

Antimony Mining at Ringwood

By H. E. Wilkinson.

INTRODUCTION

Between 1869 and 1892, the Ringwood antimony mines produced more than 3,500 tons of antimony ore, which represented about 15 per cent of Victoria's antimony production for that period. Much greater amounts were later taken from the mines at Costerfield and the Ringwood mines lapsed into obscurity. Despite their relatively minor production, it was considered worthwhile to place on record the history of antimony mining at Ringwood, especially in view of the interest created recently by an application for a lease over the area. The absence of accurate information led to erroneous statements, and exaggerated ideas on the richness of the deposits.

Most of the information in this article has been obtained from published and unpublished Geological Survey and Mines Department reports, and Lease Records. To minimise interference to the flow of the text, the following abbreviations have been used. M.S. means Mineral Statistics. Q.R. means Quarterly Reports of Mining Surveyors and Registrars. P.R. means Geological Survey Progress Reports. A.R. means Annual Reports.

A full list of references to the Ringwood Antimony Mines will be found at the end of this paper. Only those containing significant information are quoted in the text.

The section dealing with the recorded minerals is based on literature, records, specimens in my own collection, and specimens in the National Museum of Victoria. (Abbreviation N.M.V.)

The site of the Ringwood antimony mine is now occupied by the Ringwood Civic Centre, opened in February 1970, and lies within the triangular area enclosed by the Maroondah Highway, Mount Dandenong Road and Mines Road. Mining was also carried out north of the Highway, and near the Ringwood Railway Station. When I first visited the site in 1956 the

mullock heaps were still quite extensive and yielded many fine specimens of antimony minerals. The area was then known as Mines Reserve, but has since been cleared for the erection of the new Civic Centre.

The problems associated with alienating Crown Land previously used for mining were highlighted when a dramatic rise in the price of antimony, from around \$2,000 per ton to over \$7,000 per ton, led to a lease being applied for over the Civic Centre and neighbouring residential areas, before the official opening had taken place.

DISCOVERY

According to information given to me by Mr. L. J. Smith of Mildura in a letter dated 21-2-1958, his father and an uncle "found and started the mine . . . worked it for some time and then sold it to a company." Ulrich (1870) stated that the discovery was made accidentally by men breaking road metal for the Lilydale road, and if so, it would seem that these are the circumstances under which the Smith brothers made their discovery. Mr. Peter Hull ("Eastern Gazette" 18 (5) : p. 1, Feb. 11-1970) claims "Mr. Boardman was looking for eucalyptus at Ringwood when he kicked over a stone and found antimony . . ." Ulrich states that a second lode was discovered by a Mr. Finnie, but this was smaller than the first.

The discovery happened to coincide with a period when the value of antimony ore was rising (Ulrich 1870), and several small companies were formed to prospect the area. To quote the Mineral Statistics for 1869, "Very great importance is attached to the discoveries at Ringwood, and a large export of antimony during the year 1870 may be expected. The ore is chiefly oxide of antimony." The Mining Surveyors and Registrars Reports for December 1869 indicate that "one person has shipped about 100 tons of stone".

When Ulrich visited the scene in 1870 the workings on the larger lode extended over about two chains with some shallow trial shafts in the oxidised zone. Occasional residual pieces of stibnite were found. The workings on the second lode were less extensive, consisting of a trench, a shallow shaft, and a short drive from the shaft. All the ore raised had to be carted to Melbourne for treatment, over rough, unmade roads. The road was particularly bad at Tunstall (now Nunawading), and a made road was not met with until Kew was reached. Ringwood had not been settled until 1857 and the district was still in a primitive stage of development (Rouget 1923).

RINGWOOD ANTIMONY COMPANY MINE

("BOARDMAN'S") 1870 to 1934

In April 1870, Mineral Lease 210 was issued to "P. Boardman and others". Mines Department records show that the holders of Mineral Lease 210 were Pearce Boardman, James Fithie, Anthony Brownless, H. Smith and J. Smith. Pearce Boardman was a eucalyptus distiller from Box Hill and the two Smith's, also of Box Hill, were presumably the brothers who made the original discovery. This became the principal mine on the field, usually referred to in reports as either Boardman's or the Ringwood Antimony Mine. Rouget (1923) states that the first manager was a Mr. Pearce, and that in 1874 Mr. James Quigley became manager, holding this position until 1883.

During 1870 the company raised a little over 150 tons of ore (M.S. 1870). In the following year they sank their shaft to 140 feet and, in a southerly drive, struck "sulphide of antimony of fine quality, running underfoot", but ran into trouble with water. They were also having trouble disposing of low grade ore, stockpiled at the mine, (M.S. 1871). This was valued at £2-10-0 per ton, whereas good quality ore was valued at £6-0-0 per ton.



Plate 1. Ringwood Antimony Mine (from old postcard of unknown date).

In 1873 the mine was being "developed", with small amounts of ore being produced, although there were "more than 200 tons upon the bank, waiting for transit to market" (Q.R. 4/1873). Gold bearing quartz was found at this time also, but a trial crushing yielded only 2 dwt. per ton. The main shaft was deepened to 184 feet in 1874 (Kenny, 1942), and a crosscut extended east for 123 feet to the lode, which was reported to look very promising.

In 1875 it was stated that "the antimony workings at Ringwood are turning out remarkably well, some rich yields having been made. The lessees of a mine at Ringwood report having raised 652 tons 10 cwt. of ore" (M.S. 1875). The price of antimony ore had risen to

£8-0-0 per ton, and this enabled the Company to pay dividends which fully paid up the capital invested (Q.R. 3/1875), and left sufficient funds to purchase machinery. The following extract is from the managers report.

"There are employed at the mine thirty men, six boys and three horses besides two or three men and horses carting ore etc. When the steam engine just purchased has been erected a still greater number of hands will be employed. The main shaft is down 180 feet, and there is an excellent prospect underfoot; but until the machinery has been erected, it will be impossible to go deeper, as the whim is not more than sufficient to keep down the water and raise the ore from the present level." (M.S.1875).

In 1876, a 40 h.p. engine was installed for pumping and winding, and 372 tons of ore were raised. (M.S. 1876). Peak production was reached in 1877, when 930 tons 17 cwt. were raised (M.S. 1877). This was erroneously reported as being from "Box Hill, Nunawading", (Mr. Boardman's home address), a mistake which has led to both these places being listed as localities for antimony, as well as recent rumours that the Blackburn Lake covers the site of a rich antimony mine. The shaft was deepened in 1877, and a further 439 tons were produced in 1878 but a fall in the price of antimony to £6-0-0 per ton, coupled with the heavy expenditure on machinery led to a cessation of mining in

Antimony Mining at Ringwood

1879. It was reported that "... mining operations are all suspended, the only engine at work being engaged in pumping the late Boardman's lease." (Q.R. 4/1879). Boardman died early in 1879, following a fall down a winze. This accident is detailed in the Report of the Chief Inspector for Mines for 1880, p. 18. On the 1st January 1879, Boardman "—was inspecting a drive off a winze on No. 1 level shortly after a shot had been fired, when he missed his footing and fell 40 feet down the winze." He died on the 16th January, and the Coroners verdict was "Accidental death." "The inspector found all the levels and the mine in excellent working order."

In November 1879, the lease was transferred to Mr. David Mitchell of Richmond. During 1880-1881, little was done beyond maintenance and prospecting but a small quantity of ore was raised. Mr. Mitchell was granted permission to let the mine on tribute in August 1881. The New Ringwood Antimony Tribute Co. N.L. was formed to work the mine, the tributer being James Wood. The railway to Lilydale was completed in 1881 and it can hardly be merely coincidence that Boardman's mine was reopened at this time. In June 1882, the lease was transferred to the New Ringwood Antimony Tribute Company N.L. At this time, the northern part of Mineral Lease 226 was being worked by the same company. The remainder of this lease was added by transfer in September 1882. By June they were employing 30 men and raising "A large quantity of rich ore" (Q.R. 2/1882). The main shaft was deepened to 400 feet and in the No. 4 level (372 feet) they "cut a fine vein of antimony; they have also struck a rich quartz vein in the same drive" (Q.R. 3/1882). The following is a contemporary description from the Mining Chronicle (Anon. 1882). "The Ringwood Companies claim is situated on the crest of the hill to the north side of the road, their main shaft being sunk to the 400 foot level, whence they are driving

in a southerly direction. A rich vein of antimony has been cut, and in addition some very fine specimens of auriferous quartz have been discovered, but the company, not possessing the necessary machinery, were obliged to set these tailings on one side for the present, although it is probable that the result of the testing they are to undergo will prove sufficient quantity of gold to pay for the crushing."

A production of 200 tons of concentrates was recorded for 1882 (Kenny, 1942). The gold, found both in the stibnite and free in the quartz, resulted in the decision to erect a small battery for crushing purposes, and to concentrate on extracting the gold, rather than on producing antimony.

In 1883 the company suspended work, in order to reorganise with a larger capital and to erect a 10 head battery. This was completed during the year but operation was delayed by a broken fly wheel. In the meantime, the price of antimony fell, and work was suspended once again (Q.R. 1-4/1883). There appears to be no record of the quantity of gold produced from Ringwood, although at this time the mines were being worked "chiefly for gold" (M.S. 1883), and in 1884 the only reference to Ringwood states "—the gold-cum-antimony industry is also carried on but has lately been in a depressed condition." (M.S. 1884). Mineral Lease 738 was issued to the New Ringwood Antimony Tribute Co. N.L. on 31-3-1885, in lieu of M.L. 210, which was due to expire in April.

Prospecting operations at 150 feet in a shaft 100 yards north of the Main Shaft located a vein of antimony 9 inches to a foot in thickness and 4 tons of antimony ore were sent to Sandhurst for assay (Q.R. 1/1889). In July 1890, the lease was transferred to R. T. Blackwell. 130 tons of concentrates valued at £3,120 were raised by the New Ringwood Antimony Tribute Co. in 1890. A further 65 tons were produced in 1891, valued at £1,188, presumably by the same company

(A.R. 1891). There were 19 miners employed at Ringwood in 1892 (A.R. 1892), but there is no separate record of antimony production. However, Ringwood and Blackwood production combined was 294 tons, of which the major part was probably from Ringwood. There is no record of production for 1893-4, but work on a furnace was commenced in January 1894, and a man was sent to England to investigate treatment of antimony ores.

Following complaints about non-compliance with the labour covenant included in the terms of the lease, J. McGee stated that "several thousand" pounds had been spent on the mine. J. Cosmo-Newberry expressed the opinion that there was insufficient auriferous antimony ore to warrant the erection of plant for its treatment. The lease was declared void in December 1894, there being no record of the completion of the furnace. The occurrence of slag in the area suggests that perhaps it was completed to the stage of having a trial run, and that it was abandoned when Cosmo-Newberry's prediction was found to be correct.

Whitelaw (1899) stated that the mine worked till 1895, but there is no published record of any ore produced after 1892. He quoted a statement made by the caretaker of the mine that £29,000 worth of antimony had been produced, and a well defined lode of workable size left in the bottom level of the mine. Whitelaw's statement that the lode "can be traced *interruptedly to the sea coast* in a southerly direction, and away towards Yarra Glen in a northerly" has led to erroneous ideas about the extent of antimony mineralisation. This is clearly a typographical error which can be corrected by substituting "towards" for "to".

After 1895, the mine was abandoned, and lay idle for the next twenty years. Recent claims that the mine was in its heyday just before World War I certainly cannot be substantiated from departmental records. In August 1916, Gold Lease Castlemaine 7401 was issued to Mr. George Meudell

with permission for antimony to be worked as well. For reasons unstated, the Commonwealth Treasurer refused Meudell permission to form a company, and the lease was declared void in February 1918.

In January 1920, Mr. Frank Bateman pegged the same area, and was granted lease 7534 in April 1920, over the area of lease 7401. This lease was transferred to the Ringwood Antimony Gold Co. in July 1920. This Company was formed to test the belief that ore had been left in the mine when it closed in 1895. The company installed a 27 ft. by 6 ft. 6 in. Cornish boiler with a double 10-in. winch, and the mine was dewatered. Drives were cleaned out, but there was no ore available either broken or in the stopes. J. P. L. Kenny carried out a survey in December 1921 which made the position clear, and work ceased after a fruitless expenditure of £5,000.

The following extract from Kenny's report gives details of the old workings and an account of the work carried out in 1920-1921.

"A survey of all accessible workings was made in December, 1921. On the surface the lode has been traced for a length of 1,000 feet with a north and south strike and a dip of 70°W. The surface workings are marked by an open cut 50 feet long with an underlay shaft to the north. A crosscourse with a right hand heave of 100 feet intersects the lode 540 feet north of the open cut. Bright's mine, which was worked for gold, is probably north of the crosscourse. The shaft which is 11 ft. long and 4 ft. 6 in. wide has three compartments with levels at 184 feet, 244 feet, 304 feet and 372 feet. At the No. 1 level, 184 feet, the east crosscut to the lode is 125 feet long but the drives on the lode were not opened up.

At the No. 2 level, 244 feet, a crosscut east of 108 feet intersects the lode. The drives were cleaned out to 157 feet north and 117 feet south, but the old face was not reached in either case. At this level the lode has been stoped in places over a length of 230 feet.

At No. 3 level, 304 feet, the east crosscut is 80 feet long. At the time of the survey the north drive 310 feet long was being extended. The south drive was cleaned out to 485 feet without reaching the old face. At 325 feet south a crosscourse with a left hand heave of 25 feet intersected the lode. The lode was stoped in places from the shaft to 145 feet north, while to the south at 155 feet from the shaft there is a stope above the level 85 feet long. At No. 4 level, 372 feet, the lode is 20 feet east of the shaft. The north drive to the face has a length of

285 feet while the south drive also to the face is 193 feet long. The lode was stoped in places from the shaft to 250 feet north, and at 200 feet north a winze was sunk."

"The expectations that bodies of ore would be found in the old workings were not realised as practically nothing was left above the bottom No. 4 level. Evidently the lode is narrow with lenticular makes of ore and intervening blanks extending over a length of 200 feet. The lode with its westerly dip intersects east dipping strata to the depth the workings have reached. Should the lode

The recorded yields for the Ringwood Antimony Mine are shown below—

Year	Tons	Cwt.	Value per ton (at time)		
			£	s.	d.
1869	100		4	0	0
1870	153	13	5	0	0
1871	} no record of production				
1872					
1873	200		6	0	0
1874	75		6	5	0
1875	652	10	8	0	0
1876	372		8	0	0
1877	930	17	6	10	0
1878	438	10	6	0	0
1879	Nil		6	10	0
1880	18		8	0	0
1881	Nil ?		8	0	0
1882	200		7	0	0
1883	8	5	7	0	0
1884-8	Nil ?				
1889	4				
1890	130				
1891	65				
1892	Unknown portion of 294 tons from Ringwood and Blackwood				
TOTAL	Minimum of 3,347 tons 15 cwt.				

NOTES.

- (a) These figures do not include production from the smaller mines.
- (b) They are not entirely consistent, in that early figures are for hand picked ore, including oxides, while the figures for 1882 and 1890-1892 are for concentrates.
- (c) Even allowing for this, the incompleteness of the figures suggests that an estimate of production equivalent to 3,500 tons of concentrates would be reasonable.

Antimony Mining at Ringwood

at a greater depth pass through an anticlinal fold into west-dipping strata its value may be adversely affected."

If the £5,000 spent on cleaning out the old workings had been spent on deepening the shaft and prospecting the lode below No. 4 level, it is possible that the mine could have entered another productive period. The Ringwood Antimony Gold Company ceased work in 1921 and the shaft was covered in October 1923. A further attempt to work the mine was made about 1933-5 but apparently failed through inadequacy of the pump used (Baragwanath 1946). Mrs. Owen, who had lived adjacent to the mine for many years, also showed me a newspaper clipping with an application dated 12-10-1944 by the Red Shield Co. for "stibnite and gold to be worked by tunnel or adit level." This application was refused, because the area had been made a Public Reserve.

BRIGHT'S MINE 1871-1886

Bright's Mine was situated on Mineral Lease 226, issued to Mr. Richard Hodgson in March 1871, and is probably the shaft shown north of the crosscourse on Kenny's plan (fig. 1). This lease was a V-shaped one, bordering two sides of the triangular area of Mineral Lease 210, and corresponded to the road reserve for the Maroondah Highway and, in part, Mt. Dandenong Road, a provision of the lease being that the roads were to be maintained in good order for public use. Before the lease was issued, a dispute with applicants for Gold Lease Castlemaine 607 had to be settled. There are no details of this, but apparently the lease applications overlapped. This dispute was settled in November 1870, apparently amicably, in Mr. Hodgson's favour.

Fifteen tons 6 cwt. of antimony oxide were reported by Mr. Hodgson in 1871, valued at £2-10-0 per ton. The shaft had reached 110 feet in depth by September 1872, and 10 men were employed. Work was suspended in August 1873, and in May 1875, the lease was let on

tribute to the Bright Bros. In November 1875, the lease was transferred to E. Bright, R. Bright and S. Bright, and although they were doing mostly dead work, 1 ton 10 cwt. of antimony ore was raised (M.S. 1875). They also found auriferous quartz in their mine (Q.R. 3/1875). Bright's Mine probably produced the 13 tons 16 cwt. of ore recorded in M.S. 1876. The mine had been operated manually, but in 1877, they erected a steam engine, which proved inadequate (Q.R. 4/1877).

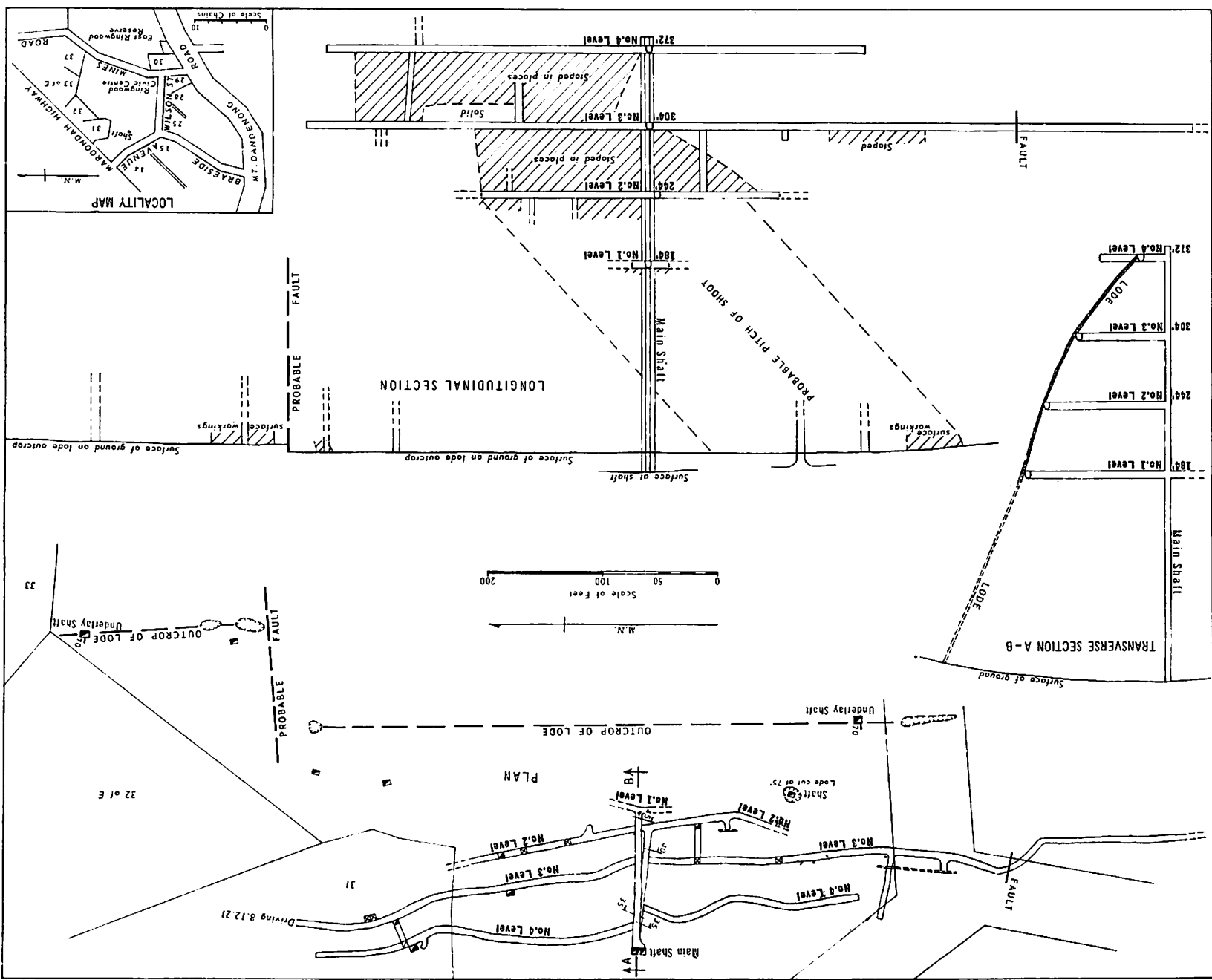
In September 1881, this northern portion was transferred to the New Ringwood Antimony Tribute Co. N.L., at the request of J. W. Wood. The remainder of the lease was transferred to this company in September 1882.

The total recorded production is a meagre 30 tons 16 cwt. of antimony oxide, but this would almost certainly be an understatement of actual production.

Ringwood Consols Co. 1882-1883

This company was formed in 1882, and invited tenders for deepening the shaft by 100 feet (Q.R. 4/1882). The Mining Chronicle article referred to earlier provides the following description (Anon. 1882). "Lower down the hill (from Boardman's Mine), the Ringwood Consols Co. have opened their shaft, which is at present only 150 feet deep, and they also are driving southwards, antimony showing freely in the face at the end, the vein varying from about 4 inches thick. A line of sandstone several feet thick runs through the slate formation, and the company are now engaged in working through it and rising. They also intend sinking their main shaft a further 100 feet, owing to there being a considerable difference in elevation between the two mines. Several directors and shareholders of the Ringwood Consols Co. visited the mines on Wednesday 20th September, and aided by a practical geologist, made a careful inspection of the property."

Fig. 1. Plan and sections Ringwood antimony mine. *Prepared by J. P. L. Kenny, 1926.



Antimony Mining at Ringwood

The discovery of the four inch vein of stibnite is confirmed in Q. R. 1/1883, where it is referred to as "payable," but there is no subsequent reference to this company, and no record of production. The location of this shaft is uncertain, but it seems most likely that it was Bright's Shaft. Mineral Lease 226, on which this shaft was situated, was transferred to J. W. Wood in September 1881, under the name of the New Ringwood Antimony Tribute Co. N.L. There is no mention of the Ringwood Consols Co. in the lease records, but the timing of the change, the presence of antimony ore, and the correspondence of shaft depths, all point to Bright's.

PATERSON AND PLANT 1870-1871

Mineral Lease 220 was issued to Hiram Paterson and George Plant in June 1870. This was an area of 52 acres in Allot. 19, Parish of Ringwood, on the north side of the Maroondah Highway. An objection to the granting of the lease was lodged by John Finnie, who claimed priority because he held a search licence over this area. The lease was almost entirely outside the mineralised zone and apparently little or no prospecting work was done. The lease was declared void in September 1871.

CURRAN'S SHAFT

This shaft is almost certainly that shown by Moon on Quarter Sheet 40 N.W., just north of the Maroondah Highway, on the northern continuation of the mineralised zone. Originally worked by Curran and Co., it was later worked by the Grand Junction Gold and Antimony Mining Company, and then by the New Ringwood Antimony Co. N.L. Apparently no payable ore was met with, and there is no record of antimony production.

Curran and Co. ? 1870 to 1876

John Curran originally held an alluvial claim on Mullum Mullum Creek, and a nearby quartz claim. In 1875 he applied for a mineral lease, to include these areas, and was issued Mineral Lease 418 of

14 acres in December 1875. This area was north of the Maroondah Highway, and included part of Allot. 20, Parish of Ringwood, and Allot. 33, Parish of Warrandyte. In 1876, he applied for an 8 acre area adjoining Mineral Lease 418 on the west, and was issued Mineral Lease 423 in May 1876.

In September 1876, both these leases were assigned to the Grand Junction Gold and Antimony Mining Company, and Mr. W. Clisby was appointed manager. This company is not mentioned in any of the published reports, but references to "Curran and Co." made in 1877 should presumably have been made under the company name, and can be taken to refer to the company.

A steam engine was erected in 1877 (M.S. 1877), and it was reported that they "are sanguine that they are near the lode from the nature of the stratum they have now reached" (Q.R. 3/1877). There is no record that it was ever reached. Leases 418 and 423 were voluntarily surrendered, and a single lease over the whole area was issued to the Grand Junction Gold and Antimony Mining Co. in October 1877 (Mineral lease 452). This lease was declared void in May 1880.

Grand Junction Gold and Antimony Mining Co. 1876-1880

(see under Curran and Co.)

New Ringwood Antimony Co. N.L. 1882-1895

Mineral Lease 554 was granted to James Wood in April 1882. This 15 acre area was part of the old lease 452 (Curran and Co.) north of the Maroondah Highway. There is some confusion in the leasing records between this company, and New Ringwood Antimony Tribute Mining Co. N.L. Both were enterprises of Mr. Wood, but the latter applied to tribute operations in Boardman's Mine, south of the highway. No ore had been raised by August 1883, according to a note in the lease book, based on a report by J. Mills.

After 1890, this mine was apparently worked concurrently with Boardman's Mine, because in July 1890, both Mineral Lease 554 and Mineral Lease 738 were transferred to R. T. Blackwell. Therefore, it is possible that some of the antimony ore attributed to Boardman's Mine for 1890-1892, actually came from this shaft.

In this period the mine was being operated by the New Ringwood Antimony Tribute Mining Co. N.L., who claimed that by August 1893 they had spent £12,000, including £5,000 on machinery. However, since they also held the lease over Boardman's Mine, this expenditure applied to both leases, and the bulk of this would have been spent on the main producing mine. The remarks about building the furnace etc. at the end of the section on Boardman's Mine, apply equally here. The lease was declared void in January 1895.

SOUTHERN SHAFTS

On Quarter Sheet 40 N.W., Moon shows shafts about 20 chains south of Boardman's Mine, just north of Mount Dandenong Road, and as far as can be ascertained, the following companies were involved.

Ringwood Antimony Mining Company Ltd. 1875-1880

In August 1875, John Finnie applied for a Mineral Search Licence over portion of Block 20, Parish of Ringwood, and apparently worked a claim within this area. In December 1875, Finnie agreed to the issue of a lease to Finlay MacDougal and P. J. Smith, of the Ringwood Antimony Mining Company. Mineral Lease 420, of 37 acres was granted to this company in March 1876. It extended from just north of Mt. Dandenong Road, south to Bedford Road. A small adjoining lease (Mineral Lease 421) was granted to Robert Wright in July 1876, and for a time, the Ringwood Antimony Mining Company operated the two leases jointly. A complaint in 1877 indicates that only two men were employed, and that no ore had been raised.

These two leases were voluntarily surrendered in March 1878, and Mineral Lease 499 was issued in lieu in June 1878. It was reported in April that two shifts of miners and an engine driver were employed in putting in a drive. By November, the shaft was down to 240 feet, and 10 men were employed.

In December 1878, Mineral Lease 507 was granted to Mac-Dougal. This was a 5 acre area west of 499. In July 1880, royalties of £11-0-0 had been paid, indicating that some ore had been produced. In July 1880, the lease was transferred to the Never Despair Antimony Mining Company Ltd. (see below).

Never Despair Antimony Mining Company Ltd. 1880-1883

This company took over Mineral Lease 499 in July 1880, and Mineral Lease 507 in August 1880. A record of £3-5-0 paid in royalties in August 1881, indicated that a small amount of ore was produced. Mineral Lease 499 was sublet to G. J. Carrall and W. Scott in June 1882, and declared void in September 1883.

Enterprise Claim 1882-1883?

The only reference to this claim is in the Mining Chronicle article referred to above, which says "The Enterprise Claim is about a quarter mile south of the above properties (i.e. Ringwood Consols and Boardman's), and to all appearances on the same line of mineral lode." It is possible that this was the name used by Carrall and Scott when they took over from the "Never Despair."

James Quigley 1891-1892

Mineral lease 1097 of about 15 acres (after excisions) was issued to Quigley in March 1891, for a 10 year term. Most of this lease lay between Mount Dandenong Road and the railway. The western portion included the ground previously worked by the Ringwood Antimony Mining Co. and the Never Despair Antimony Mining Co. (see above). There is no evidence that any further mining was done,

and the lease was declared void in May 1892.

OTHER CLAIMS

Recent newspaper articles mention "Puff and Dart", and the "Excelsio" mines of 1870, but Mines Department records provide no details of these. They were possibly operating on Miners Right Claims, pegged out after the discovery in 1869. Some of the shallow shafts associated with Boardman's workings probably go back to this period.

Moon's Quarter Sheet 40 N.W. shows a shaft near the Ringwood station, with dark shales containing pyrite and antimony, but there seems to be no other information available about it.

GEOLOGY

The country rock consists of shales, siltstones and hard micaceous sandstones, typical of the Anderson Creek Formation, of Silurian age. The rocks strike N.20°E. and dip east at 60 to 65°.

The principal antimony lode has been traced for a length of about 1000 feet (Kenny 1942). It dips westerly at angles varying between 60 and 70°, with a strike of N.7°E. to N.7°W. and when first exposed, varied from two to four feet thick (Ulrich 1870). Another vein had a strike of N.30°E., and dipped easterly at from 60° to 70°. Ulrich predicted that the two veins would intersect. Both were highly irregular in their behaviour, but patches of ore were always connected by a "strong ferruginous casing", containing veins of "antimonial ochre".

Whitelaw (1899) and Baragwanath (1946) point out that in fact there were a number of separate antimony veins and veinlets, but no detailed plan was ever prepared. Consequently, the possible significance of the opposing dip and probable intersection of the two main veins mentioned by Ulrich cannot be discussed.

MINERALISATION

The principal ore body was the main quartz-stibnite lode, worked

to a depth of close on 400 feet. The oxidised zone extended to about 100 feet in depth, although residual stibnite occurred throughout, including the surface workings (Ulrich 1870), and oxides extended to at least 160 feet in depth. The upper zone was heavily impregnated with iron oxides, as well as antimony oxides, leading to what the miners called "ferruginous antimonial ochre". Assays of material which looked like ordinary iron oxides gave results as high as 45 per cent Sb (M.S. 1871, p. 44). Hematite, goethite and limonite were all recorded from Ringwood.

The antimony oxides probably nearly all contained at least some iron, derived from oxidation of pyrite within the stibnite. The oxides were frequently found as concentrically laminated masses surrounding kernels of stibnite, clearly demonstrating their origin. Early records use "cervantite" as a general term for the antimony oxide, but most of the hydrated oxides would be better referred to as stibiconite ($H_2 Sb_2 O_5$). Cervantite ($Sb_2 O_3$, $Sb_2 O_5$) probably also occurred. Specimens from the oxidised zone at Ringwood created quite a bit of interest in the 1870's and several were assayed. Two were exhibited at the Vienna Universal Exhibition of 1873 (No's. 365 and 366).

Valentinite ($Sb_2 O_3$), one of the rarer antimony oxides, was found in crystalline form in the Ringwood Antimony Company mine in 1877, associated with copper carbonates (P.R. 4; 1877, p. 169). There are specimens in the National Museum mineral collection (No's. M7511, M7512, M483, M10281, M13024, M14810).

Kermesite ($Sb_2 S_2 O$) has also been recorded, and there are two specimens in the National Museum collection (N.M.V. 481; 19382).

Stibnite ($Sb_2 S_3$) was the principal ore mineral in the primary zone. It occurred in columnar masses, crystalline aggregates, and in recrystallised masses. Crystals have not been recorded, but may well have occurred in vughs such as were recorded from Costerfield

Antimony Mining at Ringwood

(Whitelaw 1899). Native antimony has not been recorded either, but it is a relatively common associate of its sulphide, and small quantities could have been overlooked.

The quartz-stibnite relationships are quite interesting. Polished sections show an intricate dendritic pattern of intergrowth between the stibnite and the reef quartz, while within some of the pure masses of stibnite, small crystals of quartz have formed with near perfect faces. These must have crystallised before the stibnite. Polished sections also reveal the presence of numerous finely disseminated particles of pyrite, especially along the vein margins (A. B. Edwards pers. comm.). Both sulphides occur in the country rocks, as well as in the main lodes. The occurrence of veinlets of stibnite was noted above, and pyrite occurred in the shales and sandstones in disseminated form. Small crystals of pyrite (2–3 mm.) formed in some of the sandstones, some of which were quite heavily pyritised.

Gold and silver were both associated with the quartz-stibnite ore body, and gold was also found free in the quartz. This association is characteristic of Victorian antimony occurrences. Assays showed values of up to 2 oz. 5 dwt. of gold per ton of stibnite (P.R. 2 : 1874, p. 128), but this was unusually high. As a general rule, gold was absent from pure stibnite, and, conversely stibnite with high gold values was of low grade. Sometimes gold showed freely as specks in the stibnite (e.g., N.M.V. 13211). At least some of the gold and silver was carried in the pyrite, because pyrite concentrates assayed up to 17 dwt. of gold per ton, and 2 oz. 5 dwt. of silver (P.R. 7 : 1884, p. 133).

Native lead has been recorded from Ringwood (P.R. 5 ; 1878, p. 177) and assayed 13 oz. of silver per ton. This is a record which needs confirmation, since many other early reports of native lead have proved to be erroneous.

Other minor occurrences include chalcantite (Stirling 1899) and

melanterite. The principal gangue mineral was quartz, including small amounts of an attractive pink stone which approached a true rose quartz. Other gangue minerals included barite and calcite.

ACKNOWLEDGEMENTS

This work was commenced in 1957. At that time, information was received by correspondence from Mr. L. J. Smith of Mildura, and the late Mr. W. Baragwanath (former Director of Geological Survey) and an old postcard of the Ringwood Antimony Mine (see photograph) was given to me by the then Town Clerk of Ringwood, Mr. A. Kelly. The late Dr. A. B. Edwards, C.S.I.R.O. Mineragraphic Section, examined polished sections of Ringwood stibnite for me, and gave information on the mode of occurrence of gold in antimony ores.

More recently, when my interest in the Ringwood mine was revived, Dr. A. W. Beasley gave me permission to examine specimens from Ringwood in the National Museum of Victoria mineral collection. Mr. A. B. Martin, Bendigo, prepared the copy of the old postcard.

REFERENCES

- Anon., 1873.—Catalogue of Vienna Universal Exhibition, 1873.
- Anon., 1882.—*Mining Chronicle* (San Francisco) Vol. 1, No. 24 : 5.
- Anon., 1935.—“Victoria—Gold and Minerals” Mines Dept. Vict. Handbook.
- Baragwanath, W., 1946.—“Gold and Minerals, Victoria” (unpublished).
- Crohn, P. W., 1951.—“Review of Metals and Minerals Produced in Victoria, Part 1 Metals”, *Min. Geol. Journ. Vict.* 4 (4) : 58.
- Fisher, N. H., 1945.—Antimony. Summary Report 3, Mineral Resources of Australia (B.M.R.).
- Kenny, J. P. L., 1942.—“Ringwood Antimony Mines”. (Unpublished Report 1942/7).
- Kitson, A. E., 1906.—“The Economic Minerals and Rocks of Victoria”. *Mines Dept. Vict. Spec. Rept.*
- Moon, R. A., 1893.—Quarter Sheet 40 N.W.
- Rouget, J., 1923.—“Shire of Lilydale, Past and Present, 1837–1923”.

Stirling, V. R., 1899.—“Notes on the occurrences of Copper Ores in Victoria”. *Geol. Surv. Vict. Prog. Rept.* 11 : 22–26.

Ulrich, G. H. F., 1870.—“Contributions to the Mineralogy of Victoria”. Appendix E, *Mineral Statistics Vict.* for 1869 : 52–67.

Whitelaw, H. S., 1899.—“Notes on Antimony Ores in Victoria”. *Geol. Surv. Prog. Rept.* 10 : 51–59.

Most of the detailed information was obtained from the following Victorian Mines Department publications, not all of which have been quoted in the text, and the Lease Registers.

Mineral Statistics for the years 1869 to 1872, 1874 to 1878, and 1881 to 1884, inclusive.

Quarterly Reports of Mining Surveyors and Registrars for 4th quarter, 1869; 4th quarter, 1873; 1st quarter, 1874; 3rd and 4th quarters, 1875; 3rd quarter, 1876; 3rd and 4th quarters, 1879; all quarters for 1880, 1882, and 1883; and 1st quarter, 1889.

Annual Reports for 1890–1892 and 1899.

Progress Reports of Geological Survey of Victoria. No. 2, 1874, p. 128; No. 3, 1876, p. 280–288 and 304; No. 4, 1877, p. 169; No. 5, 1878, p. 177; No. 6, 1880, p. 76; No. 7, 1884, p. 133.

Mineral Lease Registers.

Leases 210, 220, 226, 418, 419, 420, 421, 423, 452, 499, 507, 554, 738, 1097.

Castlemaine Gold Lease Registers.

Gold Leases 607 (Register missing at time of investigation), 2216, 7401, 7534. □