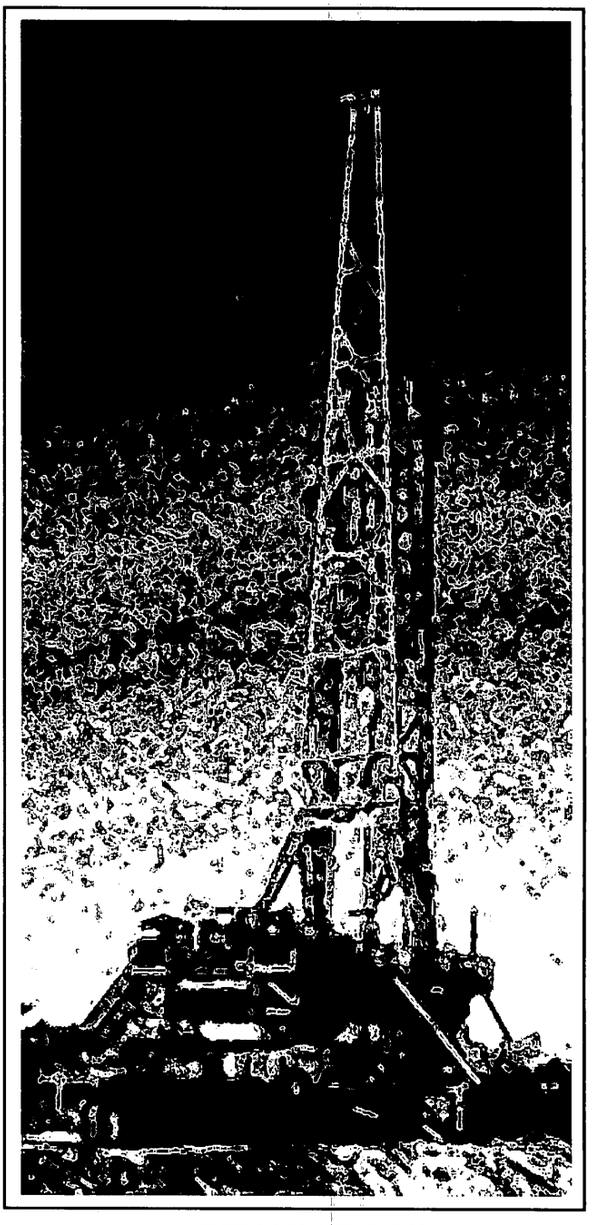
Santos

SANTOS LTD A.B.N. 80 007 550 923



LAVERS 1

GAS EXPLORATION WELL

WELL PROPOSAL

DRILLING PROGRAM
COMPLETING & TESTING PROGRAM

P.E.P. 154, OTWAY BASIN

South Australian Business Unit
Exploration & Development

909075 002

Santos (BOL) Ltd
(A.C.N. 000 670 575)

EXPLORATION & DEVELOPMENT - SA

LAVERS 1
WELL PROPOSAL

G. Parsons / M. Majedi
January 2001

909075 003

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909075 004

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909075 005

WELL DATA SUMMARY

WELL NAME: Lavers 1

WELL TYPE: Gas Exploration

LICENCE: PEP 154

EQUITY:

Voting (%)		Investment ($mm)	
Santos Ltd	90%	Santos	$1.003 mm
Beach Petroleum	10%	Beach	$0.111 mm
TOTAL	100.00%	TOTAL	$1.114 mm (P&A) **

BUDGET STATUS: 2001 Budget Item

Latitude:	38 28 44.75" S
Longitude:	142 48 12.21" E
Seismic Reference:	Inline 2490 C'vale3D CDP 10163
Ground Level:	63.5m (preliminary)
Rotary Table:	68.2m (preliminary)
Proposed Total Depth:	1723m RT (-1655m)
Rig:	OD&E 30
Nearest Facilities:	Heytesbury

Resource Estimate (Recoverable)

Mean Success Volume: 2.2 BCF
Mean Expected Volume: 0.74 BCF

Cost Estimates

P&A: $1.114 mm
C&S: $1.340 mm
Cost Code: 8EE-84D895

Objectives/Fluid Contacts

Primary
Waarre Sandstone (gas)

Secondary

Stratigraphic Prognosis

Formation	Depth (m-RT)	Depth (m-SS)
Clifton	544	-476
Pebble Pt	1005	-937
Paaratte	1043	-975
Skull Ck	1219	-1151
Nullawarre	1315	-1247
Belfast	1554	-1486
Flaxmans	1620	-1552
WAARRE	1645	-1577
Eumeralla	1688	-1620
TD	1723	-1655

Formation Evaluation

Wireline Logging:

PEX-HRS	TD to Surface Casing to Surface
SDT (WFT)	TD to Surface Casing (WFT across Waarre Sst)
MCFL-CALI	TD to 10 m above top Pember
PEX-LDL-CNL	TD to 100' above Waarre Sst (dependent on shows and reservoir development)

SWC's:
1 Gun (20)

MDT's:
20 point pressure survey

Velocity Survey:

Yes. Minimum survey points

Mudlogging:
10m Samples from Surface Casing to approx 1000m RT (-932m ss)
3m samples thereafter to TD
Samples as per well programme

Formation Testing:
None Programmed

Coring:
None programmed

REMARKS/RECOMMENDATIONS:
Nil

Hole Design/Drilling Issues

Well Class: Conventional/Exploration

Hole Type: Monobore

Hole Size	Casing Depth
9 7/8"	7 5/8" Surface to 425m
6 3/4"	3 ½" Surface to TD

Drill Fluid:
KCl/PHPA/Polymer

Deviation
Sub-Surface Targets:
Lavers 1 is a vertical well. An accuracy of 50m radius from seismic reference at TD has been requested. The critical structural directions are to the northeast.

Other Information/Hazards:
No hazardous zones in offset wells
No shallow gas expected
Waarre Sandstone has excellent reservoir properties (porosity 20%, permeability up to 20 darcies

Nearby Wells and Duration:

Callista 1 11 days 1800 m (1988)
Boggy Creek 1 22 days 1900m (1992)

Approved by::	Project Leader:	Team Leader:	Operations Geology	Drilling Engineer:

ALL COORDINATES WITHIN THIS DOCUMENT USE AN AGD84 DATUM

2. EXECUTIVE SUMMARY

Lavers 1 is proposed as an Otway Basin gas exploration well to be located in the PEP 154 licence (90% Santos (operator) and 10% Beach Petroleum N.L), It lies approximately 13 km north of the town of Peterborough, 5.6 km NNW of the Boggy Creek CO_2 field and 10 km west of the producing Mylor and Fenton Creek Gas Fields (Santos 100%). The Lavers structure is situated within the Port Campbell Embayment and the productive Waarre Sandstone play fairway. (Figure 1).

The Lavers Prospect is a tilted-fault closure within the greater McIntee Structural Complex and defined by 3D seismic. The well is expected to intersect a Waarre Sandstone reservoir with mean average net pay of 15.8m. The prospect exhibits a strong amplitude anomaly coincident with structural closure similar to other wells in the area which have proven to be gas filled.

The risk of major CO_2 is considered to be low as structurally Lavers is quite different to Boggy Creek structure (90% CO_2), which lies within a "shattered" zone, believed to provide the conduit for the migration of CO_2. Spill from Boggy Creek is likely to be to the northeast, away from Lavers 1.

The prognosed stratigraphic succession is summarised by Figures 2 & 3.

The Lavers prospect is relatively small and drilling is contingent upon success at McIntee 1. It has a mean prognosed success case of 2.2 BCF sales gas (4.92 BCF OGIP) and a Pc (probability of commercial success) of 33%, resulting in expected mean reserves of 0.74 BCF sales gas. Success at McIntee 1 would see the Pc increasing to about 50% with a resultant expected mean reserves of about 1.1 BCF.

3. GEOLOGICAL RISK ASSESSMENT

3.1 Play Analysis

The Lavers Prospect is mapped as a tilted fault-block closure with the primary reservoir the Waarre Sandstone. Vertical seal is provided by the Belfast Mudstone (Figure 4) with the critical cross-fault seal against the Skull Creek Mudstone due to large fault throw on the south-west bounding fault. The spill-point of the structure will depend on the effectiveness of shale smear where there is juxtaposition of Waarre reservoir against the Nullawaarre Greensand. Structures are charged from mature source beds located within the underlying Eumeralla and / or Crayfish Group with migration directly into the reservoir or via fault conduits. The play has proven successful to the east in Skull Creek Gas Field although at that location the Nullawaarre Greensand is absent and the Skull Creek Mudstone lies directly upon the Belfast Mudstone. Lavers exhibits a strong amplitude anomaly at the Waarre Sandstone horizon, which is interpreted as being a well-developed gas-saturated reservoir.

3.2 Trap (Pcl = 85%)

Interpretation and mapping of the Lavers prospect was based on the Curdievale 3D survey, which was recorded in early 2000. The Curdievale 3D data quality is good in the Lavers area.

Several migrated volumes including migrated stacks with and without spectral whitening, near and far offset migrated stacks were generated and used for interpretation. Due to better horizon continuity and amplitude preservation the migrated stack volume without spectral whitening was used for horizon interpretation. Far and near offset volumes were used for amplitude extraction and AVO analysis. A coherency cube (similarity volume) was also generated and used in conjunction with other volumes for fault interpretation.

Main mapping was carried out at near top Waarre Sandstone, which is the primary target reservoir (Figure 5) .The Waarre sand package has a distinctive seismic characteristic and therefore a high degree of consistancy was maintained with mapping of this unit. Well ties were performed for Boggy Creek 1 and Callista 1.

The Lavers prospect is a relatively small tilted fault block structure within a much broader McIntee Structural Complex situated southwest of Callista 1 and southeast of Rowans 1 (Enclosure 1). Three independent structural closures are present within the greater McIntee Structural Complex which are separated by shallow troughs and faulting. The McIntee Structural Complex forms a major NW-SE trending horst block. The southern margin fault dies out just south of McIntee prospect but extends northwesterly beyond the Curdievale surveyed area. The throw of this fault increases towards the northwest and as a result the Waarre sand reservoir in the footwall is in juxtaposition with the Belfast Mudstone in the hanging wall to the southeast, and with the Skull Creek Formation to the northwest within the Lavers structural closure. Such a situation could provide a critical side-seal problem along the fault plane where Waarre sand is juxtaposed against the Nullawarre Sandstone somewhere between McIntee and Lavers prospects.

The top Belfast Mudstone was interpreted over the McIntee Structural Complex on and a time-interval map for the Belfast to Waarre section was generated (Figure 7).

A strong amplitude event is present within the Waarre sand unit over the Lavers prospect (Figures 8 and 9). Similar events over all gas fields within the Port Campbell region suggest that the amplitude anomaly is likely related to the presence of gas in these structures. Furthermore, near and far-offset volumes were also used to evaluate the amplitude anomaly over Lavers structure. Figures 10 to 13 are displays of amplitudes extracted within the Waarre sand unit. Figure 13 is particularly encouraging as the display of the far-offset amplitude minus the near-offset amplitude clearly indicates an AVO anomaly over the Lavers structure.

The location for the proposed Lavers 1 was selected on inline 2490 CDP 10163. This location is at a near-crestal position and is within the highest expression of amplitude.

Depth conversion for the prognosis was performed using Callista 1 velocities. The result of this conversion is presented in Attachment 1.

3.3 Reservoir (Prs= 80%)

The Waarre Sandstone reservoir was deposited as the initial post-rift sequence at the commencement of the Turonian time under non-marine to marginal marine conditions. The section is divided into three sub-units – Waarre "A", "B" & "C". The lower A unit represents a basal transgressive systems tract (TST) characterised by the flooding of an incised valley with sediments deposited under marginal marine / estuarine conditions. The basal portion of Unit A is represented by either shale (as in Callista 1 or Boggy Creek 1 - interflue?) or sand (Curdie 1). This section was overlain by the widespread predominantly argillaceous Unit B, deposited under estuarine conditions. Unit C followed and is characterised by initial estuarine/deltaic conditions succeeded by high energy sands as the transgression pushed sediments up the valley system. Figure 14 illustrates this model. The Waarre Sandstone thins to the north and in the Callista 1 and Rowans 1 (Figures 15 & 16) wells to the north, the section appears to be relatively shaley (based on the gamma ray log) with only a thin well developed section at the top of unit C. To the south at Boggy Creek 1 (Figure 16), a thick well-developed Waarre sand was penetrated. Between Callista 1 and Lavers there is significant change in the seismic character at the top Waarre level. This possibly is indicative of better sand development at the Lavers location.

There are no secondary targets in this well although the Heathfield Sandstone Member of the Eumeralla is considered to have some (albeit minor) potential. It is not proposed to investigate this unit in Lavers 1, as it lies some 200m into the Eumeralla and when tested at other locations has proved to be tight.

3.4 Seal (Psl = 60%)

All Otway Basin successes In the Port Campbell Embayment area have been in high-side, tilted fault blocks or tilted horst blocks. The ultimate top seal to Waarre reservoirs is the marine Belfast Mudstone. While a potential waste or " thief" zone exists between the Waarre sands and the Belfast seal, the Flaxmans Formation, deposited under transitional marginal marine conditions is most likely to act as a seal.

Cross-fault seal is considered the key risk for prospects within the Port Campbell Embayment area. For structures where the fault throw is greater than the thickness of the overlying Belfast Mudstone there is considerable risk that cross-fault seal will leak due to Waarre sands being juxtaposed against sands of the Nullawarre Greensand. If the throw is great enough, the reservoir could however be juxtaposed against the Skull Creek Mudstone and this appears evident at Lavers 1.

The Lavers structure is controlled primarily by two faults lying to the southwest and south of the prospect. The fault to the south demonstrates relatively minor offset at Belfast level and is regarded as unlikely to leak. The seal across the southwest bounding fault appears to be more problematic as the fault demonstrates both growth during the time of Belfast deposition and potential Waarre/Nullawarre sand juxtaposition in the southern portion of the structure.

Figures 18 & 19 illustrate the issues relating to the southern bounding fault. Between fault cuts 5 & 7 cross-fault seal may rely on shale smear from within the Skull Creek Mudstone as the Waarre reservoir would be juxtaposed against the basal Parratte Formation. Alternatively the Parratte Formation may also provide seal although this is a higher risk.

The appearance within the proximal hanging wall zone of high angle reflectors may indicate the presence of shale smear along the fault zone that would provide additional confidence in fault seal. The presence of the higher amplitudes and AVO anomaly over the prospect (if reflecting the presence of gas as seems likely) provide corroboration of seal validity.

3.5 Charge (Pch = 90%)

Hydrocarbons are produced in the Port Campbell Embayment, with the Eumeralla Formation and/or the Crayfish Group being the source beds. Analysis of the condensates and oils from the area suggest a non-marine origin with both algal and higher land plant components (Type III kerogen). Maturation studies indicate that the top of the hydrocarbon window lies at about 2500m. Thus mature Eumeralla source units that underlie the local gas fields are most likely to charge directly into the overlying structures through source-reservoir juxtaposition or via fault conduits. This model is proposed for Lavers 1.

The formation of the Lavers structure commenced at the time of Belfast Mudstone deposition in the Late Cretacous although its current configuration was not completed until the end of the Eocene. Generation and migration commenced in the Late Cretaceous and has continued through until the present day.

3.6 CO2 Issues

The distribution of CO_2 within the Port Campbell area appears to be related to the introduction of a restricted CO_2 volume at a number of locations and its subsequent migration. The CO_2 is considered to be from a mantle source and is likely to have occurred in conjunction with the emplacement of an igneous body during the Miocene.

A review of high-resolution aeromagnetic data has been undertaken in an effort to understand the distribution of deep-seated faulting, believed to be the conduit for CO_2 migration and the location of igneous bodies. The preliminary results of the study indicate the presence of an intrusive marginal to the coast and proximal to a major NNE-SSW lineament. This lineament appears to be co-incident with major faulting identified on the seismic and is seen as a likely conduit for the Langley and Grumby CO_2. While an intrusive is not identified at nearby Boggy Creek, a similar trending lineament is mapped through the Boggy Creek well location.

4. RESOURCE DISTRIBUTION AND ECONOMIC EVALUATION

4.1 Resource Distribution

Distributions for local gas field parameters are estimated primarily from those at Boggy Creek 1 and Callista 1 with data from other nearby wells reviewed to provide details of the upper and lower limits. These results are set forth in Table 1 and are used in the resource calculation sheets.

4.1.1 Area

The seismic mapping shows an independent closure of 255 acres (Enclosure 1) and this is used as the P1 area. A low side 40 acre area forms the basis of the P99 estimation. The mean area corresponds to the extent of the main amplitude anomoly associated with the prospect.

4.1.2 Porosity

In the adjacent Boggy Creek 1 and Callista 1 wells, average porosity of about 15-17% is calculated from the logs. Spot core porosities of over 25% were measured in Boggy Creek 1. A range of 15% to 24% average porosity for min & max calculates a mean porosity around 19% for the proposed Lavers 1. Carrying a higher mean porosity for Lavers 1 is considered justified based on the shallower depth of burial and better-predicted sand quality at the proposed location.

4.1.3 Hydrocarbon Saturation

A hydrocarbon saturation distribution of 60-90% (min/max) captures all of the discoveries in the Port Campbell Embayment. Based on a log-normal distribution this calculates a mean of 73.8% which is close to the Boggy Creek 1 S_{gas} average of 71.5%.

4.1.4 Net Pay

Boggy Creek 1 has a total net sand (in Waarre A, B & C) of 30.5m (100 ft), Callista 1 has a net sand of 28.2m (93 ft). The mean average net pay estimated for Lavers is 15.8m (52 ft). Net / Gross ratios of 87% & 68% are recorded for the Waarre section in Callista 1 and Boggy Creek respectively with a range from 60% (P99) and 85% (P1) providing a mean 72% N/G for the proposed Lavers 1. This would allow for a column potentially extending into the Waarre Unit A sand which has a lower net / gross. Structural relief at the Lavers 1 is in the order of 25m (82').

4.1.5 Recovery Factor

The recovery factor for Santos' Mylor and Fenton Creek gas fields is estimated to be 50%, the mean recovery factor of 49.6% is calculated for Lavers based on 40% and 60% P90 and P10 respectively. Santos has no experience with these reservoirs in the Port Campbell area and the mean assigned RF from the existing fields reflects the best estimate from

reservoir engineering. The low recovery factor reflects a postulated strong acquifer support.

4.1.6 Gas Composition

The ranges of gas compositions utilised for Lavers were provided by the analysis of the Mylor 1 and Fenton Creek 1 gas compositions. No detailed information from other nearby fields is available although there is potential for the gas to be drier. The main risk in Lavers regarding this issue is the percentage of CO_2 and this is incorporated in the shrinkage factor low-side of 80%.

4.1.7 Flow Rate

Flow rates used range between 2 MMCFD and 25 MMCFD. These estimates are based on the results of the Mylor and Fenton Creek extended production tests and the Boggy Creek DST. Mylor flowed at 25mmcfd on a ¾" choke, Fenton Creek flowed 17mmcfd on a ½" choke and Boggy Creek flowed at 4.5mmcfd on DST (½" choke).

4.2 Location

The site for the proposed Lavers well is located within an intensive farming area and utmost attention needs to be given to environmental and landholder issues.

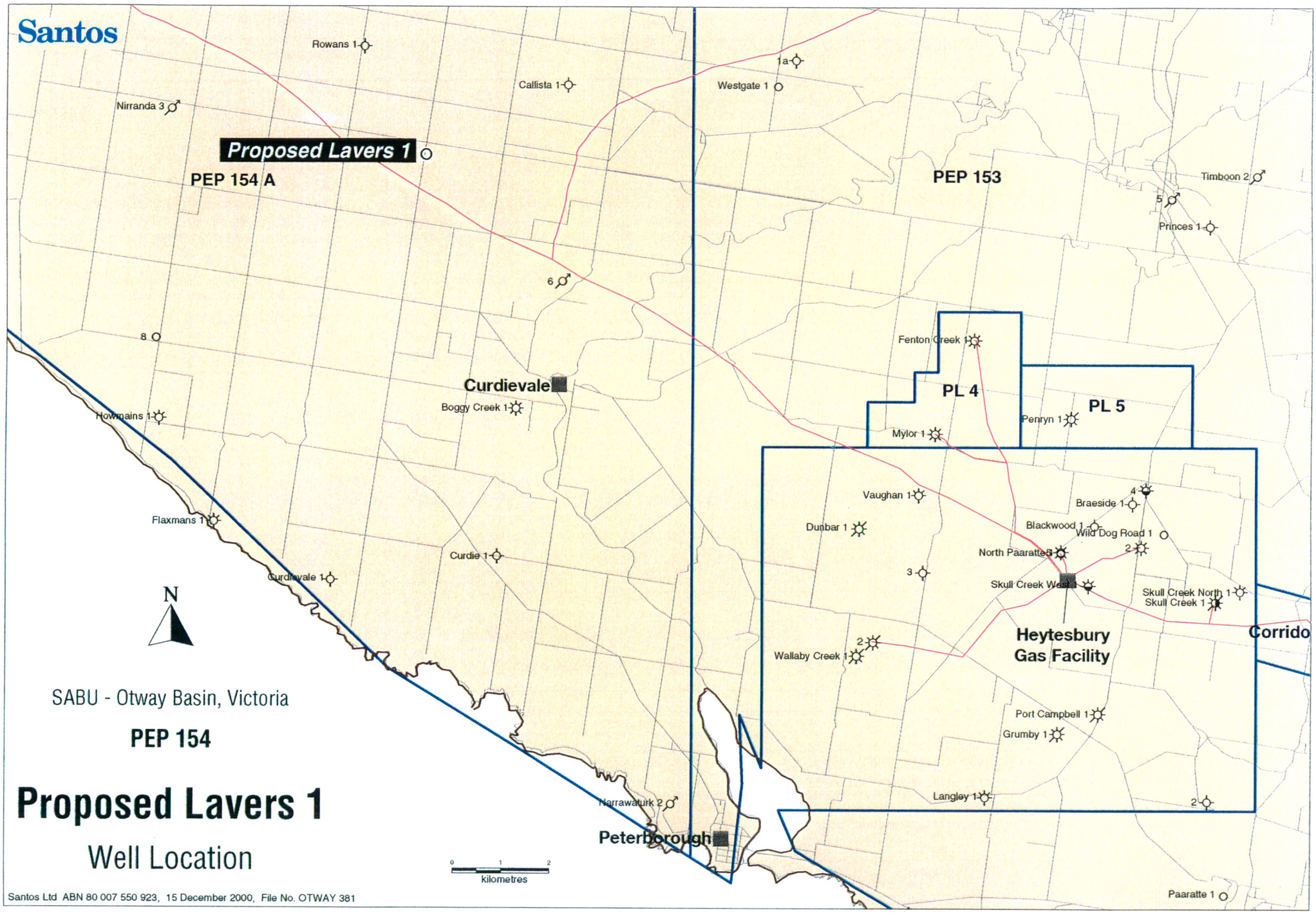

Figure 1

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OTWAY BASIN STRATIGRAPHIC COLUMN

Santos

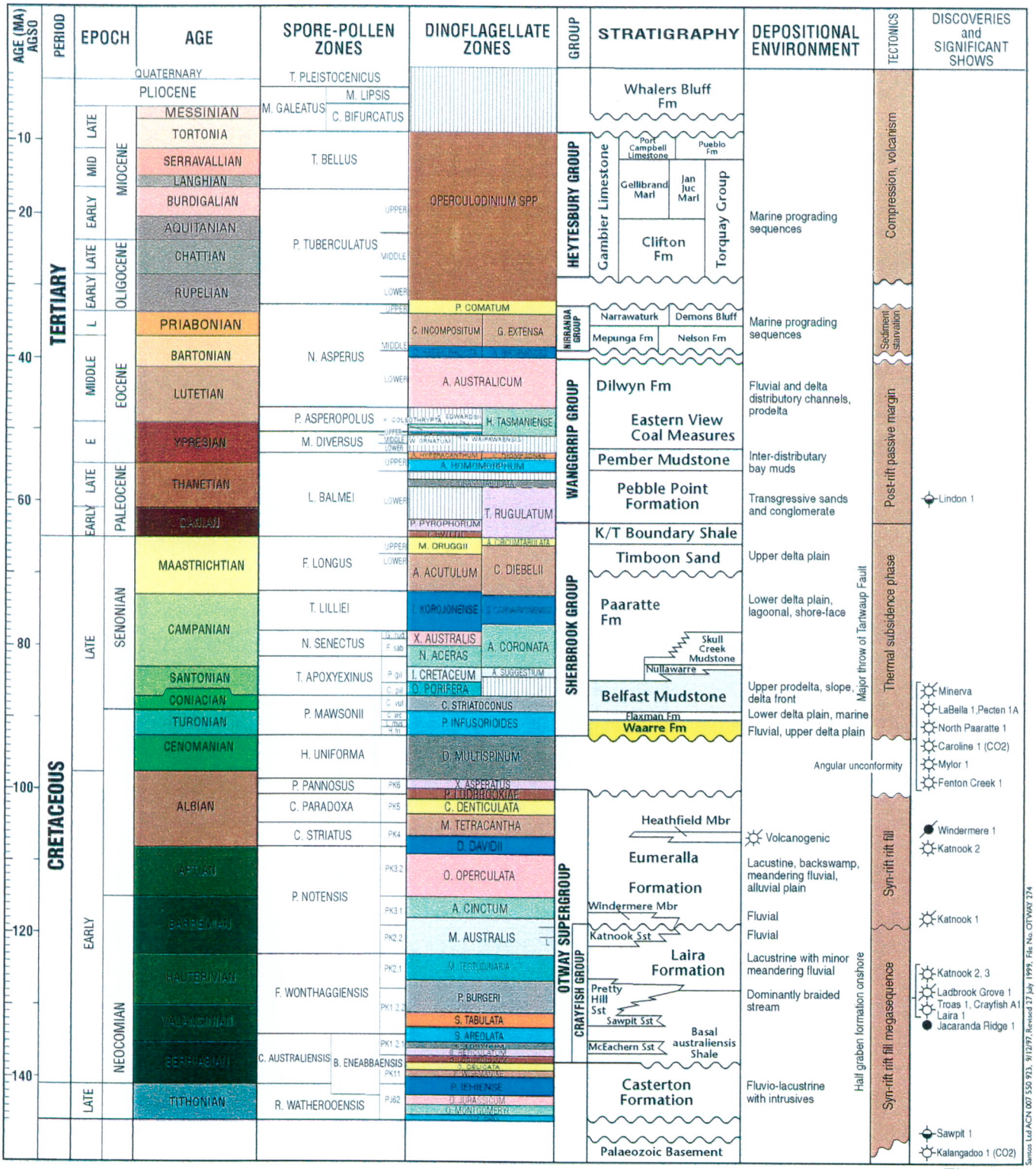

Figure 2

Santos

LAVERS 1

STRATIGRAPHIC COLUMN

Santos Ltd ABN 80 007 550 923, Dec 2000, File No. OTWAY 377

Lat.: 38° 28' 44.75"S (ANS) Long.: 142° 48' 12.21"E (ANS)
Seismic : Curdievale 3D Inline 2490, CDP 10163
G.L.: 63.5m(prelim) R.T.: 68.2m(prelim)

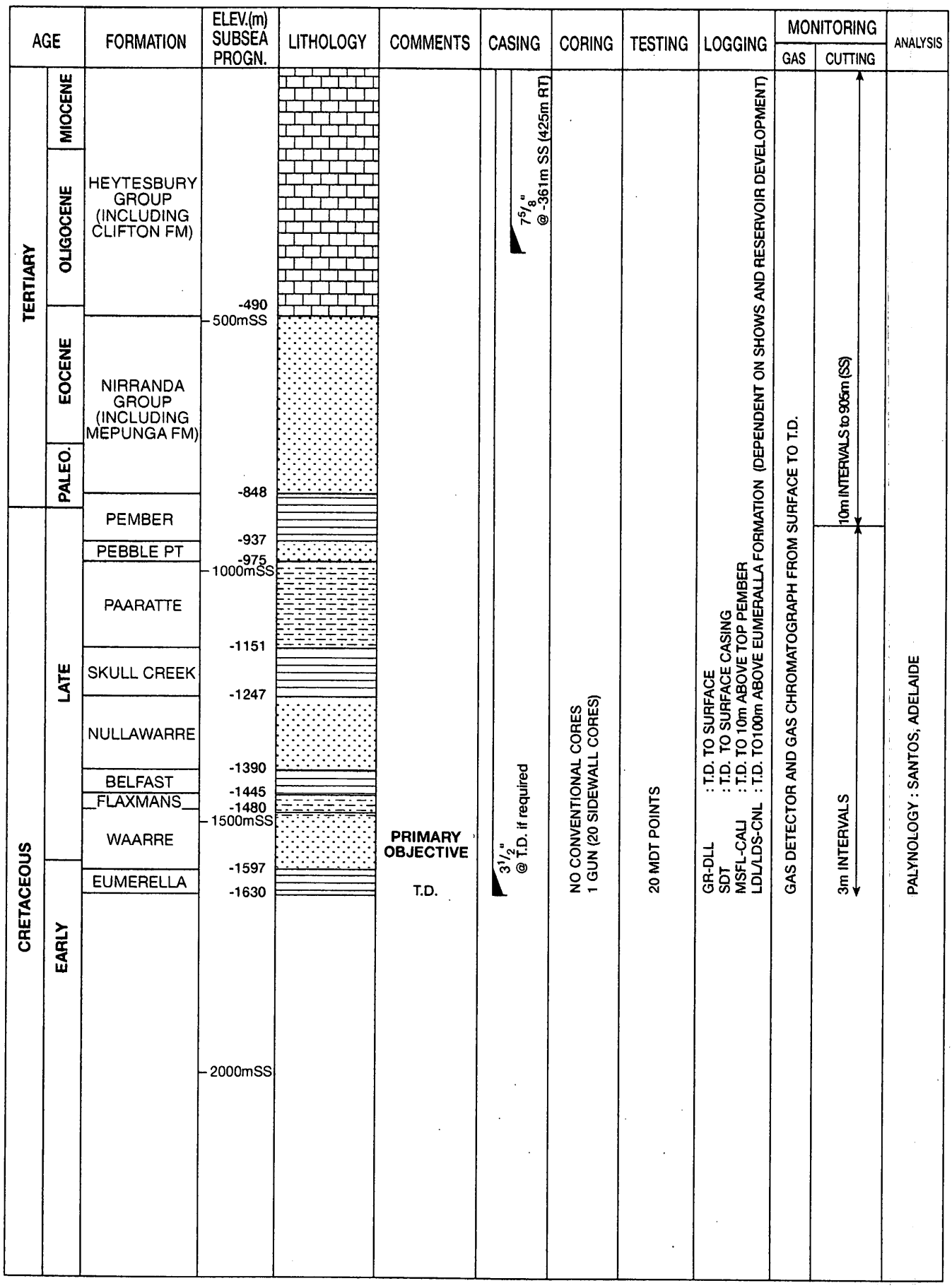

Figure 3

Otway Basin, Victoria - PEP 154 A

Proposed Lavers 1
Diagrammatic Structural Cross Section

Santos

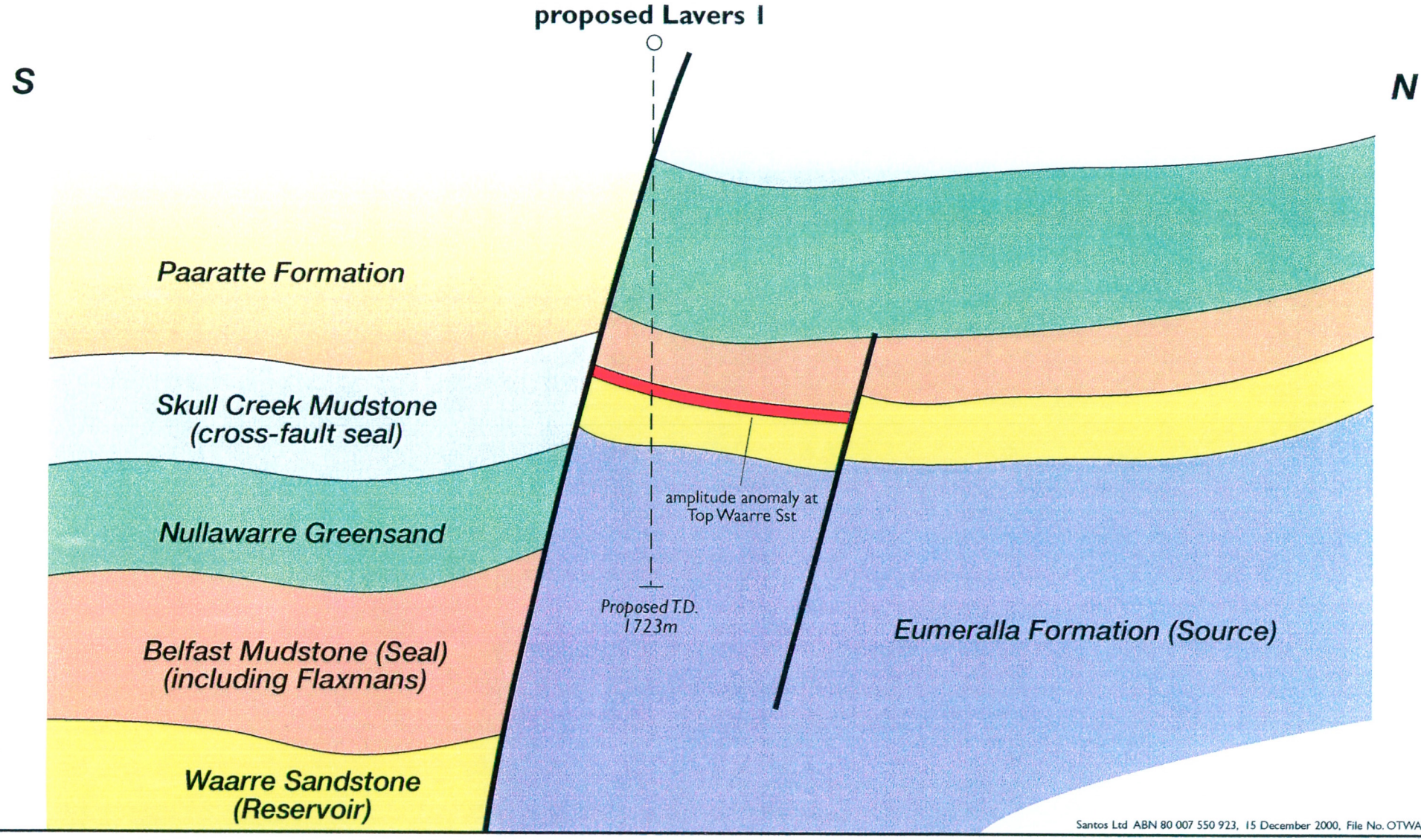

Figure 4

Santos Ltd ABN 80 007 550 923, 15 December 2000, File No. OTWAY 376

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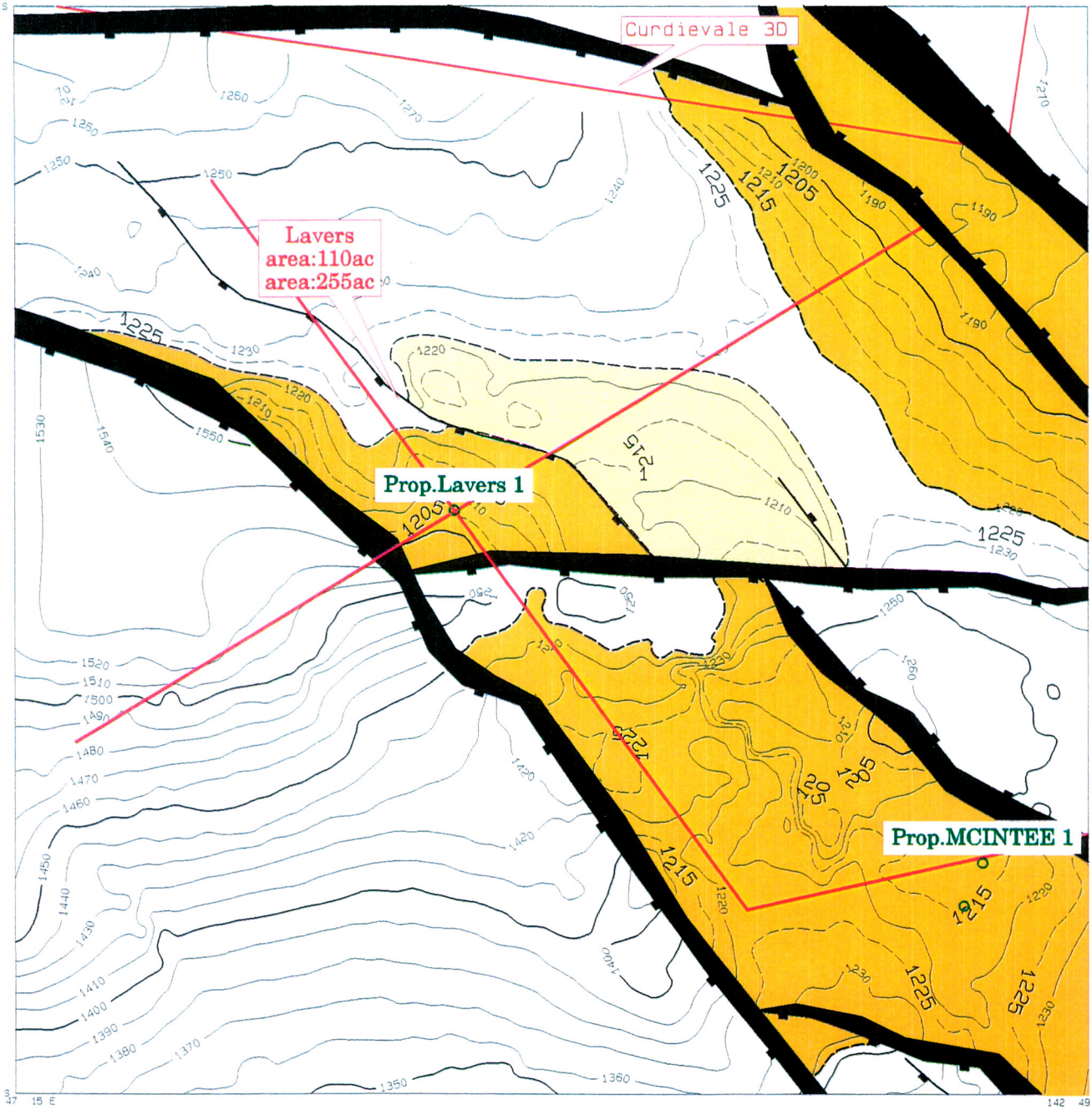
LAVERS



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Santos

TWT

Near Top Waarre Sand

Nov. 2000

M.Majedi

(Horizon : cv_war_pk)

Figure 5

Date : December 20, 2000	Author :	ENCL
Contour Interval : 10	Drafted :	
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FIGURE 5

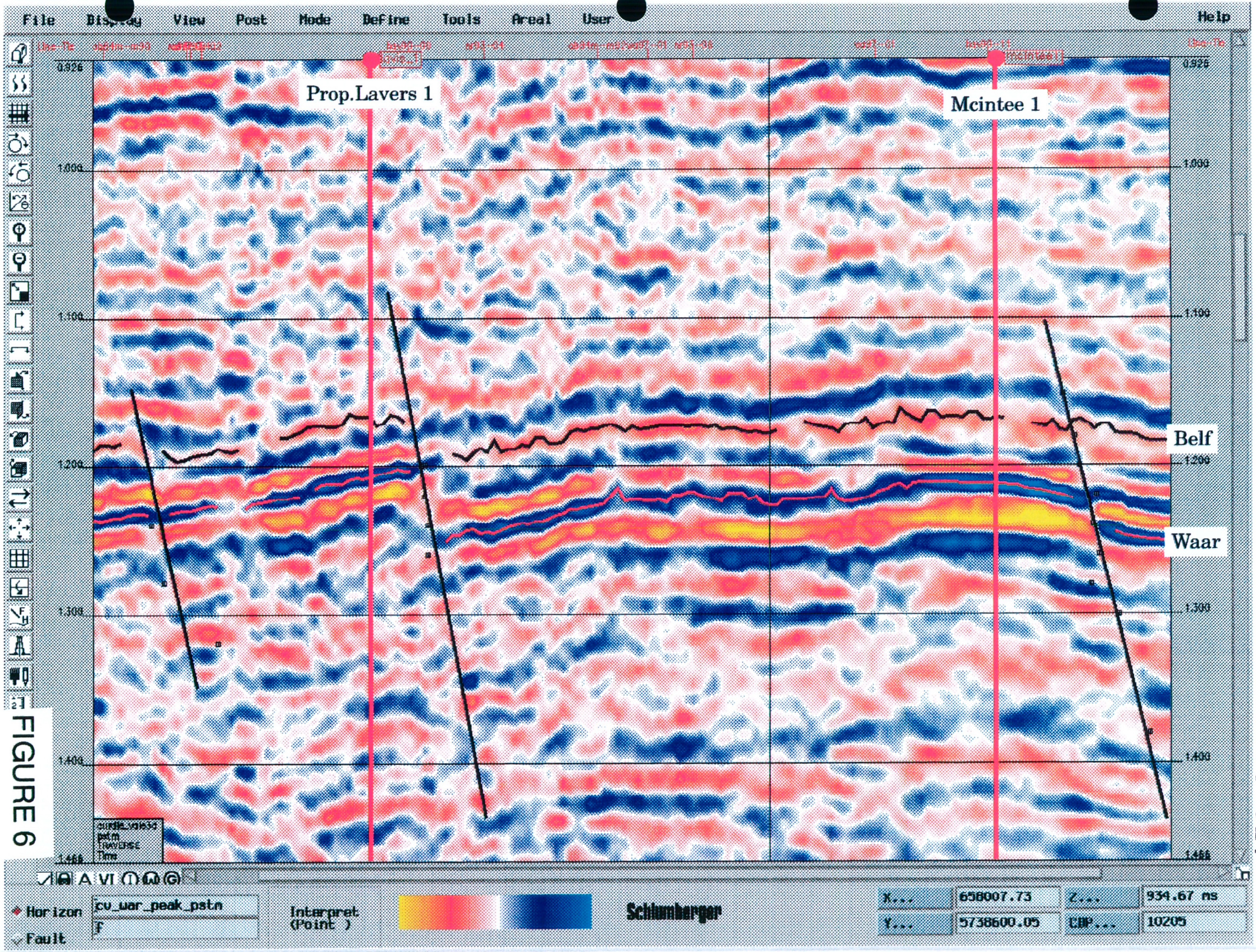

FIGURE 6

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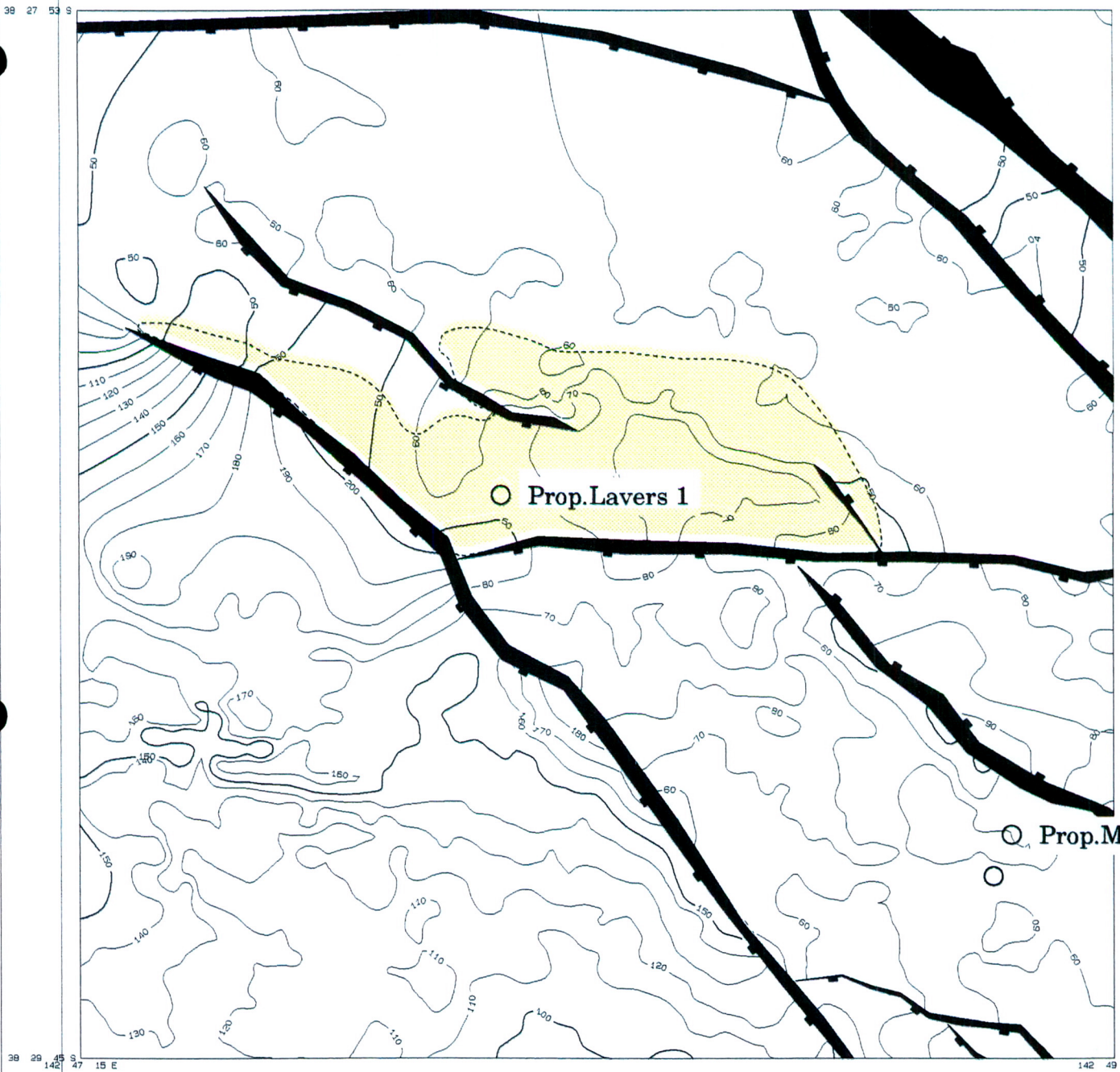
LAVERS



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Santos

Belfast - Waarre Time Interval

September 2000

M.Majedi

Date : December 30, 2000	Author :	ENCL.
Contour Interval : 10	Drafted :	
Datum : AUSTRALIAN NATIONAL	File No. :	

FIGURE 7

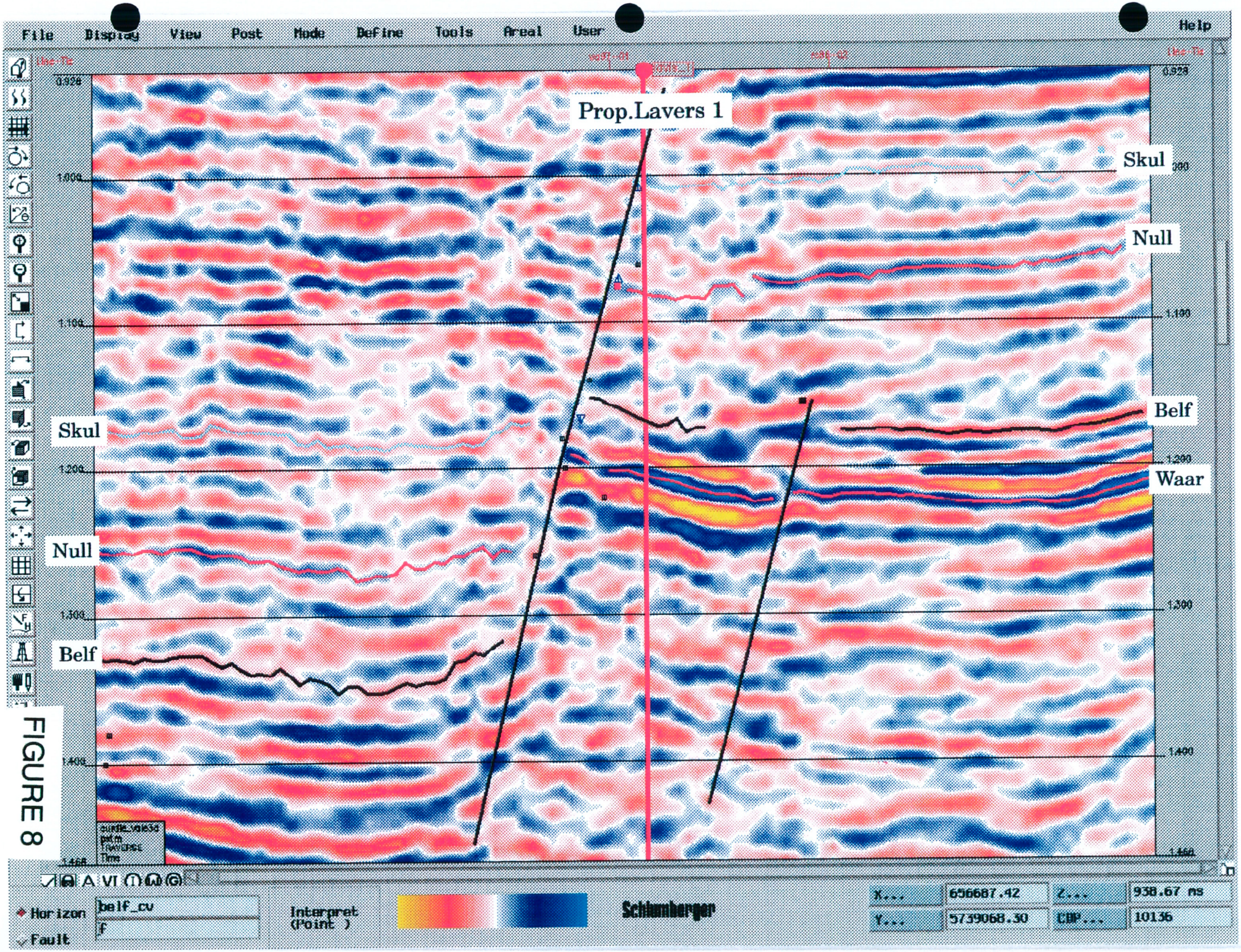

FIGURE 8

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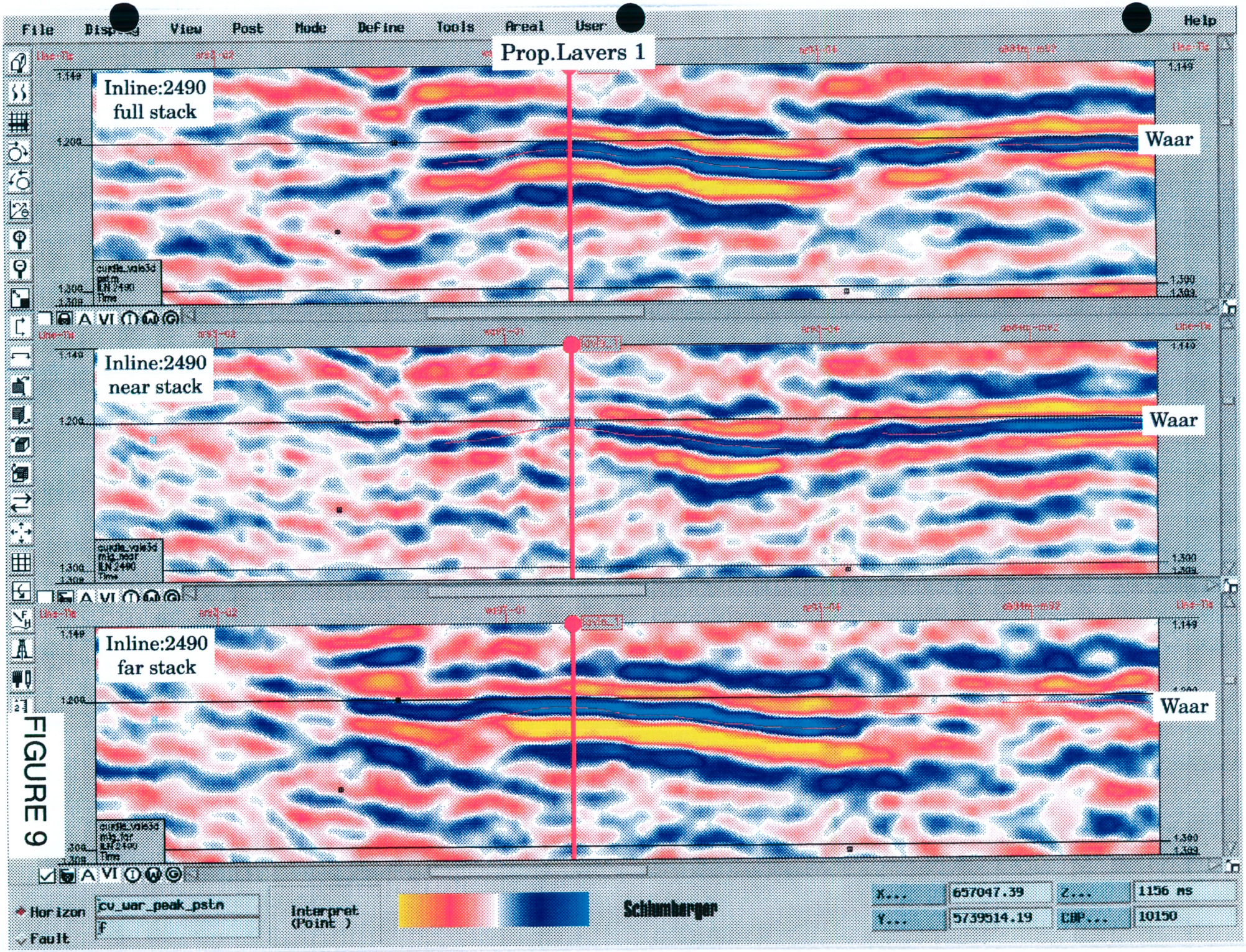

FIGURE 9

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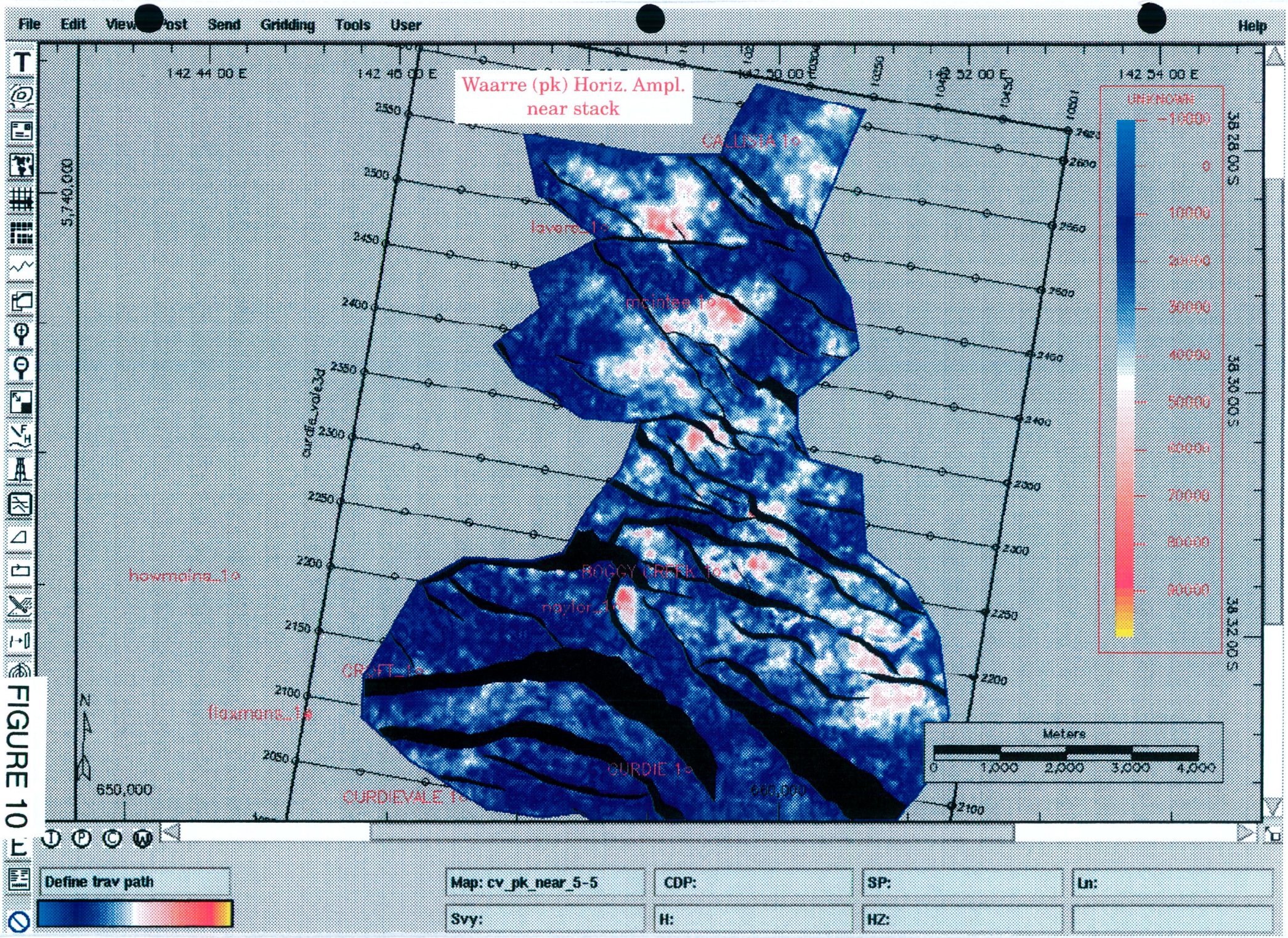

FIGURE 10

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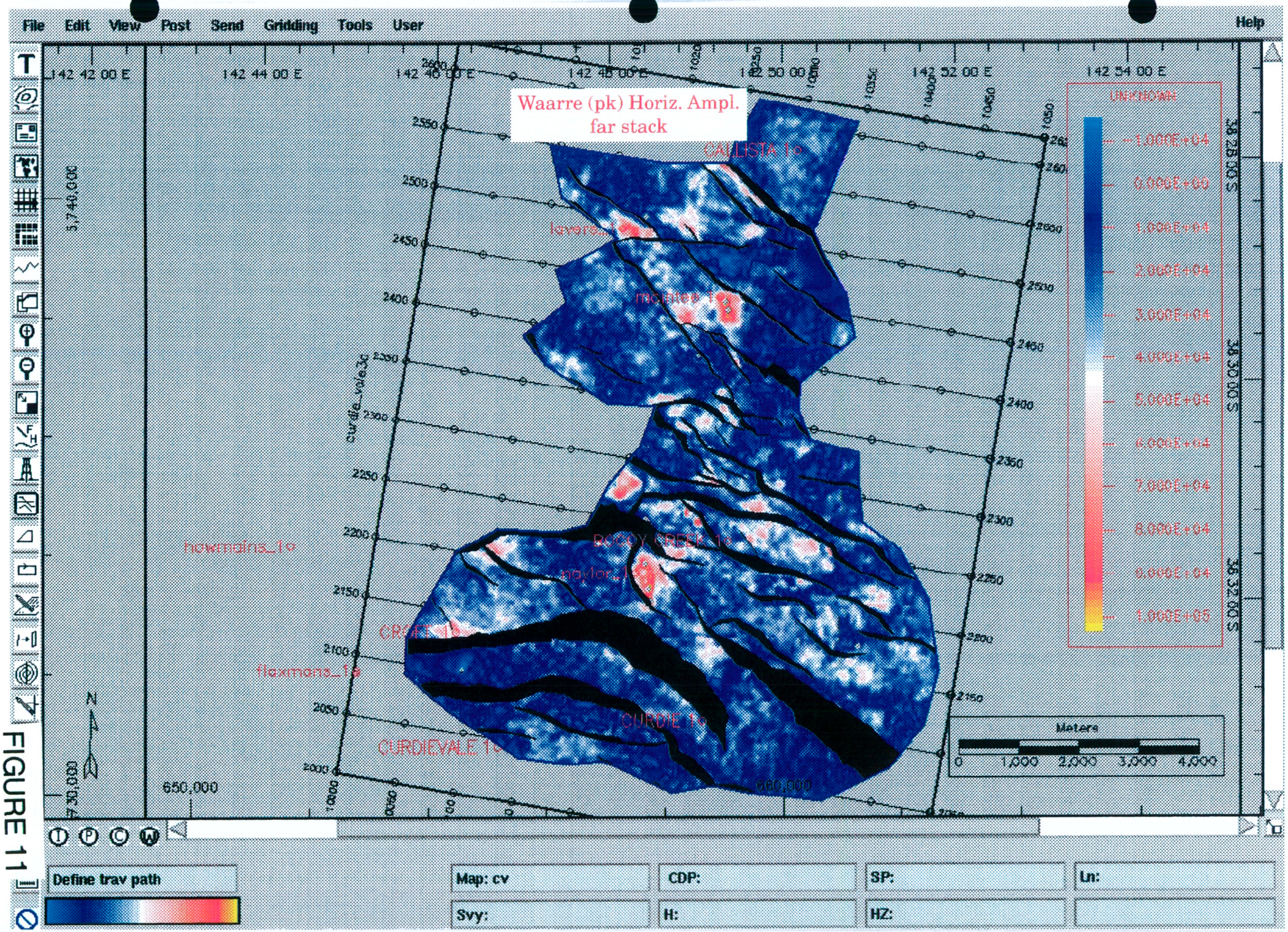

FIGURE 11

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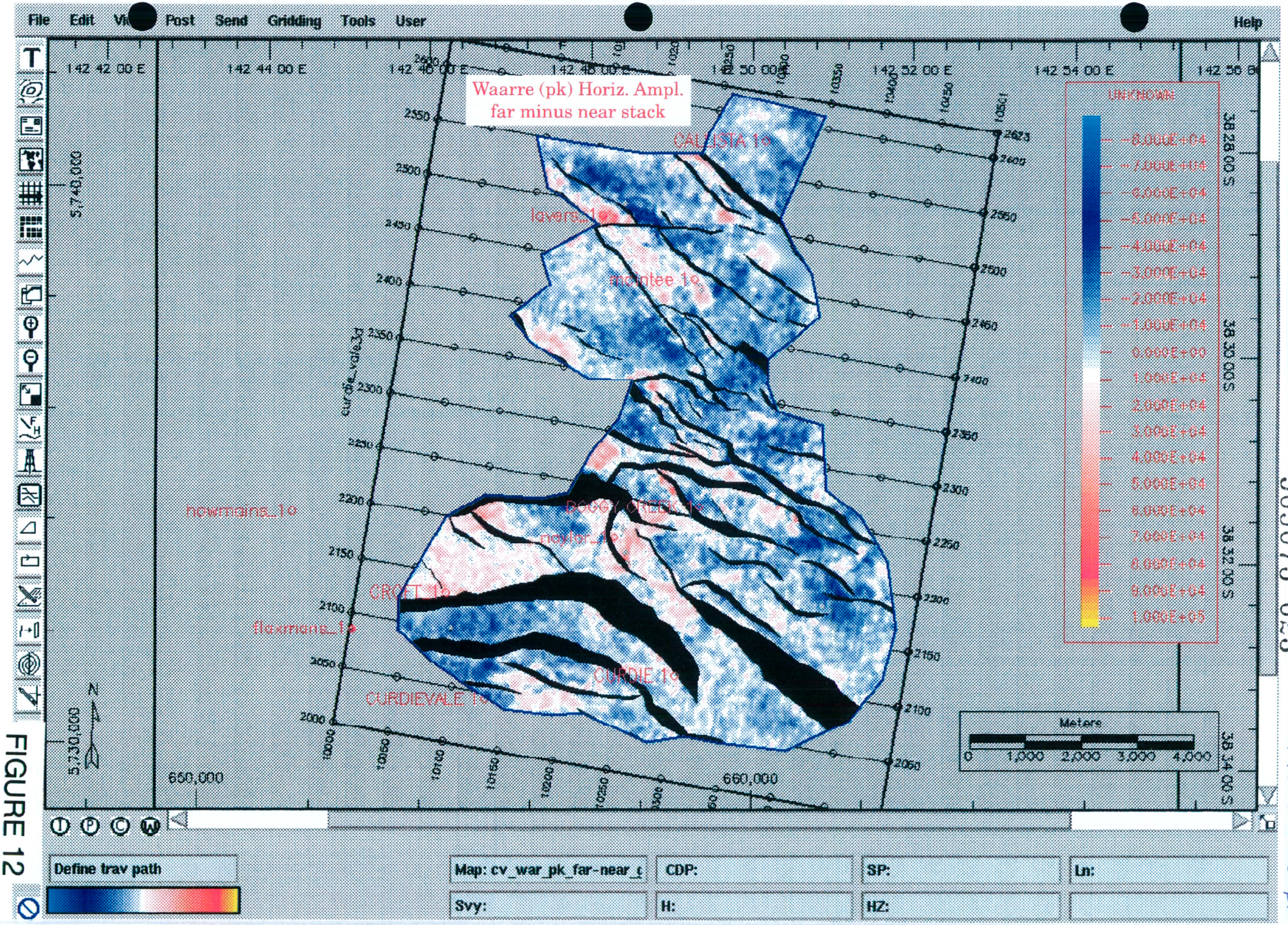
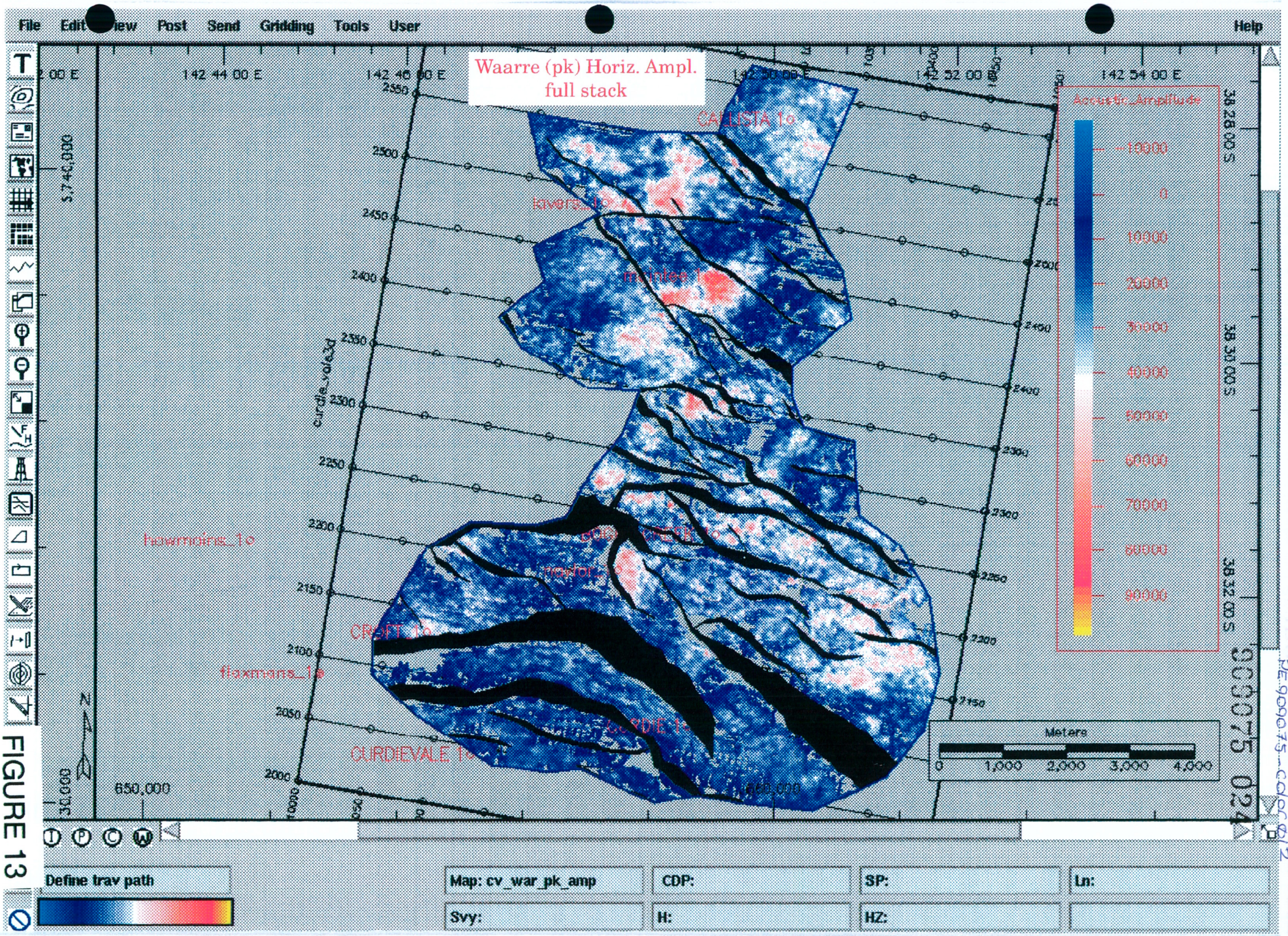


FIGURE 12

909075 023

RE909075-color011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Edit
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Gridding
Tools
User
Help
Waarre (pk) Horiz. Ampl.
full stack
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38 32 00 S
CALLISTA 1o
howmoirs_1o
CROFT_1o
flaxmans_1o
CURDIEVALE 1o
curdie_vol_e3d
Acoustic_Amplitude
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10000
20000
30000
40000
50000
60000
70000
80000
90000
Metere
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3,000
4,000
650,000
660,000
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CDP:
SP:
Ln:
Svy:
H:
HZ:

FIGURE 13

Waarre Sandstone Depositional Model

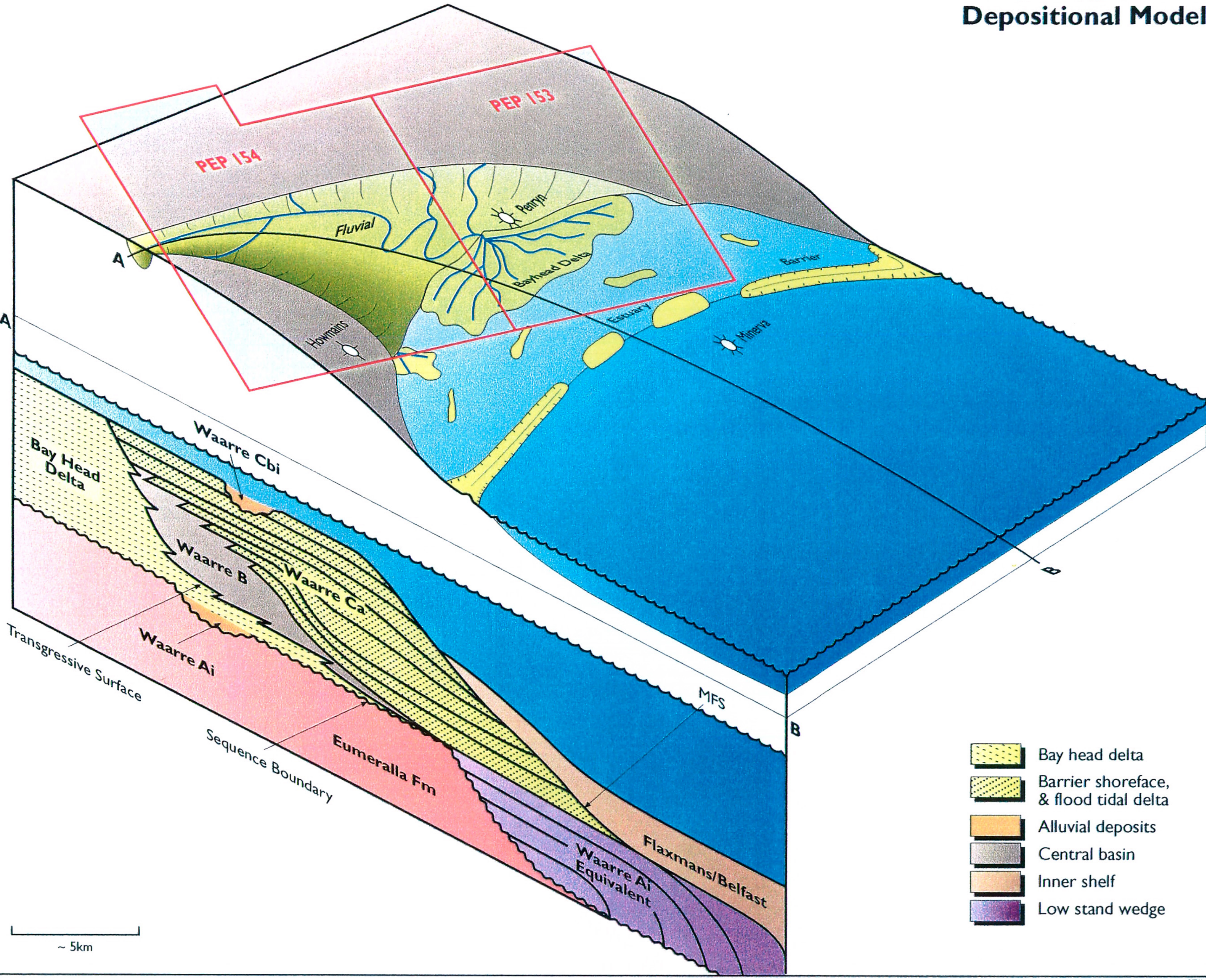

Figure 14

FIGURE 14

909075 025

PE909075_color 014
909075 026

Santos SANTOS LIMITED Santos

CALLISTA_1

RIG RELEASED : APR 1988 KB/RT (METRES) : 24.96 TOTAL DRILLED DEPTH (METRES) : 1800.0

Vertical Units METRES

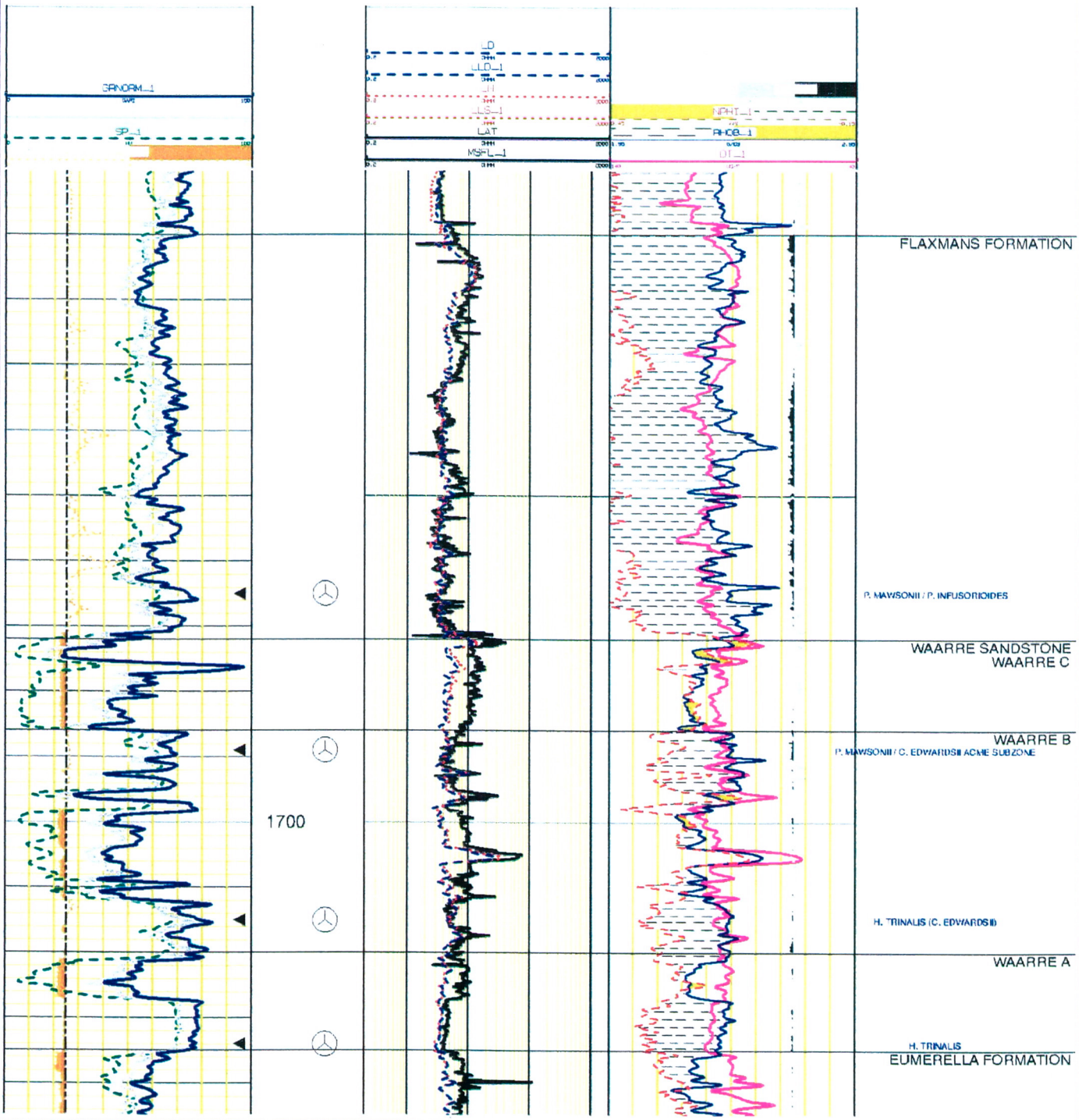

FIGURE 15

PE909075_color015
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BOGGY_CREEK_1

RIG RELEASED : 12 JAN 1992 KB/RT (METRES) : 35.0 TOTAL DRILLED DEPTH (METRES) : 1900.0

Vertical Units METRES

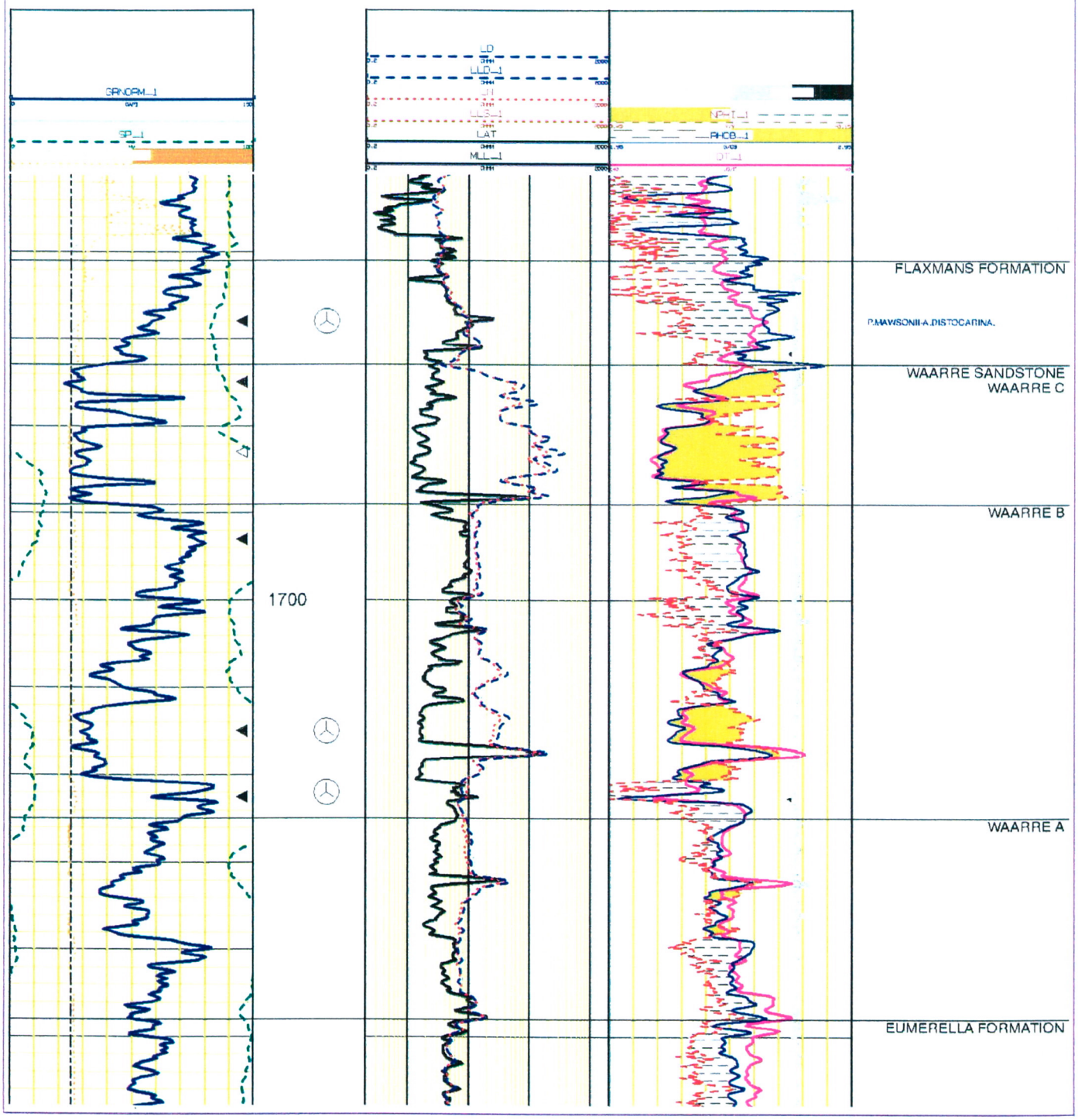


FIGURE 16

PE909075-color Ø16
909075 028

Santos SANTOS LIMITED Santos

ROWANS_1

RIG RELEASED : KB/RT (METRES) : 70.7136 TOTAL DRILLED DEPTH (METRES) : 1798.32

Date: Vertical Scale 1 : 1300 Vertical Units METRES

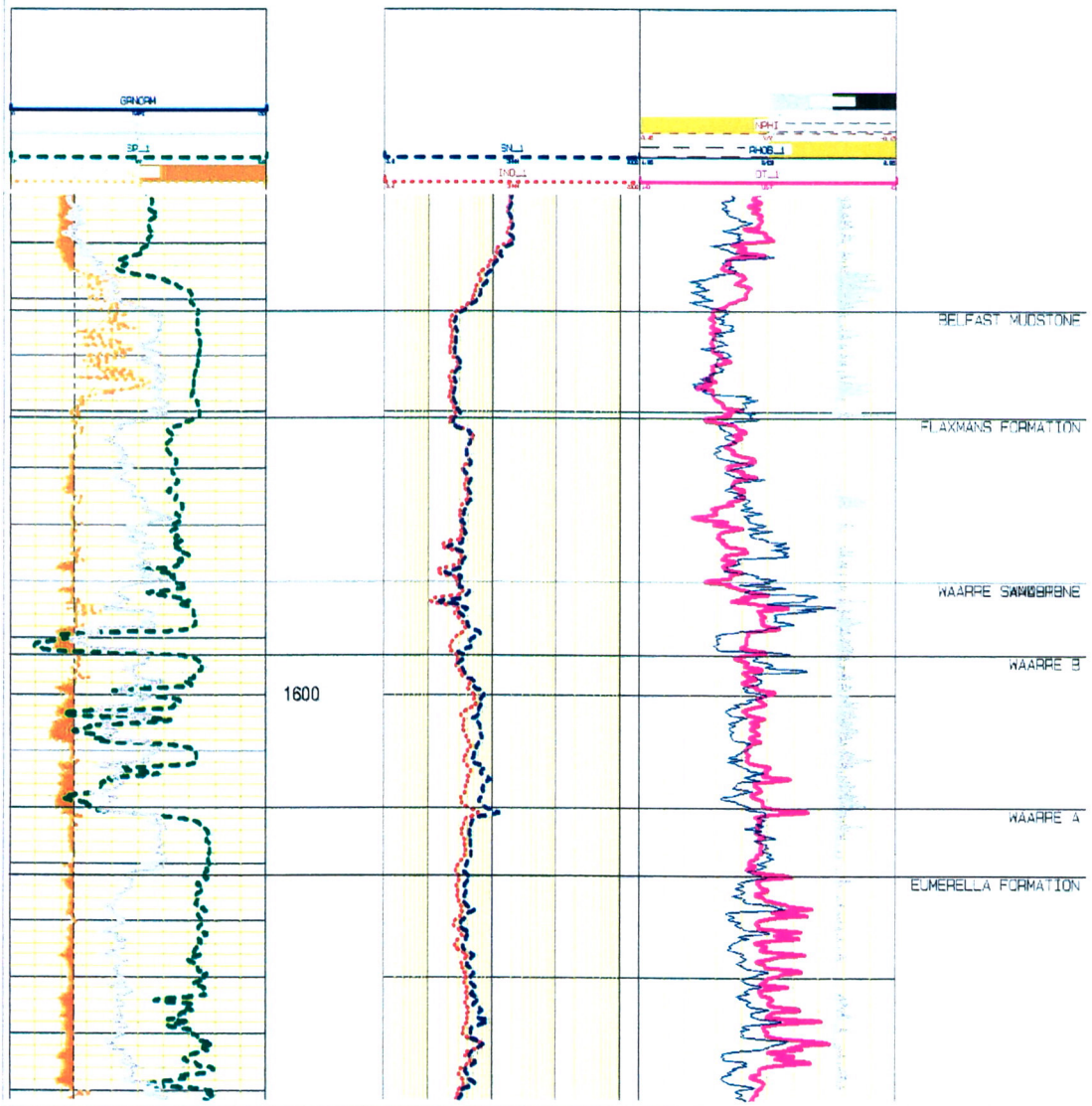


FIGURE 17

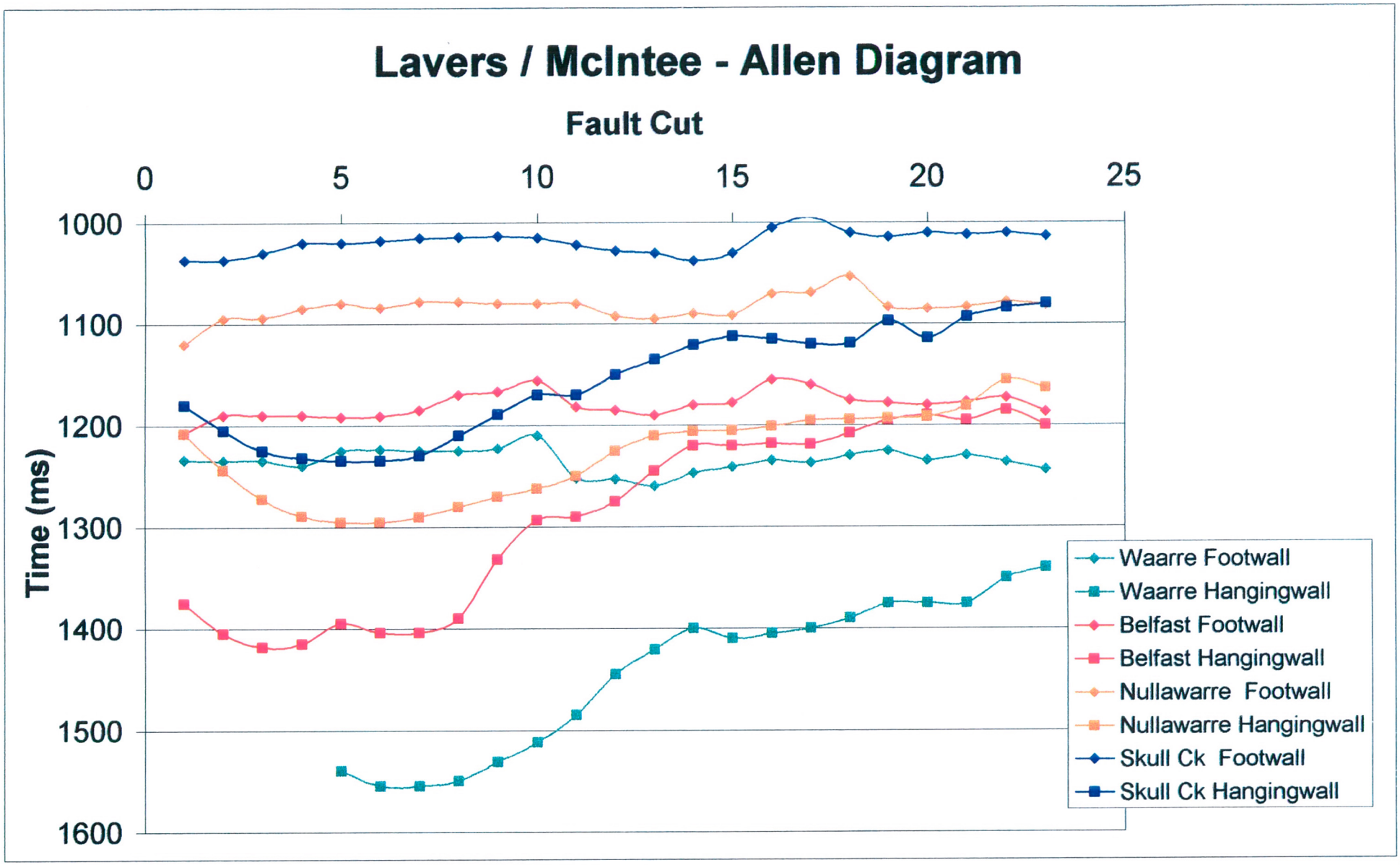
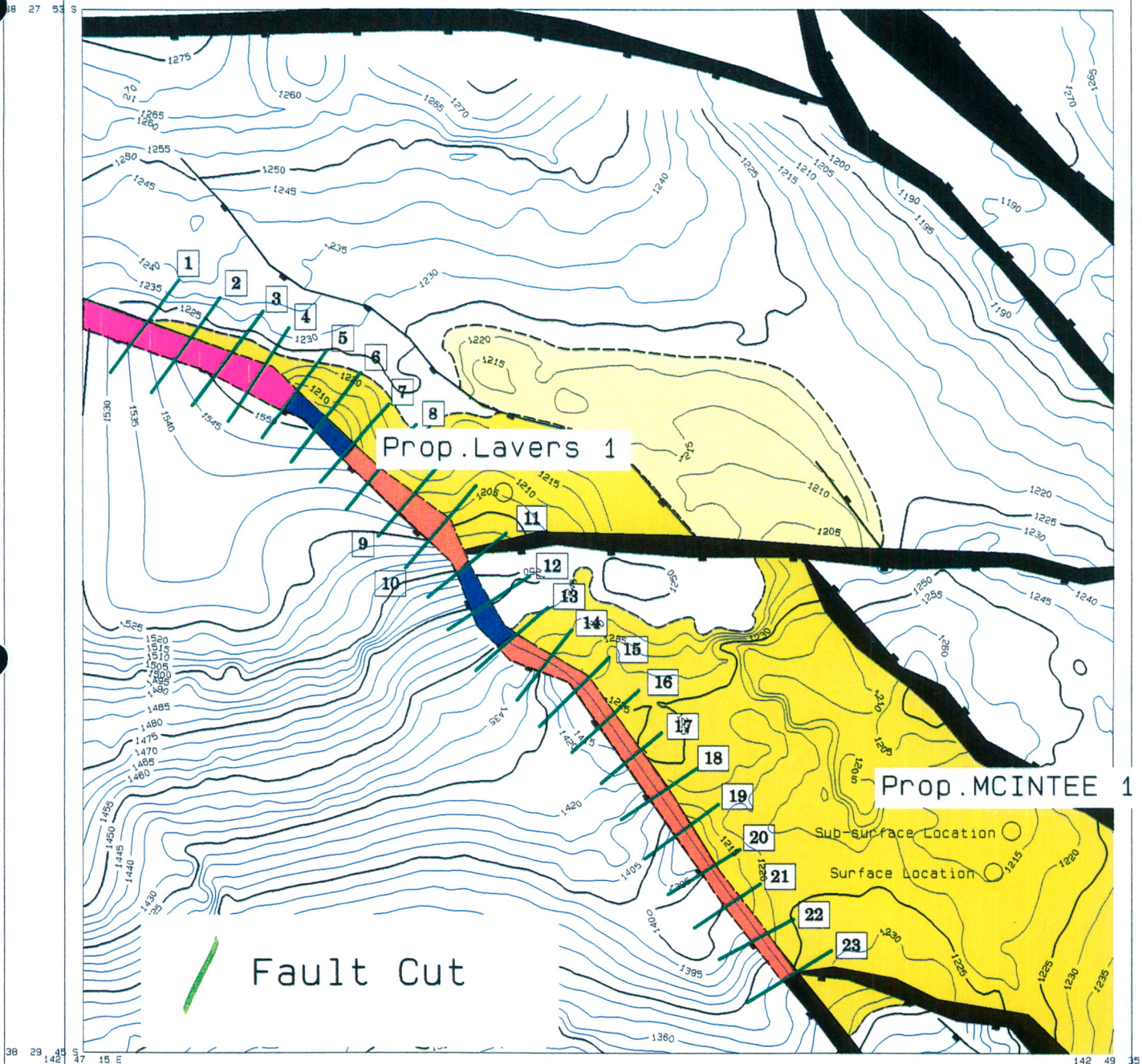


FIGURE 18

PE909075 029
PE909075_color@17

LAVERS



Fault Seal Expected

Seal Possibly Breached

Poor Data

1:20000

0 1

KILOMETRES

0 0.50

MILES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 141 00 00 E
Mapsheet datum: "Unknown"

Santos

PEP 154

Fault Seal Evaluation
Lavers & McIntee Prospects

Contours - Waarre TWT

Date : December 23, 2000	Author :	ENCL
Contour Interval :	Drafted :	
Datum : AUSTRALIAN NATIONAL	File No. :	

909075 031

ATTACHMENT 1

GEOPHYSICAL PROGNOSIS

ATTACHMENT 1

GEOPHYSICAL PROGNOSIS

Latitude 38° 28' 44.75"S Longitude 142° 48' 12.21"E

	CALLISTA 1					PROPOSED LAVERS 1					
	TWT (ms)	DEPTH (m-ss)	Isopach (m)	VAV (m/s)	VINT* (m/s)	TWT (ms)	DEPTH (m-ss)	ERROR (+/-m)	Isopach (m)	VAV (m/s)	VINT* (m/s)
CLIFF	416	408		1962		485	476			1962	
			420		2373				462		2373
PEB.P	770	828		2151		874	937			2145	
			50		3448				38		3448
PAAR	799	878		2198		896	975			2177	
			308		2976				176		2976
SKUL	1006	1186		2358		1014	1151			2270	
			101		3015				96		3015
Null	1073	1287		2399		1078	1247			2314	
			312		3410				239		3410
BELF	1189	1498		2520		1154	1486			2575	
			108		3429				91		3429
WAAR	1252	1606		2565		1207	1577	+/- 20m		2613	
			47		2765				43		2765
EUME	1286	1653		2571		1252	1620			2617	
			37						35		
(TD)		1690					1655				

9090075 032

000075 033

ATTACHMENT 2

DRILLING PROGRAM

TABLE OF CONTENTS

1. GENERAL DRILLING PROCEDURES

1.1 INTRODUCTION

This document outlines the various steps in the drilling operation. A separate document, the "Santos DQMS Drilling Operations Manual", summarises the Santos General Operating and Well Control Procedures, drilling equipment and other procedures. This 'Drilling Program' is to be read in conjunction with the above 'Drilling Operations Manual'.

Lavers #1 is a gas exploration well drilled in PEP154 in the Victorian Otway Basin. The primary target is the Waarre Sandstone for gas. Anticipated spud date is April 20, 2001.

1.2 SEQUENCE OF OPERATIONS

- Rig up, drill mousehole & rathole (Note 20" conductor pre-installed)
- Drill 9 7/8" hole to approx 425m (1395 ft).
- Wiper trip and laydown 6 ½" drill collars
- Run & cement 7 5/8" casing leaving 2m rathole
- NU & test Bradenhead & BOP's
- RIH PU 6 ¾" drilling assembly
- Drill out shoetrack & 3m (10') of new formation
  Perform LOT to fracture propagation
- Drill 6 ¾" hole to 35 m into Eumeralla (approx 1723 m TVD)
  Wireline log – 3 runs. Run 1 GR-LCS-MRS-DLS-CAL. Run 2 CDS-CNS. Run 3 RFS (20 points)
- Run and cement 3 ½" tubing or P&A. Install seal adaptor flange and Xmas tree if C&S and pressure test.
- Release rig.

1.3 SECTIONAL SUMMARY

Pre-Spud

- A 20" conductor has been pre-installed by the lease preparation contractor
- Drill rat hole and mouse hole. Inspect rig and complete prespud rig inspection form.
- Hold pre-spud safety meeting.

9 7/8" Surface Hole

Hazards & General Notes
- Mud rings may be encountered on this well in the Gellibrand Marl. The section is to be drilled with a caustic spud mud system.
- Potential total lost circulation at very shallow depths.

Operation
- Spud well with 9 7/8" bit with spud mud.
- Drill with reduced flow rate (under 300 gpm) and parameters until 6 1/2" drill collars buried. Then increase to full drilling flowrate and drilling parameters for optimum ROP. Ensure vis at least 50 sec/qrt in the surface limestone prior to reaching the marl formations. If mud rings become a problem in the clay-rich formations then dilute with drill water as a first recourse.
- Take a MSS survey at approx 30m (100ft).
- Drill ahead surveying with MSS every 150m (500ft) to approximately 425m. Allow for approximately 2m of rathole.
- Check bottoms up sample to confirm competent seat.
- Wiper trip back to old hole if required. Increase mud weight only if dictated by hole conditions.
- POOH. Laydown 6 1/2" Drill Collars.

Surface Hole Shallow Lost Circulation Contingency

On the recent "Wild Dog Road 1" well drilled by OCA/Boral nearby, total lost circulation was experienced from 14m to 16m below ground level. If uncontrollable losses are encountered on "Lavers #1", then a 13 3/8" second conductor string will be set to case off the entire limestone section. The decision to proceed with this plan will be at the discretion of the Santos representative, depending on the severity of losses experienced.

Contingency Operation
- Continue drilling 9 7/8" hole blind or with limited returns to 50m below RT.
- POOH and change bit out to 17 ½" mill tooth with open jets
- Open 9 7/8" hole to 17 ½" to up to 160m below RT
- Set LCM pill on bottom or pump LCM sweep if partial returns and POOH, layout 17 ½" bit.
- Run 13 3/8" STC casing with float shoe, 2 x centralisers and landing joint, tag bottom, pick up 3m and attempt to circulate
- Rig up STC cement head with top plug installed, pump 5 bbls water spacer then pump neat cement with 2% CaCl2. Pump as slow as practical.
- Land casing on bottom
- Drop top plug and displace plug with mud to 5m above the float shoe. Pump as slow as practical.
- If no cement returns are observed, perform top up job with neat cement with 2% CaCl with 1" cement stinger.
- Remove cement head, cut casing and weld on flow-riser sleeve and fit flowline riser
- MU 9 7/8" bit and BHA and RIH. Drill out shoe and continue drilling 9 7/8" surface hole

7 5/8" Surface Casing

Hazards & General Notes

- No hazards are anticipated during this section

Operation

- Rig up and run 7 5/8" surface casing. Thread lock shoe track. Run 3m (10') BTC pup above float collar and thread lock to float collar.
- Run casing.
- Wash last joint to bottom and cement casing.
- Soft break collar on last joint below landing joint.
- Displace cement with old mud. Do not displace more than theoretical casing volume plus half the shoetrack volume. If bump observed, increase pressure to 2000 psi for 10 mins to test casing.
- Space out to set top flange of Bradenhead 4-6" above ground level (check space underneath rig floor. If not possible to set 4-6" above ground level, then set as high as possible).
- Perform 20m top-up job while WOC regardless of cement returns.
- WOC until surface samples have set (minimum of 4hrs).
- Nipple up 5k wellhead and BOP's and pressure test BOP's with rig pumps. Pressure test casing to 2000 psi for 10 mins with rig pumps **if plug did not bump**.
- Run wear bushing.
- RIH picking up 6 ¾" drilling assembly.
- Drill shoe track & 3m (10') of new formation.
- Perform leak-off test with pressure test unit (A 15.5 ppg leak off is expected, which would give the well a 14 bbl kick tolerance. Minimum required leakoff for 10 bbls kick tolerance is 14.4 ppg EMW. Notify the drilling engineer immediately if less than 14.4 ppg leakoff is achieved). Pump to fracture propagation or max allowable surface pressure.

6 ¾" Production Hole

Hazards & General Notes

- Differential sticking has been observed in the Paaratte Formation, and the Eumeralla Formation.
- Swelling clays in the Skull Creek and Belfast mudstones and filter cake build-up in the Nullawarre greensand may cause tight hole.

Operation

- Drill 6-3/4" hole with MSS surveys every 150 m (500 ft). The target tolerance is a 50 m radius around the surface location at the Waarre formation top.
- Drill in rotary as long as possible, but if the well trajectory indicates the target may be missed, drill no further than will allow for a correction run of no more than 30 degrees maximum inclination and no more than 8 degrees / 30m dogleg. If there is need for a correction run, use a rockbit and survey with MWD as necessary.
- Drill TD at 35m into Eumeralla (at approx 1723 m TVD). Make wiper trips as required. After TD, make a wiper trip back to old hole, take final survey and POOH to run logs. Rig up & run wireline logs: Run 1 GR-LCS-MRS-DLS-CAL. Run 2 CDS-CNS. Run 3 RFS (20 points)
- Avoid a wiper trip between run 2 and 3 unless absolutely necessary. This is to avoid super charging of the formation.

3 ½" Production Casing

Hazards & General Notes

- The casing will require drifting with a 2.867" drift.
- Differential sticking of 7" casing in 8.5" hole has been observed in the Eumeralla in offset wells

- The slips will be set with buoyed casing string weight plus 40klbs against the **tail cement ONLY** WOC until tail cement sample set – lead cement samples should not have set.
- Once slip and seal assembly is in place, the annulus valve is to remain open while cement sets. Ensure this valve is closed once the lead surface cement samples have set.
- Mud left between 3-1/2" & 7-5/8" casing after cementing will contain biocide and the pH will be increased to more than 10 using caustic.

Operation

- If casing is to be run, RIH with bit (open nozzles and no stabilisers required).
- Condition hole and POOH laying down drill pipe and BHA.
- Rig up and run 3½" tubing. Threadlock the two joint shoe track. Monitor torque vs turns with JAM system provided by casing running contractor.
- Wash last joint to bottom and cement casing.
- Displace cement with 2% KCl brine. Ensure surface lines flushed from cement unit all the way to the cement head prior to displacing with the cementing unit. Use a ball below the top plug. Every attempt to bump the plug should be made. Do not displace more than 3 bbls over theoretical with the planned shoe depths and formation tops. This will be confirmed by the DE prior to the job. Pressure test casing to 2000 psi for 10 mins.
- Record string weight prior to cementing, at end of cement job and again prior to landing tubing.
- WOC until **tail cement** surface samples have set. Record string weight at start and then every 30 min. while WOC. Record these values on the Casing and Cementing report.
- Run slip and seal assembly. Set 3½" casing in tension with 40 klb overpull above buoyed string weight.
- Nipple down BOP's, install seal adaptor flange & 5k 3 1/8" Xmas Tree and pressure test (as per Section 7).
- Release rig.

Abandonment

Hazards &General Notes

- All plugs to be set on a 30 m (100ft) hi-vis pill (Min YP=50).
- Min plug length 60 m (30m above & 30m below formation top).
- Shoe plug to be 120 m (60m above and 60m below the shoe)
- All plugs 10% over calliper or 20% over gauge hole.
- Mud left in the surface casing will contain corrosion inhibitor and biocide.
- DE will confirm final depths from wireline logs.

Operation

- RIH 6 ¾" BHA and POOH laying down same.
- RIH with 2 7/8" EUE cement stinger and set balanced abandonment plugs as per program (Section 8).
- Tag shoe plug with 10klbs. Shut annular and pressure test to 500 psi above shoe leak-off pressure.
- POOH & LD DP.
- Pull wear bushing.
- Nipple down BOP's and remove Bradenhead.
- Set surface cement plug.
- Install identification plate and release rig.

2. PRELIMINARY BIT AND HYDRAULICS PROGRAMME

TBA

3. BOTTOM HOLE ASSEMBLIES

TBA

4. SURVEYING PROGRAMME

Hole section	9 7/8"	6 ¾"
Survey Type & frequency	MSS at 30m then every 150m	MWD or MSS surveys 150m minimum frequency

5. CASING PROGRAMME

5.1 CASING DESIGN SUMMARY

Casing String		Surface Casing	Production Casing
Casing size (in)		7-5/8	3 1/2"
Shoe depth (m MD/ft RT MD)		480 / 1575	2192 / 7192
Grade		L80	J55
Weight (lb/ft)		26.4	9.3
Burst rating (psi)		6020	6980
Collapse rating (psi)		3400	7400
Tensile rating (klb)		602	142
Connection		BTC	New NK3SB
Nominal Wall (in)		0.328	0.254
Inside diameter (in)		6.969	2.992
Drift Diameter (in)		6.844	2.867
Capacity (bbl/ft)		0.0472	.0087
Coupling OD (in)		8.5	4.25
Make-Up Torque (ft/lbs)	Minimum	To bottom	2160
	Optimum	Of triangle	2700
	Maximum		2970
FLOAT EQUIPMENT		Dowell	Dowell
Float Shoe		Non-Rotating	
Float Collar		Non-Rotating	
Shoe Track Length		2 Joints	1 Joint
Threadlock		Shoe Track	Shoe Track
Safety Factors			
Burst		2.4	2.8
Collapse		5.9	2.6
Tension - Running - Pressure Test		5.0 4.6	1.6 1.8

Design based on deepest possible well depth of 2192m.

5.2 CENTRALISER & MARKER JOINT PROGRAMME

Casing Size	7 5/8"	3 ½"
Centraliser Placement	Middle 1st & 2nd jts 3rd,5th and 7th coupling 1st coupling below cellar	3m above shoe Next 2 couplings Every 2nd coupling from 15m above Flaxmans formation top to 15m below the Eumeralla formation top. 1st & 3rd coupling above 7 5/8" shoe
Centraliser Type	Bow spring	Bow spring
Marker Joints	Not req'd.	15m (50ft)above each pay zone separated by more than 60m 200ft Same weight & weight & grade as casing (higher grade is OK but not heavier weight).

NOTE:

7 5/8" Surface Casing

- Drift every joint using the 6.84" drift.
- The two joint shoe-track will be made up and a 10' BTC pup joint will be run immediately above the float collar (Threadlock the float/pup joint connection). This will allow the shoe track to be stood back in the derrick if necessary.

3 1/2" Production Casing

- Drift every joint using the 2.867" drift.
- The two joint shoe-track will be made-up of a two 9.3 J55 New NK3SB.
- Dowell will provide the 3 ½" circulating swedge.

6. WELLHEAD DETAILS

	Type	Flange size	Connection
Bradenhead	Wood 5k 7 5/8" BTC Box	11" 5000psi	7 5/8" BTC Box down
Slip & Seal Assy	Wood WG-22 11" x 3 ½" S&S	NA	
Seal Adaptor Flange	Wood WG-A4-P 11" x 3 1/8" 5k	11" 5000psi x 3 1/8" 5000psi	
X Mas Tree	Wood	3 1/8" 5000psi Blind Flange, ½" NPT pressure gauge	

Santos Petroleum Engineering require that the Xmas tree (5k 3 1/8") be installed by the drilling rig and tested. Test the Xmas tree valves and the slip and seal packoff to 5000 psi. When testing the slip and seal packoff from above, ensure the bradenhead wing valve is open in case the slip and seal passes and exposes the surface casing to 5000 psi.

7. PRESSURE TESTING SCHEDULE

Component	Pressure Test
7 5/8" Surface casing	2000 psi
Pipe rams, K&C lines, choke manifold, Standpipe, kelly & safety valves	2000 psi
Annular	2000psi
Bradenhead – casing connection	2000psi
3 ½" Production casing	2000psi
Packoff and Seal Assembly	5000 psi
7 5/8" x 3 ½" annulus	2000 psi
Xmas tree valves	5000 psi
LOT	Minimum allowable 14.4ppg EMW (to fracture propagation or max allowable surface pressure)

NOTE:

Pressure tests will be a 10 minute low pressure test to 200psi and a 10 minute high pressure test as above. Pressure test BOPs, choke line and manifold, casing and conduct leak off test with rig pumps. Retest BOPs after 14 days of operations since last test, or nearest operational opportunity thereafter.

8. Abandonment Program for Lavers #1

If production casing is not run, the well will be abandoned with cement plugs and the wellhead removed.

Plug No	Depth (m RT MD / ft RT MD)	Purpose
1	1645 – 1615 m RT 5500 – 5300 ft RT	Waarre Isolation
2	1345 – 1285 m RT 4415 – 4215 ft RT	Nullawarre Isolation
3	1075 – 1015 m RT 3530 – 3330 ft RT	Paaratte Isolation
4	1000 – 940 m RT 3280 – 3080 ft RT	Pember Isolation
5	455 – 395 m RT 1495 – 1295 ft RT	Surface casing shoe
6	0 – 15 m 0 – 50 ft RT	Surface plug

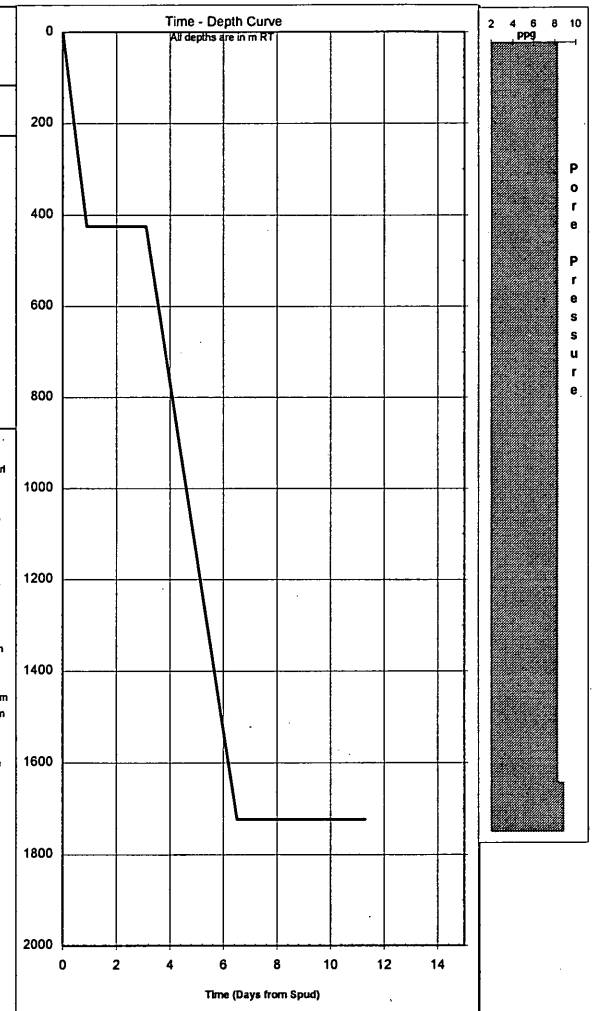
APPENDICIES

1. Montage

WELL NAME:	**LAVERS #1**	LATITUDE (SURFACE / TARGET):	38 deg 28' 44.75" S
WELL TYPE:	GAS EXPLORATION	LONGITUDE (SURFACE / TARGET):	142 deg 48' 12.21" E
WELL AREA:	PEP 154	SEISMIC REF TARGET:	CDP 10163 INLINE 2490
RIG	ODE 30	ELEVATION (prelim):	GL - 63.5.0m (208 ft) RT - 68.2m (224 ft)

SANTOS Limited

(m) MD (RT)	LITHO-LOGY	TOPS & TARGETS TVD (m)	P & A	WELL SCHEMATIC	CASING WELLHEAD	CEMENTATION	DRILLING FLUID	EVALUATION	WELL DATA	OFFSET WELL INFO.
	Limestone to 160 m (525 ft)			9-7/8" 7-5/8"	SURFACE CASING If necessary, make wiper trip with bit to conductor. 7 5/8" 26.4 ppf L80 BT&C Run Dowell non rotating float equipment. Connection to be torqued to triangle Set Shoe @ 425 m (1395 ft) Run two joint shoe track	SURFACE CASING Lead: Class G 11.8 ppg W 6% PH Bentonite, 1 % CaCl2 BWOC 0.07 gal/sx D080 and 0.01 gal/sx D047 Yield 2.92 cuft/sx Tail: Class G 15.6 ppg 0.05 gal/sx D080 and 0.01 gal/sx D047, Yield 1.19 cuft/sx Top Fill: Class G with 2% CaCl2 Lead to surface Tail slurry 300 ft rise (1095', 334m). Calculate mud and cement returns to surface. Perform Top Fill Job using 1" stinger Displace cement with old mud Use 55% excess for lead and 20% excess for tail.	SURFACE HOLE Spud Mud MW: ALAP funnel viscosity 45 - 50 sec/qrt YP 20 - 25 Use 84 / 110 mesh shaker screens Use plenty of fresh water for dilution and SAAP if mud rings noted	SURFACE HOLE Mudlogging - Samples every 15 m Mudlogging Contractor Geoservices (Equipment - Total Gas Detector and FID chromatograph)	20" Conductor set at 5.5 m below G.L. Survey every 150 m, 500 ft (MSS) Test casing to 2000 psi. when bump plug	Assumed Temp Grad 1.48 degrees / 100 ft Fenton Creek #1: 1.4deg/100ft Mylor #1: 1.7deg/100ft Boggy Creek #1 : 1.6 deg/100ft Penryn #1: 1.3 deg/100 ft Offsets include: Boggy Creek 1: 5.6 km Callista #1: 3.2 km Potential lost circulation in surface limestones and mud rings in deeper marls LOT Data:
200	Marl to 550 m (1804 ft)			425m 1395 ft						
400										
600	Clifton	544 603								
	Mepunga	686								
	Dilwyn				PRODUCTION CASING 3 1/2" 9.3 ppf J55 New NK3SB Make up a two joint shoe track Run Dowell float equipment. Use Kleepo type thread protectors and stabbing guide when handling premium threads. Run centralisers and marker joints as per programme Make up connections to optimum torque of 2,700ft.lbs (opt). Use dump valve on power tongs and monitor torque vs turns with JAM system.	PRODUCTION CASING Lead: G 11.8 ppg w/ 6% Bentonite 0.07 gal/sx D080 and 0.01 gal/sx D047 Yield 2.92 cuft/sx Tail: G 15.6 ppg w/- 0.1 gal/sx D080 0.04 gal/sx D081 and 0.01 gal.sx D047 Yield 1.19 cuft/sx The top of lead cement to go a minimum of 500 ft (150 m) inside the surface casing shoe Top of tail to go to 200' (60 m) above top Waare Use 10% excess over calliper Condition the mud prior to cementing-circ. a min. 2 hole vols AV same as whilst drilling with low YP. Hold safety meeting and pressure tests etc. prior to circulation ie. minimise delays. Displacing cement with 2% KCl brine. Pump to bump on production casing. (ensure top plug has fallen) A 3 1/2" top plug above a the ball is to be run following the cement in the production casing Reciprocate the production casing string during job.	MAIN HOLE 2 - 3% KCl/PHPA/Polymer MW : 8.6 - 9.4 ppg PV: ALAP YP: 8 - 12 6 rpm 5 - 8 PHPA 1 ppb at all times API filtrate < 10 cc/30 mins API filtrate < 8 cc/30 mins below 1300 m No requirement for tighter fluid loss unless operational conditions 2 % KCl to 1300 m 3% KCl 1300m - TD Use finest possible shaker screens to 250 mesh Ensure mud weight 9.2 ppg prior to Waare Weight up to 9.4 ppg if required in Eumerella	MAIN HOLE Mudlogging - Samples every 15m to approx 1000 m Samples every 3m to TD Coring - None Wireline Logs GR-LCS (TD to surface casing) MRS-DLS-CAL (TD to surface casing, MRS to 100m above top Pember) CDS-CNS (TD to 20m above top Flaxmans) RFS (20 points) Service Company Reeves	MAIN SECTION Install 5K Bradenhead and NU BOPs run wear bushing when rotating Pressure test BOPs to 200/2000 psi. Hydril to 200/2000 psi using rig pumps FIT 14.4 ppg EMW (min) Target Tolerance 50 m radius Survey with MSS / MWD Drop surveys where possible on bit trips	Fenton Creek 13.6 ppg EMW at 404m near base Narrawaturk Marl Mylor 1 16.5 ppg EMW at 293m middle Gellibrand Marl Penryn #1 15.9 ppg EMW at 670m in top Pember mudstone Survey Data: Fenton Creek 1 : 0.5 - 3.5 degrees Mylor #1 : 0.5 - 2.5 degrees Penryn #1 0.25 - 3.5 deg 0 - 1428 m 3.5 - 5.5 deg 1428 - 1813 m Boggy Creek #1 4 deg max at 1595 m Callista #1: 1 degree max at 1800 m Potential for 8.9 ppg reservoir pressure in Eumerella, may require weight up to 9.4 ppg Swelling clays in the Skull Creek and Belfast mudstones may cause tight hole Maximum possible surface pressure (gas filled pipe) is 2000 psi.
800	Pember	968 1005								
1000	Pebble Point	1043		6-3/4" 3-1/2"						
	Paaratte									
1200	Skull Creek	1219								
		1315								
	Nullawarre									
1400										
		1554								
1600	Belfast	1620								
	Flaxmans	1645								
	Waare ●	1688								
	Eumeralla	1723								
	TD			WELL TD AT 1723 m (5653') TVD						
1800										
2000										



TARGETS: Primary ● Secondary ○ P & A PLUGS (if required) Minimum 300' in length. Tag plug across shoe	No changes to the drilling programme can be made without the Programme Change Controll form (DQMS-F207) first being signed and sent to the rig. Any changes to the scope of the work (eg extra DST's or logging runs) must be accompanied by DQMS Form-F208 (Change of Scope).	Well Objectives: Waare Water Source: TBA DRILLING HAZARDS:	WELL COST C&S: $ 1,340,000 P&A: $ 1,114,000 Cost Code: TBA	OPERATION	NOPE / ACTUAL
				Rig Move	4 (4)
				Surface Hole - Drill 9 7/8" Hole to 425 m (1395')	0.9 (4.9)
				Run 7 5/8" casing & cement same	
				Nipple up wellhead, BOPs & Test Same	2.2 (7.1)
				Main Hole - Drill to TD at 1723 m (5653')	3.4 (10.5)
				Logs, RFS	2.4 (12.9)
				P & A / C& S	2.4 (15.3)
				TOTAL (Including rig move).	15.3

	Prepared by: Geoff Coker	Checked by:	Date:	VERSION 0 REVISION 0

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ATTACHMENT 3

COMPLETION AND TESTING PROGRAM

Santos Ltd
A.C.N. 007 550 923

Santos

Cost Code: 8ED – 83D*** - 813

BCRs:

Contractor	Contract Number	Release no.	Comment
Ascots			
Slickline contractor			
Electric-line contractor			

Purpose of Program: To complete and test Lavers #1 to determine well deliverability.
The program has been split into two parts to enable review/revision of the testing activities based on the results of the perforating. The testing equipment will be mobilised after the perforating has been completed, at a time determined by the Project Leader.

Preliminary

Part A
- drift and swab well
- slickline perforate Waarre Unit "C" sandstone underbalance
- clean up flow and wellhead samples

Part B
- 2 rate flow test complete with HP samples.

Current Well Status: 3-1/2" monobore cased and suspended as a future Waarre Unit "C" gas producer.

Block: PEP 154, Onshore Otway Basin, Victoria.

Location:

Latitude	38° 28' 44.75" S
Longitude:	142° 48' 12.21" E
Seismic line	CDP 10163 INLINE 2490

Elevation:

Ground Level	63.5m
Rotary Table:	68.2m

Elevations are Above Mean Sea Level.
All depths are m. RT unless otherwise noted.

Brief Well History: Lavers #1 was drilled as a monobore in South Western Victoria in the Otway Basin. This well is planned to intersect high porosity, high permeability net pay in the Waarre Unit "C" formation. The 3-1/2" J55 production casing will be run (based on a well life of < 4 years) to 1723 m and the well suspended as a future Waarre Unit "C" gas producer.
The well is located approximately
5.6 km from Boggy Creek #1 and
3.2 km from Callista #1

Wellhead Maintenance: A 3-1/8" x 5000# trim 2 wellhead installed & pressure tested.

Casing Details:

Surface Casing:

Plan to run 35 Joints 7-5/8" casing to 425m (1394') RT as follows:

Refer to attachment #1 - Surface Casing & Cementing report

Production Casing:

6-3/4" hole drilled to 1723m.
Plan to run 180 Jts of 3-1/2" 9.3 #/ft New NK3SB tubing to 1723m RT.

Refer to attachment #2 - Production Casing & Cementing report

TD: planned 1723m RT (5653' RT)

PBTD: planned 1712.5m RT (5618' RT)

Perforations: yet to be perforated

Preliminary

Reservoir Pressure & Temperature:

Formation	Pressure	Temperature	Source
Waarre Unit "C"	2563 psia @ 1688m RT (5538' RT)	153 F	Lavers #1 montage Feb 2001

Wellhead Equipment:

See Proposed Wellhead Schematic (Attachment 3.)

Downhole Equipment:

See Proposed Wellbore Schematic (Attachment 4.)

Preliminary

CONTENTS

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ATTACHMENTS

KILL FLUID CALCULATION SHEET

Formation:	Waarre Unit "C"
Reservoir Depth (ft.)	5538
Reservoir Pressure (psi)	2563
Reservoir Temperature (°F)	153
Kill Fluid Weight :	2563 + 150 5538 x 0.052
	9.42 lb/gal
Temperature Correction:	Average Downhole Temp. = 153 + 70 2
	= 111.5 °F
	Density Correction: = 0.003 (111.5-70) lb/gal
	= 0.125 lb/gal
	Kill Fluid Weight at 70°F = 9.55 lb/gal

Preliminary

If required to kill well, then use 2% KCl fluid with a density of at least 9.55lb/gal

PROCEDURE

Note: Refer to the following SANPE procedures where necessary.

Note: Phone numbers for the site are 03 TBA & 03 TBA

Refer to the following SANPE procedures where necessary.

1-7 Wellsite Inspection for Downhole and Surface Completion Equipment.
1-10 Tubing Conveyed Perforating – Special Considerations.
1-11 Well Control Equipment Testing
1-13 Well Maintenance-Top Up and Pressure Testing
1-14 Installation of Flarelines.
2-1 Coiled Tubing Operations
5-1 Slick line rig up
7-1 Work Place Hazard Inspections
7-2 Chemical Handling and Transport
7-3 Manual Handling Task Assessment

Preliminary

PART A - PERFORATING

1. INSTALL WELLHEAD & DRIFT WELL

1.1. Conduct wellsite safety meeting.

1.2. Install suitable flareline to flare up to 10 MMscf/d complete with 2-1/16" choke to wing valve (2-1/16") to existing flare pit.

Note: Ensure that the flare line is laid out taking into account the prevailing wind.

Rig up wing valve, variable choke and flowlines according to the normal procedures ensuring that an appropriate spacing is allowed between each major item of equipment. Refer to attachments #6 for lease layout, and #7 for equipment requirements.

Flare pit must be bunded for flare containment.

1.3. Function test 3-1/8" 5000 psi Trim 2 wellhead.

1.4. Rig in slickline with 3000 psi lubricator and pressure test to 3000 psi for 10 mins. Pressure test wellhead to 3000 psi.

1.5. Pressure test surface casing string to 2000 then to 3000 and hold for minimum of 10 minutes. Record and report results of the pressure tests.

Preliminary

Note: The maximum expected shutin surface pressure (full column of gas) is approximately 2000 psi.

1.6. Make up and RIH 1.75" drift and tag PBTD @ 1712.5m RT.

1.7. Make up and RIH 2.867" API drift and tag PBTD.

1.8. Make up and RIH 2.80" x 20' dummy perforating drift and tag PBTD (for 2-1/8" perforating guns).

1.9. Break out toolstring and prepare to run Memory Production Logging Tool (MPLT).

2. CONDUCT SLICKLINE CORRELATION LOGS

Note: If the cementing is problematic, or a successful pressure test is not obtained on the surface casing, then a Program Change Request (PCR) will be issued to mobilise electric-line to conduct a Cement Bond Log (CBL/VDL/GR/CCL). Refer to Attachment #11.

2.1. Make up MPL toolstring to record Gamma Ray (GR), Casing Collar Locator (CCL) and Temperature (T).

2.2. RIH to PBTD and log up to at to approx. 1538m RT to record GR/CCL across the Waarre Unit "C" interval for correlation to open hole logs.

Note: The pup joint (marker joint) above the Waarre Unit "C" must be logged.

2.3. POOH to approx. 455m RT (30m below surface casing shoe).

2.4. Log across the surface casing shoe to 203m RT (70m above expected top of cement) to obtain a temperature pass.
Logging speed will be approximately 18m/min (60 ft/min).

2.5. RIH and repeat log from 455 to 203m RT at a logging speed of approximately 36m/min (120 ft/min).

2.6. POOH and download data for depth correlation purposes. Correlate to open-hole log GR-LCS, MRS-DLS-CAL,CDS-CNS, dated not run yet as provided in PRA:yy/###/Rev. # (attachment #5 in the original program).

Note: If a suitable log has not been recorded, then the MPL will need to be re-run.

2.7. Prepare to swab well.

3. SWAB WELL

3.1. Rig in swabbing equipment.

3.2. RIH and swab well down to at least 400m. This will provide an underbalance of approx. 500 psi. Swabbed fluids must be directed to the flare pit.

Note: Brine in wellbore is 9.2 ppg.

A fluid head of at least 300 psi is required on top of the firing head.

3.3. Rig down swabbing equipment.

Preliminary

4. RUN SLICKLINE PERFORATING SYSTEM

4.1. Upon arrival at the wellsite, and prior to rigging up, conduct an onsite safety meeting and job review.

Note: Before commencing operations, report any wellhead pressures that may be present.

Ensure that the full details of the tubing stop and other downhole components are recorded.

4.2. RIH Slickline contractor with G type tubing stop assembly to approx. 1708m RT (20m below Waarre Unit "C" to minimise spacer requirements) and perform setting procedure in accordance with standard procedures.

Note: Ensure that the tubing stop setting depth does not interfere with the required perforation intervals given in PRA (Attachment #5).
The lowest perforation is at *****m RT - TO BE CONFIRMED

5. DEPTH CORRELATION

5.1. Connect memory CCL/GR gauges to Slickline contractor slickline.

5.2. RIH and tag tubing stop. Log off and up to at least 1524m (5000') RT (ie include marker joint at ****m RT). POOH.

5.3. The perforating engineer will download the data so that a hard copy of the depth correlation is available for reference. Correlate to the open hole depth reference log GR-LCS, MRS-DLS-CAL,CDS-CNS, dated not run yet, and cased hole GR/CCL run previously.

6. PREPARE GUN MODULE

6.1. Hold safety meeting to discuss operations with explosives. Conduct "Job Safety Analysis" and "Step Back" to review operations.

6.2. Load 2-1/8" Owen Raptor guns @ 6 spf 6.4g HMX charges, 60° phasing to perforate the Waarre Unit "C" sands as outlined in PRA:yy/###/Rev. # (Attachment #5). Determine spacer requirements taking into account the setting depth of the tubing stop.

7. RUN PERFORATING GUN MODULE & FIRING HEAD

7.1. RU Slickline contractor slickline unit and 3-1/2" lubricator.

7.2. Connect running tool to Slickline contractor slickline.

7.3. Connect spacer gun/perforating gun module to tool string and RIH.

7.4. RIH gun module and firing head.

Note: The Santos representative is to double check perforation interval as marked on gun module.

7.5. Rig down Slickline contractor.

8. DROP BAR AND FLOW

Preliminary

8.1. Conduct WSSM & OB and record on both Santos Daily Report and Slickline contractor Job Logs.

Note: Ensure that there are not any fire restrictions (ie. total fire ban), and that the appropriate authorities (CFA, Police etc.) and local residents have been notified.
Refer to attachment #9.

If fire restrictions are in place then do not proceed with perforating of the well.
Refer to attachment #10.

Ensure that the DNRE have been notified 24 hours prior to perforating the well.

Monitor annulus pressure during all of the following operations. Maximum Allowable Annulus Pressure (MAAP) is 200 psi.

8.2. Drop detonating bar **WITH THE WELL OPEN** to detonate the guns. It will be approximately 500 psi underbalance.

8.3. Flow to flare to unload water cushion and any perforating debris.

8.4. Report flare status, rates, FTHP, SIPCP and choke setting. Bleed down SIPCP as required.

8.5. Shut in well.

8.6. Report results to GWS-Adelaide immediately.

9. RETRIEVE PERFORATING ASSEMBLY

9.1. RU ET with 3-1/2" lubricator in preparation to fish perforating assembly. Ensure sufficient length of lubricator is available to fish gun hanger system components.

Note: Perforating specialist MUST be on location during slickline operations fishing gun modules.

9.2. Pressure test lubricator to 3000 psi for ten minutes

9.3. Conduct safety meeting and review JSA for pulling perforating guns.

9.4. RIH and retrieve bar, firing head and gun/spacer modules.

9.5. RIH and pull tubing stop.

Note: Advise GWS-Adelaide if any difficulties are encountered in recovering any of the perforating system components

9.6. RDMO Slickline contractor.

9.7. Flow well on cleanup for a minimum of 2 hours.

9.8. Report flare status, rates, FTHP, SIPCP and choke setting. Bleed down SIPCP as required.

Note: Obtain at least one hour of stable flowing tubing head pressure (1300 psi is the target).

Just prior to shutting in the well, obtain 2 HP gas samples from the wellhead.

Ensure that the samples are despatched to Adelaide ASAP via the Santos representative at the wellsite.

9.9. Shut in well and secure.

9.10. Report results to GWS-Adelaide.

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PART B - TESTING

10. RIG IN TESTING EQUIPMENT

10.1. Ensure that the flare line is laid out taking into account the prevailing wind.

10.2. Rig up wing valve, variable choke, flowlines, separator, heater, gauge tank and frac tank according to the normal procedures ensuring that an appropriate spacing is allowed between each major item of equipment. Refer to attachments #6 for lease layout, and #7 for equipment requirements.

Note: Connect liquid flowlines to the riser of the test tank so that a constant head is maintained against the separator.

Piping should allow flow to tank and a loading point of tanker trucks to remove condensate produced.

Tank, lines and loadout pump are to be earthed to eliminate EMF differentials.

Refer to Slickline contractor Job Safety Analysis.

Preliminary

11. PRE-FLOW & RUN BOTTOMHOLE GAUGES

Note: Ensure that there are no any fire restrictions (ie. total fire ban), and that the appropriate authorities (CFA, Police etc.) and local residents have been notified.
Refer to attachment #9.

If fire restrictions are in place then do not proceed with testing of the well.
Refer to attachment #10.

Ensure that the DNRE have been notified 24 hours prior to commencement of testing.

Do not run gauges until there is a clear indication that there will not be any fire bans for the next 2 days.

11.1. Pressure test all lines and equipment to full SITHP.

11.2. Open well to flare and determine appropriate choke settings. Warm separator and establish levels.

11.3. Shut in well to stabilise.

11.4. Rig up electronic gauge programmed as per Reservoir Development engineer's specifications. Connect battery, noting time and hang in lubricator. Pressure lubricator to full SITHP.

Note: The well must have a stable SITHP and have been shutin for at least 6 hours.

It is anticipated that the buildup will be less than 2 hours, so a high gauge rate of data sampling is required (refer to attachment #8).

11.5. After a 15 minute stop in the lubricator, RIH conducting a Static Gradient Survey with stops at each 305m (1000') (sufficient for gauge stabilisation). Hang gauges 15m (50') below the perforations at approximately 1688m RT (refer to attachment #4). Secure slickline and prepare for flow test.

12. TWO RATE FLOW TEST & SAMPLING

12.1. Prepare to flow well at pressure of 1000 psi **OR** at a rate of approximately 10 MMscf/d. During the flow periods, monitor all separator parameters every 15 minutes and calculate all flow rates every 30 minutes for the first 2 hours, then hourly thereafter. During the shutin, also monitor pressures.

Note: Wellhead temperatures are important for flowline design.

12.2. Gradually bring the well on line and trim through the separator to flare.

12.3. Commence flowing the well through the separator. Adjust the choke to maintain a FTHP of approximately 1000 psi **OR** at a rate of approximately 10 MMscf/d. Flow well for 8 to 12 hours. The flow duration will be determined based on pressure/flow stability.

Note: Test gas for both H2S and CO2 by means of a Draeger test kit. If a positive H2S reading is registered, confirm and notify GWS Adelaide immediately. Full test equipment will then be mobilised in order to accurately ascertain the gas composition.

12.4. At the end of the first flow period, adjust choke setting to obtain a flowing pressure of 1350 psi (anticipated flowline pressure) **OR** at a rate of approximately 5 MMscf/d. Flow well for 8 to 12 hours. The flow duration will be determined based on pressure/flow stability.

Note: Refer to attachment #8 for approximate condensate (C5+) volumes expected to be produced. It is anticipated that the yield will be similar to nearby wells at approximately 12-18 bbls/MMscf.Condensate volumes will also depend on duration of the test.

Scotts Transport (Colin Richardson, 08 8347 3449) need to be advised on timing for pickup of condensate from location.

Western District Pumping Service (Peter Kavanagh, 018 528549, fax 03 55611337) will be mobilised to transfer the condensate.

Preliminary

12.5. Near the end of the second rate (after stable flow has been reached), take 2 sets of high pressure samples (gas & liquid), ensuring that the flow rates and pressures are stable. All separator functions are to be monitored and recorded. Also take 2 x 20L stock tank samples of the produced condensate.

Note: All samples should be taken under the same separator operating conditions and labelled accordingly.

LGR conditions MUST be stable.

Duplicate samples should be taken approximately one hour apart.

It is required to ensure stable conditions for sampling. If necessary, extend the flow period. Use evacuated cylinders for gas and acidified saturated brine solution for condensate sampling by displacement.

During the sampling monitor all the flow parameters.

Clearly label all samples and report sample container numbers in morning and final report.

12.6. Flow the well for a sufficient period (1-2 hours) after taking the duplicate set of samples to ensure that stabilised conditions have existed after sampling.

12.7. Shut well in on build up for approximately 24 hours, or 6 hours after the surface pressure stabilises. Notify the Project Leader if there are any problems with the test, or if the shutin monitoring can be curtailed earlier.

13. STATIC GRADIENT & RIG DOWN

13.1. At the end of the shutin period with the well still shutin, POOH with gauges conducting a Static Gradient Survey at 305m (1000') intervals (stop duration dependent on gauge stabilisation time) on the way out. Stop in lubricator for 15 minutes prior to isolating and bleeding down the lubricator and retrieving the gauges. Download the data and forward to the Project Leader as soon as is practically possible.

Note: **The notice to end the test (or to rerun gauges) will be given by the on-site Reservoir Engineer.**

Rig down separator and all associated equipment and demobilise from location.

13.2. RDMO slickline equipment and secure the well. Wellhead valves are to be chained and padlocked, as is the cage surrounding the wellhead. One set of padlock keys are to be handed to the Supervisor at the Heytesbury Gas Plant and the duplicate set returned to SABU Petroleum Engineering in Adelaide.

13.3. Ensure that the total liquids production is recorded and trucked away from the well site as previously arranged. Any water can be drained to the flare pit (which must be securely fenced).

13.4. Ensure that the lease is left in a clean and tidy state and contact the Project Leader to notify Land owner that test is complete

Preliminary

Attachment #1

Surface Casing & Cementing Report

NOT YET AVAILABLE
Preliminary

Attachment #2

PRODUCTION CASING & CEMENTING REPORT

NOT YET AVAILABLE
Preliminary

Attachment #3

PROPOSED WELLHEAD SCHEMATIC

3-1/8" 5000 psi Trim 2 wellhead

NOT YET AVAILABLE
Preliminary

Attachment #4

PROPOSED DOWNHOLE SCHEMATIC

NOT YET AVAILABLE

Preliminary

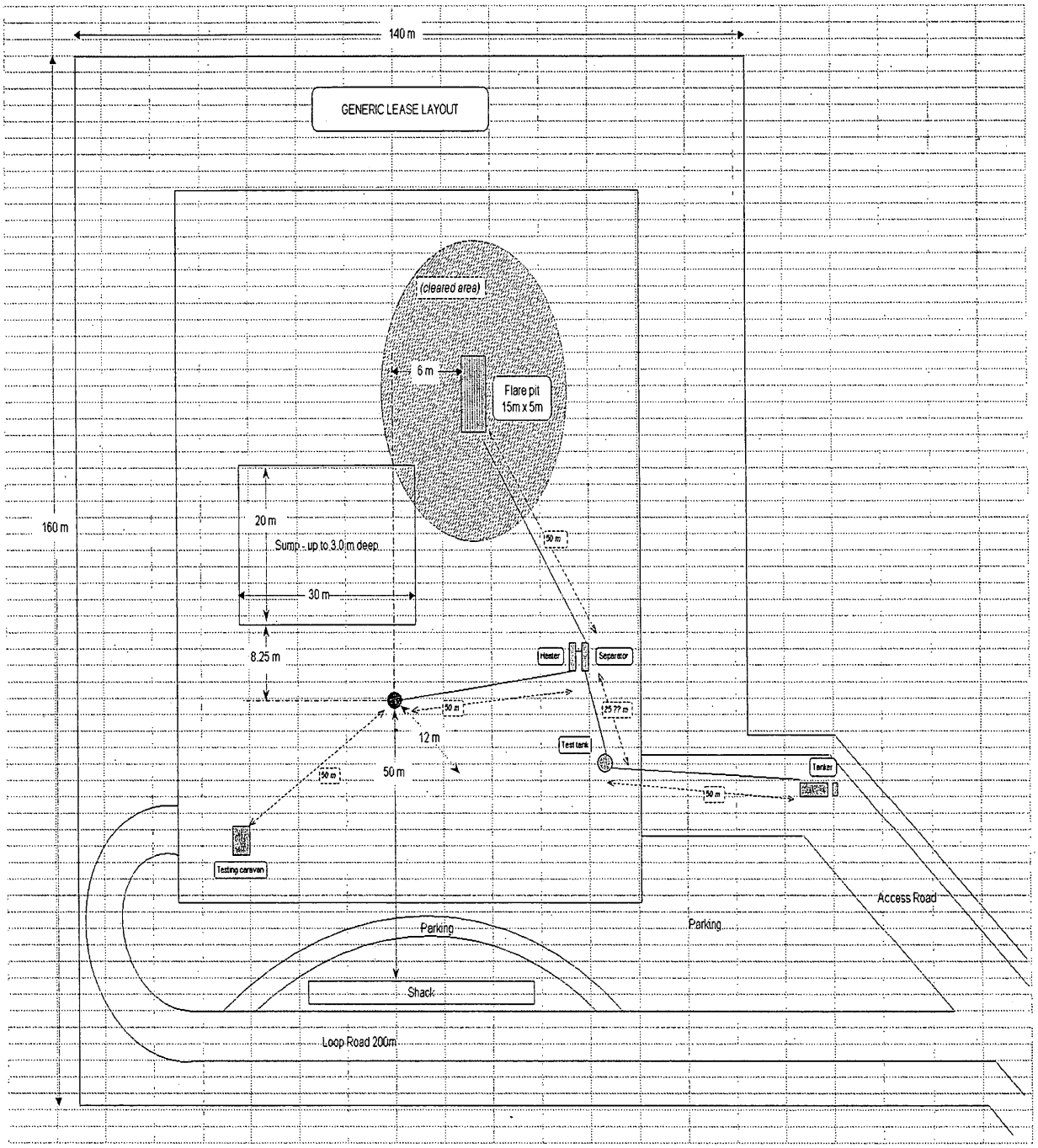
Attachment #5

PERFORATION REQUEST ADVICE

NOT YET AVAILABLE
Preliminary

Attachment #6

PROPOSED LEASE LAYOUT



Attachment #7

EQUIPMENT REQUIREMENTS

1. Swab valve to fit 3-1/8" wellhead.

2. Flowline to separator
   frac tank/road tanker c/w static earth lines and unloading pump
   small gauge tank (2 x 55 bbl compartments)
   tank piping
   chiksans
   line heater
   choke manifold
   flare line
   methanol & injection equipment

3. Caravan & generator
   lighting equipment
   fire extinguishers

Preliminary

4. Slickline unit complete with:
   - running/pulling tools for perforating system
   - high rate electronic gauges
   – swabbing equipment for 3-1/2" monobore
   – dummy gun drifts.

5. Separator (1440 psi) & well test equipment

6. PVT sampling equipment, including
   3 x 20 litre HP gas sample bombs
   3 x 0.5 litre HP liquid sample bombs

7. Memory Production Logging tool for GR/CCL correlation & associated hard/software

Attachment #8

CONDENSATE PRODUCTION

Generic well	FTHP (psi)	Anticipated rate (MMscf/d)	Test duration (hours)	Gas produced (MMscf)	C5+, @ CGR = 12 (bbls)	C5+, @ CGR = 18 (bbls)
Cleanup flow	1300	5.0	6	1.3	15	23
Rate determination	various	2.0	2	0.2	2	3
Shut well in for stabilisation			6			
RIH gauges			2			
Flow 1	1000	9.5	8	3.2	38	57
Shutin 1			0			
Flow 2	1300	5.5	8	1.8	22	33
Flow 2 (after sampling)	1300	5.5	2	0.5	6	8
Buildup			6			
Buildup			18			
SGS while POOH			2			
TOTAL				**6.9 MMscf**	**83 bbls**	**124 bbls**

Preliminary

Minimum rate to lift liquids for 3-1/2" tubing

Q (MMscf/d)	FTHP (psi)
3.0	1600
2.8	1450
2.6	1300
2.4	1150
2.1	1000

Attachment #9

EMERGENCY CONTACTS

OTWAY BASIN

POSITION	NAME	PHONE	FAX
Aboriginal Heritage	Lionel Harridine	03 5567 1236	
Aircraft Hire	Shipwreck Coast Flights	03 5598 5441	
Ambulance, Timboon		000	
Ambulance, Warrnambool		000	
Backhoe Hire	Ian White	03 5598 6376	
CFA, Colac Region 6 Headquarters Operations Officer	Brian Brady	03 5232 1923	03 5231 1370
CFA, Colac Region 6 Headquarters Operations Manager	Mark Gunning	03 5232 1923	03 5231 1370
CFA, Timboon	Bassett	03 5598 3386	03 5598 3060
D.N.R.E.	Kaurosh Mehin	(wk) 03 9412 5082 (ah) 03 9840 1079 0419 597 010	03 9412 5156
Drilling Conductor	Des Gladman	03 5562 0783	
Earth Moving	John Molan	03 5592 1261 0408 529 559	03 5592 2122
Exploration Field Service	Ray Willox	03 5598 5329 018 529 314	03 5598 5329
Fire Brigades (Fire Calls Only)	Timboon Port Campbell	03 5598 3386 03 5598 6243	
Heavy Haulage	Alan Spikin	03 5561 6111	
Helicopter Hire	Helicopter Operations Aust.	03 5561 5800 018 529 959	
Hospital, Timboon		03 5598 3000	
Hospital, Warrnambool		03 5563 1666	
Land Owner (Access)	Roland Stansfield	03 5598 5383	
Land Owner (Camp)	Wayne Thompson	03 5598 5286	
Land Owner (Penryn)	Garry Thompson Gus Thompson	03 5598 3333 03 5598 5385	
Medical Centre, Timboon		03 5598 3104	
O.D.E	Nic Hausburugh	0145 117 941	
Police, Port Campbell	B. Hair	03 5598 6310	
Police, Timboon	Russell Martin	03 5598 3026	
Police, Warrnambool		03 5562 1111	
Power Cor	Hutchins	03 5563 2512	03 5563 2511
Shire Council Corangamite	Paul Younis (Eng) Allan Kerr (Councilor)	03 5593 7100 03 5598 3240	03 5593 2695
South West Water	John Huff	03 5564 7600	
State Emergency Services Port Campbell		03 5598 6231	
Surveying	Paul Crowe	03 5561 1500 0419 515 422	03 5561 2935
Water Carting	John Molan	03 5592 1261 0408 529 559	03 5592 2122
Water Pumping	Exploration Field Service	03 5598 5329 018 529 314	03 5598 5329
Wreck Hire Warrnambool		03 5562 1411	

Preliminary

SANTOS

POSITION	NAME	PHONE	FAX
Gas Well Services Design Team Leader	Andrew DeGaris	(wk) 08 8224 7793 (ah) 08 8449 2610	08 8224 7755
Gas Well Services Operations Superintendent	Milt Gillies	(wk) 08 8224 7295 (ah) 08 8295 2414	08 8224 7755
Reservoir Development Eastern/Northern Gas Team Leader	John Hulme	(wk) 08 8224 7324 (ah) 08 8338 0169	08 8224 7755
Project Leader Staff Geologist	Graeme Parsons	(wk) 08 8224 7182 (ah) 08 8391 0967	
Environmental Dept.	Catriona McTaggart	(wk) 08 8224 7894 (ah) 08 8373 2961	08 8224 7141

SERVICE COMPANIES

Preliminary

POSITION	NAME	PHONE	FAX
Expertest Ltd	David Hawkes	08 8354 0488	08 8443 7408
Ascots Haulage	Colin Richardson David Jolley	08 8347 3449	08 8347 3414
Western District Pumping	Peter Kavanagh	018 528549	03 55611337

Attachment #10

CFA FIRE PERMITS Rz.zz.00/01

NOT YET AVAILABLE

Preliminary

Attachment #11

DETERMINATION OF CEMENT QUALITY

If the cementing of Lavers #1 was not problematic, and was pumped as per design to place the top of lead cement approximately 152m inside the surface casing shoe (ie. ~273m), the running of a Cement Bond Log (CBL/VDL/GR/CCL) will not be conducted for the following reasons:

- It is considered that a memory temperature log will be able to detect changes in geothermal gradient across the cement top.
- Due to the sensitivity of the location of Lavers #1, minimising the number of contractors on site will be beneficial in reducing the impact of operations on the local residents.
- A cost reduction will be realised, as mobilisation of the crews and equipment for the cement bond logging is substantial.
- Correlation to the open hole logs will be performed with the same Memory Production Logging Tool (MPLT) used for the temperature pass.
- A pressure test will be conducted on the Surface Casing to determine integrity of the pipe to withstand full shutin wellhead pressure.

Preliminary

PE909076

This is an enclosure indicator page.
The enclosure PE909076 is enclosed within the container PE909075 at this location in this document.

The enclosure PE909076 has the following characteristics:

ITEM_BARCODE	PE909076
CONTAINER_BARCODE	PE909075
NAME	Encl.1 Lavers-1 Curdievale 3D Time Map
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	SEISMIC
DATA_SUB_TYPE	ISOCHRON_MAP
DESCRIPTION	Encl.1 Lavers-1 Curdievale 3D Time Map, Near Top of Waarre Sand, Scale 1:25000, C.I. 10m, by Santos Ltd, W1317, PEP154. Enclosure 1 contained within "Well Proposal Report" [PE909075].
REMARKS	
DATE_WRITTEN	02-FEB-2001
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	Santos (BOL) Pty Ltd
WELL_NAME	Lavers-1
CONTRACTOR	
AUTHOR	
ORIGINATOR	Santos (BOL) Pty Ltd
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	CD000_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE909077

This is an enclosure indicator page.
The enclosure PE909077 is enclosed within the container PE909075 at this location in this document.

The enclosure PE909077 has the following characteristics:

ITEM_BARCODE	PE909077
CONTAINER_BARCODE	PE909075
NAME	Encl.2 Stratigraphic Cross Section
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	WELL
DATA_SUB_TYPE	CROSS_SECTION
DESCRIPTION	Encl.2 Stratigraphic Cross Section Boggy Creek-1, Callista-1, Rowans-1, Datum: Belfast Mudstone, by Santos Ltd, W1317, PEP154. Enclosure 2 contained within "Well Proposal Report" [PE909075].
REMARKS	Marked Enclosure 1 on Cross Section, actually is supposed to be Enclosure 2.
DATE_WRITTEN	31-DEC-2000
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	Santos (BOL) Pty Ltd
WELL_NAME	Rowans-1
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	CD000_SW

(Inserted by DNRE - Vic Govt Mines Dept)