



**AUSTRALIAN
MINING
HISTORY
ASSOCIATION**

ANNUAL CONFERENCE
Broken Hill, New South Wales
2-6 July 2003



Set-square timbering, BHP Mine, Broken Hill, 1890.



MAYORAL MESSAGE

Broken Hill, Australia's first industrialised city, is honoured to be selected as the host of the ninth annual Australian Mining History Association Conference.

Broken Hill is a unique city, with many sites of significance to our nation's mining and cultural heritage which are sure to be of particular interest to conference delegates.

I trust that all participants thoroughly enjoy the many excellent attractions and amenities that our city has to offer.

On behalf of the citizens of Broken Hill, I extend a very warm welcome to all delegates and I hope that the conference proves to be a huge success.

Ron Page
Mayor of Broken Hill
July 2003



PRESIDENT'S FOREWORD

The AMHA organising committee thank you for joining us at the 2003 conference in Broken Hill. This is a special occasion for the Association, because it is our first stand-alone conference in a major mining centre. Our previous conferences have been held in Townsville, Melbourne, Newcastle, Sydney, Hobart, Adelaide, Kalgoorlie and Brisbane, always under the umbrella of the Australian Historical Association, with its much greater numbers and more divergent interests. Only one of those conferences – Kalgoorlie in 2001 – happened to be held in a mining city. This year we have ventured out alone for the first time, and organised our own conference with our members' interests in mind. There could hardly be a more appropriate setting for a mining history conference than Broken Hill.

Broken Hill is one of the world's great base metal mining centres, famous for over 100 years for both the value of its mineral production, and its community spirit. Appropriately, a large part of our conference will be spent in telling aspects of the story of Broken Hill. We have several papers from members of the local community, bringing surprising new insights to a story that some people might think is already well known. Historians from around Australia and overseas have contributed papers on Broken Hill's place in the wider world; how the profits created here and the technology developed here went on to transform the mining industry in other places.

The conference could not have happened without the enthusiastic support of Broken Hill organisations and community members. I thank the City of Broken Hill, GeoCentre, the Barrier Industrial Council, the Trades Hall Trust and Consolidated Broken Hill Ltd, all of whom have helped to make the conference possible. I also thank my fellow members of the 2003 Conference Organising Committee in Adelaide – Greg Drew, Ross Both and Bernie O'Neil – and our Secretary/Treasurer, Mel Davies in Perth, for his superb organising and record-keeping skills.

Peter Bell

AMHA President

July 2003

PROGRAM

Wednesday 2 July

- 1500–1700 Registration and Open House at Geocentre
1800–2000 Welcoming Reception hosted by the Broken Hill City Council at Geocentre

Thursday 3 July

- 0800–0900 Registration at Trades Hall
- 0900–0910 AMHA President's Welcome
- 0910–1030 *First Session of Talks – Chair: Peter Bell*
Keynote Speaker
Ian Plimer The past is the key to the present
Gilbert Ralph The Broken Hill – Collins House connection
- 1030–1100 Morning Tea
- 1100–1230 *Second Session of Talks – Chair: Keith Johns*
Ruth Kerr The role of the Broken Hill millionaires in North Australia
Ross Both Broken Hill South's quest for new mines: the Kanmantoo venture
Fred Quivik The Inspiration Consolidated Copper Company's flotation mill and the beginnings of the flotation of copper ores in the United States
- 1230–1330 BBQ Lunch at Trades Hall
- 1330–1500 *Third Session of Talks – Chair: Ruth Kerr*
Sarah Martin Karnu Yaakaty or the Broken Hill: an Aboriginal perspective
Kathy Bennett Outback Archives: reflecting the community and region
Bill O'Neil The BHP lockout of 1909: the view from three generations of Broken Hill miners
- 1500–1530 Afternoon Tea
- 1530–1730 Broken Hill Bus Tour
- 1900–2130 Social Evening at Trades Hall

Friday 4 July

- 0900–1030 *Fourth Session of Talks – Chair: Mel Davies*
Keynote Speaker
Maja Sainisch-Plimer Charles Rasp, founder of Australia's 'Silver City' – Broken Hill
Barry McGowan Boom and bust on the Barrier
- 1030–1100 Morning Tea
- 1100–1230 *Fifth Session of Talks – Chair: Gordon Boyce*
Clive Beauchamp The anatomy of a strike: Wentworth Gold Mines, Lucknow, Orange, NSW, 1897
Jim Enever Gold mining on the Mornington Peninsula
Matthew Higgins 'To the Turon I Must Away': days of gold, decades of change at Sofala and the Turon Goldfield

- 1230–1330 Lunch
- 1330–1500 *Sixth Session of Talks – Chair: Ross Both*
 Philip Hart Australian capital in New Zealand: the Te Aroha Silver and Gold Mining Company
 Brian Hill Explaining the Reefton paradox
 Keir Reeves The forgotten quarter: Chinese diggers on the Mount Alexander diggings
- 1500–1530 Afternoon Tea
- 1530–1800 Delprat's Mine Tour or Religion Tour
- 1900–1030 Conference Dinner at the Line of Lode Complex

Saturday 5 July

- 0830–1030 City Walking Tour
- 1030–1100 Morning Tea
- 1100–1230 *Seventh Session of Talks – Chair: Philip Hart*
 Gordon Boyce Devices for reducing negotiating expenses in Australian mining
 Nicki Williams Brass among the gold: the development of the assay balance
 Sandra Kippen Responses of medical men to mining disease on the Bendigo goldfields
- 1230–1330 Lunch
- 1330–1500 *Eighth Session of Talks – Chair: Brian Hill*
 Greg Drew The dilemma of abandoned mines in South Australia
 Peter Benkendorff History of Portland cement
 Gerry MacGill The Northampton State Lead Battery, Western Australia: history and conservation
- 1500–1530 Afternoon Tea
- 1530–1700 *Ninth Session of Talks – Chair: Greg Drew*
 Keith Johns A mirage in the desert?: discovery, evaluation and development of the Olympic Dam orebody, Roxby Downs
 Ross Mainwaring Hill-Billy coal: a pictorial study of the coalfields of Kentucky and West Virginia, USA
 Justin McCarthy Heritage planning on the Line of Lode
- 1700–1800 Closing and Annual General Meeting

Sunday 6 July

- 0830–1230 Line of Lode Bus Tour or Cemetery Walk/Living Desert Sculptures

POST-CONFERENCE TOURS

Sunday 6 July

- 1330–1730 Day Dream and Silverton

Monday 7 July

- 0830–1730 Purnamoota, Terrible Dick, Euriowie and Byjerkerno Gorge

ABSTRACTS

The anatomy of a strike: Wentworth Proprietary Company gold mines, Lucknow, NSW 1897

Dr Clive Beauchamp

(Charles Sturt University, Bathurst, New South Wales)

This study analyses the background to and traces the course of the 13-week strike (involving 400 workers) at the Wentworth Proprietary Company gold mines at Lucknow, near Orange, New South Wales in 1897. The paper discusses the company's motives for reducing wages and instituting 'degrading' search conditions on employees. Were management's allegations of extensive ore pilfering merely a subterfuge? Why was the Mine Superintendent so intransigent in his dealings with miners' representatives? It also examines how ministerial interference with the role of the Mining Warden inadvertently led to the management being granted a suspension of labour conditions (preventing the lease being cancelled). This allowed management to continue operating by engaging 'black-legs' from interstate and re-employing surface workers – thus breaking the strike.

Cessation of the strike: searching relaxed and wage rates restored – but a greatly reduced workforce.

Significance of the dispute: highlighted the need for a compulsory arbitration system; ministerial intervention provoked a political storm that threatened the Reid Government; and the involvement of Labor Party members in the strike demonstrated how the parliamentary wing of the party could assist workers practically, countering charges of elitism.

History of Portland cement

Peter Benkendorff

(Retired Consulting Engineer; Member, Standards Australia Committee BD/10-Cement)

It has long been proposed that Joseph Aspdin was the father of Portland cement because he used the name in a patent dated 1824. However, evidence outlined indicates that he only produced hydraulic lime and further he was not the first to use the name Portland cement. The first to produce something close to Portland cement was William Aspdin in 1844. He did not patent his discovery and used the name Portland cement as a marketing tool. Others soon followed.

The available machinery and chemical knowledge on cement compounds held back production of quality cement until the late 1860s. The surge of production, particularly in Germany, led to the push for the world's first standard (published in 1877). This did not have a definition but an amendment in 1887 put in a definition, which required clinkering of the raw materials. Something similar was included in the USA and British standards which were first issued in 1904.

In Australia prior to 1977, it was generally believed that the first commercial Portland cement was produced at Portland in New South Wales (named after Portland cement) in 1889. Then it was claimed that William Lewis made the first cement in 1882 at a plant in Adelaide. However, the evidence indicates that Lewis followed Joseph Aspdin and made no more than hydraulic lime for a few months. All the early producers struggled to match imported cement up to 1901. A new modern plant with rotary kilns (amongst the first in the world) started in 1902 at Portland. This plant designed, constructed and managed by the brilliant Dr Scheidel expanded rapidly and by 1912 was producing 40% of Australia's cement consumption.

At Portland there exists the remains of Bottle lime kilns (1883), millstone grinding plant (1889), buildings from the plant (1902), quarries and a coal mine. It is the birthplace of the Australian cement industry and, as such, deserves recognition.

Outback Archives: reflecting the community and region

Kathy Bennett

(Information Services Officer, Outback Archives, Broken Hill City Library)

An archive collection has always existed within the Broken Hill Library Service since its inception in 1906. Today the Outback Archives is a regional repository for State Records of New South Wales as well as a recognised community archive. As a collection it has predominantly reflected the mining, industrial, commercial and physical aspects of the city and surrounding region, with less emphasis on social development and little or none on indigenous history or the role of women.

One of the challenges of the Outback Archives is to maintain and develop the existing collection while redressing the inadequacies that exist. Another is to make the collection accessible while ensuring its conservation by the use of microfilming and digital technology. The development of a digitised photographic database, both for the general collection and a special indigenous collection, has been a major component in responding to this challenge. The database includes thousands of photographs depicting Broken Hill's mining, social, industrial and physical history.

This paper discusses the history of the archive, its place within the community, aspects of the collection (both in the strengths and weaknesses of its focus and the physical nature of the material) and those areas being developed.

Broken Hill South's quest for new mines: the Kanmantoo venture

Dr Ross Both

(School of Earth & Environmental Sciences, University of Adelaide)

The Broken Hill South Silver Mining Company was floated in 1885 to work Blocks 5, 6, 7 and 8, located immediately adjacent to the southern side of the Broken Hill Proprietary Company's property. The first dividends were paid in 1897 and Broken Hill South went on to become one of Australia's major mining companies, with investments in mining and industrial operations elsewhere in the country. Its most prosperous years were in the late 1940s and the 1950s. With falling ore reserves in its Broken Hill mine, in the mid 1950s the company began an aggressive mineral exploration program on its mine leases, in the Broken Hill district in general and elsewhere in Australia. The need for copper for the smelter at Port Kembla, partly owned by Broken Hill South, led it to carry out major exploration programs in the Cobar and Kanmantoo areas.

Copper ore had been mined at Kanmantoo in the eastern Mount Lofty Ranges from 1846 until 1875, with production of about 19 000 t of ore from several small mines. Exploration by the Austral Development Company in 1938 found evidence of a wide zone of low-grade mineralisation. In 1962 Mines Exploration Pty Ltd, wholly owned by Broken Hill South, commenced an exploration program in the Kanmantoo region, employing geophysical methods. A strong induced polarisation anomaly was tested by diamond drilling and an exploratory shaft, and samples for metallurgical testing were taken from underground development from the bottom of the shaft. The decision to develop an open pit mine was taken in October 1969 and an operating company, Kanmantoo Mines Ltd, was formed, with Broken Hill South the main shareholder (51%). Mining commenced in August 1970. The mine produced good profits in the 1972-73 and 1973-74 financial years, but thereafter incurred losses as a result of falling world copper prices and rising operating costs. The mine closed on 30 June 1976, having produced 4 050 000 t of ore averaging approximately 1% copper. At least 8 000 000 t of ore averaging 1.1% copper remain beneath the now abandoned open pit.

Devices for reducing negotiating expenses in Australian mining

Professor Gordon Boyce

(School of International Business, Queensland University of Technology, Brisbane)

Strangely, transaction cost economists devote little attention to the expenses that parties incur when they actually negotiate deals. Instead, O.E. Williamson concentrated on the underlying variables (transaction-specific investment, the frequency of exchange, the number of bargainers and the degree of prevailing uncertainty) that shape the institutional outcomes of negotiating processes. He also focused on *ex post*

adjustments that are undertaken to modify an initial agreement. In this context, he highlighted the role of 'communicating economies' that parties who have some shared affiliation can achieve (see *The Economic Institutions of Capitalism: firms, markets, and relational contracting*, Free Press, New York, 1985). However, Williamson did not concentrate directly on the dynamics of initial deal making activities, and his framework treats bargainers largely as a 'given'.

In an effort to develop a more dynamic framework for evaluating co-operative inter-firm structures, P.S. Ring and A.H. Van de Ven in 'Developmental Processes of Cooperative Interorganisational Relationships' (*Academy of Management Review*, 18:1, 1994) introduced the idea of relationship building as a continuous process. This consists of three stages – negotiation, commitment, and execution – which are repeated over and over as parties forge their first agreement and then, make refinements in an ongoing manner. This approach explicitly addresses negotiating activities, and it incorporates formal, legal and informal social-psychological processes, all of which may shape outcomes.

This paper builds on the insights provided by Williamson, and Ring and Van de Ven by exploring in detail the dynamics of non-intermediated deal making. While recognising that negotiations will subsequently affect the quality of inter-firm relationships, the discussion concentrates primarily on initial bargaining in order to identify cost elements and devices that parties use to mitigate these expenses. The paper focuses on costs rather than outcomes. Although the benefits of successful deal making are alluded to, the records available do not support a comparison of expectations with outcomes. Negotiating expenses (particularly those that are time related) can be very significant indeed, especially when highly complex agreements have to be arranged between a large number of parties who must engage in multilateral discussions.

These ideas are explored using evidence drawn from the records describing how Western Mining Corporation structured its negotiations with Japanese and Canadian firms. The paper identifies distinct steps in the negotiating process, cognitive maps, devices that parties can use to facilitate transitions between these stages, and standard conventions that can be employed to accelerate progress.

The dilemma of abandoned mines in South Australia

Greg Drew

(Senior Geologist, Primary Industry and Resources SA, Adelaide)

Two major issues associated with abandoned mine sites in South Australia are the heritage significance of a site and safety and/or environmental risks.

The systematic heritage assessment of mines has been undertaken previously to develop a statewide strategy for giving systematic priority to conservation and interpretive programs. This assessment has been the basis for most of the mining heritage conservation and interpretive projects undertaken. In South Australia there are only two options for an abandoned mine site – do nothing and allow the site to decay naturally, or to conserve the remains in their present state with minor restoration and reconstruction of structures to provide focal points or visitor centres. For the vast majority of mine sites the former option is the only one.

The Office of Minerals and Energy SA has commenced an Abandoned Mines Project to create a database of historic mines with the ultimate aim of risk management of mine sites on Crown land. The project involves identifying various hazards on a site and the assessment of the overall risk on a site. A 'Risk Score', calculated using the hazard risk and the accessibility and exposure of a site, will be used in conjunction with its heritage significance to prioritise abandoned mine sites for risk management programs. Strategies for risk management will include isolating visitors from the site, backfilling, capping and fencing.

Gold mining on the Mornington Peninsula

Jim Enever

(Former mining engineer and CSIRO scientist, now an archaeology graduate)

Situated about 100 km south of Melbourne, the Mornington Peninsula separates Westernport and Port Philip Bays. Not noted among Victoria's gold producing areas, the peninsula does, however, boast a small slice of gold mining history among its better known agricultural origins. Located on Mornington Peninsula

is an area of geology reminiscent of the central Victorian goldfields, complete with auriferous reefs that have supported both alluvial and reef mining activities. Never of any great consequence in the context of the Victorian economy, these mining activities did, none the less, contribute to the development of the peninsula. Leaving behind no signs of settlement and little in the way of extant evidence of mining activities, it is difficult to build any sort of a picture of the way things were in the second half of the 19th century on these diggings. This paper attempts to draw together this limited history and integrate it with some of the remaining physical evidence to give some insight into this little known chapter in Victoria's gold mining history.

Australian capital in New Zealand: the Te Aroha Silver and Gold Mining Company

Philip Hart

(Research Associate, Department of History, University of Waikato, New Zealand)

In 1886 William Robert Wilson, a founder of the Broken Hill Proprietary Company, visited America to obtain experts for the Broken Hill mine and battery. During his return, he was told by a director and manager of the Battery Company at Waiorongomai, New Zealand of the large lodes in their property which they could not develop through lack of capital. Wilson inspected the ground, was impressed, and formed the Te Aroha Silver and Gold Mining Company with leading investors in BHP. Under the supervision of John Howell, later of Broken Hill, the 'best battery in Australasia' was erected. Although this was claimed to operate successfully, an insufficient amount of good ore meant mining ceased. To replace expensive cartage using a tramway with three self-acting inclines, a 5600 ft low-level tunnel was proposed. As financial assistance from the government was declined, the company fulfilled its threat to remove the machinery to Broken Hill and abandoned its mines.

This paper illustrates the common practice of investors erecting an expensive plant before doing sufficient prospecting to ensure there were adequate ore reserves and cheap local fluxes for the smelter. Experts were proved to be fallible, and created loss to investors and a serious setback for local mining.

'To the Turon I Must Away': days of gold, decades of change at Sofala and the Turon Goldfield

Matthew Higgins

(Historic Environment Assessment Section, Australian Heritage Commission)

The Turon Goldfield, north of Bathurst, was one of the major goldfields of New South Wales and Sofala remains as Australia's oldest surviving gold town. The Turon witnessed the intensity of the 1851 gold rush, significant technological developments spanning a number of decades, important political events and a high population of Chinese miners. Today's Turon landscape bears witness to the area's golden past, and the town of Sofala increasingly draws artists and film-makers.

Explaining the Reefton paradox

Brian R. Hill

Economic theory has it that during the period of the gold standard, because of gold's fixed nominal price, the output of gold should have varied counter-cyclically with fluctuations in the level of economic activity. However, the history of Reefton, which was New Zealand's second biggest gold field, poses something of a paradox in the field's first 40 years to 1912.

Although Reefton's level of output varied during the periods of inflation and deflation, and then inflation again, in New Zealand during this period, the variations in the field's output of gold demonstrated the opposite to this theory from 1872 to 1912.

Reefton's gold mining industry boomed during the inflationary Vogel boom in New Zealand, and then was depressed during New Zealand's 'long depression' from 1883 to 1895 despite the favourable economic conditions then for gold mining. Then Reefton's gold output expanded during the economic recovery and inflationary period in New Zealand from 1896 to 1912, even though the real price of gold fell because of its fixed nominal price.

This paper analyses the factors pertaining in Reef ton from 1872 to 1912 the economic effects of which were more dominant than the effect of the changes in the real price of gold during this period, and explains the 'Reef ton paradox'.

A mirage in the desert?: discovery, evaluation and development of the Olympic Dam orebody, Roxby Downs

R. Keith Johns

(Former Director-General, South Australian Department of Mines & Energy, Adelaide)

The discovery of extensive polymetallic mineralisation buried in a near-desert at a depth of 330 m and its subsequent development into what has become one of the world's truly great mines owes much to the endeavours of a few individuals but a great deal more to coordinated team efforts over a period of about 13 years.

In the beginning, explorationists displayed flair in generating ore model concepts and, perhaps, enjoyed some good fortune, not least of which was a supportive Board of Directors. There ensued a period of rare excitement as the dimension of the resource unfolded, and enthusiasm in preparing for its recovery and processing, and marketing its products – copper, uranium, gold and silver.

But it was not all plain sailing for Western Mining Corporation and the Olympic Dam Mine on Roxby Downs pastoral station. The developers would have to contend with politicians and government departments, not all of whom were favourably inclined – particularly as the orebody had a significant uranium content and all that entailed for the nuclear fuel cycle, for health, the environment, the Greenies and for the unknowing. Development would impinge on the Woomera Restricted Area and would have consequences for the opal mining industry at Andamooka and at Coober Pedy. And timing was coincident with moves directed toward achievement of Aboriginal land rights, a new awareness for recognition, heightened expectation of financial and other gain, and concern for the protection of ancient traditions and sacred sites; Aboriginal land rights and emotive aspects of mining had become unfortunately and irrevocably linked. There were also counterproductive blockades, protests and demonstrations; attacking the project was, for some, an exercise bordering on the inane.

Inevitably, sanity would prevail and Olympic Dam opened officially on 5 November 1988 – a mine that blinkered doctrinaire political opportunism had labelled as a mirage in the desert: some mirage, some desert!

The Broken Hillionaires in north Queensland

Ruth S. Kerr

(Team Leader, Native Title & Cultural Heritage, Queensland Department of Natural Resources and Mines)

The silver discoveries in north Queensland in 1883 at Mount Albion west of Herberton were quickly described as the new Broken Hill. From then on the north's entrepreneur, John Moffat, sought out Broken Hill and Melbourne capital to develop the mineral region. He succeeded at Chillagoe and Mount Garnet in 1896. Two directors of the Broken Hill Proprietary Company – William Knox, Melbourne and James Reid, formerly of Bowen and Ravenswood and editor of Broken Hill's *Silver Age* – were attracted to promoting new regional industrial complexes. They enlisted Herman Schlapp, metallurgist, and Alex Stewart, manager, of Broken Hill. Their enterprise transformed north Queensland, produced amazing share windfalls for the directors, but their smelters closed and had to be subsidised and taken over by the State to maintain local population centres for the next 50 years. This paper analyses what the Broken Hillionaires sought to achieve in the north.

Responses of medical men to mining disease on the Bendigo goldfields

Sandra Kippen

(La Trobe University, Bendigo, Victoria)

Mining disease, known variously as miners' consumption, miners' sickness, miners' phthisis, miners' tuberculosis or, quaintly, the disease of worn-out miners, became an issue of public concern in the early

1900s. In Bendigo the general practitioners were called upon to manage the condition, which was bringing early death in epidemic proportions to the men working underground in the goldmines. The cause of the disease was a subject of much debate and the medical opinion was divided between a 'blame the worker' approach which held that the genesis of sickness lay in the constitution and intemperate behaviour of the miners, and a 'blame the employer' approach which placed the responsibility firmly on the conditions in which the miners were forced to work. This paper examines the responses of the medical practitioners who, in aligning themselves with or against the mining companies operating on the Bendigo goldfields, were instrumental in negotiating the working conditions for miners.

The Northampton State Lead Battery, Western Australia: history and conservation

Gerry MacGill

(Gerard MacGill & Associates, Heritage Consultants, Fremantle)

The State Battery Service was established in Western Australia in 1897, when the State Parliament approved the expenditure of £30 000 for the purpose of establishing State-run batteries. The principal aim of the service was to promote mining by providing plants for crushing, ore dressing, cyanide treatment or smelting in districts where large deposits of ore were to be found, but where plant was not available at reasonable rates, and where such plant was deemed necessary for the development of mining. At its peak the system ran 40 batteries, predominantly treating gold ores. Exceptions were a tin dressing plant at Greenbushes, a small tin dressing plant installed at the Marble Bar battery, and the Northampton lead battery, established in 1954 to promote lead mining in the Northampton Mineral Field. The battery had a chequered history over its 29-year life. It is listed in the State Register of Heritage places, but many difficult issues of conservation and the legacy of a highly contaminated site dog its future.

Heritage planning on the Line of Lode

Justin McCarthy

(Managing Director, Austral Archaeology Pty Ltd)

The Line of Lode comprises all of the major mine sites in Broken Hill. These are the former North Mine, South Mine, Zinc Corporation and New Broken Hill Consolidated. As part of recent works funded from the Federal Government's Federation Fund, a major conservation management plan and integrated interpretation plan have been prepared for the Line of Lode. At the time of writing, parts of the site were still operational and plans are in place to open up a new decline that will keep the mine going for another 10 years or so. These documents consider the history and significance of the place as a basis for formulating appropriate conservation policies and interpretation strategies within an ongoing operational framework. This paper will provide an overview of the nature of the mining infrastructure at the site and summarise the approach taken for its conservation and interpretation.

Boom and bust on the Barrier

Barry McGowan

(School of Archaeology & Anthropology, Australian National University, Canberra)

Fuelled by increasingly high, and at their peak, almost outrageous silver prices, mining turned the harsh, craggy landscape of the Barrier Ranges into a hive of activity in the 1880s, as one rich surface deposit after another was discovered. This activity gave rise to a number of towns, most of them based on silver mining, but others like Euriowie, based on tin mining or other minerals. The most significant and enduring of the towns was Broken Hill, but Silverton and a number of other settlements, such as Thackaringa, Purnamoota and Day Dream, predated it. Falling yields and plummeting prices brought an end to the mines.

The early settlements were wild places and the scene of much drunkenness and disorderly behaviour. Eventually, however, they succumbed to the civilising influences of commerce, church and family. At Silverton there are numerous sandstone buildings, including several churches, a Masonic hall and municipal chambers. The remains of the other towns are less substantial, but still very compelling, for they also included churches, banks, hotels and the like. This paper discusses the growth of these settlements and their demise, placing some emphasis on their physical remains and heritage values.

Hill Billy coal: the coalfields of Kentucky and West Virginia

Ross Mainwaring
(Coal mining historian)

The coalfields of Appalachia provide a most interesting contrast with the coalfields of the different States of Australia. The early day remoteness of the mining towns, known also as 'patches', was dictated by the mountainous terrain and this isolation influenced the way of life of the miners and their families. Each mountain valley held captive its own mining town whose business revolved around a coal mine and a company store. In the days before paved roads and automobiles, the railway was the sole transport artery linking mine to market; they still are of great importance for the transport of coal. The industrial and cultural background of the region is in marked contrast to Australian coal regions. The author has undertaken many field trips to this Appalachian region so this slide presentation will feature the many sights of the coal mines and towns of these valleys.

Kamu Yaakaty or the Broken Hill: an Aboriginal perspective

Sarah Martin
(Consulting Archaeologist, Broken Hill)

The outcropping orebody of Broken Hill and many other surrounding landscape features are full of history for the Aboriginal people from the local area and as far away as the Flinders Ranges. Much of this history relates directly to the geology and landforms also of significance to mining history. This paper outlines some of the stories about creation ancestors, powerful rocks, significant landscapes, and the vitally important water resources. The creation of Broken Hill itself is discussed, the Aboriginal contribution to the identification of the famous lode, and the role Aboriginal people played in mining and the mining community. Other important landscape features such as the Pinnacles are described from an Aboriginal perspective, as is the role that the unique Broken Hill rocks played in the local and regional economy and social life prior to the rapid disruption that resulted from pastoralism and mining. The transformation of creation stories to incorporate new details about the mineralogy illustrates how elements of traditional culture adapted in an attempt to adjust to, incorporate and acknowledge the new order imposed by the miners.

The BHP lockout of 1909: the view from three generations of Broken Hill miners

Bill O'Neil
(Former President, Barrier Industrial Council, Broken Hill)

The industrial tradition of Broken Hill was shaped by the struggles of the early 20th century. This paper describes the great lockout of 1909 from the union viewpoint. Michael O'Neil, miner and unionist, was a participant in the lockout. His son, Bill 'Shorty' O'Neil was the youngest miner to take part in the strike that followed in 1919-20, and went on to become President of the Barrier Industrial Council from 1956 to 1969. The author of this paper is his son Bill, who was also President of the BIC from 1985 to 1995.

The paper describes the background to the 1909 lockout, its links with the shearers' strikes of the 1890s, and how its aftermath led to the 1919-20 strike, which was a breakthrough for the trade union movement in Broken Hill.

The past is the key to the present

Professor Ian Plimer
(School of Earth Sciences, University of Melbourne, Melbourne)

The sulphide ore bodies at Broken Hill, from stratigraphic base to top, comprise C Lode (Zinc Lode), B Lode (Zinc Lode), A Lode (Zinc Lode), 1 Lens (Zinc Lode), 2 Lens (Lead Lode) and 3 Lens (Lead Lode). The Broken Hill ores are hosted by and formed at the same time as a sequence of incredibly complicated ancient overturned rocks that have been bent double thrice and then refolded and faulted at least six times.

In the 19th and early 20th centuries, metals markets and metallurgy were such that only the lead lodes were mined for lead and silver (which reports to lead in Broken Hill concentrate), zinc ore was not mined and the zinc minerals in the Lead Lodes were discarded. Very high-grade silver ores were mined in the oxidised part of the Lead Lodes in the 19th century. Some 57 Mt of ore was mined from Consolidated Mining Lease 7 (CML7) which constitutes the old South Mine comprising the original seven leases and leases variously exploited by BHP, Sulphide Corporation, Junction, Junction North, North Broken Hill, South Broken Hill, and Minerals Mining and Metallurgy. The Zinc Lodes, which constitute the greatest mass of sulphides in the Broken Hill field, were ignored and unmined on CML7.

At the southern end of field, the exploitation of 105 Mt of ore comprising both the Zinc and Lead Lodes financed the growth of CRA. The tonnage of mined Zinc Lodes exceeded the tonnage of mined Lead Lodes. In terms of revenue generated at Broken Hill, in the 1970s zinc surpassed lead and silver. The Zinc Lodes have been mined from the old Zinc Corporation Mine up to its northern boundary (CML6–CML7 boundary). The Zinc Lodes clearly have no respect for a legal lease boundary and continue into CML7 yet they were not intersected by underground diamond drilling by either BHP or Normandy Mining Ltd. Recent drilling by Consolidated Broken Hill Ltd intersected the Zinc Lodes in a south-plunging west-dipping monoclinical structure.

In 1913 BHP discovered the Western Mineralisation, a down-dip extension of the Zinc Lodes. Because of the high costs due to labour, taxation, royalty, transport, smelter treatment charges, water, electricity and local government rates, the Western Mineralisation was too low grade for profitable mining. In the 1950s and 1960s, the Western Mineralisation was re-evaluated by Broken Hill South but was never exploited due to those high costs. In the 1970s the Zinc Lodes were discovered during deep drilling by North Broken Hill Ltd. In 1983 the zinc-rich Centenary Lode was discovered under Broken Hill and in the late 1980s zinc lodes were exposed but not mined in the Kintore and Blackwood Open Pits.

Various Broken Hill geologists have argued that there is probably more than 30 Mt of unmined medium grade zinc ore on CML7 in the Western Mineralisation and, by the late 1990s, all of the high costs at Broken Hill had greatly decreased, there was high unemployment of miners and labour conditions had changed significantly. It was at this time that Consolidated Broken Hill negotiated to purchase CML7 from Normandy Mining and since purchase has re-evaluated 120 years of data on CML7. This data was on seven different grids and in fathoms, feet and metres thereby requiring a complete resurveying of CML7.

Since the acquisition, CBH has drilled both the Zinc and Lead Lodes near the CML6–CML7 boundary, evaluated the remaining ore in the Kintore and Block 14 pits, drilled the remnant lead lodes in the Browne-Marsh Shafts area on the northern boundary of CML7 and undertook some 20 000 m of drilling of the Western Mineralisation. Since acquiring CML7, CBH has drilled more than 60 cored diamond drill holes, all of which have hit ore. Further work on the Western Mineralisation includes infill drilling, metallurgical testing, mine modelling and bankable feasibility studies for what will be a new mine at Broken Hill, the Rasp Mine. The Rasp Mine will owe its origin to an understanding of Broken Hill geology integrated with an understanding of the historical mining, metallurgical and cost conditions in the Broken Hill field.

The Inspiration Consolidated Copper Company's flotation mill and the beginnings of the flotation of copper ores in the United States

Fred Quivik

(Consulting historian specialising in mining and metallurgical technologies)

The Inspiration Consolidated Copper Company began operating its new flotation mill near its mine in the Globe/Miami mining district of Arizona in 1915. It was the first production-scale flotation mill for copper ores to be built in the USA. The paper will describe the history of its development in the context of the history of the development of flotation technologies at Broken Hill and elsewhere, in the context of the transition from selective mining to mass mining in the USA copper industry, and in the context of Inspiration's place in the corporate hierarchy of that copper industry. Rudolf Gahl was Inspiration's metallurgist in charge of developing a concentrator for the company's new porphyry mining operation in

Arizona. The paper will examine his experiments with flotation and his correspondence with officials of Minerals Separation Company Ltd, and with metallurgists at the Anaconda Copper Mining Company, with which Inspiration was closely affiliated. The paper will offer some suggestions as to why the mining industry in the USA waited nearly a decade after the successful implementation of flotation technologies at Broken Hill before fully embarking on adapting its own methods to the promises of greater recoveries offered by flotation technologies. Slides will accompany the paper.

The Broken Hill – Collins House connection

Gilbert Ralph

(Retired engineer, former Western Mining Corporation executive, Kalgoorlie, Perth and Melbourne)

Collins House, Melbourne became the headquarters of all the major Broken Hill mining companies after it was built in 1910 by W.L. Baillieu on wealth accumulated from Broken Hill investments. In examining the links between Broken Hill and Collins House, this paper reviews the inter-relationships between these independent companies and their directors and the many new enterprises which emerged from their creative minds, including smelting, refining, paint, paper, chemicals, cables, tubing, aluminium, metal fabrication, bronze, electricity generation and aircraft. Besides referring to the Collins House building, the paper looks at the involvement of the Baillieu, Robinson, Fraser, Stewart, Clark, Somerset and Monash families.

The forgotten quarter: Chinese diggers on the Mount Alexander diggings

Keir Reeves

(Department of History, University of Melbourne, Melbourne)

Past simplification of the Chinese experience on the Victorian gold diggings has highlighted the need for a more complex interpretation of their role in Castlemaine society. A case in point is the European understanding of Chinatown, initially the primary place of residence for an ethnic group in the community. Later it took on a cultural rather than spatial form: that place where the Chinese could be contained, consigned to a marginal position in history, typecast as exotic and atypical. Clearly what this discussion of Chinese–European experiences on the diggings illustrates is that the cultural identity of the Mount Alexander goldfields community (or for that matter constructions of 19th century Australian identity) need not be seen from a solely European standpoint. This is a point that previous conventional and progressive narratives have failed to fully acknowledge. This paper will argue that Chinese–European relations on the Victorian goldfields were more complex than popular historical narratives portray. It will also be argued that it is only by using a broad range of primary sources, including mining material culture and mining landscapes in conjunction with existing archival records, can a history of the Chinese on the Mount Alexander diggings be written.

Charles Rasp, founder of Australia’s ‘Silver City’ – Broken Hill

R.. Maja Sainisch-Plimer

(University of Melbourne)

Twenty years of research has uncovered the intriguing and fascinating life story of Charles Rasp, discoverer of Australia’s famous Broken Hill silver–lead–zinc ore body and founder of Broken Hill Proprietary Company, a mining company that has evolved into today’s multinational BHP Billiton.

For more than 100 years the story of Broken Hill’s discovery was the fairytale of the German-born boundary rider Charles Rasp who struck it lucky by discovering the magnificent line of lode in the gossan-capped hill called the Broken Hill in the far western corner of New South Wales. Long shunned by prospectors and nicknamed the ‘hill of mullock’, the Broken Hill made him a multi-millionaire and Australia’s ‘Silver King’.

Many have tried to uncover Rasp’s pre-Australian life story, to no avail. Charles Rasp was not Charles Rasp. He had changed his name, hidden his noble background and tightly guarded his secret: the true reason for escaping to Australia. For the media, friends and even his beloved wife he had slipped into the role of a former clerk of humble origin who had worked in the export department of a chemical firm in

Hamburg, Germany, and who had migrated to Australia for health reasons. The few who knew better had sworn to silence, and Rasp's secret was nursed and kept. It stayed intact for 100 years.

It was Rasp's portrait, taken in 1886, shortly after the Broken Hill Proprietary Company had poured out the first phenomenal dividends to its shareholders, that captivated me and caused a detective itch that did not leave until all of the mysteries surrounding Rasp were solved.

It took 13 years of intricate research *in persona* in as many countries on three continents to unravel his true identity and piece together the turbulent lives of Rasp and past generations of his family, and of the man who had adopted Rasp's true identity, playing havoc with my research. And it was to take further seven years of detective work to fathom the incredible events of Christmas Night 1870 on the outskirts of Paris that had rendered 23-year-old Rasp a fugitive for life and which prove once more that truth is stranger than fiction.

The biography of Charles Rasp is currently being written.

Brass among the gold

Nick Williams

(Monash University, Melbourne)

Assay office chimneys can still be seen in the remains of many Australian mining sites, such as Arltunga in the Northern Territory, Cue in Western Australia and Wallaroo in South Australia. Assay offices required accurate analytical balances, which were imported from overseas firms such as Oertling in London. The development of the assay balance reflects the increasing sophistication of machining and metallurgical processes. But what has been the fate of these beautiful precision instruments? Balances have been found in various states of preservation in many places in outback Australia, as well as in museums, tertiary institutions and private homes. The paper explores the background of some mining areas and associated Oertling balances discovered during exploratory trips over the last 10 years, particularly in 1995 and 2002.

BROKEN HILL TOURS

The italic references are to locations or page numbers in *The Silver Trail* guidebook supplied as part of the registration package.

CITY BUS TOUR

Thursday 3 July, 1530–1730

In following the Silver Trail from *Location 19 to 44* (pp. 5–19), the tour will give an overview of the history of Broken Hill's mining, settlement and architectural heritage. This will provide a good background for the conference participants. The tour will include stops at:

- Block 10 Lookout (*Location 112*)
- Keenan Lookout (*Location 25*)
- White Rocks Reserve (*Location 30*)
- Sturt Park (*Location 44*)

DELPRATS MINE

Friday 4 July, 1600–1800

Delprats Shaft is part of the original BHP Mine and commenced in 1900. It has been a tourist mine since 1972. This fascinating tour goes 200 m below the surface via a 1950s headframe and electric winder.

RELIGION TOUR

Friday 4 July, 1600–1800

A tour of religious sites will be an alternative for those not wishing to go on an underground tour. The bus tour will visit:

- Sacred Heart Cathedral – 1901 (*Location 40*)
- Wesley Church – 1888 (*Location 43*)
- Mosque – 1891 (*Location 56*)
- Synagogue – 1910 (*Location 24*)

CITY WALKING TOUR

Saturday 5 July, 0830–1030

Local volunteer guides will provide a walking tour of the main commercial area of Broken Hill. Commencing at the Visitor Information Centre, the tour will follow *Locations 1 to 42* on the Broken Hill Heritage Walk (p. 47).

LINE OF LODE

Sunday 6 July, 0800–1245

Tour guides: David Edwards (Perilya Ltd), Ian Plimer (University of Melbourne and Consolidated Broken Hill Ltd) and Justin McCarthy (Austral Archaeology)

0800 **sharp** Bus departs Mine Host Motel. *Please note that the bus must leave on time in order to complete the Line of Lode tour and return in time for the afternoon tour to Day Dream and Silverton.*

0815 Tour starts at lookout near Line of Lode Restaurant, then drive past Delprats Shaft (*Location 13*), BHP mill foundations (*Location 12*), slag heap (*Location 10*) and Prop Square to North Mine

0845 Drive through the North Mine complex (*Location 61*), now Perilya North lease

- 0915 Stop at Junction Mine site (*Location 65*). Drive to South Mine past Central Mine assay office (*Location 69*) and Central Power Station (*Location 70*).
- 0945 South Mine (now Consolidated Broken Hill lease). Drive to Thompson shaft (*Location 64*), open cuts (view from above only), visit No. 7 shaft complex (*Location 84*) and Central Power Station. Morning tea. Drive to NBHC Mine past Zinc Lakes (*Location 88*).
- 1145 NBHC–Zinc Corporation Mines (now Perilya South lease). Visit model room and drive past NBHC Mine complex (*Location 90*), Southern Cross Shaft (*Location 91*) and Zinc Mine complex (*Location 85*).
- 1245 Arrive back at Mine Host Motel.

CEMETERY TOUR
Sunday 6 July, 0900–1100

A walk through the local cemetery provides an insight into Broken Hill's rich and colourful history.

DAY DREAM AND SILVERTON
Sunday 6 July, 1330–1730

Tour guide: Barry McGowan

Day Dream was one of the earliest towns on the Barrier. Silver was first found in 1881 and the mines were at their peak in about 1885, the same year that the smelter was erected. The large chimney is on the road to the mine and town. Hut sites are to the west of the road. The township further along the track is on the left side. Numerous hut remains are scattered in the area. The tour includes an inspection of the mine, smelter and town site (where we intend to spend some time).

Silverton is one of the standout ghost towns in Australia. A small number of people still live in the town. Most of the buildings, other than the pub, have been reused for different purposes. Amongst the buildings are three churches, a Masonic Lodge, a gaol, a police station, the Shire council office, a schoolhouse and a courthouse. Most of the house sites are abandoned. We intend to spend an hour or so exploring the town.

PURNAMOOTA, TERRIBLE DICK, EURIOWIE AND BYJERKERO GORGE
Monday 7 July, 0830–1730

Tour guide: Barry McGowan

Good walking gear, hats, water and packed lunches are essential. This trip is a contrast to Sunday's, for the locations are much more remote and the remains are more muted.

The first stop is Purnamoota, on the station of the same name. Some of the buildings have been incorporated into the station buildings, but one stand-out remaining is the assembly hall, which is used as a mess hall for the shearers. There are still some small piles of stone from the chimneys of the huts. From there we go to the cemetery and the Terrible Dick Mine and smelter ruins.

There are a number of scattered sites on the Euriowie tin field. The first is the town site just off the Silver City Highway to Tibooburra. The remains are muted, for the buildings have all been dismantled, but the cellar or water tank of one is still intact, and the remains of the fireplaces of many others can still be seen. Next stop, a short distance away, is the cemetery. The final stop is picturesque Byjerkero Gorge, where there are miners' huts, mines and some of the battery remains. The property owner may accompany us. There is a small rocky scramble to reach the waterhole – proper walking shoes/boots are required! The time involved means that we will not, unfortunately, be able to visit Euriowie Gorge.

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