

**Annual Report**  
**for EL40/2008 East Lisle**  
**for the Period 13 January 2010 to 12 January 2011**

**Author: P W ASKINS**

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## **ABSTRACT**

EL40/2008 East Lisle is located 25km north-east of Launceston in north-east Tasmania and covers part of the historical Lisle Goldfield. The company's main focus is exploration for gold.

Work completed during the period comprised compilation and assessment of analyses from previous field sampling, a review of historical mining, review of previous investigations, development of geological models for the alluvial and bedrock gold mineralisation, a review of prospectivity, generation of targets, and recommendations for future exploration.

All of the gold production from Lisle, about 8 tonnes, was from alluvial deposits and the bedrock source has never been found.

This study concluded that the bulk of the alluvial gold at Lisle occurs in a paleochannel, here named the Donnelly Paleochannel.

The appropriate district model for mineralisation in basement was found to be IRGS type (Intrusive Related Gold Systems), and specifically basement gold mineralisation was assessed to be disseminated in granodiorite or in sheeted veins with low sulphide content and associated with magnetite destructive sericitic alteration.

Exploration in the past has been hampered by extensive talus cover.

Targets for future recommended drilling were generated in areas of gold geochemical anomalies, especially plant ash anomalies found in a previous MRT survey, and areas of postulated alteration reflected in low magnetic tenor zones in the otherwise higher tenor phase of the granodiorite.

## KEYWORDS

Lisle basin  
Geology  
Mineralisation  
Alteration  
Granodiorite  
Mathinna Group  
Gold  
Mining History  
Deposits/Occurrences  
Production  
Alluvial  
Paleochannel  
Neotectonics  
IRGS (Intrusion Related Gold Systems) Model  
Exploration Targets

## SUMMARY OF ACTIVITIES FOR EL40/2008 EAST LISLE FOR THE PERIOD 13 JANUARY 2010 TO 12 JANUARY 2011

- Compilation and Review of analyses from Previous Field Sampling
- review of historical mining,
- review of previous investigations,
- development of geological models for the alluvial and bedrock gold mineralisation,
- review of prospectivity,
- generation of targets, and recommendations for future exploration.

## CO-ORDINATES

All lat/long co-ordinates in this report refer to the GDA94 Datum, unless stated otherwise

All AMG co-ordinates in this report refer to the GDA94 - Zone55, unless stated otherwise

## FILE SUMMARY LIST

File name	Format	Contents
el402008_2011_01_report.pdf	pdf	Annual Report
el402008_2011_02_figs.pdf	pdf	Figures 1 to 13
el402008_2011_03_figs.pdf	pdf	Figures 14 to 18
el402008_2011_04_figs.pdf	pdf	Figures 19 to 27
el402008_2011_05_appendix 1.pdf	pdf	Appendix 1
el402008_2011_06_appendix 2.pdf	pdf	Appendix 2
el402008_2011_07_analyses.txt	txt	Sample analyses
el402008_2011_08_index.pdf	pdf	Exploration Index Map

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## **APPENDIX 2 - UNPUBLISHED REPORTS FROM LAUNCESTON CITY LIBRARY, PART 2 (separate pdf files).**

## **1.0 INTRODUCTION**

This report describes the exploration activities completed within EL40/2008 during the period 13 January 2010 to 12 January 2011. The tenement is located 25km north-east of Launceston in north-east Tasmania.

The tenement covers part of the historical Lisle Goldfield. The Lisle goldfield has produced an estimated 250,000 ounces of gold, nearly all of it alluvial gold. A large amount of prospecting work was carried out by miners in the 1880s with the aim of finding the source of the gold at Lisle. With the exception of a few thin quartz veins, both within the granodiorite bedrock and the adjacent Mathinna Beds, no source of the detrital gold was discovered. Comparatively little modern exploration to determine the source of gold has since been done.

The company's main focus is exploration for gold, especially in bedrock.

Work completed during the period comprised compilation and review of analyses from previous field sampling, and a review of prospectivity.

Recommendations for further exploration of target areas, including drill testing, are presented here.

## 2.0 TENEMENT DETAILS

EL40/2008 East Lisle was applied for by Greatland Pty Ltd during May 2008 and was granted during January 2009. A variation in licence area was approved in June 2009. The tenement now covers an area of some 225 square kilometres.

Table 1 – Tenement Details

<b>Tenement</b>	<b>Holder</b>	<b>Date Applied</b>	<b>Date Granted</b>	<b>Size</b>
EL40/2008 East Lisle	Greatland Pty Ltd 100%	20 May 2008	13 Jan 2009	225km <sup>2</sup>

### **3.0 LOCATION AND ACCESS**

EL40/2008 East Lisle is located 25km north-east of Launceston in north-east Tasmania (Figure 1). The tenement forms the Company's East Lisle project.

The bulk of land within the tenement is logged state forest and timber plantation, with minor areas covering private farming land.

The project lies within the Tasmania NE (SK55-21) 1:250,000 map sheet, and the 1:100,000 map sheet of St Patricks (8315).

From Launceston, access to the project area is by sealed road to Targa. Formed local roads and logging tracks provide good access within the project area.

#### **4.0 WORK DONE DURING THE REPORT PERIOD**

Work done by Greatland during the period consisted of a compilation and review of previous literature and investigations, compilation and review of analyses from field sampling in the prior report period, assessment of prospectivity, and generation of exploration targets.

This included:

- Obtaining off the MRT website all prior departmental reports and open file company reports covering the Lisle and nearby goldfields.
- Visiting the Launceston City Library to research the past mining history at Lisle. Some unpublished data was obtained.
- Obtaining all MRT geophysical datasets for the region, including magnetics, gravity, radiometrics and DEM.
- Processing geophysical datasets, and reviewing for clues to aid prospectivity.
- Reviewing the mining history so as to determine nature of the mineralisation and help with modelling and exploration targeting.
- Reviewing all past investigations.
- Compile and assess analyses received of samples of granodiorite and alluvial wash collected in the previous period.
- Report on prior field visit, which included assessment of the degree of rock and mineralisation exposures, and any visible alteration.
- Develop mineralisation models for both gold in alluvial deposits and in basement.
- Generate targets for future exploration.
- Recommendations for future work.

## 5.0 GEOLOGICAL SETTING

A number of historical gold mining areas occur within the region (Roach, 1992). These include the Lisle Goldfield, and to the north outside the Tenement are the Cradle Creek, Lone Star, Golconda, Panama, Denison and Lebrina goldfields, Figs 2, 3.

Regionally gold mineralisation has a close spatial association with small cupolas of granodiorite, which is geochemically distinct from the bulk of the Devonian Scottsdale Batholith to the east. The granodiorite cupolas are not dated and are assumed to be of Devonian age also. The cupolas intrude into Mathinna Beds, a thick, poorly-documented succession of regionally metamorphosed turbiditic sediments of presumed Siluro-Devonian age.

Granodiorite was exposed by mining activities in the Lisle, Golconda, Panama and Lone Star goldfields. The outcropping areas of granodiorite are interpreted to be the apical regions of a larger subsurface body, the extent of which is roughly delineated by the extent of the mapped area of hornfels. In terms of Rb and Sr the Lisle granodiorites are the least fractionated of the Tasmanian Devonian Granitoids.

A particularly prominent feature of the intrusions is their surface expression. Marked topographic depressions occur in all areas where the granodiorite is exposed. Hornfels within the contact aureole of the intrusion are resistant to both chemical and mechanical weathering, while the granodiorite is very highly weathered, is soft and is consequently eroded. The largest of these topographic depressions is associated with the intrusion at Lisle (Figure 3). Here the resultant crater-like feature has dimensions of approximately 4km x 5km and a depth of up to 350m. The slopes on the flanks of the depression are steep, and considerable thicknesses of talus have been shed from the enclosing ridges into the basin, the floor of which is flat or gently undulating. The single hydrological outlet from the Lisle valley is to the north through a gorge.

The smaller intrusions, such as at Panama or Golconda, display the same basic form as the intrusion at Lisle.

Tertiary basalt flows are present as erosional remnants outside the Lisle Valley.

Quaternary deposits include alluvial and colluvial valley-fill.

The Lisle goldfield has produced an estimated 250,000 ounces of gold, nearly all of it alluvial gold. A large amount of prospecting work was carried out by miners in the 1880s with the aim of finding the source of the gold at Lisle. With the exception of a few thin quartz veins, both within the granodiorite and the adjacent Mathinna Beds, no source of the detrital gold was discovered.

## **6.0 MINING HISTORY and PRODUCTION AREAS**

### **Sources of Information**

The following references were consulted:

Bessell, no date

Bottrill, 1986, 1994, 1996a, 1996b, 2010

Bottrill et al, 1994

Coroneos, 1995

Dickens, 1991

Edwards, 1952

Holmes, no date

Marshall, 1969

Montgomery, 1894

Roach, 1992

Reid, 1926

Thureau, 1882

Twelvetrees, 1909

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The unpublished reports of Bessel, no date, and Edwards, 1952, and Holmes, no date, and two newspaper extracts, were obtained from the Launceston City Library and are included here in Appendix 1 and 2.

The following review of Mining History draws on many of the references but especially Dickens, 1991.

Figs 4, 5 and 6 show locations of the production areas and prospects.

### **Introduction**

Gold at Lisle was discovered by Charles Bessell in 1878, immediately precipitating a gold rush. The population of the field peaked soon after at 2 300. It is estimated that Lisle in its first year produced 42 000 ounces (1.3 tonnes) of gold making it Tasmania's largest ever alluvial goldfield. Official production to 1925 is 2.7t of gold by 1925, but the total production to date is difficult to ascertain because of incomplete records, and Twelvetrees (1909) estimated eight to nine tonnes was produced from 1878 to 1909.

The evolution of the Lisle goldfield after the initial gold rush was unlike most other Australian goldfields. The primary gold deposits that shed the alluvial gold were not, and still have not been, located.

The gold bearing alluvium, apart from in and immediately adjacent to the Lisle Creek, (first called Bessell's Rivulet, then later called Main Creek), was on the lower eastern slopes of the valley in so-called terraces. Generally only the bottom part of the alluvium carried gold and the thickness of overburden increased upslope, making surface working in upslope positions uneconomic.

During the boom period (1879-83) the worthwhile gold-bearing ground stretched for a distance of two kilometres, commencing at Donnelly's Terrace near the gorge at the head of the valley and extending along the east side of Lisle Creek to an area known as the Red Face. The alluvial ground worked along Lisle Creek formed a belt of about 200m wide containing irregular patches of gold in wash averaging between 0.5m and 2m deep. The deepest known ground was about 5m. Donnelly's Terrace was regarded as the richest alluvial ground.

### **History**

The population declined markedly in the two years after the discovery of Lisle with 350 inhabitants, 185 of which were male, remaining on the field in 1881. By the 1890s the mining population of the goldfield oscillated between 20 and 70 males.

Because of the richness of the ground, the limited size of the claims and the intense competition for water, pot-hole mining and creek diversions were the most prevalent style of mining. Where individual miners combined, small scale ground sluicing also took place. The township of Lisle in the first year expanded linearly along the east bank of Lisle Creek for a distance of up to three kilometres.

When the easily worked alluvium was worked out extensive prospecting via shafts and shallow tunnels ("drifts") was undertaken in the terrace areas. This found gold bearing alluvium but no primary bedrock source for the gold. Some exploratory adits such as at Titmus were driven at high elevations in the valley in an unsuccessful search for bedrock mineralisation.

Before World War I alluvial mining continued with mainly ground sluicing techniques being employed. The inhabitants supplemented their gold earnings with agriculture and timber getting.

In 1901 a suction dredge was employed by the Lisle Dredging Company on the wet ground adjacent to Lisle Creek, producing unsatisfactory results partly because of trees and logs, and the operation was closed down three years later. In 1907 only 17 men were on the field.

Hydraulic sluicing was introduced during World War I. The Lisle Hydraulic Gold Mines NL and Lisle Gold Mining Co. obtained the water supply for these operations from within the Lisle valley. The war perhaps saw many of the remaining miners leaving the field and the demand on the valley's water supply being reduced in consequence. With water rights divided amongst fewer miners, the two companies would have been able to secure the water they required. With hydraulic sluicing, mining operations moved further up the slopes

of the Lisle valley where the depth of the wash had previously made ground sluicing an uneconomical proposition. The hydraulic sluicing also took place on the valley floor where hydraulic elevators lifted the wash onto sluice boxes supported by trestles. In 1918 The Hydraulic Gold Mines NL shifted to the north west of Lisle Creek for one good year's production, then the company apparently folded. Individual miners bought up the leases, the rights to the water races and the plants left behind by the companies.

Despite there being an abundance of rain throughout the year in the Lisle Valley, there was not sufficient water available to allow for hydraulic sluicing at the elevations required. In 1922 The New Bonanza Mining Co. cut a 20 kilometre long water race from the Little Forester River east of Lisle to provide the required water for large scale hydraulic sluicing. Another syndicate at that time was The Lisle Sluicing Company. These operations lasted only 3 years.

During the Depression years only the races that were previously dug with company money were utilised by small groups of miners with few capital resources.

After World War II the pattern of mining was altered again, with petrol/diesel engine pumps recirculating the water used in hydraulic sluicing, so eliminating the reliance on water races. Motor vehicle access meant that Launceston was less than two hours away and therefore not all the miners lived on the field. In 1948 there were only 24 residents in Lisle and the closing of the Post Office in 1950 signified the end of permanent settlement. In the 1970s the practice of hydraulic sluicing was stopped in recognition of the environmental damage that was being inflicted, in particular to the silting of Lisle Creek, which adversely affected dairy producers downstream.

Today there is still a proclaimed township, but there are no buildings remaining and there is no population.

### **Historical Prospecting for Bedrock Mineralisation**

Thureau's 1882 report indicated that there were attempts made to find gold on higher ground away from alluvial workings.

Charles Bessell tested the slopes of Lone Star Ridge with an adit. This was located near the source of what is now known as Bessells Creek.

On the east side of the valley, high above Donnelly's Terrace, two adits driven into the side of the hill by William Titmus, who happened to be the licensee of the "All Nations Hotel" at Lisle. Just below was a third adit, 130m in length, owned by the Defiance Tunnelling Company.

### **Main Producing Areas**

#### Donnellys Creek and Terrace

These workings were located close to the valley entrance, on the eastern side of Lisle Creek, and developed into the richest and most extensive on the Lisle Goldfield. Originally opened up by Donnelly and party during the 1880s, they were worked intermittently until 1990.

According to Charles Bessell, the original syndicate extracted more than 1000 ounces of gold from a four feet (1.2m) thickness of alluvium.

William Watts later extended operations during the 1890s, and according to Twelvetrees, was still working this claim in 1909. After a period of inactivity prior to and after World War I, interest was rekindled by a syndicate known as The New Bonanza Gold Mining Company, holding ground from Watt's Face (about 250m north of Donnelly's workings) to the northwest corner of Alfred Bessell's 147 acre (60ha) freehold, referred to as Bessell's Face, being about 1.5km southwards along the eastern side of Lisle Creek.

Watt's Face was reported as having a one metre thick band of gold-bearing wash beneath five metres of overburden, whereas Donnelly's Face had a gold-bearing band of three metres beneath 2 to 3 metres of light overburden.

Bessell's Face, on the southern boundary, had shown potential but proved to be a long term failure. A small area of about two metres in depth did produce 100 ounces of gold.

As previously mentioned, a 20 km water race from the Little Forester River was commissioned to service the New Bonanza Company leases. Completed about the end of September 1923, the new race cost \$10,000 to construct and had a carrying capacity of 25 sluice-heads of water. The race included almost one kilometre of syphon. The first fortnight's result from sluicing the three main workings yielded an encouraging 95 ounces of gold. However, after a promising start, declining production levels forced the Company to abandon its leases after only three years of operation. During the final year (1924), the New Bonanza Company had tried various areas, mainly terrace wash, for small returns.

Since 1925, Donnelly's Face has been worked periodically with mixed success. Argyle Minerals installed a \$48,000 extraction plant in 1987 which was designed for production to 6,000 ounces of gold annually. After limited success, the Company suspended operations during 1990.

#### Red Face (or Red Cliff)

This was considered the second richest 'terrace' of the Lisle Goldfield. The extensive workings were situated on the southern boundary of the Lisle township, wedged between the eastern bank of Lisle Creek and the main street. These workings were believed to be the limit of payable ground on the eastern side of the Lisle Goldfield. Charles Bessell believed that an early report showed that 200 ounces of gold was obtained at the face, from an area of less than 1000m<sup>2</sup>, while another 600 ounces was obtained from 2000m<sup>2</sup> of ground nearby.

Montgomery, 1894, reports in some detail of exploratory tunnels in the then current Mount Arthur Prospective Association's claims. Three tunnels, the newest and accessible one at the time being 185m long, explored the wash beneath a spur of talus. At its deepest point the wash was 23m below surface. There was visible faulting, striking northwards in the basement granite, displacing the wash. At one point where up-faulted granite cut the wash there was angular gold with occasional pieces of gold attached.

During a visit by Twelvvetrees in 1909, the Red Face was held by Watts and Langley, who were working a one metre thick gold-bearing wash beneath about three metres of overburden. At that time, the ground was described as clean and had the reputation of being the best on the field. Small sapphires and rubies were also being found amongst the wash.

Like Donnelly's workings, the Red Face is one of the few areas that has been an intermittent producer until recent times. Since World War II mining has been carried out by small syndicates and individual prospectors, reworking old ground.

In 1985-87 Alex White apparently was responsible for destroying workings and decimating the surrounding area.

The Synfield syndicate now holds the ground, and have carried out recent trenching and prospecting.

#### Lisle School site

This new area was opened up during the early 1970s. Wilfred Imlach and Harry Graham worked the former Lisle School site with limited success.

This area is a now a small non-contiguous part of a Mining Lease held by Martin M and Holmes A, and there is no current mining.

#### Lisle Creek

From the beginning, when the Bessell brothers discovered the area, the creek has continued to be a producer when other areas had been worked out. Originally known as Bessell's Rivulet, (not to be confused with Bessell's *Creek*, the current name for the creek on the west side of the Lisle basin), then later Main Creek, it was the scene of the initial 'rush' back in 1879.

Charles Bessell's 1894 report relates many extraordinary stories of patches of rich ground. He mentions the Clare Brothers, who obtained more than 1000 ounces of gold from two men's ground, and Shillady and party were reported to have won over 2000 ounces from their claims. The first claim that Charles Bessell worked on yielded almost 500 ounces of gold from four men's ground. (It seems at the time that the Mining Act provided for *One man's ground* of an area of 100 by 100 feet, about 30m x 30m).

The area was worked initially by ground-sluicing, and to a lesser extent, by means of hydraulicking. For the first 30 years, Lisle Creek was mainly the domain of the individual or small syndicate miner.

The gold was found to be very fine in grain with nuggets being quite rare.

The first company leases were taken up during 1900 when the Launceston-based Lisle Dredging Company was established. A suction plant commenced working the creek during the latter part of 1901. The alluvial gravel was estimated to be worth one shilling (10 cents) per cubic metre. However buried timber proved to be a constant problem. This necessitated

the dredge to be moved on each occasion. A three year struggle did manage to produce 1600 ounces of gold for the Company.

Currently a Mining Lease held by Martin M and Holmes A extends along the Creek. There is a disused camp and alluvial plant (trommel, jig) on site.

Bessells and Thomas Creeks (These are outside the Greatland tenement)

Both western tributaries of Lisle Creek, these were also important producers during the early years of the field. At the head of the Lisle Valley, situated on Bessells Creek and near its junction with the main creek, is located a deposit known as Cashmans Workings. This deposit was originally worked by Patrick Cashman, who also owned land outside the valley along Lisle Road. These workings were taken over by a prospector named Schlobohm.

Lockwood Terrace, further up Bessells Creek, was an extensive rich patch of deep ground. Originally worked by Thomas Lockwood in the early 1880s, the deepest known depth was confirmed as 20m.

According to Charles Bessell, 600oz of gold was produced in one particular year. At one stage up to 500 men were working in this area. However the lack of a reliable water supply often hampered production. During 1909, these workings were known as Harmansen's claim.

Thomas Creek, the southern and only significant tributary of Bessells Creek, was an early source of alluvial gold.

It appears that the initial rush exhausted the rich alluvial areas very quickly, leaving only the terraces for later exploitation.

In 1909, a section was taken up in partnership by Henry Faulkner and Thomas Marshall, who were working a face by hydraulic sluicing. Further south, a few colours were found in Stony Creek (a small tributary), which would suggest the limit of payable ground.

During the period from 1910 to 1914, two leases were being worked on the upper reaches of Thomas Creek by William Langley and John Marshall. Although the Hobart-based company known as the Lisle Hydraulic Gold Mines No Liability had taken up extensive leases during 1914, it was 1917 before serious mining was carried out on their western leases. The Company held a consolidated lease along Bessells Creek known as the Lisle Gold Mine, as well as a consolidated lease along Thomas Creek referred to as the Lisle Hydraulic Mine. According to Department of Mines' records, a new lead had been discovered on the eastern side of Thomas Creek during 1917. The following two years saw the Company work both areas until suspending alluvial mining along Bessells and Thomas Creeks during 1919. The Lisle Gold Mine continued to operate intermittently until the end of 1920. The final year of operation produced 96 ounces of gold while employing two men. The year 1925 saw the end of large-scale mining, when the New Bonanza Company leases were let to a local party on tribute.

### Sweeney Creek

Sweeney Creek lies 1km south of Red Face. According to Fig 4 in Coroneos, 1995, the area was hydraulically sluiced prior to 1940. No records of the operating company and the production and nature of the (assumed) wash appear to exist. However very early prospecting apparently had been done here because Thureau, 1882, mentions and has a poor sketch of tunneling at what appears to be upper Sweeney Creek, past the southern end of the main alluvial workings. The Lisle Tunnelling Company had been responsible for a 180m tunnel which intersected 45m of wash presumably beneath barren talus from upslope. This tunnel does not appear on modern maps; it is possible it was shallow and destroyed by hydraulic sluicing, or it is possible that the actual location is nearer Red Face, being tunnels later referred to there by Montgomery in 1894.

The extent of disturbed ground, here and elsewhere to the north, due to hydraulic sluicing is very apparent on imaged Lidar data, (see below).

### Conclusion

I believe that the alluvial terraces here, and continuously southwards via Red Face to Donnelly's Terrace and then beyond to Lockwood Terrace, formed part of the here named ***Donnelly Paleochannel***, and detail is presented in Section 11.0 of this report.



1999-2000	Bardenhagen	00-4461	trenching	S of Lisle basin
2004	Fitzpatrick	M Sc Thesis	Petrology of mineralised granodiorites and veins	Outside Lisle basin
2006	MRT	GPCR2008_02	Regional airmag, radiometrics	Interp by Webster
2008	Forestry Tas		LiDAR	

Key investigations have included:

### **Geological Mapping**

The area was mapped at a scale of 1:63,360 by the Geological Survey of Tasmania (Marshall et al., 1965).

Macmin geologically mapped outcrop areas, within the Lisle Basin at 1:5000 scale, Report 97-4048. This mapping shows that the MRT 1:25 000 geological map has a few errors in the position of outcrops and the contact position between Mathinna Beds and granodiorite.

### **Petrology**

Studies of the granodiorite at Lisle have been done by BP (Report 84-2287), Bottrill and Roach. Outside the Lisle basin, by Fitzpatrick.

### **Drainage Geochemistry**

Principally by Comalco, CRA, BP, and Billiton with varying techniques for Au (including BLEG by Billiton), for As and several base metals.

Gold anomalies exist in known areas of gold production only. Weak arsenic anomalies, to 23ppm, found by CRA in the southern part of the Lisle basin. Arsenic anomalism is notably low in the Lisle basin, compared to high tenors in goldfields to the north.

### **Soil Geochemistry**

Along tracks only, by Billiton using BLEG (bulk sampling, cyanide leach) analytical techniques and by Macmin using more traditional gold analyses of soil fractions collected generally by hand or in rare local places with a Wacker power auger.

The location of these samples and the relative gold anomalies so generated are shown on Figs 8 & 9.

The general anomalism is not of high tenor and is mostly spotty. The simple explanation is that most of the sampling is ineffective because of the presence of often thick talus overburden.

### **Plant Ash Geochemistry**

In 1983 Bill Baker, geochemist for the then Department of Mines, reported on very significant gold anomalies generated in ashed vegetation. The location of anomalies is shown on Fig 10.

The tenor of anomalism is extraordinarily high. Values up to 180ppm (!) were reported. All parts of several species gave readily recognizable anomalies. Species sampled included Acacia, Eucalyptus, Pinus Radiata and ferns, all of which would be regrowth plants after logging. For trees the samples were conventional second year growth whilst for ferns the stems were generally only one year old.

Tracks were sampled at 100m intervals. Anomalous areas were generated in the Donnelly Terrace area, the Sweeney Creek area and outside the tenement in the SW margin of the Lisle basin.

Follow-up traverses placed across the Donnelly terrace area were sampled at 20m intervals. These were found to define a very distinct linear anomaly in alluvium about 15m wide and 500m long, Fig 10. The alluvium was stated to be covered by 2m of soil and heavy vegetation.

One sample of alluvium from here was treated by tabling, recovering gold at 10g/m<sup>3</sup>.

Only a few conventional soil samples from plant-ash anomalous areas were analysed. The plant to soil ratios for gold in these areas ranged from 12 (plant 84ppm, soil 7ppm) to 32 (plant 27ppm, soil 0.340ppm). Specific detail of localities and analyses are not reported.

The validity of this sampling program and the results obtained have apparently been questioned by other Canadian geochemists, but Bill Baker (pers. comm.) stated "I stand by them".

### **Trenching**

According to Bottrill, 1994, extensive backhoe testing of alluvial sediments around Lisle, up to about 6m depth, has been conducted by Alec White but the results are not available.

### **Airborne Magnetism**

In 1984 modern 200m line spaced data was acquired for BP, and interpreted by them (Report 85-2361). They found high variability of magnetic tenor of the granodiorite, which was interpreted as due to differing phases and/or alteration.

Richardson, 1990, reprocessed the BP data to correct it for variable ground clearance and interpreted some areas of shallow buried granodiorite.

In 1992 Roach processed the BP data and interpreted it, together with gravity data. He like BP noted the variability of magnetic tenor and carried out field magnetic susceptibility measurements of high and low tenor granodiorite and remarked that both types of granodiorite had the same physical appearance, albeit very highly weathered.

In 2003 Tasgold again processed the BP survey and produced good quality TMI and 1VD images, Figs 11 and 12.

In 2006 Mineral Resources Tasmania funded the acquisition of aeromagnetic and radiometric data over northeast Tasmania, as part of the 2006 TasExplore initiative to promote mineral exploration in the state. The data acquisition was flown by fixed wing

aircraft and helicopter with east – west flight lines spaced 200m apart with nominal 90m terrain clearance.

Webster, 2008 interpreted the data together with gravity data, and was able to compare the signature of the Lisle pluton with other NE Tasmanian granitoids. The Lisle pluton differs from others by having variable magnetic tenor combined with only a weak gravity low.

### **Gravity**

Roach, 1992 infilled the semi-regional gravity to obtain a station density of 1 per sq km. He noted a weak gravity low over the bulk of the Lisle granodiorite. He modelled the magnetic and gravity data to predict that the granodiorite has larger areal extent subsurface beneath Mathinna beds.

As noted above Webster 2008 processed and studied the regional gravity data together with magnetics.

### **LiDAR**

MRT kindly supplied me with ermapper data for a survey conducted over part of the Lisle area. The date of the survey I do not know, but would be around late 2008.

LiDAR (light detection and ranging) is an optical remote-sensing technology in which a LiDAR instrument attached underneath an aircraft uses high-speed laser pulses to generate three-dimensional data about terrain or landscape features as light bounces back from the ground, from understorey and from canopy.

The LiDAR-based ground DEMs precisely reveal streams and contours in great detail.

I processed this data, which covers part of the alluvial mined area generally east of Lisle Creek.

Because of the high sensitivity of this DEM data it is possible to map tracks and areas disturbed by mining, such as worked creeks, Fig 13.

### **Percussion Drilling**

In 1984 BP carried out open hole percussion drilling of a number of magnetic and geological targets, Report 83-2361. In and close to the Lisle basin 27 holes were drilled averaging 30m to 40m deep. Commonly two holes were fanned in opposite directions at each site. The location of holes is on Fig 14.

At the time of drilling much of the prospective area east of Lisle Creek was held under Mining Leases by other parties, so BP did not drill many holes there. Consequently only two localities for six holes are in the Greatland Tenement. These are:

TLP13 & 14, at a site near Sweeney Ck, Fig 15. Sited upslope from some Baker plant ash gold anomalies on a relative magnetic high, they intersected weathered “granite” below around 12m of “talus”. Gold analyses of talus and granodiorite were less than 20ppb. Interestingly the talus is described as containing basalt and reef quartz pebbles. The basalt could have

readily been mistaken for fine grained hornfels which in the field does resemble basalt; however if the identification is correct, it is possible that the quartz pebbles are from Tertiary paleochannel alluvium, with basalt above, as discussed fully in Sections 10 and 11 of this report.

TLP1, 2 & 3, in a relative magnetic low zone, thought to represent a linear alteration zone in the generally high magnetic tenor granodiorite here. Weathered "granite" is logged, with much muscovite, so it is possible that the granodiorite here is altered with muscovite/sericite. However the maximum gold analyses were only 30ppb.

Outside the Greatland Licence, the several holes deserve comments:

TLP7 & 8 were drilled further south from TLP1, 2 & 3, in a relative magnetic low zone, and holes TLP5 & 6 further south-westerly. Two holes recorded vein quartz in "granite", nevertheless all gold analyses were below 30ppb.

TLP24, 25, 26 were testing a Baker plant ash anomalous area on the west side of the Lisle field. These holes intersected interesting varieties of granitoids including diorite, (black, fine grained) and quartz veining and hematitic siliceous material, and the maximum gold analysis was a much more encouraging 100ppb.

Holes TLP15 to 19 and TLP27 were in the north of the Lisle basin close to the contact of Mathinna beds and granodiorite. Holes TLP18 & 19 intersected "granite" with less than 20ppb gold, and hole TLP27 contained limonitic vein quartz with max 60ppb. Holes TLP15 & 16 interestingly intersected diorite with vein quartz and disseminated pyrite and arsenopyrite, (and fluorite, possibly mis-identified), nevertheless all gold analyses were less than 20ppb.

Hole TLP20 was in Mathinna Beds recording less than 20ppb gold.

Holes TLP21 to 23 were north of the Lisle basin on the flank of a magnetic high. They intersected Mathinna beds in the top 8 to 50m, passing into diorites which were highly altered with quartz veining and limonite in one hole, yet carrying only up to 40ppb gold.

### **Diamond Drilling**

Diamond Drilling was done by MRT in 1989, in a location shown on Fig 14. Two holes (LISLE BH1&2) were fanned in opposite directions from the same site, intersecting granodiorite with weak alteration and a maximum of only 20ppb gold.

The site is on the flank of a magnetic high, Fig 15. More than 30m of talus covers the granodiorite.

## 8.0 PREVIOUS EXPLORATION Outside Greatland Tenement

Macmin, later to become Tasgold, and yet later Frontier Resources, carried out much work to the north of the Tenement, in the north part of the Lisle-Golconda Goldfield, from 1993 to 2008, (see Fig. 7)

Their work is of relevance to help decipher the style and associated alteration of possible bedrock mineralisation at Lisle because of the same geological setting – the same type of granodiorite intruding the same Mathinna beds in a similar erosional level.

The main interest was the Enterprise, Goldcrest, Potoroo and Panama Prospects. Information below is extracted from Callaghan 2005, Fitzgerald 2004, and Tasgold open-file reports, eg 05-5207, 06-5314.

### Enterprise

Historical production from the Enterprise workings is reported to be 3,573 tonnes to produce about 50kg (1,600oz) of gold, and was the largest producer in this goldfield. There were up to 6 veins mined at Enterprise from 4 shafts 60 to 80 feet (18 to 24m) deep and from 2 adits. None of these have been accessible to modern explorers.

Drilling intersected zones of low grade gold mineralisation in quartz sulphide veinlets in granodiorite near its contact with Mathinna Group hornfels. There are narrow higher grade veins within a lower grade halo. The granodiorite is pervasively but variably altered by sericitisation, chloritisation, sulphidation and carbonates. Gold occurs erratically as fine to very fine electrum grains with pyrite, chalcopyrite, marcasite, bismuthinite and (?)maldonite. The electrum grains are all very silver rich, probably about 30 to 50% silver.

Soil sampling returned generally < 0.2 ppm Au and <150 ppm As with peak values of 1.39g/t Au and 2,670ppm As.

### Potoroo

Soil sampling discovered this prospect. C-horizon auger samples returned values up to 380ppb Au and 450ppm As, coincident with a local aeromagnetic and ground magnetic high.

Drilling intersected mineralisation consisting of sheeted gold-bearing quartz-pyrite-arsenopyrite veins and disseminated sulphides in extensively silica-sericite-pyrrhotite-pyrite altered granodiorite. Adjacent Mathinna Beds are apparently less mineralised than the granodiorite. Significant results were returned from PD002, 130m @ 0.21g/t Au from 19m in granodiorite bearing mostly disseminated. This included quartz-arsenopyrite veining within a faulted zone returning 6.9m @ 1.4g/t Au, and some veined pyrite and pyrrhotite, but most of the gold in the interval is disseminated.

### Panama

This area is in the contact zone of Mathinna Beds and granodiorite. In the upper end of the Panama Valley there are the historical Wilson-Symonds workings. The mineralisation is as quartz-arsenopyrite veins in Mathinna Group hornfels. Rock chip sampling of these lodes

within the drives returned numerous high gold analyses to 76.5g/t and drilling intersected these veins, with up to 0.5m at 9g/t, but in a complex contact zone between granodiorite and hornfels.

The largest quartz veins are typically 4cm wide and contain pyrite, arsenopyrite, and pinkish sphalerite and minor galena. Select intervals were analysed for multiple elements: peak gold was coincident with elevated silver, lead, arsenic, bismuth, zinc and antimony.

Cordierite spotting of dark grey colour is common in the hornfels and is overprinted by olive coloured silica-sericite alteration. In the zones of strongest silica-sericite alteration pyrite is occasional visible up to 10cm away from vein selvages. Hornfels at the granodiorite contact is sparsely quartz-arsenopyrite veined. Relatively barren diffuse and sometimes pygmatic silica veins and pyritic veinlets occur throughout the Mathinna beds. Arsenopyrite occurs as disseminations in some of the olive (chlorite?) spots adjacent to sulphide bearing veins. Several small (1-2cm) "breccia veins" with a pyritic matrix were intersected. Minor narrow feldspar-pyritic vein dykes to 4cm width also occur.

The granodiorite is muscovite rich approaching the irregular contact with the hornfels. Veins with brownish biotite alteration halos are crosscut by the mineralised quartz-pyrite-arsenopyrite veins which have diffuse silica-sericite alteration selvages suggesting the former were early. Silica-sericite (+/-muscovite) alteration is common in the granodiorite. Local weak to moderately magnetic zones are common due to pyrrhotite disseminations; locally pyrrhotite forms narrow veinlets.

## 9.0 FIELD VISIT AND SAMPLING

### Introduction

The Lisle Goldfield was visited in December 2009 and samples collected.

The aim of the visit was to

- Consolidate ideas on the origin in basement of the alluvial gold previously produced.
- Check the degree of outcrop exposures.
- Look for evidence of alteration.
- Collect samples of exposed basement rocks.
- Pan alluvium to inspect the alluvial gold and check for scheelite.

### Field Visit

A search was made especially along forestry tracks for rock outcrops especially inside the contact metamorphosed quartzitic Mathinna Beds. Areas of surface gold anomalism from previous surveys were visited. For example areas of extraordinary anomalism of plant ash in a survey by Bill Baker of MRT in the 1980s were inspected, but were ubiquitously covered in talus.

Outcrops are sparse because of the almost complete cover of talus derived from surrounding hills. The talus tends to be clayey with somewhat angular pebbles and cobbles of quartzite and sandstone of Mathinna Group beds.

Most of the outcrop was completely weathered granodiorite, being clay-quartz-biotite.

Within the EL40/2008 there is a Mining Lease, 7M/2008. This was visited and a Mr Selwyn Bishop, representing the owner Mr R C Synfield, was met on site. He gave permission to inspect the area and collect samples. The Synfield syndicate had recently completed a prospecting campaign using a trench digger. This created pits/trenches through the regolith, exposing wash which was being sampled and panned on site. Prior to this exposure it was very difficult to see meaningful exposures because of the extensive undergrowth.

### Mineralisation

The trench digging in a number of places has exposed talus, and below the talus a gold bearing wash, upon a basement of completely weathered granodiorite.

The basement granodiorite consists of clay-quartz-biotite.

The wash is clayey micaceous gritty alluvium containing generally well rounded pebbles and cobbles of quartzite and sandstone (contact metamorphosed Mathinna Beds) and quartz, Fig 16. Most of the quartz is white and apparently barren of signs of mineralisation such as sulphides, though rarely some is locally gossany and iron-stained presumably after pyrite. Some pebbles of quartz and sandstone contain remnants of muscovite rich greisen. One rare pebble recovered by me was a medium grained greisen apparently replacing sandstone. The

wash is locally very dark and manganese rich. The abundant mica in the wash has a very brassy sheen, and is presumably biotite.

The wash occurs well above the bed of the Lisle Creek. It is a paleochannel, as discussed in Section 10 of this report below.

Selwyn Bishop showed me gold panned from the wash. It is quite fine grained being less than 1mm in diameter in most cases. Selwyn reported the presence of occasional 1 to 3mm sapphires and possibly rare cassiterite. He has found one specimen of gold attached to a piece of quartz.

In the exposed trenched and pitted areas the wash is about 2m thick, and above it is talus, readily distinguished from the wash by being usually a red-brown colour and containing angular to sub-rounded pebbles and cobbles of Mathinna Group sandstone/quartzite, but rare quartz.

The presence of sapphire in the wash suggests that the wash was a basaltic deep lead. I tried to find basalt in the talus without success, though the talus colour may indicate the presence of completely weathered eroded basalt.

### **Sampling**

24 Samples were collected of weathered granite, fractions of the wash, and pebbles from the wash.

The location of samples is shown on Fig 17.

Samples were analysed by Genalysis Laboratory, Perth, for a suite of elements, as tabulated in Table 3:

Samples were pulverized. Digestion was by aqua regia. Determination was by solvent extraction and graphite furnace AAS for gold and by ICP Optical Emission Spectroscopy or ICP Mass Spectrometry for other elements (As, Bi, Cu, Mn, Mo, Pb, Sb, Sn, Te, W, Zn).

The wash contains up to 41 ppb gold. Sample L5, 41ppb, was from a manganese-rich wash so this type of wash in the area could preferably carry more gold - though the number of samples is certainly not statistically definitive. The highest gold content, 135ppb, was in a quartz pebble, L15, showing hints of having been attached to greisens. A sandstone pebble with a gossany veinlet after pyrite, L22, had an elevated 12ppb gold.

All arsenic values are very low, being below 12ppm, so it seems arsenic would not be a pathfinder for further geochemical sampling.

Analyses of other elements are low or of no apparent interest, except that the manganese rich sample L5 has also elevated Mo (46ppm) and Cu (31ppm), and the gossany sandstone L22, has 95ppm Cu, offering some hope that Cu may be used as a future geochemical pathfinder.

The highest gold content is quartz apparently originally associated with greisen, so this is a clue that sericite altered systems were the ultimate basement source of the alluvial gold.

However sample L23 was a greisen replacing sandstone and it carried very low gold, so not all altered rocks in the area could be expected to carry gold.

### **Panning**

One 2kg sample of basal wash from a trench at site L7, Table 3, was collected.

This was carefully panned and a concentrate containing a few very small gold grains, around 0.1mm in diameter, was obtained.

The concentrate was lamped with short wave UV light. No scheelite was present.



## 10.0 NATURE OF LISLE MINERALISATION

### Alluvium

There are three types of alluvium/ colluvium at Lisle:

1. Active alluvium. This geologically recent alluvium occurs all along the current creeks and gullies and includes the wet areas around Lisle Creek, which produced much gold in the past.
2. Terraces. These are well recorded in all the historical literature, as far back as Thureau in 1882, by Montgomery in 1894, and were being worked at the time of Twelvetrees visit in 1908. They are well above the level of Lisle Creek, and early miners attempted to follow this material at higher and higher elevations until the thickness of barren cover made this commercially unattractive. Thureau thought there were levels of auriferous wash, one being as high as the Titmus Tunnel where a small area of wash is exposed. It is of variable thickness, up to several metres from old records. The payable wash sits directly above weathered granodiorite and is a clayey micaceous gritty alluvium containing generally well rounded pebbles and cobbles of quartzite and sandstone (contact metamorphosed Mathinna Beds) and quartz. Most of the quartz is white and apparently barren of signs of mineralisation such as sulphides, though rarely some is locally gossany and iron-stained presumably after pyrite. It is clear from the early descriptions and from my inspections, outlined in Section 9.0 above, that the wash represents a paleochannel. This paleochannel I will refer to as the Donnelly Paleochannel, after the first named and richest part of the terrace production areas.  
Montgomery described the variability of the wash. In places it is very clayey, with lignite, in places sandy with much quartz. Thickness was up to 4.5m, and gold content varied. Thureau stated that as mining progressed southwards “approaching a certain line of altitude, coarser gold had occasionally been found than in any of the lower alluvium”.
3. Talus. This is very extensive in the Lisle Basin, derived from the high surrounding hills of Mathinna Group rocks. It can be quite thick, being up to 30m in drill holes. Because of it there is little outcrop of bedrock or of wash, and this made past prospecting and modern exploration difficult. It comprises the barren overburden in the worked areas of wash.

### Nature of alluvial gold and accessories

The nature of the gold is described by several workers but it is often not clear whether the gold is from this terrace wash or from the active alluvium – it could be expected that the gold is different in each location.

Montgomery in 1894 stated that the gold was fine grained and that gold with attached quartz was relatively rare.

Twelvetrees reported that the best nuggets found in Lisle came from where a bar of granite crosses the junction of Lisle and Bessel Creeks. The largest one was discovered by T. Bessell, and weighed 15 dwts (23g).

On his 1908 visit he reported on the Red Face workings. Here "The gold is not much water-worn, and is rather a coarse variety for Lisle. A flat piece, weighing 1 dwt,.....and several pieces weighing 6, 8, and 10 grains have been obtained.....A few small sapphires and rubies have been found in the wash..... stones of chalcedony are fairly common, some of them containing pyrite..... the iron-magnesia spinel (pleonaste), known on the field as black-jack, occurs in the wash, occasionally in large sizes." Also he reported that Australites were found in the wash; these had circular button shapes, dumb-bell shapes, and beetle shapes.

Overall the gold is reported as relatively pure, free, and angular (Noldart, in Marshall, 1970). This type of gold suggested a secondary origin (i.e. in situ reprecipitation of dissolved gold from groundwater, (Bottrill, 1991, 1994b).

Bottrill, 1986, studied gold concentrates from Synfield syndicate production. It seems from the suite of accessory minerals- including slag, cassiterite, wolframite, monazite- that the plant must have been used to also treat alluvial mineralisation from tin/tungsten properties elsewhere, so care must be taken utilising descriptions of the gold. One of the spectacular textured gold specimens described later by Roach, 1992, comes from this source. Inclusions of mica, rutile and magnetite were noted in the gold grains.

Storer, for BP in 1985, reported on studies of gold concentrates from a Lisle alluvial plant, and the same contaminated suite was found. It seems the BP reporting is of the same studies by Bottrill, later reported in 1986.

Roach, 1992, collected alluvial gold by panning, so presumably this gold comes from the active alluvium in Lisle Creek. He found that some gold grains are highly porous and/or colloform, while some have silver-rich cores and silver-depleted rims. He thought that some of the gold is detrital and some reprecipitated. What is not at all clear is whether a specific type of gold is typical of a modern alluvium host or of a Donnelly Paleochannel host.

Reid, 1926, contended that much of the alluvial gold was secondary, being of high fineness. He noted that it occurred associated with organic material and, he alluded to chemical solution and redeposition by organic matter.

Baker, 1978, suggested the importance of humic compounds in the transportation and deposition of gold at Lisle.

### **Host granodiorite**

It is interesting to note that as early as 1882 Thureau pointed out the clear difference between the Lisle granitoid which he called a syenite, and the granites associated with tin mineralisation further east.

Roach (1992) analysed 16 samples of the various granodiorites from Lisle, Golconda, Panama and the western margin of the Scottsdale Batholith, known as the Diddleum Pluton. There is a clear distinction between the rocks of the Scottsdale Batholith and the granodiorite from

the Lisle area. In terms of Rb and Sr the Lisle granodiorites are the least fractionated of the Tasmanian Devonian granitoids.

There is a marked variability of the magnetic susceptibility of the granodiorites. This is possibly a reflection of different intrusive phases and/or may represent areas of magnetite destruction associated with hydrothermal alteration.

In the Lisle basin there is a high magnetic susceptibility phase in the north and a lower susceptibility phase in the south, yet both look the same in the (limited) highly weathered outcrop.

BP in their percussion drilling in places intersected dark coloured 'diorite'. If this is correctly logged and it is not dyke material, (see below), then this will be another phase of the Lisle intrusion, and potentially of some genetic connection to mineralisation.

### **Veining in granodiorite**

Only very minor gold is reported in small quartz veins.

Thureau in 1882 reported on gold bearing vein occurrences known at that time:

- (a) Gruber's vein, which is described as a "quartziferous formation of very finely-grained granitoid rock, nearly two feet in width..... carries some fine gold, which is probably derived from some quartz veins permeating the vein, and which are stained by ferro-manganese....The general appearances of this vein are those of a secondary deposit only, as derived from the surrounding wall-rocks by infiltration or other mode of process." It has an easterly strike and south dip. This is possibly an aplitic dyke with quartz stringers, or a feldspathic alteration zone surrounding quartz veinlets. Its location is poorly sketched but seems to be on the west side of Lisle Creek south from Red Face.
- (b) Anvil quartz vein, is poorly described but apparently a breccia, "peculiar feature the siliceous matrix occurs in oblong blocks, each block being separated from its neighbour by the closing walls or strata". On the poor sketch the strike is northerly and dip east, and the location is south-east of Lisle township, though it might be the vein at the position marked 'Adit' on Fig 4, east of the township.
- (c) Another situated nearly opposite the All Nations Hotel, "on the flat, a most vigorous effort was being made by a strong co-operative party .... gold being present, this wet shaft—sunk night and day—should have afforded practical results, but as the vein remained thin, and the walls were not well defined with depth, the prospects are very doubtful".
- (d) Defiance tunnel, (located east of Donnelly Terrace, Fig 4), 120m long intersected two narrow veins, stained black by ferro-manganese, and also some veins outside the tunnel.
- (e) Generally he stated that "the whole of the granitoid formation to be traversed by attenuated quartz veins charged with very fine gold".

Montgomery in 1894 reported that on the Titmus and Dodgson Sections, the gold veins in granitoids consisted of a belt 1m to 1.6m wide, with veinlets 6 to 40mm wide, striking 076 degrees and dipping 48° NW. "A little gold" was apparently recovered from both the veins and granodiorite.

Twelvetrees in his 1908 visit to Red Face was informed that a vein of pyrite was once found in the 'granite' bottom.

Diamond drilling by the then Department of Mines revealed very minor quartz-carbonate-pyrite alteration zones in the magnetite and pyrite-bearing granodiorite, with trace gold (to 0.05g/t; Bottrill, 1996a).

Gold with attached quartz was relatively rare. Bottrill, 1986, studied gold concentrates from Synfield syndicate production. Inclusions of mica, rutile and magnetite in the gold grains suggest that the gold was more likely to have been disseminated in the hornfels or granitoids than in quartz veins, while rare gold-limonite composites in placers suggest gold-bearing pyrite may have originally been present.

Despite the general paucity of reported basement mineralisation, it is nevertheless possible that unrecognized or unreported low grade disseminated and fine grained gold was present locally in the totally weathered basement granodiorite. If gold in weathered granodiorite were disseminated and fine grained and low grade, say 1ppm, (similar to that at Timbarra in NSW, (see Section 12.0 of this report)), then early miners may not have recognized it, or it was ignored, or it was not reported.

### **Alteration**

Alteration is not well described at Lisle compared to that at Panama, Potoroo and Enterprise to the north.

There is only weak alteration observed and described petrographically by Bottrill, 1996a, in the Mines Department diamond drill core.

Alteration, generally muscovite/sericite, is logged in the BP percussion chips, Storer for BP, Report 85-2361.

My observations, of cobbles and pebbles in the Donnelly Paleochannel alluvium, suggest greisen style, ie sericitic alteration.

The weight of available evidence is that the predominant alteration style at Lisle in the granodiorite is sericitic, as it is at Panorama and Potoroo and Enterprise.

### **Mineralisation in Mathinna Beds**

Only minor mineralisation is known in Mathinna beds, despite the probably high level of prospecting in the early days.

Thureau, 1882, reported on the Titmus tunnel, on the higher slopes, driven 'schists' in Mathinna Beds, Fig 4. At the tunnel opening the beds were "traversed by irregular quartz veins, exhibiting micaceous and distinguishable granitoid vein-matter. A red feldspathic band, dipping at an angle of 45° west, was then intersected, followed by ..... quartz, broken schists, and feldspathic veins interlacing each other, and impregnated, so to speak, by thin veins and flakes of steatite, the whole being profusely stained black by ferro-manganese. This aggregation of yet irregularly formed vein-matter has been proved auriferous..."

Tourmaline and gilbertite(muscovite) are reported by Reid, 1926, in the Mathinna beds in talus in the workings on the west side of the Lisle basin.

Outside the basin, Reid (1926) noted that numerous sandstone beds carried disseminated gold and quartz veinlets at Bessell's Reward prospect (which is located between Lisle & Golconda), carrying up to 40g/t Au. Similar mineralisation is known further north in the Denison Goldfield.

In 1977 for Comalco, I sampled Mathinna beds surrounding the Lisle basin for disseminated gold, believing that stratabound gold may be the source of Lisle alluvial gold, (report 77-1238). The results were negative.

### **Dykes**

Thureau, 1882, mentioned dykes in the granodiorite in Lisle Creek in the north of the basin; he has a sketch map of their location. He states "They are of a hard dense nature, grey in colour, with a base of quartz in which a black (hexagonal) mica prevails, with some hornblende. These dykes are from 20 to 30 feet thick, and they may be found to contain opaque " corundum," as the latter are always found in the residues after washing the alluvial besides gold, and known amongst miners here as " black jack." They are useful for grinding hard metallic parts of machinery and fine cutting instruments, which by other means cannot be accomplished. They are now preferred to emery".

Bottrill, 1994, speculated that these dykes are lamprophyric, which he stated would have genetic implications for gold mineralisation.

## **11.0 NEW TECTONIC GEOMORPHOLOGICAL MODEL FOR THE LISLE BASIN**

### **Introduction**

In prior sections of this report I discussed the nature of gold bearing alluvial wash at Lisle and proposed that this is in a paleochannel, naming it the Donnelly Paleochannel. Its position is shown on Figs 18 & 19.

### **Historical views**

Thureau in 1882 was the first published observer, and he thought that the several alluvial horizons in the valley were formed by waves in a Tertiary inlet with connection to the sea via Lisle Gorge.

Montgomery in 1894, because of horizontally layered alluvial terraces containing lignite, thought the valley occupied a former lake bed.

Reid, 1926, and Marshall, 1969, because of the basin-shaped depression of the Lisle basin thought the same.

Roach, 1994b, thought that the geomorphology of the Lisle basin is a significant factor in the development of the alluvial deposits, and that the thick layer of sediment and the restricted hydrology within the valley have led to an environment which is favourable for the secondary remobilisation and precipitation of gold.

### **Genesis and Neotectonics**

The immediately obvious geological setting for the paleochannel is that it occurs within a Tertiary valley confined to the Lisle basin, and exiting the basin via the current Lisle Creek gorge. It was overlain by more modern talus, and then partially eroded and reworked by the current active Lisle Creek.

However the confinement to the Lisle basin, where there is only a 3km long valley above the gorge, does not stand up to scrutiny.

The sheer thickness, extent and variability of the paleochannel alluvium, and the well-worn enclosed cobbles and pebbles, suggest that the paleochannel drainage is not merely local and small but goes beyond the edges of the Lisle basin.

Furthermore there is very little gold in alluvium in and downstream of the gorge, suggesting that the gold bearing paleochannel did not ever exit through the gorge.

The paleochannel clearly predates the extensive talus cover. The current erosional regime which is generating such talus is very different to that which applied when the paleochannel was active. The current topography and erosional regime is youthful. The Lisle gorge has developed in a youthful rugged topography and captured the remainder of the drainage systems in the basin.

All of this is clear evidence for neotectonics in this region. Neotectonics has had a profound influence on the development of the gold mineralisation at Lisle.

Any geological history of the paleochannel must be cognisant of the distinct geological settings which prevailed after its initial formation. To generate the hills in the Lisle district and in turn generate the vast amount of talus in the Lisle basin, there must have been post paleochannel faulting of some magnitude.

The paleochannel is here postulated to extend beyond the confines of the Lisle basin, and because of the post-paleochannel faulting, its path will not necessarily be governed by the current topography. Much of the paleochannel would have been elevated and consequently removed by erosion.

### **Regional context**

In a regional context one can expect that the paleochannel setting is similar to those studied in the tin fields further east, for example at Rigarooma and Pioneer, Yim, 1991, and Yim, 2001.

These are Eocene age and sub-basaltic.

Assuming the same applies here I have generated a deep lead for the paleochannel as shown on Figs 20 to 23. This commences in the south where it follows known basalts, then goes into the current Lisle basin, where no basalt is mapped, then (via a current topographic high) through the Lone Star and Panama basins (which have apparently similar alluvial gold systems to those at Lisle), to exit beneath basalts north of Golconda.

The absence of basalt in the Lisle basin is a problem for this postulated lead. If the postulate is true the basalt would need to have been completely eroded. Of interest is the logged basalt in talus in BP drill logs, so it is possible that indeed basalt does exist but had not previously been identified. Furthermore the presence of sapphires in concentrates from Lisle alluvium strongly suggests a basaltic source had to occur within the present confines of the basin.

The topography at the time of the Eocene drainage could be expected to have been relatively subdued compared to the present, being developed on a Cretaceous- Paleocene landsurface, as seems to be the case in the Tasmanian midlands. The presence of lignite in the paleochannel testifies to the locally semi-swampy terrain at that time. The weathering regime may have been very tropical, giving rise to the deeply weathered granodiorite in the Lisle basin. The deep weathering has certainly not developed in recent geological times.

Interestingly Fulton for Bardenhagen, Report 00-4461, describes a paleochannel exposed in trenching within the thrust system south-west of the Lisle basin.

### **Evidence for and postulated style of Neotectonics**

There appear to be no studies of neotectonics in NE Tasmania. The nearest relevant studies are in Victoria by workers such as Sandiford, 2003. A general review concentrating on mainland Australia is in Vasconcelos et al, 2008.

The current consensus view is that the Victorian Alps and some coastal geomorphological features were formed during a tectonic event around late Miocene- Early Pliocene, and this

is supported by sequence stratigraphic studies and inversions in the Bass Basin between Tasmania and Victoria.

Direct evidence of post-paleochannel faulting at Lisle was provided by Montgomery, 1894. He visited exploratory tunnels near Red Face, and observed in three places northward striking faults in the basement granite, displacing the wash.

I have studied regional DEM imagery to see if there is evidence for modern faulting controlling the current topography. There are clear NNW lineaments, which seem likely to be reactivated Paleozoic structures, and clear ENE lineaments, as shown on Fig 24.

### **Lisle basin faults**

The current topography gives clues to the positions of faults. West of the Lisle Basin the major Paleozoic thrust system, trending generally north- westerly, has a distinct bend. I postulate that upon reactivation of this system in the Miocene-Pliocene, the hornfels surrounding the granodiorites acted as a competent locus for a pop-up structure, forming the high hills, and there was a concomitant sag producing the Lisle basin. The granodiorite was already very highly weathered and soft, and the hornfels very hard, therefore faulting preferentially occurred on the hornfels/ granodiorite contact. This postulated fault system is shown on Fig 23.

Faulting at this position is known in the Titmus adit, Thureau, 1882. Interestingly at the entrance to this adit, which is high up the slopes, Thureau also mentions a sandy quartziferous wash, with rounded quartz and hornfels ('schist') pebbles. He thought it was evidence of a high former beach level. It may actually represent a remnant part of the Donnelly paleochannel which has been upfaulted in the Miocene-Pliocene.

Apart from the Titmus adit faulting there is no other recorded evidence of the postulated Lisle basin faults.

### **Synthesis**

The history of the Lisle alluvial deposits is in summary proposed to be:

- Eocene paleochannel developed on a relatively subdued Cretaceous-Paleocene landscape.
- Deep tropical weathering produces the highly weathered granodiorite basement.
- Eocene basaltic flows fill valleys.
- Neotectonics in the late Miocene-early Pliocene rejuvenate NE Tasmanian terrain.
- Faulting at the edges of Lisle basin: a local pop-up/sag feature. High walls of Lisle basin formed, causing much talus delivery into the basin.
- Lisle basin drainages cut off, forming a possible lake. The presence of a lake combined with the lignitic material in the paleochannel could have generated humic groundwaters which generated the colloform and spongy and high fineness gold.
- Post Pliocene capture of the basin via the Lisle Creek gorge.
- Lisle creek actively erodes the paleochannel, reworking and locally enriching the alluvial gold.

## 12.0 PROSPECTIVITY FOR GOLD IN BASEMENT

### Introduction

As amply demonstrated earlier in this report very little primary gold has been found at Lisle. The source of the considerable 8 tonnes or so of alluvial gold has never been found by early miners, by prospectors or by modern explorers.

Prospecting, tunneling and scattered soil geochemical rock chip programs have failed to find any appreciable gold in the hills of Mathinna Group rocks, so I assess that Mathinna bed hosted gold is not a priority target at Lisle.

Gold disseminated or in quartz veins in the granodiorite is the obvious target. Outside Lisle Tasgold and earlier explorers have demonstrated that the granodiorite near its apical parts carries quartz vein systems with associated sericitic alteration. Veins carry pyrite, arsenopyrite and minor galena and stibnite.

Similar styles of granodiorite hosted gold could be expected to occur at Lisle, but have never been found because of the extensive talus cover.

Storer for BP in 1985, speculated that the source of the Lisle alluvial gold was from the eroded granodiorite, directly above in the basin. He calculated that at a concentration of 0.01ppm gold, a volume of rock measuring approximately 1000m x 1000m areally x 250m vertically, would be sufficient to yield 7500kg of alluvial gold produced from the Lisle goldfield.

Roach, 1994, also had similar views and calculated that, even using his measured average gold content of Lisle granodiorite of only 0.38ppb gold, sufficient gold could exist in eroded granodiorite in the basin to account for the known alluvial gold production, (assuming that such gold could be freed and concentrated). Further he calculated if there were quartz vein material containing 10g/t gold then very small volumes of eroded material would be sufficient to produce the alluvial gold.

These hypotheses neatly write off the basement prospectivity of Lisle because it implicitly assumes all the gold came from above in the apical part of the intrusion and this is eroded off. However these hypotheses must be incorrect if, as discussed above, the Lisle Eocene valley developed on a relatively subdued landsurface and no high hills around a basin then existed. There was not a confined basin delivering gold neatly to alluvium in the bottom of the valley.

### Exploration Model

In recent years a new model for granodiorite hosted gold, in provinces more commonly associated with tin and tungsten, has been put forward by several workers. They are named Intrusion Related Gold Systems (IRGS). Descriptions are given for example in Thompson et al, 1999, and Lang et al, 2000.

The model was used by Tasgold for their exploration north of Lisle, and seems an appropriate one for the area.

The paper by Morrison et al, 2003, is freely quoted here as a convenient summary of these deposits:

".....an under-recognised and economically important class of magmatic/hydrothermal gold deposits, which exhibit major distinctions from porphyry and epithermal systems. Intrusion-related deposits occur in felsic magmatic provinces best known for their tin or tungsten mineralisation. The gold deposits are mainly sourced from and hosted in intrusions of granite-granodiorite composition in cratonic or continental collision tectonic settings. They contain zoned metal suites comprising some combination of bismuth, tellurium, arsenic, tungsten, tin, molybdenum and antimony, with tungsten and tin deposits tending to be hosted in the contact aureole and gold deposits within the granitic rocks. Bismuth is the critical pathfinder element and the deposits are generally low (<5%) in total iron and base metal sulphides .....The intrusions are derived predominantly from I-type magmas with oxidation states near the Ishihari magnetite-ilmenite series boundary. Gold mineralisation is typically hosted in fractionated facies of the plutons, such as greisens, aplites, pegmatites, porphyry dykes. These facies usually occur at the margins or roof contacts of the intrusions. The deposits can be sheeted vein style, greisens or breccias, and aureoles 1–3 km from the intrusions may host skarn replacement or vein-style deposits. Potassium feldspar, albite, sericite and carbonate alteration is common, with greisen-like disseminated style mineralisation associated with the most pervasive alteration. Alteration is commonly restricted to vein envelopes. The low sulphide content often comprises mainly arsenopyrite and pyrrhotite, indicative of a reduced hydrothermal fluid in which H<sub>2</sub>S was the dominant sulphur species. Bismuth and tellurium are the clearest indicator elements and both correlate closely with gold. Most systems contain tungsten, tin, molybdenum and antimony but at the prospect scale these elements do not correlate with gold, due to metal zonation around the intrusion. The lack of a chalcophile metal association and the enrichment in lithophile ore metals distinguishes this style from porphyry copper-molybdenum-gold deposits. Thompson et al. (1999) reviewed the geology of the main IRGS ore bodies recognised to date. Several deposits contain >3 million ounces of gold; these are widely distributed in continental granitic terranes from Europe, Central Asia, Northern China, Alaska–Yukon, Bolivia and Eastern Australia”.

The style of deposits includes those in the Tintina Gold Province in Yukon/Alaska, Hart, 2004, and at Timbarra in NSW, Mustard, 2006, and Blevin, 2005.

Fort Knox in Alaska, for example, contains 158Mt @ 0.83ppm Au, and occurs in in sheeted veins hosted in a Cretaceous ilmenite-series porphyritic granite, and with the main accessory metal suite comprising bismuth, tellurium, molybdenum, arsenic, antimony and tungsten.

At Timbarra, gold is disseminated in the roof zone of a highly fractionated granite. Mineralisation and alteration are capped by microgranite, aplite and fossil crystallisation fronts close to the top of the granite, with negligible quartz veining and with minimal sulphides. The four deposits (Poverty Point, RMT, Hortons and Surface Hill) exhibit different morphologies, and have a total identified mineral resource of 13.65Mt at 0.95g/t gold (417,000oz of contained gold) and a proved and probable reserve of 10.06Mt at 1.01g/t gold (327,000oz of contained gold). The Timbarra granites evolved in an essentially closed system in which chilled carapaces were formed. Altering and mineralising fluids moved up from below and “pooled” in the partially or totally crystalline granite underneath the chilled carapaces resulting in sericitisation and corrosion of feldspars and the chloritisation of biotite. Gold deposition occurred in corroded cavities in feldspar and along crystal boundaries and joints, associated with molybdenum, bismuth, antimony and arsenic.

Fig. 25 shows the model for IRGS systems, contrasting them with porphyry systems.

Using this model attractive styles of mineralisation which seem appropriate at Lisle are:

- large low grade disseminated fine grained gold bodies in granodiorite with or without sheeted quartz veinlets, and poor in sulphides.
- Localised higher grade vein systems showing more evidence of sericitic alteration and sulphides.

### 13.0 TARGETS

Four target areas have been generated using the following parameters:

- Untested by prior drilling
- In areas of geochemical anomalies, especially plant ash anomalies.
- Likely upstream sources of gold in the worked areas of the Donnelly Paleochannel.
- Altered areas, presumed to be sericitic and magnetite destructive, reflected in low magnetic tenor zones in the otherwise higher tenor phase of the granodiorite.
- Relative ease of access in the often steep and densely vegetated terrain.

The targets areas are, as shown on Figs 26 and 27:-

Target 1:- Donnelly Terrace area.

- Highly anomalous plant ash gold geochemical anomaly with a distinct linear trend of at least 1km. This may represent a vein system in basement granodiorite.
- Close to the richest known alluvium of the paleochannel system.

Target 2:- Sweeney Creek area.

- General zone of plant ash gold anomalism.
- Was the upper southern limit of workings in the paleochannel, and thus could be the major source of gold.
- On the the contact of higher and lower magnetic tenor, so may be the edge of an alteration zone.

Target 3:- Red Face area.

- Another contact zone of high and low magnetic tenor granodiorite.
- Could be a local source of gold at Red Face.
- Gold in adits at the base of alluvium was angular, and gold at Red Face not very rounded, suggesting a nearby source.
- South of Synfield Mining Lease.

Target 4:- Watts Creek area.

- Postulated projected extension of Donnelly Paleochannel.
- May not have been discovered because of talus cover.
- An alluvial target primarily.
- Secondly, the linear nature of much of the Donnelly Paleochannel suggests structural control and thus possible mineralisation in the granodiorite below.

#### **14.0 RECOMMENDED EXPLORATION PROGRAM**

The immediate next phase of work should be drilling to test these targets. Fences of angled percussion holes across the areas would be a first pass test.

If mineralisation were found in plant ash anomalous areas, and it could be fairly established that the plant ash technique finds gold beneath talus, then the next phase of work could be an orientation survey to establish the most effective and efficient vegetation sampling methodology, followed by a new systematic grid based geochemical program. At present the geochemical work is confined to tracks, leaving large prospective areas unsampled.

If the plant ash work was judged to be of minimal value further work could be simply infill or step-out drilling. If disseminated sulphides were intersected an IP survey may be justified.

**15.0 ENVIRONMENTAL**

No ground disturbing work was done during the reporting period, so there are no environmental matters requiring attention.

**16.0 EXPENDITURE**

Expenditures have been reported via MRT Quarterly Returns.

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**Note:** References for MRT open file reports are generally not included here. These references are itemised in Table 2.

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