

**KUTh Exploration Pty Ltd**

**FIRST ANNUAL REPORT  
Period ending 6 August 2007**

**SEL 26/2005**

**4 July 2007**

**1:250,000 map sheets**

Northeast  
Southeast

**Report #1**

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## ABSTRACT

SEL26/2005 was granted on 7 August 2006 to KUTh Exploration Pty Ltd for Category 6 minerals (geothermal substances). It is believed to be the first licence for geothermal exploration in Tasmania. The SEL covers 12,360 km<sup>2</sup>, and stretches from the mouth of the Tamar River in the north west, to Hobart in the south and St Mary's in the north-east.

The ground was selected on two main criteria.

- 1) The application of a 'hot dry rock' model for the generation of electricity to the buried extensions of outcropping thermally anomalous Devonian granites in eastern Tasmania; and
- 2) The possibility of using warm to hot geothermal waters from relatively shallow depth, for 'direct use' applications (such as building and space heating, agricultural and industrial drying).

Work conducted during the period included:

- Assembly of existing borehole thermal data for Tasmania (excluding underground drilling);
- Locating of approximately 150 existing mineral exploration drill holes >300m in vertical extent, which were to be used for down-hole thermometry work (see comment below);
- A gravity survey of the south-east of the tenement, in-filling in the existing dataset to a nominal 1km spacing.

Existing borehole thermal data confirmed the prospectivity of eastern Tasmania for geothermal resources. Heat flows measured at Storey's Creek and Coles Bay were particularly anomalous and those in the Midlands area well above the continental average.

Existing gravity modelling indicates that the sedimentary cover over the westwards extension of the granitoids is of the thickness necessary for electricity-generating quality geothermal resources.

The drill hole location exercise, although successfully locating the drill pads of a significant proportion of the 150 target holes, for the most part failed to find collar pipes in the holes and most of those that were located, were obviously blocked at shallow depths. Therefore the planned down-hole thermometry and rock conductivity work was not able to be done.

The gravity survey was incomplete at the end of the tenement year.

In the coming year, KUTh intends to:

- Complete the gravity survey and re-interpret the model of buried granites in the area;
- Undertake a magneto-telluric survey of the Tamar (electrical) Conductivity Zone, to better define this potential thermal fracture zone;
- Undertake a shallow (to 300m) slimline drill program across the tenement, to take heat flow and rock conductivity measurements, to better define the thermal map of the tenement.

## 1 INTRODUCTION

This report covers the work completed on SEL26/2005 for the year ending 6<sup>th</sup> August 2007, although the required report timing means that the gravity survey scheduled for July cannot be reported on.

The year's intended program was not able to be carried out fully due to our inability to locate sufficient numbers of existing minerals exploration holes that could be re-entered to do down hole thermometry work. Consequently KUTh will be drilling new holes in the coming year for this purpose (subject to MRT approval of the work program).

## 2 TENEMENT STATUS

SEL 26/2005 was granted in August 2006, for five years. It ranges from the mouth of the Tamar River, south to Hobart and north-east to St Marys. Numerous blocks are excluded from the overall tenement outline, including National Parks, Commonwealth land, a gas pipeline easement and numerous small historic and other features.

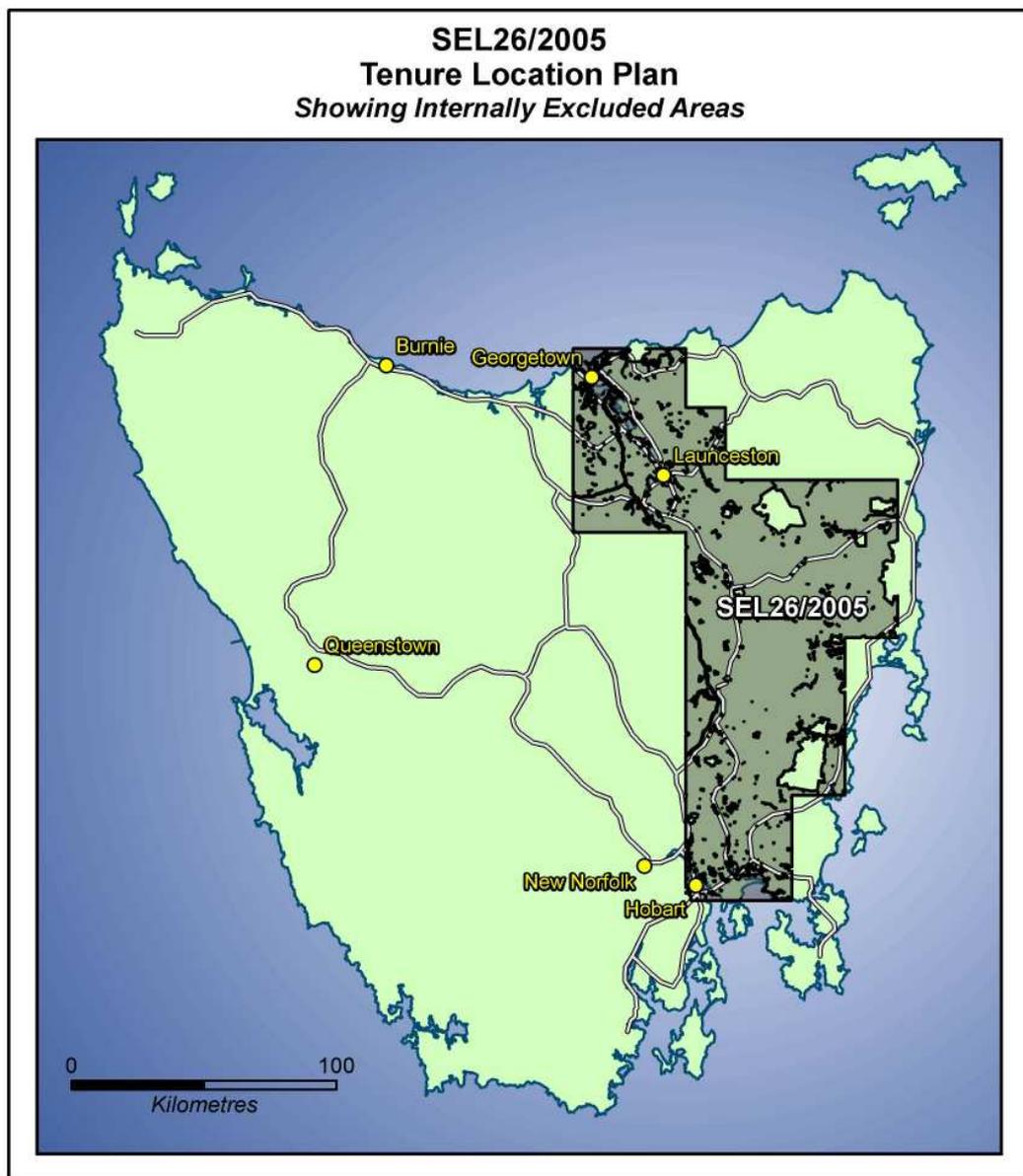


Figure 1. Tenement location

### 3 TOPOGRAPHY AND ACCESS

The SEL covers a substantial area of Tasmania, including metropolitan Hobart and Launceston. A number of highways traverse the area. Topography ranges from coastal and inland plains, to granite and doleritic ranges and tors.

### 4 GEOLOGY

The geology of eastern Tasmania has been well documented and will not be repeated in detail here. The relevant geology is the suite of Devonian granitoids which have intruded through Ordovician – Lower Devonian Mathinna Supergroup sediments, all or which have been mantled by Parmeener Supergroup sediments, which include coal measures.

The granitoids include a number of known thermally anomalous intrusions outcropping in the east, whilst the sedimentary cover is modelled to be between 0 and +6km thick over the granitoids as one progresses to the west.

KUTh’s basic model is that thermally anomalous granites will occur under the sedimentary cover. If the sedimentary cover is +3km thick, and has sufficient insulating qualities, then temperatures of +200°C may be achieved within the granitoid body, and this would be accessible by drilling.

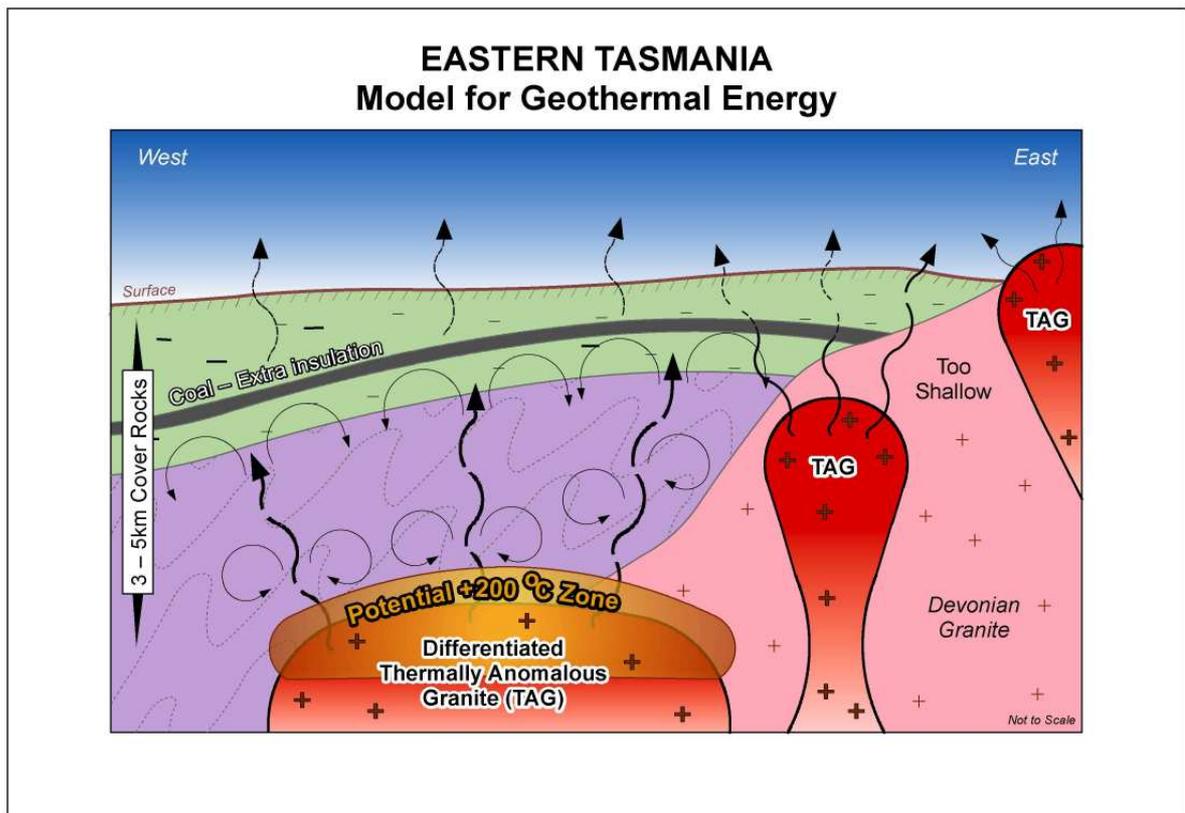


Figure 2. Model for geothermal energy in eastern Tasmania

## 5 GEOTHERMAL ENERGY

### 5.1 What is geothermal energy?

Put simply, geothermal energy is the energy stored and flowing as heat beneath the surface of the earth. This heat comes from two fundamental sources. Firstly, heat remaining from the original formation of the earth. This heat travels up through the thousands of kilometres of rock to the earth's crust, where it flows through the earth's surface. Secondly, there is heat generated locally within the earth's crust, from the natural decay of the radiogenic elements uranium, thorium and an isotope of potassium. These occur in almost all rocks, but in certain granitic bodies, they can be concentrated such that there is a marked elevation in the local surface heat flow. The average 'heat flow' through the earth's crust is about 87 milliWatts per square metre of the surface (87mW/m<sup>2</sup>) (Somerville et al 1994). The global heat flow is very large, approximately 44 teraWatts (1 teraWatt = 10<sup>12</sup> or a million million watts).

The amount of heat flow in the earth is not uniform. Beneath oceans, the average heat flow is about 101 mW/m<sup>2</sup> and beneath continents the value is about 65 mw/m<sup>2</sup>. However, there are areas within continents where the heat flow is very much larger due to either localised igneous activity or 'hot granites', and where this occurs, there is the potential for the geothermal energy to be harnessed to produce electricity, or to be used directly in heating and drying applications.

### 5.2 How much stored energy?

As the potential to utilise the energy stored as heat in the shallow earth's crust has become apparent, various agencies have begun to estimate the amount of energy that may be accessible.

A recent report by the Massachusetts Institute of Technology, looking at energy stored in rocks between 3 and 10km deep in the USA, estimated 13.3 million exaJoules (1EJ = 10<sup>18</sup> Joules = 277 million megaWatt hours) of conduction-dominated 'Enhanced Geothermal System' (EGS) resource in crystalline basement rock formations. This greatly exceeded the energy stored in other heat systems, such as volcanic and 'hot springs' types of areas and is 13,000 times the consumption of primary energy in the United States in 2005 (MIT, 2007). Of course the economically extractable amount will be much lower. The study attempted to estimate a recoverable EGS resource and if only 2% of the total resource was recoverable, it was found that this would amount to approximately 280,000 exaJoules (78 million million MWh) or 2,800 times the 2005 US energy consumption.

A similarly detailed study has not been done for Australia, but preliminary figures from Geoscience Australia estimate that Australia's hot rock energy between the depth corresponding to a minimum temperature of 150°C and a maximum depth of 5,000 m is approximately 1.2 million exaJoules (333 million million MWh) or 20,000 years of Australia's primary energy use in 2005; again this is an estimated total resource figure and not an estimate of recoverable or economic energy (Goldstein *et al* in prep.). This resource figure is currently under review.

### 5.3 Producing electricity from geothermal energy

One of the most attractive uses for geothermal energy is to convert it into electricity. This was first done at Larderello, Italy in 1904 using steam from a natural geothermal field. Since that time, harnessing of steam and hot water at or close to the surface for electricity has been undertaken at many locations throughout the world, including California, New Zealand, Iceland, Indonesia, Mexico and the Philippines. The installed world generating capacity of

this type of generation is nearly 10,000MWe (MIT, 2007). These projects have mostly tapped thermal resources associated with recent igneous and volcanic activity.

Electricity can also be generated from geothermal waters that are not boiling at the surface. Sub surface aquifers in rocks can contain water heated from below or laterally, but perhaps only to temperatures much less than 100°C. These aquifers can be drilled into, and the heated waters pumped to the surface and the heat used to generate electricity, albeit at lower efficiency than the surface boiling waters mentioned above.

Although common around the world, the only geothermal energy currently being generated in Australia is from a small binary power station at Birdsville, Queensland, which uses hot water sourced from the Great Artesian Basin flowing at 98°C and is rated at 120kW (Goldstein *et al* in prep.). Although the resource has not been explored extensively, there is no real shortage in Australia of such hot artesian waters which might be utilised to generate electricity. The reason for the lack of development is probably due to the abundant alternative sources of energy and the relative low efficiency, using current technology, of producing power from lower temperature waters.

The oil price shocks of the 1970s stimulated research in the United States and elsewhere on a possible third source of geothermal energy to produce electricity. Certain granitic bodies are well known to contain higher than average concentrations of the radiogenic elements and isotopes of potassium (K) uranium (U) and thorium (Th) and consequently, these bodies produced heat flows well in excess of the continental average. It was reasoned that if such bodies were covered by a thickness of insulating cover rocks, trapping the heat, then there may be a large reservoir of very hot rocks accessible by drilling. If this heat reservoir was found or was made to be permeable, it could act as a heater for waters injected down one drill hole and the super heated water could be extracted from an adjacent drill hole. The very hot water would then be used to generate electricity at high efficiency, and then re-injected back down again, to be re-heated. Such a system has become known by a variety of terms, including 'hot dry rocks' (HDR), 'enhanced geothermal systems' (EGS) and 'enhanced geothermal power' (EGP). KUTh Energy prefers the latter term, as it describes the need to enhance the natural setting in order to produce electricity.

#### **5.4 Engineered Geothermal Power (EGP)**

The EGP process can be summarised as follows:

- Identification of an area of high heat flow, usually caused by a thermally anomalous granitic body, with the granite insulated by thick sedimentary or other rock cover;
- Detailed heat flow measurements and modelling to establish the deep heat reservoir as being probably hot enough to support efficient electricity generation;
- Drill down into the heat reservoir; this may be through 3+km of cover rocks and 1+km into the granite (at present 5km is the limit of drilling technology);
- Stimulate or enhance the permeability of fractures within the granite by pumping water at very high pressures into the granite. This is technology adapted from the oil industry;
- Drill a second hole into the enhanced fracture system and demonstrate connectivity and adequate heat exchange and fluid flow between the two holes;
- Drill a third hole into the fracture system to complete a circuit whereby the original hole acts as the cool water injection hole and the other two holes act as extraction holes for super heated water. The hot water is put through a heat exchanger and the heated second fluid used to drive a turbine to generate electricity. The original water, having lost most of its heat, is re-injected down the first hole to repeat the

cycle. Flow directions and pressures are maintained such that little water is lost underground.

EGP was first investigated in the United States in the early 1970s at Fenton Hill, New Mexico. This site was chosen in part because of known high (approx 200°C) rock temperatures at relatively shallow depths (approx 3km). The heat reservoir was drilled into at two locations almost 100m apart and water circulated between them, passing through the hot rocks. Almost 5 GWh of energy was produced during the test work, using a 60kW binary fluid turbine generator (MIT, 2007). A key finding of the Fenton Hill and other research in the 1980s was that the enhancement of the permeability of the heat reservoir (done though pumping water into the reservoir at high pressure – a technique from the oil industry) was mainly done via the activation of existing naturally occurring fracture, rather than the artificial creation of a new fracture set.

The work at Fenton Hill to 3,000m depth was followed by Phase II work there, and this research deepened the reach of suitable drilling technologies to beyond 4,000m. By the time it concluded in the early 1990s, the Fenton Hill work showed that drilling (including directional drilling) can achieve depths beyond 4,000m; that this drilling can be controlled and directed in rocks +200°C; that reservoirs can be hydraulically stimulated to produce permeable fracture networks, and that circulation and heat exchange can occur over extended periods to produce electricity (MIT, 2007).

Fenton Hill was followed by the Rosemanowes project in Cornwall and several in continental Europe through the 1980s. In the 1990s drilling commenced at Soultz in France. Several holes here eventually reached 5,000m depth and hydraulic pressurisation again demonstrated that natural fracture networks can be stimulated and enhanced. The Soultz project is on-going.

EGP type geothermal has been embraced enthusiastically in Australia. An early study by Somerville et al (1994) was a “hot dry rock feasibility study” which assessed Australia’s HDR geothermal energy resource and the technical and economic factors involved in hot dry rock energy development. The analysis (which focussed on resources in the Great Artesian Basin) showed that the prospects for HDR development in Australia were favourable in terms of the scale of the resource, the efficiency with which the resource could be exploited and the cost of developing the resource.

Geodynamics Limited have been operating at their ‘Habanero’ project in the Cooper Basin, South Australia for several years and theirs is the most advanced EGP project in Australia. Reported findings of an initial concept study include:

- Large scale hot rock geothermal power development may be Australia’s most economic option for generating zero or low emission base-load power;
- Well spacing can be increased from the original assumptions of 500m to between 500m and 1,00m with greatly improved economics and project life;
- The economic life of an HFR power development is expected to be over 50 years;
- Temperature is clearly the most significant economic driver. (Geodynamics Limited, 2002).

Geodynamics drilled their first well to 4,421 m (including 753m in granite with a 6” diameter hole) in 2003. This encountered a fractured, brine saturated system, which was a surprise over the dry rock that was expected. The well was stimulated over several phases and an enhanced fracture system acoustically mapped over 4km<sup>2</sup>. A second well, drilled in 2006 encountered some mechanical problems resulting in the need to drill a side-track hole, which was successful but a dropped plug resulted in the hole not being able to perform the

expected test work. However some circulation was achieved between the first and second drill hole (MIT, 2007). Geodynamics have recently purchased a dedicated deep drilling rig and have announced that the drilling of their third well will occur in 2007.

Although there is no commercial electricity production for an EGP project, on-going work at Habanero and also at Soultz in France indicates that the individual technologies of target selection, deep drilling, reservoir stimulation, sustainable circulation and power generation from hot waters returned to surface should be able to be brought together technically. With appropriate connecting infrastructure and a suitable energy pricing regime, the resultant electricity should find attractive markets.

### **5.5 Direct use geothermal**

Mankind has made use of geothermal energy, expressed through surface warm to hot waters, for thousands of years, including for bathing and heating. Today, conventional drilling technology allows us to tap into suitable aquifers and draw the warm to hot waters to the surface at points where they can be put to domestic or industrial uses. Such uses include building and space heating, air conditioning, drying of agricultural crops, drying in industrial applications and other industrial processes.

Using geothermal energy as a substitute for electricity allows the conservation of electricity and hence the lessening of pollutants associated with the generation of that electricity, such as carbon dioxide.

Low to medium geothermal energy is being used on a modest scale in Australia at the moment, including the heating of swimming pools and the heating of the Geoscience Australia building in Canberra. Again, KUTh believes that the use of such geothermal resources in Australia has not been exploited to the degree possible, due to cheap alternative sources of power, but this situation will not continue due to increasing energy costs and concerns over carbon emissions.

## **6 GEOTHERMAL POTENTIAL OF TASMANIA – PREVIOUS WORK**

### **6.1 Hydrocarbon drilling**

A major problem in formulating a very detailed survey of the geothermal potential of Tasmania is the paucity of deep geological information in Tasmania. While there are deep oil holes in the offshore basins, the deepest onshore hole in Tasmania is the Shittim #1 hole on north Bruny Island which passes through the sediments and dolerites of the Tasmania Basin for 1,568m before passing into slate/phyllite/marble basement, with a total depth of 1,635m.

### **6.2 MRT drilling and gravity field**

MRT has drilled most of the other holes to about or over 1km to investigate stratigraphy. Notable are holes at Coles Bay in granite, at Tunbridge through the Tasmania Basin and at Stanley through Cambrian Volcanics.

The positions of granites are important. Leaman & Richardson (2003) have produced an image of the gravity field in Tasmania This they interpreted to give an estimate of the depth to the top of the granites which is the best estimate available at present. Tradeoffs between denser dolerite and lighter sediments may result in inaccuracies in these depth estimates.

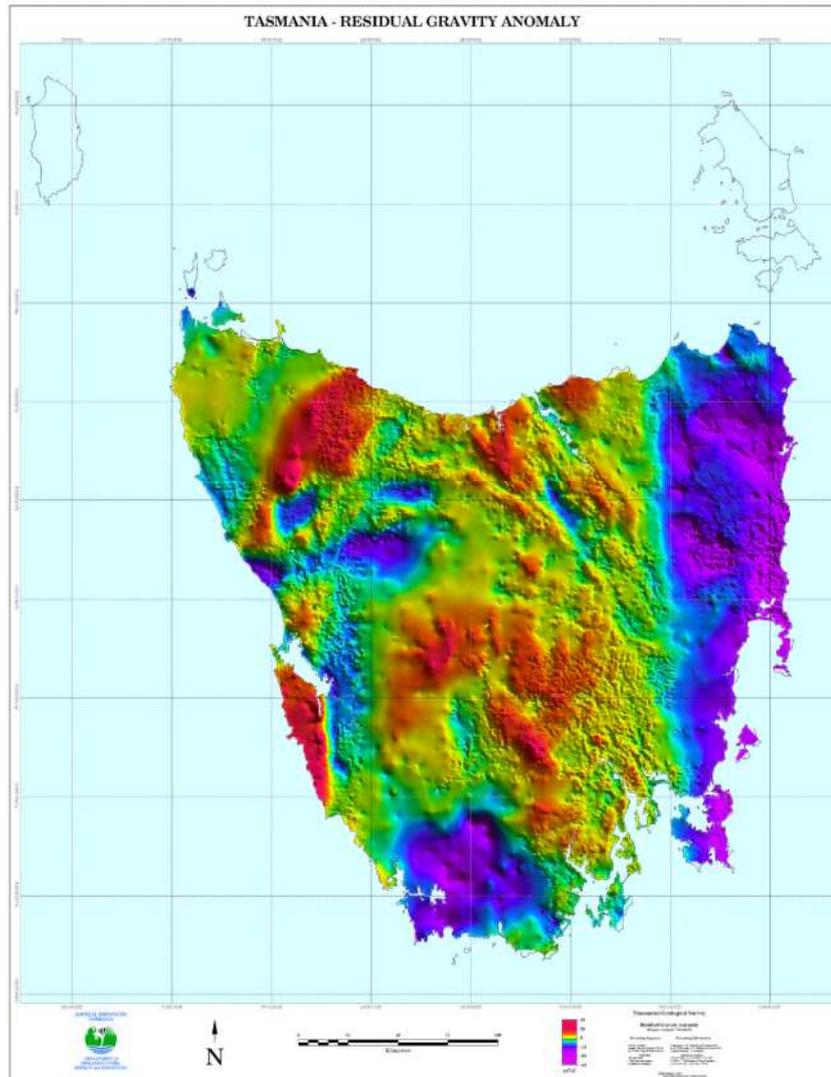


Figure 3 Residual gravity field, from Leaman & Richardson, 2003

### 6.3 MRT scintillometer work

Collins et al (1981) conducted a scintillometer survey of outcropping granites in Tasmania which gives estimates of the uranium, thorium and potassium(K40) contents of the granites. This allows a calculation of heat production in the granites. They demonstrated that the granites associated with tin/tungsten mineralization have high concentrations of these radioactive elements with consequent high heat production i.e. they are TAGs. The Coles Bay borehole was sited in a hot granite with very high heat production. Such radiometrically hot granites would be good sources for HDR if sufficiently insulated by cover rocks. Without cover they afford a geothermal gradient of some 30°C/km.

### 6.4 Borehole heat flow measurements

Starting in the early 1950's and continuing through the 1970's heat flow measurements were made in Tasmanian boreholes. The results are shown in Table 1. The heat flux is, with the exception of Olga Ridge (a site probably unsuited to such measurements), at least 80mW/m<sup>2</sup> which is much higher than which might be reasonably expected. At Storeys Creek and Coles Bay, sites with hot granites, the heat fluxes are significantly higher again reaching 159mW/m<sup>2</sup> at Storeys Creek.

Table 1. Borehole heat flow measurements

LOCALITY	Hole ID East	North	Hole Depth m	Heat Flux mWm <sup>-2</sup>	Thermal Conductivity Wm <sup>-1</sup> °C <sup>-1</sup>	Thermal Gradient °C/km	Spot Temp °C@m
Glenorchy <sup>W</sup>	Glen-1 520900	5256200	614	87	2.30°± 3%	40.4±0.5%	
Storeys Creek <sup>J</sup>	SC4 560780 #	5390368		159	5.11	30.8	
Coles Bay <sup>G</sup>	ColesBay-1 606451	5336888	1008	102.3 -93	2.87-3.87	29	37@830
Tunbridge <sup>G</sup>	RG-145 524510	5334875	914		1-2	41	45@780
Stanley <sup>N</sup>	Stanley-DOM1 352738	5480111	1000		3-4	27.8	36@830
Great Lake <sup>N</sup>	DDH5001 488400 #	5369450	320	85.4	1.98	43.2	21@315
Great Lake <sup>J</sup>	DDH5084 DDH 5154			83.7	2.27	33.8	
Dee Tunnel <sup>N</sup>	DDH7005 462000 #	5323300	96	86.2	2.02	42.7	12@96
Roseberry <sup>N</sup>	EZ 48R EZ 52R 379600	5374360	209 274	104.9	3.62	29	17.8@209 17.2@274
Olga Ridge <sup>W</sup>	400450	5264400	1100	57	2.80°± 16%	18.4±2%	
Notes: Geothermal Gradient is an average. Units and coordinates have been converted.							
+ minimum value							
# estimated position. The DDH holes are from the Hydro Electric Commission, The EZ holes from the Electrolytic Zinc Co. and exact locations may be available on more extensive search							
* These are likely ranges. Determinations were to be made after publication but the results cannot be found in MRT and we have been unable to locate the author.							
<sup>G</sup> Green, D.C. (1989).							
<sup>J</sup> Jaeger, J.C. & Sass, J.H. (1963)							
<sup>N</sup> Newstead, G. & Beck, A. (1953)							
<sup>W</sup> Wronski, E.B. (1977)							

## 6.5 Interpretation and discussion

The source of the high heat flow in Tasmania is enigmatic but several possibilities are:

- Hot granites are widespread at depth. R.G. Richardson of MRT (pers. comm. To R Lewis) considers this unlikely but it remains a possibility with the mapped granite topography representing only the higher parts of a larger mass.
- The basement rocks in Tasmania are enriched in radioactive elements producing a regional thermal anomaly as observed around Olympic Dam in South Australia. There is no evidence whatsoever to support this in the form of rocks with enhanced radiation levels.
- There is evidence for a Cretaceous thermal event in Tasmania probably associated with extensional events in the separation of Australia and Antarctica. Syenites were intruded at this time. There was also the intrusion of the Jurassic dolerites and volcanic activity in the middle Tertiary. All these events indicate an extensional environment. The mantle may still be anomalously hot under Tasmania. Extensional basins may have anomalous temperatures from hot mantle rocks for hundreds of millions of years after extension (Zhang, 1993).

- d) The South Australian thermal Anomaly is associated with the Central Australian Conductivity Anomaly, a little understood zone of enhanced electrical conductivity. There is a similar conductivity structure along the Tamar Valley and to the south which may be something similar. Perhaps these phenomena are associated with higher heat flow.

But the actual source is not critical here, only the existence of the high heat flow is important. Given we have high heat flows, hot granites and assorted cover rocks what are the Hot Dry Rock possibilities? They are outlined in the schematics below (Figure 4). The conclusion is that it is reasonable to expect temperatures in the range 190-270 °C provided the pre Permian sediments are of similar conductivity to the Tasmania Basin materials. Case B in Figure 4 is the optimum target.



Figure 4. Possible thermal profiles for Tasmania. There are two groups: the first is sourced by a granite producing typical Tasmanian heat flux of 80mWm<sup>-2</sup>. The second has a hot granite producing ~120mWm<sup>-2</sup> through the same types of rocks. Case E postulates porous material near the top of a granite acting as a heat exchanger. Note that the 'Tas Basin/Seds' package contains coal measures.

## 7 WORK PROGRAM

### 7.1 Data Compilation

KUTh compiled the previous geothermal heat flow and thermal gradient from a variety of sources, and this is tabulated in the discussion above.

### 7.2 Minerals boreholes and down-hole thermometry work

Due to the lack of thermal data from hydrocarbon exploration, a major component of KUTh's first year exploration program was to use existing minerals exploration drill holes, deeper than 300m vertical depth, and drilled since 1970, for down hole thermometry work and corresponding rock conductivity measurements from core stored in the MRT core library. KUTh engaged Professor Jim Cull of Monash University to undertake the thermal work..

Locations and parameters of the target holes were downloaded from the MRT DORIS database and open file reports on these holes consulted where available. Current EL and

ML holders were also consulted about the availability of suitable drill holes on their tenements, which would not be visible on the MRT open file.

The locations of the holes were attempted to be found using GPS using the previously recorded co-ordinates. It was recognised that some of the reported co-ordinates may be wrong or just an estimate, and that a number of the hole collars would have disappeared either through rehabilitation, clearance due to agricultural activities, or through vegetation re-growth. Further, it was recognised that even if a hole collar was located, in many cases the hole itself would probably have collapsed. However, even though most drill locations actually sought out were located (evidence of drill pad, at least), very few actual collars were located to indicate that the hole would be accessible. Also, within this limited number, abundant evidence of hole collapse was found, further reducing the applicable holes.

In view of this lack of success, it was decided to not to proceed with the planned down-hole thermometry and rock conductivity work, as obtaining just a few results would not be meaningful. It was recognised that KUTh will have to drill new holes across its lease in order to obtain this basic data set (see below).

A report on the drill hole location exercise is presented in Appendix 1.

### **7.3 Gravity survey**

In consultation with Dr David Leaman, it was decided to in-fill the existing state-wide gravity database in an area in the south-east of the tenement, on a nominal 1km spacing. The area to be surveyed is approximately from the east coast westwards to a line drawn between Lake Leake and Sorell.

This work will be planned and supervised by Dr Leaman and is scheduled to be well underway within the last month of the tenement year (July), unfortunately postdating the submission of this report. Details and results will therefore be reported in the Year 2 Annual Report.

## **8 PROPOSED WORK**

The following work program is scheduled to be undertaken in Year 2 of the SEL:

### **Gravity survey**

The gravity survey commenced in the final month of the first year will be completed, interpreted and merged with the existing state wide gravity data set. This work will in-fill the gravity coverage of the south-east of the SEL and adjacent areas to a nominal 1 km spacing. Based on quotes from the contractor, the survey is expected to cost about \$47,000 overall, mainly in Year 1. Interpretation etc in Year 2 is expected to cost approximately **\$10,000**.

### **Magneto-tellurics**

A magneto-telluric survey will be conducted across the Tamar Conductivity Zone and possibly some other areas. MT is used to measure deep electrical conductivity in the earth. High temperatures are associated with better electrical conductivity and conductivity variations between different rock types can yield structural information. KUTh will use MT to better evaluate the TCZ as a target and look for zones which may reflect higher temperatures in other parts of the tenement. Based on an indicative quote from a contractor, a 100 station MT survey may cost in the order of **\$150,000**.

## Shallow drilling

The major part of the exploration effort in Year 2 will be a shallow drilling program across the SEL in order to take heat flow measurements and rock conductivity readings. This in part replaces the measurements planned in existing minerals drill holes, that was not able to be undertaken in Year 1 and will be the first systematic measurement of heat flow across a substantial part of Tasmania. It should be noted that this form of drilling is no different from conventional 'minerals' type drilling and will not intersect any 'hot rocks' or fluids under pressure.

KUTh has taken the advice of specialist geothermal consultants Hot Dry Rocks Pty Ltd as to the required parameters for a drilling program which would yield a useful thermal map of the tenement. Their advice is a program on a 20km x 20km spacing across the tenement, with in-fill to 10km x 10km in areas of interest, with vertical holes 300m deep, cored from 150m with heat flow and rock conductivity measured through the cored sections.

Such a program would involve approximately 35 holes for 5,200m each of percussion and diamond drilling, plus costs for the thermal measurements, a very substantial program and cost. Whilst it is likely that the entire program will be undertaken, given the pioneering nature of this work, KUTh proposes to commit initially to the wider spaced program, involving perhaps 20 holes and an expenditure of approximately \$650,000, with thermal measurements costing another \$40,000 (contractor quotes). Total expected cost of this work **\$690,000**.

The drilling program is of course subject to gaining approval from MRT for the work program and the availability of drill rigs. KUTh has had discussions with contractors and understands a percussion rig for the upper part of the holes should be available in the second half of 2007.

The above work is expected to cost a minimum of \$850,000 if able to be implemented in full and will address the entire SEL.

The geophysical works are expected to have minimal environmental impact. The shallow drilling program will be conducted via a program submitted to MRT for approval. Notwithstanding that this type of drilling is little different from mineral exploration type shallow drilling, as discussed with MRT officers, the work proposal will pro-actively address risks anticipated in the program and where necessary, state how those risks will be mitigated. Environmental impacts will be kept to the minimum possible for the type of work. Rehabilitation of drill sites will occur in line with current good practice.

## 9 ENVIRONMENTAL

No ground disturbing activities were conducted on the licence during Year 1.

## 10 EXPENDITURE STATEMENT

Expenditure for the 11 months ending 6 July 2007 was:

Geology	33,550
Geophysics	<u>23,588</u>
Subtotal	<u>57,138</u>
Administration @ 10%	<u>5,714</u>
<b>TOTAL</b>	<b><u>62,852</u></b>

As mentioned above, a gravity survey is scheduled to be undertaken during July/August 2007 (contractor booked), mostly within the first year of the licence but after the submission of this report. The survey has been quoted to cost approximately \$47,000 with perhaps \$10,000 processing and interpretation costs. The shortfall in Year 1 expenditure is expected to be more than made up in Year 2 expenditure.

## 11 REFERENCES

- Collins, P.L.F., Wyatt, B.W. & Yeates, A.N. , 1981, A gamma ray spectrometer and magnetic susceptibility survey of Tasmanian granitoids, *MRT unpublished report 1981/41*.
- Geodynamics Limited, 2002, Prospectus
- Goldstein, B., Hill, A., Budd, A and Malavazos, M. *in prep*. Hot rocks in Australia – National Outlook
- Green, D.C., 1989, Heat Flow and Heat Production in Tasmania in *Geology & Mineral Resources of Tasmania*, 461-463 ed Burrett, C.F., & Martin, E.L., Geological Society of Australia Inc. Special Publication 15.
- Jaeger, J.C. & Sass, J.H., 1963, Lee's topographic correction in heat flow and the geothermal flux in Tasmania, *Geophys. Pura. Appl.*, 54, 53-63.
- Leaman, D.E. & Richardson, R.G., 2003, A geophysical model of the major Tasmanian granitoids, *Tasmanian Geological Survey Record 2003/11*.
- Massachusetts Institute of Technology, 2007, *The Future of Geothermal Energy. Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21<sup>st</sup> Century*
- Newstead, G. & Beck, A., 1953, Borehole temperature measuring equipment and the geothermal flux in Tasmania, *Aust. J. Phys.*, 6, 480-489.
- Somerville, M., Wyborn, D., Chopra, P., Rahman, S., Estrella, D. and Van der Meulen, T., 1994, Hot Dry Rock Feasibility Study Earth Research Development Corporation Report 243
- Wronski, E.B., 1977, Two heat flow values for Tasmania, *Geophys. J. R. Astr. Soc.*, 48, 131-133.
- Zhang, Y.K., 1993, The thermal blanketing effects of sediments on the rate and amount of subsidence in sedimentary basins formed by extension, *Tectonophysics*, 218, 297-308.

## 12 KEYWORDS

geothermal exploration  
engineered geothermal power  
hot rocks  
thermally anomalous granite  
deep drilling  
gravity  
heat flow  
rock conductivity  
radiometrics

## Appendix 1

### Drill hole location exercise