AUSTRALASIAN
MINING
HISTORY
ASSOCIATION

PROCEEDINGS
of the
25th ANNUAL CONFERENCE

In the Footsteps of Moffat

Atherton, Queensland
7-14 July 2019

Editors: Jan Wegner, Galiina Ellwood & Ken McQueen

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Front Cover Image:
View of the Vulcan tin mine, Irvinebank, North Queensland 18 (Source: NLA picture)

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Tablelands Regional Council

Message from the Mayor, Tablelands Regional Council

It gives me great pleasure to welcome the delegates of the 25th Australian Mining History Association Conference to our beautiful part of the world. Our region has a proud mining history and we are honoured to share our foundations, ancestry and passion for mining.

Mining is the core of who we are. Tablelanders have grown from a history of mining and our active and bustling community owes its existence to the pioneers who explored this land for its deposits. Today we are agriculture, tourism, small business, industry, construction, education, forestry, fishing, and so much more. We are multicultural, dynamic and proud of our heritage … all products of our mining beginnings.

Welcome to the Atherton Tablelands.

Mayor Joe Paronella

AUSTRALASIAN MINING HISTORY ASSOCIATION

Presidents Foreword
In the Footsteps of John Moffat

On behalf of the Executive of the AMHA it is my pleasure to welcome you to the Association's 25th Annual Conference. A quarter of a century is a milestone for any organisation.

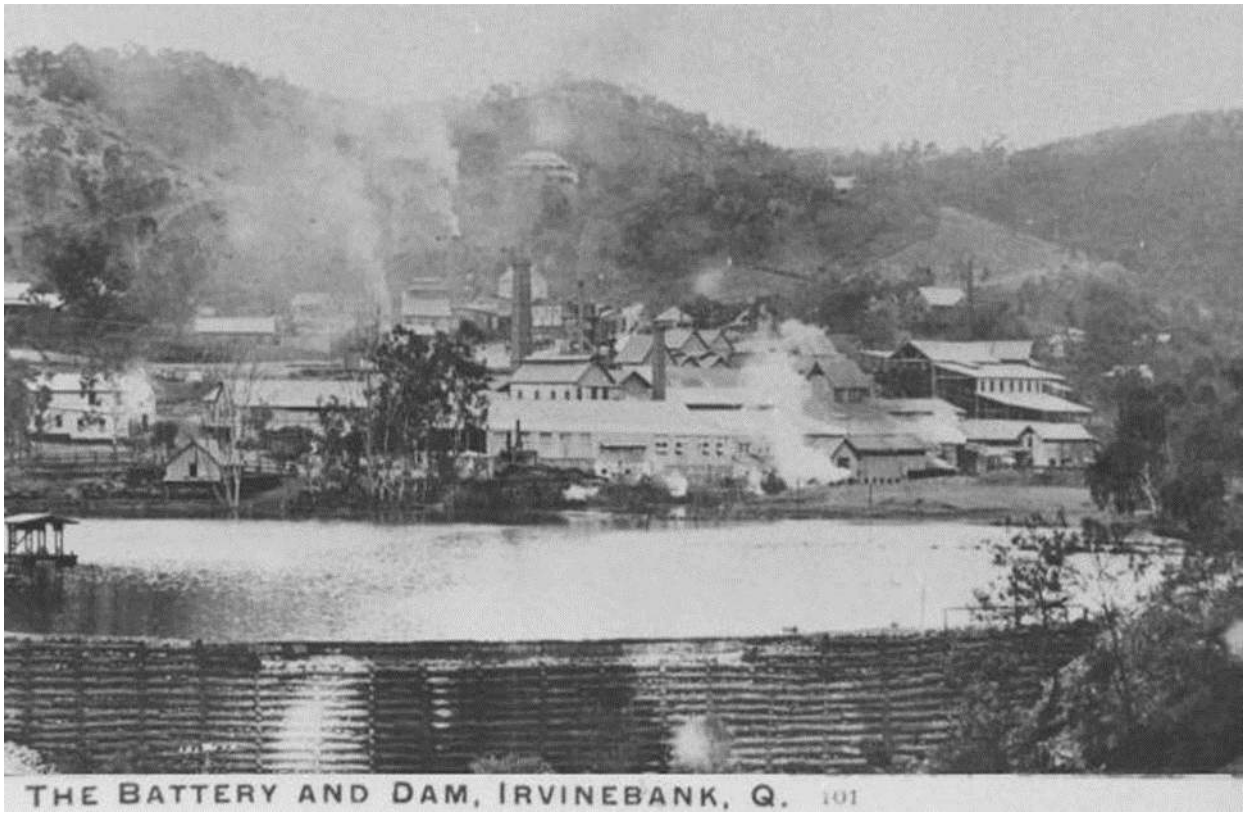
The AMHA held its first Annual General Meeting at James Cook University in Townsville in 1995. It is a little surprising that during the years following we have not until now ventured westward of Cairns to the Atherton Tableland. The theme of this conference is 'In the footsteps of John Moffat', reflecting the importance of Scottish-born mining magnate John Moffat in developing the mineral deposits and associated infrastructure of the Cairns hinterland. He was truly a giant of his day. Some will already be familiar with the Palmer and Hodgkinson gold rushes, the legend of a prospector named James Venture Mulligan and the influx of Chinese miners, but the history of mining in northern Queensland also includes pre-contact and post-contact Aboriginal mining. Aboriginal mining across Australia has an enormously long, rich and complex story. During the course of this conference we will also learn about mining in the modern era, and of course the paper and poster presentations will consider mining activity right across Australia and New Zealand.

The Annual Conference is vital to the AMHA. People have a chance to present their research, enjoy other people's discoveries and explore the full range of Australasian mining history. The social component is also important, with old friendships being renewed and new ones established. Putting on a vigorous conference every year is a challenge to which the membership has always risen. I want to thank the team 'on the ground' in Queensland, Jan Wegner, Galiina Ellwood and Ruth Kerr, as well as the remotely attached South Australian Peter Bell. Working with the even more remote Secretary-Treasurer Mel Davies, whose legendary skills have been applied to all 25 conferences, they have put together an extremely varied and interesting program. This team has worked tremendously hard to ensure the success of this conference.

There are a lot of additional people who have contributed to this event. I want to acknowledge Ken McQueen for editing the conference proceedings, as well as Ross Both and AMHA Vice-President Nick Williams. We appreciate the support of Joe Paronella, Mayor of the Tablelands Regional Council; Tom Gilmore, Mayor of Mareeba Shire; the Herberton Mining Museum (in particular Ivan Searston); the Loudon House Museum at Irvinebank (in particular Peter Shimmin); Mary Bolam, John Nethery and Wendy Hay of the Chillagoe Alliance; Ian Hodkinson, Geology Manager at Auctus Resources Pty Ltd; John and Donna Burton of the Post Office Hotel at Chillagoe; and Mount Mulligan Lodge for allowing us access to Mount Mulligan Township and Coal Mine.

Nic Haygarth

Chillagoe Smelters, ca 1918. Source: State Library of Queensland.



Irvinebank, 1910. Source: State Library of Queensland.

Transport

James Cook University (JCU) is providing us with a 12-seater mini bus and Nightsky Secrets is providing us with a closed in trailer for luggage.

Arrival, Saturday 6th July:
There will be 4 trips Cairns-Atherton, timed according to arrivals. The trip takes around 1.5 hours.
In Atherton: the minibus can collect people from accommodation in the morning. Please ensure you notify the organisers (Jan Wegner or Kal Ellwood) if you need this service. The minibus, and the Atherton International Club booze bus, can return you to your accommodation in the evening.

Sunday 7th: There are Trans North bus services as per the timetable below, and one or two minibus collections according to need.

Friday 12th: There will be one or two minibus trips dropping people to Cairns in the evening.

Sunday 13th: The bus returning from Chillagoe will drop people in Cairns as necessary. Those wanting to return to Atherton will be taken in the mini-bus.

ATHERTON TABLELANDS TO CAIRNS

Departs From	Monday to Friday 1	2	3	Saturday 1	2	Sunday *1*	**2**
ATHERTON	6.00am	9.00am	3.30pm	6.00am	9.00am	9.00am	3.30pm
MAREEBA	6.30am	9.30am	4.00pm	6.30am	9.30am	9.30am	4.00pm
SPEEWAH	6.55am	9.55am	4.25pm	6.55am	9.55am	9.55am	4.25am
KURANDA	7.15am	10.05am	4.35pm	7.15am	10.05am	10.05am	4.35pm
CAIRNS Service Terminates	8.30am	11.15am	5.35pm	8.30am	11.15am	11.15am	5.35pm

CAIRNS TO ATHERTON TABLELANDS

Departs From	Monday to Friday 1	2	3	Saturday 1	2	Sunday *1*	**2**
CAIRNS Central Rail Station	8.45am	3.30pm	5.45pm	8.45am	3.30pm	3.30pm	5.45pm
SMITHFIELD Bus Shelter	9.00am	3.45pm	6.00pm	9.00am	3.45pm	3.45pm	6.00pm
KURANDA	9.20am	4.15pm	6.25pm	9.20am	4.15pm	4.15pm	6.25pm
SPEEWAH	9.25am	4.20pm	6.30pm	9.25am	4.20pm	4.20pm	6.30pm
MAREEBA	9.55am	4.50pm	6.55pm	9.55am	4.50pm	4.50pm	6.55pm
ATHERTON Service Terminates	10.30am	5.25pm	7.30pm	10.30am	5.25pm	5.25pm	7.30pm

Atherton/Cairns Services - No Services on *CHRISTMAS DAY* or *GOOD FRIDAY*
Sunday Service *1* on *PUBLIC HOLIDAYS* - No Sunday Service **2** on *LONG WEEKENDS*

For further information please see overleaf
or visit *www.transnorthbus.com.au* 01.11.2016

Trans North - Atherton - Ph 4095 8644 during office hours

Leaving Cairns at 8:45am and 3:30pm. Fare to Atherton $25.30. NB there are no pick ups from Cairns Airport - you will need to join the bus at Platform 1 at the Cairns Railway Station, underneath Cairns Central Shopping Centre. Returning to Cairns: there is an extra charge of $5 to be dropped at the Airport.
There is a taxi rank outside Cairns Central Shopping Centre on McLeod St.

Conference Program Summary 7-14 July 2019

Day	Times	Activities and Locations
Saturday		Arrival in Atherton
Sunday	8:30 am- 5:00 pm	**Field Trip:** Mt Mulligan (Ngarrabullgan). Join at the International Club.
Monday	8.30-9.30 am	**Registration**
	9:30-9:40 am	Acknowledgement of country: Kal Ellwood President's Welcome **Nic Haygarth**
	9:40-10:30 am	Keynote Speaker – **Ruth Kerr**, *In the Footsteps of John Moffat*
	10.30-11.00 am	**Morning Tea**
	11.00-12.00 pm	Session 1 Special Address – **Jan Godłowski & Monika Dziobek – Motykal**, *Wieliczka, Poland*
	12:00-12:30 pm	Session 2 Poster Presentations
	12.30-1.30 pm	**Lunch**
	1.30-3.00 pm	Session 3 *North Queensland Mining 1*
	3.00-3-30 pm	**Afternoon Tea**
	3.30-5.30 pm	Mini Tours – Aboriginal Geology of Atherton
	3.30-5.30 pm	Advisory Committee Meeting
	6.00 pm	**Reception** at the International Club
Tuesday	9.00-10.30 am	Session 4 *Gemstones*
	10.30-11.00 am	**Morning Tea**
	11.00-12.30 pm	Session 5 *Mining Technology, Methods and Implications*
	12.30-1.30 pm	**Lunch**
	1.30-3.00 pm	Session 6 *North Queensland Mining 2*
	3.00-3.30 pm	**Afternoon Tea**
	3.30-5.00 pm	Session 7 *Geotourism, Heritage and Mine Closure*
Wednesday	8.30 am- 6.00 pm	**Field trip:** Herberton Mining Museum and Great Northern Mine, Irvinebank and Vulcan tin mine.
Thursday	9.30-10.30 am	Session 8 *Mining Heritage*
	10.30-11.00 am	**Morning Tea**
	11.00-12.30 pm	Session 9 *Ailments, Transport and Song*
	12.30-1.30 pm	**Lunch**
	1.30-3.00 pm	Session 10 *Mining Personalities*
	3.00-3.30 pm	**Afternoon Tea**
	3.30-4.30pm	Session 11 *North Queensland Mining 3*
		Conference Dinner
Friday	9.30-11.30 am	**AMHA AGM** (tea and coffee available during meeting)
	11.30- 1.30 pm	In Memory of Barry McGowan: Lunch and Aboriginal-Chinese Mining
	1.30-1.45 pm	Close of Conference and Chillagoe trip Information
	2.00-3.00 pm	Atherton Chinese Temple
Saturday - Sunday		**Field Trip:** Chillagoe, Mungana, Zillmanton Return to Cairns and Atherton

Conference Program 7-14 July 2019

Times	Activities and Location
Sunday 7 July	
8:30 am - 5:00 pm	**Mt Mulligan (Ngarrabullgan) field trip**
Monday 8 July	
8:30 - 9:30 am	**Registration**
9:30 - 9:40 am	**Acknowledgement of country: Kal Ellwood** **President's Welcome: Nic Haygarth**
9:40-10:30 am	**Keynote Speaker- Ruth Kerr,** "In the Footsteps of John Moffat: mining entrepreneur and developer of the Cairns Hinterland."
10:30 -11:00 am	**Morning Tea**
11:00 am - 12:00 pm	**Session 1 Chairperson: Ross Both** **Jan Godłowski and Monika Dziobek – Motyka, "**The history of the Wieliczka Salt Mine and the importance of Cracow Saltworks Museum in building an international community of historical mines".
12:00 - 12:30 pm	**Session 2 Posters Chairperson: Jan Wegner** 1. **T.J. Clark,** "Mining, Trade Unions and Media: loyalty and liberty during the Great War in north Queensland". 2. **Elizabeth McQueen, Ken McQueen**, "Pauline Catherine Speckhardt: The 'Lady Miner of Kingsgate', NSW".
12:30- 1:30 pm	**Lunch**
1:30- 03:00 pm	**Session 3 Chairperson: Nic Haygarth** 1. **Ivan Searston,** "Herberton: At the Beginning". 2. **Peter Bell,** "The Mount Mulligan Coal Mine Disaster, 1921" 3. **Jan Wegner,** "Mt Molloy Copper Smelter"
3:00- 3:30 pm	**Afternoon tea**
3:30-5:30 pm	**Mini-tour Aboriginal geology of the Atherton Tablelands**
3:30- 5:30 pm	**Advisory Committee Meeting**
6:00 pm	**Reception, International Club**

Tuesday 9 July	
8:30-9:00	**Registration**
9:00-10:30 am	**Session 4 Chairperson: Mel Davies** 1. **Adrian C Hutton,** "All That Glitters is not . . . – Diamonds in Australia". 2. **Jim Enever,** "Poona and the Aga Khan Emerald Mine". 3. **Bob Forsyth** (tba)
10:30- 11:00am	**Morning tea**
11:00 am - 12:30 pm	**Session 5 Chairperson: Nick Williams** 1. **Ken McQueen,** "Girilambone copper: How new technology can make a world of difference". 2. **Aert Driessen,** "A Brief History of the Weipa Bauxite Discovery". 3. **Nic Haygarth,** "The digger and the tiger: the part of mining in the demise of the thylacine (Tasmanian tiger)".
12:30-1:30 pm	**Lunch**
1:30-3:00 pm	**Session 6 Chairperson: Kal Ellwood** 1. **Carole A Hardingham,** "The stories that stones tell: a grave look at the cemeteries of the Chillagoe Mining Field". 2. **Owen Ray,** "A History of Zillmanton Mine". 3. **Jan Wegner,** "An unusual gold-chaser: Carl Axel Egerström".
3:00- 3:30 pm	**Afternoon tea**
3:30 – 5:00 pm	**Session 7 Chairperson: Ken McQueen** 1. **Angus M. Robinson,** "Proposed National Geotourism Strategy and Mining Heritage". 2. **John Baldwin,** "KEM Closure: a Sustainable Solution". 3. **Matthew Churchward,** "The blacksmith's boast: Rediscovering the remarkable story of the Rocky Mountain Extended Gold Sluicing Company, Beechworth, Victoria".

Wednesday 10 July	
8:30 am – 6.00 pm	**Herberton Mining Museum and Great Northern Mine, Irvinebank and Vulcan Mine**

Thursday 11 July	
	Registration
9:00-10:30 am	**Session 8 Chairperson: Jan Wegner** 1. **Kal Ellwood,** "Precontact Aboriginal Miners". 2. **Kevin Rains, Geraldine Mate, Nicholas Hadnutt and Hannah Craig-Ward,** "Ravenswood: the Hidden Places and People of a Goldfield". 3. **David Scott,** "Last Mine on Kozzie".
10:30-11:00 am	**Morning Tea**
11:00 am - 12:30 pm	**Session 9 Chairperson: Adrian Hutton** 1. **Gordon Boyce,** "The Impact of shipping-related technological innovations on oceanic mineral transport". 2. **Ross A. Both,** "Tales of Yellow and Black: contrasting lives of gold diggers and coal miners as seen through verse and song".
12:30-1:30 pm	**Lunch**
1:30-3:00 pm	**Session 10 Chairperson: Ruth Kerr** 1. **Nic Haygarth,** "T.B. Moore, F.R.G.S., explorer': Tasmanian prospector and bushman". 2. **Mel Davies,** "The life and times of the Hancock family: Triumphs and tribulations". 3. **R. J. (Jim) Morrison and Peter A Burger,** "Greenvale Nickel Mine: Some historical notes".
3 - 3:30 pm	**Afternoon tea**
3:30- 4:30 pm	**Session 11 Chairperson: Wendy Carter** 1. **Jan Wegner,** "Mulgrave goldfield: mines in the rainforest". 2. **Kal Ellwood,** "Mungana Archaeological Area".
7:00 for 7:30 pm	**Conference Dinner**

Friday 12 July	
9:30- 11:30am	**AGM (tea and coffee available during meeting)**
11:30 am - 1:45 pm	**In Memory of Barry McGowan: Luncheon and Aboriginal-Chinese Mining** **Chairpersons: Nic Haygarth and Kal Ellwood** **Special guest speakers:** **Uncle Rodney Chong (Senior Elder, Wakamen People) and daughter Carol Chong, talking about Aboriginal Chinese descent miners.** **Conference closure and announcements**
2:00- 3:00 pm	**Visit the Atherton Hou Wang Chinese Temple and Museum**
3:30 pm	**Minibus to Cairns if required**

Saturday 13 and Sunday 14 July		
Saturday 8.30 am	**Pick up at International Club**	**2 day trip to Chillagoe- Smelters and Zillmanton;**
Sunday 8.00 am	**Pick up at Lodge and Tourist Village**	**Mungana- Girofla, Mungana cemetery and Aboriginal Art Site** **Return to Cairns and Atherton**

Extended Abstracts

KEM Closure: A sustainable solution

John Baldwin

7A Rathmines St, Toorak, Vic, 3142, Australia

The Kelian gold deposit was discovered in 1976[1] in an isolated part of East Kalimantan, in Indonesian Borneo. During exploration and early evaluation, site access was by river boat from Samarinda up the Mahakam River then by canoe up the subsidiary Kelian River. The area is held by PT Kelian Equatorial Mining (KEM) under a third generation Contract of Work.

Kelian was the largest known gold only deposit in Indonesia. The orebody had highly complex geology and was classified as an intermediate/low sulphidation epithermal, carbonate base metal gold deposit, Host rocks were felsic volcaniclastics, andesite, rhyolite, muddy breccia/diatremes and younger basalt. Phyllic and propylitic hydrothermal alteration were pervasive. Average sulphide content was 3 wt%. Gold (electrum) occurred as disseminations, and in stockworks, veins and breccias. Although mainly disseminated in pyrite, there was significant free gold.

The Final Feasibility Study, completed late 1989, estimated a resource of 53.5 Mt at 1.97 g/t Au. Planned mining was by open pit using face shovels and haul trucks. The designed throughput of the CIP process plant was 6 Mt a year. A gravity circuit was added later. During the construction period, a port on the Mahakam River and a 47km access road to the mine site were established.

Production commenced in 1992. Mining ceased in 2003. Final Pit dimensions are 1.2km wide, 320m deep. Processing of low-grade stockpiles was completed in 2004. Processed ore totalled 91.3Mt at 2.64 g/t Au. 179t of Au and 145t of Ag were produced. During the operating period, a tailings dam and a waste rock dam were constructed, and the Kelian River diverted. These were major engineering achievements.

Extensive closure planning commenced in 1999. A Mine Closure Steering Committee was formed to consider options and develop the final closure plan. Members comprised representatives from local communities, NGOs, Indonesian Universities, Central, Provincial and Regional Governments and Company management. Planning was based on widespread stakeholder engagement and negotiations over two years. Detailed community surveys were completed which provided a clear understanding of the complex social – economic risks for closure and post closure.

A formal agreement was signed three years before mine closure. The usual requirements were met i.e. to remove all plant, buildings, restore landforms and prevent anomalous heavy metal contamination of waterways, although in this case using wetlands, past compliance points. However, the end objective was a stable landform and rehabilitation of native vegetation to provide for post closure land use as a protection forest. With the focus on environmental, community needs and sustainability[2], a trust fund was set up to cover on going costs. The open pit, waste dump and tailings dam were retained as permanent structures. This retention determined the necessity for ongoing management, by a new company separate to KEM, provision of forest rangers and external monitoring in perpetuity post closure.

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[1] Theo van Leeuwen, *The Kelian Gold Deposit. East Kalimantan, Indonesia: Its Exploration History, Evolving Geological Model, and "Invisible" Coarse Gold.* Proceedings MGEI 7th Annual Conference, 4-5 October,2015, Balikpapan, Indonesia, pp. 1-26

[2] *Dr Geraldine McGuire. Sustainability planning or closure planning, First International Congress on Planning for* Mine Closure of Mining Operations. November 20 - 22 2016, Santiago. Chile. 6 pp.

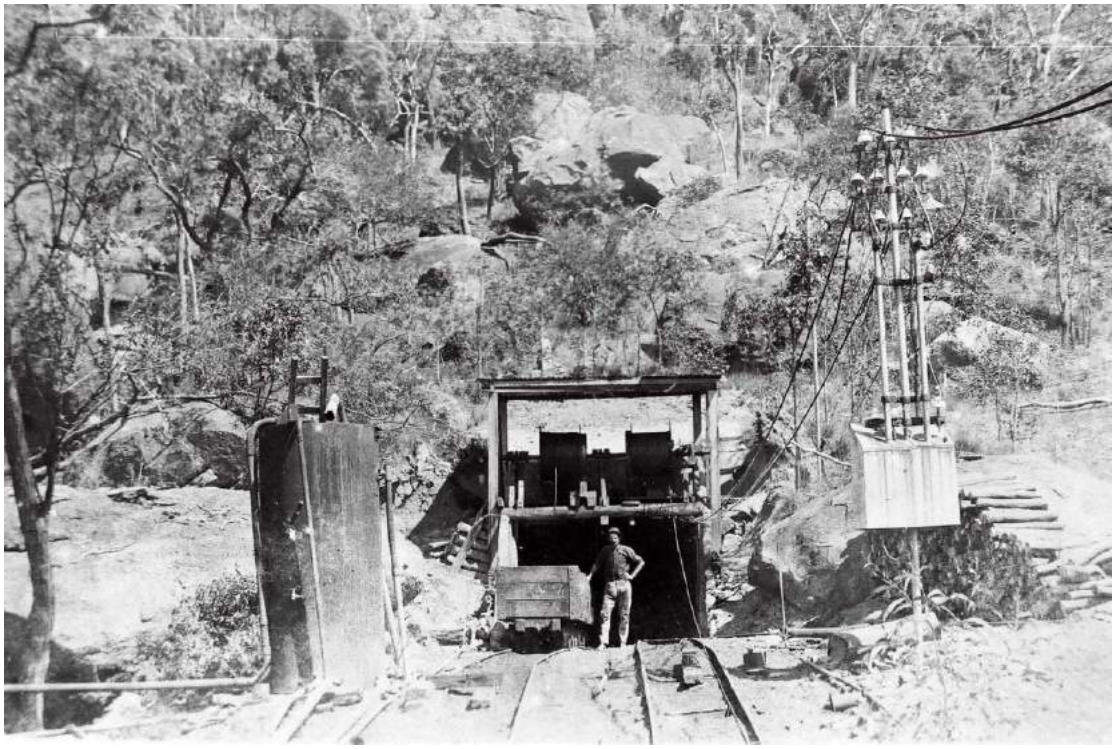
The Mount Mulligan coal mine disaster, 1921

Peter Bell

Adjunct Senior Research Fellow, Flinders University

During the conference there will be an opportunity to visit the remote and abandoned North Queensland township of Mount Mulligan. Australia's northern-most coal mine was in production there from 1914 to 1957, first owned by the Chillagoe Company and later operated as a State Mine (Fig. 1). In September 1921 the Mount Mulligan coal mine was devastated by a coal dust explosion, killing the entire underground workforce of 76. The death toll made it the third-worst industrial accident in Australian history. Ironically, the disaster was caused by work practices which had evolved in the knowledge that the mine atmosphere was free from methane, which was believed to be the cause of all coal mine explosions. The explosibility of finely-divided coal dust in the absence of methane was only dimly understood in Australia at the time. This was despite the experimental findings on coal dust behaviour that had been published in Europe and the USA for nearly ten years. This presentation looks at the impact of the Mount Mulligan disaster on the local community, and examines the ineffectual role of the subsequent Royal Commission in determining the cause of the disaster.

Figure 1: View of the entrance to the Mount Mulligan coal mine before the explosion in September 1921.



Source: Photo collection of Mary Wardle.

Tales of Yellow and Black: contrasting lives of gold diggers and coal miners as seen through verse and song

Ross A. Both

Most songs and verse from the mining fields are related to gold or coal, with some similarities but many significant differences between the two groups in terms of subject matter. Fewer contributions came from metalliferous mining fields other than gold.

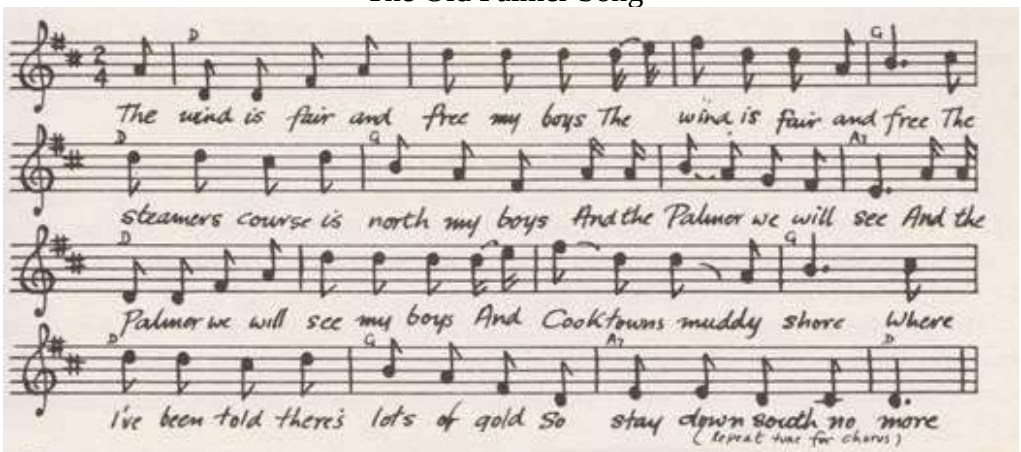
The majority of songs and verse from the goldfields date from the first rushes up to the early years of the 20th century, with the 1850s to 1870s a particularly productive period. They cover a very wide range of topics that reflect the excitement of the rushes and describe the trials and tribulations of the diggers, as well as life in general on the goldfields. Humour was also common. The early years of the goldrushes were the time of the goldfields entertainers who contributed many songs.

In contrast to gold, the most productive period for output of songs and verse related to coal mining appears to have been from the 1880s up to the 1950s. Apart from satire, they are generally of a serious nature, reflecting the arduous work of the miner in dangerous conditions, his resentment at perceived exploitation by the colliery owner, industrial unrest and mine accidents. Publication of verse in local newspapers was probably a means for the coal miner to air his grievances.

Environmental issues and mine disasters are themes in songs and verse common to both gold and coal mining.

The presentation will include some sound clips from recordings.

The Old Palmer Song[1]



Chorus
So, blow ye winds, heigho!
A digging we will go,
I'll stay no more down South, my boys,
So let the music play.
In spite of what I'm told,
I'm off in search of gold,
And make a push for that new rush
A thousand miles away.

[1] Ron Edwards, *The Big Book of Australian Folk Song.* Rigby Ltd. 1976, p. 279.

The impact of shipping-related technological innovations to oceanic mineral transport

Gordon Boyce

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It is obvious that minerals will not be exploited unless there is an accessible market for them. The relationship between market prices, production expenses, and transport costs shapes the effective range of mining activity, and this linkage is especially important to Australian mineral exploitation given its distance from major consuming centres. This paper examines the transportation element within this 'viability equation', specifically as it relates to the seaborne cost component.

The presentation shows how innovations in marine propulsion systems, vessel design, cargo handling equipment, and communication technology helped to expand the geographic range of cost-effective mineral conveyance by sea. The study begins in 1870 when the steam powered tramp ship first emerged as an effective instrument for carrying bulk goods over medium distance and concludes in 1970, by which time the modern bulk carrier entered service across the globe.[1] It is remarkable that as early as 1890 the development of steam technology had reached the stage where it was possible to convey a ton of cargo over the distance of one mile using the equivalent energy produced by burning a couple of sheets of writing paper, and that a 5,000 ton ship could be loaded with coal in just 24 hours. Nevertheless, these indicators of efficiency pale in comparison to those achieved by the 100,000 ton bulk carriers that came into operation after 1970.

Various long-distance mineral trades are examined to show how improving efficiency encouraged the transport of a progressively wider range of raw ores, scrap material, and finished metal products. Commercial innovations, more sophisticated ship management skills, and new financing methods all played important contributory roles in mineral shipment by sea. Indeed, these variables –along with the unprecedented increase in the scale of industrial plants that required reliable supplies of huge quantities of mineral inputs- played key roles in supporting the 'bulker revolution' that unfolded after 1970.

The presentation will include ship photographs and plans of specialised ship designs that were developed especially to enhance the efficiency of carrying mineral

[1] For a general history of tramp shipping, see P. N. Thomas, *British Ocean Tramps,* 2 Vols. Wolverhampton, Waine Research, 1992. The histories of tramps and bulkers are covered by, Roy Fenton, *Tramp Ships. An Illustrated History,* Barnsley, Seaforth Publishing, 2013.

The blacksmith's boast: Rediscovering the remarkable story of the Rocky Mountain Extended Gold Sluicing Company, Beechworth, Victoria

Matthew S. Churchward

Senior Curator, Engineering & Transport, Museums of Victoria

Sluicing was introduced to the Ovens goldfields by California veterans in 1853, and soon became a defining characteristic of alluvial mining throughout the district. Amongst this trend was a party of seven miners, led by Scots-born Robert Dryburgh, who applied for an extended sluicing claim in December 1856, to rework abandoned ground on Spring Creek, Beechworth, extending upstream from the Newtown Falls. Known as the Rocky Mountain Fluming Company, they invested over £3,500 building a reservoir, water races and a 450 yard tailrace blasted through the granite creek bed, clearing a tidy profit before dissolving the partnership in 1863.

With assistance from local businessmen, Dryburgh extended the lease and floated the Rocky Mountain Gold Sluicing Co. in 1867, with a capital of £6,000. They spent four years deepening and extending the tailrace to half a mile in length at a cost of £8,000. Dividends of £7,100 followed from a production of 6,500oz, creating sufficient interest to revitalise sluicing activities throughout the district and inspire a far more ambitious venture.

Figure 1: Inspecting the 'Giant' Nozzle, installed at the Rocky Mountain claim in 1895. Source: Burke Memorial Museum

Amalgamating leases and water rights with upstream claims, the enterprise was reformed as the Rocky Mountain Extended Gold Sluicing Co. Ltd, in 1876, increasing capital to £26,000, before launching "the largest piece of work of the kind undertaken in Australia" – driving a 770 yard tailrace tunnel through solid granite beneath the township of Beechworth in order to better work deep ground. Key innovations of the project included the early use of R.G. Ford's patent pneumatic rock drills and dynamite to achieve record tunnelling progress through the extremely hard granite. Then a prolonged drought caused the patient shareholders to wait 12 years before dividends resumed and the enterprise entered its golden era, returning £64,000 to investors.

Henry James Jarvis was born at Lambeth, England, in 1848, and arrived in Victoria as a boy, settling with family on the Ovens goldfields. After training as a blacksmith, he established his own business on Albert Road, opposite the sprawling workings of the Rocky Mountain Sluicing claim. He became a prominent local businessman and Shire President, serving as a director of the Rocky Mountain Co. from 1911, until his death in 1917. His story is typical of the local share-holders who supported the state's longest running alluvial mining enterprise.

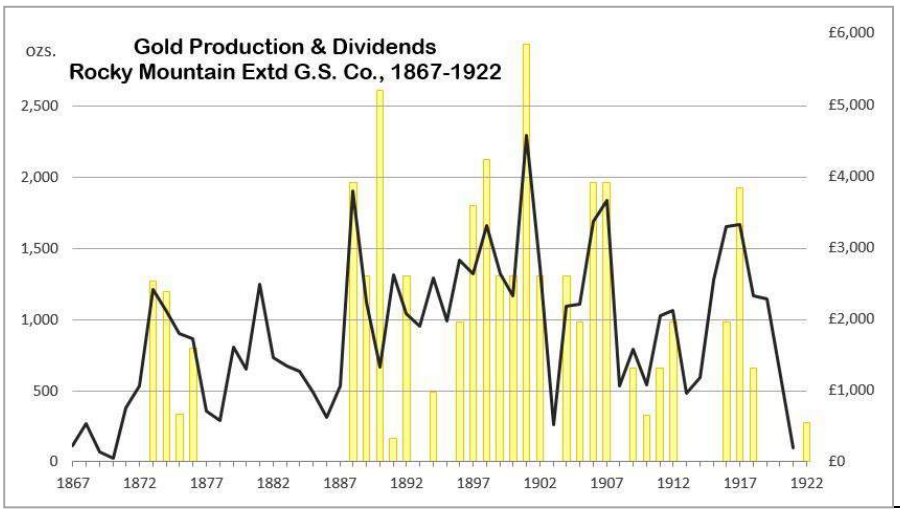

Figure 2: Gold production.

Source: Directors'& Mining Manager's Reports, *Ovens & Murray Advertiser*, 1867-1922; *Annual Report of Mines, Victoria*, 1897-1921

Mining, trade unions and media: Loyalty and liberty during the Great War in north Queensland

Trevor J. Clark

BA Honours student History & English Literature, James Cook University, Cairns, QLD, 4878

The relationship between the Labor Party, trade unionism and mining during the early 1900s in north Queensland is established.[1] Mining trade union members and leadership personalities utilised media-hegemony to help effect the high 'No' vote of the 1916 and 1917 conscription referenda.[2] The organisers of these unions, Ted Theodore and William McCormack, were pivotal personalities during the Great War and the conscription debates. Vociferous in their speeches and writings on conscription, the men's rhetoric influenced mining union members and voting discussion. Importantly, the significance of mining or ex-miner union members, their world views and political, social and personal beliefs, contributed to the proportionally high 'No' vote in north Queensland.

The presentation will illustrate the links between historical trade union leadership, high mining union membership, politics, media bias and the editorial appeals of Theodore and McCormack in the media to 'liberty-based and loyalty-based' arguments posited by Robin Archer.[3] Archer's concepts are a significant and meaningful discursive method of shedding new insights on why the 'No' vote prevailed in north Queensland: that power and hegemony of newspaper editorial during the conscription referenda was influenced by mining personalities and union leaders' choices of language and political themes.

[1] Doug Hunt, *Labour in North Queensland: Industrial and Political Behaviour, 1900-1920*, VDM Verlag, 2010, pp.
[2] John Theobald, *The Media and the Making of History*, Burlington, VT: Ashgate, 2004, pp. 1-17.
[3] Robin Archer, "Liberty and Loyalty: The Great War and Labour's Conscription Dilemma," *Australian Journal of Politics & History* 64, no. 1, 2018, pp. 18-32; Robin Archer et al., *The Conscription Conflict and the Great War, eds Robin Archer, Joy Damousi, Murray Goot, Sean Scalmer, Editors*, 2016, pp. 37-66.

The life and times of the Hancock family: Triumphs and tribulations

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Anyone interested in Australian mining history will be familiar with Lang Hancock and family (families!) links to the iron-ore industry and to a lesser extent to asbestos mining. While Lang had a pronounced impact on the iron-ore industry, his fame relates more to his drive in promoting the industry rather than in actual mining, for during his lifetime he never once owned an iron-ore mine. That role, and a very successful one, was left to his daughter Gina Rinehart after his death. While providing a brief account of Lang's early promotion of the industry, it is the intention of this presentation to look at Lang's character, his ideas, and also the involvement of other members of the Lang dynasty before and after his death in 1992. To say that Lang was unconventional in his ideas would be an understatement, as were the controversies that surrounded members of his family.[1]

Figure 1: Peter (E.A.) Wright and Lang Hancock, 12 August 1967.

Source: Courtesy *The West Australian*, in Ronda Jamieson, *Charles Court: I love this place*, Osborne Park, WA, St George Books, 2011, p. 214.

[1] Relevant references include:
Robert Duffield, *Rogue Bull: The Story of Lang Hancock, King of the Pilbara*, Collins, Sydney, London, 1979.
Adele Ferguson, Gina Rinehart: The untold story of the richest woman in the world, Macmillan Australia, 2012.
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A brief history of the Weipa bauxite discovery

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In the wake of WWII aluminium became strategically important because of its superior strength to weight ratio. Thus, in 1945 the Federal and Tasmanian governments jointly established an Australian Aluminium Production Commission with a view to building an aluminium smelter in Tasmania based on cheap hydro power. One of its Board members was Maurice Mawby (later Sir Maurice), who happened to be also on the Board of Consolidated Zinc Pty Ltd, an Australian subsidiary of UK-based Consolidated Zinc Corp Ltd.

In 1953 Maurice Mawby circulated a company memo asking geologists to 'keep their eyes open' for bauxite and phosphate rock, particularly in the Northern Territory and North Queensland.[1]In 1955, Harry Evans, a Kiwi petroleum geologist working for Frome-Broken Hill, a subsidiary of Consolidated Zinc, made plans to reconnoitre Cape York Peninsula to look for oil-bearing structures. Maurice Mawby, made aware of this, called Evans to his office to show him a piece of bauxite from the Wessel Islands off Arnhem Land which he happened to have. Evans had never seen bauxite before.

When Evans decided that Cape York Peninsula was not prospective for oil, he decided, while there, to have a look at the west coast of the Cape just to see what it looked like. On the banks of the Embley River estuary he could not miss the 'red-brown' low cliffs on the other side of the river estuary and he also figured that whatever it was, there was a lot of it. Like a good geologist, he took samples which he submitted for analyses on his return to head office in Melbourne. The results were encouraging and showed elevated aluminium values high enough to warrant his immediate return for further investigation. He completed an initial assessment using a 3-metre 'tinny' with outboard and an Aboriginal guide named Matthew; together they traversed some 80 km of coastline and 290 km in all. He also made use of a light aircraft. Erring on the conservative side, Evans determined an initial resource of 250 Mt of bauxite. By 1965, this assessment had been revised to 2000 Mt.[2]

Only a year or so later, Consolidated Zinc hived off the whole Weipa project to have it managed by a new entity called Commonwealth Aluminium Corporation Ltd (Comalco). Within 20 years of Harry Evans first setting foot on Cape York Peninsula, Comalco invested some $1.5 billion, employed about 13,000 Australians, and generated annual sales of $600 million. Such a feat will never be repeated considering today's regulatory environment.

[1] A. Trengrove, *Discovery – Stories of Modern Mineral Exploration*. Stockwell Press 1979, pp. 1-25.
[2] H. Evans, Bauxite Deposits of Weipa, in *Geology of Australian Ore Deposits, Vol 1,*. Eighth Commonwealth Mining & Metallurgical Congress, AusIMM, Melbourne, 1965, pp.3 96-401

Pre-contact Aboriginal mining

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At the time of contact with Europeans, Aboriginal people were no strangers to prospecting, mining and resource quarrying for tool making, trade and ceremony; they also understood the qualities and value of their extracted materials. This has been recognised in the archaeological literature, but the idea that Aborigines might have adapted readily to post-contact mining because of their long tradition of mining activities has not.

Archaeological investigations have shown how long this mining tradition is. Wright dated the Koonalda Cave quarry, the oldest dated stone quarry known to be in operation, between 24,000 and 14,000 years ago. Smith, Frankhauser and Jercher found that the oldest dated ochre mine, *Karrku*, was worked from around 32,000 to 13,000 years ago.

It is well known that pre-contact Aboriginal societies were stone based economies; they required good quality fine-grained stone for tool making.[1] Other good quality minerals were mined to make pigments for rock art and for religious practises such as mortuary preparations and body-painting for ceremony. Those groups with particularly good resources would often specialise in mining for trade.

Aboriginal mining practices were varied and could be complex; as well as quarrying and open cutting, underground excavations using shafts, adits, drives and stopes were employed more than 1,000 years before similar methods were employed in Settler-Australian mining. They used specialised tools, had specialised geological and petrological knowledge as reflected in language, and used fire both to assist mining and to heat-treat stone and ochre to improve their qualities for use.

Archaeologists do not have standardised terms to describe Aboriginal mines. It is recommended that pre-contact Aboriginal mining sites be classified according to standard mining terms; not only will this result in more accurate descriptions, and prevent the inadvertent denigration of complex mining processes as ‘quarries’, it will also show why so many Aborigines made the transition to post-contact mining so readily. It was because they were already familiar with most of the techniques being used by white miners. This also stops the artificial division of Aboriginal history into ‘antiquity’ and modern, post-contact times. Not only did traditional mining for traditional reasons continue well into the 20th century, and in the case of Karrku, the 21st century; traditional mining methods also continued into production for the European post-contact economy.

[1] J. Mulvaney and J. Kamminga, *Prehistory of Australia* (Crows Nest: Allen & Unwin, 1999); P. Hiscock and S. Mitchell, *Stone Artefact Quarries and Reduction Sites in Australia: Towards a Type Profile*, ed. Australian Heritage Commission, Technical Publication Series No.4 (Canberra: Australian Government Publishing Service, 1993); T. Corkill, "Red, Yellow and Black: Colour and Heat in Archaeological Stone," *Australian Archaeology* 45(1997); J. Flenniken, J. Jeffrey, and J. Peter White, "Australian Flaked Stone Tools: A Technological Perspective," *Records of the Australian Museum* 36, no. 3 (1985); I. McBryde, "Kulin Greenstone Quarries: The Social Contexts of Production and Distribution for Mt William Site," *World Archaeology* 16, no. 2 (1984).

The Aboriginal geology of the Atherton Tablelands

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The Seven Sisters. (cinder cones) between Yungaburra and Atherton

Bulmba wuygiil/ garran+gandanyundala/ yigan gubanyundala/ bulmba garran gana ngajin bama/ gana ngayu gija gunjiina bamaagu/ wanyindagang bummaanda nganyjiinda/

Atherton is the centre of the Atherton Tablelands, most of which is a 'sleeping' (not extinct) volcanic province. It was very active between about 11,000 to 18,000 years ago.

Nearby Lake Eacham (*Yidyam*) was a maar volcano formed over 9,130 years ago when molten basaltic magma from the Earth's upper mantle rose to the surface and heated the water table. The steam that resulted from the boiling water was trapped underground, until massive explosions signalled its release. Huge cracks appeared in the ground and the trees that once lathed the mountainside were levelled and burnt. Eventually, after the eruptions, groundwater filled the crater and the trees grew back, creating the tranquil lake used today by families and tourists for recreation (Fig. 1).

Lake Barrine a short distance east formed in a similar way, about 17,300 years ago (Fig. 2). At that time Aboriginal people were witnesses to volcanic eruptions which formed these lakes and Lake Euramo to the northeast, and the many other craters in the area.

This presentation explains the geology of the area and the Aboriginal eyewitness stories about its formation. Some of this will be in *Yidinji* and *Nadjon-jii* languages with English translation after. Aboriginal mining also occurred, for basalt for axes on Bone's Knob, a shield volcano at nearby Tolga; for red ochre at Butcher Creek on the Russell River goldfield; and for rhyodacite for axes at a quarry at Corduroy Creek to the south. Herberton granite supplied grinding stones. These products were traded west and to the coast.

Figure 1: *Yidyam* (Lake Eacham) in *Ngadjon-jii Bulmb* they call it *Wiinggin.*

Figure 2: Lake Barrine in *Badjabarra Yidinji Bulmba*.

Poona and the Aga Khan Emerald Mine.

Jim Enever

CSIRO (retired)

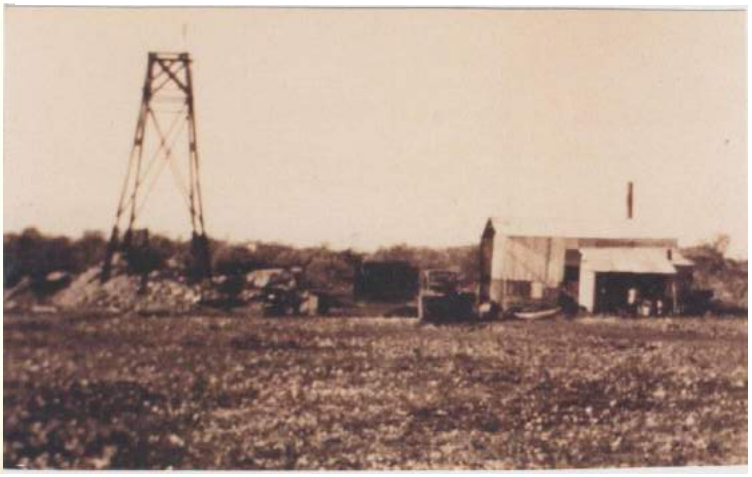
Emeralds were discovered at Poona in the Murchison Goldfield area of WA around 1912. A rush soon followed, with one syndicate ultimately emerging as the most prominent on the field. Plans by an international group to develop the area prospected by this syndicate were curtailed by the First World War. Interest in the field was re-kindled in the 1920s, with the English based Star Emerald Mining Co. assuming the predominant position.[1] This company took out a number of mining leases covering many of the outcrops previously prospected, including the area that had been of major interest pre-war. The company subsequently focused its activities on this lease, working the claim from 1926 to 1933. In later times (1970s), it was the successor mine on this lease that was to become known as the Aga Khan Mine, in recognition of the supposed involvement of the Aga Khan 111 (Fig. 1) in mining activities on this lease, most commonly thought to have been during the 1920s or early 1930s when the Star Emerald Co. held the lease.

Anecdotal stories abound in the Poona area, revolving around the involvement of the Aga Khan in emerald mining and the shipment of emeralds/emerald ore to India. The essence of these stories is summarised by Palmer in his history of Poona. [1] Documentary evidence to support these stories is, however, hard to find. The most likely vehicle for any involvement by the Aga Khan, if indeed there was an involvement, would be via an interest in the Star Emerald Co. A search of the incomplete records of the Star Emerald Co. held in the UK national archives does not, however, reveal any evidence of a direct investment by the Aga Khan in the shares of the company. Likewise, a search of the available documentary evidence relating to the Aga Khan's investments at the time concerned, held in the Beaverbrook papers of the UK House of Lords, does not show any evidence of a direct investment in the Star Emerald Co., or any speculative mining company for that matter. The possibility exists that an indirect investment of some type may have occurred, or, unlikely, that the Aga Khan's involvement was through some of the less prominent mining enterprises at Poona at the time, or later when the main lease was out of the hands of the Star Emerald Co. On balance however, it is reasonable to conclude that the role of the Aga Khan in emerald mining at Poona must remain in the realms of urban legend (Fig. 2).

Figure 1: The Aga Khan, circa 1930.

Source: Wikipedia picture gallery.

Figure 2: Emerald mine at Poona, circa 1929.



Source: Personal collection of A Palmer.

[1] Palmer, A., *Poona W.A. and the Seekers of its Emeralds*, Hesparian Press, Perth, 2010.

The history of the "Wieliczka" Salt Mine and the importance of Cracow Saltworks Museum in building an international community of historical mines.

Jan Godłowski and Monika Dziobek – Motyka

Cracow Saltworks Museum in Wieliczka, Zamkowa 8, 32-020 Wieliczka, Poland

The history of the mine:
"Wieliczka" Salt Mine in the town of Wieliczka is situated in southern Poland, only a few kilometres from Cracow, the former capital of the country. The oldest traces of salt production in the area of Wieliczka date back to the Middle Neolithic period (about 3500 years BC). Various ancient and medieval human communities have exploited the brine springs and produced evaporated salt for centuries. A breakthrough came about in the second half of the 13th century, when the rock salt was discovered and the exploitation by numerous mining shafts was launched. This enterprise, called Cracow Saltworks, has always belonged to the King of Poland, later to the state. It has operated continuously for almost 750 years, which is unique on the global scale. The mine concluded all extraction activities in 1996, but the modern evaporation plant continues processing brine from natural seepages and still produces popular evaporated table salt of highest purity. During its lifetime around 9 million cubic metres of workings were excavated in the mine, starting from level 1 up to level 9, including 245 km of galleries and 2,350 chambers. Nowadays, ca. 3% of underground workings can be visited by visitors. Tourism in the Wieliczka Salt Mine is a very long tradition and dates back to the end of 15th century. At present, Wieliczka Salt Mine is the most visited mine in the world. In 2018 the underground tourist route was visited by 1.7 m tourists and 50% of them were foreigners. Moreover, Wieliczka Salt Mine was the first industrial monument inscribed on the first UNESCO World Heritage List in 1978.

The creation and development of Cracow Saltworks Museum:
In the 1950s the management of the mine planned to liquidate many of the historic, empty excavations. Polish painter, teacher and social activist living in Wieliczka, Alfons Długosz was granted their consent to explore the workings with miners to collect old tools, devices and mining machines in order to protect them from destruction. These objects, including a unique collection of wooden hoisting machines from the 16th-19th centuries, made up the first exhibition located in 19 post-excavation chambers on the 3rd level of the mine, at the depth of 135 m. It was open for visitors in 1951. Ten years later, the exhibition was officially transformed into the national museum. Thanks to state support, the largest underground mining museum in the world was created.

International projects:
In recent years, the Cracow Saltworks Museum in Wieliczka took up the challenge of building a community of historical mining centres, both on national and global scales. Every three years the museum organizes an international conference devoted to the underground mining museums and tourist routes. The main goal of the conference is to build a platform for exchange of experience in protection and management of historic mines, as well as their transformation into centres of heritage, culture, science and tourism. On the basis of the conference and in collaboration with historic mines from many countries the museum plans to prepare "The catalogue of best practices" in this field. Moreover, the museum has the idea to institutionalize the community of mining museums by creating an International Committee for Mining Heritage within the ICOM (International Council of Museums). It will help to emphasise the great importance of mining museums in the large family of technological museums and the key role of mining in development of human civilisation.

‘The stories that stones tell: a grave look at the cemeteries of the Chillagoe Mining Field.

Carole A. Hardingham

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The fortunes of base metal mining on the Chillagoe Mining Field in far north Queensland in the late nineteenth and early twentieth centuries were subject to the vagaries of geology, mineral prices and the stock market. Consequently, population on the mining fields fluctuated wildly, and sometimes rapidly. Often, though, a cemetery would remain, even as the mines and the towns decayed and disappeared. Today, these cemeteries are a reminder of the boom times, but also of the sadder stories of individual victims of disease and accidents.

This paper examines a selection of the cemeteries remaining on the Chillagoe mining field, those near the railway line between Koorboora and Mungana. There are no active towns now, except for Chillagoe. Chillagoe has a cemetery that is still in use, but the vanished mining townships of Koorboora, Calcifer, and Mungana have little to show for their once thriving existences except for scattered artefacts and a disused cemetery.

Figure 1: Headstone of miners killed in an explosion at the Hobson Mine, Calcifer.

Source: Author, November 2018.

A close examination of the cemetery and the graves that rest within can give insights into the society and culture of the mining towns. When we have access to a Burial Register, such as the one for Chillagoe, this information is greatly enhanced. The data related to each burial can be analysed to show mortality rates of different age groups, genders, and denominations, which can either reflect wider historical trends, such as the shift from mining to pastoral occupations, or be peculiar to the particular area such as the predominance of graves from mining accidents in the Calcifer cemetery. Even if a Burial Register has not survived, the layout of the cemetery can give insights into the social structures of the town e.g. their division into religious denominations, surnames and other information which indicate countries of origin, and the placement of ‘alien’ or ‘pagan’ Chinese and Aboriginal people on the margins. The size, composition and design of the gravestones can reflect the social standing of the deceased, or can be a symbol of a community’s grieving for a needless death, such as the monument over murdered Annie Tracey or those erected by workmates for miners killed in accidents. Those graves without a headstone may never have had one because there was no-one to pay for it, or there may have been a simple painted wooden cross that has long since disintegrated. For others, particularly Aboriginal people, it may be a mound in the grass with no identifying markers.

Cemeteries are a rich source of history. They can be forgotten and uncared for and there is a risk of this history being lost. The dead can instruct the living, but only if we care for them and their resting places first.

T.B. Moore, F.R.G.S., explorer: Tasmanian prospector and bushman

Nic Haygarth

Tom Moore (1850–1919, Fig. 1) had the chance to become a hallowed name in the mining world by pegging the Mount Lyell Iron Blow—but he blew it.[1] Instead he built a reputation on his solitary exploration work, his endurance as a Tasmanian West Coast track cutter and his wonderful knowledge of the bush. A century after his death, his meticulous candlelit diary-keeping through decades as a bushman still provides a window into his inner life. Born in comfortable circumstances and educated partly in the English lake country, Moore was not the typical nineteenth-century mineral prospector. Yet this highly ambitious, literate, insatiably curious natural scientist was content in a Huon pine dugout canoe or a tent in the rainforest, living on wombat provided by his beloved dogs and hooking eels in the waterways.[2] He recorded all manner of natural phenomena in his diaries, including the passage of Halley's Comet, which he observed from the roof of his house in the copper boom town of Balfour.

Figure 1: Prospector and track-cutter T.B. Moore.

Source: Margaret Elliston, Latrobe, Tasmania.

Moore's new bride Mary Solly (1857–1944) received an introduction to his world when in 1889 the couple took a honeymoon horse ride through the Tasmanian highlands along what was known as Moore's Track to their new home at Strahan, the little port on Macquarie Harbour.[3] This most travelled of Tasmanian prospectors placed almost 40 feature names on the map, yet his own name was forgotten when a highway was opened between Hobart and Queenstown. Still, the would-be discoverer of the Iron Blow effectively received some compensation from the Mount Lyell Mining and Railway Company in the form of official and unofficial prospecting work during the latter part of his career.[4] Moore was buried overlooking Macquarie Harbour, with a Huon pine fence around his grave, resting in the heart of the country he loved.

Two historians have discussed Moore at some length. In *Explorers of western Tasmania*, C.J. Binks examined his exploration work in the period up until 1880. Ian McShane, in his B.A. Honours thesis 'T.B. Moore—a bushman of learning', sketched Moore's whole working life. Both writers provided insight into his actions and motivations. The present paper is an attempt to extend the understanding of Moore's character and achievements and place him in the context of his fellow prospectors and bushmen.

[1] Moore, T.B., 'Discovery of Mount Lyell Mine', *Zeehan and Dundas Herald*, 12 May 1919, p.1.
[2] Moore, T.B., diaries, 1–10 January 1891, ZM5627 (Huon pine dugout); 11 February–3 March 1880, ZM5617 (eating wombat); 19–23 February 1878, ZM5615 (eating eels) (Tasmanian Museum and Art Gallery, hereafter TMAG).
[3] Moore, Mary, letter to her family, 2 April 1889 (held by Margaret Elliston, Latrobe, Tasmania).
[4] Moore, T.B., diaries, 1906–08; ZM5636; 1908–10, ZM5640; 1911–12, ZM55641 (TMAG).

The digger and the tiger: the part of mining in the demise of the thylacine (Tasmanian tiger)

Nic Haygarth

The Tasmanian tiger, hyena, wolf, or thylacine (*Thylacinus cynocephalus*) was or is a marsupial carnivore. Although once widespread across Australia, at the time of European settlement it was restricted to the main island of Tasmania. The last captive specimen died in 1936; the animal was declared extinct in 1986.[1] Researchers have attributed its demise to loss of habitat, the introduction of dogs, bounty schemes and hunting by humans. Many believe that at a time when its reduced numbers made the species vulnerable, it was wiped out by a distemper-like disease.[2] Tasmanian prospectors and miners were the first non-indigenous occupants of some parts of the island, placing them in contact with the timid but curious thylacine. These people burnt vegetation to expose mineral outcrops and provide access; diverted waterways and polluted them with tailings; introduced dogs which could kill tigers; and unwittingly competed with tigers for game, taking away their food supply (Fig. 1). When hungry thylacines looked for food at mining camps, they were snared, axed or shot by men or killed by dogs.[3] Some of those which survived were driven out into farming areas, angering wool-growers who claimed that thylacines killed sheep.[4]

Figure 1: T.B. Moore, thylacine-skin cap, thylacine-killing dogs and studio snow.

Source: Moore papers, Tasmanian Museum and Art Gallery.

In the nineteenth century there was no market for thylacine skins outside of bounty schemes, the best-known being the £1 (per adult animal) government thylacine bounty 1888–1909 which netted 2184 dead specimens. However, once the thylacine became rare, the value of live specimens escalated, such that miner/hunters like Elias Churchill pocketed up to £30 for one which survived being snared.[5] Prospectors and miners' ambivalence towards thylacines was reflected in a variety of stories about encounters with them, from feeding them as if they were pets to fearing them as predators, sharing their lairs to fighting them off with sticks and guns.

[1] Paddle, Robert, *The last Tasmanian tiger: the history and extinction of the thylacine*, Cambridge University Press, Cambridge, United Kingdom, 2000, p.195.
[2] See, for example, Guiler, Eric, *Thylacine: the tragedy of the Tasmanian tiger*, Oxford University Press, Melbourne, 1985, pp. 28–29.
[3] See, for example, 'J.S.' (James Smith), 'The Black Bluff', *Launceston Examiner*, 3 June 1862, p. 5.
[4] See, for example, Norton Smith, James, to Van Diemen's Land Company Board of Directors, 29 September 1887, pp. 282-83, Outward Despatch no. 343, VDL7/1/7 (Tasmanian Archive and Heritage Office).
[5] For Churchill, see Paddle, *The last Tasmania tiger*, pp. 190–91; or Bailey, *The lure of the thylacine: true stories and legendary tales of the Tasmanian tiger*, Echo Publishing, South Melbourne, 2016, pp. 263–65.

Ailments of the miners: hard times, hard rocks

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Early Australian miners suffered greatly, many died. Our goldfields have unmarked graves; mining towns have memorials to those who died in accidents. And there those who just disappeared– lost, died of disease, thirst or starvation. Accidents were common; unguarded mine holes claimed the unwary trying to find their way home late at night or perhaps those who had lost a disagreement over a claim. Sudden floodings led to drownings– at Creswick in Victoria 22 men perished when trapped by water underground.

Sanitation on the goldfields was shocking and fresh water in short supply. Lack of vegetables led to scurvy and malnutrition contributed to pneumonia. Outbreaks of typhoid fever were common; the disease occurred in all states but was rampant at Teetulpa in SA– hundreds were infected with a high mortality.

Development of deep mines brought other problems. Instead of being hit by falling earth miners were hit by falling rock or fell from precarious ladders descending a straight 100 m.underground. Explosions above or below ground were frequent. With the advent of high speed drills, continuous working shifts and poor ventilation dust disease was universal. Dust plus tuberculosis (‘miners’ phthsis) was particularly deadly. Miners’ nystagmus, once common in Britain, also occurred in Australian miners.

Apart from all of this, there were some unusual diseases– Barcoo rot and Barcoo Fever, ailments related to conditions and climate, affecting those in remote areas, particularly those seeking new fields. Today there is improvement, we have work and safety, but accidents still occur.

All that glitters is not . . . – Diamonds in Australia

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Although Australia has a long history when it comes to mining diamonds, this history was broken into two quite separate stages: early activities during the late 1800s to early 1900s in New South Wales; and current activities which have operated at Argyle, Western Australia, since the late 1980s. Mining diamonds in Australia has not always been one of success or financial reward.

The first Australian diamonds were recorded in river deposits at Reedy Creek near Bathurst (NSW) in 1851[1] with additional finds in other creeks in the area in 1852, 1859, and significant finds at Two Mile Flat on the Cudgegong River in 1867. Diamonds were discovered by gold prospectors at Bingara in 1872 and at Copeton, near Inverell, later the same year.[2] Mining commenced in the Inverell area soon after the diamonds were discovered and continued, somewhat sporadically, until 1922. The Bingara-Copeton diamonds were found in deep leads and no primary source for these alluvial diamonds has yet been found. Total production for NSW was:

- Copeton – 170,000 carats
- Bingara – 30,00 carats
- Macquarie River – 4,000 carats
- Cudgegong River – 2,000 carats[3]

Alluvial diamonds were found in Western Australia in the late 1800s but it was not until 1969 that a systematic search for a primary source of diamonds was undertaken in that state. Indicator minerals were found in the Argyle area (Kimberley region of Western Australia) in 1976 and in 1979 the Ashton Joint Venture found alluvial diamonds. In October of that year the Argyle pipe, source of the alluvial diamonds, was discovered. The decision to commence mining was taken in 1983 and a mine was commissioned in 1985. Production of diamonds at Argyle commenced as a surface operation but in recent times an underground mine operated.

Argyle diamonds are unique in that the diamonds are coloured, varying from many shades of brown and pink-red to purplish and blue. The largest pink Argyle diamond weighed 12.76 carats (2.552 g). A 28.84 carat white diamond, named *Argyle Octavia*, was discovered in 2019.[4]

[1] *Diamonds in Australia*, http://www.minelins.com/alluvial/diamondGeology43.html, March 2011, 3 pp.
[2] Gayle Sutherland, *Diamond*, Australian Museum, https://australianmuseum.net.au/learn/minerals/gemstones/diamond, 2019, 5 pp.
[3] Anon., *Diamond*, NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/minerals/geological/industrial-mineral-opportunities. 5 pp.
[4] Evan Morgan Grahame, *Rare large white diamond found at Western Australia's Argyle Mine*, https://www.abc.net.au/news/2019-04-23/huge-diamond-founs-at-rio-tinto-argyle-mine-in-wa/11038146

In the footsteps of John Moffat:

Mining entrepreneur and developer of the Cairns Hinterland

Ruth Kerr

[1]The University of Queensland, St Lucia Qld

This presentation examines and assesses the mineral development of the Cairns Hinterland from 1880 to 1918 by the single entrepreneur of the region, John Moffat (Fig. 1). It covers the establishment of mineral treatment and associated industrial facilities. John Moffat was the mining magnate of north Queensland and successful financier of the region, developing the mineral deposits at Herberton, Watsonville, Irvinebank, Montalbion, Chillagoe, Mount Garnet, Mount Molloy, Mount Mulligan, Mount Carbine, Wolfram Camp, Koorboora, Coolgarra, OK and various adjacent smaller mining camps as well as financially underpinning the Cloncurry area developments in 1906-1914.

Figure 1: John Moffat photographed in Glasgow in 1882, aged 41.

Source: Glasgow Photographic Studio.

Moffat had arrived in Herberton in October 1880 with a battery to develop the Great Northern tin deposit, undertook a major overseas research trip in 1882 and moved west to Irvinebank in 1883 after tin lodes were discovered there. Loudoun Mill and Loudoun House became his headquarters. He continued development westwards to Montalbion becoming a millionaire there with his silver smelter development and float on the London Stock Exchange. His managers explored the Chillagoe copper, silver, lead deposits in 1886 and he opened primitive smelters on the field at Calcifer in 1894 and Girofla in 1896 enabling promotion of the field to Melbourne and Broken Hill financiers.

The Cairns Hinterland region's infrastructure is largely due to Moffat's investments and his private railways. Chillagoe, Mount Molloy, Mount Mulligan and Mount Garnet railways were all constructed in response to his companies' developments. He also ventured into timber north of Mount Molloy and at Ravenshoe. The whole empire was funded by the private company, Irvinebank Mining Company with three shareholders and Moffat's promotions of public companies.

Pauline Catherine Speckhardt: The 'Lady Miner of Kingsgate', NSW

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In the early mining history of Australia, a small number of women appear as mine owners, managers and developers. Pauline Spechkardt was one sufficiently active and determined in her mining interests to earn the appellation of the 'Lady Miner of Kingsgate'.

Figure 1: Pauline Spekhardt in 1902.

Pauline was born in Adelsheim, Baden, southern Germany on 28th January 1871 to parents Johan Christoph and Christina Speckhardt (nee Weihs).[1] She had an older brother Frederick. After Johan died, Christina married Valentine Sachs and in 1877 the family emigrated to Australia, when Pauline was six years old. Her stepfather set up as a tinsmith in Glen Innes in northern NSW and became a successful businessman, with farming property, a soap factory and mining interests. He was also a prominent member of the community, serving more than 20 years as an alderman and two terms as Mayor of Glen Innes. In 1901 he became involved in the Kingsgate mines, working unusual quartz-rich pipes containing molybdenite-bismuth. Shortly after acquiring the 'Old No. 45' pipe he struck a huge vugh with rich masses of molybdenite and over the next 10 years made a significant fortune mining several leases. Pauline developed an interest in the Kingsgate mines and assisted her stepfather in mining activities, including as his agent. In 1912 she took out her first mining lease in her own name.

Valentine Sachs died on 26th November 1913. He left his substantial mining investments to Pauline, probably because of her keen interest and involvement with the mines and possibly because he felt, that as a single women she would be able to support herself as a mining entrepreneur. Pauline energetically took up the challenge, taking out additional leases and managing mining operations. During World War I the price of molybdenum rose sharply, due to its use in armaments, and molybdenite production from the Kingsgate mines increased. Records are incomplete, but over 3 years the Speckhardt operations produced at least 22.5 tons of molybdenite concentrate worth around £4,700. After the war, the molybdenite price collapsed and the Kingsgate mines shut down, but in 1922 Pauline recommenced mining molybdenite, as well as producing bismuth concentrates.[2] From 1924, she sold molybdenite crystals for use in radio crystal sets under the registered trademark 'Sacrystal'. These retailed for 1/6 per crystal. However, financially things were not going well and in 1930 she was in the bankrupt court.

In 1932 Pauline proposed a bold plan to redevelop molybdenite mining at Kingsgate with working of four deposits around a new central treatment plant. During 1931-33 she made three dogged, but unsuccessful attempts to get financial assistance from the NSW Government for this project. She then attempted to set up a syndicate of Sydney investors to raise £2,000 to reopen the mines, but this stalled, even though molybdenite was now selling at £250 per ton. The main concern was the small size of the individual deposits. All up she had spent £10,000 of her own funds developing the mines. Despite these setbacks Pauline persisted in prospecting and small-scale mining until her death on 28th January 1938. She was described as displaying 'energy, pluck and resource' in her attempts to develop the molybdenite-bismuth resources of the Glen Innes area, but the financial rewards were not commensurate with the efforts she made.[3]

[1] Death Certificate, Reg. No. 4821/1938, NSW Registry of Births Deaths and Marriages.
[2] D.A. Nicholson, 1966. Kingsgate molybdenite & bismuth deposits. Geol. Surv. NSW Open File Report 1966/009.
[3] 'The Lady Miner', Glen Innes Examiner, 1 February 1938, p. 5.

Girilambone copper: How new technology can make a world of difference

Ken McQueen

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Advancing technology is a key driver in the successful mining and processing of mineral resources. Mining history demonstrates many cases where novel methods and technological breakthroughs have transformed the economic value and working of a mineral deposit or even changed the viability of whole mineral extraction industries. The Girilambone copper deposit in northwest New South Wales is a classic example of such transformation.

Copper was discovered at Girilambone in 1875 by Thomas Hartman, following a period of intensive prospecting in the region sparked by the discovery of copper at Cobar in 1870. Early mining from 1881 to 1885 by the Girilambone Copper Mining Company Ltd, with hand sorting of oxidised ore and direct on-site smelting or shipment for custom smelting, was a technical failure and financial fiasco. Failure was largely due to metallurgical difficulties with the smelting and lack of ore concentrating machinery. Redevelopment by the Girilambone Copper Mining Co. NL from 1896, introduced gravity concentration of the ores, with both on-site smelting and shipment of concentrates. This was more successful, but the company was unable to repay its capital investment, again due to the difficult metallurgy, as well as the relatively low grade of the ore. By the early 1900s the company had resorted to small-scale chemical leaching of low-grade ores and tailings, with copper recovery by the cementation process. This phase of mining ceased in 1907. From 1881 to 1907 total recorded production from the Girilambone deposit was 59,345t of ore for 1,159t of copper.[1]

The Girilambone mine then languished until 1990, when modern exploration defined a low-grade, but very large oxide-carbonate resource with an underlying supergene zone of enriched chalcocite ore (8 Mt of 1.4% Cu). It was thought that this material would be amenable to a new two-stage, hydrometallurgical process of bulk heap-leaching followed by solvent extraction and electrowinning of the copper (HL, SX-EW). An open pit mine, leach pads and treatment plant were constructed by the newly formed Girilambone Copper Company (initially a joint venture of Nord Australex Nominees Pty Ltd and Straits Resources Ltd). Successful mining and processing commenced in 1993, pioneering the introduction of the new technology to Australia. Improvements and developments, involving much metallurgical experimentation and some serendipitous discoveries, were required to adapt the HL, SX-EW process to local conditions. Ultimately it was possible to efficiently extract large amounts of high-quality copper from the near-surface parts of the deposit.[1] Over a ten-year period, 115,660t of 99.999% copper were produced on-site.[2] Near-mine and regional exploration during this period discovered significant primary copper ore at depth, which has extended mining in the area until the present.

Girilambone is an outstanding example of a copper deposit that had to wait for new technology in order to become a significant and economically workable resource. It provides a striking case for the more sustainable use of low-grade mineral resources through modern, high efficiency extraction technology. Metallurgical improvements at Girilambone led to the successful introduction of the HL, SX-EW process to other mines in Australia and in similar environments around the world. The process now accounts for about 20% of global copper production.

[1] Ken McQueen, 'Copper under the stars: The history of discovery and mining at Girilambone, northwest New South Wales', *Journal of Australasian Mining History*, vol. 16, 2018, pp. 127-147.
[2] Brad Cox, Geology Manager, Aeris Resources Ltd, written comm. 2018.

Greenvale Nickel Mine: Some historical notes.

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Nickel was first recognised at Greenvale by the Queensland Chief Government Geologist, Alan Denmead, in 1957. Subsequent testing by the BMR in 1958 confirmed low-grade nickel, mostly in the range 0.1 to 0.5 % Ni, with 2.4% Ni found at one locality. New Consolidated Goldfields held the Authority to Prospect (ATP) over the area and established a resource of 2 Mt of 0.8 % nickel, but decided that the nickel grades were too low and relinquished the ATP.

In 1966 Metals Exploration N.L. concluded a joint venture with Freeport Sulphur, Freeport having lost their huge Cuban Moa Bay nickel laterite operation in Cuba in 1960 following the Fidel Castro revolution. Encouraged by Forbes Wilson, the Metals Exploration team researched nickel in Australia and acquired an ATP over the Greenvale nickel laterite.

Seeing the potential for higher nickel grades beneath the surficial iron rich laterite, the first viable nickel grades were discovered in outcrop by Metals Exploration geologists David Burt and Anthony Jannink in 1966. Metals Exploration quickly mobilised and by mid-1968 had delineated 40 Mt of nickel ore grading 1.57 % nickel and 0.12 % cobalt. This led to legislated agreements between Metals Exploration, Freeport and the Queensland Government in 1970.

By 1974 the Greenvale nickel mine had been brought into production, with a new township developed and 225 km of railway to the Yabulu nickel refinery near Townsville. At Yabulu the ore was reduced then leached with ammonia/ammonium carbonate to recover a mixed nickel / cobalt sulphide and nickel oxide products.

With infrastructure well advanced, the new project suffered a severe set-back when with the oil price skyrocketing in 1973. Bunker C heavy fuel oil, the main cost component in the Herreshoff furnaces used to reduce the ore prior to leaching, at least trebled resulting in increased operating costs. The Ni price also fell dramatically, and labour costs were increased by Union agitation. The Queensland Government, however, honoured its legislated guarantee and took major equity in the Project thus enabling the operations to continue. The State sold off its interests in 1995, making a profit of over $182M.

Multiple problems were experienced during the initial months of production, with higher than anticipated mining dilution, lower grades, and low recoveries at Yabulu. Once identified, the effects were countered by changing practices to maintain ore quality and the projected mine life, at minimal production cost. That the mine was able to continue through so many years of adverse economic conditions reflects well on the dedication of the workforce at all levels.

As was originally envisaged, nickel laterite ore was imported to replace Greenvale ore when the original reserves were mined out in 1992. The Yabulu refinery continued with a chequered history until the cyclic nickel price slump of 2015 forced the operations into receivership.

Special thanks are extended to David Burt for permission to use extracts from his “Personal Account of some Orebody Discoveries 1966 – 2007 (and a few associated stories)” June 2015 (private publication) plus other information from his early involvement with the Project without which this paper would not have been possible.

A history of the Zillmanton Mine

Owen Ray

CASE, James Cook University

The Zillmanton copper mine was the major mine of the New Chillagoe Mines and Railway Company from 1898 to 1911 and at the turn of 20th century it was a major base metal mining and smelting development in North Queensland (Fig. 1). The mine produced c. 32,000 tons of copper. It suffered from a number of problems the worst of which was excessive water, requiring an increasing number of pumps and bailing of water. Other problems were swelling ground (needing square-sets), hot mine conditions (requiring ventilation), and sulphuric acid and self-igniting sulphide ore. In the end, the mine had to close due to the water problem.

The remains of the mine consist of three shafts, each with Cornish style pump foundations, and bases for winders and compressors. Inspection of the mine site and understanding of the geology leads to the conclusion that the water being pumped from the mine was probablly returning to the aquifer being pumped.

Figure 1: No. 1 Shaft, Zillmanton mine, looking north toward the surface workings, circa 1906.

Source: Cairns Historical Society.

Ravenswood: the hidden places and people of a goldfield

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Gold was discovered in Ravenswood in North Queensland in 1868, initiating various phases of gold mining activity which peaked in the early 1900s but still continues. At its height, the Ravenswood Goldfield was an important contributor to Queensland's revenue and helped pioneer a number of gold processing technologies. What exists now is the remnant township and a complex archaeological landscape relating to 150 years of gold production and domestic activity. In 2016 approximately 50 ha of the area were entered on the Queensland Heritage Register as the Ravenswood Mining Landscape and Chinese Settlement Area (QHR Item ID: 650038).

Proposed expansion of existing gold mining operations within and around the heritage area resulted in the development of conservation and archaeological management plans to form the basis of a heritage agreement with the Queensland State Government, allowing the development to proceed. Out of these plans has come an extensive archaeological salvage program, including of the first town cemetery and various goldfield homestead lease sites. This paper outlines some of the preliminary findings related to the work done to date. Its focus is not on the mine managers and other important people of the town, or on the significant mining infrastructure, for which there is abundant historical information, but on the lesser known inhabitants: the workers existing in the shadow of the mines and mills. It looks at the hidden domestic life and conditions for ordinary Chinese and European residents living scattered across the goldfield; their dwellings, material culture and occupations; and, for some, the causes of their deaths.

This project, led by Niche Environment and Heritage, has been innovative in working closely with the proponent and authorities throughout the planning process and collaborating with the Queensland Museum, University of Queensland and local community in providing long-term education, research and tourism opportunities with the data and artefacts recovered.

Warning: this presentation contains images of human skeletal remains.

Proposed national geotourism strategy and mining heritage

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Geotourism, a holistic form of nature-based tourism, is a significant emerging and growing global phenomenon. Geotourism focuses on an area's geology and landscape as the basis for providing visitor engagement, learning and enjoyment'. Geotourism is increasingly seen as a valuable tool for regional development. Geotourism focuses on an area's geology and landscape as the basis for providing visitor engagement, learning and enjoyment'. It has links with adventure tourism, cultural tourism and ecotourism, but is not synonymous with any of these forms of tourism, although in broad terms it embraces them all. In summary, geotourism:

- adds considerable content value to traditional nature-based tourism (the primary motivator of travel to Australia) as well as cultural tourism, inclusive of indigenous tourism, thus completing the holistic embrace of 'A' (abiotic –landscape and geology) plus 'B' (biotic) plus 'C' (culture) aspects. It empathises an approach of increasing interest to protected area managers, particularly given the experience gained from the now discontinued Australian National Landscape programme;
- celebrates geoheritage and promotes awareness of and better understanding of the geosciences - of increasing interest to geological survey organisations;
- contributes to regional development imperatives in areas experiencing social and economic difficulties through increased tourist visitation, particularly from overseas – of increasing interest to local government authorities (LGAs) and state based, regional development commissions and agencies;
- creates professional and career development for geoscientists;
- provides a means of highlighting and promoting public interest in mining heritage – of interest to The Australasian Institute of Mining & Metallurgy (AusIMM), the Australasian Mining History Association and the Australian Institute of Geoscientists;
- provides the means of increasing public access to geological information through a range of new information and communication technology (ICT) applications e.g. smartphones, 3D visualisation etc. – of increasing interest to geological survey organisations and visitor information centres; and
- Engenders an increasing awareness of the importance in geology as a fundamental science that has had and will continue to have major impacts on civilisations.

The Australian Geoscience Council (AGC), which is the Peak Council of geoscientists in Australia representing eight major Australian geoscientific societies with a total membership of over 8,000 individuals, is currently consulting with state/territory government agencies with the aim of developing a national strategy predicated on consideration of a number of broad topics which include identifying mechanisms for collaboration with providers of other areas of natural (bioregion) and cultural heritage content, inclusive of mining heritage. Through the auspices particularly of the Heritage Committee of the AusIMM (an AGC member), it has been recognised that much of Australia's rich mining heritage, including many outstanding mineral collections, has not been adequately integrated into tourism product development.

Other topics under consideration include geotourism as a means of celebrating and better coordination nationally of geoheritage data bases, establishing a national set of administrative procedures for 'georegional' assessment to provide for potential geopark nomination, new geotrail development, and using geotourism to strengthen Australia's international geoscience standing and enhance its influence for the long term benefits of Australian geoscientists.

Last mine on Kozzie

David Scott

Research PhD student, School of Environment, Society & Design, Lincoln University, NZ

The Grey Mare Gold Mine sits in the heart of the Jagungal Wilderness, within the Kosciuszko National Park, 28km northeast of the highest point in Australia.

From its establishment as the Boogong Mine in 1894, operations quickly shifting from shallow alluvial workings to open cut and adits, and the mine went through three major phases of activity over the following 50 years.

The final phase was enacted by a handful of locals, but was placed on hold when some were sent off on active service in the Second World War. By the time they returned, the whole area had become a new State Park and plans were afoot to commence the Snowy Mountains Scheme. Mining was not part of the new vision for the area and the lease at Grey Mare was terminated in 1953.

Throughout its life a key feature of the mine was its remoteness. At ~1650m elevation the mine is likely to be the highest major working in Australia. Miners had to cut a crude track, drag in the equipment to process the ore and cart out the gold, with operations generally ceasing each winter as snow blanketed the entire area from June to September.

The winter snow became a catalyst for recreational stories. In 1898, a party including prominent photographer Charles Kerry undertook the first ski ascent of nearby Mt Jagungal, arguably the first ski tour into the Snowy Mountains backcountry, guided by the mine manager and stopping at the miners' huts. After closure of the mine, Australian cross-country ski champion Robbie Kilpinen used the site as a training base, converting one of the old equipment crates into a sauna.

Accessible today only by walkers and skiers, the site is remarkable for its wilderness setting. the range of different types of mine workings evident, and the vast quantity of equipment left behind as each operation was closed down – the remoteness making extraction unviable.

Figure 1: Adit 1 ca. 1934.

Source: Bell Collection.

Figure 2: Stamper Battery foundation,

Source: Photo by David Scott 1991.

Herberton: At the beginning

Ivan Searston

Volunteer, Herberton Mining Museum, Jacks Road, Herberton.

North Queensland was settled as part of the Herbert ministry's strategy of continuing and expanding progressive pastoral settlement. From the southeast corner to the Gulf, expansion created with it a basic infrastructure of ports and station homesteads that could act as jump-off points for further exploration of the left-behind rougher country. Further, the potential value of minerals other than gold was known, and tin, in particular, had an industrial demand, and processing facilities were already established in southern colonies. The real impediment was cost of transport.

In north Queensland this changed with the discovery of the Palmer Goldfields - and goldfields had to be provisioned. Cooktown, the new port, was quickly linked to its rich interior by passable roads and shipping from the south became regular. This left space for backloads. When tin ore was discovered in Granite and Cannibal Creeks, tributaries of the Palmer River, its richness, and the fact that a road now existed to the port of Cooktown, and that shipping was available, attracted the interest of miners. Tin ore could now be exported profitably.

The same scenario was in place for the Hodgkinson goldfield, closer to the Tablelands. When in 1877, John Atherton took up Emerald End, near present day Mareeba, and adjacent to the track that linked Port Douglas and (to a lesser degree) Cairns, to the Hodgkinson goldfield, a find of tin near the southern boundary of his run also presented an opportunity. Further exploration in the vicinity occurred and a party, consisting of William Jack, John Newell, John Brown, and Thomas Brandon, was successful beyond its wildest expectations. The prospectors found not only rich alluvial deposits, but also extensive and rich lode deposits. Transport was deemed manageable, once the intervening dozen miles to the Hodgkinson-Port Douglas Road were bridged.

Herberton progressed apace. Extensive additional mineral lands were found, especially to the west. The issue of Mineral Licences rapidly reached the hundreds. The town was laid out and businesses flourished. Though Moffat, an early investor in Herberton, relocated to Irvinebank in 1884, Herberton had the advantage of being able to broaden its economic base to include agriculture and timber. It also became an established centre of government and a supply centre for the district. Even when a slight downturn allowed Moffat to consolidate by buying out his failing Herberton competitors, that broader economy could absorb the setback. With a spike in tin prices in 1888, the future looked assured.

But all that foundered with the 1890s. Lower tin prices, a drop in production, the collapse of the Victorian property bubble, bank collapses, red water fever and local pest outbreaks, the repeal of the Sherman Silver Act and the Silver Crash, a great fire in the main street, all contrived to turn to dust the vision of a new mining city in the north.

Mulgrave Goldfield: mines in the rainforest

Jan Wegner

Humanities Group, James Cook University, Cairns Campus

The history of Australia's smaller goldfields tends to be written by local historical societies rather than professional historians, who are mainly interested in the more important fields. However, the 'poor man's fields' can have some distinctive qualities while still reflecting the usual trends for gold mining across the nation. The Mulgrave Goldfield is one. Like other goldfields, it was affected by the 1880s capital boom when money was spent freely on goldfields; benefited from the 1890s and 1930s depressions, when gold kept its value and many goldfields revived; and was practically abandoned when World War II depressed gold mining as a non-essential industry. However, it was unusual in that it was close to a major regional town, helping to save that town when Cairns was in danger of disappearing, and providing poorer groups such as the unemployed and Aborigines with a useful source of income from alluvial gold. It was also in the Wet Tropics so it always enjoyed a plentiful supply of clean water and timber. However, that also meant it rained most months of the year, and miners had to cope with some annoying pests and plants such as paralysis ticks, leeches and stinging trees. The steep terrain of the coastal ranges and dense forests also made transport difficult, and the lodes were small and patchy. Cyaniding of mill tailings was impossible when those tailings were washed into rocky fast-flowing rivers. Company mining failed over three periods of its history and even small miners found easier places to win gold.

Figure 1: Alluvial mining, Mulgrave Goldfield.

Source: Cairns Historical Society.

Mt Molloy Copper Smelter

Jan Wegner

Humanities Group, James Cook University

The Mt Molloy smelter was built to serve the Mt Molloy Copper Mine, three km away, and operated between 1904 and 1908. It was responsible for founding the small township of Mt Molloy, 55 km northwest of Cairns. It was one of the many enterprises of mining entrepreneur John Moffat, who was involved in nearly every base metal mining field in north Queensland. It failed partly because the mine was over-capitalised, mainly because of the expense of a railway built from Mareeba, but also because of a severe fall in copper prices in late 1907, and declining ore values at depth. It was unable to carry on through taking public ore because there was only one other copper mine in the immediate area, and mines further away had the option of sending their ore to the Chillagoe smelters.

The technology used is similar to other copper smelters of its size and times in Queensland, using a blast furnace, though with the matte further treated by both a reverberatory furnace and a converter. Other copper mines were moving to flotation to treat low-grade ores but Mt Molloy Ltd was unable to raise the capital needed to implement this change, and the plant was sold off in 1919 when the company went into liquidation.

This paper uses photographs, documentary sources and site remains to analyse the way the smelter worked, how it changed over time and why it changed.

Figure 1: Mt Molloy smelter ca. 1905.

Source: Queensland State Archives, Digital Image ID 23715.

An unusual gold-chaser: Carl Axel Egerström

Jan Wegner

Humanities Group, James Cook University

Usually, individuals become of interest to historians when they either cause significant change or events, or are representative of groups of significance in history. Carl Axel Egerström was neither. He was one of that group of miners who chased gold from California to Victoria and North Queensland, and ended up in the Hodgkinson goldfield west of Cairns, but he was also a soldier, farmer, coal mine manager, and plantation owner in Fiji. A member of a Swedish gentry family in decline, he searched all his life for the fortune that would enable him to buy back the family estate in Sweden, but died poor as a small and unsuccessful miner on the Hodgkinson.

One of the most unusual aspects of his life was the extraordinarily complex home site he built near the road crossing of Caledonia Creek, between the two main towns of Thornborough and Kingsborough. Like the man, this home is atypical for small miners. This paper examines Egerström's life to help explain the remarkable cultural heritage site he left on the Hodgkinson goldfield, and to consider his significance in gold mining history.

Figure 1: Egerström's house site, Hodgkinson Goldfield.

Source: Photograph Jan Wegner.

Notes

Field Trip Program

Day	Times	Field Trip
Sunday 7 July	8.30am – 5.00 pm	Mt Mulligan: Pick up at International Club.
Monday 8 July	3.30pm – 5.30 pm	Aboriginal Geology Tour of Atherton Tablelands.
Wednesday 10 July	8.30 am-5.00 pm	Herberton Mining Museum and Great Northern Tin Mine, Herberton; Irvinebank: Loudon House Museum, town tour, Vulcan Tin Mine.
Friday 12 July	2.00-3.00pm	Atherton Chinese Temple and Museum.
Saturday 13 – Sunday 14 July	8.30 am – 6.30 pm 7.30 pm 8.00 am – 4.30 pm	Chillagoe/Mungana/Zillmanton/ Chillagoe Smelters BBQ at Post Office Hotel. John Nethery (Geologist) Talk on Chillagoe's geology, Town Hall. Pick up at Chillagoe Lodge and Chillagoe Tourist Village – Mungana; lunch at Chillagoe; to Cairns and Atherton.

Permission and assistance to visit these sites, from the relevant mining companies and land-owners, is gratefully acknowledged.

Important Safety Information for Field Trips

Please bring a hat and sunscreen. Closed in shoes are essential in case of snakes and other hazards, and long trousers or jeans are strongly advised. Wear warm weather gear for Mt Mulligan and Chillagoe, but bring a jumper. Drink plenty of water – it's easy to become dehydrated.

Do not remove artefacts, and never turn over pieces of iron (snakes, spiders, centipedes and scorpions can live there). Watch where you are going in long grass and check the other side of logs before stepping over one. First aid kits and insect repellent will be available if needed. We cannot give you painkillers so please bring your own.

Introduction to the Field Trip Program

The field trips associated with the conference will visit key historic mining areas of the Atherton region and hinterland. Mineral discovery and subsequent mine development in the regions was the catalyst for the development of an extensive railway network, necessary for the economic transport of supplies and the mineral products. These early railways assisted greatly in further settlement and development of the forestry and agricultural industries. Figure 1 (below) shows the years of initial development of the major mining areas and Figure 2 the dates of construction of the railways that followed.

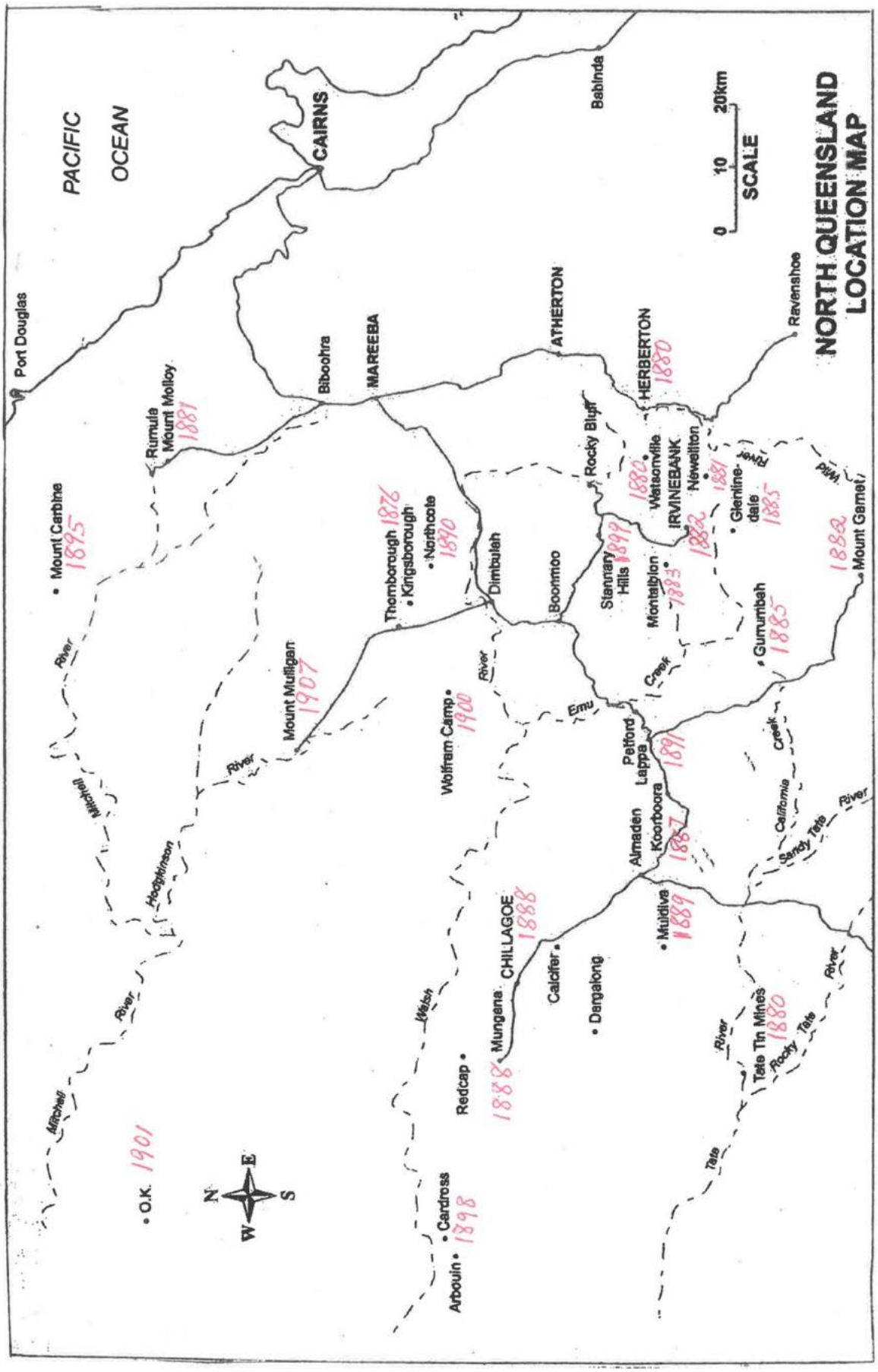

Figure 1: Map showing the dates (in red) of significant development of important mines in the Atherton region. Compiled by R. Kerr.

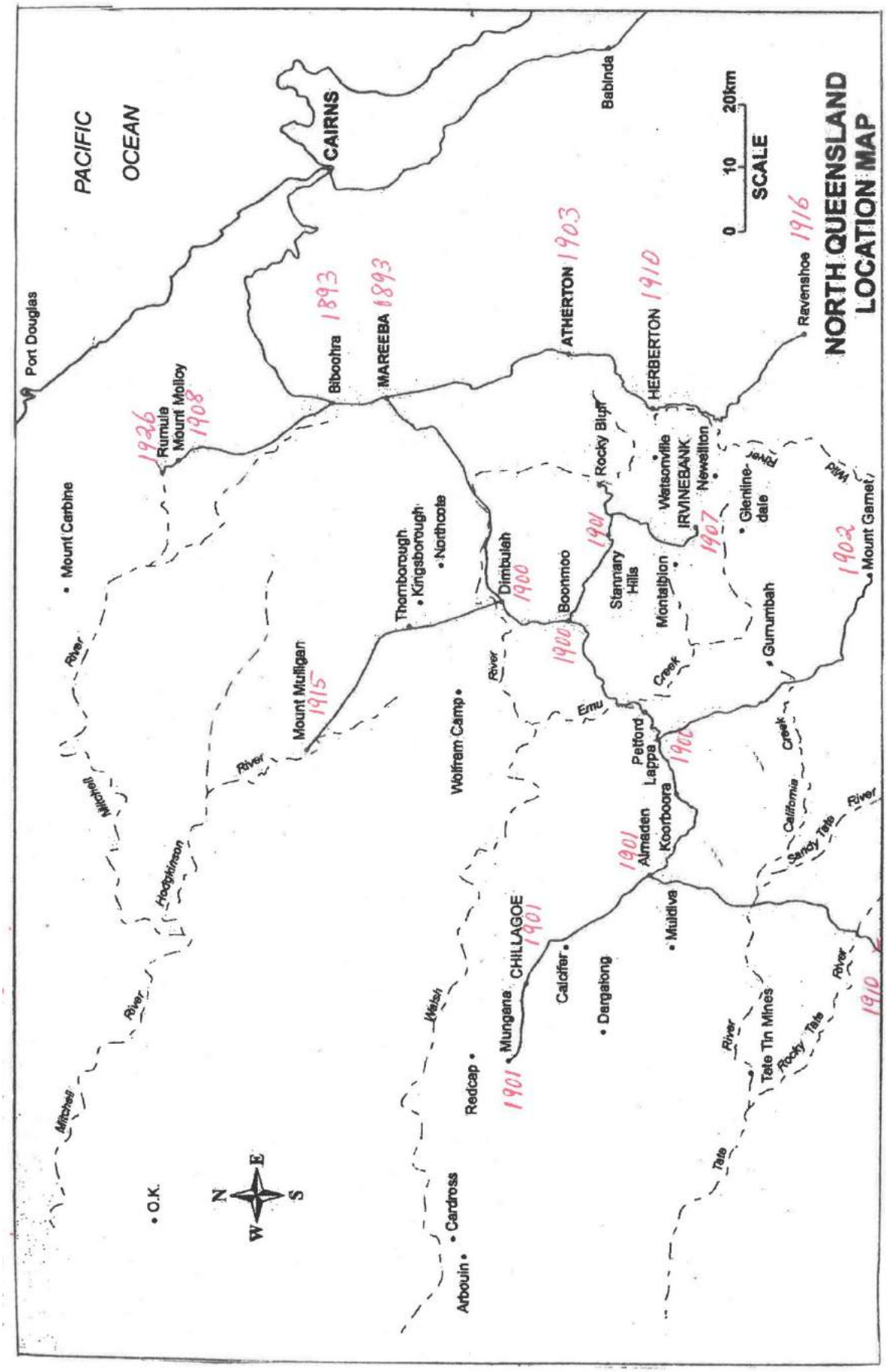

Figure 2: Map showing the opening dates (in red) of railways in the Atherton region. Compiled by R. Kerr.

Site Descriptions

Mount Mulligan

Peter Bell

Mount Mulligan or Ngurrabullgan is an impressive mountain of red sandstone (Fig. 3), which was occupied by Aboriginal people at least 37,000 years ago. It is now owned by the Djungan people. European explorers called it Mount Mulligan in 1874. Underneath it was a coal seam of Permian age which became Australia's northern-most coal mine, in production from 1914 to 1957, first owned by the Chillagoe Company and later operated as a State Mine.

On 19 September 1921 the Mount Mulligan coal mine was devastated by a coal dust explosion, killing the entire underground workforce of 76, the third-worst industrial accident in Australian history. The disaster brought to an end the 24-year unsuccessful and incompetent career of the Chillagoe Company, and the state took over the mine.

The town site was abandoned in 1958, the town hospital surviving to become the homestead of the surrounding cattle property, and now part of an upmarket tourist resort. Depending on the condition of the local roads and vegetation, the tour will visit the town site and memorial to the disaster, the mine entrance and the cemetery.

The report of the Royal Commission into the disaster can be read or downloaded from the internet at:
https://archive.org/details/ReportOfTheRoyalCommission...DisasterAtMountMulliganCoalMine1921/
or
https://www.academia.edu/39343777/Mount_Mulligan_Royal_Commission

Peter Bell's 1977 honours thesis on the topic can be read or downloaded at:
https://www.academia.edu/26713252/The_Mount_Mulligan_Coal_Mine_Disaster_1921.pdf

Figure 3: View of Mount Mulligan (indigenous *Ngurrabullgan*) from the east, showing remains of the coal loading facilities and powerhouse with chimney stack. Entrance to the coal mine is behind and left of the stack. Source: Photograph by K. McQueen 2019.

History of Mount Mulligan

Mt Mulligan was a coal mining town operating between 1914 and 1958. Its history is marked by Queensland's worst industrial accident, the coal dust explosion which killed 75 miners.

Ngarrabullgin is a sacred place to the Kuku Djungan people, who have occupied the surrounding country for over 37,000 years. It is a sandstone monolith 400 metres high and is 18 km long and 6.5 km wide. Its European name was to honour prospector James Venture Mulligan, who began the gold rushes to the Palmer Goldfield in 1873 and Hodgkinson Goldfield in 1876. The Hodgkinson goldfield adjoins the mountain. Cairns and Port Douglas began as ports for this goldfield. However, it took until 1907 for gold miner Bill Harris to find a piece of the coal that underlies this sandstone mountain.

The find was exciting news for John Moffat of Irvinebank and the Chillagoe Company, both with smelters needing fuel at a time when the price of the metals they were producing was falling. Until then, all their coal came all the way from Ipswich in southern Queensland, and Newcastle in N.S.W. Both took up leases on the coal deposit, though the Chillagoe Company bought Moffat out later. Cheap coal was also useful for the isolated railway network in the Cairns hinterland. The Company persuaded the Queensland government to build a railway to the mountain in 1913-14, when the town sprang up.

The Chillagoe Company had ambitious plans for the mine. It began coke kilns – coke is produced by heating coal in a reduced oxygen atmosphere, which gets rid of impurities. Coke burns much hotter than coal and was a useful fuel for smelters. The Company also installed worker housing, a brick-making plant, a steam boiler fired power-house which generated electricity for the town and mine buildings, and coal cutting machines to reduce labour costs. The mined coal was brought out by an adits (tunnels with only one opening to the outside), with coal trucks drawn by an endless ropeway. The cables took the trucks to a weighbridge and then to a coal tippler which loaded the coal into railway trucks. Trains were the only way in and out of the town and came twice a week. One of the adits housed a large ventilation fan at the opening to improve air quality in the mine.
By 1921 there was a small community established, with 300 people including 90 miners. They kept two pubs, a picture theatre, five stores and a church operating, though the church blew down in the 1920 cyclone.

It might have been an omen. The mine was considered very safe because it didn't produce dangerous methane ("firedamp"), an explosive gas. However, it was very dry and dusty. Dust that can burn is dangerous, and it only takes a layer of coal dust the thickness of a page to produce an explosion. It does need to be stirred up to float in the air, and then needs an explosion to set it off. At 9.25 am on 19 September 1921, this must have happened at Mt Mulligan. It sent a wall of flame through the mine at around 1000 metres a second, faster than a rifle bullet, raising more dust for fuel as it went. Witnesses heard a double explosion and saw a blast of air, smoke and debris coming from the main adit, and went running. The first person they saw was the blacksmith, dazed but alive, his smithy near the adit mouth leaning at an angle. Inside the adit they found two men badly injured but alive. One died within a few hours, the other was dead by the end of the week. Rescue volunteers came from everywhere in the north but the Company had to ventilate the mine to get rid of dangerous gases from the explosion – carbon dioxide and carbon monoxide. They finally found 72 more bodies, and some were never identified. There was one man missing and his body was found nearly 6 months later. In just one accident, the town lost a third of its adult population. 40 of the men were married, 35 with children.

There was surprisingly little damage to the mine itself and most of the repairs were done during the rescue operation. By early 1922 the mine was re-opened, but it continued its run of bad luck. The coking works had teething problems, the worst of which was the coal itself – it wasn't really suitable for coking.
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There were two long strikes. The Chillagoe Company, already financially shaky, couldn't cope with all these problems and sold the mine to the state government in 1923. Straight after, it went into liquidation.
The Queensland government operated the mine until 1957 to supply the Chillagoe smelters, also a State venture from 1918, and its own railway locomotives with coal. Peak production was in 1924. However, the coal wasn't popular with the train drivers, being 'shotty' (including lots of stone). It was said the

northern railways were lined with stones thrown out of the loco fireboxes. 1924 was also the year the coast railway reached Cairns, and Mt Mulligan coal was only marginally cheaper than the better quality coal being produced from the first Bowen Basin mine at Collinsville, near Bowen. Mt Mulligan was about to be closed when the miners offered to take it on tribute ie. run the mine themselves, and pay a royalty per ton to the State on the coal mined. It limped along until 1947 when the State took over again as part of a re-organisation of State coal mine operations. The State improved facilities, including a road to Dimbulah and change rooms for the miners, but a drilling program found that coal reserves were small and poor quality. From 1955, diesel locomotives began to replace the steam trains, and the last use for Mt Mulligan coal disappeared (the Chillagoe smelters had closed down in 1943). The final straw was spontaneous combustion in the coal of the main workings. The mine was sealed in late 1957. The miners, their housing and much of the equipment were relocated to Collinsville and the town was abandoned, apart from the hospital (built in 1936) which became the homestead for Mt Mulligan cattle station. It has since been bought by Chris Morris for an outback resort.

Another, smaller mine, the King Cole, was also operated nearby between 1941 and 1957 by Tableland Tin No Liability, for the power-house which supplied electricity to its tin dredge near Mt Garnet. It had to close because the mine destabilised the rock face, and a crack developed which eventually (April 1958) dumped 250,000 tons of sandstone off the side of the mountain.

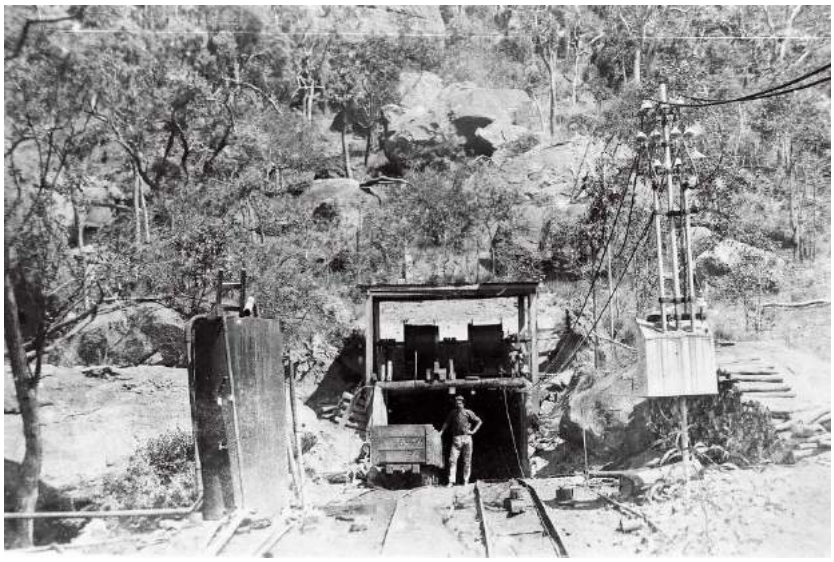

Figure 3: View of the entrance to the Mt Mulligan coal mine before the 19th September 1921 explosion. Source: Mary Wardle photo collection.

Figure 4: Collapsed entrance to the historic Mt Mulligan coal mine in 2019. Source: Photograph by K. McQueen, July 2019

Figure 5: Mt Mulligan township, showing hotel (centre).
Source: State Library of Queensland.

Figure 6: Mt Mulligan coal tippler, 1917.
Source: State Library of Queensland.

Figure 7: Coal bins above railway lines, Mt Mulligan 1917.
Source: State Library of Queensland.

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Herberton and Irvinebank

Ruth Kerr

Herberton and Irvinebank were the centres of the tin industry in north Queensland. Discovered in 1880 and 1882 respectively they were developed into major centres with up to 40 head of stamps at the Great Northern and Loudoun Batteries owned by John Moffat through private companies. John Moffat commenced the Herberton battery in 1881 and the Loudoun mill at Irvinebank in 1884. Both were custom mills serving individual miners. By continuously upgrading the machinery Moffat continued to make profits and operated a smelter at Irvinebank. In the surrounding region there were many companies promoted by Moffat operating in the smaller mining centres, as well as the rich Vulcan mine. When the state government failed to build a railway to Irvinebank, Moffat's Irvinebank Mining Company constructed the narrow gauge Irvinebank Tramway to link with the Stannary Hills Tramway. As mines were worked out, profits fell and Moffat retired. The Queensland government took over the Loudoun Mill as a state enterprise, the Irvinebank State Treatment Works, in 1919 after Moffat died. The brick chimneys of the mill were demolished by the military in 1942 and the tramway closed.

The Great Northern battery at Herberton closed when the world tin market collapsed in 1985 and the Irvinebank Treatment works ceased operation in 1996. The Great Northern battery has been totally removed. The remains of the Irvinebank Treatment Works survive in a fenced enclosure owned by the Queensland government. Both towns continue as Tableland villages.

Figure 8: View of Herberton, ca. 1895. Source: State Library of Queensland.

The Vulcan Tin Mine, Irvinebank

The Vulcan tin min produced over 10,200 tons (10,364 t) of tin concentrates during a working life of nearly 40 years. It was the mainstay of mining magnate John Moffat's base metal empire and paid regular dividends for a little over half of its working life. It was eventually closed by a combination of falling returns and declining tin prices. It is also significant for its role in the formation of the Australian Workers' Association, which became the Queensland branch of the AWU, and for launching the careers of two Premiers of Queensland, E.G. "Ted" Theodore and William McCormack.

The lode was discovered by a party of Italian charcoal burners who found ore containing 20% tin. They sold out to a party of local miners in October 1890. These miners formed the Vulcan Tin Mining Company, which paid its first dividend in January 1891 - the first for the district. John Moffat bought up a controlling interest and eventually launched the Vulcan Tin Mining Company N.L., beginning a period of vigorous exploration and development. He installed a 16 h.p. Tangye double drum winding engine powered by a 40 h.p. Cornish boiler, a 9 metre high timber headframe, and cages for hauling men, supplies and ore in the shaft. Initially water was bailed from the shaft but in 1895 a pump was installed, along with a compressor to work two rock drills in the mine. A cement and brick water tank with a domed top, on the hill above the mine entrance, supplied water into the adit. By 1903 it was one of the deepest tin mines in Australia.

High above the Vulcan was the Tornado mine, taken up in 1883. In 1900 it had a 8 hp. winding engine with double winding gear, a headframe, and a pump. Moffat's Irvinebank Company had acquired it in 1890 in case the rich Vulcan ore shoot trended into the Tornado's lease. It was only worked extensively between 1900 and 1903 until the ore became poorer and it was let on tribute.
By 1905 the Vulcan shaft was over 305 metres deep and the winding engine was replaced in 1906 by a more powerful winder of 100 h.p., capable of winding from 600 metres depth, made by Walkers of Maryborough. The timber headframe was replaced by a steel headframe 18 metres high; while it was under construction, ore was hauled up the Tornado shaft. In 1909 one of the two Cornish boilers had to be replaced and more powerful Babcock and Wilcox water tube boilers were installed. Another improvement was an aerial ropeway to take ore to the mill, replacing the dray teams. It was made by Aerial Ropeways Ltd of London and was erected in 1913. This meant constructing two new ore hoppers to sort the ore more easily, and raising the headframe 2 metres to make room for them. Firewood for the boilers was always a problem, but the construction of the tramway to link Irvinebank with the Chillagoe railway meant it could tap Mt Mulligan coal when this became available. It seems both firewood and coal were used.
After 1906 ore was becoming harder to find and an open cut on the hill above the water tank took out low-grade (3%) ore from the surface. By 1917 it was producing most of the output for the mine. Prospecting at depth, including with a Government subsidy, failed to find more than a few patches of ore and by 1922 the mine was let out to tributers. Even they abandoned it in 1926. Moffat had gained £60,000 in dividends from it, cushioning the effects of less successful ventures.

Moffat's finances were already in trouble by 1907 because of a catastrophic drop in tin prices and the cost of the tramway. He reduced wages in the Vulcan, resulting in a strike which failed. In response two young miners, 'Red Ted' Theodore and William McCormack, formed the Amalgamated Workers' Association. It won some battles elsewhere and in 1909 took on Moffat in a 4 month strike. The AWA became the Queensland branch of the AWU, the most powerful union in the country, and both Theodore and McCormack went on to become Treasurers and Premiers in the Queensland parliament, while Theodore became Federal Treasurer and Deputy Prime Minister after 1929 until both their careers were ended by the Mungana scandal.

The Vulcan mine was significant in history, not only for being one of the deepest and most productive tin mines in Australia, but for the history of industrial relations in the country. It is now on the Queensland Heritage Register.

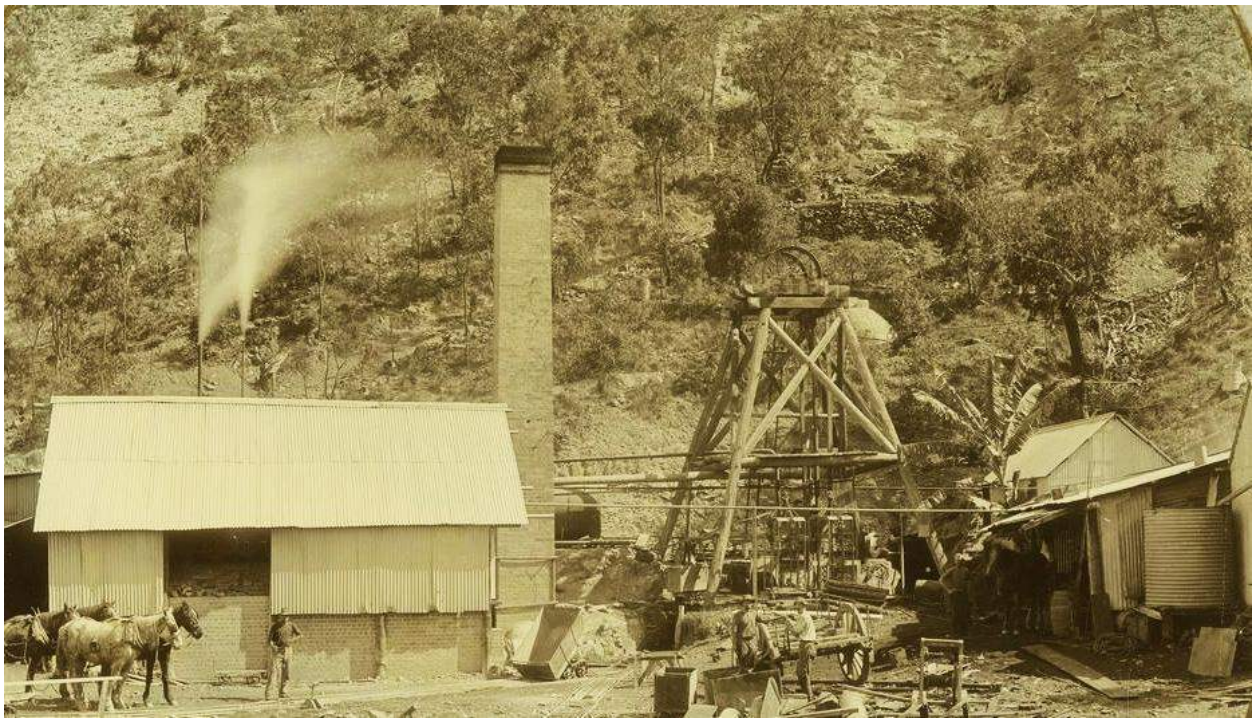

Figure 9: The Vulcan tin mine, Irvinebank, view to the west. Source: State Library of Queensland.

Figure 10: Headframe of the Vulcan tin mine in 2019.
Source: Photograph by K. McQueen, July 2019.

Chillagoe

Ruth Kerr

Chillagoe was an industrial centre with major smelters for treating the copper, silver, gold and lead mined in the Chillagoe – Mungana area. The smelters operated from 1901 to 1914 and 1919 to 1943. Copper was first discovered at John Atherton's Chillagoe Station in 1887 and Moffat financed further prospecting. Moffat's development of the area was temporarily stifled by the 1890s depression. In 1896 he succeeded in securing Melbourne capital to develop the mines and erect smelters and construct a railway from Cairns. The Chillagoe Railway and Mines Company Limited opened mines immediately and the smelters and railway in February 1901. The orebodies were chiefly surface deposits which did not warrant the vast financial investment. The Chillagoe company reconstructed several times and closed the smelters in 1914. They were reopened in 1919 by the Queensland government as a state enterprise, though the operation was plagued by scandals through the 1920s, resulting in a Royal Commission and court case which destroyed political careers. The smelter closed because of World War II and its remains were auctioned off in 1949. Remains of the machinery and chimneys are within the National Park surrounding Chillagoe and some interpretative signage has been erected.

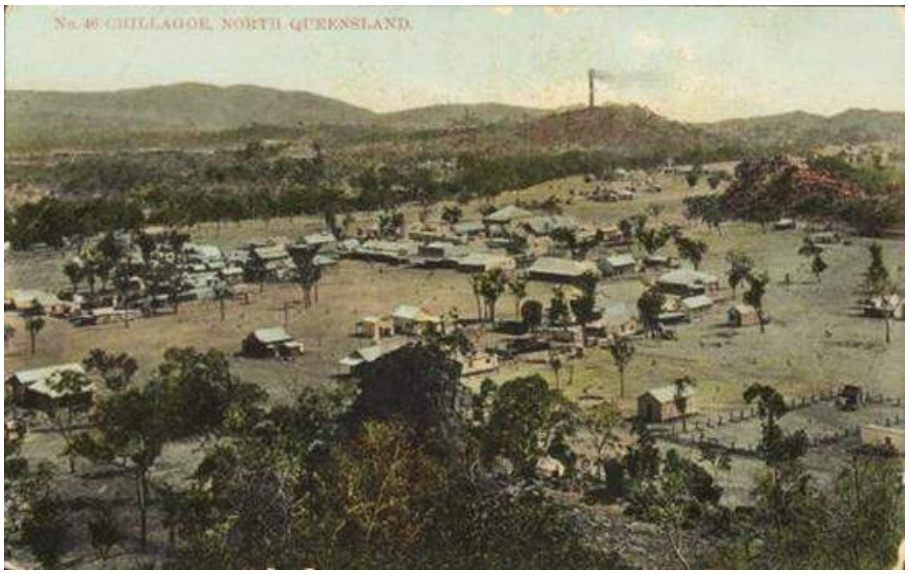

Figure 11: Chillagoe in 1905.
Source: State Library of Queensland.

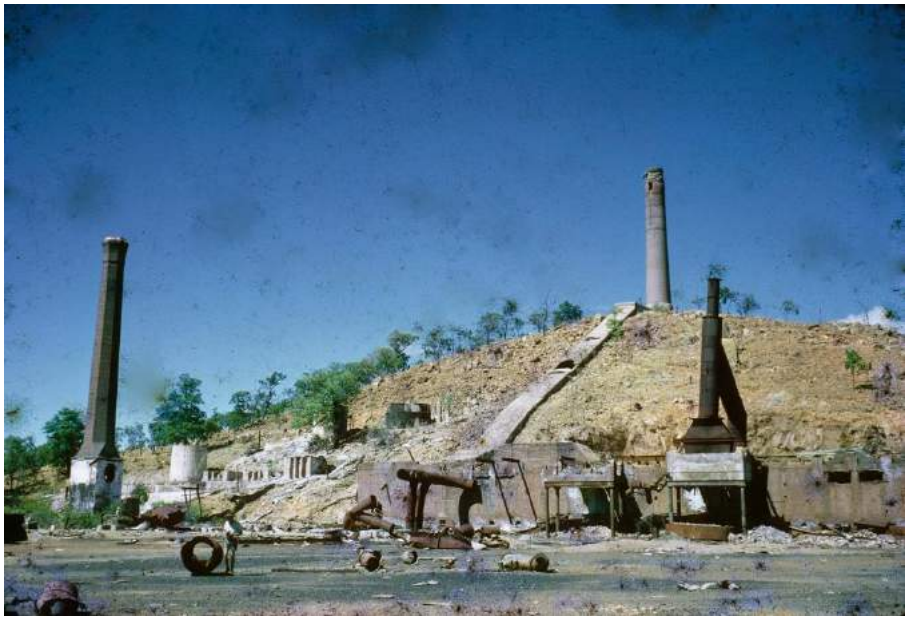

Figure 11: Remains of the state smelters Chillagoe ca. 1966.
Source: Photograph by W. Willmott.

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