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DEPARTMENT OF THE
TREASURY
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GREAT SOUTH LAND MINERALS LIMITED

ACN 068 650 386

MICROFILMED
FICHE No. 014879-

INFORMATION MEMORANDUM

MINERAL RESOURCES
13/98
21/95

SEL 13/98 See folio 31A.

JANUARY 1999 EL 1/88 See folio 35

EL 9/95 See folio 9

EL 21/95 See folio 10

99-4280

GREAT SOUTHLAND MINERALS
SEL 13/98, EL'S 1/88, 9/95 & 21/95
INFORMATION MEMORANDUM

This Information Memorandum is for private circulation only and it is intended solely for the purpose of providing information on the Company's interests and activities to interested parties. The Memorandum is not intended to, and does not, constitute an offer, invitation or recommendation to purchase or acquire any shares in GREAT SOUTH LAND MINERALS LIMITED.

RESPONSIBILITY STATEMENT

This Memorandum dated 5th January 1999 has been issued by Great South Land Minerals Limited (the "Company" or "GSLM") and contains information on the Company and its activities. At the date of the Memorandum the Company has reasonable grounds to believe and does believe that the information and statements contained in the Memorandum are true and not misleading and that this Memorandum contains no material omission and has exercised reasonable care and due diligence to ensure that this is the case.

However, except as required by law and only to the extent so required, the Company makes no representation, warranty or undertaking, express or implied, as to, and accepts no responsibility or liability for, the authenticity, origin, validity, accuracy or completeness of, or any errors or omissions in, any information or statement in this Memorandum.

Except as required by law and only to the extent so required, the Company and its directors, officers, agents, employees and advisors shall not in any way be liable directly or indirectly to any person or body for any loss or damages, costs or expenses arising out of or in connection with this Memorandum (including by reason of the information being inaccurate or incomplete in any way) or by reason of the reliance by any person or body on the information.

The Company has not lodged or registered this Memorandum with the Australian Securities and Investment Commission.

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1. OVERVIEW

Company Background

Great South Land Minerals Limited (the "Company" or "GSLM") is an unlisted public company incorporated in Tasmania in 1995 for the specific purpose of exploring for oil and gas in the onshore Tasmania Basin.

The Tasmania Basin appears to contain all the essential pre-requisites to be considered prospective for hydrocarbons, namely the appropriate juxtapositions of seals, reservoirs and perhaps most importantly, source rocks. Evidence that these source rocks are widely distributed and mature is provided by the extensive record of oil seeps across the basin margins.

The Company and its predecessors have, over a period of 15 years, researched the potential for oil and gas discovery onshore Tasmania and have shown the Tasmania Basin as being similar in geological terms to major oil producing regions such as Oman and the Cooper Basin.

The Company has demonstrated that the Tasmania Basin is prospective for oil, hydrocarbon gases and helium. This positive view has been confirmed successively in reports issued by three independent consulting petroleum geologists (Came, 1992, 1997; Mulready 1987, 1995; Young 1995).

Three years ago the Company embarked on an exploration programme to drill six stratigraphic wells for geological information. Drill site selection was based on surface mapping of geological structures, oil seep occurrences and other factors. Wells were drilled at Variety Bay and Great Bay on Bruny Island, Lonnvale and Pelham, and pre-collars at Hunterston and Bridgewater.

Hydrocarbons were encountered in all cored holes including methane and ethane through to hexane, together with significant levels of hydrogen. In addition, quantities of helium were encountered in the two wells on Bruny Island. Numerous gas samples have been analysed by AMDEL Laboratories in Adelaide and the Central Science Laboratory at the University of Tasmania. A summary of these results can be found in the 1997 Annual Exploration Report issued by the Company, a copy of which is available upon request.

Geochemical analysis indicates the presence of at least two source rock systems, the Permian Quamby Formation (including the Tasmanite Oil Shale) and inferred organic rich units of the Ordovician Gordon Limestone. Geological structures which could host hydrocarbon accumulations derived from these source rocks are anticipated to lie at depth in the basin. These possibilities, however, have not been tested by drilling. Some thirty-five historical petroleum exploration wells (mostly sited near surface seeps) were drilled earlier this century but all were shallow, with a maximum depth of less than 400 metres.

Encouraged by the positive results of its drilling programme and substantial knowledge of the geology of the Tasmania Basin, the Company is proceeding with a proposed prospectus raising and ASX listing which is scheduled to occur during 1999.

If commercial gas reserves can be established in the Tasmania Basin a reliable market exists within the State

Summary of Exploration Objectives and Strategy

The Company currently holds three Exploration Licences (EL 1/88, EL 9/95 and EL 21/95) covering a large part of the Tasmania Basin. The Company has applied for a single Special Exploration Licence, SELA 13/98, covering a total area of approximately 31,000 km² compared to the current area of 12,000 km². The boundaries of this SEL are indicated in figure 1. All existing licences fall within this SEL and will be surrendered on issue of SEL 13/98. The exploration objective of the Company is to discover commercial quantities of oil and gas in the Tasmania Basin.

The Company's current exploration strategy is based on an extensive seismic programme involving acquisition of at least 2000 line km of seismic data, and is designed to:

- determine the extent of the three petroleum systems that have been outlined by the Company;
- define potential petroleum targets;
- test potential targets through a drilling programme.

Mr G.E. Came, independent geologist, whose report forms part of this Memorandum (Independent Geological Report: Appendix 2 and Independent Valuation: Appendix 3) states in his report that: "there is a very good chance that commercial accumulations of oil and gas are present in the sub-surface. Onshore Tasmania appears to have all the criteria of a potential hydrocarbon province. Organically rich, oil prone source rocks have been identified and analysed geochemically. The Tasmanite Oil Shales are of particularly good source rock quality and there is a very good evidence that potential source units lie within the oil window across much of Tasmania"

The independent Geologist's Report, and Independent Valuation dated 7 February 1998 were provided to Gas And Oil Tasmania NL the then proposed float vehicle for Great South Land Minerals Limited.

The Tasmania Basin

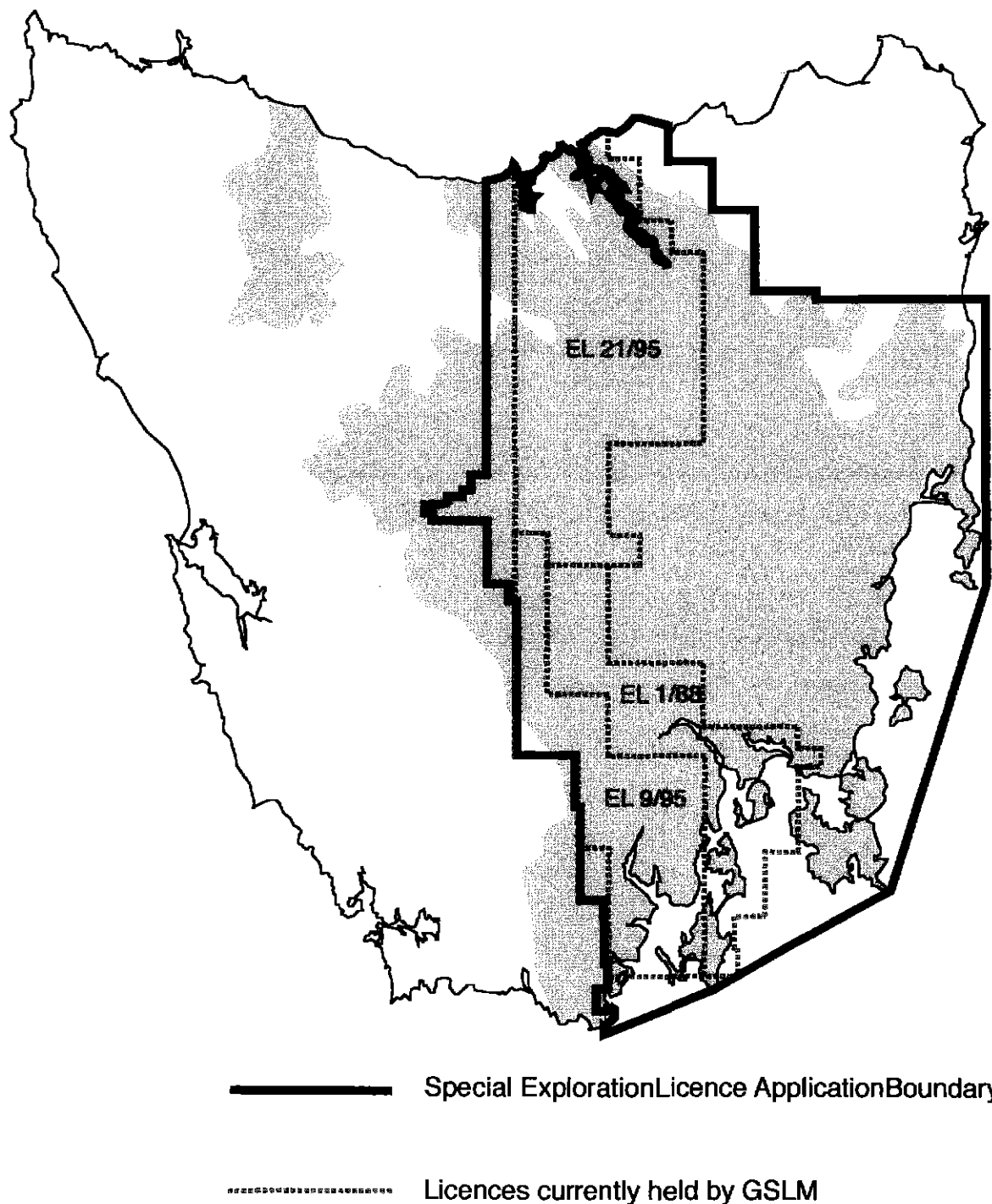


Figure 1 GSLM currently held Exploration Licences and Special Exploration Licence Application 13/98.

Note: SELA boundaries will be subject to minor change subject to negotiation with Tasmanian Development and Resources

2. FINANCIAL DATA

Capital Structure

The company presently has 221,010 ordinary shares on issue and 28 shareholders.

The existing shares were issued at issue prices ranging from \$1.00 per share to \$750.00 per share. All shares issued by the Company during 1998 were issued at a price of \$11.20 per share.

Expenditure Commitments

The non-discretionary expenditure requirements of the company to maintain its licences and core staff amount to approximately \$250,000 per year at present.

3. COMPANY HISTORY

Great South Land Minerals Pty Limited ("GSLM Pty Ltd") was incorporated in 1995. GSLM Pty Ltd was formed to acquire the assets and licences of Condor Oil Investment Trust No. 1. In March 1998 Great South Land Minerals Pty Limited changed from a private to a public company, Great South Land Minerals Limited, by way of a Special Resolution approved by shareholders, in preparation for the proposed public float.

In 1984, Conga Oil Pty Limited was formed to carry out a limited stratigraphic exploration programme on a 50 square kilometre license encompassing wells drilled in 1916 and 1929. In 1988, Conga Oil Pty Ltd was granted an exploration licence, EL 1/88, covering the majority of the Tasmania Basin, an area of over 25,000 square kilometre.

In 1989, Condor Oil Investments Unit Trust No 1 was established to provide tax effective investment opportunities to certain investors and to acquire the assets, exploration licences and permits held by Conga Oil Pty Limited.

Condor Oil Investments Pty Limited, the trustee of the above mentioned trust then commissioned independent consultant reports prior to conducting an exploration programme, the results of which were presented at the 1991 APEA conference. In 1994, the first two stratigraphic wells, Shittim #1 and Gilgal #1, were commenced on North Bruny Island. Unexpectedly, these stratigraphic wells produced significant shows of hydrocarbon gas.

A summary of research and exploration milestones can be found in Appendix 1: 'Research and Exploration History'.

4. DIRECTORS AND SENIOR STAFF

Directors and Officers

Position	Name	Occupation	Entitlement to Shares in GSLM
Chairman:	Dr Henry Askin	Geophysicist	① 9.3 %
Deputy Chairman :	Mr Malcolm Bendall	Explorationist	② 47.23 %
Director:	Dr Gordon Wise	Ophthalmologist	③ 20.8 %
CEO & Director:	Mr David Tanner	Engineer	4.1 %
Technical Director:	Mr Ian Reid	Petroleum Geoscientist	④ 4.7 %
Chief Geologist & Director:	Dr Clive Burrett	Head of the School of Earth Sciences, University of Tasmania	2.0 %
Director:	Mr Gordon Campbell	Economist & Financial Planner	1.1 %

In the lead up to the proposed ASX listing it is likely that the Board will be restructured appropriately.

- ① Henry Askin entitlement to shares that are yet to be issued and allotted.
- ② Interest based on holdings by Condor Oil Investments Pty Ltd, Bendall Family Trust and Logok Pty Ltd
- ③ Personal holding plus interests in Maiden Meadows Pastoral P/L
- ④ Ian Reid entitlement to shares that are yet to be issued and allotted.

Consultants

Petroleum Geologist:	Mr Gerald Carne
Geophysicist:	Dr David Leaman
Geophysicist:	Mr Gregory Kunda
Geophysicist:	Mr Jonathan Knight
Sedimentologist:	Dr Prasada Rao

Information on Directors

Dr Henry Askin:

Henry Askin was the exploration manager with Shell Development (Australia) in Melbourne from 1990 to December 1997, when he retired from Shell at the age of 55. He was responsible for the conduct of the company's exploration programme, with particular focus on growth by acquisition of opportunities which were not only geologically attractive but also met economic thresholds.

Dr. Askin had 24 years service with Shell in Australia, Oman, Norway, the Netherlands and India. During this time he held various positions including seismic interpreter, chief geophysicist, seismic processing manager and immediately prior to returning to Australia, general manager of Shell India Production and Development. He is currently a Director of Askin Nominees Pty Ltd, specialising in upstream management advice.

He holds a Bachelor of Science from the University of Queensland and a first-class honours degree and PhD in nuclear physics from Melbourne University.

He is a member of the Society of Exploration Geophysicists, an active member of the European Association of Geoscientists and Engineers, and a member of PESA.

Dr Gordon Wise:

Dr. Wise is a director of Great South Land Minerals and has been involved with GSLM for three years.

Dr. Wise is a founder of the Tasmanian Eye Clinic. The clinic holds VMO appointments at the Royal Hobart Hospital, St John's Hospital and St Luke's hospital at Launceston. Dr Wise is the Senior Lecturer of Eye Surgery at the University of Tasmania.

With extensive medical and business experience he is involved in a wide range of community services. Dr Wise has served on the Board of the Tasmanian Guide Dogs, St John's Hospital and Anglicare.

Dr Clive Burrett:

Dr Clive Burrett is Chief Geologist for GSLM and is the Head of the School of Earth Sciences at The University of Tasmania. Dr Burrett has studied petroleum systems in over 20 countries and has consulted to oil and gas exploration companies in the Middle East, south east Asia and Australia. He has published over 60 scientific papers and edited the Geology and Minerals Resources of Tasmania, the only reference book available on the geology of Tasmania.

Mr David Tanner:

David Tanner is the CEO and Exploration Manager of GSLM. Mr Tanner has a Bachelor of Engineering Degree from the University of Tasmania, is a Chartered Engineer and holds a Well Control and Blowout Prevention Certificate.

Mr Tanner has a background in mining and civil engineering having worked on major oil, mineral, power and construction projects in Australia and internationally. He is also a fellow of the Australian Institute of Company Directors.

Mr Malcolm Bendall:

Mr Bendall is Deputy Chairman and Director of GSLM. He is a founding Director of GSLM which took over the exploration licenses initially held by his private companies, Conga Oil Pty Limited and Condor Oil Investments Pty Ltd.

Initially employed with BHP Minerals Pty Limited, Mr Bendall discovered a 'source rock' in 1979 which confirmed the likely existence of a petroleum system in Tasmania. He decided to leave his employment to research the potential of oil and gas reserves in the Tasmania Basin and later incorporated the above companies. Mr Bendall has published in an international petroleum journal and worked as a mine manager and drilling supervisor.

Mr Ian Reid:

Ian Reid has more than 15 years worldwide hydrocarbon experience mainly with Shell International, and spent three years in Oman where the geology is similar to the Tasmania Basin. He has worked in six countries as geologist, geophysicist and geochemist. He has worked in Holland and Vietnam as a geologist, New Zealand, Oman and Australia as a geophysicist and in Norway as a geochemist. Upon arriving in Australia in 1997 he established his own consultancy Terra Firma Technology Pty Ltd and is a partner in PetroConsult Pty Ltd.

Mr Gordon Campbell:

Mr Campbell holds a Bachelor of Economics Degree from the University of Tasmania and is a graduate of the Securities Institute of Australia and a graduate member of the AICD. He is a member of the Associated Planners Group and operates as the Tasmanian representative for that financial planning group.

5. EXPLORATION LICENCES

Great South Land Minerals Limited currently holds Exploration Licences which cover a large part of the onshore Tasmania Basin, Figure 1.

GSLM ELs	Area (km ²)	Area (Acres)
EL 1/88	3,288	822,000
EL 9/95	3,121	780,250
EL 21/95	5,529	1,382,250
TOTAL:	11,938	2,984,500

The Company has applied for a single Special Exploration Licence, SELA 13/98, covering most of the Tasmania Basin, as shown in Figure 1. The total net area of SELA 13/98 is approximately 31,000 km² compared to the current area held of 12,000 km². Granting of this licence is contingent on the surrender of GSLM's three current licences. It has been agreed with the Registrar of Mines that the three existing licences will be extended until the granting of SELA 13/98.

Under Part 2, Division 4 section 44-(1) of the Mineral Resources Development Act 1995, SELA 13/98, is to be granted for an initial period of 5 years, with the ability to extend the licence for another 5 years at the discretion of the Minister.

The Minister, by letter dated 23rd December 1998, has indicated his intention to grant the licence on conditions set out in the letter; refer to Appendix 4.

6. RECENT EXPLORATION RESULTS

Following the positive results from wells drilled by the Company on North Bruny Island in 1995, the Directors engaged in further basin research including commissioning of three university honours-level research projects. After drilling Shittim #1 to a depth of 1751m, the stratigraphic drilling programme was extended to one further well site on North Bruny Island, Jericho #1, and four sites on mainland Tasmania:- Lonnavele, Hunterston, Bridgewater and Pelham. These wells have all been pre-collared and cased to depths of up to 336m, with Jericho, Pelham and Lonnavele being diamond cored to depths of up

to 640m. The drill rig is currently on-site at Lonnvale. Drilling has been suspended until seismic results are available.

All wells drilled to date have been stratigraphic (geological strata) holes and have produced encouraging results, including significant shows of petroleum hydrocarbons. Two wells have also recorded significant levels of helium. Details and results of the companies research and drilling programme can be reviewed in the 1997 Annual Exploration Report, copies of which are available on request.

In 1995, the Australian Geological Survey Organisation (AGSO) carried out an extensive offshore seismic programme during a circumnavigation of Tasmania by RV *Rig Seismic*. These data were released in May 1998, and include a complete seismic cross section across the offshore Tasmania Basin close to and parallel with the southern and northern boundaries of SELA 13/98. A short onshore seismic line AGS95-T4 was also shot by AGSO using a dynamite source, and confirmed the ability of the seismic technique to 'see through' the dolerite sills.

7. THE TASMANIAN ENERGY MARKET

The Tasmanian State Government, supported by the Nixon Report, has determined that future energy options for Tasmania must include the provision of a natural gas supply, in addition to the proposed Basslink cable.

It should be commercially viable to reticulate a significant gas find into the major population centres, large industrial concerns, or into gas turbines linked directly to the State electricity grid. The demand for electricity will soon outstrip supply by the Hydro Electric Commission, and there is a growing urgency in the need for a new power source in Tasmania.

The Yolla Joint Venture partners have been given strong encouragement by the State Government in their search for natural gas in Bass Strait, but the news has not been positive to date. The directors of Great South Land Minerals believe that the high cost of exploring and developing offshore gas fields will be difficult to justify in the relatively small Tasmanian market, and any future development in the Yolla Basin will be inevitably linked to Victorian and mainland demand. Conversely, a smaller onshore gas resource would be much cheaper and easier to develop for the local market.

In addition to the existing industrial and domestic market in Tasmania, there is a growing demand from mineral processing companies for natural gas supplies. Examples of these are the magnesite mining ventures currently being proposed by Crest Resources and Golden Triangle Resources, and a mini steel mill based on Savage River iron ore. The energy requirements for the proposed magnesium metal refineries are quoted as being 100 to 130 MW of electrical energy plus 6 to 9 Peta Joules of gas energy per year. This represents a total gas requirement of 12 to 20 PJ (or 300-500 million cubic metres) of gas per year. Based on a current market price of \$2 per GJ, this represents an approximate value of \$24 - 40 million per annum.

In recognition of the need to provide certainty on the question of future gas supply in Tasmania, the State Government has recently signed an agreement with Duke Energy International to conduct a study and make recommendations on alternatives. Recent proposed projects and other activities have substantially increased the potential market for gas in Tasmania, and presents an exciting opportunity to any supplier.

A significant oil and gas discovery in Tasmania would have widespread and positive ramifications for Australia and for the investors in the Company.

8. EXPLORATION PROGRAMME

The Company intends to carry out the following comprehensive exploration and appraisal programme in the Tasmania Basin.

Seismic programme:

The Company's seismic exploration programme of 2,000 kilometres, is focused on identifying structures, facies changes and dolerite intrusions, within the Parmeener Supergroup as well as defining the general architecture of the Tasmania Basin.

This survey aims to fulfill the following objectives:

- 1 To assess the extent and thickness of source and reservoir horizons on these seismic lines and deduce migration pathways.
- 2 Identify the geometry, extent and thickness of dolerite intrusions and their proximity to reservoir and source horizons.
- 3 To identify potential structural traps and define their extent.
- 4 The survey will provide overall definition of the basin architecture.

Field tests will be conducted over the Hunterston drill hole to make use of uphole shot velocities and give stratigraphic control.

Preliminary field reconnaissance has been completed to assess accessibility, topography, vegetation, GPS suitability and thickness of the weathered layer. Background case studies on the masking problems associated with the high velocity dolerite cover is currently being carried out by employees and consultants.

Drilling programme:

Holes at Hunterston and Lonnvale have been drilled to 336 m and 557 m respectively. Subject to confirmation by seismic mapping:

- 1 The Company will complete the stratigraphic hole at Hunterston, which will be the first deep hole in the Central Plateau area. This will give important information on both source and reservoir rocks within the Parmeener Supergroup and also information on the underlying Larapintine Supersystem or on the Tasmania Basin 'basement'. In addition, the hole will give geological and velocity control, to enable fine tuning of the acquisition parameters of the seismic survey.
- 2 Drilling will continue at Lonnvale to gain information on source and reservoir potential within the Quamby and Liffey-Faulkner Groups. The hole will be drilled to below the Parmeener Supergroup to test for source rock and reservoir potential within the Gordon Group limestones (if present).

Following seismic definition and prospect appraisal, suitable structures identified will be drilled.

Regional Basin Study

The Company has participated in developing the Regional Basin Evaluation Programme proposed by the National Centre for Petroleum Geology and Geophysics (NCPGG), (which was submitted to the State Government in October 1998.) The proposal involves regional work to be conducted as a concurrent individual project in co-operation with, but separate to, the detailed prospect level exploration work intended to be carried out by the Company.

It is proposed to enlist the skill pool of the NCPGG to conduct this evaluation as a "public good" project, including the acquisition of the 2,000 line km regional seismic survey and the drilling of a number of stratigraphic wells.

Given project approval, it is intended that a cooperation agreement be concluded between GSLM and the NCPGG to establish inter alia right of access and ensure optimal operational synergy with the exploration programme including seismic survey operations proposed to be carried out concurrently by GSLM.

State and Federal Government funding has been sought for the NCPGG to carry out this regional programme.

9. POSSIBLE RESOURCE ESTIMATES

In any given area, risked reserve estimates are usually derived by aggregating the risked volumes associated with the individual structures identified by subsurface mapping. This procedure is not applicable here due to the lack of subsurface data.

However, some indication of possible unrisked volumes may be given by reference to several named leads identified by surface mapping, and listed in table 1 below:

Lead (Anticlines)	Oil (Million barrels)	Gross Value (\$ million M.O.D)
Hunterston A	9	180
Sorrell - Forcett A	16	320
Bridgewater A	10	200

Table 1 Unproven unrisked reserves volumes

(Parameters: Percent structure charged 30%, net reservoir 35m, average porosity 10%, hydrocarbon saturation 60%, recovery factor 30%, oil price US\$12/bbl)

It is important to recognize that while these figures provide a scope estimate for the named prospects, they cannot be considered as indicative of the overall potential of the entire Tasmania Basin.

Some appreciation of this may be gained by considering other developed basins. Acknowledging that by far the greater proportion of hydrocarbons originally generated from source rocks is lost, studies of petroliferous basins of the world (Hunt 1996) nevertheless indicates that the proportion of oil retained ranges typically from two percent (the West Siberian Basin) to 10% (Arabian/Iranian Basin). It is therefore not unreasonable to suggest that conservatively, one percent of generated hydrocarbons have been retained in the Tasmania Basin.

One particularly rich source rock, the tasmanite unit of the Permian Quamby Formation, is estimated to have an average thickness of 2m and may have reached or exceeded oil generative potential over a large part of the Tasmania Basin. This source rock has the measured capacity to generate approximately two barrels of oil and 2700 cu. ft. of gas per cubic meter. It is only one example of the possible source rocks to be found in the Tasmania Basin. Others include the Permian Liffey and Faulkner Group coals, the Quamby Formation mudstones, organic rich intervals of the Ordovician Gordon Limestone and the Precambrian Smithton Dolomite and Black River Dolomite.

Assuming that a total net source rock interval (over all possible source formations) of 10 meters is present and mature over a basin area of 30,000km², and assigning a generative potential of one barrel of oil and 1300 cu.ft. of gas per cubic meter (i.e. half that of the tasmanite), it may be concluded that the Tasmania Basin has possibly retained three billion barrels of oil and 4Tcf of gas.

It has been noted that the Tasmania Basin is geological similar to parts of the southern Oman Basin and the Cooper Basin. By way of comparison, industry sources estimate oil production of 300,000 barrels per day from the southern Oman Palaeozoic Basin, while the Cooper/Eromanga Basin is estimated to contain a gas resource of 4.5 Tcf (BMR, 1989).

Reference

Hunt, John M., 1996: Petroleum Geochemistry and Geology. Second edition, published by W. H. Freeman and Company, New York

10. REGISTER OF SHAREHOLDERS OF COMPANY

SHAREHOLDER	Number of shares held	Percentage share of GSLM
Bendall Family Trust	49184	22.25%
Condor (Bendall)	44456	20.11%
Maiden Meadows (Wise)	38950	17.62%
Gordon Wise	7165	3.24%
F R English	12500	5.66%
Martin English Trust	10575	4.78%
Martin English	105	0.05%
Logok P/L (Kunda & Bendall)	10771	4.87%
David Tanner	10460	4.73%
Golden Elm (Garrott)	6958	3.15%
PRZ & Associates P/L	5614	2.54%
Clive Burrett	5238	2.37%
ACN 079 067 691 P/L (Young)	3955	1.79%
Gordon Campbell & Assoc.	2805	1.27%
Peter Elliott	2189	0.99%
Barbara Elliott	1700	0.77%
Henry Brookman	1668	0.75%
Ron Gristwood	1450	0.66%
Robert Findlay	893	0.40%
John Hickman	867	0.39%
Exergy P/L (O'Connor)	687	0.31%
David O'Connor	447	0.20%
Graeme Smith	655	0.30%
Julian Amos	515	0.23%
Hazell Bros	500	0.23%
Ken Shepherd	500	0.23%
Cheryl-Lee Randall	54	0.02%
TFT (Ian Reid)	149	0.07%
TOTALS	221010	100.00%

- Note. 1. Chairman, Henry Askin (through Askin Nominees Pty Ltd) will be granted shares giving him a 10% shareholding in the Company over the next 2 years.
2. Director and Technical Director, Ian Reid (through Terra Firma Technology Pty Ltd) will be granted shares giving him a further 5% shareholding in the Company over the next 2 years.
3. Balmoral Capital is earning an entitlement to a 3% shareholding in the Company in compensation for services being provided to the Company.

Table 2 GSLM Share Register, as at 16th December 1998.

Appendix 1 - Research and Exploration History:

- 1916 Bruny Island Oil Company Limited drilled first oil well on North Bruny Island to depth of 456 feet.
- 1921 Mersey Valley Oil Company and Adelaide Oil exploration drilled 20 shallow holes near Devonport, Northern Tasmania
- 1929 Tasmanian Oil Company Limited drilled Johnson's Well on North Bruny Island to 100 feet only.
- 1939 Oil Well Producer Supplies drilled for oil at Danbury Park, Launceston
- 1962/7 Nudac Pty Limited drilled approx. five shallow holes to no greater than about 500m
- 1965 EZ Electrolytic Zinc Company of Australasia Limited conducted a regional geological survey of the Tasmania Basin.
- 1981 Independent Report 'Petroleum Potential Onshore Tasmania' by T.G. Simmons
- 1981/2 BHP Reports "Exploration Reports on EL 37/79"
- 1994 TASGO, a joint Federal and State Government project initiated to expand understanding of Tasmanian mineral and petroleum potential
- 1998 Conclusion of TASGO Project and release of results

Research undertaken by Conga Oil Pty Limited:

- 1984 Consultant Report 'Petroleum Potential of the Gordon Limestone Source Rock' by Dr Clive Burrett
- 1985 Consultant Report 'Petroleum Potential of the Tasmanian Basin' by Jack Mulready
- 1987 CSIRO: Geochemistry of Source Rocks in the Tasmanian Basin
- 1988 Bureau of Mineral Resources: Marine Seismic - Bruny Island
- 1988 Department of Mines: 7 kms Onshore Seismic - North Bruny Island
- 1987/8 Aerial Magnetics over Tasmanian Basin undertaken by Conga Oil
- 1987/9 Department of Mines: Onshore Gravity Survey over Tasmanian Basin
- 1990 Paper to the Australian Petroleum Exploration Association (APEA) Journal "Petroleum Potential within the Tasmanian Basin" by Bendall et al
- 1990 Report on 'Permian Petroleum Potential Onshore Tasmania' by Malcolm Bendall
- 1990 Report "A History of Petroleum Occurrences and Exploration in Tasmania" by Malcolm Bendall
- 1991 Shell Australia: Reprocessed Marine and Land Seismic

Research & Exploration undertaken by Condor Oil Pty Limited:

- 1992 Consultant Report "Evaluation of Oil & Gas Potential in Tasmania" by Questa Australia Pty Limited
- 1990s Numerous Consultant Reports including geochemical analyses by Dr John Volkman (CSIRO)
- 1994 Stratigraphic Well on Bruny Island - Shittim #1 drilled to 1751m & Gilgal #1 drilled to 50m

Research & Exploration undertaken by Great South Land Minerals Pty Limited:

- 1995 Honours Project: Trent Woods "Petroleum Prospectivity of the Palaeozoic SE Tasmania"
- 1996 Honours Project: Ben Maynard "Reservoir characterisation of the Liffey Faulkner Group"
- 1996 Consultancy Engagement with UNITAS, commercial arm of the University of Tasmania
- 1996 Stratigraphic Well on Bruny Island - Jericho #1 pre-collared and drilled to 640m
- 1996 Mr Robert Young, Geologist "Potential of Oil & Gas in Onshore Tasmania Basin"
- 1997 Honours Project: Cheryl-Lee Randall "Palynology and Hydrocarbon Potential of the lower Permian Group Subgroup in Tasmania"
- 1997 Stratigraphic Well at Lonnvale #1 pre-collared and drilled to 557m
- 1997 Stratigraphic Well at Hunterston #1 pre-collared and drilled to 336m
- 1997 Stratigraphic Well at Bridgewater #1 pre-collared and drilled to 252m
- 1997 Stratigraphic Well at Pelham #1 pre-collared and drilled to 503m

**AN EVALUATION
OF THE OIL AND GAS POTENTIAL
OF TASMANIA**

**PREPARED FOR
GAS AND OIL TASMANIA NL (ACN 080 168 314)**

**BY
Gerald E. Carne and Associates**

FEBRUARY 1998

GERALD E. CARNE AND ASSOCIATES
118 HEWITT AVENUE TOORAK GARDENS SOUTH AUSTRALIA
telephone and fax 08 8332 7730

07 February 1998

The Directors,
Gas and Oil Tasmania NL
Level 3
65 Murray Street
HOBART Tasmania 7000

Dear Sirs,

RE EVALUATION OF EXPLORATION INTERESTS TO BE ACQUIRED BY GAS AND
OIL TASMANIA NL

This report has been prepared at the request of Gas and Oil Tasmania ("GOTAS") for inclusion in a Prospectus to be dated on or about 1 July 1998, for the issue to the public of 500 million fully paid shares at a price of 20 cents, and to apply for admission to the official list of the Australian Stock Exchange Ltd ("ASX").



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INTRODUCTION

Gas and Oil Tasmania NL (GOTAS), upon acquiring the petroleum interests currently held by Great South Land Minerals Pty Ltd, will have registered hundred percent interests in Tasmania Oil and Gas Exploration Licences 1/88, 9/95 and 21/95 which together cover 1,193,800 hectares of onshore, eastern Tasmania (Figures 1 & 2). The Licences have only recently been explored for hydrocarbons using modern concepts and practices, but all three are considered prospective for both oil and gas.

Numerous companies have demonstrated an interest in the oil and gas potential of the State's offshore sedimentary basins, but until recently, the hydrocarbon potential of Tasmania's onshore sedimentary basin areas has been largely ignored. Until Conga Oil Pty Ltd, and later Condor Oil Investments Pty Ltd and Great South Land Minerals Pty Ltd, predecessors of Gas and Oil Tasmania, became interested, explorationists considered onshore Tasmania to have little or no hydrocarbon potential. New concepts and interpretations by Conga shed a new light on the oil and gas prospectivity of Tasmania, and the results of recent drilling by Great South Land Minerals have provided considerable encouragement. Although commercial volumes have not been encountered, Great South Land has demonstrated that both oil and gas have been generated in the subsurface of eastern Tasmania.

The first serious and methodical investigations into the petroleum potential of Tasmania were initiated by Conga Oil in the 1980s, financed entirely by its own resources. Conga Oil realised that there was considerable potential for commercial accumulations of oil and gas being present in Tasmania and commenced a programme in 1989 to verify (or deny) their original expectations. Information on reported oil "seepage" sightings were collated and "seep" locations mapped to determine trends (Figure), geochemical analyses were performed to identify and quantify oil and gas source potential, detailed and extensive gravity and magnetic acquisition and interpretation were carried out to better determine the structural configuration and magnitude of Tasmania's onshore sedimentary basins and a small amount of seismic was acquired to determine the feasibility of obtaining good and useable data in Tasmania. All of Conga's findings proved very positive and indicated that onshore Tasmania is prospective for oil and gas. Work carried out, in particular over the past two years, has led to some very encouraging results, including the recovery of small volumes of oil, methane, wet gas, hydrogen and helium, providing a considerable degree of optimism that all of the elements essential for hydrocarbon generation and accumulation are present in Tasmania, and that commercial accumulations of oil and/or gas might be discovered in the near future with an efficient exploration program, a program which is backed by sound scientific concepts and sufficient funding.

Petroleum exploration in Tasmania is still at a preliminary stage. The exploration program planned by GOTAS over the next few years will achieve many goals. Most importantly, it will greatly improve the knowledge and understanding of subsurface Tasmania and this will provide direction as to where GOTAS should intensify their exploration efforts, and hopefully lead to identifying structures which might contain commercial volumes of gas and/or oil.

EARLY EXPLORATION FOR PETROLEUM IN TASMANIA

The first onshore petroleum occurrence in Tasmania was recorded more than 115 years ago. Some 200 examples of possible onshore petroleum seepages and bitumen occurrences in Tasmania have been reported during the past 100 years (Figure 3). From 1915 to 1940, there was considerable exploration for oil in Tasmania. This exploration was inspired by the numerous reports of oil "seepages" across the State and the occurrences of what now appears to be unrelated bitumens on the west coast of Tasmania. To date some 13 companies have actively explored for petroleum in the island State (Figure 4). A total of 127 exploration licences have been held and some 50 shallow boreholes drilled. Almost all of the wells were drilled solely on the basis of petroleum seepages without any real knowledge of subsurface structure and stratigraphy. In spite of considerable early activity, Great South Land is the first

company to drill into the pre-Permian sedimentary sequence (Figure 5). Most wells entered near-surface Jurassic dolerite (subvolcanic) intrusions and many terminated within them. Until recently, there were no valid methods to predict the distribution and magnitude of dolerite stacks in the subsurface. In spite of the above, small volumes of oil and/or gas are reported to have been recovered or noted in several of the early drill holes.

Around the world, oil strandings, seeps and other surface petroleum occurrences have led to the discovery of many significant oil fields. Before success can be met in pursuing the origin of such seeps, however, the explorer must have a good knowledge of the structural history of the basin from which the seeps are originating, of the stratigraphy and structural geometry in the environs of recognised seeps and of the maturation history of potential source rocks. These are elements which have not been observed in petroleum exploration in Tasmania in the past.

GEOLOGICAL HISTORY

Pre-Cambrian quartzites, phyllites and dolomites which are exposed extensively in the central and northwestern part of Tasmania and which may date back as far as 1100 Ma, constitute the oldest rocks in the State (Figure 5). They are almost entirely of sedimentary origin and range from relatively unmetamorphosed subgreenschist facies sequences through to highly metamorphosed amphibolite facies. The sediments were severely deformed and intruded with granites during the Penguin Orogeny which occurred about 725 -750 million years ago. Terrestrial sediments and shallow marine, predominantly quartzose, sandstones and dolomites, deeper marine mudstones and turbidites and basalts were deposited across the deformed surface during late Pre-Cambrian and Early Cambrian time.

A thick sequence of volcano-clastic sediments was deposited during Middle and Late Cambrian time. The sequence includes the arcuate zone of the mineral rich Mt. Read Volcanics, and the Dundas Group, which comprises conglomerates and finer grained clastics of a predominantly volcanic origin, deposited in a basin setting. Local interruptions of conglomerates suggest intermittent uplift of the basin margins. Tensional tectonics gave rise to horst and graben development.

The Ordovician is represented by the Denison and Gordon Groups. The Denison Group comprises a succession of predominantly silici-clastic sediments which were deposited in a spectrum of depositional environments ranging from braided stream and meandering stream through to deltaic and shallow and deep marine and indicate a Late Cambrian to Early Ordovician marine regression, followed by a later Early Ordovician marine transgression. Late Cambrian submarine fans and other slope deposits are progressively overlain by shallow marine and later terrestrial deposits (regression), which are in turn progressively overlain from the southeast by a sequence of shallow marine silts and muds. Highland areas appear to have developed in the western and northwestern part of the State as is evidenced by conglomeratic alluvial fan complexes.

As stream gradients on the uplifted areas decreased, limiting clastic transport, carbonate deposition began to replace clastic deposition. Up to 2000 metres of Gordon Group carbonates overlie the Denison Group clastics in central Tasmania. Shallow marine to platform margin build-ups to deep water (>200m) carbonate and turbidite - graptolitic shale environments are present with rapid lateral and vertical facies changes noted.

The change from clastic deposition to carbonate deposition was gradual and considerable inter-fingering of the two rock types occurs. Dolomitization of inter and supratidal rocks is widespread and believed to have occurred shortly after deposition, although in some cases, rocks have been de-dolomitized. Limestone is richly fossiliferous in many places, the biota indicating deposition in warm, clear, shallow water. Evidence of evaporite producing conditions is seen in several places. Coral gardens appear to have been widespread and

possible back reefs have been identified. Algal "lawns" are also reported to be widespread across the State.

Towards the end of the Ordovician, clastic material advanced rapidly across the carbonate platform, and the Gordon Group carbonates were conformably overlain by predominantly shallow marine silici-clastics of the Late Ordovician - Early Devonian Eldon Group. The Eldon Group comprises three major cycles of sandstone and siltstone, which, with a minor limestone contribution, reaches a thickness over 2000 metres. The greater coarseness of grains and the higher sand to shale ratios of the Eldon Group in western Tasmania, imply a source area in the west of the State. In the eastern part of the basin, basinal graptolitic, turbidite deposits were deposited (Mathinna Beds).

Lower Devonian and older rocks were extensively deformed during the Tabberabberan Orogeny. Approximately northwest to north-northwest trending folds developed across most of the State, but east-west trending folds developed in the northwest. Several laterally and vertically extensive, north-south trending thrusts developed and numerous and relatively large granitoids were discordantly intruded between about 348 and 395 Ma in northeastern Tasmania and 332 and 367 Ma in western Tasmania. Conodont colour alteration indices (CAI) indicate that Lower Palaeozoic sediments were heated to about 300°C adjacent to intrusions in the western part of the State. In central and southern Tasmania, Lower Palaeozoic sediments were heated up to an estimated 100°C, even where distant from the granitoid masses. This major heating event is relevant to the development of petroleum in Tasmania.

During the Late Carboniferous and Permian, glacial deposits (Lower Parmeener Supergroup) were deposited unconformably across the deformed, uplifted and eroded, older rocks. Lateral variations in lithofacies are considerable, particularly in the vicinity of topographic highs generated during the Tabberabberan Orogeny. As a result, rock unit nomenclature varies widely from place to place. Environments of deposition range from glacio-terrestrial (including glacio-lacustrine) to glacio-marine. The basal part of the Supergroup includes the Tasmanites oil shales, glacio-restricted marine deposits which have an extremely high organic content. Permian rock sequences typically are 600-1000 metres thick.

Triassic rocks are represented by up to 750 - 800 metres of fresh water, lacustrine and fluvial deposits of the Upper Parmeener Supergroup. In places, Triassic sediments rest directly on Devonian granites. The lower part of the upper Parmeener Supergroup commonly consists of granular conglomerate and coarse sandstone. The upper parts of the sequence are commonly represented by up to 400 metres of feldspathic and coal-rich sandstone. Dark grey shale horizons and subordinate coal measures occur throughout the sequence. Almost everywhere in Tasmania, rocks of the Parmeener Supergroup are regionally sub-horizontal, although contrary to many published reports, they are in many areas, highly deformed.

Extensive sills of dolerite fed by narrow feeder dykes were intruded during the Middle Jurassic. The intrusions, which presently extend over half of the land mass of Tasmania, were probably related to tensional stresses between continental blocks at the commencement of breakup of the Gondwanaland supercontinent. Within the dolerite swarm there are generally 2 or more stacked sills, each averaging about 200 to 350 metres in thickness. Large scale thrusting affected much of the State.

While thick (up to 8000 metres) accumulations of alluvial fan, fluvial and volcanic sediments were deposited in the newly formed Bass, Otway and Sorell marginal basins which now occupy offshore Tasmania, only a relatively thin succession of non-marine and volcanic sediments were deposited in local depressions across onshore Tasmania. During the Late Cretaceous to Early Tertiary, a series of large scale, north to northwesterly trending horsts and grabens were formed as an extensional regime was set up and Antarctica fully separated from Australia. Up to a kilometre of mainly terrestrial sediments was deposited in the grabens. Syenite intrusions up to 300 metres in thickness and of Cretaceous age are not uncommon. At the end of the Eocene and in the earliest Oligocene, northwesterly directed compression

rejuvenated many of the earlier formed structures, but this period of compression was centred more on the Gippsland and Otway basins to the north. Tertiary basalt flows are common throughout Tasmania with sheets up to 300 metres in thickness.

KNOWN PETROLEUM OCCURRENCES

In 1871, surface tar was reported from Prime Seal Island on the west coast of Flinders Island. Since that time, some 200 reports of possible onshore, liquid petroleum and natural gas "seepages" and "flows" and bitumen occurrences in Tasmania have been documented, most of these before 1970 but some as recent as the late 1980's. Many of these were confirmed by government geologists of the time.

Samples and photographs of some of the tars collected from Tasmania beaches have been preserved in museums and libraries, further validating early reports, but geochemical analyses of beach collected bitumens strongly suggest that they are related to Tasmania's offshore basins. Unfortunately, although numerous, there are mainly only written, unconfirmed reports of seepages and shows in the interior of the State with very few preserved samples.

Considerable enthusiasm is, however, justified by the abundance of early records. The following excerpt is from a report by a consulting geologist to the Tasman Oil Company in 1921, concerning a property in the Derwent Valley:

"I have no hesitation in confirming Black's (Field Manager for the Tasman Oil Company) statement that oil exists at Barn Bluff, gas and oil seepages being plainly manifest during my recent inspection there. Also the geological features of the field generally indicate that large quantities of oil have unquestionably been produced by natural processes of distillation and may be confidently sought for in the Anti-Clines."

Although the word "field" is not applicable and the general tone of the full statement was intended to promote the Tasman Oil Company, reports such as the above provide encouragement that commercial volumes of oil may have accumulated in the subsurface in Tasmania.

Until very recent years, the only paper to look seriously at the possibility of oil in on-shore Tasmania was prepared 75 years ago by government geologist W. H. Twelvetrees. Numerous hydrocarbon occurrences were reported by Twelvetrees in 1915 and in 1917.

Seepages in Tasmania appear to be related to seismic activity as most of the sightings of seepages have been made directly after major earth tremors. Most sightings are within five years of the occurrence of either considerable, long term seismic activity or events greater than a magnitude of 4 on the Richter Scale. There have not been a large number of reports of petroleum shows since 1969 but then Tasmania has not experienced a major earth tremor since 1958. Figure 3 shows the distribution of reported seeps in Tasmania (from Bendall 1990). Northeast - southwest trends in seep distribution are evident from the Figure and these trends correspond very closely to established gravity and magnetic trends, which have been interpreted as representing deep seated (crustal) thrust faults and lineaments (Leaman and Richardson 1990). Seepage appears, therefore, to be related to movements along established fault lineaments during times of seismic activity.

Records are incomplete, but it appears that not more than about 35 boreholes have been drilled in Tasmania with petroleum objectives. Wells have been very shallow; -until Great South Land's drilling in 1996, the deepest being no more than about 500 metres. All wells drilled to date have been initiated solely on the basis of effusive oil or tar seepages, without any real knowledge of subsurface structure or stratigraphy. Nevertheless, oil was reported to have been recovered from a depth of 27 metres at Johnson's Well on Bruny Island in the south of Tasmania, and a small quantity of gas was reported to have been produced from a well at Port Sorell in the north. Reports describe storage of some of the light oil from Johnson's Well

in drums. Minor oil and gas flows were reported from at least two other petroleum boreholes and from at least one water bore. Minor oil was recovered from a Tasmanites oil shale interval from the Ross No. 2 stratigraphic borehole, drilled to 480 metres in 1985 by the Department of Mines and a gas flow was reported by Dr. D. Leaman, from a stratigraphic borehole, while drilling through the Quamby Mudstone at Douglas River. Low volume seepage has been occurring off and on over a large part of Tasmania.

"Seepages" in the Bruny Island region may represent migration updip along the pre Permo-Carboniferous unconformity surface to Jurassic induced faults disturbed during the Tertiary, from the concealed lower Palaeozoic basin some 10 to 20 kilometres to the west (Leaman, 1990).

GEOCHEMISTRY

Potential Source Rocks

Until the late 1980's, explorers and geoscientists had very little knowledge regarding the actual source(s) of the tars, bitumens and natural gas occurrences across the State. The original explorers of New River (circa 1915 - 1925) conjectured, and perhaps correctly, that the Gordon Limestone was the primary source of the abundant oil seeps and tars. Similarities were drawn between the Gordon Limestone and time equivalent, prolific oil producing limestones in the U.S.A. It has been presumed by more recent investigators, however, that oil generated and revealed as "seeps" was derived from the Permian oil shales. Although organically very rich and often oil saturated themselves, these rocks were not, however, considered to have ever been sufficiently buried to achieve temperatures sufficient for the generation of significant hydrocarbons to occur.

Today, as a result of considerable work initiated primarily by GOTAS and its predecessors and analyses carried out by CSIRO, the BMR and AMDEL, there is considerable evidence that carbonates, shales and evaporates of the Gordon Limestone Group and shales and coals of the lower Parmeener Supergroup all have the potential to have generated significant volumes both oil and gas. Other known potential source rocks include Pre-Cambrian shales and dolomites.

The Gordon Limestone was formed under shallow water, marine conditions. Dark graptolitic shales and evaporite sequences within the Group should provide excellent, oil prone, source potential. The frequent occurrences of pyrite in conjunction with carbonaceous shales implies an anaerobic and toxic environment, which is vital for the preservation of algal and other oil prone organic material.

Most "seepage" sites are adjacent to or overlie areas known to contain Ordovician and older rocks, or are related to drainage catchments containing such rocks (Figure 6). Organic geochemistry reveals a very close similarity between hydrocarbons extracted from Ordovician Limestones from Ida Bay and those obtained from the surface sediments at the drilling site of the Johnson's Well on Bruny Island. Geochemical analyses of two soil samples from Johnson's Well revealed only traces of hydrocarbons. The low concentrations of petroleum derived hydrocarbons indicate that petroleum seeps are no longer active at Johnson's Well, but provide some evidence for their former presence. These analyses indicate that neither the oil from Bruny Island, nor the coastal bitumens were generated from the Tasmanites oil shales.

Hydrocarbons isolated from Ordovician limestones from Lune River and Queenstown show distributions of biomarkers characteristic of mature crude oils. Although the Gordon Limestone has been identified as the most likely source for the hydrocarbons in southern Tasmania, it is not known whether it remains a source across the entire State. The very limited number of samples analysed precludes authoritative conclusions and judgements to be made. Considerably more investigations must be initiated.

The Parmeener Supergroup also includes intervals of organically rich, oil and gas prone source rocks. Very little work has been completed on the organic petrology of the Parmeener Supergroup, but that which has been completed indicates the unit is highly variable both in a lateral and a vertical sense, with total organic carbon values (TOC's) ranging from just a trace, to more than 30 percent in oil shales and coals. Organic quality too, is highly variable with some samples particularly rich in exinite (oil prone) and other samples consisting of predominantly inertinite (neither oil nor gas prone). Sampling within the Parmeener Supergroup has been very limited to date (17 samples from Douglas River, Ross River and Tunbridge borehole No. 2, analysed by BMR) and samples on hand may not be representative of the unit as a whole. Nevertheless, results are very encouraging.

It appears the Tasmanites oil shales provide the best potential source interval in Tasmania. The oil shale had been mined at Latrobe from 1910 to 1932, with artificial distillation resulting in the recovery of 939,221 litres (248,114 gallons) of oil. Total organic carbon (TOC) values within the Tasmanites range up to 30 percent and higher and even on world standards, provides an exceptionally rich, Type 1, oil prone source rock. The Tasmanites in north and northwest Tasmania consists of a single celled algae known as Tasmanites punctatus, which has a H/C ratio of about 1.5 and an O/C ratio of about 0.12. It may thus be considered as representing the optimum type of oil source rock.

Banks (1968) described oil shale and cannel coal from the top of the Mersey Coal Measures. These potential source rocks are similar to the Tasmanites oil shales in their thin and patchy distribution and in their organic richness.

A rock sample of lower Permian mudstone from Poatina, and stratigraphically related to the Quamby Mudstone, was analysed by CSIRO. The sample was grey in colour and had a noticeable petroleum-like odour when broken open. The sample was found to contain considerable amounts of hydrocarbon having the characteristic distribution found in mature crude oil. Biomarkers were distinctly different from those found in Ordovician carbonates and it is believed (Volkman 1989) the Quamby Mudstone hydrocarbons were indigenous to the rocks from which they were extracted. Thin, oil shale intervals are commonly present with the Quamby Mudstone sequence. A borehole drilled beside the Douglas River Bridge as part of the Tasmanian Department of Mines coal assessment program flowed gas during penetration of the formation (Leaman - pers comm). Geochemical analysis indicated the formation to be geochemically mature, albeit only marginally mature, at the Douglas River location.

Dark grey shale and subordinate coal horizons occur throughout the Parmeener Supergroup sequence and these too could offer considerable source potential.

Unusual tars obtained from Bridgewater and other locations appear to be derived from higher plants.

Oil obtained from an oil seep near the Lonnvale 1 well, has been found to be migrated, lightly biodegraded, sweet (low sulphur) crude, derived from the Tasmanite oil shale.

ORGANIC MATURATION

There have been numerous misconceptions concerning the maturity of organic material contained in potential source rocks in Tasmania. Many investigators believed the early Palaeozoic sequence constituted effective basement, having neither reservoir nor source potential.

Due to insufficient depths of burial, Parmeener Supergroup sediments were considered to be nowhere sufficiently mature for the generation of significant volumes of oil and/or gas. The high organic content of the Tasmanites oil shales was well known, but explorationists

considered the unit was everywhere insufficiently mature for the generation and release of significant quantities of hydrocarbons.

In more recent years, as initial geochemical data was obtained, researchers became aware of the excellent source potential of Ordovician and older sequences across Tasmania, but another misconception led many to believe that hydrocarbons generated from within the early Palaeozoic sequence would have escaped when strata were deformed and uplifted, and anticlinal closures breached during the Devonian Tabberabberan Orogeny. These researchers believed that hydrocarbon generation from the Early Palaeozoic and Pre-Cambrian sequence would have been initiated in response to high heat flows introduced into the basin during the orogeny. With no effective seals, migrating and entrapped hydrocarbons would have found their way to the Earth's surface where they would have been destroyed by bacterial and weathering action. The particularly high basin temperatures were interpreted from conodont colour alteration index (CAI) values from Early to Middle Palaeozoic marine carbonate rocks of western and west central Tasmania. Low vitrinite reflectance values from unconformably overlying Parmeener Supergroup sediments suggested that the major heat input into the pre-Carboniferous sequence occurred prior to Parmeener Supergroup deposition.

Isograds of CAI values in western and northwestern Tasmania form an arcuate belt following the outcrop of the early Palaeozoic rocks around Pre-Cambrian metamorphic basement rocks (Figure 6). Regional metamorphism in western and northwestern Tasmania is interpreted to have been in excess of 300°C immediately adjacent to igneous intrusions. Low CAI values, however, in the south west and central Tasmania, suggest that if Gordon Group source rocks are present at depth, and there is strong evidence that they are, they are currently within the oil and gas windows. Maturation modelling suggests that it is unlikely that hydrocarbons would have been expelled from these more basinward sediments (at least from the upper part of the Gordon Group) until after a considerable and protective Parmeener Supergroup cover (seal) was in place. Over large parts of the State, therefore, the Gordon Group offers considerable hydrocarbon potential.

Until very recent time, no mature source rocks of Carboniferous - Permian age were thought to exist in Tasmania. Recent investigations by CSIRO, the Bureau of Mineral Resources in Canberra, the Tasmanian Department of Mines, Amdel Core Laboratories and others have demonstrated that organic sediments within the Tasmania Basin are in the oil window, with vitrinite reflectance values ranging from 0.7% (lower oil window) at the edge of the basin to 1.35% (upper oil window) towards the centre of the basin. The 1.35% value was estimated on the basis of spore colouration interpretations. The Methyl Phenanthrene Index (MPI) measured from the aromatic fractions of hydrocarbons extracted from Permian rocks in the basin, indicates a similar range of maturity for the basin. One might ask how this can be, given relatively shallow depths of burial experienced by the Upper Palaeozoic sediments. Tasmania currently has a relatively high heat flow which is up to twice the world average of 60 mW/M². Present geothermal gradients onshore Tasmania are 30 - 40°C/km and up to 60° and 70°C/km (Summons 1981).

Gravity and magnetics and surface outcrop data, and apatite fission track data, and most significantly, recent apatite fission track thermochronology investigations by O'Sullivan and Kohn (in press), indicate 3-4 km of Jurassic to mid Cretaceous sedimentary succession covered much of Tasmania prior to mid Cretaceous rifting. The cover, much of which has been removed through subsequent erosion, placed much of the Tasmania Basin in the oil window prior to the mid Cretaceous.

All of the geochemical evidence to date indicates that within Tasmania there is a wide range of maturation levels, from early mature to extremely over mature (post wet gas preservation), for Ordovician and older sediments. Parmeener Supergroup sediments appear to range from immature to marginally mature on the edges of the Tasmania Basin, to fully mature for peak generation of oil and gas at the centre of the basin. This makes much of onshore Tasmania prospective for hydrocarbons.

RESERVOIRS

Very little definitive data is available on the reservoir potential of the sedimentary rock sequence in Tasmania, but several potential reservoirs are present within the Gordon 'Limestone' Group and the Parmeener Supergroup.

A Lower Palaeozoic and Upper Pre-Cambrian sequence extends as far east as Ross, Oatlands and Sorell. There is thus, a thick (up to several thousand meters) and geographically extensive, sedimentary sequence in which well developed reservoirs should be present.

Coral shoals appear to have been common across much of Tasmania during the Upper Ordovician, but to date no authentic bioherms have been identified. C. F. Burrett (Summons T. G. 1981) postulates that the coralline facies at the top of the Benjamin Limestone in the Florentine Valley was a backreef, with a yet to be discovered foreereef to the east. Foreereef development would be anticipated and would have migrated westward (landward) from the southwest with the westward transgressing sea.

Thick sections of Ordovician reef and shelf limestones appear to have been re-crystallized (at Lune River at least) and have high porosity, where the limestone was exposed during the Tabberabberan Orogeny, and karst and weathering porosity was developed.

Secondary dolomites are known from several places in the Gordon Group. At Lune River, secondary dolomites were formed through the action of hypersaline brines which developed in supratidal depressions. The dolomite at Lune River is porous and vuggy.

The Eldon Group comprises alternating sequences of sandstone and siltstone with minor limestone. The Group has a high sandstone to shale ratio and should therefore offer considerable reservoir potential. No data relevant to its porosity or permeability, however, is available.

Until very recently, it was believed that reservoir conditions within the Permian/Triassic sequence were virtually nonexistent. Several potential reservoir intervals are, however, present. These include the Liffey and Risdon Sandstones.

The Permian Liffey/Faulkner Group comprises predominantly fluvial and coastal, commonly coarse grained sandstones, that provide important reservoir objectives. The unit is the first semi-regional, coarse, clastic unit (? reservoir) above the Tasmanites oil shales. A 'reservoir characterisation' study, recently (May 1996) completed as part of a Bachelor of Science Honours degree by a student at the University of Tasmania, addressed the reservoir potential of this unit.

Sandstones which constitute the Malbina Formation, the Triassic Ross Sandstone and the Permian Risdon Sandstone should also be considered as potential reservoirs although artesian flows through these units are uncommon. Porosity - permeability data is apparently totally lacking for these units. A strong hydrocarbon smell is present in outcropping Risdon Sandstone at Risdon, a suburb of Hobart after which the unit was named. Basal Permian conglomerates and tillites provide further potential.

SEALS

Intraformational seals are abundant within both the Lower Palaeozoic (Gordon Group) and Upper Palaeozoic (Parmeener Supergroup) sequences. There has been, however, considerable concern that anticlines formed during the Tabberabberan Orogeny would have been breached during an extensive period of erosion which accompanied and followed the orogeny. The concern is that hydrocarbons generated during this time would have escaped to the Earth's surface, there being no effective vertical seals to hold any significant accumulations. The concern appears to be largely unwarranted.

The thought process which generates the concern implies either that the vertical succession of pre-Permian rocks constitute one continuous, extensive and thick reservoir, or that all potential reservoirs have been breached. Both of these possibilities are very unlikely. The breaching of Devonian generated anticlines has been documented in outcrop, but the degree of breaching is expected to vary according to the relative position of structures in the basin and the degree of structural relief imposed upon the anticlines as a result of the orogeny.

Up to 420 metres of shale, siltstone and mudstone (Bell Shale) has been recognised at the top of the Eldon Group (Baillie 1989). Its original actual thickness is unknown but may have exceeded 1500 metres. This would provide a competent and conformable seal where not entirely eroded away, for underlying reservoirs. It is quite possible and perhaps even probable, that the Bell Shale has been preserved on some of the lower relief anticlines in the centre of the basin. The formation is certainly present in synclines and on the flanks of anticlines over at least parts of Tasmania. Anticlines truncated beneath the Pre-Permian unconformity surface may form effective trapping mechanisms with the Bell Shale providing a lateral seal and Permo-Carboniferous tillites, and fine grained clastics providing the vertical (top) seal. Maturation modelling suggests that over much of Tasmania, the main phase of oil and gas generation from potential source rocks of the Gordon Group would not likely have been reached until after Permian deposition had commenced.

Late Permian and post Permian siltstones, shales and marls and Jurassic dolerites present imposing semi-regional top seals for the Parmeener Supergroup reservoirs.

STRUCTURE

Pre-Permian rocks are concealed across more than half of Tasmania and the described source rocks and reservoir rocks of the Gordon Limestone Group are rarely exposed where the Parmeener cover is absent. Pre Cambrian rocks are exposed in the west and Ordovician to Devonian turbidites are exposed in the northeast. Borehole data is limited to the east of the State and very few wells have fully penetrated the Parmeener Supergroup cover. Over much of the State, the geology of the pre Permo-Carboniferous sequence is unknown. Gravity and magnetics interpretations by Dr. D. E. Leaman indicates Ordovician to Devonian sediments to be present under a relatively thick Parmeener and Tertiary cover in central Tasmania.

Only a paucity of seismic data is available and the limited onshore record sections acquired have been generally poor. High velocity surface problems coupled with stacked, near surface Jurassic dolerite sheets have made it very difficult to obtain good seismic data. Acquisition and processing problems associated with such difficult conditions are now being assessed and it is hopeful that all major difficulties can be overcome. The inability to acquire good quality seismic data beyond the base Parmeener unconformity would be of considerable concern.

Fair seismic data has already, however, been obtained in some locations with clear reflections being observed over many seconds of record. At one locality, records to two-way times of 11 seconds (mantle levels) were obtained. Most records, however, appear blind for times in excess of 300 - 900 ms, or below the base Parmeener unconformity.

Gravity and magnetics, where properly integrated, have a proven record for subsurface structural assessment and are together ideal for targeting areas for more detailed (and considerably more expensive) seismic reconnaissance.

Preliminary and in places detailed gravity and magnetics analyses and interpretations have been made by Dr. Leaman for the eastern part of the State. Although much of Dr. Leaman's work remains provisional, the gravity and magnetics data in association with surface geology, has delineated several areas of particular merit, all of which include Silurian and/or Ordovician rock sequences. It is evident that pre-Devonian rocks are highly folded. Dr. Leaman's work has established large scale, basement involved thrust sheets (Figure 7). In

some locations, rock sequences appear to be repeated more than once as a consequence of the thrusting. Overthrust structures have subsequently been established by drilling. Structures are complex and considerable work is required to sort the main features out. In western Tasmania, westward trending Devonian thrusts have overprinted pre-existing east facing thrusts.

Evidence is strong that Cambrian and Ordovician sequences have been preserved beneath the Upper Carboniferous unconformity in numerous locations and in places. Gordon Group carbonates are interpreted to be thick, particularly in synclinal positions. Interpretations indicate that in southern Tasmania, Ordovician - Devonian rocks overlap older Palaeozoic and Precambrian rocks and may be traced to outcrops of the Gordon Group in the Picton River area.

Descriptions in the literature suggest that Parmeener Supergroup (Permian - Triassic) sediments are essentially flat lying and undeformed. Generally speaking, and in comparing the Supergroup with the highly deformed and underlying Early Palaeozoic succession, this may be considered true. Nevertheless, Permo-Triassic sediments have been considerably deformed and effective trap mechanisms involving these sediments are expected.

Supratenuous folding (drape) of Permian sediments across on undulating pre-Permian unconformity surface would generate passive structuring through differential compaction of sediments. On a much larger scale, Jurassic compression resulted in extensive, large scale thrusting which involved Permo-Triassic sediments.

Structures formed during Devonian, Jurassic and other times were reactivated during periods of Tertiary movements. The emplacement of igneous intrusions at various times throughout Tasmania's geological history further deformed the sedimentary sequence.

Tasmania appears to be a typical fold-thrust province. Several minor and large scale thrusts are stacked and the entire overthrust system has been folded and intruded, and in places reactivated.

MATURATION MODELLING

Maturation modelling requires a knowledge of both the depositional (and erosional) and the geothermal history of a basin. Our current knowledge of these two entities in Tasmania is poor, but nevertheless, some meaningful findings have resulted from the modelling which has been performed (Figure 8).

The depositional history of onshore Tasmania remains clouded due to the considerable erosion which has taken place along basin edges, and the concealing nature of Tertiary and upper Permian sediments in the centre of the basin. Seismic coverage is almost nonexistent. There have been several periods of deformation which have affected the basin, but it remains uncertain as to how much sediment may have been removed through erosion during tectonic activity and through Permian glaciation. G. Carne and Associates is not aware of any complete or even nearly complete measured stratigraphic sequences in the basin. Gravity and magnetics along with measured outcrop intervals and a minimum amount of bore-hole information provide considerable insight regarding current stratigraphic thicknesses. It still remains difficult, however, to gauge the amount of sediment which may have been removed during the Tabberabberan Orogeny, the Cretaceous uplift and during the latter part of the Tertiary. Up to three (3) kilometres is suggested by Hills et al (APEA)

There is considerable evidence to suggest that geothermal gradients in Tasmania have remained high since at least Devonian time and that there have been several major heating events. The degree and extent of heating episodes remain largely unknown.

In most basins, a good impression of basin heatflow can be obtained through comparing results of maturation modelling with results obtained through quantitative geochemical analyses. One must first have some knowledge of the depositional history of the basin.

Very little geochemical work has been carried out to determine the maturation of source rocks and in particular pre Tasmania Basin (Late Carboniferous to Triassic) source rocks in Tasmania, certainly not enough to answer the required questions. The analyses which have been completed do, however, demonstrate that there is a considerable volume of potential source rock in Tasmania within the oil window and they also provide some standards on which to evaluate the results of maturation modelling.

Maturation modelling indicates that over much of Tasmania, source rocks within the Ordovician Gordon Group would not have reached the conditions required for significant generation and release of hydrocarbons until after deposition of a protective Permo-Carboniferous cover. Anticlines breached during the Tabberabberan Orogeny would most probably not have contained any significant volumes of oil or gas at the time of breaching. Modelling also supports the results obtained from direct geochemical analysis in indicating that the Tasmanites oil shales should be sufficiently mature for the generation and release of large volumes of oil over much of central Tasmania. The abundance of Type I algae Tasmanites punctatus in the Tasmanites oil shales suggests that oil would have been generated from this unit at relatively low temperatures. Conditions suitable for the main phase of oil generation and expulsion from Permian source rocks are interpreted to have been achieved during Cretaceous time.

Gordon Group source rocks, where overlain by a full sequence of Eldon Group and younger sediments, are probably matured beyond the wet gas preservation deadline and are therefore probably prospective only for dry gas (methane). In such situations, however, oil and wet gas generated from the Gordon Limestone while the intra-group source rocks were at shallower depths of burial may have been preserved through upwards migration along fracture and fault planes and unconformity surfaces, into stratigraphically younger and less deeply buried rocks. Towards and on the edges of the main basin, the full post Gordon Group sedimentary sequence is not present and Gordon Group source rocks would consequently be less mature, and in places remain prospective for oil and wet gas.

PLAY CONCEPTS

As there are numerous and varied potential reservoir objectives and source rocks ranging in age from Pre-Cambrian to Triassic, as the geothermal history of source rocks, in particular those within the Gordon Group, varies considerably, both regionally and locally, across the State and as structuring of the stratigraphic sequence has been complex, there being at least three significant periods of structural deformation which affected the basin, many possible play concepts can be envisaged.

Both structural and stratigraphic hydrocarbon trapping mechanisms are foreseen. Conventional and simple closed anticlinal structures up to four kilometres long and involving Ordovician to Devonian carbonates and clastics, are believed to occur at the base of the Parmeener Supergroup unconformity. Similar or larger closures should be present beneath major thrust surfaces and these should include sequences of up to four kilometres in thickness. Where Gordon Group carbonates were folded, uplifted and exposed to the atmosphere during and immediately after the Tabberabberan Orogeny, palaeo-karst reservoirs may be expected beneath Parmeener Supergroup seals. Subconformity karsts and sandstones could provide significant hydrocarbon trapping potential.

Hydrocarbon trapping potential of Parmeener Supergroup sediments is seen where reservoir/seal pairs drape across Devonian induced horst blocks and other topographic highs.

Conventional anticlinal development is also seen in Parmeener Supergroup sediments, the result of Jurassic and Tertiary earth movements.

Specific prospect definition will not, however, be possible until more knowledge about the subsurface stratigraphy of Tasmania is acquired and until better, more definitive, structural control is obtained. With the exception of the "seeps" themselves, there is insufficient geological information at this time to initiate or even to consider a wildcat drilling program. The origin of the hydrocarbons seen as "seepages" at fault exposures is unknown. Hydrocarbons may be migrating some considerable distances, both laterally and vertically along fault planes towards the earth's surface where they are revealed as "seeps". It is essential that boreholes be drilled specifically for the purpose of obtaining much needed information on source rock and reservoir quality, on the stratigraphic succession in general and on the structural configuration of the subsurface sequence. The positions of the proposed stratigraphic boreholes will be determined largely on the basis of reported hydrocarbon seeps and gravity and magnetics results. Stratigraphic drilling should considerably reduce the risk of future, more expensive, conventional, Wildcat drilling.

There is considerable evidence to suggest that the most prospective part of Tasmania for oil and gas will be the east central part (Central Plateau) of the State. The evidence comprises gravity and magnetics data and extrapolations of surface geology. There is, however, absolutely no subsurface information for this part of the State. No boreholes have been drilled, even to shallow horizons. Borehole information is essential, not only to provide stratigraphic, geochemical and structural information, but also to provide control points for seismic velocity information. Processing of acquired seismic has been hampered in part by a lack of subsurface velocity knowledge.

NEAR-SURFACE DOLERITES AND OTHER IGNEOUS INTRUSIONS

Near surface dolerite intrusions and feeder dykes have perhaps more than anything else discouraged oil and gas exploration in Tasmania. Several thousand cubic kilometres of magma formed what might be perceived as a nearly continuous body through the Permian and Triassic sediments over almost all of the State. In places up to three dolerite sills may have to be penetrated while drilling within the Parmeener Supergroup sequence, the lowest of these being located near the pre-Permian unconformity.

The Jurassic dolerites reflect considerable seismic energy in the upper surface, leaving predominantly low frequency energy to define structurally deeper horizons. Reflector shadows appear beneath the dolerites. The high velocity inherent to the dolerites along with topographic effects, impose considerable static difficulties. Seismic processing problems are being assessed. It is simply a matter of not being able to see (seismically) through the dolerite bodies which may each be as thick as 200 - 350 metres. The problem can theoretically probably be overcome through sophisticated seismic processing and acquisition techniques.

Expert gravity/magnetics interpretation can resolve where the dolerites are of least significance and this will assist the location of both future seismic lines and well locations. A regional seismic line recently acquired by the Australian Geological Survey Organisation, shows that structural and certain stratigraphic features of the underlying sedimentary sequence can be delineated through the dolerites. It is very probable that modern seismic data will be able to adequately resolve sediment thicknesses and trap configurations beneath the dolerite layers.

Stocks of porphyritic syenite and a radial dyke system of various porphyries occur at Port Cygnet and are thought to be of Cretaceous age. Tertiary basalt flows are common throughout Tasmania with sheets up to 300 metres in thickness.

The abundance of igneous intrusions throughout the stratigraphic sequence across much of Tasmania is on first impression discouraging, but the major portion of the sedimentary section appears to have been relatively unaffected by the dolerite intrusions, contact metamorphism being of minimal proportions. It may be viewed that the high heat flows associated with the intrusions were necessary to bring Permian source rocks to a state of organic maturity and the intrusions themselves would have generated structures capable of trapping migrating hydrocarbons.

RESULTS OF RECENT DRILLING

The stratigraphic boreholes drilled by Great South Land in 1995 - 1997 have all yielded encouraging shows of hydrocarbons. All have been located on surface defined features and all have been fully cored using slim hole drilling rigs.

The most significant well to date has been Shittim 1 on Bruny Island (EL 1/88) which was drilled to a depth of 1751 metres. The well, commenced in 1995, encountered methane (C1) gas shows throughout much of its penetration. Ethane (C2) was first encountered at 1528 metres and higher hydrocarbons (propane [C3] - octane [C8]) first recorded at 1630 metres. Traces of oil were reported from recovered water samples and crushed core. Relatively large percentages hydrogen and helium were measured in the large number of analysed gas samples.

Jericho 1 was drilled by Great South Land near the Shittim 1 well on North Bruny Island (EL 1/88). The well encountered a dolerite sill at 255 metres and drilling was terminated in altered doleritic rock a depth of 640 metres. Significant levels of gas comprising mainly hydrogen, methane and helium were recorded throughout the dolerite interval, with hot wire readings reaching 100 units and averaging about 20 units. Carbon isotope analysis indicates a thermogenic origin for the methane.

Four wells drilled in the central Tasmania Basin have been precollared to depths of about 300 metres on fault block (Lonnvale 1 and Pelham 1), domal (Hunterston 1) and anticlinal (Bridgewater 1) structures.

Lonnvale 1 is being drilled in EL 9/95, on a fault block near the settlement of Lonnvale. The borehole is currently at a depth of 557.2 metres, in fault breccias beneath a dolerite sill, and less than 200 metres to sandstones of the Permian Faulkner Group which provide the primary reservoir objective. Cuttings gas readings of 20 - 50 units with a high proportion of hydrogen, were recorded while drilling through fractured dolerites in the basal 365 metres of the drilled interval. Gas-peaks of 300 units were recorded at 220 metres and 430 metres.

Pelham 1 is being drilled on a fault block in EL 1/88. The well was precollared to 300 metres and is currently at a depth of 370 metres in a Liffey Group sandstone. Gas readings up to 80 units were recorded when coring commenced at 300 metres, but dropped off to less than 5 units as drilling progressed. Readings of about 10 units were recorded over the basal 35 metres of the bore hole.

Hunterston 1 is situated near the centre of the Hunterston Dome which was mapped in 1949. The hole has been precollared to a depth of 336 metres and will be cored to basement late in 1998.

Bridgewater 1 is an anticlinal structure located in EL 1/88. Surface casing has been set at 220 metres and coring of the hole to basement is to proceed after completion of Lonnvale 1 and Pelham 1.

Sorrell 1 is to be drilled near the centre of the Forcett structural dome on an extension of EL 1/88 (in application).

SIGNIFICANCE OF GAS SHOWS

Gas shows of up to about 100 units (equivalent to 1 percent) have been recorded while drilling through tillites, fractured dolerites and phyllites at Shittim 1, carbonates, sandstones and dolerites at Jericho 1, dolerites and mudstones at Lonnavale 1, and carbonates and sandstones at Pelham 1. Gas analyses carried out by AMDEL indicate, in addition to the hydrocarbon gases, high proportions of hydrogen in all four wells, and helium in the Bruny Island wells. Hydrocarbons comprise mainly methane with minor wet gas and oil.

A commercial or even marginally commercial gas accumulation has not been found, but one would not be expected at such an early exploration phase. It may prove that commercial onshore hydrocarbon accumulations do not exist in Tasmania, but it appears that it is highly probable that they do. The presence of shows in each of the wells that have been drilled indicates that hydrocarbon gases and oil have been generated within the onshore Tasmania sedimentary basin, and this should be considered as both significant and encouraging. Isotopic analyses indicate the methane recovered from drilling on Bruny Island is of thermogenic origin.

The presence of large proportions of helium, in gas recovered from recent drilling operations on Bruny Island is exciting. Should larger volumes of gas with higher deliverabilities be found, the helium content could provide a substantial cash flow to GOTAS. The source of the helium at Jericho and Shittim remains unknown. It is probable the helium originated through radioactive decay of Precambrian (basement) rocks.

CONCLUSIONS

Tasmania is prospective for oil and gas; there is no longer any reason to say otherwise. Although it remains uncertain as to whether or not significant hydrocarbon accumulations will ultimately be found, evidence suggests that there is a good chance that commercial accumulations of oil and gas are present in the subsurface. A carefully planned and methodical exploration program should reveal optimum drilling locations and hopefully identify accumulations of significance.

Onshore Tasmania appears to have all of the criteria of a potential hydrocarbon province. Organically rich, oil prone source rocks have been identified and analysed geochemically. The Tasmanites oil shales are of particularly good source rock quality and there is very good evidence that potential source units lie within the oil window across much of Tasmania. Considerable work remains to be carried out on reservoir distribution and quality, but several potential, porous reservoirs have already been identified. Permeability relationships must still be verified. The integrity of seals has been challenged many times in the past, but there appear to be an abundance of seals. Structures have not been adequately defined, there being very limited seismic control in Tasmania, but the Tasmania Basin (in particular the Early Palaeozoic basin which underlies it) appears to be a typical thrust-fold province which should offer a broad spectrum of structural and stratigraphic trapping possibilities. Maturation modelling indicates that structures were formed prior to the primary periods of peak oil and gas generation.

Numerous past reports of oil and gas seepages provide considerable encouragement and small volumes of oil and gas have been recovered from shallow boreholes. What appears to be the most prospective region of Tasmania, the central (Derwent Valley) part of Tasmania, has not been penetrated by deep well bores. Great South Land has very recently precollared four wells: - Lonnavale 1, Hunterston 1, Bridgewater 1 and Pelham 1, in this region, and these will be the first penetrations.

Even small accumulations of oil and/or gas would prove to be commercially attractive in Tasmania, as distances to potential markets and ports are nowhere large and land access is very good.

Before a well can be drilled with the primary objective of finding a commercial hydrocarbon accumulation, boreholes must be drilled to obtain stratigraphic, structural and geochemical information. Without such information, petroleum exploration wells could prove to be of very high risk and petroleum exploration wells are considerably more expensive than stratigraphic boreholes.

The biggest risk in exploring for oil and gas in onshore Tasmania appears to lie in the ability to acquire meaningful seismic data which will define the structural configuration of the subsurface.

DECLARATIONS

QUALIFICATIONS

The geological report included in this Prospectus was prepared by Gerald E. Carne. Mr. Carne graduated from Queen's University in Kingston, Ontario, Canada in 1971 with a Bachelor of Science degree, receiving First Class Honours. He worked as a petroleum geologist for major and junior companies in Canada, Indonesia and Australia before becoming a consultant in 1984. He has had considerable experience in sedimentary basin analysis in Australia, Canada and Indonesia.

INDEPENDENCE

G. E. Carne has no pecuniary or professional interests which could reasonably be regarded in any manner as affecting his ability to report impartially on the petroleum interests of either Gas and Oil Tasmania NL or Great South Land Minerals Pty Ltd. G. Carne has undertaken valuation work for Great South Land and its predecessor companies in the past, but all work has been conducted on a fully independent basis.

PURPOSE OF THE REPORT

This report has been prepared solely for Gas and Oil Tasmania NL for inclusion in a prospectus to be dated on or about 1 July 1998, AND TO APPLY FOR ADMISSION TO THE OFFICIAL LIST OF THE Australian Stock Exchange (ASX) and should not be relied on for any other purpose.

DISCLAIMER

Gerald E. Carne and Associates has relied on published documents which for the most part, originated from Gas and Oil Tasmania NL, and predecessor companies, and on discussions with senior professionals involved in the "oil search" in Tasmania, to formulate the ideas and conclusions contained in the above geological report. Gerald E. Carne and Associates has no first hand experience with the geology of the State of Tasmania. We have relied on geochemical, petrophysical and geophysical analysis carried out by others, to form the basis of this report. G. E. Carne and Associates has no reason to doubt the expertise, the motives or the credibility of those concerned and accept the data used in the preparation of the report as being factual.

GLOSSARY OF GEOLOGICAL TERMS

Aeromagnetic Survey:	Magnetic observations made from a specially equipped aircraft. Provides information on subsurface configuration.
Anticline:	A fold in layered rocks in which the strata slopes down and away from the axis. Provides an ideal hydrocarbon trap mechanism
Back Reef:	Depositional environment between a reef and the shoreline.
Basement:	Non prospective rocks underlying a sedimentary basin.
Basin:	A segment of the earth's crust which has downwarped and in which sediments have accumulated.
Bioherm:	A mound-like mass built exclusively or mainly by sedimentary organisms such as corals, etc. Often contain important hydrocarbon accumulations.
Carbonates:	Sedimentary rocks composed mainly of calcium carbonate (eg. limestone and dolomite).
Cambrian:	The oldest geological period of the Palaeozoic Era corresponding to approximately 500 - 570 million years ago.
Closure:	An upwardly confined, three dimensional configuration of strata; generally implies capable of hosting an accumulation of oil and/or gas.
Conglomerate:	Rounded, water-worn fragments of rock or pebbles cemented together by another mineral substance which may be of siliceous or argillaceous (clay rock) nature.
Conodont:	Microscopic phosphatic tooth-like structures from probable vertebrate which ranged from Cambrian to Jurassic time.
Core:	A cylindrical sample of rock obtained when drilling a bore hole, through the use of a hollow drilling bit.
Cretaceous:	Geological period corresponding to approximately 65 - 135 million years ago.
Devonian:	Geological period corresponding to approximately 345 - 395 million years ago.
Dolerite:	An igneous rock also known as diabase.
Dolomitization:	The process whereby limestone becomes dolomite by the substitution of magnesium carbonate for a portion of the original calcium carbonate, thereby becoming porous.

Evaporites:	Sediments deposited from an aqueous solution through evaporation (e.g. sodium chloride and gypsum).
Exinite:	Organic constituents comprising plant spores and cuticular matter considered to be capable of forming oil.
Exploration Well:	A well drilled to discover whether a previously untested trap contains oil or gas - often called a wildcat well.
Facies:	The aspect of belonging to a geological unit of sedimentation including mineral composition, type of bedding, fossil content, etc.
Farm-in	Descriptive of a joint venture in which an incoming (farm-in) partner earns an interest in a property by funding costs of exploration
Fault:	A break in a body or layers of rock across which there has been some vertical or lateral displacement.
Fluvial:	Pertaining to a river.
Fold:	The bending of strata, usually as the result of compression.
Formation:	The basic unit for the naming of rock units in stratigraphy.
Graben:	An elongate downthrown block between parallel faults; antonym is horst.
Graptolite:	Extinct colonial organism.
Gravity Survey:	Airborne or ground survey over a grid, using instruments which measure variations in the magnitude of the earth's gravitational field.
Horst:	An elongate upthrown block between parallel faults.
Hydrocarbon:	Any organic compound comprising carbon and hydrogen. Examples are coal, natural gas and oil.
Igneous:	Pertaining to rock units which are formed by solidification from a molten or partially molten state.
Igneous Rocks:	Rocks which have been consolidated from hot liquid magmas. These include granite and pegmatite as examples.
Inertinite:	Plant material of various origins which has undergone extensive oxidation prior to deposition and which will not yield significant hydrocarbons.
Intertidal:	Bounded by the high and low water extremes of the tides.
Intrusion:	A body of igneous rocks that invades older rock.

Joint:	A large planar feature in a rock in which there is no relative displacement of the two sides.
Jurassic:	Geological period corresponding to approximately 135 - 195 million years ago.
Karst:	Limestone dissolved by rain or rivers giving rise to surface erosional features as well as caves and even underground river channels into which the surface drainage sinks by rifts and swallow-holes which have been similarly dissolved out.
Kerogen:	Usually defined as that organic material in sedimentary rocks which is insoluble in ordinary organic solvents.
Lacustrine:	Pertaining to a lake.
Lithology:	Systematic description of rocks in terms of mineral composition and texture.
Marine Transgression:	Progressive submergence of the land by rising sea level.
Mature Source Rocks:	Rock containing organic material and considered able to release liquid or gaseous hydrocarbons which have been generated from within.
Metamorphic:	Pertaining to rocks which have formed in the solid state in response to pronounced changes in pressure, temperature and chemical environments.
Migration:	The movement of hydrocarbons within sedimentary rocks.
Oil Seep:	A natural flow of oil to the earth's surface.
Ordovician:	The second geological period in the Palaeozoic Era, corresponding to approximately 435 - 500 million years ago.
Orogeny:	Profound deformation of rock bodies along restricted zones and within a limited time interval; essentially mountain building.
Outcrop:	That part of a rock unit occurring at the surface of the earth.
Overthrust:	In a position overlying a thrust fault plane.
Palaeozoic:	A geological era comprising the Cambrian, Ordovician, Silurian, Devonian, Carboniferous and Permian periods and corresponding to approximately 225 - 570 million years ago.
Permeability:	The degree to which fluids (such as gas and oil) can move through a reservoir rock - measured in darcies or millidarcies.

Permian:	Geological period corresponding to approximately 225 - 280 million years ago.
Phyllite:	A rock containing appreciable clay and which is intermediate in metamorphic grade between slate and schist.
Porosity:	A measure of the free pore space of voids in a reservoir rock compared with the total rock volume.
Prospect:	A geological feature in which there is thought to be the potential for oil or gas accumulation.
Quartzite:	A granulose metamorphic rock consisting essentially of quartz.
Regressive:	Applies to sediments deposited during the relative lowering of sea level.
Reservoir:	A permeable sedimentary rock containing adequate pore space to provide storage room for fluids such as oil, gas and water.
Rock Eval Pyrolysis:	A standardised geochemical technique of pyrolysis used to indicate source rock potential.
Seal:	An impervious layer of rock over a reservoir which prevents escape of fluids from the reservoir.
Sedimentary Rocks:	Rocks formed by the accumulation on land or in water of mineral or skeletal particles.
Seismic:	A method of geophysical prospecting involving the generation and recording of reflected sound waves to determine the structure and depth of sedimentary layers.
Shows:	The detectable presence of hydrocarbons observed during the drilling of a well - not necessarily indicative of a commercial accumulation.
Sill:	An intrusive body of igneous rock of approximately uniform thickness and relatively thin with respect to lateral extent which has been emplaced parallel to the bedding of host rocks.
Static (Seismic):	Interferences with acoustic and seismic waves.
Stratigraphic Well:	A borehole drilled solely to obtain subsurface information on sediments, structure, organic maturity, etc. Usually a small diameter borehole.
Syncline:	A structure in which strata are folded into a concave upwards, trough like form.
Source Rock:	An organic rich sedimentary rock which is capable of generating hydrocarbons under optimum maturation conditions of temperature and time.

Stratigraphic Traps:	Type of trap where hydrocarbons are enclosed as a result of a change in rock from porous/permeable to non permeable.
Stratigraphy:	That part of geology dealing with the subdivision, composition, age and correlation of sedimentary rocks.
Tectonic:	Pertaining to structural movements of the earth's crust.
Tertiary:	Geological period corresponding to approximately 3 - 65 million years ago.
Thrust Fault:	A fracture characterized by a low angle of inclination which results in the emplacement of older strata above younger strata.
Total Organic Carbon (TOC):	A measure of the relative organic richness of a potential source rock.
Trap:	A body of reservoir rock, vertically and laterally sealed, the geometry of which allows it to retain hydrocarbons should they migrate into it.
Triassic:	Geological period corresponding to approximately 195 - 225 million years ago.
Turbidite:	Sediments deposited in deep water by the process of gravity sliding off the continental shelf.
Unconformity:	A surface of erosion or non deposition, usually the former, that separates younger rocks from older rocks.
Vitrinite Reflectance:	A technique of measuring degree of organic maturity.
Volcanogenic:	Produced by volcanic activity or derived from previously deposited volcanic products.

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Dear Sirs

RE: VALUATION OF EXPLORATION ASSETS TO BE ACQUIRED BY GAS AND OIL TASMANIA NL

This report has been prepared at the request of Gas and Oil Tasmania ("GOTAS") for inclusion in a prospectus to be dated on or about 1 July 1998, for the issue to the public of 500 million fully paid shares at an issue price of 20 cents, and to apply for admission to the official list of the Australian Stock Exchange Ltd ("ASX").

SCHEDULE OF INTERESTS

Gas and Oil Tasmania NL (GOTAS) will have registered hundred percent interests in Tasmania Oil and Gas Exploration Licences 1/88, 9/95 and 21/95 which together cover 1.193 million hectares of onshore, eastern Tasmania. The Licences have only recently been explored for hydrocarbons using modern concepts and practices, but all three are considered prospective for both oil and gas.

PERMIT	AREA (square km))	EXPIRY
EL 1/88	3288	December 1998
EL 9/95	3129	December 1998
EL 21/95	5529	December 1998

All three Blocks are being renewed on an annual basis with current expiries in December 1998. Each has an annual work program commitment of 1600 metres of drilling and 70 km of seismic.

SOURCES OF INFORMATION

G. E. Carne and Associates has relied on published documents which for the most part, originated from Gas and Oil Tasmania NL, Great South Land Minerals Pty Ltd, Condor Oil Investments Pty Ltd, and Conga Oil Pty Ltd, and on discussions with senior professionals involved in the "oil search" in Tasmania, to formulate the ideas and conclusions contained in the above geological report. G. E. Carne and Associates has no first hand experience with the geology of the State of Tasmania. We have relied on geochemical, petrophysical and geophysical analysis carried out by others, to form the basis of our report. G. E. Carne and Associates has no reason to doubt the expertise, the motives or the credibility of those concerned and accept the data used in the preparation of the report as being factual.

METHODOLOGY

As a commercial discovery of petroleum has not been made in the Tasmania Basin and as exploration for petroleum in Tasmania is at a very early stage, values assigned for Great South Land's acreage holdings must be considered as being highly subjective. Some explorers no doubt would assess the Tasmania Basin as being high risk with low potential, while others may see considerable potential in the basin and be prepared to pay a premium prices to assume controlling interests in the area at a 'grass roots' stage.

Three valuation methods have been considered in obtaining a value for the permits:

- 1) Investment to date value: - The amount of money invested by GOTAS and its predecessors in exploring the three license areas to date
- 2) farm-out value: - terms that a potential farminee might be willing to agree to in order to obtain a working interest in the permits
- 3) comparative acreage value: - a comparison of the hydrocarbon potential of the Tasmania Basin with other onshore sedimentary basins in Australia that are currently being explored.

In assessing a value for the three License Areas, the probability of finding hydrocarbon accumulations of commercial volume must be considered. In September 1996, G. E. Carne and Associates undertook a Minimum Viable Reserves (MVR) Analysis to determine the minimum viable reserves of oil/gas, that would be necessary to present a commercial development opportunity in Tasmania.

Investment to Date Cash Value

Conga Oil, Condor Investments, and Great South Land have spent some \$5.4 million in their exploration of Tasmania Petroleum Exploration Licences EL 1/88, EL 9/95 and EL 21/95:

Expenditures Conga/Condor to 1992 (approx)	\$3.3 million
Expenditures Great South Land minerals 1995-1997 (approx)	\$2.1 million
Total Expenditure to date	\$5.4 million

In addition the Australian Geological Survey Organisation (AGSO) recently acquired \$3.0 million of regional seismic in the central part of Tasmania.

The results of the exploration programme effected to date by Great South Land and its predecessors have reversed the opinion previously held by most explorationists that the Tasmania Basin is non prospective for oil and gas.

The more important elements of the recent exploration programme that has been carried out in onshore Tasmania are:

- location and identification of oil seepages reported over past 100 years
- acquisition of three petroleum exploration licences
- gravity and magnetics surveying of the D'Entrecasteaux region
- structural interpretation of gravity and magnetics data in Tasmania
- source rock sampling and analyses
- geochemical analyses of seep material
- study of reservoir potential of Liffey/Faulkner Group
- positive light
- test seismic surveying in D'Entrecasteaux region

- Slim hole drilling of Shittim 1 (1751 metres), Gilgal 1 (50 metres), Jericho 1 (640 metres), Lonnavale 1 (557 metres), Pelham (370 metres) Hunterston 1 (336 metres) and Bridgewater 1 (252 metres).

Farmout Value

G. E. Carne and Associates believes interested parties would be willing to pay certain exploration costs to assume interests in the Exploration Licences currently owned by Great South Land Minerals, as follows:

EL 1/88 (to earn 50 percent interest)	
200 km seismic at \$4,000 per km	\$800,000
one conventional exploration well, logged and tested	\$900,000
EL 21/95 and EL 9/95 (to earn 50 percent interest)	
200 km seismic at \$4,000 per km	\$800,000
one conventional exploration well, logged and tested	\$900,000

Total expenditure for the above two programmes to earn 50 percent interests would be \$3.4 million. This gives the licences a value of \$6.8 million (100 percent interest)

Comparative Acreage

The nearby Otway Basin is geographically the nearest onshore sedimentary basin to the Tasmania Basin, but structurally and stratigraphically the two basins are very dissimilar. Given the magnitude of exploration that has been conducted, the results of exploration in the Otway Basin to date have proven to be disappointing., there being an apparent lack of organically rich and mature source rocks in communication with potential reservoir units. The hydrocarbon potential of the Tasmania Basin appears to be greater than the remaining potential of the onshore Otway Basin, but this is based on perception and is largely a reflection of the differences in exploration maturity of the two basins.

The Cooper/Eromanga basin has been and remains Australia's most important onshore hydrocarbon producing province. The most prospective acreage (PELs 5 and 6) is held by Santos Ltd. Three Exploration Licences were recently awarded by the South Australian Government over the Pedirka sector of the Eromanga Basin, with exploration commitments of about \$1.5 million to \$2.0 million for each Block. The blocks range in size from hectares to hectares. The prospectivity of the Tasmania Basin is considered to be as good as, or better than that of the Pedirka sector of the Eromanga Basin.

The Tasmania Basin remains essentially untested, and given that effective source rocks and reservoirs have been identified, the hydrocarbon potential of the basin remains high. There is extremely little seismic coverage within the Tasmania Basin (only a few short, experimental lines) and hence no real subsurface knowledge of individual structures and regional structuring. No conventional petroleum wells have been drilled, but through Great South Land's fully cored, slim hole drilling programme and outcrop information, potential reservoir rocks and organically rich and mature source rocks have been identified. Data obtained through Conga/Condor and Great South Land suggest that both the Permian and pre-Permian intervals of the Tasmania Basin offer potential for both oil and gas. The Cooper Basin's gas production is largely from Permian reservoirs.

The near lack of sub-surface structural control limits the value that can be placed on Great South Land's exploration licences, as a considerable amount of seismic will have to be acquired to delineate valid drilling targets. The presence of dolerite sills across the basin will make it difficult to obtain good structural definition of the pre-Permian section

As there is currently very little onshore acreage in Australia that offers the potential for hosting significant volumes of undiscovered oil and gas, the Tasmania Basin, with proper promotion, should attract considerable interest and funding.

Minimum Viable Reserves Analysis

In September 1996, G. E. Carne and Associates was commissioned by Condor Investments Pty Ltd. to attempt to quantify the minimum viable reserves (MVR) that would be necessary to present a development opportunity in Tasmania (those quantities that would provide a project cash flow with a rate of return (ROR) of not less than 10 percent after tax) for both oil and gas. Product values of \$2.30 per Mscf for gas and \$22.00 per barrel of oil were used in the analysis. In general terms, the results showed that:

- 1) for gas prospects,
 - the minimum viable reserves are greater than 40 Bscf.
 - The market needs to be greater than 15 MMscfd, and
 - the project life must be greater than 15 years.

- 2) for oil prospects,
 - in central Tasmania
 - the minimum viable reserve is between 1 and 2 million barrels
 - the minimum initial well rate is approximately 200 BOPD, and
 - the project life must be greater than 9 years.

On Bruny Island

- the minimum viable reserve is about 4 million barrels
- the minimum initial well rate is approximately 400 BOPD, and
- the project life must be greater than 10 years.

The thresholds indicated above remain valid today. However, analysis of gas samples obtained during the drilling of the Shittim 1 well (and Jericho well) on Bruny Island indicate high concentrations of both hydrogen and helium. These products offer a higher value than the conventional hydrocarbon gases upon which the MVRs were determined, and consequently, should commercial volumes of hydrogen or helium be discovered, the above gas thresholds may be slightly reduced.

VALUATION

On the basis of recent drilling results, a value range of between \$2.5 million and \$7.5 million is placed on a 100 percent interest in the exploration permits currently held by Great South Land, with a most likely value being around \$5.0 to \$6.0 million.

In a report prepared for Condor Investments in September 1996, G. E. Carne and Associates placed a value range of between \$2.5 million and \$6.0 million for a 100 percent interest in the three onshore Tasmania Petroleum Exploration Licences held by Condor, with a most likely value of around \$4.0 million. The valuation was requested by Condor after encountering encouraging shows of methane and hydrogen during the drilling of the Shittim 1 well on Bruny Island.

Since the 1996 valuation, the Shittim 1 well has been deepened, and two wells are being drilled by Great South Land on the mainland of the State. Gas shows continued to the final drilling depth at Shittim 1, with relatively large percentages of the total gas volumes comprising helium and hydrogen. Wet gas shows are being recorded from the Lonnavale 1 and Pelham 1 wells. All of Great South Land's wells are being drilled on surface defined features without sub-surface structural control.

Yours sincerely



Gerald E Carne
07/02/98



Tasmania

561046

DEPUTY PREMIER

23 DEC 1998

Mr Henry Askin
Chairman
Great South Land Minerals Ltd
Level 3, 65 Murray Street
HOBART TAS 7000

Dear Mr Askin

GRANTING OF SPECIAL EXPLORATION LICENCE 13/98

I have been advised by Mineral Resources Tasmania that you have agreed to a number of conditions which are a prerequisite to my granting of an application for a Special Exploration Licence over a large portion of the Tasmania Basin.

These conditions are:

- provision of rentals and bonds within two months of public advertisement of application;
- completion of public float of company within twelve months of issue of licence;
- no transfer of the licence during the term of the licence. This does not exclude creation of joint ventures or farm-ins;
- completion of a minimum of 600 line kilometres of 2D onshore seismic reflection by the end of the second year of the licence;
- completion of direct on-ground exploration, exclusive of administrative costs, at the rate of \$2,000,000 per annum by the end of the second year of the licence;
- review of licence at end of second year with above two points being the minimum requirement;

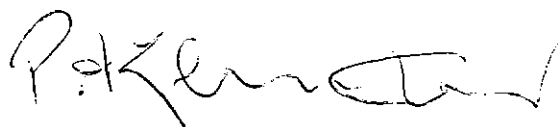
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- the licence shall be issued for five years. At the end of the licence period, the more prospective areas must be converted to exploration licences with appropriate conditions, if continued tenure is required;
- rental to be paid at prescribed rates;
- written acknowledgment by Great South Land Minerals Ltd of these licence conditions.

It is my intention at the appropriate time, subject to due process, to grant the licence for a period of five years.

It is my understanding that the licence will be publicly advertised on Saturday, 9 January 1999.

Yours sincerely



Paul Lennon
Deputy Premier