

1908.

WESTERN AUSTRALIA.

GEOLOGICAL SURVEY.

BULLETIN No. 9.

THE Geological Features and Mineral Resources of Northampton,

BY

A. GIBB MAITLAND,
Government Geologist,

WITH

APPENDICES

BY

H. P. WOODWARD, JOHN PROVIS, and E. S. SIMPSON.

*Issued under the authority of the Hon. H. Gregory, M.L.A.,
Minister for Mines.*

WITH A MAP AND SECTIONS.



PERTH:

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1908.

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PLATE.

Sections showing results of Boring for Copper and Lead in the
Northampton Mining District.

MAP.

Geological Map of Northampton: A. Gibb Maitland.

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PREFATORY NOTE.

CONSIDERABLE attention having been directed to the resources of the Northampton District, the Hon. the Minister for Mines determined upon the publication of the Departmental Reports presented to the Government from time to time, but which, up to the present, have never been issued in such a form as would render them readily accessible to the general public.

A. GIBB MAITLAND,
Government Geologist.

Geological Survey Office,
Beaufort Street,
Perth, 1st July, 1903.

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THE GEOLOGICAL FEATURES

AND

MINERAL RESOURCES OF NORTHAMPTON.

The month of January, 1897, found me at Northampton, engaged upon an examination of the geological features of the lead and copper mining district.

The ground, which was examined and mapped in some detail, embraces an area of about 100 square miles, and is depicted on the accompanying map, which has been photographically reduced from the large scale Geological Map of the district.

Mining in the early days was carried out in the most parsimonious manner, and sinking was discontinued when the lodes showed signs of contracting—a condition, however, to which all such deposits are subject. This circumstance, coupled with the low price of both lead and copper, would appear to have been the reason which led to the suspension of mining operations.

Mr. F. T. Gregory, writing * in the year 1861, would seem to have been the first to describe the occurrence of the lodes of lead and copper, in the following words:—

“These lodes take an almost invariable direction of N. 32° E., with a general dip of about 80° to the W.N.W., and are accompanied by parallel dykes of whinstone, quartz, or porphyry, varying from a few feet to 50 or 60 yards in breadth.”

In the year 1871 Mr. H. Y. L. Brown, at that time Government Geologist, examined the neighbourhood, and in his report † gave a description of such of the properties as were then accessible. This report, and the accompanying small scale map, is long since out of print. Mr. Brown, who had far better opportunities of examining the mines than any of his successors, wrote in no uncertain terms as to the district affording a wide field for the profitable employment of capital.

The report of Mr. Brown was followed in 1888 by that of Mr. H. P. Woodward, who noted the difficulty he experienced in examining any of the mines, which were either full of water or

* On the Geology of a part of Western Australia.—Q.J.G.S.: London, 1861: Vol. xvii., p. 478. † Geological and Mining Report on the Champion Bay Mining District, Western Australia. Perth: By Authority, 1871.

otherwise inaccessible. By far the best description of the copper and lead mines of the district is that from the pen of this author in 1895.*

My own visit added nothing to our knowledge of the underground workings, which were even in a worse condition than when visited by my predecessors, and were absolutely inaccessible.

During the course of the examination of the district, I was forcibly impressed with the association described by Gregory† of the lodes with the basic dykes which traverse the country for considerable distances with a remarkably persistent trend. The dykes being of commercial importance, owing to their intimate connection with the deposition of metalliferous minerals, it seemed to me that the greatest assistance the geological survey could render to private enterprise in the district would be in the direction of accurately mapping these igneous rocks, and by so doing afford a reliable guide as to the horizontal extent of the ore bodies, and possibly lead to the discovery of others.

Owing, however, to the absence of a topographical map on a sufficiently large scale, upon which the geological features could be shown in sufficient detail, the geological survey had to be delayed until this had been accomplished. The topographer completed this work by the end of June, but it was not until the month of September that I was able to proceed to Northampton to put in the geological details.

The district under examination occupies an elevated tract of country, drained by the tributaries of the Bowes River, which all take their rise in the rugged hills forming the most northerly portion of the district under examination.

The banks of the more important watercourses, Udandarra Creek and Nokenena Brook, are skirted by a width, more or less great, of recent superficial deposits: these have been shown upon the map. It is worthy of note that Mr. F. T. Gregory, writing in 1861,† notes the discovery by some member of his party of gold in these alluvial deposits in the Bowes River.

A series of sandstones and conglomerates once covered the whole surface of the ground, and now the only remnant left consists of an extensive tableland, whose extent is marked by a bold precipitous escarpment of several miles in length on the Eastern portion of the district. A similar tableland occupies the north-western corner in the vicinity of Weeine Well and Appedagena Peaks, whilst the series is represented on the south by a narrow bed, due south of Loc. 2190, drained by the southern waters of Nokenena Brook. Some of the sandstone beds are quasi-vitreous.

In one portion of the district is a comparatively thin bed of very ferruginous conglomerate, which contains a fairly large proportion of clayey matter. In its characteristic mode of weathering, the rock differs materially from that of the sedimentary beds beneath.‡

* Copper and Lead Mines of the Victoria District, *vide* Mining Handbook to the Colony of Western Australia, Perth: By Authority, 1895. 2nd Edition, pp. 117-126.

† Loc. Cit. ‡ This bed is in reality a residual conglomerate, to which the term laterite has been officially applied in the case of similar deposits in other portions of the State.

One section shows the conglomerate passing down insensibly into the underlying rocks. The ferruginous conglomerate is not, strictly speaking, horizontal, but seems to have adapted itself to the shape of the ground, forming as it were a thin covering, now partially denuded, which extended over the whole surface.

In a traverse from Northampton to the mouth of the Bowes River, these sedimentary beds are seen to consist of grits and flagstones, dipping at a low angle to the west, and are covered by the much newer beds of the Coastal Limestone Series. There is no evidence as to the geological age of the grits, flagstones, and conglomerates; they are, however, coterminous with those which form what is shown on all the maps as Moresby's Flat-topped Range to the south.

From beneath these sedimentary beds emerge those granites, gneisses, mica schists, quartz schists, etc., intersected by veins and masses of pegmatite, which, from an economic point of view, form by far the most important feature in the structural geology of the district, and cover the largest area of ground. It has been found quite impossible to draw any line separating each of these rocks, hence all have been delineated on the map by the same colour and symbol. In the absence of chemical analysis and microscopic examination, no further details can be given regarding these rocks.

The summit of a bare bill east of Brookside Farm is interesting, as showing a sheeted zone of micaceous and garnetiferous schist. The rock is traversed by bands of quartz, often much contorted and puckered, and stands out in such bold relief as to be readily followed by the eye across country. The general trend of these sheeted zones, as can be seen by an inspection of the map, is generally north-west and south-east. Another similar parallel sheeted zone of garnetiferous gneiss occupies the country to the north-east of the Baddera Mining Lease 1472, and an identical band makes its appearance to the south-east of Reserve 1374, at the foot of the sandstone tableland at the head waters of the Bowes River. What appears to be a continuation of this band is again visible on the surface in what is known as Poison Well.

A remarkably persistent band of quartz schist can be traced from the Two-mile Hill, just to the south of the limits of the map. The schist, which forms a bold topographical feature, forms a horse-shoe-shaped curve, passing through the Two-mile Hill and Trig. Station No. 18, and for some considerable distance further, occupying in all a distance of about three miles. The quartz schist has a steep dip to the East.*

In the bed of the Bowes River, just above the station, is a bed of very coarse pegmatite intersecting the gneiss; the pegmatite is about 10 to 12 feet in thickness, and has a general trend to the northwards. In portions of the pegmatite there appear to be bands of gneiss caught up in the rock mass.

* A much wider acquaintance with the geology of the mineral-bearing districts of the State leads me to believe that this quartz schist is merely another form of those laminated quartzites (cherts?) which form such a pronounced feature in certain districts.

The most important structural feature is the system of basic dykes with which the whole area is seamed; these extend far beyond the limits of the country examined. So far as my operations have extended, these dykes have no apparent connection with any visible deep-seated rock of similar composition. The basic rocks exhibit, when their trend is laid down upon a map with some degree of accuracy, a remarkable parallelism, having a general trend of north-east and south-west. The longest has been traced across country without interruption for a distance of over 10 miles, and extends, both north and south, far beyond the limits of the country examined. The breadth varies very much in different places, but in no case was the width exposed on the surface very great; although according to Mr. F. T. Gregory * the width of some of these examined by him reached as much as 180 feet. Wherever any sections were visible the dykes were either vertical or inclined at very high angles.

The rocks of which the dykes are composed are all basic compounds. An analysis of one of the most typical of these (200) from the vicinity of the crossing at Udandarra Creek, yielded at the hands of Mr. E. S. Simpson the following composition:—

Silica, SiO_2	53.06
Alumina, Al_2O_3	13.67
Ferric Oxide, Fe_2O_3	4.83
Ferrous Oxide, FeO	9.96
Manganese Oxide, MnO	0.56
Lime, CaO	8.62
Magnesia, MgO	5.31
Potash, K_2O	1.29
Soda, Na_2O	3.22
Loss on ignition	0.38
	<hr/>
	100.90
Specific gravity... ..	<hr/>
	3.07

This rock was found to be coarse grained, consisting almost entirely of multiply-twinned felspar and augite, together with a little magnetite.

FUTURE PROSPECTS.

Over the whole of the district under examination there is not a mine which has been sunk to a greater depth than 300ft., and operations ceased when the lodes showed signs of cutting out.

From an examination of the geological map of the district it can be seen that the area is traversed by a series of basic dykes which are continuous for miles, and that parallel to these are those lodes of lead and copper which have already been opened up in one or two localities. Igneous dykes of this nature represent what were originally fractures in the earth's crust, which pass downwards to very considerable depths, and the copper and lead lodes fill in fissures of a similar character, which find their origin far below the limit of practical mining. The lodes in consequence will continue downwards as far as ever operations are likely to be carried.

The method of the formation of fractures, and the movement of either of the walls, have the effect of producing alterations in

* Loc. Cit.

the nature of the fissures by forming wide or narrow portions, which have been subsequently filled with ore. There must always be local variations in the metallic contents of ore bodies, but there are no scientific grounds for believing that what may be called the shallow mines of the Northampton District have reached the limits of ore deposition, and that the ore bodies will not prove equally productive when followed either horizontally or vertically. As the deposition of the ore bodies is most intimately connected with the system of fracturing to which the district has been subject, it is evident that the search for further lodes must follow that direction which the evidence already accumulated has shown to be that of greatest ore deposition; and this direction is that which lies parallel to the system of basic dykes shown upon the map. A system of judicious prospecting carried out upon these lines should result in the discovery of other lodes equally productive to those already exploited.

THE OUTPUT OF ORE.

It appears that mining first commenced in the year 1842, and since that date 9,349·78 tons of copper and 33,643·85 tons of lead ore have been raised from the mines and exported from the district.

Unfortunately, it is impossible to give the output of the individual mines of the district, but I am under obligation to Mr. S. Mitchell, for the following returns shown in the tables appended. These, however, do not in all cases represent the actual output of ore, but are merely data of which a record has been kept; and on that account are worthy of record. These data have been compiled from the sale notes supplied to the vendors in England, where most of the ore had been sent; and the figures in the second column represent the value of shipments of copper and lead, from which it can readily be seen that ore of very different metallic percentages must have been raised.

Statement of Lead Ore raised from some of the Northampton Mines.

Name of Lease.	Date.	Quantity of Ore raised.	Total value of Ore.		
		tons cwt. qrs.	£	s.	d.
Baddera, No. 1	1883	40 0 1	299	6	0
Do.	1884	29 14 4	172	11	8
Baddera, No. 2	1884	14 9 0	67	5	0
Do.	1885	26 10 2	103	15	7
Do.	1886	0 8 2	2	10	11
Do.	1891	118 0 1	766	8	9
Geraldine, South	1886	6 8 0	44	17	8
Uga No. 1, South	1883	163 5 3	1,218	15	8
Do.	1884	51 19 2	277	17	10
Do.	1885	174 0 3	965	11	7
Uga No. 2, South	1883	13 6 1	80	17	7
Do.	1884	2 4 1	10	14	10
Wheal Ellen...	1883	0 4 2	1	16	4
Yiapa	1885	88 12 2	444	10	7
Baddera and South Uga	1884	143 14 0	789	1	5
Different Mines mixed	1890	74 9 1	483	8	4

Statement of Copper Ore raised from some of the Northampton Mines.

Name.					Date.	Quantity of Ore raised.	Total value of Ore.		
						tons cwts. qrs.	£	s.	d.
Gwalla	...	...	...	...	1863	12 3 0	260	4	8
Do. ...	...	...	...	...	1864	132 14 0	3,956	9	6
Do. ...	...	...	...	...	1865	88 11 0	1,866	16	9
Do. ...	...	...	...	...	1866	163 13 0	1,044	9	8
Do. ...	...	...	...	...	1867	172 7 0	2,976	1	1
Do. ...	...	...	...	...	1868	263 1 0	3,664	19	8
Do. ...	...	...	...	...	1869	70 18 0	904	7	1
Yanganooka	...	...	...	...	1866	292 0 0	3,725	16	7
Do. ...	...	...	...	...	1867	164 18 0	2,155	3	7

Appended will be found a table taken from the report of the Statist to the Mines Department, showing the quantity and value of copper and lead ore exported from the neighbourhood since 1850. The first shipment of ore from the district is said to have taken place during the year 1845, but no details as to either the quantity or the value are obtainable.

Table showing the Export of Copper and Lead Ore from the Northampton Mining District.

YEAR.			COPPER ORE.		LEAD ORE.	
			Quantity.	Value.	Quantity.	Value.
			tons	£	tons	£
1850	...	...	...	...	5'00	55'00
1	...	...	...	...	...	...
2	...	...	...	...	...	...
3	...	...	*	7'50	*	4'00
4	...	...	...	...	...	...
5	...	...	2'05	26'45	25'00	250'00
6	...	...	57'00	1,017'90	...	...
7	...	...	80'00	1,920'00	...	...
8	...	...	433'25	9,531'50	...	...
9	...	...	941'50	14,122'50	13'50	135'00
1860	...	...	517'50	8,021'25	98'50	985'00
1	...	...	409'00	6,339'50	79'00	790'00
2	...	...	783'50	12,536'00	9'00	90'00
3	...	...	763'00	12,208'00	230'00	2,300'00
4	...	...	1,076'00	17,216'00	80'00	800'00
5	...	...	886'00	13,290'00	703'00	8,436'00
6	...	...	557'50	8,362'50	273'50	3,282'00
7	...	...	337'00	5,055'00	902'00	10,824'00
8	...	...	83'00	1,245'00	1,100'50	13,206'00
9	...	...	155'00	2,325'00	699'50	8,394'00

* Declared weight not stated.

Table showing the Export of Copper and Lead Ore from the Northampton Mining District—continued.

YEAR.			COPPER ORE.		LEAD ORE.	
			Quantity.	Value.	Quantity.	Value.
			tons	£	tons	£
1870	...	...	6'00	90'00	1,209'50	14,514'00
1	...	...	...	...	420'00	5,040'00
2	...	...	...	...	364'00	4,368'00
3	...	...	56'50	847'50	965'50	11,586'00
4	...	...	66'50	997'50	2,143'75	25,725'00
5	...	...	204'75	3,071'25	2,289'00	27,468'00
6	...	...	279'00	4,185'00	2,191'50	26,298'00
7	...	...	53'50	802'50	3,955'50	47,466'00
8	...	...	9'00	135'00	3,617'50	43,410'00
9	...	...	...	...	2,775'00	33,300'00
1880	...	...	8'00	120'00	1,921'00	15,368'00
1	...	...	...	...	1,400'50	11,204'00
2	...	...	1'50	22'50	1,793'50	14,348'00
3	...	...	5'00	75'00	1,038'00	7,266'00
4	...	...	118'00	1,770'00	696'00	4,872'00
5	...	...	119'50	1,792'50	465'00	3,255'00
6	...	...	249'00	3,735'00	611'00	4,277'00
7	...	...	23'00	345'00	471'00	4,710'00
8	...	...	87'50	1,487'50	532'00	5,320'00
9	...	...	112'00	1,904'00	250'00	2,500'00
1890	...	...	8'00	136'00	213'50	2,135'00
1	...	...	...	...	25'00	250'00
2	...	...	155'00	2,377'20	29'75	150'00
3	...	...	...	...	...	...
4	...	...	...	...	...	...
5	...	...	24'00	120'00	...	...
6	...	...	...	...	...	...
7	...	...	21'15	302'00	*	4'00
8	...	...	†74'53	931'50	5'00	33'00
9	...	...	586'55	9,473'25	16'00	96'00
1900	...	...	...	...	26'85	242'00
1	...	...	50	10'00	...	...
Total	...	...	9,349'78	147,954'30	33,643'85	364,756'00

* Declared weight not stated. † 74 tons 10cwt. 2qrs.

A. GIBB MAITLAND,

Government Geologist.

APPENDIX A.

THE NORTHAMPTON MINING DISTRICT.

Although this district has the honour of claiming that it was here that the first mine opened in the whole of Australia, at the present time so little mining is being done that Northampton, which was once a flourishing mining centre, is now little more than a deserted village.

The mines in this district are for the most part situated upon private property, the titles being acquired with all mining rights many years ago, and, therefore, it is purely optional whether the owners work them or not. The majority of these properties fell into the hands of creditors at the time when the great fall in the metal market took place; and, since the present owners have no desire to launch into mining, but continue to hold the property until a purchaser presents himself, there is no immediate prospect of a revival taking place in the near future. The remaining properties which still belong to the Crown are, for the most part, insignificant, although one or two good lodes have been worked upon them.

This year only two or three leases have been taken up, but at the present time not a single one is being worked: the only lead production being by tributaries working over the old dumps.

WHITE PEAK COPPER MINE.—This mine is situated upon freehold block No. 4, between the railway line and the road nine miles north of Geraldton; in it a rich bunch of ore is said to have been met with and worked, but as no work has been done since 1858, and the shaft has fallen in, no very reliable information can be obtained.

GRAY'S LEAD MINE.—This mine is situated upon freehold block 29, which is a little over a mile to the north-east of White Peak railway station. A shaft was sunk upon this property, said to be 40 feet in depth, from which the lode was worked by means of levels, and a considerable quantity of ore is said to have been raised about 1866. The strange fact is that the manager did not seem to place any value upon carbonates, of which there are at least 20 tons still at grass. The lode is strong and well-defined, the cap being easily traced for a considerable distance north and south at the surface.

GELIRAH LEAD AND COPPER MINE.—This mine is upon freehold block No. 328, which lies close to and upon the eastern side of the railway line, about 12 miles from Geraldton. There are two parallel lodes, the most eastern of which outcrops for a distance of 300 yards, along which several shafts have been sunk to various depths of from 40 to 120 feet, from which a large quantity of copper is said to have been raised. The western lode has been traced at the surface for a distance of 200 yards, and has been

opened upon by a series of shafts. This lode was found to contain a considerable quantity of lead in places, associated with zinc blende and iron pyrites. These lodes strike north-east and south-west, and dip towards one another. A considerable quantity of both lead and copper ore is said to have been raised when this mine was worked prior to 1860, when it closed down, but was again re-opened for a short period in 1872.

OAKAJEE LEAD MINE.—This mine is upon freehold property No. 311, which is situated upon the eastern side of the railway line, 16 miles from Geraldton. The lode, which carries a considerable quantity of pyrites mixed with the galena, strikes 20 deg. east of north, dipping at an angle of 80 deg. to 85 deg. in a south-west direction, and has been opened by two shafts 40 feet in depth. The lode, although large, is not well defined, the galena being embedded in a mass of hard quartzite and granitic rock, containing much iron pyrites. This mine, although only worked upon a small scale, is said to have produced several hundred tons of ore prior to 1870, when it was closed down.

MCGUIRE LEAD MINE.—This mine is upon freehold block 832 upon the railway line, 25 miles from Geraldton, and was owned by the Melbourne and Champion Bay Smelting Company, who had their works upon this area, but at present the chimney stack is all that remains. One shaft has been sunk to a depth of 60 feet and one 30 feet, whilst there are several small pits and trenches upon a lode which evidently contained a considerable amount of copper mixed with the lead. This now belongs to the Fremantle Smelting Company.

KOBIJAWANNA LEAD MINE.—This is situated upon Crown lands upon the western side of the railway line, about half a mile north of McGuire. It is now partly included in the Railway Reserve, and is made the main settlers camp, owing to the fact that a splendid supply of water is obtainable from one of the old shafts. The lode has been opened up by a series of small shafts and pits for a considerable distance, and shows a rich body of carbonate ore in places. This has not been worked since 1872.

NARRA TARRA COPPER MINE.—This mine is situated upon Freehold Nos. 118 and 119, being about 25 miles north-east from Geraldton and six miles east of the railway line. This is one of the old mines, which has not been worked since 1865, when three shafts were sunk to a depth of 20 to 25 feet, and some driving done. The lode is well defined, striking in a north-east and south-west direction, with an underlie to the north-west. From the two southern shafts copper was raised, but in the northern one galena was encountered; this at the time was thrown aside, but later on it was dressed and bagged. A little to the north-west there is the outcrop of another lode, which can be traced for a considerable distance, showing lead carbonates of good quality.

NARRA TARRA LEAD MINE.—This consists of Freeholds 42, 336, 337, 830, and 833, and adjoins the last-mentioned to the

north-east. It was formerly worked by the Melbourne and Champion Bay Mining and Smelting Co., but now belongs to the Fremantle Smelting Co. All the lodes in the old mine run into it, whilst there is also a more western one, which is the main one, that has been worked. A vertical shaft, timbered and divided into three compartments, was sunk to a depth of 180 feet, with levels at 60, 120, and 180 feet. Owing, however, to the fact that it was sunk upon the cap of the lode, which was dipping to the south-east, crosscuts had to be driven from the shaft to the lode, the bottom one being 90 feet in length; it was therefore proposed to sink another shaft farther to the dip, with the object of cutting it at a depth of 300 feet, but, when this had been sunk 140 feet, the mine was abandoned. The lode near the shaft is said to have been nearly pure galena, from four to six feet in width. It is evident that a considerable quantity of work was done here, and a large plant has been in use, as well as smelting furnaces. Farther to the north-east are some more workings, where one shaft is down to a depth of 115 feet, and two or three other shafts of uncertain depth. The original management of this mine evidently failed to recognise the value of carbonates of lead, which were, in consequence, either not raised or tipped upon the dump; these are now being worked upon tribute, and 28 tons have already been dressed. This mine was worked from 1870 to 1884, during which time the company sent away £60,000 worth of ore. In the vicinity of these mines there are several other lodes which outcrop in places, upon which a little work has been done, but which have now been abandoned for many years.

NORMAN'S WELL LEAD MINE.—This abandoned mine is situated upon the Narra Tarra-Northampton road, about seven miles from the latter township. The lode is well defined, starting in a north-easterly and south-westerly direction, with an underlie to the north-west at an angle of 60° . There are several shafts, the deepest of which is 80 feet, and, to judge from appearance, a good deal of lead must have been raised. The old dumps have recently been dressed, and several tons of galena obtained from them.

GWALLA COPPER MINE.—This mine is situated upon the boundary of the township of Northampton, and consists of Freehold Blocks Nos. 140, 141, 250, 315, 331, and 359—covering a total area of 362 acres. There are two parallel lodes, which strike north-east and south-west, and dip to south-east. A considerable amount of work has been done upon the property, and several shafts sunk, the deepest being 198 feet upon the underlay. A main vertical shaft was in progress when the mine closed down, in 1868. This mine was only worked for a period of about five years, during which time 902 tons of ore, valued at £16,573, were raised. There were extensive buildings and plant upon this mine, most of which was left when the mine closed down.

WANERENOOKA COPPER MINE is situated at the north-west corner of the township of Northampton, and was worked about 45 years ago, but it was recently re-opened by an English company,

who did a considerable quantity of prospecting, but not finding any ore, closed down. The main shaft is 240 feet deep, from which there are several levels and drives, in which the lode proved to be about 30 feet in width, but carried rich ore in large bunches, sometimes upon one wall and sometimes upon the other. A winze has been sunk from the bottom level, in which there is said to be good ore. This company also owns Blocks 313, 27, 324, and 325, upon all of which lodes have been opened up to moderate depths.

WHEEL FORTUNE COPPER MINE.—This freehold property, consisting of Blocks Nos. 360, 334, and 437, is situated about three miles due west of Northampton. The main shaft on this mine is 300 feet in depth, and is connected with another, just outside the boundary, by a level some 500 feet in length. The lode when first opened up was only copper, but in depth a crosscourse was cut which carried lead, which cut out the lode, and thus the latter ore was worked. This mine was worked from 1862 to 1868, and produced 2,475 tons of lead and 985 tons of copper.

RHYS LEAD MINE.—This is on a freehold block, No. 436, which adjoins the Wheel Fortune upon the east, and into which the main lode worked upon that property runs; in fact, one shaft has been sunk in it. The workings upon this property are situated a little further eastward, upon a galena lode, which has been opened up to a depth of 50 feet. This mine has been worked recently, as there are several tons of ore, dressed and bagged, still on the dressing floor.

MARTIN'S SPRING COPPER MINE.—This mine is about three miles north of the Wheel Fortune, and is on a freehold block (No. 312) owned by the Wanerenooka Company. There are two shafts, the deepest of which is 42 feet, from which the lode was crosscut for a distance of 30 feet. Some of the copper from this mine carried a large percentage of silver, said to be as much as 50 ounces per ton. About a quarter of a mile farther south a third shaft has been sunk upon a lead lode, but little work has been done.

WOOMBOARO LEAD MINE.—This mine is on a small freehold block, about half a mile south of Martin's Spring, where a lead lode was opened upon many years ago, but is a series of shallow pits and trenches.

YANGANOOKA COPPER MINE.—This mine is about three miles north of Northampton, upon the main road, the area being held as freehold blocks, No. 32 and No. 314. There are two parallel lodes upon this property, which strike north-east and south-west, and dip at an angle of 75° north-west. The main workings are situated upon the western lode, which has been opened up by several shafts and levels, the deepest shaft being 180 feet. This mine has not been worked for 35 years, and the only record seems to be that the dressed ore went from 17 to 34 per cent., and the 458 tons sent away realised £5,880.

BADDERA LEAD MINE is situated upon Freehold Block 1472, about one and a-half miles to the north-east of the last mentioned.

There are two lodes upon this property, which run parallel in a north-east and south-west direction, dipping at a high angle to the north-west. These lodes vary from six inches to eight feet in width, the larger portion often consisting of almost pure carbonate or sulphide ore, which was so readily dressed by hand that the 677 tons of which a record has been kept averaged 72 per cent. The greatest amount of work has been done at the southern end of the lease, where the lode has been worked to a depth of 100 feet and 220 feet of drives. The other workings are at the north-east corner, where the lode has been opened up to a depth of 72 feet. This property was discovered in 1873 and worked for about 10 years, since which time little has been done. It now belongs to the Fremantle Smelting Company, who sunk a shaft to a depth of 160 feet, but stopped work before the lode was cut.

WHEAL MARY LEAD MINE.—This mine is situated upon a small freehold property about one mile south of the Baddera, and upon it a considerable quantity of work has been done; 2,200 tons of ore are said to have been sent away, but no work has been done during the last 12 years.

WHEAL ELLEN LEAD MINE.—This mine, No. 1146, is another freehold belonging to the Fremantle Smelting Works Company, being situated about a mile in a south-west direction from Northampton. This lode which strikes in a north-east and south-west direction and dips to the north-west, was first opened in 1872, and vigorously worked for about 10 years, during which time it is estimated that £16,000 worth of ore was raised. The lode has been worked to a depth of 158 feet and driven on 1,200 feet.

UGA LEAD MINE.—This abandoned lead lease was first opened in 1873. To judge from the extent of the old workings, the lode must have been of considerable size; whilst the refuse that remains after the ore dressing, proves that a large quantity of lode matter was dressed.

STRICKLAND'S BLOCK 326.—The southern continuation of the Uga lode extends into this property. It is very similar in character, being well defined and of considerable width and length of chute. These two mines are said to have contributed a considerable proportion of the ore exported between 1873 and 1884, when the price of lead dropped.

NOOKA LEAD MINE.—This abandoned lease is situated nearly one mile north of the last mentioned, which it greatly resembles in character. It was opened upon to a depth of 90 feet, but a large quantity of the work consisted of open trenches and underlay shafts. This mine was worked in the later seventies, and is said to have produced about 1,000 tons of ore.

CHIVERTON LEAD MINE.—This is also an abandoned lease, which adjoins the Nooka to the south, and into which that lode runs. This, however, has not been opened upon, but a parallel lode upon the western side of the lease has been worked to a limited

extent. This lode dips towards the Nooka lode, which it will probably junction with at a depth.

KIRTON'S LEAD MINE.—This group of three abandoned leases was formerly known as Kirton's and West Wheal Virgin, and upon them a line of lode was opened for a distance of half a mile, there being three large chutes in this district, which have been worked upon, the three leases at the southern part to a depth of 100 feet, and the northern to 160 feet. In the central lease, whilst the Fremantle Smelting Company were prospecting, a low grade lode was driven through for a distance of 30 feet without any walls being met with. This mine was worked from 1873 to 1884, and was extremely rich in parts, being said to have yielded from four to six tons of clean galena per fathom in sinking.

YIAPA LEAD MINE.—This is a small lease about six miles north of Northampton, and it is the farthest north of the group around that township. It is now held by Mr. Reynolds, who has a shaft down 90 feet, which is worked by a horse whip; there is another shaft down about 40 feet. This mine seems to be situated at the intersection of a mineral vein with a dyke, the ore chute being short, but rich. The shafts are now full of water.

ALMA LEAD MINE.—This is a small lease situated a little nearer to Northampton than the last mentioned, upon the western side of the road, and is held by Mr. Harvey, who has sunk a shaft to a depth of 42 feet, from which a little stoping has been done. The cap of the lode has also been opened by a series of small shafts and trenches. Twenty-eight tons of ore have been shipped from this mine.

WHEAL MARGARET COPPER MINE consists of a number of abandoned leases about one mile east of Northampton. The lode is from seven inches to two feet in width, but pretty rich ore, and was worked by five shafts, close together upon the central lease, to a depth of 180 feet upon the underlay, and the chute stoped for a length of 200 feet. Very little has been done upon the other leases, although the continuation of the lode can be traced.

VICTORIA COPPER MINE.—There are also a series of abandoned leases about half a mile south of the last mentioned, but, as upon the Margaret, although the lode can be traced for a considerable distance, it has only been worked at one point by two shafts about 100 feet apart. The great difficulty here was the great influx of water, whilst the ore was mixed with a large proportion of mundic.

WHEAL ALPHA COPPER MINE.—This is also an abandoned lease, upon which a considerable amount of work has been done to a depth of about 60 feet. An attempt was recently made to sink a new vertical shaft, but this was abandoned.

YANKEE CROSSING COPPER MINE.—This is another small abandoned lease, adjoining the Gwalla, and in this property a small but rich chute was worked to a depth of about 40 feet.

GERALDINE LEAD MINE.—This mine is situated upon Freehold Block No. 1, 40 miles north of Northampton, upon the Murchison River. It was worked from 1857 to 1878, during which period a considerable quantity of lead was raised and dressed. In the very earliest days smelting was attempted, but this proved a failure, so the ore was shipped from Port Gregory; but since no record of the ore shipped from this port has been kept independently of the general shipment, the quantity raised from this district cannot be estimated. The deepest shaft is 320 feet on the incline, and from this and the others there are very extensive workings.

LADY FLORENCE LEAD MINE is about one mile lower down the river upon Location 2, which belonged to the same company as the preceding. It is apparently a large, well-defined lode, which was worked by a number of shafts to a depth of from 60 to 80 feet, the ore being dressed at the Geraldine.

NORTH GERALDINE LEAD MINE.—This is situated about one and a-half miles east of the Geraldine, upon Location 4, which was owned by the same company. It has not been extensively worked, the deepest shaft being only about 50 feet.

SOUTH GERALDINE LEAD MINE is situated upon Location 9, about two miles south of the Geraldine. This mine has not been worked for at least 20 years, but prior to that about 500 tons of galena are said to have been raised. The only shaft is down about 66 feet, but in it the lode is said to have been very rich.

LOCATION No. 7 LEAD MINE.—This mine is owned by the Wanerenooka Company. It was worked from 1888 to 1890, and is said to have yielded about 700 tons of ore. The deepest shaft is 44 feet, from which the lode has been driven upon, which proved to be very rich and pure.

GERALDINE COPPER MINE.—This mine, which consists of a number of leases, is situated about four miles north-east of the Geraldine mine. It is not being worked at present, but is still held. A shaft has been sunk to a depth of 150 feet, from which the workings are of considerable extent, which proves the existence of a very large lode, which is rich in places; 130 tons of ore, assaying 28 per cent., has been sent away the last year.

LADY MAUDE LEAD MINE is a lease a little to the eastward of the last mentioned. It has been opened up to a depth of 50 feet, and from it 60 tons of galena have been shipped.

OURAKA COPPER MINE is a lease a little south of the last mentioned. It has merely been prospected to a depth of 80 feet.

HENNINGS COPPER MINE.—This is merely a prospecting show, a few pits having been sunk, and about five tons of ore raised from a small but rich vein.

TAMBARRA COPPER MINE is a little north of the last mentioned, to which it is similar, the deepest shaft being 15 feet.

GIBSON'S COPPER MINE is one of the same group, just to the north of the last named. It has been opened to a depth of 40 feet

upon a low grade lode, in which there is a rich ore chute, which increases in width from two inches at the surface to 18 inches at the shaft bottom.

TWO SISTERS LEAD MINE.—These were two old leases held and worked by the Geraldine Company, who opened up a lode at various points for a distance of half a mile. The deepest shafts are from 60 to 70 feet, but the whole of the lode has been taken out up to the surface, and appears to have been from 10 to 15 feet wide at the chutes.

FOUR MILE POOL LEAD MINE.—This lode is situated south-west of the last, and is probably only the same vein; only a little work has been done on it of a purely prospecting nature.

MARY SPRING LEAD MINE.—This old mine, that was worked by the Geraldine Company, is about four miles north of the Geraldine Copper Mine, and on it two parallel lodes have been worked to a depth of 75 feet, from which, apparently, a large quantity of ore was taken and dressed at the Geraldine.

LADY TILLY LEAD MINE is about one and a-half miles north-west of the Geraldine Copper Mine. Very little work has been done upon it, but 120 tons of ore is said to have been shipped.

WHEAL LILY LEAD MINES is situated upon the south side of the river, about three miles east of the Geraldine mine. There are several old shafts, but as the ore has been stoped to the surface, these have mostly fallen in. The lode was apparently of good size, and a good deal of ore is said to have been sent away.

GENERAL.—It will be seen from the above that in all 45 properties are included, out of which 16 are copper and 29 lead, whilst 22 are situated upon freehold property, and 23 upon Crown lands. With the exception of one or two, the freehold properties are by far the most valuable, but since no regulations apply to them, there is no prospect of their being worked. The four most important lead mines were the Geraldine, the Narra Tarra, the Wheal Ellen, and the Baddera; and they are all freehold. With regard to the copper mines, the same remarks may apply, since there is no single leasehold copper mine that has acquired any prominence as an ore producer. If, however, an average is struck, we find that in the last 50 years the 16 copper mines have produced about 8,000 tons of ore, and the 29 lead mines 33,500; or 500 tons of copper and 1,155 tons of lead to each mine.

At the present time there are only a few small lodes that could be made productive without the expenditure of considerable capital. This condition of things is really the fault of the local miners, who, in their desire to obtain every scrap of ore, have rendered the workings not only unsafe, but have precluded their use for further development or prospecting, thus entailing the necessity of shaft sinking to a depth of 100 feet and more, in order to prove whether a payable lode does exist or not.

30th May, 1901.

H. P. WOODWARD.

APPENDIX B.

RESULTS OF BORING.

In the year 1901, Messrs. Woodward and Lightly were commissioned to visit the Murchison district in connection with a proposal to erect State smelting works at Geraldton. As a result of their investigations it was recommended, *inter alia*, that a diamond drill be sent up to the district with a view of testing some of the lodes at a depth. Instructions were ultimately issued for the selection of sites for experimental boring to be carried out on Crown Lands.

A site was eventually selected at the Wheal Margaret Copper Mine. The lode is embraced within the limits of a number of abandoned leases, lying about one mile to the East of Northampton. The "Wheal Margaret" lode is said to have varied from seven inches to two feet in width of pretty rich ore. The lode was originally worked by five shafts, which were put down in close proximity in the central lease to a depth of 180 feet in the underlay, and the chute stoped out for a length of 200 feet. Boring operations commenced on the 12th of July, and were suspended on the 8th of October, after the drill had penetrated to a depth of 651 feet. Operations commenced at a point about 257 feet from the outcrop, and boring was carried out at an inclination of about 59 degrees from the horizontal. The bore proved unsuccessful; full details of the strata pierced are found in the Plate herewith. It is conceivable that what is shown in the bore record as fault rock (lode stuff?) occurring between 387 and 408 feet, may represent the Wheal Margaret lode, occurring along a line of fault; if so, the drill pierced the deposit at a point where it happened to be poor. The total cost of the bore, including incidentals, etc., amounted to £807 16s. 5d.

The second bore was put down at the Old Cow Rock, at Narra Tarra, at an angle of 45 degrees. Operations were commenced on the 1st of November, 1902, and ceased on the 3rd February, 1903, having penetrated to a depth of 600 feet. The drill passed through more or less decomposed granite. At 83 and 90 feet, bands of decomposed rock, with a little copper sulphide, were passed through, and at 239 feet a small quartz leader, carrying a little galena and zincblende, was met with. The bore-hole intersected no lode of any importance. Particulars of the strata pierced will be found on the accompanying Plate.

The total cost of this hole amounted to £635 18s. 11d

A. GIBB MAITLAND,

24th April, 1903.

Government Geologist.

APPENDIX C.

THE NORTHAMPTON MINING DISTRICT.

According to instructions received from the Honourable the Minister for Mines, I paid a visit to Northampton, leaving Perth on the 17th May, and returning on 2nd June.

As far as I can gather, the first discovery of copper ore was made in this district in 1842, when the Wanerenooka mine was discovered, and operations were commenced and continued actively for some 10 or 12 years after. Several other copper mines were subsequently opened, then lead mines; the lead mines ultimately predominating over the copper mines in the larger output.

The value of lead ore raised in this district up to 31st October, 1899, is given me as £364,514, being the value of 33,617 tons of ore shipped. The value of copper ore raised up to 31st October, 1899, is given as £457,944 from 9,349 tons of ore. For the last 30 years the district has been practically idle. No mines are now being worked, and the miners seem either to have left the district or settled down to farming in the immediate vicinity of the mines.

The district is about 110 miles in length, and extends from the Geraldine mine on the Murchison River in the north, to the Irwin River in the south, and is about 30 miles wide.* Throughout the whole district, mining has now entirely ceased, and it is pitiable to see so much utter desolation and abandonment as the shafts present with their surface timbers and collars all removed, and the sides caved in. The refuse heaps have been picked over and over again, so that they are now as clean and free from payable ore as they can well be.

The mines I visited were as follow :—

WANERENOOKA MINE.—It is situated on the northern boundary of the township of Northampton, on Block 27. Its area is 60 acres. A considerable amount of work has been done here. There is a good three-compartment shaft sunk to a depth of 240 feet vertical. The lode is reported to have passed through the shaft at the 180 feet level, and since then has not been seen. There is an open cut for about 250 feet north of the main shaft, which has been filled in with waste rock. Ore is reported to be standing at the 138 feet level and at the 180 feet level. Galena occurs occasionally with the copper ore, but I was unable to ascertain if any had been sold. About 120 feet north-east from the shaft a winze has been sunk 60 feet below the 180 feet level which carries a bunch of black ore, said to be rich enough to pay working expenses. The walls of the lode are stated to be 30 feet apart, smooth, and well defined, with a payable streak on the hanging wall and another on the footwall, averaging one foot in width. It is reported

* The proclaimed Mining District extends only as far south as the Chapman River, and is 67 miles in length and 24 miles in width in its widest part, from which it will be seen that the legal boundaries do not coincide with the geological boundaries.—A.G.M.

that it took two and a-half years to sink this shaft this last 60 feet, a work which could easily have been done in six weeks.

VICTORIA COPPER MINE.—There are two shafts here, situated on the crest of a hill and about 200 feet apart, from which a considerable amount of ore is said to have been raised. The ores are apparently yellow sulphides, although it is reported that a good body of black sulphides existed between the shafts, which, when extracted, realised sufficient to pay the entire costs of the eight men who were steadily working here. The ore-body is stated to have been two feet six inches wide, and the lode seven feet wide. There is a drive at 36 feet, connecting these two shafts. One of these is 60 feet deep and the other 50 feet deep. The lode may be traced on surface for a distance of two miles from these shafts. North-east from these shafts is another small shaft at about 60 feet distant, which is 25 feet deep. This mine is situated one mile and a quarter east from the railway station.

WHEAL MARGARET.—Several shafts have been sunk on this block. One, a two-compartment shaft, is said to be 30 fathoms deep, and a fair quantity of ore has been raised. Travelling north from this shaft are several shallow workings, from all of which ore has been raised. These workings have since caved in and are full of water. The ores found were principally green and blue carbonates. Sulphides are just coming in, in the bottom of the shaft. The property is situated one mile north-east from the railway station.

WHEAL FORTUNE.—There is a shaft here said to be 300 feet deep, which has an 8-inch cast iron water-pipe column standing in it. The mouth of the shaft is badly caved in, and I doubt if it would be economical to repair and clear it for further work. The refuse heaps seem to be soft clayey decomposed rock, and to have carried carbonate ores of good quality for copper. Working ceased here 35 years ago, and since then nothing has been done. Another shaft, known as the "Old Wheal Fortune," is situated in a hollow close by, where water would be expected to be plentiful. This is about four miles west from the railway station.

WHEAL FORTUNE EXTENDED OR RHY'S MINE.—Two small shafts have been sunk about eight fathoms deep, and there are some 60 bags clean galena ore lying at the surface. There are numerous shallow holes near the shafts from which ore has been taken out. A horse whim seemed to be the only machine used here. Everything seemed cleaned right up. The mine is situated three miles north-west from the railway station.

SOUTH KIRTON'S AND NORTH KIRTON'S.—These are a group of mines about four miles from Northampton. In South Kirton's there are two or three shallow workings near the bottom of a depression, but no ore is visible in any of them. The lode is traceable for a considerable distance along the depression. To the north of these workings is another shaft, near which is a pile of some 20 tons of lode matter which carries galena. This would require dressing before being fit for the market.

In the North Kirton's is a shaft on which an engine had been used, and a small heap of lode matter, said to have come from the bottom of the shaft, shows a little lead, say, from 5 per cent. to 10 per cent., in a quartz matrix. The lode has been traced on the surface for about 150 feet north from the shaft.

WHEEL BETA.—This mine was worked by T. Scott. Two shafts have been sunk, 120 feet apart, on the crest of a hill; one is 54 feet deep, and the other 48 feet deep. Everything in the shape of ore has been cleaned up, and the mouth of the shaft caved in. It is two miles from the railway station.

WHEEL MAY.—Three shafts have been sunk here, the deepest being 90 feet. About 250 feet of driving on the lode has been done. The lode averages 18 inches in width. There is a six-inch Cornish lift in one of the shafts and an engine to drive it.

Mr. Chism, a former manager here, tells me he took out 2,200 tons of lead ore, which realised £14 per ton. Work was suspended entirely, owing to a depressed lead market, and not from any want of lead ore or pinching of the lode.

BADDERA MINES.—These mines are situated about six miles from Northampton railway station, and, judging from the large heaps of lodestuff lying about, I should say that a considerable amount of work has been done. The mine was discovered in 1873, and afterwards fell into the hands of Messrs. Crowther and Mitchell. The old shaft is about 15 fathoms deep, and about 130 feet has been driven on the lode, which has been stoped away right to the surface from the level, said to be 25 feet deep. A vertical shaft has been sunk more recently. This is said to be 80 feet deep, and at the bottom a crosscut has been driven 36 feet to intersect the lode. Another shaft is said to be 14 feet deep. The lode is said to be in good ore under foot in the level, and, as far as I could see, this property would be very productive of lead ore if again worked.

UKKERHERI MINE.—This mine is about two miles north from the Baddera mine. There is one shaft about five fathoms deep, from which a little lead ore has been sold, but very little work has been done. It was worked in the early days by one John Hosking, and subsequently by James Mitchell.

YIAPA MINE.—A little work has been done on a lode 3 feet wide. A shaft has been sunk 90ft. in soft, easy ground. There is about 10cwt. galena on the floors and a small pile of two tons seconds. This mine has produced 500 tons to 600 tons of galena.

ALMA MINE.—A shaft has been sunk in soft, decomposed country 48 feet deep. A little galena is showing in the lode near the surface, which is about three feet wide. No walls are showing. The lode has been traced on the surface for a distance of 1,300 feet.

YANGANOOKA MINE.—An old working stopped many years ago. The shaft has fallen in and there is a general wreck. I saw some good stones of copper ore said to have come from the bottom of the mine. The mine is on private property, and I could get no information as to the size and productiveness of the lode.

IGA MINE is about quarter of a mile south of Yanganooka mine. Not much work has been done, but it is reported that some 400 tons of ore were shipped from here.

GWALLA MINES are located on the south side of the township of Northampton. The railway terminus is situated within the boundaries of the property. There are two parallel lodes, a shaft has been sunk to about 200 feet, and seems to have been well equipped with pumping and winding gear, and there has also been some attempts at ore dressing. It was discovered in 1863, and was very successfully worked for some time.

CAMP HILL MINE adjoins the Gwalla mines on the west. Two shafts have been sunk about 50 feet each. No information was available as to quantity and quality of ore yielded.

WHEAL ELLEN.—This has been one of the best lead mines in the district, and a large amount of work has been done, and there seems to have been a continuous chute of ore for about 300 feet in length on the surface. There was a pumping engine and dressing plant here in operation, and ores used to be dressed from the Baddera mines as well as the Wheal Ellen mines. This mine was first opened in 1872, and returned about 1,000 tons of lead ore per annum whilst being worked. This mine is said to be only 26 fathoms deep, and the length of the workings 200 fathoms.

STRICKLAND'S BLOCK, or South Uga, is about west of north from Wheal Ellen three-quarters of a mile. This shaft is 12 fathoms deep, and I am told there is two feet of clean galena in the bottom of the shaft.

UGA MINE.—The shaft is 75 feet deep. This mine is said to have produced a large quantity of lead ore. The ore has been stowed up to the surface. The appliances for hoisting were too crude to enable them to go deeper.

CHIVERTON MINE.—This shaft is said to be seven fathoms deep. There is a little blende to be picked up on the surface, but not enough to be payable.

NOOKA MINES.—These have been fair producers. There is a quantity of blende associated with the lead ores. It is stated that there is a good body of blende opened up in the mine, which is 14 fathoms deep.

WHEAL ALPHA MINE.—This is about one mile and a quarter east from Northampton, and is a copper show. Three shafts have been sunk, the deepest being about 60 feet. The lode at the surface is one foot six inches wide. Water is stated to be plentiful here, and the ground seems favourable for the production of mineral. A vertical shaft sunk by Mr. S. Mitchell, 25 feet deep, did not reach the lode.

MARTIN'S SPRING MINE.—Two shafts have been sunk here, one 42 feet, the other 50 feet, and a level connects them. There are other smaller workings to the south on the same block. Lead and copper ores occur in the lode, and are said to contain an appreciable quantity of silver. A parcel of copper ore was sold at a very

satisfactory return, and was said to contain 55 per cent. copper. The lode is 25 feet wide, and the ore makes in bunches throughout the whole width of the lode. No walls have been reached in the last working. There has been about 20 tons of ore sold from here. No work has been done along the course of the lode.

SCOTT AND GALE'S MINE.—South of Martin's spring, on block 312, a shaft was sunk 54 feet, and a fair parcel of galena was sent away. The lode has been traced north from the shaft for a considerable distance.

Wanerenooka Estate have a block north of this, about a quarter of a mile distant, and a small working which is said to be on the same lode.

NORMAN'S WELL OR NORMANTINE MINE.—Several shafts have been sunk on the top of a hill, the lode showing clearly at surface for a long distance. One of the shafts has an abundant supply of good water, which is now being used to irrigate an orchard close by. The lode seems much mixed up with quartz and garnets where I saw it.

NARRA TARRA LEAD MINES.—These are situated some 13 miles south-east from Northampton. A considerable amount of work has been done here, and the lode, which is reported to have consisted of pure galena in places, is from four feet to six feet in width. The output from the mine is valued at £60,000, and the depth of the shaft at 30 fathoms. The mines seem to have been well equipped with machinery.

GENERAL.—There are also some mines at McGuire's, Oakajee, and White Peak. At White Peak but little work has been done. I saw some copper stains near one of the workings, but the ores were evidently poor in quality. At Gelirah, two lodes have been worked and a considerable quantity of copper raised. Time did not allow me to visit this mine.

ZINC BLENDE.—A careful search over the refuse heaps at the various mines visited leads me to the conclusion that blende was not so plentifully found as was generally reported. It certainly does occur in several of the mines, notably, Wheal Ellen, Nooka, and Uga mines, and at Nooka and Uga mines might pay to work in conjunction with the lead ores.

While I am satisfied that there are abundant supplies of lead and copper ores in the Northampton district, I am not so sanguine of their being worked at a profit owing to the present low price of lead and comparatively low price for copper. With galena and blende marketable something might be done, provided sufficient capital was available to give any one of the mines a thorough test. A pumping plant and small winding engine would be indispensable. With these provided, £5,000 should be able to thoroughly test a property, as the ground is not hard, nor are wages exorbitantly high.

JOHN PROVIS, F.C.S.,

17th June, 1903.

Ass. Mem. Inst. C.E.

Appendix D.

TABLE OF ASSAYS OF COPPER AND LEAD ORES
from the Northampton Mining District made in the Geological
Survey Laboratory.

Lab. No.	Mine.	Locality.	Nature of Ore.	Copper.	Lead.	Silver.	Gold.
				parts per 100.	oz. per ton.		
3105	Wanerenooka	Northampton	Chalcopyrite and quartz ...	6.54	Nil	...	...
M183	Nooka ...	do. ...	Chalcopyrite, galena, and quartz	5.34	8.6	Nil	Nil
...	Racecourse	do. ...	Cupriferous gossan ...	8.08	...	0.87	Nil
3905	Derby Syndt.	do. ...	Chalcopyrite and quartz ...	24.01	Nil	1.78	0.08
3906	Do. ...	do. ...	do. ...	13.52	Nil	0.44	Nil
673	?	do. ...	Malachite, iron oxides, etc.	18.63	...	2.29	trace
674	?	do. ...	do. ...	15.08	8.8	Nil	Nil
675	?	do. ...	do. ...	14.48	...	Nil	Nil
676	?	do. ...	do. ...	31.94	...	2.45	trace
677	?	do. ...	do. ...	37.85	...	...	...
672	do. ...	do. ...	Galena and quartz ...	...	70.3	0.26	Nil
1559	Geraldine ...	Geraldine ...	Pyromorphite	Nil	62.5	Nil	Nil
4134	McGuire's ...	Oakabella ...	Galena, chalcopyrite, and quartz	1.75	39.5	Nil	Nil
3281	Lauder's ...	Narra Tarra	Cerussite ...	Nil	66.9	0.25	trace
3943	Mendip ...	do. ...	Cerussite and quartz ...	...	50.7	0.45	trace
3944	Do. ...	do. ...	do. ...	...	54.0	0.72	Nil
3945	Do. ...	do. ...	Galena, cerussite, and quartz	...	64.1	2.41	trace
3930	Narra Tarra	do. ...	Galena, blende, quartz, and granite	...	59.3	0.16	Nil
3931	Lead	do. ...	Cerussite, galena, and quartz	...	39.6	1.38	Nil
3941	Do. ...	do. ...	do. ...	...	52.4	3.76	trace
3942	Do. ...	do. ...	Cerussite and quartz ...	...	44.3	0.98	trace
4135	Do. ...	do. ...	Galena and quartz ...	...	59.5	Nil	Nil
3925	Narra Tarra	do. ...	Azurite and quartz ...	14.61	Nil	2.33	0.11
3926	Copper	do. ...	Azurite, malachite, and quartz	8.98	Nil	1.07	trace
3927	Do. ...	do. ...	Galena, cerussite, and quartz	...	46.7	0.57	Nil
3928	Do. ...	do. ...	do. ...	...	51.0	0.73	Nil
3929	Do. ...	do. ...	do. ...	...	63.2	2.94	Nil
4281	Gelirah ...	White Peak	Chalcocite, quartz and iron oxide	21.99	...	...	...

ANALYSIS OF A SAMPLE OF DARK BROWN ZINC BLENDE
from the Nooka Mine, Northampton.

Zinc, Zn	...	59.04
Cadmium, Cd	...	5.78
Iron, Fe	...	2.08
Lead, Pb	...	.37
Sulphur, S	...	32.66
		99.93

Specific gravity ... 4.07

EDWARD S. SIMPSON, B.E., F.C.S.,
Mineralogist and Assayer.

1903.

WESTERN AUSTRALIA

GEOLOGICAL SURVEY.

BULLETIN No. 9.

GEOLOGICAL MAP

AND

SECTIONS SHOWING RESULTS OF BORING
FOR COPPER AND LEAD,

TO ACCOMPANY REPORT ON

The Geological Features and Mineral
Resources of Northampton,

A. GIBB MAITLAND,
Government Geologist.

*Issued under the authority of the Hon. H. Gregory, M.L.A.,
Minister for Mines.*

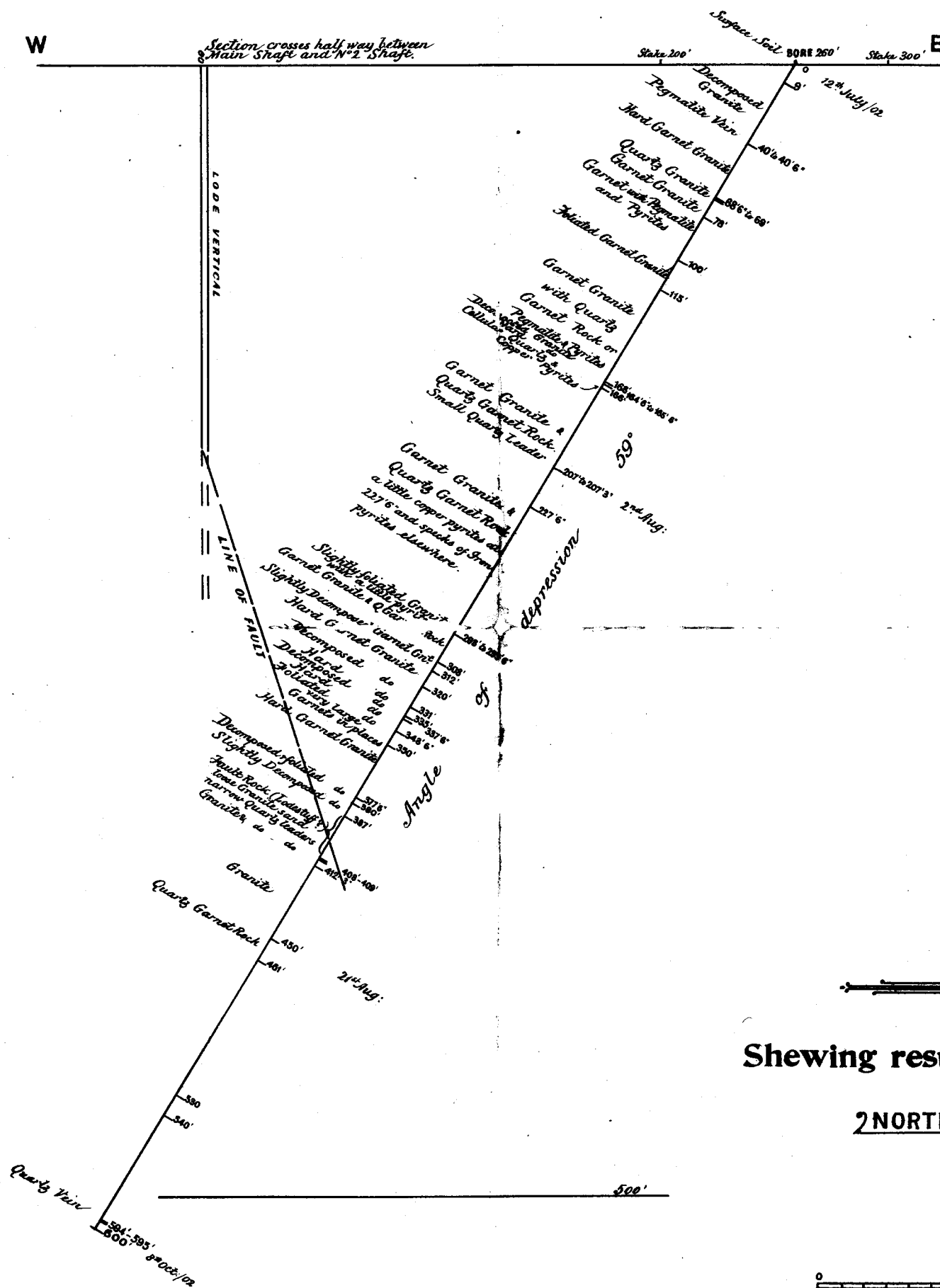


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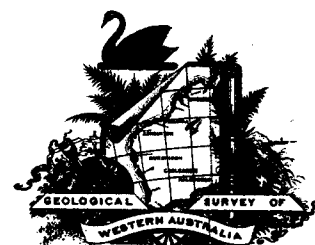
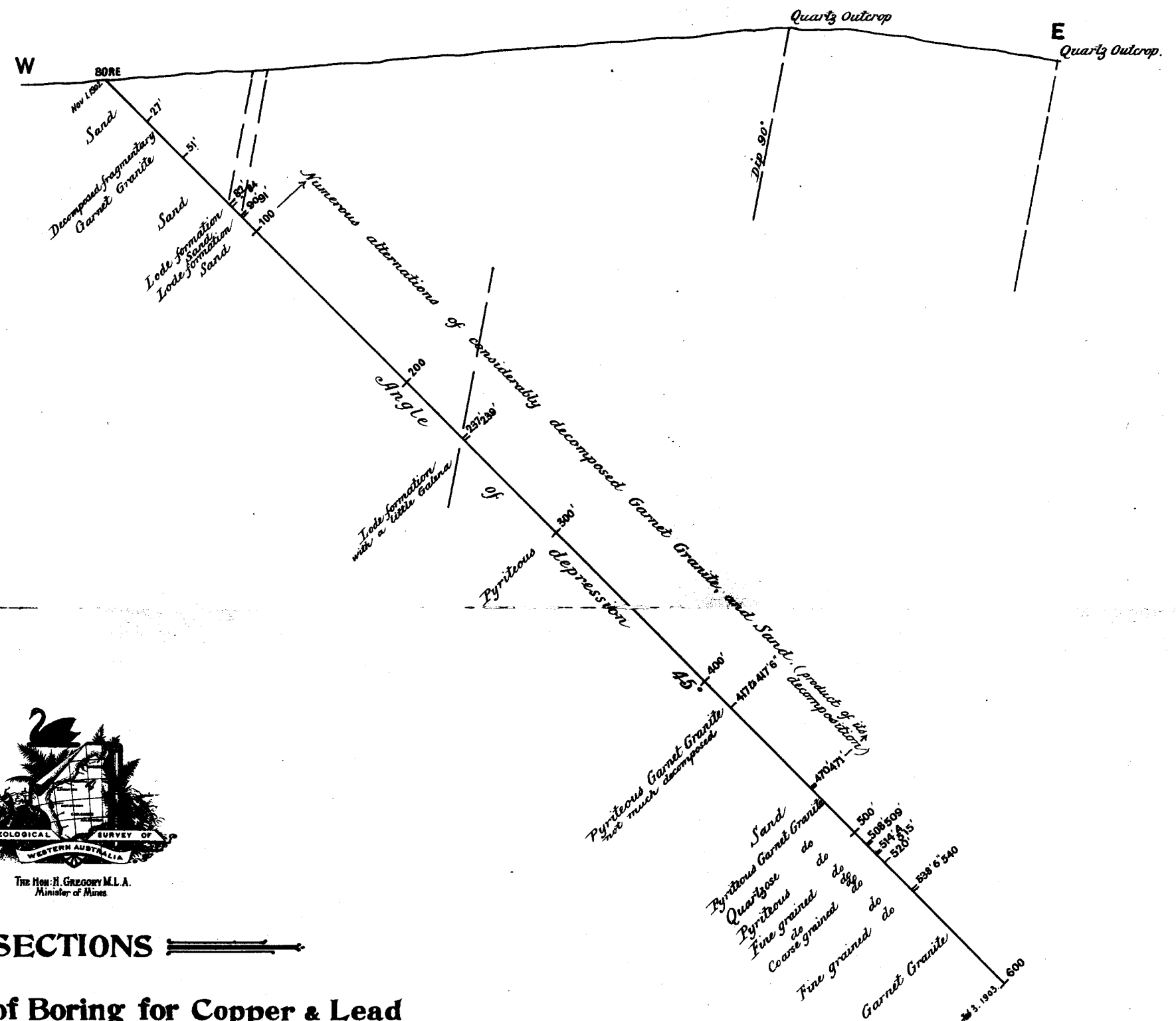
BY AUTHORITY: WM. ALFRED WATSON, GOVERNMENT PRINTER.

1903.

CROSS SECTION
OF THE
WHEEL MARGARET COPPER MINE
MAGNETIC BEARING 142°

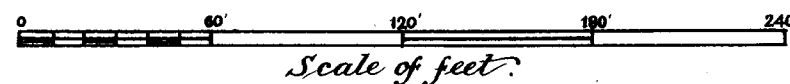


CROSS SECTION
AT
BORE SITE NEAR OLD COW ROCK NARRA TARRA.
MAGNETIC BEARING 284°



THE HON. H. GREGORY M.L.A.
Minister of Mines

SECTIONS
Shewing results of Boring for Copper & Lead
IN THE
NORTHAMPTON MINING DISTRICT
BY
W.D. Campbell AM.I.C.E., F.G.S.,
ASSISTANT GEOLOGIST



Alfred Waitland
Government Geologist

R. H. Smith del. 11/3/03



The Hon. H. Gregory M.L.A.
Minister for Mines.

GEOLOGICAL MAP OF NORTHAMPTON

BY
J. GIBB MAITLAND.
GOVERNMENT GEOLOGIST.

TOPOGRAPHY FROM PLANE TABLE SURVEY BY THE LATE S.J. BECHER.

REVISED 1903
SCALE OF CHAINS

INDEX OF COLOURS & SIGNS

- ALLUVIUM.....
- SANDSTONE & CONGLOMERATE (of age undetermined).....
- DIORITE DYKES.....
- GNEISS, MICA SCHIST, QUARTZ SCHIST & (Schistose?).....
- LODES OF LEAD & COPPER (Arrow showing direction of outcrop).....
- FRESHOLD MINING PROPERTIES.....
- MINERAL LEASES.....
- AGRICULTURAL BLOCKS.....
- RAIL VIGNOLES.....
- BUILDINGS.....
- SURVEYED ROADS.....
- ROADS SUITABLE FOR VEHICULAR TRAFFIC (IN USE).....
- WELLS.....
- THERMOMETRIC SURVEY STATIONS.....
- TELEGRAPH LINE.....
- WATER HIGHWAY BONE.....

