

Gold in the ‘Mundic’: The Saga of Dargue’s Reef, Majors Creek, NSW

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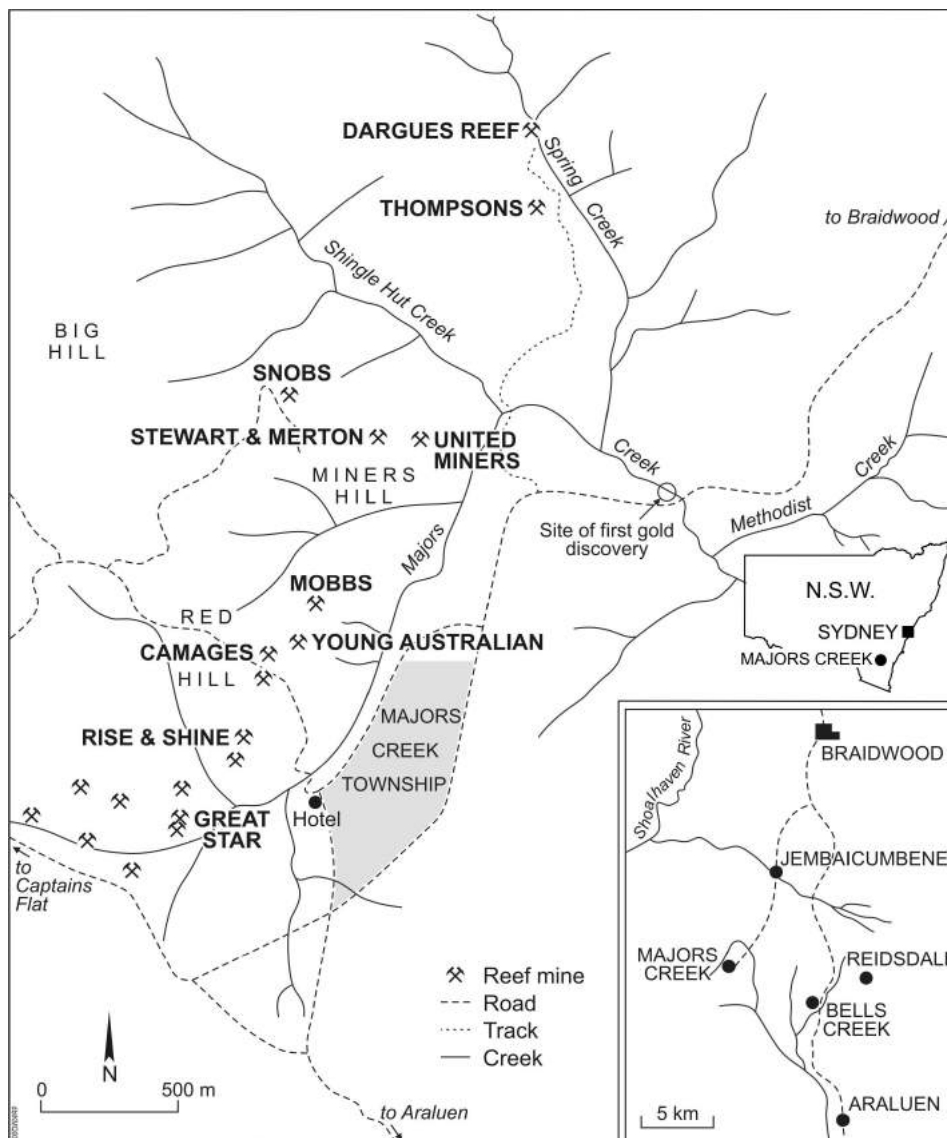
Gold is found in bedrock reefs and lodes, generally in its elemental form, as well as in secondary deposits formed by weathering and erosion of these primary occurrences (for example, alluvial gold). After quartz, the mineral most commonly associated with gold is pyrite (iron sulphide) also known colloquially as ‘fools gold’ or ‘mundic’. This association has guided prospectors to new lode gold deposits, but also plagued attempts to extract the gold where the two minerals are rather too intimately associated. In these refractory ores the gold is commonly locked in the pyrite as small, in some cases sub-microscopic, inclusions or even dissolved in the pyrite host. Up until the end of the nineteenth century refractory gold ores, including those at such famous deposits as the Golden Mile, Kalgoorlie, and some of the ores on the Witwatersrand in South Africa, posed a major challenge to metallurgists. In many cases, some gold could be released by fine grinding, but a significant proportion was lost with the pyrite in the tailings. Various methods of roasting and chemical treatment, particularly using chlorination and cyanidation, were ultimately developed to recover this ‘lost’ gold.¹

Dargue’s Reef, near Majors Creek in southern New South Wales (Fig. 1), is a pyritic gold deposit and the history of its mining and exploitation highlight some of the challenges and developments in extracting gold from the ‘mundic’. The deposit was discovered in 1868 by Joseph Dargue while he was mining alluvial gold in Spring Creek and it is still the largest known bedrock gold deposit in the Majors Creek area. Natural surface weathering had broken down the pyrite in the upper part of the deposit to release its contained gold. Much of the fine alluvial gold in the Majors Creek and surrounding goldfields of Jembaicumbene, Bells Creek and Araluen was probably derived from the weathering and oxidation of similar pyritic bedrock deposits.² Within the upper oxidised zone it was relatively easy to extract the free gold by gravity separation or grinding of consolidated material and mercury amalgamation, but below this zone the difficulties of extracting gold from the unweathered ‘mundic’ soon became apparent. Over the next 140 years numerous attempts were made to profitably work the ‘mundic’ at Dargue’s Reef. All failed, although not just because of the metallurgical difficulties. Modern gold extraction methods can effectively treat pyritic ores and now a new attempt is being made to mine Dargue’s Reef. An extensive drilling program has indicated a viable resource and against some local opposition, approval has been granted to establish an underground mine. A new chapter in the history of Dargue’s Reef may be beginning.

Discovery and early history of the Majors Creek Goldfield

Catherine Baxter, accompanied by a boy named Jack Higgins (commonly known as Jack Baxter) discovered payable alluvial gold in Majors Creek on the 5th October 1851. This find followed the initial discovery of gold in the Araluen valley downstream from Majors Creek in September 1851 and at Bells Creek in the nearby escarpment. Mrs Baxter was the wife of George Dunny Baxter, a pardoned convict, and she appears to have been employed by Andrew Badgery of Jembaicumbene Creek, who owned property surrounding Majors Creek.³ Using a cradle, she and Jack recovered four ounces of gold on the first day and subsequently sufficient gold to purchase a small farm at nearby Irish Corner (later known as Reidsdale). Here she grew vegetables and poultry to supply the gold diggers at Majors Creek until she was tragically killed on the 11th June 1858 when her cart overturned while travelling to Majors Creek.⁴

Figure 1: Location and map of the Majors Creek goldfield showing the position of Dargue's Reef and other reef mines. Also shown is the site of the first discovery of alluvial gold by Catherine Baxter.



Source: R.K. Close 1980, various historic records and ground checking by the author.

Within two days of discovery there were 50 miners on Majors Creek.⁵ Initially considered a small, short-term field it proved to be one of the richest in the Braidwood region. The early miners were able to obtain good returns from the creek bed and bank material, probably averaging 1 oz per day per miner and commonly 2-3 ozs. There were also some exceptional finds including by one party of four who extracted 118 ozs in the first week.⁶ By December 1851 there were between two and three thousand diggers at Majors Creek and most were getting gold.⁷ Gold was found from the surface to the water level and later mining continued below this and into the weathered upper part of the granite bedrock.

Parts of the Majors Creek and adjacent diggings were on private land, owned by Andrew Badgery and Messrs Hassall and Roberts, and the miners (usually each party) had to pay a fee to the landowner as well as take out an individual miners licence of 30 shillings per month. Other parts of the field, including on the south side of Majors Creek, were on Government land. Following working of the main section of Majors Creek down to the falls at the edge of the escarpment, other discoveries were made and rushed in the adjacent tributaries and surrounding areas including to the west at Long Flat. A rush to Spring Creek, a northern tributary of Majors Creek, occurred in the latter part of 1852 followed a couple of months later by short rushes to Methodist Creek, further east, and Kennedy's Creek.⁸

Alluvial gold mining at Majors Creek reached its peak in the early 1850s, but continued sporadically over a significant period due to frequent water shortages (the field is on the tableland and has a small catchment), occasional new discoveries and reworking of the old diggings, particularly by Chinese miners. Severe flooding, for example in September 1852 and May 1854, also hampered alluvial mining by disrupting the workings and washing away dams and water races.⁹ During this early alluvial mining phase Majors Creek was a very lively place. Martin Brennan, who served as a trooper at Majors Creek in 1859 and later became Senior Superintendent of Police in New South Wales, recalled:

There were numerous so called hotels on the creek, and centres of population, where Bacchanalians – and their name was legion – worshipped their god. The strains of the Scotch pibroch, the Irish pipes, fiddles, flutes, drums, dulcimers, a German band, as well as the rattle of skittles and the click of the bagatelle balls, could be heard nightly at these dens ... The publicans alive to their interests, imported, at high wages, dancing girls from Sydney, the arrival of each contingent being marked by a great demonstration, which was familiarly known as the 'New Rush'.¹⁰

By the early 1860s the easily recovered alluvial gold had been largely worked out and the population of the field had substantially decreased. However, the area had become more settled with miners establishing their families in permanent dwellings. An itinerant schoolteacher, Mr John Merest, was appointed in 1868 to superintend three 'teaching stations' at Long Flat, Harold's Cross and Vernelly. In 1870 planning and erection of the first stone church, Saint Stephens, commenced.¹¹ Increasing numbers of Chinese miners were coming to the field to work over the old claims. To this point there

had been little interest in reef or hard rock mining as this required significant capital for deeper mining and crushing machinery. Tom Cook made the first discovery of a reef at Majors Creek, it is believed, in about 1865, when he discovered a quartz 'leader' on Miner's Hill and recovered gold by hand crushing and washing the rubble.¹² Edward Wilson in the same general area made a more important find and this later became the United Miners reef mine.¹³ By October 1868 greater attention was being directed towards the numerous bedrock and quartz reef deposits that were being discovered and it was suggested that Majors Creek would become an important reefing district, particularly if capital could be attracted from 'really moneyed men'.¹⁴

Joseph Dargue and the prospector ants

Joseph Dargue arrived in Australia in January 1857 with his wife Sarah and two young daughters. The family were assisted immigrants from Lancashire and Joseph, aged 31, was described as a farm labourer. It is not clear whether he immediately moved to the goldfields, but he was in the area in 1858 and 1861 when his third daughter and son were born in Braidwood. He was certainly working as a gold miner at Majors Creek before April 1868.¹⁵ By the late 1860s alluvial gold mining at that location was in significant decline, although about 220 miners, including European and Chinese, continued to work the field largely by ground sluicing and 'surfacing'.¹⁶ Dargue was engaged in this activity in July 1868 near Spring Creek, and he later recalled that he noticed an 'ant bed' which he sampled and panned. Seeing colours of gold he powdered the whole bed and recovered £20 worth of gold (about 6 ozs). Convinced that a valuable reef was nearby he continued to search and work the vicinity for some time without much success until he persuaded a group of mates to fund a small syndicate to help define and develop the reef.¹⁷ Members of the syndicate included William Lee, Bob Carter and possibly Nathan and James Piggott.¹⁸

Dargue named the mine the 'Homeward Bound' and major work commenced in September 1869 as an open-cut on both sides of Spring Creek. Near surface, the 'reef' consisted of a 9-20 foot wide zone of oxidised, disseminated pyrite in weathered granite (Fig. 2) with the gold as fine, free particles released by natural alteration of the pyrite.¹⁹ A crushing plant was constructed about three-quarters of a mile from the mine on Majors Creek and officially opened on the 24th of November by Mrs Dargue, who cracked a bottle of champagne over the machine and named it the 'Welcome Stranger'.²⁰ This was only the second plant built in the district and consisted of 10 head of stamps in 2 sets of 5, driven by a 16 horsepower steam engine. The crushed ore was passed over mercury plates to extract the finer gold and then blanket strakes to recover any gold that escaped amalgamation. Later a smaller 10 head battery was added to treat the softer ore and the whole plant was capable of treating about 200 tons per week.²¹ At first the ore was easily excavated by digging up the partly decomposed granite and loading into drays to convey to the crushing plant. Shallow shafts were also excavated to explore the deposit.²²

Additional claims were quickly taken up adjacent to Dargue and Co. along the same line of mineralisation, including the No. 1 East claim or 'Enterprise' worked by Atkinson, Morris and Co., the No. 2 East claim of May and Plum and the No. 1 West

claim of Allan and party. Thompson's Reef, discovered south of Dargue's Reef, was of a similar style of mineralisation. Other reefs or lines of mineralisation discovered in the surrounding area included Wilson's Reef also known as the United Miners Co., the No. 1 North held by Thomas Stewart (later spelt Stuart) and Co. and No. 2 North taken up by Snare and party.²³ Another crushing plant built by Wilson and Munro was opened on the 11th of December on Majors Creek, just upstream from the 'Welcome Stranger'. This new plant was to process ore from the United Miners Co. and other reefs on the field.²⁴ The Enterprise Co. working immediately to the east of Dargue's claim completed an elaborate crushing plant in September 1870, but took some time to locate good ore.²⁵ Throughout 1870 there was consistent production from Dargue's claim and numerous other reefs and showings were opened up and tested on Miner's Hill, Red Hill, the Big Hill and Shingle Hut Creek (Fig. 1). Many of these deposits yielded high-grade ore up to 3 ozs per ton, but typically from a small tonnage.²⁶ The highergrade ores were generally in narrow quartz veins or 'leaders' and in some cases these passed at depth into wider, but lower grade zones of 'mundic' similar to that at Dargue's. By early 1871 there were five crushing plants with a total of 65 head of stamps processing ore from the various reefs in the Major's Creek area, including one crusher, the Iron Duke, in the centre of town.²⁷

Figure 2: View (looking east) showing Dargue's Reef exposed by surface workings in January 1870. The letters R define the edges of 'reef', which is 15 foot (4.6 m) wide.



Source: *Australian Town and Country Journal*, 29 January 1870, p. 13.

Early mining at Dargue's Reef and problems with the 'mundic'

By June 1871, when a correspondent from the *Town and Country Journal* inspected Dargue's Reef, there were 20 men working the mine, along with seven to eight horse carts, each transporting ten loads a day to the crushing plant. Two shafts had been sunk to 30 feet on either side of the reef to test it at depth and a small tunnel commenced at the western end of the lode. Most of the ore being excavated at creek level now

contained a large proportion of unweathered or partly weathered 'mundic' and it was becoming clear that a different processing method would be needed to efficiently extract the gold from this material.²⁸

Weekly gold production to this time had ranged from 30 to 150 ozs, averaging around 60 ozs from about 120-180 tons of processed ore. Operating expenses for the mine and plant was £70 per week and the return to each of the shareholders between £10 and £15. Initially there were eight shareholders in the Dargue's syndicate, but in December 1870 one sold out for £1,000, which was considered at the time to be a bargain price.²⁹ The deposit was becoming wider at depth, but the refractory nature of the ore was increasing. The primary sulphide-rich ore contained approximately 2 dwt per ton of free gold, but the remainder, amounting to about 8 dwt, was now locked in the 'mundic'. Without a means to extract all the gold, it would be unprofitable to work this ore. Towards the end of the year several of the shareholders visited Victorian gold plants to see if they could discover a method for treating the refractory ore.³⁰

On the 25th of February 1872 there was a tragic accident at Dargue's mine. George Stubbins was blasting a rock at the bottom of a shaft when the charge misfired. After waiting a lengthy period he re-entered the mine and began removing the charge just as it exploded killing him instantly. He left a large and young family.³¹ In July, Dargue and Co. advertised the mine and plant for sale as six shares, with a seventh share retained. The sale was quickly and satisfactorily concluded in August.³² It is not recorded how much the six shares sold for but it was probably in the range of £1,000-£2,000 per share.³³ After the sale and during the period from late 1872 to 1875, Joseph Dargue appears to have moved to the Ironbarks area (now Stuart Town) south of Wellington in central New South Wales. There he took up gold mining leases and built and operated a crushing plant with William Lee, one of the other original shareholders in Dargue's Reef.³⁴ In early 1876 Dargue and his family moved to the Grafton area where he became involved in reef mining at Nana Creek on the Orara Goldfield.³⁵

During this first stage of mining from November 1869 to May 1872, the Dargue syndicate had worked their mine to a depth of 80 feet and produced 6,610 ozs of gold. After all expenses, including the cost of machinery and royalties, they cleared a profit of £12,291, a considerable sum at the time.³⁶ In mid 1872, the Enterprise group, which had been working Dargue's line of mineralisation at the No. 1 East claim, publicly floated their operation into the Enterprise Gold Mining Company.³⁷ The aim was to obtain capital to install furnaces, grinding pans and amalgamators to treat the pyritic tailings from their plant and recover sufficient gold to make the operation profitable. Production records for this and other sections of the 'reef', including No. 2 East and No. 1 West, are not available, but it is likely that at least several hundred ounces of gold were produced.

Dargue and Co. had recognised the difficulty of profitably extracting gold from the 'mundic' at Dargue's Reef and subsequent owners were to struggle with this reality. There is no record of activity in the period immediately following the sale of the mine, however, in December 1875 it was reported that a company had taken up the claim and installed a Denny's pulveriser to help process the ore.³⁸ In June 1876 contracts were let to dewater Dargue's Shaft and to start raising ore.³⁹ During that year the first furnaces to

roast the 'mundic' ores of the area were trialled and some parcels of ore were sent to Melbourne for test treatment.⁴⁰ The 'mundic' problem was now apparent in a number of mines at Majors Creek and Bells Creek, and a Pyrites Committee had been established to investigate processing options. Samples were tested by John Masters of the Pyritic Reduction Works in Thames, New Zealand, but his report to the committee in January 1877 concluded that he was not prepared to set up a pyrites treatment plant at Majors Creek, given the type and availability of ore. He did recommend that Dargue's Reef be explored at depth as it represented the best chance for a payable deposit.⁴¹

Attempts to mine and process ore from Dargue's Reef continued and in May 1877 a large parcel was crushed by Stephens and party at the Enterprise plant. Mining operations by the Enterprise Gold Mining Company on the eastern end of Dargue's Reef appear to have ceased by this time and there was some doubt about who owned the plant, as rents were owing to Hassall and Roberts, the landowners.⁴² In June the Dargue's Reef company was reconstructed by the addition of 20 shareholders who paid only £5 each for their shares. Further mining indicated that the mineralisation, which previously had appeared to pinch out, had now widened to 8 feet.⁴³

Clearly the treatment methods applied to the 'mundic' ores at Major's Creek were not recovering all the gold and further trials were conducted to test new methods. In September 1879 parcels of ore from various Majors Creek mines were tested at Clunes in Victoria by the newly developing chlorination process, reportedly with splendid results. The workings at Dargue's Reef appear to have been inactive at this point, but Edwin Field, manager of the gold and antimony mine at Costerfield in Victoria, secured the mine for a Melbourne based company and instructed that it be baled out and 20 tons of ore extracted for testing at Clunes.⁴⁴ In early 1880 the new company moved a crushing plant from Mongarlowe to Majors Creek, where the manager, Mr Cheesewright, erected it adjacent to the main shaft at Dargue's Reef. Two new dams were constructed on Spring Creek; a large one with a stiff clay wall about 30 feet high and a second dam further downstream close to the crushing plant. Edwin Field approached the Sandhurst Pyrites Works Company in Bendigo to determine if they would be interested in establishing treatment works for the 'mundic' at Majors Creek.⁴⁵ This did not eventuate and the cost of transporting material to Victoria for treatment rendered this alternate option uneconomic.

Despite setbacks, attempts to crack the 'mundic' problem continued. In January 1881 Mrs Elizabeth Barnston Parnell, a metallurgical inventor from Sydney, who had developed an interest and some expertise in treating pyritic gold ores, visited Majors Creek to obtain parcels of ore for experimental treatment using a roasting and washing technique that she had developed.⁴⁶ During February Mr W.H. Harrison of the Phoenix Pyrites Company at Greenwich on the Parramatta River successfully treated pyritic ore from Dargue's Reef using a method that he had developed, which did not employ amalgamation.⁴⁷ However, the real challenge was to develop a process that was economic and applicable on an industrial scale. Later in the year Dargue's Reef was acquired by the Warren brothers through a lease from the private landowners. Henry Warren was a civil engineer from Glen Innes and William Edward Warren a Sydney

physician and surgeon. It was reported in April that they proposed reworking the mine with additional capital, and in June miners extracting a shelf in the wall of the old workings near the surface, discovered a new lode missed by the earlier miners.⁴⁸ In February 1882 the Dargues Reef Gold-mining Company (NL) was registered with nominal capital of £6,000 in 200 shares of £30 pound each. Henry Deakin was the manager and the major shareholders were the Warren brothers and James Davies another civil engineer. The other shareholders were mostly Sydney based professional men including surgeons, chemists, solicitors, a draper, a tobacconist and a gunsmith.⁴⁹ It is not clear what process they were planning to use on the 'mundic', but they may have been encouraged by some of the developments happening in Sydney. The new company set up roasting furnaces at Majors Creek and crushing began in May.⁵⁰ At the first annual general meeting of the company on the 23rd June, Edward Warren outlined progress at the mine and reported that the operation was showing good prospects of return under the able management of Mr G. Pender.⁵¹ However, the company was unable to make a profit and in October the Dargue's Reef lease, mine, and plant were put up for sale. The sale advertised a seven year lease with the option for renewal to 14 years, and the plant at this point consisted of two reverberatory furnaces, a 10 head stamp battery, Wheeler and Arastra pans and six concentrators.⁵² Reports indicate that during its short tenure the Dargue's Reef Gold-mining Company produced minimal gold, largely the free gold in the mundic ore and possibly some gold from roasted material and remnant oxidised ore.⁵³ In his annual report for 1882 the local mining warden, John Heazlett, noted that opinion was divided as to whether the Dargue's Reef deposit was a good proposition, some believing that money had been wasted on useless equipment and plant instead of exploring the reef to greater depth. He also commented that the 'future prosperity of the Major's Creek gold-field depends on whether capital and common sense, that is, good management, be brought to bear on our quartz-reefs.'⁵⁴

For the next four years there was no mining of Dargue's Reef, although Robert Carter, one of the shareholders in the original Dargue and Co. syndicate, treated some of the 'mundic' tailings from previous operations by roasting, grinding in a Chilean mill and amalgamation to produce at least 11 ozs of gold. Reef mining across the field was generally in a desultory state.⁵⁵ Then in 1886 a small syndicate, including R.P. Simpson and E.P. Simpson, took up the Dargue's Reef claim.⁵⁶ The workings were dewatered and in early 1887 a 30-ton parcel of ore was sent to England for testing. The results from this bulk test were sufficiently encouraging for the syndicate to interest a group of London investors in setting up a 'pyrites' mining company with nominal capital of £70,000 to acquire 640 acres, including the area covering Dargue's Reef. This initiative led to the formation of the Dargue Gold Mining Company in 1888.⁵⁷

New investment and technology

By the late 1880s a range of new techniques had been developed for treating 'mundic' ores. One of the most promising was the Newberry-Vautin chlorination process, which combined with roasting and fine grinding offered the hope of economically processing such refractory ores.⁵⁸ Thomas D. Merton was a leading proponent of the chlorination

process in New South Wales and had built an innovative treatment plant for the Cunnigar Proprietary Gold Mining and Chlorination Company at McMahons Reef near Harden. In 1888, Merton, with partners, also built a similar plant near Parramatta for the Clyde Ore Crushing, Amalgamation and Chlorination Company of Sydney.⁵⁹ Through his contacts in Sydney, Merton appears to have been approached to take on the role of manager of the Dargue Gold Mining Company. Rowland Hassall, one of the landowners, was the local director, and other directors included James W. Johnson and E.P. Simpson.

The Dargue Gold Mining Company commenced building a new plant in November 1888, located where Joseph Dargue's original crusher had been erected on the north side of Majors Creek (Fig. 3). The plant consisted of a stone-breaker, five foot diameter Huntington mill, two Duncan concentrators and two Frue vanners, designed to produce a pyrite concentrate. These were driven by a 25 horsepower horizontal steam engine with a 30 horsepower boiler. Water for the boiler was pumped from a sunken reservoir in the bed of Majors Creek. The plant was in place by February 1889 and crushing commenced in March. Initial mining and processing was on ore from the United Miners deposit with work at Dargue's Reef to follow. It was proposed to transport the concentrates to Parramatta for treatment and if all went well to build a chlorination plant at Majors Creek.⁶⁰ With large scale mining of several deposits this was the most ambitious plan up to this point to mine and process the 'mundic' ores of Majors Creek. There was much speculation and exuberance in the press suggesting that this new development would be a great boon to the district, employing up to 400 workers and also providing a facility for other local mines to process their ores more cheaply.⁶¹

Operations continued smoothly through the early part of 1889 with the plant successfully separating and concentrating the 'mundic' as well as extracting the free gold by amalgamation. The concentrate was transported by horse teams to Tarago and then railed to Harden for treatment at the Cunnigar company works at McMahons Reef.⁶² A total of 150 tons of pyrite concentrates were sent to the Cunnigar works giving a return of 2 ozs to the ton. This material had been produced from 750 tons of ore. With the gold price at £4 4s per oz, transport costs of £2 10s per ton and treatment cost at £3 10 s per ton, the margin for the concentrate was only £2 8s per ton, which still had to cover the cost of mining and crushing. Clearly this was not a profitable arrangement.

In June 1889 Thomas Merton entered into a contract with the company to erect a chlorination plant at Majors Creek for £8,000, which he agreed to take out in paid-up shares. At this point the company appears to have been restructured and publicly floated as the Major's Creek Proprietary Gold-mining Company Limited. The chlorination plant was to be similar to that at McMahons Reef and capable of processing 100 tons of concentrate per week. Tenders were called for the supply of 150,000 bricks and construction commenced in August.⁶³

Mining and crushing continued at about 70 tons per week and from July 1889 ore was obtained from the United Miners, Plum's and Dargue's deposits, with

significant development work at the first two sites.⁶⁴ Dr Hartnung, an experienced assayer, had been appointed to carefully test the different ore types from the various deposits and was impressed with the grades and tonnages of ore available. He also indicated that some of the previous tailings could be treated for payable returns. Concentrates were now stockpiled on site for treatment in the planned chlorination plant and at the end of the year concentrates from 4,121 tons of ore were ready for processing.⁶⁵

Progress of the venture was beginning to attract the attention of local business people and Mr P. Madigan of Araluen purchased Johnson's old hotel with a view to reopening and enlarging the premises. It was reported that a Braidwood storekeeper was intending to open a branch establishment at Majors Creek and the local press also optimistically proclaimed that 600 men would be employed at the mine to support a population of 2,000.⁶⁶

By the end of the year the chlorination works were nearing completion with one of the two roasting furnaces, together with an 85-foot chimney erected, the chlorination building and assay house built, and most of the equipment in place, including a second Huntington mill and two additional Frue vanners.⁶⁷

In January 1890 the main shaft at the United Miners workings had reached 210 feet and intersected a second narrow reef carrying about 2 oz of gold per ton.⁶⁸ Development was well underway at Dargue's Reef and a cross cut from the No. 1 engine shaft through the 'big blow' lode indicated a width of 32 feet. The winding plant and poppet head were in place and a tramway connecting the mine and crushing plant was completed.⁶⁹

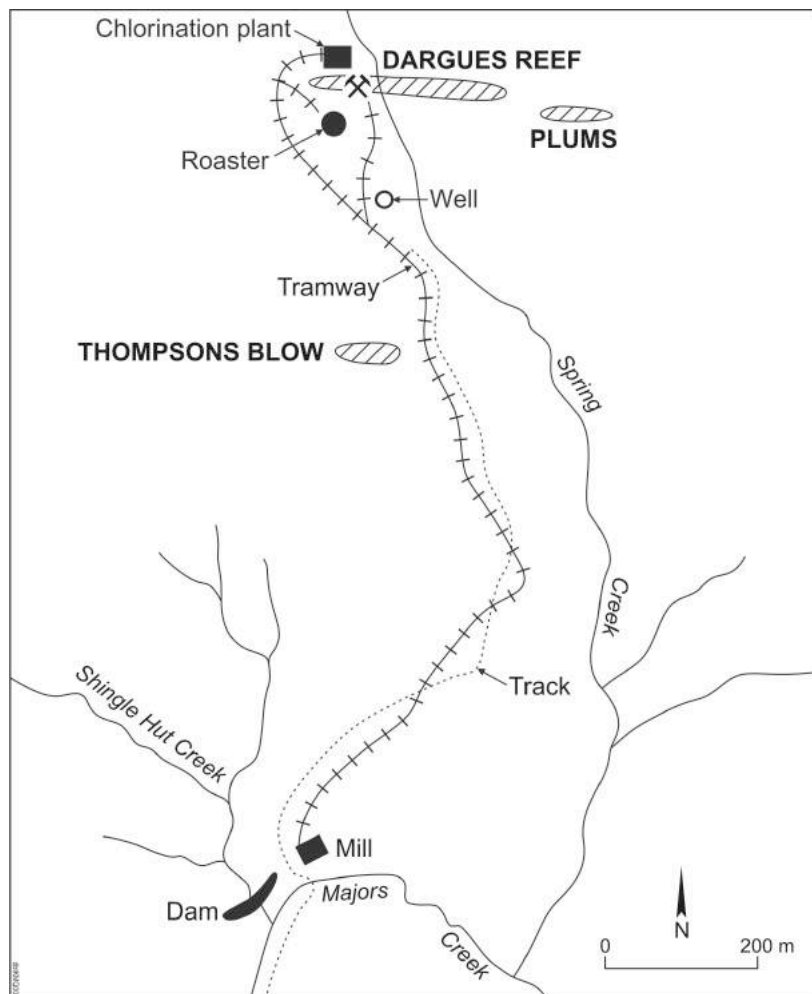
At the half yearly meeting of the Major's Creek Proprietary Gold-mining Company in early February it was reported that the company's finances were in a healthy state and that the chlorination works were expected to be operational within a week. Development on the United Miners Reef had deepened the main shaft to 214 feet and the recently discovered new reef had widened, with assays up to 4.5 ozs per ton. At Dargue's Reef, timbering of the engine shaft was almost complete and the No. 2 whim shaft had been dewatered, with the eastern drive at the base of this shaft cleaned out and extended to a total of 104 feet from the shaft. A rise and other exploratory developments indicated that the total mineralised zone had widened to 42 feet. Concentrates from the ore being raised from the various workings were reported to assay from 3.5 to 6 ozs per ton.⁷⁰

The chlorination works began operating in mid February after a short delay caused by heavy rain. The manager reported that the mills were running full time and that all machinery and the new tram were working well. A weighbridge had been installed and the ore was now housed in ore bins to keep it dry.⁷¹ A week later he reported that heavy rain had impeded operations, with water inflow into the Dargue's Reef engine shaft and difficulty in operating the rock breaker. All the dams were overflowing and the main creek was flooded.⁷²

From March through to August 1890 the plant operated steadily, crushing between 100 and 240 tons per week for an output of 20-46 tons of concentrate. Between 10 and 20 ozs of free gold were also extracted each week by amalgamation. The first

partial clean up of chlorinated gold appears to have been in early June, when just over 403 ozs were recovered.⁷³ Another clean up of almost 154 ozs was reported in July.⁷⁴ There had been some stoppages to the furnaces and in early August a number of workers were laid off pending a 're-arrangement' of the company, suggesting that all was not well, even though operations were continuing.⁷⁵ At the end of October there was a call on contributing shares and shortly after the plant was completely stopped due to lack of operating funds.⁷⁶ The company had invested between £30,000 and £40,000 and was now unable to pay its liabilities from the proceeds of the mine.⁷⁷ Records of production are incomplete, but figures reported in the press suggest that something more than 4,500 tons of ore had been processed. Gold recorded from early processing and amalgamation was 632 ozs and if all the gold assayed in the concentrates had been extracted by chlorination this could be a further 1,408 ozs, giving a total of 2,040 ozs. The value of this amount of gold would have been approximately £8,568.⁷⁸

Figure 3: Map showing the layout of the mining infrastructure at Dargue's Reef in 1890 during the operations of the Major's Creek Proprietary Gold-mining Company Limited.



Source: Map prepared by the author from historic descriptions and ground checking of ruins, using Google Earth as the base.

Following closure of the plant there was dismay in the local community and much analysis of the causes of failure. It was suggested that a major cause was the layout of the plant, which resulted in expensive materials handling.⁷⁹ Ore from the mine at Dargue's Reef was taken by horse-drawn tram down to the mill on the edge of Majors Creek and then the concentrate transported back to the roaster and chlorination plant at the mine site (Fig. 3). The crushing plant was located on the main creek to be close to a good water supply. It is also likely that this site was considered more central to the other deposits in the area, particularly the United Miners, where much of the early production occurred. Building the roasters and chlorination plant at Dargue's Reef may have been to reduce the hazard of fumes to the town of Majors Creek and also to allow the tramway to be used to back load the concentrate. Clearly all this transport and handling significantly added to the cost of processing. The trucking cost alone was at least 1s per ton and the separate supply of firewood and water to the various dispersed boilers also increased the cost. There are no clear figures on gold recoveries from the chlorination plant, but the available evidence suggests that there may have been problems with this part of the process. The crushing and concentration appear to have been effective at recovering the pyrite, although the concentrate probably also retained a significant component of the gangue, due to the use of Huntington mills, thus adding to the cost of roasting.⁸⁰ Assays of the tailings and slimes from the concentration plant in March 1890 indicated 6.8-10 gr of gold per ton, a loss of less than 2.5 per cent of the total average contained in the ore.⁸¹

Numerous intermittent attempts to work the 'mundic'

From 1891 to 1892 there were hopes that the 'state of the art' chlorination plant might be restarted. It was thought there were large reserves of ore in the Dargue's Reef deposit, which had been tested to a depth of 137 feet with drives 100 foot west at the 70 foot level and 110 feet west on the 120 foot level. Most of the ore processed had come from shaft sinking, other development and about 30 feet of stoping on the 70-foot level.⁸² Thomas Merton was still active in the area and had acquired a newly discovered reef with Thomas Stuart. In June 1892 Sydney mining agent James Antrobus succeeded in selling the Major's Creek Gold-mining Company to an English syndicate, which proposed to float a new company with capital of £105,000.⁸³ This was near the start of Australia's second gold boom and British capital was flooding into speculative Australian gold mines.⁸⁴ Over the next 15 years Dargue's and the other reef deposits of Majors Creek were subjected to renewed inspection, sampling, development rumours and sporadic mining related to 'English syndicates', promoters and local miners.

An attempt to float the proposed new company in late 1892 appears to have stalled, and in 1896 it was reported that several English capitalists, through Mr Austin Chapman MP and the Major's Creek Gold-mining Company, were trying to purchase the freehold title over Dargue's Reef for £20,000 and also acquire other properties, including the recently developed Snob's Reef at Majors Creek and the Lady Mary's Reef at Bells Creek.⁸⁵ Soon after, another syndicate represented by Richard A. Watson and Harold Sparkes attempted to obtain a 10 acre lease over Dargue's Reef, including

the mine and plant, as these were still inactive. This attempt ran into a legal dispute in August 1897 over the lease arrangement between the syndicate, the land owners and the Major's Creek Gold-mining Company, the latter now being in default of a mortgage used to purchase the freehold title.⁸⁶ The dispute seems to have been resolved and the following month it was reported that the new group were pumping out the mine and setting up winding gear in preparation for 'mining operations in real earnest'.⁸⁷ Mining operations commenced in April 1897 with 25 men employed.⁸⁸

From 1899 the focus of large scale company investment in gold mining in the Major's Creek and Araluen district shifted to alluvial gold dredging, using large mechanical dredges.⁸⁹ This continued up to 1914 and the start of WW1. Nevertheless there was still significant interest in reef mining, particularly by local miners and companies who could see a potential in the 'mundic' ores if an efficient processing method could be applied. In October 1899 it was reported that a representative of a large London syndicate had visited the Dargue's Reef mine and made a positive report on its development potential, but nothing seems to have eventuated.⁹⁰ Then in October 1900, Thomas Merton was able to interest another English syndicate in Dargue's Reef and this group entered into negotiations to take over the property, including Dargue's, Thompson's Blow and the United Miners, and spend £66,000 for development and additional machinery to treat the large volume of refractory ore.⁹¹ The following February the company, under the management of Mr A. Wilson, secured the property from the land owners for a four month trial, agreeing to purchase for £16,000 if the trial was successful. By May the workings had been dewatered and 25 tons of ore raised and sent to three different reduction works in Victoria for testing.⁹² There was a proposal to build a smelting works to process the ore, but this did not eventuate and by the end of 1901 the company had withdrawn.⁹³

Towards the end of 1902 a local syndicate proposed reopening Dargue's Reef and by December, ten men were bailing out the workings in preparation for mining 100 tons per week. The plan was to process the ore through a battery close to the mine, extract the free gold and send pyrite concentrates away for treatment.⁹⁴ Other local syndicates were now actively working a number of the other reefs at Major's Creek, including the Snob's (Mount Hope), the United Miners and Stuart and Mertons. Experiments were conducted on samples of different ores and tailings from the chlorination plant by J.W. Summers to see if they were amenable to treatment by a bromo-cyanide process. It was reported that these 'proved highly satisfactory'.⁹⁵

During the period 1901-1905 the parcels of 'mundic' concentrates produced by the small local operations at Majors Creek were sent to custom treatment works in Victoria and later to Dapto and Cockle Creek in New South Wales and even to Maryborough in Queensland. These works smelted the gold-bearing pyrite concentrates in combination with copper and lead ores to produce a matte that efficiently extracted the gold for later recovery. The irony was that although these plants could now successfully treat the ores the cost of transport largely ruled this out as a profitable option, except for the highest grade ores. In 1901 there was a proposal to set up a smelting plant at Majors Creek, similar to those at Dapto and Cockle Creek.⁹⁶ When this

did not eventuate as a commercial proposition a deputation lobbied the State Government to build a plant in the Braidwood area to process the gold ores from Majors Creek and Bells Creek. However, a report by J.B. Jaquet of the New South Wales Geological Survey concluded that such a plant would not be viable as there was an insufficient local supply of copper or lead ores to combine with the siliceous and pyritic gold ores to produce sufficient metal matte to extract the gold.⁹⁷

About 1904, J.W. Summers constructed a bromo-cyanide plant at Majors Creek as an addition to the crushing plant set up by the Major's Creek Proprietary Gold-mining Company, which was still on site. The latter was now owned by R.G. Hassall and J.E. Mackellar and rented by Thomas Keyte to process ore from the United Miner's Reef. It was suggested that concentrates from Dargue's Reef could be processed on site by roasting, followed by either the ordinary cyanide or the bromo-cyanide process for a cost of 30s per ton, compared to the cost of transport and treatment at Dapto or Cockle Creek of upwards of £4 10s per ton.⁹⁸ In April 1905, following negotiations by Samuel Holmes with the landowners for a long-term lease, Dargue's Reef was taken up on three month trial by a Sydney syndicate with yet another plan to establish a company and install the requisite machinery.⁹⁹ In May, James Gegg applied for a gold mining lease over Dargue's, which led to a dispute with the landowners who had not yet registered or arranged a lease with the Sydney group. The Mining Warden granted Gegg a six-month period to prospect the site and apply for a lease. Nothing substantive eventuated from these activities and Dargue's Reef continued to lie idle.¹⁰⁰

There was renewed excitement at Majors Creek in April 1907 when Mr Ernest Edwards, representing the famous mining consultants Bewick, Moreing and Company, visited the area and inspected the reefs. This was followed in June with a visit to Dargue's Reef by Mr John Ditchburn (Jun.), a Melbourne mining agent with connections to London mining interests, who commenced negotiations for an option on the property.¹⁰¹ In October it was reported that the investors were negotiating with the land owners for a lease over 100 acres of land including Dargue's and some of the other gold reefs and if successful they intended to erect reverberatory smelting furnaces to treat the ore on site. The Dargue's workings were dewatered in December, inspected, and carefully sampled for further testing. The samples returned results of around 11 dwt per ton.¹⁰² Rumours were rife about successful capital raising and 'satisfactory' negotiations, but it was not until November 1908 that the company agreed to purchase 40 acres over Dargue's Reef, subject to a successful six-month trial, and began development. A new poppet head and pumping equipment were installed and the main shaft re-timbered.¹⁰³ In January 1909 Mr J. Gore Adams, the new company manager, arrived from England to oversee operations, with the aim of thoroughly testing the ore by crushing on site and treatment of the pyrites concentrate at Cockle Creek. This work continued through to May, but the results appear to have been insufficiently encouraging for the company to purchase the mine and by January the following year negotiations had ceased.¹⁰⁴

In September 1910, two local syndicates took control of Stuart and Merton's and Dargue's Reef with a plan to try cyanide treatment again. It was thought that treating all of the crushed ore, including the fines, would be more successful than treating the

coarser pyrite concentrates as previously attempted by J.W. Summers. Analysis by Mr John Heazlett (Jun.) indicated that this treatment could yield a profit of 2 shillings per ton on the low grade ore, with the whole cost of treatment and crushing amounting to 20 shillings per ton, much cheaper than treatment at Cockle Creek. By the end of October a large quantity of ore from Dargue's Reef had been crushed and added to the cyanide vats as a trial.¹⁰⁵ This did not prove profitable and the operation was abandoned. In 1914 Dargue's was again re-opened, this time by six tributors of the Major's Creek Gold Mining Syndicate. Over a two year period, a new shaft was sunk 150 feet at the east end of the deposit, revealing an eight-foot wide mineralised zone with ore averaging 11 dwt per ton. About 609 tons of ore were raised and processed by the battery and cyanide plant for 283 ozs of gold. One hundred tons of old tailings were also treated for 12.5 ozs.¹⁰⁶

For the next three decades little is recorded about Dargue's Reef and it appears to have been largely abandoned. Disruption by WWI, post-war inflation, the relatively low gold price and the general decline in the gold mining industry, apart from the period of the great depression, probably discouraged further attempts to work such a refractory deposit. There was a brief revival of interest in gold mining at Major's Creek in the 1930s with activity at some of the old reef mines around Red Hill, including at Camage's by the Sperantum Gold Mining Company Ltd.¹⁰⁷ In late 1933 the Great Star Gold Mines Company was formed in Sydney to prospect and develop a lease west of the Major's Creek Hotel (Fig. 1). Consulting geologist, Dr Guy Harris, was confident that he had located a large body of ore in several shafts and trial mining commenced in early 1934.¹⁰⁸ The company indicated that if all went well a large treatment plant would be erected, which could also service other mines and eliminate the cost of ore transport to Cockle Creek. This resulted in an optimistic stir in the local community. A reporter for the *Braidwood Review and District Advocate* visited the site and concluded that:

After going over the field and listening to the expert reasonings of the learned geologist, one would not need to be a super-optimist to visualise in the near future a humming hive of industry at Major's Creek, with the whistle of engines and the hum of motors shattering the serenity of the village. What a great thing the consummation of such a vision would be in the Braidwood district!¹⁰⁹

Development continued through 1934, with shaft sinking and installation of mining plant, but then there was a hiatus until June 1935 when activity was resumed using tribute miners. At the beginning of 1936 the state battery at Deua River was relocated to Major's Creek to assist the miners. In May it was reported that good ore had been struck and there was mention that the large body of ore at Dargue's Reef might also be developed.¹¹⁰ By the end of 1936 the Great Star mine had produced a total of 66 tons of ore for a yield of 202 ozs of gold, obviously high-grade material, but of insufficient quantity to justify investment in a large treatment plant. In February 1938 there was an attempt to further develop the mine by sinking the shaft to 420 feet, but by August, the operation had been abandoned.¹¹¹

Following WW II there was a general resurgence of interest in mining and mineral exploration, particularly by the large Broken Hill mining companies. During

1947 Broken Hill South Ltd investigated Dargue's Reef, and in June, M.L. Wade, assisted by R.L. Stanton, conducted geological and structural mapping, which led to a three hole diamond drilling program to test the Dargue's and Plum's sections of mineralisation at depth.¹¹² This drilling intersected mineralisation in all three holes, indicating that it extended to at least 500 feet (152 m) below surface. However, the company considered the average ore grade sub-economic at the gold price of the time and discontinued exploration at the end of 1948.¹¹³

The recent era

Australia entered its third gold boom in the early 1980s following removal of the artificially low, fixed gold price in 1971 and development of the revolutionary Carbon in Pulp (CIP) gold extraction process.¹¹⁴ This renaissance of the gold mining industry resulted in a dramatic expansion in gold exploration, including renewed interest in historic gold mining areas. Much of this activity was in Western Australia and Queensland, but New South Wales and Dargue's Reef did not escape attention.

Even before the main phase of the gold boom there was exploration around Dargue's Reef, accompanying the general upswing in mineral exploration stimulated by the nickel boom of the late 1960s. In 1972 Otter Exploration N.L. conducted an IP geophysical survey to test the area for drill targets. This failed to detect the main lodes at Dargue's, but did indicate some minor anomalies, possibly related to hanging wall mineralisation intersected by the earlier drilling. Another geophysical survey conducted in 1974 by Esso Exploration and Production Australia Inc. as part of a regional reconnaissance exploration program and using a combined electromagnetic-magnetic technique, detected an anomaly in the vicinity of Dargue's Reef, but at the time this was not considered significant or of particular interest.¹¹⁵ The following year Alan Jordan obtained the 13 ha mining lease (ML301) over Dargue's Reef.¹¹⁶

In 1980 Amdex Mining Ltd, a consortium of Triako Mines N.L. and Buka Minerals N.L., commenced detailed exploration of the Dargue's Reef deposit, including surface mapping, sampling and analysis of rock chips from costeans and the old dumps, a Rapid Reconnaissance Magnetic Induced Polarisation survey and a six hole diamond drilling campaign. This comprehensive program was aimed at testing the possibility of a mineable reserve of 500,000 tonnes of 10 gram per tonne gold ore (g/t Au). Drilling confirmed that significant mineralisation continued well below the historic workings and an initial estimate indicated reserves of 97,700 tonnes at 11.8 g/t Au, plus 90,600 tonnes at 4.5 g/t Au. Further work was proposed to test the deposit to greater depth and it was also suggested that the upper parts of the deposit could be mined in small open pits. Prior to this work, a reassessment of the prospect, including a more sophisticated geostatistical ore reserve estimate and a financial analysis of a potential mining operation was conducted by the parent company of the Triako Group, Elf Aquitaine Australia Ltd. This study indicated a lower grade and tonnage, below that needed for economic mining, and the property was dropped at the end of 1980 after exploration expenditure of \$64,720.¹¹⁷

From 1983 to 1987 Canyon Resources Pty Ltd conducted an extensive regional exploration program over the whole Majors Creek goldfield surrounding the Dargue's Reef mining lease (ML 103). This included geological mapping, geochemical sampling and induced polarisation geophysical surveys, culminating in a percussion drilling program to test identified targets.¹¹⁸ As in earlier periods, it was hoped that additional gold discoveries would add to the resource identified at Dargue's Reef and improve the viability of mining in the area. At this time Dargue's Reef was the subject of an environmental impact assessment, prior to possible development, and it was envisaged the mineshaft would be rehabilitated and an on-site crusher and CIP gold plant installed.

In late 1986 an option over Dargue's Reef was negotiated by Horizon Pacific Ltd, a small Sydney based gold mining company operating the Cowarra mine near Bredbo in southern NSW. A subsidiary company, Horizon Resources was floated to conduct exploration in the Bredbo-Cooma area and at Majors Creek, with the aim of locating new gold resources that could be treated at the CIP plant at the Cowarra mine.¹¹⁹ The vendors of the Dargue's Reef mine, Alan Jordan and R. Beavis, had dewatered and reconditioned the Main and East Shafts, while Horizon Resources inspected and sampled the old underground workings. Chip-channel samples and a bulk sample of ore were sent to the Cowarra gold mine for assay and test treatment. Consulting geologist, Lincoln McClatchie, estimated a probable reserve for the Big Blow lode at Dargue's Reef of just under 50 thousand tonnes grading 7.2 g/t Au, and additional possible resources in all the lodes totalling 184,451 tonnes at around 5 g/t Au.¹²⁰ McClatchie suggested a program of further work to fully establish the resource, including drilling up to sixty 50-100m diamond drill holes, additional costeaning, as well as testing of some of the alluvial material in the vicinity, all at a cost of around \$324,000. Before this work could proceed Horizon Pacific ran into financial and management difficulties and eventually relinquished interest. In 2001 the mining lease was transferred from Alan Jordan to Ominco Mining NL.¹²¹

Hibernia Gold Limited (subsequently Moly Mines Ltd) acquired the Dargue's Reef property in 2004 and began a drilling program to further test the deposit at depth. This program was very successful, indicating that the mineralisation was far more substantial than previously thought, extending to at least 400 m below surface with multiple lodes in a system between 20 and 55 metres wide. An initial JORC compliant inferred mineral resource was estimated at 2.38 million tonnes with a grade of 4.1 g/t Au for a cut-off grade of 2 g/t (i.e. 310,000 ozs of gold).¹²² In July 2007 Moly Mines sold a major interest to Cortona Resources Ltd, a junior Western Australian gold exploration company. As operator, Cortona continued ore reserve definition and also initiated detailed near-mine and regional exploration.¹²³

Drilling continued through to 2011, extending the inventory to 327,000 ozs of gold and confirming the feasibility of a mining operation. A mine plan was developed involving an underground mine with spiral decline access, long hole open stope mining method and an on-site plant for crushing, grinding, gravity separation of free gold and flotation to produce a pyrite concentrate. It was proposed to truck the concentrate to a mothballed CIP gold treatment plant at the London Victoria mine near Parkes.¹²⁴ This

off-site treatment would avoid the need to construct a cyanide plant at Majors Creek, allaying some of the local environmental concerns. Development approval for mining was received from the NSW Planning Assessment Commission in September. There had been some local opposition to development of a mine, citing water usage and environmental impact concerns, including noise from the plant, and the Eurobodalla Shire Council, the Coastwatchers Association and the South East Region Conservation Alliance lodged an appeal against the development approval. In December 2011 the Eurobodalla Council withdrew its appeal and in the following January, Cortona reached agreement with the other objectors prior to the appeal going to litigation. On the 29th April 2012, a mining lease granted to Cortona by the NSW Minister for Resources and Energy¹²⁵ was the first gold mining lease granted in New South Wales for more than ten years, and came with strict environmental protection conditions. To further develop the project Cortona sought additional finance and a joint venture partner with the appropriate technical capability.

In September 2012, Cortona announced a merger arrangement with Unity Mining Ltd (previously Bendigo Mining Ltd), a company operating the Henty gold mine in Tasmania and which had also attempted to redevelop the Bendigo quartz reef gold deposits. The Minister for Resources and Energy approved the merger and in January the following year development work commenced on some site infrastructure and the boxcut entrance to the proposed underground decline (Fig. 4). In December 2013 Unity Mining announced a hiatus to review the details of the project, particularly some potential cost savings, and to seek additional development capital of up to \$70 million.¹²⁶ The latest and largest scale development of Dargue's Reef is thus currently poised on the brink of this review.

Conclusion

Dargue's Reef provides a remarkable example of how the complex interplay of exploration, discovery, optimism, entrepreneurship, metal price, investment climate, management practice, changing technology, societal attitudes and the fundamental geology of a gold deposit determine its mining history.

At the time of its discovery Dargue's Reef offered an unknowable opportunity to its discoverer, when the price of an ounce of gold was roughly equivalent to the average weekly wage. The early miners were fortunate that the near surface oxidised ore contained easily extractable gold and their initial entrepreneurship, skill and hard work were rewarded with the largest production of gold to date from the deposit. Deeper mining revealed the refractory nature of the 'mundic' rich ore and this reality challenged subsequent, persistent attempts to work the deposit. The size of the deposit, particularly its width compared to other deposits at Major's Creek, was a key attraction. Although the grade is lower, the potential large tonnage made it a target, assuming the problem of extracting the gold could be solved. Many of the gold processing methods developed through the 19th century were tried without commercial success, but in part it was due to investment and management shortcomings. Although the records are fragmentary, the minimum total gold production from Dargue's Reef and its extensions

can be estimated at 8,946oz, with the largest component of 6,610 ozs produced by Dargue and Co.

Modern exploration has shown that Dargue's Reef is much larger than the early miners knew, although by present day mining standards it is still considered a small deposit. Advances in mining and processing methods have solved the problem of extracting gold from the 'mundic' and it is now technically and economically feasible to mine the deposit given the current gold price and the required capital investment.

Figure 4: *View (to the northeast) of earthworks for the new box cut entrance to the planned underground decline at Dargue's Reef. This 'simple' entrance to the proposed new mine is some distance to the northwest of the original workings and larger than the entire open cut developed by Dargue and Co.*



Source: Photo by the author 26 April 2013.

However, there may be new challenges. For example, there is now increased awareness and public concern about environmental impacts from mining. This has resulted in community opposition to developing mines in closely settled and environmentally sensitive areas such as Majors Creek. If the new Dargue's Mine can be successfully operated within appropriate environmental conditions it could provide an important template for modern mining in such sensitive areas. Future mining will tell.

Acknowledgements

My thanks to Horizon Resources Ltd, Cortona Resources Ltd, Unity Mining Ltd and local landowners for providing access to Dargue's Reef and other sites at Majors Creek. I acknowledge the National Library of Australia, the Mitchell Library of the State Library of New South Wales, the Geological Survey of New South Wales, the Braidwood Museum and Brian McDonald of Majors Creek for help with locating information for this article. Darren Glover provided some anecdotal information. Constructive comments by two reviewers are also gratefully acknowledged.

Glossary of some terms used in the text

Chilean mill – type used at this time consisted of two vertical steel wheels at opposite ends of a revolving axle. Effective crushing results from the rotation of the heavy wheels combined with their twisting action.

Duncan concentrator – device for separating particles of different density, consisting of one or more V shaped chambers with lateral pockets on the inner sloping sides, which trap heavier particles as the added pulp is agitated by an upward flow of water injected at the base of the chamber. Lighter particles are carried in suspension out of the chamber.

Frue vanner – a rotating belt with adjustable slope onto which crushed material is placed and a flow of water maintained. The heavier concentrate particles settle on the belt and are carried up slope by its movement and the lighter material is washed down slope.

Gangue – the waste component of ore.

Grinding Pans – various designs, such as Arastra and Wheeler's pans, but basically consist of a horizontal fixed annular plate and an overlying rotating annular plate. Sands introduced to the pan through a central spindle are ground as they move outwards between the two plates. Wheeler's Pans have raised dies in the fixed plate and shoes in the rotating plate.

Huntington mill – a vertical cylindrical mill containing a rotating plate with a series of four suspended rollers. Centrifugal force causes the rollers to swing against the side of the pan to grind the ore.

JORC – Joint Ore Reserves Committee, which sets the mandatory Australasian code for public reporting of exploration results, mineral resources and ore reserves. The committee consists of representatives of the Minerals Council of Australia, the Australasian Institute of Mining and Metallurgy, the Australian Institute of Geoscientists, the Australian Securities Exchange (ASX), the Financial Services Institute of Australia (FinSIA) and the accounting profession.

Mundic – a Cornish word used to refer to sulphides, but particularly pyrite (FeS₂). It dates back to at least the 17th Century. Also now used to refer to concrete deleteriously affected by oxidation of contained pyrite.

Units

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

1 troy oz (the standard measure of gold) = 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 = 4.4561 litres.

Pre-decimal currency

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

Endnotes

¹ Ken McQueen, 'Early developments in treating pyritic and refractory gold ores in Australia', *Journal of Australasian Mining History*, vol. 10, 2012, pp. 88-102.

² K.G. McQueen and C. Perkins, 'The nature and origin of a granitoid-related gold deposit at Dargue's Reef, Major's Creek, New South Wales', *Economic Geology*, vol. 90, 1995, pp. 1646-1662.

³ 'The Gold Fields', *Sydney Morning Herald*, 22 November 1851, p. 3; Richard Kennedy, 'Braidwood & district Goldfield', *Braidwood Dispatch*, 1907, reprinted in R.H. Maddrall, *Braidwood Gold Fields*, 3rd reprinting, A.R. McLean Printing, Fyshwick, ACT, 2000, p. 1; J.H. Clarke and C. Burrott-Maloney, *Reidsdale remembered, the history of the Irish Corner: A rural community*, Ulludulla Printing Service, Ulludulla, N.S.W., 2012, p. 156. It is interesting that Edward Hargraves, who visited the Majors Creek area in early October 1851 claims to have 'discovered' Majors Creek, even though miners were already on the field, 'Copy of letter from E.H. Hargraves, Esq, to the Colonial Secretary, Camp at Jembaicumbene, October 7th 1851', *Maitland Mercury and Hunter River General Advertiser*, 21 February 1852, pp. 4-5.

⁴ 'Braidwood', *Sydney Morning Herald*, 22 June 1858, p. 5.

⁵ 'Geological Surveys – Mr Edward Hargraves Correspondence', *Maitland Mercury and Hunter River General Advertiser*, 21 February 1852, p. 4.

⁶ 'The Gold Fields – Goulburn', *Sydney Morning Herald*, 22 November 1851, p. 3; Gold buyers on the field were purchasing gold at £3 2s- £3 3s per oz and at this time the working wage was around £3 for a 6 day week, so 1oz per week would have been equivalent to wages and 1oz per day significantly better. 'The Gold Fields – Braidwood Diggings', *Maitland Mercury and Hunter River General Advertiser*, 10 December 1851, p. 3.

⁷ 'Sydney News – The Gold Fields', *ibid.*, 3 December 1851, p. 4; 'The Gold Fields', *ibid.*, 10 December 1851, p. 3; In the first year of alluvial mining on the Braidwood diggings, including Araluen, Bells Creek

and Majors Creek, approximately 100,000 ozs of gold were produced, based on the official escort and mail returns of 52,820 ozs and an estimate of private conveyance up to 10 May of that year of 37,865 ozs. 'The Gold Fields – Braidwood', *ibid.*, 4 September 1852, p. 4.

⁸ Richard Kennedy, 'Braidwood & district Goldfield', *Braidwood Dispatch*, 1907, reprinted in Maddrall, *Braidwood Gold Fields*, p. 2.

⁹ 'The Gold Fields – Braidwood', *Maitland Mercury and Hunter River General Advertiser*, 4 September 1852, p. 4; Barry McGowan, *The Golden South*, Barry McGowan, printed by Capital Fine Print, Canberra ACT, 2000, pp. 42-51.

¹⁰ Martin Brennan, *Reminiscences of the Gold Fields*. William Brooks and Co. Sydney, 1907, p. 12.

¹¹ Ned, *Major's Creek Memories*, Majors Creek Progress Association, Bayprint Printing, Reprinted 1997, pp. 12, 17.

¹² Richard Kennedy, 'Braidwood & district Goldfield', *Braidwood Dispatch*, 1907, reprinted in Maddrall, *Braidwood Gold Fields*, p. 3; Dunshea, *Major's Creek Memories*, p. 5.

¹³ 'Mining Gazette', *Sydney Mail*, 2 October 1869, p. 8; *ibid.*, 16 October 1869, p. 9.

¹⁴ *Ibid.*, 31 October 1868, p. 3.

¹⁵ 'Assisted immigrants 1826-1912', New South Wales State Records: Births Register 5795/1858 and 5600.1861, NSW Registry of Births, Deaths and Marriages.

¹⁶ McGowan, *The Golden South*, p. 83.

¹⁷ 'Major's Creek – Homeward Bound Reef', *Australian Town and Country Journal*, 3 June 1871, p. 687. The 'ant bed' was probably a nest of meat ants (*Iridomyrmex purpureus*) that are still common in the area today. These ants bring material to the surface during excavation of their nest and also transport small stones and particles from horizontal distances typically up to 15m to cover and protect the surface of their nest. If correct, six ounces of gold seems a large quantity to extract from such a nest, however it may be possible that dense gold particles can accumulate on a nest surface over a long period of time as heavy rainfall washes away the less dense materials and the ants continue to replace the surface protection (a type of natural 'ant panning'). It is known that meat ant nests can exist for up to 100 years and possibly longer. See, J.A. Cowan, G.S. Humphreys, P.B. Mitchell and C.L. Murphy 'An assessment of pedoturbation by two species of mound-building ants, *Camponotus intrepidus* (Kirby) and *Iridomyrmex purpureus* (F. Smith)', *Australian Journal of Soil Research*, 1985, vol. 32, pp. 95-107.

¹⁸ 'Araluen and Major's Creek', *Australian Town and Country Journal*, 25 June 1871, p. 784; 'Petition supporting Edward Greville', *Sydney Morning Herald*, 3 October 1870, p. 6; 'Trunkey Creek', *ibid.*, 12 June 1872, p. 3.

¹⁹ 'Mines and Mining – The Braidwood District', *Australian Town and Country Journal*, 22 January 1870, p. 15; 'Mines and Mining – Dargue's Reef, Majors Creek', *ibid.*, 29 January 1870, p. 13; 'Major's Creek – Homeward Bound Reef', *ibid.*, 3 June 1871, p. 687.

²⁰ 'Mining Gazette', *Sydney Mail*, 4 December 1869, p. 8. The famous 'Welcome Stranger' gold nugget had been found at Moliagul in Victoria in February 1869 and the crusher was probably named after this nugget for good luck.

²¹ *Ibid.*, 11 December 1869, p. 2; 'Major's Creek – Homeward Bound Reef', *Australian Town and Country Journal*, 3 June 1871, p. 687.

²² 'Mining Gazette', *Sydney Mail*, 21 May 1870, p. 9; 'The Gold-Fields', *Sydney Morning Herald*, 1 June 1870, p. 2.

²³ 'Mining Gazette – Major's Creek', *Sydney Mail*, 18 June 1870, p. 3.

²⁴ *Ibid.*, 25 September 1869, p. 9; *ibid.*, 25 December 1869, p. 9.

²⁵ *Ibid.*, 18 June 1870, p. 3; *ibid.*, 24 September 1870, p. 9; 'The Gold-Fields, Majors Creek', *Sydney Morning Herald*, 28 December 1870, p. 2.

²⁶ 'Mining Gazette – Majors Creek' *Sydney Mail*, 18 June 1870, p. 3; 'The Gold-Fields', *Sydney Morning Herald*, 28 December 1870, p. 2.

²⁷ 'Braidwood', *Australian Town and Country Journal*, 28 January 1871, p. 6.

²⁸ 'Major's Creek – Homeward Bound Reef', *ibid.*, 3 June 1871, p. 687; 'Araluen and Majors Creek', *ibid.*, 25 June 1871, p. 784.

²⁹ 'Mining Gazette', *Sydney Mail*, 10 December 1870, p. 8; 'Major's Creek – Homeward Bound Reef', *Australian Town and Country Journal*, 3 June 1871, p. 687.

³⁰ 'Old Braidwood – Gathered from Old Files', *Braidwood Dispatch*, 21 September 1917, p. 4.

³¹ 'Braidwood', *Australian Town and Country Journal*, 2 March 1872, p. 5; 'Fatal Accident at Major's Creek', *Sydney Morning Herald*, 5 March 1872, p. 4.

³² 'To Capitalists, Dargue's Celebrated Claim, Major's Creek', *ibid.*, 29 July 1872, p. 6; 'Mining', *Maitland Mercury and Hunter River General Advertiser*, 27 August 1872, p. 2.

³³ 'Mining Intelligence', *Freeman's Journal*, 2 July 1870, p. 10.

- ³⁴ 'Mining', *Newcastle Chronicle*, 31 October, 1872, p. 3; 'Latest Mining', *Evening News*, 5 June 1873, p. 2; 'Mining Summary – Gold', *Sydney Morning Herald*, 9 August 1873, p. 3; 'Cancelled Mineral and Gold-mining Leases', *Australian Town and Country Journal*, 3 July 1875, pp. 19-20.
- ³⁵ 'Marriage Jackson-Dargue', *Clarence and Richmond Examiner and New England Advertiser*, 11 July, 1876, p. 2; 'Mining Intelligence – Central Kempsey' *Sydney Morning Herald*, 12 August, 1881, p. 5; 'Wardens Court' *Clarence and Richmond Examiner & New England Advertiser*, 24 September 1881, p. 4.
- ³⁶ 'Prospectus of the Enterprise Gold Mining Company, Majors Creek', *Sydney Morning Herald*, 7 May 1872, p. 7; 'To Capitalists, Dargue's Celebrated Claim, Major's Creek', *ibid.*, 29 July 1872, p. 6.
- ³⁷ 'Prospectus of the Enterprise Gold Mining Company, Majors Creek', *ibid.*, 7 May 1872, p. 7: 'Mining Gazette', *Sydney Mail*, 22 July 1872, p. 780.
- ³⁸ 'Mining – Major's Creek', *Freeman's Journal*, 11 December 1875, p. 13; Denny's combined pulveriser and buddle was an ingenious combination of a Chilean mill, with four rotating rollers in an amalgamating pan and a buddle to concentrate and further treat the residue. It was invented by Thomas Denny from the Denison Foundry in Bathurst and designed to further process ore after initial crushing by stamp battery and amalgamation. It was one of many finer grinding devices developed around this time in an attempt to treat refractory ores. 'Mines and Mining – Denny's Combined Pulveriser and Buddle', *Australian Town and Country Journal*, 12 July 1873, pp. 13-14.
- ³⁹ 'Mining Items', *Australian Town and Country Journal*, 17 June 1876, p. 20.
- ⁴⁰ 'Telegrams This Day', *Evening News*, 17 May 1876, p. 2.
- ⁴¹ Annual Report of the New South Wales Department of Mines [hereafter ARNSWDM] for 1876, p. 96; 'Treatment of Auriferous Mundic', *ibid.*, 25 January 1877, p. 4.
- ⁴² 'Mining Items', *Australian Town and Country Journal*, 10 February 1877, p. 18.
- ⁴³ 'Braidwood', *Sydney Morning Herald*, 6 June 1877, p. 8.
- ⁴⁴ 'Mining Items', *Australian Town and Country Journal*, 27 September 1879, p. 22; ARNSWDM for 1879, pp. 111, 119.
- ⁴⁵ 'Braidwood', *Maitland Mercury and Hunter River General Advertiser*, 11 December 1879, p. 3; 'Mining at Majors Creek, New South Wales', *McIvor Times & Rodney Advertiser*, 29 January 1880, p. 3.
- ⁴⁶ 'Mining Items – The Treatment of Mundic', *Australian Town and Country Journal*, 1 January 1881, p. 19.
- ⁴⁷ 'Mining', *Sydney Morning Herald*, 24 February 1881, p. 7.
- ⁴⁸ 'Mining Items – Braidwood', *Australian Town and Country Journal*, 25 June 1881, p. 1222.
- ⁴⁹ 'Braidwood', *Maitland Mercury and Hunter River General Advertiser*, 30 April 1881, p. 3; Mining Companies Registration 1882, 1438, Dixson Library, University of New England, p. 1072.
- ⁵⁰ 'Treating Pyrites', *Australian Town and Country Journal*, 25 February 1882, p. 358; 'Braidwood', *Maitland Mercury and Hunter River General Advertiser*, 25 May 1882, p. 3.
- ⁵¹ 'Dargue's Reef, Braidwood', *Evening News*, 1 July 1882, p. 5.
- ⁵² 'Advertisement – Dargue's Reef Gold Mine', *Southern Argus*, 14 October 1882, p. 5.
- ⁵³ 'Mining in the Braidwood District', *Goulburn Herald*, 26 July 1881, p. 4; 'Mining Gazette', *Sydney Mail*, 27 August 1881, p. 360; ARNSWDM for 1882, p. 65.
- ⁵⁴ *Ibid.*
- ⁵⁵ ARNSWDM for 1883, p. 77; *Ibid.*, for 1884 p. 79; *Ibid.*, for 1885, p. 74.
- ⁵⁶ Robert Percy Simpson was a stock and station agent in Sydney in the 1880s with interests in various properties and mining operations. His son Edward Percy was a solicitor. Biographical Note to Simpson Family papers, Mitchell Library, State Library of NSW, MSS498.
- ⁵⁷ Personal Papers, Robert Percy Simpson 1852-1887, Mitchell Library, State Library of NSW, MSS498; 'Mining News', *Goulburn Evening Penny Post*, 15 January 1887, p. 4; 'Intercolonial News', *Australian Town and Country Journal*, 17 September 1887, p. 25; ARNSWDM for 1888, p. 89.
- ⁵⁸ McQueen, 'Early developments in treating pyritic and refractory gold ores in Australia', pp. 88-102.
- ⁵⁹ 'Treating Refractory Ores', *Australian Town and Country Journal*, 26 December 1885, p. 24; 'Advertisements', *ibid.*, 27 July 1889, p. 8; 'A Visit to Cunningar (N.S.W.)', *ibid.*, 1 March 1890, pp. 24-26; 'A New Gold Saving Process', *Clarence & Richmond & New England Advertiser*, 17 July 1888, p. 2. Thomas Daniells Merton was originally from Victoria and appears to have had considerable experience as a miner, metallurgist and mining entrepreneur. For some time he was at Ballarat and also appears to have had connections with James Cosmo Newberry and Claude Vautin, through their treatment works at Footscray in Melbourne. He adopted the Newberry-Vautin chlorination process at the various plants that he constructed. He was also an innocent victim of the Taranganba gold mining swindle, near Rockhampton, Qld, where he built a chlorination plant in 1888. See, John Peach, *The Biggest-Ever Mining Swindle in the Colonies*, Interactive Publications, Carindale, Qld, 2008, pp. 105-110.

- ⁶⁰ 'Mining – Majors Creek', *Goulburn Evening Penny Post*, 3 November, 1888, p. 6; ARNSWDM for 1888, p. 89; 'The Dargue Gold Mining Company', *Braidwood Dispatch*, 27 February 1889, p. 2; ARNSWDM for 1888, p. 89.
- ⁶¹ *Ibid.*; 'Local News – Mining', *ibid.*, 20 March, 1889, p. 2; 'Local News – Chlorination Works at Majors Creek', *ibid.*, 8 June 1889, p. 2.
- ⁶² 'Local News – Mining', *ibid.*, 20 March 1889, p. 2; 'Mining', *Goulburn Evening Penny Post*, 7 May, 1889, p. 4; 'Pyrites for Harden', *Braidwood Dispatch*, 11 May 1889, p. 2.
- ⁶³ 'Mining', *Goulburn Evening Penny Post*, 11 June 1889, p. 4; *ibid.*, 29 June 1889, p.6; 'Mining', *Evening News*, 27 June 1889, p. 8.
- ⁶⁴ 'Major's Creek Gold-Mining Company', *Braidwood Dispatch*, 13 July, 1889, p. 2; 'The Major's Creek Proprietary Gold-Mining Company, Limited', *ibid.*, 17 July 1889, p. 2.
- ⁶⁵ 'Major's Creek Gold-Mining Company', *ibid.*, 13 July 1889, p. 2; ARNSWDM for 1889, p. 19.
- ⁶⁶ 'Major's Creek', *ibid.*, 24 July 1889, p. 2.
- ⁶⁷ 'Mining', *ibid.*, 11 December 1889, p. 2; 'Major's Creek', *Australian Town and Country Journal*, 28 December 1889, p. 23; 'Mining in the Braidwood District', *Evening News*, 9 December 1890, p. 7.
- ⁶⁸ 'Major's Creek', *Australian Town and Country Journal*, 1 February 1890, p. 44.
- ⁶⁹ 'Majors Creek', *ibid.*, 25 January 1890, p. 25.
- ⁷⁰ 'Intercolonial Mining News – New South Wales', *ibid.*, 8 February 1890, p. 25.
- ⁷¹ 'Intercolonial Mining News – Major's Creek', *ibid.*, 15 February 1890, p. 24; 'Latest Mining News – Major's Creek', *ibid.*, 22 February 1890, p. 41.
- ⁷² 'Major's Creek', *ibid.*, 1 March 1890, p. 24.
- ⁷³ 'Major's Creek Gold Mine', *ibid.*, 14 June 1890, p. 21.
- ⁷⁴ *Ibid.*, 26 July 1890, p. 24.
- ⁷⁵ *Ibid.*, 19 July 1890, p. 24; 'Braidwood', *ibid.*, 9 August 1890, p. 24.
- ⁷⁶ 'Advertisement - The Major's Creek Proprietary Gold-Mining Company, Limited', *Sydney Morning Herald*, 23 October 1890, p. 1.
- ⁷⁷ ARNSWDM for 1890, p. 84; 'The Old Dargue's Reef', *Australian Town and Country Journal*, 14 March 1891, p. 24.
- ⁷⁸ Reports in *Australian Town and Country Journal*, June 1889 – August 1890. The price of refined gold at this time was £4. 4s per oz. 'Local News – Chlorination Works at Major' Creek', *Braidwood Dispatch*, 8 June 1889, p. 2.
- ⁷⁹ 'Mining in the Braidwood District', *Evening News*, 9 December 1890, p. 7; Hamilton Wilson, 'Original Correspondence – The Major's Creek Works', *Braidwood Dispatch*, 4 February 1891, p. 2; 'The Old Dargue's Reef', *Australian Town and Country Journal*, 14 March 1891, p. 24; 'Dargue's Reef, Major's Creek' *ibid.*, 21 March 1891, p. 24.
- ⁸⁰ Wilson, 'Original Correspondence – The Major's Creek Works', p. 2.
- ⁸¹ 'Major's Creek', *Australian Town and Country Journal*, 1 March 1890, p. 24.
- ⁸² 'Mining in the Braidwood District', *Evening News*, 9 December 1890, p. 7.
- ⁸³ 'The Major's Creek Gold Mine', *Sydney Morning Herald*, 20 June 1892, p. 5.
- ⁸⁴ Geoffrey Blainey, *The Rush That Never Ended*, 2nd edn, Melbourne University Press, Carlton, 1969, pp. 248-256.
- ⁸⁵ 'Mining at Braidwood etc', *Goulburn Evening Penny Post*, 10 December 1892, p. 7; 'Mining – Braidwood Dispatch', *Bowral Free Press and Berima District Intelligence*, 15 January 1896, p. 3.
- ⁸⁶ 'The Major's Creek Mining Dispute', *Braidwood Dispatch*, 28 August 1897, p. 2.
- ⁸⁷ 'Braidwood', *Goulburn Evening Penny Post*, 29 September 1897, p. 4; 'Mining – Braidwood', *Evening News*, 27 October 1897, p. 3.
- ⁸⁸ 'Major's Creek', *Braidwood Dispatch*, 27 April 1898, p. 2.
- ⁸⁹ McGowan, *The Golden South*, pp. 119-158.
- ⁹⁰ 'Braidwood', *Goulburn Evening Penny Post*, 3 October 1899, p. 4.
- ⁹¹ 'Reefing at Braidwood. *Evening News*, 4 October 1900, p. 4.
- ⁹² 'Braidwood District – An Important Development', *ibid.*, 18 February 1901, p. 7; 'Mining News', *Braidwood Dispatch*, 16 February 1901, p. 2; 'Major's Creek', *ibid.*, 11 May 1901, p. 7.
- ⁹³ ARNSWDM for 1901, p. 18.
- ⁹⁴ 'Braidwood District', *Sydney Morning Herald*, 27 October 1902, p. 9.
- ⁹⁵ 'Mining at Major's Creek', *Goulburn Evening Penny Post*, 2 December 1902, p. 4; ARNSWDM for 1902, p. 25.
- ⁹⁶ 'Mining – Braidwood District – An Important Development', *Evening News*, 18 February 1901, p. 7.
- ⁹⁷ J.B. Jaquet, 'Proposed smelting works at Braidwood', Special Report ARNSWDM for 1902, p. 121.
- ⁹⁸ 'Notes by the Way – Major's Creek', *Braidwood Dispatch*, 25 February 1905, p. 2.

- ⁹⁹ 'Braidwood' *Goulburn Evening Penny Post*, 5 April 1905, p. 5; 'Major's Creek, *Braidwood Dispatch*, 24 May 1905, p. 2.
- ¹⁰⁰ 'Mining News', *ibid.*, 3 May 1895, p. 2; 'Dargue Mine Dispute', *Queanbeyan Leader*, 23 May 1905, p. 2; 'Major's Creek', *Braidwood Dispatch*, 22 July 1905, p. 2.
- ¹⁰¹ *Queanbeyan Leader*, 12 April 1907, p. 2; 'Braidwood', *Goulburn Evening Penny Post*, 14 June, 1907, p. 4. John Ditchburn was a well-known Melbourne mining identity and legal manager of a number of gold and tin mines, including in 1886 the Cunningar Quartz-Mining Company NL near Harden, set up by T.D. Merton. Later he became prominent in mining in Tasmania. 'Tasmanian Mining', *Launceston Examiner*, 8 August 1916, p. 2.
- ¹⁰² 'Rich Gold Ores', *Sydney Morning Herald*, 28 October 1907, p. 9; 'Local News – The Major's Creek Reefs', *Braidwood Dispatch*, 30 October 1907, p. 2; 'Major's Creek', *ibid.*, 20 November 1907, p. 2; ARNSWDM for 1907, p. 24; 'Dargue's Reef', *Shoalhaven News and South Coast Advertiser*, 21 December 1907, p. 4; 'Big Company Promotion', *ibid.*, 4 April 1908, p. 4.
- ¹⁰³ 'Local News – Mining', *Braidwood Dispatch and Mining Journal*, 12 September 1908, p. 2; 'Major's Creek Mines', *ibid.*, 11 November 1908, p. 2; ARNSWDM for 1908, p. 21.
- ¹⁰⁴ 'Mining', *Braidwood Dispatch and Mining Journal*, 12 January 1910, p. 2; ARNSWDM for 1909, p. 21; *Ibid.*, for 1910, p. 22.
- ¹⁰⁵ 'Mining Affairs at Major's Creek', *Braidwood Dispatch and Mining Journal*, 21 September 1910, p. 2; 'Major's Creek Reefs', *ibid.*, 26 October 1910, p. 2.
- ¹⁰⁶ ARNSWDM for 1914, p. 25; *Ibid.*, for 1915, p. 23; *Ibid.*, for 1916, p. 22.
- ¹⁰⁷ *Ibid.*, for 1931 and 1933
- ¹⁰⁸ 'Mining at Major's Creek – Encouraging Prospects', *Braidwood Review and District Advocate*, 6 March 1934, p. 3. Dr Guy Harris is probably best known for his role in the aerial search for Lasseter's Reef in 1936-37, which he debunked as a myth. Barry McGowan, *Fools Gold: myths and legends of Australian gold seeking*, Lothian Books, Sydney, 2006, pp. 227-228; 'Lasseter's Reef Survey', *Sydney Morning Herald*, 13 June 1936, p. 14; 'Lasseter's Reef is definitely a myth', *Barrier Miner*, 5 February 1937, p. 3.
- ¹⁰⁹ 'Mining at Major's Creek – Encouraging Prospects', *Braidwood Review and District Advocate*, 6 March 1934, p. 3.
- ¹¹⁰ 'Leaving Us', *ibid.*, 23 October 1934; 'State Battery at Major's Creek', *ibid.*, 14 June 1935, p. 2; 'Mining', *ibid.*, 5 November 1935, p. 2; *Ibid.*, 21 January 1936, p. 6; *Ibid.*, 19 May 1936, p. 7; ARNSWDM for 1934, p. 13; *Ibid.*, for 1935, p. 12.
- ¹¹¹ *Ibid.*, for 1935, p. 12; *Ibid.*, for 1936, p. 11; 'Local and General – Mining' *Braidwood Review and District Advocate*, 1 February 1938, p. 8; *Ibid.*, 2 August 1938, p. 5.
- ¹¹² M.L. Wade, *Geological Report on Dargue's Reef*, Geological Survey of NSW, Open File Report, MR 1152; K.F.H. Walker, *Dargue's Reef Gold Mine - Summary and Recommendation to Drill*, *ibid.*, MR 1152; 'Hopes for Mining Boom', *Braidwood Review and District Advocate*, 1 June 1948, p. 1.
- ¹¹³ R.K. Close, *Report on exploration and proposed work on Dargues Reef mining lease 103(73)*, July 1980, Geological Survey of NSW, Open File Report, GS1980/471, p. 8.
- ¹¹⁴ S.E. Close, *The Great Gold Renaissance*, Surbiton Associate, Melbourne, 2002, 281 pp.
- ¹¹⁵ Close, *Report on exploration and proposed work on Dargues Reef mining lease 103(73)* 1980, p. 8.
- ¹¹⁶ *Prospectus Hibernia Gold Limited*, 27 January 2004, pp. 85-87.
- ¹¹⁷ Close, 'The Great Gold Renaissance', pp. 10-30; K. Wall, *M.L. 203 (73) Report for the six months ending 31st December 1980*, May 1981, Geological Survey of NSW, Open File Report, GS1980/471, pp.1-4 and Appendix 1.
- ¹¹⁸ G.L. Duncan, *Exploration Licence 2063 – Exploration summary and drilling report*, Canyon Resources Pty Ltd, April 1986, Geological Survey of NSW, Open File Report, GS 1984/28.
- ¹¹⁹ 'Company to invest in local gold', *Canberra Times*, 22 September 1987, p. 3.
- ¹²⁰ L. McClatchie, *Report on Dargues Reef gold resources, Braidwood, New South Wales*, September 1987, Geological Survey of NSW, Open File Report, GS1980/471, 15 pp.
- ¹²¹ *Prospectus Hibernia Gold Limited*, 27 January 2004, pp. 85-87.
- ¹²² *Quarterly Activity report for the 3 months ended 30 September 2005*, Moly Mines Ltd, p. 5; Moly Mines Press Release November 25, 2005.
- ¹²³ R. Berryman, 'Exciting new fields for Cortona', *Resource Stocks*, March 2008, pp. 42-43.
- ¹²⁴ Cortona *ASX/Media Release*, 8 September, 2011; *Ibid.*, 2 March, 2012.
- ¹²⁵ *Ibid.*, 8 September, 2011; *Ibid.*, 21 December 2011; *Ibid.*, 31 January 2012; *Ibid.*, 9 February, 2012; *Ibid.*, 24 April, 2012.
- ¹²⁶ Unity Mining Ltd, *Investor Presentation*, February 2014.