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REPORT

on

**PROSPECTIVITY
of EL 65/2004
DERBY DEEP LEADS TIN PROJECT
Tasmania**



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GEOLOGY**

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1. INTRODUCTION

This report, on Exploration Licence 65/2004, the Derby Deep Leads Tin Project, in the north-east of Tasmania, covers history, geology, past production, previous investigations, and a detailed assessment of the prospectivity of identified target areas.

The Licence (The 'Tenement') covers an area with significant past production of alluvial tin in Tertiary Leads.

2. LOCATION

The Tenement is centred on the township of Derby, located approximately 110km by road from the City of Launceston, Fig 2. The area is well serviced with roads, towns, water, electricity and a local work force. Most of the area is covered by private farming lands, Fig 5.

The Tenement lies on the Pioneer, Derby and Ringarooma 1:25 000 geological map sheets.

3. TENURE

The tenement details are

Tenement No.	Title	Applicants	Area, km ²	Date of grant	Annual exploration Commitment A\$
EL65/2004	Derby	James Ian Stewart and Paul Winston Askins	100	22 Nov 2005 for 5 years	75 000 in first 2 years



Derby from the air, showing flooded Briseis mine workings and typical basalt covered farming terrain in mid distance.

4. GENERAL HISTORY

The first discovery of tin in north eastern Tasmania was evidently made in 1872 by a Mr. Benjamin Brooks near Mount Maurice, however this was soon dwarfed by the more famous discoveries made by George Renison Bell at several locations in the Boobyalla River catchment in 1874. Although the resulting Boobyalla Tin Mining Company failed to make a profit, it did prove the high grade and extent of the resident tin deposits and thus served to attract further prospectors who during the ensuing two years to 1876, explored all the region's waterways and identified the bulk of the region's major tin deposits. A number of famous discoveries soon followed including the Krushka Brothers strike at the Briseis mine (Derby) and William Bradshaw's discovery of the Pioneer tin deposit in 1876. These mines and their surrounding mineral fields developed rapidly with the growth of lease numbers and private settlements that were ultimately gazetted as townships by the Crown. Most production occurred before 1900 but continued at a reduced level until 1982 when the remaining large mines such as the Pioneer and South Mount Cameron mines closed.

The tin, which occurs as cassiterite in basal gravel in deep leads in the Tertiary sediments stretching from near Branxholm to Ringarooma Bay, was derived from erosion of the tin-rich alkali-feldspar granites of Mt Paris, and other smaller bodies in the Blue Tier Batholith. The main mines were the Briseis, Pioneer, Endurance, Valley and Arba. Mining also occurred in the Tertiary sediments west of St Helens. Recorded production until the early 1960s was about 41 660 tonnes of metallic tin (TCR 64-381). Most of the mining was by hydraulic sluicing but some dredges were used including the Dorset dredge which operated from 1944 to 1971.

The Utah Development Company carried out a major assessment of the alluvial tin resources in the 1960s (TCR 64-381). Since that time a number of other companies have also made assessments, including Santos Ltd and Hellyer Mining (TCR 87-2692), Mineral Holdings Aust. Pty Ltd (TCR 85-2404), and Australian Anglo American Ltd, Buka Minerals NL and Triako Mines NL (TCR 84-2101, TCR 85-2358). More recently Van Dieman Mines has assessed resources from Pioneer northwards, and mining of Scotia and Endurance is imminent.

Of interest is the Chinese history of tin mining in the district. Chinese tin miners were amongst the early pioneers of Tasmania's North East and constitute the largest group of non European immigrants to early Tasmania. They started arriving in the late 1870s and at their peak in the 1880s numbered around 1,000. In places Chinese outnumbered Europeans by up to 10 to 1. At its peak, Weldborough had about 700 Chinese miners: most of the State's 1,000 to 1,300 or so Chinese. The original pub slept three shifts to a bed. Not roulette but mahjong and fan tan were played in the island's first casino. A lottery was part of gambling and a Chinese man was murdered while taking the proceeds to the bank at nearby Moorina. In 1893 a visiting Chinese opera company performed at Weldborough. Also at Weldborough there was an elaborate local temple - this joss house, with its ornately dressed figures, intricate carving, scrolls and plaques, is now at the Queen Victoria Museum in Launceston. The Chinese were present at Weldborough, Branxholm, Gladstone, Pioneer and Moorina. Interestingly they were excluded from the rich Briseis mine at Derby. They were industrious and tended to work the small scale, poorer, more isolated mine sites. They displayed considerable ingenuity in getting water to their alluvial mines.

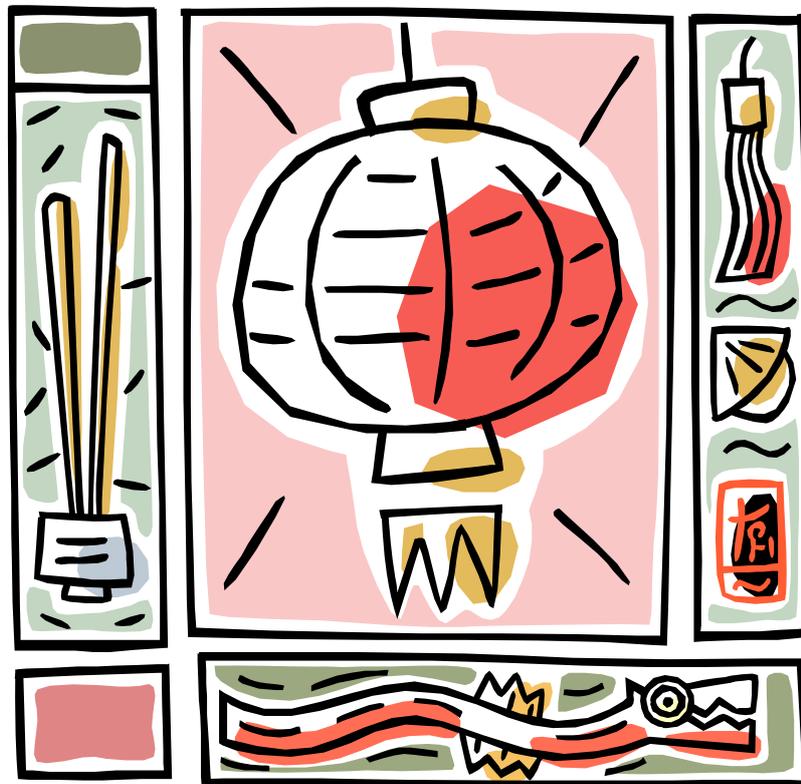
The population was transient with people staying only long enough to accumulate sufficient funds to move on. Consequently their dwellings were mainly temporary bush huts.

Those that stayed after the collapse of the tin price gravitated to the larger settlements of Launceston and Hobart where they mostly became market gardeners and merchants.

The Chinese community in Launceston became wealthy and influential in the development of the city.

Today the remaining evidence of the Chinese is being documented and publicized by local Shires with a program called the Trail of The Tin Dragon.

An excellent history of the Derby Town and Mines is given in the book:
Beswick, RJ &DM., 2003 Brothers Home: The Story of Derby, Tasmania.



Trail of the Tin Dragon

5. GEOLOGY

A useful summary is given by YIM, Wyss W.-S., Department of Earth Sciences, The University of Hong Kong: (from several publications, edited by PWA):-

A heavy mineral provenance study of alluvial tin placers in northeastern Tasmania indicated that episodic recycling dating back to at least the Permian was involved in their formation.

These placers are associated with deeply buried high-energy alluvial channel deposits referred to as deep leads. Age constraints of the deep leads are provided by Tertiary basalts overlying the deposits which can be K-Ar dated; alluvial zircons within the deposits which can be fission track dated; palynoflora associated with the deposits, and, the occurrence of overlying post-Middle Miocene duricrusts. The sequence of events forming the placers are:

- (1) Pre-Permo-Triassic erosion and unroofing of mineralised Devonian to Carboniferous granitic batholiths;
- (2) Intrusion of Jurassic dolerite sheets followed by extensive erosion;
- (3) Middle Eocene basaltic volcanic activity;
- (4) Post-Middle Eocene period of rapid erosion;
- (5) Post-Oligocene lateritisation;
- (6) Middle Miocene basaltic volcanic activity;
- (7) The capture of streams draining from the Blue Tier Massif by the present day Ringarooma River;
- (8) The capture of the tributary of the Great Mussel Roe River by the Ringarooma River, and
- (9) Reworking of alluvial deposits along the course of the Ringarooma River associated with periods of high discharge in the Quaternary.

The following is based on published reports by Nye, 1932, and Yim, 1991, and modified by me. It is intended only as a broad outline of the origins and formation of the cassiterite bearing alluvial deposits of the area.

The original sources of the cassiterite were the tin-bearing granites of the Blue Tier Batholith, Fig 3, Fig 8. Crustal uplift, and a northwards shedding erosional profile, related to tropical or semi-tropical environments during the Tertiary, resulted in rapid denudation of the Batholith and the formation of blanket and reworked tin bearing alluvials over a wide area of the north east.

The relevant history of the region, Fig 4, commenced in Permo-Triassic time (ca 250 Ma) with the unroofing and erosion of the cassiterite bearing granitic rocks of the Blue Tier Batholith.

In late Jurassic time (ca 150 Ma) further uplift occurred with intrusion of extensive igneous dolerite sheets followed by a long period in the Late Cretaceous (ca 75Ma) of widespread and intense erosion. Deep weathering of the granites during this period resulted in liberation of large amounts of cassiterite from the granitic hosts and their deposition in alluvium of the streams draining the highlands. At this time there were generally north-west flowing streams from the Blue Tier; Black Creek, Cascade River, Main Creek, Weld River and the Wyniford River flowed towards the Boobyalla area.

During Middle Eocene time (about 46 million years ago) volcanic activity commenced along the Blue Tier and into the Boobyalla area with the extrusion of the Older Basaltic lava flows. It is likely that these were emplaced along stream valleys incised into the pre-Eocene granitic land surface, and so buried the older alluvial

cassiterite deposits. Rich pre-Middle Eocene leads may still exist beneath the eroded remnants of the Older basalt flows.

From the Mid Eocene to Late Oligocene (ca 46 to 24 Ma) uplift and a humid tropical climate resulted in rapid erosion of the basalts, and renewed liberation of cassiterite from granites and reworking and upgrading of the earlier pre Middle Eocene alluvial deposits. The Ancestral Ringarooma River formed as the general drainage was forced southwards by the Mid Eocene basalts and this major river captured all the streams coming off the Blue Tier.

The Middle Miocene (ca 14 Ma) saw a second period of basaltic volcanism with extensive lava flows down many of the larger valleys in the region, including the Ancestral Ringarooma River. These caused the diversion of the river and the eventual displacement of the river to its current position. The pre-existing alluvial deposits were buried, and now occupy leads under the basalt.

Post Middle Miocene to Recent alluvial deposits were then formed along the alluvial flats of the Ringarooma River but the amount of cassiterite in these is minor compared to the pre Middle Miocene accumulations. Locally, earlier deep leads were exhumed by the Ringarooma River, such as the mined exposures at Arba, Briseis, and Valley. During and after the Miocene a period of uplift and/or marine regression resulted in the lateritisation and silicification of much of the land surface and probably the down-cutting by some streams to form the Scotia and Lochaber Leads. Subsequent rises in sea level developed broad marine embayments at Boobyalla and in the lower Ringarooma River area, and resulted in the formation of cassiterite bearing, blanket-type deposits derived from nearby cassiterite bearing alluvial deposits, from some cassiterite bearing hard-rock deposits, and from larger streams such as the Scotia Lead.

Nye, 1932, reported that estuarine sediments can be recognised throughout the Scotia Project area and while this may be so in the northern end of the area at the Scoloch Lead, the southern section takes the form of a deeply incised active terrestrial stream system.

In the Great Northern Plain deposits north of Scotia, the major controls on tin deposition were almost certainly marine concentration possibly by wave action in shallow waters or by current movement during periods of heavy terrestrial flood outflow, and complicated by stream influx into an active estuarine environment. Locally around this former marine embayment marine processes appear to have resulted in the development of some cassiterite-bearing strand line deposits, now preserved beneath the coastal lowlands.

6. INTERPRETED PALEOCHANNELS

The interpreted position and history of drainages is very important to define and rank alluvial exploration targets.

I have sought to re-interpret the history of drainages, paleochannels and leads by attempting to reconstruct the history with the aid of modern DEM and Landsat imagery not available to previous workers, and (trying not to be biased by the dictums of the past) thoroughly reviewing past literature.

The best available magnetic and gravity surveys were also processed but did not yield any useful information to constrain the interpretations. An image of the magnetics is shown on Fig 15.

The DEM images in particular give good overviews of the dominant fracture pattern controlling the drainages. Drainages coming from the granite hills of the Mt Paris Batholith, sourcing the alluvial cassiterite, have a pronounced WNW trend. When projected under the basalt these trends give a better fix on where to expect the course of leads than were used in the past.

The interpretation was an iterative process, having to accept or reject previous interpretations of drainages and previous hypotheses of the geological history. The net result is depicted of Figs 9 to 12.

For convenience on the diagrams the pre Middle Eocene drainages are labelled Eocene, and the post-Older-basalt pre-younger-basalt, ie mid Eocene to Miocene drainages, are called Miocene.

The interpretation has similarities and important differences to some past reconstructions. The overall pattern of drainages is similar to that proposed by Nye in 1925, Fig 7; this pattern of drainages has several leads draining west from the Batholith towards an ancestral Ringarooma River beneath the dominant basalt terrain (younger Miocene basalt). So there was postulated, and I still have, a huge Ringarooma Lead.

I agree with many elements of the rather radical interpretation by Newton-Smith for Australian Anglo American in 1981 (TCR 81-1534), shown on Fig 16. He shows many NW trending leads heading many kilometres into the Warrentinna region, but I think several drainages should be merged. A comparison of the two interpretations is shown on Fig 17. One of the compelling reasons there must have been a drainage system trending that way is that there needs to be a source of the alluvial tin at Boobyalla and at Banca and at other known occurrences well away from known or credible bedrock sources. That ancient drainage I interpret to be pre Middle Eocene, so the basalts in that area must be Older basalt.

North and NE of the Tenement the drainage history is even more complicated, with the combined effects of river capture and marine incursions, and I strongly suspect many interpretations are wrong. But that, as they say, is another story and beyond the scope of this report.

The overall drainage system is designed to honour where old valleys must have occurred based on the position of mapped basalts and Tertiary sub-basaltic

(interpreted) sediments. Conflicts with drainages apparently going over ridges and uphill seem to have forced some previous interpretations, such as by Brown 1982 (in GSB 61 Geol Ringarooma & Boobyalla, also UR1978_07), to require internal basins and drainage systems going the wrong way. This is because there has been considerable tectonic adjustment during the Tertiary as one would expect with the basaltic activity of the region. Sedimentological studies offshore also support tectonism. Using an assumption that the Older basalts occupy old valleys also emphasizes the tectonic adjustments and amount of erosion that have taken place since the Middle Eocene.

My interpretation requires that the drainage system from the Tenement exited to the coast via Boobyalla, and that the major drainage through the Pioneer lead trends WSW into the Tenement, not WNW.

7. PAST PRODUCTION

In NE Tasmania the total recorded production from alluvial deposits is about 36 300 tonnes of tin metal. 23 855 tonnes of this, or 65.7%, was produced in the Tenement area. By far the largest producer was the Cascade Lead, about 21 000 tonnes, or about 58% of all alluvial tin in NE Tasmania. It is also interesting that recorded production from non alluvial lode tin deposits in NE Tasmania, including the well known Aberfoyle/Storeys Creek and Blue Tier/Anchor deposits did not exceed 25 000 tonnes.

The Briseis Mine on the Cascade Lead produced concentrates containing 20 787 tons of tin metal, the average grade of the alluvium being about 1.7 lb/cu yd of 70% tin. The lead contained up to 300 ft of river gravels covered by approximately 150 ft of basalt; 50% of the cassiterite occurred within 30 ft of the bottom of the lead where values up to 78 lb/cu yd occurred over 5 ft bore lengths.

In the unworked portion of the lead there remains reserves of 2 000 tons of cassiterite; the overall grade from surface to bedrock is 0.4 lb/cu yd of 70% tin, the grade of the stanniferous drift averages 0.98 lb/cu. yd. of 70 per cent tin, (see section 10 of this report).

The Branxholm Lead was worked to a depth of 190 ft including 50 ft of basalt overburden, the average grade was 0.9 lb/cu yd of 70% tin.

The Valley Lead has been worked in the top 45 ft and averaged 1.2 lb/cu yd, while boring to 120 ft in the lead indicates the grade of the unworked lower part to be about 1.5 lb/cu yd of 70% tin.

The Clifton Lead worked by the Endurance Tin Mining Company is up to 120 ft deep, and the grade during recent years has been about 0.35 lb/cu. yd. of 70 per cent tin, though higher grade material was worked in the past. Concentrates containing approximately 2 550 tons of tin have been produced from this lead to the end of 1961.

The Pioneer Lead was worked until 1929, approximately 9 050 tons of cassiterite, equivalent to 6 300 tons of tin, having been produced. The grade varied from 2.16 lb/cu. yd. in the early workings to 0.74 lb/cu. yd. of 70 per cent tin in 1928. Drilling ahead of the workings has shown values of 0.26 lb/cu. yd. to a depth of 120 ft.

LEAD	MAIN MINE	PRODUCTION PERIOD	TIN, metal	Length of Lead Extracted (m)	Approx tonnes of Tin per 300m Length of Lead
MT JOSEPH	RUBY FLAT	ca 1875-	?		
BRANXHOLM VALLEY	ARBA VALLEY	-1960 -1945	2300 370	1200 600	500 180
CASCADE	BRISEIS	1876-1960	21000	3000	2000
MAIN	Sarah Anne/ Mutual	1882-1918	?		
WELD-FROME	ECHO	1901-1922	185		
OK	HERRICK	1881-	?		
WYNIFORD	PIONEER	-1982	6600	1900	1500
CLIFTON	ENDURANCE	-1968	3300	1900	450
	MONARCH	-1973	250		
Ringarooma River	DORSET	1944-1971	2300		
TOTAL			36305		

Notes: 1. Highlighted deposits are within EL65/2004.

2. The resource figures come from several sources. Most sources quote different numbers making compilation fraught with difficulty. I have attempted to be diligent.

8. CURRENT RESOURCES

A recent table of current resources is presented below;

NE TASMANIA: Remaining resources of alluvial tin

Mine/ Deposit	Volume	Grade
	(million m ³)	(g/m ³ Sn)
Briseis	7.44	1367
Braithwaites prospect	21.2	102
Macgregors Deposit (Dorset)	5	83
Pioneer	21.3	127
Scotia Lead	12.2	104
Endurance	8.4	160
Monarch	4.23	224
Ringarooma Bay	21.23	174

Source: Table 5.6 in Tasmanian-Commonwealth Regional Forest Agreement Background Report Part D, Social and Economic Reports Vol III (Chapter 5 Minerals). Published by: Tasmanian Public Land Use Commission, November 1996.

NOTE WELL! The Briseis resource is incorrect! Very overstated overall grade. See section AA of this report for correct figures. The other quoted resources may also be incorrect.

VAN DIEMAN MINES

Most of the known remaining published resources of alluvial tin are held by Van Dieman Mines, so relevant information extracted from their web site is included below:-

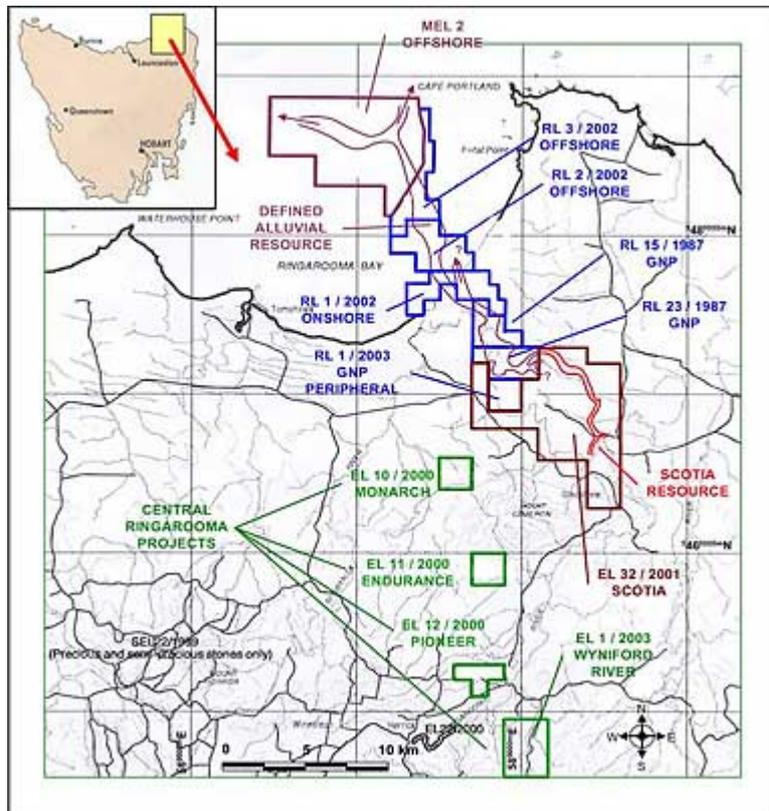
Van Dieman Mines plc, a UK AIM listed company holds alluvial tin/sapphire projects in Australia, through Van Dieman Mines Pty Ltd.

The Tasmanian alluvial resources are located within the north east Tasmanian tin region that stretches from the Blue Tier granite massif in the south through to the north and north east coasts and into offshore Bass Strait. This region has been a significant contributor to the overall production of tin and precious stones in Tasmania. Historical records up to 1980 indicate that in excess of 40,000t of tin has been recovered from the region, most of it from alluvial operations.

During the 1960s and 1970s a number of major companies conducted exploration throughout the region and substantial drilling programmes saw the delineation of the Offshore, Great Northern Plains, Scotia and Central Ringarooma deposits.

Following an independent technical review resources measuring in excess of 100M m³ of alluvial sediments have been delineated within the Scotia, Central Ringarooma and Great Northern Plains areas. Of these 11.5M m³ contained in the Scotia and Central Ringarooma project areas are considered to represent measured mineral resources which the Directors believe can be immediately developed and economically exploited. In addition these project areas are considered to contain a further 27.5M m³ classified as inferred mineral resources and with ongoing exploration it is anticipated these will become measured mineral resources. Onshore, on the Great Northern Plains, a measured mineral resource of 40M m³ has been delineated. Further areas immediately adjoining this resource are estimated to contain in excess of 39M m³. Offshore, extending into Bass Strait a tin mineralised zone of some 200M m³ has been delineated.

The location of the Scotia, Endurance and Pioneer resources shown on the maps demonstrates their close proximity to established infrastructure services such as roads, electricity, communications and townships.



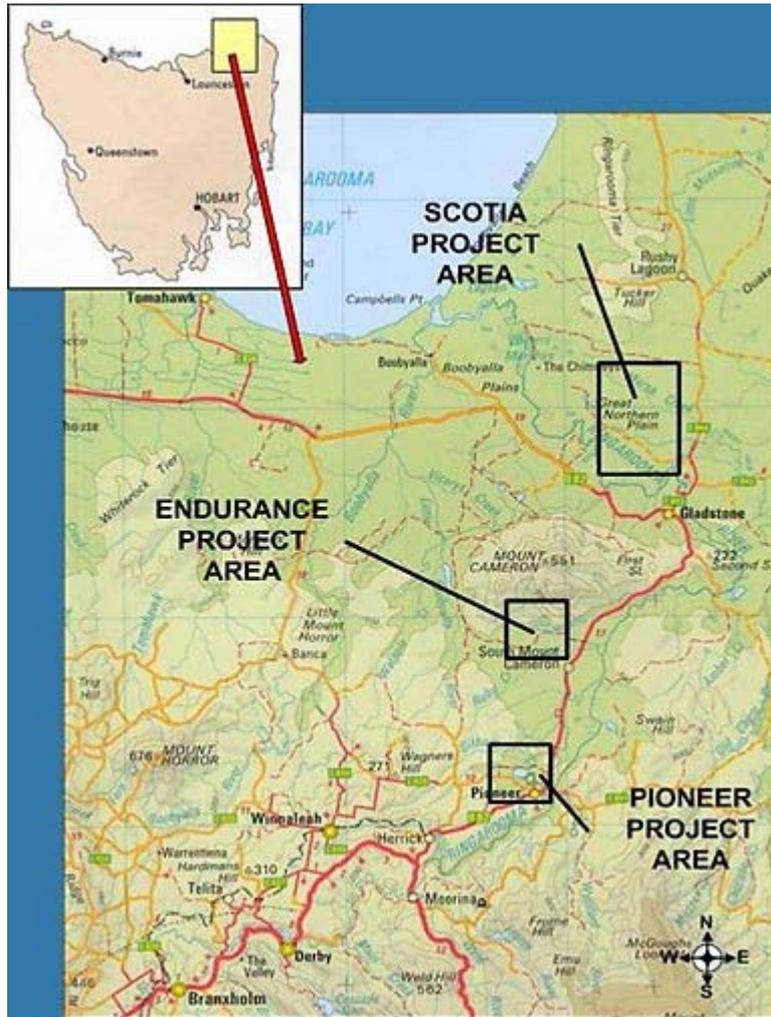


Table 1: Mineral resources

Tenement	Volume (million m ³)		Grade (kg SnO ₂ /m ³)	Total SnO ₂ (tonnes)	Resource Classification	Strip Ratio
	Ore	Overburden				
Central Ringarooma						
Endurance	1.57 2.40	8.94	1.065 0.972	1,674 2,300	Measured and Inferred	5.7
Pioneer	4.62 3.50	22.73	0.872	4,027	Measured and Inferred	4.9
Scotia	5.32 21.35	24.90	1.300 0.348	6,913 7,430	Measured and Inferred	4.7
Gt. Northern Plains						
Fosters Marsh	34.10	77.40	0.260	8,878	Measured	2.3
Braithwaites	5.16	14.46	0.282	1,416	Measured	2.8
Peripheral Resource Areas	39.70		0.100 to 0.300		Inferred	2.3 to 2.8

Table 2: Estimated recoverable content of associated mineralisation

	Zircon (g/m ³)	Rutile (g/m ³)	Gold (mg/m ³)	Tantalite (g/m ³)	Sapphire (g/m ³)*
Central Ringarooma	100	100	15	1.5	2.0
Scotia	100	100	15	1.25	2.0
Gt. Northern Plains	100	100	10	1.2	1.0

Mining Strategy

The alluvial mineral resources encompass a number of discrete project areas. Some deposits such as Endurance and Pioneer which form part of the Central Ringarooma area are "stand alone" projects whilst others such as Scotia, Great Northern Plains and Offshore are linked together, such that they each form one part of a major resource area.

At end 2006 planning and mining approvals were well advanced for the mining of Scotia and Endurance.

There is a six year contract with tin smelter and refiner, Thaisarco, for the offtake of the entire tin concentrate output of 1,350-1,500 tonnes contained tin per year at prevailing market prices. Also there is a joint marketing agreement with a major gem wholesaler in the US to develop sales of cut sapphire to leading US jewellery outlets.

9. SAPPHIRE AND OTHER ACCESSORY MINERALS

[The following was largely derived from the web site or the 2004 Prospectus of Van Dieman Mines]:-

Sapphire has been recorded from a number of localities throughout Tasmania, however it is only those locations in the north and north east that have sufficient size potential to become attractive for large scale mining exploitation. Sapphire was regularly reported as a component of the tin bearing alluvial gravels in north east Tasmania and was often recovered from tin shed concentrates at such operations as the Briseis, Pioneer, and Endurance Mines and from the Dorset dredging operations in the Ringarooma River.

At Monarch, Endurance, Pioneer, GNP and Scotia, test results indicated that sapphire as a resource base would not be of sufficient grade (approximately 2 g/bcm) to stand alone in economic terms, however when recovered along with tin, gold and tantalite it is a significant economic component of the recoverable minerals. The source of the sapphire has now been determined and while much of the source volcanic material has been eroded the known former locations of the source rock has enabled specific areas to be targeted for further test work.

Most of the test work conducted by various parties over the last two years has been oriented toward tin testing and thus the lighter sapphire component of the heavy mineral train is usually lost to tailings. Recent broad based testing indicates that the ore grade tin bearing gravels, usually contain sapphire grades of 1 to 3 g/bcm, of which about 20% are of gem quality.

Recent research on the tin deposits at Monarch, Pioneer, Endurance, Scotia and the GNP indicates that sapphire is known to be a minor component after cassiterite in the basal zone resources and that if recovered the sapphire component will enhance the economic viability of those particular projects. Several conclusions have been drawn as a result of those studies:

Sapphire has a dominant blue hue and responds well to conventional heat treatment to enhance clarity and value;

Size varies from 1 mm through to pieces of more than 25 mm;

Sapphire is recoverable from the basal sections of almost all Tertiary and Quaternary alluvial deposits in the north east;

It is unlikely that any stand alone sapphire deposits will be located, however sapphire can be economically recovered along with the cassiterite;

Parcels of Tasmanian cut sapphire have been accepted by established sapphire marketing groups who compare their quality and colour to the best small to medium size Sri Lankan gems.

History

Early tin miners first reported the presence of sapphire from many mining locations throughout the north east. None of those early reports were quantified and sapphire was not treated as a significant component of the alluvial deposits. Sapphire was reported from all areas but was not of interest to miners and explorers.

Sapphire is a significant component of the tin shed tailings at the Pioneer, Endurance and Dorset Mines. Previous operators report that sapphire of fine blue colour was regularly recovered from the primary and secondary jig beds during clean-up, which were collected by the operators.

In all the exploration programmes involving cassiterite bearing alluvials of the Great Northern Plains region, sapphire was never treated as a significant component of the heavy mineral fraction.

Historically there have been a number of significant stones recovered by fossickers. A 264 carat stone was reported to have been recovered in the Weld River in the Catalogue of Minerals of Tasmania, published by the Tasmanian Department of Mines. In 1933, a 900 carat stone was reported to have been discovered in mining detritus at the Weld River.

Recent finds of coarse-grained zircon, sapphire and spinel at Ruby Flat, Branxholm and at Main Creek by VDM illustrate the extent of the sapphire occurrences within the tin project area. Recent exploration has confirmed that gem quality sapphire is a component of many of the tin bearing alluvial leads, and along with gold and tantalite comprises a potential economic component previously overlooked in most test programmes. This relates not only to its occurrence, but also to the blue hues, pale to cornflower, exhibited by the 20% gem fraction of the sapphire concentrate. A small component also has a milky appearance like the Sri Lankan Gueda gems that heat treat to the finest blue. Cutting of several parcels of stones collected by fossickers suggest this is the case, are many fine blue stones have resulted from heat treatment of this milky material.

Size and colour of sapphires vary greatly throughout the area and there are clearly a number of original sources with slightly different elemental composition.

A significant statistical review was carried by MHAPL on the size range of sapphires in public and private collections. All parcels of sapphire recovered by MHAPL in its test programmes since 2001, or observed in the collections of local miners and prospectors appeared to contain between 20 to 30% blue gem material. Large stones, greater than 6mm, were rarely observed although historically such stones were regularly reported to have been recovered during alluvial tin sluice box and jig plant clean-up. Such stones are in the collection of the Derby Museum, and other private collections in the region.

The absence of such stones in most parcels can be explained by their removal by the owners as specimens or for cutting. While this does in part explain the lack of larger stone it was not seen by MHAPL as the complete answer. In order to determine if a larger fraction may in fact exist, a size distribution analysis was carried using data derived from various sources including MHAPL test records, from local collections and from information provided to MHAPL.

This indicated that the parcels of stone recovered by MHAPL while corresponding closely to sizing of parcels from New South Wales and Queensland in the smaller size fractions did not contain similar proportions of larger stone. A theoretical distribution curve was constructed using historical data and observed size range measurements taken from private collections. When the data of larger stones observed in those collections were added to the curve, it more closely corresponds to those of the sapphire parcels from the other states. The occurrence of known larger stones confirmed the presence through the region and supported the conclusions that large stones are generally not observed in parcels because:

- * They have been preferentially removed for cutting or into collections; and
- * Most weekend prospectors are only able to excavate surface horizons and not the basal layers, it is these basal layers in which the larger size sapphire would be expected to occur.

In addition to the sizing analysis, MHAPL arranged to have some small parcels of very poor quality blue sapphire/corundum heat-treated, by an Australian gem cutter. Heat treatment proved effective in that most untreated parcels containing between 20 and 30% blue gem, appear to improve to between 30 and 40% blue gem.

Other Accessory Minerals

Zircon:

Three types of zircon have been recognized in the alluvial deposits including: Fine zircon grains, -5 mm in size, commonly observed in the cassiterite concentrates at all mine locations, are considered to have been derived from the acid igneous intrusive rocks and to a lesser extent from both basaltic units. This material is now considered to be a significant accessory mineral and of potential economic importance, as zircon concentrate.

Two separate generations of coarse zircon observed at widespread locations in the north east. They are derived from the Tertiary basaltic units and probably the bulk are derived from the Older Basalts and associated pyroclastic rocks. The material varies in size from 1 mm to +10 mm. Colour varies from pale red to bright foxy red. A proportion of the larger stones make attractive faceted gems.

Rutile:

Rutile occurs in most of the alluvial deposits and reports to the cassiterite concentrates, rarely more than 1 mm in size. The source of the rutile is considered to be the acid igneous rocks and to a lesser extent the Tertiary basalts and associated pyroclastics.

Grades of TiO₂ are reported to lie between 4 and 140 g/bcm. Test plant losses would indicate higher grades as being present.

Ilmenite:

Ilmenite is the most abundant of the titanium bearing minerals. Field observations indicate that ilmenite content substantially exceeds that of rutile. Much of the ilmenite is traditionally lost to tailings and no effort has been made to quantify content.

Gold:

Gold is a regular component of the heavy mineral suite. Traditionally gold has been recovered as a by-product of all the alluvial tin operations and the Dorset Dredge recovered sufficient gold from its operation to meet part of its annual cost. The gold grade averaged around 30 mg/bcm and this appears to agree with the general reported recoveries from other operations. Gold was also recovered from the Monarch, Pioneer and Endurance Mines and high grades were reported to have been recovered from the Lochaber lead north of Gladstone. Concentrates obtained by MHAPL as part of its recent testing all contained fine gold and the deposits tested around the fringe of the Great Northern Plain all contain visible free gold.

Tantalite/Columbite:

There is evidence that the heavy mineral fraction also contains one of the tantalite–columbite series minerals. Testwork has indicated that at least some of the Ta + Nb occurs within the cassiterite as well as in discrete fine grains of the heavy mineral fraction.

Rare Earth Oxides:

Tin shed tailings from Pioneer, Endurance and the Dorset Dredge are all observed to contain appreciable rare earth oxides (REO), principally in monazite–xenotime. These minerals report to the magnetic fraction of the heavy mineral concentrate and comprise between 0.2 to 5% by weight of the concentrate.

Topaz:

Gem quality topaz, some of considerable size and excellent blue colour occurs throughout the project area.

Peridot (Olivine):

Gem quality green olivine is abundant in the Younger Tertiary Basalts particularly in the vicinity of the Briseis Mine at Derby. Grains of bright apple green olivine have been reported from most of the alluvial deposits.

10. TARGET AREAS

The targets are discussed below in the order they appear on fig 13, ie from south to north. The order is not a ranking of size/grade/prospectivity.

TARGETS 1 and 2 UNNAMED

There is no recorded exploration here for alluvial tin despite the fact that deep leads must exist and there are ample tin deposits upslope not far distant. Doubtless there has been small scale alluvial production here, but no known records.

TARGET 3 MT JOSEPH LEAD, RUBY FLATS, Figs 18 to 20

Warin Appleby 64-0381, (Australian Anglo American) extract:-

“At Ruby Flat to the south of Branhholm shallow rich alluvials were worked during the earliest history of the tinfield. Removal of the alluvials revealed tin-bearing greisenous granite, which was worked with only limited success. Similar greisen veins and overlying eluvial material were also worked at Mt Paris and at other places to the south and east of Ruby Flat.”

“Topographically Ruby Flat is a broad, flat-floored north-west trending valley cut into bedrock. The valley is perched and ends abruptly at the north-west end at the Ringarooma River (Fig. 20). The river is here rigorously contained along a strong north-south lineation, with basalt on the west side and basement granite and slate on the higher east side. The Ruby Flat valley is perched above the Ringarooma, its floor being at about the same height as the top of the basalt on the west side of the River. An isolated remnant of basalt, some 200 feet higher than the basalt of the main valley, forms Grey's Hill on the north side of Ruby Flat. It appears that the Ruby Flat valley was once part of an early Tertiary lead flowing north-west but that it has been faulted up and has most of its basalt and alluvial fill stripped out. Its continuation is thought to be at the Mt Joseph mine where Nye (1925) records that mining of a lead type of deposit was hampered by the presence of a great deal of marcasite. This newly recognised Ruby Flat/Mt Joseph Lead may persist on a north-westerly course under the narrow basalt-capped ridge and under the Legerwood Creek flats.”

Note that the name Mt Joseph has been annotated by someone on Fig 18 to read Mt George or Royal Gordon. Which is correct is not known to PWA.

TARGET 4 BRANXHOLM LEAD, ARBA, Figs 6,7, 8,20,21,22.

King 63-064, (Australian Anglo American) extract, edited by PWA:-

“The Arba Mine is situated immediately to the north east of Branhholm. Part of the workings were described as the Ormuz Mine in recent years.

History: Prior to 1883, the ground was being worked by the Arba Tin Mining Coy. They evidently were successful at some periods, as a production of 51 tons of tin ore

is recorded for three months in 1886. However, the drifts were deepening as work progressed. Much developmental work was carried out during the period 1899-1902 and was followed by continuous production from 1902 to 1920. Company operations ceased in 1920, when the readily accessible parts of the lead were worked out and the depth of overburden in the working face became unmanageable.

Grade and Production: The average grade of 3,260,850 yards of drift treated during the period 1903 to 1920 was 0.933 lbs tin. The total recorded production is 2,180 tons of metallic tin.

Reserves: Practically all the Tertiary drifts have been removed from the old Arba leases, with the exception of small lengths of tributary leads. To the north west, however, the lead passes under a hill on Edwards' property which is capped with up to 60 ft. of decomposed basalt. The face of the abandoned workings was 167 ft. high, and the floor of the workings here was 30 ft. above basement.”

Drilling ahead of the old working face has been carried out by three different interests.

Briseis Consolidated drilled 26 holes on behalf of Burma-Malay Tin in the vicinity of the working face on Edwards' property.

Bores Nos. 1 to 13 were sited in the actual working face below the natural surface. The lead was encountered in bores Nos. 1, 2, 3, 9, 10 and 12, over a width of about 300 ft, for which the average corrected depth and tin values are 172 ft. at 0.50 lbs cassiterite per yard. The central part of the gutter (Bore 12) averages 0.95 lbs per yard.

Bores nos. 23-26 were collared in basalt above the lead. The average depth from the natural surface to basement in these holes was 234 ft, and the overall grade 0.41 lbs cassiterite per yard.

Average values for the best part of the lead, say 200 ft. wide, would be nearer 0.8 lbs cassiterite per yard.

The Government is known to have carried out boring in the flats north of Edwards' property, towards the junction of the Branxholm and Ringarooma Leads.

Fourteen shallow holes (not to basement) were put down on the flats immediately north of Edwards' property. The low values obtained are inconclusive at such shallow depths.

Warin Appleby 64-0381, (Australian Anglo American) extract:-

“The lead mined in the Arba workings was the north flowing Branxholm Creek Lead. At the extreme north end of the old Arba workings a second lead, flowing north-west, joined the Branxholm Creek Lead and the united lead is thought to continue to the north-west under Arba Hill. Further north again the Black Creek Lead flowed north-west under Arba Hill and probably joins the other two. The united leads, termed here the Arba Lead, which Nye thought would emerge at the north-east end of Arba Hill and head north to join his “main Ringarooma Lead”, is now thought likely to emerge

at the north-west corner of Arba Hill and to follow a predominantly north-westerly course under the Ringarooma River flats.

Drilling ahead of the Arba face has indicated approximately 4.5 million cubic yards of 0.28 lb Sn/cu.yd at depths of up to 200 feet (King, 1963). This drilling may not have been across the full width of the lead, particularly on the south side. The basalt cap on Arba Hill is said to be about 60 feet thick and to be made up of 30 feet of fairly solid basalt and 30 feet of solid, decomposed material. The depth of the Arba Lead when it emerges from Arba Hill is likely to be about 100 feet. The Branxholm Lead seems to have averaged more than 500 tons of tin to each 1000 feet of lead, and the Arba Lead emerging from under Arba Hill might be of comparable richness.”

Drilling Campaigns

Drilling has been done spanning many years by the mine operators, by the Briseis company, the Mines Department, and finally by Australian Anglo American in 1981-4.

The aim was to drill just ahead of the working face and try to track the lead beyond the basalt hill.

The best compilation is by Munro 84-2101. All holes are plotted and drill sections presented.

In summary the operators found that to the north of Arba Hill either the lead was not found or grades in it are poor. The thrust of the work was based on the lead trending northerly or north easterly.

Prospectivity of the Arba Lead, (PWA).

In the literature there is quite a bit of confusion about the names and locations of various leads here. I believe that the old Arba Valley trends NW not NE or northerly, Fig 21, and if so nearly all of the drilling must have missed the lead.

Therefore renewed efforts to find high grade material at bedrock should be directed there. Of course overburden depths would probably be too great to enable open pit mining, so new and innovative remotely operated underground recovery methods may be necessary.

It is possible that the alluvial tin in this area is post early Eocene, say Oligocene in age, and that the alluvials to the north of Arba Hill are entirely miencan, i.e. perched, deposited on pre-existing alluvium, and there is no placer tin at bedrock very far north or north east of the hill . The placer tin at the old Arba mine was on basement at about RL140m, and the mined miencan placer tin at the north of the hill at the Groper and Roper Mines was also at about RL 140m. Miencan grades can be expected to be lower than the reworked bedrock mineralisation. This would reduce the potential of the area but there would still be a resource, potentially open pitable if basalt were also mined, between the old Arba and the Groper and Roper mines. An early calculation of the potential under the hill is relevant in this respect:-

[from King 63-064]:-

Length of Lead (untested)	say 2,000 ft.
Width of Lead	300 ft.
Average depth	200 ft.
Average overall grade	0.4 lbs. cassiterite per yard.
Total yardage involved	$\frac{2000 \times 300 \times 200}{27}$
	= 4450000 cu.yds.
Tons cassiterite returned	$\frac{4450,000 \times 0.4}{2240}$
	= 793 tons
	or 555 tons metallic tin.

A calculation of potential was also made by Munro for Amdex, 81-1529:-

“expected maximum reserves for a block (Fig 22) underneath Arba Hill.

Assumptions:-

1. Safe mining conditions would necessitate a cut at the base of at least 120m and a batter of 70° or less.
2. Grade used in calculations representative of the width of the cut.
3. Length of unmined section under hill is 780m.
4. Depth of basement from top of the basalt is
 - (a) southern end 61m Block 1
 - (b) northern end 105m Block 2
5. Average grade 600g/m³ - Block 1, 350g/m³ - Block 2
(ie optimistic). Grade partly based on Briseis Consolidated drilling in mine face.

Results:-

Block 1	Total Volume	3,380,000 m ³
	Volume of Basalt 0/B	1,100,000 m ³
	Volume of Drifts etc.	2,290,000 m ³
	SnO ₂ content	1,264,000Kg
Block 2	Total Volume	6,480,000 m ³
	Volume of Basalt 0/B	1,470,000 m ³
	Volume of Drifts etc.	5,010,000 m ³
	SnO ₂ content	1,474,000Kg

Total Volume 10,860,000 m³

Total SnO₂ content 2,738,000Kg

Average grade 277g/m³

Note:- Minimum reserve figures could be as low as 10% of the last two quoted figures, ie. if the lead is not mineralized.....”

NOTE BY PWA:- A recalculation of the figures above to separate out overburden gives:

7.30M m³ of “drift” @ 375g/m³, with 2.6M m³ of basalt overburden. The only overburden calculated is for basalt. A better calculation would be one where low

grade “drift” is separated, so the volume of mineralisation would be smaller but higher grade. If 20% of the “drift” is barren then a recalculation gives:-
5.8M m³ of mineralisation @ 470g/m³, with 4.1M m³ of overburden.

Newton-Smith 81-1534 (Australian Anglo American), states:-

“Remaining reserves lie beneath a cap of basalt 18m thick and have been estimated by King at 3.24M m³ at 181g/m³ and by Amdex at 7.30M m³ at 375g/m³.” However such reports differ from those in the open file system and so were presumably internal reports.

TARGET 5A VALLEY LEAD, Fig 6, Fig 7, Fig 18, Fig 20.

P.B. Nye, Government Geologist. (1924) ‘THE BRISEIS CENTRAL TIN MINING CO. N.L’, UR1924_054-58, (edited by PWA.)

Location and Access.

The Briseis Central Mine is situated on the South Bank of the Ringarooma River near the junction of Valley Creek between Branxholm and Derby. The main road from Launceston passes through the property midway between Branxholm and Derby.

History. The discovery of tin was not made until several years after the majority on the north-east coast, as the first lease was not applied for until 1882. The property was held by several leases until taken over and worked by the Ringarooma Valley Tin M.C. N.L. This company was formed in 1885 and continued operations until 1892 at intervals and the mine became known as the Ringarooma Valley Mine. The method of working is stated to have been very inefficient and only a small amount of ground was treated. In 1904 the Briseis Extended Tin Mines Co., N.L. was formed to work the deposit and continued operations until 1910. A more modern plant was used and more material treated, but the lower portions of the drifts were not treated over part of the workings. The Briseis Central Tin Mining Co. N.L. was formed in 1918 and holds the property at the present time.....a large amount of boring has been carried out to test the property.

Geology. The main road from Branxholm to Derby runs practically along the boundary of the granite to the south and the flats of the Ringarooma River to the north. The granite forms the hills which rise steeply to the south...The flats of the Ringarooma River consist of a shallow depth of recent alluvium containing several feet of shingle. To the north of the river Tertiary basalt overlies Lower Tertiary tin-bearing drifts. These latter deposits extend below the alluvial flats of the Ringarooma River and rest on a bedrock of granite.

Ore-Deposit. The tin-bearing deposit consists of Lower Tertiary stanniferous drifts. The south-eastern boundary is the main road at the locality where the valley Creek crosses the road. The deposit is 300 to 400 feet wide at the top and trends to the north-west below the river flats. It is shallow at its south-eastern end but deepens to over 100 feet to the north-west.....This lead should join the Ringarooma lead at a distance of approximately half a mile from its south-eastern extremity. The leases include a length of about 1750 feet of this lead, the remaining portion (about 690 feet) being situated under the river or on private property north of the river. The depth of the junction of the two leads should be approximately 200 feet below the present river level.

Production. It is generally stated that the Ringarooma Valley Co produced about 400 tons of tin ore, but according to Montgomery in 1894 (about two years after work ceased) the production was 90.5 tons of tin ore.

The Official statistics show the production of the Briseis Extended Co. to be 428.7 tons obtained during the years 1905 to 1909.

The total production has, therefore been 519.2 tons of tin ore.

Value of the Drift. Approximate estimates of the content of cassiterite in the drifts can be arrived at by two methods. Firstly there is the results obtained by past working and secondly the results from boring. The first is necessarily very approximate as the amount of ground treated is not definitely known. The old workings cover an area of 15 acres and have a maximum depth of 50 feet, and the assumption of an average depth of 40 feet is rather high than otherwise. These figures give a total volume of 968,000 cubic yards. The total production from this amount has been 520 tons, so that the context of tin ore was 1.2 lbs. per cubic yard.

Several boring campaigns have been undertaken in order to test the drifts both in the old workings and to the north of them. The earliest of these was in 1900 and gave results up to 2.48 lbs. per cubic yard, the average being much lower than this. The upper portion of the ground in which these bores were put down, was treated by the Briseis Extended Co at a later date. In 1920 a further campaign gave results in the old workings ranging from a little tin to 1.5 lbs. per cubic yard, but the results were generally lower than those previously obtained. Another campaign was carried out by a different operator in 1921,.....[boring information omitted]..... The past workings were carried out in the upper part of the drifts and it is generally found that the tin ore is more concentrated in the lower than the upper part of a lead, so that it would be reasonable to expect the lower drifts to contain more than 1.2 lbs. per cubic yard. That this fact is not reflected in the boring results does not necessarily mean that it is not the case. At the bottom of the drifts, boulders of granite, quartz etc occur among which concentrations of tin ore are likely to exist, and boring under such conditions is not necessary accurate.

From the above review it is seen that approximate calculations of the results of past workings show a tin ore content of 1.2 lbs. per cubic yard, while boring of remaining portions of the drift indicate a content of 0.5 lbs. per cubic yard, though the latter might reasonably be anticipated to contain a higher content,

Quantity of Ground. As already recorded the property contains about 1750 feet of the Valley Creek lead. At the upper and shallower end 1450 feet have been removed to a depth of 40 feet and a width of between 300 and 400 feet. Below these workings, there exists virgin drifts 60 to 70 feet deep in the gutter and which should increase rapidly in depth to the north-west. To the north-east of these old workings there is about 300 feet of the lead, and the gutter should be about 150 feet below the surface. The quantity of drifts below the old workings should be approximately 600,000 cubic yards and in the north-western part of the lead 300,000 cubic yards. The total quantity is therefore approximately 900,000 cubic yards. It depends upon the course of the Valley Creek lead as to whether a further length of it is situated upon the property or not.

Director of Mines for 1962, stated that Briseis TinN.L. "ceased working the Valley Mine at the beginning of the year in the face of a combination of adverse factors, e.g., heavy shingle, inadequate water supply and a low ratio of recovery to bore value".

A small operator mined and drilled holes in the pit around 1964 (64-0382 Tucker), and reported low grades in drilling.

Newton-Smith 81-1534 (Australian Anglo American), states:-

“possible remaining reserves have been calculated by King at 0.69M cu m at 886g/cu m and by Amdex at 0.22M cu m at 431 g/cu m.” PWA NOTE:- Such reports are not in the open file system and so were presumably internal reports. He also states that the Valley Lead has a small catchment area and tin grades fall off rapidly downstream.

TARGET 5B FRASER FLATS, Fig 6.

Amdex and later Australian Anglo American considered that the Fraser Flats area, 2 to 3km west of Derby Township, to the north east of the Valley workings, was prospective because it may have hosted relatively recent placer tin in, effectively, terraces of the present river, and also be a site where the ancestral Ringarooma Lead was at relatively shallow depth because of the absence of basalt. Two holes were drilled with low tin (and gold) content, (95-3710 Fleming Munro, an Amdex report from 1979, not 1995!).

Prospectivity of Targets 5A and 5B

The accounts of mining and geology indicate that the Valley Lead has been worked only to the south of the Ringarooma River. The workings were not at the bottom of the lead. The parts not worked are below the Ringarooma River level, as is the case for the Cascade Lead, and consequently would have not been able to be mined without river diversion.

My assessment of the trend of the lead, Fig 13, Fig 18, is north westerly, along the same trend that the valley occupies in granite to the south. The Ringarooma Lead would be well to the north of the Fraser Flats.

A large area, below the current river level is apparently unexplored. Before thick basalt overburden is reached about 300m of strike is available northwards from the end of the existing workings, and perhaps 200m of strike to reach basement below the current workings. Potentially an open pitable resource about 500m x 200 x 10m, say about 1M m³, of unknown grade and about 3M m³ of low grade overburden can be anticipated. If Nye's estimate of grade at depth is reliable, grade would be 0.4 lbs/cu yd or 230g/m³.

TARGET 6 CASCADE LEAD, Fig 6, 7, 18, 20, 23, 24, 24, 26, 27, 28.

The deposit, the biggest alluvial tin producer in Tasmania, is located at the town of Derby. A convenient summary is:

Braithwaite, JB., 'Ore Reserves in the Cascade Deep Lead', Technical Reports No 9, Tas Dept Mines 1964; 132-142 [extracts, edited by PWA, figure numbers as in this report]:-

Cassiterite was found by the Krushka Brothers in the Cascade River about the end of 1875 and the area was worked until the 1960s. **It proved to be by far the greatest alluvial tin deposit in Tasmania**, and although records prior to 1900 are meagre, the **total production was approximately 20,787 tonnes of tin metal.**

Table 1 summarizes the information available as regards production, values and labour employed.

Geology

The early workings were shallow and rich, and as they moved downstream it was realized that the main body of ore was a Tertiary deep lead under basalt. This lead occupied the old valley of the Cascade River, passed under the present position of the Ringarooma River and was presumed to join the old course of the Ringarooma well to the NW. The bottom of the lead is some 45m below the present Ringarooma River and to the NE is over 120m below the present surface. The bedrock in the upper portion of the lead is Devonian granite but near the lower limit of the workings this passes into sandstone of the Ordovician-Devonian Mathinna Beds. The alluvial tin is derived from bedrock greisen and other lode deposits of the Blue Tier Batholith to the south-east.

Drilling

Drilling was done between 1907 and 1941, and none since. Bores were drilled by hand and with power drills at 30m intervals on lines about 100m apart, Fig 25. Along Line 2 hand bores were sunk from an underground drive. Cross sections and bore values are shown on Fig 27, and 28, and Table 2 shows various statistics based on the results. Fig 27 shows a profile along the deepest section of the lead, and the corresponding average bore values over an assumed economic width (assuming a side batter of 45°).

Working Methods

The method of working adopted by Briseis Tin Consolidated No Liability was to break down the drift immediately below the basalt with hydraulic monitors, thus causing the basalt to collapse, pop any large boulders and remove the whole of the overburden hydraulically in a flume located in a tunnel. From the end of the flume fines went direct to the river while the oversize was stacked by a conveyor belt. In a similar manner the remainder of the drift was broken down by monitors and elevated to sluices by gravel pumps. Ample water at high pressure was provided by long races from the Ringarooma River and the Cascade River.

During the course of operations the Ringarooma River was diverted three times and although there were two disastrous floods which completely wrecked the plant and workings the present river diversion bund would appear to be well above any possible flood level.

The overburden face along the eastern side of the lead was very high and as the original overburden tunnel was not far in from this face the lateral extent of the workings on this side was restricted. With the construction of the new tunnel the workings were extended to the east but not to the full extent of the lead as the overburden had not been stripped far enough back. The use of water for the movement of both overburden and drift would tend to make the face unstable and it appears that even a batter flatter than 45° was insufficient.

The profit made by the Company in 1945 was small and it was realised that with decreasing values below Line 4 future operations were likely to be at a loss. Furthermore overburden along the eastern wall collapsed and the workings were buried under 8 to 10m of slurry and rock. Some major items of plant were recovered but a great deal was lost and mining of the deep lead ceased in the middle of 1946. Figures 21 and 22 show the mine as it was just prior to the cessation of operations in 1946 and that subsequently there was a large fall of overburden along the eastern face and extensive mining was then done, but only on the shallow tin-bearing alluvium, particularly along the old river bed. The quantity of tin in the deep lead is therefore unchanged and also the total quantity of overburden to be moved although some of the latter may not be in the position shown in the figures.

Ore Reserves

Fig 25 shows the extent of the lead as indicated by previous boring, the area worked out, and the area remaining which could be worked, all at bedrock level. The total quantity of cassiterite proved by boring and remaining unmined when operations ceased in 1946 was 2200 tons but some of the higher level deposits have since been mined and the total now remaining is probably not more than 2000 tons, not all of which could be mined.

From Fig 27 it will be seen that, while in the vicinity of Bore Line No. 2 tin values are distributed over the full depth from RL 720 feet to bedrock, lower down the lead values are almost entirely below RL 600 feet. The present calculations are therefore based on the quantity of ore below RL 600 feet and that between 720 feet and 600 feet and the results are shown in Table 4. In this Table the overburden involved in stripping to a 45° batter is shown against the nearest bore in each case.

Possibly the best method of working under modern conditions with heavy earth-moving equipment would be to strip to RL 600 feet and treat the balance in a high efficiency jig, cyclone and table plant. This would involve stripping 8,600,000 yards of overburden and treating 1,128,000 cu. yards of wash containing 3.20 lb. of cassiterite per cu. yd. The overall value of the ground to be moved in this scheme would be 0.37 lb/cu yd.

It will be noted from Table 4 that bore values are erratic and that 6 bores account for 1000 tons of ore out of a total of 1600. Owing to the very large yardage represented by each bore it is extremely difficult to check past recoveries against bore values but an attempt to do this is shown on Fig 27. Recoveries for the years 1941 to 1946 have been adjusted to allow for the increased overburden ratio involved in stripping to RL 720 feet and plotted on the approximate positions along the lead. It will be noted that although the average value of Line 3 is very much below that of Line 4 this is not fully matched by a corresponding fall in recoveries and in fact recoveries fall off steadily and follow very closely the interpolated curve of bore values. It must also be remembered that the old plant consisted of sluice boxes only, and as the yardage handled was very large owing to the inclusion of so much barren overburden, the tin losses must have been high compared to what can be expected in a modern plant treating the wash only.

An alternative would be mining by underground methods.

Possible extensions of lead

When the values fell off so rapidly below Line 2 the management at that time are believed to have considered the possibility that the lead had swung away to the right. A more reasonable explanation is that the deposit was formed in a lake and this would account for the rapid drop in values away from the inlet, the great width of the lead and the great change in the distribution of tin in depth from Line 2 to Line 7, i.e. in Line 2, there are values all the way down from RL 720 feet and 50% of the tin is more than 30 feet from the bottom while on Line 6 there is practically no tin above RL 600 feet and 50% of the tin is within 10 feet of bedrock.

Although it is unlikely that the lead was lost below Line 2 it is still possible that there are extensions to the right. There is no great rise in bedrock, as shown by the bores in Lines 3 to 7, which would indicate a definite boundary such as exists on the left, and further bores, particularly on Line 5, could show results. The bores on Line 7 show very little variation in depth and further boring in both directions is necessary to show whether this high bedrock does extend right across the lead. There is always the possibility that there is a narrow channel through this bar and that the lead will open out again below it as was the case with other leads in the district. Even if the deposit was formed in a lake there must have been an outlet and there could be an extension of the lead along this. Such a lead would be on a very much smaller scale but could be so concentrated, both in width and depth, that it would be an economic underground mining proposition.

NOTE BY PWA

The working south from line 2 had values distributed through the profile, and overburden thickness was much less. This suggests to me that the upper parts of the lead south of line 2 were reworked to a much greater degree and so tin was upgraded in the total profile.

The "reserves" in Table 4 are 1685 tons cassiterite in 3 325 000 cu yd, with 6 414 000 cu yd of overburden.

When converted to metric these are:-

1712t cassiterite in 2 542 000m³, say 5Mt.

2.5M m³ @ 680g cassiterite/m³ with 4.9M m³ of overburden.

Or

1350t Sn metal in 5Mt alluvium, with 10Mt of overburden.

This equates to 270g metallic tin/t, or 0.6 lb per ton, in the mineralised alluvium.

With modern terminology, and restrictions imposed by the JORC Code, this cannot be called a reserve. It is possibly best described as an inferred resource.

On the MRT website the Briseis resource is quoted in the Indicated category as 850 190t at 1367g/m³. No explanation of this calculation is given. This would equate to 425 000 m³ containing a resource of 580t tin metal. Presumably this is a calculation derived from part of Braithwaite's Table 4.

**TABLE 1
PRODUCTION RECORDS**

Period.	Tons of Tin.	Grade of Drift, lb/cu yd	Grade overall, lb/cu yd	Men Employed.	Remarks.
1876 to 1900-07	7100	3.41	2.09		Production outside Briseis Tin & General Mining Co. Ltd.
1900 to 1922	8935	3.41	2.09		Briseis Tin & General Mining Co. Ltd.
1923	254			91	
1924	179			126	
1925	140			120	
1926	118			99	
1927	184			104	
1928	217			102	
1929	89			61	Flood destroyed workings and plant
1930	45			25	
1931	43			34	Taken over by Briseis Tin Mines N.L.
1932	47			30	
1933	49			40	
1934	35				Briseis Tin Consolidated N.L. formed.
1935	18				
1936	55			103	Workings flooded.
1937	158	1.57	1.30	128	
1938	394	1.75	1.34	142	
1939	364	1.57	1.15	149	
1940	482	2.05	1.62	163	
1941	425	1.86	1.45	152	
1942	329	1.49	1.08	146	
1943	253	1.08	0.85	150	
1944	191	0.86	0.66	140	
1945	168	0.68	0.51	124	
1946	95	0.63	0.52	80	Work on main lead ceased.
1947	75		0.84	42	
1948	36		0.45	36	Briseis Tin Nl. took over.
1949	14		0.25	37	Main workings cleaned up and operations moved to Cascade River.
1950	40		0.74	NA	
1951	39		0.26	NA	
1952	39		0.26	42	
1953	26		0.21	40	
1954	40		0.22	39	
1955	33		0.27	39	Retreatment started.
1956	16		0.21	37	Cascade River workings finished.
1957	25		0.26	28	
1958	18		0.32	27	
1959	13		0.38	20	
1960	6		0.95	20	
TOTAL	20787				

TABLE 2**Summary of Bore Results in Tunnel Lines 2 to 7**

Tunnel Line No	2	3	4	5	6	7
Total depth of bores in lead (from RL 720 to bedrock)	605'	855'	1065'	1255'	1040'	545'
Width of lead	400'	500'	600'	600'	600'	300'
Average value of lead in lb/cu.yd of SnO ₂ over all bores including a batter of 45°	3.74	1.06	1.77	0.92	0.87	0.42
As above but corrected to 72% Sn	N.A.	0.98	1.62	0.88	0.80	0.38
Depth of wash containing 50% of the ore	30'	5'	20'	15'	10'	10'
RL of lowest point of lead	544.0'	536.0'	531.5'	530.4'	526.1'	538.6'

TABLE 3 Corrected Bore Values – not included here. See original report if required.

TABLE 4**“ORE RESERVES”**

Line No.	Bore No.	<i>Below RL 600</i>			<i>From RL 720 to 600</i>			<i>Above RL 720</i>
		Corrected Grade, lb/cu yd	Volume, 1000 cu yd	Tons SnO ₂	Corrected Grade, lb/cu. yd.	Volume, 1000 cu yd	Tons SnO ₂	Overburden Volume, 1000 cu yd
3	8,9	2.68	84	100	0.13	60	3	330
4	6	0.00	2	0	0.00	6	0	
	7	3.91	12	21		9	0	
	8	4.24	32	60	0	10	0	
	9	10.24	46	210	0.04	25	0	
	10	7.36	65	215	0.04	80	2	15
	11	2.03	73	66	0.24	120	13	60
	12	3.73	22	37	0.20	120	11	900
5	5	0.48	13	3	0.08	133	5	60
	6	1.36	60	36	0.04	140	3	120
	7	4.92	83	183	0.08	140	5	120
	8	3.30	70	103	0.04	140	2	120
	9	1.84	70	58	0.05	140	3	125
	10	2.19	74	72	0.11	140	7	180
	11	1.21	50	27	0.08	140	5	1060
6	6	0.62	28	8	0.06	140	4	83
	7	3.00	65	87	0.07	140	4	240
	8	1.55	65	45	0	140	0	400
	9	5.80	73	190	0.02	140	1	446
	10	1.33	85	50	0.06	140	4	530
	11	2.10	40	38	0.08	110	4	1625
TOTALS		3.20	1,112	1,609	0.08	2,213	76	6,414

Newton-Smith 81-1534 (Australian Anglo American), extracts:-

The lead has been traced by drilling to the northwest and was found to rise topographically on the last line of holes with an associated decrease in tin content of the lead. Geophysical evidence (Howland-Rose, A.W.1966: Derby-Winneleah gravity survey, Tasmania 1964. BMR Record 1966/10) suggests that the lead changes direction beyond the last line of holes to flow north but later drilling by the Mines Department failed to confirm this trend. If the Cascade Lead continues towards the northwest as postulated a possibility of some 20M cu m of reserves remain in the lead with a grade of about 200 g/m³. These reserves lie beneath a cover of some 70m of basalt and about 20m of sub basaltic, largely barren overburden.

Prospectivity of the Cascade Lead

The lead apparently trends northerly in the last line of drill holes as shown on Fig 13. The calculation by Braithwaite does not include any potential mineralisation in the open positions shown. Newton-Smith, above, states that drilling by the Mines Department failed to confirm this trend, but there is no published data and the available MRT digital plots do not show drilling here, the Briseis drilling in 1965 being to the south of the main workings. A further check of Mines Department drilling is to be made.

It is likely the lead goes north under thick basalt for several hundred metres as shown on Fig 13, where no drill testing has been done, and so a very large deposit of good grade may exist. It is potentially mineable underground by innovative or even conventional methods.

TARGET 7 MAIN LEAD, Figs 7, 9, 34.

Nye, PB., 1925 GSB35, extracts, edited by PWA:-

(a) Sarah Ann Tin Mine.

A portion of the workings of the old Sarah Ann Tin Mining Company Registered (formed in 1882) is situated on the south-west bank of the Main Creek, about 500m from its junction with the Ringarooma River. In the bottom of the workings both granite and slates and sandstones occur....Overlying the granite there are conglomerates, pebbles, sand, &c...represent Tertiary sediments formed near the head of the Main Creek Lead. The base of these beds is nearly 100 feet above the Main Creek, and their immediate extension to the north has been denuded by the present stream.

It was the drifts of this lead and the detrital material from them occurring on the hillside below that were worked at this locality. They appear to have been worked by the Sarah Ann Company in the early 1880s, and by the Briseis Company during part of the period 1913-1918. The drifts represent the head of the Main Creek lead, and only a very short length of the lead can occur to the south of the faces which have been worked, so that the deposits are of little economic importance. The fact that the operations on them have been abandoned also suggests that the tin content is low.

(b) Mutual Hill Tin Mine.

The Mutual Hill is situated on the east bank of the Main Creek, immediately to the south of its junction with the Ringarooma River. The old workings are situated on the western slope of the hill adjacent to Main Creek.

Tin ore was discovered at this locality in 1884 and appears to have been worked during the 1880s. It was later held by numerous individuals and companies, including the Native Paint and Oxide Proprietary No Liability and the Tasmanian Tin Dredging Company Limited, but no record of any work exists. The Mutual Hill Tin Mines No Liability was formed in 1910 to work the deposit, but this does not appear to have been done, and in 1912 arrangements were made with the Briseis Company to equip and work the mine. The latter company carried out sluicing operations until 1918. The Mutual Hill is a basalt-capped one, the basalt overlying Lower Tertiary sediments on the western side and granite on the eastern side. The Lower Tertiary sediments rest upon a bedrock of granite.

The deposit worked upon this hill consists of part of the stanniferous drifts of the Main Creek lead. The head of this lead occurs on the Sarah Ann workings described above, but the part of the lead between these and the Mutual Hill workings has been removed by the denudation of the present Main Creek. Similarly, the part of the lead to the north of the Mutual Hill has been removed by the Ringarooma River. There thus exists only a portion of the lead, with a length of 300 to 400m. Further, the whole of the width of the lead has not been preserved on the Mutual Hill, but only the eastern portion thereof.

(c) Private Property W. Krushka.

This property occurs on the west side of the Ringarooma River opposite the junction of Main Creek. Old workings are found at two localities on this property on the steep slopes to the river. Two adits (now fallen in) have been driven, one being 60 feet below the other.

The grits exposed represent the drifts of the Main Creek lead. The valley of the old Main Creek widens rapidly going north-westerly, and the drifts extend over a width of 900m to 1km to the west of the Ringarooma River. The above workings are situated on the south-western side of the lead, and are some distance above the bottom of it. It is impossible to ascertain upon what the workings were carried out, but there may have been rich stanniferous seams in the drifts. The extent of the workings is not large, and results were apparently not favourable. As already stated, however, the workings were some distance above the bottom of the lead, and this fact may have contributed to the unsuccessful nature of the work, as the upper drifts of a lead are usually poorer than the lower ones.

(d) Private Property C. Krushka.

Old -workings occur at three localities on this property, -and will be described separately.

(i) South-Eastern Corner.—A large working face (sometimes referred to as the Lone Brothers' Home) occurs here at a distance of 150m to 200m west of the river... grits are exposed, with an overburden of very coarse-grained basalt. These grits represent the north-eastern portion of the drifts of the Main Creek lead. It could not be ascertained whether the workings followed the bedrock for the whole of their length, but they probably did not do so. The drifts treated were portion of those on the north-eastern side, and therefore likely to be poorer than those in the centre of the lead. For this reason the operations were probably unprofitable, although no record of the results obtained is in existence.

(ii) North-Eastern Corner.—Another old working occurs at the head of the next small creek to the north. The material in the workings consists of decomposed granite and hill-slip material from the basalt and drifts of the Main Creek lead to the south-west.

There may have been a concentration of tin ore along the gully, but the hill-slip material is probably relatively poor.

(iii) North -Central Portion.—Mining operations have been carried out along the unnamed creek which flows north-westerly to join Krushka Creek near its junction with the Ringarooma River. The material treated was Recent and hill-slip material formed along the course of this and tributary creeks. The head of these workings reached the north-eastern edge of the drifts of the Main Creek lead. The drifts consist of grits with abundant lignite, and are overlain by coarse-grained basalt. The tin ore in the creeks was derived from these drifts, but, being right on the edge of the drifts and some distance above the gutter, they are probably too poor to work by themselves.

(e) Future Prospects of the Main Creek Lead.

Any future work on this lead should be devoted to that part on the western bank of the Ringarooma River. The gutter occurs about 30 to 40 feet above the river, and is situated approximately to the north-west of the sharp bend from north to south-east, adjacent to W. Krushka.

Scott, JB 1928 (State Mining Engineer) , NOTES ON RINGAROOMA TIN (ALLUVIAL) LTD. (Formerly, Mutual Hill Mine), (extracts, edited by PWA).

Situation and Access

...situated on the eastern side of Main Creek at its junction with the Ringarooma River abutting to the south bank of the latter....

Topography

Mutual Hill is the general designation of the area, which is dome shaped and when viewed from the west it presents an appearance resembling that of an inverted bowl. The area generally speaking is cleared farm land, the superficial earth consisting of rich basaltic soil.

The valley of Main Creek is within a few hundred feet of the western portion of the southern end of the workings; the valley of the Ringarooma River is similarly adjacent to the northerly portion of the former workings.

Economic Geology

The tin bearing drifts are exposed along the foot of the hill in the old workings 15 to 20m above River level over a distance of about 600m. From the level of the former workings two tunnels 180m apart have been driven into the hill in a general north easterly direction and have penetrated the drifts for distances up to 180m. This work was carried out many years ago, the openings are now inaccessible.

These tunnels go to prove that considerable quantities of alluvial material have been deposited to the east of the former workings. Information concerning the average tin content of the drift material passed through in the tunnel, or, if it is a portion of a gutter extending below the level of former workings, along the fringe of the deposit is not forthcoming. A good exposure of the deposit can be seen in the southern part of the property where active sluicing operations are now in progress.

So far as this lead of drift at the south end of workings has been worked the bed rock indicates a progressive rise from west to east.....

King 63-064, (Australian Anglo American) extract, edited by PWA:-

Mutual Hill and Sarah Ann Mines (Main Creek Lead):The head of this lead occurs on the Sarah Ann workings.....The main work was done by the Briseis Coy. in 1913-18, but the size of the deposit was found to be very limited.

Between the Sarah Ann and Mutual Hill mines, which are about 400m apart, the Tertiary drifts have been largely removed by erosion.

The Mutual Hill mine, also worked by the Briseis Coy. during 1912-18 for a return of at least 80 tons of cassiterite concentrates, exploited another small remnant of the Main Creek Lead where it is preserved on the western side of a basalt-capped hill.

On the north western banks of the Ringarooma River, the drifts of the Main Creek Lead are again exposed in some old working faces along the margin of an extensive basalt plateau. Nye (1925) considered that the worked ground was above the bottom of the lead. He suggested that testing might disclose a limited reserve of payable ground and that the values obtained by such testing would determine whether the lead was worth following to the north-west below the basalt.

Newton-Smith 81-1534 (Australian Anglo American):-

“The Main Lead has been worked on a small scale at Mutual Hill and north of the Ringarooma River; the latter workings were not profitable but they are not considered to have been located at the base of the lead (Nye) which does not appear to be exposed north of the Ringarooma River. The Main Lead has not been prospected northwards from these workings. If the lead continues to the northwest a possibility of some 15M m³ of reserves remain in the lead beneath a cover of 70m of basalt and a variable thickness of barren overburden. The grade of the tin-bearing wash is unknown.” (PWA underlining).

Prospectivity of the Main Lead

The past production from here may have been substantial, but no records of production and recovered grades seem to exist. There is a very large well mineralised hinterland from which to derive a large amount of alluvial tin, as can be seen from Fig 9. Nye thought that the base of the lead had not been worked, and Newton-Smith , above, considered that large potential exists. A very large prospective area exists to the north of the Ringarooma River, and the base of the lead in the old workings should also be investigated. There are no records of any drilling in the entire Main Lead area.

TARGET 8 ECHO LEAD (WELD RIVER LEAD), Figs 7, 29 to 34.

Nye, PB., 1925 GSB35, extracts edited by PWA:-

The Echo Mine is situated immediately to the north of Moorina....

History.—Alluvial tin deposits have been worked in the vicinity of Moorina since the late 1870s. Operations were carried out to the north and west of the Ringarooma River, and progressed up the small unnamed creek which enters the river to the north of Moorina. The deposits worked were shallow ones of recent origin, but near the

Moorina-road it was found that the shallow deposits dipping to the south-east gave place to others dipping to the north. This led to the discovery of the Weld River lead in 1901. The lead was found on the leases of the Moorina Tin Mines Limited, which company was formed in 1900, and continued to work the lead until 1907. In 1911 the leases and water-rights of this company were purchased by J. A. Thompson, proprietor of the Weld River Tin Mining Company, and both the Weld and the Echo (or Moorina) Mines were worked up till 1922. The Echo Mine is not being worked at present.

Geology.—From the Herrick turn-off to the southern extremity of the Echo workings the main-road to Moorina runs along the boundary of the granite to the east and Tertiary sediments to the west. The granite also appears to the south of the workings. To the north-west the Tertiary sediments; are overlain by Tertiary basalt. Small areas of Recent alluvial and detrital deposits occurred along the course of the unnamed creek and the Ringarooma River.

The Ore-Deposit.—The deposit worked in this mine was one composed of stanniferous drifts of Lower Tertiary age. These drifts filled the valley of the Weld River, and represent the lead of this stream. The part of the lead to the south of the workings was removed by denudation by the present Ringarooma River. To the north the lead continues in a general northerly direction to join the main lead of the ancient Ringarooma River at a point about 24 miles north-west of Herrick.

The workings are situated at the eastern side of the drifts where they junction with the granite. The bottom of the drifts or the bedrock of granite is not clearly exposed, and as the drifts extend 300m westward it is possible that the actual gutter of the lead was not worked, unless it is situated very close to the eastern side of the lead.

To the north-west the basalt covers the drifts in the vicinity of the main-road to Derby. Production.—From the year 1902 till 1907, 77.95 tons of tin ore were produced from the Echo Mine. From 1908 onwards, until 1922, the production was not separated from that of the Weld Mine, worked by the same company, although the Echo worked during the greater part of the period. The recorded production of the two mines from 1908 until 1918 was 340.17 tons of tin ore, and from 1918 till 1922 it was 27.73 tons of metallic tin produced in the form of ore. It is probable that half of these figures represent the production of the Echo Mine, and the total production would therefore be not less than 265 tons of tin concentrates.

King 63-064, (Australian Anglo American) extract, edited by PWA:-

Shallow alluvial deposits of recent origin were worked in the Weld and Frome Rivers near Moorina in the early days, but it was not until 1901 that the Weld Lead of Tertiary age was discovered on the opposite (northern) side of the Ringarooma River, half a mile north of Moorina township.....

The full width of the Tertiary deposit is about 400m... but the workings were confined to the eastern side of the drift along the margin of outcropping granite. Total production for the mine during its main period of operation (1901-1922) is stated to be not less than 265 tons of cassiterite concentrates (Nye, 1925), but no information is available on the tin values of the worked ground. Increasing depths of overburden ahead of the workings, caused by the northerly dip of the gutter, evidently resulted in the closure of the mine.

The results of more recent boring in both shallow and deep ground are shown on Mines Department plans and indicate consistently low tin values.

Plans Nos. 557 and 557C-32 show 13 Government bores sunk in 1930 ranging from 134 to 280 ft. in depth with values from 0.05 to 0.2 lbs tin oxide per yard. Plan No.

1311-25 (Keid, 1953) records twenty shallow bores between Hardwick Creek and Echo Creek with values ranging up to 0.4 lbs tin oxide per yard to a maximum depth of 19 ft.[for plotted holes, see Munro, below].

Newton-Smith 81-1534 (Australian Anglo American)(edited, underline by PWA) :-

The Echo Lead is described by Nye and is currently held under Mining Lease by Mr. George Machen who is presently equipping the abandoned workings.

The Echo Lead has been traced northwest in front of the abandoned working face with grades of about 100 g/m^3 over a thickness of about 30m beneath some 50m of overburden. If the lead continues towards the northwest it will pass beneath a basalt hill and emerge in the vicinity of Davids Creek where it will lie beneath some 50m of largely barren overburden. Early records of drilling in Davids Creek (Thureau, G. 1884: Stanniferous deposits at Ringarooma. Report to the Parliament of Tasmania.) indicate that tin was located in two places 6.44 km apart at depths of 34.7m and 7.9m-15.2m. There is no indication of the location of this drilling but a map accompanying the report shows tin-bearing wash outcropping beneath the basalt on the south side of Davids Creek between Herrick and Winneleah which may be a continuation of the Echo Lead.

If the lead continues to the northwest a possibility of some 10M m^3 of reserves remain in part beneath a basalt cap up to 40m thick and a variable thickness of barren overburden. The grade of the lead is unknown.

Munro 82-1774_(Australian Anglo American):- (edited and highlight by PWA)

The Echo Lead has been worked in a down-lead direction with the last worked face and mine hole located one kilometre north of the Ringarooma River between Moorina and Herrick.

The mine was discovered in 1900 and worked intermittently until 1922. During 1981, the present lease holder, Mr. G. Machen, re-equipped the mine using water from the Ringarooma River for a sluice box operation. Mining was short lived and the mine is idle once more.

The tin occurs as cassiterite in Tertiary sediments, in a north flowing gutter on a granite basement which rises steeply to crop out in the hills to the east and west. Tertiary basalt caps the granite to the west and to the north ahead of the mine face where the ground surface rises to 110 metres above the basement at a distance of approximately 500m ahead of the mine face.

In 1930, the Mines Department drilled 13 prospecting holes, 9 of which were in two lines ahead of the mine face. These holes show that the Echo Mine has not worked the basal mineralisation, but the perched mineralisation above a horizon of clay sediments described in the driller's log as "pug". The grade of this mineralisation as indicated by the 5 holes, Nos.1 and 5 to 8, is $58.3\text{g SnO}_2/\text{m}^3$. The grade of the basal mineralisation which lies below the floor of the Echo Mine has not been definitely tested, but the grade indicated by 8 holes, Nos. 1 to 8, is $128\text{g SnO}_2/\text{m}^3$. If the mineralisation was mined to the basement, dilution by an unknown volume of clay located above the basement mineralisation would reduce the grade to less than $128\text{g SnO}_2/\text{m}^3$.

The Mines Department 1930 drilling tested approximately 700 metres ahead of the mine face with 9 holes in two lines (Fig 29). The mean grade of the basal

mineralisation is $119\text{g SnO}_2/\text{m}^3$ for the overall grade from surface to basement. The low grade, combined with the high overburden to ore ratio, due to the rise in topography, would prevent the economic mining of the Echo Lead far ahead of the mine face.

Davids Creek area (Fig 29)

Davids Creek is a tributary of the Ringarooma River. Through active back-cutting towards its source near the Winnaleah township, this small stream has incised a valley 90m through basalt flows and the upper section of the underlying Tertiary alluvial sequence:- coarse sand, fine gravel and clay bands.

Long section constructions (e.g. Fig 31) using sparse drilling information and basement outcrop trends have been used to infer the depth of remaining alluvials for exploration planning. The resultant predictions range from 35 to 55m, the shallow ground being to the east.

Reverse Circulation Drilling Results

The programme of testing by Jetstream method totals 378.3m of sample drilling. Depth probing with subordinate grade indications was attempted at nine of the eighteen pre-determined sites. Only one hole can truly be regarded as satisfactorily completed to a granitic basement. Mineralisation levels for all holes were low, the range being 4 to 34g/cu m of cassiterite...

Seven of the nine bores contained cassiterite at a background cassiterite count level. It must be emphasised that these holes are not fully tested. DRCl and DRC3 at the Herrick end of the line have the highest grade. In DRCl, a thin perched placer at the 10-12m level was discovered. Cassiterite similarly positioned in the Government Echo Lead bores may be related to this occurrence.

Basement Investigation: Very little was accomplished toward the main aim of depth probing the Tertiary sediments in this part of the Ringarooma Basin. Most holes terminated in the ? basal wash horizon mentioned above....

From the information gathered, a gentle westward basement dip is inferred along the DRC line of holes. The depth to basement at the junction of the DRC line of holes and the linear north-west trending Echo Lead would be approximately 58m. This suggests there is a pronounced flattening of the gradient of the Echo Lead over the 1.3km between the line of Mines Dept. holes Nos. 10 to 13, and the DRC line of holes.

TARGET 9 OK CREEK LEAD, (Golden Sovereign Lead), Figs 7, 33, 34.

Nye, PB., 1925 GSB35, extracts edited by PWA:-

A small amount of work has been performed at a point about 1.2km south-south-east of Herrick. The land in this vicinity was first leased by the Moorina Tin Mining Company Registered, which was formed in 1881, but it is doubtful if the presence of a lead was known... The workings ...are about 100m across.

The material exposed in the workings consists of grits and clayey beds, very similar to those of the Weld River lead in the Echo Mine. These beds represent the drifts of a small lead formed by the ancestor of the present O.K. Creek.

Granite occurs immediately to the south-west, south, and east of the lead, and also forms the bedrock. The southern part of the lead has been denuded by the unnamed creek entering the Ringarooma River, and also by the river itself. The lead extends to the north-west, and passes about 400m to the east of Herrick, to ultimately join the Ringarooma lead about 3km to the north-north-west of Herrick.

For a distance of 1.2km northwards from the workings the lead has no basaltic overburden, but from this point (immediately to the north of the Herrick-Boobyalla-road) the lead has for the most part a thick overburden of basalt.

The lead is only a small one relatively to those of the Branxholm Creek, Cascade River, Main Creek, &c, but it should increase somewhat in size to the north-west. The tin content is the determining factor as to whether the lead is of economic importance, and could be determined by boring or other methods. If the content be satisfactory the lead could be readily worked as far as the Boobyalla road. Reliable information would then be known as to possibilities of success if the lead was followed further to the north-west, below the basalt overburden.

Newton-Smith 81-1534 (Australian Anglo American), edited by PWA:-

Little is known of this lead. The catchment area is small and devoid of greisenised sheets and early mining operations appear to have been unprofitable. The Mines Department has done some drilling in the area but their results are not yet available. The lead is held in part under Exempt Area by the Mines Department...

A possibility of some 7M m³ of reserves exist in this lead at an unknown grade.

Prospectivity of the Echo and OK Leads

Figs 33, 34 show my interpretation of the projected positions of these leads, based on the limited drilling results. In the case of the OK Lead there are no plans or reports of the Mines Department drilling at Surrey lagoon available from the MRT website– this drilling is plotted on Munro's figure (here Fig 29), so it is important to obtain these. In the case of the Echo lead it probably trends under basalt, but because of erosion along Davids Creek the basalt may be relatively thin, allowing cheap drilling and the possibility of open pittable resources. There is at least 3km of strike length untested, where grades around 200g/m³ seem possible based on previous drill intersections. The estimates of potential volumes of mineralisation by Newton-Smith are vindicated, but I think the grade for Echo could be expected to be better than his estimate of 100g/m³.

TARGET 10 UNNAMED

As shown on Fig 13 a postulated lead exists here, entirely basalt covered, with a hinterland towards the east. Hereabouts there is the possibility that the western extensions of the Pioneer lead passes through. There is no recorded drilling.

TARGET 11 RINGAROOMA LEAD, Fig 13.

The lead within the ancestral Ringarooma River has long been postulated to exist, as discussed in Section 6 of this report. In most places it will now be under basalt. In some places in the past it was claimed that drilling may have intersected the lead but this is very unlikely. There are no known drill holes into the lead, and within the tenement it is still totally unexplored. It has a very large potential to host a vast amount of tin.

11. SUMMARY OF POTENTIAL OF TARGET AREAS

Tin Potential

For open pitable deposits, the table below summarises the potential tonnes or volume and grade for each of the target areas, extracted from previous reports or as assessed by me. The best potential in terms of tonnage and lesser overburden is at the Main, Echo and OK Leads, though the grades are perhaps half that which could be expected at Arba and Cascade.

The grades quoted are overall grades of the potential resources. Within those potential resources, higher grades occur. Modern open pit mining adopting grade control methods to optimise head grades, and with perhaps suction pump mining in selected areas below the water table, could be viable.

None of the target open pit areas are in current drainages where major environmental problems would occur.

With underground mining, perhaps with remote unmanned methods, there is an enormous tonnage potential in the target leads and in the main as yet totally unexplored Ringarooma Lead. If such methods were thought feasible, a further study to rank target areas would be necessary.

POTENTIAL KNOWN DEPOSITS, OPEN PITTABLE					
TARGET AREA	NAME	VOLUME, M m ³	OVER-BURDEN M m ³	GRADE, cassiterite, g/m ³	SOURCE, NOTES
1 & 2	UNNAMED	?			
3	RUBY FLATS	?			
4	ARBA	6	4	470	PWA, derived from Munro 81-1529
5	VALLEY	1	3	230	PWA
6	CASCADE	2.5	5	680	Metric conversion direct from Braithwaite 1964. Open sections to north will increase this volume.
7	MAIN	15		?	Newton-Smith 81-1534
8	ECHO	10	20	200	Derived from Newton-Smith 81-1534, PWA grade estimate
9	OK	7			Newton-Smith 81-1534
TOTAL		42		?250	ie.10500t concentrates or 7350t tin metal

Other Commodities

The potential for other commodities has not yet been reviewed.

The leads are known to carry significant quantities of sapphires, and this has captured the attention of Van Dieman Mines in their planned operations. It can be expected that credits from by-product sapphire and other heavy minerals could have a crucial impact on the economics of future mining.

Gold occurs in the Alberton Field to the south-east of the Tenement, as quartz vein deposits in turbidites of the Mathinna Group. The southern-most parts of the Tenement may be prospective for gold, for example as alluvial gold in local leads.

Basalt occurs as overburden in most target areas. This may not necessarily be entirely waste if it is saleable as aggregate. The same applies to sand and gravel which could be valuable by-products.

12. RECOMMENDATIONS FOR FUTURE WORK

There is considerable potential for mineable alluvial deposits in the area. The area was a major past producer, so with current high tin prices, offers attractive exploration targets.

A recommended next phase exploration program is

- Mines Department drilling at the Cascade Lead and the OK Lead is missing from this evaluation as it is not available on the MRT website. This should be obtained, processed and interpreted.
- Obtain good topo and contour control orthophoto maps.
- Replot, convert to metric measures, ground check past drilling and recalculate potential resources.
- Visit all Target areas for reconnaissance mapping, and assessment of landholder and environmental sensitivities.
- Some areas such as the Main Lead have high potential but there is no geological mapping to place the early description in perspective.
- Assess prospectivity for other commodities such as gold and sapphires.
- Preliminary scoping study of appropriate mining methods and project economics.
- With this new information re-rank target areas. Select one or two for follow up, which would consist of
 - Compensation land holder agreements
 - Ground mapping
 - Fences of good quality drilling to confirm the position and grade of the lead.
 - If positive, design and implement a resource definition drilling program.

13. REFERENCES

Note

The references are split up according to General references covering all areas, and references specifically consulted for each Target area. The references are often in abbreviated format as per the MRT website, so company open file reports are listed with year, report no., author, company, as per this example: 64-0381 Warin Appleby Utah

Prefix UR unpublished report, MRT

Prefix GSB Geological Survey Bulletin

Prefix TR Technical Report

General

Beswick, RJ &DM., 2003 Brothers Home: The Story of Derby, Tasmania. 352pp.

Jennings, D.J. 1975 Alluvial tin deposits of Tasmania. Australasian Institute of Mining and Metallurgy, Monograph Series 5, p.1053-1054.

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