STRUCTURAL CONTROL OF MINERALISATIO N BASED ON GEOLOGICAL REPORTS AND AEROMAGNETICS COVERING THE LEFROY GOLDFIELD, TASMANIA

REPORT NUMBER WA04/038

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Executive Summary

The Lefroy Goldfield in NE Tasmania was the centre of discontinuous gold mining between 1869 and 1915 during which time approximately 180,000ozs of gold was extracted. The records indicate that the average mined grade of the field was in excess of 30g/t Au to a depth of approximately 230m. Underground development and diamond drilling at the Pinafore-Chum, Native Youth and Volunteer reefs (where the bulk of the gold came from) has shown that the reef structures continue at depth (up to 380m) and are locally mineralised at economic grades. Higher grades were mined at the Volunteer and Golden Point/Crown e.g. 2-3 oz/ton. The smaller lodes contained satisfactory gold values but were only worked to shallow depths (~30m).

The recently acquired airborne data has made it possible to produce a better geological map of the district than any other to date. There are, however, zones of complicated stratigraphic disturbance that are difficult to interpret. The magnetic images were not as useful in defining direct (bulls-eye) drilling targets because of the low contrasts in magnetic properties between the various rock types.

A robust structural model has been produced for the Lefroy Goldfield, which is based on research by Mineral Resources Tasmania and CODES at the University of Tasmania and Lefroy Resources Limited.

A robust structural model has been produced for the Lefroy Goldfield that has the following elements:

- D_1 formed the basic structural architecture of the belt, eg., thrusts, folds and overturning of the stratigraphy.
- D_2 further structured the belt (with W-dipping thrusts) and produced a NNW trending "structural corridor" that ultimately focussed D_3 shears,
- D_3 event producing easterly trending shears and the auriferous reefs and lode.

Rheology contrast has focussed mineralisation, in particular favouring the sandstone units.

Thirty one exploration targets have been defined in the historic Lefroy Goldfield in NE Tasmania. 19 belong to the category of extensions to known or existing workings (Type 1), 10 are grassroots or regional targets (Type 2) and two are deep conceptual targets (Type 3). A programme including a total of 2,890 metres of RC drilling (with 210 metres of diamond 'tails'), 1,500 metres of diamond drilling, 2,000m metres of RAB drilling and geochemical auger soil sampling are recommended as an effective test of these targets.

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Introduction

Continental Resource Management Pty Ltd (CRM) was requested by Lefroy Resources Ltd to undertake a desk study of the structural controls of mineralisation in the Lefroy Goldfield in northeastern Tasmania. The study is based on published information including Groves (1965), Reed (2001, 2002). and Keele (2004a & b) together with aeromagnetic and radiometric data acquired by UTS Geophysics and prepared for interpretation by Andrew Boyd.

The Lefroy Goldfield was the centre of discontinuous gold mining between 1869 and 1911 during which time approximately 180,000ozs of gold was recorded as being produced. The records indicate that the average mined grade of the field was in excess of 30g/t Au, with most of the mining being restricted to a depth of approximately 30m however some mining occurred to depths of 200m. Testing of some of the reefs at depth, up to 380m, by both underground development and diamond drilling shows that the reef structures continue at depth and in places are mineralised at economic grades.

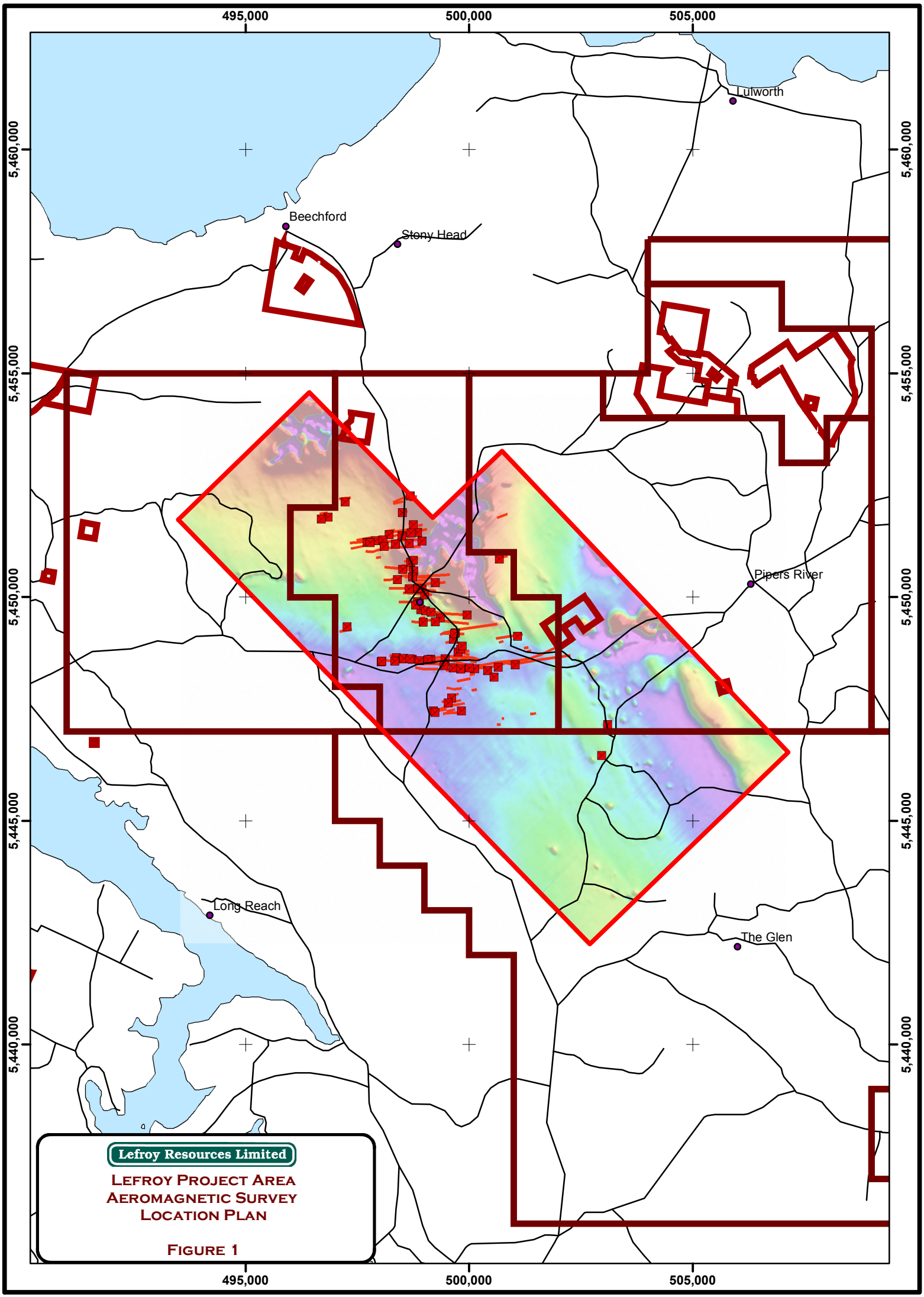
Location and access

The Lefroy Goldfield is located approximately 45km north of Launceston on the east side of the Tamar River. The principal access is the Birdport Highway that passes through the south end of the field. There are a number of track and roads that have been made during previous mining and exploration activity.

Tenements and ownership

Table 1 Tenements

Tenement	Applicant	Area (km2)	Status	Minimum statutory commitment for first 2 years ($)
EL 35/2001	Sapphire Trading Ltd	42	Granted	41,250
EL 2/2002	Sapphire Trading Ltd	55	Granted	100,000
ML 16M/91	Sapphire Trading Ltd	0.31	Granted	500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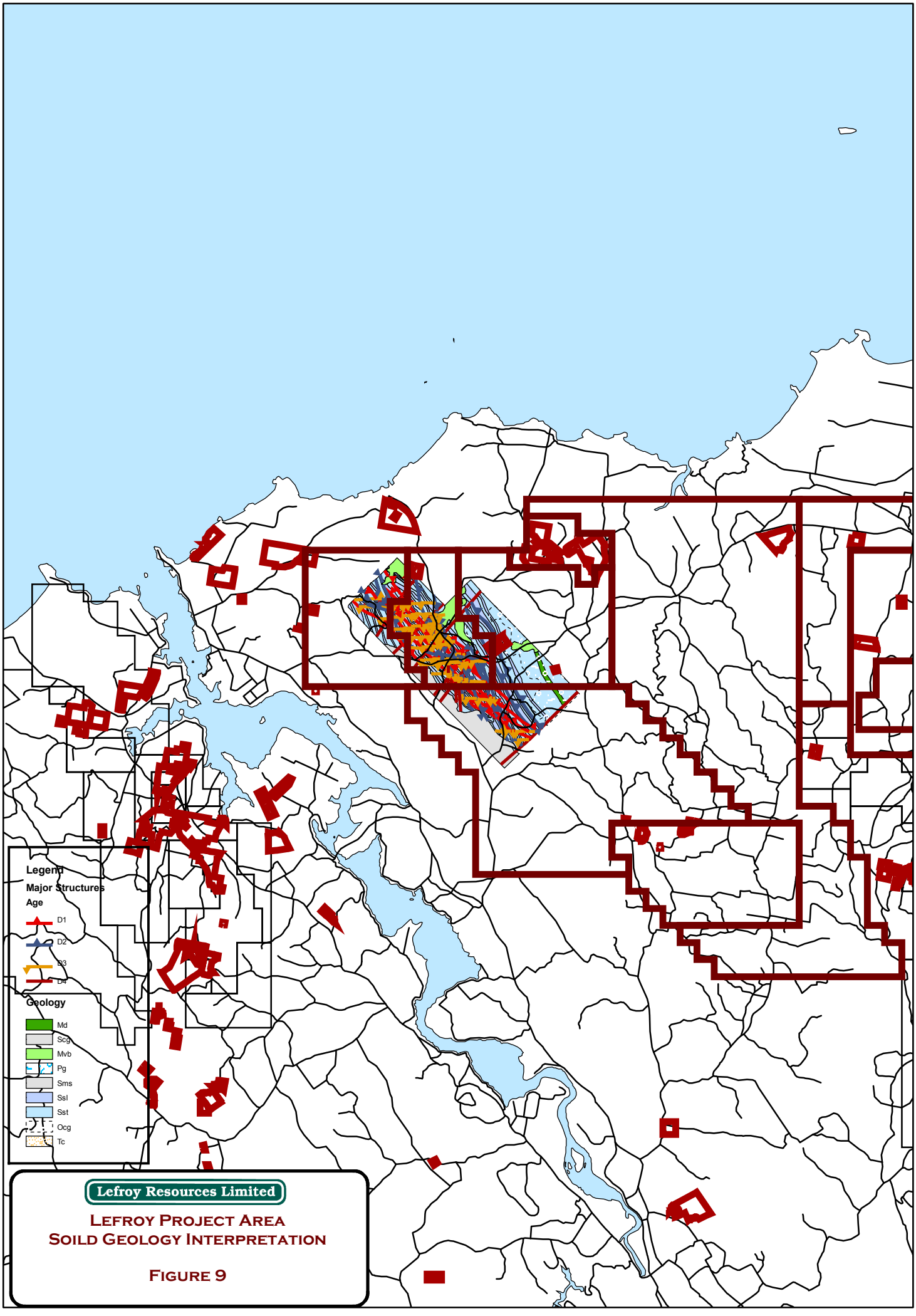
500,000
505,000
5,460,000
5,455,000
5,450,000
5,445,000
5,440,000
Beechford
Stony Head
Lulworth
Pipers River
Long Reach
The Glen
Lefroy Resources Limited
LEFROY PROJECT AREA
AEROMAGNETIC SURVEY
LOCATION PLAN
FIGURE 1



Lefroy Resources Limited

Lefroy Project Area
Soild Geology Interpretation

Figure 9

Geology

Regional Geology

Powell and Baillie (1992) showed that Lefroy lies on the overturned limb of an E-directed D_1 recumbent fold in the Pipers River Recumbent Zone (Figure 2). Fold structures east of the Pipers River are upright in style, which has led other workers - notably Reed (2001) - to speculate that there is an unconformity separating these two structurally distinct domains, in which these Benambran-aged (or late Delamerian?) recumbent structures are absent to the east.

The crustal structure beneath the Lefroy deposits has been modelled by Keele et. al., (1994) and Reed (2004). The regional model is of a thrust terrain with fluids sourced from a shallowly E-dipping D_3 detachment fault that daylights beyond the Beaconsfield gold mine on the western side of the Tamar Fracture Zone (Figure 3). The steeply dipping D_3 vein structures and faults short-circuited the gold-bearing fluids at depths of between 5 and 10 kms. Arsenopyrite geothermometry data suggests that Lefroy was closer to the fluid source than Beaconsfield: Lefroy fluids were hotter (460-470° C) than Beaconsfield (370-440°C, unpublished data).

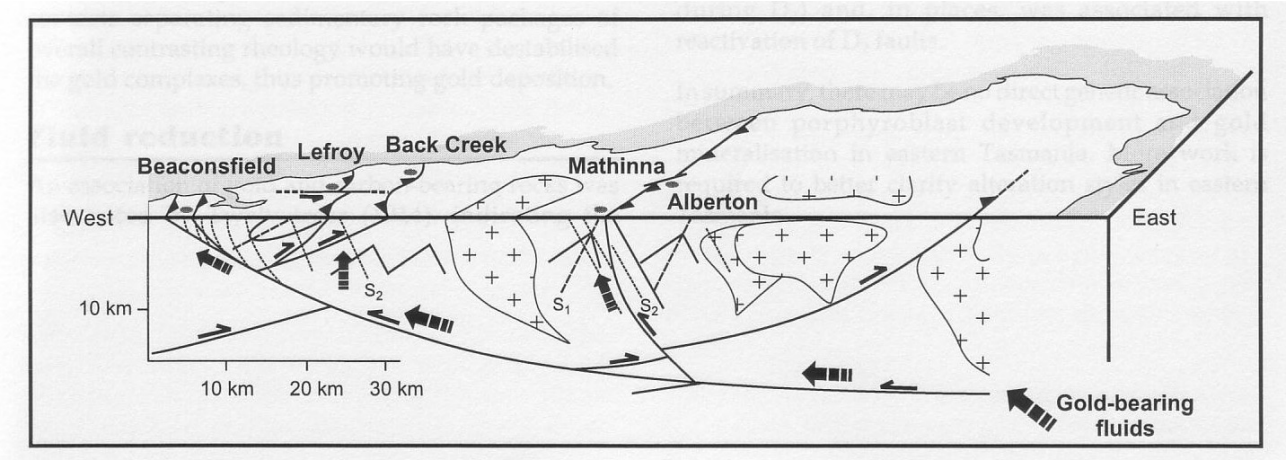


Figure 3 Block diagram of eastern Tasmania, below the Lefroy and Beaconsfield goldfields (Reed, 2004)

Goldfield Structural Geology

Richard Keele has provided major input into the following summary of the timing and naming of deformation events in the Lefroy district.

Table 2 Summary of Deformation Events

Tectonic Event	Age	Style	Gold	Comments
D_1	Benambran?	Shallow W-dipping, NE-trending thrusts/ recumbent folds	No	Main architecture of deformation zone
D_2	Devonian	W-dipping thrusts and extension event	No	S2 is reactivation of D1/extension crenulation of S1
D_3	Devonian	Upright folding and S3 crenulation cleavage (of S1)	Yes	Main gold event forms vein arrays in D2 corridor
D_4	Devonian	Brittle-style NW & (NE) trending faults	No	Post-gold event

In the Bridport Highway section S_1 is a gently SW-dipping penetrative foliation developed in overturned sandstone-siltstone-mudstone sequences (Figure 4). A number of faults can be seen in the road cut, which make up the NW-trending D_1 "corridor" that runs through the goldfield (Keele 1996).

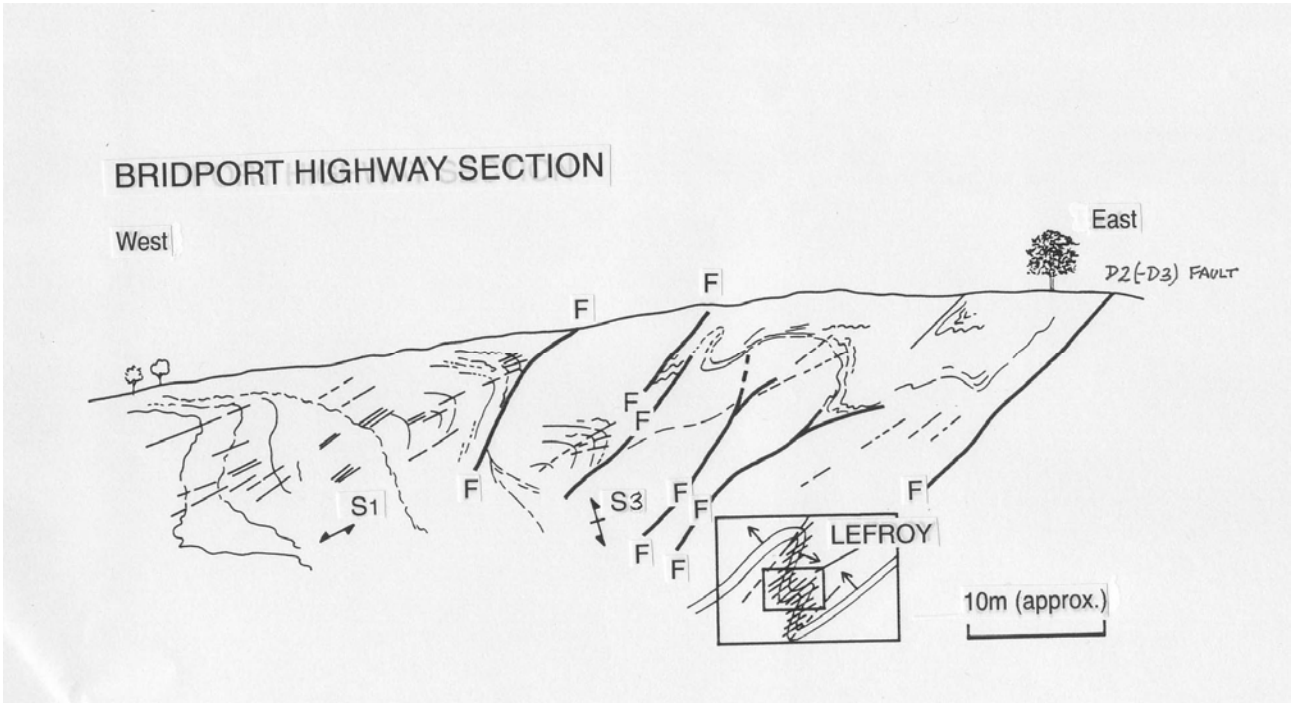


Figure 4 Section of road cut on the Bridport Highway section, looking north (Keele, 2004) –Inset shows relationship between the overturned limbs of D_1 folds and the S_1 cleavage

The second deformation event identified is an extensional crenulation/shear band fabric (S_2) that gives a consistent normal sense of shear in outcrop. D_2 faults are 1-30 cm wide moderately W-dipping zones that contain quartz veining, alteration and cataclastic textures. The anastomosing or "stripey" S_2 cleavage, which is well developed in certain units that are composed of alternating sandstone and siltstone. This indicates that shearing dominated the D_2 event. The D_2 faults (and shear bands) have exploited the rheological contrasts in the sandstone-siltstone-mudstones; hence these D_2-D_3 faults generally follow stratigraphic contacts (Figure 4) except where the stratigraphy has been folded.

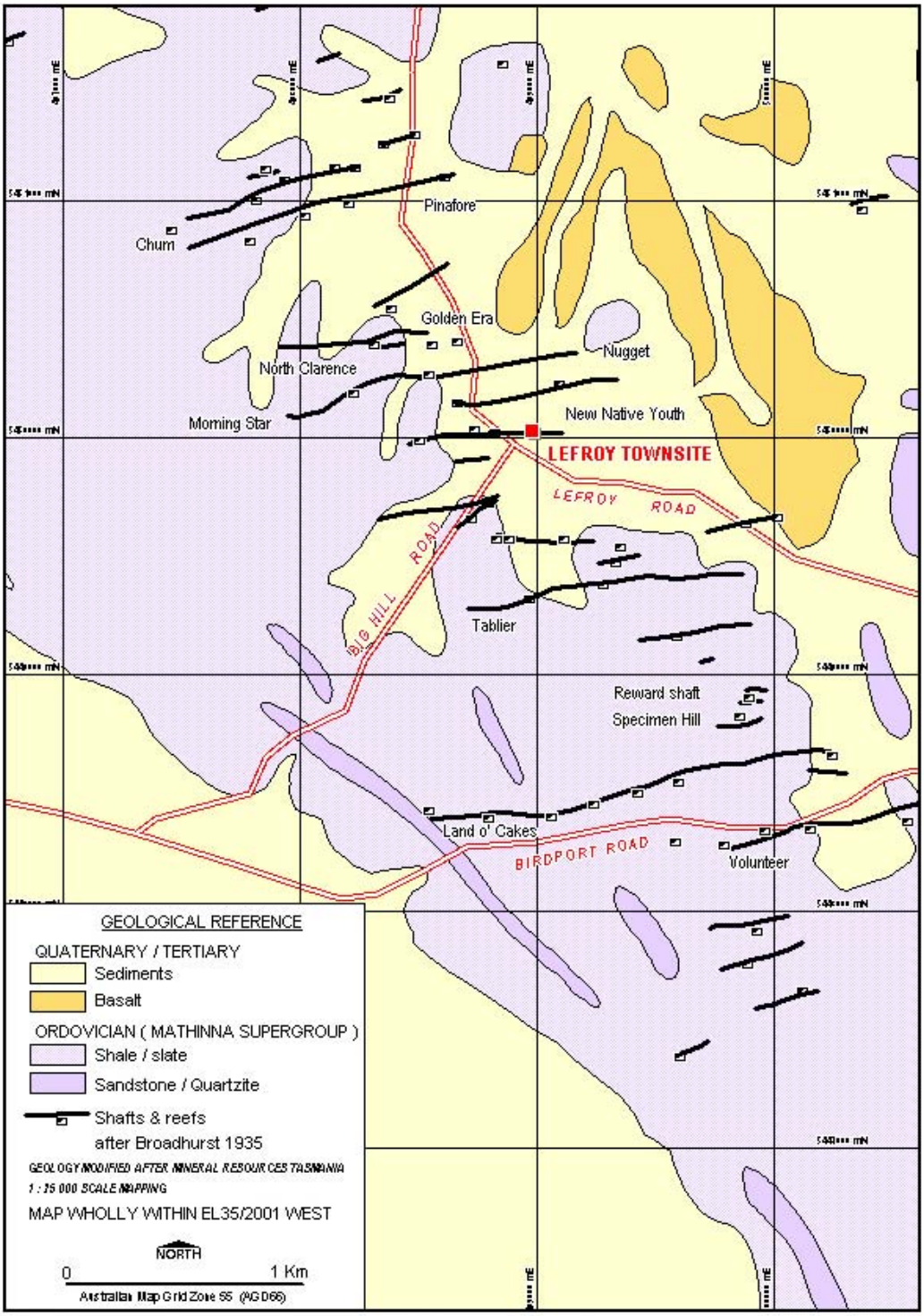
D_1 and D_2 are strongly developed in a corridor through the Lefroy Goldfield and appear to focus the mineralisation by providing structures for reactivation in D_3.

The Lefroy Goldfield is dominated by an *en relai* array of D_3 structures (Powell 1991). A number of structures such as quartz veins, joints, intersecting lineations, fold axes etc, are attributed to this deformation. There is a high probability that veins associated with this deformation are mineralised. Au-Sulphide mineralisation is associated with D_3 brecciation and folding of D_1/D_2 structures.

D_3 is partitioned with development of right hand step-over faults and veins developed such as at Land O' Cakes and Volunteer. Cross faults and mineralised veins such as at Golden Point S_1/S_2 cleavage, brecciation and disruption of D_1/D_2 veins and development of crenulation cleavage is reported.

Refolding of D_2 folds and S_1/S_2 fabrics are an indicator of D_3 high strain zones.

Structural Observations Associated with Mineralisation



LEFROY TARGET AREA SHOWING OLD WORKINGS AND LINES OF REEF

Figure 5 Distribution of D_3 lodes at Lefroy

The mineralisation at Lefroy is hosted by a series of steeply dipping east-west shears up to 1.5km in length, which dip steeply north or south. The shear zones are generally 10-20m wide and contain auriferous planar quartz veins or shallow plunging shoots. In the largest reef, Volunteer, the lode has been mined along 1.2km of the 1.6km length of the shear zone.

A detailed study of the diamond drill core from Allstate's drilling at the Volunteer (Reed 2001) concluded that the westerly plunge of the Volunteer ore body was due to the intersection of a shallow W-dipping D_1 thrust with the ENE-trending D_3 quartz veins. This observation is consistent with and association of shoots with rheology changes, that is likely to be more directly related to stratigraphy than earlier structures. Facing evidence in drill core (DDH L1) showed that the Volunteer mineralisation coincided with a change from overturned (down-hole facing) sandstone beds in the west from normal facing (up-hole facing) siltstone-mudstone units the east. Reed recognised D_3 by its localized folding of S_1/S_2 and disruption to the D_1/D_2 veins. Auriferous sulphide mineralisation is typically associated with D_3 brecciation and folding of D_1/D_2 structures in core. Chisholm (2004) has related the shoots to intersections of D_3 shears (Figure 6).

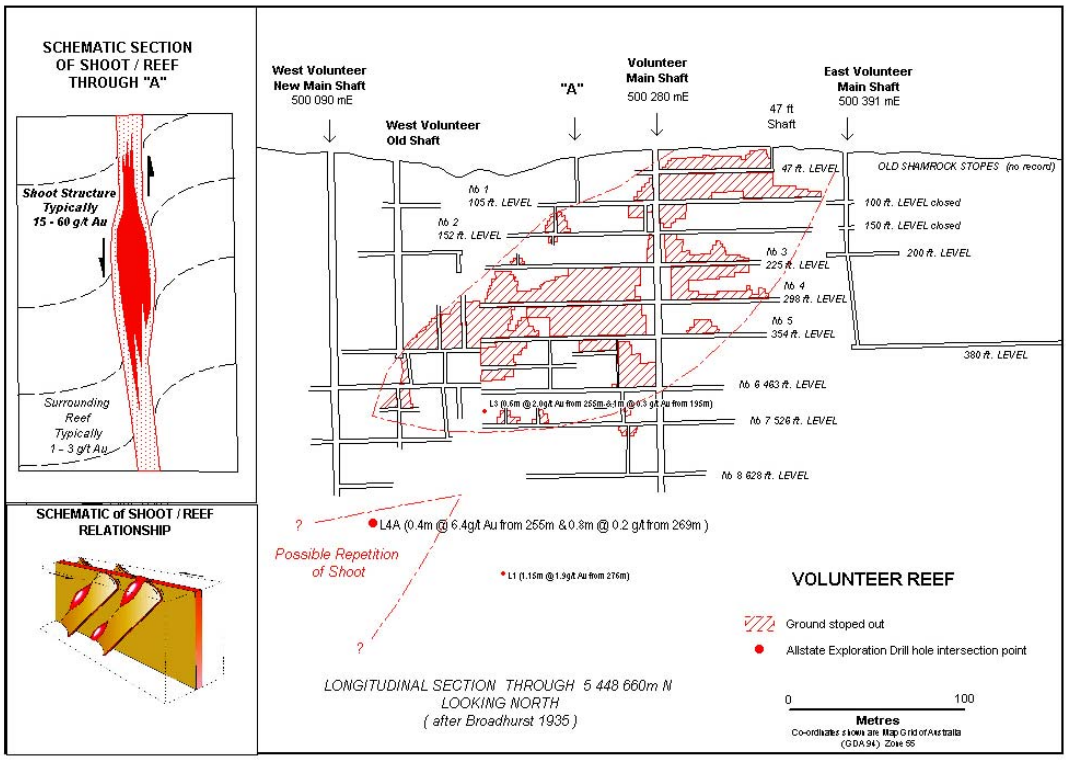


Figure 6 Longitudinal section of Volunteer with D_3 secondary shear model (Chisholm, 2004)

The geological model derived from this study indicates that the country rock was rotated and partitioned during D_1/D_2 deformation developing asymmetric recumbent folds with limbs sheared out on steeply dipping zones. Veins associated with this event have no mineralisation, but are commonly associated with minor alteration. It is expected that the stress field during this deformation was E-W compression and σ_3 vertical.

In D_3 a spaced cleavage developed axial planar to open upright buckles. Sub-parallel "Reidel" shears have formed along the belt and these are occupied by shear veins. Stepping faults propagating further to the east on southerly steps are common. Extension veins parallel to σ_1 occur at Golden Point etc.

At Lefroy there are clearly a number of factors associated with mineralisation. These are summarised in Figure .

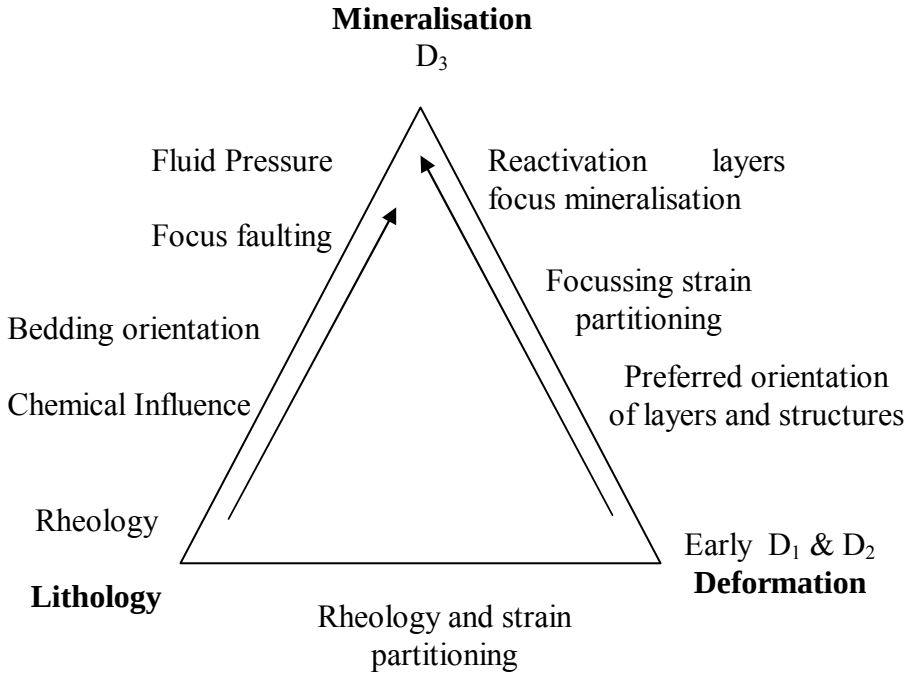


Figure 7 Illustration of the interaction of deformation, stratigraphy and mineralisation at Lefroy (after Reed, 1999)

Mineralisation – D_3

The richer and more substantial lodes such as the Volunteer, Native and Pinafore-Chum produced the bulk of the gold in the field at grades between 20-30 g/t; locally grades were much higher, e.g. 2-3 oz/ton at the Volunteer and Golden Point/Crown. Mining on the deeper lodes rarely went below 120 metres and never below 220 metres. Drill core from DDH L3 & L4 shows that the host rocks are fractured and broken to a vertical depth of approximately100-110 metres. This indicates that much of the historic mining activity ceased at a depth where the rock became totally fresh, i.e., where it was unaffected by circulation of groundwaters during the Tertiary. The implication here is that the ore is more likely to be refractory below this depth.

Many of the smaller lodes contained satisfactory gold values at the surface but were only worked at very shallow depths. These include the Old Comrades, Perpetual, Equila, White Pinafore, Welcome Nugget, Australasian and McIvor, Prince of Wales, Brisbane Tablier, Monkland, Windermere, Rifleman and Leefloyd Reefs.

Recruit Reef

The Recruit Reef has high-grade shoots plunging 60^o E on two levels of the workings, mineralisation appears to be related to reverse bends.

Perpetual-Comrades Reefs

The lode is displaced by faults $30^o \rightarrow 300^o$. The lode is situated on a left lateral bend. There is a flattening of the dip at Perpetual.

Chum Reef

Chum Reef has been worked to a depth of 175m and three holes have been drilled to test the depth 240-275m deep with one intercept of 0.6g/t Au over 2.4m of core. Siltstone host. Mineralisation plunges west at about 60^o. In section the lodes dip north and south, in plan the movement appears to be left lateral.

Pinafore

The lodes are quartz veins in a wide fault zone dipping south and with a plunge at about 60^o to the E. The mine has been worked extensively to a depth of about 90m with further development to 370m. There are three separate veins that diverge at depth, there are linking shears between lodes, and on link lodes there is an easterly plunge. The host is siltstone. In plan the movement appears to be left lateral.

Clarence

Cataclastic lodes of the Clarence structure have some mineralisation in the fault planes. The mineralisation plunges 60^{o}E.

Native Youth –City of Launceston

The line of workings provides and excellent example of a step over between Native Youth line and City of Launceston line. In section the lodes dip steeply south and north. Plunge of mineralisation is to the west at about 60^{o}.

Nugget

The plan movement looks to be left lateral and there are linking lodes developed.

Bain & Richardson - Golden Crown- McIvor

These lodes are on a link; they plunge easterly at about 65^{o}E. The main mineralisation is intersection shoots on the cross link, particularly at Golden Crown and Golden Point.

Admiral-Peden

Step over structure apparent. The reef lies to the north and west of the Land O'Cakes line.

Land O'Cakes – Volunteer

On the Land O'Cakes line of lode the there is variation in strike indicating left lateral movement. The mineralisation plunges 60^{o}W. The Waverly workings may be a bend focused shoot.

The Volunteer line of lode is a step south and east from the Land O'Cakes line and the mineralisation plunges 60^{o}W.

Monkland

The Monkland lode has dips to the north and south. It is supposed to be the extension of the Windermere Line.

Stereographic Nets

Stereographic net analysis is limited by the exposure. In a desk study the observations of Groves were digitized and adjusted for analysis. The result was a relatively simple dip slip shear array. From other mapping in the area this stereographic net appears to be associated with the D_1-D_2 thrust arrays rather than shears associated with the easterly trending mineralized D_3 shear zones.

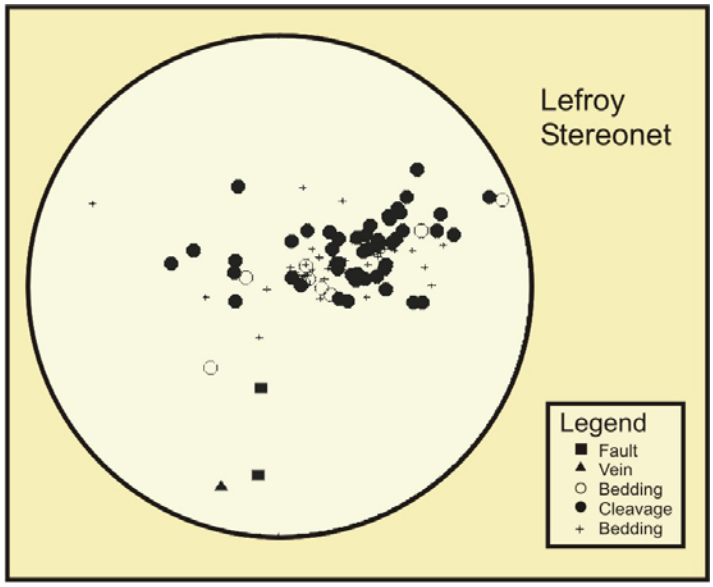


Figure 8 Stereographic projection of data collected from Groves (1965)

Geophysical Images

UTS geophysics acquired images from a survey of the Lefroy district undetaken on behalf of Lefroy Resources Ltd. Further processing was undertaken by Integrated Geophysical Solutions.

The images collected are included as Appendix 1 and these are:

- Digital Terrain Model
- Total Magnetic Intensity
- Total Magnetic Intensity Highly processed
- Total magnetic intensity highly process with Automatic Gain Control
- Total radiometrics
- Ternary Image of Radiometrics
- Potassium Thorium ratio
- Potassium radiometrics
- Uranium radiometrics
- Thorium radiometrics

These maps were combined with an aerial photograph image to form the basis of a geological interpretation. The features used as a basis for the interpretations are:

- Shale units are more highly magnetised than sandstone units
- Basalt is extremely magnetised
- Disruption of stratigraphy indicates faults that are likely to:
  - Be oblique reverse faults
  - Correlate with a developing orogenic event
- Mineralisation is associated with east-west reverse faults

The resulting map is shown in

Figure 9 has been produced based on geological mapping by Richard Keele and geophysics interpretation by John Baxter and Richard Keele.

Richard Keele has constructed two cross-sections across the Lefroy Goldfield and these are reproduced as

Figure 10.

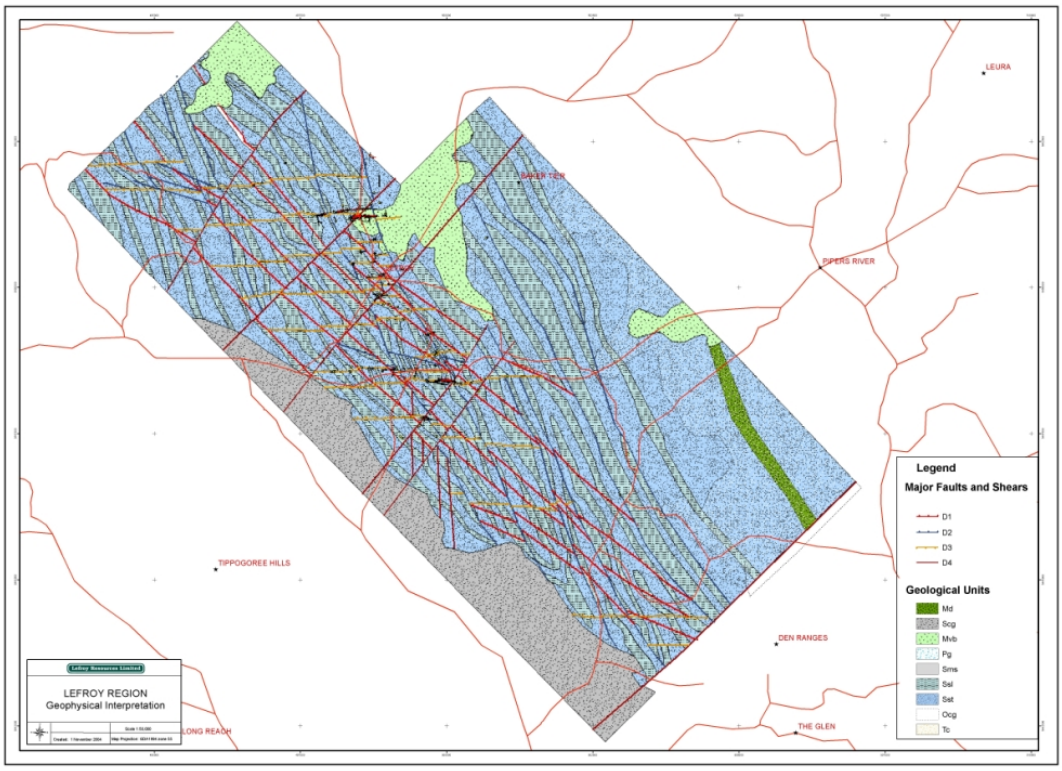


Figure 9 Solid Geology Interpretation of the Lefroy Goldfield

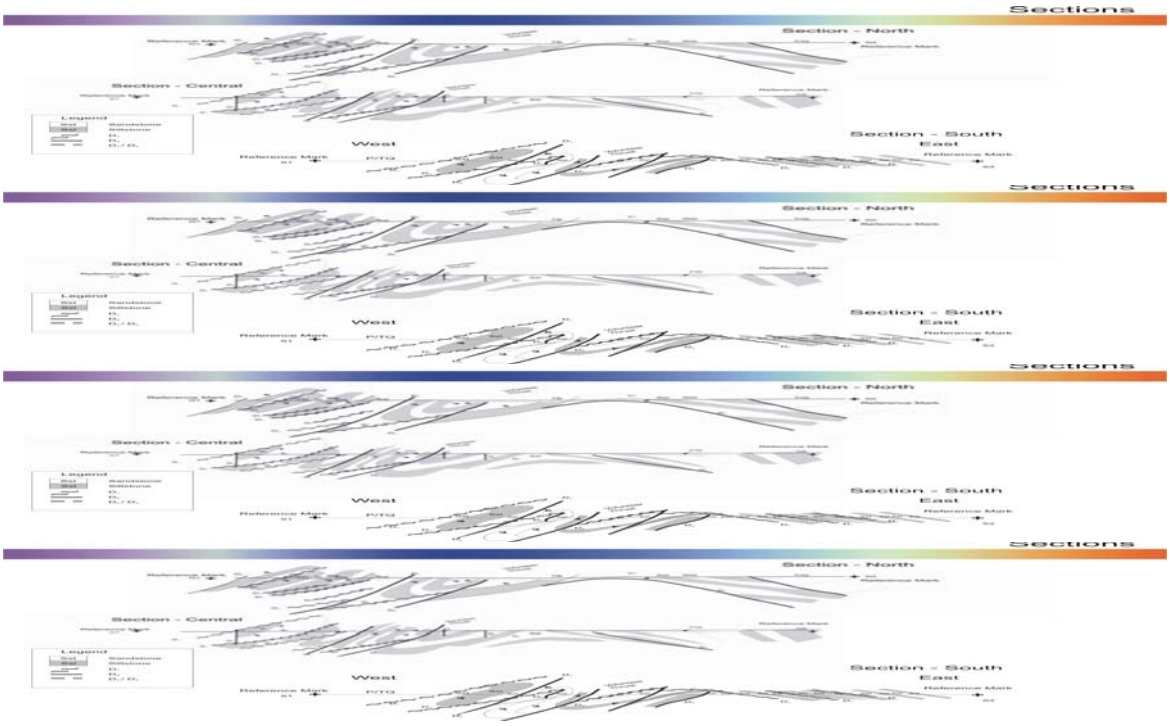


Figure 10 Cross-sections of the Lefroy Goldfield

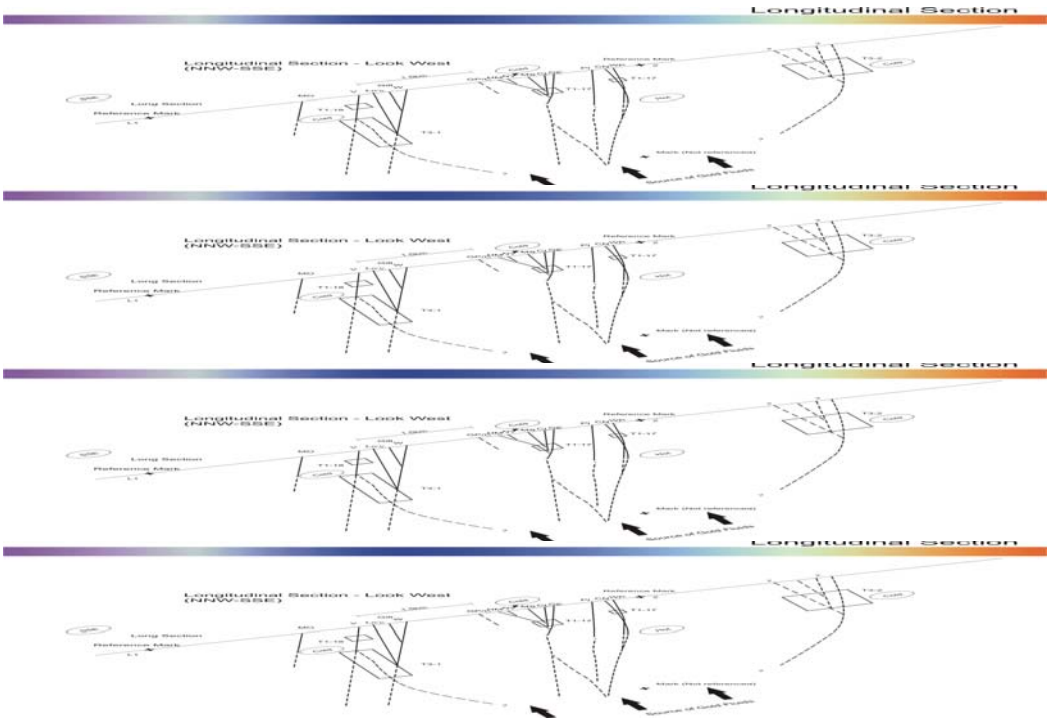


Figure 11 Longitudinal Section Lefroy Goldfield

Targets

Targets have been generated from this study based on:

- D_3 being the favourable deformation event
- Zones of intense deformation are favourable for mineralisation
- Sandstone being the favourable wallrock lithology
- Jogs in shears, or displaced sandstone beds are favourable zones

Three types of target have been generated:

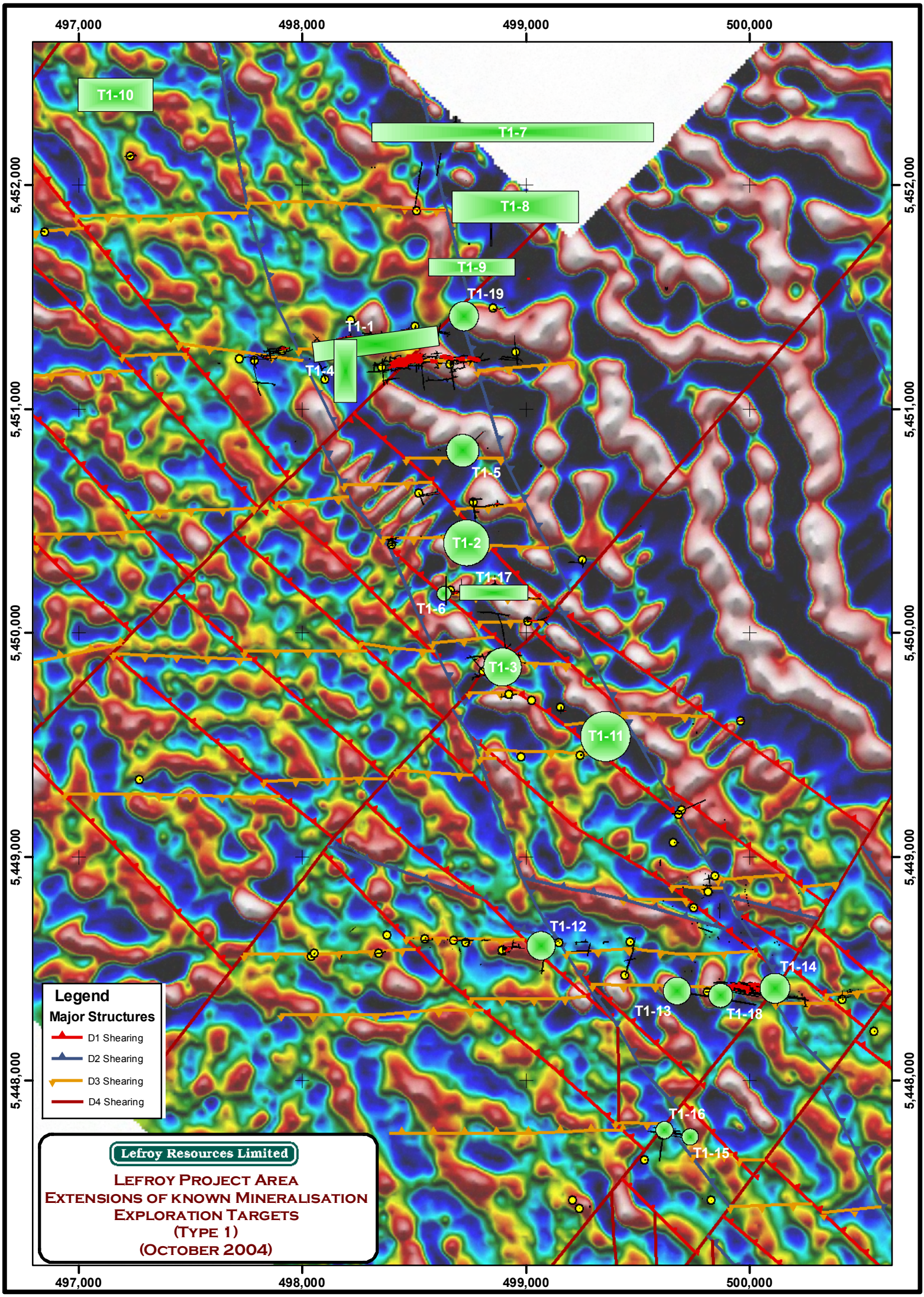
- Extensions to existing workings based on the structural model (T1)
- Regional targets based on the aeromagnetics and the structural model (T2)
- Conceptual particularly based on the Beaconsfield model (T3)

Each target has been ranked in priority based on the structural model with decreasing confidence in the target selection:

- Rank 1 is of high priority with numerous indicators of potential success
- Rank 2 has less pointers to success, but with at least two positive property
- Rank 3 has at least one positive property

Three styles of drilling are recommended and some regional geochemistry to be collected by augers. The drilling styles are:

- RAB drilling to identify geology and the possibility of anomalous zones sited due to favourable lithology and structure. All holes will require geological logging to determine the basement rocks
- RC drilling to fairly well defined targets where there is an expectation of mineralisation in the intercept
- Diamond tails that need to be oriented to establish the local structural conditions of the intercepts. These holes will require detailed structural logging.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T1-16
T1-15
Legend
Major Structures
D1 Shearing
D2 Shearing
D3 Shearing
D4 Shearing
Lefroy Resources Limited
LEFROY PROJECT AREA
EXTENSIONS OF KNOWN MINERALISATION
EXPLORATION TARGETS
(TYPE 1)
(OCTOBER 2004)

Extension to existing workings (T1)

Chum Line of Workings (T1-1)

The Chum Reef is one of the longest and most continuous reefs in the Lefroy field and consists largely of gold-bearing quartz with minor pyrite and stibnite. It has been worked to a maximum depth of 500 feet and from the mine plans appears to have been stoped out almost continually over the explored length and depth. The mineralisation is deposited within a E-W fissure lode formed in D_3. The main lode has a westerly plunge, but local extension zones plunge easterly.

The easterly continuation to the Pinafore line of workings has been excluded as the D_4 fault appears to cut off the lode.

The recommended intercepts are 498440E, -100m; 498120E, -130m and 498440E, -130m. It is estimated that this target willl require 500m of RC drilling and up to 75m of diamond tails. It is recommended that a psuedo log of the holes be prepared from the database prior to drilling. The target has a rank of 1.

Morning Star (T1-2)

This reef has been worked to a depth of 130m in the Morning Star Mine. Satisfactory gold values were obtained to the east of the shaft in the upper levels and to the west in the lower levels. The available information suggests a west plunging ore-body which became unpayable at the 130m level. The mineralisation is located in bends on the main lodes producing west plunging shoots.

The Morning Star was drilled without any great success in 1937 (4 holes). Hole 4A hit 10.6 m of lode (not true thickness) at 172m. The programme was not considered an adequate test of the reef potential because of the early drilling methods employed (AXT core) and the poor sample medium used (e.g. cuttings).

It is recommended that two holes be drilled below the Morning Star to intersect the down plunge position of the shoot. The recommended intercept locations are 498695E, -120m and 498615E, -160m. The target will require about 350m of RC drilling and 60m of diamond tail. The target has a rank of 1.

Golden Crown (T1-3)

This reef is unusual as it trends NE, which is closer to the true extensional direction in the far field stress direction (e.g. Tasmania Reef at Beaconsfield). It is a short reef and occurs in strongly fractured siltstone and slate, with numerous irregular quartz veins. The longitudinal section of the reef indicates two near-vertical shoots of ore to a maximum depth of about 100m. The structural model indicates these deposits are extension vein arrays in D_3; the lodes are brecciated and steeply east plunging.

The recommended hole is designed to intersect the mineralisation at about 498910E, -140m where the lode could be up to 20m. The target will require about 160m of RC drilling and a 25m tail. The ranking on this target is 1.

Pinafore (T1-4)
The Pinafore Reef comprises a series of quartz veins in a wide fault zone, and is generally obscured by overlying Tertiary gravel and basalt. It has been worked extensively to a depth of 90m with fair success. The reef was tested in depth by underground mining to ~400m (1200 feet), small pockets of fairly rich ore occurring at 246m and 332m. Extensive driving and crosscutting was carried out at 370m and five lodes were intersected, all proving un-payable. The Pinafore is a lode style deposit in D_3.

It is recommended that a fence of holes be drilled centred on 498230E, 5451210N with the objective of intersecting a new shoot adjacent to sandstone within the D_3 lode shear. Approximately 600m of RC drilling will be required to test this target, but no diamond tails are recommended. The ranking for this target is 2-3.

Golden Era (T1-5)
The reef had been developed to a depth of 74m. Gold grades were high in the east drive developed on the main lode and 29 tons of ore were removed for a grade of 3.3 oz/ton! The auriferous quartz extended underfoot but the mine was closed due to water problems and lack of capital.

The Golden Era was drilled in 1936 without success (4 holes). Best indications (DDH 13) were traces of Au + Ag in cuttings at 83m and 105m depth. Rich stone was reported beneath the lowest level at 76m.

The Golden Era target is directed at an east or steep plunging dilatational breccia on a D_3 extension structure. Two RC holes are recommended centred on 498720E, 5450820N for about 300m and diamond tails up to 50m. This target is ranked 2.

Excelsior (T1-6)
Little is known about the Excelsior reef, which forms the western end of the City of Launceston and Native Youth Reef. It dips N and is not affected by subsequent faulting.

This deposit is a D_3 lode style with a westerly plunge of mineralisation. The objective of the planned holes is to test the down plunge extension of the mineralisation. One hole is recommended centred on 498605E, 5450170N. It is recommended this be drilled with RC for approximately 130m. The target is ranked 2.

Equila (T1-7)
Equila is a lode style deposit with well-developed D_3 shears adjacent to sandstone units. It is recommended that the target be examined using RAB drilling across the D_3 structure. Up to 250m of RAB drilling centred on 498820E, 5451885N will be required for the Rank 3 target.

Perpetual (T1-8)
The Perpetual Reef is a S-dipping D_3 shear system that has three distinct lines of lode to it. It was cut off at its western end by a D_4 fault. The S reef is a shear zone, whilst the N reef is likely to be a shear vein that is narrow but rich in gold. The Recruit Reef

is the western extension of the Perpetual Reef. The lode passes beneath the Tertiary gravels and basalt. It is a well-developed D_3 target with sandstone host rocks. It is recommended a RAB drilling program be centred on 498500E, 5452230N and that up to 250m of drilling be undertaken. The target is ranked 2.

White Pinafore (T1-9)
There is little information on this reef; it apparently passed under deep gravels at its western end and was never followed. There was a D_4(?) fault between the 40 m and 61m levels that displaced the reef. The White Pinafore lode is the extension of a D_3 lode shear where it intersects sandstone at about 498760E, 5451620N. It is recommended a program of RAB drilling be undertaken for a total of 250m. This target has been assigned a rank of 3.

Far East Recruit (T1-10)
This reef dips S and is an extension of the Perpetual Reef system to the east. It is a faulted reef (i.e. it contains slickensides and brecciated reef). The Far East Recruit and western Equila lode is the extension of a D_3 lode shear where it intersects sandstone at about 487700E, 5451885N. It is recommended a program of RAB drilling be undertaken for about 250m. This target has been assigned a rank of 3.

Wallis (T1-11)
The target is situated at the intersection of compressive and dilatational shears in D_3. There is magnetic low, indicating sandstone and we expect the target to be shallow. Two RC holes are proposed in the vicinity of 499360E, 5449550N for a total depth of 150m. The target is ranked 3.

Land O'Cakes- Waverley (T1-12)
This target is a D_3 lode in a left hand bend that may indicate dilation on the lode. Two holes are recommended to test the Rank 2 target for about 160m of drilling. This target is ranked 2.

West Volunteer Extended (T1-13)
The target is in the position of an extensional shear within the Volunteer Extended D_3 lode shear. The target is ranked 3.

East Volunteer (T1-14)
Two relatively shallow RC holes (140 metres) are designed to target the up-plunge extension of the D_3 Volunteer Reef. The rationale for these holes is that the eastern end of the Volunteer is not well explored and the E-pitching "arm" has yet to be located (Purvis 1998). Ranking 2.

Monarch East (T1-15)
This target is a dilational bend in an E-W D_3 shear and the eastern end of the Monarch underground workings (see below). The presumed plunge is steep easterly. One or two RC holes for a total of 150m are recommended. Ranking 1.

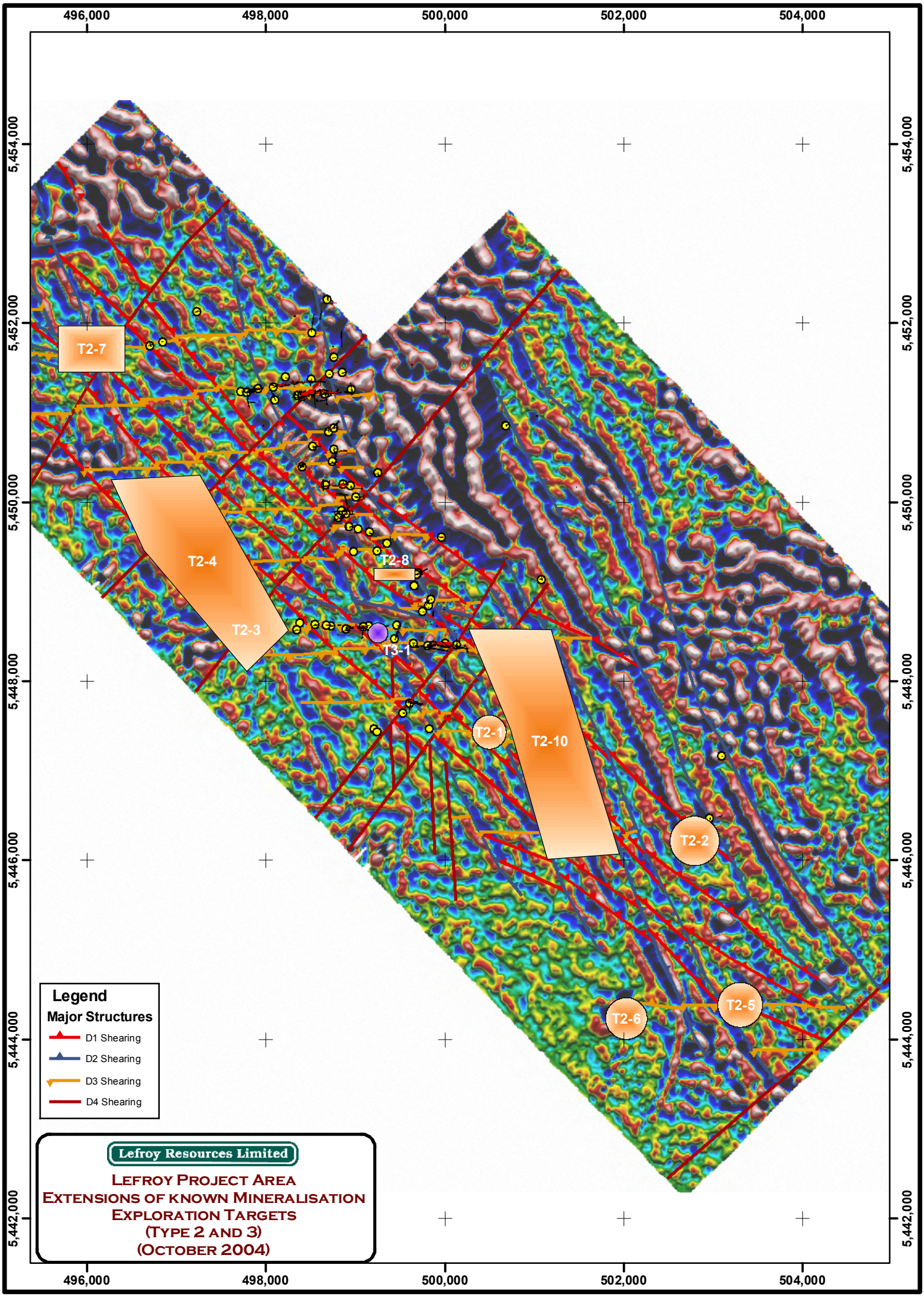
Monarch (T1-16)
There were extensive workings on the Monarch Mine. The main shaft was sunk to 122 metres. The reef hit a shallow-dipping fault (probably D_3) in the upper workings; the lode was picked up again in the New Monarch mine, where the grades were considerably better than above the fault. The western end of the reef was also cut off by a D_4 fault. Ranking 2.

The target is a dilational bend in the D_3 reef below the old workings at approximately 499,650E, 5,447,760N. The host rock is sandstone inferred from the magnetics. One hole (100m) is recommended. Ranking 2.

Native Youth (T1-17)
This target is a deep extension to the Native Youth based on the prediction that the split in the reef at higher levels will repeat at depth below 250 m depth. Native Youth is a D_3 shear array with shears intersecting to produce a westerly plunge. Requires confirmatory geophysics to produce drillable target. 500m of diamond drilling is assigned to this target. Ranking 1.

West Volunteer Branch (T1-18)
There is a potential dilational D_3 shear at West Volunteer. Two holes (total 500 metres) designed to test the E-plunging extensional model. Oriented core measurements required. Ranking 2.

Chum (T1-19)
Chum and Never-Go-Bung D_3 mineralised shears appear to intersect at depth (see Figure 10 in Appendix 1 – Lefroy Structural Model). 500m of diamond drilling has been earmarked for this target, which is an extensional D_3 E & W plunging shoot geometry. CSAMT geophysics is required (500m). Ranking 1.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T2-7
T2-4
T2-3
T2-8
T3-1
T2-1
T2-10
T2-2
T2-5
T2-6
Legend
Major Structures
D1 Shearing
D2 Shearing
D3 Shearing
D4 Shearing
Lefroy Resources Limited
LEFROY PROJECT AREA
EXTENSIONS OF KNOWN MINERALISATION
EXPLORATION TARGETS
(TYPE 2 AND 3)
(OCTOBER 2004)

Grass roots targets based on regional airborne magnetic image and structural model (T2)

SW Corner Volunteer "Compartment" (T2-1)

Shear zones partition the stratigraphy into compartments in the Lefroy district. The structural compartment situated immediately SE of the Volunteer mine appears to have controlled the flow of mineralising crustal fluids (the Volunteer deposit lies at the NW tip of this structure). The target consists of an E-W D_3 structure with a right-step, the definition of the edge of the compartment through magnetic images and the presence of sandstones. Ranking 1

Native Industry (T2-2)

This target lies near the Native Industry mine on a set of parallel E-W D_3 shears. Sandstone is inferred to be the host rock. Ranking 2

West Land O'Cakes (T2-3)

This target is the western extension of the Land O'Cakes structure where there is a considerable amount of sandstone indicated from the magnetics and a disruptive potentially mineralsied shear. It lies on a major D_{2-3} shear. Ranking 2

SW Curries River/Rifleman (T2-4)

This is an extensive target area that lies southwest of the Curries River doubles as a target zone, i.e. D_1 structure, "broken up" sandstone signature from magnetics and an E-W D_3 shear, as well as the other arm of the conceptual D_3 structure that opened up the D_1 transfer (see T2-10, below). An auger geochemical programme is recommended. Ranking 1

Den (T2-5)

The Den has the first record of gold in the district. No production was recorded. This target lies on a D_1 structure, an E-W D_3 shear with disrupted sandstone beds. Ranking 2

Den West (T2-6)

This target lies on the same E-W D_3 shear as T2-5 but lies under Permian cover. Ranking 3

Comrades West (T2-7)

This target lies on a E-W D_3 shear, which is the extension of the Equila RAB target. There is a weak D_1 structure present and sandstone is present. This target also lies along the western D_3 wrench corridor (along strike from T2-4). Ranking 2

Windermere (T2-8)

The Windermere reef was a small, irregular D_3 reef that dips south. This is a soils target in a "periodicity" gap in the mineralised structures between the Volunteer and Native Youth reefs. The magnetics indicate a low (sandstone host) in a region where the trends are rotated. Ranking 3

Orlando West (T2-9)

Little is known about the Orlando other than there were many shafts sunk in the vicinity of the lode and gold had been reported from these. This target is based on soil geochemical signature, a magnetic low and an intersection of D_2 northerly and D_4 NW-trending shears. Ranking 3

"Eastern Shear" (T2-10)

This is the conceptual play that requires there to be a major eastern flanking D_3 structure(s) that controlled the opening of the D_1transfer fault during mineralisation. It is a soils target -40m samples along 400 spaced lines. Ranking 1

Conceptual targets based on the Beaconsfield model (T3)

"Basement Shear" (T3-1)

An outstanding feature of the TMI image (**Error! Reference source not found.**) and the combined radiometric images (**Error! Reference source not found.**) is a major change in the crustal conditions along a west-northwesterly trend just north of the Volunteer mine. Interesting observations about this structure are:

- There is no obvious stratigraphic change across the structure
- TMI indicates the magnetic feature is not deep <300m
- Radiometrics indicate there is some chemical change that is reflected in the surface rocks
- The structure is toward the cooler end of the field from known mineral zonations at Lefroy
- Beaconsfield appears to be developed in a prominent structure approximately parallel to this feature

It is likely this feature is a basement fault at a depth of less than 1km. There is an expectation that this structure will provide geochemical anomalism on all of the faults in the cover sequence above it. Consequently there is expected to be anomalism showing up on both of the regional soil geochemical projects identified (T2-10 & T2-4). Once the results of the geochemistry are received refinements may be possible, but it appears the most likely spot, with a mild inflexion, for a mineralised structure in the basement is at about 499000E, 5448500N. The target depth will be approximately 0.5-1.5km.

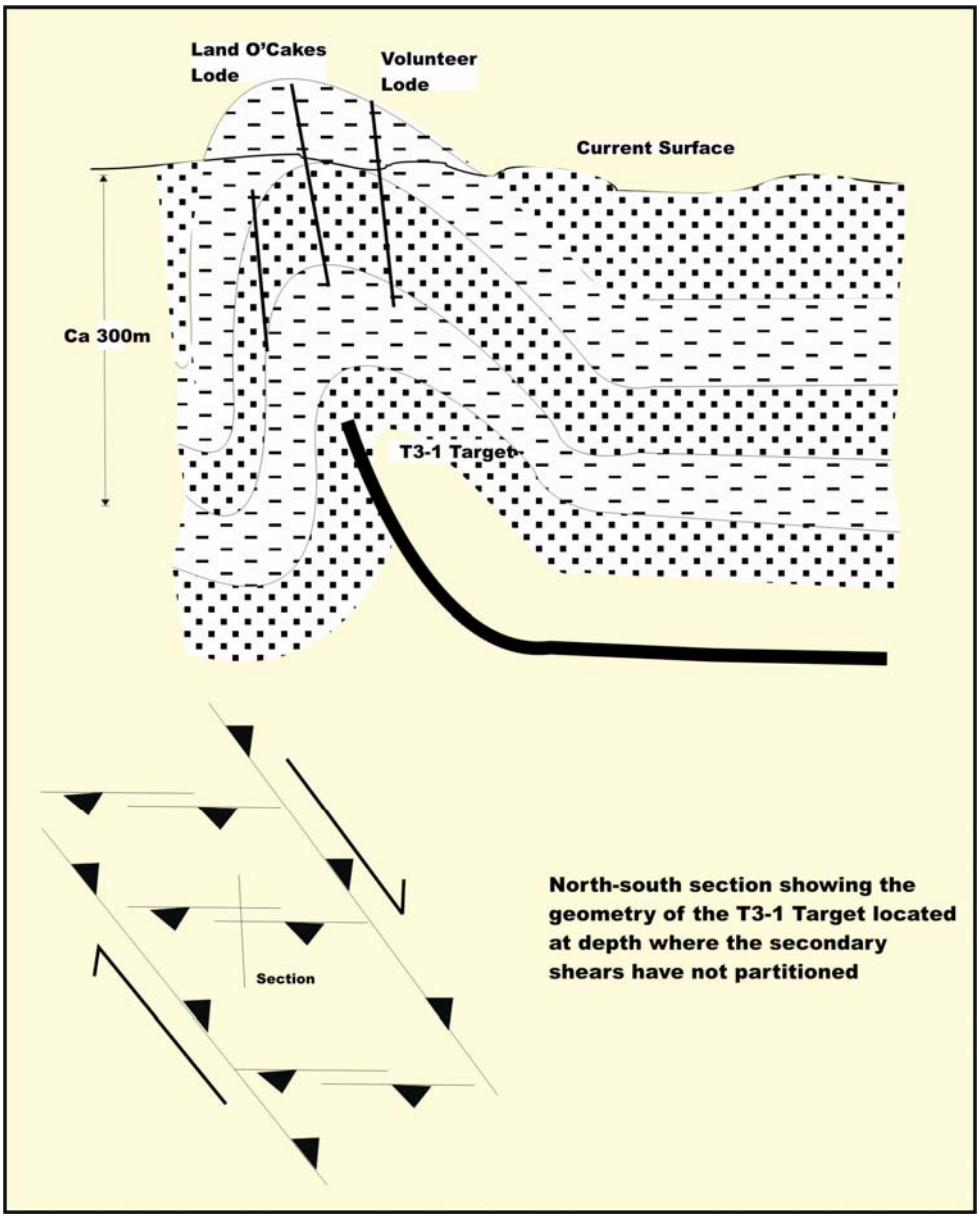
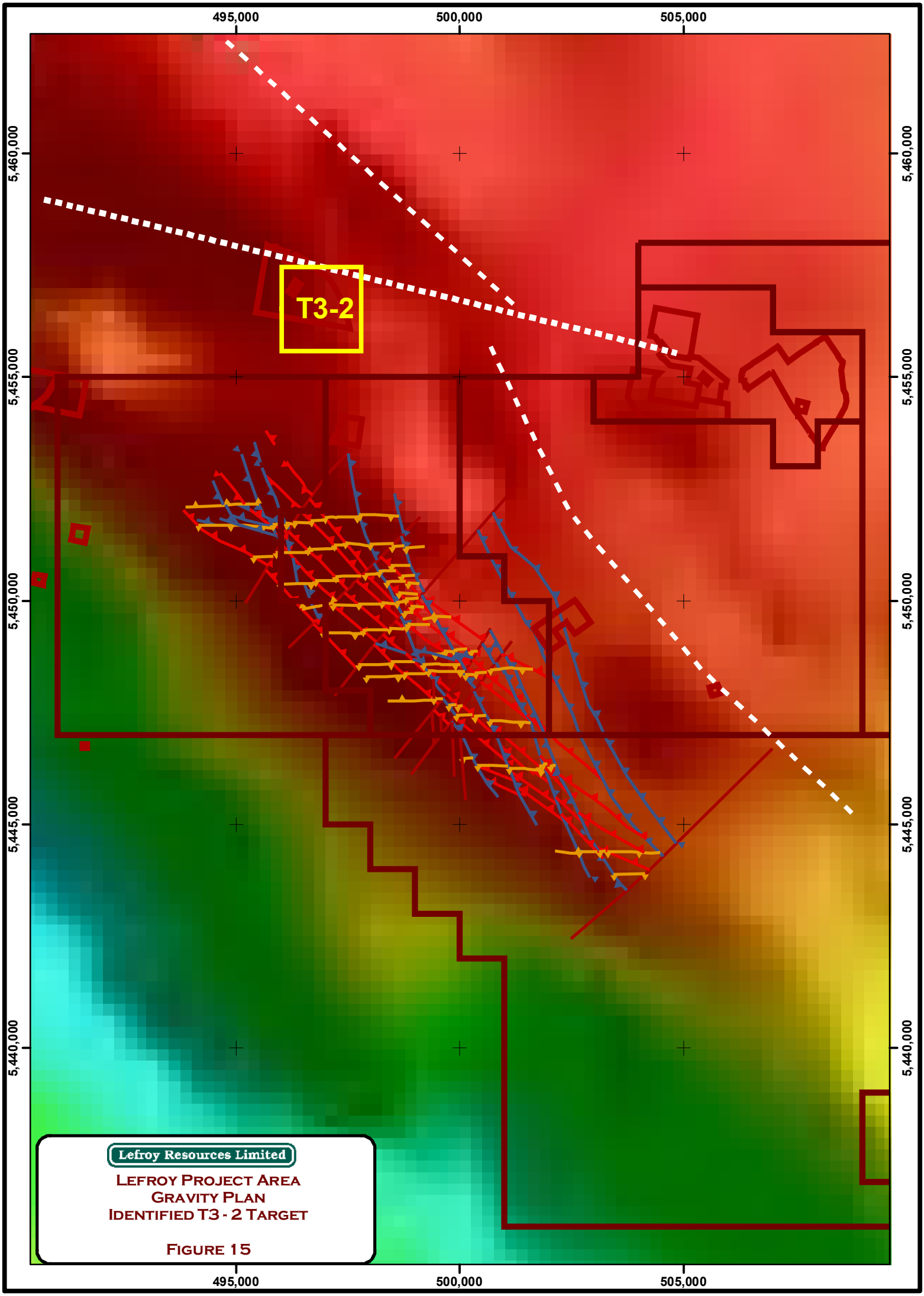


Figure 14 North-south section through Lefroy goldfield T3-1 Target

Gravity-mineral indicator target (T3-2)

The gravity image shows that the mineralisation at Lefroy lies along the edge of a NW- to NNW-trending gravity high. A disruption to this basement feature occurs approximately 4.5 km north of the Pinafore-Chum. On this basis, a potential E-W trending basement transfer structure intersects the main mineralisation trend at 5,455,000N, 497,500E. Depth to this target is inferred to be 0.5 - 1.5km (Figure 14). The spacing between this transfer and the Pinafore is 4.5km and that compares with 3.0-3.5 km between the Pinafore and Volunteer reefs.

The convergence of this anomaly in the gravity field with the fluid temperature vectors across the goldfield suggests: (1) the centre (or hottest part) of the hydrothermal system is located at the Pinafore-Chum and (2) that another mineralised D3 structure should exist in the northern portion of the field.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T3-2
Lefroy Resources Limited
LEFROY PROJECT AREA
GRAVITY PLAN
IDENTIFIED T3 - 2 TARGET
FIGURE 15

Table 3 Lefroy Target Selection

LEFROY TARGET SELECTION

Type 1	**Existing workings, extensions**
Type 2	**Regional geology, grass roots**
Type 3	**Deep conceptual**

Type	Location	Characteristics/Style	Comment
T1 -1	498440, 100m below surface, 498120, 130m below surface, 498440, 130m below surface.	E-W fissure lode D3, W-plunge, Ext. E-plunge.	Chum. 2 x New Chum, 1 x W. Ext Chum. D4 faults excludes Pinafore as valid target. High grade beneath old workings.
T1 - 2	498695 120m below 1000, 498615 160m below 1000.	Shoot style, W-plunge 2 x holes below workings.	Morning Star. 2 x holes
T1 - 3	860RL, 498910	Extensional, E-plunge, breccia lode.	Golden Crown, 1xhole 20m wide zone, percussion drilling.
T1 - 4	498230, 5451210	W-plunge, sst.	Pinafore 4 x hole (add to Chum fenceline?). Look for new shoot. No Diamond tails to start.
T1 - 5	498720, 5450820	Extension structure? E or W plunge: steep. Dilational breccia.	Golden Era. 2 x holes. 2nd priority target.
T1 - 6	498605, 5450170	W-plunge, lode style. Down plunge extension.	Excelsior. 1 x hole.
T1 - 7	498820, 5451885	Extension of D3 lode sst.	RAB Target. Equila.
T1 - 8	498500, 5452230	Extension D3 lode E-W sst, gravel & basalt.	RAB Target. Perpetual.
T1 - 9	498760, 5451620	Extension of D3 lode sst.	RAB Target. White Pinafore.

Lefroy Target Selection (Con

Type	Location	Characteristics/Style	Comment
T1 - 10	487700, 5451885	Extension of D3 lode sst.	RAB Target. Equila W/Far E Recruit.
T1 - 11	499360, 5449550	Intersection compressive/dilational shear. Mag low in sst.	Wallis - Shallow RC Target. 2 x holes.
T1 - 12	925RL, 499045 980RL, 499050	W-plunge D3 lode, left hand bend.	Land O'Cakes/Waverley. 2 x holes.
T1 - 13	499680, 5448400	Extensional shear, D3 lode shear.	W. Volunteer (Ext).
T1 - 14	500100, 5448420	Up plunge ext of Volunteer lode.	E Volunteer. Shallow RC holes (2 x)
T1 - 15	499730, 5447740	Dilational bend, E-W D3 structure.	Monarch East
T1 - 16	499650, 5447760	Sst, E-W structure, dilational bend.	Monarch under workings.
T1 - 17	498780, 5450180	Re-make of structure at depth.	Native Youth. Test below 250m. RE-make of structure at depth.
T1 - 18	499890, 5448400	Extensional shear with D3 lode. Steep E-plunge.	West Volunteer branch. 2xholes. E-plunge of extension made. Oriented core required.
T1 - 19	499655, 5451415	E & W-plunge of lode and extensional vein style	Chum & Never-Go-Bung projected to meet at depth
T2 - 1	5003366E, 544750N	E-W Struct, Mags, Sst. Right - step.	SW corner of Volunteer compartment. SE of Volunteer.
T2 - 2	502980, 5446260	E-W Struct, Sst, 2 // Shears	Near Native Industry
T2 - 3	497710, 5448530	E-W Struct, Sst, $D_{2\text{-}3}$.	West Land O'Cakes
T2 - 4	497300, 5449200	D, Zone, broken Sst, E-W shears	Sw of Curries R. Dam, includes Rifleman. Geochem auger programme.
T2 - 5	503270, 5444390	D, Zone, E-W D3. Disrupted Sst.	Near Den.
T2 - 6	501980, 5444260	E-W D3 Structure.	Near Den West, under Permian cover.

T2 - 7	496100, 5451800	E-W D3, Sst, ?D1 (weak)	Comrades West.
Lefroy Target Selection (Con			
Type	**Location**	**Characteristics/Style**	**Comment**
T2 - 8	499420, 5449190	Sst host, D3 W-plunge lode style. Periodicity gap. Rotated mag low.	Windermere, soils target.
T2 - 9	499485, 5447640	Geochem & signature, low mag & intersecting shears	Orlando West
T2 - 10	501050, 5447430	Eastern D3 structure in transfer model	Geochem 400m by 40m soils.
T3-1	499,000, 5,448,500 RL~550	Deep transfer structure related D1 & D3 wrench fault in basement	WNW trend structure in the vicinity of Volunteer at depth 500-1000m
T3-2		Deep gravity anomaly supported by mineralisation temperature and surface structures (?)	

Conclusions & Recommendations

A number of exploration targets have been selected on the basis of:

- the Structural Model (reproduced below in Appendix 1),
- the airborne geophysical data from UTS
- geological interpretation and
- GIS compilations of geological interpretations on the above.

Important guidelines for developing exploration targets in the Lefroy field include the following:

1. D_1 formed the basic structural architecture of the belt, eg., thrusts, folds and overturning of the stratigraphy.
2. D_2 further structured the belt (with W-dipping thrusts) and produced a NNW trending "structural corridor",
3. D_3 event producing the auriferous reefs and lode.

The airborne data was invaluable for interpreting lithology (sandstone versus shales) and structure as defined by stratigraphic elements. However, the magnetics were not as useful in defining direct (bulls-eye) type targets.

It was clear from the structural modelling that D_3 is the most important structural event in the Lefroy Goldfield with respect to focussing mineralisation. Many of the D_3 east-west shears and some of the linking structures have focussed mineralisation.

Rheology contrast between sandstone and shale have provided a secondary focus for mineralisation. The airborne data provided discrimination as the shaes were more highly magnetised than the sandstone.

Thirty one exploration targets have been defined in the Lefroy Goldfield. 19 belong to the category of extensions to known or existing workings (Type 1 target), 10 are grassroots regional targets (Type 2 target) and two are deep conceptual targets (Type 3 target). A programme including a total of 2,890 metres of RC drilling (with 210 metres of diamond 'tails'), 1,500 metres of diamond drilling, 2,000m metres of RAB drilling and geochemical auger soil sampling are recommended to effectively test these targets.

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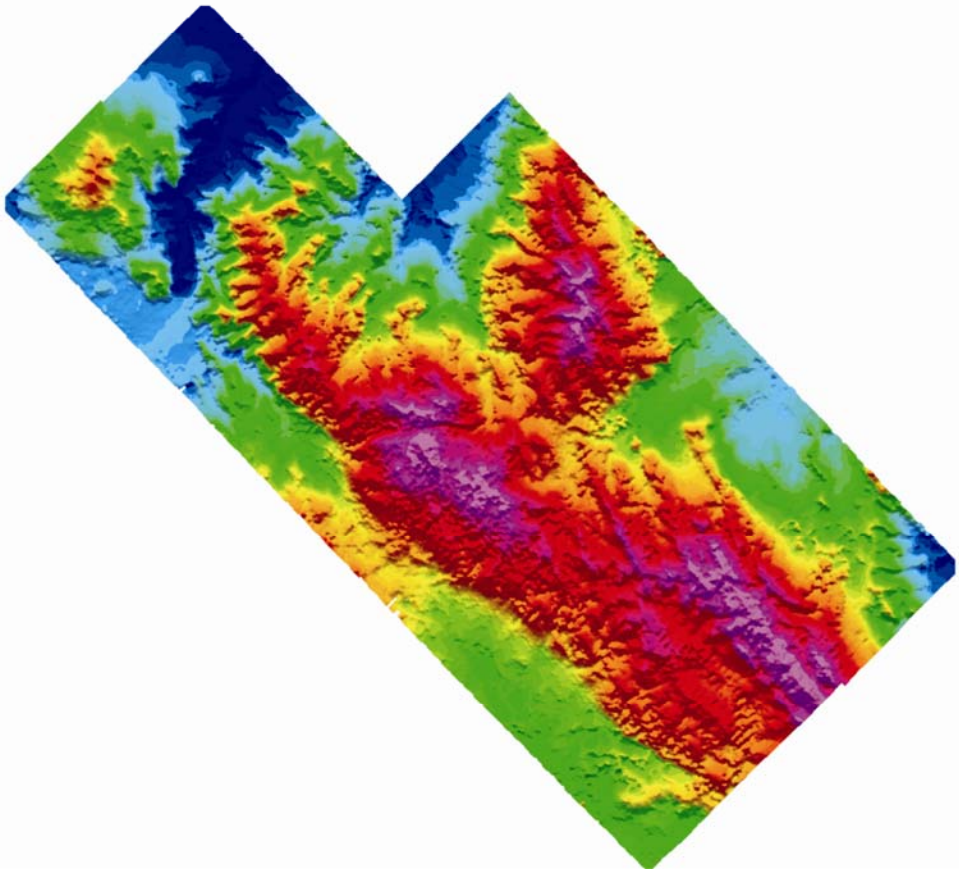
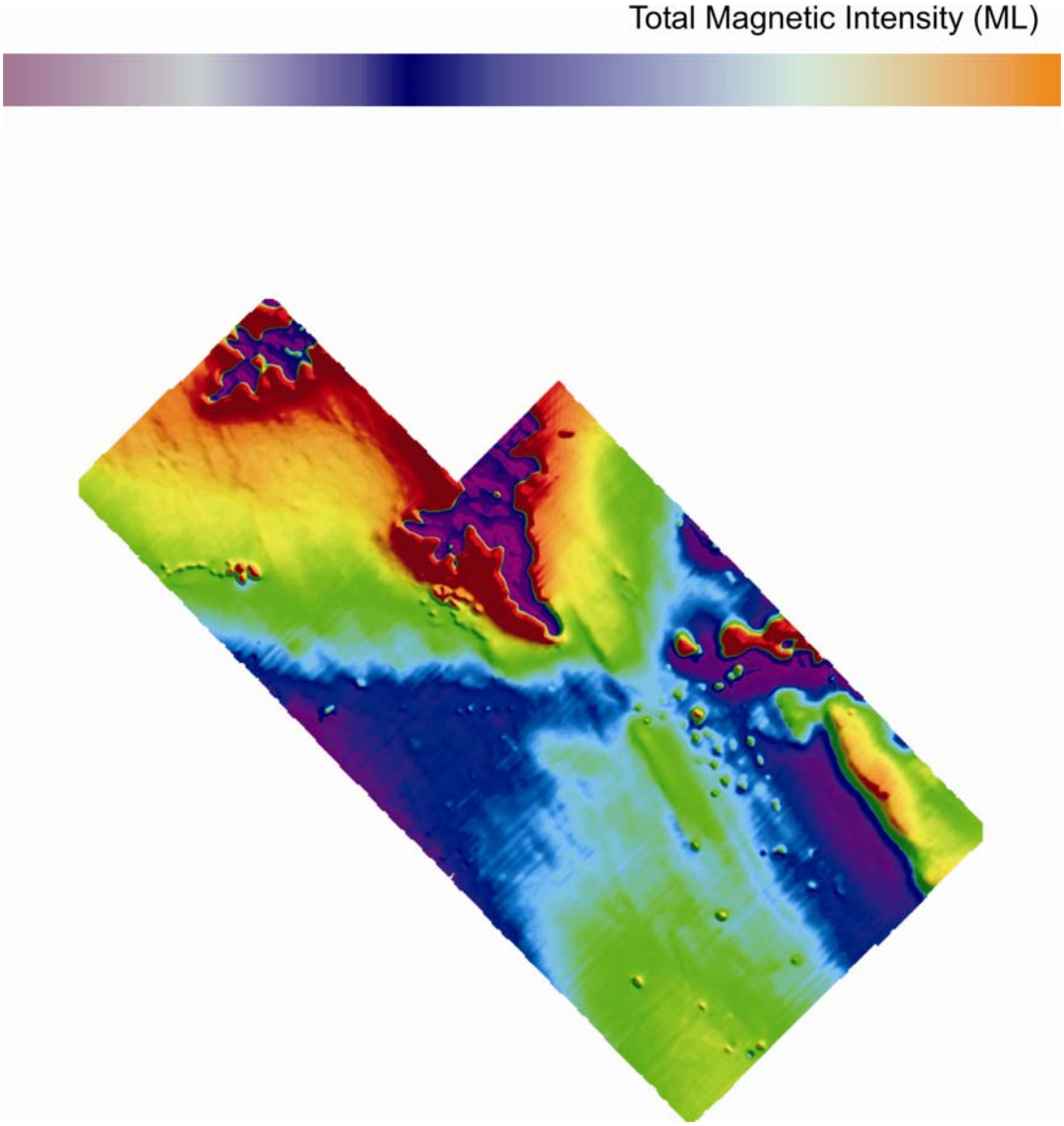
Appendix 1 – Reduced scale images used in the interpretation

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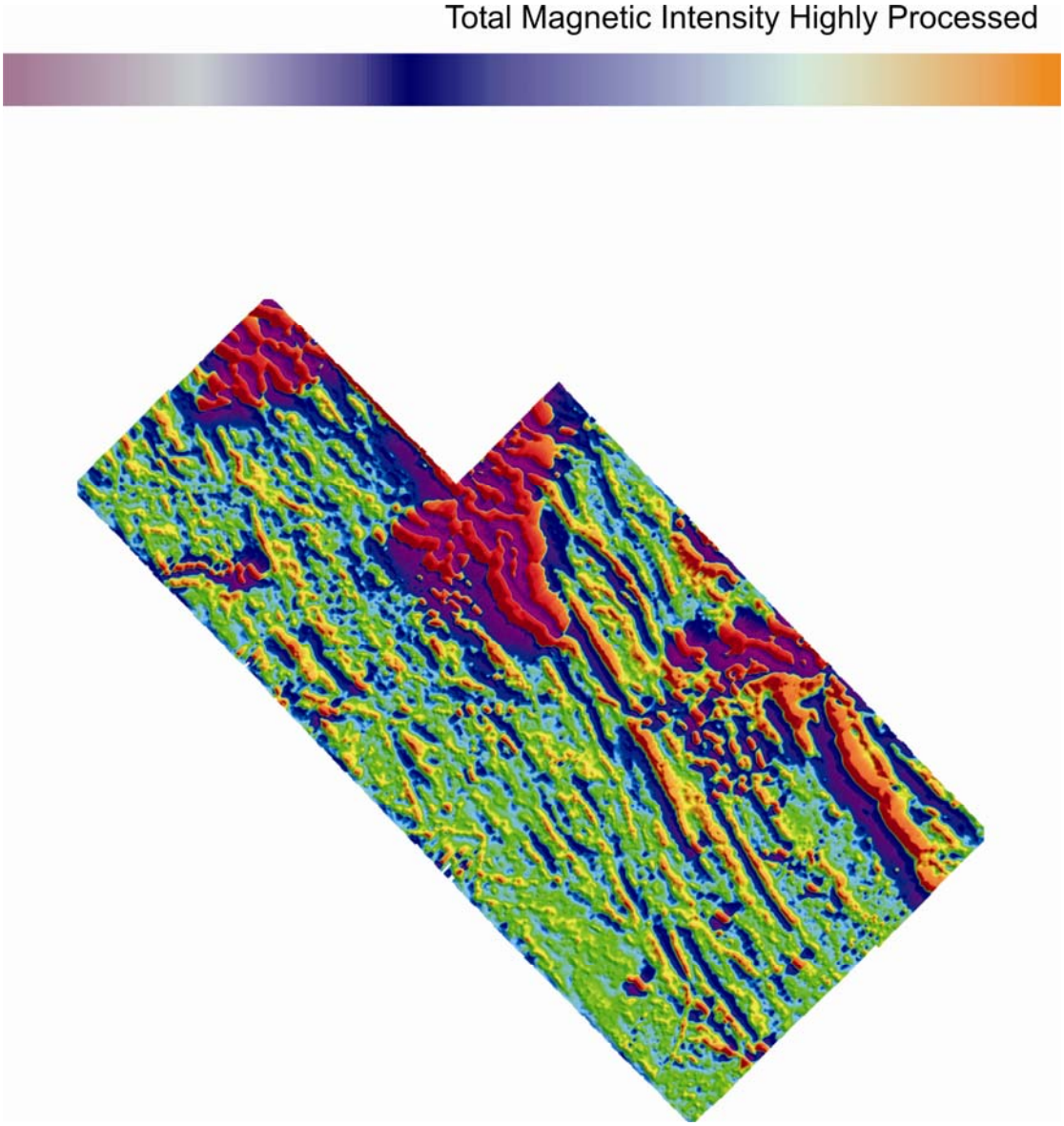
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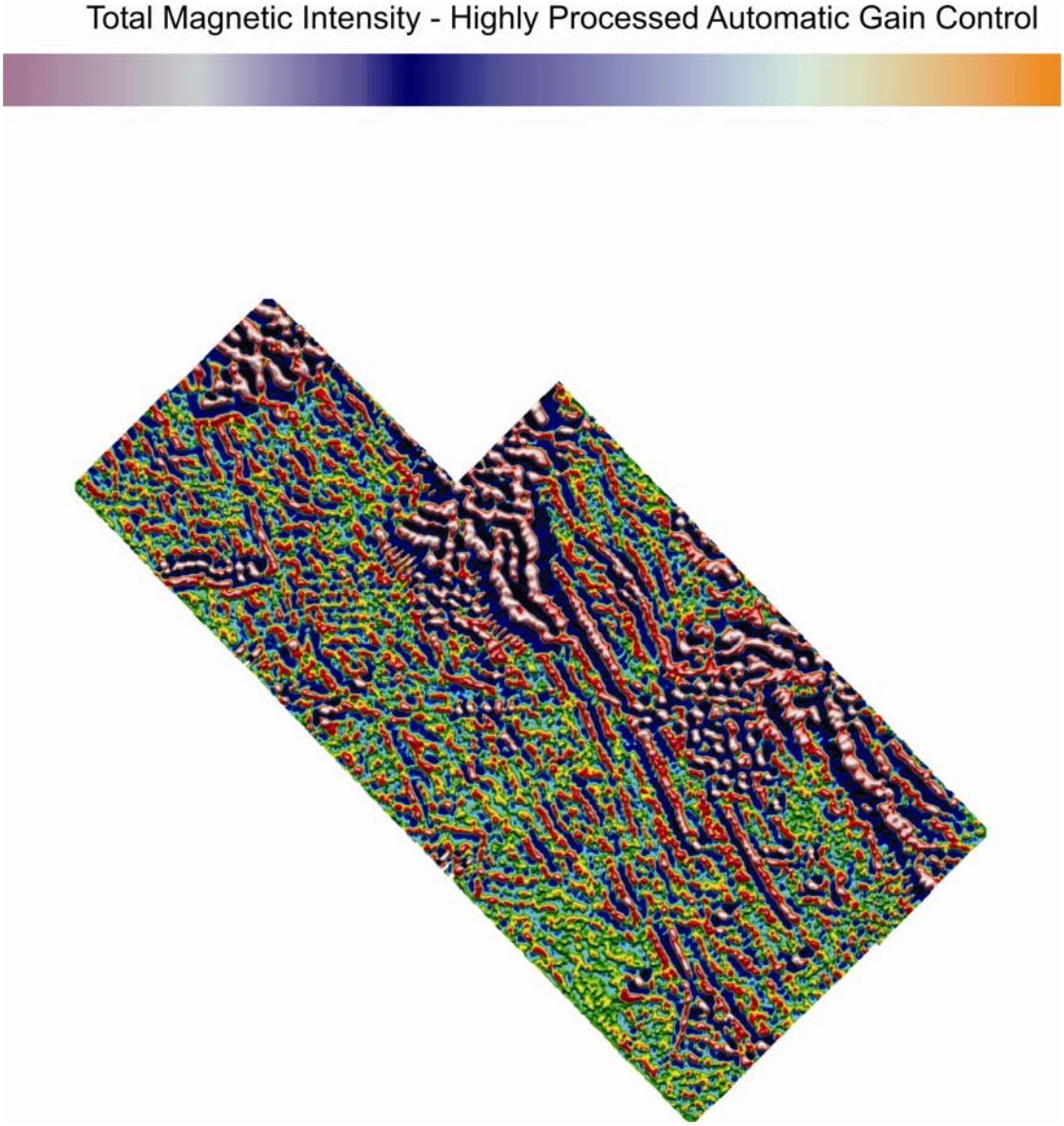
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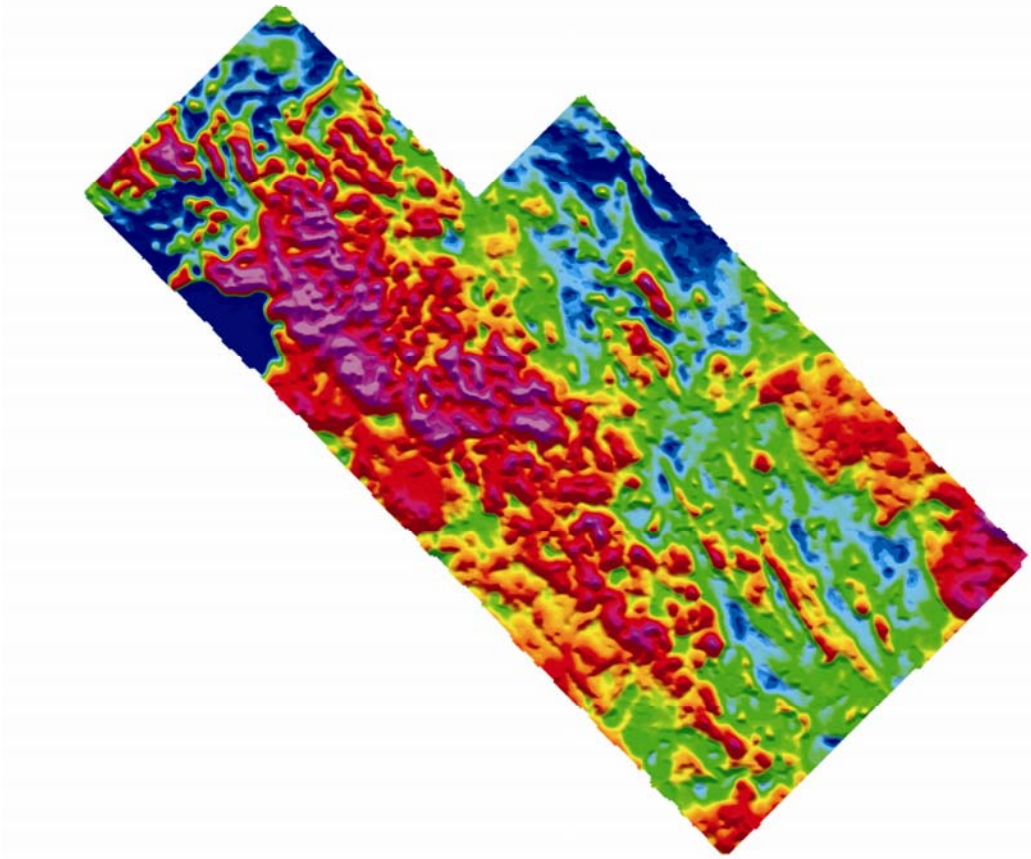

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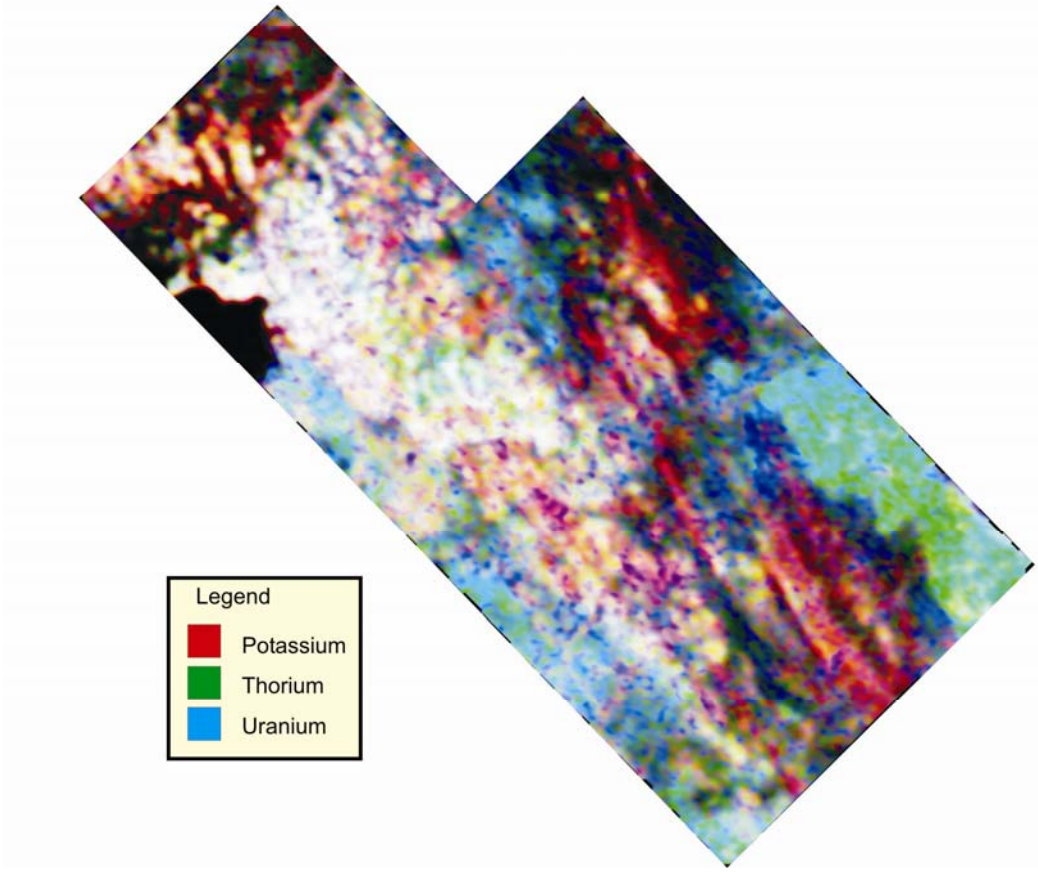

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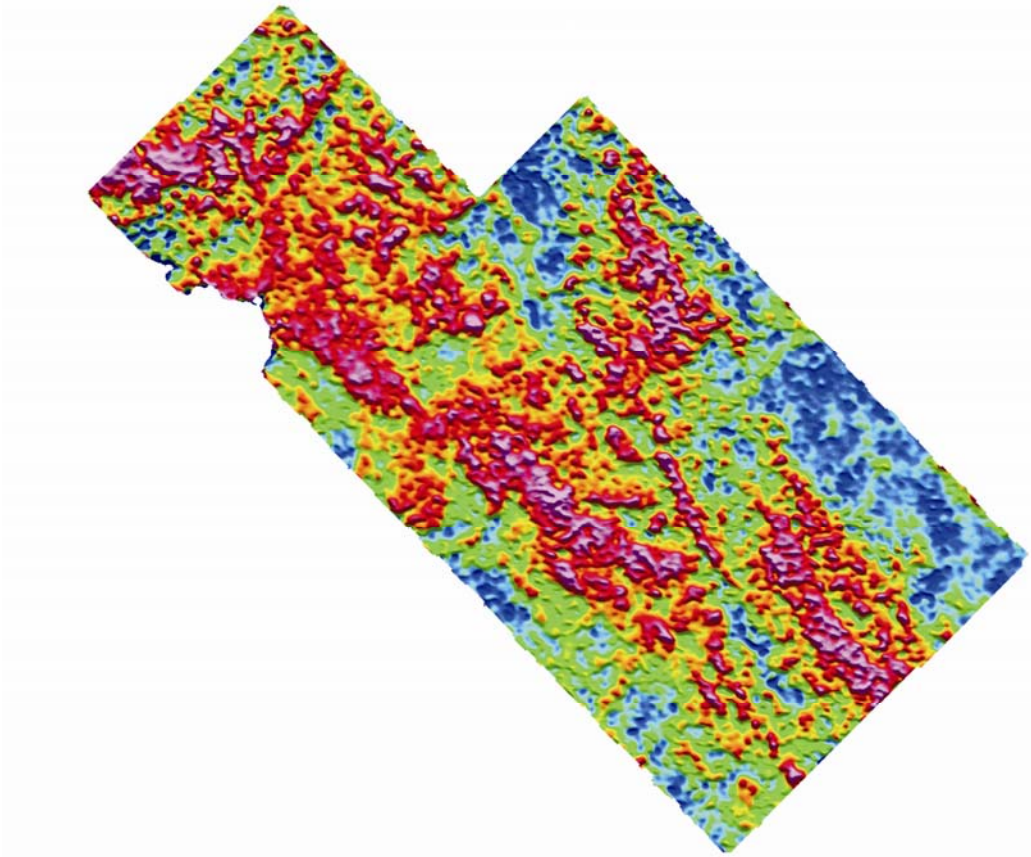
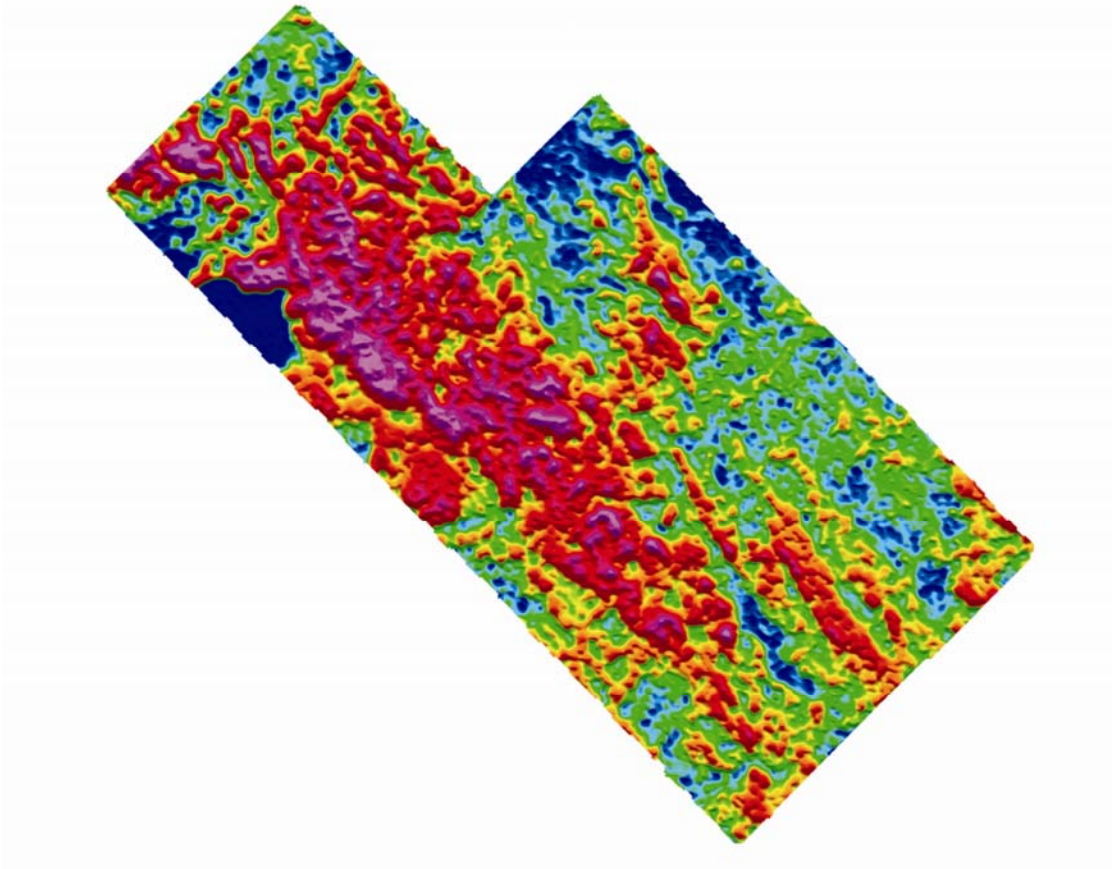
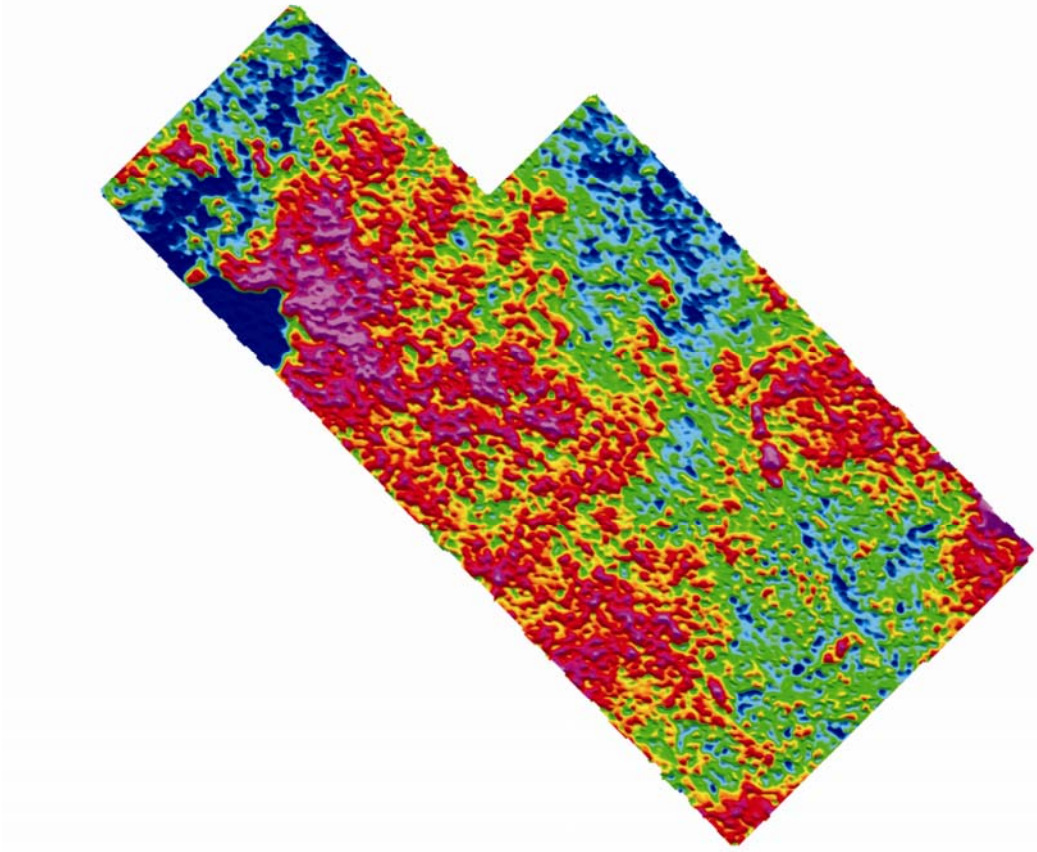


Potassium Radiometrics





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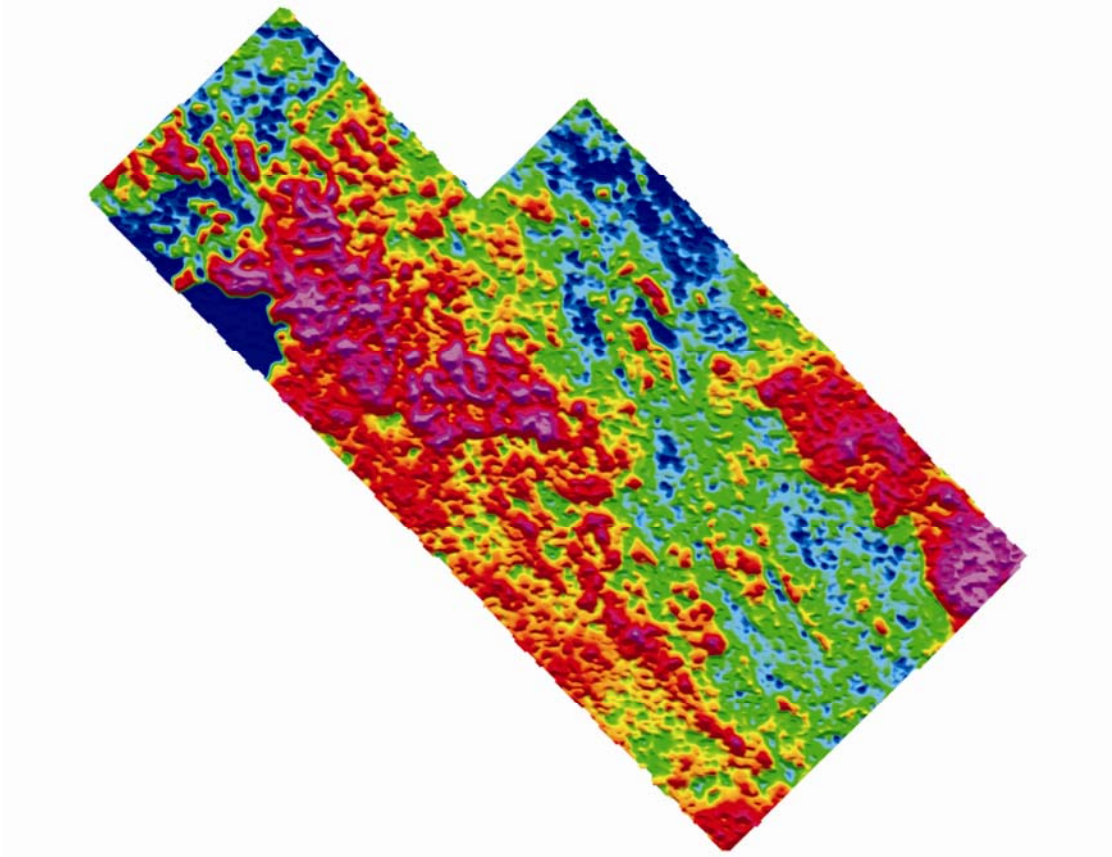

Appendix 2 Richard Keele's Report

LEFROY STRUCTURAL MODEL

LOCATION

1:25,000 Topographic Map Sheets:
Bell Bay 4844, Retreat 5044, Weymouth 5045, Low Head 4845

1:50,00 Geological Map Series:
Beaconsfield, Pipers River

PREPARED FOR
LEFROY RESOURCES LIMITED

Suite 5, 589 Stirling Hwy, Cottesloe 6011, Perth WA

BY
RICHARD A. KEELE
144, BRISBANE STREET, HOBART, TASMANIA 7000
(with contributions from John Baxter)

DATE:

1st October 2004

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LIST OF FIGURES

Figure 10 N-S Cross–section through the Lefroy Quartz reefs (looking west). The fault lodes are marked (F) and the quartz lodes (Q). Note the convergence of the two types beneath the Native Youth (from Groves 1965).

Figure 11 Longitudinal section through the Volunteer, showing the secondary shear model and the potential for further ore shoots at depth (from Chisolm 2004).

1.0 SUMMARY

The Lefroy mineralised system comprises a quartz vein array, of D3 age, arranged in a ladder style along a NNW-trending D1-D2 structural corridor. Individual E-W auriferous quartz veins formed as a result of wrench faulting in a stress regime in which σ2 was vertical at the close of the Mid-Devonian Tabberabberan Orogeny.

D3 "saddle reefs" - formed as a result of tightening of pre-existing folds in the D1 fold-thrust zone – controlled high-grade gold shoots at the Native Youth. The 45° W plunge of the gold shoot at the Volunteer is principally due to the intersection of D2-D3 faults with the steeply S-dipping reef.

It is recommended that a conceptual deep target beneath the Native Youth and Morning Star reefs be investigated with deep sounding CSAMT with the aim of locating another D_1 thrust system at depth.

2.0 INTRODUCTION

Lefroy Resources Limited (LRL) was floated on the ASX in 2004 with the aim of exploring and developing the historic gold mining field of Lefroy, situated in northeast Tasmania. The Lefroy Structural Model has been developed: (1) as a means of providing LRL with a robust targeting tool for drilling in the Lefroy goldfield, and (2) as part of a commitment to the Australian Stock Exchange.

The report has been compiled in conjunction with John Baxter of Continental Resource Management in Perth, WA.

3.0 LOCATION, ACCESSIBILITY AND PHYSIOGRAPHY

Lefroy is located on the eastern side of the Tamar River approximately 30 km NE of the Beaconsfield gold deposit (Figure 1). Although the Lefroy goldfield is easily accessible outcrop is poor (<5%). Much of the current surface structural information on the field has come from the Bridport-Georgetown Highway road cut that passes within 20m of the Volunteer reef. Tertiary basalt, and their associated gravels and sand deposits, obscure much of the geology at the north end of the field (eg. Native Youth and Pinafore-Chum).

4.0 PREVIOUS STRUCTURAL STUDIES

Thureau (1882, 1883) was the first geologist to recognise that the auriferous veins at Lefroy occurred in an anticline "almost four miles across" that was developed in slate beds, prompting an analogy with the saddle reefs in Bendigo. His reference to the Native Youth, in which he described the gold reefs as occurring in "very thinly laminated beds, exhibiting a wavy texture throughout and almost horizontally deposited" is a reference to stripey S1 cleavage

commonly deformed by D3 folds in the district. He also showed that a folded quartz sandstone bed, in part, controlled the shoot geometry at the Native Youth (Figure 2).

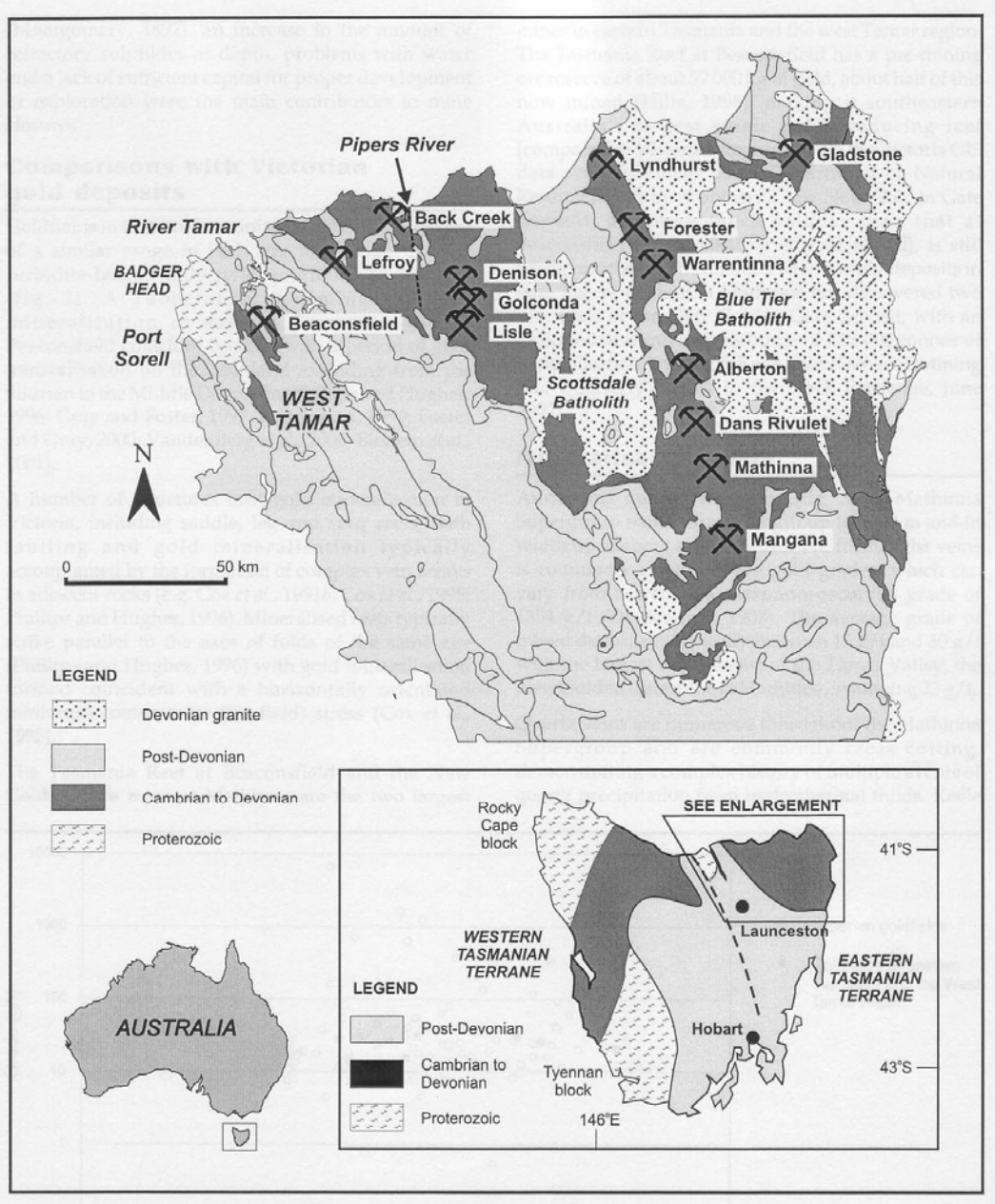

Figure 1 Location and simplified geology of the major goldfields in eastern Tasmania. Lefroy lies between the Beaconsfield and Back Creek deposits

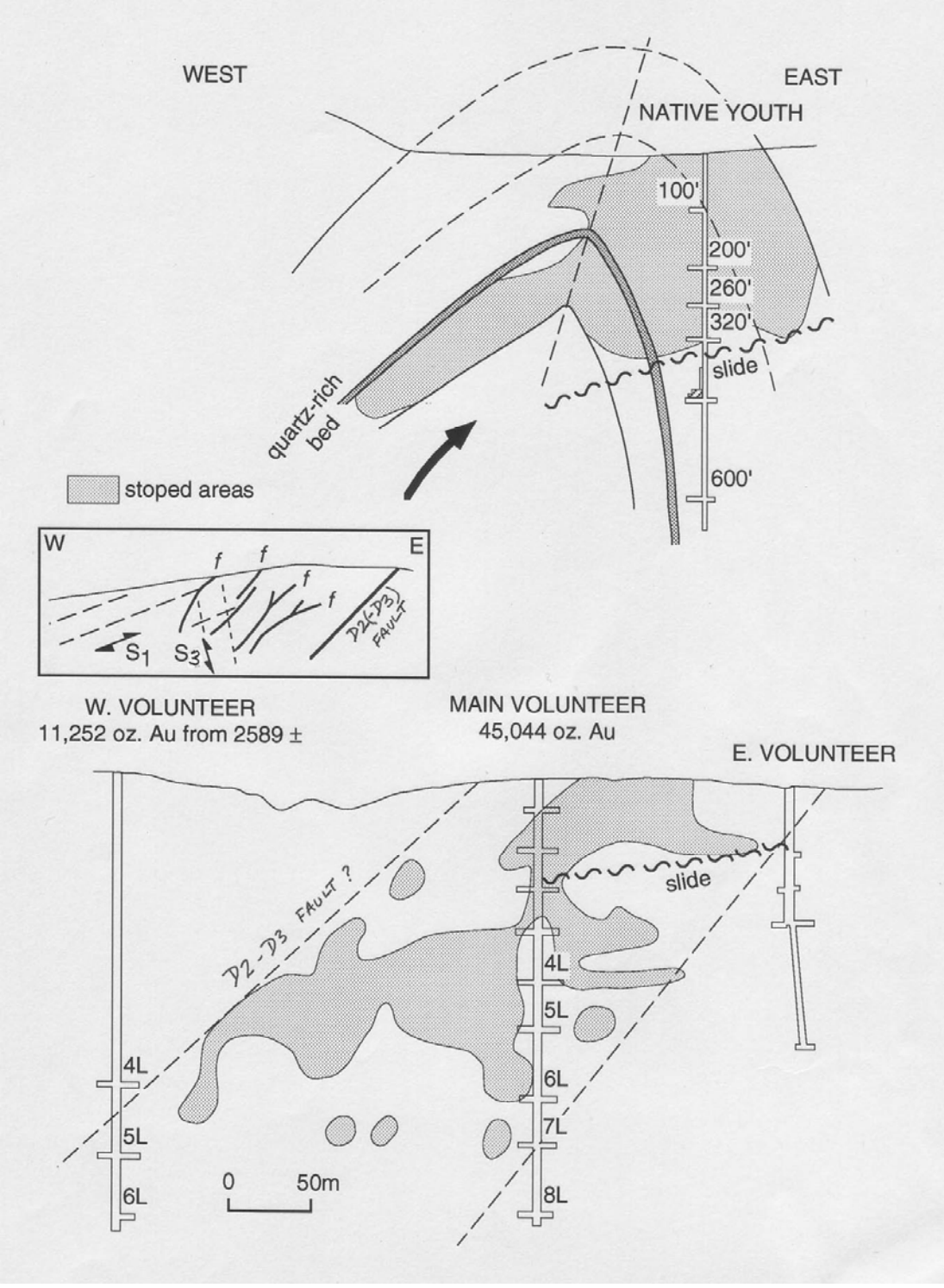

Figure 2 Long section through the Native Youth and Volunteer mines.

Montgomery (1897) recognised there were two types of auriferous lode at Lefroy: these he called "mullocky lodes" and "quartz lodes" respectively. The "mullocky lode" was recognised as a fault because of the broken nature of the auriferous quartz, which had experienced considerable post-depositional disruption and dislocation. The second type of lode was called "quartz formation" because of its thick regular development of gold-bearing quartz reef. The Volunteer-

Land O'Cakes, the Clarence and Pinafore reefs were good examples of the former, whereas the Native Youth, Chum and Morning Star were all excellent examples of the latter. The Golden Point & Crown was considered to be a hybrid because it showed characteristics of both. Montgomery believed that the quartz lodes formed first and that the "mullocky formation" was the result of later movements across the lodes.

Thureau and Montgomery both recognised the fact that mudstone-shale sequences tended host the mullocky lodes, whereas sandstone sequences generally hosted the quartz lode types. This demonstrated that host-rock rheologies were always considered important controls to major lode systems at Lefroy.

The landmark study Powell and Baillie (1992) showed that Lefroy lies on the overturned limb of an E-directed D1 recumbent fold in the Pipers River Recumbent Zone (Figure 3). Fold structures east of the Pipers River are upright in style, which has led other workers - notably Reed (2001) - to speculate that there is an unconformity separating these two structurally distinct domains, in which these Benambran-aged (or late Delamerian?) recumbent structures are absent to the east.

The Volunteer-Land O'Cakes reefs is a jogged fault system, in which a strong As + Au soil anomaly defined a zone of high fluid permeability at the overlap between the two faults (Keele 1996). The movement has been suggested to be dextral; however, given the orientation of the far field stress at the time of D3, the movement is likely to be sinistral. Therefore, the ore fluids had been introduced into a contractional (and not an extensional) jog.

A detailed study of the diamond drill core from Allstate's drilling at the Volunteer (Reed 2001) concluded that the westerly plunge of the Volunteer ore body was due to the intersection of a shallow W-dipping D1 thrust with the ENE-trending D3 quartz veins. Facing evidence in drill core (DDH L1) showed that the Volunteer mineralisation coincided with a change from overturned (down-hole facing) sandstone beds in the west from normal facing (up-hole facing) siltstone-mudstone units the east (Figure 4). Reed recognised D3 by its localized folding of S1/S2 and disruption to the D1/D2 veins. Auriferous sulphide mineralisation is typically associated with D3 brecciation and folding of D1/D2 structures in core.

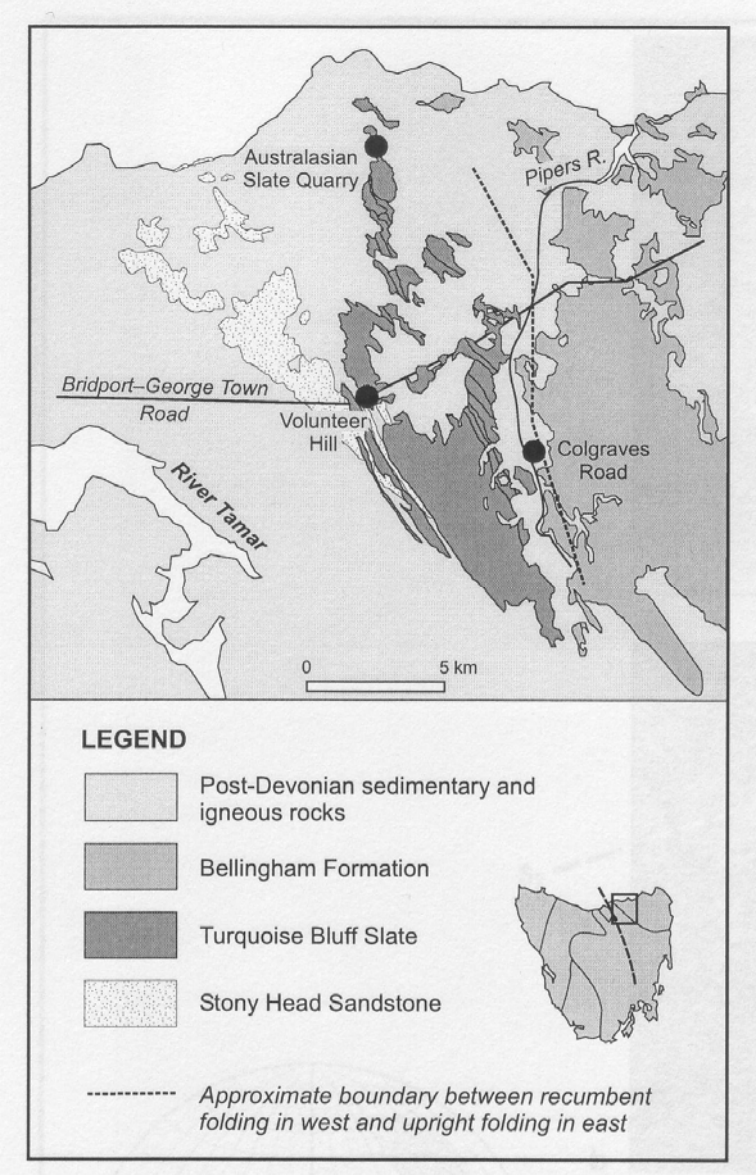

Figure 3 Location of the Volunteer lode in Lefroy showing the position of the eastern boundary to the Pipers River Recumbent Zone (from Reed 2004)

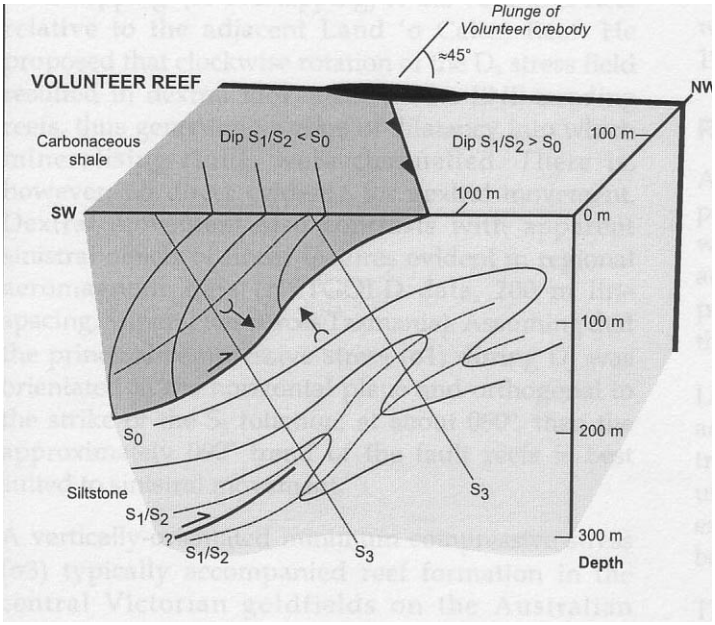

Figure 4 Block Diagram of the Volunteer D 1 thrust (from Reed 2001)

5.0 STRUCTURAL HISTORY

There are three major phases of deformation in the Lefroy district related to two orogenies (Reed 2001). D1 is an E-directed recumbent folding event that is either a very Late Delamerian (Cambro-Ordovician) or Benambran (E. Ordovician) in age. D2 is an E-directed thrusting event during the first phase of the Tabberabberan (Middle Devonian) Orogeny. D3 is a W-vergent thrusting event that stitched the eastern and western Tasmania terranes together at the close of the Tabberabberan Orogeny (Figure 5). Gold mineralisation in NE Tasmania occurred between 389-391 Ma (Reed 2004, & Black pers. com. 2004).

The extensional nature of the D2 fabric at Lefroy (see below) suggests that D2 may have been related to the emplacement of granitoids at depth, i.e., the equivalent of the (405-395 Ma) Pyengana and Georges River Plutons, east of the Scottsdale Batholith. There is little evidence for D2 folding at Lefroy.

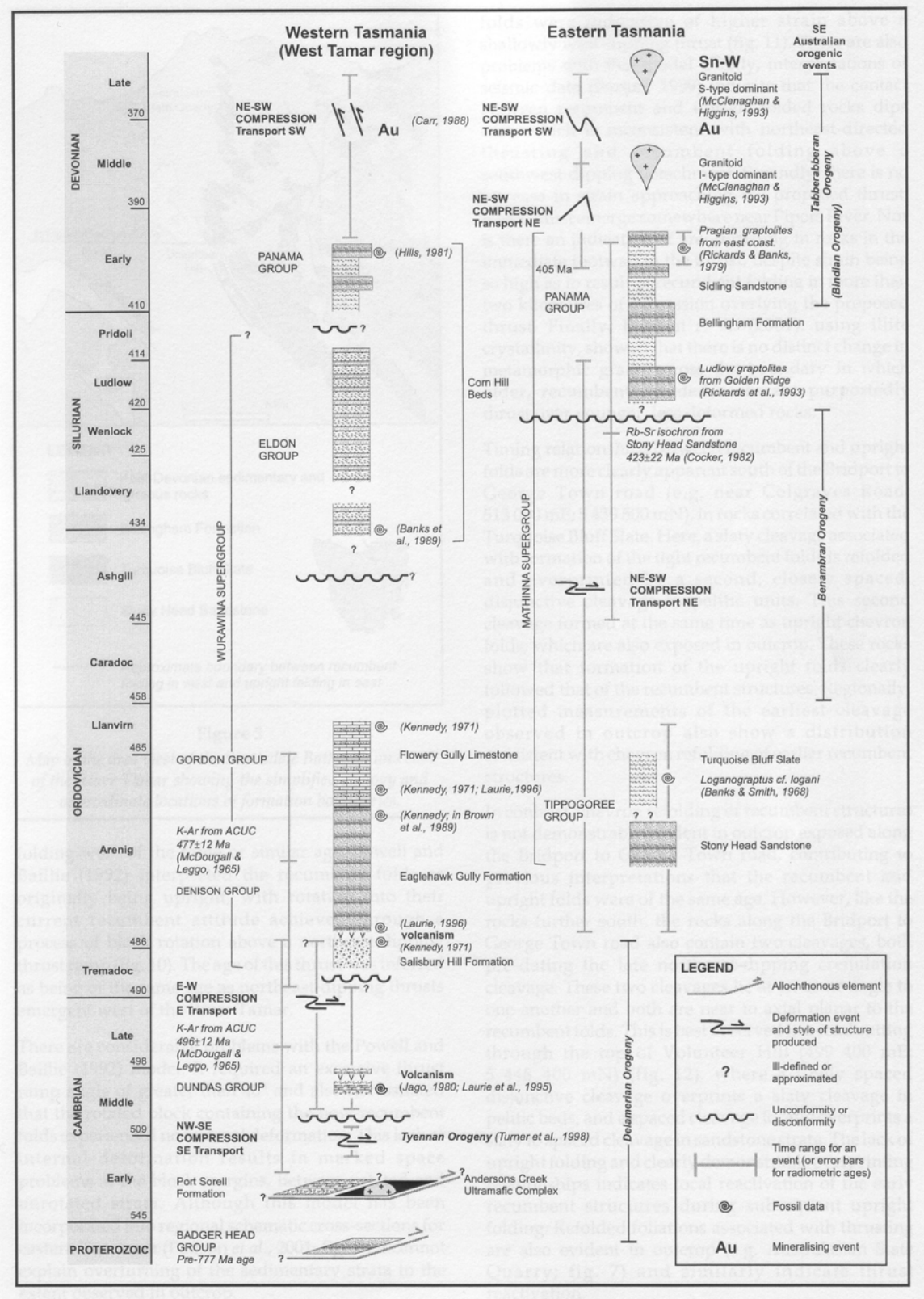

Figure 5 Time–Space diagram for eastern Tasmania (from Reed 2004).

6.0 STRUCTURAL SETTING

Regional Structures

The crustal structure beneath the Lefroy deposits has been modeled by Keele et. al., (1994) and Reed (2004). In both models the fluids are sourced from a shallowly E-dipping D3 detachment fault that daylights beyond the Beaconsfield gold mine on the western side of the Tamar Fracture Zone (Figure 6). The steeply dipping D3 vein structures and faults tapped, or "short-circuited" the gold fluids at depths of between 5 and 10 kms. Arsenopyrite geothermometry data suggests that Lefroy was closer to the fluid source than Beaconsfield: Lefroy fluids were hotter (460-470° C) than Beaconsfield (370-440°C, unpublished data).

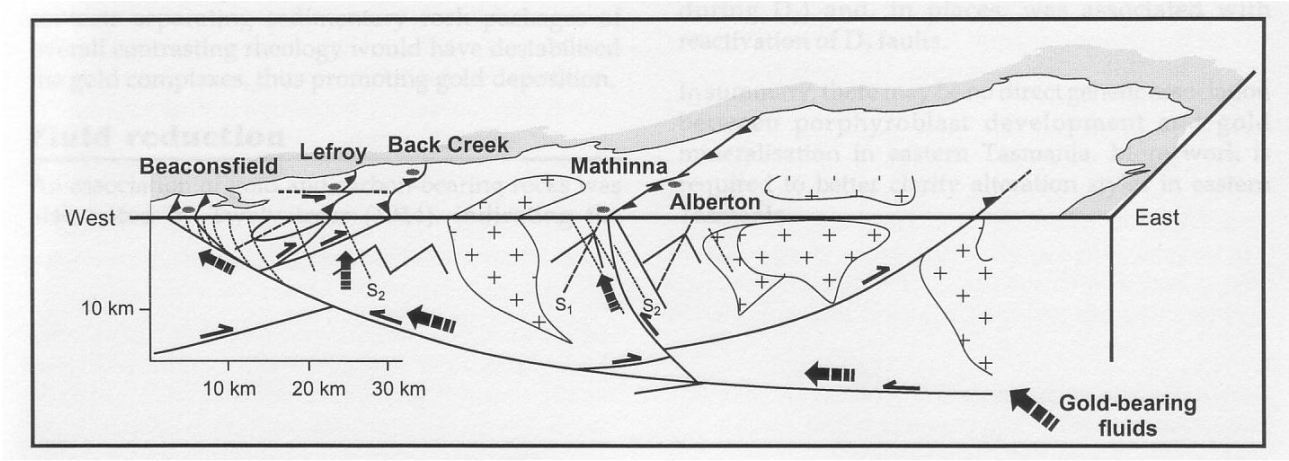

Figure 6 Block diagram sketch of eastern Tasmania showing possible fault architecture beneath the Lefroy deposit (from Reed 2004).

Local Structures

The local setting is dominated by an *en-echelon* D3 quartz vein array that trends in a NW to NNW direction along the length of the goldfield (Figure 7). Individual reefs trend ENE to NE and dip vertically or steeply S, with the exception of the Native Youth that dips N. A number of these D3 structures are faults (e.g. Volunteer, Pinafore & Clarence) with unknown displacements. The longest of these structures is the Volunteer, which may be traced for 10 km in the magnetic images. The remaining reef structures, however, do not occur beyond two important quartzite-mudstone marker beds situated east and west of the town and average from 250 m to 1.5 km in length (Figure 7). The longest of these reefs in the central part of the field is the Morning Star reef, which has been traced across the Tertiary basalt out crop, a total distance of 2-3 km.

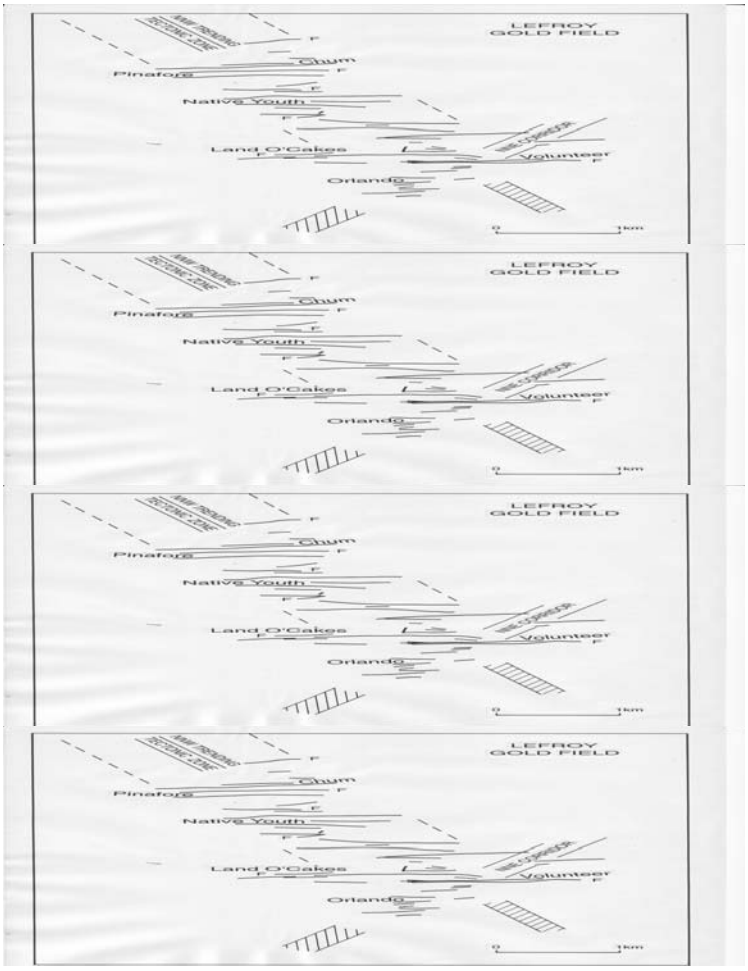

Figure 7 D3 quartz vein array in the Lefroy goldfield. Reefs marked "F" are the D3 faults (or "mullocky formation" in the old terminology)

Volunteer–Specimen Hill Area

D1

Detailed observations along the road cut show that S1 is a gently SW-dipping penetrative foliation developed in overturned sandstone-siltstone-mudstone sequences (Figure 8). A number of faults can be seen in the road cut, which make up the NW-trending D1 "corridor" that runs through the goldfield (Keele 1996) (Figure 7).

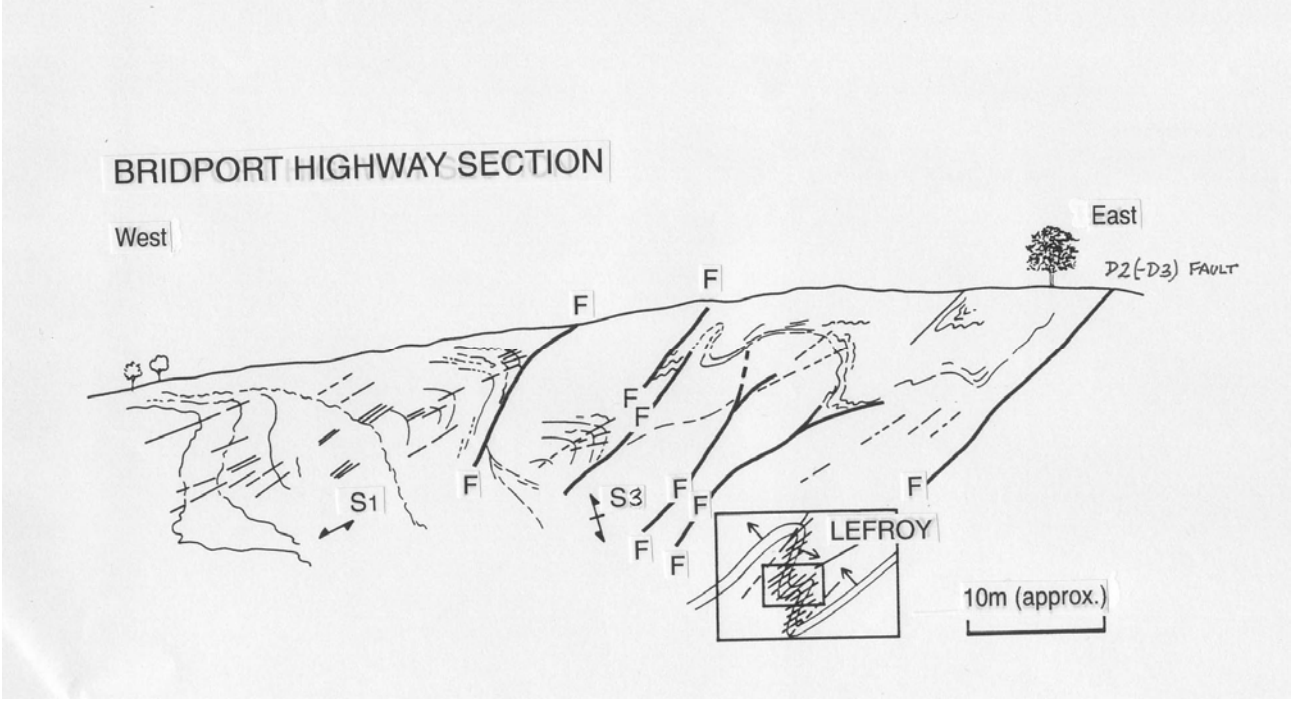

Figure 8 Structural geology sketch of the south side of the road cut at the Volunteer; note that the view has been made looking north by reversing the image.

D2

S2 is an extensional crenulation/shear band fabric in S1 that gives a consistent normal sense of shear in outcrop. D2 faults are 1-30 cm wide moderately W-dipping zones that contain quartz veining, alteration and cataclastic textures. These faults are probably re-activated during D3. The anastomosing or "stripey" S1 cleavage, which is well developed in certain units that are composed of alternating sandstone and siltstone. This indicates that shearing dominated the D2 event. The D2 faults (and shear bands) have exploited the rheological contrasts in the sandstone-siltstone-mudstones; hence these D2-D3 faults generally follow stratigraphic contacts (Figure 8).

D3

At Lefroy vein orientation is geometrically related to D3 structures (Powell 1991): S3 is a steep E-dipping NNW-trending crenulation cleavage developed in the finer grained lithologies. It strikes NNW and is related to the W-vergent collisional phase of the Devonian Orogeny. A number of structures such as quartz veins, joints, intersecting lineations, fold axes etc, are attributed to this deformation (Figure 9). The NE-trending "breakthrough veins" are related the NE vein array, which is well developed at the south end of the field (Monarch-Orlando); a NE cut-off to quartz reefs at the north end of the field (Chum-Pinafore-Golden Era) may also be an expression of this array (Figure 7). There is a high probability that these veins are mineralised.

A series of NW-trending post-ore faults with small displacements cut the reef at the Native

Youth. These contain no quartz and are not mineralised.

A regional cross-section through the Lefroy field (Groves 1965) reveals that the fault lodes (F) generally have S-dips (Volunteer, Pinafore and Clarence), whereas the dilational quartz lodes (Q) have vertical or steep N-dips (Native Youth, Morning Star (Figure 10). Individual reefs at Lefroy appear to have experienced either extension (dilational quartz lodes) or wrenching (fault lodes), or a combination of both (Golden Point & Crown).

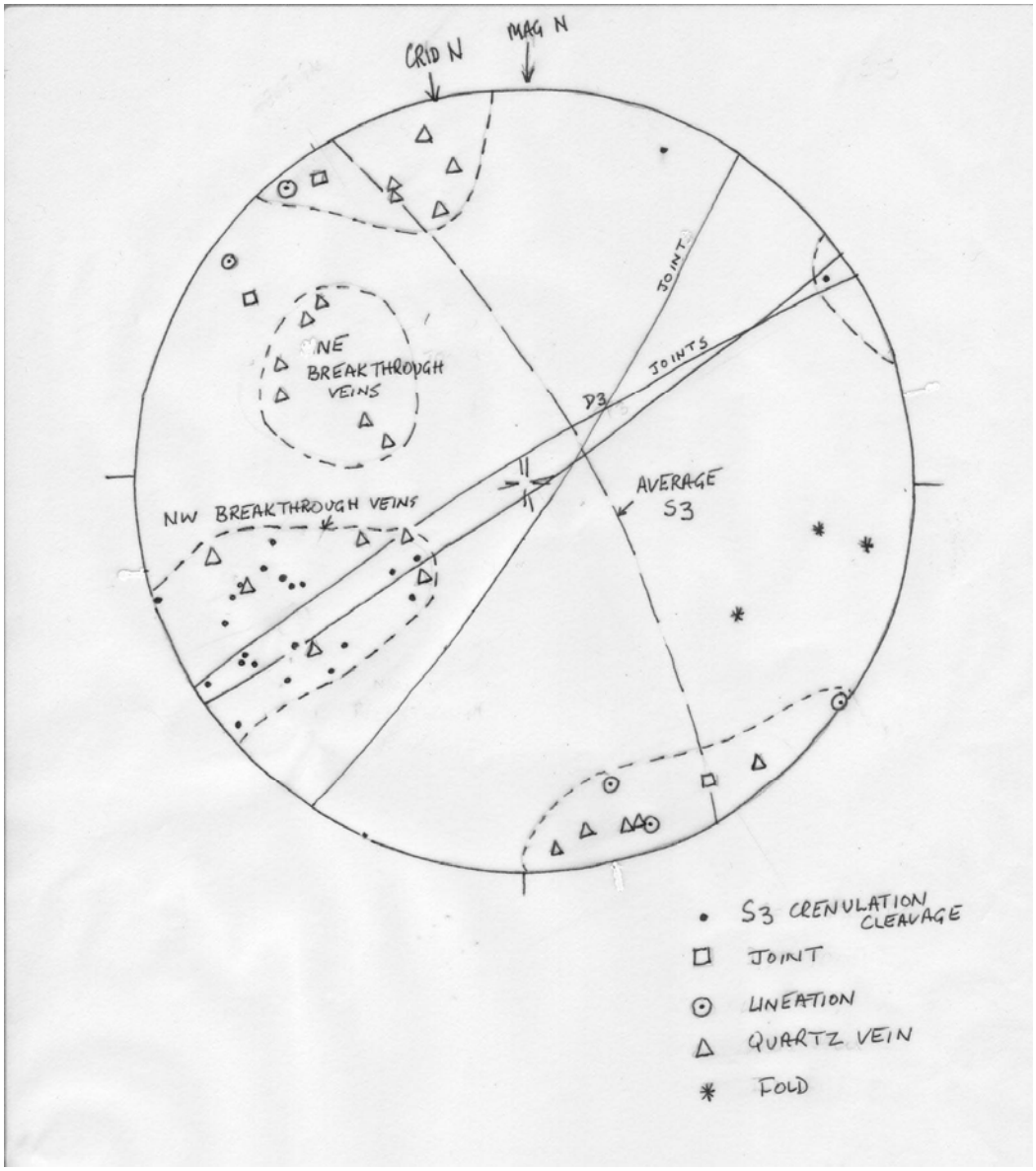

Figure 9 Stereonet of D3 structures (equal angle). Data is mostly from the Volunteer-Specimen Hill-Monarch Hill area. (Note this stereonet is plotted with Magnetic north: AMG north is 14° in an anti-clockwise direction)

7.0 MICROSTRUCTURES

Microscopically, three cleavages are present in the deformed slates associated with the reefs (e.g., Chum and Pinafore). S1 is a penetrative foliation (usually at a low angle to bedding); S2

is an extensional crenulation cleavage - often in a conjugate relationship with the crenulation cleavage, S3, which is best developed in the siltstone-mudstone lithologies. By its very nature, S3 is a brittle-ductile event. Mineralised quartz veins, which contain small amounts of gold, arsenopyrite, chalcopyrite, tetrahedrite, bournonite, galena, sphalerite and pyrite (Bottrill 1996), are therefore syn to post-D3 in age (Reed 2001, Powell 1991).

8.0 DISCUSSION

In summary, the Lefroy Structural Model consists of a quartz vein array, of D3 age, arranged in a ladder style along a NNW-trending D1-D2 structural corridor. Individual E-W auriferous quartz veins formed as a result of wrench faulting in a stress regime in which σ2 was vertical.

A longitudinal section through the Volunteer (Chisolm 2004) indicates that the 45° W plunge of the shoots may be the result of secondary shear movement during D3 (Figure 11). Alternatively, the 45° W plunge of the Volunteer shoot is due to the intersection of W-dipping D2-D3 faults (controlled principally by rheological differences across bedding surfaces) with the steep S-dipping reef.

The orientation of the D3 fold axes (and earlier D1 folds) suggests that the main litho-structural control to shoot development at Lefroy is sub-horizontal. The implication is that further substantial gold reserves may be found at depth in a re-make of the kind of structures found at surface. The main challenge is to find another D1 thrust system (and associated D1 to D3 anticlines) beneath the current Volunteer Thrust. If the system is stacked then there is every prospect of finding further rich ore shoots at depth.

An interesting possibility is that the reefs currently mined may merge into a single reef (or at the least a few reefs) at depth. There is some evidence that this could happen (see Figure 10).

A challenge will be to model in 3D the shallow-dipping Volunteer D1 thrust system through the goldfield.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The Lefroy Structural model is able to:

- Explain the nature of the quartz vein arrays with respect to the stress field.
- Establish that the fault regime was one of wrenching (σ2 vertical) rather than thrusting during the mineralizing event.
- Establish the timing of the gold mineralisation with respect to the Tabberabberan Orogeny of Middle Devonian age.
- Demonstrate that pre-existing geometry (due to early deformation) played a crucial role in the localizing the ore shoots
- Show the high-grade gold shoots at the Native Youth are controlled by D1 fold-thrusts that have been modified during D3 forming “saddle reefs”.
- Indicate D2 is an extensional (shear) event at Lefroy

- Suggest the permeability of the wall-rocks were enhanced by D3 reactivation of D2 faults in the vicinity of the quartz reefs (Volunteer)
- Demonstrate the slightly different orientations of the two types of reefs in the goldfield (F = "mullocky" and Q = dilational quartz) carry possibility that a target zone exists at depth.
- Explain the 45 W plunge of the Volunteer shoot as the intersection of bedding (or rheologically) controlled D2-D3 faults with the vertical reef.

It is recommended that the Deep Target (Figure 10) at the Native Youth be investigated with deep sounding CSAMT in order to locate another D1 thrust/D3 anticline system at depth.

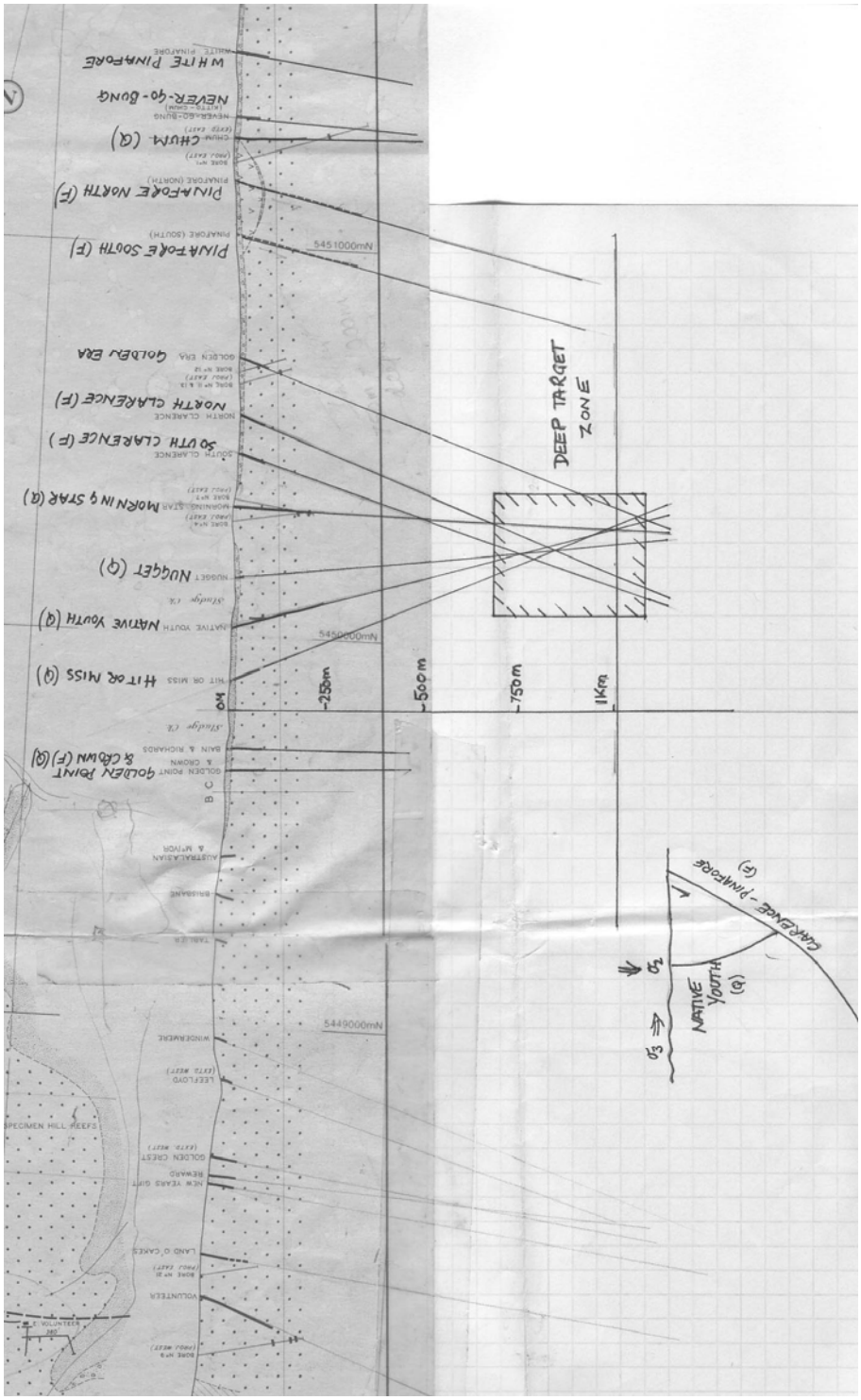

Figure 10 **N-S Cross–section through the Lefroy Quartz reefs (looking west). The fault lodes are marked (F) and the quartz lodes (Q). Note the convergence of the two types beneath the Native Youth (from Groves 1965).**

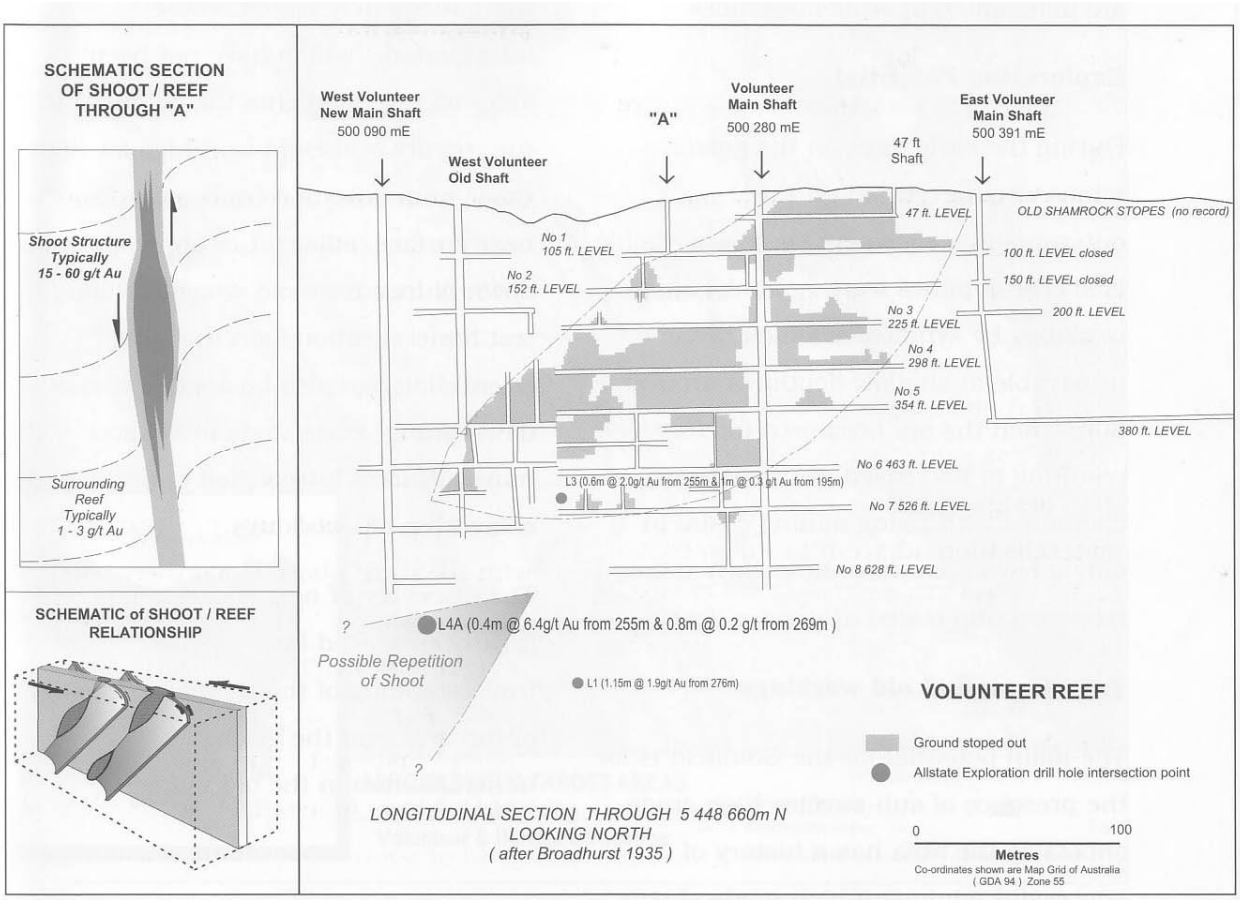

Figure 11 Longitudinal section through the Volunteer, showing the secondary shear model and the potential for further ore shoots at depth (from Chisolm 2004).

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Appendix 1 Lefroy Structural Database

Lefroy Structural Database

	AMG Aus 66		(Magnetic azimuth - add 14 degrees of declination to get grid N)					
Field No.	Easting	Northing	S0	S1	S3	Quartz Veins	Other	Comments
LF1	498,860	5,448,800	198/82w	182/39sw				Overturned limb
LF3	500,527	5,448,499	298/26w		327/82e			Overturned limb
LF3A	500,527	5,448,499	306/48sw	315/28sw				
LF3B	500,527	5,448,499	282/63sw					
LF5	498,947	5,448,680		177/7w				Land O'Cakes
LF19	499,173	5,448,590		335/24w				
LF27	499,672	5,448,676	326/85w	307/42w	342/90	256/79s		Specimen Hill
LF27A	499,672	5,448,676			341/71e	265/87n		
LF27B	499,672	5,448,676				346/80e		
LF27C	499,672	5,448,676				005/5w		
LF31	498,770	5,448,702		296/11sw				
LF31A	498,770	5,448,702		274/40sw				
LF32	498,720	5,448,747		323/73sw				
LF35	498,672	5,448,422		165/26w		165/26w		
LF72	499,346	5,448,255		133/29w				Monarch Hill
LF-VHT1-0	499,230	5,448,320		325/15sw		025/70se		Volunteer Hwy Section
LF-VHT1-10	499,250	5,448,320	150/32sw	325/18sw		072/85n		
LF-VHT1-20	499,270	5,448,325				286/6n		
LF-VHT1-40	499,310	5,448,330				338/75e		
LF-VHT1-70	499,330	5,448,335					058/84n	joint
LF-VHT1-90	499,350	5,448,340				065/81s	287/65sw	D2-D3 fault
LF-VHT1-90A	499,350	5,448,340				280/36s		
LF-VHT1-90B	499,350	5,448,340				065/81s		
LF-VHT1-110	499,370	5,448,350					306/61sw	D2-D3 fault
LF-VHT1-120	499,385	5,448,350				073/85s		
LF-VHT1-130	499,400	5,448,355				040/70se		
LF-VHT1-150	499,440	5,448,355	308/65sw					
LF-VHT1-170	499,470	5,448,360	282/36sw	335/23e				
LF-VHT1-170A	499,470	5,448,360		304/30sw				
LF83	499,523	5,447,851		160/38w		050/86n		Top of monarch hill
LF86	499,387	5,449,008		290/23sw	326/80e	295/17sw		Windermere tunnel
LF106A	498,095	5,448,809	138/62w	130/46sw	167/68e			
" B	"	"		160/8sw				
LF120	498,042	5,448,758		106/7n			5/330	F3 fold
LF130	499,480	5,450,400		185/24e	146/86w	155/37e		
" A	"	"				137/40e		
" B	"	"				160/48e		
" C	"	"				087/31s		
LF135	510,209	5,451,917	123/10n		295/90		027/81e	Conjugate fracture
LF136	509,945	5,451,987			292/85s		16/098	F3 fold
LF136A	509,894	5,452,005		050/6e	145/38e			
" B	509,747	5,452,011	135/58e					
LF137	508,607	5,451,587		072/9s				
LF-VHT2-0	499,030	5,448,300						Volunteer highway
-VHT2-10	499,020	5,448,300		145/29sw		130/155		section, start (east to west)
-VHT2-30	499,000	5,448,300	157/66sw			160/52w		
-VHT3-0	498,759	5,448,280						
-VHT3-10	498,745	5,448,280				066/23s		
-VHT3-20	498,732	5,448,275				015/41e		

-VHT3-30	498,720	5,448,270		143/13sw	160/76e				
-VHT3-70	498,690	5,448,260				120/25s			
-VHT3-100	498,660	5,448,240				072/72s			
-VHT4-0	498,463	5,448,100							
" -30	498,400	5,448,080		156/35sw	156/67e				
" -100	498,325	5,448,060	150/55sw	145/48sw					
" -110	498,310	5,448,060	155/62sw			198/68s			
LF229	500,764	5,448,585	337/75w	312/51sw	327/88e	153/57w			PipersRiver shop
" A	"	"				200/48e			o/turned beds
" B	"	"				080/84n			
" C	"	"				215/70e			
LF249	499,150	5,448,000	322/38e	336/42w	325/45e				Monarch Hill
	499,925	5,448,195		310/41sw					
LF-VC-14	499,920	5,448,250		272/29s					Volunteer Costean
LF-VC-35	499,920	5,448,227					266/68s		Shear=HW of Qtz-sul zone
LF-VC-35A	499,920	5,448,227		140/30sw		253/85n			
LF-VMS	499,895	5,448,220	186/12e						normal facing by main Volunteer shaft
LF274	498,913	5,447,645		155/34sw			4/160		Plunge of crenulation
LF276	499,086	5,447,636		163/30sw	140/77e				Old Lncst Rd
LF276A	499,086	5,447,636		035/16se					F3 folded S1
LF277	499,134	5,447,832		153/11sw					Old Rd
LF278	499,162	5,447,809		140/21sw					
LF279	499,200	5,447,900		140/63sw					
LF283	499,239	5,448,321		145/40w	138/64e	142/70e	3/306		S3-S1 intersection (cren)
LF283A	499,239	5,448,321				213/65nw	088/54s		Fr. Cleav. in qv
LF283B	499,239	5,448,321					055/87s		jnt. adjacent to qv
LF284	499,283	5,448,330		146/16sw	148/81e	165/15w	1/125		Lin, S3-S1 intersect.
LF285	499,350	5,448,334	138/23sw	128/35sw	338/78e	110/24s	13/165		Lineation
LF285A	499,350	5,448,334	280/75s				146/48sw		D2-D3 Fault Zone
LF286	499,422	5,448,346	122/54sw	110/25s	155/65e				
LF287	498,170	5,446,810		120/52sw	158/68e				Lefroy road cut
LF287A	498,170	5,446,810		135/8s			132/75w		D2-D3 zone
LF288	500,453	5,448,549	127/40sw	125/15sw	155/81e				Beds overturned
LF289	506,339	5,450,142	130/80e	090/70s			7/100		F3 fold
LF290	502,634	5,447,960	180/10w				2/320		Lin on S1, Troopers Track
LF291	503,097	5,446,627	330/17ne	327/7ne	315/70ne				
LF292	503,071	5,446,479	315/55ne	145/14sw	135/45e		25/122		F3 fold
LF293	507,300	5,450,400	125/76e	090/36s					
LF294	507,740	5,450,700	088/57s	085/32s					
LF295	508,500	5,451,230		042/5s	140/88ne				
LF296	510,000	5,451,960		135/34ne					
LF297	502,300	5,444,980		010/8e	145/72ne				Native Industry
LF297A	502,300	5,444,980		138/45sw					
LF298	502,450	5,443,500		150/46w					

Appendix 3 John Baxters Original Review

REVIEW OF LEFROY GOLDFIELD

My over all impression of the data is that there is a fairly simple structural array in the Lefroy district.

It is clear that the dominant deformation is reverse shearing accompanied by overturned asymmetric folds. This is no doubt equated to the D_1/D_2 deformation events identified by all who have written on the area. The reverse system appears in the MRT250K, MRT25K and Groves data sets.

The strike slip system that is attributed to the zones where D_3 has developed is very weakly explained. There are suggestions of a strike-slip shear system in some of the D_3 data reported from Lefroy and Back Creek areas. These data do not support an association with the mineralisation.

Clearly from the longitudinal section data there is a plunge to the west on the high grade shoots. The mineralisation appears to be associated with brecciation and consequently is likely to have formed in the brittle regime.

On the plan we have digitised there is a dip slip array present. The orientation of the array is not consistent with a 45^o westerly plunge to mineralisation.

From this data it is quite difficult to develop a structural model for the mineralisation and I recommend that:

- Richard investigates the possibility of collecting some geometric observations adjacent to the mineralisation
- In the field the 45^oW plunge, suggested by the longitudinal sections and the write up by John Chisholm, be identified and the geometry defined

Notes

D_1 Structures

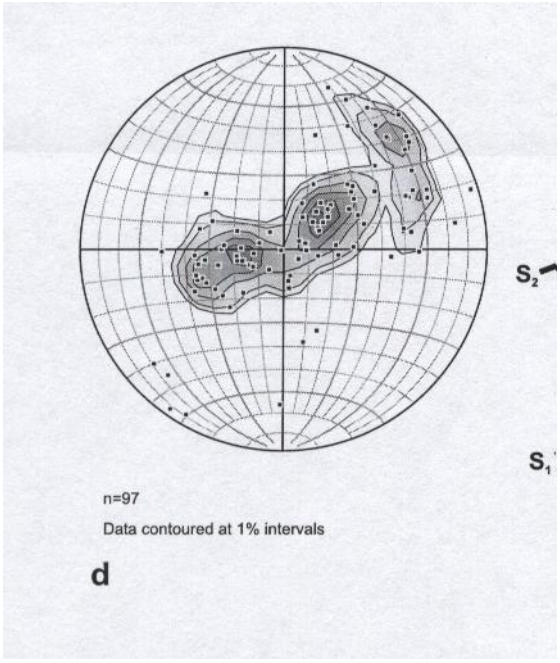
Produces east-facing recumbent folds and thrusts in Tippogoree Group (Stony Head Sandstone & Turquoise Bluff Siltstone). The folds trend northwest and have a shallow southwesterly dipping axial planar cleavage. There is a regional disruption/unconformity between the Tippogoree Group and the overlying Panama Group post D_1.

The event was mid-Ordovician to Silurian.

D_2 Structures

D_2 produces upright north-east verging chevron to concentric style folds with a weak slaty cleavage. D_2 probably reactivates D_1 structures.

The diagrams below indicate that the labelled S_1 is folded by a dip slip movement, the recumbent fold inicates reverse movement, hence D_3.



Stereoplot of poles to S_1 data , indicates folding with a shallow plunge to 315^{o}in Colgraves Road Area

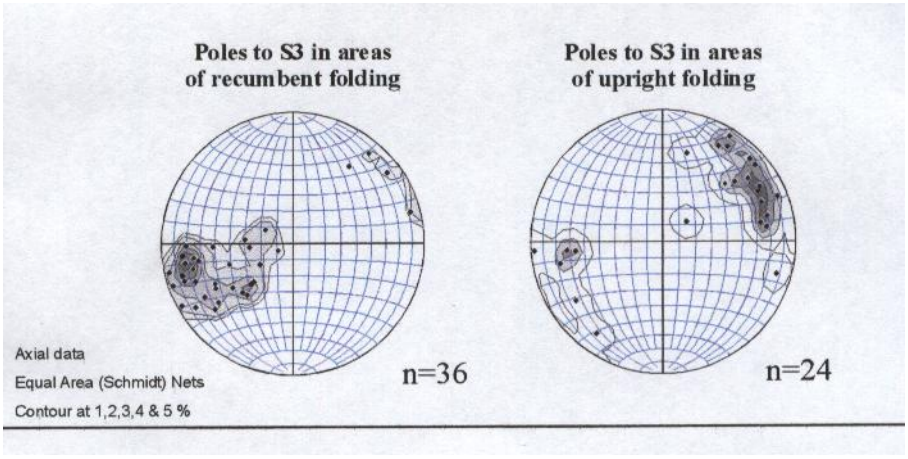
A similar pattern to this is seen in S_o and S_2 cleavage in the Bridport to Georgetown road cutting. *There must be a question in whether the S_2 cleavage in this road cutting is not the same as the S_1 cleavage in Colgreaves Road.*

D_1/D_2 structures including brecciation, folding, northwest striking quartz-carbonate-chlorite-(ankerite) D_1/D_2 veins with no gold. The veins arte discontinuous and truncated along bedding planes where there is rheology contrast.

D_2 and D_3 are correlated with the Devonian Tabberabberan Orogeny.

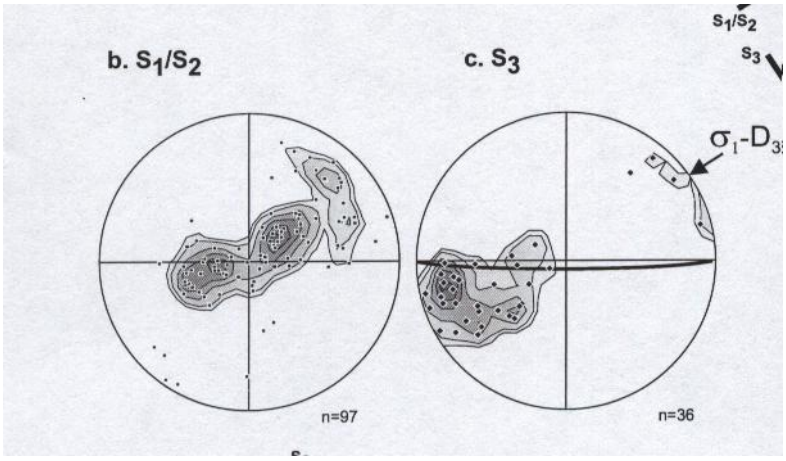
D_3 Structures

Both recumbent and upright fold structures of D_1 and D_2 are deformed by south-westerly verging open folds, faults and a north-easterly dipping crenulation cleavage. Strain associated with D_3 increases toward the Tamar River to the west.



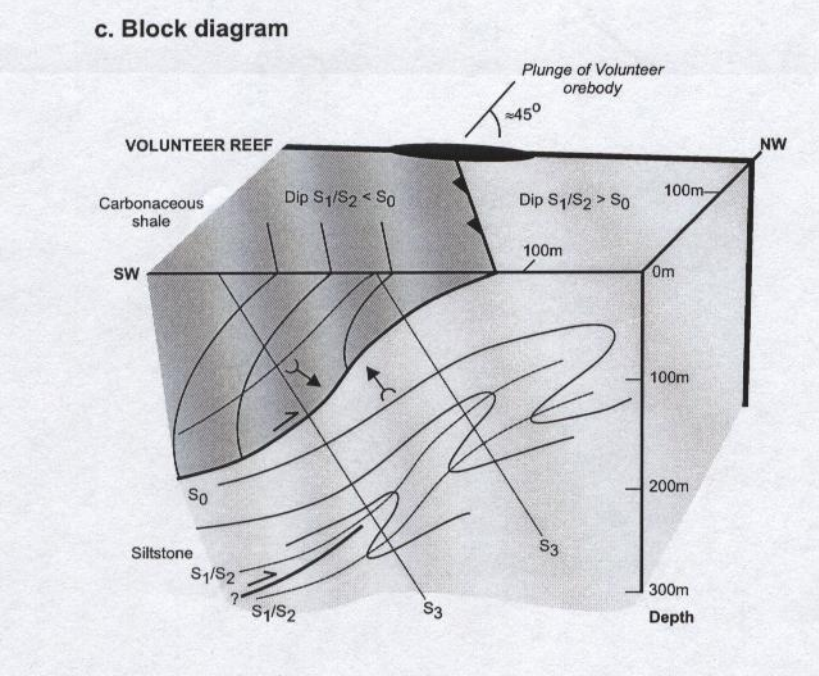
D_3 deformation in the vicinity of Lefroy and Back Creek areas

This seems consistent with cleavage being rotated by predominantly strike slip movement in the case of the stereoplot on the right, and possible positive flower structure in the plot on the left. *Is D_3 strike slip shearing?*



D_3 deformation in the vicinity of the Lefroy Goldfield

There appears to be an element of inconsistency here as the fabrics in the left hand diagram look like the D_2 deformation, while the S_3 cleavage looks more like the D_3 strike slip pattern.



Block model of Volunteer Reef showing the steep lodes and the high grade shoots being controlled by the orientation of the D_1/D_2 thrust plane, which is in turn controlled by the stratigraphy.

Note that the oblique shear, may be a secondary shear as indicated by Chisholm in the IGR.

D_3 is partitioned with localised folding of S_1/S_2 cleavage, brecciation and disruption of D_1/D_2 veins and development of crenulation cleavage. Au-Sulphide mineralisation is associated with D_3 brecciation and folding of D_1/D_2 structures.

Refolding of D_2 folds are an indicator of D_3 high strain zones.

Post-D_3 Faults

North-easterly and north-westerly trending unmineralised faults displace the mineralised D_3 lodes. They are unmineralised.

Mineralisation

Much of the gold in eastern Tasmania is associated with shear zones through packages of sandstone and shale. At Lefroy gold mineralisation is located in sub-vertical planar easterly trending quartz reefs in a north-westerly trending mineralised ladder like array. The trend of the mineralised array is sub-parallel to the contact between the Stony Head Sandstone and the Torquoise Bluff Slate.

Mineralisation entirely within the veins, little wall rock alteration.

Secondary enrichment is indicated by decrease in fineness and ore tenor with depth

The Volunteer shoot plunges 45^{o} to the west.

Mineralisation at Lefroy is associated with D_3 that occurred as wrench faulting in the late stages of southwesterly directed Devonian thrusting and thrust stacking. *Are these wrench faults transfer faults?*

Richard, I do not quite understand the overlapping between the Land O'Cakes and Volunteer