'No Good is to be Found in the Granite': Aspects of the Social Maintenance of Mining Concepts on Blue Tier Tin-Field, Tasmania

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A century of small scale mining on Blue Tier tin-field, Tasmania, has resulted in the creation of a cultural landscape of considerable complexity and archaeological integrity. Analysis of historical sources and archaeological survey data indicates that control of mining operations has been primarily a function of close social allegiances, dependent on local pools of received wisdom founded upon often inappropriate models of ore formation. The persistence of the local orthodoxies resulted in the application of inefficient extraction and treatment principles over a long period and the formation of a landscape with considerable horizontal stratification. An examination of the distribution and form of mining related sites on Blue Tier can provide insights into the intellectual positions underpinning the local mining industry and generates the framework for a socially determined model of resource exploitation on Blue Tier tin-field.

> One thing new fields do to the individual is this – it opens the mind. We are all more or less brought up in a narrow groove, and it is only by mixing with the cosmopolitan crowd that the narrowness can be overcome.[1]

So wrote Mark Ireland, an itinerant labourer and miner from New Zealand who had crossed the Tasman in 1876 and immediately joined the rush to the new tin-fields of North East Tasmania. Ireland's wry observations, recorded in 1913 after almost 40 years of tin mining in the region, came as a call for the district's mines to be operated on a more scrupulously business-like footing and in belated lamentation of the toll that constrained information flow and entrenched mining practices had taken on the development of the tin-fields up to that time.

Ironically, the year 1913 also saw the closure of the Anchor mine on Blue Tier, a granite plateau in the heart of the North East tin-fields, for reasons quite the opposite of those referred to by Ireland. Five years previously a loan of £5 000 had been taken out from the Tasmanian government for the purpose of financing the construction of a system of aerial ropeways designed to link up a number of promising Blue Tier mines. The aerial transfer system, while technologically unremarkable for the time, represented a significant departure from the patterns of capital investment and exploitation which had characterised development of mining on the Tier for the previous three decades. The government's descision to foreclose on the loan brought about the failure of the project.

The closure of the company signalled a return to subsistence mining on the Tier and the re-emergence of dynastic modes of mine ownership and activity which owed much in method to the early uninformed years of itinerant mining. These had become unavoidably institutionalised through the longevity of the field and the development of complex and unassailable community interrelationships. In this paper the study of the working relationships and archaeology of the Moon Mine provides a case study for the examination of some of the cardinal perceptions operating over the life of the Blue Tier tin field.

BACKGROUND

Blue Tier is a granite plateau covering approximately 80 km^2 of State Forest at an altitude above 700 metres approximately 25 kilometres north west of the coastal town of St. Helens on Georges Bay. The top of the Tier is a gently undulating peneplane, with occasional hills standing up to 100 metres above the surrounding country, which is dissected by the tributaries of many of the major river systems of the North East. The plateau is covered by wide expanses of tussock grassland and grassy shrubland surrounded by relict myrtle and sassafras forest, a vestige of the dense temperate rainforest which cloaked the Tier at the time of tin discovery.

The Tier forms the central part of the Blue Tier Batholith, an extensive composite magmatic intrusion of Upper Devonian age covering 1 800 kilometres. The batholith, subdivided into 18 distinct plutons or bodies was emplaced in an evolutionary sequence which saw tin concentrated from residual fluids during the cooling of the last of the bodies to be formed.[2] Within the study area the principal rock types are porphyritic, medium to coarse grained biotite adamellite variants of the Poimena pluton, which is intruded by smaller masses of equigranular biotite muscovite granite. Tin mineralisation is

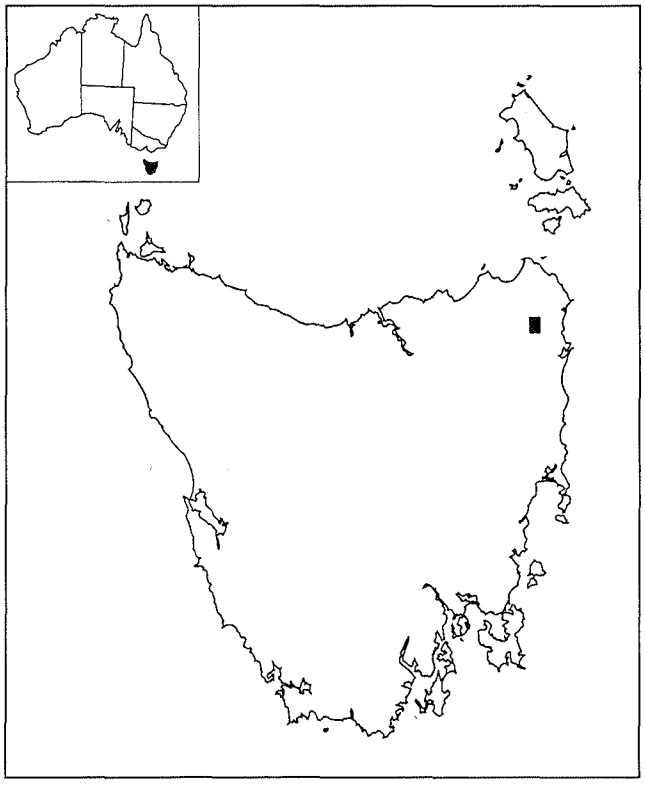

Fig. 1: Blue Tier tin-field, North East Tasmania.

associated with cyclic apical greisen formation, or stacked and discontinuous lenses or autometamorphised granite, in the sill-like granite intrusion but is also present as narrow dykes and veins intruding the country rock within a kilometre or so of the granite/adamellite contact.[3]

Prior to the commencement of tin mining, tin was concentrated in Quaternary alluvials which were widespread along the Wyniford River and its tributaries on the plateau, being derived from the erosion of decomposed eluvial caps over the outcropping mineralised zones within the tin-bearing granite. These sediments and soils have been universally worked over during the past century and essentially depleted of their tin reserves.

Promotion of Blue Tier as a recreational destination by local community groups has lead to an increase in tourist visitation to the area over recent years. The resultant need for a comprehensive heritage inventory for the area provided the impetus and rationale for an archaeological survey of the historic tin mining sites during 1994. The Blue Tier Mining Heritage Study was carried out by Forestry Tasmania with the assistance of funds made available by the Commonwealth of Australia under the National Estate Grants Programme. The study focussed on 24 discrete tin working areas, each comprising a specific mineral depositional environment, as determined by a synthesis of historical information regarding the distribution and form of the mine workings and observations made during the archaeological field survey. A total of 33 site complexes were identified during the study, comprised of 211 features which were able to be grouped into 90 discernible activity phases.

DEVELOPMENT OF THE MINING INDUSTRY ON BLUE TIER

The history of mine development and mineral exploitation on Blue Tier comprises a series of fundamental developmental phases, reflecting the evolution of the way in which the field was conceptualised by the local mining industry, and which is expressed in the changes in management structure, development emphasis and practical techniques employed over the life of the field.

The discovery of tin at numerous places in the North East during 1875 precipitated a rush to the district with thousands throwing up tents and constructing crude humpies amongst the tall timber within weeks of the news breaking. Experienced prospectors and first-timers from around the mainland states and New Zealand joined in the exodus to the new fields, prospecting individually, in groups or on behalf of city-based syndicates in search of quick profits. Considerable numbers of the first arrivals were drawn from the depressed goldfields of Northern Tasmania while others and some of the old hands, including the doyen of North East prospecting, George Renison Bell, had experience on the Victorian and New Zealand diggings in their youth. Nonetheless, experience of tin mining was in short supply and the early techniques employed on the fields were better suited to winning alluvial gold than they were for concentrating the lighter tin oxide, cassiterite. Box sluicing of the alluvials was begun immediately and reigned unchallenged as the principal method for at least the first three years before ground sluicing was attempted, so great was the fear that the tin would be lost in the wash,[4] despite the fact that ground sluicing had been successfully employed for centuries on the great tin moors of the south west of England.[5] The relative inefficiencies of box sluicing were occasionally compensated for by the extraordinary richness of some of the deposits; in the case of the Full Moon seven men bagged 25 hundredweight in a day using nothing but shovel, barrow and sluice-box, and several prospects at Weldborough averaged 20 tons of alluvial tin per chain.[6] On claims so rich previous experience in any sort of mining seemed almost unnecessary. In 1880 G. W. Robinson, former captain of one of E. L. Crowther's Hobart whalers, was appointed by his employer to manage the Wheal Tasman on Blue Tier, and the manager of the neighbouring Marie Louise mine, John Symons, a miner with extensive gold crushing experience, was considered even by Robinson to have little idea about tin dressing.[7]

Ground sluicing was first introduced to the North East in 1878, initially to the cynicism of most of the mining population, but by the early 1880s the technique had been widely adopted and the working down of the alluvial deposits accelerated. Chinese miners, recently arrived onto the fields during this period, proved particularly skilful in the method and in many cases were able to achieve satisfactory returns from previously worked areas, or prospects considered too poor for the Europeans who tended to be suspicious of the longevity of the field and who kept constant vigil for news of better diggings elsewhere. On Blue Tier the shallow alluvial and eluvial deposits overlying the granite were effectively exhausted by 1886[8] and the focus of the industry shifted to exploiting the primary deposits exposed during the sluicing of the previous decade.

> In one sense it might be said that the whole art and mystery of mining consists in a knowledge of the courses, characters, conditions and apparent caprices of mineral lodes.[9]

A succession of government geologists reported on the field between the years 1886 to 1943 and the changes in official wisdom as regards the source and form of the tin formations can be traced through the varying descriptions contained in the accompanying inspectorate reports. Gustav Thureau in 1886 considered the tin mineralisation to be of four distinct types; true fissure lodes, quartz porphyry dykes, soft formations within a major east-west fault zone, and basaltic dykes. Thureau's successor Alexander Montgomery reporting on the field in 1889 re-classified the primary mineralisation as being associated either with small lodes, or larger and more permanent dykes of variably altered quartz porphyry.[10] Thureau's purported major fault zone received no mention. Three years later a visiting academic, Professor G.F.H. Ulrich, denied even the existence of the dyke style, instead viewing the tin bearing granite as being altered portions, incorrectly described as stockworks, within the main porphyritic granite mass.[11] Montgomery's successor W.H. Twelvetrees, reporting on the field in 1901, similarly tended towards the single granite theory. However, he sided with Montgomery in discerning that the tin mineralisation was an autometamorphic effect and likely to be irregular and unpredictable in occurrence.[12] From at least the early 1880s onwards, lode deposits were not considered in official circles at least to constitute important likely sources of ore.

While the character and provenance of the primary tin was the subject of considerable lively and occasionally acrimonious hypothesising and debate among the government geologists, on Blue Tier adherence to a more inductive mining orthodoxy dictated the way in which development of the orebodies was approached. As the alluvial tin worked out and sluicing gave way to true mining, the focus of the industry shifted to the numerous small vein deposits scattering through the granite, in line with practice suited less to the geological circumstances in which it found itself than to the rich tin and copper mining districts of Cornwall. According to Ireland,

> The impression was that a tin lode was worth all the alluvial because it would practically last forever. Alluvial tin would soon be worked out. We apparently had the Cornish mines on the brain, and some of our Cornish friends, I am afraid, encouraged the impression that there was nothing like a tin lode.[13]

So impressed upon the minds of the British-schooled mining fraternity was the ubiquity and importance of Cornish style lodes, which had dominated world tin production up until the early 19th century, that little credence was given to the more common and ultimately economically more important, if more problematical to comprehend, forms of primary deposit being worked in other parts of the world. Such considerations were typically relegated to the colonial or regional geologists who were not only required to map out and piece together the geological history of the unexplored territories but were often at the cutting edge of ore genesis model building in general, essentially for want of existing explanations by which to understand their new environs.

Celebration of the Cornish model continued to be a particularly potent doctrine throughout the former British colonies well into the twentieth century, long after the economic importance of the English mines had been diminished in the face of Australian discoveries and afterwards of the massive placer deposits of the Malay Peninsula which by 1950 were responsible for over half the world production of tin.[14] The success of the British school in exporting the Cornish concept of economic ore occurrence and mine development can be easily seen in the case of the South Australian copper fields, where entire villages were trans-shipped for working the mines of Burra, Walleroo, Kadina and Moonta. The rich legacy of Cornish engineering and the resultant social development of those districts bears vivid testament to the ongoing processes of industrial and academic imperialism in the wake of first settlement.[15]

The importation of the Cornish mining concepts to Tasmania are considerably less obvious, but a number of significant clues exist to indicate that they influenced the vernacular perception of the geological environment, and hence the economic values of the Blue Tier deposits. Most of the mining terminology utilised on the field was borrowed indiscriminately from the south west of England, including the occasional prospect name, such as Wheal Tasman – one of the early, and more profitable of the alluvial claims on the plateau. Cornish surnames, including Tregaskis and Griffin, managers of the McGough and Southern Cross mines respectively, suggest further local affinity. A more publicised instance of direct Cornish involvement came in the form of W. H. Wesley, a native of St. Just who had worked from the age of nine in the underground tin and copper mines of Balleswidden and Wheal Hearl, who was appointed to take control of the Anchor mine in 1895. Wesley had emigrated to Australia in 1867 and spent a number of years as mine surveyor under Captain W. R. Hancock at Moonta as well as a short period working at Walleroo. At the time of Wesley's arrival at the Anchor mine the neighbouring Liberator mine was under the management of John White, another Cornishman. Considerable industry approbation accompanied the appointment of the pair to their respective positions. Within a short time both mines had failed to fulfil expectations. Wesley resigned in 1897.

With the Cornish came the practices not only for developing, but also for working the mines. Working on tribute found ready acceptance on the field, among both European and, after 1881, Chinese miners. In a departure from its usual application within large mines, the small returns offered by most Blue Tier prospects meant than in most instances whole leases were let out on tribute. While the practice was principally confined to the period of alluvial working prior to 1890, in numerous instances afterwards ailing hard rock workings were also put up for tender.

Unlike the Cornish style lode deposits, where the tin was present in the form of steeply dipping fault controlled quartz-cassiterite veins within the granite and slate country rock, often extending over considerable distances and depth with relatively constant dip and strike, most of the primary tin on Blue Tier was in the form of finely disseminated cassiterite within greisenised granite lenses which were characteristically discontinuous, variable in grade and largely unpredictable in orientation. Where vein style deposits did occur they were invariably narrow and of limited longitudinal and vertical extent. Despite the disparity throughout the 1880s, and even for the next 50 years on some Blue Tier prospects, exploration and mine development became fixated upon the lode as the sure source of the alluvial tin so readily abundant during the first decade. Lodes were attacked vigorously by shaft and adit at the Full Moon, Lottah and Wellington mines, ultimately without inviting success. This should not have come as a surprise, as government geologist Gustav Thureau had pointed out as early as 1886 the intrusive nature of the tin-bearing portion of the granite, and the plastic margins evinced along Haleys Dyke on the denuded Marie Louise sections should have raised caution in the minds of the mine managers against searching for large features indicative of more brittle deformation as the mainstay of their economic hopes.

The implications of misperceiving the field as being structurally controlled were enormous. The predictability of lodes meant that typically little effort was expended in searching for extensions. The lode could simply be followed and new drives, winzes and crosscuts installed as required to develop the unworked areas. Greisen lenses did not require such obvious mineralising channels for their creation and could disappear suddenly and without apparent trace in the workings. Advance testing, either in the form of costeaning, or more appropriately drilling was required to identify the location of the orebodies ahead of the working faces, but despite being continuously and piteously advocated by the Mines Department over a 20-year period the industry deferred in favour of costly shaft sinking and open cutting. The diamond drill did not make an appearance on Blue Tier until 1905.

Tin bearing elvans, or altered granite dykes, were not unknown in south west England, but were typically not regarded as significant sources of tin and the Cornish adage of 'no good is to be found in the granite' often found uncritical acceptance abroad.[16] On the other hand extensive tin greisen deposits of a similar type to those on Blue Tier had been worked successfully at Altenberg and Zinnwald in Saxony since the mid-fifteenth century. Mining in both provinces was carried out by driving off from shafts and underhand stoping as much of the mass as possible, leaving large caverns separated by pillars of lower grade ground. The massive scale on which operations were undertaken can be seen at Altenberg where during 1880 twenty seven separate mills with a total of 1386 head of stamps were in use. From the batteries the pulp went to settling boxes after which the various classes of ore were washed and sorted in a complex array of setting boxes, 84 end-percussion tables, 67 tyes and 42 inclined tables.[17] Considerable care needed to be exercised so as not to pulverise the rock too finely and overslime the already fine tin.

The Altenberg example was promoted in 1901 by Twelvetrees as a suitable model to apply to the Blue Tier field. A native of Bedfordshire, Twelvetrees had studied geology and ore dressing at the Johanneum Institute and the University of Bonn and worked at the Voskrensensky Copper mine and smelting works in Eastern Russia and the Lidjezsi silver/lead mine in Asia Minor before emigrating to Tasmania in 1892.[18] German institutes were at the forefront of research into complex ores at this time and two graduates of the famous mining school at Clausthal were to make significant impacts on the Tasmanian scene. Under the leadership of Heinrich Kayser, George Smith's tin show at Mt Bischoff was developed into the world's largest tin mine and Australia's first electrified industrial complex, while at the newly opened Mt Lyell copper mine Robert Sticht was to introduce and perfect the technique of pyritic smelting. The gamble of looking beyond the south west of England for sound management was

evidently paying dividends for the large companies working the complex ores of the west coast of Tasmania but the lessons were slow to be appreciated on the other side of the state. Despite a succession of government geologists being aware of the potential for large scale mining on Blue Tier, and being repeatedly outspoken on the subject, the numerous syndicates and small companies operating on the flanks of the mountain remained aloof from the debate. The advice of geologists, particularly those in the employ of the government, was rarely sought by the developers of smaller mines, and even more rarely taken, during the nineteenth and early twentieth centuries, so great was the gulf that separated the academic and vernacular aspects of the industry.[19]

By the turn of the century the last of the industrialised operations on the plateau had folded and only the mines open-cutting the outcropping greisen lenses on the southern side on the tier were operating. For the smaller independent mines, the last of the legion of Blue Tier companies floated during the mining share boom of the early 1890s, the writing was on the wall as it was becoming obvious that the field was to be treated as a large low grade producer if it was to pay at all. The first practical manifestation of this realisation was in 1898 when the Don mine was purchased by the Australian Tin Mining and Crushing Co. as a second quarry to augment the dwindling reserves in their original cut at the Puzzle, so named because of the seemingly incomprehensible nature of the deposit.

The mood of the investment community also shifted to accommodate the inevitable, and the following year a large parcel of leases, incorporating most of the old workings along the Marie Louise formation, were taken up by London magnate, Montague Rhys Jones. Speculation was further fuelled when the state government commissioned a study into the potential for developing an integrated water supply system on the Plateau to enable articulated working of the remaining mines and the opening up of other areas.[20] The scheme never eventuated and Jones' accumulated holdings were relinquished to be taken up by Melbourne broker and Mt Lyell investor Frank Duff.

Perhaps the most ambitious expression of the new industry approach to the tin-field came between the years 1905–1907 in the form of the Mt Lyell Mining and Railway Co. which carried out an extensive two year exploration programme, which involved cutting 49 000 feet of trenches and diamond drilling 7 200 feet of core along the Marie Louise greisen formation and down the face of Australia Hill as far as the Crystal Hill prospect. In the scale of the Altenberg undertaking, the company had plans to erect up to 2 000 head of stamps should sufficient ore reserves be proved up. Although the £10 000 campaign identified a number of promising deposits the company could not be enticed to stay on and develop them.

In the wake of the departure of the Mt Lyell Co. Duff's interests were acquired by the directors of the ailing Anchor Co. and two of the newly discovered orebodies opened up. Haulage ways and a long aerial ropeway connected the new workings to the existing one hundred head Anchor battery. Plans were advanced to construct more ropeways to bring ore from the Full Moon and Marie Louise sections when the State government foreclosed on the operation.

The failure of the Anchor company dashed the grand vision and heralded the return to subsistence-only mining on the tin-field. Without a stable employer old and overgrown prospects were revisited and numerous small parties and tribute gangs set about wringing the last of the good ore from the battered outcrops with pick, shovel, and sluice-box, or with the occasional battery scavenged from one of the other defunct workings. To the few remaining inhabitants of the tin-field survival rather than development was the main aim. The government geologists had no choice but to throw up their hands in dismay for the opportunities lost during the years when the local companies had staunchly refused to restructure their operations to suit or adopt the necessary principles for making their marginal mines profitable in the long term. To the soothsayers, apart from the period between 1898–1913 when the field was briefly treated by the mining industry as a large low grade proposition, the failure of the Tasmanian companies and syndicates to comprehend the nature of their physical environment was manifest at all stages in their operations. The shortcomings typically included lack of appropriate testing to determine ore location and reserves, working on too small a scale, underestimating power and access requirements, and the installation of inappropriate and/or inefficient processing equipment. In 1926 Government geologist Mackintosh-Reid cited these and a long list of other specifically economic causes for what he described as the unbroken list of failures in lode mining on the tier.[21]

Reid omitted to consider, or at least to comment on in print, the impact of social variables on the development of the tin mines. The field was poor enough and lasted long enough for the early unsophisticated mining practices to become entrenched. Inappropriate concepts of the form of the enrichments and of ways to work them persisted on the tin-field because they went unchallenged, not so much by the colonial geological bureaucracy but from within the mining community itself. The predominantly locally controlled mining syndicates operated in cultivated ignorance of geologists' advice, evidently dismissing information considered not only to be suspicious in fact, but also which threatened to de-stabilise the hierarchy of local mining wisdom and disrupt decision making and household units through its constant emphasis on new management and capital restructure towards proving up the ore reserves.

These very factors once again came to the fore following the main industrial period. The children and grandchildren of the original tin sluicers returned to the higher grade but smaller lodes at the Moon, Wellington and Lottah mines, and struck out beyond the granite contact in search of new deposits sufficiently compact for a small group to work without major capital outlay. The depression years of the 1930s saw new lode workings at the Chintock, Doyles and FB prospects at the north west end of the field and at the Cambria mine to the south, as well as ushering in a revival in alluvial mining on the worked out ground along the Wyniford River and its main tributaries on the plateau.

THE MOON MINE

The role of social variables in perpetuating the vernacular modes of mining activity on Blue Tier is best explored through an examination of the history and archaeology of a single site, the Full Moon, or Moon, mine. The Moon mine is situated at and above the confluence of Hope and Moon Creeks, seasonal streams dissecting a low adamellite range rising above the east side of the plateau. All three styles of deposit worked on the field are represented at the site, with one metre of alluvial gravels overlying quartz/cassiterite vein sets midway along Hope Creek as well an intrusive greisen bulge within unmineralised porphyritic adamellite at the waters meet.

Discovery of the rich deposits of alluvial and detrital tin along Hope Creek is attributed to a party including Christopher Isles, Charles McGough, Charles Sandberg and Albert Wagonknecht, itinerant miners from the depressed alluvial goldfield at Mathinna, who in 1875 had fossicked their way onto Blue Tier in search of the source of the tin recently discovered along the tributaries of the George River below. On arrival the party encountered James Gaylor, a former workmate of the group from the No. 1 South White Boy mine at Mathinna, and J. C. Macmichael, both being members of Bell's original prospecting party. An agreement was reached whereby

Gaylor and Macmichael left the field to the newcomers. At the Hope Creek prospect a syndicate of eight men, including the discoverers, was formed and for the next few years box sluicing was carried out on the 80 acre prospect, named the Full Moon. Another 80 acres on the east side was taken up at the same time by Isles' brother Samuel. In the process of working down the shallow alluvials along the creek several intersecting tin-bearing quartz vein sets striking principally north-north-west and north-east were exposed beneath the head of the wash. Only small vestigial areas of box and ground sluiced soils exist to testify to this early alluvial phase.

The need to attract further investment to attack the lodes resulted in the formation of the Full Moon Tin Mining Company in July 1881. Although no details are recorded of the deal originally struck with Gaylor and Macmichael it is not surprising to note that J. C. Macmichael's brother William was the first appointed manager of the company. John Macmichael had in the meantime discovered rich tin at Weldborough and operated the Marie Louise Co. store at Poimena during the late 1870s before establishing stores of his own at St. Helen's, Lottah and Weldborough (the latter purchased from Harry White, another member of Bell's party). Under William Macmichael's management the new company set about sinking shafts and driving on the lodes and by the cessation of its activities in 1884 the total amount of tin ore won from the alluvial and lode material totalled some 875 tons.

Archaeological evidence relating to this phase of operations indicates the manner of working. Only one shaft of this period remains open and it is situated on the intersection of two sub-parallel south-east trending veins with a north striking lode within the decomposed country rock. Both lode sets have been alluvially worked to a depth exceeding two metres, with the workings being reactivated in more recent times. A large dump of coarse adamellite and quartz mine

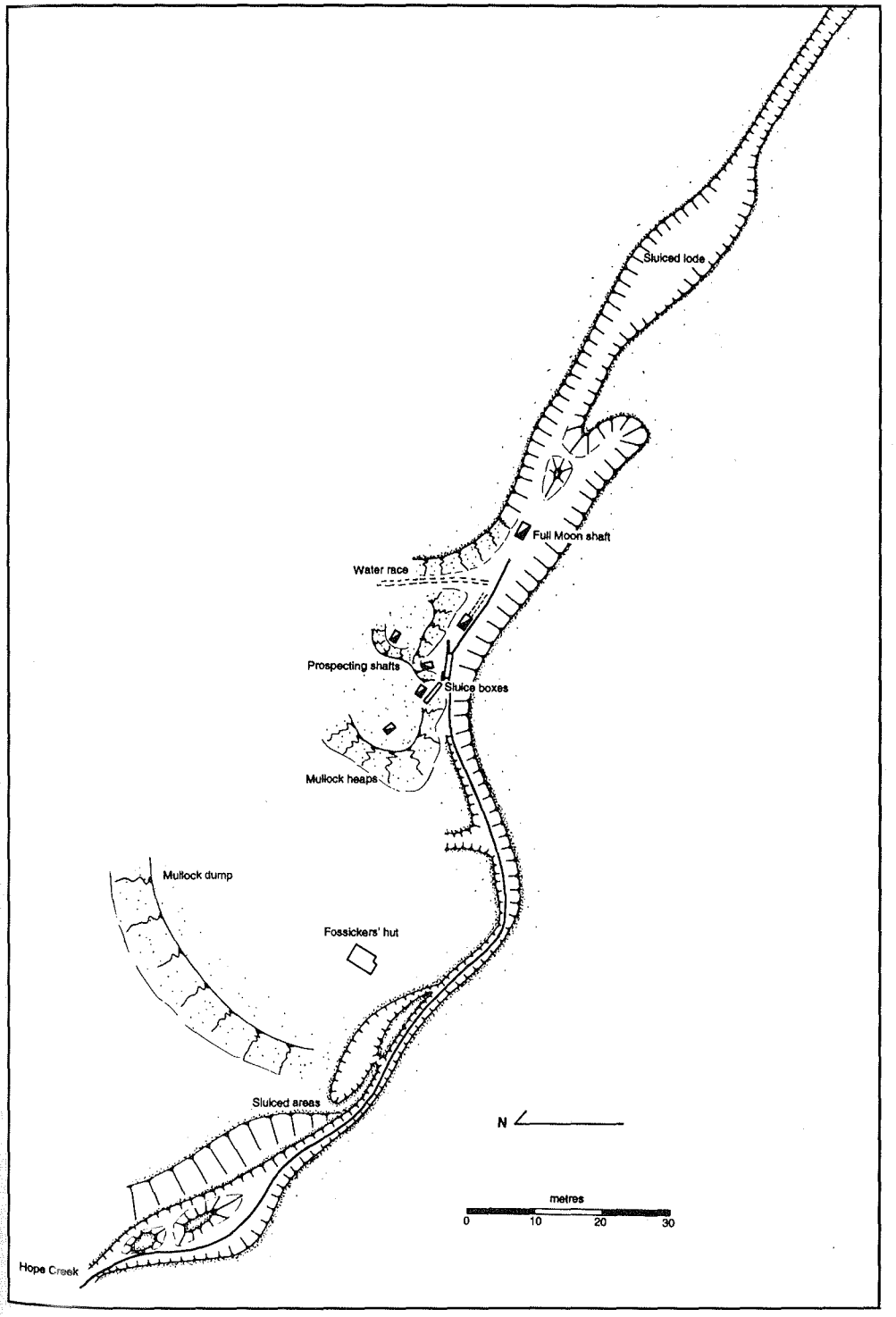

Fig. 2: Surface features, Hope Creek workings.

waste and lode stone, containing a little low grade ore, has been built out from the base of a low rise beside the creek, roughly 90 metres down stream from the shaft. A trial crushing from the underground workings was made by the company but some of the best ore was reputedly tampered with or stolen.[22] No machinery was ever erected on the site and development stalled. It is evident from the existence of the stockpile and character of the material worked that ore must have been hand dollied and washed in sluice-boxes on site.

Around the workings and stockpile innumerable small sluicing scars coalesce to form an expansive worked out area. Extensive lag deposits and mounds of re-deposited gravel tailings, dissected by seasonal rains, blanket the gully floor about the narrow creek channel which incises its way eastwards for 500 metres to its junction with Moon Creek. The surface deposits have been worked over a number of times by later parties and each time on a successively smaller scale as the tin reserves became depleted.

Between February 1885 and the following January, 160 acres covering the former Full Moon Co. and syndicate sections was applied for by John Macmichael and Alfred Gifford, and surface sluicing recommenced immediately on tribute. The leases were in turn transferred in May 1888, evidently in exchange for shares, to a new Full Moon Tin Mining Company which began operations on a plug of tin greisen at the creeks' junction, laid bare by the earlier years of sluicing below the Hope Creek lodes. A number of shafts were sunk and short trenches cut in order to both drain the wet ground at the waters meet and prospect the altered and silicified granite. Eventually a shallow quarry was opened near the southern edge of the formation. The quarry consists of a small, irregularly shaped open cut up to three metres deep with short lobate extensions separated by narrow baulks of lower grade stone and with a broad washed out gully extending eastwards in the direction of Hope Creek. The form of the cut indicates that the patchy ore was being carefully selected, high grading the assay, but effectively precluding further horizontal development of the faces.

Ore was hauled from the cut up a short inclined tramway to a small and well equipped mill where it was fed through a 'Giant' Rockbreaker into a 'Huntingdon' Centrifugal Roller Mill. The crushed ore passed to three Frue vanners for concentrating. The milling machinery was driven by a 12 horsepower Porter Engine powered by a Tangye upright boiler. Water was supplied by race to the mill from a small dam built across a narrowing of Moon Creek, some 500 metres to the south.

The small scale of workings and the expense associated with handling the ore exhausted the capital of the company and in December 1891 the mine was sold to the newly formed New

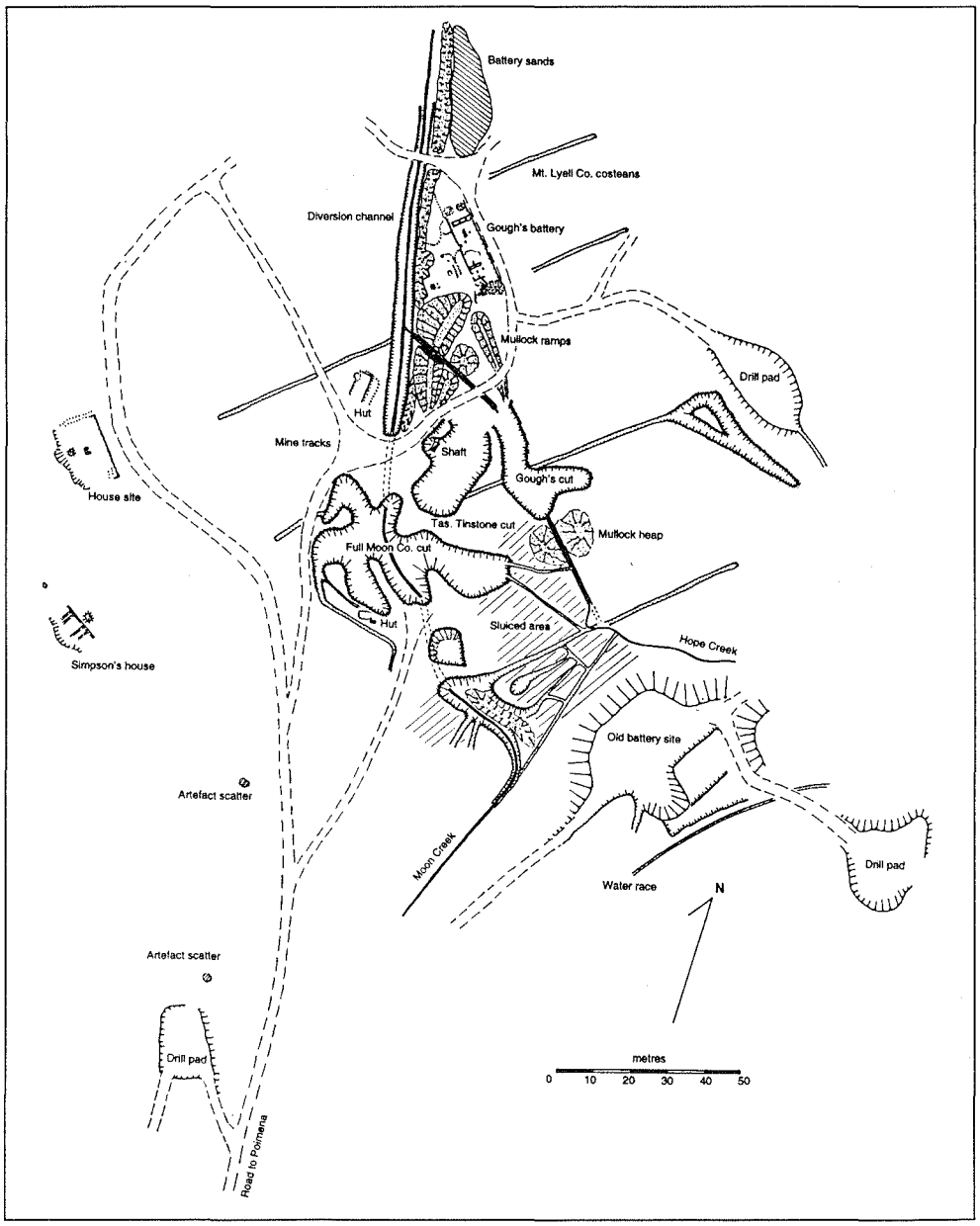

Fig. 3: Feature plan, Moon Mine greisen.

Moon Tin Mining Co. The new owners dismantled and moved the crushing plant to a section on the Marie Louise formation which had been acquired from Charles McGough, a founding member of the original Full Moon Syndicate, and began to erect in its place at the Moon section a standard configuration 30 head stamp battery. A great deal of development was subsequently attempted, which included the difficult task of re-directing the flow of Moon Creek through a long channel, cut in a futile attempt to drain the low ground and allow resumption of mining. A line of small cottages was erected beside the road a little distance from the mine to house the labourers employed on the project and a house for the manager, Henry Simpson, was built atop the low hill overlooking the mine. The failure of the Bank of Van Diemen's Land during the depression of the early 1890s brought operations at the mine to a halt however and in January 1893 the New Moon Company was wound up.

The dominant improvement identifiable archaeologically consists of a long trench and tail race draining the lower, western, side of the ore-zone across the floor of the open cut. A small mullock dam has been built across Moon Creek to the south of the sluiced area and a channel cut directly below the battery site. This diverted the creek to the mouth of a drive opened at the base of the southernmost of the Full Moon Co.'s test trenches and from there into the south side of the Full Moon quarry. Another drive in the opposite face directs the flow through 18 metres of silicified granite before exiting northwards in a 280 metre long tail race, two metres wide and up to four metres deep. A small cutting over a narrow, south east dipping vein has been made into the baulk separating the head of the diversion and the open cut.

There is also surviving evidence of the accommodation for those employed at the site which was provided on the hillside to the west of the workings. The manager's house site consists of a level pad, dissected by numerous bearer slots, benched into the top of the hill. A square stone and brick mound marks the location of the single centrally positioned fireplace and a deep well, infilled with household rubbish is situated on the west side. The pit has been robbed by bottle collectors and a substantial number of artefacts, including fragments of tweed fabric and a woman's shoe, have been scattered around the disturbed feature. The only remnants of the workers huts are two artefact scatters containing a mixture of Chinese and European late nineteenth-century domestic artefact types, including celadon bowls, tiger whisky and soy sauce jar fragments, and British transfer printed earthenware and beer bottle fragments.

A decade of speculation and inactivity at the prospect followed while the leases to both the greisen and Hope Creek lodes were unsuccessfully offered for sale in London. Between 1903 and 1908 Melbourne broker Frank Duff held the mine sections amongst a large parcel of plateau leases, totalling in excess of 300 acres, but to no ultimate economic advantage. A little interest in the mine was however generated through the efforts of the Mt. Lyell Company between 1905 and 1907, which as part of its £10 000 exploration programme sampled the pit faces and cut 490 metres of trenches across the exposed greisen orebody. Nine diamond bores, totalling a further 500 metres of sample were also drilled but the results were inconsistent and on the whole too low for the company to consider as viable.

The work done by the company can be traced as a series of four parallel straight sided costeans, approximately 70 centimetres wide, running in a north easterly direction across the mine area and linked by a central trench cut along the lower portion of Hope Creek. A bifurcating quartz vein exposed in the eastern end of the central north eastern costean has been worked to a depth of two metres over a distance of 42 metres leaving a central baulk of barren rock at the west end of the small workings. Apart from operating a small mine at Cream Creek on the north western edge of the tin-field the company used the tin recovered during the its costeaning programme, as well as any other pockets uncovered in the course of sampling, to help defer the cost of the exercise.

Following the departure of the Mt. Lyell Co. from the field Henry Cochrane, Adam Lee and M.W. Simmons, directors of the Anchor Company took up the Moon leases. Lee had previously been joint owner of the Cambria mine, a lode proposition on the west side of the field. The Cambria was subsequently owned by Stella Chapman, daughter of Charles Chapman, one of the early gold miners to reach the tier in the mid 1870s and who assisted in the discovery of the Anchor orebody in 1881. Cochrane, Lee and Simmons were acting under the advice of a new mine manager James Lewis, a mining engineer recently arrived from Melbourne. Lewis hoped to boost the company's flagging fortunes by linking the Moon prospect to the Anchor battery by means of an aerial ropeway, a method which was already in operation on the south side of the tier, bringing in ore from the Australian and Summit quarries. The collapse of the Anchor Co. in 1913 intervened and the Moon leases were auctioned along with all other company assets by the Tasmanian Government four years later.

In 1918 another local syndicate, headed by Jack Hodgman, the local council clerk and justice of the peace, took out two small sections over the greisen and lode deposits at the Moon. The syndicate tried unsuccessfully to re-open the Hope Creek lodes but only succeeded in scavenging a small amount of ore from the old Full Moon Co. workings below the creeks junction, which was raised from the open cut by a horse whim and processed in a five head battery. The operations were very small, producing only 9.5 tons by the end of 1920. Subsequent tin production appears to have declined substantially and the lease was surrendered in February 1923. Hodgman, this time in partnership with Gavan Bryce Jnr., re-leased the mine section between 1924 and 1928. Gavan and his brother Thomas had previously been part of the Allied Tin Syndicate, working the Don mine, which also included Bill Gough, Alex Sculthorpe (Gough's father-in-law), and Maurice Russell. Maurice's father Charles had been a member of George Renison Bell's original prospecting party and Gavan Bryce Sr. was among the first miners to reach nearby Weldborough and almost certainly worked with J.C. Macmichael at the Union Sands mine there. Prior to the Allied Syndicate being formed Hodgman, Bill Gough and his wife Amelia, the Bryce brothers and Edwin Charlesworth, a Lottah shop owner and local councillor had been members of The Anchor Tin Syndicate, which worked the Anchor mine on tribute following the collapse of the company. No re-start to production is recorded for the second of Hodgman's periods of tenancy at the Moon and an apparent broadening of the gully on the east side of the Full Moon workings is the only likely indication of the earlier episode.

The mine was subsequently operated for a short time during 1928–1929 by the Tasman Tinstone Association which recommenced operations on a limited scale, opening a small cut within the greisen immediately north of the Full Moon Company workings. The straight sided rectangular pit, measuring 27 metres by 16 metres, has been opened to a depth of three metres on an outcrop of silicified greisenised granite in the centre of the site directly beside a 13 metres shaft, cut by the Full Moon Co. and which showed good tin below four metres. The pit is separated from the earlier Full Moon pit by a baulk as little as four metres wide, with no attempt being made to develop the faces and connect the workings. Stone taken from the pit has been formed into a long flat-topped tramway embankment running from the pit mouth towards the present battery site on the north side of the Hope Creek trench. The formation is dry stone or Welsh walled where it abuts the south side of the trench.

Thirteen months later saw the mine section in the hands of yet another syndicate, this one headed by Charles Hawker. Hawker appointed Bill Gough as works manager and a ten head stamp battery, powered by a gas converting Hornsby Rushton Engine formerly used at the Michael mine, was installed at the Moon site. An opening was made on a promising patch of silicified tin granite, exposed in the trench cut by Mt. Lyell Co. along the lower end of Hope Creek, and the tin ore winched to the small mill which was situated on the east side of the New Moon Co.'s creek diversion channel. As with the previous venture Gough's cut is completely separate from the earlier workings, concentrating solely on the tin show in the side of the Mt. Lyell Co. trench and with considerable care evidently being taken in maintaining a narrow baulk between his and the Tasmanian Tinstone cut immediately to the west. An inclined mullock tramway embankment connects the cutting with the crusher footing at the east end of the battery site which comprises an elongate stone edged platform supporting granite and concrete machinery footings and a partially collapsed timber framed ten head stamp battery. Fragments of the wood gas producer which once powered the mine plant are located at the north west end of the battery pad. The footing pads for two timber and corrugated iron huts are situated to the west of the creek diversion, being where a lightweight singlemens' block formerly used at the Michael mine was re-erected as two structures to serve as workers' accommodation.

Operations only lasted a few months before the plant fell into disuse and only the trial crushing of some selected ore brought from the Michael mine during 1937 saw the batteries operating again. A new lease over the greisen was held between 1939 and 1952 by Rudolph Major, who had worked at the mine with Bill Gough, but historical and archaeological evidence suggests that there was no re-start to tin production during those years.

Further to the east, the Hope Creek lodes were the subject of renewed activity during 1931 and 1932 by Hubert Windred, who at the time also held leases over the Australia and Puzzle mines, taking them over from Andrew and John Dishington, who also happened to work under Gough for Hawker's Moon syndicate. The Dishingtons had in turn taken over the Australia and Puzzle mines from another syndicate which included Hodgman and Monty Isles, son of Christopher Isles, one of the original Full Moon Syndicate members during the mid 1870s. Hubert Windred's brother, James, meanwhile had taken over the lease to the Don mine, adjacent to the Australian, from the Allied Syndicate of Gough, Sculthorpe, Russell and the Bryce brothers.

Five shallow prospecting shafts clustered within 30 metres of the Full Moon shaft relate to this period. The rectangular pits, which display relict plank shoring, are surrounded by small mounds of upthrown granite subsoil. Nearby, an arrangement of three narrow flat-bottomed hardwood sluice boxes lie embedded into the floor of the sluiced gully. A segment of six inch galvanised iron water pipe enters the sluice from the east. A small hut is located on the north bank of the creek 35 metres west of the sluicing site. The balloon-frame vertical-board-clad hut contains a granite-lined sheet iron fireplace and is rudely furnished with hessian-sack bunks, planking shelves and with a decomposing tablecloth nailed to the wooden floorboards as a floor covering. A number of domestic utensils, some evidently of 1960s–1970s derivation, indicate intermittent occupation of the structure until that time.

DISCUSSION

The manifestation of vernacular and derivative modes of operating are apparent in the physical form of both the Hope Creek and Moon Creek workings. The predilection for box sluicing throughout the life of the prospect is evident in the form and extent of the alluvial workings which encompass and link the hard rock deposit, and in the presence of the sluice boxes themselves at the lodes intersection on Hope Creek. The nature of the environment is indicated by the character of the vein at outcrop and from an examination of stockpile material and from these it is apparent that it was unlikely to have been remunerative from an early stage, yet the persistence of the lode workings to considerable vertical and horizontal extent suggests substantial pre-judgement of the worth of that style of deposit on the field.

The form of the lode workings lend further support to the contention that received and untested modes of mining were being injudiciously adopted. It was common practice in Cornish copper and tin mines at the time for levels to be driven at ten fathom or 60 foot intervals, with air shafts put down every 100 yards on a level. Each 60 foot by 300 foot block was further subdivided by winzes into pitches for stoping. This principal is evident in mines such as the Dalcoath in Redruth and also in Wallaroo mines, South Australia.[23] Such 'blocking out' divisions are not so demonstrably evident in Blue Tier lode mines, probably for the reason that the lodes there were typically ephemeral. However, features characteristic of this style of mining are evident at the Full Moon as well as at the Lottah mine which is situated below the eastern side of the plateau and comes in beneath the Hope Creek lodes. At the Full Moon, of the two shafts put down to intersect the lode prior to 1884 one was sunk to 120 feet and the other to 60 feet. Some 700 feet of driving was carried on from the base of the shafts resulting in two levels 60 feet apart. At the Lottah mine different spacings were employed with four levels being driven along the lodes at depth intervals of 18, 89, 80 and 80 feet respectively, the lower level or main adit coming in at 60 feet above the level of the creek. The larger distance between drives may have been a concession to the narrowness of the Lottah veins which in the workings varied between two and 20 centimetres in width, less than a fifth of the average thickness of the Cornish lodes.[24]

Early development of the Moon greisen also seems to support an essentially incautious and inductive approach to mining, with only minimal prospecting being carried out and reserves proven prior to a battery being erected. Significantly, no serious attempt was made to determine the precise lateral extent of the orebody, the intrusive form of which is obvious on even a cursory examination of the workings. The main opening was made in the south central portion of the outcrop and its bizarrely ramifying outline is a positive indication that a process of careful selection was taking place with only the highest grade stone being picked out for sending to the battery. This strategy was bound to end in failure for the immediate venture as well as to prejudice future operations through reducing the bulk grade of the remaining material.

Underlying the apparent differences in technique applied between the alluvial, lode and early greisen workings was the simple rationale of making each day pay for itself. Exposed pockets were seized upon and exploited vigorously while the ore remained in sight and profits from the sale of the tin either paid out in dividends or expended in battling the inefficiencies of a small plant with limited throughput. Very little was reinvested in advance testing ahead of the immediately visible ore. It is perhaps not surprising to consider that continuity, or at least circularity of management and ownership was the hallmark of operations at the Moon site over the first 15 years of its operations. The original Full Moon Syndicate remained a closed investment cartel for the first decade, and J. C. Macmichael, prospector turned entrepreneur, was at least one individual who maintained an interest in sustaining the elevated profitability of the prospect during and beyond that time.

The advent of the New Moon Co. heralded in a new management emphasis towards engineering and increased ore production and throughput, if only for a brief period. The small experimental plant of the Full Moon Co. was removed to one of the company's neighbouring sections where two more pits

were opened up, while a standard configuration 30 head mill was in the process of being set up at the Moon when the depression struck. No mining was undertaken at the site by the company, but the germination of the concept of the prospect being a volume producer of low grade ore can be seen in the infrastructure improvements such as the creek diversion and battery tail race. The fact that drilling was still not being carried out demonstrates that the transition in thinking was at an immature stage with still no reserves being known on which the company could establish long term viability.

Following the collapse of the company in 1893 a 25 year period of relative idleness, if not disinterest, descended on the mine. For almost 20 of those years the mine section was included in, if not central to, numerous grand schemes to operate the tin-field on a massive scale. However, most of the large leaseholds assembled to cover the plateau in the years up until 1917 were held purely on speculation with little if any effort expended in adding real value to a mining proposition. The sole exception was in the case of the Mt. Lyell Co, whose trenching and drilling of the Moon greisen in the months between April 1906 – June 1907 represented a high standard of work for the time and still remains a thoroughly respectable survey, so much so that plans and hole logs made by the company were used as baseline data for a large scale survey undertaken on the field during 1978–1985 by Renison/Hellyer.[25] The costean pattern in evidence at the site and associated drill holes were able to define the inconsistent grade of the tin mineralisation over the horizontal extent of the outcropping tin granite and to a depth exceeding 30 metres and determined that the body widened with depth, the outcrop being the tip of a cupola as predicted by Twelvetrees in 1901.[26]

Despite the positive news from the Mt. Lyell prospects, when Hodgman's local syndicate resumed activity at the site in 1918 the only accomplishment was a return to picking over the old workings, a strategy which had been previously employed by Hodgman's party at the Australian/Puzzle mine. The Tasman Tinstone Association was a little more adventurous in making a new opening but its efforts were focussed specifically on exploiting a rich shoot picked up by the Mt. Lyell Co.'s work and exposed in an old Full Moon Co. shaft beside their open cut, with work stopping immediately the grade dropped. The subsequent Michael Moon Co. operation, under the management of Bill Gough, utilised an identical strategy, exploiting a small show exposed in one of the costeans so far as the high grade ore persisted before abandoning the excavation in favour of bringing in hand picked ore from the neighbouring Michael mine. The processes of panelling out the richer portions is also evident at the Don mine, worked by the Gough's Allied Syndicate in the wake of the Anchor Co. collapse.

CONCLUSION

This brief archaeological survey of the Moon mine demonstrates several of the larger scale historical processes operating on the Blue Tier tin-field over the 65-year period to 1940. Foremost among these are the changes in the way the site and the field were conceptualised by the local mining industry over that time. Techniques brought directly to the tin fields from the alluvial gold fields of the north, the mainland states and New Zealand, found ready, if not defensive, application on the superficial tin drifts, giving way to received notions of the nature of tin orebodies which were borne not so much of personal experience than of hearsay and out of homage to British industrial models. Even after the focus of attention shifted to the disseminated tin greisens the modes of operating remained fastened for a considerable time, if not intractably in the case of many of the smaller mines, to what was only appropriate to the more predictable and amenable style of deposit. The appearance of the giant Mt Lyell Co. on the field in 1905 was a pivotal moment in the life of the field, threatening as it did to transgress the boundaries of past ventures and amass irrevocably the fractured stakes of the past. The sudden disinterest of the company was a severe blow to government hopes and in the wake of its departure, and with the last of the large amalgamated leases passed in, the field was once again flooded with small parties, jostling for sustenance on the seemingly slain and gaping carcass.

Only the large Anchor mine was able to make headway against the revival of dynastism. Out of the control of the domestic syndicates and with a qualified mining engineer in the form of J. B. Lewis in charge, the company tried to put into practice what the Mt Lyell Co. had indicated was possible through centralising operations, only to be sacrificed in 1913 on the altar of government perversity. With the sole remaining industrial employer gone, local syndicates swept the field, dividing its remaining spoils among lines of friendship and family which in many cases were into their third generation of existence on the Tier.

The case study outlines only the most superficial of the innumerable and complex permutations of philosophical and social associations operating at a single mine site within a discrete mineral field over its life. Closer examination of the data available for this and other sites will doubtless reveal more fundamental systems of connection on a range of scales. Substantial insights may be gained through attempting to comprehend mining and other cultural landscapes in terms of the role of internal social structures in propagating and maintaining vernacular and received perspectives and modes of operating. A significant portion of the story lies in the detail, for it is through the often chaotic interpretation by local systems of wider sets of principles that marginal landscapes are transformed.

NOTES

1 Ireland 1913:76.
2 Gee and Groves 1971.
3 Groves and Taylor 1973.
4 Ireland 1913:55.
5 Leifchild 1857.
6 Ireland 1913:54.
7 Nicklassen 1994.
8 Thureau 1886:3.
9 Leifchild 1857.
10 Montgomery 1889:2.
11 Montgomery 1893:3.
12 Twelvetrees 1901.
13 Ireland 1913:68.
14 Mantell 1949.
15 Faull 1983.
16 Earl 1968:18.
17 Charleton 1884:13.
18 Bacon 1989:4.
19 Blainey 1993:283.
20 Rahbek 1901.
21 Reid and Henderson 1928:65.
22 Montgomery 1889:5.
23 Johns 1986.
24 Earl 1968:18.
25 Renison Ltd. 1977-1984.
26 Twelvetrees 1901:114.

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