/s
1	0.0			0.0000				
							2004	
2	150.2	285.0	0.2889	0.0749				2004
					54.0	0.0293	1843	
3	204.2	339.0	0.3038	0.1042				1959
					193.0	0.0915	2109	
4	397.2	532.0	0.3568	0.1958				2029
					70.0	0.0303	2309	
5	467.2	602.0	0.3776	0.2261				2067
					69.0	0.0265	2605	
6	536.2	671.0	0.3958	0.2526				2123
					76.5	0.0306	2504	
7	612.7	748.0	0.4174	0.2831				2164
					268.1	0.1040	2578	
8	880.9	1043.0	0.4873	0.3871				2275
					126.4	0.0474	2667	

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Well Seismic Report

Check Shot Data (Continued)

LEVEL NUMBER	VERTICAL DEPTH FROM SRD m	MEASURED DEPTH FROM KB m	OBSERVED TRAVEL TIME owt s	Vertical Transit Time-SRD owt s	DELTA DEPTH m	DELTA TIME s	ACOUSTIC INTERVAL VELOCITY m/s	ACOUSTIC AVERAGE VELOCITY m/s
9	1007.3	1219.0	0.5205	0.4345				2318
					95.7	0.0342	2801	
10	1103.0	1359.0	0.5494	0.4687				2353
					37.5	0.0142	2635	
11	1140.4	1417.0	0.5627	0.4829				2361
					19.9	0.0066	2999	
12	1160.3	1448.0	0.5692	0.4896				2370
					3.2	0.0009	3508	
13	1163.6	1453.0	0.5701	0.4905				2372
					9.0	0.0032	2844	
14	1172.6	1467.0	0.5733	0.4937				2375
					1.9	0.0008	2392	
15	1174.5	1470.0	0.5741	0.4945				2375
					21.4	0.0072	2974	
16	1195.9	1503.0	0.5815	0.5017				2384
					7.1	0.0026	2720	
17	1203.1	1514.0	0.5842	0.5043				2386
					5.9	0.0020	2943	
18	1208.9	1523.0	0.5863	0.5063				2388
					12.4	0.0041	3025	
19	1221.4	1542.0	0.5907	0.5104				2393

© 1994 Schlumberger

Output Data Arrays (Channels):

Measured Depth:	MD .TVD [A]
True Vertical Depth:	TVD .TVD [A]
X-Component of Well Departure	DX .TVD [A]
Y-Component of Well Departure	DY .TVD [A]

Output Array Data

Depth ft	Measured Depth m	True Vertical Depth m	X Well Departure m	Y Well Departure m
0.0	0.0	0.0	0.0	0.0
100.0	30.5	30.5	0.0	0.0
200.0	61.0	61.0	0.0	-0.0
300.0	91.4	91.4	0.1	-0.0
400.0	121.9	121.9	0.2	-0.1
500.0	152.4	152.4	0.2	-0.1
600.0	182.9	182.9	0.3	-0.2
700.0	213.4	213.4	0.4	-0.2
800.0	243.8	243.8	0.5	-0.3
900.0	274.3	274.3	0.5	-0.4
1000.0	304.8	304.8	0.6	-0.4
1100.0	335.3	335.3	0.7	-0.5
1200.0	365.8	365.8	0.7	-0.5
1300.0	396.2	396.2	0.8	-0.6
1400.0	426.7	426.7	0.8	-0.7
1500.0	457.2	457.2	0.8	-0.8
1600.0	487.7	487.7	0.8	-0.9
1700.0	518.2	518.2	0.8	-1.1
1800.0	548.6	548.6	0.8	-1.1
1900.0	579.1	579.1	0.8	-1.2
2000.0	609.6	609.6	0.7	-1.3
2100.0	640.1	640.1	0.6	-1.3
2200.0	670.6	670.6	0.2	-1.3
2300.0	701.0	701.0	-1.8	-1.3
2400.0	731.5	731.3	-5.2	-1.2
2500.0	762.0	761.3	-10.3	-1.4

Output Array Data (Continued)

Depth ft	Measured Depth m	True Vertical Depth m	X Well Departure m	Y Well Departure m
2600.0	792.5	791.0	-17.0	-2.2
2700.0	823.0	820.3	-25.3	-3.2
2800.0	853.4	849.1	-35.2	-4.4
2900.0	883.9	877.4	-46.6	-5.8
3000.0	914.4	905.1	-59.1	-7.4
3100.0	944.9	932.3	-72.7	-9.3
3200.0	975.4	959.0	-87.2	-11.5
3300.0	1005.8	985.0	-103.0	-13.7
3400.0	1036.3	1010.3	-120.0	-15.5
3500.0	1066.8	1034.5	-138.4	-17.2
3600.0	1097.3	1057.5	-158.2	-19.0
3700.0	1127.8	1079.7	-179.1	-21.1
3800.0	1158.2	1100.9	-200.8	-23.5
3900.0	1188.7	1121.7	-223.0	-25.8
4000.0	1219.2	1142.2	-245.4	-28.3
4100.0	1249.7	1162.9	-267.7	-30.4
4200.0	1280.2	1183.6	-289.9	-32.6
4300.0	1310.6	1204.5	-311.9	-35.3
4400.0	1341.1	1225.6	-333.8	-37.5
4500.0	1371.6	1246.1	-356.3	-39.8
4600.0	1402.1	1265.7	-379.5	-42.1
4700.0	1432.6	1285.2	-402.8	-44.3
4800.0	1463.0	1304.8	-426.0	-46.5
4900.0	1493.5	1324.6	-449.1	-49.1
5000.0	1524.0	1344.4	-472.1	-51.7
5100.0	1554.5	1364.4	-495.0	-54.0

Schlumberger

GEOGRAM+

Drift & Sonic Adjustment

DATE 8/11/99

Client and Well Information

Country	AUSTRALIA
State	VICTORIA
Logging Date	
Company	Western Underground Gas Storage
Field	IONA
Well	IONA #4

Knee and Zone Data

Raw Drift is computed at each shot level as

Shot Time - Sonic Time

From the raw drift curve, knees are selected. Knee depths define the zones for adjustment. Selected drift values define the amount of time adjustment to the sonic log in each zone.

When the gradient versus depth of the selected drift is POSITIVE, sonic velocities are deemed too fast. Sonic transit times are increased by a constant shift, the value of the selected drift gradient :

Adjusted DT = DT + Shift

When the gradient is NEGATIVE, sonic velocities are deemed too low. The excess sonic transit time over a threshold DT_Minimum is reduced by a constant reduction factor, G :

When DT < DT_Minimum   Adjusted DT = DT

When DT > DT_Minimum   Adjusted DT = G *(DT - DT_Minimum) + DT_Minimum

AFTER THE ADJUSTMENT OF THE SONIC LOG :

Residual is computed at each shot level as

Shot Time - Adjusted Sonic Time

It indicates how closely the adjustment has followed the shot times

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Drift & Sonic Adjustment

Zone Set Data

KNEE NUMBER	MEASURED DEPTH FROM KB m	VERTICAL DEPTH FROM SRD m	SELECTED DRIFT AT KNEE ms	SHIFT US/M	DELTA_T MINIMUM US/M	REDUCTION FACTOR G	SELECTED DRIFT GRADIENT US/M
1	529.9	395.1	-0.0029				
				19.3			19.3
2	625.2	490.4	0.0032				
				20.1			20.1
3	651.0	516.2	0.0049				
				19.8			19.8
4	673.7	538.9	0.0064				
				14.2			14.2
5	781.5	643.2	0.0112				
				9.4			9.4
6	928.2	776.5	0.0153				
				9.9			9.9
7	1051.3	886.8	0.0189				
				19.1			19.1
8	1220.7	1008.4	0.0265				
				3.2			3.2
9	1346.0	1094.1	0.0274				
				22.2			22.2
10	1454.3	1164.4	0.0326				
					324.1	0.97	-1.1
11	1512.0	1201.8	0.0324				
				70.3			70.3
12		1234.7	0.0401				

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Drift & Sonic Adjustment

Sonic Adjustment Data

MEASURED DEPTH FROM KB m	VERTICAL DEPTH FROM SRD m	VERTICAL SHOT TIME ms	ADJUSTED SONIC TIME ms	RAW DRIFT SHOT - SONIC ms	RESIDUAL SHOT - ADJUSTED SONIC ms	ADJUSTED INTERVAL VELOCITY m/s	ADJUSTED RMS VELOCITY m/s	ADJUSTED AVERAGE VELOCITY m/s
	0.0	0.0	0.0					
						2027		
[illegible]85.0	150.2	74.9	74.1				2027	2027
						2027		
339.0	204.2	104.2	100.7				2027	2027
						2027		
532.0	397.2	195.8	195.8	-0.0	-0.0		2029	2029
						2399		
602.0	467.2	226.1	226.9	0.5	-0.8		2061	2059
						2483		
671.0	536.2	252.6	253.4	1.9	-0.8		2126	2116
						2308		
748.0	612.7	283.1	283.8	3.1	-0.7		2172	2159
						2289		
1043.0	880.9	387.1	388.0	5.6	-0.9		2288	2270
						2910		
1219.0	1007.3	434.5	435.4	8.1	-0.8		2333	2314
						2704		
1359.0	1103.0	468.7	469.7	8.4	-1.0		2370	2348
						2631		
1417.0	1140.4	482.9	483.7	9.4	-0.8		2379	2358
						2816		
1448.0	1160.3	489.6	490.1	10.1	-0.5		2391	2368

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Drift & Sonic Adjustment

Sonic Adjustment Data (Continued)

MEASURED DEPTH FROM KB m	VERTICAL DEPTH FROM SRD m	VERTICAL SHOT TIME ms	ADJUSTED SONIC TIME ms	RAW DRIFT SHOT - SONIC ms	RESIDUAL SHOT - ADJUSTED SONIC ms	ADJUSTED INTERVAL VELOCITY m/s	ADJUSTED RMS VELOCITY m/s	ADJUSTED AVERAGE VELOCITY m/s
						2710		
1453.0	1163.6	490.5	491.3	9.9	-0.8		2391	2368
						2473		
1467.0	1172.6	493.7	494.7	9.8	-1.0		2394	2371
						2999		
1470.0	1174.5	494.5	495.3	9.9	-0.8		2395	2371
						2899		
1503.0	1195.9	501.7	502.8	9.6	-1.1		2402	2379
						3446		
1514.0	1203.1	504.3	505.2	10.0	-0.9		2406	2382
						2816		
1523.0	1208.9	506.3	507.5	10.0	-1.2		2406	2382
						2650		
1542.0	1221.4	510.4	509.9	12.2	0.5			2396

© 1994 Schlumberger

908903 403

GEOGRAM+

Time To Depth Report

Schlumberger

DATE 8/11/99

Client and Well Information

Country	AUSTRALIA
State	VICTORIA
Logging Date	
Company	Western Underground Gas Storage
Field	IONA
Well	IONA #4

Time To Depth Data

TWO WAY SONIC TIME FROM SRD ms	DEPTH AT TIME +0 ms m	DEPTH AT TIME +1 ms m	DEPTH AT TIME +2 ms m	DEPTH AT TIME +3 ms m	DEPTH AT TIME +4 ms m	DEPTH AT TIME +5 ms m	DEPTH AT TIME +6 ms m	DEPTH AT TIME +7 ms m	DEPTH AT TIME +8 ms m	DEPTH AT TIME +9 ms m
0	0.0	1.1	2.0	3.0	4.1	5.0	6.1	7.2	8.1	9.1
10	10.2	11.1	12.2	13.1	14.2	15.2	16.2	17.2	18.3	19.2
20	20.3	21.3	22.3	23.3	24.4	25.3	26.4	27.4	28.3	29.4
30	30.5	31.4	32.5	33.4	34.4	35.5	36.4	37.5	38.6	39.5
40	40.5	41.6	42.5	43.6	44.7	45.6	46.6	47.7	48.6	49.7
50	50.7	51.7	52.7	53.6	54.7	55.8	56.7	57.8	58.8	59.7
60	60.8	61.9	62.8	63.9	64.9	65.8	66.9	68.0	68.9	70.0
70	71.0	71.9	73.0	73.9	75.0	76.0	77.0	78.0	79.1	80.0
80	81.1	82.1	83.1	84.1	85.2	86.1	87.2	88.2	89.2	90.2
90	91.3	92.2	93.3	94.2	95.2	96.3	97.2	98.3	99.4	100.3
100	101.3	102.4	103.3	104.4	105.5	106.4	107.4	108.5	109.4	110.5
110	111.6	112.5	113.5	114.5	115.5	116.6	117.5	118.6	119.6	120.5
120	121.6	122.7	123.6	124.7	125.7	126.6	127.7	128.8	129.7	130.8
130	131.8	132.7	133.8	134.9	135.8	136.9	137.8	138.8	139.9	140.8
140	141.9	143.0	143.9	144.9	146.0	146.9	148.0	149.0	150.0	151.0

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Time To Depth Report

Time To Depth Data (Continued)

TWO WAY SONIC TIME FROM SRD ms	DEPTH AT TIME +0 ms m	DEPTH AT TIME +1 ms m	DEPTH AT TIME +2 ms m	DEPTH AT TIME +3 ms m	DEPTH AT TIME +4 ms m	DEPTH AT TIME +5 ms m	DEPTH AT TIME +6 ms m	DEPTH AT TIME +7 ms m	DEPTH AT TIME +8 ms m	DEPTH AT TIME +9 ms m
150	152.1	153.0	154.1	155.1	156.1	157.1	158.0	159.1	160.2	161.1
160	162.2	163.2	164.1	165.2	166.3	167.2	168.2	169.3	170.2	171.3
170	172.4	173.3	174.3	175.4	176.3	177.4	178.3	179.4	180.4	181.4
180	182.4	183.5	184.4	185.5	186.5	187.5	188.5	189.6	190.5	191.6
190	192.6	193.5	194.6	195.7	196.6	197.7	198.6	199.6	200.7	201.6
200	202.7	203.8	204.7	205.7	206.8	207.7	208.8	209.9	210.8	211.8
210	212.9	213.8	214.9	216.0	216.9	217.9	218.8	219.9	221.0	221.9
220	223.0	224.0	224.9	226.0	227.1	228.0	229.1	230.1	231.0	232.1
230	233.2	234.1	235.2	236.2	237.1	238.2	239.3	240.2	241.2	242.2
240	243.2	244.3	245.2	246.3	247.3	248.3	249.3	250.4	251.3	252.4
250	253.4	254.4	255.4	256.5	257.4	258.5	259.5	260.5	261.5	262.4
260	263.5	264.6	265.5	266.5	267.6	268.5	269.6	270.7	271.6	272.6
270	273.7	274.6	275.7	276.8	277.7	278.7	279.8	280.7	281.8	282.7
280	283.8	284.8	285.7	286.8	287.9	288.8	289.9	290.9	291.8	292.9
290	294.0	294.9	296.0	297.0	297.9	299.0	300.1	301.0	302.1	303.0
300	304.0	305.1	306.0	307.1	308.2	309.1	310.1	311.2	312.1	313.2
310	314.2	315.2	316.2	317.3	318.2	319.3	320.3	321.3	322.3	323.2
320	324.3	325.4	326.3	327.4	328.4	329.3	330.4	331.5	332.4	333.5
330	334.5	335.4	336.5	337.6	338.5	339.5	340.6	341.5	342.6	343.5
340	344.6	345.6	346.6	347.6	348.7	349.6	350.7	351.7	352.7	353.7
350	354.8	355.7	356.8	357.8	358.7	359.8	360.9	361.8	362.9	363.9
360	364.8	365.9	366.8	367.9	369.0	369.9	370.9	372.0	372.9	374.0
370	375.1	376.0	377.0	378.1	379.0	380.1	381.2	382.1	383.1	384.2
380	385.1	386.2	387.1	388.2	389.2	390.1	391.2	392.3	393.2	394.3

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Time To Depth Report

Time To Depth Data (Continued)

TWO WAY SONIC TIME FROM SRD ms	DEPTH AT TIME +0 ms m	DEPTH AT TIME +1 ms m	DEPTH AT TIME +2 ms m	DEPTH AT TIME +3 ms m	DEPTH AT TIME +4 ms m	DEPTH AT TIME +5 ms m	DEPTH AT TIME +6 ms m	DEPTH AT TIME +7 ms m	DEPTH AT TIME +8 ms m	DEPTH AT TIME +9 ms m
390	395.3	396.5	397.8	399.0	400.0	401.1	402.2	403.4	404.3	405.4
400	406.5	407.4	408.4	409.3	410.3	411.3	412.2	413.2	414.1	415.1
410	416.2	417.3	418.5	419.6	420.6	421.8	423.1	424.1	425.3	426.6
420	427.8	428.9	430.1	431.3	432.4	433.6	434.8	435.9	437.1	438.3
430	439.5	440.7	442.0	443.0	444.2	445.5	446.5	447.8	448.8	450.0
440	451.1	452.2	453.4	454.5	455.5	456.7	457.8	459.0	460.2	461.5
450	462.7	463.8	465.0	466.2	467.4	468.6	469.7	470.9	472.1	473.4
460	474.4	475.5	476.7	477.8	479.0	480.1	481.3	482.5	483.7	485.1
470	486.3	487.7	488.9	490.3	491.6	492.9	494.1	495.5	496.8	498.2
480	499.7	501.2	502.9	504.4	506.0	507.3	508.9	510.2	511.6	513.0
490	514.3	515.7	517.2	518.6	520.0	521.4	522.6	524.0	525.2	526.4
500	527.6	528.8	530.2	531.6	532.8	534.2	535.2	536.4	537.7	538.9
510	540.3	541.5	542.8	544.1	545.3	546.7	547.9	549.1	550.3	551.5
520	552.8	554.1	555.3	556.6	557.8	558.9	560.1	561.3	562.5	563.9
530	565.1	566.3	567.7	568.9	570.3	571.5	572.7	573.9	575.2	576.5
540	577.9	579.3	580.5	581.7	582.8	584.1	585.7	586.9	588.1	589.3
550	590.5	591.9	593.0	594.4	595.6	597.0	598.2	599.4	600.6	601.8
560	603.0	604.1	605.5	606.7	608.1	609.3	610.7	612.0	613.1	614.3
570	615.4	616.6	617.7	618.9	620.1	621.3	622.6	623.6	624.8	626.1
580	627.3	628.5	629.7	630.9	632.3	633.5	634.6	635.8	637.2	638.3
590	639.5	640.7	642.1	643.3	644.5	645.7	647.1	648.3	649.5	650.7
600	652.1	653.3	654.6	655.8	657.1	658.5	659.7	661.0	662.2	663.5
610	664.8	666.0	667.4	668.6	670.0	671.2	672.4	673.6	675.0	676.2
620	677.6	678.8	680.2	681.4	682.6	683.8	685.0	686.4	687.6	688.8

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Time To Depth Report

Time To Depth Data (Continued)

TWO WAY SONIC TIME FROM SRD ms	DEPTH AT TIME +0 ms m	DEPTH AT TIME +1 ms m	DEPTH AT TIME +2 ms m	DEPTH AT TIME +3 ms m	DEPTH AT TIME +4 ms m	DEPTH AT TIME +5 ms m	DEPTH AT TIME +6 ms m	DEPTH AT TIME +7 ms m	DEPTH AT TIME +8 ms m	DEPTH AT TIME +9 ms m
630	690.1	691.3	692.7	693.9	695.2	696.5	697.7	699.1	700.4	701.8
640	703.2	704.5	705.9	707.1	708.4	709.7	710.9	712.3	713.7	714.9
650	716.1	717.3	718.7	719.9	721.2	722.4	723.7	725.0	726.3	727.6
660	728.9	730.1	731.5	732.9	734.1	735.3	736.7	737.9	739.3	740.5
670	741.9	743.1	744.5	746.0	747.7	749.0	750.4	751.8	753.2	754.5
680	755.8	757.1	758.5	759.7	761.1	762.5	763.8	765.0	766.4	767.6
690	769.0	770.4	771.6	772.8	774.2	775.4	776.8	778.0	779.2	780.6
700	781.8	783.0	784.4	785.6	787.0	788.4	789.6	791.0	792.3	793.5
710	794.9	796.1	797.4	798.7	799.9	801.3	802.5	803.8	805.0	806.3
720	807.6	808.9	810.2	811.5	812.7	814.1	815.3	816.7	817.9	819.3
730	820.7	822.0	823.3	824.6	826.0	827.2	828.6	830.0	831.2	832.6
740	833.9	835.2	836.5	837.7	839.1	840.3	841.7	842.9	844.1	845.5
750	846.7	848.0	849.3	850.7	851.9	853.1	854.5	855.9	857.1	858.3
760	859.7	860.9	862.1	863.5	864.7	865.9	867.2	868.5	870.2	871.7
770	873.1	874.3	875.5	876.9	878.1	879.5	880.7	882.1	883.5	884.8
780	886.2	887.4	888.8	890.2	891.4	892.6	894.0	895.2	896.4	897.8
790	899.2	900.4	901.6	902.8	904.2	905.7	906.9	908.3	909.7	911.0
800	912.4	913.8	915.0	916.4	917.8	919.1	920.5	921.7	923.1	924.3
810	925.5	926.9	928.3	929.5	930.7	932.1	933.3	934.7	935.9	937.4
820	938.6	940.0	941.4	942.6	944.0	945.3	946.6	947.9	949.3	950.7
830	952.0	953.4	954.8	956.2	957.5	958.7	960.3	961.6	963.0	964.4
840	965.8	967.1	968.5	969.9	971.2	972.6	974.0	975.4	976.7	978.1
850	979.5	980.8	982.2	983.6	985.0	986.3	987.6	988.9	990.1	991.5
860	992.9	994.3	995.6	996.8	998.2	999.6	1000.8	1002.2	1003.6	1004.[illegible]

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Time To Depth Report

Time To Depth Data (Continued)

TWO WAY SONIC TIME FROM SRD ms	DEPTH AT TIME +0 ms m	DEPTH AT TIME +1 ms m	DEPTH AT TIME +2 ms m	DEPTH AT TIME +3 ms m	DEPTH AT TIME +4 ms m	DEPTH AT TIME +5 ms m	DEPTH AT TIME +6 ms m	DEPTH AT TIME +7 ms m	DEPTH AT TIME +8 ms m	DEPTH AT TIME +9 ms m
870	1006.3	1007.7	1009.0	1010.6	1012.2	1013.9	1015.3	1016.7	1018.0	1019.6
880	1021.1	1022.6	1024.3	1025.8	1027.3	1028.9	1030.5	1032.1	1033.4	1034.8
890	1036.0	1037.4	1038.6	1040.0	1041.3	1042.7	1044.1	1045.6	1047.0	1048.4
900	1049.7	1051.1	1052.3	1053.7	1054.9	1056.1	1057.5	1058.9	1060.1	1061.5
910	1062.8	1064.2	1065.4	1066.8	1068.2	1069.5	1071.2	1072.6	1074.0	1075.3
920	1076.7	1077.9	1079.3	1080.5	1081.7	1083.0	1084.3	1085.7	1087.1	1088.4
930	1090.0	1091.5	1093.0	1094.4	1095.8	1097.1	1098.3	1099.7	1101.1	1102.5
940	1103.7	1105.1	1106.3	1107.6	1109.0	1110.2	1111.6	1112.8	1114.2	1115.6
950	1116.8	1118.3	1119.7	1120.9	1122.3	1123.5	1124.9	1126.2	1127.5	1128.8
960	1130.0	1131.4	1132.8	1134.2	1135.5	1136.9	1138.3	1139.8	1141.2	1142.7
970	1144.1	1145.7	1147.3	1148.9	1150.5	1152.1	1153.8	1155.3	1157.0	1158.5
980	1160.1	1161.4	1162.8	1164.0	1165.4	1166.6	1168.0	1169.4	1170.7	1172.1
990	1173.8	1175.2	1176.5	1177.9	1179.3	1180.6	1182.0	1183.4	1184.9	1186.3
1000	1187.7	1189.0	1190.4	1191.9	1193.3	1194.8	1196.6	1198.5	1199.8	1201.2
1010	1202.6	1204.0	1205.2	1206.4	1207.6	1209.0	1210.4	1211.7	1213.0	1214.3

© 1994 Schlumberger

908903 403

Schlumberger

GEOGRAM+
Velocity Report

DATE 8/11/99

Client and Well Information

Country	AUSTRALIA
State	VICTORIA
Logging Date	
Company	Western Underground Gas Storage
Field	IONA
Well	IONA #4

Velocity Data

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	INTERVAL VELOCITY m/s
0		0.0			
					2027
2		2.0	2027	2027	
					2027
4		4.1	2027	2027	
					2027
6		6.1	2027	2027	
					2027
8		8.1	2027	2027	
					2027
10		10.2	2027	2027	
					2027
12		12.2	2027	2027	
					2027
14		14.2	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
16		16.2	2027	2027	
					2027
18		18.3	2027	2027	
					2027
20		20.3	2027	2027	
					2027
22		22.3	2027	2027	
					2027
24		24.4	2027	2027	
					2027
26		26.4	2027	2027	
					2027
28		28.3	2027	2027	
					2027
30		30.5	2027	2027	
					2027
32		32.5	2027	2027	
					2027
34		34.4	2027	2027	
					2027
36		36.4	2027	2027	
					2027
38		38.6	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
40		40.5	2027	2027	
					2027
42		42.5	2027	2027	
					2027
44		44.7	2027	2027	
					2027
46		46.6	2027	2027	
					2027
48		48.6	2027	2027	
					2027
50		50.7	2027	2027	
					2027
52		52.7	2027	2027	
					2027
54		54.7	2027	2027	
					2027
56		56.7	2027	2027	
					2027
58		58.8	2027	2027	
					2027
60		60.8	2027	2027	
					2027
62		62.8	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
64		64.9	2027	2027	
					2027
66		66.9	2027	2027	
					2027
68		68.9	2027	2027	
					2027
70		71.0	2027	2027	
					2027
72		73.0	2027	2027	
					2027
74		75.0	2027	2027	
					2027
76		77.0	2027	2027	
					2027
78		79.1	2027	2027	
					2027
80		81.1	2027	2027	
					2027
82		83.1	2027	2027	
					2027
84		85.2	2027	2027	
					2027
86		87.2	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
88		89.2	2027	2027	
					2027
90		91.3	2027	2027	
					2027
92		93.3	2027	2027	
					2027
94		95.2	2027	2027	
					2027
96		97.2	2027	2027	
					2027
98		99.4	2027	2027	
					2027
100		101.3	2027	2027	
					2027
102		103.3	2027	2027	
					2027
104		105.5	2027	2027	
					2027
106		107.4	2027	2027	
					2027
108		109.4	2027	2027	
					2027
110		111.6	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
112		113.5	2027	2027	
					2027
114		115.5	2027	2027	
					2027
116		117.5	2027	2027	
					2027
118		119.6	2027	2027	
					2027
120		121.6	2027	2027	
					2027
122		123.6	2027	2027	
					2027
124		125.7	2027	2027	
					2027
126		127.7	2027	2027	
					2027
128		129.7	2027	2027	
					2027
130		131.8	2027	2027	
					2027
132		133.8	2027	2027	
					2027
134		135.8	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
136		137.8	2027	2027	
					2027
138		139.9	2027	2027	
					2027
140		141.9	2027	2027	
					2027
142		143.9	2027	2027	
					2027
144		146.0	2027	2027	
					2027
146		148.0	2027	2027	
					2027
148		150.0	2027	2027	
					2027
150	286.9	152.1	2027	2027	
					2027
152	288.9	154.1	2027	2027	
					2027
154	290.9	156.1	2027	2027	
					2027
156	292.8	158.0	2027	2027	
					2027
158	295.0	160.2	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
160	297.0	162.2	2027	2027	
					2027
162	298.9	164.1	2027	2027	
					2027
164	301.1	166.3	2027	2027	
					2027
166	303.1	168.2	2027	2027	
					2027
168	305.0	170.2	2027	2027	
					2027
170	307.2	172.4	2027	2027	
					2027
172	309.1	174.3	2027	2027	
					2027
174	311.1	176.3	2027	2027	
					2027
176	313.1	178.3	2027	2027	
					2027
178	315.2	180.4	2027	2027	
					2027
180	317.2	182.4	2027	2027	
					2027
182	319.2	184.4	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
184	321.3	186.5	2027	2027	
					2027
186	323.3	188.5	2027	2027	
					2027
188	325.3	190.5	2027	2027	
					2027
190	327.4	192.6	2027	2027	
					2027
192	329.4	194.6	2027	2027	
					2027
194	331.4	196.6	2027	2027	
					2027
196	333.4	198.6	2027	2027	
					2027
198	335.5	200.7	2027	2027	
					2027
200	337.5	202.7	2027	2027	
					2027
202	339.5	204.7	2027	2027	
					2027
204	341.6	206.8	2027	2027	
					2027
206	343.6	208.8	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
208	345.6	210.8	2027	2027	
					2027
210	347.7	212.9	2027	2027	
					2027
212	349.7	214.9	2027	2027	
					2027
214	351.7	216.9	2027	2027	
					2027
216	353.6	218.8	2027	2027	
					2027
218	355.8	221.0	2027	2027	
					2027
220	357.8	223.0	2027	2027	
					2027
222	359.7	224.9	2027	2027	
					2027
224	361.9	227.1	2027	2027	
					2027
226	363.9	229.1	2027	2027	
					2027
228	365.8	231.0	2027	2027	
					2027
230	368.0	233.2	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
232	370.0	235.2	2027	2027	
					2027
234	371.9	237.1	2027	2027	
					2027
236	374.1	239.3	2027	2027	
					2027
238	376.1	241.2	2027	2027	
					2027
240	378.0	243.2	2027	2027	
					2027
242	380.0	245.2	2027	2027	
					2027
244	382.1	247.3	2027	2027	
					2027
246	384.1	249.3	2027	2027	
					2027
248	386.1	251.3	2027	2027	
					2027
250	388.2	253.4	2027	2027	
					2027
252	390.2	255.4	2027	2027	
					2027
254	392.2	257.4	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
256	394.3	259.5	2027	2027	
					2027
258	396.3	261.5	2027	2027	
					2027
260	398.3	263.5	2027	2027	
					2027
262	400.3	265.5	2027	2027	
					2027
264	402.4	267.6	2027	2027	
					2027
266	404.4	269.6	2027	2027	
					2027
268	406.4	271.6	2027	2027	
					2027
270	408.5	273.7	2027	2027	
					2027
272	410.5	275.7	2027	2027	
					2027
274	412.5	277.7	2027	2027	
					2027
276	414.6	279.8	2027	2027	
					2027
278	416.6	281.8	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
280	418.6	283.8	2027	2027	
					2027
282	420.6	285.7	2027	2027	
					2027
284	422.7	287.9	2027	2027	
					2027
286	424.7	289.9	2027	2027	
					2027
288	426.6	291.8	2027	2027	
					2027
290	428.8	294.0	2027	2027	
					2027
292	430.8	296.0	2027	2027	
					2027
294	432.7	297.9	2027	2027	
					2027
296	434.9	300.1	2027	2027	
					2027
298	436.9	302.1	2027	2027	
					2027
300	438.8	304.0	2027	2027	
					2027
302	440.8	306.0	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
304	443.0	308.2	2027	2027	
					2027
306	444.9	310.1	2027	2027	
					2027
308	446.9	312.1	2027	2027	
					2027
310	449.1	314.2	2027	2027	
					2027
312	451.0	316.2	2027	2027	
					2027
314	453.0	318.2	2027	2027	
					2027
316	455.1	320.3	2027	2027	
					2027
318	457.1	322.3	2027	2027	
					2027
320	459.1	324.3	2027	2027	
					2027
322	461.1	326.3	2027	2027	
					2027
324	463.2	328.4	2027	2027	
					2027
326	465.2	330.4	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
328	467.2	332.4	2027	2027	
					2027
330	469.3	334.5	2027	2027	
					2027
332	471.3	336.5	2027	2027	
					2027
334	473.3	338.5	2027	2027	
					2027
336	475.4	340.6	2027	2027	
					2027
338	477.4	342.6	2027	2027	
					2027
340	479.4	344.6	2027	2027	
					2027
342	481.4	346.6	2027	2027	
					2027
344	483.5	348.7	2027	2027	
					2027
346	485.5	350.7	2027	2027	
					2027
348	487.5	352.7	2027	2027	
					2027
350	489.6	354.8	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
352	491.6	356.8	2027	2027	
					2027
354	493.6	358.7	2027	2027	
					2027
356	495.7	360.9	2027	2027	
					2027
358	497.7	362.9	2027	2027	
					2027
360	499.6	364.8	2027	2027	
					2027
362	501.6	366.8	2027	2027	
					2027
364	503.8	369.0	2027	2027	
					2027
366	505.7	370.9	2027	2027	
					2027
368	507.7	372.9	2027	2027	
					2027
370	509.9	375.1	2027	2027	
					2027
372	511.8	377.0	2027	2027	
					2027
374	513.8	379.0	2027	2027	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2027
376	516.0	381.2	2027	2027	
					2027
378	517.9	383.1	2027	2027	
					2027
380	519.9	385.1	2027	2027	
					2027
382	521.9	387.1	2027	2027	
					2027
384	524.0	389.2	2027	2027	
					2027
386	526.0	391.2	2027	2027	
					2027
388	528.0	393.2	2027	2027	
					2027
390	530.1	395.3	2027	2027	
					2027
392	532.6	397.8	2029	2030	
					2466
394	534.9	400.0	2031	2031	
					2382
396	537.0	402.2	2031	2032	
					2117
398	539.1	404.3	2032	2032	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2388
400	541.3	406.5	2032	2032	
					2033
402	543.2	408.4	2032	2032	
					2098
404	545.1	410.3	2031	2032	
					1879
406	547.0	412.2	2030	2031	
					1946
408	548.9	414.1	2030	2031	
					1870
410	551.0	416.2	2030	2031	
					2083
412	553.3	418.5	2031	2032	
					2202
414	555.4	420.6	2032	2033	
					2245
416	557.9	423.1	2034	2034	
					2114
418	560.2	425.3	2035	2036	
					2374
420	562.6	427.8	2037	2038	
					2385
422	564.9	430.1	2038	2039	

© 1994 Schlumberger

GEOGRAM+
Velocity Report

Schlumberger

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2337
424	567.2	432.4	2040	2041	
					2325
426	569.6	434.8	2041	2042	
					2307
428	571.9	437.1	2043	2044	
					2269
430	574.3	439.5	2044	2046	
					2421
432	576.8	442.0	2046	2048	
					2377
434	579.0	444.2	2047	2049	
					2289
436	581.3	446.5	2048	2050	
					2372
438	583.6	448.8	2050	2051	
					2293
440	585.9	451.1	2051	2053	
					2235
442	588.2	453.4	2051	2053	
					2201
444	590.3	455.5	2052	2054	
					2183
446	592.8	458.0	2053	2055	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2250
448	595.1	460.2	2055	2057	
					2382
450	597.5	462.7	2056	2058	
					2397
452	599.8	465.0	2057	2060	
					2268
454	602.2	467.4	2059	2061	
					2359
456	604.5	469.7	2060	2063	
					2492
458	606.9	472.1	2062	2064	
					2299
460	609.2	474.4	2063	2065	
					2368
462	611.5	476.7	2064	2066	
					2240
464	613.8	479.0	2064	2067	
					2276
466	616.1	481.3	2066	2068	
					2269
468	618.5	483.7	2067	2070	
					2308
470	621.1	486.3	2070	2073	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2524
472	623.7	488.9	2072	2075	
					2517
474	626.4	491.6	2074	2078	
					2634
476	628.9	494.1	2076	2080	
					2552
478	631.6	496.8	2079	2083	
					2457
480	634.5	499.7	2082	2087	
					2839
482	637.7	502.9	2087	2093	
					3076
484	640.8	506.0	2091	2098	
					3195
486	643.7	508.9	2094	2102	
					2935
488	646.4	511.6	2097	2105	
					2911
490	649.2	514.3	2100	2108	
					2753
492	652.1	517.2	2102	2111	
					2694
494	654.8	520.0	2105	2114	

© 1994 Schlumberger

Schlumberger

GEOGRAM+

Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2766
496	657.4	522.6	2107	2117	
					2632
498	660.0	525.2	2109	2119	
					2759
500	662.4	527.6	2111	2121	
					2419
502	665.0	530.2	2112	2122	
					2459
504	667.6	532.8	2114	2124	
					2547
506	670.0	535.2	2116	2126	
					2736
508	672.5	537.7	2117	2127	
					2411
510	675.1	540.3	2119	2129	
					2419
512	677.7	542.8	2120	2131	
					2470
514	680.1	545.3	2122	2133	
					2748
516	682.8	547.9	2123	2134	
					2549
518	685.2	550.3	2125	2136	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2504
520	687.7	552.8	2126	2137	
					2409
522	690.3	555.3	2128	2139	
					2466
524	692.7	557.8	2129	2140	
					2419
526	695.0	560.1	2130	2141	
					2396
528	697.5	562.5	2131	2142	
					2449
530	700.1	565.1	2132	2144	
					2591
532	702.7	567.7	2134	2145	
					2480
534	705.3	570.3	2136	2147	
					2425
536	707.7	572.7	2137	2148	
					2610
538	710.2	575.2	2138	2150	
					2429
540	713.0	577.9	2140	2152	
					2836
542	715.6	580.5	2142	2154	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2959
544	717.9	582.8	2143	2155	
					2341
546	720.8	585.7	2145	2158	
					2386
548	723.2	588.1	2147	2159	
					2802
550	725.7	590.5	2148	2160	
					2404
552	728.1	593.0	2149	2161	
					2464
554	730.7	595.6	2150	2163	
					2523
556	733.3	598.2	2151	2164	
					2565
558	735.8	600.6	2153	2165	
					2478
560	738.3	603.0	2154	2166	
					2480
562	740.7	605.5	2155	2167	
					2357
564	743.3	608.1	2156	2169	
					2608
566	745.9	610.7	2158	2171	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2533
568	748.4	613.1	2159	2172	
					2723
570	750.9	615.4	2159	2173	
					2284
572	753.4	617.7	2160	2173	
					2343
574	756.1	620.1	2161	2174	
					2295
576	758.8	622.6	2161	2174	
					2370
578	761.3	624.8	2162	2175	
					2354
580	764.0	627.3	2163	2176	
					2363
582	766.7	629.7	2164	2177	
					2436
584	769.5	632.3	2165	2178	
					2399
586	772.0	634.6	2166	2179	
					2455
588	774.9	637.2	2167	2180	
					2371
590	777.4	639.5	2168	2181	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2421
592	780.3	642.1	2169	2182	
					2425
594	782.9	644.5	2170	2183	
					2461
596	785.8	647.1	2171	2184	
					2494
598	788.5	649.5	2172	2186	
					2537
600	791.3	652.1	2174	2187	
					2425
602	794.0	654.6	2175	2188	
					2451
604	796.9	657.1	2176	2189	
					2513
606	799.7	659.7	2178	2191	
					2651
608	802.4	662.2	2178	2192	
					2492
610	805.2	664.8	2179	2193	
					2442
612	808.1	667.4	2181	2194	
					2494
614	811.0	670.0	2182	2196	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2626
616	813.6	672.4	2183	2197	
					2585
618	816.5	675.0	2184	2198	
					2503
620	819.3	677.6	2186	2200	
					2450
622	822.2	680.2	2187	2201	
					2547
624	824.9	682.6	2188	2202	
					2480
626	827.6	685.0	2189	2203	
					2454
628	830.4	687.6	2190	2204	
					2468
630	833.1	690.1	2191	2205	
					2539
632	835.9	692.7	2192	2206	
					2482
634	838.8	695.2	2193	2207	
					2706
636	841.5	697.7	2194	2208	
					2549
638	844.5	700.4	2196	2210	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2589
640	847.5	703.2	2198	2212	
					2717
642	850.5	705.9	2199	2213	
					2732
644	853.2	708.4	2200	2215	
					2513
646	856.1	710.9	2201	2216	
					2566
648	859.1	713.7	2203	2217	
					2464
650	861.8	716.1	2204	2218	
					2515
652	864.6	718.7	2205	2219	
					2501
654	867.3	721.2	2206	2220	
					2517
656	870.1	723.7	2207	2221	
					2375
658	873.0	726.3	2208	2223	
					2661
660	875.8	728.9	2209	2224	
					2639
662	878.7	731.5	2210	2225	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2552
664	881.5	734.1	2211	2226	
					2763
666	884.4	736.7	2212	2227	
					2592
668	887.2	739.3	2213	2228	
					2719
670	890.1	741.9	2214	2229	
					2585
672	892.9	744.5	2216	2231	
					2580
674	896.5	747.7	2219	2234	
					2884
676	899.5	750.4	2220	2236	
					2932
678	902.5	753.2	2222	2238	
					2568
680	905.4	755.8	2223	2239	
					2807
682	908.4	758.5	2224	2240	
					2585
684	911.2	761.1	2225	2242	
					2632
686	914.2	763.8	2227	2243	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2682
688	917.1	766.4	2228	2244	
					2608
690	919.9	769.0	2229	2245	
					2434
692	922.8	771.6	2230	2246	
					2593
694	925.6	774.2	2231	2247	
					2490
696	928.5	776.8	2232	2248	
					2566
698	931.2	779.2	2233	2249	
					2537
700	934.0	781.8	2234	2250	
					2529
702	936.9	784.4	2235	2251	
					2549
704	939.7	787.0	2236	2252	
					2515
706	942.6	789.6	2237	2253	
					2620
708	945.6	792.3	2238	2255	
					2749
710	948.3	794.8	2239	2256	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2659
712	951.1	797.4	2240	2257	
					2542
714	954.0	799.9	2241	2257	
					2525
716	956.8	802.5	2242	2258	
					2585
718	959.5	805.0	2242	2259	
					2556
720	962.4	807.6	2243	2260	
					2538
722	965.2	810.2	2244	2261	
					2612
724	968.1	812.7	2245	2262	
					2593
726	970.9	815.3	2246	2263	
					2644
728	973.8	817.9	2247	2264	
					2572
730	976.8	820.7	2248	2265	
					2672
732	979.6	823.3	2249	2266	
					2624
734	982.7	826.0	2251	2268	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2656
736	985.5	828.6	2252	2269	
					2584
738	988.4	831.2	2253	2270	
					2662
740	991.4	833.9	2254	2271	
					2666
742	994.2	836.5	2255	2272	
					2565
744	997.1	839.1	2256	2273	
					2568
746	999.8	841.6	2256	2273	
					2559
748	1002.6	844.1	2257	2274	
					2520
750	1005.5	846.7	2258	2275	
					2609
752	1008.3	849.3	2259	2276	
					2626
754	1011.2	851.9	2260	2277	
					2632
756	1014.0	854.5	2261	2278	
					2566
758	1016.9	857.1	2261	2279	

© 1994 Schlumberger

GEOGRAM+

Schlumberger

Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2622
760	1019.7	859.7	2262	2279	
					2568
762	1022.4	862.1	2263	2280	
					2428
764	1025.2	864.7	2264	2281	
					2425
766	1027.9	867.2	2264	2281	
					2528
768	1031.3	870.2	2266	2284	
					2589
770	1034.5	873.1	2268	2286	
					3946
772	1037.2	875.5	2268	2286	
					2576
774	1040.0	878.1	2269	2287	
					2535
776	1042.9	880.7	2270	2288	
					2543
778	1046.6	883.5	2271	2289	
					2814
780	1050.5	886.2	2272	2290	
					2576
782	1054.1	888.8	2273	2291	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2763
784	1057.7	891.4	2274	2292	
					2490
786	1061.3	894.0	2275	2293	
					2609
788	1064.7	896.4	2275	2293	
					2455
790	1068.5	899.2	2276	2294	
					2604
792	1071.9	901.6	2277	2295	
					2566
794	1075.5	904.2	2277	2295	
					2530
796	1079.3	906.9	2279	2297	
					2746
798	1083.1	909.7	2280	2298	
					2662
800	1087.0	912.4	2281	2299	
					2849
802	1090.6	915.0	2282	2300	
					2655
804	1094.4	917.8	2283	2301	
					2683
806	1098.0	920.3	2284	2302	

© 1994 Schlumberger

GEOGRAM+
Velocity Report

Schlumberger

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2656
808	1101.8	923.1	2285	2303	
					2656
810	1105.2	925.5	2285	2304	
					2510
812	1109.0	928.3	2286	2305	
					2510
814	1112.4	930.7	2287	2305	
					2608
816	1116.0	933.3	2287	2306	
					2614
818	1119.6	935.9	2288	2307	
					2498
820	1123.4	938.6	2289	2308	
					2677
822	1127.3	941.4	2290	2309	
					2532
824	1130.9	944.0	2291	2310	
					2689
826	1134.5	946.6	2292	2310	
					2545
828	1138.3	949.3	2293	2311	
					2625
830	1142.1	952.0	2294	2313	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2764
832	1145.9	954.8	2295	2314	
					2693
834	1149.8	957.5	2296	2315	
					2729
836	1153.6	960.3	2297	2316	
					2847
838	1157.4	963.0	2298	2317	
					2847
840	1161.2	965.8	2299	2318	
					2735
842	1165.0	968.5	2300	2319	
					2745
844	1168.9	971.2	2301	2320	
					2849
846	1172.7	974.0	2303	2321	
					2816
848	1176.5	976.7	2304	2323	
					2699
850	1180.3	979.5	2305	2324	
					2739
852	1184.1	982.2	2306	2325	
					2679
854	1188.0	985.0	2307	2326	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2612
856	1191.6	987.6	2307	2326	
					2608
858	1195.2	990.1	2308	2327	
					2622
860	1199.0	992.9	2309	2328	
					2631
862	1202.8	995.6	2310	2329	
					2723
864	1206.4	998.2	2311	2330	
					2663
866	1210.0	1000.8	2311	2331	
					2661
868	1213.8	1003.6	2312	2332	
					2727
870	1217.7	1006.3	2313	2333	
					2665
872	1221.6	1009.0	2314	2334	
					2735
874	1226.3	1012.2	2316	2336	
					2959
876	1230.7	1015.3	2318	2338	
					3366
878	1234.8	1018.0	2319	2339	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2796
880	1239.0	1020.9	2320	2340	
					2796
882	1243.9	1024.3	2323	2343	
					3316
884	1248.4	1027.3	2324	2345	
					3270
886	1253.0	1030.5	2326	2347	
					3086
888	1257.3	1033.4	2328	2349	
					3128
890	1261.1	1036.0	2328	2349	
					2690
892	1264.9	1038.6	2329	2350	
					2585
894	1268.9	1041.3	2330	2351	
					2610
896	1272.9	1044.1	2330	2351	
					2583
898	1277.1	1047.0	2332	2353	
					2951
900	1281.1	1049.7	2333	2354	
					3135
902	1284.9	1052.3	2333	2354	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2593
904	1288.7	1054.9	2334	2355	
					2858
906	1292.5	1057.5	2334	2356	
					2490
908	1296.3	1060.1	2335	2356	
					2613
910	1300.3	1062.8	2336	2357	
					2570
912	1304.1	1065.4	2337	2358	
					2949
914	1308.1	1068.2	2337	2359	
					2644
916	1312.3	1071.1	2339	2360	
					2571
918	1316.6	1074.0	2340	2361	
					3114
920	1320.6	1076.7	2341	2362	
					2675
922	1324.2	1079.1	2341	2362	
					2565
924	1327.9	1081.7	2341	2363	
					2575
926	1331.7	1084.3	2342	2363	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2497
928	1335.7	1087.1	2343	2364	
					2639
930	1340.0	1090.0	2344	2365	
					2754
932	1344.4	1093.0	2345	2367	
					3026
934	1348.5	1095.8	2346	2368	
					2968
936	1352.2	1098.3	2347	2369	
					2726
938	1356.3	1101.1	2348	2369	
					2654
940	1360.1	1103.7	2348	2370	
					2655
942	1364.1	1106.3	2349	2370	
					2637
944	1368.4	1109.0	2349	2371	
					2700
946	1372.4	1111.6	2350	2372	
					2557
948	1376.4	1114.2	2351	2372	
					2668
950	1380.4	1116.8	2351	2373	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2592
952	1384.9	1119.7	2352	2374	
					2733
954	1388.9	1122.3	2353	2374	
					2736
956	1392.9	1124.9	2353	2375	
					2605
958	1396.9	1127.5	2354	2375	
					2650
960	1400.9	1130.0	2354	2376	
					2621
962	1405.1	1132.8	2355	2376	
					2650
964	1409.4	1135.5	2356	2377	
					2689
966	1413.6	1138.3	2357	2378	
					2713
968	1418.1	1141.2	2358	2379	
					2802
970	1422.6	1144.1	2359	2381	
					2832
972	1427.6	1147.3	2361	2383	
					3022
974	1432.6	1150.5	2362	2385	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					3239
976	1437.6	1153.7	2364	2387	
					3299
978	1442.8	1157.0	2366	2389	
					3299
980	1447.6	1160.1	2368	2390	
					3265
982	1451.8	1162.8	2368	2391	
					2699
984	1455.6	1165.3	2369	2392	
					2454
986	1459.9	1168.0	2369	2392	
					2534
988	1464.1	1170.7	2370	2393	
					2515
990	1468.6	1173.6	2371	2394	
					2727
992	1473.1	1176.5	2372	2395	
					3159
994	1477.3	1179.3	2373	2396	
					3026
996	1481.5	1182.0	2374	2397	
					2811
998	1486.0	1184.9	2375	2398	

© 1994 Schlumberger

Schlumberger

GEOGRAM+
Velocity Report

Velocity Data (Continued)

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	INTERVAL VELOCITY m/s
					2760
1000	1490.2	1187.7	2375	2399	
					2575
1002	1494.4	1190.4	2376	2399	
					2863
1004	1498.9	1193.3	2377	2400	
					2800
1006	1504.1	1196.6	2379	2403	
					2925
1008	1509.0	1199.8	2381	2404	
					3632
1010	1513.2	1202.6	2381	2405	
					2857
1012	1517.2	1205.2	2382	2406	
					3019
1014	1521.0	1207.6	2382	2406	
					2459
1016	1525.2	1210.4	2383	2406	
					2499
1018	1529.1	1213.0	2383	2407	

© 1994 Schlumberger

908903 451

PE908904

This is an enclosure indicator page.
The enclosure PE908904 is enclosed within the container PE908903 at this location in this document.

The enclosure PE908904 has the following characteristics:

```
     ITEM_BARCODE = PE908904
CONTAINER_BARCODE = PE908903
             NAME = Iona-4 VSP Plot
            BASIN = OTWAY
         ONSHORE? = Y
        DATA_TYPE = WELL
    DATA_SUB_TYPE = SYNTH_SEISMOGRAM
      DESCRIPTION = Iona-4 Vertical Seismic Profile Z-Axis
                    Processing Steps Z Median Stack
                    Appendix 7 Plot 1
          REMARKS =
     DATE_WRITTEN =
   DATE_PROCESSED =
    DATE_RECEIVED =
    RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
        WELL_NAME = Iona-4
       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)

PE908905

This is an enclosure indicator page.
The enclosure PE908905 is enclosed within the container PE908903 at this location in this document.

The enclosure PE908905 has the following characteristics:

ITEM_BARCODE =	PE908905
CONTAINER_BARCODE =	PE908903
NAME =	Iona-4 VSP Plot
BASIN =	OTWAY
ONSHORE? =	Y
DATA_TYPE =	WELL
DATA_SUB_TYPE =	SYNTH_SEISMOGRAM
DESCRIPTION =	Iona-4 Vertical Seismic Profile Composite Display Normal Polarity Appendix 7 Plot 2
REMARKS =	
DATE_WRITTEN =	
DATE_PROCESSED =	
DATE_RECEIVED =	
RECEIVED_FROM =	Western Underground Gas Storage Pty Ltd
WELL_NAME =	Iona-4
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)

PE908906

This is an enclosure indicator page.
The enclosure PE908906 is enclosed within the container PE908903 at this location in this document.

The enclosure PE908906 has the following characteristics:

```
     ITEM_BARCODE = PE908906
CONTAINER_BARCODE = PE908903
             NAME = Iona-4 VSP Plot
            BASIN = OTWAY
        ONSHORE? = Y
        DATA_TYPE = WELL
    DATA_SUB_TYPE = SYNTH_SEISMOGRAM
      DESCRIPTION = Iona-4 Vertical Seismic Profile
                    Composite Display Reversed Polarity
                    Appendix 7 Plot 3
          REMARKS =
     DATE_WRITTEN =
   DATE_PROCESSED =
    DATE_RECEIVED =
    RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
        WELL_NAME = Iona-4
       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)

908903 454

PE908907

This is an enclosure indicator page.
The enclosure PE908907 is enclosed within the container PE908903 at this location in this document.

The enclosure PE908907 has the following characteristics:

```
     ITEM_BARCODE = PE908907
CONTAINER_BARCODE = PE908903
             NAME = Iona-4 Check Shot Survey Plot
            BASIN = OTWAY
        ONSHORE? = Y
        DATA_TYPE = WELL
    DATA_SUB_TYPE = VELOCITY_CHART
      DESCRIPTION = Iona-4 Check Shot Survey Velocity Cross
                    Plot Appendix 7 Plot 4
          REMARKS =
     DATE_WRITTEN =
   DATE_PROCESSED =
    DATE_RECEIVED =
    RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
        WELL_NAME = Iona-4
       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)

PE605545

This is an enclosure indicator page.
The enclosure PE605545 is enclosed within the container PE908903 at this location in this document.

The enclosure PE605545 has the following characteristics:

```
     ITEM_BARCODE = PE605545
CONTAINER_BARCODE = PE908903
             NAME = Iona-4 Drift Corrected Sonic Plot
            BASIN = OTWAY
        ONSHORE? = Y
        DATA_TYPE = WELL
    DATA_SUB_TYPE = VELOCITY_CHART
      DESCRIPTION = Iona-4 Drift Corrected Sonic Plot
                    Appendicx 7 Plot 5
          REMARKS =
     DATE_WRITTEN =
   DATE_PROCESSED = 12-AUG-1999
    DATE_RECEIVED =
    RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
        WELL_NAME = Iona-4
       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)

908903 456

PE908908

This is an enclosure indicator page.
The enclosure PE908908 is enclosed within the container PE908903 at this location in this document.

The enclosure PE908908 has the following characteristics:

ITEM_BARCODE = PE908908
CONTAINER_BARCODE = PE908903
NAME = Iona-4 VSP Plot
BASIN = OTWAY
ONSHORE? = Y
DATA_TYPE = WELL
DATA_SUB_TYPE = SYNTH_SEISMOGRAM
DESCRIPTION = Iona-4 VSP Composite Display Normal Polarity Plot 1s:50cm Appendix 7 Plot 6
REMARKS =
DATE_WRITTEN =
DATE_PROCESSED =
DATE_RECEIVED =
RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
WELL_NAME = Iona-4
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)

PE908909

This is an enclosure indicator page.
The enclosure PE908909 is enclosed within the container PE908903 at this location in this document.

The enclosure PE908909 has the following characteristics:

ITEM_BARCODE = PE908909
CONTAINER_BARCODE = PE908903
NAME = Iona-4 VSP Plot
BASIN = OTWAY
ONSHORE? = Y
DATA_TYPE = WELL
DATA_SUB_TYPE = SYNTH_SEISMOGRAM
DESCRIPTION = Iona-4 VSP Composite Display Reversed Polarity Plot 1s:50cm Appendix 7 Plot 7
REMARKS =
DATE_WRITTEN =
DATE_PROCESSED =
DATE_RECEIVED =
RECEIVED_FROM = Western Underground Gas Storage Pty Ltd
WELL_NAME = Iona-4
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)