

AUSTRALIAN MINING HISTORY ASSOCIATION INC.
9th ANNUAL CONFERENCE
BROKEN HILL 2003

PROGRAMME TIMETABLE

Thursday 3 July

0900-1030

Keynote Speaker

Ian Plimer
Gilbert Ralph

The Past is the Key to the Present
The Broken Hill - Collins House Connection

1100-1230

Ruth Kerr
Ross Both

The Role of the Broken Hillionaires in North Australia
Broken Hill South's Quest for New Mines: the Kanmantoo venture

Fredric L. Quivik

The Inspiration Consolidated Copper Company's Flotation Mill and the Beginnings of the Flotation of Copper Ores in the United States

1330-1500

Sarah Martin
Kathy Bennett
Bill O'Neil

Karnu Yaakatyj or the Broken Hill: an Aboriginal perspective
Outback Archives: Reflecting the Community and Region
The BHP Lockout of 1909: the view from three generations of Broken Hill miners

Friday 4 July

0900-1030

Keynote Speaker

Maja Sainisch-Plimer
Barry McGowan

Charles Rasp, Founder of Australia's Silver City Broken Hill
Boom and Bust on the Barrier

1100-1230

Clive Beauchamp

The Anatomy of a Strike: Wentworth Gold Mines, Lucknow, Orange, NSW, 1897

Jim Enever
Matthew Higgins

Gold Mining on the Mornington Peninsula
'To the Turon I Must Away': days of gold, decades of change at Sofala and the Turon Goldfield

1300-1530

Ralph Birrell
Philip Hart

Gold Amalgamation and Chlorination
Australian Capital in New Zealand: the Te Aroha Silver and Gold Mining Company

Brian Hill
Keir Reeves

Explaining the Reefton Paradox
The Forgotten Quarter: Chinese diggers on the Mount Alexander diggings

Saturday 5 July

1100-1230

Gordon Boyce
Nicki Williams
Sandra Kippen

*Devices for Reducing Negotiating Expenses in Australian Mining
Brass among the Gold
Responses of Medical Men to Mining Disease on the Bendigo
goldfields*

1330-1500

Greg Drew
Peter Benkendorff
Gerry MacGill

*The Dilemma of Abandoned Mines in South Australia
History of Portland Cement
The Northampton State Lead Battery, Western Australia: History
and Conservation*

1530-1700

Keith Johns

Ross Mainwaring

Justin McCarthy

*A Mirage in the Desert?: discovery, evaluation and development
of the Olympic Dam orebody, Roxby Downs
Hill-Billy Coal: a pictorial study of the coalfields of Kentucky and
West Virginia, USA
Heritage Planning on the Line of Lode*

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ABSTRACTS

Clive Beauchamp: *The Anatomy of a Strike: Wentworth Proprietary Co. Gold Mines, Lucknow, NSW 1897*

This study analyses the background to and traces the course of the thirteen-week strike (involving 400 workers) at the Wentworth Proprietary Co gold mines at Lucknow, near Orange, NSW. in 1897. It 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 miner's 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 inter-state and re-employing surface workers- thus breaking the strike. Cessation of the strike: with searching relaxed and restoration of wage rates-but greatly reduced workforce.

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

Peter Benkendorff: *History of Portland 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, lead 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 US and British standards first issued in 1904.

In Australia prior to 1977, it was generally believed that the first commercial Portland cement was produced at Portland NSW (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 upto 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 1883 Bottle lime kilns, 1889 millstone grinding plant, a number of buildings from the 1902 plant, quarries and a coal mine. It is the birthplace of the Australian cement industry and deserves recognition.

Kathy Bennett: Outback Archives: Reflecting the Community and Region

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 and 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 heritage, social, industrial and physical history.

This paper will discuss the history of the Archives, 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 currently under development.

Ralph Birrell; Gold Amalgamation and Chlorination

Although the extraction of gold from crushed ores was described in detail by Agricola in the sixteenth century the introduction of the process in eastern Australia was accompanied by continuous debate on whether it was best to use mercury in the mortar box or not, whether mercury wells were effective, whether blanket strakes should be vibratory, whether mercury coated copper plates were better than strakes and whether to roast before or after crushing or not to roast. These issues were made more complicated when mine depths reached the water line and the presence of sulphides in the ore often sickened the mercury and reduced the amount of gold recovered. Years of experiment solved this problem for many mines but the more refractory ores defied treatment. In 1875 the Plattner process to extract gold was introduced in Bendigo and Ballarat successfully but was expensive and further experiments in the 1880s developed a more effective and cheaper process which was used widely in eastern Australia up to WWI for very refractory ores until replaced by processes using cyanide. The paper will argue that the Australian mining industry of the nineteenth was more sophisticated in the use of science and technology than is often believed and will question Jan Todd's comment that 'despite some pockets of experiment with chlorination, the vast bulk of the gold mining industry was ignorant of chemical extractive processes and the scientific principles which governed them'.

Ross Both; Broken Hill South's Quest for New Mines: the Kanmantoo venture

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 tonnes of ore from several small mines. Exploration by the Austral Development Company in 1938 found evidence of a wide zone of low grade mineralization. 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 polarization 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 per cent). Mining commenced in August 1970. The mine produced good profits in the financial years 1972-73 and 1973-74, 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 tonnes of ore averaging approximately 1 per cent copper. At least 8 million tonnes of ore averaging 1.1 per cent copper remain beneath the now abandoned open pit.

Gordon Boyce; *Devices for Reducing Negotiating Expenses in Australian Mining*

Strangely, transaction cost economics devotes little attention to the expenses that parties incur when they actually negotiate deals. Instead, Williamson concentrates 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 focuses on *ex post* adjustments that are undertaken to modify an initial agreement, and in this context he highlights the role of “communicating economies” that parties who have some shared affiliation can achieve (1985: 64). However, Williamson does not concentrate directly on the dynamics of initial deal making activities, and his framework treats bargainers largely as “given”.

In an effort to develop a more dynamic framework for evaluating co-operative inter-firm structures, Ring and Van de Ven (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.

The aim of the present paper is to build on the insights provided by Williamson and Ring and Van de Ven by exploring in detail the dynamics of non-intermediated dealmaking. 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 we do allude to the benefits of successful deal making, the records available do not support 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 the 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.

References:

Ring, P.S. and A.H. Van de Ven. 1994. Developmental Processes of Cooperative Interorganisational Relationships. *Academy of Management Review*, 18 (1): 90-118.
Williamson, O.E. 1985. *The Economic Institutions of Capitalism: firms, markets, and relational contracting*. New York: Free Press.

Greg Drew: *The Dilemma of Abandoned Mines in South Australia*

The two major issues associated with abandoned mine sites in South Australia are the heritage significance of the site and its safety and/or environmental risk.

Systematic heritage assessment of mines has been previously undertaken 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 conservation of mine sites – do nothing and allow the site to decay naturally, or conservation of ruins 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 is the only option.

The Office of Minerals and Energy SA (MER) 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. This will involve the identification of the various hazards on the site and the assessment of the overall risk of the site. A *Risk Score*, calculated using the hazard risk, and 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.

Jim Enever: *Gold Mining on the Mornington Peninsula*

Situated about 100km south of Melbourne Vic, the Mornington Peninsula separates Port Philip and Westernport 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 the 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 nineteenth 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.

Philip Hart: *Australian Capital in New Zealand: The Te Aroha Silver and Gold Mining Company*

In 1886, William Robert Wilson, a founder of BHP, 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 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 5,600 feet 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.

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

The Turon Goldfield, north of Bathurst, was one of the major goldfields of NSW and today Sofala remains as Australia's oldest surviving gold town. The Turon witnessed the intensity of the 1851 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.

Brian Hill: *Explaining the Reefton paradox*

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 Reefton 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 "Reefton paradox."

R. Keith Johns: *A Mirage in the Desert? Discovery, evaluation and development of the Olympic Dam Orebody, Roxby Downs*

The discovery of extensive polymetallic mineralisation buried in a near-desert at a depth of 330m 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 generation of 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 preparation for its recovery and processing, and marketing its products - copper, uranium, gold and silver.

But it wasn't 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 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 was officially opened on 5 November 1988 - a mine that blinkered doctrinaire political opportunism had labelled as a mirage in the desert: some mirage, some desert!

Ruth S. Kerr: *The Broken Hillionaires in North Queensland*

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. Directors of Broken Hill Proprietary, William Knox of 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.

Sandra Kippen: *Responses of Medical Men to Mining Disease on the Bendigo goldfields.*

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 local 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.

Ross Mainwaring: *Hill Billy Coal: the coalfields of Kentucky and West Virginia*

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.

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

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 forty 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 its future is dogged by many difficult issues of conservation and the legacy of a highly contaminated site.

Sarah Martin: *Karnu Yaakaty or The Broken Hill: an Aboriginal perspective*

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.

Justin McCarthy: *Heritage Planning on the Line of Lode*

The Line of Lode comprises all 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 Commonwealth 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 ten 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.

Barry McGowan: *Boom and Bust on the Barrier*

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 it was predated by Silverton and a number of other settlements, such as Thackaringa, Purnamoota and Day Dream. 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 civilizing 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. My paper discusses the growth of these settlements and their demise, placing some emphasis on their physical remains and heritage values.

Bill O'Neil: *The BHP Lockout of 1909: the view from three generations of Broken Hill miners*

The industrial tradition of Broken Hill was shaped by the struggles of the early twentieth 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 on to the 1919-20 strike, which was a breakthrough for the trade union movement in Broken Hill.

Ian Plimer: *The Past is the Key to the Present*

The sulphide orebodies 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 Century, 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 7 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 monoclinial 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 the above high costs. In the 1970s, the Zinc Lodes were discovered during deep drilling at North Broken Hill Ltd. In the 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 >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 Ltd negotiated to purchase CML7 from Normandy Mining Ltd and since purchase has re-evaluated 120 years of data on CML7. This data was on 7 different grids and in fathoms, feet and metres thereby requiring a complete resurveying of CML7.

Since acquisition, Consolidated Broken Hill Ltd 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 acquisition of CML7, Consolidated Broken Hill Ltd has drilled more than 60 cored diamond drill holes, every one of which has hit ore. Further work on the Western Mineralisation includes infill drilling, metallurgical testing, mine modeling 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.

Fredric L. Quivik: *The Inspiration Consolidated Copper Company's Flotation Mill and the Beginnings of the Flotation of Copper Ores in the United States*

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 United States. This 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 U.S. 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. Finally, the paper will offer some suggestions to explain why the mining industry in the United States 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. The paper will be illustrated with slides.

Gilbert Ralph: *The Broken Hill - Collins House Connection*

This paper examines the links between Broken Hill and Collins House, Melbourne, which 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. It 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. The paper refers

not only to the building itself but the involvement of the Baillieu, Robinson, Fraser, Stewart, Clark, Somerset and Monash families.

Keir Reeves: *The Forgotten Quarter: Chinese diggers on the Mount Alexander diggings*

Past simplification of the Chinese experience on the 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 nineteenth 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, mining landscapes in conjunction with existing archival records can a history of the Chinese on the Mount Alexander diggings be written.

R. Maja Sainisch-Plimer: *Charles Rasp, Founder of Australia's Silver City Broken Hill*

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 a mining company that evolved into today's multinational Broken Hill Proprietary Company Limited.

For more than a century 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 west 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 one hundred years.

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

It took thirteen 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 twenty-three-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.

Nicki Williams: *Brass Among the Gold*

Assay office chimneys can still be seen in the remains of many Australian mining sites, such as Arltunga in NT, Cue in WA, and Wallaroo in SA. 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? We have found balances, in various states of preservation, in many places in outback Australia, as well as in museums, tertiary institutions and private homes. This paper explores some of the background of mining areas and associated Oertling balances discovered during exploratory trips over the last ten years, particularly in 1995 and 2002.