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DATED 5 APRIL 2001

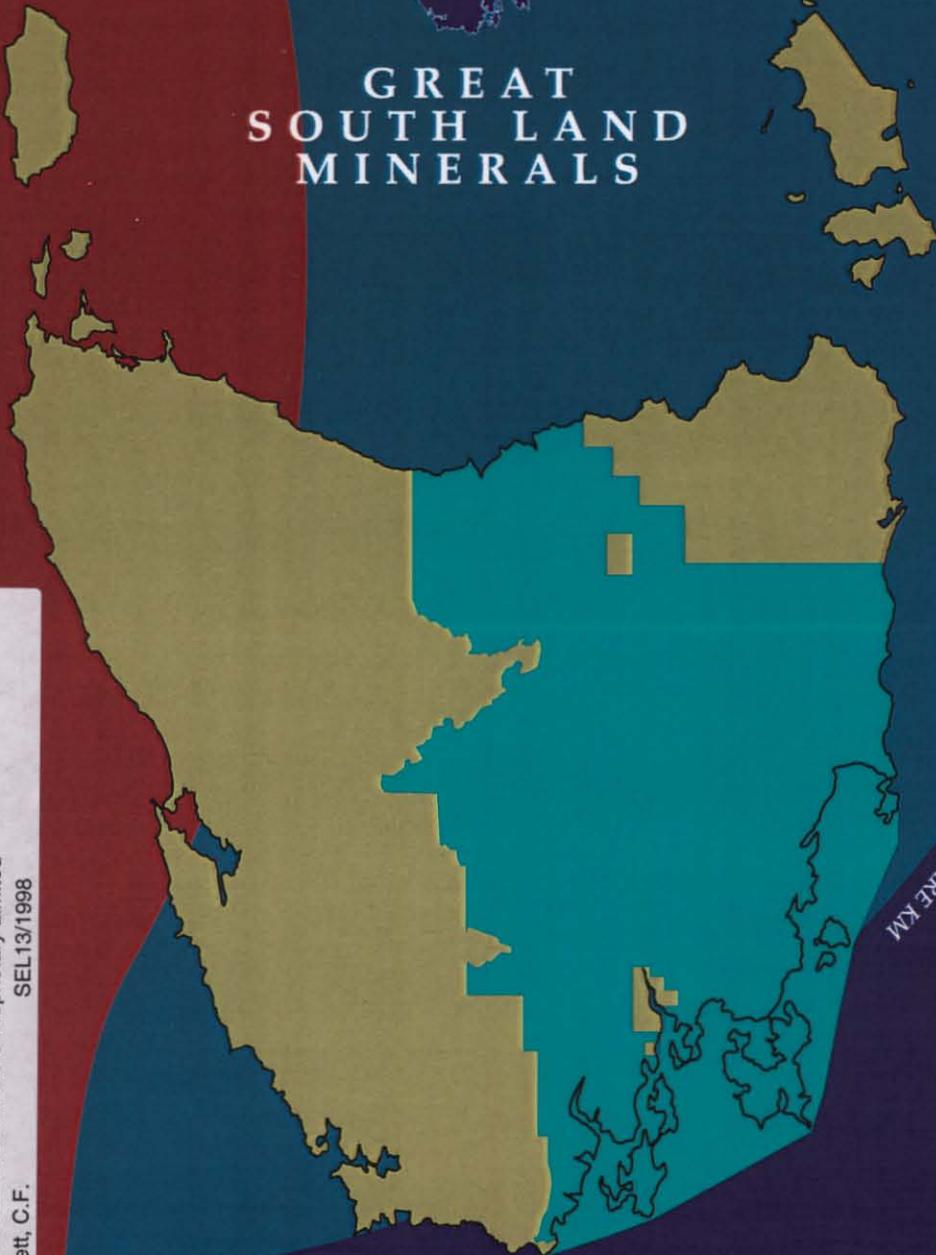
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ANNUAL REPORT 2001



GREAT
SOUTH LAND
MINERALS



OIL & GAS EXPLORATION ONSHORE TASMANIA - SPECIAL EXPLORATION LICENCE 13/98 COVERING AN AREA OF 30 356 SQUARE KM

01_4561

Annual Report 2001 - SEL 13/1998

Great South Land Minerals Proprietary Limited*
Burrett, C.F. SEL13/1998

HOBART TASMANIA AUSTRALIA

01-4561

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GREAT SOUTH LAND MINERALS LIMITED

ABN 54 068 650 386

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2001 ANNUAL REPORT

FOR

MINERAL RESOURCES TASMANIA

SPECIAL EXPLORATION LICENCE 13/98

Dr Clive Burrett – Chief Geologist
Mr Rod Tabor – Exploration Manager
Mr David Tanner – Chief Executive Officer

5 April 2001

MINERAL RESOURCES		
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GREAT SOUTH LAND MINERALS LIMITED

ABN 54 068 650 386

Level 3, 65 Murray Street Hobart Tasmania 7000
Tel: (03) 6231 9339 Fax: (03) 6231 9338 e-mail: gslm@gslm.com.au

5 April, 2001

Director of Mines
Mineral Resources Tasmania
30 Gordons Hill Road
ROSNY PARK TAS 7018

Attention : Dr A.V. Brown

Dear Tony,

2001 Annual Report

I have pleasure in forwarding our 2001 Annual Report covering work on special exploration licence, SEL 13/98, up to the end of March 2001.

Should you require any further information to meet your specific requirements, please contact me on 6231 9339.

Yours faithfully



David Tanner
Chief Executive Officer
Great South Land Minerals Limited

Statutory Declaration

I, David Andrew Tanner, Chief Executive Officer

for Great South Land Minerals Limited

of level 3, 65 Murray Street, Hobart Tasmania.

Declare that the information herein pertaining to the 2001 Annual Report on Oil and Gas Exploration is true and I make this solemn declaration by virtue of Section 132 of the Tasmanian evidence Act 1910.

Declared at Hobart this day of 2001.

.....(signature), before a Justice of the Peace or a

Commissioner of Declarations (signature)

Executive Summary

Great South Land Minerals Limited has commenced an in-depth regional geophysical analysis of the area covered by its licence SEL 13/98.

Great South Land Minerals Limited carried out a limited gravity survey in September and October 2000. The data collected was used to refine the geological model of the Tasmania Basin.

Using the refined geological model over 600 kilometres of seismic lines have been located both in the Central Highlands and in the North Midlands areas. A number of seismic lines have been recorded to accurately define the dome structure that was the target of the Hunterston well drilled in 1997. The Hunterston well was drilled and collared to a depth of 336 metres.

Invitations to tender for the seismic acquisition were sent to two contractors, Trace Energy Services and Western Geco. Both companies expressed interest in tendering and inspected the area in early December 2000. Trace Energy Services was awarded the contract and commenced ranging and surveying in February 2001. The vibroseis equipment and personnel were mobilized in early March and the recording of seismic lines started on 10 March 2001. The survey is ongoing at the time this report is written with over 300 kilometres of seismic data acquired to date.

Invitations to tender for the seismic processing were sent to two companies, Robertson Research Australia Pty Ltd and Velseis Processing Pty Ltd. The contract was awarded to Robertson and data is currently being processed. The interpretation of the seismic sections is being undertaken by Ian Reid of Terra Firma Technology and Dr Mike Swift of Applied GeothermEx Pty Ltd with guidance from the company's geologists, Dr Clive Burrett and Paul Heath.

Great South Land Minerals Limited together with the School of Earth Sciences at the University of Tasmania have successfully applied for a Strategic Partnership with Industry – Research and Training Scheme grant. This grant will enable a team of university and GSLM geoscientists to develop a computer model for the geological, tectonic and fluid flow evolution of central Tasmania for the last 500 million years. This project will increase substantially our understanding of the structural evolution, subsurface fluid flow, heat transport and petroleum migration in and below the Tasmania Basin. In addition a set of gas/oil forming models will be developed for the petroleum supersystems in and below the Tasmania Basin.

Assessment of Value

A study was prepared by Great South Land Minerals Limited to assess the value that may be placed upon the Special Exploration Licence area 13/98.

In the absence of relevant geophysical subsurface data, a comparative value/probabilistic approach has been adopted in which the Expected Monetary Value, EMV, is taken as the indicative value.

For the three oil and gas discovery scenarios examined, the EMV ranges from A\$30 million to A\$48 million; average EMV is A\$37 million. For the low oil volume discovery scenario, the EMV is A\$30 million. All EMVs quoted are pre-tax, as are NPVs.

The estimation of an upside potential is usually based on the value of the highest reserves that could be reasonably attributed to a permit area, albeit at a low probability. In this case, the exploration is at an immature stage and it is not really possible to make any such reasonable estimate. However, some indication may be gained by the NPV of A\$383 million that would be crystallised by a successful 30mbbl oil development.

Therefore, while recognising the possibility of a considerable upside, at this stage of the exploration program the permit is ascribed a value of at least A\$30 million.

The complete report "Assessment of Value, Special Exploration Licence SEL 13/98, Onshore Tasmania Basin" is attached as Appendix A.

The report has been critically reviewed by an independent geologist, Dr Larry L. Wakefield who concluded that in his professional opinion the approach and methodology provides fair and reasonable expectation of the value of Special Exploration Licence 13/98, onshore Tasmania Basin. He endorsed the conclusions derived from the outcome of the economic analysis carried out by Great South Land Minerals Limited.

Independent Geologist's Report

Great South Land Minerals Limited commissioned Dr Larry Wakefield to submit a technical report on the exploration prospectivity of the onshore Tasmania Basin.

Larry L. Wakefield is a petroleum geologist with 24 years experience in the international petroleum industry. He is currently an independent consultant, based in Melbourne, where he is providing technical and managerial advice in petroleum exploration. Prior to commencing his consultancy, he spent 23 years with Shell International Petroleum and was assigned to Shell companies in New Zealand, Spain, Thailand, England, The Netherlands and Australia. In his last assignment with Shell Development (Australia) Pty

Ltd, he was Exploration Portfolio Manager, being responsible for improving Shell's exploration position through his identification and acquisition of prospective acreage as well as high-grading the existing exploration portfolio of prospects and leads. He graduated from the University of Auckland, New Zealand with a Doctor of Philosophy in Geology in 1974.

Dr Larry Wakefield report includes a brief history of the exploration of the Tasmania Basin and describes the regional geology, structural elements and petroleum systems. He examines the planned exploration strategy and suggests the acquisition of high-resolution magnetics and additional gravity data prior to seismic acquisition. He ranked the structural regions in the following way;

Highest Ranked	Northern Grabens Province
Ranked Second	Central Lakes Plateau
Ranked Third	Douglas River Block
Ranked Fourth	Hobart-Huon Block

In conclusion Dr Wakefield considers that the exploration licence is prospective for hydrocarbons on the basis of the available data. Although the Tasmania Basin is classified as a frontier basin, he concludes that there is sufficient encouragement to invest in the next phase of exploration. The acquisition of seismic data along with continued geological studies will enable the emerging prospect and lead portfolio to be quantified, risked and ranked. By way of this process, investors in the venture will be in an improved position to make an objective assessment of the future rewards of the Tasmania Basin.

The complete report "The Exploration Prospectivity of the Onshore Tasmania Basin" is attached as Appendix B.

Gravity Survey

Following the recommendation of Dr. Larry Wakefield Great South Land Minerals Limited carried out a limited gravity survey in September and October 2000.

The survey was carried out by Solo Geophysics & Co. They were in the field from 25 September 2000 until 3 November 2000 and acquired approximately 700 data points in the Hunterston area of the Central Plateau and in the Northern Midlands.

The raw data was terrain corrected and used to produce a revised trend compilation map.

A listing of the acquired data and a 1:250,000 Updated Residual Gravity plot are attached as Appendix C.

Regional Seismic Survey

Using the newly acquired gravity data and the latest geological interpretation over 600 line kilometers of seismic survey were laid out. In order to minimise the impact of this survey on private land and environmentally sensitive areas the lines were located wherever possible along public roads. Approximately 200 line kilometers were located in the Central Highlands and the remainder in the Northern Midlands.

The potential seismic lines were submitted to Mineral Resources Tasmania in order to obtain approval for the survey. Conditional approval was granted on 21 December 2000. The approval was conditional on meeting the following:

- Any requirements from the relevant Councils and the Department of Transport are to be met, in the use of infrastructure, services and property under their authority.
- The areas outlined by the Threatened Species Unit may not be accessed without prior discussion and comment from Mineral Resources Tasmania and Naomi Lawrence (Botanist – Threatened Species Unit).

A submission was made to the Federal Minister for the Environment and Heritage in order to seek a ruling on whether the seismic survey would require approval under the Environment Protection and Biodiversity Conservation Act 1999. Notification that the Minister had determined that the seismic survey was not a controlled action was received on 7 February 2001.

Discussions were held with the Department of Primary Industry, Water and the Environment's Threatened Species Unit and on their advice a botanist, Mr Philip Barker was engaged to identify areas known to contain threatened flora species. Areas that were identified were surveyed by Mr Barker once the exact position of the seismic line had been pegged out. Where necessary no-go areas were marked out and gaps left in the line to avoid damage to the threatened flora. At the conclusion of the seismic program a report will be submitted by Mr Barker to the Threatened Species Unit.

A list of the roads that we wished to use to acquire seismic data together with details of the size and weight of the vibrator trucks were sent to the Department of Infrastructure, Energy and Resources. Following discussions and the submission of a detailed traffic management plan the Department issued a permit to authorize the carrying out of works within the state roads reservations. They also authorized the operation of the vibrator trucks on public roads. Details of these permits were submitted to the Southern Midlands, Northern Midlands, Central Highlands and Meander Valley councils who subsequently authorized us to operate in council road reservations.

The approximate locations of the seismic lines were given to the Department of Primary Industry, Water and the Environment's Geodata Services unit. They used the seismic line locations to search through all property titles in Tasmania and provided us with a listing of all owner names and addresses of property titles that were located within 300 metres of the seismic lines. This data was fed into an "Access" database and used as the basis for

the mail out of an information pack to land owners whose land was likely to be crossed by the survey.

In parallel, a permitting team started visiting properties in the area and talking with land owners about the planned seismic survey.

Invitations to tender for the seismic acquisition were sent to two contractors, Trace Energy Services and Western Geco. Both companies expressed interest in tendering and inspected the area in early December 2000. Trace Energy Services was awarded the contract and commenced ranging and surveying in February 2001 using Wilson Survey Group Pty Ltd.

In early February 2001, Dr Mike Swift was appointed to supervise the acquisition and processing contracts. Dr Swift took over the supervision of all permitting activities as well as the fencing and line clearing tasks shortly after his arrival in the field

The vibroseis equipment and personnel were mobilized in early March and the recording of seismic lines started on 10 March 2001. The survey is ongoing at the time this report is written with over 300 kilometres of seismic data acquired to date. A map showing completed and planned seismic survey lines is attached as Appendix D.

Invitations to tender for the seismic processing were sent to two companies, Robertson Research Australia Pty Ltd and Velseis Processing Pty Ltd. The contract was awarded to Robertson on 7 March 2001 and data is currently being processed.

The interpretation of the seismic sections is being undertaken by Ian Reid of Terra Firma Technology and Dr Mike Swift of Applied GeothermEx Pty Ltd with guidance from the company's geologists, Dr Clive Burrett and Paul Heath.

SPIRT Grant

During 2000 Great South Land Minerals Limited together with the School of Earth Sciences at the University of Tasmania prepared an application to the Australian Research Grants Committee for a SPIRT (Strategic Partnerships with Industry – Research and Training Scheme) grant. This was successful and will be initiated in 2001 with funding of \$417,000 from the Federal Government and \$303,800 from Great South Land Minerals Limited.

The completed application entitled "Petroleum System Modelling Onshore Tasmania" is attached as Appendix E.

Appendices

1. Assessment of Value, Special Exploration Licence SEL 13/98 – Onshore Tasmania Basin
2. The Exploration Prospectivity of the Onshore Tasmania Basin – Independent Geologist's Report by Dr Larry L. Wakefield.
3. Gravity Survey and Data Listing by David Leaman
4. Completed and planned Seismic Survey Lines
5. Petroleum System Modelling Onshore Tasmania – SPIRT Application.

Appendix 1

Assessment of Value, Special Exploration
Licence SEL 13/85 – Onshore Tasmania
Basin

Dr Henry Askin

834013

SPECIAL EXPLORATION LICENCE SEL 13/98

ONSHORE TASMANIA BASIN

ASSESSMENT OF VALUE

**Great South Land Minerals Ltd.
ACN 068 650 386
M.L.C. Building
Level 3/65 Murray Street
Hobart Tasmania 7000.**

40B Gardiner Parade
Glen Iris
Victoria, 3146

9th August 2000

The Chairman
Great Southland Minerals Ltd
M.L.C. Building
Level 3/65 Murray Street
Hobart
Tasmania, 7000

Dear Sir,

RE: Assessment Of Value, Special Exploration Licence (SEL 13/98), Onshore Tasmania Basin.

I have critically reviewed the document entitled "Assessment Of Value, Special Exploration Licence (SEL 13/98), Onshore Tasmania Basin" prepared by Great Southland Minerals Ltd. In my opinion, the contents of the document present a balanced and objective assessment of the acreage value.

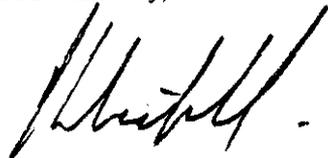
Since comprehensive subsurface data and information does not exist for the Tasmania Basin and therefore the prospectivity remains unrealised, the valuation methodology used by Great Southland Minerals is pragmatic and follows accepted industry practice. The use of analogue basins with their ultimate recoverable potential, current production and historical success rates, affords a reasonable basis on which to ascertain acreage value for the Tasmania Basin.

The assignment of risk to the parameters controlling successful discovery and recovery of hydrocarbons in a situation where the range in uncertainty is broad, always poses a challenge. In the case of the Tasmania Basin, allocation of risk by Great Southland Minerals is regarded as reasonable considering that the venture is at a very early stage of exploration. The resulting probability of success for the scenarios offered by GSLM is objective and reflects fairly on the wide latitude of uncertainty in the subsurface parameters.

The input parameters to the project economics and the range of adopted scenarios result in a fair and transparent analysis. The GSLM analysis includes a discussion on sensitivities, which offers a broader perspective on the effects of parameter variation. The spectrum of positive expected monetary value (EMV) underscores the potential robustness of the venture. The analysis provides more than adequate risk coverage to progress the exploration campaign.

In my professional opinion, the approach, and methodology provides fair and reasonable expectation of the value of Special Exploration Licence 13/98, onshore Tasmania Basin. I endorse the conclusions derived from the outcome of the economic analysis carried out by Great Southland Minerals.

Yours sincerely,



Dr Larry L. Wakefield
Consulting Geologist

ASSESSMENT OF VALUE**SPECIAL EXPLORATION LICENCE SEL 13/98
ONSHORE TASMANIA BASIN****CONTENTS**

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5. Expanded Scale, Economic Analysis, ref. Fig 4
6. Production Profile, medium case, 30 mmbbls sales oil
7. NPV / EMV, med case, 30 mmbbls sales oil, 5 wells (2 pages)
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Summary: This study presents an assessment of the value that may be placed upon the licence area SEL 13/98, and in so doing relies in part upon material and opinion contained in the independent geologist's report. In the absence of relevant geophysical subsurface data, a comparative value/probabilistic approach has been adopted in which the Expected Monetary Value (EMV) is taken as the indicative value.

For the three oil and gas discovery scenarios examined, the EMV ranges from A\$30 million to A\$48 million; average EMV is A\$37 million.

For the low oil volume discovery scenario, the EMV is A\$30 million.

All EMV's quoted are pretax, as are NPV's.

Estimation of an Upside potential is usually based on the value of the highest reserves which could be reasonably attributed to a permit area, albeit at a low probability.

In this case, the exploration is at an immature stage, and it is not really possible to make any such reasonable estimate. However, some indication may be gained by the NPV of A\$383 million which would be crystallised by a successful 30mmbbl oil development.

Therefore, while recognising the possibility of a considerable upside, at this stage of the exploration programme the permit is ascribed a value of at least A\$30 million.

ASSESSMENT OF VALUE
SPECIAL EXPLORATION LICENCE SEL 13/98
ONSHORE TASMANIA BASIN

Introduction:

Special Exploration Licence SEL 13/98 has been issued for the purpose of exploration for hydrocarbons, and geographically covers essentially the Eastern half of the State of Tasmania including some adjacent territorial waters. There are a number of small excluded areas, notably the residential areas of Launceston and Hobart.

The licence area encompasses approximately 90% of the onshore Tasmania Basin.

Previous Exploration:

This is reviewed in a recent study commissioned by GSLM Ltd., titled "Independent Geologist's Report on the Exploration Prospectivity of the Onshore Tasmania Basin", October 1999, (the Report). The author of this study is Dr. Larry L. Wakefield, recently a senior professional geologist/manager with Shell International Exploration and Production, whose responsibilities included Basin Evaluation and prospectivity assessment.

As discussed, exploration drilling has been sporadic, with wells being located without any direct knowledge of the subsurface structure. Most of these wells were no deeper than 350m and many were abandoned within the Jurassic dolerite before reaching the objective section. An exception was the well Shittim-1, a stratigraphic well drilled to 1751m in 1996/97, which encountered shows of highly mature thermal gas. The well Lonnvale-1, presently suspended at 557m, encountered a gas kick in fractured dolerite, and again has not yet reached the primary objective formations.

There are numerous anecdotal reports of oil seepage, one of which has been confirmed at Lonnvale. Samples have been geochemically analysed and found to have been sourced from thermally mature Tasmanite oil shale. Although this formation has not been observed in the area, until 1932 it was mined (at Latrobe) and retorted for oil, and presumably is present at depth in the Lonnvale area.

Seismic data available is limited to several lines recorded by AGSO in 1994 over the Northern Grabens area, and indicate the presence of a sedimentary section probably in excess of 8km.

Present Status:

Petroleum exploration in the Basin is highly immature, and the potential for commercial accumulations of hydrocarbons remains entirely untested. In his report, Dr. Wakefield examines the evidence in support of the presence of viable petroleum systems in the Basin, the term "petroleum system" referring to all the elements essential for the generation and entrapment of hydrocarbons, namely the presence of source, reservoir and seal rocks in favorable juxtaposition together with the appropriate timing of the generation and migration of hydrocarbons.

Dr. Wakefield concludes that two viable petroleum systems may exist, the Larapintine Petroleum System of Ordovician-Silurian age, and the Gondwanan Petroleum System of Late Carboniferous- Middle Triassic age. It is noted that these petroleum systems are present in other Australian onshore basins which have a similar structural history and hydrocarbon habitat to the Tasmania Basin, and in which petroleum has been discovered and commercially developed. These are described in the Report, and are listed below.

Larapintine: Amadeus Basin, N.T., Mereenie Field, UCR 50mmb/oil, 600bcf/gas
 Palm Valley Field, UCR 750bcf/gas
 Adavale Basin, Qld., Gilmore Field, UCR 25bcf/gas

Gondwanan: Bowen Basin, Qld., Turkey Creek, Rolleston, Yellowbank Fields,
 UCR 300bcf/gas.

In summary, previous exploration efforts in the Tasmania Basin have failed to provide a single penetration of these petroleum systems in a valid structural setting, no relevant seismic exists, and the potential remains untested. Nevertheless as stated in the Report, *quote in comparison with basins where a significant hydrocarbon discovery is yet to be made, the Tasmania Basin has a considerable advantage in having proven high quality mature source rocks unquote.*

In fact, given that the producing onshore basins in Australia including the successful analogues of the Amadeus, Adavale and Bowen Basins are notably devoid of surface indications of hydrocarbons or source rocks, the Tasmania Basin has persuasive a priori credentials to be viewed as a petroliferous basin.

Valuation Methodology:

A number of techniques are conventionally used, most of which can not reasonably be applied in the case of an untested basin, and particularly so when the lack of seismic data precludes detailed subsurface mapping and the identification of structural prospects. These various approaches are examined below.

Previous expenditure: this relates to sunk costs which can give no indication as to the potential future value that may be derived from the licence.

Farmin value: this establishes a licence value in terms of how much expenditure another party is prepared to commit in return for a defined licence equity. In the absence of a farmin agreement, this becomes highly subjective and infinitely variable, and again cannot be regarded as a reliable indicator as to future value.

Risked reserves value: in the case of a licence with a comprehensive seismic coverage, prospects may be identified and risked probablistically, mean success volumes of reserves derived, and an expected monetary value (EMV) established. This may then be used, with appropriate discretion, as a basis for an estimation of the licence value. This method is not applicable here since no seismic is available, hence no subsurface mapping.

Comparative value: in the case that successful analogue basins exist, relevent parameters are estimated by comparison of the subject basin with these proven analogues. Such analogue basins have been identified in the Wakefield Report, and in view of the greenfield nature of the Tasmania Basin is the method chosen here to support the determination of an EMV.

Valuation Rationale:

Noting the ultimate recoverable reserves (UCR) attributed to the three analogue basins, three scenarios will be examined whereby the exploration programme in the Tasmania Basin results in the establishment of sales oil volumes of 11 and 30 mmbbls (low and medium oil case respectively, cf UCR Amadeus Basin of 50mmbbls), and of 185 bcf sales gas (nominal gas case, cf UCR Bowen Basin of 300bcf). These are considered to be reasonable benchmark volumes in view of the established presence of a world class algal source rock (the Tasmanite oil shale) in the Tasmania Basin. The cases are treated separately, although both oil *and* gas may be found.

Because these petroleum systems have been proven, and because these are analogues of the Tasmania Basin, a probability of success that a well in the Tasmania Basin will discover similar volumes may be assigned as follows:

	low oil, 11mmb	med oil, 30mmb	nominal gas, 185bcf
reservoir prob.	0.5	0.5	0.5
seal prob.	0.7	0.7	0.7
structural prob.	0.25	0.125	0.25
charge prob.	0.7	0.7	0.7
POS	0.06 (6%)	0.03 (3%)	0.06 (6%)

It should be restated that if proven analogue basins were not present, these probabilities would be somewhat lower. Qualitatively, the high case is assigned a higher structural risk than the low case because of the observation that large unbreached structures are less

frequently encountered than smaller ones. It should also be noted that the nominal gas volume proposed is somewhat conservative in comparison with the proven UCR's of the analogues, but has been constrained in consideration of the anticipated limitations of the Tasmanian gas market.

By reason of their remote locations (the Amadeus in particular) the economics of the gas projects actually in place in the analogue basins are not really relevant to Tasmanian conditions. However the onshore Otway Basin in S.A. and Vic. provides a prime marketing parallel, whereby local gas production is sold locally, local small towns are reticulated and small local industries are customers. Gas producers sell at the well head for around \$2.40/kcf, and it may be inferred from the Cultus 1997 annual report that a net profit of ca \$0.85 million per bcf of sales gas is achieved. Importantly, Tasmania offers the additional potential for major industrial clients and correspondingly increased sales volumes.

In contrast, any established oil reserves can be readily marketed.

The exploration programme:

The essential parameters are now in place to enable a calculation of project net present value (NPV) under a variety of marketing scenarios, with the exception of the exploration cost component. In this valuation, the assessment relates to the total project, and not some lesser proportion that would be the GSLM entitlement following any farmout agreement.

Furthermore, the exploration programme incorporated in the analyses is considered robust and fit for purpose. It is however only one possibility, since clearly the actual programme carried out will depend on a number of factors including finance available and the workings of chance concerning drilling success, (see later section "Historical Review").

In all cases considered, seismic will be acquired to the extent of 800km in each of years 1 and 2, and 200km in year3. Assumed cost is \$2500/km in year1, and \$3000/km in each of years 2 and 3.

It is assumed that this seismic will identify a variety of prospects, sufficient to allow, in a five well case, one exploration well in year 1 and two in each of years 2 and 3, of which one in year 3 will be a discovery and completed as a producer. Two additional production wells are drilled, one in each of years 4 and 5, and production sales commence in year 4.

Exploration wells are costed at ca \$1 million each, production wells at \$1.5 million as shown in the attached tables.

Valuation: (Oil Scenario).

Since oil sales are not subject to the development of a local market, any reserves that might be established can be produced and marketed at a rate constrained only by the well initials and the requirements of good oil field practice.

In the absence of any reservoir data, production profiles broadly in line with qualitative experience have been adopted, namely an early peak followed by an approximately exponential decline.

For the 11mmbbl reserve scenario, production is assumed to commence at 2000bopd in year 4, reach a maximum of 6000bopd in year 6 and thereafter decline to 1000bopd in year 13.

For the 30mmbbl reserve scenario, production is assumed to commence at 5000bopd in year 4, reach a maximum of 12000bopd in year 6, and thereafter decline to 4000bopd in year 13.

Although onshore fields would remain on production at these flow rates, for the purpose of analysis the projects are considered terminated at end year 13. Because of the time dependent nature of the discounting process, this has little effect on the derived project NPV's.

The oil price is taken as A\$38 per bbl (ca US\$25) in MOD year 4, escalating annually at cpi 2%. Opex and Government royalties are assumed to be 40% of gross sales revenue, and oil sales take place at the well head; corporate tax and deductible expenses have been ignored. The probability of success for each individual well has been taken to be 6% in the 11mmbbl case and 3% in the 30mmbbl case. A discount rate of 10% has been applied in deriving the NPV.

Calculated NPV's are: for 11mmbbls sales oil, NPV is A\$139 million
 for 30mmbbls sales oil, NPV is A\$383 million.

Production profiles and spreadsheets detailing these calculations are attached.

Valuation: (Gas Scenario).

In this case, the production profile adopted is governed by expectations of market development, rather than by usual considerations of typical field performance. Gas sales are assumed to commence in year 4 at a rate of 1bcf/yr, rising to 12 bcf/yr in year 10 and to 16bcf/yr in year 20, at the end of which a total of 185bcf will have been produced. For the purpose of analysis, project life beyond year 20 is not considered. Again, this has little effect on the project NPV.

Commencing gas sales price at well head is set at A\$2.50/kcf in MOD year 4 (cf Otway Basin), escalating annually at cpi 2%.

Opex and Government royalties are assumed to be 20% of gross sales revenue; corporate tax and the accounting of deductible expenses has been ignored. The probability of success for each individual well has been taken to be 6%. A discount rate of 10% has been applied in deriving the NPV.

The calculated NPV is: for 185bcf sales gas, A\$126 million.

The production profile and detailed spreadsheet is attached.

Expected Monetary Value (EMV):

These three NPV estimates range from A\$126 million to A\$384 million, demonstrating as expected that onshore oil production projects, and gas production projects once established in a market, are highly attractive.

However in this case where no reserves are yet identified, the expected monetary value is required to give a measure of the balance between the NPV (the reward of success) and the exploration risk of failure.

If the outcome relies on a single well with a probability of success POS, then the EMV is calculated according to the formula:

$$EMV = POS * NPV - (1 - POS) * (COST OF FAILURE)$$

An EMV of zero represents the threshold of risk coverage, namely that the weighted reward is in balance with the weighted risk. When the EMV is greater than zero, the proposal is biased towards reward, and in general the more positive the EMV the more robust the proposal.

If a success/failure outcome depends on a number of wells (five in this proposed programme), the above formula is not precisely applicable. Whereas the probability POP of *at least* one project (ie at least one success) is given by:

$$POP = 1 - (1 - POS) ^ (no. of wells drilled),$$

this does not determine the separate probabilities that 2, 3, 4 or even 5 successes can occur, and hence POP should not be substituted for POS in the above EMV formula. It can be used in this way as a screening exercise, but will deliver a significant underestimate of the actual EMV.

In this case the individual probabilities relating to specific numbers of success outcomes must be derived using Binomial statistics, and this is illustrated in attachments.

Specifically: for a POS/well of 3%.

prob. 0 success = 86%; prob. 1 success = 13%; prob. 2 successes = 1%
prob. for 3 or more successes is vanishingly small.

for a POS/well of 6%.

prob. 0 success = 73%; prob. 1 success = 23%; prob. 2 successes = 3%
prob. for 3 or more successes is vanishingly small.

for a POS/well of 9%.

prob. 0 success = 62%; prob. 1 success = 31%; prob. 2 successes = 6%
prob. 3 successes = 1%; prob. for 4 or 5 successes is vanishingly small.

With the 5 well programme as currently proposed, the EMV is then (POS/well = 6%)

$$EMV = (NPV * 0.23) + 2 * (NPV * 0.03) - (10.5 * 0.73)$$

where the 10.5 is the A\$10.5 million cost of failure.

For the three production scenarios previously discussed, results are as follows:

	nominal gas bcf	low oil mmbbls	medium oil mmbbls
sales volume	185	11	30
pos/well	6%	6%	3%
exploration wells	5	5	5
NPV (A\$m)	126	139	383
EMV (A\$m)	30	34	48

It is seen that all cases achieve robust risk coverage, with an average EMV of A\$37 million. EMV results of this magnitude indicate the high potential of the exploration project proposal.

It will further be recognised that the derived EMV's are sensitive to the value assigned to the POS/well, being in fact approximately inversely proportional to this necessarily subjective parameter.

Consequently, the upside potential of the basin is perhaps better indicated by the NPV results, being as they are predicated upon success.

Note on the significance of the EMV:

As a statistical parameter, the expected monetary value (EMV) as named is somewhat misleading, since it is not a possible outcome for the exploration project. The outcome of the project can in reality only be failure or success, and in the case of the latter the full NPV is realised. The EMV is the NPV, weighted according to the probability of success, less the weighted cost of failure. Nevertheless in the absence of any other reasonable procedure, it may be taken as an indicative estimate of value.

Details of the individual analyses are presented in the attached spreadsheets and displays.

Sensitivities:Discount Rate vs NPV :

The discount rate for which the NPV becomes zero is variously known as the internal rate of return (IRR) or real terms earning power (RTEP). In this case, the RTEP is 101%, 158% and 48% for the low oil (11mmbbls), medium oil (30mmbbls) and nominal gas (185bcf) scenarios respectively.

For the gas scenario, the reduced RTEP results from the backloading of income, as a consequence of necessary and expected market development.

Product Price:

For the low and medium oil scenarios, the EMV remains positive for oil prices down to A\$10/bbl and below.

For the nominal gas scenario, the EMV remains positive at A\$10 million at a gas price as low as A\$1.40/kcf.

POS/well vs EMV:

For the 5 well programme, the EMV becomes zero (threshold for risk coverage) for the low oil and nominal gas scenarios at a POS/well of approximately 1.5%. For the medium oil scenario, risk coverage is maintained until the POS/well falls to 0.5%.

Reserves (mmbbl) vs NPV, EMV:

Based on a scaling of the production profile for the low oil case (11mmbbls sales oil , A\$38/bbl), the NPV may be derived for successively lower reserve scenarios. It is seen that for a discovery of producible reserves as low as 1mmbbls, the NPV remains positive at A\$1 million. This is the PV cash surplus accruing to the equity holders after the capital has been recovered together with the required rate of return (in this case DR = 10%).

The risk coverage threshold (EMV = 0) occurs at just under 3 mmbbls of reserves, namely EMV = A\$0.5 million, at a constant POS/well of 6%.+ Given this, a reasonable estimate of the reserves required for commercial development is 2mmbbls.

Illustrations of the above are included in attachments.

Historical Review:

As already explained, the likelihood that a particular number of exploration wells will result in a discovery is quantified in this analysis by the Probability of Project (POP) parameter. However, for a qualitative appreciation of the chance for success it is useful to examine the outcome of the initial exploration programmes in the analogue and other Australian basins.

Amadeus Basin: drilling commenced on surface anticlines with Ooraminna-1 and Alice-1 (1963) followed by the field discovery at Mereenie-1 (1964). After appraisal drilling at East Mereenie-1 and East Mereenie-2, (14.04.64 to 6.11.64), a further exploration well Mt. Charlotte-1 was spudded 12.12.64, encountering oil and gas shows. Following this, the second discovery well Palm Valley-1 was spudded in January 1965. The first commercial discovery was therefore number 3 in the initial drilling sequence, at that time a post facto success rate of 33%. If Palm Valley-1 is included (exploration well number 5), at that stage in the exploration the success rate was 40%, having by then identified the two major fields in the basin.

Bowen Basin: drilling commenced in 1957, but it was not until 1963 that the Rolleston gas field was discovered. The discovery well (Rolleston-1) was well number 9 in the basin, at that time a post facto success rate of 11%.

Adavale Basin: after the drilling of wildcat wells at Buckabie-1, Cothalow-1 and Etonvale-1 (1961) and Gumbardo-1 (1962), gas was discovered by the Gilmore-1 well in 1964. This well was number 5, at that time a post facto success rate of 20%.

Cooper Basin: Innamincke-1 (1959) was the first test of the basin, followed by Betoota-1 and Dullingari-1. This latter well was initially classified as dry, but subsequently was found to contain oil in the Cretaceous and gas in the Permian which has now been developed. At the time, the first recognised discovery was in Gidgealpa-2, which was well number 9 in the sequence, although with the benefit of hindsight this status should be accorded to well number 3. Considering both, a post facto success rate of 22% is indicated.

This listing is not claimed to be exhaustive, but nevertheless it is seen that in three of the four ultimately successful basins considered, significant hydrocarbons were discovered within the first five wells. It should also be noted that following the establishment of the credentials of these basins by these initial discoveries, many dry holes have been drilled. Many holes have also been drilled in other onshore basins (not however analogue basins) without success. Nevertheless, given this record, the proposed programme of five exploration wells in the Tasmania Basin may reasonably be considered adequate as a test of potential.

Although not geologically comparable, it is also useful to note that the prospectivity of a number of prolific Australian offshore basins was in practice established by the first well

in each, e.g. the Gippsland (Barracouta-1), Barrow Sub-basin (Barrow-1) and Dampier Sub-basin (Legendre-1). Each of these basins has subsequently had its share of dry holes.

References: Historical Review.

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2. The Central Australian Basins, R. M. Hopkins, APEA Journal, vol 29 part 1, (1989), pages 347-365.
3. Adavale Basin, G. Auchincloss, Economic Geology of Australia and Papua New Guinea, vol 3, Petroleum, (1976), pages 309-315, AIMM monograph 7.
4. Palaeozoic of the Adavale Basin, H.H. Heikkla, Proceedings 8th Commonwealth Min. Met. Congress Australia and New Zealand, (1965), pages 157-165.
5. Exploration in the Cooper Basin, R. Heath, APEA Journal, vol 29 part 1, (1989), pages 366-378.
6. The Surat and Bowen Basins, L. Elliott, APEA Journal, vol 29 part 1, (1989), pages 398-416.
7. Buckabie-1 well completion report (1961), W. L. Kitsman, J. H. Lewis and S. M. Rowe (Phillips Petroleum Company), Petroleum Search Subsidy Acts Report No. 62/1073.
8. Cothalow-1 well completion report (1961), J. H. Lewis (Phillips Petroleum Company), Petroleum Search Subsidy Acts Report No. 62/1080.
9. Etonvale-1 well completion report (1962), J. H. Lewis and N. Kyranis (Phillips Petroleum Company), Petroleum Search Subsidy Acts Report No. 62/1079.
10. Gumbardo-1 well completion report (1963), Phillips Petroleum Company, Petroleum Search Subsidy Acts Report No. 62/1095.
11. Gilmore-1 well completion report (1965), J. H. Lewis and N. Kyranis (Phillips Petroleum Company), Petroleum Search Subsidy Acts Report No. 64/4039.
12. Relevant Commercial Data Bases:
 - (i) AGSO well data base, Amadeus, Adavale and Bowen Basins.
 - (ii) Encom GPINFO well data base.
 - (iii) AESIS, Australian Mineral Foundation Issue 3, Oct. 1999.

NOTIONAL E&P PROGRAMME ---- 5 WELL CASE.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
SEISMIC SURVEY	800 km A\$2.0m	800 km A\$2.4m	200 km A\$0.6m	nil nil	nil nil
EXPLN WELLS	1 well A\$1.5m	2 wells A\$2.0m	2 wells A\$2.0m	nil nil	nil nil
PDN WELLS			1 cmplt A\$0.5m	1 well A\$1.5m	1 well A\$1.5m
COST A\$M	A\$3.5m	A\$4.4m	A\$3.1m	A\$1.5m	A\$1.5m

Figure 1: Exploration Programme

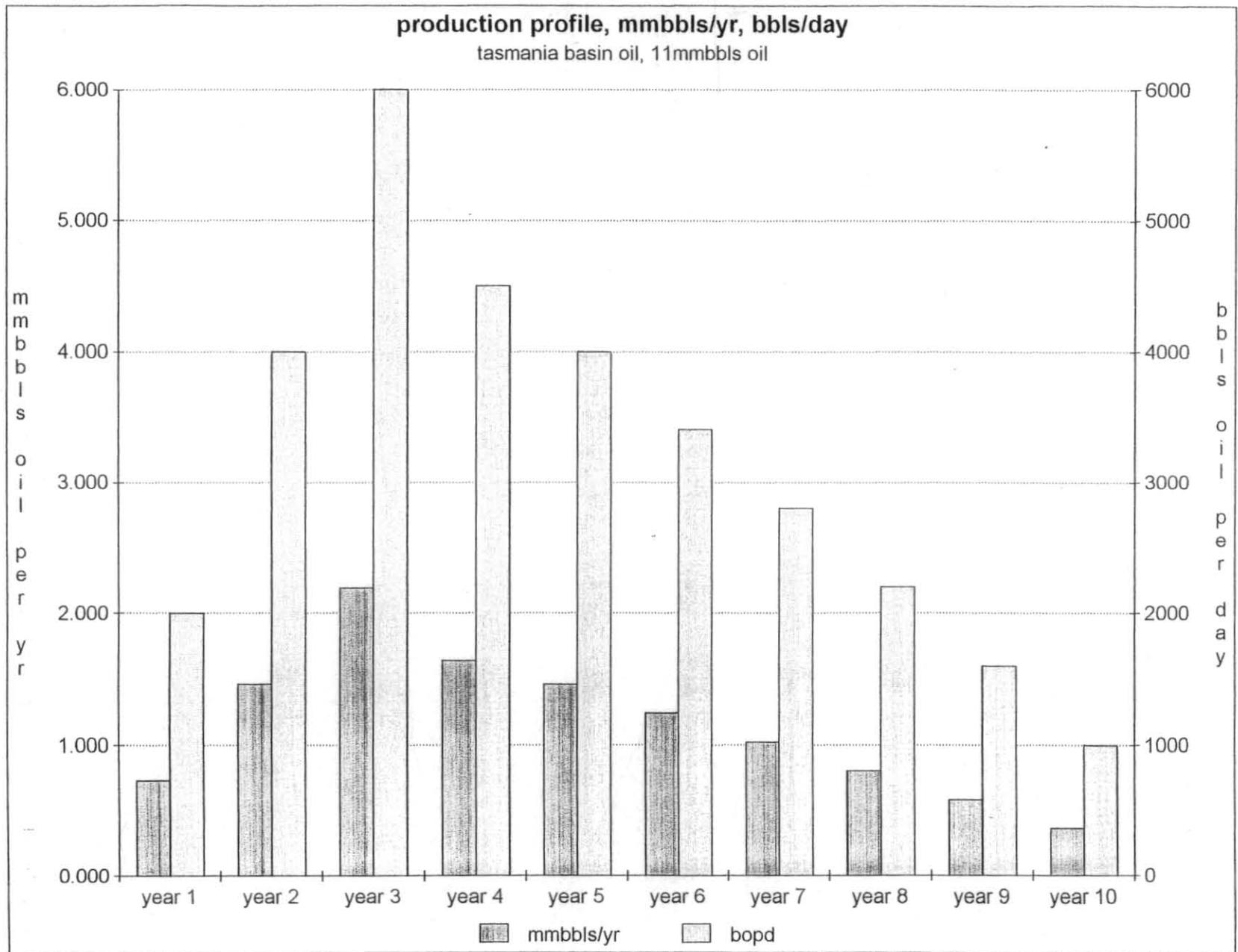
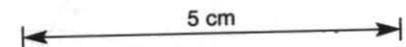


Figure 2: Production Profile, low case, 11 mmbbls sales oil.



	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10
seismic km	800	800	200							
cst/km, A\$	2500	3000	3000							
cst \$m	2.0	2.4	0.6							
prospects	2	3	2							
expl wells	1	2	2							
well cst \$m	1.5	2	2							
well cmplt			0.5							
prod wells				1	1					
well cst \$m				1.5	1.5					
bopd mbbbls				2000	4000	6000	4500	4000	3400	2800
mmbbls/yr				0.73	1.46	2.19	1.64	1.46	1.24	1.02
A\$/bbl	38									
cpi	0.02									
A\$/bbl/year				38.00	38.76	39.54	40.33	41.13	41.96	42.79
revenue \$m				27.740	56.590	86.582	66.235	60.053	52.066	43.736
cum rev \$m				27.740	84.330	170.912	237.147	297.200	349.267	393.002
opex/gov %	40									
opex/gov \$m				11.096	22.636	34.633	26.494	24.021	20.826	17.494
net income	-3.5	-4.4	-3.1	15.144	32.454	51.949	39.741	36.032	31.240	26.241
cum b4 tax	-3.5	-7.9	-11	4.144	36.598	88.547	128.288	164.320	195.560	221.801
discnt rate	0.1									
discnt nos.	-3.500	-4.000	-2.562	11.378	22.166	32.256	22.433	18.490	14.574	11.129
NPV \$m	139.11									
POS well	0.06									
1-POS	0.94									
POProjects	0.734	0.234	0.030	0.002	0.000	0.000				
1-POP	0.73									
failure cost	10.50									
EMV \$m	34.03									
NPV includes cost of seismic and 5 exploration wells						scenario: low oil case		RTEP = 101%		
Each well has an individual POS						discovery year 3				
But, project depends on at least 1 success in these 5 wells						sales oil in year 4		cpi escalation		
Statistically, Prob. of Project = 1 - Prob. of 5 dry holes						low case reserves (15mmbbls), cf Amadeus with 50mmbbls.				
POProject (at least one) = 1 - (1 - POS)^5						oil price A\$38 (US\$25)/bbl in year 4 notionally 2003.				
EMV = POP(1)*NPV+POP(2)*2*NPV+POP(3)*3*NPV.... - (1-POP)*Failure Cost										
FIVE WELLS, LOW OIL CASE SHEET ONE										

Figure 3: NPV/EMV, low case, 11mmbbls sales oil, 5 wells.

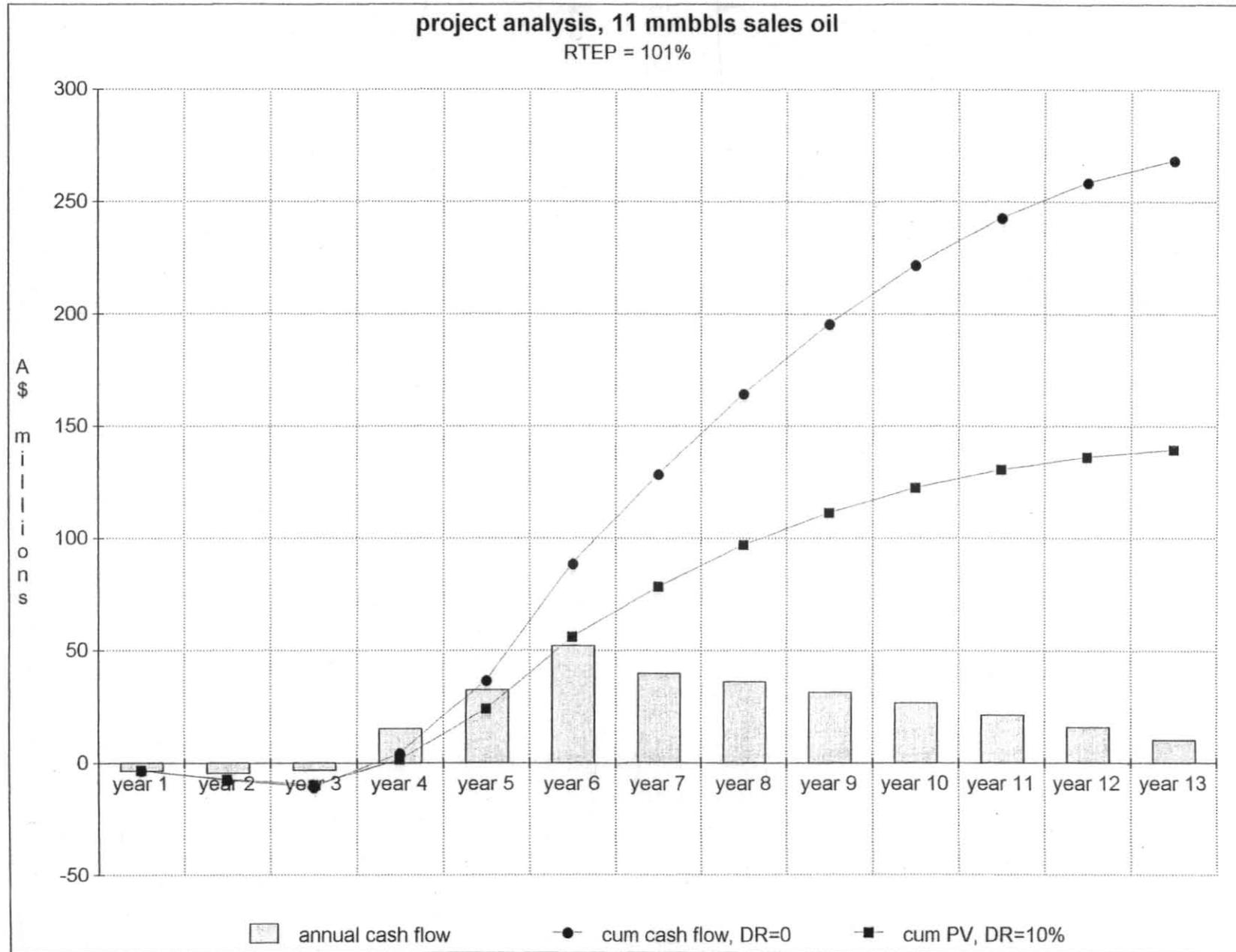


Figure 4: Economic Analysis, ref. Fig. 3.

5 cm

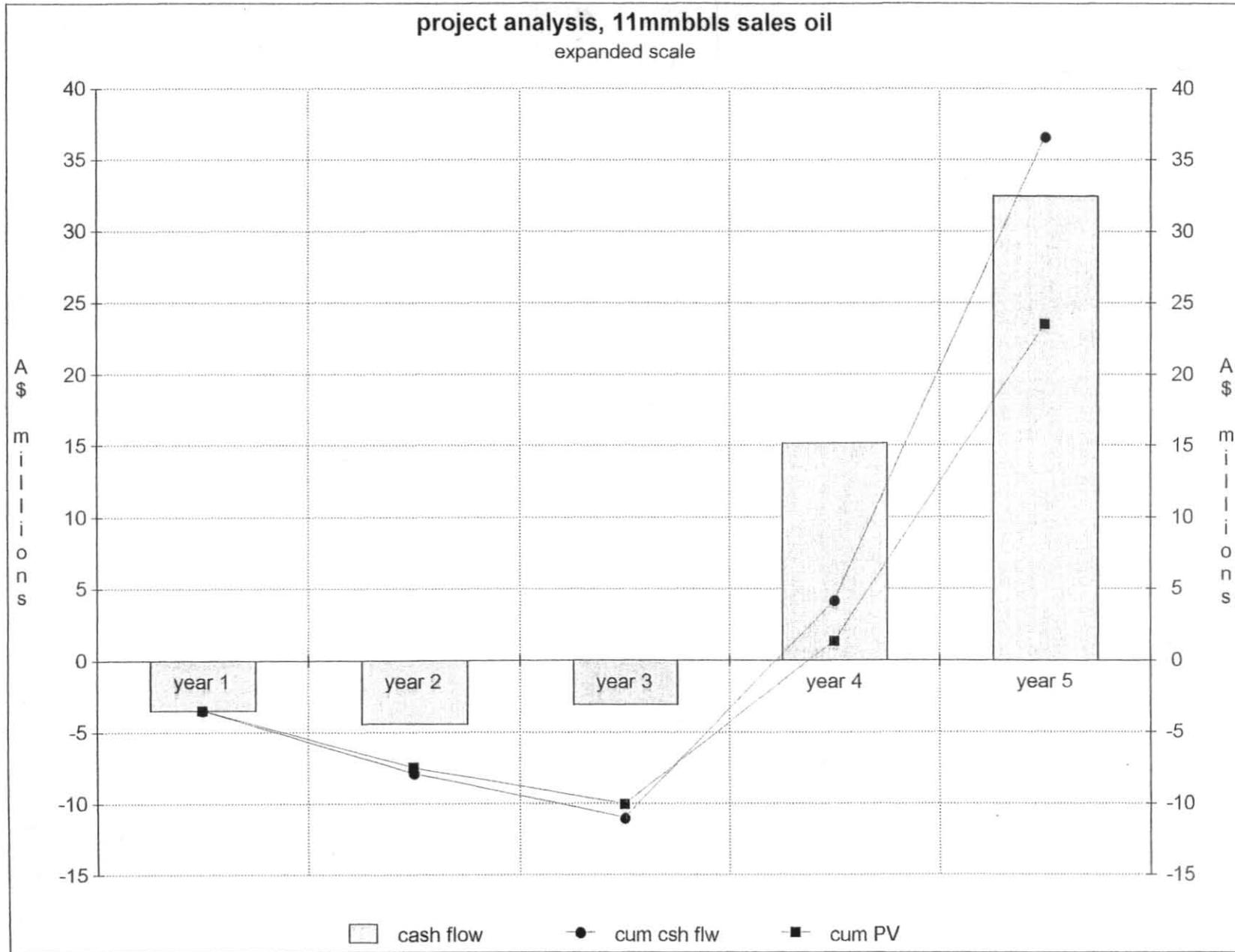


Figure 5: Expanded Scale, Economic Analysis, ref. Fig. 4.

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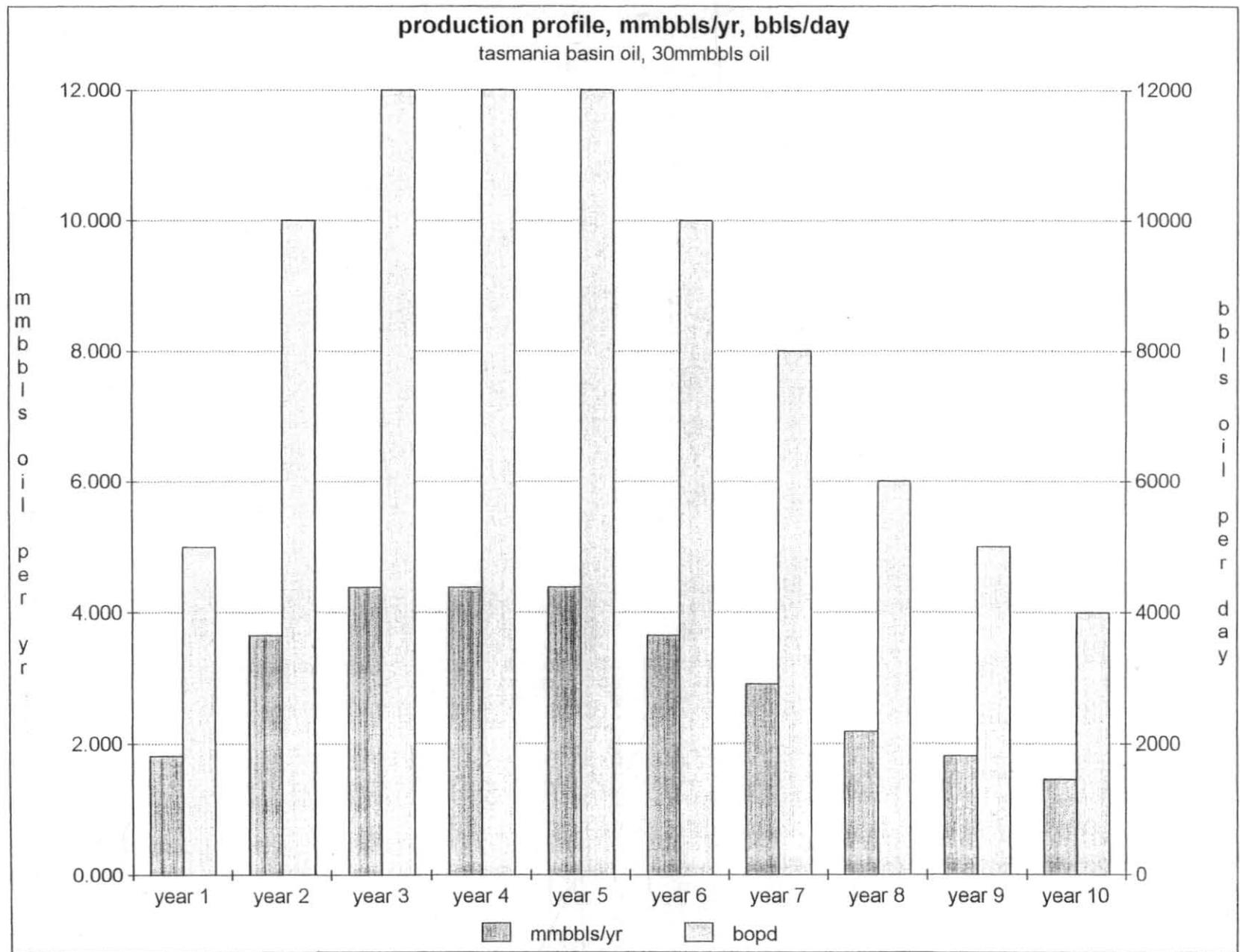
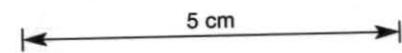
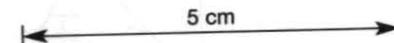


Figure 6: Production Profile, medium case, 30 mmbbls sales oil.



	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10
seismic km	800	800	200							
cst/km, A\$	2500	3000	3000							
cst \$m	2.0	2.4	0.6							
prospects	2	3	2							
expl wells	1	2	2							
well cst \$m	1.5	2	2							
well cmplt			0.5							
prod wells				1	1					
well cst \$m				1.5	1.5					
bopd mbbbls				5000	10000	12000	12000	12000	10000	8000
mmbbls/yr				1.83	3.65	4.38	4.38	4.38	3.65	2.92
A\$/bbl	38									
cpi	0.02									
A\$/bbl/year				38.00	38.76	39.54	40.33	41.13	41.96	42.79
revenue \$m				69.350	141.474	173.164	176.627	180.160	153.136	124.959
cum rev \$m				69.350	210.824	383.988	560.616	740.776	893.912	1018.871
opex/gov %	40									
opex/gov \$m				27.740	56.590	69.266	70.651	72.064	61.254	49.984
net income	-3.5	-4.4	-3.1	40.110	83.384	103.899	105.976	108.096	91.882	74.975
cum b4 tax	-3.5	-7.9	-11	29.110	112.494	216.393	322.369	430.465	522.347	597.322
discnt rate	0.1									
discnt nos.	-3.500	-4.000	-2.562	30.135	56.953	64.513	59.821	55.470	42.863	31.797
NPV \$m	383.37									
POS well	0.03									
1-POS	0.97									
POProjects	0.859	0.133	0.008	0.000	0.000	0.000				
1-POP	0.86									
failure cost	10.50									
EMV \$m	48.49									
NPV includes cost of seismic and 5 exploration wells						scenario: medium oil case		RTEP = 158%		
Each well has an individual POS						discovery year 3				
But, project depends on at least 1 success in these 5 wells						sales oil in year 4		cpi escalation		
Statistically, Prob. of Project = 1 - Prob. of 5 dry holes						med case reserves (30mmbbls), cf Amadeus with 50mmbbls				
POProject (at least one) = 1 - (1 - POS)^5						oil price A\$38 (US\$25)/bbl in year 4 notionally 2003.				
EMV = POP(1)*NPV+POP(2)*2*NPV+POP(3)*3*NPV.... - (1-POP)*Failure Cost										
FIVE WELLS, MEDIUM OIL CASE SHEET ONE										

Figure 7: NPV/EMV, med case, 30mmbbls sales oil, 5 wells



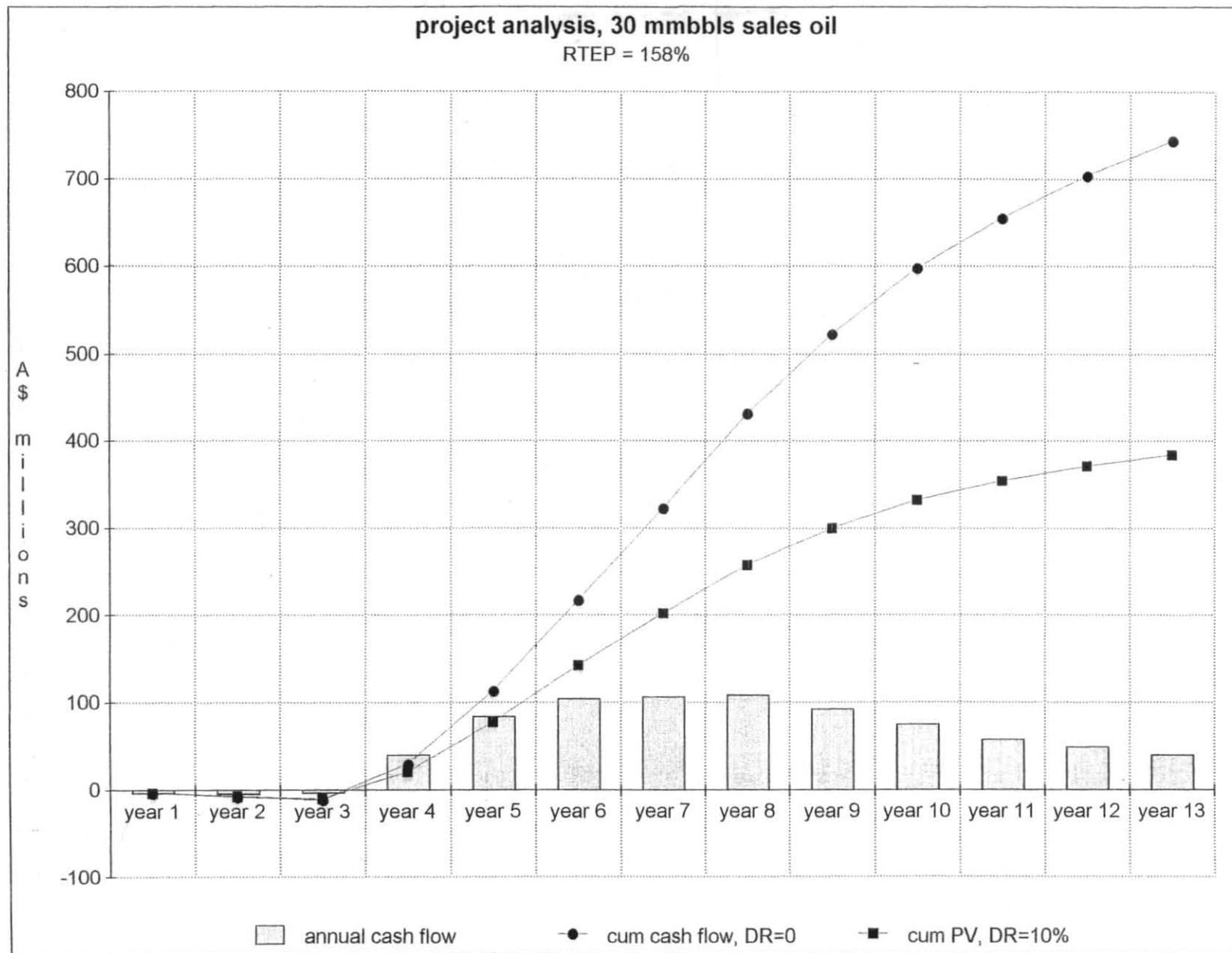


Figure 8: Economic Analysis, ref. Fig. 7.

←————— 5 cm —————→

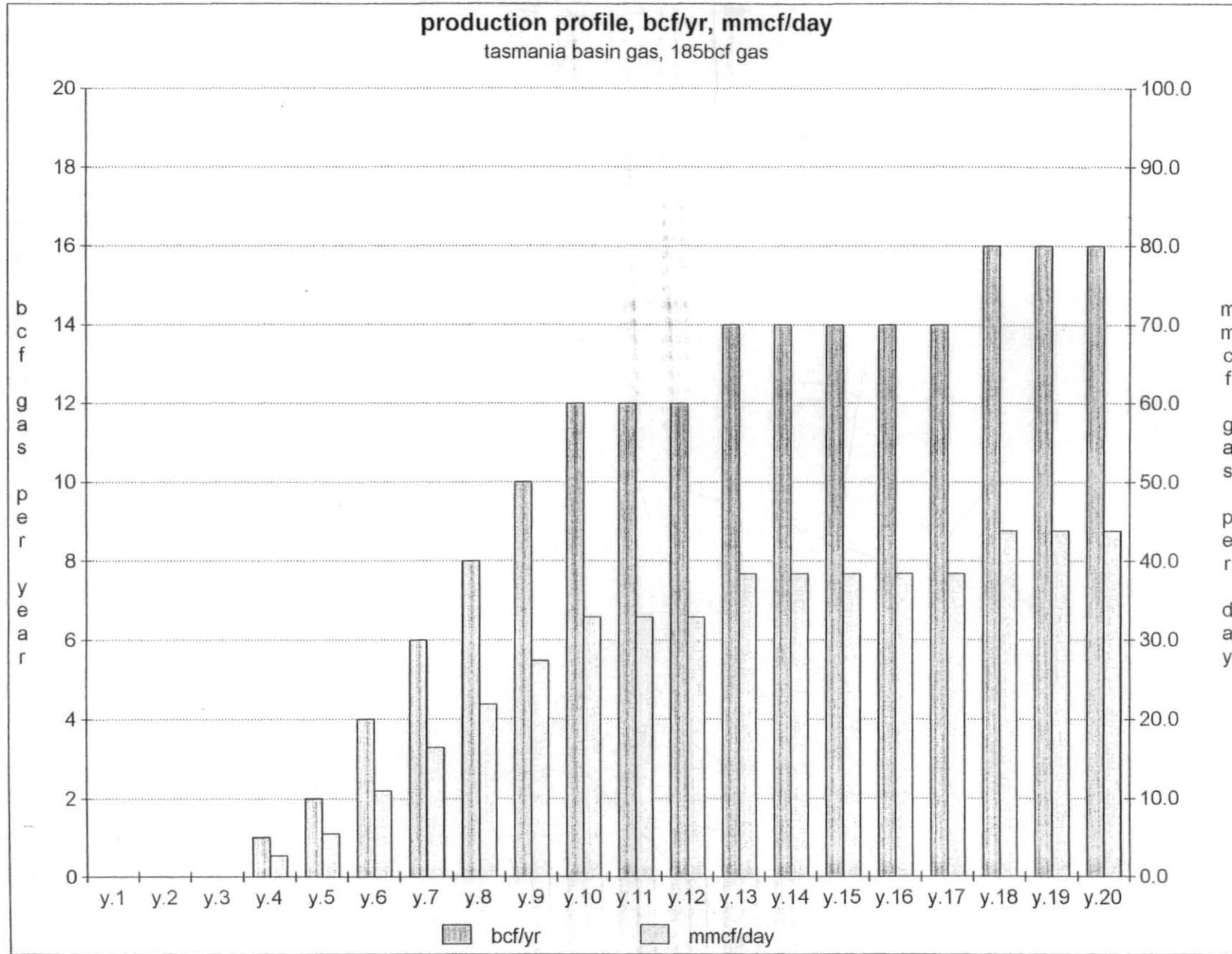
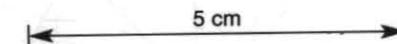


Figure 9: Production Profile, nominal case, 185bcf sales gas.



	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	year 11
seismic km	800	800	200								
cst/km	2500	3000	3000								
cst \$m	2	2.4	0.6								
prospects	2	3	2								
expl wells	1	2	2								
well cst \$m	1.5	2	2								
well cmplt			0.5								
prod wells				1	1						
well cst \$m				1.5	1.5						
sale gas bcf				1	2	4	6	8	10	12	12
cpi	0.02										
\$/kscf				2.50	2.55	2.60	2.65	2.71	2.76	2.82	2.87
revenue \$m				2.50	5.10	10.40	15.92	21.65	27.60	33.78	34.46
cum rev \$m				2.50	7.60	18.00	33.92	55.57	83.17	116.96	151.42
opex/gov %				20	20	20	20	20	20	20	20
opex/gov tk				0.50	1.02	2.08	3.18	4.33	5.52	6.76	6.89
net income	-3.50	-4.40	-3.10	0.50	2.58	8.32	12.73	17.32	22.08	27.03	27.57
cum b4 tax	-3.50	-7.90	-11.00	-10.50	-7.92	0.40	13.14	30.46	52.54	79.57	107.13
discnt rate	0.1										
discnt nos.	-3.5	-4.0	-2.6	0.4	1.8	5.2	7.2	8.9	10.3	11.5	10.6
NPV \$m	125.7										
POS well	0.06										
1-POS	0.94										
POProjects	0.734	0.234	0.030	0.002	0.000	0.000					
1-POP	0.73										
failure cost	10.50										
EMV \$m	30.02										
NPV includes cost of 5 expl wells.						scenario: nominal gas RTEP = 48%					
Each well has an individual POS						discovery year 3					
But, project depends on at least 1 success in these 5 wells						sales gas in year 4					
Statistically, Prob. of Project = 1 - Prob. of 5 dry holes						nominal reserves (185bcf sales gas), cf Amadeus					
POProject (at least one) = 1 - (1-POS)^5						gas price on market cpi escalation					
EMV = POP(1)*NPV+POP(2)*2*NPV+POP(3)*3*NPV..... - (1-POP)*Failure Cost											
FIVE WELLS, NOMINAL GAS CASE SHEET ONE											

Figure 10: NPV/EMV, 185 bcf sales gas, 5 wells

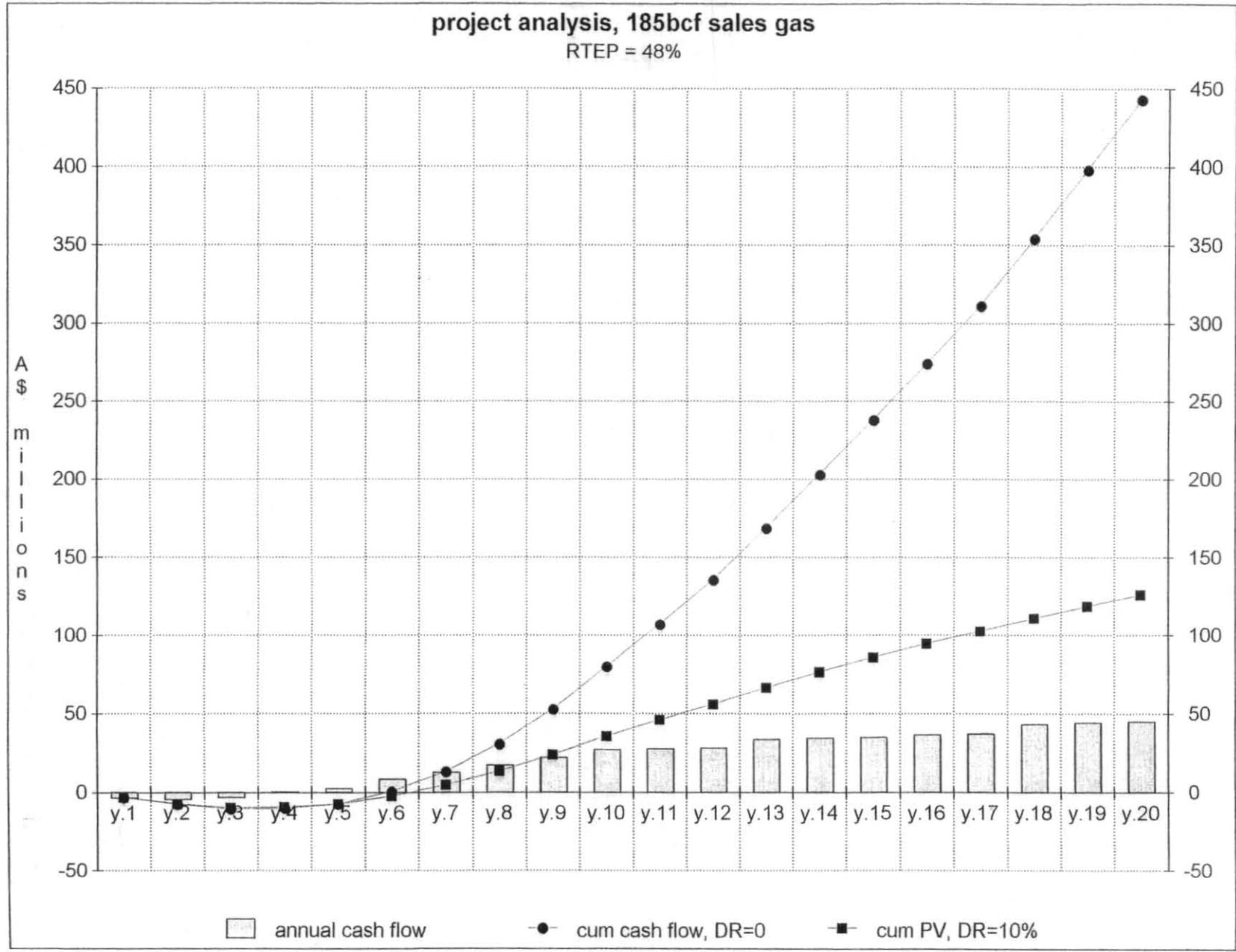
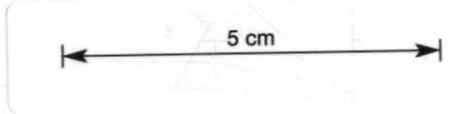


Figure 11: Economic Analysis, ref. Fig. 10.



EMV**EXPECTED MONETARY VALUE**

MEASURE OF RISK/RETURN BALANCE

**FOR A SINGLE WELL,
= (POS*NPV) - (1-POS)*(FAILURE COST)**

**WHEN EMV = 0,
RISK AND REWARD ARE IN BALANCE**

**WHEN EMV > 0,
PROPOSAL IS BIASED TOWARDS REWARD**

**THE LARGER THE EMV, THE MORE ROBUST
THE PROPOSAL**

**EMV IS A STATISTICAL PARAMETER
WHICH IS NEVER REALISED IN PRACTICE**

**OUTCOME CAN ONLY BE FAILURE OR
SUCCESS. IN THE LATTER, THE FULL NPV
IS REALISED.**

**NEVERTHELESS, EMV IS AN INDUSTRY
RECOGNISED YARDSTICK**

Figure 12: Expected Monetary Value (EMV).

THE BINOMIAL DISTRIBUTION

a count of X successes in n trials, each independent and each having the same probability p of success

result can only be success or failure

BINOMIAL PROBABILITY FORMULA

$$P(X=k) = \binom{n}{k} * p^k * (1-p)^{n-k}$$

where the possible outcomes for X are
 $k = 0, 1, 2, \dots, n$.

n = no. of tests (wells)

k = no. of successes (projects)

p = probability of success in any one test.

$$\text{Binomial Coefficient} = \binom{n}{k} = \frac{n!}{k! * (n-k)!}$$

Figure 13: The Binomial Distribution.

	NOMINAL GAS bcf	LOW OIL mmbbls	MED OIL mmbbls
SALES VOLUME	185	11	30
POS/WELL	6%	6%	3%
DISCOUNT RATE	10%	10%	10%

3 EXPLN WELLS

NPV (A\$M)	NA	NA	NA
EMV (A\$M)	NA	NA	NA

5 EXPLN WELLS

NPV (A\$M)	126	139	383
EMV (A\$M)	30	34	48

GAS PRICE \$2.40/kcf ESCALATING CPI ANNUAL

OIL PRICE A\$38/bbl (US\$25) in MOD Y.4, ESCALATING CPI ANNUAL

CPI TAKEN AS 2%

GAS CASE OPEX PLUS ROYALTY ASSUMED 20% OF GROSS

OIL CASE OPEX PLUS ROYALTY ASSUMED 40% OF GROSS

COST OF FAILURE 5 WELL CASE IS A\$10.5 MILLION

Figure 14: NPV/EMV Summary Table

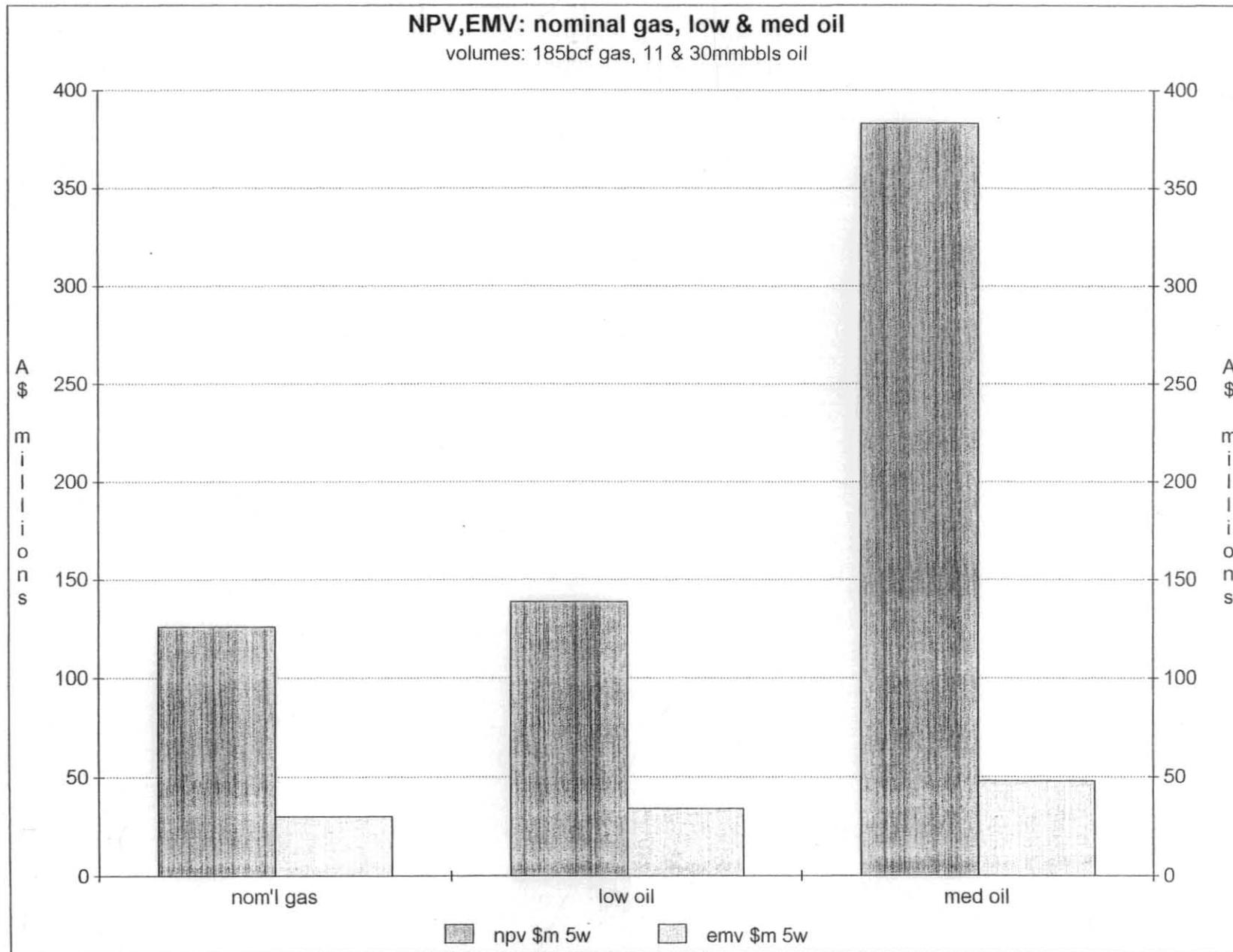


Figure 15: NPV/EMV Summary Chart, ref. Fig.14.

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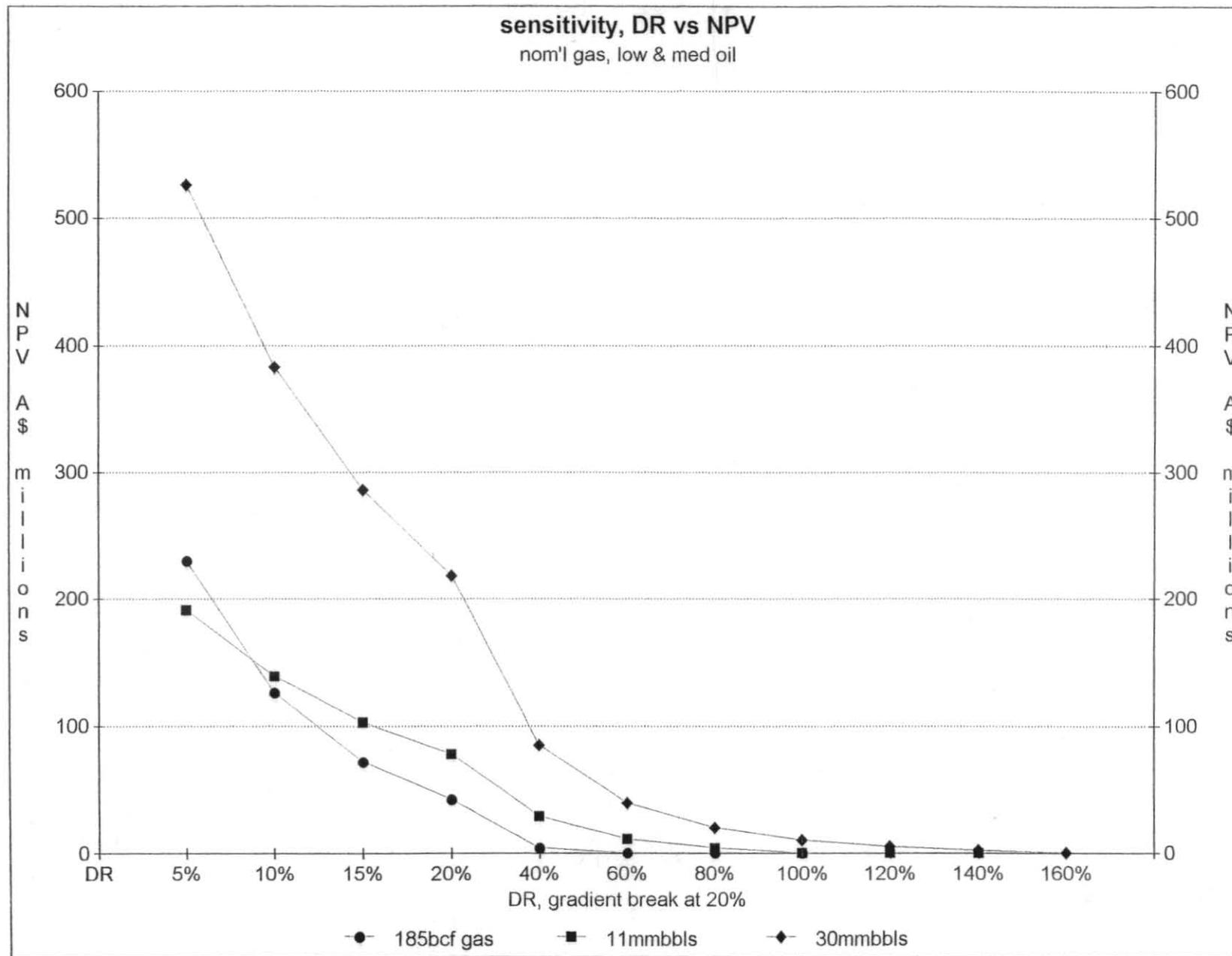
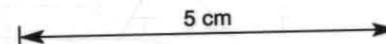


Figure 16: Sensitivity Plot, DR vs NPV.



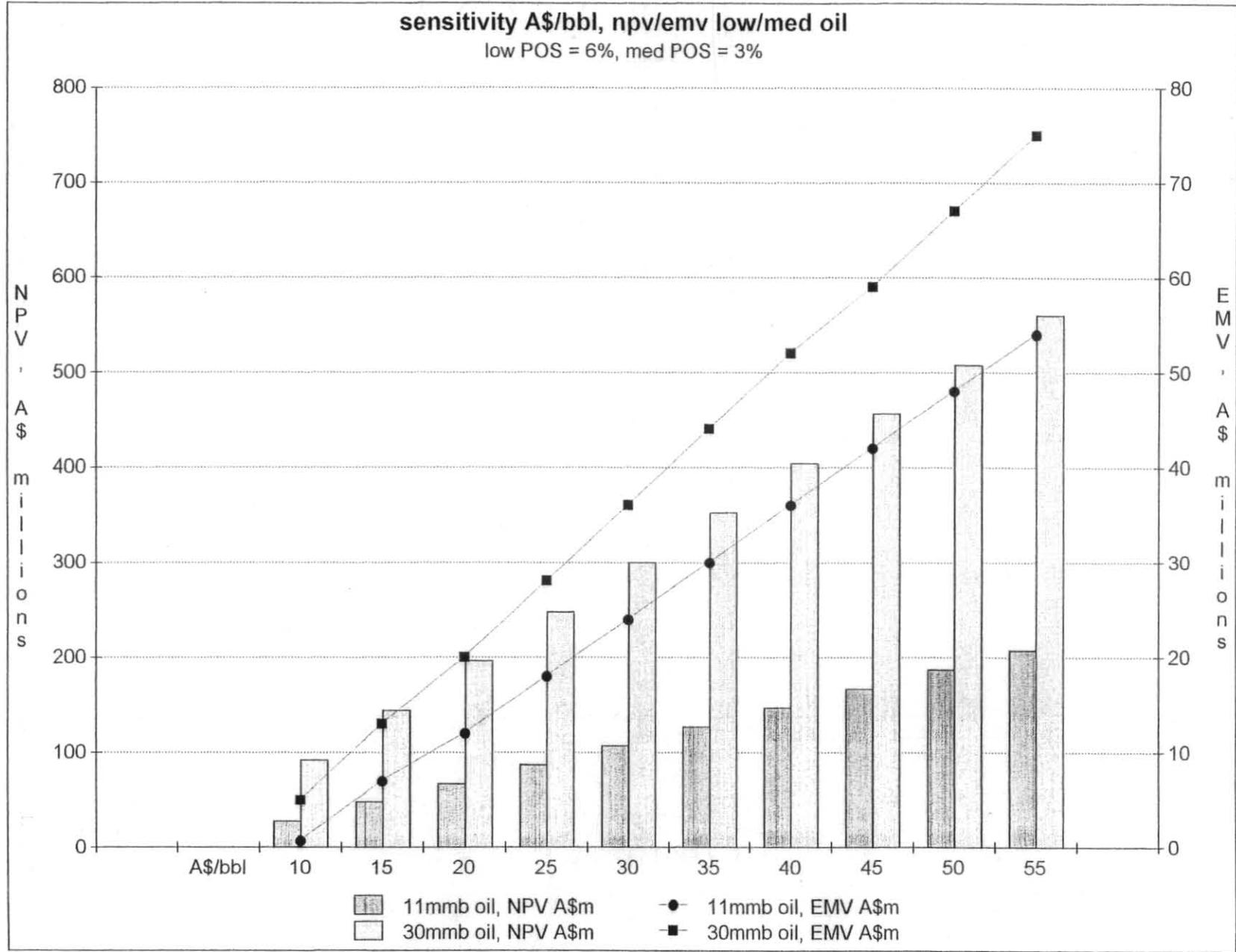
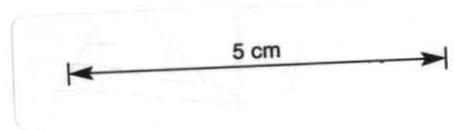


Figure 17: Sensitivity Plot, A\$/bbl vs EMV, low & med oil cases.



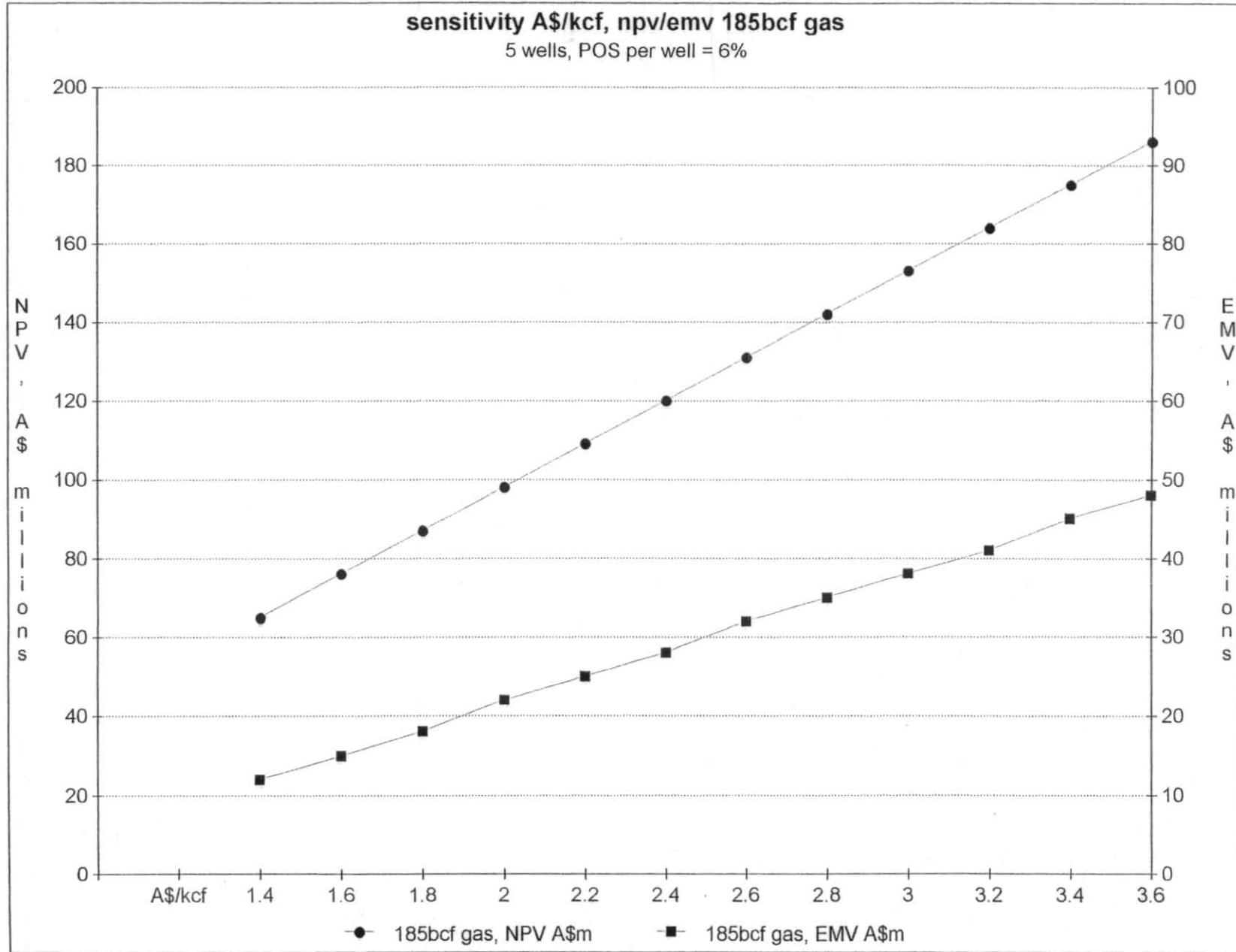
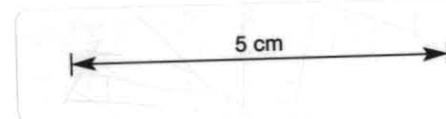


Figure 18: Sensitivity Plot, A\$/kcf vs EMV, nominal gas case.



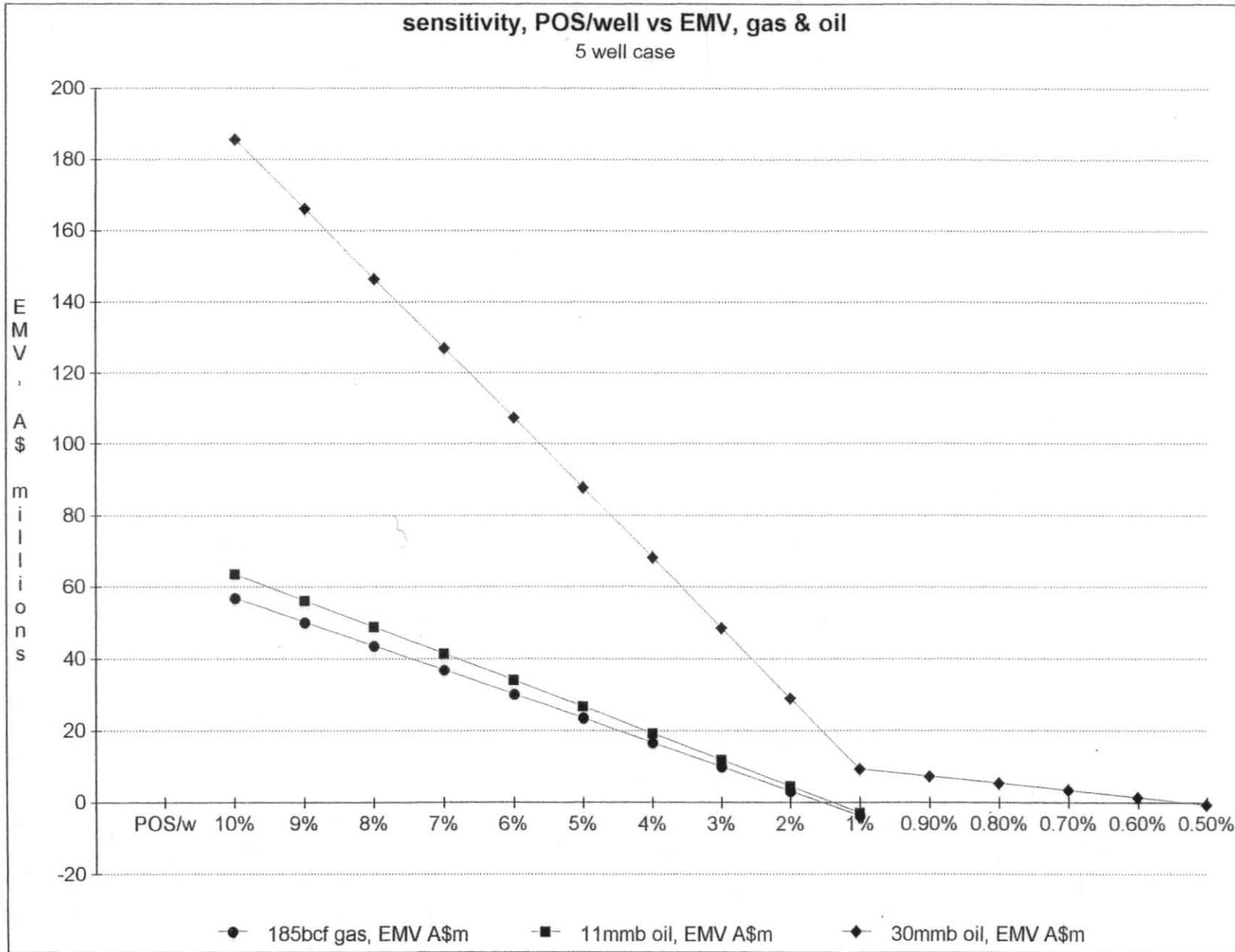
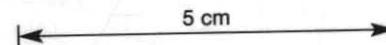


Figure 19: Sensitivity Plot, POS/well vs EMV.



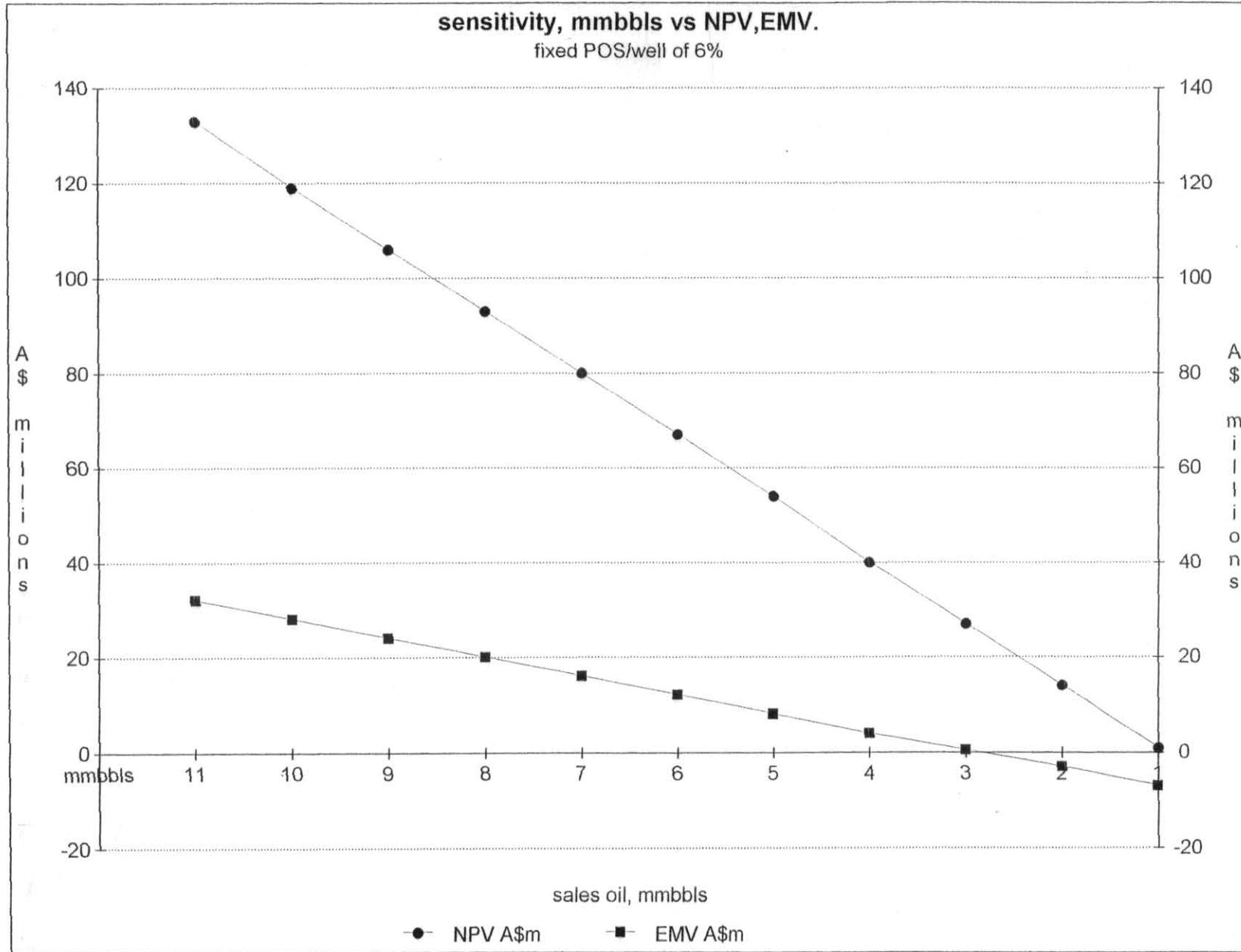
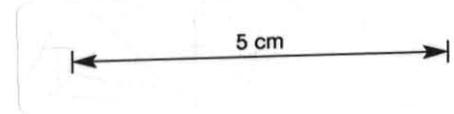


Figure 20: Sensitivity Plot, Reserves (mmbbls) vs NPV, EMV (A\$m)



ANALOGUE BASINS

SUCCESS RATE
OF THE DAY

834050

AMADEUS BASIN

WELL 1	OORAMINNA-1 (1963)		
WELL 2	ALICE -1 (1963)		
WELL 3	MEREENIE-1 (1964)	50mmbbl oil/600bcf gas	33%
WELL 4	MT. CHARLOTTE-1 (1964)		
WELL 5	PALM VALLEY-1 (1965)	750bcf gas	40%

BOWEN BASIN

WELL 9	ROLLESTON-1 (1963)	300bcf gas with others	11%
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ADAVALE BASIN

WELL 1	BUCKABIE-1 (1961)		
WELL 2	COTHALOW-1 (1961)		
WELL 3	ETONVALE-1 (1961)		
WELL 4	GUMBARDO-1 (1962)		
WELL 5	GILMORE-1 (1964)	25bcf gas	20%

SIMILAR BASIN

COOPER BASIN

WELL 1	INNAMINCKE-1 (1959)		
WELL 2	BETOOTA-1 (1960)		
WELL 3	DULLINGARI-1 (1962)	gas/oil now on production	33%
WELL 9	GIDGEALPA-2 (1963)	commercial gas discovery	22%

OTHER BASINS

GIPPSLAND BASIN

WELL 1	BARRACOUTA-1 (1964)	1776bcf gas plus 26.4mmb cond/62.9mmb LPG	100%
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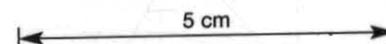
DAMPIER BASIN

WELL -1	LEGENDRE-1 (1968)	45mmbbbls oil	100%
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BARROW BASIN

WELL -1	BARROW-1 (1964)	1000mmbbbls oil	100%
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Figure 21, Historical Review Summary



Appendix 2

The Exploration Prospectivity of the
Onshore Tasmania Basin
Independent Geologists Report

Dr Larry Wakefield

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**The Exploration Prospectivity of the Onshore
Tasmania Basin.**

Independent Geologist's Report
for
Great Southland Minerals Ltd

Dr Larry L. Wakefield

Consultant Petroleum Geologist

Melbourne

August 2000

40B Gardiner Parade
Glen Iris
Victoria, 3146

9th August 2000

The Chairman
Great Southland Minerals Ltd
M.L.C. Building
Level 3/65 Murray Street
Hobart
Tasmania, 7000

Dear Sir,

RE: Assessment Of Value, Special Exploration Licence (SEL 13/98), Onshore Tasmania Basin.

I have critically reviewed the document entitled "Assessment Of Value, Special Exploration Licence (SEL 13/98), Onshore Tasmania Basin" prepared by Great Southland Minerals Ltd. In my opinion, the contents of the document present a balanced and objective assessment of the acreage value.

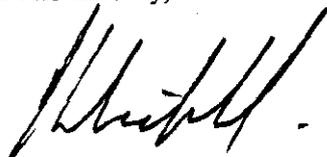
Since comprehensive subsurface data and information does not exist for the Tasmania Basin and therefore the prospectivity remains unrealised, the valuation methodology used by Great Southland Minerals is pragmatic and follows accepted industry practice. The use of analogue basins with their ultimate recoverable potential, current production and historical success rates, affords a reasonable basis on which to ascertain acreage value for the Tasmania Basin.

The assignment of risk to the parameters controlling successful discovery and recovery of hydrocarbons in a situation where the range in uncertainty is broad, always poses a challenge. In the case of the Tasmania Basin, allocation of risk by Great Southland Minerals is regarded as reasonable considering that the venture is at a very early stage of exploration. The resulting probability of success for the scenarios offered by GSLM is objective and reflects fairly on the wide latitude of uncertainty in the subsurface parameters.

The input parameters to the project economics and the range of adopted scenarios result in a fair and transparent analysis. The GSLM analysis includes a discussion on sensitivities, which offers a broader perspective on the effects of parameter variation. The spectrum of positive expected monetary value (EMV) underscores the potential robustness of the venture. The analysis provides more than adequate risk coverage to progress the exploration campaign.

In my professional opinion, the approach, and methodology provides fair and reasonable expectation of the value of Special Exploration Licence 13/98, onshore Tasmania Basin. I endorse the conclusions derived from the outcome of the economic analysis carried out by Great Southland Minerals.

Yours sincerely,



Dr Larry L. Wakefield
Consulting Geologist

Larry L. Wakefield
Consultant in Petroleum Exploration
40B Gardiner Parade
Glen Iris
Victoria 3146
Phone: 61-3-9885 0458
Email: larry_wakefield@hotmail.com

9th August 2000

The Directors
Great South Land Minerals Ltd
Level 3 65 Murray Street
Hobart
Tasmania, 7000

Gentlemen

RE: INDEPENDENT GEOLOGIST'S REPORT ON THE EXPLORATION
PROSPECTIVITY OF THE ONSHORE TASMANIA BASIN.

STATEMENT

Larry L Wakefield was commissioned by Great South Land Minerals Ltd (ACN 068 650 386) to provide a technical report on the exploration prospectivity of the onshore Tasmania Basin, over which GSLM holds licence SEL 13/98. This report is to be included in a prospectus as part of the company's public listing on the Australian Stock Exchange.

The author considers that the exploration licence is prospective for hydrocarbons on the basis of the available technical data. Although the Tasmania Basin is classified as a frontier basin, there is sufficient encouragement to invest in the next phase of exploration. The acquisition of geophysical data along with continued geological studies will enable the emerging prospect and lead portfolio to be quantified, risked and ranked. By way of this process, investors in the venture will be in an improved position to make an objective assessment of the future rewards of the Tasmania Basin.

LIMITATIONS

The report is based on documents and reports provided by GSLM as well as the results of geoscience investigations carried out by state and national geological surveys and universities, and is reliant on geological, geophysical and geochemical analyses and interpretations carried out by others. Much of the data and information and data have been generated through the activities of GSLM and its predecessor companies. Discussions were held with directors and senior staff of GSLM. The

author has no reason to believe that any information has been withheld but this does not imply that an audit has been made of technical, legal or accounting records.

QUALIFICATIONS OF THE AUTHOR

Larry L Wakefield is a petroleum geologist with 24 years experience in the international petroleum industry. He is currently an independent consultant, based in Melbourne, Australia where he is providing technical and managerial advice in petroleum exploration. Prior to commencing his consultancy, he spent 23 years with Shell International Petroleum and was assigned to Shell companies in New Zealand, Spain, Thailand, England, The Netherlands and Australia. In his last assignment with Shell Development (Australia) Pty Ltd, he was Exploration Portfolio Manager, being responsible for improving Shell's exploration position through the identification, and acquisition of prospective acreage as well as high-grading the existing exploration portfolio of prospects and leads. He graduated from the University of Auckland, New Zealand with a Doctor of Philosophy in Geology in 1974.

DECLARATION

The author has no pecuniary or vested interest, that could be reasonably regarded as being capable of affecting his ability to give an unbiased opinion in relation to the petroleum exploration assets of Great South Land Minerals Ltd.

Yours faithfully



Dr Larry L Wakefield

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Figure 2. Generalised Stratigraphy of Tasmania

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Figure 6. Timing Risk Chart for Gondwana Petroleum System

1. Introduction

Great Southland Minerals Pty Ltd (GSLM) has been granted exploration licence, SEL 13/98 that covers the onshore Tasmania Basin. The licence area is 30,356 square kilometres (Figure 1). Terms of the licence, which was granted in June 1999 for the duration of 5 years, requires completion of a \$2 million work program including the acquisition of a minimum of 600 line kilometres of 2D onshore seismic data within the first 2 years and thereafter, at \$2 million per year.

As part of the preparation to float the company on the Australian Stock Exchange, GSLM has commissioned this independent geologist's report to be included in the company prospectus. The purpose of this report is to provide a current review and assessment of the prospectivity of the Tasmania Basin. The report is based on documents and reports provided by GSLM as well as the results of geoscience investigations carried out by state and national geological surveys and universities, and is reliant on geological, geophysical and geochemical analyses and interpretations carried out by others. Much of the data and information and data have been generated through the activities of GSLM and its predecessor companies from 1984 onwards. Discussions were held with directors and senior staff of GSLM. A field excursion was conducted to obtain first hand impressions on the geology of Tasmania. The author has no reason to believe that any information has been withheld.

The report reviews the exploration history of the Tasmania Basin. A brief summary of the geological history helps put the prospectivity in a regional context. A description of the main structural elements combined with an analysis of the factors necessary for a successful hydrocarbon habitat provides insight into the risks and rewards for investment into exploring for petroleum in the Tasmania Basin

2. Database and Information Sources

The Tasmania Basin is still at a very immature phase of petroleum exploration. Regional geological field mapping is reasonably comprehensive, and a wealth of published literature exists on many aspects of Tasmanian geology. In recent years, 3 B.Sc (Hons) theses from the University of Tasmania have made special reference to aspects of petroleum geology namely, reservoir distribution and quality, source rock identification and hydrocarbon maturity modelling. Regional magnetic and gravity surveys are available, providing input for models describing possible scenarios on the distribution of rock types and structural elements under the Tasmania Basin. Within the Tasmania Basin, seismic data is confined to two lines (20 kilometres in total) of stack data, recorded by AGSO in 1994 as part of their contribution to the TASGO project, as well as a short line on Bruny Island, acquired by Conga Oil. There is a series of seismic lines recorded in Storm Bay, D'entrecasteaux Channel and the Huon Estuary. Of these, the Storm Bay transect has been fully processed and is the only one available for interpretation.

A series of stratigraphic boreholes were drilled by the Tasmanian Department of Mines, some of which tag pre-Carboniferous lithologies. Information on the lithologies and sequences penetrated by these wells is available at the Tasmania Department of Mines. Of the 45 wells drilled by private companies, most have lithological descriptions. Electrical logs have been sighted only from BHP's oilshale

venture in the Styx Valley. Gas chromatograph and mudlogs have been recorded from GSLM's wells Shittim-1 and Jericho-1 on Bruny Island (Figure 1).

Known source rocks have been sampled and analysed. In recent years, tars, bitumens water and gas samples have been analysed using modern analytical techniques.

3. Exploration History of the Tasmania Basin

For over 100 years, the occurrences of bitumens and tars along reports of oil and gas seeps have led to varying degrees of effort to locate commercial quantities of hydrocarbons in onshore Tasmania. Over 130 reports of oil and gas seeps have been registered at the Tasmania Mines Department. On investigation, although most have turned out not to be naturally occurring hydrocarbons, about 10% of the cases have confirmed the presence of naturally occurring hydrocarbons in the form of seeps, tars and bitumens. This element along with the occurrence of the rich Tasmanites oilshale has motivated some 13 companies to actively explore for oil over the past 75 years. Some 38 wells have been drilled in the vicinity of seepages without any detailed knowledge of structure or stratigraphy. Most wells are drilled to depths of 350 metres or less and most bottomed in Jurassic dolerite. A peak of activity occurred in the 1920s, in the region between Devonport and Launceston, northern Tasmania. Another phase of activity occurred from 1967-1974, when 7 wells were drilled west and north-west of Launceston. The wells ranged in depths from 50-831metres and all bottomed in the Jurassic dolerite.

From 1984, GSLM and its predecessor companies, Condor Oil Pty Ltd and Conga Oil Pty Ltd, took out various licences over the Tasmania Basin. In the 1980s, geochemical analyses using current technologies was carried out on source rocks, seeps, tars and bitumens. A regional aeromagnetic survey was acquired in 1988. Short lines of seismic were acquired in the waters around and on Bruny Island. In the 1990s, routine geochemical analyses were carried out on new sample material. In 1994, Condor Oil Pty Ltd commenced drilling 2 stratigraphic wells (Shittim-1, and Gilgal-1). Shittim-1 was completed to a depth of 1751m in 1996/7 and encountered around 600m of Permian glaciogene sediments intruded by two dolerite sills, and reached metamorphic basement. In 1997, the stratigraphic well campaign was continued by GSLM with the completion of Jericho-1 (640m) on Bruny Island, followed by Lonnavale-1(557m), Hunterston-1 (336m), Bridgewater-1 252m, and Pelham-1 503m (Figure 1). All wells have been suspended in the Permian sequence or in the Jurassic dolerite.

Since well locations have not been located on structural features constrained by seismic data, it is not surprising that there are few reports of hydrocarbons. Oily water was recovered from 30 metres below surface in Johnson' well on Bruny Island (originally drilled in 1929). Gas was reported from the Iles well at Port Sorell in 1923. Gas shows have been recorded in GSLM wells, Shittim-1 and Jericho-1 on Bruny Island. The gas from Shittim-1 has been analysed and shown to be a highly mature thermal gas with the presence of methane, carbon dioxide, nitrogen, hydrogen and helium. The latter two gases indicate a source from deep in the basement.

4. Regional Geology

The geological sequence in Tasmania (Figure 2) begins with metamorphosed Late Proterozoic schists, phyllites, dolomites, and quartzites. Prior to the Middle Cambrian, two phases of structuring and deformation occurred with an intervening phase of tholeiitic volcanism. During the Delamerian Orogeny (Middle-Late Cambrian), a rifting episode initiated flysch deposition followed by the formation of a volcanic arc (Mt Reid Volcanics), culminating in east-west compression, uplift and erosion. Throughout the Ordovician to Early Devonian, in the west, stable epihercynian conditions representative of a passive sag phase established an extensive carbonate platform (Gordon Group). Following carbonate deposition, cycles of siliclastics were laid down (Eldon group). To the east, a thick succession (5-6km) of deepwater sandy flysch and mudstone was deposited in a subsiding trough throughout this time period.

These sequences were deformed by the Middle Devonian Tabberabberan Orogeny with structural development being controlled by the older structural grains. Folds developed over Cambrian fold trends (E-W trends), together with WNW and NW trending thrusts and folds. In the north-east and east, a complex fold thrust belt developed at the boundary between the shelfal and basinal facies. Widespread intrusion of granitoids occurred at this time.

The Tasmania Basin is made up of an Upper Carboniferous to Middle Jurassic succession, up to 1500m thick. Early basin fill was deposited on a glacial landscape with relief up to 1000m, and consists of glaciogenic tillites, diamictites and claystones passing up into lower coastal plain and shallow marine cold water mudstones, siltstones, sandstones and minor limestones. Of note is the occurrence of an algal (Tasmanites) oilshale. This sequence, termed the Lower Parmeener Group, is Upper Carboniferous to Permian in age and is unconformably overlain by the Upper Parmeener Group comprising sandstones and coal measures of Late Permian to Triassic age. There is some evidence for a phase of gentle folding of the Parmeener Group in the Late Triassic.

During the Middle Jurassic, a large volume of tholeiitic dolerite was intruded into the Tasmanian crust, mainly as sills into the flat-lying sediments of the Tasmania Basin. There are generally 1-2 sheets that can reach a total thickness of 400-500m. Intrusion of the dolerite was via many points centred mainly in the vicinity of Hobart. The dolerite sheets are thickest in this area. There are a few occurrences of basalt (Lune River) that are associated with the dolerite. This phase of dolerite intrusion is associated with the onset of rifting of Australia and Antarctica. Separation of the two continents had occurred by the Mid Cretaceous, accompanied by underwent regional uplift of onshore Tasmania. This event is likely to have generated block faulting and folding of the Parmeener Group. Offshore Tasmania experienced continued rifting throughout the Middle Cretaceous to Palaeogene with the deposition of thick deltaic sequences (eg Bass, Durroon and Sorrell Basins). Late Cretaceous to Tertiary sequences, up to 800m thick, are to be found in narrow grabens around Launceston, Hobart and Macquarie Harbour. A veneer of Upper Oligocene-Early Miocene, shallow marine limestones and sandstones is found in northern coastal sections up to 100m above sea level attesting to Neogene uplift. Tertiary basalts are scattered across northern Tasmania and range in age from Palaeocene to Miocene.

5. Structural Elements

The present day structural elements (Figure 3) affecting the Tasmania Basin consist of:

- **Northern Grabens Province.** Narrow grabens occur in the vicinity of Launceston (Tamar, Devonport/Port Sorell and Longford). There is a well-defined NW strike to bounding faults. Similar structural trends are seen in the offshore Durroon and Sorell Basins. Up to 800m of Tertiary to Recent sediments have accumulated in these grabens. The grabens surround an exposed block of Proterozoic basement (Badger Head Block), which appears to have been subject to Neogene reactivation.
- **Central Lakes Plateau.** A mildly structured, uplifted block, bounded by the Tamar Lineament and the Derwent Lineament shows gentle tilting to the south and west. There is little evidence of large fault systems. Some gentle warping of the Tasmania Basin sediments is evident.
- **Douglas River Block.** This block lies to the south-east of the Northern Grabens Province. The block appears to have structural characteristics similar to the Central Lakes Plateau. The dolerite cover has no erosional windows to the underlying Permo-Triassic sequence. To the north of a marked east-west lineament, the dolerite has been largely eroded away exposing mildly structured Parmeener Group.
- **Hobart-Huon Block.** A complexly structured block that makes up the country north-west and south of Hobart. The Tasmania Basin sequence is well dissected indicating many intersecting, minor, but pervasive fault systems emanating from the complex grain of underlying Lower Paleozoic and Proterozoic structural elements. It is worthy of note that this region contains the greatest density of dolerite feeder centres. Erosional remnants of Tertiary grabens with NW strike are preserved at Hobart (Derwent, Coal River), indicating the block has experienced some Neogene uplift.

The structural elements of the Lower Paleozoic and Proterozoic succession require comment as the distribution of potential reservoirs and structures beneath the Tasmania Basin unconformity constitute an exploration play. Of relevance is the structural style of the Middle Devonian deformation event, the Tabberaberan Orogeny. Open to tight folds form structures with two trends, N-S (earlier event), and NW-SE to WNW-ESE (later event). This structural style probably extends underneath the Central Lakes Plateau and the Hobart-Huon Block. East of the Tamar Lineament, the two stages of deformation during the Devonian have generated complex structures comprised of NNW trending folds associated with a thrust complex, with the main thrust zone dipping eastwards. This zone is coincident with the transition from the Ordovician to Devonian shelfal facies to the west and the basin flysch facies to the east.

The Tasmania Basin is a mildly structured sequence and covers most of central and eastern Tasmania. The present limits of the basin are erosional and the original basin was probably much larger, although a thin, incomplete succession in the north-east suggests the proximity of a depositional margin. Total thickness is in the order of 1,500m, the preservation of the thickest sequences centred along the axis of the Tamar Lineament.

6. Petroleum Systems

Based on the evidence gathered to date, two petroleum systems may occur in EL 13/98 held by GSLM. A petroleum system is identified by the presence of a mature source rock that provides charge for hydrocarbon accumulations. The system includes all the other factors required for oil and gas fields to exist, namely reservoir, seal, and trap configuration. Following the nomenclature set up for petroleum systems of Australia by Bradshaw (1993), the potential systems for onshore Tasmania are:

- Larapintine (Ordovician-Silurian sequence)
- Gondwanan (Late Carboniferous-Middle Triassic sequence)

6.1 Larapintine Petroleum System (Figure 5)

Source rocks

Although not located, source rock facies should occur within the Gordon Limestone Group. Flooding events within the shallow marine sequence are the best candidates. The laterally equivalent Turquoise Bluff Slate (Mathinna Group) in NE Tasmania was deposited in an optimal environment for source rock development and is expected to interfinger with shallow marine facies in the east.

Based on conodont alteration indices (CAI), the outcropping Gordon Group is post mature for oil and gas except for some localities in the south where CAI and other geochemical data indicate maturities within the oil and gas window. Maturity modelling carried out by Woods (1995) caters for a wide range of outcomes for a potential source rock passing through the oil/gas window. This could occur in the Devonian, Triassic, Jurassic or Lower Cretaceous, depending on location, heat flow and burial history.

Reservoirs

There are no porosity and permeability data available for the Ordovician-Silurian sequences. The Gordon Limestone appears to have limited possibilities for primary porosity development. However, secondary porosity development is a possibility with the recorded descriptions of porous and vuggy dolomites. Furthermore, the Gordon limestone has a well-developed karst at the Devonian-Carboniferous unconformity. Further karstification is likely to have occurred during the Cretaceous. Permeability through fracturing is another possibility for reservoir development in the Gordon limestone.

Due to estimated paleoburial depths in excess of 3000m and the potential for a prolonged diagenetic history, porosities and permeabilities of the overlying Eldon Group sandstones are expected to be low. Porosity enhancement may occur close to unconformities. However, the sandstones have potential as gas-bearing reservoirs.

Seals

Intraformational mudstones occur within the Gordon and Eldon groups. However, paleoburial depths and the effects of the Devonian and subsequent deformations would have embrittled these lithologies, turning them into high risk seals.

Trapping Configurations

Possible trapping configurations for the Larapintine System are:

- Anticlines formed during Tabberaberan Orogeny with intraformational seals.
- Broad folds or fault assisted folds formed during Triassic or younger deformation events. These structures may be separate from or modify older Devonian structures.
- Stacked thrust sheets. This trapping configuration is likely to be encountered in a swath along the Tamar Lineament.
- Truncation traps at the Devonian unconformity.
- Erosional outliers of Gordon limestone sealed by Upper Carboniferous tillites and marine mudstones.
- Down faulted inliers of Gordon or Eldon Group laterally sealed by Cambrian or older sequences with top seal of Upper Carboniferous tillites and marine mudstones.
- Buried hill topography sealed by Upper Carboniferous tillites and marine mudstones.

6.2 Gondwana Petroleum System (Figure 6)

Source Rocks

Organic facies within the Parmeener Group are highly variable. The best source rock is the Tasmanites oilshale that is a widespread, 2 metre thick unit near the base of the Quamby Mudstone in the north of the basin. This oilshale is a world-class source rock with algal Type I oil-prone kerogen and TOCs up to 30% (Figure 4). There are good indications that this marine source rock facies occurs as thin streaks throughout the Quamby Mudstone. Coal measure sequences within the Parmeener Group contain organic facies that have the potential to generate light oil and gas (Type II/III) and gas only (Type III).

Vitrinite reflectance measurements and biomarker maturity indicators from source rock extracts show that the Parmeener Group source rocks are presently immature to low mature for oil generation. The frequent observation that source rocks at some localities have a petroliferous odour or ooze oil when broken open (as well as high S1 Rock Eval values) is indicative of in situ kerogen conversion. The oil sampled at the Lonnvale seep has been typed to the Parmeener Group Type I oil source rock.

Timing of maturation

Some basic maturation modelling has been carried out on the Permian source rocks (Woods, 1995). His results indicate the source rocks entered the oil window as early as the Mid Cretaceous.

Fission track analyses from outcrop and drillhole samples indicate three cooling (uplift) events. The first is associated with the Middle Cretaceous break-up of Australia and Antarctica. Fission track data suggest the removal of up to 2-3km of Upper Jurassic to Lower Cretaceous sediments. This is in agreement with the maturity profile of outcropping Permian source rocks. There is evidence for a Palaeogene cooling event in eastern and western coastal areas suggesting changes in heat flow or another phase of uplift and erosion. A third Neogene cooling event, which can be taken as evidence of the latest phase of uplift, is confined to the north-western areas of the state. The fission track data helps to refine the burial and uplift history from Upper Jurassic to Recent times. These data should be incorporated into more detailed modelling to define charge dynamics. The continued subsidence in the northern grabens during the Tertiary provides a site for the latest maturation phase of the Permian source rocks. Apart from the graben areas, regional Neogene uplift has arrested further maturation of the source rocks over most of the Tasmania Basin.

Apart from local contact metamorphism, the changes and impact on maturation timing due to heat flow caused by the intrusion of the Jurassic dolerites is a topic that requires further investigation.

Reservoirs

The Permian-Triassic sandstones, deposited in fluvial to shallow marine environments, are widespread in the Tasmania Basin. Woods (1995) and Maynard (1996) log and detail facies associations, and describe diagenetic events for the Lower Parmeener Group. The sandstones are fine to medium, occasionally coarse grained, moderately to well sorted, quartz-rich with subordinate feldspars and micas. Upper Parmeener Group sandstones contain more feldspathic and lithic units. The diagenetic sequencing follows the usual pattern of early quartz overgrowths, pressure solution and silica cementation, followed by clay authigenesis (kaolinite, smectite) and feldspar dissolution. Carbonate cements occasionally occur.

Lower Parmeener Group sandstones range from 10-40m in thickness, while Upper Parmeener fluvial sandstones aggregate to a gross thickness of 200-300 metres. Porosities range up to 25%, averaging 13%. The few permeability measurements from outcrop samples and Shittim-1 range from 386mD to less than 1mD. Contact heat metamorphism of the sandstones is recorded in the proximity of the Jurassic dolerite sheets that can effect porosities up to 30 metres from the contact.

Seals

Two regional seals occur within the Lower Parmeener Group, mudstones of the Quamby/Woody Island and Ferntree Formations. The Woody Island Formation tends to become silty in the south of the basin. The Quamby/Woody Island Formation occurs above the basal tillite/diamictite sequence, which could constitute a seal in its own right. The Ferntree Formation is the primary seal for the sandstone reservoirs of

Liffey Group in the north of the Basin and the Malbina Formation sands in the south of the Basin. No regional seals have been identified in the Upper Parmeener Group.

The Jurassic dolerite could be invoked as a sealing lithology. However, there is a strong likelihood that the dolerite will display pervasive jointing and be fractured by fault systems. The dolerite's effect on surrounding sediments may have enhanced their sealing capacity through contact metamorphism.

Trapping Configurations

For the Gondwana system, the following trapping configurations are envisaged.

- Low relief anticlines
- Tilted fault blocks
- Compaction drape over the pre-Permian unconformity

7. Play Concepts

A future exploration portfolio of prospects and leads in the four structural zones of the Tasmania Basin would probably feature the following main plays.

Northern Grabens Province, Douglas River Block.

Trapping configurations consist of tilted fault blocks or fault-assisted anticlines in Lower Parmeener Group. The main reservoir target is the Liffey sandstone. Top and lateral seals are formed by Fernree mudstones. Oil or light oil and gas charge is derived from Lower Parmeener source rocks.

Central Lakes Plateau, Huon-Hobart blocks.

A variety of trapping configurations is likely such as Devonian folds, erosional outliers or buried hills of karstified and fractured Gordon limestones for both areas. The Central Lakes Plateau may contain the additional possibility of gentle anticlines and tilted fault blocks forming traps in the Parmeener Group. Seals are formed by Lower Parmeener Group tillites and mudstones. Charge from both the Larapintine and Gondwana systems is possible. A dry gas charge is sourced from highly mature Ordovician source rocks with oil charge from lower Parmeener source rocks.

8. Risks

The Tasmania Basin is a good example of an Australian frontier basin. Examining the exploration campaigns, and the nature of oil and gas discoveries in other analogue Australian basins, a frontier basin of this type presents a significant challenge. However, hydrocarbons have been discovered and commercially developed in basins with similar structural history and hydrocarbon habitat as the Tasmania Basin. Examples from the Larapintine system are the Mereenie Field, ultimate recoverable reserves (UCR) around 50 million barrels oil and 600 billion cubic feet gas and Palm Valley Gas Field (UCR 750 billion cubic feet gas) in the Amadeus Basin, Northern Territories; Gilmore Gas Field (proven recoverable gas reserves around 25 billion cubic feet) in the Adavale Basin, Queensland. Examples from the Gondwana System are the producing gas fields such as Turkey Creek, Rolleston, Yellowbank, in the

Denison trough of the Bowen Basin, Queensland. Ultimate recoverable reserves of the gas fields in the Denison Trough could be in the order of 300 billion cubic feet.

In comparison with basins where a significant hydrocarbon discovery is yet to be made, the Tasmania Basin has a considerable advantage in having proven high quality, mature source rocks. Their presence provides a strong incentive to continue with an exploration campaign. However, other hydrocarbon habitat elements such as trapping configuration, timing of maturation and charge and hydrocarbon retention in traps are still very much in the unquantified category. Quantification of elements requires subsurface data coverage and further methodical analysis and modelling. Until this data is gathered and analysed, it is difficult to accurately assess the risks of the hydrocarbon plays in the Tasmanian Basin.

It has been widely surmised that the recovery of useful seismic data from beneath the dolerite would be unsuccessful due to masking effects by the dolerite. However, the seismic line 95AGS-T4, acquired and processed by AGSO in 1994/5 clearly shows coherent reflection events from the pre-dolerite section, indicating that useful data can be obtained.

Other subordinate elements that require addressing are the distribution and quality of seals, and the possibilities of waste zones reducing hydrocarbon column lengths through poorly developed reservoirs due to depositional setting or diagenesis. Predicting the subsurface distribution of reservoirs in the Gordon limestone will not be an easy task. Long residence time coupled with the uplift history presents the possibility of biodegraded oils in accumulations.

9. Exploration Strategy

Up until now, GSLM and its predecessor companies had been pursuing a strategy of reducing the uncertainties of petroleum systems by way of regional studies of the geochemistry of source rocks, seeps, tars and bitumens, reservoir distribution and quality, structural elements of the basin and the nature of the geology below the Jurassic dolerites. This strategy has been further augmented by the drilling of stratigraphic wells to acquire more information on the position and thickness of the dolerites within the Parmeener Group.

GSLM's intended future strategy is to embark on a 2D seismic program to:

- determine the extent of the petroleum systems
- define potential petroleum targets.

Based on the results of the seismic program, suitable prospects will be tested with a drilling campaign.

The company's strategy is considered to be appropriate for the next phase of exploration. It is recommended that the company take into consideration the following additional activities that could make a significant contribution to the execution of a cost-effective program and improve the chances of a successful hydrocarbon discovery.

- Acquire high resolution magnetic and additional gravity data prior to seismic acquisition. AGSO have recently completed and processed a survey covering the northern part of the basin. However, new data will be required for the southern area. These data will help refine structural domains, the distribution and thickness of dolerites and the nature of the pre-Permian sequence. This data will be of great benefit in the specification of acquisition and processing parameters of subsequent seismic programs.
- Acquire a limited regional 2D seismic survey guided by the magnetic and gravity results. This investment, while not directly delineating drilling locations, will allow for the focussed layout of the subsequent detailed seismic program.
- Based on the interpretation of the gravity/magnetic and regional 2D seismic data, acquire denser 2D seismic coverage over structural trends and areas of focus for hydrocarbon charge. The structural complexities of the Larapintine System and the subtleties of the less deformed Gondwana System both require seismic coverage that is sufficient to give confidence that future drillable prospects have low risk in trap delineation.
- Build up portfolio of traps prior to the drilling campaign. Rigorous ranking of the portfolio will improve chances of success.
- Continue with geological studies and include the following activities:
 - systematic assessment of additional porosity and permeability data using minipermeameter on outcrop and borehole samples.
 - investigate porosity reduction effects close to dolerite sills.
 - investigate SR distribution, quality and maturity of the Larapintine System.
 - improve maturity modelling with emphasis on heatflow history and the impact of Jurassic dolerite event. Improve understanding on timing of charge.
 - map the distribution of regional seals and their proximity to reservoirs. Factor in the risk of potential waste zones.
 - obtain more information and models for the buried hill play and karst development.

10. Ranking Regions in the Tasmania Basin

Based on the available evidence on the prospectivity of the Tasmania Basin, the structural regions can be ranked according to the state of the hydrocarbon habitat and the degree of difficulty in acquiring further data to improve the chances of success.

Highest Ranked. *Northern Grabens Province*

Factors include:

- favorable maturation and charge history
- preservation of Permian Group with well developed reservoirs and seals
- Jurassic dolerite sills less frequent and thinner than in the south

- pre-Permian sequence is complex but may provide secondary target at the unconformity
- dense seismic acquisition is achievable
- prospects may be small.

Ranked Second. *Central Lakes Plateau*

Factors include:

- Lower Parmeener Group drape and broad, low relief structures
- large Devonian structures
- Gordon limestone karst is the target reservoir
- Lower Parmeener reservoir units may have shaled out
- possible oil charge from Gondwana System, but there may be a risk of biodegradation
- post-mature Larapintine source rock is a risk. Prospects may be charged with dry gas with high inert gas content
- good seismic coverage is achievable.

Ranked Third. *Douglas River Block*

Factors include:

- Lower Parmeener source possibly mature
- Parmeener Group well preserved under dolerite cover
- Traps may have a high integrity
- Dolerites may be very thick
- Seismic acquisition will be moderately difficult

Ranked Fourth. *Hobart-Huon Block*

Factors include:

- a structurally complex region. Prospects are likely to be small
- outliers of Gordon Limestone may be limited in areal extent
- Larapintine source rock probably has favorable maturity for gas/condensate
- Seismic acquisition very difficult and expensive. Seismic coverage is likely to be inadequate to produce robust trapping configurations.

11. Conclusion

It is concluded that there is a probability that petroleum exploration in the Tasmania basin will encounter hydrocarbons in quantities to justify commercial development of the hydrocarbons in the domestic market. Although the Tasmania Basin is classified as a frontier basin, there is sufficient encouragement to progress on to the next phase of exploration, namely the acquisition of geophysical data with adequate density. This data will enable the emerging prospect and lead portfolio to be quantified, risked and ranked. By way of this process, investors will be in an improved position to make a balanced and objective assessment of the future rewards of the Tasmania Basin.



Dr Larry L. Wakefield
Melbourne
August 2000

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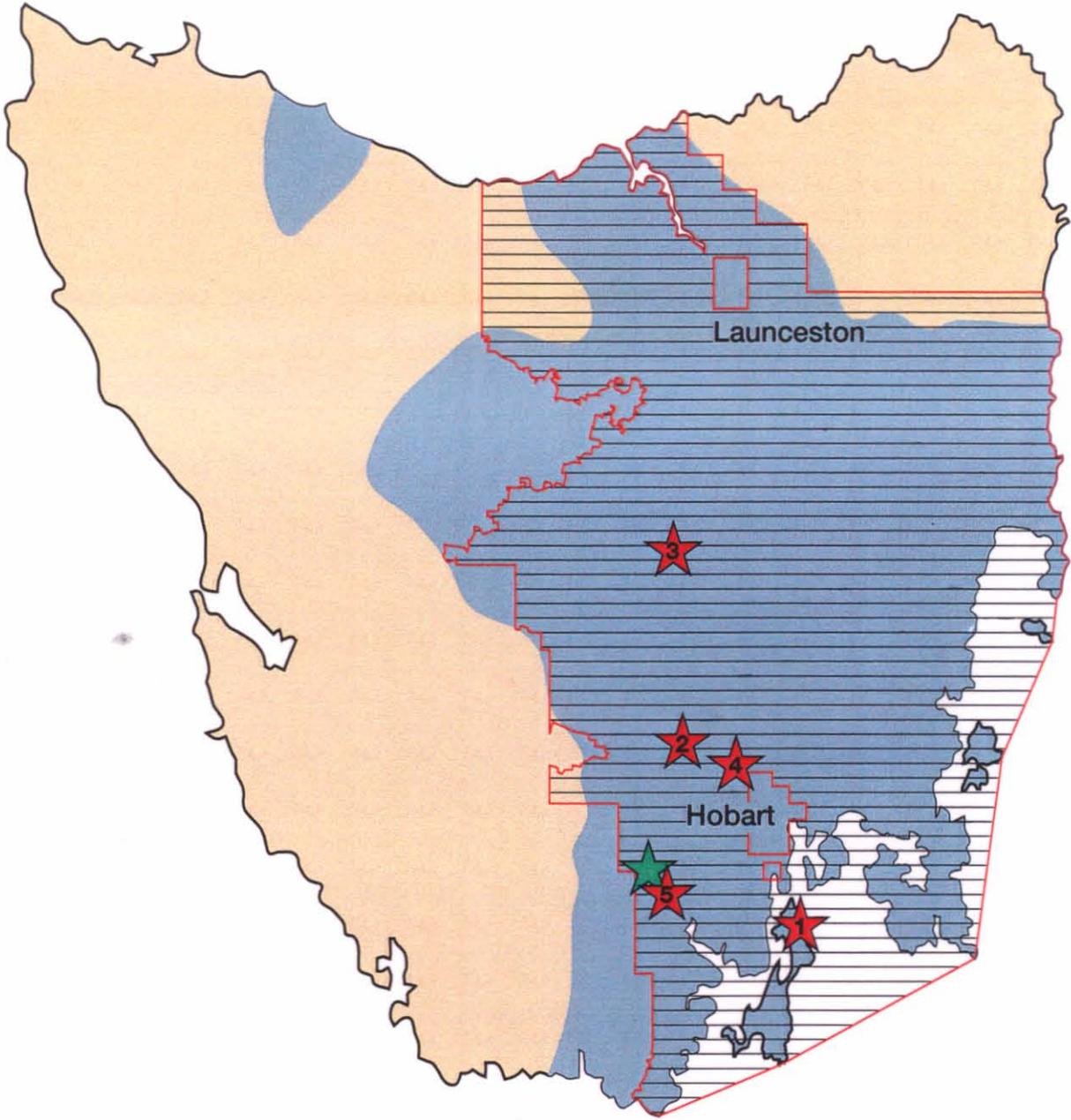
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Locality Map, Tasmania Basin



 SELA 13/98

 Tasmania Basin

 Lonnvale Oil Seep

 GSM's Stratigraphic Wells

- 1 - Shittim#1, Jericho #1 (Bruny Island)
- 2 - Pelham #1
- 3 - Hunterston #1
- 4 - Bridgewater #1
- 5 - Lonnvale #1

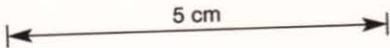
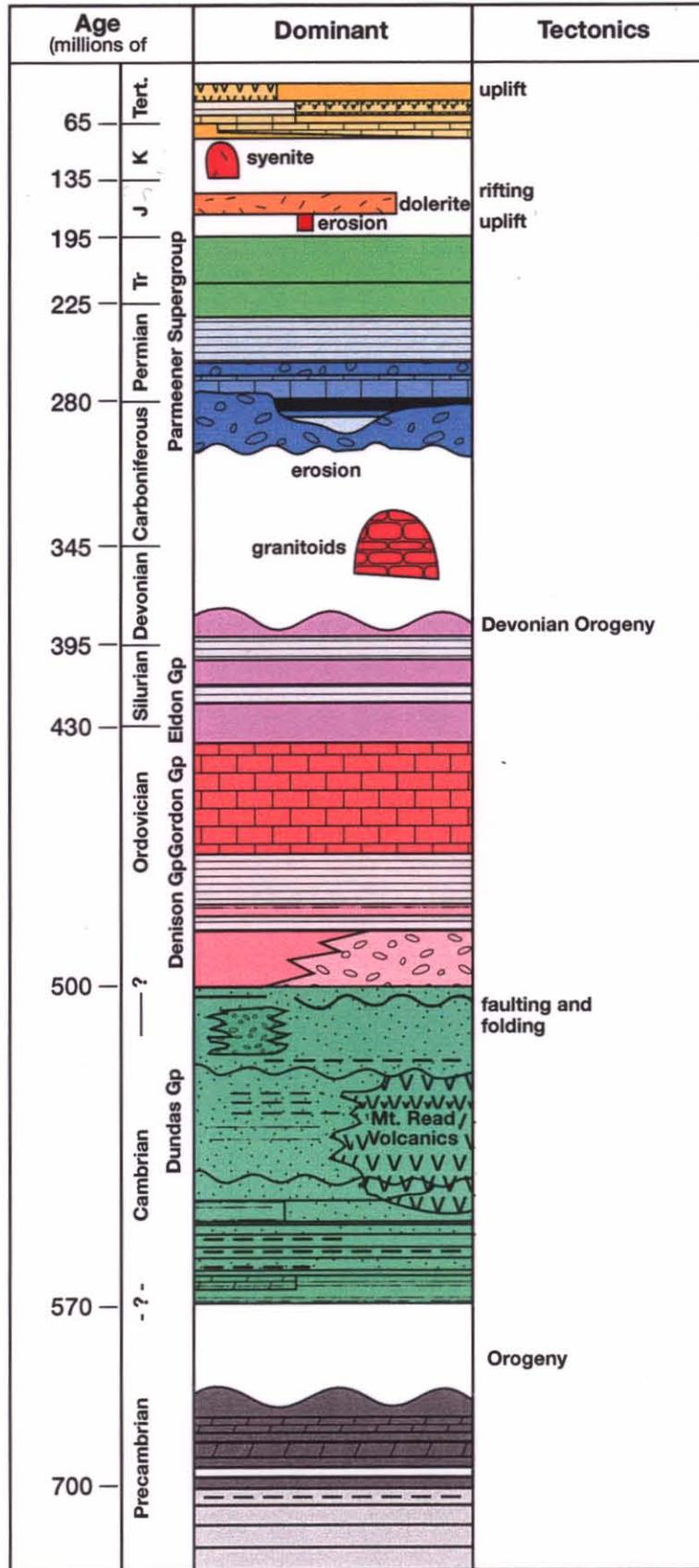


Figure 1

Generalised Stratigraphy of Tasmania

834071



Rock Types

- | | | |
|--------------|-----------|-----------------------------|
| conglomerate | mudstone | volcanics |
| siliclastics | limestone | granitoids |
| oil shale | dolomite | intrusions at shallow depth |
| siltstone | | |

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Figure 2

5 cm

Structural Elements of Tasmania Basin

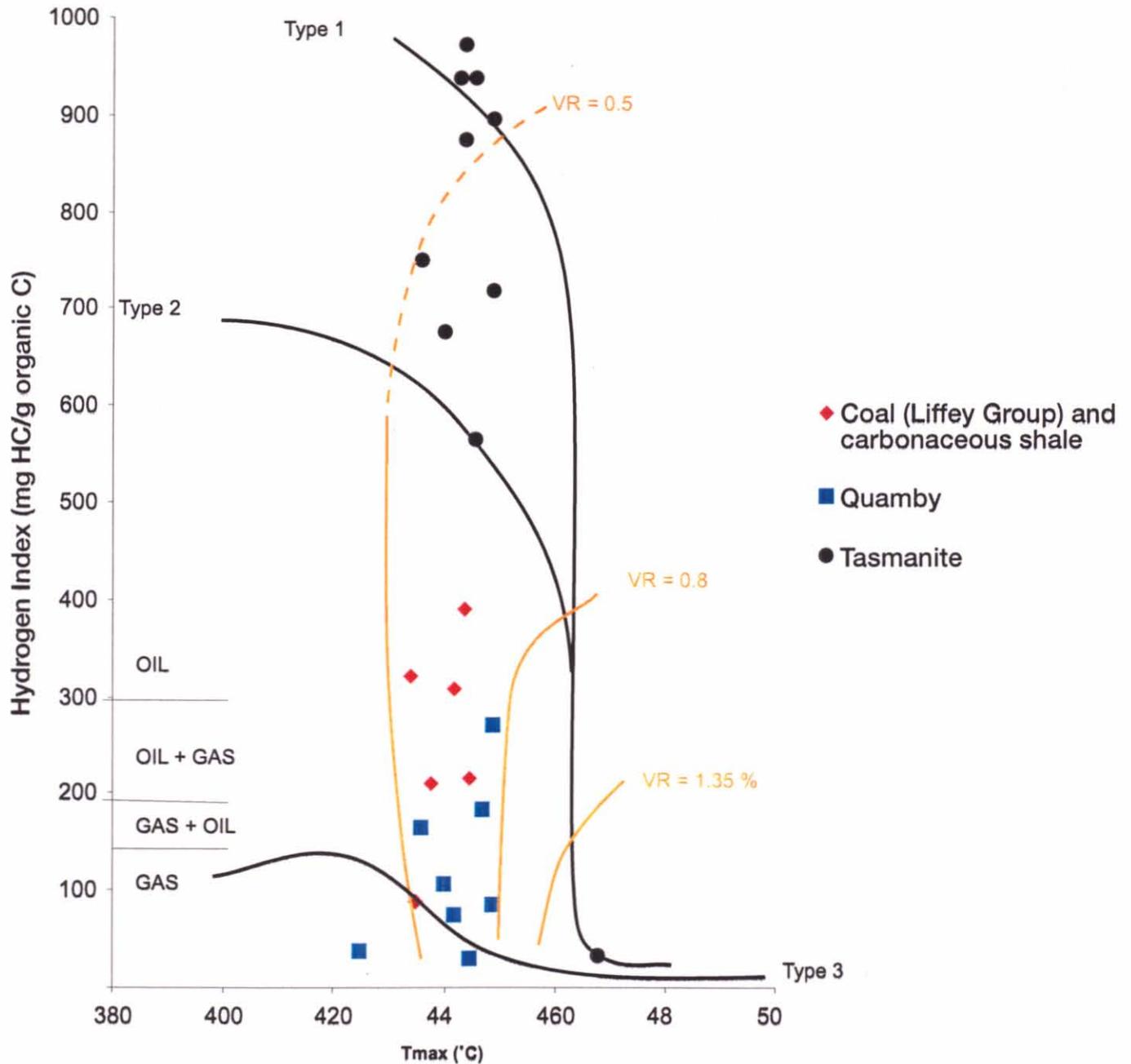


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Figure 3

5 cm

Tasmanian Source Rock Characteristics based on Rock Evaluation data

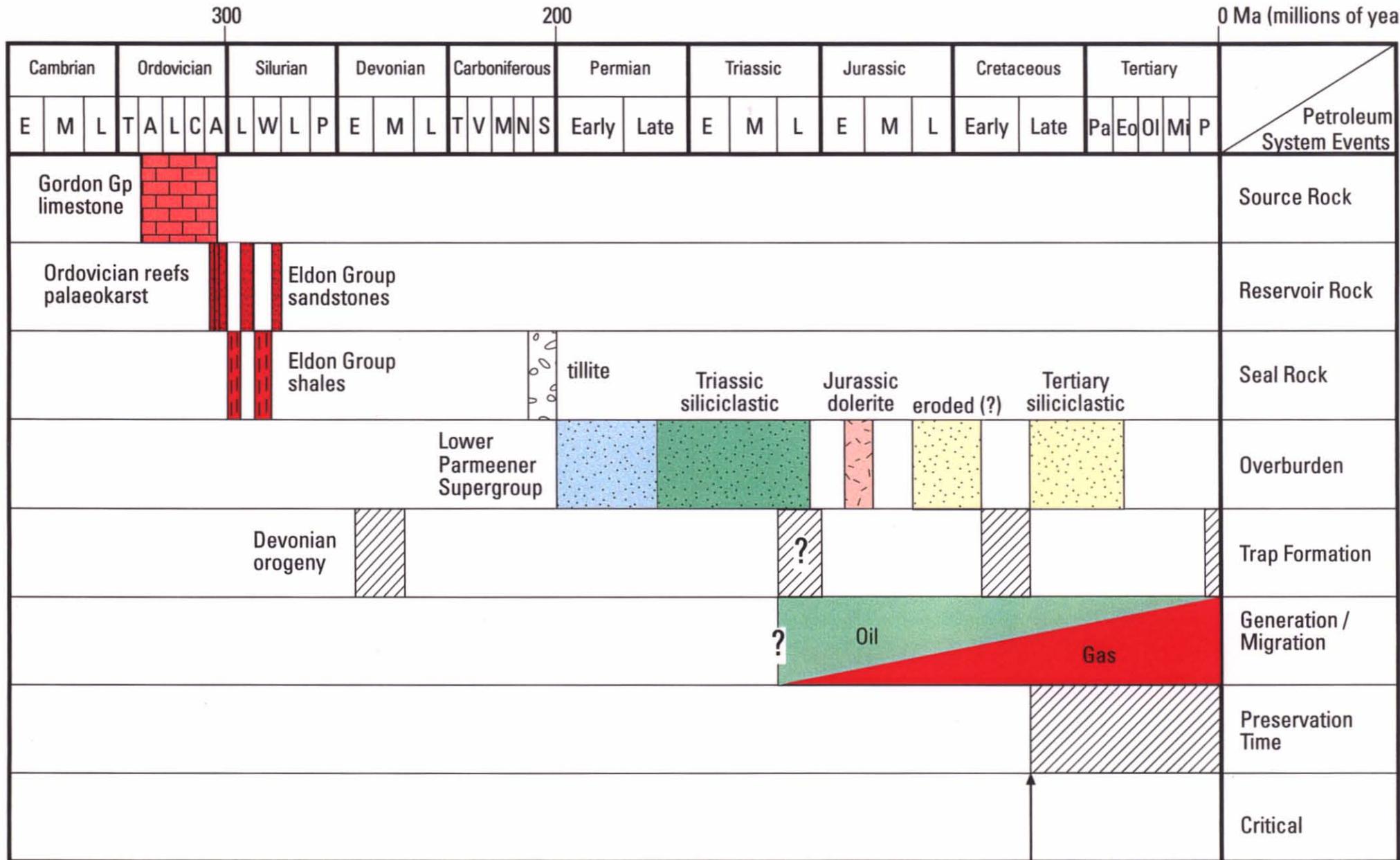


Hydrogen Index vs T_{max} (°C) for Tasmanian Source

5 cm

Timing Risk Chart for the Larapintine Petroleum System, Tasmania

834074

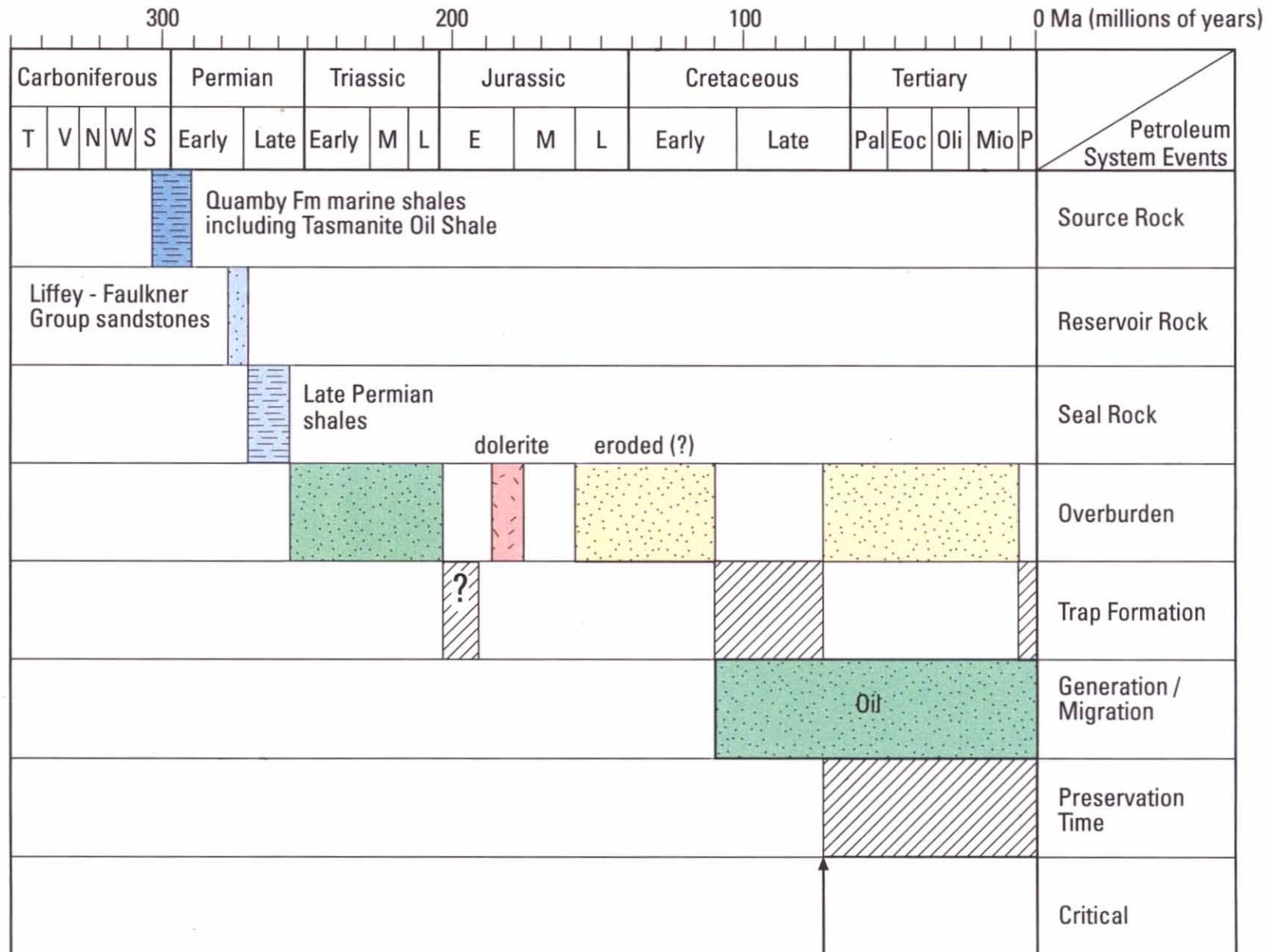


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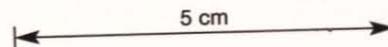
Figure 5

Timing Risk Chart for the Gondwana Petroleum System, Tasmania



#99013

Figure 6



834076

Appendix 3

Gravity Survey and Data Listing

Dr David Leaman

LEAMAN GEOPHYSICS

ABN 34 479 871 658

Registered office:
3 MALUKA STREET, BELLERIVE, TAS. 7018
All correspondence to:
GPO BOX 320 C, HOBART, TAS. 7001
Telephone: (03) 6244 1233
Fax: (03) 6244 6674

November 11, 2000

Mr D Tanner,
Chief Executive Officer,
Great South Land Minerals Limited,
MLC Building,
Level 3/65 Murray Street, -
Hobart, Tas. 7000

Dear David,

I have enclosed the final data file for the gravity survey and a listing of the data. A copy of this should be given officially to Mineral Resources Tasmania to register your exploration commitment.

The map roll includes several images I had prepared in order to assess differences from previous compilations and contribute toward a revision of earlier trend analyses.

The survey results have been presented in standard Tasmanian data base format: Namely: Station number, Easting, Northing, Elevation, Observed Gravity, Theoretical Gravity, Terrain Correction and Bouguer anomaly (density 2.67) and comment.

I have also included a revised trend compilation map. It benefits from variation in the gravity coverage, a new look at existing data, and sundry ideas since 1991.

Yours faithfully,



Dr. D.E. Leaman

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.9111	495517.1	5318346.4	521.63	980.264100	980.384886	0.23	-17.94***GSLM1	
0051.0001	495726.0	5318495.1	515.26	980.265900	980.384766	0.22	-17.29***GSLM1	
0051.0002	495370.3	5319538.7	504.45	980.266940	980.383921	0.16	-17.59***GSLM1	
0051.0003	494915.6	5320501.9	482.76	980.269710	980.383142	0.23	-18.24***GSLM1	
0051.0004	494683.0	5321445.2	498.71	980.265910	980.382378	0.27	-18.10***GSLM1	
0051.0005	496048.1	5317497.5	498.69	980.270200	980.385573	0.25	-17.02***GSLM1	
0051.0006	496508.1	5315377.1	430.57	980.286190	980.387289	0.19	-16.21***GSLM1	
0051.0007	497363.8	5313398.4	428.75	980.285930	980.388890	0.43	-18.19***GSLM1	
0051.0009	493770.2	5322503.9	515.87	980.260690	980.381521	0.33	-19.02***GSLM1	
0051.0010	493937.9	5323455.9	546.98	980.254320	980.380751	0.37	-18.46***GSLM1	
0051.0011	494064.3	5324428.1	579.15	980.246710	980.379965	0.25	-19.08***GSLM1	
0051.0012	493936.7	5325501.9	527.57	980.256470	980.379096	0.26	-18.59***GSLM1	
0051.0013	493209.4	5326496.2	536.34	980.251910	980.378292	0.27	-20.61***GSLM1	
0051.0014	492072.7	5327580.6	586.08	980.234760	980.377414	0.35	-27.01***GSLM1	
0051.0015	491153.1	5328438.8	631.79	980.224070	980.376719	0.18	-28.18***GSLM1	
0051.0016	494113.1	5326510.7	543.90	980.248730	980.378281	0.33	-22.23***GSLM1	
0051.0017	494832.0	5327493.0	609.15	980.236730	980.377487	0.59	-20.33***GSLM1	
0051.0018	495142.3	5328394.7	648.06	980.227370	980.376757	0.75	-21.15***GSLM1	
0051.0019	494188.1	5328563.4	641.24	980.227060	980.376620	0.65	-22.76***GSLM1	
0051.0020	496484.2	5328092.4	643.93	980.227210	980.377003	1.20	-21.92***GSLM1	
0051.0021	495945.1	5327482.8	624.10	980.233870	980.377495	1.01	-19.84***GSLM1	
0051.0022	494294.1	5327726.2	592.95	980.238540	980.377298	0.67	-21.44***GSLM1	
0051.0023	493836.2	5326350.6	541.68	980.251430	980.378410	0.27	-20.15***GSLM1	
0051.0024	493924.7	5321141.0	526.98	980.259970	980.382624	0.23	-18.76***GSLM1	
0051.0025	493051.6	5321273.9	524.56	980.260760	980.382516	0.26	-18.31***GSLM1	
0051.0026	491944.7	5321477.6	546.68	980.255110	980.382350	0.21	-19.49***GSLM1	
0051.0027	490983.8	5321496.6	523.52	980.258110	980.382334	0.24	-21.00***GSLM1	
0051.0028	490171.8	5321666.8	489.64	980.262750	980.382195	0.29	-22.84***GSLM1	
0051.0029	489299.2	5322332.0	556.19	980.246760	980.381656	0.51	-24.97***GSLM1	
0051.0030	488767.2	5323533.8	568.38	980.242070	980.380683	0.44	-26.36***GSLM1	
0051.0031	488605.0	5324543.4	564.53	980.242070	980.379866	0.31	-26.43***GSLM1	
0051.0032	488463.8	5325489.3	588.89	980.235980	980.379101	0.17	-27.10***GSLM1	
0051.0033	488098.1	5326537.3	593.21	980.233790	980.378253	0.20	-27.57***GSLM1	
0051.0034	488201.0	5327539.5	592.08	980.231970	980.377442	0.33	-28.67***GSLM1	
0051.0035	487071.1	5328521.9	642.91	980.221680	980.376646	0.36	-28.13***GSLM1	
0051.0036	491338.2	5320553.7	553.05	980.252990	980.383097	0.20	-21.11***GSLM1	
0051.0037	490245.2	5320466.4	518.17	980.258110	980.383166	0.37	-22.76***GSLM1	
0051.0038	491065.1	5320232.1	579.04	980.248240	980.383357	0.27	-20.94***GSLM1	
0051.0039	491154.0	5319448.1	574.18	980.249850	980.383991	0.40	-20.79***GSLM1	
0051.0040	490985.1	5318482.7	603.98	980.242950	980.384772	0.73	-22.28***GSLM1	
0051.0041	490878.6	5317465.8	704.33	980.224360	980.385595	0.56	-22.11***GSLM1	
0051.0042	489716.2	5316331.3	647.78	980.236020	980.386511	0.76	-22.30***GSLM1	
0051.0043	489775.1	5319421.0	558.14	980.252060	980.384012	0.57	-21.59***GSLM1	
0051.0044	489019.0	5318474.5	597.79	980.245130	980.384776	0.33	-21.72***GSLM1	
0051.0045	489112.6	5317628.2	530.79	980.258030	980.385461	0.53	-22.49***GSLM1	
0051.0046	497321.7	5313422.3	428.96	980.285990	980.388871	0.46	-18.04***GSLM1	
0051.0047	498611.9	5311512.4	391.53	980.298100	980.390416	0.37	-14.93***GSLM1	
0051.0048	503959.8	5311584.9	358.43	980.306720	980.390357	0.09	-13.04***GSLM1	
0051.0049	505410.4	5313511.6	419.48	980.292450	980.388797	0.27	-13.56***GSLM1	
0051.0050	500532.0	5307370.9	348.24	980.312440	980.393768	0.10	-12.73***GSLM1	
0051.9111	495517.1	5318346.4	521.63	980.264120	980.384886	0.23	-17.92***GSLM1	
0051.0051	499622.0	5309476.3	350.47	980.309110	980.392064	0.16	-13.86***GSLM1	
0051.0052	496986.8	5305771.6	360.74	980.310990	980.395062	0.24	-12.87***GSLM1	
0051.0053	495620.1	5305912.7	337.30	980.314790	980.394947	0.37	-13.44***GSLM1	
0051.0054	493142.4	5305916.1	305.06	980.321490	980.394943	0.73	-12.72***GSLM1	
0051.0055	491022.0	5306487.9	379.43	980.303980	980.394478	0.37	-15.49***GSLM1	
0051.0056	489111.0	5307615.4	382.60	980.300730	980.393563	0.53	-17.04***GSLM1	
0051.0057	487254.7	5308895.3	356.81	980.304630	980.392525	0.75	-16.96***GSLM1	
0051.0058	478549.5	5311390.7	383.54	980.297730	980.390488	0.59	-16.72***GSLM1	
0051.0059	480262.7	5311361.3	366.64	980.302300	980.390516	0.57	-15.53***GSLM1	
0051.0060	479019.5	5313442.4	392.09	980.292200	980.388829	0.84	-18.66***GSLM1	
0051.0062	480810.0	5318427.3	339.12	980.297940	980.384800	1.45	-18.71***GSLM1	
0051.0063	493678.9	5315816.4	482.39	980.275480	980.386932	0.85	-15.71***GSLM1	
0051.0064	492281.3	5315216.8	535.41	980.264080	980.387416	0.50	-17.51***GSLM1	
0051.0065	495028.1	5315251.1	465.78	980.280060	980.387390	0.32	-15.39***GSLM1	
0051.0066	497187.7	5317416.7	493.09	980.271400	980.385639	0.29	-16.95***GSLM1	
0051.0067	497273.6	5318485.5	481.52	980.274300	980.384774	0.26	-15.49***GSLM1	
0051.0068	497384.2	5319529.2	471.19	980.275380	980.383930	0.20	-15.66***GSLM1	

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouguer Anomaly (2.67)	Comments
0051.0069	498040.4	5318518.0	464.25	980.277000	980.384748	0.22	-16.21***	GSLM1
0051.0023	493836.2	5326350.6	541.68	980.251430	980.378410	0.27	-20.15***	GSLM1
0051.0070	491535.1	5329248.3	629.36	980.224350	980.376064	0.39	-27.51***	GSLM1
0051.0071	492073.8	5330830.0	642.90	980.221190	980.374786	0.91	-26.21***	GSLM1
0051.0072	491757.2	5332925.1	704.00	980.207180	980.373091	0.43	-26.98***	GSLM1
0051.0073	490950.5	5336190.9	831.89	980.177160	980.370449	0.29	-29.34***	GSLM1
0051.0074	491388.7	5338467.8	826.72	980.177860	980.368609	0.23	-27.87***	GSLM1
0051.0075	495480.5	5336740.7	751.78	980.195170	980.370008	0.26	-26.68***	GSLM1
0051.0076	500021.4	5335737.4	899.63	980.169940	980.370821	0.29	-23.60***	GSLM1
0051.0077	509621.7	5334281.4	810.44	980.192420	980.371993	0.18	-19.95***	GSLM1
0051.0078	509424.8	5328142.6	784.41	980.207860	980.376958	0.17	-14.61***	GSLM1
0051.0079	507445.4	5320347.3	655.44	980.239000	980.383265	0.39	-14.93***	GSLM1
0051.0080	504619.0	5316289.5	488.20	980.273540	980.386550	0.63	-16.35***	GSLM1
0051.0081	487871.6	5327663.0	617.59	980.226590	980.377342	0.29	-28.97***	GSLM1
0051.0082	486359.2	5329524.4	681.68	980.212000	980.375834	0.24	-29.49***	GSLM1
0051.0083	485312.4	5330727.4	729.85	980.199950	980.374860	0.77	-30.56***	GSLM1
0051.0084	483401.0	5332687.6	780.19	980.189400	980.373271	0.26	-30.12***	GSLM1
0051.0085	481056.7	5333218.7	709.90	980.205240	980.372837	1.55	-26.39***	GSLM1
0051.0086	479391.6	5334258.7	593.75	980.228670	980.371992	2.29	-24.23***	GSLM1
0051.0087	486046.4	5328787.5	641.96	980.221840	980.376430	0.35	-27.95***	GSLM1
0051.0088	479773.6	5327496.2	694.55	980.218410	980.377462	0.15	-22.27***	GSLM1
0051.0089	479254.1	5329517.0	711.23	980.214100	980.375826	0.16	-21.65***	GSLM1
0051.0090	480107.1	5331504.5	698.39	980.211790	980.374221	0.55	-24.49***	GSLM1
0051.0091	481212.6	5327995.5	695.96	980.217380	980.377061	0.41	-22.36***	GSLM1
0051.0092	478912.9	5323531.3	659.58	980.230430	980.380667	0.23	-20.25***	GSLM1
0051.0093	476278.0	5321702.2	688.39	980.227480	980.382140	0.16	-19.08***	GSLM1
0051.0094	476240.3	5317906.9	618.23	980.245810	980.385210	0.32	-17.46***	GSLM1
0051.0095	475788.4	5315630.2	590.37	980.252510	980.387051	0.54	-17.86***	GSLM1
0051.0096	472926.6	5316563.8	683.07	980.233380	980.386287	0.23	-18.30***	GSLM1
0051.0097	480038.6	5325651.8	720.41	980.216190	980.378954	0.68	-20.36***	GSLM1
0051.0098	493812.3	5316585.4	697.63	980.228360	980.386310	1.45	-19.26***	GSLM1
0051.0099	497303.3	5320282.3	468.28	980.275490	980.383320	0.29	-15.42***	GSLM1
0051.0100	497980.2	5320518.9	462.70	980.276000	980.383129	0.35	-15.76***	GSLM1
0051.0101	498996.3	5321129.8	523.17	980.259910	980.382635	0.88	-18.93***	GSLM1
0051.0102	499863.7	5321429.1	611.34	980.241770	980.382393	1.04	-19.32***	GSLM1
0051.0103	500759.7	5322714.9	718.11	980.217710	980.381353	0.64	-21.73***	GSLM1
0051.0104	500105.9	5323665.4	780.54	980.204630	980.380584	0.93	-21.47***	GSLM1
0051.0105	499401.5	5323657.1	808.36	980.198160	980.380591	1.44	-21.96***	GSLM1
0051.0106	498965.5	5324372.0	829.69	980.192670	980.380012	1.60	-22.51***	GSLM1
0051.0107	499005.5	5325391.2	794.29	980.198350	980.379188	0.99	-23.58***	GSLM1
0051.0108	498087.6	5325193.1	804.09	980.196350	980.379348	2.89	-21.92***	GSLM1
0051.0109	497830.4	5325749.6	722.29	980.214230	980.378898	1.43	-21.14***	GSLM1
0051.0110	499697.9	5326259.3	845.01	980.187690	980.378486	0.80	-23.75***	GSLM1
0051.0111	500947.5	5327144.4	806.56	980.194070	980.377770	0.48	-24.54***	GSLM1
0051.0112	501740.4	5326787.8	770.25	980.202860	980.378058	0.45	-23.21***	GSLM1
0051.0113	501900.5	5327759.2	808.93	980.193360	980.377273	0.44	-24.33***	GSLM1
0051.0114	502075.6	5328734.3	867.60	980.181590	980.376484	0.40	-23.80***	GSLM1
0051.0115	501991.3	5329511.3	914.94	980.170780	980.375855	0.43	-24.64***	GSLM1
0051.0116	502754.1	5330019.2	854.21	980.183920	980.375444	0.36	-23.11***	GSLM1
0051.0117	503612.3	5330433.3	807.82	980.194300	980.375109	0.33	-21.55***	GSLM1
0051.0118	503523.7	5331350.1	822.40	980.190880	980.374368	0.28	-21.41***	GSLM1
0051.0119	504017.3	5332488.6	905.63	980.171710	980.373447	0.96	-22.60***	GSLM1
0051.0120	504094.5	5333222.1	921.43	980.168600	980.372854	0.37	-22.60***	GSLM1
0051.0121	503487.8	5334164.1	922.95	980.168280	980.372092	0.23	-22.00***	GSLM1
0051.0122	501951.9	5326291.4	785.17	980.200960	980.378460	0.59	-22.44***	GSLM1
0051.0123	502205.6	5325607.4	825.79	980.194130	980.379013	0.64	-21.78***	GSLM1
0051.0129	494981.7	5318183.8	557.83	980.256890	980.385017	0.24	-18.15***	GSLM1
0051.0130	493703.2	5318276.8	556.65	980.257210	980.384941	0.29	-17.94***	GSLM1
0051.0131	493176.1	5318737.1	571.40	980.253510	980.384568	0.25	-18.40***	GSLM1
0051.0132	492012.9	5318924.2	604.25	980.245820	980.384416	0.36	-19.37***	GSLM1
0051.0133	493077.6	5324637.9	522.27	980.257360	980.379795	0.48	-19.22***	GSLM1
0051.0134	492104.4	5324533.7	544.76	980.251000	980.379878	0.55	-21.16***	GSLM1
0051.0135	491231.0	5324420.8	500.44	980.259800	980.379969	0.37	-21.36***	GSLM1
0051.0136	490239.0	5324690.9	543.61	980.247740	980.379749	0.35	-24.72***	GSLM1
0051.0137	490184.7	5325452.9	566.85	980.241280	980.379133	0.29	-26.05***	GSLM1
0051.0138	489830.9	5326221.4	593.67	980.233970	980.378511	0.24	-27.51***	GSLM1
0051.0139	489357.6	5324830.9	597.22	980.235170	980.379635	0.25	-26.73***	GSLM1
0051.0140	491301.0	5325237.3	538.61	980.250560	980.379308	0.39	-22.41***	GSLM1

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouguer Anomaly (2.67)	Comments
0051.0141	491335.2	5326121.5	575.58	980.240450	980.378593	0.59	-24.33***GSLM1	
0051.0142	492370.1	5323612.2	562.72	980.249000	980.380624	0.38	-20.55***GSLM1	
0051.0143	495158.8	5329295.2	692.17	980.215650	980.376029	0.99	-23.22***GSLM1	
0051.0144	496192.7	5336103.0	743.51	980.197850	980.370524	0.45	-25.95***GSLM1	
0051.0145	491250.0	5338750.0	845.30	980.171300	980.368380	0.22	-30.56***GSLM1	
0051.0146	494929.6	5326522.1	541.94	980.250780	980.378272	0.53	-20.35***GSLM1	
0051.0147	495918.1	5326460.1	572.63	980.244970	980.378323	0.83	-19.88***GSLM1	
0051.0148	497008.9	5326311.8	610.04	980.237560	980.378443	0.97	-19.91***GSLM1	
0051.0149	497542.4	5325664.9	690.65	980.221370	980.378966	1.41	-20.32***GSLM1	
0051.0150	497615.5	5325169.9	676.69	980.224070	980.379367	1.29	-20.88***GSLM1	
0051.0151	495866.1	5325324.6	586.87	980.243960	980.379241	0.63	-19.20***GSLM1	
0051.0152	496918.4	5324909.2	592.88	980.243730	980.379577	0.59	-18.63***GSLM1	
0051.0153	497572.4	5324325.3	641.69	980.232180	980.380050	1.36	-20.27***GSLM1	
0051.0154	496900.0	5324015.5	613.17	980.239320	980.380300	0.81	-19.55***GSLM1	
0051.0155	495461.4	5326432.6	551.69	980.249270	980.378345	0.60	-19.95***GSLM1	
0051.0156	545184.1	5355564.3	223.40	980.296500	980.354677	0.31	-13.93***GSLM2	
0051.0157	545841.5	5354920.4	237.79	980.295590	980.355194	0.45	-12.38***GSLM2	
0051.0158	546863.1	5354534.4	254.89	980.292150	980.355501	0.67	-12.54***GSLM2	
0051.0159	547923.8	5354629.4	279.54	980.286740	980.355418	0.91	-12.78***GSLM2	
0051.0160	545609.9	5353831.8	263.41	980.291610	980.356075	0.41	-12.24***GSLM2	
0051.0161	544665.0	5354137.1	229.92	980.295860	980.355833	0.30	-14.45***GSLM2	
0051.0162	543932.6	5354256.8	221.60	980.295640	980.355740	0.27	-16.24***GSLM2	
0051.0163	544054.5	5355446.4	235.62	980.292210	980.354778	0.31	-15.91***GSLM2	
0051.0164	541344.8	5358402.0	203.67	980.292950	980.352403	0.16	-19.23***GSLM2	
0051.0165	542461.1	5358219.0	207.78	980.293920	980.352546	0.23	-17.53***GSLM2	
0051.0166	543265.8	5358406.1	213.04	980.293250	980.352391	0.25	-16.99***GSLM2	
0051.0167	544182.7	5359155.2	229.51	980.291370	980.351781	0.24	-15.03***GSLM2	
0051.0168	545207.8	5359753.8	263.03	980.285760	980.351292	0.41	-13.38***GSLM2	
0051.0169	545999.3	5360467.8	274.13	980.282450	980.350711	0.49	-13.85***GSLM2	
0051.0170	546601.0	5361284.2	296.98	980.276100	980.350049	0.62	-14.91***GSLM2	
0051.0171	547874.2	5361379.7	358.73	980.262760	980.349965	0.67	-15.97***GSLM2	
0051.0172	549102.5	5361205.1	418.45	980.249770	980.350099	0.50	-17.52***GSLM2	
0051.0173	549999.3	5361710.2	456.21	980.240810	980.349686	0.48	-18.65***GSLM2	
0051.0174	540548.7	5358715.1	212.71	980.290960	980.352154	0.11	-19.25***GSLM2	
0051.0175	540541.8	5358973.6	230.29	980.285790	980.351945	0.12	-20.74***GSLM2	
0051.0176	542728.7	5351331.6	226.75	980.297510	980.358110	0.16	-15.84***GSLM2	
0051.0177	544157.7	5351497.6	213.76	980.302840	980.357969	0.20	-12.88***GSLM2	
0051.0178	542572.2	5355213.4	218.45	980.296620	980.354974	0.21	-15.18***GSLM2	
0051.0179	542273.9	5354083.4	208.32	980.298880	980.355889	0.23	-15.80***GSLM2	
0051.0180	542289.1	5353116.7	210.32	980.298790	980.356670	0.27	-16.24***GSLM2	
0051.0181	543083.0	5352812.8	210.17	980.301260	980.356911	0.21	-14.10***GSLM2	
0051.0182	544253.3	5352752.8	218.67	980.299400	980.356954	0.29	-14.25***GSLM2	
0051.0183	545027.1	5352648.3	227.54	980.297670	980.357035	0.26	-14.35***GSLM2	
0051.0184	545885.1	5353103.3	263.72	980.292130	980.356663	0.40	-12.26***GSLM2	
0051.0185	547502.0	5352540.4	380.48	980.269010	980.357109	0.75	-12.51***GSLM2	
0051.0186	546685.1	5352968.8	286.21	980.287620	980.356767	0.57	-12.28***GSLM2	
0051.0187	546249.1	5346189.6	223.49	980.307250	980.362248	0.24	-10.80***GSLM2	
0051.0188	545811.2	5347135.3	221.54	980.307500	980.361486	0.29	-10.12***GSLM2	
0051.0189	545430.7	5347921.2	221.46	980.306210	980.360853	0.25	-10.83***GSLM2	
0051.0190	546019.0	5349078.2	228.46	980.303530	980.359915	0.40	-11.05***GSLM2	
0051.0191	546845.2	5349683.4	241.71	980.298600	980.359421	0.49	-12.79***GSLM2	
0051.0192	546578.6	5350634.8	241.18	980.297770	980.358654	0.57	-12.87***GSLM2	
0051.0194	544891.3	5350487.6	217.59	980.303490	980.358782	0.29	-12.20***GSLM2	
0051.0195	544377.2	5347864.8	208.13	980.306720	980.360904	0.28	-12.97***GSLM2	
0051.0196	543308.3	5347686.0	211.85	980.307830	980.361054	0.21	-11.34***GSLM2	
0051.0197	542296.4	5347497.3	203.17	980.309160	980.361211	0.20	-11.89***GSLM2	
0051.0198	542172.2	5346751.2	191.09	980.314510	980.361815	0.16	-9.56***GSLM2	
0051.0199	546082.8	5348152.1	227.35	980.304460	980.360663	0.32	-11.16***GSLM2	
0051.0200	547235.4	5348489.5	256.91	980.298860	980.360384	0.59	-10.40***GSLM2	
0051.0201	546743.3	5345659.7	241.70	980.306000	980.362674	0.57	-8.56***GSLM2	
0051.0202	545670.7	5344912.3	269.57	980.299070	980.363284	0.41	-10.78***GSLM2	
0051.0203	544815.4	5344265.2	241.65	980.305900	980.363811	0.31	-10.07***GSLM2	
0051.0204	543863.1	5343650.9	224.63	980.308680	980.364313	0.23	-11.22***GSLM2	
0051.0205	542626.7	5343202.2	260.47	980.301160	980.364682	0.27	-12.02***GSLM2	
0051.0206	545958.2	5343843.8	247.51	980.301720	980.364146	0.49	-13.25***GSLM2	
0051.0207	546504.1	5342966.8	251.82	980.301600	980.364852	0.54	-13.18***GSLM2	
0051.0208	546485.4	5341948.9	253.59	980.305590	980.365675	0.48	-9.72***GSLM2	
0051.0209	545613.5	5341511.9	235.65	980.307460	980.366033	0.44	-11.78***GSLM2	

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.0210	544718.3	5341170.8	240.85	980.307380	980.366313	0.27	-11.29***GSLM2	
0051.0211	543690.5	5340803.0	202.38	980.315630	980.366616	0.19	-10.99***GSLM2	
0051.0212	546977.6	5341997.0	262.72	980.303520	980.365634	0.52	-9.92***GSLM2	
0051.0213	547863.7	5344799.0	253.57	980.304640	980.363364	0.64	-8.21***GSLM2	
0051.0214	541259.5	5345940.1	195.03	980.310190	980.362475	0.11	-13.81***GSLM2	
0051.0215	541227.6	5344913.7	180.96	980.314340	980.363305	0.12	-13.25***GSLM2	
0051.0216	541676.4	5343856.7	182.23	980.314980	980.364157	0.16	-13.17***GSLM2	
0051.0217	542016.3	5342609.0	189.63	980.315950	980.365164	0.15	-11.77***GSLM2	
0051.0218	542608.4	5341472.0	190.18	980.316450	980.366080	0.20	-12.02***GSLM2	
0051.0219	543197.6	5340595.7	189.60	980.318720	980.366786	0.16	-10.61***GSLM2	
0051.0220	541027.8	5351740.8	329.73	980.278240	980.357788	0.28	-14.41***GSLM2	
0051.0221	539743.4	5360030.9	215.71	980.291620	980.351095	0.11	-16.94***GSLM2	
0051.0222	539350.9	5361002.0	210.04	980.291530	980.350312	0.10	-17.37***GSLM2	
0051.0223	538931.8	5362027.3	204.22	980.293840	980.349485	0.09	-15.39***GSLM2	
0051.0224	538515.4	5363028.7	199.39	980.294750	980.348678	0.09	-14.62***GSLM2	
0051.0225	538156.6	5364011.4	194.69	980.294270	980.347886	0.10	-15.22***GSLM2	
0051.0226	537818.4	5365049.6	192.28	980.289910	980.347049	0.10	-19.22***GSLM2	
0051.0227	537507.3	5365980.3	187.77	980.291320	980.346298	0.09	-17.96***GSLM2	
0051.0228	537162.7	5367020.0	185.58	980.291030	980.345460	0.10	-17.83***GSLM2	
0051.0229	537039.9	5368125.9	189.56	980.289330	980.344567	0.12	-17.83***GSLM2	
0051.0230	535984.8	5368953.2	210.64	980.284360	980.343903	0.10	-18.01***GSLM2	
0051.0231	535034.1	5369955.5	209.28	980.286410	980.343098	0.09	-15.43***GSLM2	
0051.0232	534212.3	5370796.0	208.76	980.286330	980.342422	0.09	-14.94***GSLM2	
0051.0233	533462.9	5371622.7	206.42	980.288360	980.341757	0.09	-12.71***GSLM2	
0051.0234	537525.6	5368221.2	191.71	980.290680	980.344488	0.11	-15.99***GSLM2	
0051.0235	538017.6	5368310.6	193.85	980.290050	980.344414	0.10	-16.13***GSLM2	
0051.0236	538496.6	5368399.4	201.25	980.289190	980.344340	0.10	-15.47***GSLM2	
0051.0237	538955.7	5368482.3	204.42	980.287360	980.344271	0.11	-16.59***GSLM2	
0051.0238	539447.5	5368568.7	203.54	980.287790	980.344199	0.12	-16.25***GSLM2	
0051.0239	539933.2	5368654.4	203.96	980.287840	980.344128	0.13	-16.04***GSLM2	
0051.0240	540413.5	5368740.9	208.35	980.287360	980.344056	0.16	-15.55***GSLM2	
0051.0241	541004.1	5368954.8	206.06	980.289450	980.343880	0.17	-13.73***GSLM2	
0051.0242	541590.9	5369018.9	214.08	980.289400	980.343826	0.19	-12.13***GSLM2	
0051.0243	542099.2	5369299.0	232.32	980.283940	980.343597	0.21	-13.75***GSLM2	
0051.0244	542640.1	5369459.7	217.93	980.288390	980.343465	0.25	-11.96***GSLM2	
0051.0245	543162.6	5369506.6	213.80	980.288660	980.343424	0.27	-12.44***GSLM2	
0051.0246	543666.9	5369680.8	217.16	980.287530	980.343281	0.30	-12.74***GSLM2	
0051.0247	540871.5	5357833.1	198.97	980.294450	980.352865	0.09	-19.19***GSLM2	
0051.0248	540651.4	5356837.1	195.65	980.297420	980.353671	0.10	-17.67***GSLM2	
0051.0249	540753.7	5355984.4	202.16	980.294460	980.354360	0.10	-20.04***GSLM2	
0051.0250	541004.9	5354990.4	201.19	980.295000	980.355162	0.11	-20.48***GSLM2	
0051.0251	541246.3	5354039.3	203.58	980.295970	980.355929	0.16	-19.76***GSLM2	
0051.0252	541515.8	5352979.1	209.29	980.297110	980.356785	0.18	-18.33***GSLM2	
0051.0253	541792.4	5351885.5	215.40	980.298050	980.357667	0.27	-16.98***GSLM2	
0051.0254	541710.1	5350912.1	210.54	980.303050	980.358454	0.31	-13.68***GSLM2	
0051.0255	541374.8	5349978.7	204.95	980.305360	980.359210	0.13	-13.41***GSLM2	
0051.0256	541012.3	5349021.3	199.72	980.307270	980.359986	0.11	-13.32***GSLM2	
0051.0257	540593.3	5347985.4	180.76	980.311590	980.360825	0.10	-13.58***GSLM2	
0051.0258	540722.2	5346987.7	180.48	980.313750	980.361631	0.09	-12.29***GSLM2	
0051.0265	539907.5	5345687.0	182.56	980.312350	980.362686	0.12	-14.31***GSLM2	
0051.0266	539242.3	5347090.0	180.82	980.312140	980.361555	0.11	-13.74***GSLM2	
0051.0267	541694.8	5356759.0	201.61	980.295720	980.353729	0.13	-18.22***GSLM2	
0051.0268	542640.6	5356429.3	201.67	980.297170	980.353991	0.19	-16.96***GSLM2	
0051.0269	543738.0	5356219.7	214.29	980.295790	980.354155	0.22	-16.00***GSLM2	
0051.0270	544762.0	5356456.6	213.49	980.296570	980.353959	0.25	-15.15***GSLM2	
0051.0271	545681.1	5356567.6	219.50	980.297070	980.353864	0.31	-13.31***GSLM2	
0051.0272	546715.8	5356585.4	245.69	980.291770	980.353844	0.42	-13.33***GSLM2	
0051.0273	548138.0	5356607.0	335.90	980.273990	980.353819	0.49	-13.27***GSLM2	
0051.0274	549089.9	5356362.1	409.04	980.260010	980.354012	0.72	-12.82***GSLM2	
0051.0275	549965.0	5356159.4	476.04	980.246830	980.354171	0.46	-13.24***GSLM2	
0051.0276	550437.7	5355210.1	490.60	980.243830	980.354935	0.50	-14.10***GSLM2	
0051.0277	551112.0	5354402.0	539.94	980.233410	980.355584	0.67	-15.29***GSLM2	
0051.0278	551833.4	5354019.0	573.83	980.227920	980.355889	0.62	-14.47***GSLM2	
0051.0279	545724.3	5370304.6	210.53	980.288210	980.342767	0.71	-12.44***GSLM2	
0051.0281	544233.7	5369869.8	214.76	980.288640	980.343126	0.72	-11.52***GSLM2	
0051.0282	544756.3	5370060.5	239.23	980.283530	980.342969	0.87	-11.51***GSLM2	
0051.0283	545306.4	5370089.1	222.18	980.286150	980.342943	0.76	-12.33***GSLM2	
0051.0284	546205.8	5370480.4	194.22	980.291210	980.342622	0.81	-12.40***GSLM2	

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.0285	546722.8	5370398.1	189.83	980.291250	980.342686	0.87	-13.23***	GSLM2
0051.0286	547252.0	5370315.7	191.90	980.289550	980.342750	0.96	-14.49***	GSLM2
0051.0287	547787.6	5370359.5	201.20	980.287830	980.342712	1.03	-14.28***	GSLM2
0051.0288	548586.7	5370738.1	196.75	980.285640	980.342401	1.20	-16.86***	GSLM2
0051.0289	549085.4	5370877.7	189.82	980.287570	980.342286	0.89	-16.49***	GSLM2
0051.0290	549591.0	5370963.9	194.65	980.285130	980.342213	0.92	-17.88***	GSLM2
0051.0291	550106.5	5370863.7	194.28	980.282860	980.342291	0.93	-20.29***	GSLM2
0051.0292	550619.4	5370683.0	191.46	980.282540	980.342434	0.82	-21.42***	GSLM2
0051.0293	551675.2	5370785.2	204.66	980.278600	980.342346	0.72	-22.77***	GSLM2
0051.0294	551219.2	5370763.2	199.71	980.280040	980.342366	0.77	-22.27***	GSLM2
0051.0295	552223.0	5370726.7	215.83	980.276120	980.342390	0.70	-23.12***	GSLM2
0051.0297	551952.1	5370742.0	211.50	980.277560	980.342379	0.71	-22.51***	GSLM2
0051.0298	552769.1	5370704.0	212.88	980.276460	980.342405	0.69	-23.38***	GSLM2
0051.0299	553326.9	5370782.1	210.54	980.276100	980.342339	0.65	-24.18***	GSLM2
0051.0300	553813.7	5370897.1	206.88	980.276240	980.342243	0.63	-24.68***	GSLM2
0051.0301	554364.1	5370958.2	207.49	980.275150	980.342190	0.61	-25.62***	GSLM2
0051.0302	554910.1	5370945.4	205.91	980.276040	980.342197	0.61	-25.05***	GSLM2
0051.0303	555510.5	5370939.2	206.20	980.275940	980.342198	0.59	-25.11***	GSLM2
0051.0304	556012.0	5371188.3	205.88	980.275160	980.341994	0.55	-25.79***	GSLM2
0051.0305	556415.7	5371358.6	208.08	980.274320	980.341854	0.48	-26.13***	GSLM2
0051.0306	556907.9	5371714.4	210.52	980.272670	980.341563	0.42	-27.06***	GSLM2
0051.0307	557339.1	5371885.2	216.41	980.271310	980.341423	0.50	-27.05***	GSLM2
0051.0308	557878.5	5372076.6	214.20	980.270440	980.341264	0.57	-28.12***	GSLM2
0051.0309	558464.4	5372325.5	213.03	980.269420	980.341060	0.45	-29.29***	GSLM2
0051.0310	558865.8	5372748.0	219.94	980.268560	980.340716	0.35	-28.54***	GSLM2
0051.0311	560090.1	5373884.0	213.09	980.270520	980.339790	0.39	-26.97***	GSLM2
0051.0312	560360.1	5374351.8	221.34	980.268560	980.339411	0.42	-26.89***	GSLM2
0051.0313	561049.3	5375003.9	223.67	980.268680	980.338879	0.40	-25.80***	GSLM2
0051.0314	560310.8	5374235.2	218.96	980.269250	980.339505	0.41	-26.78***	GSLM2
0051.0316	559426.7	5373557.3	208.25	980.270560	980.340058	0.36	-28.18***	GSLM2
0051.0317	559754.7	5373982.3	204.21	980.271860	980.339713	0.42	-27.27***	GSLM2
0051.0318	561388.5	5375362.3	212.22	980.270940	980.338588	0.64	-25.26***	GSLM2
0051.0319	561783.3	5375759.1	218.20	980.268560	980.338264	0.67	-26.12***	GSLM2
0051.0320	562166.0	5376148.1	216.10	980.268720	980.337948	0.68	-26.04***	GSLM2
0051.0321	562549.9	5376640.4	211.95	980.269400	980.337547	0.74	-25.72***	GSLM2
0051.0322	562960.3	5377022.4	205.53	980.270930	980.337236	0.93	-24.95***	GSLM2
0051.0324	563506.8	5377214.6	207.79	980.269570	980.337077	0.90	-25.74***	GSLM2
0051.0325	564018.3	5377279.1	210.89	980.270090	980.337021	0.87	-24.58***	GSLM2
0051.0326	564562.9	5377446.0	202.81	980.272330	980.336883	0.88	-23.78***	GSLM2
0051.0327	564947.3	5377819.0	202.38	980.273240	980.336579	0.94	-22.59***	GSLM2
0051.0328	565378.0	5378156.1	204.24	980.271840	980.336303	1.05	-23.24***	GSLM2
0051.0329	565855.9	5378528.0	206.70	980.272010	980.335999	1.23	-22.10***	GSLM2
0051.0330	566501.1	5378756.7	206.59	980.274230	980.335810	1.09	-19.85***	GSLM2
0051.0332	560792.3	5374711.9	214.62	980.270730	980.339117	0.41	-25.76***	GSLM2
0051.0333	559092.8	5373104.7	215.78	980.269000	980.340426	0.37	-28.61***	GSLM2
0051.0356	522395.2	5385576.7	183.69	980.273560	980.330525	0.09	-20.74***	GSLM3
0051.2334	507897.3	5388632.4	171.43	980.268660	980.328083	0.06	-25.64***	GSLM3
0051.2333	507897.3	5388697.2	170.24	980.268890	980.328031	0.06	-25.60***	GSLM3
0051.0334	507083.8	5388065.7	154.48	980.271970	980.328541	0.05	-26.14***	GSLM3
0051.0335	506926.6	5387080.3	158.85	980.271430	980.329337	0.07	-26.59***	GSLM3
0051.0336	506760.5	5386038.8	160.64	980.271250	980.330178	0.07	-27.26***	GSLM3
0051.0337	506596.1	5385020.4	163.39	980.271360	980.331000	0.07	-27.43***	GSLM3
0051.0338	506426.6	5383993.0	156.31	980.272810	980.331830	0.08	-28.19***	GSLM3
0051.0339	506326.0	5382964.0	146.50	980.275740	980.332660	0.08	-28.03***	GSLM3
0051.0340	506787.8	5381865.7	142.77	980.279140	980.333547	0.11	-26.22***	GSLM3
0051.0341	507956.1	5381528.3	153.74	980.279610	980.333818	0.07	-23.90***	GSLM3
0051.0342	508911.8	5381324.1	158.20	980.280710	980.333982	0.07	-22.09***	GSLM3
0051.0343	509889.0	5381117.8	149.46	980.280250	980.334148	0.05	-24.45***	GSLM3
0051.0344	510895.9	5380913.3	148.64	980.281540	980.334312	0.11	-23.43***	GSLM3
0051.0345	511555.0	5381528.8	142.52	980.280240	980.333814	0.09	-25.45***	GSLM3
0051.0346	512369.5	5382114.3	145.46	980.276550	980.333340	0.07	-28.11***	GSLM3
0051.0347	513178.1	5382696.2	151.82	980.273630	980.332869	0.09	-29.29***	GSLM3
0051.0348	513978.7	5383266.6	156.52	980.273090	980.332407	0.10	-28.43***	GSLM3
0051.0349	514917.8	5383587.8	158.21	980.273780	980.332146	0.13	-27.12***	GSLM3
0051.0350	515765.1	5383205.7	162.46	980.272680	980.332453	0.13	-27.69***	GSLM3
0051.0351	516688.6	5383076.6	164.21	980.274700	980.332556	0.14	-25.42***	GSLM3
0051.0352	517742.4	5383256.9	171.71	980.274660	980.332408	0.16	-23.81***	GSLM3
0051.0353	518465.3	5383370.5	178.44	980.274880	980.332315	0.14	-22.20***	GSLM3

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouguer Anomaly (2.67)	Comments
0051.0354	519588.3	5383377.0	199.28	980.271660	980.332308	0.19	-21.26***	GSLM3
0051.0355	520239.3	5383934.0	191.86	980.274070	980.331856	0.10	-19.95***	GSLM3
0051.0356	522395.2	5385576.7	183.69	980.273550	980.330525	0.10	-20.74***	GSLM3
0051.0357	521755.4	5386464.4	179.31	980.275730	980.329810	0.09	-18.72***	GSLM3
0051.0358	520926.3	5387382.9	176.86	980.278160	980.329071	0.09	-16.03***	GSLM3
0051.0359	519874.4	5388869.0	173.27	980.279850	980.327874	0.09	-13.85***	GSLM3
0051.0360	519333.3	5389954.0	166.31	980.281550	980.326999	0.07	-12.67***	GSLM3
0051.0361	518866.6	5390946.4	166.11	980.281570	980.326199	0.07	-11.89***	GSLM3
0051.0362	518693.0	5392027.7	163.24	980.281870	980.325327	0.07	-11.28***	GSLM3
0051.0363	518470.3	5392876.0	164.67	980.282780	980.324643	0.09	-9.38***	GSLM3
0051.0364	517400.8	5392585.7	155.51	980.283440	980.324879	0.08	-10.77***	GSLM3
0051.0365	516554.2	5392309.9	150.67	980.282630	980.325103	0.07	-12.77***	GSLM3
0051.0366	515425.9	5392011.4	143.91	980.282700	980.325346	0.07	-14.27***	GSLM3
0051.0367	514459.4	5391658.1	142.04	980.283780	980.325633	0.07	-13.84***	GSLM3
0051.0368	513382.6	5391460.7	156.86	980.275550	980.325794	0.06	-19.33***	GSLM3
0051.0369	512416.4	5391276.5	150.25	980.274230	980.325944	0.10	-22.06***	GSLM3
0051.0370	511245.0	5391656.9	135.42	980.277460	980.325639	0.06	-21.48***	GSLM3
0051.0371	510591.3	5391860.2	140.61	980.277240	980.325475	0.05	-20.53***	GSLM3
0051.0372	510609.2	5392948.6	148.72	980.272510	980.324597	0.06	-22.77***	GSLM3
0051.0373	507687.0	5389980.5	157.02	980.270990	980.326995	0.06	-25.06***	GSLM3
0051.0374	508717.0	5389818.0	166.10	980.269770	980.327126	0.06	-24.62***	GSLM3
0051.0375	508983.0	5390805.2	157.62	980.270960	980.326329	0.05	-24.32***	GSLM3
0051.0376	509224.1	5391740.3	151.54	980.274080	980.325574	0.05	-21.64***	GSLM3
0051.0377	509479.0	5392708.2	148.95	980.275450	980.324792	0.05	-19.99***	GSLM3
0051.0378	509707.5	5393654.7	142.52	980.273530	980.324028	0.05	-22.42***	GSLM3
0051.0379	509962.4	5394642.7	144.32	980.277820	980.323231	0.06	-16.96***	GSLM3
0051.0380	509940.1	5395539.2	137.72	980.280430	980.322507	0.07	-14.92***	GSLM3
0051.0381	514984.7	5390765.6	151.81	980.280770	980.326352	0.07	-15.65***	GSLM3
0051.0382	515490.2	5389967.1	174.81	980.278100	980.326996	0.07	-14.44***	GSLM3
0051.0383	515759.1	5389075.0	175.58	980.278290	980.327716	0.08	-14.81***	GSLM3
0051.0384	514747.2	5389851.4	163.79	980.279710	980.327091	0.07	-15.09***	GSLM3
0051.0385	512913.0	5392286.7	160.42	980.274910	980.325128	0.09	-18.57***	GSLM3
0051.0386	512603.8	5393203.6	157.19	980.277650	980.324389	0.09	-15.73***	GSLM3
0051.0387	512161.6	5393748.0	157.89	980.276290	980.323950	0.08	-16.52***	GSLM3
0051.0388	512004.7	5394577.8	159.81	980.272470	980.323280	0.09	-19.29***	GSLM3
0051.0389	512734.2	5390476.8	151.58	980.274670	980.326589	0.06	-22.04***	GSLM3
0051.0390	512620.8	5389502.7	156.91	980.273190	980.327375	0.07	-23.25***	GSLM3
0051.0391	512431.7	5388457.5	152.10	980.277510	980.328219	0.08	-20.71***	GSLM3
0051.0393	514406.6	5387623.1	166.03	980.276330	980.328890	0.09	-19.81***	GSLM3
0051.0394	515277.5	5387481.1	169.98	980.273870	980.329003	0.09	-21.61***	GSLM3
0051.0395	515870.5	5387384.2	171.26	980.273330	980.329080	0.09	-21.97***	GSLM3
0051.0396	515701.5	5386383.4	170.55	980.275630	980.329888	0.09	-20.62***	GSLM3
0051.0397	515536.5	5385451.0	166.63	980.274970	980.330641	0.10	-22.80***	GSLM3
0051.0398	516292.2	5385295.3	169.66	980.273560	980.330766	0.10	-23.73***	GSLM3
0051.0399	516264.5	5384247.2	155.85	980.277170	980.331612	0.12	-23.67***	GSLM3
0051.0400	516230.2	5383322.3	160.55	980.274410	980.332358	0.13	-26.24***	GSLM3
0051.0401	516084.1	5381928.3	173.36	980.275110	980.333484	0.13	-24.15***	GSLM3
0051.0402	515446.9	5381312.7	171.58	980.276470	980.333982	0.16	-23.60***	GSLM3
0051.0403	515893.0	5380335.2	181.44	980.279730	980.334771	0.13	-19.22***	GSLM3
0051.0404	516224.2	5379765.7	175.06	980.281650	980.335230	0.15	-19.00***	GSLM3
0051.0405	513861.1	5383936.1	157.69	980.277250	980.331867	0.11	-23.49***	GSLM3
0051.0406	508359.2	5382390.5	151.02	980.280170	980.333122	0.07	-23.18***	GSLM3
0051.0407	505219.2	5383266.4	164.96	980.270910	980.332417	0.09	-28.97***	GSLM3
0051.0408	505068.9	5382229.5	150.08	980.275630	980.333254	0.09	-28.01***	GSLM3
0051.0409	505029.7	5381318.4	149.45	980.275410	980.333990	0.09	-29.09***	GSLM3
0051.0412	523189.4	5384573.9	178.03	980.274880	980.331333	0.09	-21.35***	GSLM3
0051.0413	523495.4	5385081.0	178.08	980.274720	980.330922	0.09	-21.09***	GSLM3
0051.0414	523980.5	5383458.0	182.76	980.275070	980.332231	0.09	-21.12***	GSLM3
0051.0415	519912.9	5388821.3	172.13	980.280060	980.327912	0.09	-13.91***	GSLM3
0051.0416	517375.7	5394912.7	173.68	980.280660	980.323001	0.09	-8.09***	GSLM3
0051.0417	516281.0	5395402.8	161.30	980.282230	980.322608	0.09	-8.56***	GSLM3
0051.0418	515408.3	5396242.9	153.70	980.283990	980.321932	0.10	-7.61***	GSLM3
0051.0419	514568.5	5396878.7	163.63	980.281000	980.321420	0.09	-8.14***	GSLM3
0051.0420	514674.8	5398017.7	169.20	980.282500	980.320501	0.11	-4.61***	GSLM3
0051.0421	515536.7	5398396.9	150.79	980.286820	980.320193	0.13	-3.58***	GSLM3
0051.0422	516610.2	5398310.1	181.63	980.281440	980.320261	0.13	-2.97***	GSLM3
0051.0423	517296.6	5398899.4	184.11	980.279220	980.319785	0.10	-4.25***	GSLM3
0051.0425	517827.6	5398131.1	176.66	980.281270	980.320403	0.10	-4.29***	GSLM3

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.0426	518649.8	5397642.7	162.56	980.279870	980.320796	0.11	-8.84***	GSLM3
0051.0427	518360.2	5399011.7	167.11	980.275220	980.319692	0.11	-11.49***	GSLM3
0051.0428	519262.3	5398471.1	162.92	980.278150	980.320126	0.12	-9.81***	GSLM3
0051.0429	520133.6	5397924.9	170.09	980.278340	980.320565	0.10	-8.67***	GSLM3
0051.0430	519485.4	5397080.2	157.78	980.278180	980.321248	0.10	-11.93***	GSLM3
0051.0431	518951.2	5396208.6	164.07	980.285040	980.321952	0.10	-4.54***	GSLM3
0051.0432	518404.5	5395445.8	165.22	980.284420	980.322569	0.09	-5.56***	GSLM3
0051.0432	518404.5	5395445.8	165.22	980.284370	980.322569	0.09	-5.61***	GSLM3
0051.0433	519300.3	5395067.7	154.45	980.285520	980.322872	0.09	-6.88***	GSLM3
0051.0434	519572.9	5394537.0	155.45	980.286220	980.323300	0.09	-6.41***	GSLM3
0051.0435	518073.3	5393632.3	164.52	980.282310	980.324033	0.09	-9.27***	GSLM3
0051.0436	517833.3	5395947.3	175.83	980.281560	980.322166	0.10	-5.92***	GSLM3
0051.0437	518932.3	5394097.2	155.25	980.284910	980.323656	0.09	-8.12***	GSLM3
0051.0438	519733.0	5392997.8	156.71	980.285280	980.324542	0.09	-8.35***	GSLM3
0051.0439	520627.2	5389634.5	158.80	980.283670	980.327254	0.09	-12.26***	GSLM3
0051.0440	521416.0	5390208.3	158.37	980.282770	980.326789	0.09	-12.78***	GSLM3
0051.0441	521443.7	5384918.7	179.39	980.275830	980.331059	0.10	-19.84***	GSLM3
0051.0442	520756.9	5397127.7	153.49	980.283180	980.321207	0.09	-7.75***	GSLM3
0051.0443	521282.4	5396227.8	168.31	980.280490	980.321932	0.09	-8.25***	GSLM3
0051.0444	521919.7	5395488.7	168.73	980.279340	980.322527	0.10	-9.90***	GSLM3
0051.0445	522586.9	5394714.4	158.28	980.281650	980.323150	0.10	-10.27***	GSLM3
0051.0446	522797.4	5394476.4	156.07	980.283240	980.323341	0.11	-9.29***	GSLM3
0051.0448	523521.7	5393501.1	163.06	980.282840	980.324126	0.11	-9.10***	GSLM3
0051.0449	523532.8	5392523.7	156.94	980.282450	980.324915	0.11	-11.49***	GSLM3
0051.0450	523541.0	5391477.1	160.24	980.283350	980.325760	0.11	-10.78***	GSLM3
0051.0451	523543.7	5390850.4	160.59	980.282630	980.326266	0.12	-11.93***	GSLM3
0051.0452	524556.1	5391263.8	163.28	980.281790	980.325929	0.12	-11.90***	GSLM3
0051.0453	525503.0	5391290.8	167.92	980.283950	980.325905	0.13	-8.80***	GSLM3
0051.0454	524819.9	5392100.7	163.73	980.284940	980.325253	0.12	-7.99***	GSLM3
0051.0455	524172.9	5392853.0	161.58	980.282150	980.324648	0.12	-10.60***	GSLM3
0051.0456	524782.3	5389988.5	166.80	980.281530	980.326958	0.09	-12.53***	GSLM3
0051.0457	526144.6	5390571.7	172.68	980.282740	980.326483	0.13	-9.65***	GSLM3
0051.0458	526842.0	5389749.8	176.15	980.282090	980.327144	0.12	-10.29***	GSLM3
0051.0459	527440.7	5388958.4	176.61	980.283440	980.327781	0.12	-9.48***	GSLM3
0051.0460	527831.5	5388020.7	174.98	980.283620	980.328537	0.11	-10.39***	GSLM3
0051.0461	527155.3	5387240.8	168.91	980.282950	980.329169	0.10	-12.90***	GSLM3
0051.0462	526457.2	5386564.0	163.28	980.283180	980.329717	0.10	-14.32***	GSLM3
0051.0463	525839.8	5385742.1	162.17	980.281130	980.330382	0.10	-17.25***	GSLM4
0051.0464	528345.7	5387113.3	172.20	980.285620	980.329268	0.12	-9.66***	GSLM4
0051.0465	528987.8	5386186.4	170.43	980.286630	980.330014	0.12	-9.74***	GSLM4
0051.0466	528642.7	5385045.1	168.07	980.286040	980.330936	0.11	-11.73***	GSLM4
0051.0467	529633.5	5385065.3	169.08	980.287790	980.330917	0.13	-9.74***	GSLM4
0051.0468	528934.6	5384348.5	167.39	980.286520	980.331498	0.11	-11.94***	GSLM4
0051.0469	528314.1	5383605.5	163.12	980.286290	980.332100	0.10	-13.63***	GSLM4
0051.0470	528171.6	5383198.4	163.81	980.285640	980.332429	0.10	-14.47***	GSLM4
0051.0471	529809.0	5383689.0	167.02	980.288430	980.332027	0.11	-10.64***	GSLM4
0051.0472	530094.9	5383206.4	166.31	980.289050	980.332416	0.11	-10.54***	GSLM4
0051.0473	530195.8	5384236.0	169.93	980.287170	980.331584	0.12	-10.87***	GSLM4
0051.0474	530974.1	5383360.0	192.77	980.284190	980.332289	0.18	-10.00***	GSLM4
0051.0475	531708.5	5383050.9	202.57	980.282110	980.332536	0.17	-10.41***	GSLM4
0051.0476	531736.0	5382155.6	181.27	980.287360	980.333258	0.16	-10.08***	GSLM4
0051.0477	531863.7	5381279.4	171.46	980.288520	980.333965	0.13	-11.59***	GSLM4
0051.0478	531840.6	5380868.0	172.70	980.288620	980.334298	0.12	-11.59***	GSLM4
0051.0479	532550.9	5382611.4	201.71	980.282190	980.332888	0.19	-10.83***	GSLM4
0051.0480	533585.5	5382390.4	212.48	980.276350	980.333062	0.18	-14.74***	GSLM4
0051.0481	534412.7	5381706.3	217.14	980.277350	980.333611	0.16	-13.39***	GSLM4
0051.0482	534296.2	5379922.1	182.89	980.286350	980.335052	0.14	-12.59***	GSLM4
0051.0483	534161.9	5380792.4	185.94	980.283160	980.334350	0.16	-14.46***	GSLM4
0051.0484	535213.9	5381086.0	219.45	980.278280	980.334109	0.17	-12.49***	GSLM4
0051.0485	536143.9	5380566.9	248.18	980.274480	980.334524	0.19	-11.04***	GSLM4
0051.0486	537462.8	5379609.1	211.47	980.281120	980.335292	0.20	-12.38***	GSLM4
0051.0487	538669.1	5379322.9	229.61	980.277090	980.335518	0.17	-13.09***	GSLM4
0051.0488	540505.4	5377701.3	182.26	980.287070	980.336819	0.23	-13.67***	GSLM4
0051.0489	540237.0	5376644.2	177.49	980.288750	980.337674	0.24	-13.77***	GSLM4
0051.0490	524624.7	5382632.4	189.81	980.274680	980.332896	0.09	-20.79***	GSLM4
0051.0491	525130.2	5381950.1	182.84	980.277270	980.333446	0.09	-20.12***	GSLM4
0051.0492	526408.8	5380233.2	171.39	980.282470	980.334828	0.10	-18.55***	GSLM4
0051.0493	527007.7	5379430.3	178.53	980.281810	980.335474	0.10	-18.45***	GSLM4

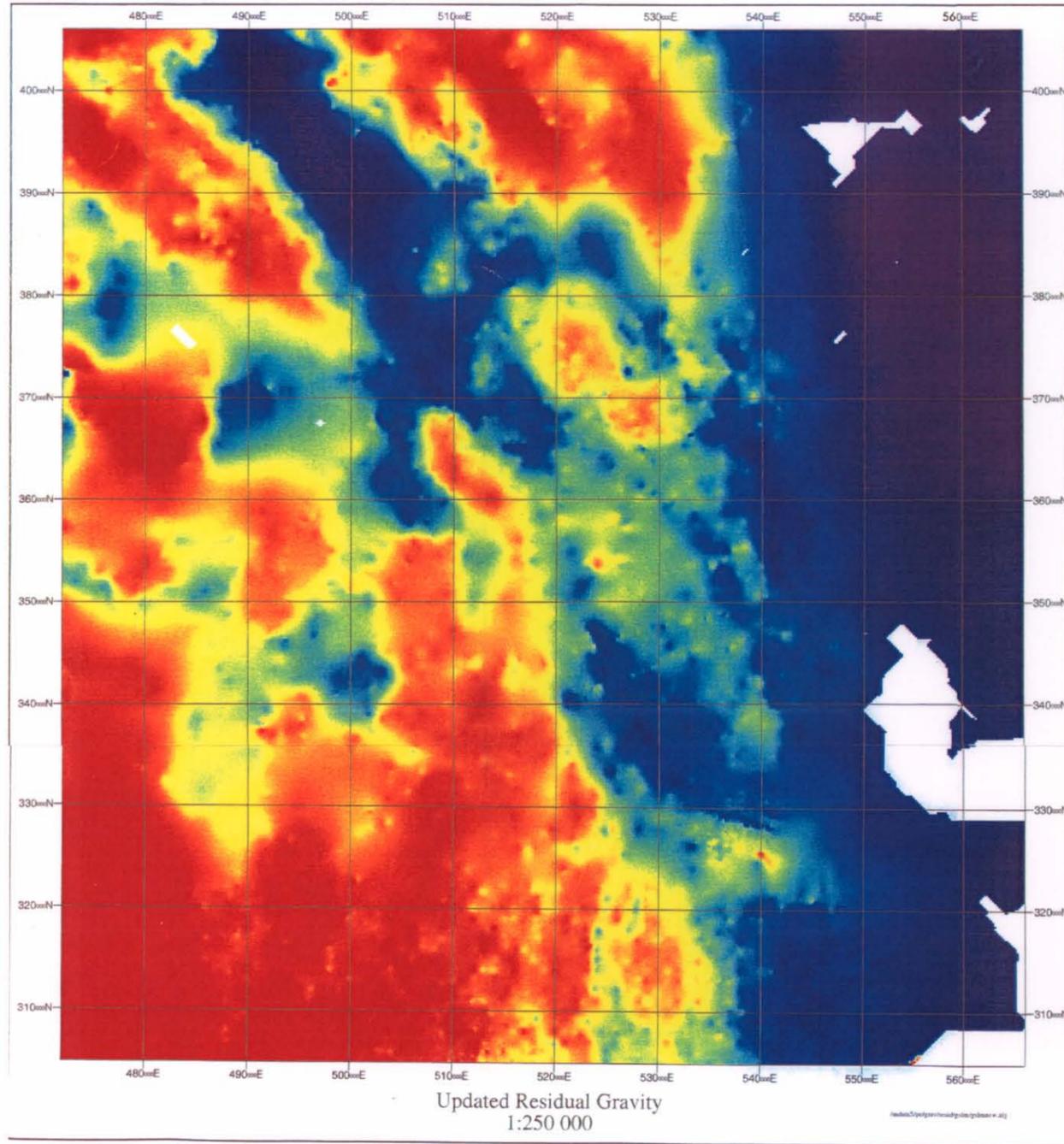
Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.0494	527550.6	5378707.4	179.94	980.282310	980.336056	0.11	-18.24***	GSLM4
0051.0495	528233.5	5377765.3	194.48	980.279630	980.336815	0.10	-18.83***	GSLM4
0051.0496	528894.6	5376905.2	196.54	980.279390	980.337507	0.09	-19.37***	GSLM4
0051.0497	530244.2	5375434.2	185.45	980.283870	980.338691	0.09	-18.25***	GSLM4
0051.0498	530781.8	5374712.9	190.50	980.282930	980.339271	0.09	-18.78***	GSLM4
0051.0499	531408.7	5373874.9	197.37	980.283660	980.339946	0.10	-17.36***	GSLM4
0051.0500	532250.7	5372964.7	203.51	980.287760	980.340678	0.09	-12.80***	GSLM4
0051.0502	532805.5	5372345.5	213.89	980.287140	980.341176	0.09	-11.87***	GSLM4
0051.0503	529406.7	5376133.2	198.54	980.280690	980.338129	0.09	-18.30***	GSLM4
0051.0504	529736.5	5377543.7	172.83	980.284130	980.336989	0.09	-18.77***	GSLM4
0051.0505	530469.0	5378110.1	176.16	980.284080	980.336529	0.11	-17.69***	GSLM4
0051.0506	531361.0	5378727.0	171.69	980.289850	980.336028	0.11	-12.30***	GSLM4
0051.0507	532186.0	5379091.3	171.90	980.290420	980.335731	0.11	-11.39***	GSLM4
0051.0508	533194.2	5379556.7	177.58	980.289130	980.335351	0.12	-11.17***	GSLM4
0051.0509	534119.6	5378902.6	178.83	980.288010	980.335876	0.13	-12.56***	GSLM4
0051.0510	523440.6	5384206.6	176.94	980.275190	980.331628	0.09	-21.55***	GSLM4
0051.0511	520711.8	5384348.7	190.35	980.273720	980.331521	0.10	-20.26***	GSLM4
0051.0512	522478.5	5386991.7	162.20	980.278570	980.329383	0.09	-18.82***	GSLM4
0051.0513	522813.7	5387233.5	161.56	980.278880	980.329187	0.09	-18.44***	GSLM4
0051.0514	522974.7	5388121.5	161.08	980.279980	980.328470	0.09	-16.72***	GSLM4
0051.0515	522921.2	5384867.7	178.82	980.274690	980.331096	0.09	-21.14***	GSLM4
0051.0516	523930.7	5386086.1	159.15	980.279490	980.330110	0.11	-19.21***	GSLM4
0051.0517	524248.4	5385986.5	159.73	980.279750	980.330190	0.10	-18.92***	GSLM4
0051.0518	524275.2	5386524.7	156.97	980.280360	980.329755	0.10	-18.42***	GSLM4
0051.0519	521610.5	5397551.6	166.83	980.279780	980.320863	0.09	-8.18***	GSLM4
0051.0520	522519.4	5397447.3	164.19	980.279750	980.320945	0.11	-8.79***	GSLM4
0051.0521	523518.8	5397488.0	164.97	980.278360	980.320909	0.12	-9.98***	GSLM4
0051.0522	524193.8	5397980.9	171.03	980.276790	980.320510	0.12	-9.96***	GSLM4
0051.0523	525160.1	5398579.0	169.95	980.277670	980.320024	0.19	-8.74***	GSLM4
0051.0539	526047.2	5398664.0	170.51	980.278580	980.319953	0.20	-7.63***	GSLM4
0051.0524	526534.6	5398080.4	177.18	980.277600	980.320423	0.21	-7.76***	GSLM4
0051.0525	526068.6	5397010.5	177.44	980.280020	980.321287	0.18	-6.19***	GSLM4
0051.0526	526700.6	5396235.8	176.17	980.279880	980.321911	0.16	-7.22***	GSLM4
0051.0527	527393.9	5395412.1	179.38	980.281680	980.322573	0.20	-5.41***	GSLM4
0051.0528	526838.0	5394521.5	186.97	980.280660	980.323294	0.16	-5.70***	GSLM4
0051.0529	525444.8	5394740.1	169.43	980.283430	980.323121	0.12	-6.25***	GSLM4
0051.0530	528230.4	5395839.2	210.83	980.275730	980.322226	0.53	-4.50***	GSLM4
0051.0531	529243.5	5395972.0	252.71	980.267530	980.322116	0.40	-4.48***	GSLM4
0051.0532	529898.9	5396288.3	264.59	980.265380	980.321858	0.44	-3.99***	GSLM4
0051.0533	529766.8	5397282.4	286.78	980.259580	980.321056	0.51	-4.56***	GSLM4
0051.0534	528985.7	5397438.1	239.20	980.269780	980.320933	0.40	-3.70***	GSLM4
0051.0535	527964.2	5397685.0	213.06	980.274480	980.320737	0.55	-3.80***	GSLM4
0051.0536	527377.0	5398375.1	199.56	980.275920	980.320182	0.43	-4.58***	GSLM4
0051.0537	527063.3	5399187.2	187.77	980.278280	980.319528	0.36	-3.95***	GSLM4
0051.0538	526962.0	5399615.2	190.93	980.277360	980.319183	0.34	-3.93***	GSLM4
0051.0540	527693.3	5400131.2	219.23	980.271740	980.318765	0.37	-3.53***	GSLM4
0051.0541	528212.1	5400732.8	238.39	980.266120	980.318278	0.39	-4.88***	GSLM4
0051.0542	527806.2	5401219.8	224.68	980.268970	980.317886	0.35	-4.37***	GSLM4
0051.0543	528570.1	5401797.1	302.29	980.252720	980.317418	0.60	-4.64***	GSLM4
0051.0544	529313.2	5401928.7	311.52	980.248240	980.317309	0.59	-7.20***	GSLM4
0051.0545	530155.8	5402669.1	352.97	980.240060	980.316709	0.45	-6.77***	GSLM4
0051.0546	529651.1	5403450.8	329.85	980.244340	980.316080	0.31	-6.55***	GSLM4
0051.0547	528714.6	5404335.1	316.18	980.246450	980.315370	0.32	-6.41***	GSLM4
0051.0548	529540.4	5404745.5	386.66	980.231630	980.315036	0.51	-6.84***	GSLM4
0051.0549	530373.7	5404639.1	363.08	980.233140	980.315119	0.53	-10.03***	GSLM4
0051.0550	531440.9	5404655.2	351.68	980.238040	980.315103	0.59	-7.29***	GSLM4
0051.0551	531876.2	5405469.9	366.26	980.236070	980.314444	0.67	-5.66***	GSLM4
0051.0552	531779.4	5403726.4	364.63	980.235350	980.315851	0.63	-8.14***	GSLM4
0051.0553	531180.7	5403301.1	417.88	980.227070	980.316196	0.73	-6.19***	GSLM4
0051.0554	534716.0	5403460.9	583.37	980.194360	980.316054	0.48	-6.45***	GSLM4
0051.0555	539684.3	5399245.9	457.53	980.215130	980.319434	0.77	-13.53***	GSLM4
0051.0556	539745.4	5398462.8	416.66	980.224730	980.320065	0.86	-12.51***	GSLM4
0051.0557	538800.2	5398109.8	348.81	980.240800	980.320354	1.12	-9.82***	GSLM4
0051.0558	538202.0	5397250.6	278.63	980.255230	980.321050	0.80	-10.21***	GSLM4
0051.0559	537446.4	5396730.9	268.03	980.256590	980.321472	0.77	-11.39***	GSLM4
0051.0560	536991.6	5395773.3	258.51	980.260530	980.322247	0.81	-10.06***	GSLM4
0051.0561	536565.1	5394892.6	265.84	980.260210	980.322959	1.32	-9.14***	GSLM4
0051.0562	535637.4	5394725.0	252.27	980.266170	980.323098	0.76	-6.55***	GSLM4

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouguer Anomaly (2.67)	Comments
0051.0563	534737.6	5394178.0	244.82	980.266760	980.323543	0.78	-7.85***	GSLM4
0051.0566	534164.5	5393272.1	243.52	980.265370	980.324277	1.16	-9.85***	GSLM4
0051.0567	533434.9	5392381.9	229.61	980.270770	980.324998	1.24	-7.82***	GSLM4
0051.0568	533178.7	5391466.9	227.17	980.271830	980.325737	0.76	-8.46***	GSLM4
0051.0569	532103.5	5390905.1	247.76	980.272310	980.326195	0.44	-4.71***	GSLM4
0051.0570	531455.1	5390047.4	203.39	980.281730	980.326889	0.27	-4.88***	GSLM4
0051.0571	530675.3	5389821.9	221.10	980.278490	980.327074	0.20	-4.89***	GSLM4
0051.0572	529704.6	5389371.7	189.84	980.284360	980.327441	0.13	-5.61***	GSLM4
0051.0573	528681.7	5388840.0	181.79	980.284160	980.327873	0.12	-7.84***	GSLM4
0051.0574	526443.4	5391839.9	172.83	980.284150	980.325459	0.13	-7.18***	GSLM4
0051.0575	527265.2	5392240.5	179.00	980.283110	980.325133	0.14	-6.67***	GSLM4
0051.0576	528227.7	5392489.6	196.31	980.280380	980.324929	0.20	-5.74***	GSLM4
0051.0577	529080.8	5392991.7	200.59	980.279560	980.324521	0.29	-5.22***	GSLM4
0051.0578	529879.4	5393359.7	207.02	980.278360	980.324221	0.52	-4.62***	GSLM4
0051.0579	530993.3	5393422.2	226.22	980.274470	980.324167	0.32	-4.88***	GSLM4
0051.0580	532072.5	5393298.2	252.93	980.269220	980.324263	0.45	-4.84***	GSLM4
0051.0581	532747.1	5393095.7	269.97	980.265570	980.324424	0.80	-4.95***	GSLM4
0051.0582	551084.5	5371635.1	186.21	980.285560	980.341663	0.92	-18.56***	GSLM4
0051.0583	551368.7	5372505.5	192.75	980.283500	980.340958	1.17	-18.38***	GSLM4
0051.0584	551728.6	5373374.1	197.99	980.279350	980.340255	0.71	-21.25***	GSLM4
0051.0585	552014.1	5374304.5	206.71	980.275520	980.339502	0.73	-22.59***	GSLM4
0051.0586	552143.2	5375200.2	220.70	980.271430	980.338778	0.75	-23.19***	GSLM4
0051.0587	559291.0	5374672.9	210.36	980.270280	980.339159	0.48	-27.02***	GSLM4
0051.0588	559160.2	5375534.3	211.18	980.269830	980.338464	0.54	-26.56***	GSLM4
0051.0589	558722.2	5376443.5	228.17	980.264700	980.337733	0.91	-27.24***	GSLM4
0051.0590	558336.1	5377201.1	237.29	980.261440	980.337123	1.32	-27.69***	GSLM4
0051.0591	558025.3	5378051.0	253.93	980.256110	980.336439	2.09	-28.29***	GSLM4
0051.0592	557622.3	5378854.0	269.80	980.251780	980.335794	2.85	-28.09***	GSLM4
0051.0593	556967.7	5379335.7	310.46	980.242830	980.335409	3.33	-28.18***	GSLM4
0051.0594	556288.9	5379889.8	425.71	980.219910	980.334966	2.80	-28.51***	GSLM4
0051.0595	555554.0	5380311.6	467.02	980.211560	980.334630	1.63	-29.57***	GSLM4
0051.0596	557759.4	5379678.8	314.05	980.241400	980.335127	3.87	-28.08***	GSLM4
0051.0597	557987.9	5380467.4	369.55	980.229820	980.334489	4.67	-27.31***	GSLM4
0051.0598	558254.4	5381332.7	442.48	980.215340	980.333788	4.03	-27.38***	GSLM4
0051.0600	557760.6	5384636.7	720.30	980.160330	980.331124	1.18	-27.91***	GSLM4
0051.0601	556800.5	5384751.4	699.10	980.165600	980.331038	1.25	-26.65***	GSLM4
0051.0602	556132.5	5385333.8	716.70	980.161140	980.330572	1.15	-27.28***	GSLM4
0051.0603	555732.6	5386170.8	773.26	980.148180	980.329899	1.18	-28.41***	GSLM4
0051.0604	554945.0	5387354.8	753.20	980.152330	980.328948	1.13	-27.31***	GSLM4
0051.0605	554292.3	5387792.2	749.93	980.152190	980.328599	1.49	-27.38***	GSLM4
0051.0606	554297.3	5389064.3	725.83	980.156850	980.327573	1.47	-26.46***	GSLM4
0051.0607	553426.0	5389395.0	748.27	980.151990	980.327311	2.13	-25.98***	GSLM4
0051.0608	552600.0	5389603.3	653.41	980.170800	980.327148	2.32	-25.48***	GSLM4
0051.0609	552306.0	5388721.3	609.53	980.179840	980.327861	1.67	-26.44***	GSLM4
0051.0610	551596.5	5389358.7	594.48	980.183700	980.327351	1.53	-25.17***	GSLM4
0051.0611	558135.2	5383904.8	659.27	980.172510	980.331713	1.87	-27.64***	GSLM4
0051.0612	558370.0	5382891.6	544.38	980.194530	980.332529	2.00	-28.91***	GSLM4
0051.0613	559170.6	5374400.1	202.68	980.271750	980.339380	0.44	-27.32***	GSLM4
0051.0614	552723.8	5353702.5	572.13	980.228410	980.356140	0.32	-14.86***	GSLM4
0051.0615	556796.3	5350976.9	545.02	980.237040	980.358317	0.20	-13.86***	GSLM4
0051.0616	557770.2	5350937.1	544.24	980.235530	980.358343	0.31	-15.44***	GSLM4
0051.0617	558762.6	5350736.0	565.01	980.232120	980.358499	0.42	-14.81***	GSLM4
0051.0618	559312.1	5349990.0	620.00	980.222760	980.359098	0.32	-14.05***	GSLM4
0051.0619	559816.6	5348999.7	657.11	980.216260	980.359895	0.42	-13.94***	GSLM4
0051.0620	555963.2	5350942.3	537.04	980.239030	980.358350	0.17	-13.51***	GSLM4
0051.0621	555226.2	5351573.7	543.32	980.235550	980.357845	0.17	-15.24***	GSLM4
0051.0622	554558.3	5352196.3	557.49	980.231610	980.357346	0.22	-15.85***	GSLM4
0051.0623	553593.1	5352940.7	555.64	980.232770	980.356750	0.34	-14.34***	GSLM4
0051.0624	550035.6	5362638.1	486.38	980.234170	980.348936	0.56	-18.53***	GSLM4
0051.0625	550574.1	5363208.1	474.90	980.236120	980.348472	0.55	-18.38***	GSLM4
0051.0626	551212.2	5362398.7	473.26	980.236840	980.349123	0.65	-18.54***	GSLM4
0051.0627	550221.0	5363912.3	560.77	980.219190	980.347906	0.58	-17.82***	GSLM4
0051.0628	550727.9	5364251.8	597.79	980.211510	980.347628	0.65	-17.87***	GSLM4
0051.0629	550711.7	5365341.8	556.51	980.218560	980.346748	0.39	-18.32***	GSLM4
0051.0630	548986.4	5363708.4	575.78	980.216120	980.348077	0.65	-18.04***	GSLM4
0051.0631	548416.8	5364357.6	534.03	980.223920	980.347556	0.60	-17.98***	GSLM4
0051.0632	548388.1	5365233.7	515.80	980.227430	980.346848	0.40	-17.55***	GSLM4
0051.0633	535272.3	5370955.5	207.86	980.287480	980.342289	0.09	-13.83***	GSLM4

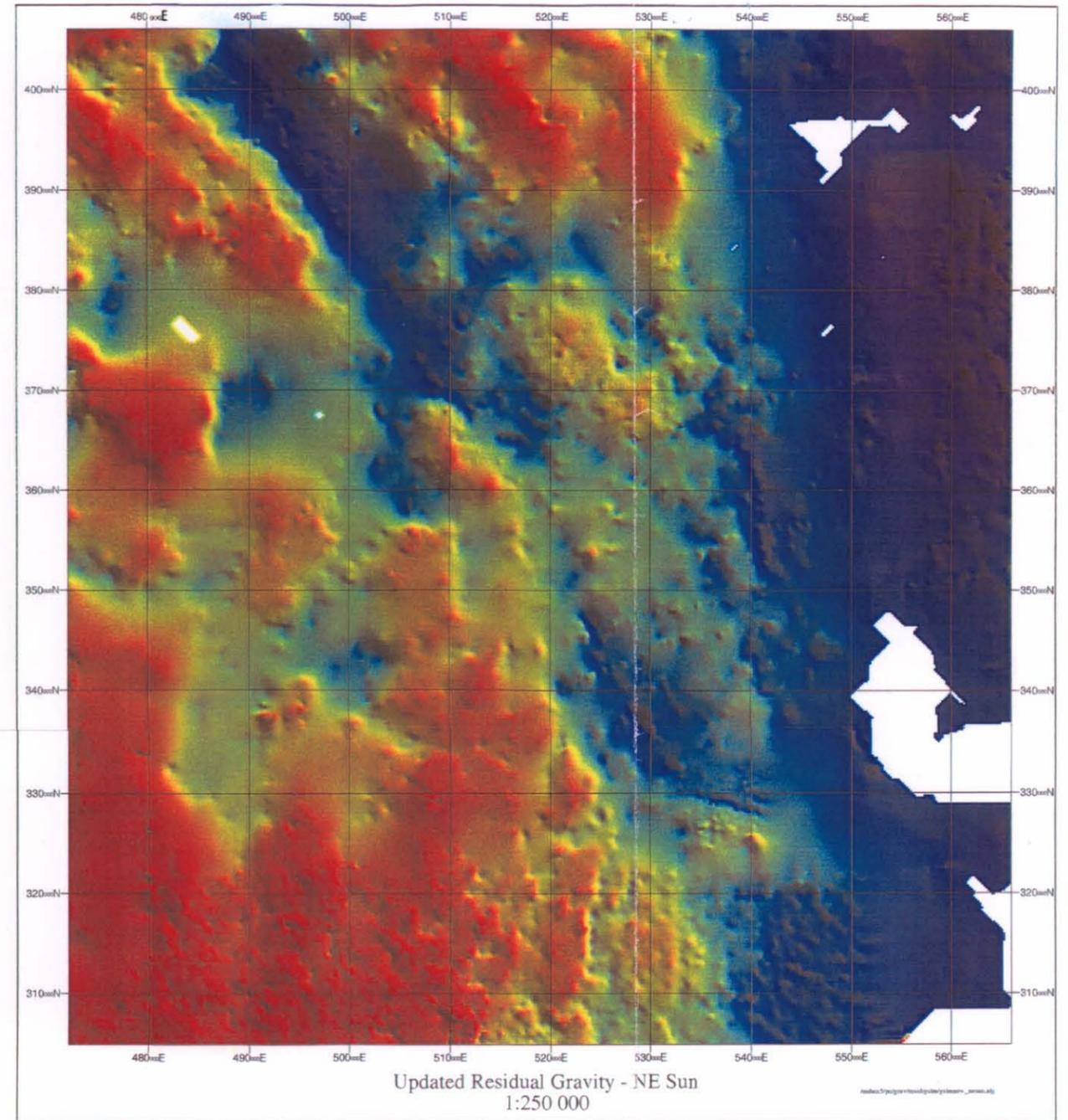
Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.0634	535437.8	5371931.9	208.54	980.288110	980.341500	0.12	-12.25***GSLM4	
0051.0635	536498.8	5372646.9	207.94	980.288110	980.340918	0.25	-11.66***GSLM4	
0051.0636	537008.5	5373312.2	194.27	980.287260	980.340379	0.20	-14.71***GSLM4	
0051.0640	537465.1	5374404.3	175.52	980.288360	980.339495	0.15	-16.46***GSLM5	
0051.0639	535305.1	5371196.0	206.50	980.287200	980.342095	0.09	-14.19***GSLM5	
0051.0641	538109.4	5375007.9	183.40	980.289800	980.339005	0.20	-12.93***GSLM5	
0051.0642	539097.0	5374658.9	179.28	980.290100	980.339282	0.21	-13.71***GSLM5	
0051.0643	539601.0	5375565.6	174.62	980.289710	980.338548	0.23	-14.26***GSLM5	
0051.0644	539641.5	5378292.0	189.28	980.285200	980.336346	0.20	-13.72***GSLM5	
0051.0645	541069.0	5378735.4	193.05	980.282790	980.335982	0.48	-14.74***GSLM5	
0051.0646	541233.1	5379706.7	206.75	980.279400	980.335197	0.62	-14.51***GSLM5	
0051.0647	541135.7	5380601.5	210.36	980.277930	980.334475	0.77	-14.40***GSLM5	
0051.0648	540996.0	5381465.6	225.86	980.274630	980.333778	1.05	-13.67***GSLM5	
0051.0649	541586.0	5382066.6	209.71	980.276230	980.333290	1.24	-14.57***GSLM5	
0051.0650	541862.9	5382614.5	231.02	980.272190	980.332846	1.33	-13.88***GSLM5	
0051.2651	542597.3	5383335.0	232.54	980.271350	980.332261	1.15	-14.02***GSLM5	
0051.0651	542596.6	5383334.7	232.48	980.271350	980.332261	1.15	-14.03***GSLM5	
0051.0652	543420.8	5383484.3	249.90	980.267500	980.332136	1.20	-14.28***GSLM5	
0051.0653	544364.0	5383457.2	253.75	980.266210	980.332154	1.23	-14.80***GSLM5	
0051.0654	545214.6	5383566.4	250.46	980.265840	980.332061	1.12	-15.84***GSLM5	
0051.0655	546153.8	5383673.7	253.08	980.263820	980.331970	1.18	-17.19***GSLM5	
0051.0656	546485.7	5383572.4	263.49	980.262300	980.332050	1.15	-16.77***GSLM5	
0051.0658	498984.6	5374470.9	175.98	980.276980	980.339520	0.93	-27.00***GSLM5	
0051.0659	498164.6	5374304.3	183.60	980.275740	980.339655	1.13	-26.67***GSLM5	
0051.0660	497139.6	5373992.0	197.20	980.271790	980.339907	1.31	-28.02***GSLM5	
0051.0661	496229.8	5373359.6	255.89	980.258590	980.340417	1.64	-29.85***GSLM5	
0051.0662	496351.1	5372304.2	319.19	980.246010	980.341269	2.47	-30.00***GSLM5	
0051.0663	496515.5	5372614.2	314.63	980.247070	980.341019	2.35	-29.71***GSLM5	
0051.0664	495587.6	5371898.3	345.36	980.239960	980.341597	3.43	-30.27***GSLM5	
0051.0665	494987.6	5371209.2	354.36	980.237280	980.342153	3.63	-31.54***GSLM5	
0051.0666	494196.5	5370880.5	362.74	980.233920	980.342418	4.28	-32.86***GSLM5	
0051.0667	493201.9	5370863.9	364.08	980.231290	980.342431	6.29	-33.23***GSLM5	
0051.0668	492798.4	5370914.5	428.40	980.218220	980.342390	7.16	-32.74***GSLM5	
0051.0669	492016.8	5371081.5	499.04	980.202680	980.342254	10.05	-31.35***GSLM5	
0051.0670	491553.3	5371194.2	548.07	980.192290	980.342163	9.31	-32.75***GSLM5	
0051.0671	491502.9	5371053.3	591.10	980.182600	980.342276	9.61	-33.78***GSLM5	
0051.0672	491609.8	5370824.3	636.39	980.172220	980.342461	9.84	-35.21***GSLM5	
0051.0673	491013.2	5371042.2	731.44	980.153640	980.342285	9.03	-35.72***GSLM5	
0051.0674	490702.9	5371421.9	783.79	980.143140	980.341978	9.60	-35.04***GSLM5	
0051.0675	490519.2	5371659.3	810.37	980.138430	980.341786	9.40	-34.52***GSLM5	
0051.0676	490702.0	5370991.9	868.75	980.126240	980.342325	9.65	-35.51***GSLM5	
0051.0677	490009.4	5371417.2	941.83	980.112820	980.341981	8.80	-35.06***GSLM5	
0051.0678	489075.6	5371203.5	1000.43	980.103290	980.342152	7.46	-34.57***GSLM5	
0051.0679	488394.0	5370870.0	1063.37	980.090080	980.342421	7.15	-35.97***GSLM5	
0051.0680	487668.3	5370497.4	1120.94	980.083570	980.342721	3.20	-35.39***GSLM5	
0051.0681	499782.0	5374804.0	166.66	980.279770	980.339251	0.63	-26.07***GSLM5	
0051.0682	499339.3	5375330.8	170.58	980.279190	980.338826	0.69	-25.39***GSLM5	
0051.0683	498796.4	5376182.1	170.42	980.278530	980.338138	0.67	-25.42***GSLM5	
0051.0684	499016.9	5377308.8	166.17	980.278920	980.337229	0.61	-25.01***GSLM5	
0051.0685	499153.8	5378215.4	168.67	980.278140	980.336497	0.56	-24.62***GSLM5	
0051.0686	499605.6	5379082.1	187.27	980.270850	980.335797	0.44	-27.67***GSLM5	
0051.0687	500526.3	5379661.4	186.05	980.270130	980.335329	0.29	-28.31***GSLM5	
0051.0688	501723.8	5380270.4	201.90	980.264600	980.334837	0.33	-30.19***GSLM5	
0051.0689	502574.1	5380864.1	177.35	980.265640	980.334358	0.25	-33.58***GSLM5	
0051.0690	538983.8	5393389.2	314.02	980.248450	980.324162	1.00	-12.94***GSLM6	
0051.0691	539673.0	5392597.0	314.90	980.248670	980.324799	1.60	-12.59***GSLM6	
0051.0692	540170.1	5391749.1	362.27	980.239890	980.325481	1.29	-13.04***GSLM6	
0051.0693	540929.2	5391157.0	379.99	980.236550	980.325955	0.91	-13.75***GSLM6	
0051.0694	541687.7	5390632.4	390.48	980.236840	980.326375	0.88	-11.84***GSLM6	
0051.0695	542364.8	5389917.3	423.36	980.229660	980.326949	0.69	-13.32***GSLM6	
0051.0697	542923.6	5388907.0	439.72	980.228180	980.327762	0.48	-12.60***GSLM6	
0051.0698	538496.4	5394069.9	291.03	980.252330	980.323615	1.04	-13.00***GSLM6	
0051.0699	537744.9	5394871.6	266.79	980.256250	980.322972	1.56	-12.68***GSLM6	
0051.0700	538897.5	5403097.4	575.17	980.189510	980.316330	0.68	-12.99***GSLM6	
0051.0701	542866.4	5400734.1	650.01	980.173090	980.318218	1.25	-16.00***GSLM6	
0051.0702	547030.9	5401771.8	702.23	980.160240	980.317360	3.14	-15.83***GSLM6	
0051.0703	552705.4	5369739.8	245.90	980.271760	980.343184	1.15	-21.91***GSLM6	
0051.0704	552221.1	5369006.4	362.46	980.251670	980.343779	1.40	-19.41***GSLM6	

Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.0705	552004.3	5368284.1	374.91	980.250110	980.344364	1.60	-18.91***GSLM6	
0051.0706	552073.5	5367443.7	477.80	980.230410	980.345042	0.81	-19.83***GSLM6	
0051.0707	551544.9	5366966.9	405.49	980.241710	980.345431	0.84	-23.12***GSLM6	
0051.0708	550839.8	5366989.2	379.18	980.249890	980.345417	0.50	-20.44***GSLM6	
0051.0709	550132.1	5366782.6	446.68	980.238930	980.345588	0.52	-18.27***GSLM6	
0051.0710	549551.4	5366650.0	430.77	980.242270	980.345698	0.57	-18.12***GSLM6	
0051.0711	543054.6	5372503.2	213.24	980.287190	980.341005	0.28	-11.59***GSLM6	
0051.0712	543317.7	5371863.2	184.03	980.292830	980.341520	0.27	-12.22***GSLM6	
0051.0713	544154.1	5371406.1	181.26	980.290060	980.341885	0.45	-15.72***GSLM6	
0051.0714	544993.3	5370880.4	188.83	980.290900	980.342306	0.51	-13.75***GSLM6	
0051.0715	540772.1	5375796.7	206.56	980.283800	980.338356	0.26	-13.67***GSLM6	
0051.0716	541508.1	5375034.4	198.64	980.285950	980.338968	0.35	-13.60***GSLM6	
0051.0717	543795.4	5373082.9	187.90	980.290200	980.340533	0.72	-12.65***GSLM6	
0051.0718	543261.0	5373901.9	208.68	980.285660	980.339874	0.52	-12.65***GSLM6	
0051.0720	542469.9	5374510.1	203.17	980.286240	980.339387	0.67	-12.51***GSLM6	
0051.0721	548147.2	5370497.2	198.91	980.287550	980.342598	1.15	-14.77***GSLM6	
0051.0722	559227.3	5371932.3	227.46	980.266360	980.341372	0.26	-30.01***GSLM6	
0051.0723	559352.1	5371083.2	215.95	980.269540	980.342057	0.39	-29.65***GSLM6	
0051.0724	559905.0	5370208.9	225.64	980.267770	980.342759	0.53	-30.08***GSLM6	
0051.0725	559434.4	5369496.1	250.08	980.265800	980.343338	0.57	-27.78***GSLM6	
0051.0726	559049.5	5368694.7	252.31	980.267040	980.343988	0.96	-26.36***GSLM6	
0051.0727	558771.8	5367709.3	273.52	980.264050	980.344786	1.17	-25.76***GSLM6	
0051.0728	558709.0	5366890.5	301.52	980.258820	980.345447	1.59	-25.73***GSLM6	
0051.0729	558710.4	5366114.8	352.36	980.249510	980.346074	1.74	-25.51***GSLM6	
0051.0730	558862.8	5365268.4	440.54	980.233130	980.346757	1.66	-25.31***GSLM6	
0051.0731	558972.9	5364165.9	441.09	980.234790	980.347647	0.88	-25.21***GSLM6	
0051.0732	559359.0	5363632.6	489.89	980.227810	980.348075	0.61	-23.29***GSLM6	
0051.0733	559522.1	5362926.7	501.46	980.226830	980.348644	0.64	-22.53***GSLM6	
0051.0734	559258.5	5362215.9	554.90	980.216340	980.349220	0.80	-22.92***GSLM6	
0051.0735	559035.5	5361310.3	597.74	980.209830	980.349953	0.39	-22.14***GSLM6	
0051.0736	559541.5	5360611.3	598.60	980.212090	980.350514	0.26	-20.41***GSLM6	
0051.0737	559335.2	5359782.6	562.78	980.219630	980.351185	0.52	-20.33***GSLM6	
0051.0738	559845.3	5359088.7	549.50	980.223580	980.351742	0.32	-19.75***GSLM6	
0051.0739	560204.0	5358276.9	551.44	980.223200	980.352396	0.29	-20.43***GSLM6	
0051.0740	559601.1	5357574.4	562.31	980.223870	980.352967	0.32	-18.16***GSLM6	
0051.0741	559442.7	5356683.1	583.45	980.221530	980.353689	0.17	-17.21***GSLM6	
0051.0742	559182.1	5355834.7	618.79	980.216270	980.354376	0.13	-16.25***GSLM6	
0051.0743	558896.4	5355193.6	633.12	980.214130	980.354896	0.24	-15.98***GSLM6	
0051.0744	558683.1	5354603.2	648.11	980.211390	980.355374	0.23	-16.25***GSLM6	
0051.0745	559584.4	5354594.7	609.79	980.218870	980.355375	0.48	-16.07***GSLM6	
0051.0746	559861.2	5353647.3	581.56	980.224660	980.356139	0.69	-16.38***GSLM6	
0051.0747	559586.6	5352730.5	599.55	980.223170	980.356882	0.35	-15.42***GSLM6	
0051.0748	559624.9	5351613.8	641.36	980.215830	980.357784	0.31	-15.47***GSLM6	
0051.0749	557617.1	5354114.1	621.99	980.217230	980.355777	0.28	-15.91***GSLM6	
0051.0750	560293.0	5360257.8	590.25	980.213300	980.350795	0.57	-20.81***GSLM6	
0051.0751	560023.0	5362442.0	531.17	980.220730	980.349032	1.15	-22.66***GSLM6	
0051.0752	561588.6	5361297.3	643.70	980.199300	980.349946	1.41	-22.60***GSLM6	
0051.0753	562382.7	5360733.2	638.63	980.202440	980.350396	0.59	-21.73***GSLM6	
0051.0754	563340.1	5360799.2	658.76	980.197350	980.350336	0.31	-23.08***GSLM6	
0051.0755	564455.1	5360779.4	644.69	980.202990	980.350344	0.35	-20.18***GSLM6	
0051.0756	564998.4	5360561.6	641.16	980.205600	980.350516	0.37	-18.41***GSLM6	
0051.0757	558349.7	5363982.5	541.39	980.213870	980.347799	1.19	-26.24***GSLM6	
0051.0758	558097.5	5363185.4	631.37	980.198690	980.348444	0.65	-24.90***GSLM6	
0051.0759	556891.1	5363561.1	587.36	980.209530	980.348149	0.39	-22.68***GSLM6	
0051.0760	555934.9	5363815.4	573.88	980.213310	980.347949	0.27	-21.48***GSLM6	
0051.0761	554930.6	5364184.7	578.49	980.211650	980.347657	0.32	-21.89***GSLM6	
0051.0762	554134.1	5364638.8	600.05	980.205220	980.347296	0.50	-23.53***GSLM6	
0051.0763	560859.8	5371672.6	201.82	980.271160	980.341571	0.31	-30.40***GSLM6	
0051.0764	547147.9	5383284.5	267.41	980.261210	980.332279	1.08	-17.39***GSLM6	
0051.0765	547638.0	5382450.6	273.57	980.259050	980.332949	1.20	-18.89***GSLM6	
0051.0766	548471.0	5381925.3	278.64	980.257150	980.333369	1.17	-20.24***GSLM6	
0051.0767	549278.7	5381507.2	298.68	980.251840	980.333702	1.07	-22.04***GSLM6	
0051.0768	550035.9	5380946.6	301.91	980.251140	980.334150	1.05	-22.57***GSLM6	
0051.0769	550605.3	5380179.5	307.67	980.246890	980.334766	1.03	-26.33***GSLM6	
0051.0770	551192.4	5379481.3	315.44	980.245860	980.335327	1.01	-26.41***GSLM6	
0051.0771	551312.2	5378935.7	295.93	980.250580	980.335766	0.87	-26.11***GSLM6	
0051.0772	551938.3	5378349.5	245.44	980.260790	980.336236	0.91	-26.26***GSLM6	
0051.0773	549375.7	5380282.4	300.61	980.252300	980.334690	0.98	-22.28***GSLM6	

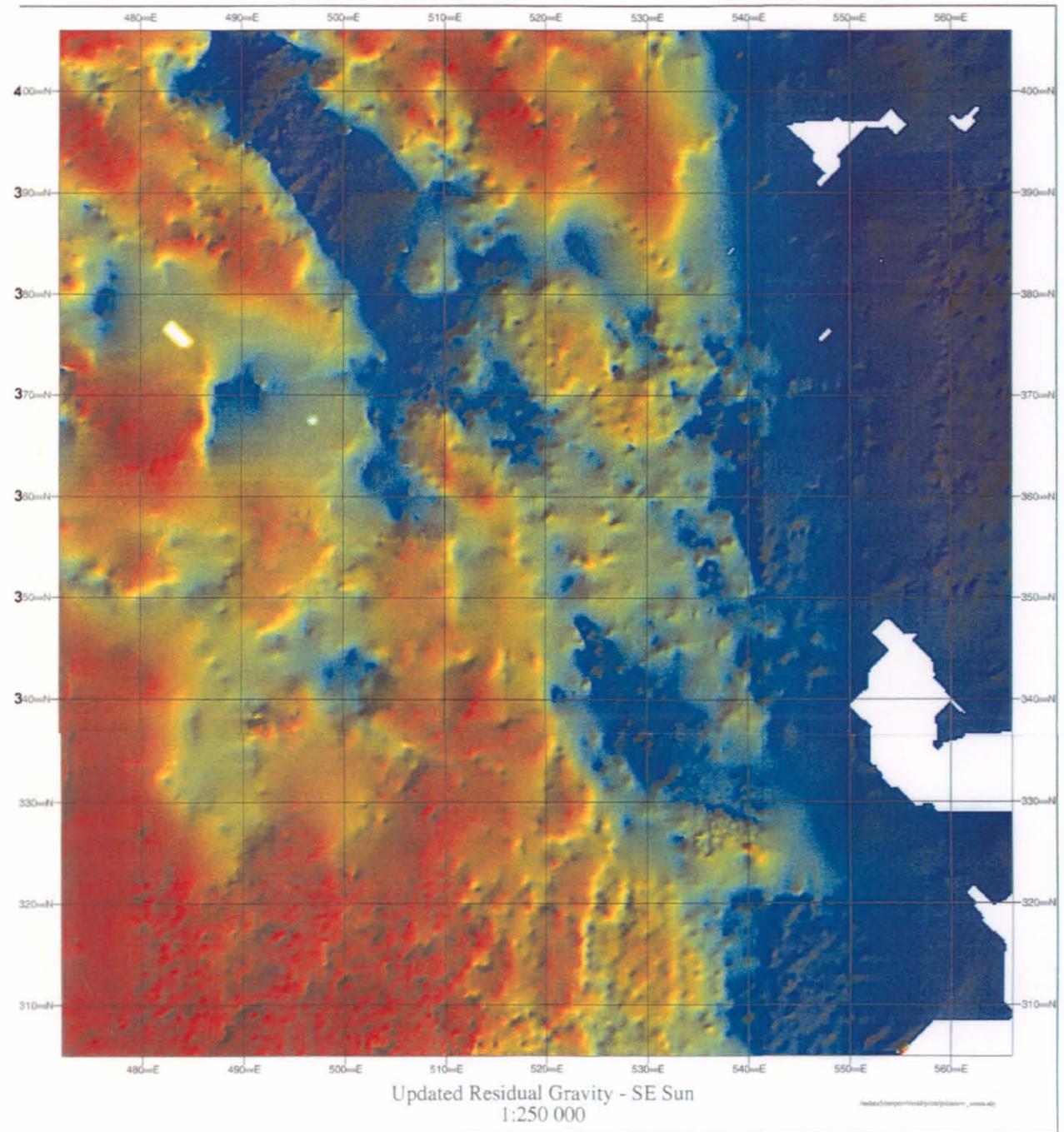
Station Number	Easting	Northing	Elevation	Observed Gravity	Theoretical Gravity	Terrain Corr.	Bouger Anomaly (2.67)	Comments
0051.0774	545654.0	5384825.4	280.21	980.257350	980.331043	1.09	-17.48***	GSLM6
0051.0775	545348.8	5385238.7	307.55	980.252090	980.330710	1.32	-16.80***	GSLM6
0051.0776	544546.2	5385828.1	391.25	980.237290	980.330239	0.85	-15.14***	GSLM6
0051.0777	544118.8	5386437.1	409.22	980.234610	980.329749	0.69	-13.95***	GSLM6
0051.0778	544057.7	5387144.3	409.58	980.234730	980.329179	0.63	-13.25***	GSLM6
0051.0779	546834.8	5384235.7	266.56	980.260060	980.331512	1.16	-17.86***	GSLM6
0051.0780	547504.3	5384950.3	285.81	980.254180	980.330932	1.44	-19.09***	GSLM6
0051.0781	548140.1	5385687.1	311.55	980.245770	980.330334	2.36	-20.92***	GSLM6
0051.0782	548382.2	5386483.6	393.07	980.227220	980.329690	1.87	-23.28***	GSLM6
0051.0783	549200.6	5387167.6	511.28	980.203300	980.329133	1.20	-24.05***	GSLM6
0051.0784	549654.5	5388077.7	481.66	980.208150	980.328396	1.28	-24.22***	GSLM6



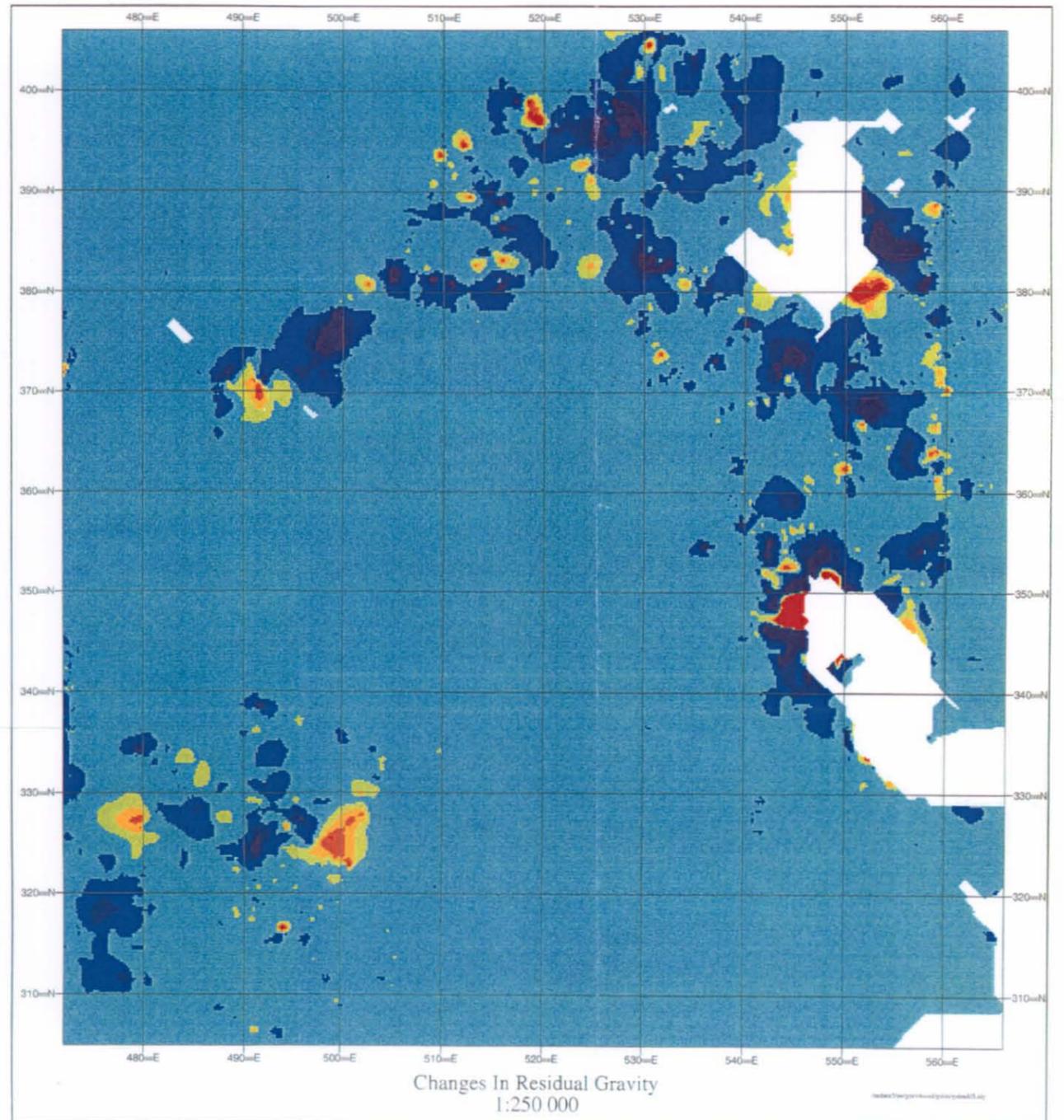
5 cm



5 cm



5 cm

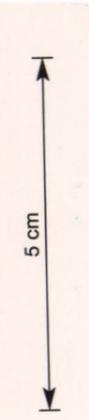
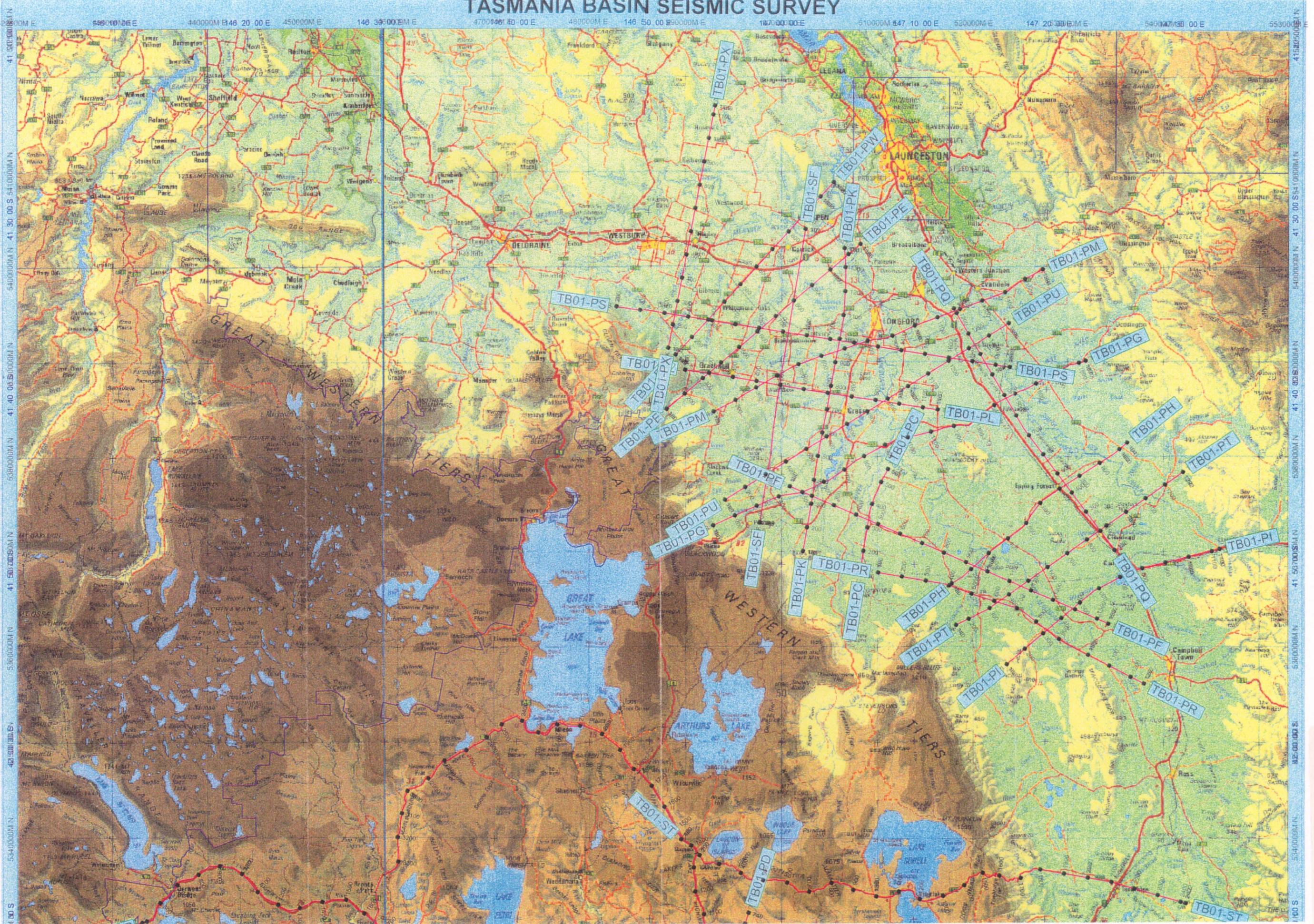


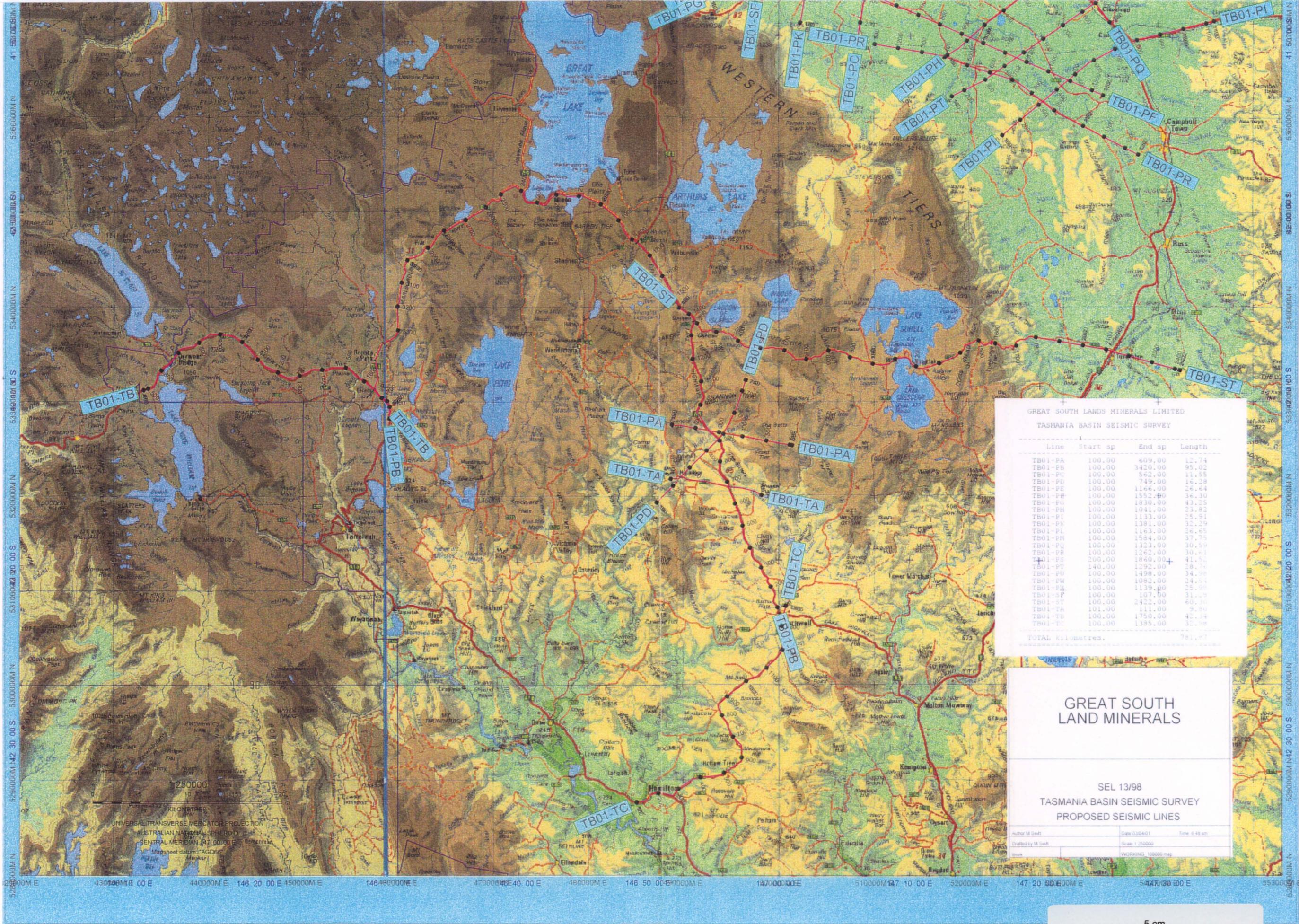
5 cm

Appendix 4

Completed and planned Seismic Survey
Lines

TASMANIA BASIN SEISMIC SURVEY





GREAT SOUTH LANDS MINERALS LIMITED
TASMANIA BASIN SEISMIC SURVEY

Line	Start sp	End sp	Length
TB01-PA	100.00	609.00	12.74
TB01-PB	100.00	3420.00	95.02
TB01-PC	100.00	562.00	11.35
TB01-PD	100.00	749.00	16.28
TB01-PE	100.00	1166.00	26.64
TB01-PF	100.00	1552.00	36.30
TB01-PG	100.00	1830.00	43.25
TB01-PH	100.00	1041.00	23.82
TB01-PI	100.00	1133.00	25.91
TB01-PJ	100.00	1381.00	32.29
TB01-PK	100.00	1163.00	26.65
TB01-PL	100.00	1584.00	37.75
TB01-PM	100.00	1323.00	30.59
TB01-PN	100.00	1262.00	30.61
TB01-PO	200.00	1860.00	41.56
TB01-PP	140.00	1292.00	28.76
TB01-PQ	100.00	1498.00	34.98
TB01-PR	100.00	1082.00	24.24
TB01-PS	100.00	1139.00	25.99
TB01-PF	100.00	107.00	31.19
TB01-ST	100.00	2422.00	60.10
TB01-TA	101.00	111.00	9.90
TB01-TB	100.00	1750.00	42.14
TB01-TC	100.00	1385.00	32.98
TOTAL kilometres.			781.67

GREAT SOUTH LAND MINERALS

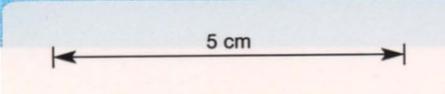
SEL 13/98
TASMANIA BASIN SEISMIC SURVEY
PROPOSED SEISMIC LINES

Author: M. Swift Date: 03/04/01 Time: 6:48 am
 Drafted by: M. Swift Scale: 1:250000
 Check: Working: 100000 map

1:250000

KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00 E
Mapsheet datum: AGD66



Appendix 5

Petroleum System Modelling Onshore
Tasmania – SPIRT Application

834096

RECEIVED
24 APR 2001

AUSTRALIAN RESEARCH COUNCIL

**STRATEGIC PARTNERSHIPS WITH INDUSTRY –
RESEARCH AND TRAINING –
(SPIRT) SCHEME**

COLLABORATIVE RESEARCH AGREEMENT

Between

UNIVERSITY OF TASMANIA ABN 37064374782

And

GREAT SOUTH LAND MINERALS NL 54 068 650 386

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This Agreement is dated

2001

BETWEEN:

UNIVERSITY OF TASMANIA ABN 30 764 374 782, a body corporate established under the University of Tasmania Act 1992, Churchill Avenue, Sandy Bay, Tasmania 7005 ("the University")

AND:

GREAT SOUTH LAND MINERALS NL, ABN 54 068 650 386 Level 3/65 Murray Street, Hobart, Tas 7000 (Industry Partner)

INTRODUCTION

- A. The University and the Industry Partner have collaborated in the preparation and submission of the Application for a grant from the Commonwealth under the Australian Research Council's SPIRT Scheme for the purposes of carrying out the Research Project.
- B. The Application has been successful and the University has been awarded a grant from the Commonwealth to collaborate with the Industry Partner to carry out the Research Project in accordance with the Conditions of Grant.
- C. The University and the Industry Partner have agreed to carry out the Research Project in accordance with the terms and conditions of this Agreement.
- D. The Industry Partner has agreed to be bound by the Conditions of Grant.

OPERATIVE PART

1. Definitions and Interpretation

1.1 Definitions

- 1.1.1 The following definitions will apply to the interpretation of this Agreement:

"Application" means the application made to the Australian Research Council Strategic Partnerships with Industry – Research and Training SPIRT Scheme as specified in Schedule A.

"Candidate" means the person(s) who is enrolled or to be enrolled at the University for examination for the award of a postgraduate research degree.

"Commencement Date" means the date of this Agreement.

"Commercially Exploit" means to develop, manufacture, use, hire, sell, licence or otherwise exploit Products for commercial gain.

"Confidential Information" means any and all information belonging to a Party, whether existing prior to the commencement of the Research Project, or created in the course of the Research Project, which is disclosed by one Party to the other and includes all technical, proprietary and operational information, drawings, techniques, processes, know-how and other commercially valuable information of any kind, but does not include information which:

- (a) is already in the public domain;
- (b) becomes available to the public by any means other than breach of this Agreement;
- (c) is received by a Party from an independent third party who is lawfully in possession and has the power and authority to disclose the information;
- (d) is required to be disclosed by law.

"Conditions of Grant" means the Conditions of Grant at Schedule C.

"First Named Investigator" means the first named Investigator in Item 5.1 in the Application.

"GST" means any tax imposed upon the supply of goods and services imposed or assessed in accordance with the GST Law.

"GST Law" means A New Tax System (Goods and Services Tax Act 1999 or any amendment or re enactment thereof).

"Internal Purposes" means for internal business purposes, excluding Commercial Exploitation.

"Intellectual Property" includes without limitation all copyright including future copyright, trademarks, designs, patents registered and unregistered plant breeders rights, trade secrets and know-how, semiconductor or circuit layouts and all other intellectual property as defined in the convention of 1967 establishing the World Intellectual Property Organisation.

"Management Group" means the group established in accordance with clause 2.1.2.

"Management Plan" means the plan for completing the Research Project at Schedule D.

"Option Period" means for the period of 6 months after the completion of the Research Project.

"Parties" means the Industry Partner and the University.

"Pre Existing Intellectual Property" means Intellectual Property rights existing prior to the Commencement Date, or which are created independently of this Agreement, which are owned or controlled by either Party.

"Product" means any product or item of manufacture based upon or derived from the Project Intellectual Property.

"Project Intellectual Property" means Intellectual Property rights created in the course of or arising from the conduct of the Research Project (with the exception of copyright in a Thesis), including all modifications, enhancements or developments thereto.

"Publication" means any conference paper, article for a journal, portion of a book, broadcast, or other means of disclosure which may emerge from the Research Project but does not include any thesis prepared by a Candidate involved in the research project for purposes of examination for the award of a postgraduate degree of the University.

"Research Project" means the program of research specified in Schedule A.

"Term" means from the Commencement Date until the completion of the Research Project.

"Thesis" means the dissertation which is submitted by the Candidate for examination for the award of the postgraduate research degree connected to the Research Project specified in Schedule A.

1.2 Interpretation

1.2.1 Where possible words and phrases in this Agreement will be interpreted to have the same meaning as in the Conditions of Grant, however to the extent of any inconsistency in relation to the interpretation of this Agreement, the following documents will prevail in accordance with their alphabetical order:

- (a) the Conditions of Grant;
- (b) clauses 1 to 14 of this Agreement;
- (c) the Schedules and Attachments to this Agreement.

2. Obligations of the Parties

2.1 Joint Obligations

2.1.1 The Parties agree to undertake the Research Project in accordance with the Management Plan.

2.1.2 The Parties agree to establish the Management Group to oversee the implementation of the Management Plan and to resolve any disputes arising out of the performance of the Agreement.

2.1.3 The membership of the Management Group will comprise the following:

- (a) the First Named Investigator; and
- (b) one member nominated by each Party.

2.1.4 The University will notify the Commonwealth if it needs to change the First Named Investigator in accordance with the Conditions of Grant.

2.1.5 Each Party will notify the other Party in writing if they wish to change the member nominated to participate in the Management Group in accordance with clause 2.1.3.

2.2 University Obligations

2.2.1 The University will provide the basic facilities and infrastructure for the Research Project specified in Schedule D.

2.2.2 The University will apply the Grant to meet expenditure on the Research Project in accordance with Conditions of Grant. The University's obligation to apply the Grant is subject to the University being in receipt of the Grant from the Commonwealth.

2.2.3 The University will procure in its favor, an assignment of all Project Intellectual Property created by any Candidate in the course of their involvement in the Research Project.

2.3 Industry Partner Obligations

2.3.1 The Industry Partner will provide all personnel, facilities and infrastructure specified in Schedule D.

2.3.2 All personnel to be made available by the Industry Partner in accordance with clause 2.3.1 will be made available for at least the number of working days specified in Schedule D. If for any reason such personnel cannot be made available for the minimum number of working days, the Industry Partner will provide appropriately qualified replacement personnel.

- 2.3.3 The Industry Partner will supply the University with the cash and/or inkind contributions specified in Schedule B by the dates specified in Schedule B.
- 2.3.4 To the extent that the Conditions of Grant relate to the Industry Partner's obligations under this Agreement, the Industry Partner agrees to be bound by the Conditions of Grant.
- 2.3.5 The Industry Partner agrees to supply the University with all the information it needs to comply with the reporting requirements under the Conditions of Grant.
- 2.3.6 The Industry Partner agrees to perform its obligations in accordance with the standards of professional skill and care of the industry to which it belongs.

3. GST

- 3.1 If this Agreement or any supply under or in respect of this Agreement becomes subject to GST including any in-kind contributions, and if the recipient of the consideration is liable to GST in relation to any supply under this Agreement, the Parties agree that the amount payable for any supply under or in respect of this Agreement by any Party shall be adjusted by the amount of the GST.
- 3.2 Each Party agrees to do all things, including providing the other Party with invoices or other documentation for their contributions made under this Agreement in such form and detail that may be necessary to enable or assist the other Party to claim or verify any input tax credit, set off, rebate or refund in relation to any GST payable under this Agreement or in respect of any supply under this Agreement.
- 3.3 As required by any applicable legislation, where identifiable cost savings are realised by virtue of the enactment of the GST Law, those cost savings will be reflected in any increase in fees under clause 3.2.

4. Intellectual Property

- 4.1 The University grants the Industry Partner a non-exclusive, world wide, royalty free licence to use its Pre-Existing Intellectual Property in conjunction with the Project Intellectual Property for Internal Purposes.
- 4.2 The Industry Partner grants the University a non-exclusive, world wide, royalty free licence to use its Pre-Existing Intellectual Property in conjunction with the Project Intellectual Property.
- 4.3 Each Party warrants that they have the right and authority to grant the licences under clause 4.1 and 4.2.
- 4.4 Each Party acknowledges that ownership of Pre-existing Intellectual Property will not be altered, transferred or assigned by virtue of its use in accordance with clause 4.1 and 4.2.
- 4.5 Project Intellectual Property will vest in the University upon creation.
- 4.6 The University grants to the Industry Partner a non-exclusive, worldwide, royalty-free, licence to use, adapt and modify the Project Intellectual Property for Internal Purposes, with no rights of sub-licence.
- 4.7 The Industry Partner agrees to provide the University with copies of all materials incorporating any modifications, enhancements or developments it makes to the Project Intellectual Property at least annually, but promptly if a significant progress eventuates or upon request.
- 4.8 The University grants the Industry Partner an option to acquire an exclusive license to Commercially Exploit the Project Intellectual Property during the Option Period.

- 4.9 The University agrees not to negotiate with any third party to obtain a licence to Commercially Exploit the Project Intellectual Property until the expiration of the Option Period.
- 4.10 The University will be free to license third parties to commercially exploit the Project Intellectual Property if the Parties cannot agree to terms prior to the expiration of the Option Period.
- 4.11 On termination of this Agreement under clause 7 the Industry Partner will promptly supply to the University all materials incorporating Project Intellectual Property and Pre-existing Intellectual Property necessary to enable the University to make use of the Project Intellectual Property. The Industry Partner will be permitted to retain a copy of these materials for the purpose of taking advantage of the licence granted to the Industry Partner pursuant to this clause 4, unless the agreement is terminated pursuant to clause 7.2.

5. Confidentiality and Publication

- 5.1 Subject to this clause 5, each Party agrees not to disclose any Confidential Information disclosed to them ("the Receiving Party") by the other Party ("the Disclosing Party") in the course of the Agreement, without the written consent of the Disclosing Party.
- 5.2 If the Receiving Party wishes to make a disclosure of Confidential Information by way of Publication it will submit a draft version of the proposed Publication to the Disclosing Party at least thirty days prior to the date upon which it is due to be published.
- 5.3 The Disclosing Party will respond within thirty days of receiving the request from the Receiving Party in accordance with clause 5.2, with one of the following options:
- (a) consent to the Publication; or
 - (b) consent to the Publication subject to data being anonymised or severed from the draft (if there are reasonable ground for doing so); or
 - (c) request a delay in disclosure of the Publication for a specified period of not more than six months (if there are reasonable ground for doing so).
- 5.4 In the event that the Receiving Party does not receive a response from the Disclosing Party to a request for Publication within thirty days of a request for a consent in accordance with clause 5.3 it will be entitled to make the Publication.
- 5.5 Consent to Publication will not be required if the Agreement is terminated due to the default of the Industry Partner or twelve months has elapsed since the termination of this Agreement.
- 5.6 Subject to clause 5.7, the Industry Partner agrees that nothing in this Agreement prevents the disclosure of any of the results of the Research Project by a Candidate, in whole or in part, as part of their Thesis.
- 5.7 Upon reasonable written request from the Industry Partner, the Thesis may be submitted to the examiners in confidence and following examination of the Thesis may be held by the University in confidential restricted storage for a maximum of two years, in accordance with the University's policies and procedures.

6. Indemnity and Insurance

- 6.1 The Industry Partner shall at all times indemnify and hold harmless the University, its officers, employees and agents (in this clause referred to as "the indemnified") from and against any loss (including legal costs and expenses on a solicitor/own client basis) or liability, reasonably incurred or suffered by any of those indemnified arising from any claim, suit, demand, action or proceeding by any person against any of those indemnified where such loss or liability was caused by a wilful, unlawful or negligent act or omission of the Industry Partner, its employees, agents or subcontractors in connection with this Agreement or any breach of intellectual property rights.

- 6.2 The Industry Partner acknowledges that any use that it makes of the results of the Research Project will be at its own risk.
- 6.3 The indemnity referred to above shall survive the expiration or termination of this Agreement.
- 6.4 The Industry Partner must at all times maintain:
- (a) workers' compensation insurance as required by law for its employees and for taking all other action required as an employer;
 - (b) professional indemnity and public and product liability insurance to the value specified in Schedule E.
- 6.5 The Industry Partner will provide the University with a copy of the policies required to be taken out in accordance with clause 6.4.

7. Termination

- 7.1 This Agreement will commence on the Commencement Date and continue for the Term unless otherwise terminated in accordance with this clause 7.
- 7.2 The University will be entitled to terminate this Agreement, without the need to resort to alternative dispute resolution under clause 8 and without prejudice to any other right of action or remedy which has accrued or which may accrue in its favour, in the following circumstances:
- (a) immediately on termination of the Conditions of Grant;
 - (b) in the event that the Industry Partner is in breach of a material provision of this Agreement including for breach of obligations specified in clause 2.3 and thirty days has elapsed since notice from the University describing the breach and the Industry Partner has not remedied the cause of the breach, the University will be entitled to terminate the Agreement immediately;
 - (c) immediately if the Industry Partner goes into liquidation or a receiver or receiver and manager or mortgagee's or chargee's agent is appointed.
- 7.3 In the event that this Agreement is terminated under clause 7.2, the Industry Partner will upon request, render to the University all such assistance that the University may reasonably require to enable the University to continue the performance of the Research Project in collaboration with a replacement industry partner.
- 7.4 Termination of this agreement in accordance with clause 7 will not effect the rights of the parties accrued prior to termination, unless the agreement is terminated in accordance with clause 7.2(b) and/ or 7.2(c) in which case the rights of the Industry Partner under clause 4 will cease.

8. Dispute Resolution

- 8.1 Any dispute arising between the Parties in connection with the Research Project will in the first instance be referred to the Management Group for resolution.
- 8.2 If the dispute remains unresolved for a period of 30 days after being referred as specified in clause 8.1, the dispute will be referred to the Pro-Vice-Chancellor (Research) of the University and the Chief Executive Officer of the Industry Partner for resolution.
- 8.3 If the dispute cannot be resolved within 21 days of being referred to the Pro-Vice-Chancellor (Research) of the University and the Chief Executive Officer of the Industry Partner, the Parties can seek to resolve it by alternative means.
- 8.4 Nothing in this clause prevents the Parties taking court action to obtain urgent interlocutory relief.

9. Notices

- 9.1 Notices served pursuant to this Agreement will be deemed to have been received three working days following the date of postage by pre paid mail where addressed to the Party at the address indicated in the Schedule A to this Agreement. If transmitted by facsimile then the relevant notice will be deemed to be received at the time of successful transmission.

10. Non-assignment

- 10.1 The Industry Partner will not assign or novate this Agreement to any third party without the written consent of the University.

11. Entire Agreement

- 11.1 This Agreement and the Conditions of Grant comprise the entire Agreement between the Industry Partner and the University in respect of the Research Project.

12. Amendment

- 12.1 Any amendment or alterations to this Agreement will have effect only following prior written agreement from each Party.

13. Applicable Law

- 13.1 This Agreement will be interpreted according to the laws of the State of Tasmania and the Parties submit themselves to the non-exclusive jurisdiction of the Courts of that State.

14. Negation of Employment, Agency or Partnership

- 14.1 Nothing in this Agreement constitutes the Parties as employees, agents or employees of the other, and the Parties expressly deny this relationship.

IN WITNESS WHEREOF the Parties have executed this Agreement the date and year first above written:

SIGNED for and on behalf of:
UNIVERSITY OF TASMANIA

by Professor A Glenn
Pro-Vice-Chancellor (Research)

SIGNED for and on behalf of:
Great South Land Minerals NL

its duly authorised signatory

(Witness)

(Witness)

SCHEDULE A including a copy of the **Application** attached and marked "A1"

RESEARCH PROJECT TITLE: Petroleum System Modelling Onshore Tasmania

INDUSTRY PARTNER: Great South Land Minerals NL

PRINCIPAL INDUSTRY CONTACT:

Name: Mr David Tanner

Position/Title: Chief Executive Officer

Telephone: 6231 9339 **Fax:** **Email:** dtanner@gsim.com.au

Address for notices/courier: Level 3/65 Murray Street, Hobart, Tas, 7000

UNIVERSITY OF TASMANIA

School/Centre: Earth Sciences

First Named Investigator: Dr J Yang

Telephone: 6226 2804 **Fax:** 6226 7662

Address for all notices: Research and Development Office, University of Tasmania, GPO Box 252-01;
Hobart TAS 7001

SCHEDULE B**Industry Partner Great South Land Minerals NL Contributions exclusive of GST**

Cash: Year 1 \$76,913
 Year 2 \$76,913
 Year3 \$76,913

¹**In-kind:** Year 1 \$20,000
 Year 2 \$15,000
 Year 3 \$15,000

Schedule of Invoices for Payment:

1. Amount	\$38,457	Date	on signing of agreement
2. Amount	\$38,456	Date	1 July 2001
3. Amount	\$38,457	Date	1 January 2002
4. Amount	\$38,456	Date	1 July 2002
5. Amount	\$38,457	Date	1 January 2003
6. Amount	\$38,456	Date	1 July 2003

¹ In-kind contributions - The University Finance Branch will contact you separately in relation to any GST implications of in-kind contributions. However you may wish to obtain your own taxation advice on this issue.

SCHEDULE C

Conditions of Grant as attached and marked "C1"

SCHEDULE D**Management Plan**

1. **Members of the Management Group**

2. **Personnel and time commitments, Facilities and Infrastructure provided by the University of Tasmania**

3. **Personnel and time commitments, Facilities and Infrastructure provided by the Industry Partner(s)**

4. **First and subsequent year objectives for the Research Project**
(Including but not limited to the following criteria)

Research activity objective	Organisation/individual responsible	Date for completion

5. **The Management Group will meet at least yearly, and at least by 30 January in each year of funding after 2001 to:**
 - (a) review the progress of the Research Project against the research activity objectives (so that the First Named Investigator can provide the annual progress report required by DETYA);
 - (b) make amendments to the research activity objectives;
 - (c) develop the following years research activity objectives;
 - (d) review the progress of the Candidate if applicable; and
 - (e) decide the date for the next Management Group meeting.

SCHEDULE E**Insurance**

The Industry Partner must hold the following insurances:

Professional indemnity insurance to at least the value of 5 million.

Public liability and product insurance to at least the value of 10million.

Workers Compensation - Unlimited Common Law

Which cover to be maintained for at least 24 months after expiry of contract.

834111

Australian Research Council / Department of Education, Training and Youth Affairs
Strategic Partnerships with Industry - Research and Training Scheme
Application Form for Year 2001 Grants

Total number of sheets contained in this application	47
Chief Investigator/Supervisor	YANG, Jianwen
Project Id (Research Office use only)	C00107253

When completing this form, please comply strictly with the 'Strategic Partnerships with Industry - Research and Training Scheme Guidelines for Year 2001 Grants'.

1. Organisation to administer grant

University of Tasmania

1.1 Australian Business Number (ABN)

2. Support being applied for

2.1 **Type(s) of support** Tick all relevant boxes. For example, if you are applying for both an 'APDI' and 'Personnel and project costs other than for APDIs and APAIs', tick the first and last boxes.

- | | Number sought |
|---|--------------------------------|
| <input checked="" type="checkbox"/> Australian Postdoctoral Research Fellowship (Industry) - APDI | |
| <input checked="" type="checkbox"/> Australian Postgraduate Award (Industry) - APAI | <input type="text" value="3"/> |
| <input type="checkbox"/> Australian Postgraduate Award (Industry) for IT - APAI (IT only) | <input type="text"/> |
| <input checked="" type="checkbox"/> Personnel and project costs other than for APDIs and APAIs | |

2.2 Total project funds requested (\$)

2001	2002	2003	Total
143,626	135,757	137,783	417,166

2.3 Do you wish this application to be assessed as a project of benefit to regional or rural community/ies? (see section 6.1 of the guidelines) Yes No

3. Project title Provide a short descriptive title of no more than 20 words. Please do not use quotation marks as they create information storage problems.

PETROLEUM SYSTEM MODELLING ONSHORE TASMANIA

4. Project summary In no more than 100 words, summarise aims, significance and expected outcomes.

The School of Earth Sciences and Great South Land Minerals NL will develop a computer model of the geological, tectonic and fluid flow evolution of central Tasmania for the last 500 million years. A team of university and company geoscientists including one post doctoral fellow and three jointly supervised PhD students will supply the basic data and computer skills to develop this continually updated interactive model. This project will help Great South Land Minerals in its search for oil and gas onshore Tasmania which, if successful, will have enormous beneficial effect on the economy and employment situation of Tasmania.

5. Participant summary

5.1 Team Leader (TL), Chief Investigator(s) (CI), Partner Investigator(s) (PI), Chief Investigator seeking an APDI (APDI) and Associate Investigator(s) (AI)

(Participant details are sought at Section 8)

Person number	Family name	Title	Initials	Organisation	Role (TL, CI, PI, APDI or AI)
1	YANG	DR	J	University of Tasmania	CI
2	BURRETT	DR	CF	University of Tasmania	CI
3	HAINES	DR	PW	University of Tasmania	CI
4	REID	MS	C	University of Tasmania	APDI
5	ASKIN	DR	H	Great South Land Minerals NL	AI
6					
7					
8					
9					
10					

5.2 Industry Partner organisation(s) and contributions

(Industry Partner organisation details are sought at Section 7)

Org. num.	Organisation	Amount committed (\$)					
		2001		2002		2003	
		Cash	In-kind	Cash	In-kind	Cash	In-kind
1	GREAT SOUTH LAND MINERALS NL	76,913	20,000	76,913	15,000	76,913	15,000
2							
3							
4							
5							
6							
GST		7,691	-	7,691	-	7,691	-
Total		84,604	20,000	84,604	15,000	84,604	15,000

5.3 Total of all Industry Partner(s) contributions

Cash (\$)	In-kind (\$)	Total (\$)
253,812	50,000	303,812

5.4 Financial summary

Year	Support requested (\$)					
	Personnel	Equipment	Maintenance	Travel	Other	Total
2001	114,569	9,000	7,000	-	GST 13,057	143,626
2002	116,415	-	7,000	-	GST 12,342	135,757
2003	118,257	-	7,000	-	GST 12,526	137,783
Total funds requested						417,166

NB. Totals must equal those shown in Section 2.2.

6. Budget

834113

NB. Each Industry Partner must sign their Industry Partner organisation details page, which includes their proposed contribution, at Section 7.3.

Detailed budget

Items (Personnel, Equipment, Maintenance, Travel, Other)	Priority A, B, C	Amount requested (\$)		
		2001	2002	2003
<u>Personnel</u>				
APAI 1	A1	21,445	21,445	21,445
APAI 2	A1	21,445	21,445	21,445
APAI 3	A2	21,445	21,445	21,445
APDI	A1	50,234	52,080	53,922
<u>Equipment</u>				
Purchase of permeability and porosity meters	A1	9,000		
<u>Maintenance</u>				
Computer software	A1	7,000	7,000	7,000
Subtotal		130,569	123,415	125,257
GST COMPONENT – 10%		13,057	12,342	12,526
Total		(n/a) 143,626	135,757	137,783

NB. Totals must equal those shown in Section 2.2.

7. Industry Partner organisation details

Please complete a copy of this page for each Industry Partner listed in Section 5.2.

7.1 Industry Partner organisation contact details

Organisation number (see Section 5.2)

1

Organisation contact

Family name	TANNER		Title	MR
First name	DAVID	Second name		
Phone	03 6231 9339	Fax	03 6231	
Email	dtanner@gslm.com.au			

Organisation postal address (please abbreviate the State)

Organisation	GREAT SOUTH LAND MINERALS NL				
Postal address line 1	Level 3, 65 Murray Street				
Postal address line 2					
Locality	HOBART	State	TAS.	Postcode	7000
Country	AUSTRALIA				

Other organisation details

Australian Business Number (ABN)	Applied for	ANZSIC	120
Web page address (URL)			

7.2 Industry Partner contribution

NB. The Industry Partner must sign this page.

Items (Personnel, Equipment, Maintenance, Travel, Other)	Amount committed (\$)					
	2001		2002		2003	
	Cash	In-kind	Cash	In-kind	Cash	In-kind
Travel						
• Car hire 4 wheel drive for Ph.D. students, APDI and CIs		20,000		15,000		15,000
• Diesel @\$100 per day	25,000					
• Food and accommodation @\$60 per day	15,000					
Maintenance						
Thin section @\$15 each	4,500		4,500			
Film for photomicrographs & field photographs plus xeroxing	3,873		1,793		2,046	
Organic geochemistry (AMDEL)						
• Isotope analysis @\$200 each	9,600		2,000		2,000	
• Rock eval & TOC @\$95 each	9,500		9,500		9,500	
• Gas analysis @\$85 each	6,800		-		17,000	
• High resolution gas chromatographs of C12-C30 @\$263 each	-		26,300		26,300	
• Vitrinite reflectance @\$132 each	2,640		13,200		13,200	
• TAI kerogen @\$327 each	-		19,620		6,867	
Total excluding GST	76,913	20,000	76,913	15,000	76,913	15,000
GST Component	7,691	-	7,691	-	7,691	-
Total	84,604	20,000	84,604	15,000	84,604	15,000

NB. Totals must equal those shown in Section 5.2.

7.3 Industry Partner signature

 (D.A. Tanner)
Chief Executive Officer, Great South Land Minerals

8. Participant details

834115

8.1 Personal details for all investigators

8.1.1 Abbreviated details

Please complete a copy of this page for each participant listed in Section 5.1.

GAMS Id		Person number (see Section 5)	1	Role	CI
Family name	YANG			Initial	J.
Department/school/other	School of Earth Sciences				
Organisation	University of Tasmania				

8.1.2 Full details

If you have provided a GAMS Id in 8.1.1 you are not required to complete this section.

Personal details (Gender and date of birth data are used only for statistical and identification purposes. This section will not be provided to assessors.)

First name	JIANWEN		Second name		
Title	DR	Gender	M	Date of birth (dd/mm/yyyy)	01/12/62
Phone	03 6226 2804		Fax	03 6226 7662	
Email	Jianwen.Yang@utas.edu.au				

Organisation postal address (please include area and country codes)

Organisation	University of Tasmania				
Postal address line 1					
Postal address line 2	GPO Box 252-79				
Locality	HOBART	State	TAS.	Postcode	7001
				Country	AUSTRALIA

8.1.3 Other details

Current position

Position title	Lecturer (Level B) in Hydrogeology	Year appointed	1999
----------------	------------------------------------	----------------	------

Highest academic qualification

Type	PhD	Organisation	University of Toronto	Country	Canada
Year awarded	1997	(or) Date thesis submitted			

Affiliations

Are you associated in any way with any Industry Partner(s) or a Commonwealth-funded Centre?

Yes No

If Yes, please specify the nature of your employment, association and/or financial interest.

I am currently employed 30% in the School of Earth sciences and 70% in the CODES SRC. My salary is paid 55% by industry and the University operating grant and 45% by CODES SRC. I am associated with the CODES SRC for research on ore deposit genesis. This proposed project is in no way associated with the CODES SRC's core activities.

Time commitment

Number of days to be spent on this project out of a maximum of 21 working days per month available for all activities.	5
--	---

Are you a member of the ARC or its committees or panels? Yes No

Are any of your relatives, or social/professional associates a member of the ARC or its committees or panels? Yes No

If Yes, please name the ARC member(s).

If you are a TL or CI, are you a supervisor of an APAI in this application? Yes No

8.2 Additional APDI participant details

Please complete a copy of this page for each participant listed in Section 5.1 as an 'APDI'. If no funding for an APDI is being sought in this application, leave this page blank and submit it as part of your application.

8.2.1 APDI salary and citizenship details

APDI's family name Person number (see Section 5.1)

Academic salary details

Classification	Salary (\$A gross)	Current position status

Citizenship details

Australian citizen	Yes <input type="checkbox"/> No <input type="checkbox"/>
If No: Country of citizenship	
Country of residence	
Do you have Australian permanent resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Do you have Australian temporary resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>

8.2.2 Have you been granted an eligibility exemption for this application? Yes No

If Yes, please indicate the type of exemption granted:

- More than required years since PhD awarded
 PhD not yet awarded
 Financial
 Other (please specify)

8.2.3 Is the success of this project dependent on the funding of this APDI? Yes No

8.3 Total research support

Please complete a copy of this page for each Team Leader, Chief Investigator or Partner Investigator (including APDIs) listed in Section 5.1.

Support types (**Sup. type**) are 'P' for past support, 'C' for current support, and 'R' for requested support for 2001.

Asterisk (*) any support **related** to this project.

The **current application must be included as 'R' under 'Sup. type'.**

The **Project Id** (if known) is only for past and current ARC/DETYA grants.

Time commitment (Time com.) is the number of days to be spent on each project/scheme out of a maximum of 21 working days per month available for all activities.

Participant's family name

YANG

Person number (for each TL, CI, PI listed in Section 5.1)

1

Description (first-named investigator's family name, project title, source of support, scheme)	(*)	Sup. type (P, C, or R)	Project Id (if known)	Time com. (days)	1999 (\$'000)	2000 (\$'000)	2001 (\$'000)
Yang, Burrett, Haines, Reid, and Askin this proposal, ARC-SPIRT	*	R		5			143.6
Davidson, Yang and Cooke, ARC-SPIRT proposal 'The interaction of base metal sulfide mining activities with the groundwaters of mountainous, wet, temperate settings: Rosebery, Tasmania.'		R		2			21.2

8.1.1 Abbreviated details

Please complete a copy of this page for each participant listed in Section 5.1.

GAMS Id	200529	Person number (see Section 5)	2	Role	CI
Family name	BURRETT			Initial	CF
Department/school/other	School of Earth Sciences				
Organisation	University of Tasmania				

8.1.2 Full details

If you have provided a GAMS Id in 8.1.1 you are not required to complete this section.

Personal details (Gender and date of birth data are used only for statistical and identification purposes. This section will not be provided to assessors.)

First name	CLIVE	Second name	F
Title	DR	Gender	M
		Date of birth (dd/mm/yyyy)	22/09/1948
Phone	03 6226 2470	Fax	03 6223 2547
Email	Clive.Burrett@utas.edu.au		
Organisation postal address (please include area and country codes)			
Organisation	University of Tasmania		
Postal address line 1			
Postal address line 2	GPO Box 252-79		
Locality	HOBART	State	TAS.
		Postcode	7001
		Country	AUSTRALIA

8.1.3 Other details

Current position

Position title	Head, School of Earth Sciences and Reader	Year appointed	1991
----------------	---	----------------	------

Highest academic qualification

Type	PhD	Organisation	University of Tasmania	Country	Australia
Year awarded	1978	(or) Date thesis submitted			

Affiliations

Are you associated in any way with any Industry Partner(s) or a Commonwealth-funded Centre?
Yes No

If Yes, please specify the nature of your employment, association and/or financial interest.

Non-stipendiary director and minor shareholder (1.7%).

Time commitment

Number of days to be spent on this project out of a maximum of 21 working days per month available for all activities.	8
--	---

Are you a member of the ARC or its committees or panels? Yes No Are any of your relatives, or social/professional associates a member of the ARC or its committees or panels? Yes No

If Yes, please name the ARC member(s).

--

If you are a TL or CI, are you a supervisor of an APAI in this application? Yes No

8.2 Additional APDI participant details

Please complete a copy of this page for each participant listed in Section 5.1 as an 'APDI'. If no funding for an APDI is being sought in this application, leave this page blank and submit it as part of your application.

8.2.1 APDI salary and citizenship details

APDI's family name Person number (see Section 5.1)

Academic salary details

Classification	Salary (\$A gross)	Current position status

Citizenship details

Australian citizen	Yes <input type="checkbox"/> No <input type="checkbox"/>
If No: Country of citizenship	
Country of residence	
Do you have Australian permanent resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Do you have Australian temporary resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>

8.2.2 Have you been granted an eligibility exemption for this application? Yes No

If Yes, please indicate the type of exemption granted:

- More than required years since PhD awarded
 PhD not yet awarded
 Financial
 Other (please specify)

8.2.3 Is the success of this project dependent on the funding of this APDI? Yes No

8.1 Personal details for all investigators

834121

8.1.1 Abbreviated details

Please complete a copy of this page for each participant listed in Section 5.1.

GAMS Id	X01853	Person number (see Section 5)	3	Role	CI
Family name	HAINES			Initial	PW
Department/school/other	School of Earth Sciences				
Organisation	University of Tasmania				

8.1.2 Full details

If you have provided a GAMS Id in 8.1.1 you are not required to complete this section.

Personal details (Gender and date of birth data are used only for statistical and identification purposes. This section will not be provided to assessors.)

First name	PETER		Second name	Wyaff	
Title	DR	Gender	M	Date of birth (dd/mm/yyyy)	22/05/1960
Phone	03 6226 7157		Fax	03 6223 2547	
Email	Peter.Haines@utas.edu.au				
Organisation postal address (please include area and country codes)					
Organisation	University of Tasmania				
Postal address line 1					
Postal address line 2	GPO Box 252-79				
Locality	HOBART	State	TAS.	Postcode	7001
				Country	AUSTRALIA

8.1.3 Other details

Current position

Position title	Lecturer (Level B) in Sedimentology	Year appointed	1999
----------------	-------------------------------------	----------------	------

Highest academic qualification

Type	PhD	Organisation	University of Adelaide	Country	Australia
Year awarded	1988	(or) Date thesis submitted			

Affiliations

Are you associated in any way with any Industry Partner(s) or a Commonwealth-funded Centre?
 Yes No

If Yes, please specify the nature of your employment, association and/or financial interest.

Time commitment

Number of days to be spent on this project out of a maximum of 21 working days per month available for all activities.	5
--	---

Are you a member of the ARC or its committees or panels? Yes No

Are any of your relatives, or social/professional associates a member of the ARC or its committees or panels? Yes No

If Yes, please name the ARC member(s).

If you are a TL or CI, are you a supervisor of an APAI in this application? Yes No

8.2 Additional APDI participant details

Please complete a copy of this page for each participant listed in Section 5.1 as an 'APDI'. If no funding for an APDI is being sought in this application, leave this page blank and submit it as part of your application.

8.2.1 APDI salary and citizenship details

APDI's family name Person number (see Section 5.1)

Academic salary details

Classification	Salary (\$A gross)	Current position status

Citizenship details

Australian citizen	Yes <input type="checkbox"/> No <input type="checkbox"/>
If No: Country of citizenship	
Country of residence	
Do you have Australian permanent resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Do you have Australian temporary resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>

8.2.2 Have you been granted an eligibility exemption for this application? Yes No

If Yes, please indicate the type of exemption granted:

- More than required years since PhD awarded
- PhD not yet awarded
- Financial
- Other (please specify)

8.2.3 Is the success of this project dependent on the funding of this APDI? Yes No

8.3 Total research support

Please complete a copy of this page for each Team Leader, Chief Investigator or Partner Investigator (including APDIs) listed in Section 5.1.

Support types (**Sup. type**) are 'P' for past support, 'C' for current support, and 'R' for requested support for 2001.

Asterisk (*) any support related to this project.

The current application must be included as 'R' under 'Sup. type'.

The **Project Id** (if known) is only for past and current ARC/DETYA grants.

Time commitment (Time com.) is the number of days to be spent on each project/scheme out of a maximum of 21 working days per month available for all activities.

Participant's family name

HAINES

Person number (for each TL,
CI, PI listed in Section 5.1)

3

Description (first-named investigator's family name, project title, source of support, scheme)	(*)	Sup. type (P, C, or R)	Project Id (if known)	Time com. (days)	1999 (\$'000)	2000 (\$'000)	2001 (\$'000)
Yang, Burrett, Haines, Reid, and Askin this proposal, ARC-SPIRT	*	R		5			143.6
Haines Title: Cainozoic low-angle multiple impact event and probable impact tsunami deposit, South Australia ARC Small Grant		C				17.5	

8.1 Personal details for all investigators

8.1.1 Abbreviated details

Please complete a copy of this page for each participant listed in Section 5.1.

GAMS Id		Person number (see Section 5)	4	Role	APDI
Family name	REID			Initial	C
Department/school/other	School of Earth Sciences				
Organisation	University of Tasmania				

8.1.2 Full details

If you have provided a GAMS Id in 8.1.1 you are not required to complete this section.

Personal details (Gender and date of birth data are used only for statistical and identification purposes. This section will not be provided to assessors.)

First name	CATHERINE		Second name		
Title	MS	Gender	F	Date of birth (dd/mm/yyyy)	24/01/1972
Phone	03 6226 2478		Fax	03 6223 2547	
Email	C.Reid@utas.edu.au				
Organisation postal address (please include area and country codes)					
Organisation	University of Tasmania				
Postal address line 1					
Postal address line 2	GPO Box 252-79				
Locality	HOBART	State	TAS.	Postcode	7001
				Country	AUSTRALIA

8.1.3 Other details

Current position

Position title	Postgraduate	Year appointed	
----------------	--------------	----------------	--

Highest academic qualification

Type	Ph.D.	Organisation	University of Tasmania	Country	Australia
Year awarded			(or) Date thesis submitted	Prior to Dec. 2000	

Affiliations

Are you associated in any way with any Industry Partner(s) or a Commonwealth-funded Centre?

Yes No

If Yes, please specify the nature of your employment, association and/or financial interest.

Time commitment

Number of days to be spent on this project out of a maximum of 21 working days per month available for all activities.	21
--	----

Are you a member of the ARC or its committees or panels? Yes No

Are any of your relatives, or social/professional associates a member of the ARC or its committees or panels? Yes No

If Yes, please name the ARC member(s).

[Empty box for ARC member names]

If you are a TL or CI, are you a supervisor of an APAI in this application? Yes No

8.2 Additional APDI participant details

Please complete a copy of this page for each participant listed in Section 5.1 as an 'APDI'. If no funding for an APDI is being sought in this application, leave this page blank and submit it as part of your application.

8.2.1 APDI salary and citizenship details

APDI's family name Person number (see Section 5.1)

Academic salary details

Classification	Salary (\$A gross)	Scholarship	Current position status	Completing PhD (Postgraduate)

Citizenship details

Australian citizen	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If No: Country of citizenship	New Zealand
Country of residence	Australia
Do you have Australian permanent resident status?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Do you have Australian temporary resident status?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

8.2.2 Have you been granted an eligibility exemption for this application? Yes No

If Yes, please indicate the type of exemption granted:

- More than required years since PhD awarded
- PhD not yet awarded
- Financial
- Other (please specify)

8.2.3 Is the success of this project dependent on the funding of this APDI? Yes No

[Large empty area for project details]

8.1 Personal details for all investigators

834127

8.1.1 Abbreviated details

Please complete a copy of this page for each participant listed in Section 5.1.

GAMS Id		Person number (see Section 5)	5	Role	AI
Family name	ASKIN			Initial	H
Department/school/other					
Organisation	Great South Land Minerals NL				

8.1.2 Full details

If you have provided a GAMS Id in 8.1.1 you are not required to complete this section.

Personal details (Gender and date of birth data are used only for statistical and identification purposes. This section will not be provided to assessors.)

First name	HENRY	Second name			
Title	DR	Gender	M	Date of birth (dd/mm/yyyy)	14/04/1942
Phone	03 9819 3131	Fax	03 9819 3432		
Email	gslm@gslm.com.au				
Organisation postal address (please include area and country codes)					
Organisation	Great South Land Minerals NL				
Postal address line 1	Level 3, 65 Murray Street				
Postal address line 2					
Locality	HOBART	State	TAS.	Postcode	7000
				Country	AUSTRALIA

8.1.3 Other details

Current position

Position title	Chairman, Great South Land Minerals	Year appointed	1998
----------------	-------------------------------------	----------------	------

Highest academic qualification

Type	PhD	Organisation	University of Queensland	Country	Australia
Year awarded	1993	(or) Date thesis submitted			

Affiliations

Are you associated in any way with any Industry Partner(s) or a Commonwealth-funded Centre?
 Yes No

If Yes, please specify the nature of your employment, association and/or financial interest.

Chairman, director and minority shareholder of Great South Land Minerals NL.

Time commitment

Number of days to be spent on this project out of a maximum of 21 working days per month available for all activities.	2
--	---

Are you a member of the ARC or its committees or panels?

Yes No

Are any of your relatives, or social/professional associates a member of the ARC or its committees or panels? Yes No

If Yes, please name the ARC member(s).

[Empty text box for ARC member names]

If you are a TL or CI, are you a supervisor of an APAI in this application? Yes No

8.2 Additional APDI participant details

Please complete a copy of this page for each participant listed in Section 5.1 as an 'APDI'. If no funding for an APDI is being sought in this application, leave this page blank and submit it as part of your application.

8.2.1 APDI salary and citizenship details

APDI's family name [] Person number (see Section 5.1) []

Academic salary details

Classification	Salary (\$A gross)	Current position status

Citizenship details

Australian citizen	Yes <input type="checkbox"/> No <input type="checkbox"/>
If No: Country of citizenship	
Country of residence	
Do you have Australian permanent resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Do you have Australian temporary resident status?	Yes <input type="checkbox"/> No <input type="checkbox"/>

8.2.2 Have you been granted an eligibility exemption for this application? Yes No

If Yes, please indicate the type of exemption granted:

- More than required years since PhD awarded
- PhD not yet awarded
- Financial
- Other (please specify) []

8.2.3 Is the success of this project dependent on the funding of this APDI? Yes No

9. Classifications and other statistical information

9.1 Keywords

Petroleum
Oil
Gas

Modelling
Tasmania
Fluid flow

9.2 Research classifications

Research Fields, Courses and Disciplines (RFCD)	%
260105	100

Socio-Economic Objective (SEO)	%
Div. 2 650103	100

9.3 If the proposed research involves international collaboration, please specify country/ies.

10. Additional application details

10.1 Concurrent ARC/DETYA grant applications: List ALL other ARC/DETYA scheme applications for funding in 2001.

Description (Name of applicant, administering organisation)	Project Id (if known)	Success dependent (1)	Dual request (2)
Davidson / Yang, University of Tasmania	C00107407	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>

(1) Tick the box if the success of this project is dependent on the associated application.

(2) Tick the box if anything applied for in this application has been applied for on the associated application.

10.2 Has an applicant submitted a similar application to any other agency? Yes No

If Yes, please provide details.

--

10.3 Is funding for this project contingent on support from elsewhere? Yes No

If Yes, please provide details.

--

10.4 If any Team Leader, Chief Investigator or Partner Investigator is associated with, but not the Director of, a Commonwealth Government-funded Centre (eg. Special Research Centre, Key Centre of Teaching and Research, Cooperative Research Centre), please explain the difference between the research proposed in this application and the core activities of the Centre.

Dr Jianwen Yang is associated with the CODES SRC for research on ore deposit genesis. This research on petroleum is in no way associated with CODES research.

11. Certifications

Each Industry Partner must also sign their Industry Partner Organisation details page at Section 7.3.

The completion of this page is the responsibility of the administering institution/research body which must obtain the required signatures prior to submission of the application to DETYA.

Certification by the Industry Partner(s)

I/we certify that all details in this application regarding our participation in, and financial contribution to, the project are correct.

I/we agree to provide support as indicated at Section 7.

Signature of the Industry Partner(s)



Name(s) (please print)

David A Tanner

Date

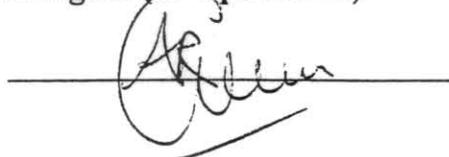
19/04/2000
/ /2000
/ /2000

Certification by the Pro Vice-Chancellor (Research) or his/her delegate (or equivalent) in the administering institution/research body

I certify that:

- I. this institution supports this application and, if it is successful, will provide basic infrastructure for the project;
- II. the project can be accommodated within the general facilities in this institution and sufficient working and office space is available for any proposed additional staff;
- III. I am prepared to have the project carried out in my institution under the circumstances set out by the applicant(s);
- IV. if successful, the project will not be permitted to proceed until appropriate ethical clearance has been obtained; and
- V. the amount of time which the investigator(s) will be devoting to the project is appropriate to existing workloads.

Signature of PVC(R) or delegate (or equivalent)



Professor Andrew Glenn
Pro-Vice Chancellor (Research)
University of Tasmania

Date

/ /2000

4 May 2000

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Executive Summary

- Recent studies on oil seeps, organic geochemistry, geophysics, structural geology, palaeontology, drilling results and heat-flow suggest that there is considerable potential for onshore petroleum in the Tasmania Basin.
- The aim of this study is to provide the basic R&D to support an upcoming phase of petroleum exploration by Great South Land Minerals NL. Structural, sedimentological, stratigraphic, geochemical and fluid flow studies will be integrated into an interactive 3D computer based model of the evolution of the Tasmanian crust in and below the Tasmania Basin. This will provide both practical benefits – the probable discovery of economic petroleum- but will also be one of the first studies where a consistent methodology has been used in the collection, analysis, integration and construction of a large, powerful computer model of a whole petroliferous basin.
- Although the potential source rocks, reservoirs, seals and traps have been well identified, no effort has been made to conduct computational simulations of subsurface fluid flow and petroleum migration in the Tasmania Basin.
- We propose a three year project to characterize 1) the structural history of the Early to Middle Palaeozoic fold and thrust belt and of the Tasmania Basin from initiation to inversion, 2) the palaeogeographic development and maturation history of central Tasmania from the Late Proterozoic to the present, 3) the physical properties of source rocks, reservoirs, seals and traps and 4) the migration patterns of the Tasmanian onshore petroleum systems.
- The ultimate objectives of this innovative project are 1) to increase substantially our understanding of the structural evolution, subsurface fluid flow, heat transport and petroleum migration in and below the Tasmania Basin, 2) to develop a set of gas/oil-forming models for the petroleum supersystems in and below the Tasmania Basin and 3) to develop a range of criteria and computer modeling methodologies to characterise potential petroleum systems which can be used by Australian companies exploring for hydrocarbons worldwide.
- Potential benefits to the industry partner will be a reduction in drilling expenditure and more focussed exploration based on 1) a set of oil-forming models, 2) selection criteria to distinguish potential petroleum systems, 3) a clear understanding of the petroleum systems and 4) better targeting of seismic lines and well locations.
- The research team at the School of Earth Sciences, University of Tasmania, has developed broad skills and international reputations in geology, structure and paleogeography (Clive Burrett, Peter Haines), geophysics, hydrogeology and computational modelling (Jianwen Yang).
- Industry partner, the Great South Land Mineral Limited NL, is supporting this project with a total support of \$303,812 (\$253,812 cash and \$50,000 in-kind) for 3 years and company chairman Dr Henry Askin will be closely involved in the project along with other company geologists.

Aims and Expected Outcomes

Recent geological, organic geochemical, geophysical and drilling results suggest that there is a valid hydrocarbon play in the Tasmania Basin. Although the major elements of an economic oil/gas system (i.e., source rocks, reservoirs, seals and traps) have been well identified, there are significant gaps in our knowledge of the migration patterns of subsurface hydrocarbons and fluid flow in the Tasmania Basin. While recent studies have established few qualitative play concepts of hydrocarbon resources, no effort has been made to simulate actual oil/gas migration within the major petroleum supersystems in Tasmania.

The ultimate objectives of this project are to:

- 1) substantially increase our understanding of subsurface fluid flow, heat transport and petroleum migration in the Tasmania Basin,
- 2) develop a set of gas/oil-forming models for the petroleum supersystems in and below the Tasmania Basin,
- 3) develop a range of criteria to distinguish potential petroleum systems which can be used by Australian companies exploring for hydrocarbons worldwide and
- 4) construct a continuously updated, three-dimensional computer model for Tasmania, showing the evolution of petroleum systems through time.

The major benefits of this research to the industry partner will be:

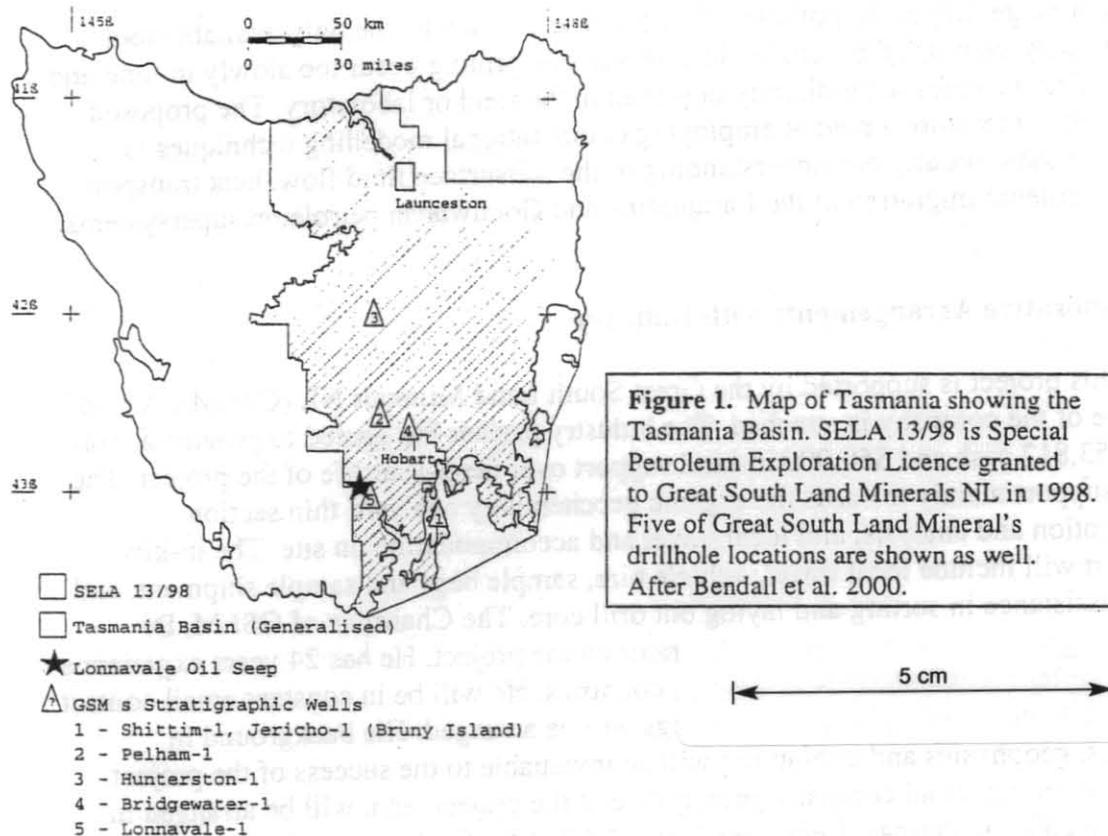
- 1) new knowledge of the Tasmania Basin's structural history, palaeogeographic history and maturation history,
- 2) new gas/oil-forming models particularly in the Tasmania Basin and in similar environments worldwide,
- 3) potential reduction in drilling expenditure and more focussed exploration and
- 4) new database of the physical properties (i.e., porosity, permeability, and thermal conductivity) of source rocks, reservoirs, seals and traps of the Tasmanian petroleum systems.

Background and Significance

The Tasmania Basin covers an area of approximately 240 km by 140 km over the majority of the central and eastern portions of Tasmania with the axis trending approximately from Launceston to Hobart (Figure 1).

Petroleum exploration commenced in Tasmania in the early 1890s. Since 1871, there have been many reported occurrences of tar, oil and gas, notably along the edges of the Tasmania Basin and along lineaments such as faults and fractures. In the early part of this century, over 900,000 litres of oil were produced from the Permian Tasmanite Oil Shale outcrops by artificial distillation (Woods 1995). There were reports of oil being encountered in a shallow well of less than 30 m on Bruny Island in southern Tasmania in 1929 (Burrett 1997). The unsuccessful 'oil boom' of the 1920s was partly due to direct drilling of shallow occurrences of thermally immature Tasmanite Oil Shale and partly due to misunderstandings or ignorance about the nature and origin of the many occurrences of hydrocarbons previously recorded (Bendall et al. 2000; Burrett 1997).

The major features of an economic oil/gas system are source rock, heating, migration, reservoir, seal and trap. Oil and hydrocarbon gases are formed by the



natural heating of organic-rich material in sedimentary rocks (source rock). Heating of the source rock due to burial to about 100° C will produce oil (oil window) whilst higher temperature of up to about 200° C will produce gas (gas window). Over time spans of thousands to millions of years, the oil and gas migrate upwards and laterally through the sedimentary pile in the basin. If there is no impediment to migration, then the oil and gas reach the surface as seeps. If the flow is impeded by seal rocks of low permeability and trapped in a high porosity reservoir rock, then an accumulation of oil and gas occurs. A trap structure is needed to restrict and enhance the flow into the reservoir. Good structural traps are domes, anticlines and faults.

Recent studies indicate all these elements are present in and beneath the Tasmania Basin and occurred in the appropriate geochronological sequence (Burrett and Martin 1989; Bendall et al. 1991; Burrett 1992; Maynard 1996; Randall 1997; Tanner and Burrett 1997). Two major petroleum supersystems, the Ordovician Larapintine system and the Permo-Triassic Gondwanan system, have been identified respectively below and in the Tasmania Basin (Bendall et al. 2000). Detailed analyses of oil seeps, organic geochemistry, geophysics, structural geology, palaeontology, drilling results and heat-flow suggest there is considerable potential for onshore petroleum in Tasmania. The most recent discovery of thermogenic gas from between 1630 m and 1686 m in the Shittim #1 drill hole on Bruny Island has substantially enhanced the prospectivity of the Tasmania Basin for economic hydrocarbons (Burrett 1997). Helium may also be present in economic grades.

Although the previous studies have successfully identified the potential source rocks, reservoirs, seals and traps, and have established potential qualitative play concepts for the Tasmanian petroleum systems, no effort has been made to investigate actual subsurface fluid flow and petroleum migration below and in the Tasmania Basin. It is well known that numerical simulation provides an efficient way of testing

qualitative geological hypotheses. In most cases, it may be the only available tool since many geological processes such as gas/oil-forming occur too slowly in time and too widely in space to be directly observed in the field or laboratory. The proposed research is therefore aimed at employing computational modelling techniques to increase substantially our understanding of the subsurface fluid flow, heat transport and petroleum migration in the Larapintine and Gondwanan petroleum supersystems.

Collaborative Arrangements with Industry

This project is supported by the Great South Land Minerals NL (GSLM). A brief profile of the company is attached. The industry partner has agreed to provide a total of \$253,812 cash and \$50,000 in-kind support over the 3-year life of the project. The cash support mainly towards the organic geochemistry analysis, thin section preparation and analysis, and local travel and accommodation on site. The in-kind support will include local travel, vehicle hire, sample bags and sample shipment, and field assistance in sorting and laying out drill core. The Chairman of GSLM, Dr Henry Askin, will be the main collaborator on the project. He has 24 years experience as an explorationist with Shell in many countries. He will be in constant email contact with team members and regular meetings will be arranged. His background in physics, geophysics and computing will be invaluable to the success of the project. Major meetings of all company geologists and the project team will be arranged in January 2001 (planning), December 2001, 2002 and a final meeting in December 2003. Other GSLM geoscientists will be closely involved in phases of the project. These are Ian Reid, director and geologist with considerable experience in Shell and as a consultant. He is particularly knowledgeable in computing and geological software development and will play an important support role to the project.

Economic and/or Social Benefit

Tasmania has the highest unemployment rate in Australia due in large part to the lack of labour intensive industry. Studies by GSLM have indicated that there are at least 6 gigalitres of oil and gas equivalent stored in the Tasmanian onshore petroleum systems. Successful exploration of the hidden petroleum resources and the resulting development of an oil industry will completely change the current economic and social situation of Tasmania. The immediate economic stimulus of major exploration and production programs in terms of increased local employment and royalty payments to the Tasmanian Government will be substantial. The discovery of local onshore oil and gas will encourage the establishment of energy-intensive manufacturing industries with enormous positive potential for changing Tasmania. Discovery of onshore petroleum in Tasmania will encourage exploration in the offshore parts of the Tasmania Basin to the south of Hobart and in other, younger, offshore basins around Tasmania. The major outcomes of this research will greatly assist the discovery and exploration of the petroleum resources in Tasmania. The project will concentrate on the Tasmania Basin, however the methodological results will have application for exploration in similar geological environments throughout Australia.

Research Team

This research program will bring together a team of researchers who have considerable experience and a strong international reputation in the study of geology, structure, palaeogeography, geophysics, hydrogeology and computational modelling.

Dr Jianwen Yang: University of Tasmania; lecturer (level B) in hydrogeology; expertise in exploration geophysics, hydrogeology and computation simulation.

Dr Clive Burrett: University of Tasmania, head of the School of Earth Sciences; associate professor in geology; expertise in geology, structure, palaeogeography and palaeoclimate and has studied petroleum systems in more than 20 countries.

Dr Peter Haines: University of Tasmania, lecturer (level B) in sedimentology; expertise in sedimentology, basin studies and structural mapping.

Ms Catherine Reid: University of Tasmania, Ph.D. candidate (submission date: August 2000); expertise in palaeontology and basinal studies.

Dr Henry Askin: Chairman, Great South Land Minerals NL. Twenty-four years experience in Shell as a geophysicist and explorationist.

The varied expertise outlined above allows us to develop a multidisciplinary approach to tackle the complexities of the Tasmanian petroleum systems. In addition, this research team also has both academic and industry experience: Jianwen Yang has 5 years experience as a consultant to exploration industry and Clive Burrett has consulted to oil and gas exploration companies in the Middle East, southeast Asia and Australia for more than 20 years. All have a good understanding of the relevance of research to industry objectives.

Role of APAI students

Three APAI Ph.D. scholarships are requested in this proposal. The three APAI students will benefit from working in a team environment, and from regular contact and interaction with industry representatives.

APAI 1

One APAI student will undertake field mapping and core logging, infer structural history (including fold and fault timing and geometry). The candidate will also need to interpret the geophysical data (potential fields and seismic surveys). The major role of this candidate is to provide the structural history and geometry of folds and faults which will form the basis for constructing the fluid flow and basin evolution numerical models.

APAI 2

The role of the second APAI student is to contribute to the computational simulation of subsurface fluid flow, heat transport and oil/gas migration within the major petroleum systems in and below the Tasmania Basin based on the geological and structural findings of the research team. The candidate will need to become familiar with several existing computer software packages and apply them to the Tasmania Basin. Although this candidate will mainly undertake numerical modelling, he or she will also need to understand the geological, structural and thermal environments of the Tasmanian petroleum systems, and their historic relationships. The candidate will also be involved in some software development.

APAI 3

The third Ph.D. candidate will study the source rocks and seeps in the Larapintine and Gondwanan supersystems. Recently described organic-rich shales in the Late Proterozoic of Tasmania will also be examined as shales of this age are important

source rocks in closely comparable Gondwana basins as south Oman. Palynological and vitrinite reflectance studies will be carried out to help constrain thermal history. An analysis will be made of the available fission track data and further specimens may be collected and measured to fill in critical gaps.

The three APAI Ph.D. students will be based at the University of Tasmania and will be directly supervised by the Chief Investigators (Jianwen Yang for numerical simulation and Peter Haines and Clive Burrett for the geochemical, geological and structural investigations). Co-supervisors will be Senior Lecturer Dr Ron Berry (structural geology) and lecturer Dr Michael Roach (geophysics and computing). Dr Henry Askin from the industry partner will also be closely involved in supervision. By undertaking this research project, the Ph.D. candidates will develop a variety of analytical and numerical skills essential for describing and interpreting geological, structural and geophysical data associated with the petroleum systems, and in predicting where the hydrocarbon occurrences are located. These skills will be of great benefit for the candidates in future careers as academic researchers in petroleum systems, or as geologists working for an oil exploration company.

Role of APDI

The APDI will be a critical member of the research team and will be involved in fieldwork, measuring sections, collecting fossils from outcrops and cores and in associated laboratory work and modelling. The APDI will also be responsible for the maturation and thermal studies in the basin. Catherine Reid, the APDI candidate, is ideally suited for this Post Doctoral position based on her academic and industry background (see justification for the APDI on page 11 for further information).

The role of each member of the research team is shown on the project summary diagram illustrated in Chart 1.

Research Plan and Methodology

Researchers in this project will have full access to analytical equipment at CODES SRC, the School of Earth Sciences and the Central Science Laboratory at the University of Tasmania. This includes facilities for the preparation of thin sections and polished sections, petrologic microscopes, a wide range of computers, drafting equipment and a scientific library.

This project will utilise integrated field, laboratory and numerical techniques to satisfy the aims of this research, with each team member contributing to an overall synthesis of the results. Chief Investigators, Jianwen Yang, Clive Burrett and Peter Haines will be the main supervisors of the three APAI Ph.D. students and Associate Investigator Henry Askin will also be involved in supervision.

As shown in Chart 1, the major research themes will be:

- 1) Compilation of existing data (lithostratigraphy, biostratigraphy, structural, geochemical, geophysical, drilling, and maturation) and entering these data in a consistent digital format for immediate GIS access and for later incorporation into the main fluid flow and basin evolution models.
- 2) APA I 1 and 3 and APDI Catherine Reid will be involved in substantial fieldwork, collecting and measuring previously unmeasured stratigraphic sections, collecting microfossils from key localities, and samples for maturation studies (palynology, fission track samples, vitrinite samples), assessing potential source rocks,

Project Summary

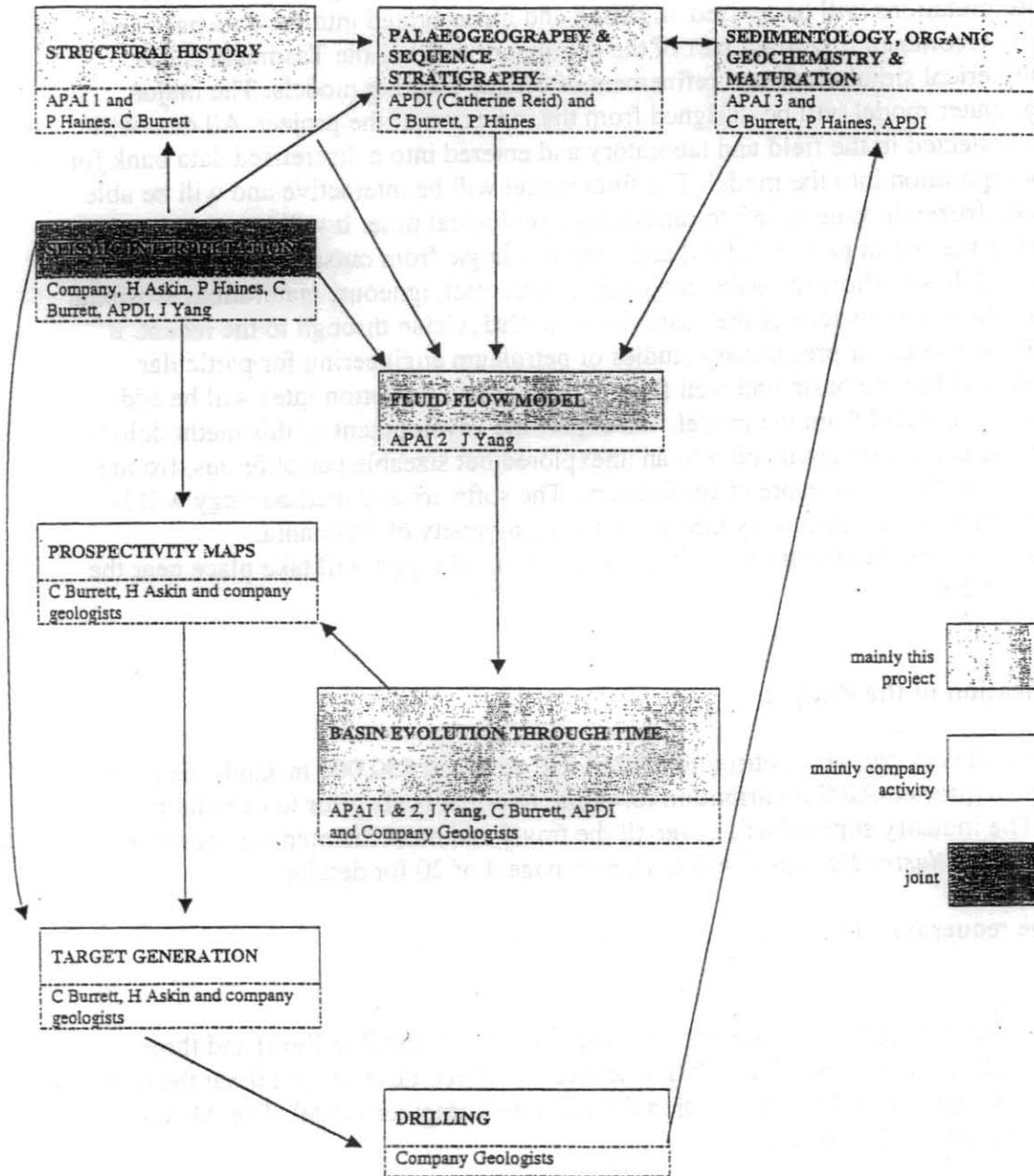


Chart 1. Project flowchart showing the relationship among the major research themes.

measuring folds and faults, detailed studies on faults for kinematic and permeability estimates and sample collections for diagenetic, porosity and permeability studies.

- Laboratory work will include thin section preparation for rocks and fossils, studies on the fossils in order to establish a tight time framework, plotting and entering all field data, development of a sequence stratigraphic model using field sections and seismic data, detailed studies on the diagenetic evolution of reservoir, overburden and seal rocks in each of the petroleum supersystems, and measurement of

permeability and porosity for different rock units. The preliminary phase of seismic acquisition will take place in late 2000 and early 2001. The project team will have access to the seismic data and to the seismic interpretations. These interpretations will be revised, digitised and incorporated into the data base and will become an important part of the computer model of the Tasmania Basin.

- 4) Numerical simulations and refinement of oil/gas-forming models. The major computer model will be designed from the inception of the project. All data will be collected in the field and laboratory and entered into a discretised data bank for incorporation into the model. The final model will be interactive and will be able to be frozen in time or left to run through geological time. It will be capable of being viewed in part or in total and from any angle from outside or from inside the model. It will show the paleogeographic, structural, igneous, maturation, erosional and fluid flow history of the basin from the Ordovician through to the recent. It will be useful for preliminary studies of petroleum engineering for particular fields within the basin and well flow rates and field depletion rates will be added to or calculated from the model. We expect the development of this methodology and its consistent application to an unexplored but sizeable petroliferous, frontier basin will have widespread applications. The software and methodology will be commercially exploited by GSLM and the University of Tasmania.
- 5) Publications, development of final model and final report will take place near the end of 2003.

Justification of the Budget

The industry partner contribution (\$253,812 cash and \$50,000 in-kind) matches well the requested ARC contribution for dollar to dollar basis prior to calculating GST. The industry support will cover all the travel and most maintenance costs. See the section *Industry Partner Contribution* on page 4 of 20 for details.

The requested ARC contribution is justified as follows:

Personnel

The major budget items are one APDI scholarship (Catherine Reid) and three APAI Ph.D. scholarships. The APDI is needed to collect, develop and input the basic geological, age control and maturation data into the computer model. The APAIs' roles are explained in the text.

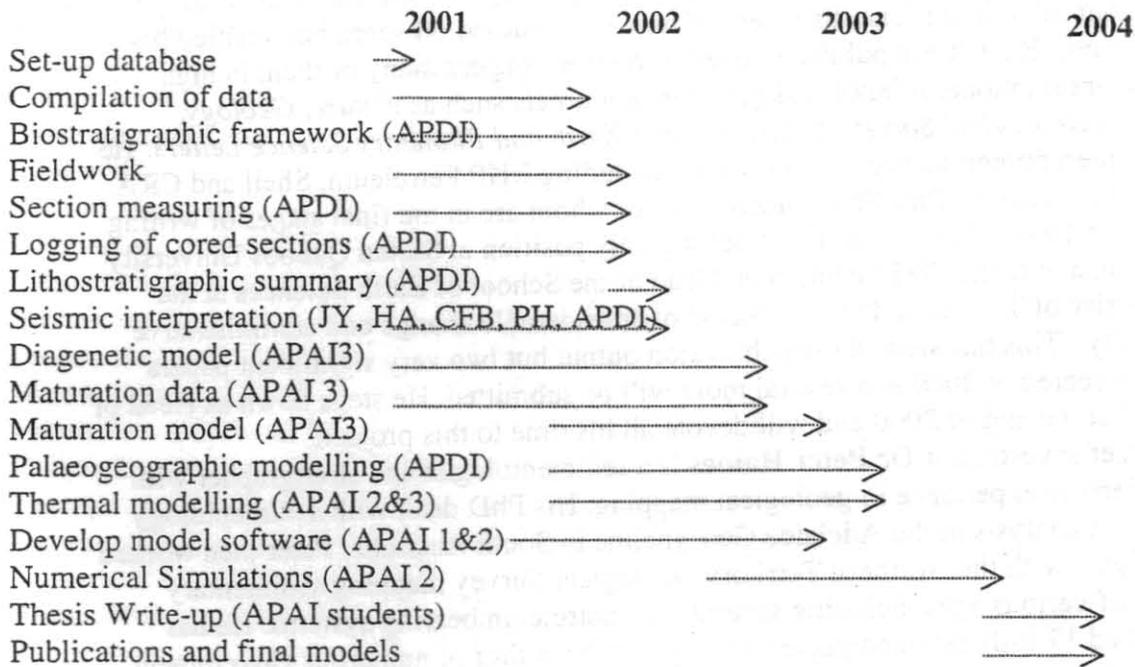
Equipment

Among all the controlling parameters, permeability and porosity are the most critical variables governing oil/gas migration within a petroleum system. Fully quantifying these physical parameters for different rock units in and below the Tasmania Basin is therefore essential to establish valid computer models. A permeability/porosity meter is requested for these essential determinations. It is expected to cost about \$9,000.

Maintenance

The maintenance costs are for purchasing computer software only. Although much of the programming for this project will be carried out by Yang and APAI2 we expect that some software will have to be bought at about \$7,000 p.a.

Timetable



Track Record of Chief Investigators

Chief Investigator **Dr Jianwen Yang** is a geophysicist and hydrogeologist. Since 1991 he has been actively involved with research on the numerical simulation of subsurface fluid flow, heat and solute transport in complex earth structures and has published 14 fully refereed papers in international journals. His Ph.D. thesis at the University of Toronto (92-96) was an investigation of the physical behaviour and computational techniques of fluid flow and heat transport in discretely fractured porous media. Both analytical and numerical methods were developed to study problems related in particular to 3-D multiphase hydrothermal fluid migration in continental and submarine systems. The numerical scheme has fully incorporated the hydrodynamic coupling between discrete fractures and the surrounding porous media thus produced many important yet unexpected results. His post-doctoral project (96-98) focused on assessing the importance of density-variation-driven, free-convective solute transport in discretely fractured porous media. The results will be published once the confidentiality periods have expired. Since joining the University of Tasmania as a Lecturer in 1999, he has been involved in two confidential industry funded research projects (the SPIRT/AMIRA P552 – Fluid Flow Modelling in the Mt Isa and McArthur Basins, and the SPIRT/AMIRA P588 – Epithermal Gold-Silver Deposits: Geological, Geochemical and Isotopic Vector to Target Major Deposits). His contribution is the numerical simulation of fluid flow-based on the geological findings of the two research teams. He is currently supervising two Ph.D. and two honours students.

Chief Investigator **Dr Clive Burrett** is a stratigrapher, palaeogeographer, tectonician and palaeontologist. In the last 15 years he has used these specialities in studying petroleum systems in more than 20 countries and has consulted to oil and gas exploration companies in the Middle East, southeast Asia and Australia. He is particularly interested in the similarities of the Gondwana basins of Oman (where he

worked for 3 years) and Tasmania. Although onshore Tasmania has long been thought to be lacking in petroleum Burrett suggested otherwise in 1980 based on a study of conodont maturation. The discovery of now well studied oil seeps has verified his prediction. Burrett has published over 70 refereed papers many of them in high impact international science and geoscience journals such as *Nature*, *Geology*, *Bulletin Geological Society of America* and *Earth and Planetary Science Letters*. He has written numerous reports to industry including BHP Petroleum, Shell and CRA. He is supervisor of four PhD students two of whom are in the final stages of writing up. From 1991-1994 he was in a teaching only position at Sultan Qaboos University in Oman and from 1995 he has been Head of the School of Earth Sciences at the University of Tasmania during a period of considerable change and administrative difficulty. This has slowed his publication output but two very significant papers have appeared in 2000 and several more will be submitted. He steps down as Head of School at the end of 2000 and will devote all his time to this project.

Chief Investigator **Dr Peter Haines** is a sedimentologist and stratigrapher with considerable experience in geological mapping. His PhD dealt with sedimentology and basin analysis in the Adelaide Geosyncline in South Australia. Peter then worked for 8 years with the Northern Territory Geological Survey mapping sedimentary basins of various ages including several with petroleum bearing systems. He has published 17 fully refereed papers, and is also the author of numerous Government geological reports and maps. It should be pointed out that most of the papers have been written since he returned to academia and held Post Doctoral positions at the University of South Australia and University of Adelaide (1995-1998). Since early 1999 he has been Lecturer in Sedimentology at the University of Tasmania. During 1999- early 2000 much effort has been put into setting up and teaching a number of new sedimentological courses, with a corresponding slump in research and publication rate, but the situation is currently improving and he intends to submit a number of papers in 2000. He currently holds an ARC Small Grant for the year 2000.

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Justification of APDI: Applicant – Catherine Reid

The APDI applicant (Catherine Reid) will be one of the principal researchers on the proposed ARC-SPIRT project entitled "Petroleum System Modelling Onshore Tasmania".

Significance

The APDI applicant will be responsible for the palaeontology and stratigraphy of the Tasmania Basin to develop a basin wide concept of the biostratigraphy and palaeoenvironment, and a centralised nomenclature, all of which will be applied to assess palaeogeography and basin evolution. The ADPI will supply the well constrained time lines, the stratigraphic columns and the isopachs which will form the major basis for the final computer model of central Tasmania which is the major aim of this project.

To fully understand the palaeogeography, and to achieve maximum benefit from the structural history and fluid flow studies, comprehensive analysis of the sequence stratigraphy, bio- and lithostratigraphy, palaeoenvironment and organic geochemistry must be undertaken. To develop an applicable model of the oil migration within the Tasmania Basin, the detailed palaeontology, biostratigraphy, lithostratigraphy and palaeogeography of the Tasmania Basin must be understood to provide the highest quality data for modeling. The APDI applicant will also be involved in the modelling process to ensure the results are robust and can be practically applied to the Tasmania Basin for the benefit of the Industry Partner.

The Tasmania Basin, incorporating sediments of Carboniferous to Late Triassic age, is unique on a global scale for its development at high latitudes in a glaciomarine setting. The faunas are abundant and diverse but are not yet fully understood. The study of the Tasmania Basin faunas and environments is vital to fully understand mechanisms operating in these high latitudes at the edge of a major continent. A full study of these types of environments is highly valuable in the understanding of global biologic, environmental and resource development.

Many studies of aspects of the Tasmania Basin have been undertaken in the past, each contributing valuable information. However most of these studies have examined geologic aspects that are limited in time and space, and do not attempt to examine the basin as a whole. Much of the biostratigraphy and stratigraphic nomenclature has been developed from regionally isolated outcrops, and have not taken into account the vast amount of data now available in drill core.

The Tasmania Basin has a diverse and unique macrofauna in the marine units of the Permian, with abundant Bryozoa, Brachiopoda, and Mollusca. The existing biostratigraphy that is used in correlation within the basin and to mainland Australia is based largely on brachiopods and bivalves, which are very difficult to identify successfully in drill core. As a result the Tasmania Basin is not well accounted for in Australia wide biostratigraphic studies, and a Tasmanian standard involving all available macrofaunas is required. Recent advances in the methodology and approach to the Bryozoa have shown their great importance in the understanding of biostratigraphy and palaeoenvironment in any basin system containing them. Bryozoa are an appropriate tool in biostratigraphic studies of marine sediments in drill core sections, as small fragments may be all that is required to successfully identify separate taxa.

The existing stratigraphic nomenclature for the Tasmania Basin is disjointed as it is based on isolated regional outcrops, that in a dynamic basin system may appear quite different to each other. A number of unit names may exist for the same facies unit, and transgressive units and lateral facies variations are poorly accommodated for in the existing nomenclature.

The weaknesses in the above areas of stratigraphy, palaeontology and biostratigraphy have a run-on effect of further limiting the effectiveness of any palaeoenvironmental or palaeogeographic assessment of the basin as a whole. The sediments need to be assessed in a basin wide setting, and its development and evolution considered from the Carboniferous to the late Triassic, rather than focus on one unit or group of units in a restricted time frame.

One of the roles of the APDI research is to address the above weaknesses and gaps in information. By studying the major palaeontological groups, most importantly including the Bryozoa in both outcrop and in drill section, a comprehensive data base will be developed. This will be used to develop a new biostratigraphic scheme that can be applied both within the Tasmania Basin and in comparison with global deposits of the same age. The work to be undertaken by the APDI applicant is significant as it addresses the problem of the current poor understanding of the biostratigraphy and palaeoenvironment of the Tasmania Basin. Scientific knowledge will be advanced in gaining a full understanding of the faunal and environmental development of this unique high latitude basin. The result will be further insight into the development of faunas, environments and resources on a global scale.

Innovation

While the study of biostratigraphy, lithostratigraphy and palaeogeography are not new to the petroleum industry, the APDI project will be innovative as applied to the Tasmania Basin, where such studies are lacking, and yet are a vital requirement in the exploration of petroliferous basins.

The APDI project will also be applying palaeontological methods (Bryozoa as a biostratigraphic tool) in the development of a dynamic palaeogeographic and basin model, a methodology that can be adopted elsewhere.

Palaeontological studies will be incorporated with fluid flow, structural history and organic geochemistry to develop a basin evolution model. The ADPI applicant will be involved in all steps in developing the model and will provide critical data on lithostratigraphy, chronology and basin thermal history through the project.

Approach

Detailed measured sections will be used to assess the stratigraphy on a basin wide scale, and develop a workable comprehensive stratigraphic nomenclature. The information gained from the palaeontological and stratigraphic studies will be combined with sequence stratigraphy and seismic interpretation to synthesis a basin wide concept of the stratigraphic nomenclature, biostratigraphy, palaeogeography and palaeoenvironment. Computer modeling of this information will be an important contribution to the team objective of developing a basin evolution model.

Researcher

The APDI applicant, Catherine Reid, has an excellent academic record, completing a Bachelor of Science degree at the University of Auckland in 1993, graduating Senior Scholar in Geology (graduation 1994). She then undertook a Master of Science degree at the same university, studying palaeontology, sedimentology, and hydrogeology in 1994. In 1995, as the research component to her masters degree, she studied a Miocene fore-arc basin on the east coast of New Zealand. The East Coast Basin is being developed as an economic resource for oil and gas, and her studies of the biostratigraphy, palaeoenvironment and tectonics in an area of an active tectonic basin were important in defining the prospectivity in the local area. This research provided an early comprehension of petroleum studies, and a recognition of the requirements for the economic development of petroliferous basins.

After completing her Master of Science degree well within the time allowed for submission, and graduating with First Class Honours (graduation 1996), Catherine joined the Geology and Marine Biology Department at the Auckland Institute and Museum. Catherine had held a short term contract research position with the Museum during her masters studies, and was employed on a full-time basis in 1996. There she was involved in a team responsible for the quantitative and qualitative study of New Zealand shallow water benthic forams. This led to the production of a number of papers in refereed journals, and Catherine was responsible for the accurate identification and comparison of foraminiferal faunas from throughout New Zealand.

In late October 1996 Catherine came to the University of Tasmania, on a School of Science Scholarship, to study for her Ph.D. (to be submitted in August 2000). Her Ph.D. research has focused on the advancement of identification and biostratigraphy of Bryozoa within Gondwana. Her studies have centered on Permian deposits in Tasmania, New South Wales and southern Thailand. The Bryozoa as a group are poorly understood in these regions, and the project has required Catherine to work independently in an area many people are unfamiliar with, as she was herself at the start of her Ph.D. Catherine has shown an excellent ability to research and understand a topic outside her previous experience, and one that has required her to liaise with other international researchers in this field. Other important aspects of her project are the ecological significance of morphological variation within Permian Bryozoa, and the effect of environment on the distribution of taxa. The results of her studies will have a strong influence on the understanding of global Permian bryozoan biogeography, and can be expected to be published in the coming future.

Catherine brings many skills to this proposed SPIRT project, not least a good understanding of the Tasmania Basin. Her previous experience in smaller petroliferous basins, analysis of a basin as a palaeontological, sedimentological and structural whole to produce a basin evolution model ensures she is fully capable of undertaking this project, and will bring new ideas and approaches to the group. The collaboration of the APDI with the other researchers involved in the broader project will be beneficial to the applicant, and can only advance the understanding of their individual study. The content and scale of the work proposed is significant and appropriate to that required for independent postdoctoral research. The project will extend the applicant beyond her postgraduate studies, and is a suitable career development path.

Environment

The APDI applicant will be based at the School of Earth Sciences, University of Tasmania. Facilities available at the University of Tasmania include:

- Thin section and palaeontological peel laboratory.
- Scanning Electron Microscope.
- High quality petrologic microscopes.
- Computer software and technical support.
- Organic geochemical analyses will be carried out at AMDEL laboratory in Adelaide.

Curriculum Vitae – Catherine Reid

Personal Details

Catherine Mary Reid	Nationality: New Zealand
School of Earth Sciences	Age: 28 yrs.
University of Tasmania	
G.P.O Box 252-79	Phone: (03) 62 262 478 (work)
Hobart, Tasmania 7001	email: C.Reid@utas.edu.au

University Education

University of Tasmania - November 1996 to present

Working towards a Ph.D. by research in Geology.

Expected completion date July 2000.

Thesis topic - The palaeontology, biostratigraphy and palaeobiogeography of Permian Bryozoa of Tasmania, New South Wales and southern Thailand.

University of Auckland - 1991-1996

1994 B.Sc., Senior Scholar in Geology; 1996 M.Sc. in Geology - First Class Honours

M.Sc. papers - Palaeontology A+, Sedimentology A, Hydrogeology A+.

M.Sc. Thesis title - The Palaeontology, Palaeoecology and stratigraphy of Lower Miocene sediments in the Waipatiki/Mangatuna area, Wairarapa, New Zealand.

Prizes and scholarships

1994 Senior Scholar in Geology

1995 Dean of Science Prize

1995 R N Brothers Memorial Award (\$1,000 field work costs)

1995 Geological Society of New Zealand Student Research Award

1996 Bartrum Memorial Prize

1996 University of Tasmania School of Science Scholarship (standard stipend)

1997 Australian Postgraduate Award (standard stipend)

Employment record

University of Tasmania: 1997 to 1999

Design and teaching of selected Palaeontology practical courses for second year students. Tutor in undergraduate Palaeontology, Mapping and Structural Geology.

Auckland Institute and Museum: 1995 to 1996

Foraminiferal Research Assistant. Quantitative identification of recent brackish and fully marine foraminifera, biogeographic and environmental analysis and presentation of data. Publications resulting from this employment are listed below.

Auckland University Geology Department

Tutor in undergraduate Palaeontology, Sedimentology and Petrology laboratories.

Auckland Uniservices Ltd.

Contract to Kingett Mitchell & Associates for Hauraki Gulf sediment analysis.

Memberships

Geological Society of Australia (Tasmanian Division)

Association of Australasian Paleontologists

The Paleontological Society (US)

Society of Economic Geologists (University of Tasmania Student Chapter)

Referees

Dr. Clive Burrett – School of Earth Sciences, University of Tasmania, G.P.O. Box 252-79, Hobart, Tasmania 7001.

Dr. Bruce Hayward – Department of Geology, University of Auckland, P.O. Box 92019, Symonds Street, Auckland, New Zealand. A written reference is included.

Publication

Gregory, M.R., C.M. Reid and M. Wiley, Analysis of Hauraki Gulf Sediments, *Report for Kingett Mitchell and Associates*, 1995.

Hayward, B.W., H.R. Grenfell, A.D. Pullin, C.M. Reid and C.J. Hollis, Foraminiferal associations in the upper Waitemata Harbour, Auckland, New Zealand, *Journal of the Royal Society of New Zealand*, **27**, 21-51, 1997.

Hayward, B.W., H.R. Grenfell and C.M. Reid, Foraminiferal associations in Wanganui Bight and Queen Charlotte Sound, New Zealand, *New Zealand Journal of Marine and Freshwater Research*, **31**, 337-365, 1997.

Reid, C.M. and B.W. Hayward, Near-shore foraminifera from Taiwawe Bay, Northland, New Zealand, *TANE*, **36**, 113-130, 1997.

Reid, C.M., Stratigraphy, palaeontology and tectonics of lower Miocene rocks in the Waipatiki/Mangatuna area, southern Hawke's Bay, New Zealand, *New Zealand Journal of Geology and Geophysics*, **41**, 115-131, 1998.

Hayward, B.W., H.R. Grenfell, C.M. Reid and K.A. Hayward, Recent New Zealand shallow water benthic foraminifera: Taxonomy, ecologic distribution, biogeography and use in palaeoenvironmental assessment, *Institute of Geological and Nuclear Sciences Monograph 21*, 264 pages, I. G. N. S Ltd, Lower Hutt, New Zealand, 1999.

Reid, C.M., Tasmanian Permian bryozoans, *In Abstracts, The Permian of Eastren Tethys: Biostratigraphy, Palaeogeography and Resources*, Deakin University, Melbourne November 30th to December 3rd, 1997.

Reid, C.M., Permian bryozoan faunas of Tasmania, Australia, and their comparison to those of the Uralian region, *In Abstracts of the International Symposium on Upper Permian Stratotypes of the Volga Region*, July 28th to August 3rd 1998, Kazan.

Reid C.M., New species of Trepostomatida (Bryozoa) from the Permian of Tasmania, Australia, in preparation.

Reid, C.M., Fenestrada (Bryozoa) from the Permian of Tasmania, Australia, new species and redescriptions, in preparation.

Publication List of Chief/Partner Investigators (1995-2000)**Publications by Jianwen Yang (1995-2000)****Refereed Papers:**

- Yang, Jianwen, Hydrothermal fluid circulation in anisotropic permeable media associated with discrete fractures, *Transactions of NFsoc*, in press, 2000.
- Yang, Jianwen and R.N. Edwards, Predicted groundwater circulation in fractured and unfractured anisotropic porous media driven by nuclear fuel waste heat generation, *Canadian J. of Earth Sciences*, in press, 2000.
- Yang, Jianwen, Electric potential arising from a point-source near a cylinder in layered earth structures, *Exploration Geophysics*, in press, 2000.
- Yang, Jianwen, K. Latychev and R.N. Edwards, Numerical computation of hydrothermal fluid circulation in fractured earth structures, *Geophysical Journal International*, **135**, 627-649, 1998.
- Yang, Jianwen, Controlled source time-domain electromagnetic methods for seafloor conductivity mapping, *Chinese J. of Nonferrous Metals*, **8(4)**, 705-713, 1998.
- Yang, Jianwen, R.N. Edwards, J.W. Molson and E.A. Sudicky, Three-dimensional numerical simulation of the hydrothermal system within the TAG-like sulfide mound, *Geophysical Research Letters*, **23(23)**, 3475-3478, 1996.
- Yang, Jianwen, R.N. Edwards, J.W. Molson and E.A. Sudicky, Fracture-induced hydrothermal convection in the oceanic crust and the interpretation of heat-flow data, *Geophysical Research Letters*, **23(9)**, 929-932, 1996.

Conference Abstracts:

- Yang, Jianwen and J. McPhie, Influence of volcanic facies architecture on hydrothermal fluid migration, submitted to *Western Pacific Geophysics Meeting*, Tokyo, Japan, 2000.
- Yang, Jianwen, Numerical simulation of variable-density solute transport within discretely fractured earth structures, submitted to *The 4th International and 25th Annual Minerals Council of Australia Environmental Workshop*, Perth, Australia, 2000.
- Ross R. Large, Stuart W. Bull, David R. Cooke, Grant Garven, Peter J. McGoldrick, and Jianwen Yang, Ground selection for stratiform zinc deposits in North Australian Proterozoic Basins: sources, aquifers, seals, faults, traps and halos, submitted to *Geological Society of Australia Convention*, Sydney, Australia, 2000.
- Solomon, M. and Jianwen Yang, Hoburobu, Hellyer and Mount Lyell VHMS deposits differ because of variations in the permeability and rock-buffering capacity of deep footwall rocks, submitted to *Geological Society of Australia Convention*, Sydney, Australia, 2000.
- Ryan, M.P. and Jianwen Yang, On the convective colloidal transport of extremophilic microbes, submitted to *AGU Spring Meeting*, 2000.
- Yang, Jianwen and P.A. Pezard, The Effect of normal faults on hydrothermal fluid circulation and seafloor heat flow: example of the DSDP/ODP site 504, *EOS Trans. AGU*, **80**, 1999.
- Yang, Jianwen, Robina Sharpe and Ross Large, Numerical simulation of subseafloor hydrothermal fluid migration associated with the genesis of the Gossan Hill volcanic-hosted massive sulfide deposit, Australia, *EOS Trans. AGU*, **80**, 1999.
- Ryan, M.P. and Jianwen Yang, Fracture-dominated hydrothermal convection, *EOS Trans. AGU*, **80**, 1999 (invited).

- Ryan, M.P. and Jianwen Yang, The convective transport of extremophilic microbes in two- and three-dimensions: interacting biological, geological, and fluid physical property variables, *EOS Trans. AGU*, **80**, 1999.
- Yang, Jianwen and R.N. Edwards, A finite element algorithm for simulating groundwater flow, heat and contaminant transport in discretely fractured rocks, *The 23rd General Assembly of the European Geophysical Society*, Nice, France, 1998.
- Latychev, K., Jianwen Yang and R.N. Edwards, Three-dimensional modeling of Multi-component convection in porous medium, *Annual Meeting of CRESTech*, Toronto, Canada, 1998.
- Ryan, M.P. and Jianwen Yang, Development, function and three-dimensional structure of the subsurface hydrothermal biosphere: hydrothermal convection and the continuous transport of thermophilic and hyperthermophilic microbial life, *EOS Trans. AGU*, **79**, 1998.
- Ryan, M.P., F.W. Klein, J.R. Smith, Jianwen Yang, J.E. Nakata, K. Laurent and M. Hogan, Restless hydrothermal systems: Kilauea volcano and Loihi seamount, Hawaii, *EOS Trans. AGU*, **79**, 1998.
- Ryan, M.P. and Jianwen Yang, Life at low Reynolds number and high temperature: hydrothermal convection and development of folded habitats and compartmentalized community structure in the subsurface biosphere of mid-ocean ridges and basaltic rift-zone volcanoes, *EOS Trans. AGU*, **79**, 1998.
- Ryan, M.P. and Jianwen Yang, The structure of hydrothermal convection within centers of active volcanism: influences of internal structure and dynamic deformation patterns, *Materials Recycling Near Convergent Plate Boundaries*, Puerto Azul, Philippines, 1997.
- Ryan, M.P. and Jianwen Yang, Dike-forming intrusions and hydrothermal circulation in compartmentalized volcanic systems: evolutionary patterns in internal porous media convection and external heat flow, *EOS Trans. AGU*, **78**, 1997 (invited).
- Yang, Jianwen and R.N. Edwards, Numerical simulation of oceanic crustal hydrothermal system, *The 30th International Geological Congress*, Beijing, China, 1996 (invited).
- Ryan, M.P. and Jianwen Yang, The three-dimensional structure of basaltic rift zone hydrothermal convection systems, *EOS Trans. AGU*, **77**, 1996 (invited).
- Ryan, M.P. and Jianwen Yang, The hydrothermal convection system of Kilauea volcano, Hawaii, *EOS Trans. AGU*, **77**, 1996.
- Yang, Jianwen, R.N. Edwards, J.W. Molson, and E.A. Sudicky, Fracture-controlled hydrothermal convection in the oceanic crust, *EOS Trans. AGU*, **76**, 1995.

Publications by Clive Burrett (1995-2000) excluding abstracts

- Burrett, C.F., and R. Berry, Proterozoic Australia-western United States (AUWUS) fit between Laurentia and Australia, *Geology*, **28**, 103-106, 2000.
- Bendall, M.R., C.F. Burrett and H.J. Askin, Petroleum systems in Tasmania's frontier onshore basins, *APPEA Journal*, in press, 2000.
- Chaodumrong, P., and C.F. Burrett, Stratigraphy of the Lampang Group in central north Thailand. *CCOP Technical Bulletin*, **26**, 65-73, 1997.
- Chaodumrong, P. and C.F. Burrett, Early Triassic collision between Shan-Thai and Indochina terranes as indicated by occurrence of fan delta red beds, Pha Daeng Formation, central north Thailand, *Stratigraphy and Tectonic Evolution of*

- Southeast Asia and the South Pacific*, Department of Mineral Resources, Bangkok, Thailand, 143-157, 1997.
- Carey, S., C. Burrett, and P. Chaodumrong, Triassic and Permian conodonts from the Lampang and Ngao Groups northern Thailand, *Courier Forschung Institut Senckenburg*, **18**(2), 497-513, 1995.
- Burrett, C.F., Ordovician Gordon Group carbonates, Zeehan region Tasmania Australia-stratigraphy and paleoenvironments. Report to CRA exploration unpublished, 1995.

Publications by Dr Peter Haines (1995-2000) excluding abstracts

- Haines, P.W., Problematic fossils in the late Neoproterozoic Wonoka Formation, South Australia, *Precambrian Research*, **100**, 97-108, 2000.
- Carson, L.J., P.W. Haines, A.T. Brakel and B.A. Pietsch, Milingimbi, Northern Territory - 1:250 000 Geological Map Series, *Northern Territory Geological Survey and Australian Geological Survey Organisation (National Geoscience Mapping Accord)*, *Explanatory Notes*, SD 53-21, 1999.
- Haines, P.W., D.J. Rawlings, I.P. Sweet, B.A. Pietsch, K.A. Plumb, T.L.A. Madigan and A.A. Krassay, Blue Mud Bay, Northern Territory - 1:250 000 Geological Map Series, *Northern Territory Geological Survey and Australian Geological Survey Organisation (National Geoscience Mapping Accord)*, *Exp. Notes*, SD 53-7; 101 p, 1999.
- Sweet, I.P., A.T. Brakel, D.J. Rawlings, P.W. Haines, K.A. Plumb and A.S. Wygralak, Mount Marumba, Northern Territory - 1:250 000 Geological Map Series, *Northern Territory Geological Survey and Australian Geological Survey Organisation (National Geoscience Mapping Accord)*, *Exp. Notes*, SD 53-6; 84 p, 1999.
- Flöttmann, T., P.W. Haines, D. Cockshell and W.V. Preiss, Re-assessment of early Palaeozoic seismic stratigraphy of the Stansbury Basin (Gulf St Vincent, South Australia), *Australian Journal of Earth Science*, **45**, 547-557, 1998.
- Flöttmann, T., P.W. Haines, P. James, J.B. Jago, A.P. Belperio and J.C. Gum, Formation and reactivation of the Cambrian Kanmantoo trough, southeast Australia - implications for early Palaeozoic tectonics at eastern Gondwana's plate margin, *Journal of the Geological Society*, **155**, 525-539, 1998.
- Haines, P.W., The carbonaceous fossil *Chuarina* Walcott (Neoproterozoic) in the lower Wessel Group, Arafura Basin, northern Australia, *Alcheringa*, **22**, 1-8, 1998.
- Haines, P.W. and T. Flöttmann, The Delamerian Orogeny and potential foreland sedimentation: a review of age and stratigraphic constraints, *Australian Journal of Earth Science*, **45**, 559-570, 1998.
- Jago, J.B. and P.W. Haines, Recent radiometric dating of some Cambrian rocks in southern Australia: relevance to the Cambrian time scale, *Revista Espanola de Palaeontologia*, no. extr. Homenaje al Prof. Gonzalo Vidal, 115-122, 1998.
- Flöttmann, T., P.W. Haines, D. Cockshell and W.V. Preiss, An early Palaeozoic foreland basin succession beneath Gulf St Vincent, South Australia? - Implications for petroleum plays, *PESA Journal*, **25**, 33-40, 1997.
- Haines, P.W., Tool marks from ca. 1750 Ma, northern Australia: evidence for large drifting algal filaments?, *Geology*, **25**, 235-238, 1997.
- Jago, J.B. and P.W. Haines, Poorly preserved trilobites and brachiopods from the Kanmantoo Group, Fleurieu Peninsula, *Transactions of the Royal Society of South Australia*, **121**, 75-77, 1997.

Pietsch, B.A., D.J. Rawlings, P.W. Haines and M. Page, Groote Eylandt Region, Northern Territory - 1:250 000 Geological Map Series, *Northern Territory Geological Survey, Explanatory Notes*, SD 53-7,8,11,12, 32 p, 1997.

Rawlings, D.J., P.W. Haines, T.L.A. Madigan, B.A. Pietsch, I.P. Sweet, K.A. Plumb, A.A. Krassay and Z.U. Bajwah, Arnhem Bay/Gove - 1:250 000 Geological Map Series, *Northern Territory Geological Survey and Australian Geological Survey Organisation (National Geoscience Mapping Accord), Exp. Notes*, SD 53-3,4, 113 p, 1997.

Haines, P.W. Goyder impact structure, Arnhem Land, Northern Territory, AGSO *Journal of Australian Geology and Geophysics*, **16**, 561-566, 1996.

Progress on Other Closely Related ARC/DETYA Projects

No other closely related projects.



Auckland Institute
and Museum

Private Bag 92018
Auckland
New Zealand

Telephone
09-309 0443

Facsimile
09-379 9956

17 October 1996

REFERENCE FOR CATHERINE REID

Catherine Reid has worked full-time as a research assistant in the Marine Invertebrates and Geology Department at Auckland Museum for the past 7 months, during the period between finishing her MSc degree and starting her PhD. She also worked on several short-term contracts with us prior to this.

Catherine's position has been to assist with a Government-funded research project on the taxonomy, ecology and biogeography of New Zealand's shallow water modern foraminifera (Protozoa). During her time with us, she has participated fully in this research programme undertaking a wide variety of tasks requiring the usual range of skills of a fully-fledged research worker.

Her extensive computer skills have been particularly valuable in the compilation and manipulation of spread-sheet data, in the preparation of CorelDraw diagrams, maps and histograms to publication readiness, in writing sections of text for papers and in the preparation and compilation of publication-standard SEM plates using Photoshop.

Catherine's previous experience in the study of fossil foraminifera, as part of her MSc thesis, provided her with the background to quickly grasp the intricacies of the taxonomy of modern faunas. Thus her most outstanding contribution to our research programme has been in the identification of species and compilation of quantitative census data for our studies on their ecological distribution. She has also spent several months reviewing the current taxonomic identifications used for some of the more difficult groups of New Zealand Recent foraminifera to bring them into line with modern world nomenclature.

Catherine's work has always been careful and thorough and her skill level in taxonomy and scientific writing greatly surpasses that of most others so early in their careers. She is always cheerful and helpful and gets on extremely well with the wide diversity of people she encounters at the Museum. She is self-motivated requiring no supervision and works well in a research team situation. She also works well on her own undertaking parts of the programme allocated to her.

Catherine shows considerable promise of becoming a prominent research paleontologist in whatever area she decides to specialise in. I will be following her career achievements with interest in the years to come. I am certain that she will be a valuable member of any Geology Department or Research organisation that may employ her in the future. I would have no hesitation in offering her a job back here with us again should she so desire.

Your sincerely,

Dr Bruce W. Hayward

Curator of Marine Invertebrates and Geology

GREAT SOUTH LAND MINERALS LIMITED

ACN 068 650 386

Level 3 65 Murray Street

Hobart Tasmania 7000

Tel: (03) 6231 9339

Fax: (03) 6231 9338

e-mail: gslm@gslm.com.au

April 19th 2000

Letter of Support for SPIRT proposal Drs Yang, Burrett and Haines

We are very pleased to support strongly the attached SPIRT proposal Modelling of Petroleum Systems Onshore Tasmania.

Great South Land Minerals Limited (GSLM) has already obtained encouraging results from its stratigraphic drilling program, from geochemical analyses of oil seeps and from interpretations of AGSO's Tasmania Basin seismic line. Company specialists, with Dr Clive Burrett from the university, have recently written a summary of the petroleum systems in Tasmania which will be published next month in the APPEA Journal.

We now propose a continuation of this close collaboration with University of Tasmania geoscientists by allocating \$303,812.00 total in support of this proposal over the three years of the project. This support will consist of \$50,000 of in-kind support (4-wheel drive vehicle) and \$253,812.00 in cash (including 10% GST). The support for the project is contingent on the successful public float of GSLM during 2000. We expect the collaboration between the University of Tasmania and GSLM to extend well into the future.

The three PhD students and the post-doctoral fellow - Ms Catherine Reid, will be valuable additions to the exploration/R&D team by providing large amounts of ancillary data not normally acquired in a tightly focussed exploration program. Most importantly, though, they will synthesise the existing and soon-to-be-acquired data into an innovative, interactive computer model that will not only help in GSLM's immediate and future exploration and production activities but will also provide insights into basin processes worldwide. The methodology and model will themselves be a

saleable commodity which will be marketed jointly by GSLM and the University of Tasmania.

The varied expertise of the research team will be complemented by company geoscientists especially Mr Ian Reid and most actively Dr Henry Askin. The APAIs will be jointly supervised by Dr Askin who has 24 years experience as a successful explorationist with Shell. The APAIs will benefit by being involved in an active exploration program and from active positive contact with GSLM geoscientists. The university team has the experience to collect and synthesise the data and with Dr Jianwen Yang they have the ability to design and develop a valuable, innovative, interactive computer model of the petroleum systems of central Tasmania from the Ordovician to the Recent.

GSLM has produced a draft prospectus and is moving rapidly towards a \$15,000,000 public float and ASX listing. This is likely to take place before August 2000.

Yours sincerely

David Tanner, BE, MIEAust, CPEng, FAICD
Chief Executive Officer