

## **Nymagee copper: Birth, death and resurrection?**

By KEN MCQUEEN

*University of Canberra*

The discovery of rich copper ore at Cobar in September 1870 by three itinerant tank sinkers resulted in a boom in copper prospecting throughout this region of northwestern New South Wales. Awareness that this was ‘copper country’ meant that the local population, as well as experienced prospectors, were alert for the telltale signs of green and blue copper carbonates. A number of new discoveries were made by pastoral workers, who had the opportunity to traverse and closely examine the landscape. One such discovery was made at Nymagee by two shepherds, partly assisted by a knowledgeable boundary rider. The discovery was inspected and purchased by Russell Barton, one of the major investors in the Cobar copper mines. A private company was quickly formed and mining rapidly developed.

The subsequent history of the Nymagee mine followed a pattern similar to that of other copper mines in the Cobar region. Early mining was of rich, near-surface carbonate-oxide ore and secondary supergene sulphides. Reverberatory furnaces were built on site to effectively smelt the ore. As mining progressed, primary sulphide ores were encountered and new metallurgical methods had to be introduced. Key factors affecting the economic viability of the mine were major fluctuations in the copper price, uncertainty of water supply, depletion of local fuel resources and the cost of transport. Unlike the Cobar mines, Nymagee was never connected to the railway network and this disadvantage combined with rising costs, labour shortages and uncertainty over copper prices led to closure of the mine in 1917.

Early mining at Nymagee did not exhaust the ore and from the 1960s a number of mining and exploration companies investigated the potential for mining the remnant resource. Most recently, a concerted deep drilling and geophysical exploration program has indicated that the ore lenses extend well below the known deposit, raising the possibility of future large-scale mining.

### **Discovery**

Copper was discovered near the boundary of Hartwood and Nymagee stations by Henry (Harry) Manly and his mate Bryson in September 1876.<sup>1</sup> At the time, Harry was living on Hartwood Station on a small 20 acre block that he had selected. A story of the find recorded in 1919 states that Manly and Bryson were minding sheep around a small hill and while sitting down near an outcrop one of them noticed unusual colours on the rocks. He broke off a piece to reveal some fine green and blue stains. Unsure of the material both men collected samples and took them back to the station, where one of them showed the material to a boundary rider, who at once pronounced it to be copper carbonate from Cobar and was ‘prepared to bet his hat on it’. The shepherd replied that the boundary rider would lose his hat, for the stone was never at Cobar as he had found it in one of the local hills that day. The next morning Manly and Bryson decided to revisit the site and keep their find quiet. Later, the boundary rider enquired if they had

found any more of the stone and failing to elicit a satisfactory answer became suspicious. He attempted to locate the hill, but by the time he found it a claim had been pegged.<sup>2</sup> Harry Manly applied for a Mineral Conditional Purchase claim of 80 acres in November 1876, which was declared in January 1880.<sup>3</sup> It is not clear whether Bryson was still involved in the find at this stage.

Russell Barton, one of the major investors in the Cobar Copper mine, became aware of the discovery at Nymagee and visited the site sometime before 1880. He was sufficiently impressed to purchase the claim from Manly in 1880 for the modest sum of £1,200.<sup>4</sup> When Barton signed the final instalment of £800, he is reported as saying it was equivalent to signing Harry's death warrant, as it was considered that the latter would almost certainly spend the money on drinking himself to death.<sup>5</sup> However, Harry used the proceeds to set up the Traveller's Rest Hotel in Nymagee and purchase a liquor licence, as well as to marry Bridget Hardy in Cobar on the 24<sup>th</sup> of August 1880.<sup>6</sup> He continued as licensee of the Traveller's Rest until 1881, when he appears to have vanished from the records, possibly finally succumbing to the 'demon drink'. His wife Bridget died in Nymagee on the 19<sup>th</sup> February 1886 aged 46, her cause of death listed as a 'chronic liver complaint'.<sup>7</sup>

### **Early mining stage (1880-1895)**

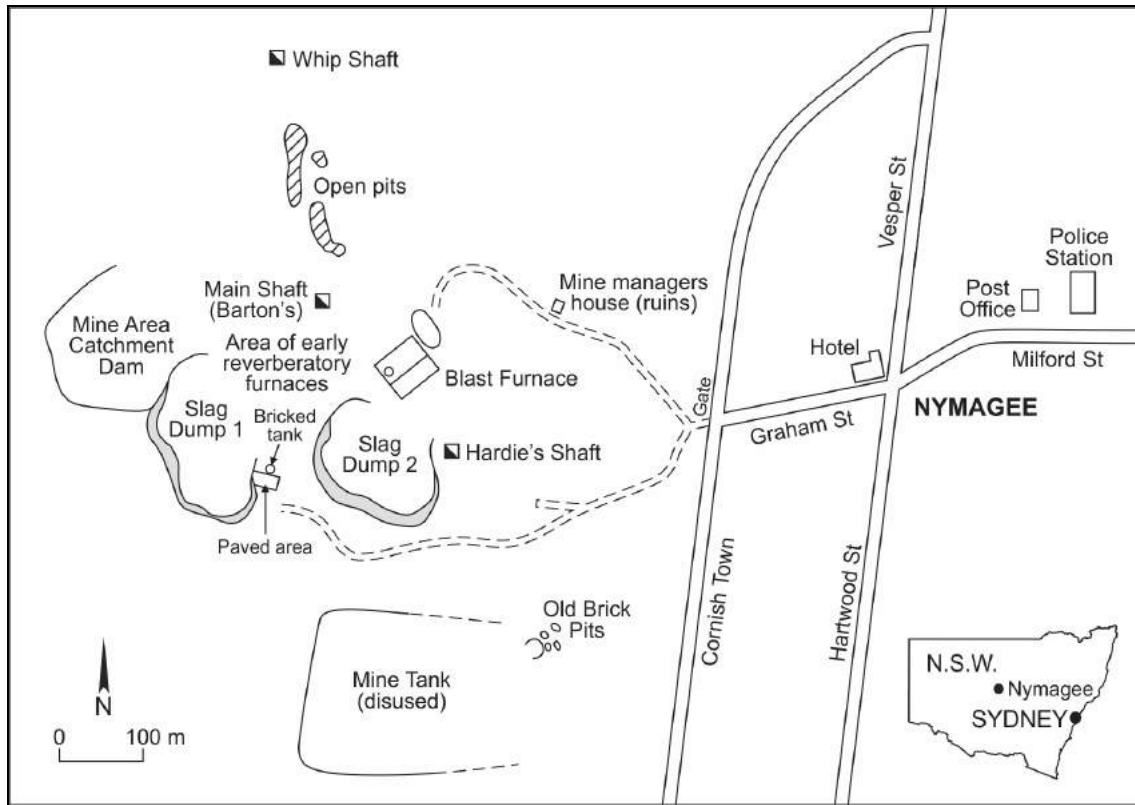
In March 1880, the Nymagee Copper Mining Company Ltd was formed with nominal capital of £60,000. Russell Barton initially took on the role of managing director. Development of the mine commenced almost immediately and an additional block of 320 acres of land was acquired.<sup>8</sup> Captain John Wills was appointed mining manager and by the end of the year three shafts had been commenced on the main western lode, Barton's (No. 1 or Main Shaft), Pope's (north shaft) and Threlkeld's (middle shaft, later renamed Harcourt's) - all named after directors of the company (Fig. 1).

A fourth shaft, Broomfield's, was commenced on an eastern lode.<sup>9</sup> Early development on the main lode revealed 'green' (copper carbonate) and 'grey' (enriched chalcocite) ores to a depth of around 160 feet and up to 40 feet in width.<sup>10</sup> Primary 'yellow' (sulphide) ore was encountered by October 1880 in Popes Shaft.<sup>11</sup> The company also began constructing four reverberatory furnaces, a large powder magazine, brick kilns for manufacture of fire and building bricks, a large surface tank, storerooms and 20 cottages for the workmen.<sup>12</sup>

Smelting commenced in early December 1880, with two furnaces, the copper initially being sold to the Great Cobar Copper mine.<sup>13</sup> At this stage Barton's shaft was down 141 feet, with the lode showing at 6 feet wide. Pope's and Threlkeld's shafts were at 161 and 153 feet respectively with a 153 foot drive developed south of Threlkeld's shaft.<sup>14</sup> To expand the mine and plant, the Company raised an additional £12,500 by increasing the nominal capital to £80,000. By the end of June 1881, 2,435 tons of ore had been raised and 2,085 tons smelted to produce 272 tons of fine copper. Two additional furnaces were under construction.<sup>15</sup> Captain Francis Jolly took over as mine manager in September 1881 and the mine was connected to the telegraph system in December of that year, allowing regular reports to be made to the newspapers and share market.<sup>16</sup> About this time another company, the Hartwood Copper Mining Co. Ltd, took

up a lease just north of the Nymagee mine to prospect for extensions of the Nymagee lodes. By March 1883 this group had sunk four shafts from 80 to 229 feet depth, but had found only minor mineralisation.<sup>17</sup>

**Figure 1:** *Plan of the current Nymagee mine site and town. Pope's and Harcourt's shafts are located in the area of the open pits. Insert shows location of Nymagee in New South Wales.*



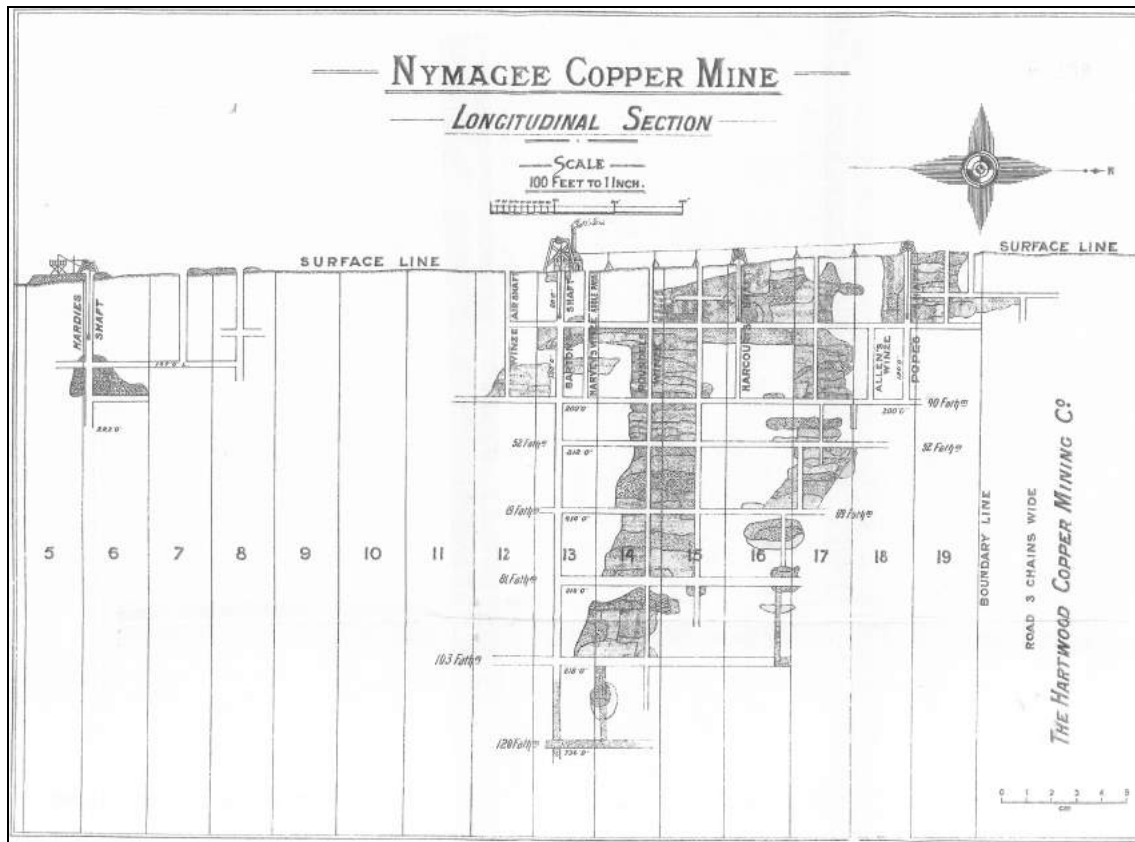
Source: Drawn by the author using Google Earth as a topographic base.

Mine development to the end of 1882 indicated that Nymagee was shaping up as a significant copper deposit, ranked the second most important in the Cobar region after the Great Cobar.<sup>18</sup> The main lode was reported to be 15 to 25 feet wide and the lodes, though 'bunchy' (in clusters of lenticular blocks), appeared to continue to depth, with the workings now down 286 feet. A Hancock jigger had been added to the plant to process lower grade ore and in September, Captain Jolly began installing tramways underground to transport the ore and mullock - prior to this, wheelbarrows had been used. Claude Vautin, consultant metallurgist, had tested a new patented process to improve the copper refining at Nymagee.<sup>19</sup> This process was successful and also adopted at the Great Cobar Mine. During the year, 7,258 tons of ore were raised with 6,618 tons smelted to yield 1,144 tons of refined copper valued at £80,000.<sup>20</sup> Drought conditions had hampered smelting operations and the transport of copper from the mine.

In February 1883 the Nymagee mine employed 500 men, including 109 miners and 200 woodcutters and carters. The number of reverberatory furnaces had been increased to eight.<sup>21</sup> For each ton of produced copper about 29 tons of firewood were required to fuel the furnaces and the boilers for the steam engines.<sup>22</sup> Initial smelting was of the rich secondary near-surface ore, but by 1884 this had evolved to blending two thirds of

calcined sulfide ore with secondary ore.<sup>23</sup> Two calciners and eleven furnaces were operating when Inspector of Mines W.H.J. Slee, visited the mine in July 1884.<sup>24</sup> In his report, Slee also reported on a new lode of high-grade, grey copper ore 720 feet south of Barton's shaft, discovered in a prospecting shaft in April. This was an exciting new find indicating that mineralisation extended significantly south of the hilly country, and a new shaft, Hardie's shaft, was quickly developed to exploit this lode (Figs 1 and 2).<sup>25</sup> On the northern extremity of the lease a lode of rich, lead carbonate and silver, overlying grey copper ore, was also detected, and appeared to extend into the Hartwood company ground.<sup>26</sup>

**Figure 2:** Longitudinal section of the Nymagee mine in 1890.



Source: NSW Geological Survey, Nymagee Copper Mine, Nymagee, Mine Record 1881-1981 MR00138.

A major drawback for the Nymagee Copper Mining Company was the cost and difficulty of transporting supplies to the mine and the smelted copper to Sydney for export. From as early as mid 1882 there were proposals and agitation to extend the expanding railway network to Nymagee.<sup>27</sup> Transport from Nymagee to the closest railhead at Dubbo by teams was expensive – up to £18 a ton – and difficult during drought when there was limited feed for the horses and also in wet conditions when the road was commonly impassable.<sup>28</sup> It was often necessary to stockpile the refined copper at the mine until transport could be resumed and in the drought of 1882-83, 1,300 tons of refined copper accumulated at the mine.<sup>29</sup> Periods of drought and high fodder prices also reduced the ability of the wood cutters to supply the smelting plant with fuel.<sup>30</sup> By June 1883 the railway had reached Nyngan, 100 km from Nymagee, reducing transport

costs. The growth of Nymagee also ensured a more regular supply of teams as they could now transport merchandise to the town and backload refined copper to Nyngan.<sup>31</sup>

By 1885, the mine workings had reached a depth where most of the mined ore was of primary sulphides, requiring calcining prior to smelting. The lower grade and higher iron content of the ore also required a more complex process of multiple smelting to produce refined copper, resulting in a drop in production and higher costs. Four of the reverberatory furnaces were used for reduction and five for roasting. The operation was now consuming 52,000 tons of wood annually. To help overcome the smelting problems, head smelterman, William Blakemore, experimentally added a steam-driven Root's air blower to one of the reverberatory furnaces. After the furnace was charged with regulus (matte) and the charge heated until liquid a blast of cold air was passed over the surface of the matte to remove sulphur. By this means it was found that one furnace could do the work of three and save time and costs. To capture any copper particles blown out of the furnace a large culvert and stack were added about 90 feet away.<sup>32</sup> This innovation was most timely as the copper price declined to around £43 per ton by the end of the year and all cost savings were critical.<sup>33</sup>

In February 1886, Captain Jolly left Nymagee mine and William Blakemore took over as manager.<sup>34</sup> The copper price continued to languish and in July the company proposed a 10% reduction in wages for the workers. There was a short strike, before the men agreed to the reduction on the assurance that full wages would be re-instated when the copper price improved.<sup>35</sup> The price did improve from late 1887 into 1888, largely as a result of the French syndicate, Société des Métaux, gaining significant control of the global copper market and artificially setting the price.<sup>36</sup> Beginning in February 1888 there was a strike by the miners over pay, as the company had not re-instated the 10% wage cut as promised. Management argued that the shareholders still needed to recoup a significant loss from when the mine was kept open during the period of low prices. After five weeks the company agreed to restore wages and the men returned to work.<sup>37</sup> Although the Nymagee Copper Mining Company was not a member of the Société des Métaux, the tenders for its copper progressively increased up to £71 10s per ton.<sup>38</sup> However, the good times were short lived and in early 1889 the copper price plummeted when the attempt to control the market collapsed. The company responded by cutting back operations and laying off most of the 480 employees at the mine. By July 1889 there were about 40 miners employed, where previously there had been over 100, and only three of the nine furnaces were in operation.<sup>39</sup>

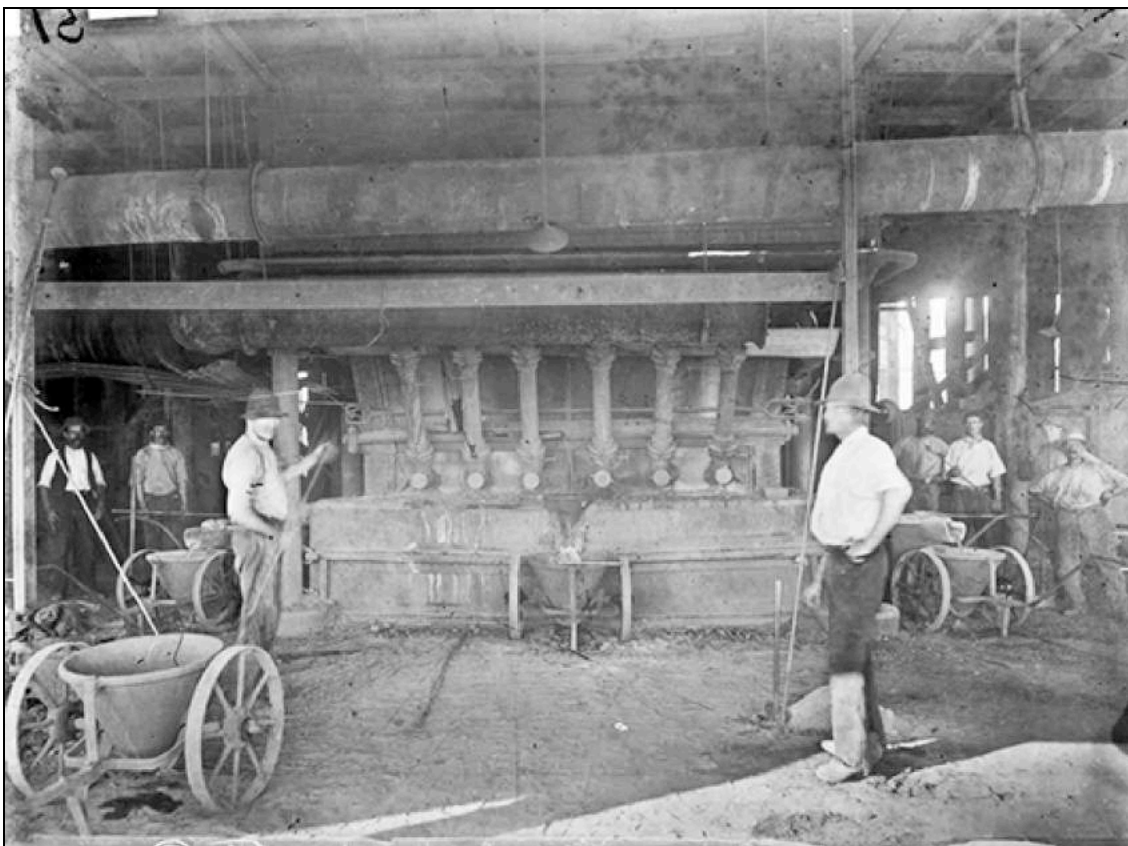
From the start of mining in April 1880 to the end of 1887 the Nymagee Copper Mining Company had smelted 81,585 tons of ore, from which 10,400 tons of copper was produced. Wages paid during this time totalled £371,700 and dividends £58,000.<sup>40</sup> The copper produced at Nymagee was of high purity with very low deleterious impurities such as bismuth and arsenic. The NGE brand of ingot (Fig. 6) became a standard for high quality copper used by the Royal Navy for sheathing the hulls of its ships.<sup>41</sup>

Operations at the Nymagee mine continued at a subdued level until late 1892 when the mine was closed due to the continuing low copper price.<sup>42</sup> In October the Nymagee Copper Mining Company Ltd was liquidated and reformed under the No Liability Act

1884 (Victoria) as the Nymagee Copper-mining Company NL. The new company was set up with nominal capital of £80,000 in £1 shares paid up to 15s, with existing share holders issued shares proportional to their current holding. The new company proposed to develop the promising signs of a new lode to the south of the existing workings.<sup>43</sup> There had already been some offers from tributers to work the mine and in 1895 it was re-opened by the company on tribute to a Mr Jones, the late foreman.<sup>44</sup> In March the following year, a syndicate issued a prospectus for another company, the North Nymagee Copper Company NL, to take over and further explore the ground of the former Hartwood Copper Mining Company. This was essentially a prospecting company with nominal capital of £18,750 and 120 acres of freehold land.<sup>45</sup>

The Nymagee Copper-mining Company appears to have continued operating its smelting plant and in August 1896, William Blakemore who was still the manager, recommended that a small water jacket blast furnace be installed to more efficiently smelt the low-grade sulphide ore. Such a furnace would have a great advantage over the existing reverberatory furnaces as the latter required a large supply of firewood and, as Blakemore remarked, ‘every shower of rain retards the delivery of the fuel and increases the smelting cost through the frequent stoppages and expense of relighting.’<sup>46</sup> Water jacket furnaces had recently been installed at the Great Cobar copper mine to great effect.

**Figure 3:** *Water jacket blast furnace, Nymagee mine ca. 1900.*



Source: NSW Geological Survey Photo Collection.

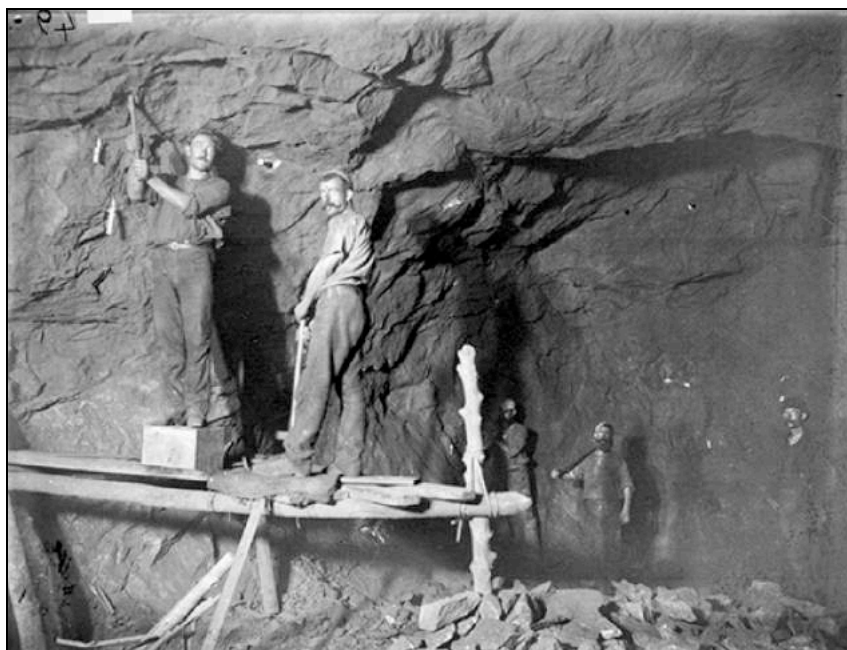
### **Great Cobar Mining Syndicate takes control (1896 – 1906)**

In September 1896 the Nymagee mine was purchased by the Great Cobar Mining Syndicate for £10,000.<sup>47</sup> This syndicate (also referred to as the Longworth Syndicate) had been set up by brothers Bill and Tom Longworth and Dr Richard Reid, to successfully re-develop the Great Cobar Copper mine after the railway reached Cobar in 1892. The Longworths had interests in the Rix's Creek coal deposits near Singleton and planned to take advantage of the new railway connection to cheaply bring coke to Cobar to operate new water jacket blast furnaces and transport the copper matte to Lithgow, where they eventually built a large refining plant with roasting furnaces and an electrolytic refinery.<sup>48</sup>

At Nymagee the new management substituted a water jacket blast furnace for ore reduction, retaining the reverberatory furnaces for matte roasting (Fig. 3). With this new smelting technology, it was planned to more cheaply treat the abundant sulphide ore and also process the 30,000 tons of low-grade ore stockpiled by the Nymagee Copper Mining Company. The syndicate also made other improvements to the plant including installing electric lighting.<sup>49</sup> All up about £27,000 was spent on the redevelopment.<sup>50</sup>

Prior to 1897 most mining, apart from some at Hardie's shaft, had been north of Barton's shaft (Fig. 4). Two drives to the south had indicated the possible presence of blind lodes at depth and this area was progressively developed by the Great Cobar Syndicate.<sup>51</sup> Two new shafts were sunk in this area between Barton's and Hardie's shafts. In 1899 mining was focussed on the eastern lode, working sulphide ore with a grade of 3-4%.<sup>52</sup> In late 1898, lack of water due to drought conditions resulted in the smelting plant (Fig. 5) being shut down for about five weeks, before heavy rains in February filled the mine tank with a sufficient supply until May when operations were again suspended due to lack of water.<sup>53</sup>

**Figure 4:** *Miners on the 250 foot level, Nymagee mine in the 1890s, showing typical working conditions.*

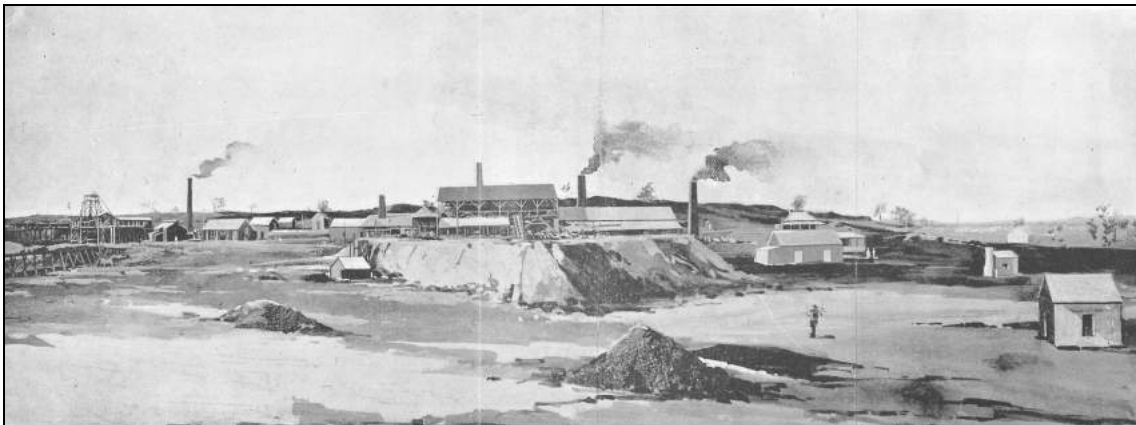


Source: NSW Geological Survey Photo Collection

Transport costs were still a major issue for the mine, particularly as coke now had to be brought from the coalfields to operate the blast furnaces. The Great Cobar Syndicate offered to build a railway line 72 km to the nearest rail point at Hermidale, but the offer was refused as private railway lines were against government policy at this time.<sup>54</sup> The syndicate then offered to cover the interest payments on government expenditure on a line for four years, but this was also declined. Coke and coal continued to be transported from Hermidale by teams at great expense and erratic delivery. The syndicate purchased a large steam traction engine in an attempt to improve transport. The Nymagee community appeared ambivalent about a railway connection, possibly because many local teamsters were profitably employed transporting goods and coke.<sup>55</sup>

In 1901, the Great Cobar Syndicate established partial pyritic smelting at Nymagee, removing the need to heap roast the ore.<sup>56</sup> This type of smelting also reduced the amount of fuel required, as the oxidising ore itself provided heat. The more efficient processing and reduction in smelting cost, meant that even lower grade ore (2-3% copper) could be treated. By 1906 the Nymagee plant consisted of three blast furnaces for ore reduction and four reverberatory furnaces for refining (Fig. 5).<sup>57</sup>

**Figure 5:** *View from the southwest of the Nymagee smelting works ca. 1899.*



Source: J.E. Carne, *The Copper Mining Industry and the Distribution of Copper Ores in New South Wales*, 1899.

### **British investment (1907 – 1917)**

In December 1906, the Great Cobar Syndicate sold the Nymagee operation to a group of British investors for £50,000 and the Nymagee Copper Limited Company was formed.<sup>58</sup> At the time of purchase the copper price was nearing a peak of £80 per ton, but the company decided to close the mine to totally replace the ramshackle plant, and during this period the copper price dropped to £60 per ton.<sup>59</sup> W.H. Corbould, manager of the Lloyd copper mine at Burruga, had acted as representative of the new investors and was appointed managing director of the new company at Nymagee as well as of the Lloyd copper mine.<sup>60</sup> He was given directions to develop the property on a large scale. The existing furnaces were demolished and a new blast furnace, capable of processing 130 tons of ore per day, installed. Additional new plant included: two Babcock and Wilcox high-pressure tube boilers; a cross compound, two-stage air compressor capable of driving 20 machine drills; a direct-acting winding engine, capable of raising 3.57 tons



from a depth of 2,000ft; an improved horizontal lever crusher; and new equipment for the machine shop.<sup>61</sup> A total of £18,000 was spent on upgrading the plant and underground development.<sup>62</sup>

Smelting recommenced in October 1907 and in August 1908 the nearby Crowl Creek and Shuttleton mines, discovered in 1900, were purchased to provide siliceous ore to blend with the sulphide-rich 'basic' ore at Nymagee.<sup>63</sup> However, without cheaper transport to supply coke for the smelter and to ship out the refined copper, the cost of large-scale production from lower grade ore rendered the operation unprofitable, particularly given the prevailing low copper price. The chief consulting engineer of the Great Cobar mine, J.D. Kendall, was asked to report on the operation and he confirmed that it was essential for a railway to be extended to Nymagee. He also recommended that the mine be developed to greater depth, that the smelting plant be upgraded with three furnaces to process 460 tons per day and that a converter plant be installed capable of treating 30 tons of 40% copper matte per day.<sup>64</sup> The mine was closed in January 1908, while attempts were made to lobby the New South Wales government for construction of a light railway line from Hermidale to Nymagee. It was argued that such a line would be relatively cheap to construct, particularly given the flat terrain, and would provide other benefits to the district.<sup>65</sup> A government committee was set up to investigate the merits of the scheme.<sup>66</sup>

To encourage the railway scheme, the company agreed to underwrite the cost of any loss on the line for four years. The government stipulated that the company should also spend £50,000 on further developing the mine. To raise sufficient funds to cover these expenditures the company announced it would issue first mortgage debentures to the value of £70,000.<sup>67</sup> The mine was dewatered and Dr Robert Logan Jack, formerly with the Queensland Geological Survey, conducted an 18-day inspection. Jack estimated a remaining resource of 209,840 tons of copper at a grade of 3.8%.<sup>68</sup> Assistant Government Geologist, Joseph Carne, was asked by the government to report on the viability of the Nymagee mine in June 1909. He tendered a cautious report, noting that in his opinion the mines in the Nymagee field were 'permanent in character', but he could not prove this and the Nymagee mine (now re-flooded) would need to be dewatered and the lodes tested at the greatest depths. He did not agree with a statement that copper could be produced from the mine at £48 per ton, but that £55 was more likely. Carne concluded that the prospects of the Nymagee, North Nymagee and Crowl Creek mines were sufficient to justify construction of a railway under the proposed conditions.<sup>69</sup>

After much deliberation the New South Wales Government deemed the railway project, with an estimated cost of £123,637, too risky for the public purse, arguing its economic viability would depend largely on a single mine, currently closed because it was unprofitable. The notion that the mine could be profitable if it had a railway connection was dismissed. It was agreed that the line could be privately built if an investor was interested.

The combination of a low copper price, inability to convince the government to construct a branch railway from Hermidale and likely difficulties in raising additional capital to further develop the mine or underwrite any loss on a railway, meant that the

operation remained unviable. The Nymagee property was sold at auction for £15,000 and lay idle until the latter part of 1912 when there was a rise in the price of copper and another British funded company, the Mouramba Copper Mines Ltd. took over.<sup>70</sup> Under the management of Charles Hansen, ten months were spent in dewatering the underground workings and enlarging the main shaft. The surface plant was also overhauled and new boilers and two additional blast furnaces installed. It was also planned to introduce motorised transport from Hermidale. The new smelting plant was officially opened on the 27<sup>th</sup> October 1913, but after four months, smelting operations were suspended due to drought conditions and high transport costs.<sup>71</sup> This was then followed by a sharp drop in the copper price due to market uncertainty at the declaration of war in September 1914. It appears that about this time the company had plans to build the long-desired railway link to Hermidale, but these were also wrecked on wartime uncertainty. Up to this point 3,813 tons of ore had been treated for 141 tons of refined copper.<sup>72</sup> Mine development, assisted by underground diamond drilling on the 5, 6 and 7 levels had indicated continuations of highly payable ore bodies.<sup>73</sup>

All operations remained suspended at Nymagee until the copper price rebounded in 1915 in response to the dramatic increase in demand for copper for the war effort. During 1915 the Mouramba mine smelted 18,500 tons of ore to produce 663 tons of copper.<sup>74</sup> Mining continued until November 1916, when operations were again suspended because the company was unable to obtain coke due to a coal miners' strike.<sup>75</sup> Limited work resumed in 1917 and some previously undiscovered carbonate ore was found and mined, but operations were hampered by a shortage of water. The Nymagee mine was finally closed at the end of 1917.<sup>76</sup>

Total copper production for the Nymagee mine from 1881 to 1917 was approximately 24,800 tons.<sup>77</sup> Up to 1896 the average grade of smelted ore was around 10% copper, but after that date declined progressively from about 4% to 2%.<sup>78</sup> The mine had been worked on eight levels to a maximum depth of just over 800 feet (244 m).

**Figure 6:** *Ingot of Nymagee copper with the brand NGE ca. 1884.*



Source Powerhouse Museum collection, Sydney.

### **Development of Nymagee township**

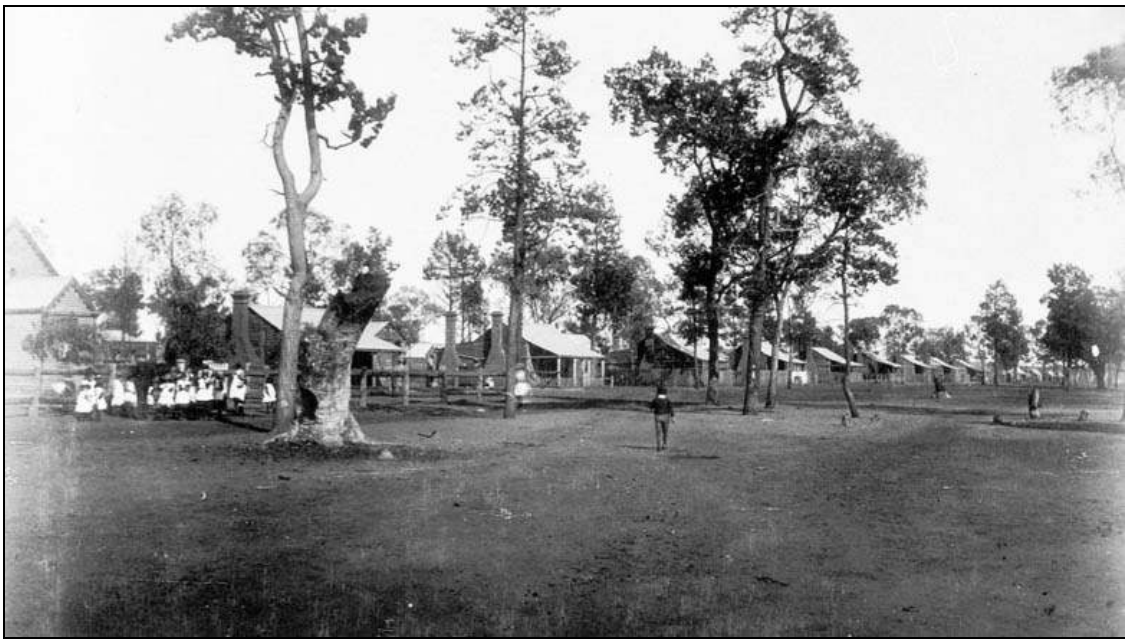
From the start of mining at Nymagee, a small settlement developed just to the east of the mine (Fig. 1). By March 1881, the town had a population of 700 and contained five hotels, several stores, post office, a branch of the Commercial Bank, and other businesses including butcheries, bakeries, blacksmith, wheelwright shops and a large sawmill. A public school had also been established with more than 60 children enrolled.<sup>79</sup> In October 1883, the town had its own newspaper, the *Nymagee and Cobar Star and Mount Hope Record*, established by Mr S.E. Collow of Cobar, clearly with the hope of a wide subscriber base.<sup>80</sup> By 1883 the population had increased to about 1,000 and the town, now boasting substantial brick buildings and several 'respectable hotels', was beginning to rival the major settlement of Cobar 100 km to the northwest.<sup>81</sup> Nymagee had reached sufficient size to attract a surprisingly wide range of diversionary leisure activities and visiting entertainers. As well as the pubs, there was Coate's Billiard Saloon and various church groups with organised entertainment. Mesmerist, Madame Sibly had already appeared with her lectures and snake enchanting performance. In 1883, Ashton's Circus paid a visit, followed by the Australian Dwarfs and accompanying Magnetic Lady, who could surprise patrons with an electric shock when they shook her hand. Later in the year, McLean's Comic Opera Company performed for seven nights and Clarke and Rymans American Comedy Company also appeared. There were proposals to set up a 'Young Man's Mutual Improvement and Debating Society' and a 'Quadrille Assembly', but it is not clear if these civilising initiatives came to full fruition.<sup>82</sup>

As the mine expanded, despite some ups and downs, the town of Nymagee continued to grow and consolidate. In the short boom of 1888 the population was estimated at 1,200 Europeans, plus a varying number of Chinese, who were mostly engaged in land clearing and wood gathering. A detailed report in the *Australian Town and Country Journal* in May 1888 recorded numerous stores, a police station with lock-up, a new imposing post office, court house, small hospital, two churches and a convent school in addition to the public school, which had grown to 180 enrolments. There were also several Chinese gardens supplying vegetables. Many of the miners lived to the southwest of the main town on the mine property, in what was referred to as 'Cornish Town'. Here a group of houses fronting the street had been built by the company and leased to miners at a modest rent (Fig. 7). Behind these were other houses and humpies erected by the miners themselves.<sup>83</sup> Although Nymagee was not on the road to anywhere in particular it had a large amount of traffic, mostly associated with the mine. Cobb and Co. and John Buckley provided coach services to Nyngan and there were also coach connections to Cobar, Warren, and Euabalong via Mount Hope.<sup>84</sup> There were three mail services a week via Nyngan.<sup>85</sup>

The major cut back at the mine in April 1889 resulted in a large exodus of residents and was a stunning blow to a town highly dependent on a single mine and with virtually no other local industry.<sup>86</sup> The situation worsened in 1892 when the mine was closed and Nymagee entered some of its darkest days. The depressed state of the town was highlighted by a correspondent to *Freeman's Journal*, who visited in June 1894 and noted that 'Nymagee may fairly be credited with being the most dismal and desolate

town in the whole of the colony.’ Given the general economic depression of the 1890s, things in Nymagee must have been exceedingly dismal. The correspondent did go on to point out that there were rumours that work at the mine would shortly resume and if this came to pass ‘Nymagee will rise Phoenix-like from its ashes and once more blossom as a busy mining centre.’<sup>87</sup> The prediction of a new flowering for Nymagee did indeed come true when the Great Cobar Syndicate purchased and redeveloped the mine in 1896. Almost immediately, people and businesses returned to the town.<sup>88</sup> In February 1897, the Minister for Mines, Sydney Smith, accompanied by three other members of the New South Wales Legislative Assembly, visited Nymagee to inspect the reopened mine and the new revolutionary smelting plant, which promised to, and in fact did, revitalise copper production.<sup>89</sup> The new investment and employment opportunities provided a much-needed economic boost to Nymagee and a modest level of prosperity was restored, with the mine employing an average of 200 workers over the next ten years. Perhaps reflecting greater commercial activity and wealth, a substantial new police station, brick court house and lock-up complex was constructed in 1902 to replace the original dilapidated wooden building and cells.<sup>90</sup>

**Figure 7:** *View of Cornish Town, Nymagee, 1888. Public School is at far left.*



Source: *Australian Town and Country Journal*, 19 May 1888.

After the mine closed in 1917, Nymagee continued on as a small service town to the local rural community with a much reduced population. Today, Nymagee is almost, but not quite, a ghost town with a population of about 100. The town has one hotel, the Metropolitan, a police station, post office and around 20 houses. The recent development of the Hera mine, 5 km to the south, has attracted some new residents, although most of the employees live at the mine camp and work shifts on a ‘drive in drive out’ basis.

### **Sporadic post-mining interest in Nymagee**

Following closure of the Nymagee mine in 1917, interest in copper waned for some time. Post-war inflation and labour costs also put a dampener on new mining development. Unlike the Cobar copper deposits, the Nymagee ore was essentially devoid of gold so that there was no interest in the mine during the upturn in gold mining that accompanied the Great Depression of the 1930s. The need for copper during WWII caused a spark of interest and enquiries were made to the New South Department of Mines for information on the old workings and the possibility of remnant ore, but little work if any appears to have been done.<sup>91</sup>

After WWII the Australian Government saw a need to rehabilitate the mining industry and the Bureau of Mineral Resources, together with the NSW Geological Survey, established a project to reassess the Cobar field. The Broken Hill companies also became interested in exploring the potential of the area. However, the corpse of Nymagee was again largely neglected.

The mineral exploration boom of the 1960s and 1970s saw a renewed interest in base-metals, including at Nymagee. Attention was drawn to many of the historic mines in Australia, which had never been tested by modern exploration techniques, particularly geophysical methods and deep diamond drilling. This approach led to the discovery of a large copper and lead-zinc resource below the old C.S.A. mine, 13 km northwest of Cobar, and its re-development as a modern underground mine in 1964.<sup>92</sup> The C.S.A. success provided a model for other possible mine re-developments in the region. Vam Limited acquired leases over the old Nymagee mines and surrounding area and with joint venture partners commenced exploration. From 1964 to 1967, Ausminda Pty Ltd, a consortium of two large multi-national companies, Placer Development Ltd and Noranda Mines Ltd, conducted detailed mapping, geochemical sampling, geophysical surveys and a limited diamond drilling program of four holes. The consortium was seeking a large-tonnage, low-grade resource suitable for an open cut mine, totally unlike the Nymagee style of deposit, and interest waned soon after the drilling.<sup>93</sup> Ausminda withdrew from the joint venture after which there was minor exploration of the old mine workings by Shoring Services for Vam Ltd.<sup>94</sup> Prior to this, Vam also investigated the possibility of small scale copper leaching of the workings and drilled a 4-inch diameter churn drill hole to circulate water and installed an air-lift pump and precipitation vats. This project was abandoned due to complications from high concentrations of iron nitrate in the mine waters.<sup>95</sup> The vats and associated scrap iron for copper extraction are still extant at the site.

In 1973, Cyprus Mines Corporation took an interest in the Nymagee project. This company had the aim of locating several small deposits (up to a million tonnes) in the area, that could be worked from underground mines, similar to the operation of Peko Mines at Tennant Creek in the Northern Territory.<sup>96</sup> Drilling up to 1974 defined a remnant pillar resource at the Nymagee mine of 821,000 tonnes at 2.3% Cu and a total resource in the Pb-Zn lodes of 363,000 tonnes of 0.5% Cu, 3.0% Pb and 7% Zn. This was considered too small for a stand alone operation. Cyprus Mines withdrew from the joint venture and Vam Ltd abandoned the mine in 1975.<sup>97</sup>

### **New awakening**

The new gold boom of the 1980s saw significant mineral exploration across the Cobar region. CRA Exploration Pty Ltd was successful in defining a new gold and base metal deposit below the old Peak mines just south of Cobar in 1982.<sup>98</sup> In 1984, CRAE intersected sub-economic mineralisation 4.5 km south of Nymagee, a prospect initially identified by Buka Minerals in 1974 during a geophysical survey. This was not followed up until 2000 when Pasminco, as part of an exploration program over the larger Nymagee area, drilled ore-grade mineralisation below a geochemical anomaly along strike from the earlier drilling at the prospect now known as Hera.<sup>99</sup> Shortly after this discovery, Pasminco went into receivership when the company participated in some poor investments and disastrous metal hedging contracts, and the prospect was purchased from the receiver by Triako Resources Ltd in 2003.<sup>100</sup> Triako completed a drilling program of 105 holes and a pre-feasibility study, focussing on the gold potential, before being taken over by CBH Resources in 2006. CBH assessed the Hera prospect for its base metal potential with some additional drilling, and in 2009 sold the Nymagee project, including Hera, the nearby Hebe prospect and the old Nymagee mine, to YTC Resources Ltd (now renamed Aurelia Metals Ltd). This company, as part of a joint venture group, conducted further exploration at both Hera and Nymagee and in 2014 established an underground mine for high-grade gold and base metals at Hera.<sup>101</sup>

Geophysical exploration and deep drilling by YTC/Aurelia at Nymagee from 2010 to 2014 revealed significant extensions to the deposit, continuing to at least 450 m below the old workings on a southerly plunge. This deep exploration was greatly assisted by modern Down Hole EM geophysics, useful in indicating ore lenses proximal to the drill holes. A gravity survey suggested that the Nymagee mineral system could extend for 1.2 km along strike and additional gravity-high targets were identified within the system.<sup>102</sup> This new information suggests that the geometry and nature of the Nymagee deposit is similar to that of the major C.S.A. copper deposit, which extends to a depth of at least 1.8 km. The implication that the Nymagee deposit could be much more extensive than previously known, is an exciting prospect.

Currently Aurelia is focussed on bedding down the operating mine at Hera, while Nymagee rests on the cusp of a possible new life as it awaits full resource estimation and a mining feasibility study.

### **Discussion and conclusions**

The history of the Nymagee copper mine has many parallels and links to that of the Great Cobar mine in the same region. Both operations experienced similar difficulties in terms of mining in an arid and remote environment with erratic water supply, high transport costs and hard living conditions. Both followed a similar evolution in mining and smelting technology, also reflecting that of the broader copper industry across Australia. Initial mining was of rich, secondary carbonate ore, commonly grading over 30% copper. Early smelting employed reverberatory furnaces, which were well suited to this ore type and the local conditions at the time. These furnaces could be built on site with bricks made from local clay, and they worked well using the ready supply of firewood for fuel. Importantly, the furnaces did not require water. Their main

disadvantages were that they were labour intensive to operate and required continual maintenance, due to the batch nature of smelting with repeated heating and cooling. They were also limited in their size of construction, which meant that to increase the scale of production more smelters had to be built, each requiring three or four smelter attendants to operate them. All of these factors increased the cost of smelting, although it did provide employment for many men. When ore grades were high, the high smelting cost was not a great problem, particularly as transporting refined copper rather than ore over long distances was still a great saving. As mining progressed to greater depth and into lower grade, primary sulphides, the inefficiency of the reverberatory furnaces in handling this type of ore and the resulting higher cost eventually rendered operations uneconomic. Depletion of the local firewood supply also became a problem. Initially there was reluctance to introduce new methods of copper smelting and the industry languished, particularly when copper prices were low. Reverberatory smelting was more of an 'art' than a science and this probably contributed to the conservatism of many in the smelting fraternity who were reluctant to embrace new, more scientific methods. One commentator on the malaise of the local copper mining industry at the time observed that:

Doubtless this circumstance is due to the traditional conservatism of the Swansea smelter – of whom there is a goodly leaven in this colony – and his utter abhorrence of any proposal to change the methods of smelting carried on in his great-grandfather's day.<sup>103</sup>

To be fair, early attempts at using blast furnace technology in Australia, for example at Burra in 1846-47, had not been encouraging, probably reinforcing belief in the 'tried and true' reverberatory smelter.<sup>104</sup> Some improvements to reverberatory smelting were made, such as the use of forced air blowers at Nymagee to achieve a primitive type of matte conversion.

The adoption of water jacket blast furnaces at Cobar and Nymagee by the Great Cobar Syndicate was a game changer, and allowed a renaissance in profitable copper mining in the district. Water jacket furnaces had a great advantage in working sulphide ores in that the ore did not generally need to be calcined prior to smelting, and oxidation of the sulphides in the smelter produced heat, reducing fuel requirements. The furnaces could also operate continuously, reducing thermal stress and energy loss from alternate heating and cooling. Water jacket furnaces were portable and could be easily up-scaled because of their modular construction. They were also more forgiving of variability in the charge mix. Disadvantages included the need for a reliable water supply for the water jacket, and provision of coke or coal for fuel.<sup>105</sup> Once Cobar was connected by rail to the coalfields, the latter was not such a problem, at least for Cobar. For Nymagee coke still had to be transported from Hermidale by teams or the company's steam traction engine at unsustainable cost.

The period of operation of the Nymagee and Great Cobar mines by the Great Cobar Mining Syndicate was probably the most innovative and successful in the history of both mines. The founding members of this syndicate (W. and T. Longworth and R. Reid) were very astute businessmen. They saw the opportunities of revitalising both

mines with new technology and they were also impeccable in their timing when they sold both mines to British investors in the early 1900s. British investment in the Great Cobar and Nymagee mines occurred during a period at around the turn of the century of greatly increased interest and capital investment in Australian mining, particularly gold but also base metal mining. This investment was generally aimed at developing mines on a large scale and using the latest technology. In a number of cases, including at Nymagee and Cobar, this approach was thwarted by local conditions and difficulties on the ground, as well as costly mistakes, resulting in very slim returns to investors.<sup>106</sup> The large capital injections did however provide money and jobs to local contractors and the many workers of the mining towns. During this period the people of Cobar and Nymagee were in effect on 'sustenance' support from the overseas shareholders.

The Nymagee mine closed in 1917 not for a lack of ore, but rather from a number of confounding factors, particularly related to the copper price, transport costs and shortage of water. Recent exploration and the resulting indications of a significantly more extensive ore deposit system give hope for a new life for Nymagee.

#### **Acknowledgements**

The author thanks the National Library of Australia and the Geological Survey of New South Wales for access to information, particularly through their online services (including 'Trove' and 'Digs'). Thanks also to the Great Cobar Heritage Centre for providing information and some photographs and to Stuart Jeffrey from Aurelia Metals Ltd for providing access to the Nymagee site. The article benefited from the constructive comments of two anonymous reviewers.

#### **Glossary of some terms used in the text**

Calcining – preliminary oxidation by heating or burning of sulphide ores to remove much of the sulphur as sulphur dioxide. Often conducted in open air on roasting heaps or stalls, or in calcining furnaces.

Down Hole EM (DHEM) – electromagnetic geophysical technique in which a probe is lowered down a drill hole to detect conductive sulphide bodies, not necessarily intersected by the hole and up to some distance away.

Plunge – the linear direction of elongation of an ore body, as distinct from the dip, which is the angle of tilt of an ore lens from the horizontal.

Supergene – formed by descending waters during surface weathering.

#### **Units**

1 inch = 25.4 mm, 1 foot = 0.3048 m, 1 mile = 1.609 km, 1 acre = 0.4047 hectares.

1 troy oz (the standard measure of gold and silver) = 20 dwt = 31.10348 g; 1 dwt = 1.555 g.

1 pound (lb) = 0.454 kg, 1 ton (long) = 2,240 pounds (lbs) = 1.01604 tonnes.

1 (imperial) gallon = 4.5461 litres.

#### **Pre-decimal currency**

£1 (pound) = 20s (shillings) and 1 shilling = 12d (pence)

---

#### **Endnotes**

<sup>1</sup> *Mineral Conditional Purchases made since January 1 1870*, Legislative Assembly New South Wales 1884, C.P. No. 76-277, pp. 26-27; 'In and Around Nymagee – A Coming Mining Centre', *Australian Town and Country Journal*, 19 May 1888, pp. 24-25. On some documents Henry Manly's surname is spelt 'Manley', 'Nimagee' is the original spelling of the station name.

<sup>2</sup> 'Discovery of the Nymagee Copper Mine', *Western Age*, 10 June 1919, p. 3.

<sup>3</sup> *Mineral Conditional Purchases made since January 1 1870*, Legislative Assembly New South Wales 1884, C.P. No. 76-277, pp. 26-27.

<sup>4</sup> 'Discovery of the Nymagee Copper Mine', *Western Age*, 10 June 1919, p. 3.

<sup>5</sup> Marian La Weslee, *N L 'Australie Nouvelle*, cited in Neville Burgess, *The Great Cobar*, Revised and 2<sup>nd</sup> Reprint, 2006, Great Cobar Heritage Centre, Cobar, pp. 119-125.



- 
- <sup>6</sup> Marriage Certificate, New South Wales Births, Deaths and Marriages, Registration [hereafter NSW-B/D/M] No. 2815/1880. At the time of his marriage Henry's occupation is described as 'Publican'; NSW – West, Hotel Publican's Licences, [homepages.rootsweb.ancestry.com](http://homepages.rootsweb.ancestry.com).
- <sup>7</sup> Death Certificate, NSW-B/D/M, Registration No. 9531/1886.
- <sup>8</sup> 'Mining', *Sydney Morning Herald*, 2 March 1880, p. 4; 'Nymagee Copper Company', *ibid.*, 30 June 1880, p. 6.
- <sup>9</sup> 'Mining', *Sydney Morning Herald*, 8 October 1880, p. 4.
- <sup>10</sup> 'The Nymagee Copper Mine – Report of Mr Slee, Inspector of Mines', *The Riverine Grazier*, 3 March, 1883, p. 2.
- <sup>11</sup> 'Mining', *Sydney Morning Herald*, 8 October 1880, p. 4.
- <sup>12</sup> 'The New Mining Township of Nymagee', *Sydney Morning Herald*, 31 July 1880, p. 3; 'The Nymagee Copper Mine', *Mount Barker Courier and Onkaparinga and Gueracha Advertiser*, 19 November 1880, p. 3. Cottages for the workers were built just east of the mine and cost the Company about £50 each to build. This area became known as Cornish Town, after the Government town was surveyed further to the northeast.
- <sup>13</sup> 'Mining Report – Nymagee Copper Mining Co.', *Sydney Morning Herald*, 24 December 1880, p. 4.
- <sup>14</sup> 'Mining Report', *Sydney Morning Herald*, 24 December 1880, p. 4.
- <sup>15</sup> 'Mining Reports – Nymagee Copper-Mining Company (Limited)', *Sydney Morning Herald*, 7 February 1881, p. 4; 'Public Companies – Nymagee Copper-Mining Company, Limited', *ibid.*, 25 August 1881, p. 6.
- <sup>16</sup> 'Late Mining', *Sydney Mail and New South Wales Advertiser*, 10 December 1881, p. 994; 'Nymagee Copper Mining Company Limited', *Sydney Morning Herald*, 2 March 1882, p. 6; 'Nymagee Copper Mine', *Australian Town and Country Journal*, 8 April 1882, p. 11.
- <sup>17</sup> 'Nymagee Copper Mine – Report of Mr Slee, Inspector of Mines', *Sydney Mail and New South Wales Advertiser*, 3 March 1883, p. 405.
- <sup>18</sup> Annual Report of the New South Wales Department of Mines (hereafter *ARNSWDM*) for 1882, pp. 101-102.
- <sup>19</sup> 'The Smelting of Copper', *Yorke's Peninsula Advertiser*, 27 June 1882, p. 2; The process involved oxidation of impurities, either by forcing air through the molten copper or adding compounds to the mix, such as manganese dioxide or copper oxide, that would release oxygen, 'Patents 3113' *Leader*, 19 August 1882, p. 5.
- <sup>20</sup> *ARNSWDM* for 1882, pp. 101-102; 'Intercolonial Mining News in Brief', *Queenslander*, 1 April 1882, p. 403; 'Mining Intelligence', *Sydney Morning Herald*, 28 September 1882, p. 8.
- <sup>21</sup> 'Mining', *Sydney Morning Herald*, 8 October 1880, p. 4; 'The Nymagee Copper Mine – Report of Mr Slee, Inspector of Mines', *The Riverine Grazier*, 3 March, 1883, p. 2.
- <sup>22</sup> J.E. Carne, *The Copper Mining Industry and the Distribution of Copper Ores in New South Wales*, 2<sup>nd</sup> Edition, Department of Mines, Geological Survey, Mineral Resources No. 6, 1908, p. 257.
- <sup>23</sup> *Ibid.*
- <sup>24</sup> 'The Nymagee Copper Mine – Report of Mr Slee', *Sydney Morning Herald*, 1 August 1884, p. 9.
- <sup>25</sup> 'Mining Intelligence', *Sydney Morning Herald*, 23 April 1884, p. 10; 'Mining Intelligence', *ibid.*, 30 July 1884, p. 10.
- <sup>26</sup> 'The Nymagee Copper Mine – Report of Mr Slee', *Sydney Morning Herald*, 1 August 1884, p. 9.
- <sup>27</sup> 'The Minister for Works at Nymagee', *Sydney Morning Herald*, 14 June 1882, p. 6.
- <sup>28</sup> 'Nymagee Copper Mine', *Australian Town and Country Journal*, 8 April 1882, p. 11.
- <sup>29</sup> 'Public Companies - Nymagee Copper Mining Company Limited', *Sydney Morning Herald*, 25 August 1882, p. 6; Carne, *The Copper Mining Industry and the Distribution of Copper Ores*, p. 256.
- <sup>30</sup> 'Late Mining – Nymagee', *Sydney Mail and New South Wales Advertiser*, 8 April 1882, p. 560; 'Nymagee', *Australian Town and Country Journal*, 5 August 1882, p. 39.
- <sup>31</sup> F. Jolly, Report to the Chairman and Directors, Nymagee Copper Mining Limited, 1 July 1883.
- <sup>32</sup> F. Jolly, Report to the Chairman and Directors of the Nymagee Copper Mining Company Limited, 1 July 1885.
- <sup>33</sup> 'Mining – Nymagee Copper Mining Co.', *Evening News*, 27 February 1886, p. 6.
- <sup>34</sup> 'Nymagee Copper Mines', *Evening News*, 24 February 1886, p. 5.
- <sup>35</sup> 'New South Wales', *South Australian Register*, 14 July 1886, p. 6; 'Local and General News', *Newcastle Morning Herald and Miner's Advocate*, 20 July 1886, p. 5; 'The Nymagee Strike', *ibid.*, 30 July 1886, p. 5.
- <sup>36</sup> 'The Copper Syndicate – The Opinion of a Colonial Copper King', *Express and Telegraph*, 25 October 1888, p. 4.
- <sup>37</sup> 'In and around Nymagee', *Australian Town and Country Journal*, 19 May 1888, pp. 24-25.

- <sup>38</sup> 'The Copper Syndicate – The Opinion of a Colonial Copper King', *Express and Telegraph*, 25 October 1888, p. 4.
- <sup>39</sup> 'Nymagee Copper Mine', *Evening News*, 1 April 1889, p. 6; 'A Trip to Nymagee', *Australian Town and Country Journal*, 20 July 1889, p. 43.
- <sup>40</sup> 'In and around Nymagee', *Australian Town and Country Journal*, 19 May 1888, pp. 24-25.
- <sup>41</sup> 'Mouramba Copper Mines Limited', *Sydney Morning Herald*, 28 December 1912, p. 15; Interim Report on Copper Resources, Department of Supply and Development, Commonwealth Copper and Bauxite Committee 2<sup>nd</sup> Report, 1941, Geological Survey of NSW Report GS 1941/2, p. 28.
- <sup>42</sup> 'Nymagee Copper Mine Closes', *The Advertiser*, 26 August 1892, p. 3.
- <sup>43</sup> 'Meetings', *Sydney Morning Herald*, 6 October 1892, p. 7.
- <sup>44</sup> 'Mining Intelligence – Nymagee Copper Mine', *South Australian Chronicle*, 9 June 1894, p. 6.
- <sup>45</sup> 'North Nymagee Copper Co.', *Evening News*, 5 March 1896, p. 4.
- <sup>46</sup> W. Blakemore, Report to the Chairman and Directors, Nymagee Copper-mining Company NL, August 1896.
- <sup>47</sup> 'Nymagee Copper Mine' *The Sydney Mail*, 19 September 1896, p. 620; Carne, *The Copper Mining Industry and the Distribution of Copper Ores*, p. 257.
- <sup>48</sup> *Ibid.*, p. 238; Burgess, *The Great Cobar*, pp. 207-208; C.J. Stegman, and T.M. Stegman, 'The history of mining in the Cobar Field', in W.G. Cook, A.J. Ford, J.J. McDermont, P.N. Standish, C.J. Stegman, and T.M. Stegman (eds), *The Cobar Mineral Field – A 1996 Perspective*, The Australasian Institute of Mining and Metallurgy, Melbourne, Spectrum Series No. 3/96, 1996, pp. 3-39.
- <sup>49</sup> 'The Minister for Mines on Tour – The Nymagee Copper Mine', *Sydney Morning Herald*, 6 February 1897, p. 5; Carne, *The Copper Mining Industry and the Distribution of Copper Ores in New South Wales*, 2<sup>nd</sup> Edition, Department of Mines, Geological Survey, pp. 255-258.
- <sup>50</sup> 'The Minister for Mines on Tour', *Sydney Morning Herald*, 6 February 1897, p. 5; 'Mining in New South Wales – The Nymagee Copper Fields', *ibid.*, 10 January 1899, p. 7.
- <sup>51</sup> 'Mining ' Nymagee Copper Mines', *Evening News*, 30 April 1898, p. 3.
- <sup>52</sup> 'Mining in New South Wales – The Nymagee Copper Fields', *Sydney Morning Herald*, 10 January 1899, p. 7.
- <sup>53</sup> 'Nymagee', *Western Champion*, 3 February 1899, p. 6; 'Nymagee', *Cobar Herald*, 6 May 1899, p. 3.
- <sup>54</sup> 'The Nymagee Copper Mine', *Cobar Herald*, 27 October 1906, p. 8.
- <sup>55</sup> 'Mining in New South Wales – The Nymagee Copper Fields', *Sydney Morning Herald*, 10 January 1899, p. 7.
- <sup>56</sup> Carne, *The Copper Mining Industry and the Distribution of Copper Ores*, p. 256.
- <sup>57</sup> 'Nymagee Copper Mine – Sold to an English Company', *Sydney Morning Herald*, 15 January 1907, p. 10.
- <sup>58</sup> 'The Nymagee Copper Mine', *Cobar Herald*, 27 October 1906, p. 8.
- <sup>59</sup> 'Nymagee Copper Mine', *Sydney Morning Herald*, 16 October 1907, p. 9.
- <sup>60</sup> 'The Nymagee Copper Mine – Sold to and English Company', *Sydney Morning Herald*, 2 January 1907, p. 13.
- <sup>61</sup> 'Nymagee Copper Mine – Smelting Operations Begun', *Sydney Morning Herald*, 16 October 1907, p. 9.
- <sup>62</sup> Hermidale to Nymagee Railway Bill, NSW Legislative Council Papers, 20 December 1910, p. 1223.
- <sup>63</sup> *Ibid.*; 'Nymagee Copper Mine', *Sydney Morning Herald*, 26 August, 1908, p. 4.
- <sup>64</sup> 'Nymagee Copper Mine – Purchase of Mines', *Cobar Herald*, 1 September 1908, p. 3.
- <sup>65</sup> *Ibid.*; Letter to Inspector of Mines from the Manager Nymagee Copper Limited, 13<sup>th</sup> January 1908, Geological Survey of New South Wales Report File, MR 138; 'Waiting for a Railway – Nymagee Copper Mine Idle', *Evening News*, 7 April 1908, p. 7.
- <sup>66</sup> Hermidale to Nymagee Railway Bill, NSW Legislative Council Papers, 20 December 1910, pp. 1221-1234.
- <sup>67</sup> 'Nymagee Copper Mine', *Cobar Herald*, 15 September 1908, p. 3.
- <sup>68</sup> Hermidale to Nymagee Railway Bill, NSW Legislative Council Papers, 20 December 1910, p. 1223.
- <sup>69</sup> *Ibid.*, p. 1225; 'Hermidale Nymagee Line – Mr Carne's Report', *Cobar Herald*, 22 June 1909, p. 3.
- <sup>70</sup> ARNSWDM for 2012, p. 87; Burgess, *The Great Cobar*, pp. 248-250.
- <sup>71</sup> 'Mouramba Copper Mines Ltd.', *Sydney Morning Herald*, 5 Jul 1913, p. 17; 'Nymagee', *Daily Telegraph*, 6 November 1912, p. 12; 'In and About the Mines', *ibid.*, 28 October 1913, p. 11.
- <sup>72</sup> ARNSWDM for 1913, p. 85; *ibid.*, for 1914, p. 199; Burgess, *The Great Cobar*, Revised ..., pp. 285-287
- <sup>73</sup> ARNSWDM for 1914, p. 199.
- <sup>74</sup> *Ibid.*, for 1915, p. 48.

- 
- <sup>75</sup> *Ibid.*, for 1916, p. 17.
- <sup>76</sup> *Ibid.*, for 1917, p. 93; *ibid.*, for 1918, p. 92; Burgess, *The Great Cobar*, Revised ..., pp. 285-287.
- <sup>77</sup> L.B. Gilligan, 'Cobar and Mineral Hill Synclinal Zones', in N.L. Markham and H. Basden (eds), *The Mineral Deposits of New South Wales* ..., p. 165.
- <sup>78</sup> Carne, *The Copper Mining Industry and the Distribution of Copper Ores* ..., p. 257.
- <sup>79</sup> 'Nymagee', *Riverine Grazier*, 2 March 1881, p. 2.
- <sup>80</sup> 'Nymagee', *Australian Town and Country Journal*, 20 October 1883, p. 15.
- <sup>81</sup> 'The Nymagee Copper Mine – Report of Mr Slee, Inspector of Mines', *The Riverine Grazier*, 3 March, 1883, p. 2.
- <sup>82</sup> 'Nymagee', *Australian Town and Country Journal*, 23 June 1883, p. 15; 'Nymagee', *ibid.*, 6 October 1883, p. 15; Burgess, *The Great Cobar*, p. 141.
- <sup>83</sup> 'In and Around Nymagee', *Australian Town and Country Journal*, 19 May 1888, pp. 24-25.
- <sup>84</sup> 'The Traveller', *Australian Town and Country Journal*, 18 June 1881, p. 27.
- <sup>85</sup> 'Government Notice – Conveyance of Mails', *Sydney Morning Herald*, 10 September 1885, p. 13.
- <sup>86</sup> 'Nymagee Copper Mine', *Evening News*, 1 April 1889, p. 6.
- <sup>87</sup> 'A Sketch of Nyngan, Cobar and Nymagee, with a Few Men of Mark', *Freeman's Journal*, 2 June 1894, p. 17.
- <sup>88</sup> 'Nymagee News', *Evening News*, 2 February 1897, p. 2.
- <sup>89</sup> 'The Minister for Mines on Tour', *Sydney Morning Herald*, 6 February 1897, p. 5.
- <sup>90</sup> Nymagee Centenary Committee, *Nymagee Centenary 1879-1979*, 1979, p. 23.
- <sup>91</sup> The Mouramba Copper Mine – Nymagee', Report of the Chief Inspector of Mines 1942, Geological Survey of NSW, Report File MR 00138.
- <sup>92</sup> Ken McQueen, 'Hidden copper: The early history of the Cornish, Scottish and Australian (C.S.A.) Mine', *Journal of Australasian Mining History*, vol 4, 2006, pp. 20-46.
- <sup>93</sup> Auminco Pty Ltd, Compilation of recent exploration of the Mouramba copper mine Nymagee, N.S.W., Geological Survey of NSW, Report GS 1967/358, 7 pp.
- <sup>94</sup> Nymagee Division, Summary Report 1970, Geological Survey of N.S.W., Report File MR 138.
- <sup>95</sup> Ausminda Pty Ltd, Final annual exploration report 1967, Geological Survey of N.S.W. Report GS1967/084, p. 6.
- <sup>96</sup> Nymagee Division, Summary Reports 1973-1975, Geological Survey of N.S.W., Report File MR 138.
- <sup>97</sup> *Ibid.*
- <sup>98</sup> C.J. Stegman, and T.M. Stegman, 'The history of mining in the Cobar Field', in W.G. Cook, A.J. Ford, J.J. McDermont, P.N. Standish, C.J. Stegman, and T.M. Stegman (eds), *The Cobar Mineral Field – A 1996 Perspective*, The Australasian Institute of Mining and Metallurgy, Melbourne, Spectrum Series No. 3/96, 1996, pp. 3-39.
- <sup>99</sup> M. Skirka and V. David, Hera Au-Cu-Zn-Pb-Ag prospect, Nymagee, New South Wales, in C.R.M. Butt, I.D.M. Robertson, K.M. Scott, and M. Cornelius (eds), *Regolith Expression of Australian Ore Systems*, CRC LEME, Perth, 2005, p. 262.
- <sup>100</sup> G. Galley, The Fall and Rise of Pasmenco, Melbourne Mining Club Lunch Address, 24 April 2003, <https://www.ausimm.com.au/content/docs/speech270403.pdf>
- <sup>101</sup> Skirka and David, Hera Au-Cu-Zn-Pb-Ag prospect, Nymagee, New South Wales, in C.R.M. Butt, I.D.M. Robertson, K.M. Scott, and M. Cornelius (eds), *Regolith Expression of Australian Ore Systems*, CRC LEME, Perth, 2005, p. 262.
- <sup>102</sup> Annual Reports YTC Resources Ltd and Aurelia Metals Ltd for 2011, 2014. <http://www.aureliametals.com.au/reports/>
- <sup>103</sup> 'The Minister for Mines on Tour – The Nymagee Copper Mine', *Sydney Morning Herald*, 6 February 1897, p. 5.
- <sup>104</sup> Peter Bell and Justin McCarthy, The evolution of early copper smelting technology in Australia, *Journal of Australasian Mining History*, vol. 8, 2010, pp. 1-22.
- <sup>105</sup> *Ibid.*
- <sup>106</sup> E.C. Andrews, *A general note on the position of the copper industry at Cobar*, New South Wales Internal Report, 1919, Geological Survey of New South Wales,