

## THE HISTORY OF IRON SMELTING IN AUSTRALIA

The story of early iron smelting in Australia was one of insurmountable economic difficulties due primarily to the transport problems in bringing the raw materials to the most suitable location for the smelter. The Colonial Governments considered that the infant manufacturing industries being developed at the time could not afford to pay a premium for iron over the price for the material landed in Australian ports. This imported iron came out as ships ballast. Although the Governments were impressed with the achievements of producing iron from local raw materials they would not protect the infant iron industry. A policy of free trade was maintained and all attempts at iron production were doomed to run at a loss.

The density of iron thus weighed heavily against it, notwithstanding that the first iron ore discovered in Australia was recognised after rocks of ore had been considered heavy enough to be used as ship's ballast.

The history of the five furnaces in Tasmania, three in Victoria, one in South Australia and seven in New South Wales that had a life of less than twenty years is thus one of exploratory or experimental attempts to demonstrate the feasibility of producing iron from native raw materials rather than an economic exercise in the production of iron. They all failed because no one was prepared to buy the iron at a price equal to or higher than the actual cost of production. These 16 furnaces were built and operated from 140 years ago during the 80 years from 1848 until 1928.

### TASMANIA

In Tasmania where ironstone was first discovered in Australia, the attempts at iron smelting were carried out in the four years from 1873 to 1877 mostly in the area now known as Beaconsfield. Beaconsfield in northern Tasmania is generally known for the large production of gold from one of the richest quartz reefs. Gold was discovered in 1847 and the reef mined from 1877 to 1914.

Near Beaconsfield, west of the Tamar River, was the site of the earliest recorded mineral deposit discovered in Australia except for coal reported in 1793 at South Cape Bay by French explorers and by George Bass in New South Wales in 1797. Colonel Paterson of the military corps had established a settlement at Yorktown on the Tamar West Arm in 1804 and in preparing his ship "Lady Nelson" for a return voyage to England in 1805, took aboard a ballast of iron ore, it being the heaviest material to be found in the locality. First reports identifying the material as iron ore were made in 1822 then the first geological investigation and report was made in 1866.

The iron ore was considered of equal or higher grade than many English ores and in 1872 two companies were formed to commence smelting, the Tasmanian Charcoal Iron Co. to exploit the first discovered ore at Mt. Vulcan and the Ilfracombe Iron Co. utilising an ore deposit six miles to the south at the foot of Blue Peaked Hill or Sugarloaf. The Ilfracombe blast furnace stood on a sandstone base and was contained in an iron shell approximately ten feet in diameter and 45 feet high. The Tasmanian Charcoal Iron Co. experimented with a hydrogen reduction reverberatory furnace, the hydrogen being produced by a charcoal fired retort. After two or three attempts, samples of iron were produced but failure to maintain furnace heat and allow fluid iron to be tapped from the furnace forced the enterprises to be abandoned. The remnants of the Ilfracombe furnace still remain.

At the same time in 1873, in Hobart, the Derwent Iron Works built a brick blast furnace 23 feet high on a ten feet square base in Hampden Road, Battery Point. After several attempts produced a few tons of iron but the plant was abandoned similarly to the Ilfracombe furnace due to the charcoal fuel not producing sufficient heat to prevent a chilled hearth.

In 1874 a similar furnace to the Derwent was built in Beaconsfield by Tamah Hematite Iron Co., 40 feet high on a 20 feet square base. With improvements including hot blast produced by an air oven and two flues below the hearth to reduce the possibility of a chilled hearth, the furnace was able to produce 500 tons of iron in six months to June, 1875 at a rate of five tons per day. The furnace was shut down when it was found the iron could not be sold at a price above the cost of production.

In the meantime the Tasmanian Charcoal Iron Co. was reformed in 1874 into the British and Tasmanian Charcoal Iron Co. and with English capital, imported a

complete blast furnace plant including an iron clad blast furnace 23 feet in diameter and 75 feet high, a vertical steam charging lift and hot blast facilities. With a six feet diameter hearth, the furnace capacity was 250 tons per week and 10,000 tons of iron was produced in 12 months to August, 1877. Coke was used as fuel, procured from the Illawarra being produced at Wollongong Harbour. To reduce costs, 40 coke ovens were built alongside the furnace at Port Lempriere and Bulli seam coal was imported. However, in addition to the high production costs, the Mt. Vulcan iron ore was found to contain varying proportions of chromium which considerably restricted the use of the iron, much was left unsold and no further attempts at iron smelting were made in Tasmania. The furnace was demolished and the shell cut into sections to make water tanks for the Tasmanian Main Line Railway Co., supported on columns from the furnace charge hoisting lift. The locomotive supplied by Andrew Barclay for ore haulage on the six mile tramway from the quarry at Mt. Vulcan to the blast furnace at Port Lempriere was sold, it is thought, to a New South Wales north coast timber operation from where it was purchased by G & C Hoskins 40 years later in May, 1916 for the branch railway to connect the Wongawilli colliery and coke ovens with the Illawarra railway at Brownsville. Here it worked under the name of "Wonga" until 1922, being stored in a worn out condition until sold again in October, 1927 to the Southern Blue Metal Quarries Ltd. who were operating in association with Southern Portland Cement Ltd. at Berrima. The locomotive worked in the Gingen Bullen Quarry at Berrima for 12 months until September, 1929 then was scrapped in 1942.

#### VICTORIA AND SOUTH AUSTRALIA

Similar attempts at iron smelting were made in Victoria and South Australia. In 1873 the Victorian Iron Co. built a small brick blast furnace at Maldon near Castlemaine in central Victoria and in 1874, a three feet hearth blast furnace was built by the South Australian Iron & Steel Co. Ltd. on the Hindmarsh River north of Victor Harbour to use ore from Mt. Jagged. Using charcoal as fuel the Maldon furnace produced about one ton of metal while the Hindmarsh River furnace, equipped with a hot blast stove, produced 30 tons of iron before being abandoned, both with chilled hearths.

The main interest in the production of iron from natural sources in Victoria was in Ballarat which in the 1870s had become a large engineering centre providing machinery for the mining industry. Iron ore had been discovered in 1857 on the west bank of the West Moorabool River at Lal Lal, 16 miles south east of Ballarat and the Lal Lal Iron Mining Co. was formed in 1874. An iron plated blast furnace was built 28 feet high with a 30 inch diameter hearth, four tuyeres and capable of producing some 30 tons of iron per week. The furnace was lit in October, 1875 and 127 tons of iron were produced by the end of the year during which experiments were carried out using charcoal, lignite and coke as fuel. Lignite was found unsatisfactory and coke too expensive. From October, 1878 to March, 1880 another 240 tons of iron were produced but to increase production a new brick blast furnace was constructed, standing on a 25 feet square base. It was 56 feet high with a four feet diameter hearth and capable of producing 50 tons of iron per week. The new furnace was blown in March, 1881 and produced 860 tons of iron by March, 1882 but production costs were exceeding the price of imported iron. Another 600 tons were produced by May, 1883 then 800 tons by April, 1884 when the furnace was finally shut down having made a total of 2260 tons of iron over a period of three years but unable to compete with the cheap imports of iron arriving as ballast in the wool clippers. The remaining ruins of this furnace have been listed by the National Trust.

(To be continued) — J.L.N. Southern, B. Met. E. M. Aus. I.M.M.

# THE HISTORY OF IRON SMELTING IN AUSTRALIA

(Continued from December Bulletin)

## New South Wales

In New South Wales, as elsewhere, the initial discovery of minerals was usually accidental. The explorers, squatters and pastoralists set the pattern of settlement but, with little disturbance of the land, would only discover any mineral deposit if it occurred as a rocky outcrop. Surveyors, road makers and railway constructors had increased opportunities for discovering minerals exposed in cuttings and other excavations. It was thus in 1833 that Surveyor Jaques discovered pure ironstone in a cutting made for a creek crossing on the Southern Road at Nattai, near the present Mittagong, and the bridge became known as the Ironstone Bridge. The incentive to produce iron from these deposits came with the move to build railways from Sydney, the Great Southern Railway being planned to pass close to the location of the ore deposits.

Thus in 1848 the first iron smelted in Australia was produced in a Catalan type furnace built in two months. A cast iron stove and wrought iron spades were manufactured from the iron produced and exhibited in Sydney. One of the spades was used in the turning of the first sod at the commencement of construction of the railway from Sydney to Parramatta. The spade still exists today.

The name of the mine was changed from Ironstone Bridge to the Fitz Roy Iron Mine after the Governor, following his visit to the plant in 1850. The Fitz Roy Iron Mining Co. was formed in 1851. The Catalan furnace was fired with charcoal but it was realised that a cheap source of suitable coal would have to be found if smelting was to be conducted on a large scale. Only poor quality coal was found in the vicinity, the nearest of satisfactory quality being 18 miles to the south west near Berrima. Smelting continued intermittently until 1855, when three tons of wrought iron had been produced, but operations ceased with the fracture of the tilt hammer used in the production of wrought iron.

The company was incorporated in 1854 into the Fitz Roy Iron and Coal Mining Co. With extra funds rolling machinery was purchased in England, but this did not arrive in Australia until 1857. After a change in ownership the new plant was installed, then in 1860 yet another new company was formed, the Fitz Roy Iron Works Co. Renewed activity at the works came with the leasing of the plant in 1862 to B.W. Lattin who engaged an experienced English ironworker, Enoch Hughes as furnace manager. Hughes had helped establish the Victorian Iron Rolling Mills in Melbourne in 1860. The Catalan furnace was restarted so that a demonstration could be made of the capability of the new mills to produce iron bars of acceptable quality, resulting in orders for rails for the Great Southern Railway being lodged by the Government.

In 1863 construction of a blast furnace commenced. The furnace was of sandstone and firebrick construction with a 28 feet square lower part 23 feet high and a circular upper part a further 23 feet in height, the structure being reinforced with steel bands. The hearth diameter was four feet and the output was expected to be 60 to 80 tons per week. The furnace commenced operation in July, 1864 but Lattin surrendered the lease and Hughes left in August. However by May, 1865, hot blast had been introduced to the furnace using a coal fired stove and some 2,400 tons of iron had been produced by June, 1865 at rates of 60 to 120 tons per week. The iron however could not be sold at a profit so the plant was closed in April, 1866. A final attempt at ironmaking was made by an English company formed 1874 under the name of the Fitzroy Bessemer Steel and Hematite Iron & Coal Co. Ltd. The furnace was equipped with a closed top to recover the furnace gases to be used as fuel to heat the hot blast and it was decided to replace the local high ash anthracite fuel with Lithgow splint coal and Bulli seam coke, the railway having been opened from Sydney to Lithgow and Goulburn during 1869. The furnace was finally blown in again in February, 1876 and produced 3273 tons of iron in the nine months by when it was shut down in March, 1877 due to the high cost of the long distance transport of the fuel and flux. The furnace was demolished in 1927.

In 1884 the works were sold to a new company known as the Mittagong Land Co. and in 1886 William Sandford leased the rolling mills with the object of pro-

ducing sheet iron and rerolling rails for the Government. Sandford had come to New South Wales in 1883 from a rolling mill in Bristol to set up a wire netting plant on the Parramatta River for John Lysaght. In 1885 he went to Mittagong to inspect the Fitz Roy Ironworks and took a lease of the rolling mills in 1886. He soon realised that neither the plant or the location was suitable for iron production and rolling, and in 1887 went to Lithgow. There he was more impressed with the plant and found James Rutherford equally eager for him to have a seven year lease of the plant.

James Rutherford, the New South Wales manager and main shareholder in Cobb and Co., had been persuaded by Enoch Hughes and Dan Williams that Lithgow, with its coal deposits, was an ideal location for an ironworks. Williams, with the contract to construct the Government railway west of Lithgow, had unearthed what appeared to be iron ore in one railway cutting and limestone in another. Enoch Hughes had left Mittagong in 1868 and established an iron foundry in Pymont in 1871 before meeting Williams and Rutherford in 1874. Rutherford and Williams leased coal bearing land from Thomas Brown, the owner of the Eskbank Colliery, commenced construction of the Eskbank Ironworks and laid the foundation stone for a sandstone blast furnace on New Years Day, 1875. The furnace was 55 feet high and equipped with a hot air oven. With a hearth diameter of the order of 3 feet 6 inches, the furnace was considered capable of producing 100 to 120 tons of iron per week. The fuel came from the local Eskbank Colliery but the ore was from a variety of sources the most distant being near Blayney, 77 miles away to where the railway had been completed in 1876.

Hughes was the manager when the furnace was lit in December, 1875. It could have been unfortunate that this furnace was built at the time when the Fitzroy Bessemer Steel and Hematite Iron & Coal Co. furnace at Mittagong was ready for the final and most successful run, however competition did not eventuate. The Mittagong furnace finished in 1877 at the time that the Lithgow furnace was able to achieve continued operation. It produced 8,800 tons of iron in five years until it was closed down in 1882 for the usual reason, a failure to show a profit. Rutherford was so disappointed at the failure of his project that he is reported to have taken two wagonloads of blasting powder to the site in the dead of night and blown the furnace up so that he would not be tempted to repeat his folly of starting it in the first place. Thus ironmaking at Lithgow and indeed in New South Wales, ceased and was not to recommence for a further 25 years.

After the demolition of Rutherford's blast furnace, his rolling mill plant was still rerolling old iron rails to produce merchant bar and rails for the new tramways of Sydney. In 1886 after finding the rolling mills at Mittagong inadequate, Sandford was quite impressed with the plant at Lithgow and to their mutual agreement first leased the mills from Rutherford for seven years, then purchased the works outright in 1894. By this time the railways were importing steel rails in place of iron rails as they were scrapped and in anticipation of the end of free trade with Federation in 1901, Sandford built a four ton Siemens-Martin open hearth steel furnace and tapped the first steel in Australia in April, 1900.

In December, 1904 the Government called tenders for the supply of all Government requirements in iron and steel in New South Wales for seven years,

provided 90% of the iron was produced from local raw materials. Sandford being the only bidder, he was given the contract and immediately proceeded with the purchase of a steel plate blast furnace from England. The furnace was 75 feet high with the shaft supported on ten cast iron columns. With a hearth diameter of nine feet and hot blast supplied by three Cowper stoves the furnace was capable of producing 1000 tons of iron per week. The stoves and boilers were heated with blast furnace gas, the furnace top being closed with a single bell operated by a steam cylinder.

**J.L.N. Souther, B.Met.E.M.Aus. I.M.M.**

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**THE GOLDEN SANDS OF SHELLHARBOUR**

## THE HISTORY OF IRON SMELTING IN AUSTRALIA

(continued from May bulletin)

The furnace was blown in in April, 1907 but initial operation proved difficult due to the inadequate quantity and quality of the coke available. The lack of sufficient coke supply was supplemented by the direct charging of coal to the furnace which did nothing to improve its operation.

Sandford had anticipated a Federal Iron Bonus would be paid when he decided to establish the blast furnace plant. This bonus did not eventuate however, and this, coupled with the initial overexpenditure and numerous operating difficulties, forced Sandford deeper into financial difficulties. The bank finally foreclosed on his loans and the works were closed down on 8 December 1907, with the exception of the blast furnace, which was kept working to avoid damage to the lining. The Government had been considering Sandford's request for a financial advance when they found G. & C. Hoskins, Sandford's largest outside shareholder and customer for pig iron, willing to purchase the plant, pay all debts and take over the operation from 1st January 1908.

Hoskins immediately commenced reconstruction of the plant, replacing the wrought iron puddling furnaces and the three small steel furnaces with two steel furnaces of 50 tons capacity and one of 75 tons then constructing a second blast furnace of 11 feet 6 inches hearth diameter and 200 tons per week capacity which was blown in during November 1913. By this time the quality of the locally made coke had led Hoskins to import coke from Newcastle and the Illawarra, even though Hoskins had built a battery of eighty coke ovens in 1912. In 1916 Hoskins purchased the Wongawilli colliery on the South Coast and erected a washery and 40 coke ovens on the site, with a further 80 ovens being added in 1925.

With the commissioning of the second blast furnace and the increasing proportion of non-Lithgow coke being used the tonnages of materials railed to and from Lithgow rose rapidly, highlighting the disadvantages of its location relative to both high quality raw material supplies and to the marketplace. Facing competition from the Newcastle plant of BHP from 1915, a move to Sydney on the Parramatta River at Clyde or the seaboard at Port Kembla was considered. Port Kembla, with its proximity to coke and limestone, was decided upon and land was purchased in 1921. Iron ore leases had been acquired over deposits in the Goulburn district to augment supplies from Cadia but qualities and quantities were not



impressive. Leases were obtained for ore deposits in Tasmania and Western Australia but development and transport costs appeared prohibitive and the only practical solution appeared to be the purchase from BHP of Iron Knob ore from the Middleback Ranges in South Australia. BHP was thus the lucky company, being fortunate in that their iron ore leases contained ore with consistent quality and quantity in contrast with those of all other prospective producers of iron. All previous ore deposits varied in grade with increases in silica, chromium or titanium together with falls in iron content while the total mineral content never amounted to the estimated tonnage, as proved in those that were worked out. With all state Governments mindful of the value of industrial development, they instilled into their respective Departments of Mines a policy of optimism that is quite apparent when reading their geological survey reports. Department surveyors and geologists were the worst offenders in overestimating the value and extent of mineral deposits, so much so as to be largely to blame for the failure of enterprises which achieved the production of iron from inadequate raw materials. Even this short lived production could never have been economical while the same Governments continued their free trade policy. However, without the optimism most of the enterprises would possibly have not been attempted.

BHP's proposition for a seaboard iron and steel works was to succeed with the decrease in pig iron being used a ship ballast as woden ships were replaced by iron ships. The main product with which BHP had to compete with imports was steel rails and they were not arriving as ships ballast. Hoskins realised they would be in a similar position with the establishment of their Port Kembla works of Australian Iron and Steel Ltd. and Lithgow blast furnaces were shut down in November 1928 as soon as the Port Kembla blast furnace achieved normal production.

Finally there were two small experimental blast furnaces in New South Wales, the remains of which were still in existence for some years after their abandonment. On the Sydney to Melbourne road within four miles of Bookham, 15 miles south of Yass an iron ore deposit was leased in the vicinity of Bogolong Creek, a tributary of Jugiong Creek flowing into the Murrumbidgee River. A syndicate from Albury in April, 1874 had erected a small brick blast furnace to be fired with charcoal. A small amount of iron was produced, no more than to allow the testing of its quality. The contract for the extension of the Southern Line railway from Yass to Cootamundra was let in May 1874 and the establishment of an ironworks was dependent on its completion. By the time the railway was completed to Murrumburrah by March 1877, the scheme had been abandoned.

- J.L.N. Southern, B.Met.E.M. Aus. I.M.M.

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(Continued from June Bulletin)

In Illawarra, Patrick Lahiff had been taking a keen interest in the attempts of the various enterprises to produce pig iron by smelting local ores. He was manager of the Illawarra Coal Co. at Mount Pleasant Colliery, which opened in 1861. He had approached the managers of the various ironworks in Tasmania, Victoria, Mittagong and Lithgow recommending the use of Illawarra Bulli seam coal or coke to solve their fuel problems. Lahiff was taking quite an active part in the development of Wollongong, in the construction of sandstone buildings in the town as well as the building of Belmore Basin in Wollongong harbour. Lahiff knew of the existence of ironstone deposits along with the coal seams on the Illawarra Range from Coalcliffe to Jamberoo that had been discovered in 1863. These deposits, in various places, were described as ferruginous shale, clayband, carbonate of iron and brown hematite, varying from 20% to 50% iron.

Very little coke was being produced in Illawarra prior to 1888 and when Lahiff found coke produced by spontaneous combustion at the base of the coal slack dumps, he built a small blast furnace in 1882. Using this coke as fuel he produced some ten tons of iron to test the local materials. This furnace is of particular interest as it was the only experimental blast furnace built that could be examined in modern times.

It was typical of such furnaces and gave an insight to the relatively modest outlay needed to test local ores and fuels. This was built at the foot of the Mt. Pleasant Colliery incline, at the end of what is now Robsons Road. It stood on a six feet square sandstone base four feet high above which was erected a cylindrical brick furnace bound for reinforcement with the material most readily available to the owner, a colliery haulage rope. This brick structure was six feet high and six feet in diameter. There were two nine inch courses, the outer of common building brick from which the inner firebrick lining was separated by the usual layer of 4½ inches of insulation. The hearth diameter was 30 inches and there was a 16 by 14 inch opening in the side of the furnace for a single uncooled tuyere. When inspected by the author in 1943 there was severe burning of up to three inches of the firebrick lining in the lower part and a hole had been knocked through the side of the furnace allowing the close inspection to be made.

By 1955 only the sandstone hearth remained and in 1970 the whole site disappeared completely in the excavation for the extension of Robson Road. No provision was made for continued operation of the furnace and it would appear that the three feet eight inch gauge skipway and its rails, near which the furnace was built, would have had to be covered with sand to allow the furnace to be tapped.

Following the successful trial smelting Lahiff tried to encourage investors into setting up a local coal industry. The name of the company was changed to the Mt. Pleasant Coal and Iron Co. in 1888 and the Wollongong Argus of 28 November, 1894 carried reports of a meeting of local dignitaries and businessmen at the O'Briens Hotel to discuss the matter. Two proposals were discussed, one for a furnace producing 500 tons per week and a less ambitious scheme for a 70 tons per week furnace. After inspection of the nearby iron ore seam was carried out by representatives of the interested parties interest appears to have waned and no more was heard of the project. The quality and quantity of ore in the local deposit, the costly transport problems to obtain limestone and the experience of previous iron smelting enterprises prevented any enthusiastic support.

Other schemes in the Illawarra included the formation of the North Bulli Coal and Iron Mining Co. in 1863 but they did no more than observe Lahiff's attempts. From the 1870's, two politicians, Henry Parkes and John Sutherland, with land holdings in the Shoalhaven and Jamberoo areas, had plans to produce iron from ore, coal and limestone in the district. Plans initially called for the iron to be shipped from Jervis Bay or Kiama, then by rail with the move to build the Illawarra railway. In 1890 the location suggested for the smelting works was Port Kembla but again further interest in the scheme was not forthcoming and nothing more was heard of the project.

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J.L.N. Southern,  
B. Met.E., M. Aust.I.M.M.