

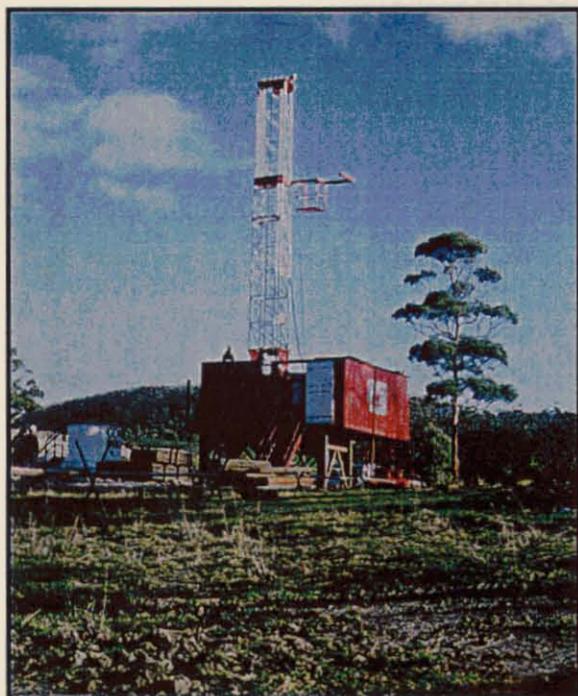
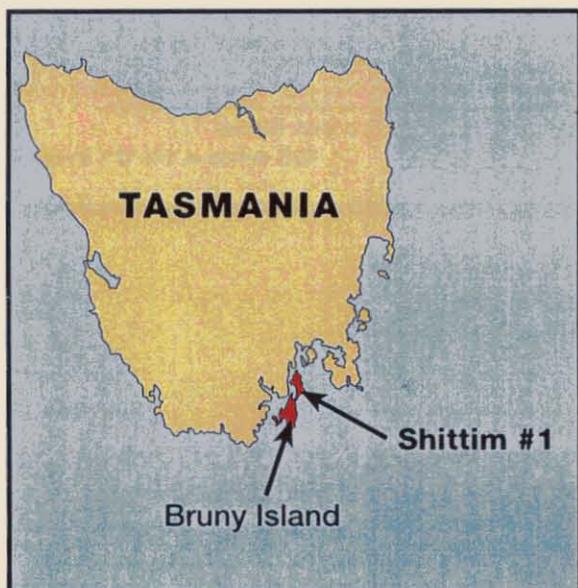
# GREAT SOUTH LAND MINERALS PTY LTD.

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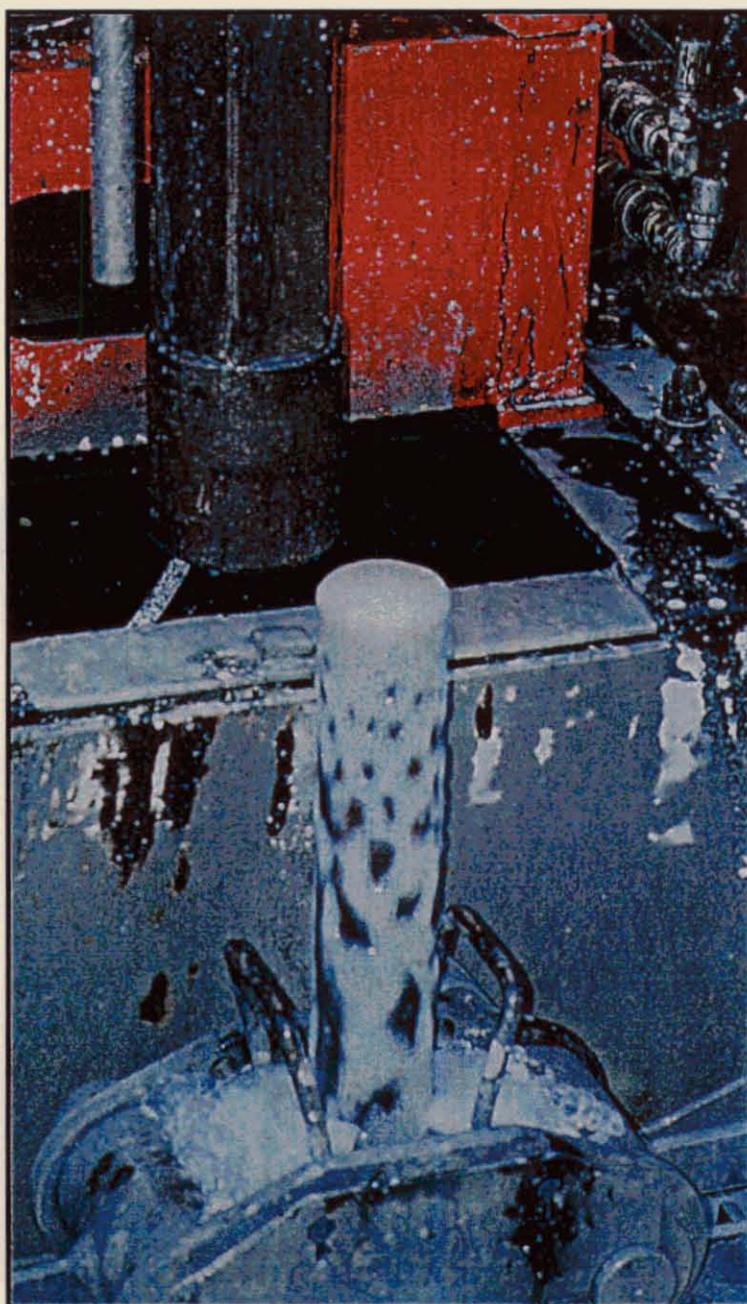
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## Report from the Shittim #1 Well January 1997

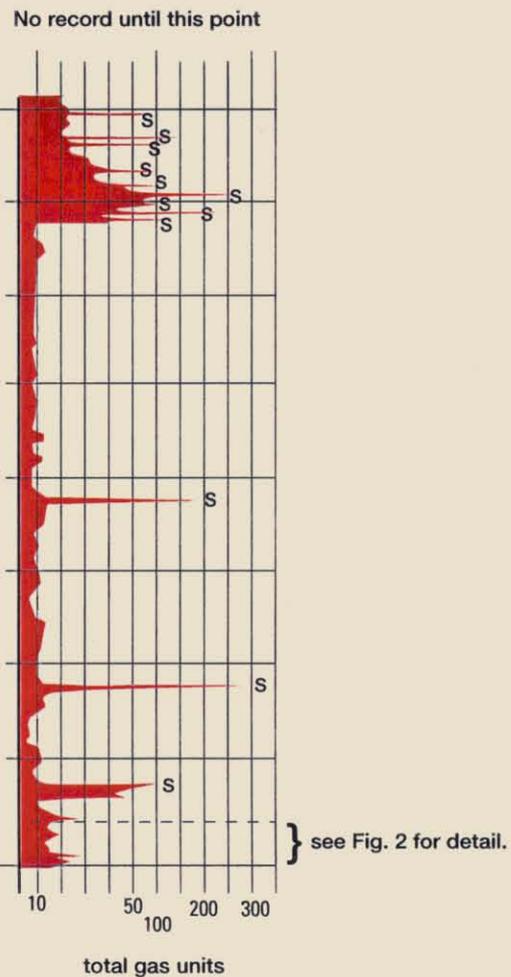
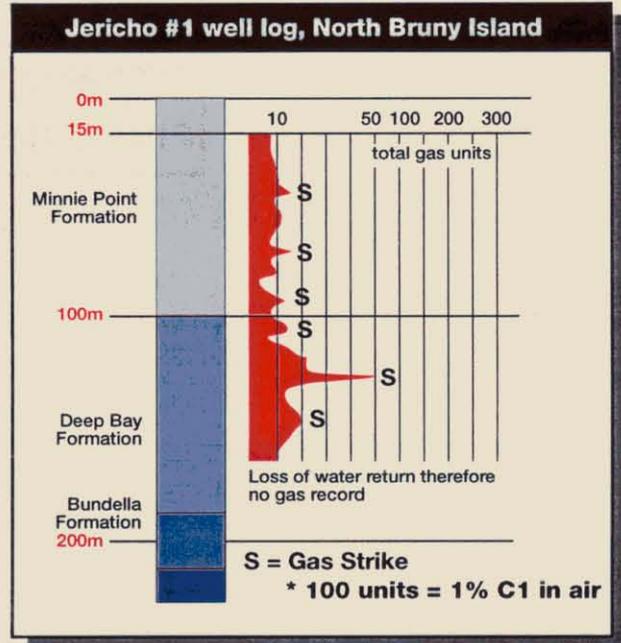
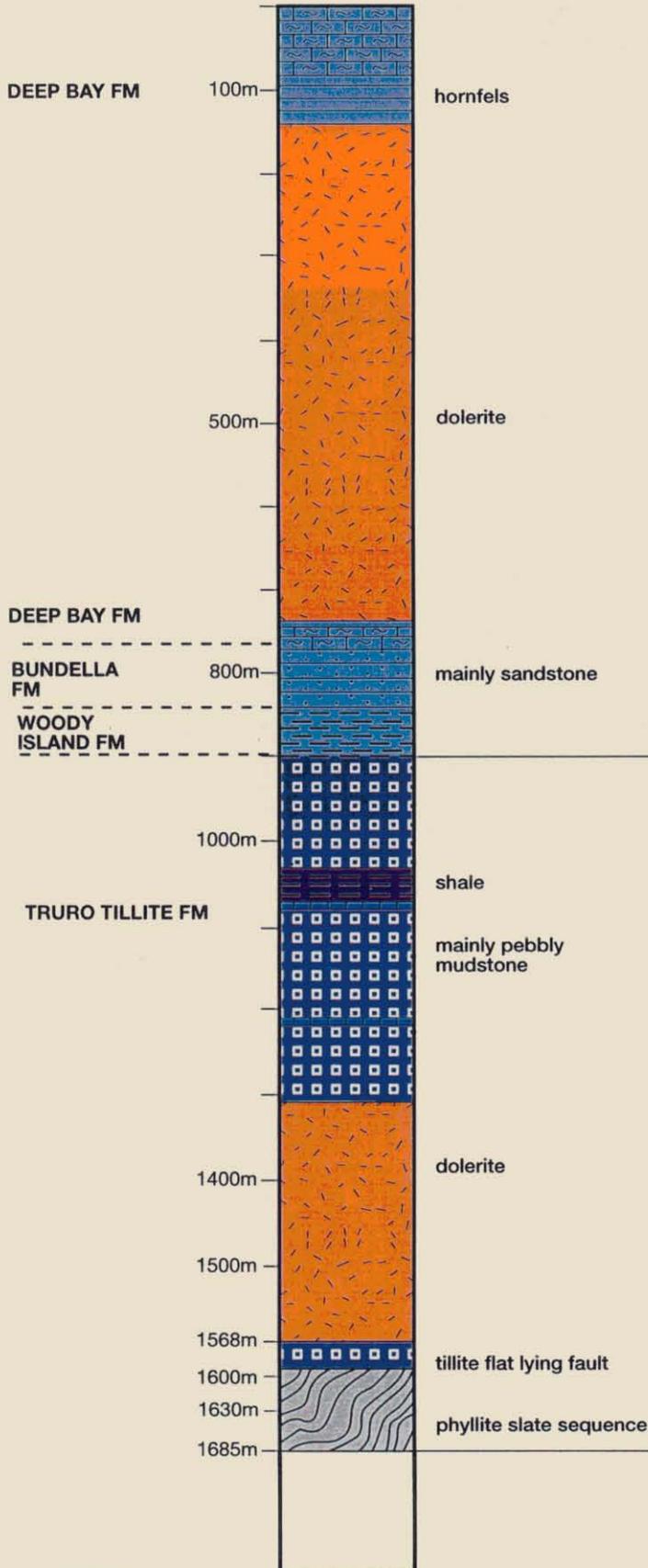


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# Shittim #1 well log, North Bruny Island



## INTRODUCTION

A stratigraphic drillhole on north Bruny Island was planned in 1994 to test structures identified on nearby marine seismic lines across Storm Bay. The hole, known as Shittim #1, was suspended at 1686m in December 1996 pending a full analysis of results to date. A dipmeter survey showed that the hole did not deviate from the vertical by more than 2 degrees.

The fully cored stratigraphic succession is summarised in Fig. 1. Notes on the method of collection of samples and on the collection of data are included at the end of this document.

## STRATIGRAPHY

The Lower Parmeener Supergroup in Shittim#1 has been intruded by two major dolerite sills - an upper sill which is 580m thick and a lower sill which is 250m thick. In addition there are thinner sills with one minor sill being 3m thick.

All of the sedimentary succession in Shittim #1 has been contact metamorphosed by one or both of the thick dolerite sills. Details of the mineralogy of the contact metamorphics and of the metallic minerals in the dolerite can be found in Bottrill (1995) and Woods (1995). Metamorphic assemblages and vitrinite reflectance data show that all of the Parmeener metasedimentary rocks have experienced temperatures of 300-500°C

The formations however, are easily recognised (Forsyth 1995) and are summarised in the attached log. The uppermost formation cored is the Deep Bay Fm, followed by the Bundella Fm (and its several members), then by the Woody Island Fm and Truro Tillite.

There are no surprises in the stratigraphy of the Lower Parmeener Supergroup and even the very thin formations (probably best regarded as members) erected on Satellite Island (previously Woody Island) by Banks *et al* (1955) can be readily identified. The Truro Tillite at slightly over 400m is thicker than in most other Tasmanian sections. The Truro Fm also contains minor conglomerate, sandstone, shale and limestone interbeds, all of which have been recorded in other Tasmanian sections of the Truro Fm.

## STRUCTURE

The section is jointed throughout, is cut by several small faults and the more ductile Woody Island Formation is deformed. Horizontal fracturing in the Woody Island Fm may indicate low angle faulting.

The lower dolerite sill is underlain at 1568m by 33cm of metatillite. At 1568.3m there is a 10cm wide, horizontally striated fault zone and beneath the fault is 118m core thickness of highly deformed slates and phyllites with very minor marble (dolomite +

calcite) beds. Spotting in the phyllite/slate rocks decreases away from the fault suggesting that this low angle fault is pre-dolerite in age and is therefore most likely a listric fault of early Jurassic age.

A low angle, probably listric, fault was identified on a seismic line from nearby in Storm Bay by Leaman in 1987.

#### **POROSITY AND PERMEABILITY**

Porosity measurements were carried out on the sandstones of the Bundella Fm. Woods (1995) found a relationship between both porosity and permeability and distance from the upper dolerite sill. Porosities range from 7.5% to 12% and permeabilities from 0.1 to 9.8 md.

Porosity has probably been enhanced by decarboxylation. The potential reservoirs intersected are few and include a few metres of porous sandstones in the Bundella Fm. This is the distal, feather-edge, facies equivalent of the thicker glacial sandstones of the Liffey and Faulkner Groups that do not occur on Bruny Island but are attractive reservoir targets on the mainland of Tasmania (Maynard 1996).

Fracture porosity may be present in several of the formations but is most obvious in the Woody Island Fm. Fracture porosity is difficult to measure and it is difficult to say whether or not a potential reservoir exists in the Shittim #1 area based solely on fracture porosity.

#### **PRE-PARMEENER METAMORPHICS**

A total of 118m of pre-Parmeener metamorphics have been drilled. These grey to black metamorphics vary from phyllite to slate and all have an intense, closely spaced cleavage. The cleavage maintains a high angle to the core and the bedding, where identifiable, is usually (but not always) at a low angle of about 10-15 degrees.

At least two thin (15cm) beds of highly deformed dolomitic marble are present. There is a suggestion of a stromatolitic texture in one of these beds. No fossils have been found in the slates or phyllites.

These phyllites and slates are lithologically reminiscent of some parts of the Ordovician-Devonian Mathinna Group (particularly near granites), of some highly deformed pelitic areas of the Ordovician to Devonian Eldon Group and of some parts of the Upper Proterozoic metamorphics of Tasmania.

There is also a resemblance to the Cambrian to earliest Ordovician Robertson Bay Group of Victoria Land in Antarctica which consists of a thick pile of slates and minor limestone beds. The dolomitic limestones probably suggest that the greatest similarity is to the Late Proterozoic metamorphics of Tasmania.

### Variations in air corrected gas content in Shittim #1

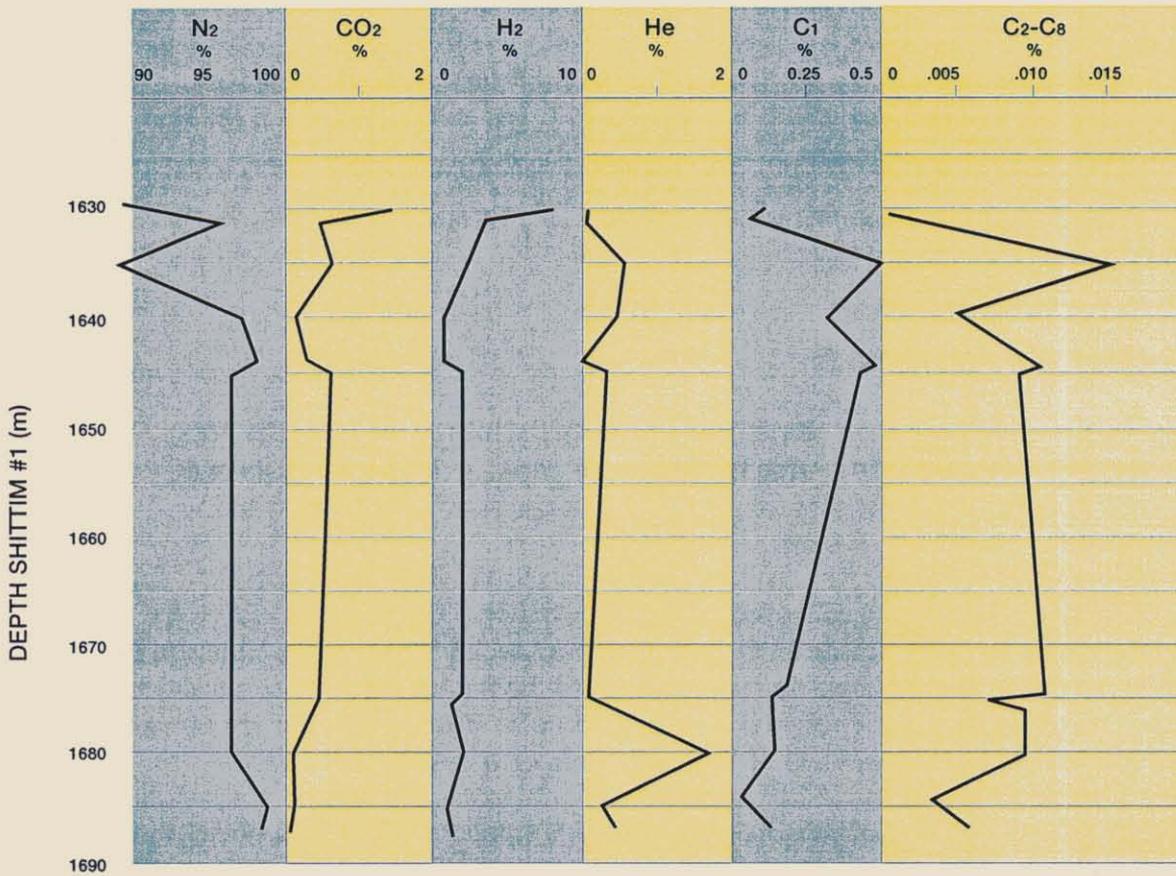


Figure 2

### Natural gas analyses compared to analyses from Shittim #1 (from Nikinov in North, 1985)

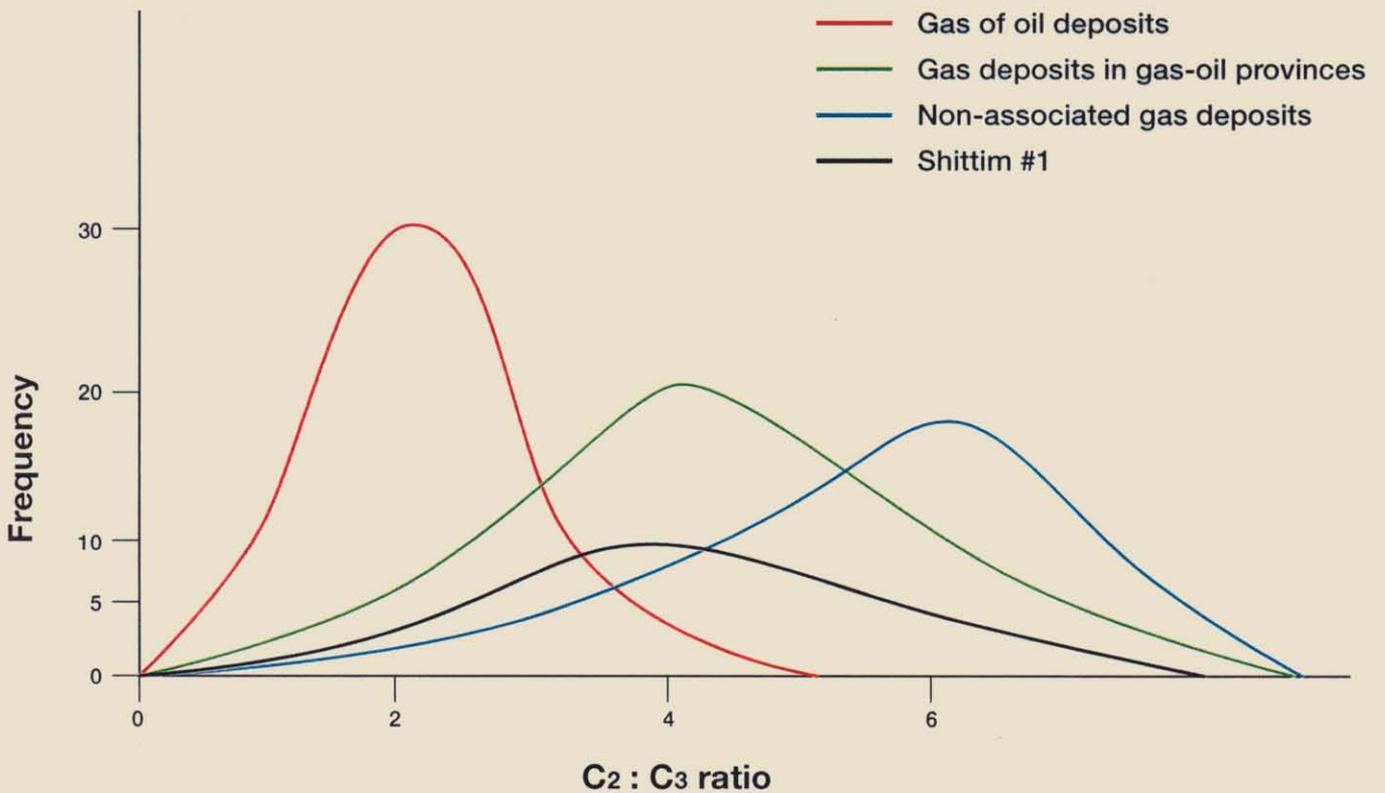


Figure 3

## NATURAL GAS AND OIL

Although Shittim #1 was designed as a stratigraphic hole, the discovery of hydrocarbons was not totally unexpected, as oil had been reported in a nearby shallow hole at Johnson's Well in 1929.

Gas was reported by the drillers at shallow depths and high pressures were reported in porous sandstones within the Bundella Fm correlate under the first thick dolerite sill at about 800m. This necessitated the installation of a hotwire below this level.

Total gas units from 875m to the bottom of the hole are shown in Figure 1. A more sensitive gas chromatograph was installed at 1021m which could detect total gas, hydrogen, methane and C<sub>2</sub>+ separately. Generation of hydrogen caused by acid-water reaction with drill rods was prevented by increasing the pH of the drilling fluids.

However, hydrogen occurred in all samples and ranges from 0.45% to 8.49% (air corrected). The reactivity of hydrogen makes air-corrections based on oxygen unreliable due to the probable removal of free oxygen by hydrogen to form water. Air-corrected values of hydrocarbons cited here are probably underestimates due to this effect.

The uncertainties for air correction also make it difficult to be sure of the nitrogen composition of the gas. Values range from 55 - 98% and suggest that nitrogen is a major component of the gas. The analyses show that from 1630-1686m there is a decrease in hydrogen, an increase in nitrogen and a decrease in carbon dioxide to zero.

Low levels of methane (C<sub>1</sub>) were recorded continuously from about 800m to 1686m., with analyses by AMDEL confirming values of up to 8.9% in air. Background methane levels for most of the section ranged from a few hundred to a few thousand parts per million. A carbon isotope analysis of the methane gave values of -50.1 parts per thousand PDB, placing it firmly in the middle of the "gas associated with oil generation" range (Feux, 1977).

Ethane (C<sub>2</sub>) was first detected at low levels in four samples collected from trip gas at 1528m (Davies 1996). Samples collected whilst drilling beneath the low angle fault and within the phyllite/slate complex from 1630-1686m contain increasing levels of ethane plus propane through to octane (C<sub>2</sub>-C<sub>8</sub>).

A histogram of the ratios of C<sub>2</sub> to C<sub>3</sub> show that the gas is typical of 'gas associated with oil and gas provinces' (Fig. 3) and is unlike that from 'non-associated gases' (Nikonov 1972).

Water samples, with a distinctive unusual lime-green colour, from a swab at 1635m, and associated with elevated C<sub>1</sub>-C<sub>8</sub> values, reveal traces of an oil with a high pristane-phytane ratio (Wythe 1996). A high pristane-phytane ratio usually suggests an origin from a source rich in material from higher land plants. This oil is therefore presumably from the the Permian or younger strata and has migrated in.

# Shittim 1C

## Gas Results

(air, nitrogen - CO<sub>2</sub> corrected)

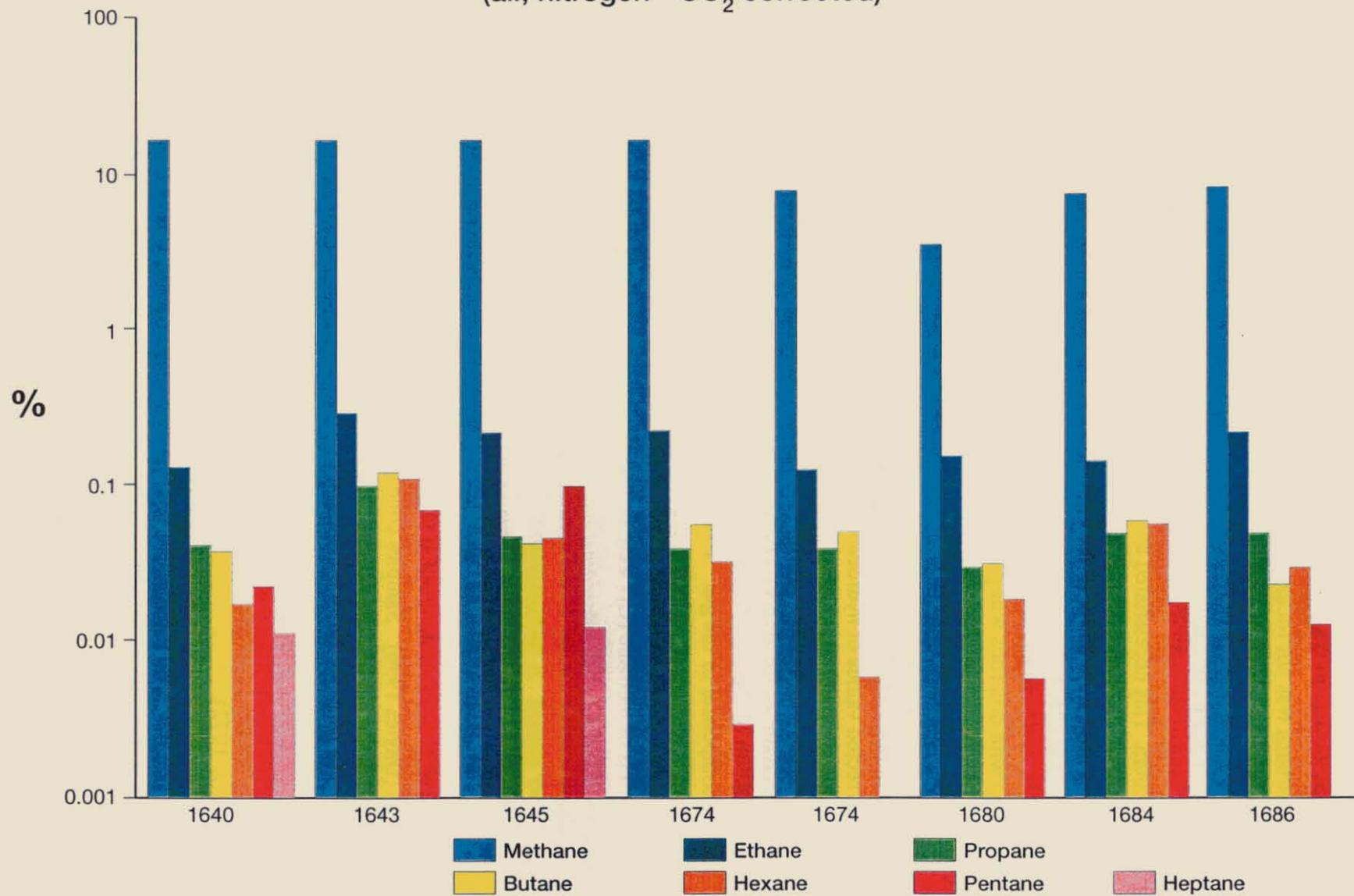


Figure 4

As the rocks containing the oil and wet-gas are metamorphics and are most unlikely to be sources for the hydrocarbons, then both the oil and gas must have migrated in either laterally or from depth. A deep crustal or even mantle origin is likely for the helium.

### HELIUM

Helium is present in eight samples with concentrations ranging from air-corrected values of 0 to 1.62%. Four of the samples have greater values than the economic cut-off value of 0.3%.

A sample from 1680m contains 0.18% (air-corrected) and 42% (air and nitrogen corrected). A sample taken from the choke manifold at 1635m, is probably the least contaminated by air and has an uncorrected helium value of 0.9% and an air, nitrogen and carbon dioxide corrected helium value of 1.2%.

These results strongly suggest the possibility of economic quantities of helium on Bruny Island.

### CONCLUSIONS

The results of gas and trace oil show that the Shittim#1 stratigraphic hole is 'live' with respect to hydrocarbons. The levels of methane and higher hydrocarbons up to C<sub>8</sub> are encouraging. If flow rates continue, then the levels of helium already sampled appear to be economic.

Results from Shittim #1 have been reviewed by independent, international, petroleum consultant Mr Gerald Carne. In a report to the company dated January 1997, he notes *inter alia* that:

- Shittim was drilled for stratigraphic purposes
- the shows are significant and demonstrate that gas, condensate and oil have been generated in the north Bruny Island area
- the identification of gas, condensate, oil, hydrogen and helium provides considerable optimism towards the future of the onshore petroleum industry in Tasmania.

## REFERENCES

- Banks, M.R., Hale, G.E., and Yaxley, M., (1955) - The Permian rocks of Woody Island, Tasmania, *Papers and Proceedings of the Royal Society of Tasmania* 89, 218-230.
- Bottrill, R.S. (1995) - Petrographic examination of rocks from DDH Shittim 1, Variety Bay, Bruny Island. *Record Geological Survey Tasmania* 1995/13,1-5.
- Davies, N. (1996) - Analysis of gas from Shittim #1 (Bruny Island), CSL, University of Tasmania, 1pp
- Feux, A.N. (1977) - The Use of Stable Isotopes in Hydrocarbon Exploration, *Journal of Geochemical Exploration*, 7, 155-188
- Forsyth, S. (1995) - Inspection of core from a hole drilled on Exploration Licence 1/88, North Bruny Island. *Record Geological Survey Tasmania* 1995/08
- Leaman, D. (1987) - Conga Oil Current Exploration Status, Project D, Entrecasteaux, south east Tasmania, Leaman Geophysics, 1-34
- Nikonov, V. (1972) - Distribution of methane homologs in gas and oil fields, *Doklady Akademii Nauk SSSR*, 206 (4) 234-236
- Maynard, B. (1996) - Reservoir Characterisation of the Liffey/Faulkner Gp, Unpublished Honours Thesis, University of Tasmania, 1-81
- Woods, T. (1995) - Petroleum Prospectivity of the Palaeozoic, Southeast Tasmania, Unpublished Honours Thesis, University of Tasmania, 81pp
- Wythe, S. (1996) - AMDEL Report, 2pp

## DATA COLLECTION

A hotwire (readings taken by Mr E. McNally) was used to record hydrocarbons from 880m to 1025m. A gas chromatograph supplied by Colin Higgins and Associates Pty Ltd and operated by Mr M. Purvins under the direction of Mr Higgins was used to measure and plot total gas, hydrogen and C<sub>1</sub> to C<sub>5</sub> from 1025m to 1650m.

Hydrocarbon samples were collected by Mr M. Purvins and Dr C. Burrett, using glass and metal gas collecting containers provided by CSL and AMDEL and analyses were carried out by Dr N. Davies at the Central Science Laboratory (CSL) of the University of Tasmania and by AMDEL Laboratories in Adelaide.

Geological logging was carried out by Mr M. Purvins (Colin Higgins and Associates), by Mr T. Woods, Ms Cheryl-Lee Randell and Dr C. Burrett of the Geology Department, University of Tasmania and Mr S. Forsyth (Mines Department).

XRD analyses were carried out by the Mines Department and porosity and permeability determinations by ACS Laboratories in Brisbane.