

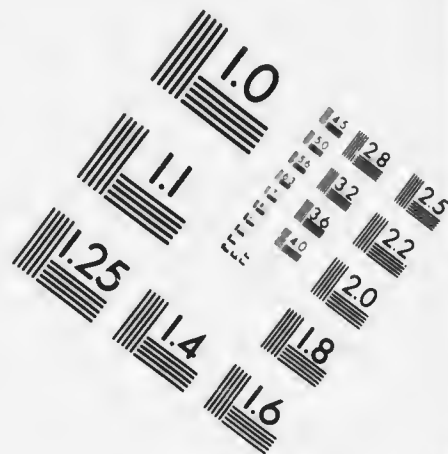
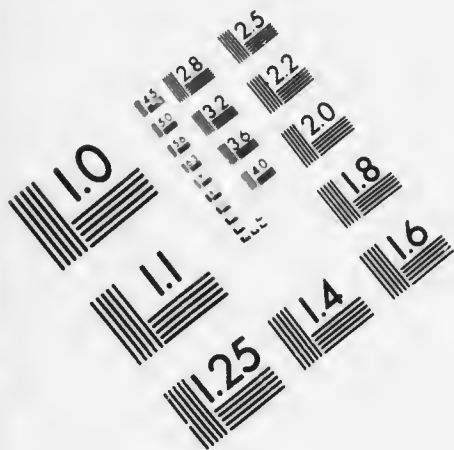
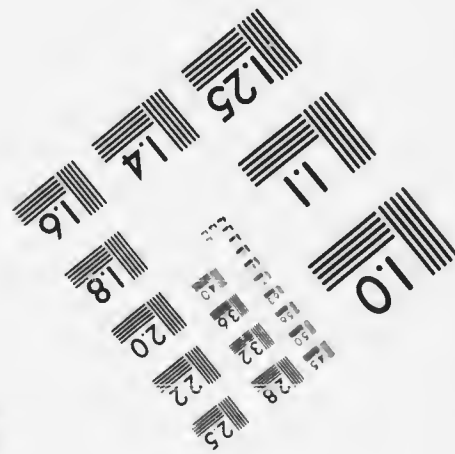
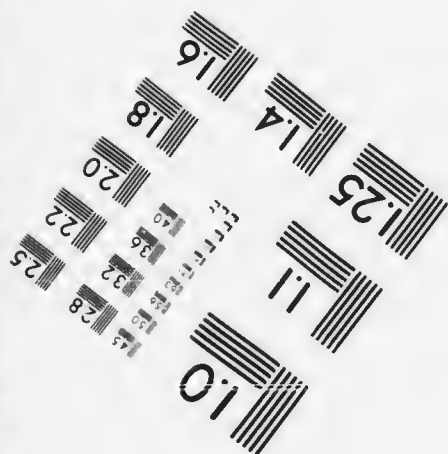
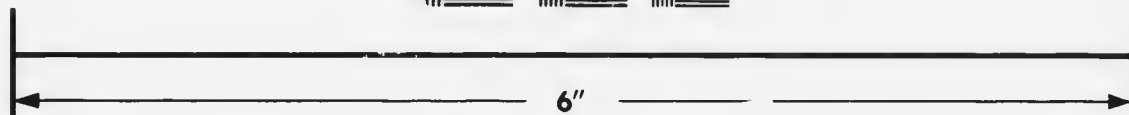
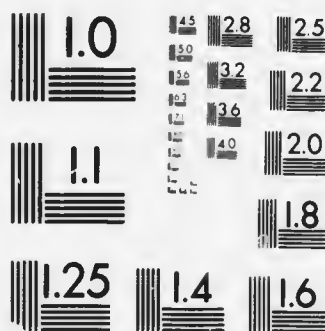


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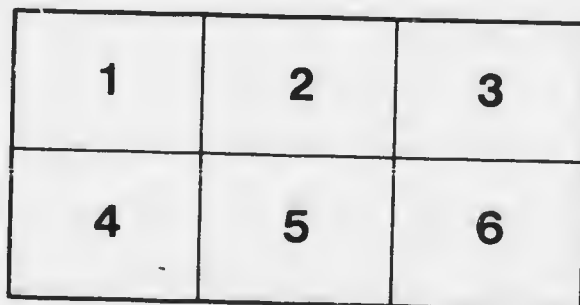
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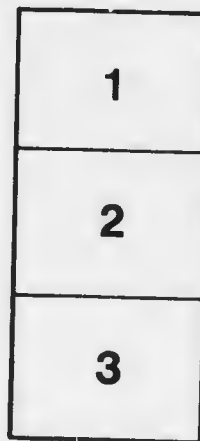
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REPORT
ON THE
MOUNT UNIACKE, OLDHAM, AND RENFREW
GOLD MINING DISTRICTS,
WITH PLANS AND SECTIONS.

BY
HENRY YOULE HIND, M. A.

MADE UNDER INSTRUCTIONS FROM THE HON. COMMISSIONER OF PUBLIC WORKS
AND MINES.



HALIFAX, N. S.
PRINTED BY CHARLES ANNAND,
1872.

TO THE HON. WILLIAM GARVIE, M. P. P.,
Chief Commissioner of Public Works and Mines.

SIR,—

In compliance with the instructions of the Hon. Robt. Robertson, M. P. P., under date October 27th, 1870, I have the honor to submit a Report on the structure of the Gold Districts of Mount Uniacke, Oldham, and Renfrew, together with such observations on the treatment of Gold bearing quartz and Gold bearing minerals generally as might conduce to the spread of information on these subjects.

The present condition of Gold mining in Nova Scotia appears to be due far more to circumstances which can be controlled than to any diminution in the yield of Gold, and although the depression which obtains in some Districts is the reverse of encouraging, it is to be attributed to causes which time and experience will remove.

Little or no improvement has taken place in the treatment of auriferous rock, and the same may be said, with a few striking exceptions, of the mining practice pursued.

A knowledge of the distribution of the Gold, or as it is termed the 'Gold streak,' is essential to the successful pursuit of Gold mining on the comparatively thin lodes which are found in Nova Scotia, and great benefits would result to mine owners if careful attention were generally given to the recording and the delineation of the 'Gold streak' on each lode, for future reference and comparison.

Especial attention is called to this subject in the text, and numerous instances are given of well defined 'Gold streaks,' and of the application of the knowledge thus acquired.

I have the honor to be,

Your obedient servant,

HENRY Y. HIND.



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I.—SYSTEM WITH AMALGAMATION IN THE BATTERY.

I.—QUANTITY OF MERCURY TO BE USED IN THE BATTERY.

The general rule is to introduce about the same relative weight of mercury as there is gold in the quartz, or in the ratio of about an ounce of mercury to an ounce of gold. "One ounce of gold requires for its collection about an ounce of mercury; but where the gold is in a finely divided state, the addition of another quarter of an ounce of this metal is thought advantageous. The proper proportion is, however, readily ascertained by closely watching the discharge. If any particles of amalgam which may pass through be hard and dry, a little more quicksilver must be introduced; but if, on the contrary, they be soft and pasty, or globules of mercury make their appearance, the supply in the battery must be diminished." *

* J. A. Phillips—"The Mining and Metallurgy of Gold and Silver," page 178.

Kustel gives similar directions, adding, however, that the mercury must be introduced every half hour, or every hour, from one-eighth to one-half an ounce of mercury at a time.

A common electro-plate *tea spoon*, such as are in daily use holds about three ounces of mercury; an eighth of an ounce would be about the twenty-fourth part of a tea spoon, half an ounce about one-sixth, and an ounce and a half of mercury would only half fill an ordinary tea spoon.

Hence we need not be surprised at finding abundance of globules of mercury in the tailings of some of our mills when we witness the mode of introducing mercury. Assuming that the average yield of gold in any parcel of quartz is one ounce to the ton, and that in a battery containing five stampers, five tons of ore are crushed in twenty-four hours, the total quantity of mercury which should be added according to the foregoing directions is six ounces, allowing one ounce and one-fifth per ton. This quantity should be distributed at the rate of one quarter of an ounce per hour, or about *one-twelfth* of a tea spoon at a time.

Without a graduated measure it would be difficult to guess at the proper quantity: but there is reason to apprehend that too little attention is given to the introduction of mercury, both as to time and quantity. In one mill in Nova Scotia, which has turned out during the past eighteen months some fifteen hundred ounces of gold, the mercury is added once in six hours. If the proper mode be to add a little every half hour, or every hour, it is clear that loss of mercury, if not of gold, must have taken place to a considerable extent, and an examination of the tailings showed that losses from both causes had occurred.

When mercury is added in quantities of two or more ounces at a time (a tea spoon full), some of it cannot fail to be splashed through the screens out of the stamping boxes without doing its work. Probably the condition of the amalgam outside the screens is the best guide as to the quantity of mercury to be used, and if found to be soft, yielding easily to the finger, the supply of mercury must be stopped for an hour or two. For a recent illustration of the abuse of mercury at Oldham, see the Chief Commissioner's Report for 1870, p. 9.

It is not sufficient that the platform in front of the screens be covered with amalgamated copper plates; no doubt much escaped mercury will be caught and retained by the plates, especially if the plates are kept perfectly clean. Unfortunately, it is impossible to keep the plates clean,—hence contact is not ensured, and some of the globules of mercury, as well as some fluid amalgam when the mercury is considerably in excess, always escape with the sands.

2.—WIRE NET TROUGHS.

In place of troughs lined with amalgamated copper plates, Kustel recommends narrow troughs closely covered with amalgamated copper wire net. The net should contain three or four meshes to the inch, and be closely attached to the bottom of the trough, so that all the sands may flow over it. The inclination of the trough should be one and a half to two inches to the foot. Mercury should be strained through leather over the head of the copper wire trough every day, or every other day, and the deposited amalgam brushed off once a week or fortnight. The wire meshes act as shallow ripples, and the inclination being sufficient to keep them free from sand or pyrites, the particles of mercury and amalgam are brought with force against the wire and contact secured.

When mercury forms in globules, or in a condition of soft amalgam immediately in front of the screens, it is a sure indication that too much has been introduced, and yet how frequently do we notice this accumulation of globules and soft amalgam in our mills.

Kustel does not approve of amalgamating in the battery.

Phillips states that when the proportion of mercury has been properly adjusted, the amalgamation of the gold is very completely effected, and when the quartz contains coarse gold, from sixty to eighty per cent. of the gold saved, is caught in the battery. If, however, the gold is in a very finely divided state, and is associated with ores of silver and other sulphides the results are less satisfactory: a light amalgam being produced which is easily carried off, over copper plates, blankets, or riffles. Ores of silver may be said to be practically unknown in our Nova Scotian mines, but there are other ores, such as sulphide of lead (*galena*), sulphide of iron (*cubic*

pyrites), sulphide of zinc (*blende, black jack*), arsenical pyrites (*mispickel*), which are of common occurrence. Mispickel is extremely common, and very often associated with fine gold. Manganese is much more rarely seen. As far as amalgamation in the battery goes, Phillips agrees with Kuetel that there is no evidence that battery amalgamation possesses *under any circumstances* a decided advantage for gold ores not associated with ores of silver, over stamping without the use of mercury.

Amalgamation in the battery is almost universal in Nova Scotia, and our mills are provided with copper plates in front of the screens to arrest the gold, the amalgam, and the mercury which escapes from the stamping boxes. An examination of the tailings in every district affords satisfactory proof that a large per centage of the gold in the quartz is carried away, notwithstanding the succession of amalgamated plates over which it has to travel. This loss varies from forty to twenty per cent., and in some cases, where arsenical ores are abundant and the gold is finely distributed, it even amounts to fifty per cent. The processes employed for saving the gold which escapes in the manner indicated above, are the same whether amalgamation takes place in the battery or is reserved for the concentrated products of the crushing process.

II.—SYSTEM WITHOUT AMALGAMATION IN THE BATTERY

3.—BRIEF DESCRIPTION OF THE CALIFORNIAN PROCESS.

The following brief description of the process commonly followed in California is from the pen of Mr. J. A. Phillips.* The treatment of the pyrites, whether common or arsenical, is contained in succeeding pages, or in the chapter on "The Chlorination Process."

"On being brought to the surface the auriferous rock is first passed through a Blake crusher, or is broken into fragments of a suitable weight, by the use of heavy hammers, and then reduced to the state of a very fine sand under the pestles of a stamping mill. This machine differs from that employed in Cornwall for the treatment of tin ores, inasmuch as the

*The "Quarterly Journal of Science," 1868.

heads and lifters, or 'stems,' are both invariably of iron, and of a cylindrical form, whilst the cams are arranged around a heavy wrought-iron shaft in such a way as to cause them to be raised in regular succession, giving to each at the same time a rotary motion. The 'battery boxes,' or 'cofers,' are also formed of a single iron casting, and movable 'dies' are so placed along its bottom as to correspond with the 'shoes' which form the wearing surfaces of the pestles. These shoes and dies possess the advantage of being readily changed when worn out, and the motion of rotation before referred to has the effect of keeping the faces constantly even. These machines, instead of being driven by toothed gearing, are worked by means of broad India rubber belts, and fed by a shovel through a long slot at the back of each battery box.

"In some cases a little quicksilver is at regular intervals dropped into the battery, but in others no mercury is used under the pestles, and the pulverized rock is simply washed by a stream of water which is admitted into the arrangement by ordinary gas pipes, then through fine gratings in front of each cofers, and over a series of blankets covering the inside the surfaces of wooden troughs inclined at a slight angle with horizon.

"These blankets are frequently removed for the purpose of being washed in large tanks, in which the auriferous matter accumulates, and from thence it is subsequently removed to be passed through an amalgamator. In order that there should be no interruption in the continuous action of the machinery, two of these blanket troughs are laid down before each battery, so that when the blankets from one of them are being washed, the stream of water and sand from the mill is conducted over the other.

"Beyond the blankets are troughs lined with amalgamated sheet copper, to retain any light particles of gold that might otherwise escape: these again terminate in settling pots, or tyes, in which a portion of the sand and the greater part of the auriferous pyrites are collected.

"The gold and other heavy materials collected in the vats in which the blanket washing is carried on, is afterwards passed through the amalgamator. This machine consists of two wooden rollers, about eight inches in diameter and two feet in length, furnished, on their circumference, with knife-bladed pieces of iron arranged around them with their edges at right angles to the cylinders, and working in cisterns containing mercury. Above these rollers, which are set in motion by belts, both in the same direction, but contrary to the course of the water flowing through the apparatus, is a hopper for receiving the sand to be washed. Below the cylinder is a 'rifle board,' having an inclination of about seven degrees

from the horizontal, and generally covered by plates of amalgamated copper, which can readily be slipped out for the purpose of having the gold amalgam which may have become attached to them scraped off. When copper plates are not employed for this purpose, the transverse grooves of the riffles are charged with mercury. To use this apparatus, some of the sand taken from the cistern in which the blankets have been washed, is placed in the hopper, and a small stream of slightly warm water allowed to play on it, in such a way as to gradually wash it under the revolving spiked cylinders, and from thence, over the amalgamated riffles. The riffle board is usually nine feet in length, is divided by ribs into several channels, and has at its lower extremity, a cistern for retaining the pyrites, which not combining with mercury, escapes amalgamation.

"The sulphides thus collected are sometimes ground with mercury in a small arrastre, or edge mill, and, after extracting from them as much gold as can be thus obtained, they may if they still retain a sufficient amount of the precious metal, be drawn off, and, after settling, be collected and sold for treatment by chlorination, or smelting with lead ore.

"The quicksilver drawn off from the amalgamator is first strained, either through close canvas or buckskin, the solid amalgam is distilled in a cast iron retort, and the gold fused in black lead crucibles, and cast into ingots.

"The auriferous pyrites is concentrated by washing, and when the chlorination process is employed, it is subsequently roasted "dead" in a reverberatory furnace, and afterwards subjected, in a moist state, to the action of chlorine gas. Chloride of gold is subsequently washed out with hot water, the gold precipitated by sulphide of iron, and then run into jars in the usual way."

4.—BLANKETS.

The gold which escapes amalgamation will be associated with auriferous cubic pyrites, arsenical pyrites or galena. Even in the absence of notable quantities of these minerals, free gold escapes in consequence of the grease from candles or lumps in the mine preventing contact with mercury. All of these separate sources of loss, together with floating amalgam and mercury, can be brought under control by the use of properly arranged blanket troughs or similar contrivances hereafter described, attached to the foot of the amalgamated copper plates, and over which the sands must flow.

BLANKET TROUGHS.

The action of blankets—one of the oldest gold-saving appliances known—is extremely simple. Gold pyrites, amalgam, mercury, &c., being considerably heavier than quartz sand, become entangled in the fibres of the wool and remain behind, while the lighter particles of quartz, slates, and fine mud, are carried forward by the current.

The fibres of the blankets soon become charged with the heavier materials, and require washing; hence, with a view to secure uninterrupted action, two sets of blanket troughs should be attached to each battery, so that while one set of blankets is being washed the current may be turned into the other line of troughs.

The troughs are generally made about twelve inches wide, ten feet long, and three inches deep. Two or three troughs are joined together so as to make a sluice twenty or thirty feet in length. The blankets in California are woven expressly for the purpose, and the pieces are generally twenty-four inches in width and sixty feet long, from which lengths are cut as required. Common horse blankets cut into strips serve the purpose, but not so well as those specially manufactured for the object in view.

The blanket should hang over the sides of the trough, and be firmly pressed to the bottom. Their ends are arranged like the shingles of a house, in order to prevent accumulations of sand at the joints. The current should be strong enough to prevent sand from accumulating, consequently the inclination of the troughs must be regulated accordingly. The blankets must be washed in a tank placed close to the troughs, which should not be less than three feet six inches, or four feet, in height, and about the same width, and five feet in length. Two or more of these tanks should be provided.

The first row of blankets, or those nearest the discharge from the plates, are washed every two hours, or oftener, according to the accumulation of material in the fibres of the wool. The second row will require to be washed less frequently, because the greatest accumulation takes place in first row. If sand accumulates in the blankets it is a proof that either the inclination of the troughs is not sufficiently

great, or that the current of water is too feeble for the work it has to do. When one set of blankets is being washed the supply from the battery is cut off and allowed to flow into the second row of troughs, and when these require to be cleaned the current is diverted into the first row. The washing process is very simple. The blankets are carefully taken from the troughs and plunged into the tank which had been previously filled with water. A few turns are sufficient to wash out the entangled metals, when the blankets are in a fit condition to be replaced. The richest portion of this entangled "stuff" is in the first set of blankets, or those nearest to the discharge from the amalgamated plates. Attention to the nature and quantity of the substances collected by the blankets will enable the operator to determine whether it is necessary to add another length of trough. In some mills in California, four, five, and even six lengths are found advantageous. The first blankets are not unfrequently washed separately, if free gold is present, in a tank provided for the purpose, and a crop of gold obtained from the proceeds by direct amalgamation in pans.

5.—TREATMENT OF THE BLANKET SANDS.

The minerals caught in the blankets consist of:

- 1st. Free Gold.
- 2nd. Auriferous sulphides (iron pyrites, galena, blende.)
- 3rd. Auriferous arsenides (mispickel, &c.)
- 4th. Amalgam.
- 5th. Floured mercury.
- 6th. Quartz sand, often auriferous.

In some Nova Scotia gold districts the quantity of auriferous arsenical ores is enormous, (Tangier, Waverley, &c.) In others, the sulphurets predominate, and it sometimes happens that the quartz is remarkably free from either arsenical or sulphuretted ores. Hence, the mode of treatment will vary according to the "blanket stuff," and resolves itself into three distinct operations, as follows:

- I. Treatment of blanket stuff containing only free gold, amalgam and mercury to be extracted, with some auriferous sand.

II. Treatment of blanket stuff containing auriferous sulphurets, free gold, amalgam and mercury, with some auriferous sand.

III. Treatment of blanket stuff containing arsenical ores, sulphurets, free gold, amalgam and mercury, with some auriferous sand.

The process employed for No. I., is now generally merged in that for No. II. The only difference between the processes being that in one case amalgamation without *grinding* is employed, in the other case *grinding* and amalgamation take place simultaneously.

The blanket stuff can be worked in grinding pans with quick-silver without any preparation or further concentration if the adjustment of the slope of the blanket troughs and the force of the current has been carefully attended to, in order to prevent the accumulation of sand on the blankets. It will be borne in mind that the blankets are used to collect gold that has escaped amalgamation in the battery and heavy auriferous ores, not quartz sand, which ought to flow over them. It is quite impossible to prevent some sand being caught by the fibres, but it is quite possible to prevent large accumulations of sand; hence, the blanket stuff in this case will consist of a certain proportion of sand, free gold, amalgam, flowered mercury, and iron pyrites: all of these substances are to be ground together in a suitable pan of which there are numerous varieties in use*. Many of the pans used in California are

* Kustel mentions the following:—

I.—PANS WITH PLANE CIRCULAR MULLERS.

- 1st. The common pan.
- 2nd. The Tab Grinder and Amalgamator.
- 3rd. The Bartolo Pan.
- 4th. The Knox Pan.
- 5th. Varney's Pan. "This pan is one of the best grinders and amalgamators, and very extensively in use."
- 6th. Wheeler's Pan.
- 7th. Union Grinder and Amalgamator.
- 8th. Moore's Quartz Grinder and Amalgamator. "This is a very simply constructed machine, used in several mills of California with great satisfaction."
- 9th. Gaston's Grinder and Amalgamator.

II.—PANS WITH CONICAL MULLERS.

- 1st.—Hepburn and Peterson's Pans.
- 2nd. Bodden's Pan.
- 3rd. Baux and Guio's Grinder and Amalgamator.

adapted to the saving of gold *and silver*. Where they are largely used amalgamation in the battery is not general, hence the blanket stuff is richer than where battery amalgamation takes place, and for this reason the blankets in Nova Scotian mills do not require to be washed so frequently, as in those mills where no mercury is introduced into the battery. Chilian mills are also employed for the same object as pans, and in the tabulated results of different processes hereafter introduced, instances are given of the use of Chilian mills.

The gold in Nova Scotia is frequently very finely distributed throughout the quartz, hence fine crushing and a subsequent *grinding* and amalgamation of the blanket stuff is essential in order to save a large per centage of the gold. In cases where gold is so finely distributed that it can be rarely seen with the naked eye, the blanket troughs should not in the aggregate be less than from twenty to thirty feet in length, with a view to catch as much *auriferous sand* as possible, which, from its greater specific gravity, will get entangled in the blankets with the pyrites.

THE COMMON PAN.

This apparatus consists of a flat-bottomed circular pan, from four to six feet in diameter, and two feet deep. It may be made of wood or iron, and in order to keep the bottom from wearing, it is supplied with a false bottom of iron about one inch in thickness. A hollow pillar in the centre admits the passage of an upright shaft, which is generally worked by gearing beneath the pan, capable of communicating to it from ten to fifteen revolutions per minute. A yoke, to which four wooden arms are attached, revolves upon the central pillar. To the arms blocks of wood are fixed, to which are screwed iron shoes. "The false bottom is made one inch less than the diameter of the pan itself, and has an aperture in

III.—PANS WITH TRACTORY CONOIDAL MULLERS.

- 1st. Excelsior Pan.
- 2nd. Wheeler and Randall's Pan.
- 3rd. Excelsior Continuous Grinder.

IV.—PANS WITH PERPENDICULAR MULLERS.

- 1st. The Centrifugal Ore grinder.
- 2nd. Varney's Quartz Grinder.

the centre an inch larger than the base of the pillar in which the vertical shaft works. To fasten the bottom in its place, and prevent the mercury from finding its way under it, strips of cloth, about two inches in width, are lapped around the edge of the false bottom, as well as applied against the sides of the pan. A little iron cement is then poured in, and the bottom secured in its place by means of well dried wooden wedges tightly driven between the two layers of cloth. These wedges, which are driven quite close to one another, must be somewhat shorter than the thickness of the false bottom, thus leaving a space above them which is subsequently covered with a paste of iron cement, that is allowed to set before using the apparatus. About one horse power is required to work this pan, which will amalgamate from one and a half to two tons of ore in the course of 24 hours." *

Phillips states that results from the Common Pan can be obtained, with careful working, almost as good as from the patented pans of Varney and Wheeler, or that of Hepburn and Peterson. It is much cheaper, and does not require much power. It is, however, essential that the sands be crushed tolerably fine. The grains should not exceed the sixteenth of an inch, according to Kustel, the grinding power of the apparatus being inconsiderable. It is charged with from one hundred and fifty to three hundred pounds of ore at a time, first with water when the mullers are in motion, and then with the ore and quicksilver.

THE VARNEY PAN.

"This pan is one of the best grinders and amalgamators and very extensively in use. The pan is constructed after the principle of the 'horizontal stone mills.' The bottom is formed by four dies of white cast iron, each die has a counter sink, for the reception of a bolt by which it is fastened to the bottom of the pan. The die has two radial grooves, and does not join the next die, so that other grooves are formed between the dies. According to Varney, the grinding capacity of the pan is greatly increased by filling these grooves tightly with hardwood. The annular space between dies and cone is filled with cement or wood. There are twelve shoes, riveted or bolted to the muller. The muller is separate from

* Phillips,—*"The Mining and Metallurgy of Gold and Silver,"* p. 394, with Drawings.

the hub, which forms a cone, covering the pan cone. It has two projections at the base by which the motion is imparted to the miller. The hub is fastened to the vertical shaft by a set screw and key. The gear in which the shaft can slide up and down rests on a two legged chair or support, which is bolted to a cross and this again to the four legs of the pan. In putting up this pan the cross must be bolted first firmly to the legs; the lever and step-box put in its place; the chair bolted to the cross and the gear wheel placed on it. The top of the legs should be levelled, and the pan with its corresponding projections set on them. The shaft is then put in its place and the pan or step-box moved until it is perpendicular. For this purpose the step-box has sufficient play in the box of the cross, some fine cement or soft clay must be equally spread over the bottom of the pan and the dies put in, with the bolts through them. Between the periphery of the dies and the pan four wedges are driven, each wedge pressing against the corners of two dies and so driven as to make the space between the edge of the dies and the pan equal all round. First a rubber, then an iron washer, is placed on the bolts under the pan; then the nuts screwed on and the dies drawn as close to the bottom of the pan as possible, taking care to keep them perfectly level on their upper surface. The radial slots in and between the dies are filled with hardwood driven end ways, also the space around the cone as thick as the dies. The wedges can be removed now. A tram is put on the vertical shaft and the lower box moved until it is perpendicular with the dies; then the box bolted to the cross. The driving shaft must be levelled, put in line, and the driving gear put on, etc. After this the hub is placed on the vertical shaft and then the miller in its place. The hub must be raised now, and fastened with the set screws to the shaft. As the dies wear down the hub can be occasionally lowered on the shaft, so as to keep the top of the box about level with the cross. The guide plates are put in the pan, bolted fast to a ring, and the pan covered. A hand wheel is put on the rod and the guide plates raised, so as to clear the miller. By aid of a lever, the miller can be perfectly regulated so as to grind not at all or only partially, or with its full force. Always before the start (of the whole set) the millers must be raised. When in motion at the rate of between eighty and one hundred revolutions per minute, and after sufficient water has been introduced, the ore can be charged with the shovel. From six to eight hundred pounds constitute a charge. Coarse stuff, as obtained from sifting, with screens of four meshes to the inch or coarser, is ground better if the miller is lowered by degrees. The rapid motion throws the ore towards the side of the pan. In order to

change the current there are the curved plates, which guide the stuff back to the centre and under the miller. A charge of coarse ore is ground perfectly fine in about four hours. Finer stuff as usually charged for amalgamation turns into a fine pulp in less than two hours. The pulp must be kept diluted so much that a swift motion of it around and behind the guide plates can be observed.

"For the purpose of heating the pulp there is no steam chamber in Varney's pan: the steam (for amalgamation) is introduced through a steam-pipe above the miller, directly into the ore. There is really no reason for a steam chamber which consumes more steam. Varney's pan is generally charged with eight hundred pounds of crushed ore, and revolves eighty times per minute. It requires from three to five horse-power. With new shoes on the miller, and grinding with the full weight, it takes a good deal of power on coarser sand, especially in the beginning; but the effect is in proportion,—eight hundred pounds of sand, through No. 4 sieves, are ground exceedingly fine in two or three hours. Shoes and dies wear out in from forty to sixty days run of twenty-four hours. Constant good working of these and similar pans depends on keeping them constantly in perfect order. The part most frequently neglected is the oiling of the box of the pan cone and the part of the chair upon which the gear runs. This happens in consequence of not keeping clean the top of the hub, from which the oil passes through an oil hole into the box and down on the chair. The Babbett metal soon wears on one side, the shaft plays loose, comes out of the perpendicular line, and the miller runs unevenly, causing very bad wear of shoes and dies. There are mills in Mexico and also in California where Varney's, Hepburn's and other pans, after one or two years use, can be seen in a horrible condition. The advice cannot be repeated too often, to repair any part of the machinery which gets out of order without delay, no matter whether it would run a day or two longer or not; one evil creates, generally, several others." *

G.—TREATMENT OF BLANKET STUFF CONTAINING ARSENICAL ORES, SULPHURETS, &c.

The presence of arsenic and sulphur is injurious to the amalgamating process, hence, before arsenical ores can be treated for gold the arsenic and sulphur they contain must be driven off by heat. Mispickel, the common form in which auriferous arsenical ores occur in our gold-bearing rocks, con-

* Kustel.

sists of two parts iron, two parts arsenic, and two parts sulphur, or 31 per cent. of iron, 16 per cent. of arsenic, and 19 per cent of sulphur. Common cubic pyrites consists of two parts sulphur and one part iron.

The sulphur and arsenic in these minerals require to be expelled by heat, and the iron oxidized, before the gold with which they are associated can be amalgamated. The ordinary heat of an open fire or kiln is not sufficient to drive off all the sulphur or arsenic, and the roasting has to be accomplished in a reverberatory furnace, so that the flames of the fuel and highly heated air may be made to play upon the stirred mass of ores and oxydize them.

Expensive kilns have been constructed at Waverley and in other districts for the purpose of roasting the arsenical ores, which are not only very abundant in some parts of Nova Scotia, but also frequently highly auriferous. At Waverley, Montague, and Tangier, mispickel abounds on certain areas; it is, however, inclined to be local rather than general in its distribution. Kiln roasting is wholly inapplicable for driving off the arsenic; in some instances it does more harm than good, by coating the gold and quartz with arsenious acid in the cooler portions of the kiln. It is essential that the iron associated with the arsenic and sulphur in mispickel be converted into an oxide, and, to effect this, exposure to heated air is necessary. Hence, the crushed material requires to be submitted to the action of a current of highly heated air, and, in order that air may have access to all the particles, they require to be frequently turned so that they may be brought to the surface and exposed to heated air. A reverberatory furnace is the only convenient form of apparatus suitable for this operation.

At the commencement of roasting, a portion only of the sulphur and arsenic is driven off, and a lower state of sulphide and arsenide of iron is produced, together with sulphates and arsenates of that metal. Continued heat, with air, decomposes these compounds and leaves the iron in the condition of oxides of iron, the sulphur and arsenic passing off with the other results of combustion, in the form of sulphurous and arsenious acids, &c., &c.

The hearth of a reverberatory furnace for roasting sub-

plides and arsenides is about twelve feet square, and is constructed of the hardest bricks laid edgeways. Below the floor is an arch three feet wide through the whole width of the furnace, into which an iron wheelbarrow, or car on rails, may pass to receive the roasted ore through a discharge hole. The working doors are four in number, two on each side of the furnace, which enable the roaster to reach all points of the hearth with short rakes.

The bridge is 10 or 12 inches wide and 8 or 10 inches high: it separates the hearth from the fireplace, and should be made of soapstone, refractory sandstone, or granite. The outside wall ought to be eighteen inches in thickness. The arched roof may be about twenty inches from the hearth, and its thickness about eight or nine inches, according to the length of the bricks used. The ores are introduced through openings in the roof. The door of the fire-place is at the side of the furnace, so that the length of the fire-place is the width of the furnace, less the thickness of the walls, and about twenty inches in breadth, being limited on one side by the bridge, on the other by the wall of the furnace. The draught can be regulated by a damper in the chimney. The whole body of the furnace must be firmly bound with grappling irons.

The roasting operation is very simple. After the furnace has been heated for some hours, the ores are introduced through a hopper above and through the roof into the furnace and spread over the hearth. The charge is one ton of ore, and one man is sufficient to attend the operation. The fire is first kept moderate, the burning sulphur creating much heat. As soon as the surface of the burning mass assumes a dull red heat it must be stirred, and the stirring continued at intervals until it ceases to give off brilliant sparks when portions are tossed in the furnace. As soon as all appearance of the blue flame of burning sulphur has disappeared, fuel must be added to the fire, and a good red heat kept up with occasional stirring. It takes from twenty to twenty-four hours to complete the roasting of one charge*. When the operation is completed, the roasted ore is passed through the discharge

* For full details and plans of Furnaces, see K. G. P. Construction and Chlorination.

hole at the bottom of the hearth, and wheeled to the cooling house, where it remains until introduced into the amalgamating pans or Chillian mills, or subjected to the chlorination process, as the case may be. Where arsenical ores are abundant it will be desirable to have the furnace placed at a distance from the battery house, and proper precautions taken to avoid danger from the fumes of arsenious acid, which may be condensed by passing through a long flue with a condensing chamber. In some cases it may be worth while to save the arsenic for exportation. The total quantity of this mineral produced in the United Kingdom in the years 1861, 1867, 1868, and 1869, was as follows* :

	Tons Crude Arsenic.	Value.
1861	1,450	£ 10,875
1867	1,255	2,112
1868	3,300	9,710
1869	2,561	11,464

In 1868 the value of the crude arsenic appears to have been about £3 stg. or \$15 a ton: in 1869 it reached upwards of £4 or \$20 a ton. The price of crude arsenic, as well as refined or white arsenic, is very variable. In 1869 white arsenic was quoted at £8 stg. or \$40 a ton in London: but in one part of 1863 it rose to £14 or \$70 a ton.

7.—CLEANING OF BLANKET STUFF CONTAINING ARSENICAL ORES, PREVIOUSLY TO ROASTING.

It is desirable that all siliceous particles should be removed from the arsenical and sulphuretted ore previously to roasting, and for this purpose various contrivances have been introduced, each with a different measure of success. The simplest will doubtless be found the most economical in Nova Scotia, and this certainly appears to be the Common Rocker. Phillips† describes the Rocker used in California. It is more easily managed than many other appliances, and, with care, does its work well. Auriferous sand may also be separated by the Buddle, of which there are several varieties, and some of these, when properly adjusted, assort and arrange the material operated on in the order of their specific gravi-

* London Mining Journal, Nov. 19th, 1870.

† The Mining and Metallurgy of Gold and Silver, page 191.

ties.. 1st. A ring of free gold and arsenical iron pyrites, with a quantity of auriferous sand of certain specific gravity.* 2d. Common pyrites, with auriferous sand. 3d. Auriferous sand and other minerals. 4th. Sand passing through the discharge hole. Buddles require careful adjustment, and intelligent management; when properly attended to, they do their work well. At Tangier, two buddles were in operation in 1863 and '64, and are described by Silliman in his report on that district. These, as well as the Chillian mills formerly in operation there, are now abandoned. Evidently one link in the process of reduction of the rich arsenical ores of Tangier was wanting, namely, the roasting of the arsenical ores in a *reverberatory furnace*, in place of kilns. The buddles and Chillian mills could be of little use if the preparation of the ore for amalgamation was incomplete. The addition of a reverberatory furnace, instead of the kiln, would doubtless call into renewed action these neglected appliances.

The comparatively new process of chlorination applied to arsenical ores and concentrated sulphuretted tailings is given in the next chapter.

THE ROCKER.

"The rocker consists of a trough about twelve feet in length, fourteen inches in width, and ten or twelve inches deep at the sides. In appearance this contrivance is not unlike a school form, of which the top constitutes the bottom of the trough, and of which one leg is shorter than the other, so as to give a slight inclination to the machine. The two legs, which are very short, are rounded at the bottom like rockers, and kept in their positions by articulations which allow of the arrangement working from side to side; this motion being communicated to it by means of a crank or eccentric, and small sweep rod, attached to a pulley driven by a narrow belt. The trough thus formed is rocked at the rate of forty-five strokes per minute with a one inch throw, and is furnished with an end at the higher extremity only, the other remaining open and forming a spout for the escape of water and sand. Water is admitted at the upper end by means of a flexible tube, and the bottom is lined with sheet iron to prevent wearing. To use this machine, the workman stands at one side of it, near its upper end, and, having turned on the

* See table of the different specific gravities of auriferous sand in the appendix.

supply of water, he throws in a few shovelfuls of the sand which has been collected either in the settling pits or tyes. The rocking motion, together with the stream of water, aided by the judicious use of the shovel, causes the lighter silicious particles to be carried off, whilst the heavier pyrites remain in the trough of the rocker. This is removed by the shovel, and another charge of unwashed tailings introduced, the operation being carried on continuously in the same way. This machine washes the pyrites very clean, but appears to allow too large a portion of it to be carried off in the final tailings."

PORT PHILLIP BUDDLE.

Different varieties of buddle are also employed for separating the pyrites from the sand. The following is a description of the buddle used in the Port Phillip Company's Works, Australia:

"It is a circular wooden basin, eighteen feet in diameter, having its discharge through an aperture in the centre, two feet six inches in diameter, boxes being fixed underneath for conveying away the sand as it escapes. The bottom of the basin is a plain surface, having an inclination towards the centre of half an inch to the foot. The rim of the basin is eighteen inches high, with a groove round it for receiving the mineral as it is delivered from the pipes attached to the centre shaft. In the centre of the buddle is an upright revolving shaft, working by belting from the main machinery, and fixed on this revolving shaft is a trough rather higher than the level rim of the buddle, where the sand for operating on is conveyed through an open box by water. Attached to the trough are six pipes, discharging themselves at the rim of the buddle. Six arms are also attached to the revolving shaft, to which are nailed small pieces of cloth for passing over the surface of the sand to keep it smooth. A centre piece is also attached to the shaft, the size of the discharging aperture which, by a rather complicated mechanical arrangement, is made to rise as the sand rises in the buddle, and so to prevent its too rapid discharge. The arms are also raised gradually by the same contrivance. On the sand being caused to flow through the trough, and the shaft set revolving, the discharge takes place through the pipes at the rim of the buddle, down the edge of which the mineral flows to the bottom, and on the periphery the heaviest matter deposits itself, as it would on the upper part of a common sleeping table, while the lighter material is washed down by the stream of water towards the centre, and is ultimately carried away through the discharging trough and boxes underneath."

* J. B. Smith's Gold Fields of Victoria, p. 299.

8.—VALUE OF THE PYRITES IN THE TAILINGS.

Numerous analyses and 'estimates' of the value of different samples of pyrites from the Nova Scotian Gold Districts have been published from time to time. In attempting to form a correct judgment respecting the actual value of any particular analysis as representing the approximate value of tailings or ores, or the sample itself, the standing and capacity of the analyst, and the mode of analysis, have to be taken into consideration. It requires an accomplished practical chemist to make an exact analysis of an ounce or so of ore. He must be provided with a chemical balance which should turn with the five-hundredth part of a grain, or his analysis should be made with considerably more than an ounce of the material. In our mining districts we not unfrequently hear of analyses being made of ores under circumstances which create grave suspicions that the details of a purely chemical analysis cannot be properly attended to, owing to the absence of the requisite apparatus, especially a good chemical balance. A scientific assayer employs an instrument which turns with the 1000th part of a grain. when analysing, say 1000 or 600 grains, (one ounce and a quarter), of an auriferous ore. Half an ounce of gold to the ton, or, more accurately, 10 dwts., 18 grains to the ton, would yield in an analysis of an ounce and a quarter of the ore, only the one hundredth part of a grain. Five hundredths of a grain of gold in an ounce and a quarter of ore is equal to two ounces, fourteen pennyweights, ten grains to the ton; and one-tenth of a grain of gold in an ounce and a quarter of the ore is equal to five ounces, eight pennyweights, and twenty-one grains per ton. Hence, it will appear that an error of one, two, or three hundredths of a grain, in the result of an analysis of an ounce and a quarter of ore, would lead to very erroneous conclusions. In the hands of practised chemists, however, analysis of an ounce and a quarter of auriferous ore can be made with remarkable accuracy, but without practical skill it is very delusive.

Subjoined are a number of assays of ores from different districts, with the name of the Assayer. From these it will be seen that in many cases the value of the pyrites is very considerable.

TANGIER GOLD DISTRICT.

No. 1.* Assay of a sample of pyrites worked from tailings at the mill of the New York and Nova Scotia Co., Tangier, made at the United States Assay Office, Sept. 23, 1863, as reported by Dr. John Torrey, Chief Assayer.

Gold per ton, (of 2000 lbs.).....	\$122.13
Silver.....	2.67

\$124.80

No. 2. Pyrites from Lake Co.'s lead, crushed at White and Esty's mill on the Tangier River, Nov., 1863. These assays were made January 14, 1865, by O. D. Allen, Chief Assistant in the Laboratory of Yale College.

Mean of two assays gave—

Gold per ton (2000 lbs.).....	\$187.04
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No. 3. Assay of pyrites from tailings of the Leary lode. This assay was made Dec. 31, 1863, by E. N. Kent, Chemist and Melter, in the U. S. Assay Office, in New York.

Gold, per ton (2000 lbs.).....	\$93.05
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Mean of three assays—

Gold, per ton (2000 lbs.).....	\$134.99
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WAVERLEY GOLD DISTRICT.

No 1. One ton (2000 lbs.).....	\$6.30
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No. 2. " " 	7.78
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No. 3. " " 	7.59
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From five pounds of tailings (No. 2) all the siliceous particles were washed out leaving 3 oz. 11 dwt. of sulphurets, which gave 6 oz. 14 dwts. 1 gr. of gold and 10 dwts. silver to the ton of 2000 lbs.†

Mr. Burkner sent to Freiburg, 1st—850 lbs. of pyrites from cleanings in stamper boxes, in which quartz of $2\frac{1}{2}$ to 3 oz. per ton had been crushed; the assay return was \$600 to the ton. 2d. Two tons of pyrites from quartz from 15 dwts. to 20 dwts. to the ton, assay return \$150 per ton. 3d. 8 or 10 tons pyrites from tailings which gave \$18 or \$20 to the ton; the first and

* From B. Silliman's Report on Tangier Gold District, 1864.

† H. Perley, quoted in How's Mineralogy of Nova Scotia.

‡ How's Mineralogy Nova Scotia, page 57.

second lots of pyrites gave about as much quicksilver as gold.

"Assays made under my (Prof. B. Silliman) directions on the waste tailings from "Barrel quartz," run through a stamping mill at Waverley, showed the presence of nearly fifteen pennyweights of gold to the ton of tailings, not over eight pennyweights having been saved in the original working."

The following assays are by Mr. Kirkpatrick:

	PER TON.					
	Yield of Gold.			Yield of Silver.		
	Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
WINE HARBOR GOLD DISTRICT.						
Assay of pure Arsenical Pyrites from } Provincial Co.....	11	8	16	..	..	..
SHERBROOKE GOLD DISTRICT.						
Assay of pure Arsenical Pyrites and } Galena from Boulder Lot.....	4	1	16	8	19	10
Assay of pure Arsenical Pyrites (no } Galena) from Cobourg Co.....	1	12	16	6	10	16
Assay of pure Arsenical Pyrites from } Kingston and Sherbrooke Co.....	4	18	..	5	14	8
Assay of pure Arsenical Pyrites from } Canada Co... ..	45	..	..	..	..	..
Assay of pure Arsenical Pyrites from } Wentworth Co. (Ferguson lode)..	..	16	8	..	..	..
Assay of pure Arsenical Pyrites from } Meridian Co. (Sears lode).....	1	12	16	9	..	..
Assay of Concentrated Tailings (ave- } rage)	2	10	..	..	..	..

MONTAGU GOLD DISTRICT.

"With a view to determine its actual value, I have caused a sample of several pounds of Mispickel which I brought with me from the O'Connor claim to be analyzed in the Sheffield Laboratory, here. The results are as follows:—

Gold value of the Mispickel.

The ore was pulverized and sifted through a fine sieve to separate the coarse gold for the purpose of determining the proportion of coarse and fine gold in the ore. The fine portion after roasting was fused with litharge, and cupelled. The coarse gold was fused with borax to separate all adhering particles of ore, and weighed. The results are as follows, calculated for the net ton of 2000 lbs.

2000 lbs.	gave	0.5679 lb.	coarse gold,
"	"	"	0.2740 lb. fine gold.
0.8419			

Reduced to Troy weight this amounts to 13 oz. 12 dwts. 22 grs. per ton of 2000 lbs.

Analysis gave the following per centage composition for the gold:—

Gold	96.66
Silver	3.34
100.00	

Gold of this fineness is worth.....	\$19.97	per oz.
The silver it contains is worth.....	.43	"

Value of the precious metals.....\$20.30 "

This gives \$276.49 at the value per ton of the sample of Mispickel assayed.

The samples from which this assay was made, I selected from average specimens; they showed only one or two particles of gold, and are probably as fair an average as can be obtained in the small way.

The relation of the fine to the coarse gold in this assay is interesting; it shows that mechanical means alone may be made to save nearly three-fourths of the gold.*

Mr. Browne, the able and successful manager of one of the Montagn Gold Mines, informs me that he crushed for Mr. Lawson of Montagu, one ton of "pockets of auriferous arsenical pyrites and obtained 37 ounces per ton." The tailings from this crushing were saved, and a sample submitted to Mr. Fraser, of Halifax, for analysis, who returned their value at eleven ounces per ton.

Mr. Browne's experiment on one ton of arsenical pyrites is important, for it suggests the subsequent crushing of pyrites

* Professor B. Silliman.

saved by concentration, as a means of obtaining a crop of gold without recourse to roasting. It is probable that if such concentrated pyrites from tailings were well mixed with a small per centage of lime as they accumulated, they would yield a paying crop of gold, the residue, after crushing, might then be submitted to the processes described for treating arsenical ores.

ANALYSIS OF TAILINGS.

The mean yield of two samples of tailings from Montagu quartz crushed at Waverley, gave Professor Silliman 16 dwts. 13 grs. gold per ton.

The "Montreal Herald" of February 4th, 1870, in a summary of mining operations in Nova Scotia during the year 1869, contains the following statement respecting the tailings at Montagu. Mr. Longmaid having left the country, I have not been able to ascertain his method of analysis, but from that gentleman's experience and standing, I have no doubt the assays were scientifically conducted.

"A series of careful assays made by Mr. John Longmaid, an English engineer, proved that the tailings taken from the bank close to the Montagu mill contained \$37 per ton, and gradually decreased towards the furthest end of the heap, to \$2.80 per ton. A natural concentration had here taken place—the heavier portions, consisting principally of pyrites carrying gold, had settled close to the mill, while the lighter portions, poor in gold, were carried by the water to a greater distance."

Mr. Brown states that he panned some pyrites with great care from the tailings of the Montagu mills, and submitted them to Mr. R. G. Fraser, of Halifax, for analyses, who returned a yield of 28 oz., 14 dwts. per ton of pyrites. Mr. Frecheville, of the Westminster Co.'s mine, at Lawrencetown, assayed two samples of tailings from the Montagu mill; one taken from near the mill yielded about $2\frac{1}{2}$ ounces to the ton, another sample taken from half way down the heap yielded 11 dwts. per ton.

Some years ago I submitted two samples of the cakes of concentrated sand and pyrites taken by myself from the foot of the tail sluice of the Montagu mill, to Dr. Hayes, of Boston, which assayed upwards of five ounces per ton and three ounces per ton respectively.

FINENESS OF NOVA SCOTIA GOLD.

All native Gold is an alloy, in which silver is the most common admixture. The value of bar gold or bullion per ounce, as it comes from the mines, is generally estimated by the proportion of pure gold it contains. As this proportion is very variable, it is not improbable that in many instances, with regard to Nova Scotia gold, the value paid for bar gold is below its real market price.

The average fineness of the gold from different countries is as follows :—

Victoria	958	in 1000.
Nova Scotia.....	955	" "
Anstralia.....	925	" "
California	880	" "
Russia	891	" "
British Columbia.....	875	" "

When samples of gold from different mines, or even different mining districts, are taken, the variation is sometimes remarkable, and, owing to impurities introduced during the smelting operation, the bar gold is sometimes by no means so fine as the native alloy; but, by care in the manipulation, the fineness of many samples could be materially increased, and the character of the native gold at any particular mine sustained.

The character of the gold at any particular mine is of more importance than generally supposed. Gold from Tangier, for example, yielded to Marsh, 981 parts gold in 1000 of the native alloy; whereas, gold from the Ovens gave the same assayer 920 parts to 1000, being a difference of 61 ounces in a thousand ounces of the metal. Isaac's Harbour gold gave Mr. R. G. Fraser 955 parts in a thousand; Oldham, (Andrew Co.) 960; Waverley, (Chebucto Co.) 982 and 949; Montagu, (Lawson's Mine) 947, 942, 949.

Amalgam gold is much more variable, owing to the mode of crushing, amalgamating, retorting and smelting. In Victoria the loss of amalgam gold varies from one quarter to fifteen per cent; in Nova Scotia, from one half to about fifteen per cent.

CHAPTER II.

THE CHLORINATION PROCESS.

- 1.—Plattner's Chlorination Process.
- 2.—Manufacture of the Chlorine.
- 3.—The Chlorination Vat.
- 4.—The Precipitation of the Gold.
- 5.—Extracting Gold from Arsenical Ores.
- 6.—Dr. Crace Calvert's Method.
- 7.—Importance of the Pyrites, Mispickel, &c.
- 8.—Detection of Gold by means of Iodine and Bromine.

1.—PLATTNER'S CHLORINATION PROCESS. *

The Chlorination process is used in Germany for the extraction of gold from auriferous arsenical ores. It has been introduced into California by Mr. Deetken (1858) for treating auriferous sulphurets, and is employed in some establishments for treating quartz containing very fine gold and no sulphurets or arsenical ores. It is, however, essential that the gold be in a state of very minute subdivision, otherwise considerable loss will occur. In Nova Scotia it will be applied to the extraction of gold from the arsenical ores which abound in some mines, or the mixture of sulphuretted and arsenical pyrites which are largely found in the tailings.

It is absolutely necessary that the common pyrites and mispickel be properly roasted in a reverberatory furnace previously to the use of the chlorination process. The operation is based upon the property of chlorine gas to transform metallic gold into a soluble perchloride of gold, (three parts chlorine and one part gold). Chlorine is an irrespirable gas, producing an intolerable irritation in the trachea, even when diluted largely with atmospheric air, and causing much

* For full details of this process, with diagrams of apparatus, see Kustel's "Concentration and Chlorination."

coughing and oppression in the chest, which may be partially relieved by *inhaling* the *vapour* of alcohol. It is about two and a half times heavier than air, of a pale, yellowish-green colour. Water, at a temperature of 60 degrees, dissolves twice its volume of this gas, and acquires the colour, odour and properties of chlorine; it must be preserved in an opaque bottle, otherwise the action of light would decompose the water and form hydrochloric acid and free oxygen. Chlorine water is useful in determining the presence of gold in pyrites or mispickel, and in assaying these ores. This gas is applied to an enormous extent in the arts, as in bleaching, &c. It is also employed as a disinfectant, and it is now largely used for the purpose of extracting gold from certain auriferous ores.

Nova Scotian gold, which possesses a high degree of fineness, is well adapted for the chlorination process. The presence of silver in considerable percentage is injurious. Lime and silicates of magnesia are also prejudicial. But when these minerals occur in the ores, the addition of common salt during the roasting process removes the difficulty. All metals, with exception of gold, must be in the state of oxides, which is effected by roasting in a reverberatory furnace.

The Chloride of Gold is very soluble in water, and from it the gold is precipitated by sulphate of iron, (green vitriol) as metallic gold, or by sulphuretted hydrogen, as a sulphide of gold. In roasting the ores, before the sulphur is driven off, sulphate of iron is formed. This must be decomposed by heated air in the furnace, otherwise, if permitted to remain, it would precipitate the gold from the chloride of gold during lixiviation in the chlorination vats. Hence, roasting has to be carefully and effectually performed.

2.—MANUFACTURE OF THE CHLORINE.

Chlorine is manufactured in a leaden vessel of globular form and from four to six feet in diameter. Knstel recommends for three tons of Sulphurets a charge of—

- 30 lbs. Black Oxide of Manganese,
- 30 to 40 lbs. Common Salt, according to quality,
- 75 lbs. Sulphuric Acid of 66 degrees,
- 45 lbs. Water.

The apparatus is largely used in various manufactories

where Chlorine is employed, and can be purchased with all the necessary fittings for introducing the sulphuric acid and agitating the mixture.

The rationale of the operation is simple, and is thus expressed :—

Before Decomposition.		After Decomposition.
Common Salt, or	{ Chlorine.....	Chlorine.
Chloride of Sodium	{ Sodium	} <i>Sul. of Soda.</i>
Sulphuric Acid	{ Sulphuric Acid	
Binoxide of Manganese	{ Oxygen	} <i>Sul. of Man.</i>
	{ Protox. Manganese	
	{ Sulphuric Acid	

Or one atom of chloride of sodium, two atoms of sulphuric acid and one atom of binoxide of manganese, produce one atom of sulphate of soda, one atom sulphate of the protoxide of manganese and one atom chlorine.

It is not advisable to use hydrochloric acid with binoxide of manganese in a leaden vessel for the production of chlorine, owing to the action of the acid upon the lead and the evolution of hydrogen gas, (which produces a spontaneously-explosive mixture with chlorine) or it is said with euehlorine. (Graham.)

The Chlorine gas is conducted into a wash bottle to free it from muriatic acid. It then passes into a vat containing the sulphurets or arsenurets to be operated on.

A recent improvement in the manufacture of Chlorine permits of the production of this element continually, and at comparatively small cost, and is thus described :

“ A mixture of muriatic acid and air is passed at an elevated temperature over a mass of bricks which have been saturated with sulphate of copper. The result is that the oxygen of the air seizes the hydrogen of the acid to form water, and the Chlorine is liberated in a constant stream. The remarkable feature in this operation is the *physical* influence of the copper-saturated bricks. The arrangement once adjusted does not appear to require any restoration, and the decomposing power acts uninterruptedly. Muriatic acid vapour and common air, in mixture, are driven in, and Chlorine and water flow out.”

3.—THE CHLORINATION VAT.

This is a wooden box or tub, from five to seven feet in diameter, 30 to 36 inches in depth, and provided with a tight

fitting cover, into which the moistened and sifted ores are introduced. The vat is supplied with a false bottom, perforated with half-inch holes. Over the false bottom is spread a layer of clean quartz from one and a half to two inches in thickness, then a layer of small pieces of quartz, and finally a layer of coarse quartz sand, the whole forming a filter, on which the ores are placed. A lead pipe communicates from the chlorine generator to the space below the false bottom in the vat, and another pipe, provided with a stop cock, is for the discharge of the lixivium. The vat is coated internally with a mixture of pitch and tar, to prevent absorption of the chloride of gold. When the vat is supplied with sulphurets, and connection made with the gas generator, the sulphuric acid is added and the operation commences. In from three to six hours, according to the thickness of the stratum of ores in the vat, the gas will permeate through the heap and begin to overflow its surface. The cover of the vat must now be put on and luted with dough. The chlorine must be allowed to act on the ores for twelve or eighteen hours.

4.—LIXIVIATION.

When the ores have been exposed to the gas for the length of time stated above, the cover is carefully removed and water introduced by means of a hose attached to a gutta percha tube until it flows over the surface of the ores. The stop cock in the false bottom is then opened, and the lixivium received into a precipitating vat or tub, four feet in diameter, and three feet high, for three tons of ore. Water is allowed to flow into the chlorination vat during the time the lixivium is flowing out through the stop cock in the false bottom, so as to keep the ores constantly covered. After a considerable quantity of the lixivium has escaped, samples are taken in a tumbler from the mouth of the stop-cock, and tested with a solution of sulphate of iron or green vitriol. As long as a dark coloured precipitate is produced on addition of a few drops of the sulphate, the water supply is continued; as soon as no precipitate or discolorization is occasioned by the sulphate the supply of water is stopped and the contents of the chlorination vat are allowed to flow into the precipitating vat.

5.—PRECIPITATION OF THE GOLD.

A freshly prepared solution of green vitriol is added to the lixivium until no further discolorization takes place. This is ascertained by testing. The precipitate is gold in a state of extreme subdivision. It is collected in a porcellain dish after a few hours repose, the supernatant liquid being drawn off by a syphon. The gold is then dried on filtering paper and melted in a crucible with borax or nitrate of potash. Full details of the entire process, with lithographic representations of the apparatus required, are given in Kustel's work on "Concentration and Chlorination."

The working expenses for three tons of ore are stated to be as follows, (California prices):

Superintendence	\$ 6 00
Four Roasters, at \$3.50	14 00
Three cords of Wood, at \$4.00	12 00
Thirty pounds of Manganese, at 6½c	1 87½
Forty pounds Salt, at ¾c	30
Seventy-five pounds Sulphuric Acid, at 2½c	1 87½
One man at the Vats two days, at \$3.50	7 00
Sulphate of Iron	60

Total cost of three tons

or \$14.35 per ton of Sulphurets.

Professor Silliman's opinion of the Chlorination process is as follows:—

"The Sulphurets occurring in the Grass Valley District (California) are usually rich in gold—some of them remarkably so. In quantity they probably do not on an average amount to over one per cent. of the mass of the ores, although in certain mines they are found more abundantly. For a long time there was no better mode known of treating them than the wasteful one of grinding them in pans and amalgamating. In this way rarely was 60 per cent. of the gold tenor saved. After many abortive efforts, at length complete success has been met with in the use of Plattner's Chlorination process. Mr. Deetken, now connected with the reduction works of the Eureka mine, is entitled to the credit of having overcome the difficulties which formerly prevented the successful use of this process in Grass Valley, a more detailed description of which will be found in our notice of the Eureka mine." *

* American Journal of Science and Arts, Sept., 1867.

† Phillips says:—"This process, when the gold is in a finely divided state, affords good results, but the larger particles of the metal not being dissolved in the time necessary for effecting the solution of the smaller ones, they are often partially attacked only, and unless great caution be exercised a loss is the result."

6.—EXTRACTING GOLD FROM ARSENICAL ORES.

The following extract is from Kustel's work referred to in the preceding paragraph---

"The chlorination works at Reichinstein, Silesia, were erected for the working of arsenical pyrites. The gold is extracted by Plattner's chlorination process. The building contains forty-eight earthen chlorination pots, of which twenty-four are always charged with roasted ore, while the contents of the other twenty-four are under going chlorination. The pots are strengthened with iron hoops, and so prepared that for discharging they can be turned over on two journals. The lower end is conical, and contains an earthen perforated plate. There is a wooden cover with a small round hole in it on the top of the pot. The gas pipe communicates with the conical end. The gas generators are also earthen pots with leaden covers, twenty-five pounds each, provided with an opening for the charge, and with a leaden gas pipe.

"There are twenty glass globes, used as precipitating vessels, standing on a sand-bath. There are also ten bottles for the production of sulphuretted hydrogen.

"The conical part of the chlorination pot is charged with small pieces of quartz, and covered with the perforated plate. After the concentrated arseniurets are moistened (in winter with warm water), each pot is charged with one hundred and fifty pounds. The gas generators are covered and secured air-tight with flour dough, and the gas pipes arranged to convey the chlorine into a washing vessel to free it from muriatic acid. Each generator receives thirteen pounds muriatic acid and seven pounds of sulphuric acid, diluted with the same quantity of water; and as soon as the chlorine is required, seven pounds of manganese are added. The charging hole is shut, and the fire started underneath the sand-bath.

"After the chlorine has passed through the ore for an hour, the pots are closed with covers, and examined from time to time to see whether the chlorine rises above the ore. This is the case, when a glass rod dipped in ammonia, creates white fumes above the whole of the cover. After six to seven hours the impregnation is finished; and all the joints of the cover and

† The Mining and Metallurgy of Gold and Silver.

pot are secured by dough, and the chlorine allowed to act on the gold until the next day. The covers are then taken off and water of fourteen to twenty degrees R. introduced. Boiling water would absorb less gas and dissolve more salts. The leaching is stopped as soon as about ninety-six cubic feet of the lixivium from twenty-four pots is obtained. (From three thousand six hundred pounds of ore.)

"The lixivium from all the pots is conveyed into four vats, beginning at the first, so that the fourth vat receives the poorest leach. The very small quantity of gold contained in this is not precipitated, but the fluid is used over again for leaching the next day.

"The fluid from the other three vats is drawn over into three glass globes which stand on a sand-bath in order to bring the temperature of the contents up to twenty degrees R. Sulphuretted hydrogen, obtained from bleistein (sulphide of lead obtained in smelting ores), and diluted hot sulphuric acid, is conducted into globes until the fluid appears perfectly black from precipitated sulphide of gold. This remains warm in the vessel until next day, when the gold is found deposited in the bottom. From each globe the clear fluid is drawn into a filter by means of glass syphons, the end of which can be corked more or less tightly, so that the supply can be regulated according to the capacity of the filter. That which goes through the filter, is conveyed through cisterns filled with saw dust, in order to absorb any sulphide of gold which may have escaped. The precipitated gold is finally washed into the filters. In the course of sixteen days, three hundred and twenty filters containing sulphide of gold are obtained: these are dried and burned on four large dishes, then boiled in *aqua regia*, filtered, and the gold of the filtrate precipitated by sulphate of iron.

"The precipitated gold is placed upon filters and washed, first with diluted muriatic acid, and then with water. After this the filters are dried and burned, and the gold melted with borax and saltpetre in clay crucibles.

"The quantity of concentrated arseniurets daily subjected to chlorination is three thousand six hundred pounds, containing about five-ninths of an ounce of gold per ton: so that not more than from twenty to twenty-one pounds of gold is extracted yearly."

7.—DR. CRACE CALVERT'S METHOD.

Finely divided auriferous quartz should be intimately mixed with about one per cent. of per oxide of manganese and common salt, added at the same time as the manganese, in the pro-

portion of three parts of the former to two of the latter. This mixture should be introduced into closed vats, having false bottoms with holes in them, upon which is laid a quantity of small branches covered with straw to prevent the powdered quartz from filling the holes. Diluted sulphuric acid is now added in sufficient quantity to moisten the mass, and the whole allowed to remain in contact for twelve hours. Water should now be added, so as to fill up the space between the false and true bottoms. The fluid should then be pumped up and allowed to percolate through the mass. After this has been done several times the fluid should be ran off into separate vats, and the metals which it contains extracted. If silver is present, an excess of salt must be used in the process, for the purpose of holding in solution any chloride of silver that may have been formed.

Blades of copper placed in the saline solution precipitate the silver; then the copper is thrown down by metallic iron, and the gold is extracted by adding to the fluid a concentrated solution of the sulphate of the protoxide of iron, (green copperas), which throws down the precious metal in a metallic form.*

S.—IMPORTANCE OF PYRITES, MISPICKEL, &C.

The importance of the sulphides of iron, arsenic, copper, zinc and lead as depositories of gold in quartz lodes—is greatly underrated in Nova Scotia. In an article on the chemical geology of the gold fields of California, by J. A. Phillips, read before the Royal Society, March 12th, 1868, the author states that "these sulphides invariably contain gold" in California. The subjoined quotation from the paper referred to is worthy of careful attention on the part of our miners:

"The metallic minerals enclosed in the gangue of auriferous veins are ordinary iron pyrites, blende, and galena, and, less frequently, arsenical pyrites, magnetic and copper pyrites, and cinnabar. These sulphides invariably contain gold; and veins in which some one or more of them does not occur in considerable amount, are not regularly and lastingly productive. In the earlier days of quartz mining these sulphides

* Quarterly Journal of Science.

were allowed to escape, and "free gold" was alone obtained; but at the present time they are all carefully collected, and form an important addition to the profits of the miner.

"Near the surface iron pyrites and other sulphides become decomposed by the action of air and the percolation of meteoric water through the mass, staining the quartz of a red or brown colour, and leaving the gold in a form highly favourable for amalgamation. Under such circumstances numerous cubical moulds of iron pyrites are found in the vein-stone; and although this mineral has been entirely removed by chemical action, the cavities remaining contain finely divided gold, obviously liberated by the decomposition of pyrites.

"Beneath the line of natural drainage of the country the sulphides remain undecomposed, and the extraction of gold becomes more difficult; but if "rock" containing crystals of pyrites, be placed in nitric acid and allowed to remain for a few hours in a warm place, the sulphide becomes dissolved and finely divided, or filiform gold will often partially occupy the resulting cavities."

The presence of pyrites as indicating the auriferous or non-auriferous character of a lode is a fact of common occurrence in most gold mines in all countries. At the well-known Morro Velho mine, in Brazil, the vein-stone is mostly composed of quartz with iron pyrites disseminated more or less regularly throughout its mass, and the lode is not unfrequently traversed by clay-slate and barren white quartz. When pyrites is absent in these rocks gold is seldom present. *

9.—DETECTION OF GOLD BY MEANS OF IODINE OR BROMINE.†

"The large number of non-auriferous, or but slightly auriferous, specimens of quartz and pyritous rocks, which have lately been submitted here for examination for gold, has rendered it very desirable that some quicker, less laborious, and if possible more exhaustive, method of analysis, than the current one (that by amalgamation) should be employed.

"In recognition of this I have frequently been urged by the director of this department to attempt some other process, and after several preliminary experiments, I turned my attention especially to the use of iodine or bromine for this object.

"Both of these substances differ from chlorine especially in their respectively feebler affinities for hydrogen, so there

* Quoted by J. R. Phillips, — *Mining and Metallurgy of Gold and Silver*.

† On the application of Iodine and Bromine for the Detection of Gold when in minute quantities. By W. Skey, Analyst to the Geological Survey of New Zealand

would be the less to fear, that from the generation of hydra-acids, any great preponderance of other matters would be dissolved along with the gold we wish to separate from the sample under examination.

"Iodine, indeed, has already been used with advantage in the analysis of certain meteorites, for the separation of the iron and nickel existing therein in a metallic state: these it combines with, leaving the associated silicates, iron-oxides, and sulphides intact.

"It was this comportment of iodine with other substances that determined me to the trial of both it and bromine for the purpose named.

"The results of my experiments certainly show that either of these agents may be safely and advantageously employed for the separation of gold from its matrices.

"The following are the particulars of a few of these experiments which, besides their present use, will, I think, be useful in showing what is, approximately, the smallest quantity of gold that can be positively separated and identified, by a certain course of analysis operating upon a limited quantity: the first time, I believe, anything of this kind has been attempted.

"1st. 2 grammes of roasted "buddle headings," from a quartz mine at the Thames, known from previous analysis to contain gold at the rate of one ounce or so to the ton, was well shaken for a little while with its volume of alcoholic solution of iodine (tincture of iodine of chemists), then allowed to subside. A piece of Swedish filter-paper was then saturated with the clear supernatant liquid, and afterwards burned to an ash: the ash, in the place of being white, as it would be if pure, was coloured purple: the colouring matter was quickly removed by bromine,—a clear indication of the presence of gold. The time occupied by the whole process was twenty minutes.

"2nd. 1 gramme of the same "buddle headings," mixed with such a quantity of soil as to reduce the proportion of gold present to 2 dwts. per ton, was allowed contact with its volume of tincture for two hours, with occasional stirring: a piece of filter-paper was then saturated with the tincture, and dried five times consecutively, and finally burnt off as before; in this case, also, the color of the residual ash was purple, and it gave the reaction of gold.

"3rd. 32 grammes of silicious hematite finely-pounded, was thoroughly mixed with precipitated gold to the amount of 2 dwts. per ton; then ignited, and treated with bromine water. After two hours the solution was filtered, and evaporated to a bulk of twenty minims; this gave good reaction of gold to the "chloride tin" test.

"4th. 100 grammes of the hematite, with precipitated gold

at the rate of $\frac{1}{2}$ dwt. per ton, treated as before, but this time well washed, at the expiration of two hours, and the washings evaporated along with the first filtrate, gave a fainter, but still decided, reaction of gold to the same test.

"5th. Iodine, as tincture, submitted for bromine in experiments 3 and 4, gave similar results: the only variation made was that as a precautionary measure allowing for its feebler, or rather, slower, action, I gave contact for twelve hours.

To compare the results of the common amalgamating process with the foregoing, I have made some careful experiments: and I find, that it is not certain, with the same expenditure of labor, to get reliable indications of gold, when present in less quantity than 2 dwts. per ton, operating upon about 160 grammes of material, which is about the quantity I usually take.

In summing up the results of these experiments, it appears, then, that for qualitative examinations for gold, or for quantitative determinations in certain cases, iodine and bromine are each superior to mercury. It also appears that a proportion of gold equal to $\frac{1}{2}$ dwt. per ton upon a bulk of 104 grammes (4 ozs.) of ferruginous matters, can be easily and rapidly detected.

"Of course, by operating upon larger quantities, gold could be discovered by this process, were it present in far less quantities, but this is sufficiently near for the majority of cases.

"These processes are especially adapted for the separation of gold from sulphides, as the preliminary roasting is extremely favorable to them, not so much chemically as mechanically, I think: the loss in the substitution of oxygen for sulphur, amounting to 25 per cent. by weight, while the volume remains constant (or nearly so): hence there is a corresponding porosity in the product, by which it is certain every atom of it is thrown open to contact with the solution of these agents.

"This mechanical accessibility obviously cannot be taken advantage of by mercury.

"With sulphides these process are practically exhaustive, while, at the same time, the simultaneous extraction of other matters is avoided: or at any rate, is so trifling, that the proper test for gold can be safely applied directly to the concentrated solution.

"Regarding the choice between iodine and bromine, I would prefer the former, when mere traces of gold are supposed to be present; or if the ore is in a finely divided state, as is generally the case when the matrix is iron pyrites.

"In the roasting of such pyrites it is necessary to raise the temperature towards the end to a full red-heat, in order to

decompose the ferruginous sulphides, since if these remained much iron would get into the solution.

"In the case of much carbonate of lime being present, it is proper to gently re-ignite the roasted mineral, &c., with carbonate of ammonia, or much lime might get in to the iodine or bromine solution.

"On the other hand, a very high temperature is to be avoided, for, from my own experience, I find that a considerable quantity of fine gold can escape detection in this way, by the partial vitrification of the more fusible of the silicates.

"The identification of gold by combustion of its salts with filter-paper, as suggested in this paper, seems to promise a rapid method of estimating it comparatively, by the aid of a series of prepared test papers, representing gold in different degrees of dilution."

CHAPTER III.

DISTRIBUTION OF THE GOLD IN LODES.

‘Pay Chimneys—‘The Gold Streak.’

Pay Chimneys in California—Gold Streak at Tangier, Mount Uniacke, Wine Harbour, Montagu, Sherbrooke, Isaac’s Harbour, Lawrence-town, Waverley.

It is well known that gold is not usually distributed uniformly throughout quartz lodes. It occurs frequently within well defined limits, which in Nova Scotia are termed ‘Gold Streaks,’ and in California ‘Pay Chimneys.’

Different writers have called attention to this important subject. J. Ross Browne, in his “Mineral Resources of the United States,” in enumerating the blunders in quartz mining once common in California, says:—“The next error was that nothing was known of Pay Chimneys, and if good quartz was found in one place, it was presumed that the whole mine was of the same quality. In some cases the pay chimney was near the end of a claim, into which it dipped not far from the surface, leaving the mill without work. In other cases, the miner has the pay chimney in his own claim, but he did not know enough to follow it, and he worked straight down into the barren rock, while there was an abundant supply of good quartz higher up.”

In Victoria (Australia) “Mr. R. H. Bland and Captain Courtman, the Chief Mining Surveyor, have frequently called attention to the mode in which gold is generally distributed in our veins, and have explained how the impression that reefs become poorer as the depth from the surface increases, originated.”

In many quartz lodes the auriferous vein stuff is confined to bands which dip along the strike of the vein, and the inter-

vening spaces are either destitute of gold, or very poor. When one of these bands has been cut, and the quartz excavated, and the shaft is sunk to a greater depth, the yield falls off, the mine is abandoned, and fresh evidence in support of the old theory (that gold diminishes with the depth) is at once communicated. But when, owing to the results of operations in neighbouring mines, the ground is again taken up, and the shaft is sunk still deeper, a new band of auriferous vein stuff is cut. Hustler's Reef, at Sandhurst, and some of the reefs at Clunes, exhibit this peculiarity.*

Professor Silliman has stated, in regard to California, that:

"The rich 'chimneys,' or productive zones of ore ground, are known to be of various extent in quartz veins, from a few feet to many hundreds of feet and it is impossible to assign any valid reason why we may not expect the same changes in a vertical direction which we find in a horizontal. As the ore-bearing ground or shoots of ore have in many, if not in most cases, a well-determined pitch off the vertical, it is self-evident that a vertical shaft or incline at right angles to the veins, must, in descending, pass out of the rich into the poor ground at certain intervals, and it is perhaps due to the ignorance of this fact that miners have abandoned sinking, because they found the 'pay' suddenly cease in depth, when a short distance more would probably bring them into another zone of good ore. The experience of every gold mining district offers examples in illustration of these remarks."†

No one can examine the returns from different mines or lodes without the impression being produced that if attention had been directed to the manner in which gold is usually distributed in lodes, trials would have been made either to the right or left of the shaft or slopes before finally abandoning a lode because the gold "gave out." Pay chimneys or gold streaks are usually continuous for long distances vertically. Indeed, all experience tends to show that the gold streaks more frequently widen, as they descend, than thin out, and that when a highly productive spot is found, it is generally part of a 'streak,' or separated from it by a barren area. The day will come when, as at Montagu, the lodes which for a short distance down have yielded good results, and then falling off, were abandoned, other explorers, with a ripper

* Gold Fields of Victoria.

† American Journal of Science and Arts, September, 1867.

knowledge of the law which apparently governs the distribution of the gold, will resume operations with success. The following illustration of 'pay chimneys' or 'gold streaks' are worthy of attentive perusal, and they may point to conditions which have led to the temporary abandonment of really valuable lodes, and induce fresh explorations in the proper direction.

Subjoined are given the dimensions and dips of some important 'chimneys' in California. In many mines, no doubt, a record has not been kept of the distribution of the gold.

CALIFORNIA.*

MARIPOSA COUNTY.

MOTHER LODE.†—The Pay Chimneys are usually large and regular, and are either vertical, or have a slight dip to the north. Strike of lode N. 40 degrees W. Dip E. angle 45 to 50 degrees.

PINE TREE.—Strike N. W. and S. E. Dip N. E. Seven Pay Chimneys, varying from 40 to 200 feet horizontally. The rock in each chimney has a peculiar appearance.

JATEPLUME.—Strike N. E. and S. W. Dip N. E. Seven Pay Chimneys, 40 to 100 feet horizontally, separated by barren streaks, 4 to 6 feet broad. Dip of Chimney 45 degrees to the south east. Richest deposit on the foot wall.

MARIPOSA.—West of the Fork, gold is in rich pockets, associated with large quantities of mispickel and common pyrites. "The presence of these minerals is considered a certain sign that a good deposit of gold is not far distant."

MISSOURI.—Strike E. and W. Dip S. One pay chimney worked dips east at an angle of 50 degrees, containing rich pockets.

COWARD.—Strike E. and W. Dip N. Angle 45 degrees. Two pay chimneys, each about 100 feet long, dip east, angle 40 degrees.

MARBLE SPRING.—Strike NE. and SE. Dip E. Pay chimney dip SE.

CHEROKEE.—Strike E. and W. Pay chimney dip E.

* J. Ross Browne—"Mineral Resources of the U. S."

† The Californian gold bearing rocks belong to the Jurassic age.

GOODWIN.—Strike E. and W. Dip S. Pay chimneys, dip E. at angle of 70 degrees, and widen as they descend. One chimney has 'pinched out.'

MARY HARRISON.—Pay claim 150 feet long. Dip S. E., angle 60 degrees.

TUOLUMNE COUNTY.

GOLDEN RULE.—On the 'Mother Lode,' "the vein is a black slate bearing much resemblance to ordinary roofing slate, and is penetrated in every direction by seams of quartz, seldom more than two inches in thickness. The gold is found in the slate, seldom in the quartz."

APP.—On the 'Mother Lode,' at the surface, there were three pay chimneys, 75, 100, and 125 feet, in horizontal length respectively, separated by intervals of 60 and 35 feet, with a dip to the North eastward of 70 on the upper side, but widening out on the under side, and at 180 feet the three had worked into one chimney 235 feet long horizontally. Horizontal sections of the chimneys would represent, not rectangles, but quadrangular parallelograms, with two very acute angles. The chimneys have not run out in any place, but in several places the walls have pinched close together, so that there were only seven inches of quartz. In these spots the chimneys were of the same richness to the ton as elsewhere. Each chimney has its peculiar quartz,—one chimney has white quartz, another greenish, another bluish, and the last is richest. The gold is fine, and seldom visible in the quartz.

LESBY.—Strike N. and S., dip E., angle 60 degrees. Five pay chimneys, longest 200, shortest 15 feet horizontally. Most of them dip North at an angle of 60 degrees, and run to a feather edge in every direction. In some cases there is a connection of pay quartz between the chimneys. Between the chimneys the walls come together, except in a few spots.

STARR KING.—Strike N. and S., dip E., angle 40 degrees. Two pay chimneys, almost vertical.

MOUNT VERNON.—Strike N. E. and S. W. Dip 45 to the S. E. About two feet wide, between granite walls. One Pay Chimney, dips 45° to the S. W., 60 feet long horizontally at the surface, and 300 feet down it is more than 100 feet long.

SNELL.—Strike N. E. and S. W., nearly vertical. Pay Chimney pinched out.

SELL AND MARTIN.—Strike N. W. and S. E. Dip 60 N. E. A Pocket Vein. This vein cuts dykes which intersect the slates, and the pockets are found near the intersection of the Dykes.

SOPHIA.—Strike N. E. and S. W. Dip 80 $\approx$ S. W. Vein crossed by Dykes. Gold found in pockets near the dykes.

BALD MOUNTAIN.—Gold in Pockets, and the popular impression is that all the gold near the limestone which runs through Tuolumne county is in pockets. Pockets on Bald Mountain have yielded \$70,000, \$40,000, and \$30,000.

DAAPER.—Strike N. and S. Dips nearly vertical, 15 inches thick in granite walls. Three pay chimneys: one 70, one 99, one 60 feet, in horizontal length. Between the pay chimneys the walls pinch together.

CALAVERAS COUNTY.

STANISLAUS.—On a branch of the Mother Lode, strike nearly N. and S., dip E., angle 75 degrees. The chimneys incline 34 degrees to the South. The gold is here associated with tellurium, which is very prejudicial to amalgamation.

BOYLE.—Two pay chimneys, nearly vertical.

WOODHOUSE.—Strike N. and S., dip W., angle 45. Walls are granite. Two pay chimneys 600 feet apart, one 150 feet and the other 100 feet long.

BAXON.—Adjoins the Woodhouse. Small rich pay chimneys.

CRISPIN.—Strike E. and W., dip S., at an angle of 80 degrees. Pay chimney 30 feet long at the surface, and widens in descending.

AMADOR COUNTY.

CONEY.—Dip 72 N. E. Five per cent. of the veinstone, and in spots 20 per cent. is sulphurets, which yields \$7.50 cents per ton of unconcentrated rock, and \$200 per ton of clean sulphurets. Chlorination process employed at an estimate cost of \$25 per ton.

OXEDIA.—Strike nearly N. and S. Dip E., from 65 to 80 degrees. Main shaft 500 feet deep. Two pay chimneys, dip N. One pay chimney is 300 feet long horizontally at the surface, and 400 feet long at a depth of 100 feet. Vein pinches out at the end of the pay chimneys, so that there is very little barren rock.

HAYWARD.—Dip 75 degrees E. One pay chimney, 500 feet long horizontally and at 1200 feet below the surface, the supposed length is 600 feet. Dip N., angle 80 degrees. The deepest incline is 1230 feet.

LINCOLN.—Strike N. 17 W. Dip 75 E. Two pay chimneys, one 150 feet and the other 250 feet long. Dip slightly to the north. Depth of deepest shaft 669 feet.

POTOSI.—Pay chimney four feet wide.

TELLURIUM.—Strike N. 40 degrees E. Dip E., angle 75 degrees. Two pay chimneys each 130 feet long horizontally.

CRAFTS.—Strike E. N. E. and W. S. W. Dip 60 degrees S. E. One pay chimney, dip 60 degrees N. W.

EL DORADO COUNTY.

PACIFIC.—Pay chimney nearly vertical 200 feet—200 feet deep.

POCAHONTAS.—Pay chimney 100 feet long.

WOODSIDE.—Strike N. E. and S. W. Dip vertical. Pay chimney, dip N. E.

NEVADA COUNTY.

BAUNER MINE.—N. and S. nearly, dip E., angle about 50°. Two chimneys: both widen with the depth.

PITTSBURGH.—Pay Chimney rapidly widens with the depth.

NEVADA QUARTZ MINING Co.—Rude Chimney.

SIERRA COUNTY.

SIERRA BUTTES.—The mine is situated on a lode which is split up into several branches, the width from wall to wall being from 70 to 100 feet; and of this width from 40 to 70 feet is quartz, with intervening horses or beds of hard blue slate, of the same character as the walls. In some places there are two, and in others six, branches. The course of the lode is a few degrees north of west, and the dip is 40 degrees to the northward. Ten pay chimneys have been found, one of them 500 feet long horizontally. All these chimneys are vertical: the pay is irregular in them, skipping from one branch to another; if the chimney disappears in one branch, the miners look for it in the other branch. No pay chimney gives out.

INDEPENDENCE.—Three Pay Chimneys, nearly vertical, with a slight westerly dip.

KEYSTONE.—E. and W. Dip nearly vertical. There is no barren vein-stone. The walls pinching together at the ends of three pay chimneys, which go down perpendicularly. A depth of 550 feet has been reached. Gold fine and free, evenly distributed in the chimney, except one streak in the middle, which is the richest.

YUBA COUNTY.

JEFFERSON.—Strike N. and S. Dip 45 E. Pay chimney 100 feet at surface, and at a depth of 160 feet, enlarged to 300 feet, maintaining the same width to the 300 feet level, where it seemed to split.

PENNSYLVANIA.—Two pay chimneys worked, and two others found. A depth of 600 feet has been reached on the incline.

DANNEBRAGE.—Strike N. E. and S. W. Dip N. W., at an angle of 40 degrees. One pay chimney, 150 feet long horizontally.

PLUMAS COUNTY.

EUREKA.—Strike N. E. and S. W. Dip N. E., at an angle of 45. Main pay chimney 250 feet long, dips S. W. at an angle of 52 degrees, but at a depth of 300 feet seems to bend to the North East.

MAMMOTH.—One pay chimney 20 feet long horizontally, 10 feet thick, nearly vertical, and goes down with nearly uniform size. A depth of 200 feet has been reached.

CRESCENT LODGE.—Six pay chimneys, of which two have been worked. The eastern 108 feet long, western, 100 feet. Average width of pay quartz, five feet. Mean width of lode, fifteen feet. Deapest workings, 140 feet.

HORSESHOE LODGE.—Two pay chimneys, eastern, 120 feet, at surface, 200 feet long 200 feet below the surface: western, 100 feet long at first level, and 125 feet at third—dip a little to the east—a depth of 280 feet has been reached.

PET LODGE.—Pay chimney 50 feet long and four feet thick.

GREENVILLE.—Two pay chimneys, each about 30 feet long, dipping to the west.

These illustrations are sufficient to show that "chimneys" or "gold streaks," are by no means accidental in California, that they are well worthy of careful study, and that a faithful record of the distribution of the gold in the lode is of the utmost importance in mining operations.

THE "GOLD STREAK" OR CHIMNEYS IN NOVA SCOTIA.

TANCIER.

From the information obtained it appears that the gold streak always dips west on the Forest lode in this district, and is cut off by breaks or faults. The dip of the gold streak is about 75 degrees. The numerous breaks, and the constant recurrence to a greater or less extent of the gold streak between the breaks, appears to show conclusively that there are on this lode two or more broad gold streaks, or, which is more probable, several narrow ones. The remarkable richness of the Forest lode (north), the disposition of the gold it holds, and the regularity of the breaks, fully warrants the conclusion that deeper mining will eat the continuation of some of the streaks which have proved so rich. It is a result of so probable a nature that it ought to exercise considerable influence on the prospective value of the ore obtained from these lodes.

One great source of outlay on the Strawberry Hill property hitherto has arisen from the occurrence of the numerous faults, which, in the absence of systematic records and plans of the works, has led to the sinking of new shafts to search for the lode, in point of fact equivalent to opening a new mine each time a fresh break cut off the lode. If the method had been pursued of following the break always to the South in drifting from west to east, a large expenditure of money and loss of time would have been avoided, and the gold streak would have been found shifted by the fault at the precise distance measured by the throw, which could be very approximately determined by observation alone. In consequence of the structure of the faulted strata being that of regular, parallel upthrows, all the expenses of new shifts to search for the lode and streak would have thus been avoided, and two or three main shafts would have served the purpose of the twenty-two shafts which now "cumber the ground" and supply the mine with perennial springs of drainage water, to be pumped out.

MOUNT UNIACKE.

WESTLAKE LODE.—The streak on this lode is inclined at a very low angle to the horizon, it does not appear to exceed seven degrees; its dip is east, and its breadth about twenty feet.

HALL LODE.—Queen's Company. This lode is supposed by some to be a continuation of the Westlake lode. Thickness, 11 inches. Dip of streak, *west* at an angle of 45 degrees. Breadth of strata at surface, twenty feet, at a depth of 60 feet, the streak has widened to 75 feet. Its shape resembles apparently the streaks in the Belt lode at Montagu.

WINE HARBOUR.

PROVINCIAL.—The gold streak on the Provincial dips to the east at an angle of 13 degrees; horizontally the auriferous zone is about 100 feet in breadth.

ELDORADO.—On the middle lode the gold streak dips east at an angle of 13 degrees, with a horizontal breadth of a little more than one hundred feet.

EUREKA.—No gold streak has been recognized. The gold occurs in pockets or patches, where cross lodes intersect the main lodes, but gold in remunerative quantities has not been found in the cross lodes.

MONTAGU.

I am indebted to Mr. Walter H. Brown of Montagu, for the following information respecting the gold streak on the Belt lode in that district:—

THE BELT LODE.

"Respecting the "gold streak" on the Belt lode with which I have had some experience, I have been able to arrive at the following conclusions:—That the "streak" is longer at the present depth of the mine than it was at the surface, having extended from 150 feet horizontally at the surface to 310 feet at a depth of 145 feet. That it has not a dip to the westward in going down at its eastern edge, which is perpendicular, but it dips to the westward on its westerly edge at an angle of about 10 degrees. I have repeatedly tested the ground at intervals to the east of the eastern edge of the 'streak' and have uniformly found the quartz poor, about 6 dwts. to the ton, which on a five inch lode will not pay.

"I have also tested to the westward of the eastern edge of the streak at the surface, and have found the quartz to be generally 1 oz. 10 dwts. to the ton, and improving to the westward.

"I do not think the rolls in the footwall have anything to do with the richness or poverty of the quartz, as the parts within the streak, not rolled are as good as those which are so, and outside the streak, the rolled parts are as poor as the others.

"As to the distribution of the gold in the streak, it is generally the richest in the middle, that is the furthest away from either end, and decreases towards the edges, though not regularly.

"The distribution of gold seems to be different from that in the streak on Mr. Lawson's property (the next succeeding property to the east on the same lode), where there appear to be several very rich chimneys within the streak on that part of the Belt lode, separated distinctly by poorer but still good quartz: a cross lode which, however, appears to be quite barren, passes from surface to bottom, in the middle of each of these rich chimneys.

"I do not find on the part of the Belt lode on this property, that this holds good: there does not seem to be any part very much richer than others inside the streak, except that the middle of it is the best, and though we have cross lodes, I can not find that they influence the quartz one way or the other: with Mr. Lawson's streak, however, it is certainly different."

THE SARAH LODE AND A CROSS LODE.

"The only other lode concerning which I can give you definite information is the cross lode running north and worked from the Sarah lode. This lode I discovered Sept. 1st, 1868, and have worked since, so that I know it from the top to its present depth, 110 feet. The Sarah lode, the main lode spoken of, is not very rich, and I only work enough to approach the cross lode, the shaft and buildings being upon it. The Sarah lode descends perpendicularly, and the cross lode is only worked to the north, I never having been able to find it to the south of the main lode.

"The cross lode was opened by a drift at 60 feet down, carried in until the quartz showed poor, and the ground has since been stoped over hand to surface and down to present depth underhand. On the top the streak is about 20 feet long, in the bottom it is 35 feet, poor, and dipping north going down, and the quartz is just as good at intersection of main lode as at top. The richest portion is, however, about 13 feet from the main lode, where the lode intersects a clay band.

"Width of cross lode, 2 inches: 3 tons 6 cwt. by measure, yielded last September, 112 oz. 9 dwts. The yield varies somewhat, but it has paid very handsomely every month since its opening."

Mr. Walter Lawson, one of the enterprising proprietors of the Albion Mine, states as follows :

"In this part of the Belt lode the richest parts are generally on each side of different small cross-lodes, and as far as I have sunk they have gone down nearly perpendicularly, and, by report, have done so from the first opening of the mine. The richest part of the lode is for about 70 feet west of the main shaft, where it separates into two.

In September last a side lode, cut in from the hanging lead and crossed the main stope in about 15 feet, thus cutting the Belt lode. Under this the lode becomes more solid, the richest part running into one and becoming less rich, but the lode in general equally productive. The stope, when we got possession, was over four hundred feet long,

	West End	Main Shaft	East End.
And was sunk	57	95	67
We have sunk	43	84	47
Present depth.	100	179	114

We commenced operations in September, 1869, so that to February, 1871, it is just eighteen months, and is an average of a little over $1\frac{1}{2}$ feet per month in the shaft, and $2\frac{1}{2}$ at the ends.

The following is the produce of the mine, from which I think you will get a better idea of the streak than from any description of mine.

The quartz is taken over the length of the stope much in the proportion of the sinking:

	Tons.	Ozs.	Dwts.	Rate per Ton.
1869 { Sept.	11	39	9	3.5 ozs.
{ Oct.	18	39	9	2.2 "
{ Nov.	54	120	16	2.2 "
{ Dec.	23	68	9	3.0 "
{ Jan'y	20	55	9	2.7 "
{ Feb'y	16	49	13	3.0 "
{ March	25	86	7	3.4 "
{ April	120	677	5	5.6 "
{ May				
{ June				
1870 { July	50	358	12	7.1 "
{ August	50	564	15	11.5 "
{ Sept.	41	113	—	3.4 "
{ Oct.	35	230	10	6.5 "
{ Nov.	68	313	14	4.6 "
{ Dec.	51	221	—	4.3 "
1871 { Jan'y	41	184	—	4.5 "

There is about thirty feet at the east side of the slope that I have for the present abandoned, as it does not pay expenses. From 6 tons I had 5 ozs. The next 100 feet east is much the same. Then another 100 feet, from which I took 6 tons which yielded 12 ozs.; this I propose to work again next summer, when there is less water at the west end. There is also a piece that does not pay, about fifty feet long, from which, last month, was taken four tons, which gave six ounces; this I shall continue to mine, as it has slightly improved and may further improve as we go down.

The corrugations on the foot wall are about an angle of 10 degrees to the surface, but do not seem to affect the streak.

SHERBROOKE

At Sherbrooke on some lodes on the north side of the anticlinal the dip of the zone or streak is to the west, at an angle of about 35 degrees in the plane of the lode; on the south side the dip is nearly vertical, but slightly to the east in the plane of the lode.

ISAAC'S HARBOR.

At Isaac's Harbor the gold streak dips to the east at a high angle in one of the lodes, and when projected it has the form of a very acute triangle. In sinking some hundred feet east of the rich auriferous zone in the lode, with a view to strike it at a depth of about 300 feet, the miners at Isaac's Harbor came across another and parallel streak.

LAWRENCE TOWN.

Dip of streak, as far as observed, is to the west, at an angle of about thirty degrees.

WAVERLEY.

Streak on the north lode dips from west to east, on the north Taylor, south Taylor, and No. 6 lode, the streak dips from east to west.

CHAPTER IV.

AURIFEROUS SLATE BELTS AND LOW GRADE ORES.

- 1.—Slate Belts.
 - 2.—Examples of the working of low grade Quartz.
 - 3.—Mixed vein stone in Nova Scotia—Tangier—The Forest lode—The Burlington mine—Indian Path.
 - 4.—Character of Quartz lodes in California.
 - 5.—Auriferous Slate in California—Gold in Granite, Scotland.
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1.—SLATE BELTS.

In the Report on the Sherbrooke Gold District, page vii., I have alluded to the auriferous Slate bands in several Districts. I now propose to refer more at length to this important source of gold in the province.

The belts of auriferous slate are almost always found to be interseamed with large or small quartz lodes, and frequently minute veins of quartz cross the slates at different angles. Sometimes the belts show large and well defined quartz lodes with a number of small parallel lodes and interlacing cross veins. There are illustrations to be found in every district, and where water power is available or where steam power can be used with economy, these belts furnish a valuable supply of low grade quartz, which is well fitted for crushing according to the system common in Victoria and in California, namely, *without* amalgamation in the battery and by the use of blankets or of Atwood's or other amalgamators.

It should always be borne in mind that a mine must be regarded as a manufactory of gold, and be conducted, even in its minutest details, with the most jealous regard to economy in all departments. There are many existing gold mines which produce only from 2 dwts. 3 gr. to 2 dwts. 15 gr. per ton, and yet yield very handsome returns; but this result is only attained by crushing large quantities of cheap ore of

low grade with the strictest economy. The profit being in fact derived from the tailings, the actual first yield of the stampers paying working expenses of the mine only.

2.—EXAMPLES OF THE WORKING OF LOW GRADE ORES.

The Port Phillip and Colonial Gold Mining Company of Australia have long been instanced as successful miners, with comparatively poor material to work upon. During the past seven years the company has paid £87,750 stg. in dividends, about 90 per cent. upon the capital invested, or an average of nearly 13 per cent. per annum. By careful manipulation, they now expect to work veinstone yielding 4 dwts. to the ton, with profit: hitherto, owing to a large expenditure, they have not made a profit on veinstone yielding 5 dwts. to the ton. In a report presented to a meeting of the shareholders, January 26th, of the present year, some very interesting details were given respecting the yield of gold and the results of manipulating the quartz tailings and pyrites in this celebrated mine:

"The report of the directors stated that the return of gold for the year had been small, and compared unfavourably with previous years, the average yield being only 4 dwts. 20 $\frac{3}{4}$ grs. per ton, against 7 dwts. 3 grs. last, and 8 dwts. 23 grs. the preceding year. For the first ten months the yield from quartz alone in no case came up to an average of 4 $\frac{1}{2}$ dwts. per ton. During the month of April it fell to the unprecedented low average of 3 dwts. per ton; the last three months show a considerable improvement, the average being 5 dwts. 15 grs. per ton. The pyrites and blanket sand treated during the year amounted to 456 tons 16 cwts., and produced 1420 ozs. 6 grs. of gold, or 12 grs. per ton on the total quantity of quartz crushed. The quantity of quartz crushed during the year of 52 weeks, ending Oct. 12, 1870, was 55,240 tons, being a decrease of 9033 tons against the previous year. The produce of gold, including that from pyrites, &c., during the same period, amounted to 13,441 ozs., being a decrease of 9849 ozs. 17 dwts. compared with the yield obtained in the previous year. The average yield per ton on the quantity crushed from the commencement—565,595 tons—has been 9 dwts. 21 grs. The loss on reduction, as shown by the assays of tailings, compares very favourably with previous years, averaging 1 dwt. 2.14 grs. per ton, against 2 dwts. 4 grs. per ton on the previous year; and deducting the gold obtained

from the pyrites by subsequent treatment, the average loss is reduced to 0.1968 grs. per ton, or 14.12 per cent. of the entire gold contents of the quartz." *

In the report on the Sherbrooke district instances are quoted of successful operations in Victoria on very low grade quartz and veinstone, or better, *auriferous rock*, which may be again introduced here, for the time will arrive when, in favorable localities, the enormous water power of Nova Scotia will be utilized in crushing with profit low grade auriferous rock, and the advantages which an abundant supply of this source of gold present cannot be too prominently kept in view.

Table showing the average yield of Gold from cert tin parcels of Quartz Tailings, Cement, Mullock, &c., crushed in the years 1864 to 1868 inclusive, in the several mining districts; from returns made by the Mining Surveyors and Registrars: +

MINING DISTRICT.	Quantity Crushed		Total Produce		Average yield per ton.		
	Tons.	Cwt.	Ozs.	dwt.	Ozs.	dwt.	Grs.
Ballarat	92498	6	9699	14	0	2	2.38
Beechworth	7904	16	1415	17	0	3	13.97
Sandhurst	441592	0	85123	8	0	3	20.52
Maryborough	115137	10	30946	3	0	5	9.01
Castlemaine	238357	0	53593	13	0	4	11.74
Ararat	97669	0	23382	14	0	4	18.91
Gippsland	445	0	69	12	0	3	3

At one mine in Ballarat 7,453 tons of quartz yielded no more than 2 dwts. 10½ grs. per ton, yet the company paid a dividend £2,101 10s. The quartz was easily obtained, and at small cost, but the manipulation was very economically conducted. At the Black Hill Mine, Ballarat, the total quantity of quartz crushed up to 1868 was 190,118 tons, yielding 22,801 ozs. 18 dwts. 13 grs. The average yield being 2 dwts. 9.7 grains per ton.

The lode is of great thickness, and the cost of getting out the quartz is, for open cutting 1s. 2d. per ton, from levels: through shafts, 8s. 6d. per ton. Cost of crushing, 1s. 6d. per ton. Wages, 7s. 6d. per diem. for miners 8s., s cond 7s. 6d., boys 6s.

* "London Mining Journal."

+ Gold Fields of Victoria.—R. B. Symth.

The stamps are provided with self-feeding apparatus, and the occasional attendance of one boy is sufficient for supplying the whole battery of 60 stamps with the material brought to the hoppers. Amalgamating troughs and blanket strakes are employed for collecting the fine gold. Hot water is used. The gold obtained from the different parts of the reduction machinery averages about 75 per cent. from the stamp boxes; 25 per cent. from the mercury troughs; 5 per cent. from the blankets.

3.—MIXED VEIN STONE IN NOVA SCOTIA.

Great facilities for working by water-power exist at Tangier and Moseland, also at Waverley, Lawrencetown, and in some other Districts. Auriferous slate bands are common at Moseland, Tangier, Sherbrooke, Wine Harbor, Isaac's Harbor, Musquodoboit, Indian Path, &c., &c. But unfortunately the water power available is not equally convenient in all the districts named. It is, however, worth considering whether by combining together, different companies could not construct with great profit to each, a tram-road to the nearest available mill stream, where mills might be erected. In some instances such a combination would be of the greatest value to the district, and the principle might be introduced in other districts not so favorably situated, of separating the mining of the vein stone from its manipulation, and placing the latter in the hands of properly qualified mill-men, whose processes should embody all the improvements which experience in different gold mining countries has suggested. This refinement in gold mining will one day be adopted in a greater or less degree in many parts of Nova Scotia.

As illustrations of low grade quartz and slate which may be cheaply mined, the following are introduced. It is to be distinctly understood that these do not represent the most important auriferous Slate bands in the several districts. They are examples of mixed 'vein stone' which may be profitably worked with economical management.

TANGIER.

The Hill Lode.—This is a remarkable aggregate of alternations of quartz and slate, as follows, commencing from the south wall:

No. 1.—2 feet	.....	Quartz
2. 4 "	.....	Slate, interseamed with quartz lodes.
3. 0 " 6 inches	.....	Slate.
4. 0 " $\frac{1}{2}$ "	.....	Slate.
5. 0 " 4 "	.....	Quartz.
6. 2 " 0 "	.....	Slate.
7. 0 " 3 "	.....	Quartz.
8. 3 " 6 "	.....	Slate interseamed with quartz.
9. 5 " 5 "	.....	Slate.
10. 1 " 6 "	.....	Quartz.

Total 19 feet $1\frac{1}{2}$ inches.

A portion of this aggregate has been crushed in the mill, and yielded at the rate of $2\frac{1}{2}$ dwts. to the ton. Loss of gold to the extent of probably one-third, occurred during the crushing: the average may be put at $3\frac{1}{2}$ dwts. per ton. But this represents the yield at the surface only. Below the influence of the atmosphere it will probably be found to exceed $3\frac{1}{2}$ dwts. per ton.

Mr. Forest, the Manager of the Strawberry Hill mine, states that this mass of auriferous lodes and slate can be mined for one dollar a ton. When the mill is working day and night the cost of crushing is one dollar a ton.* Add to these expenses an additional 50 cents, the total cost of winning the gold will be \$2.50 per ton.

The Tunnel Lode is in some respects similar to the Hill lode. It consists of the following aggregate at its eastern section.

1. Sandstone.
2. Quartz, 1 to $1\frac{1}{2}$ inches.
3. Slate with seams of quartz, 2 feet.

* The mill with 10 stamps can crush 10 tons per diem, working day and night.	
Wages, 2 men at \$1.25 each.....	\$2.50
" Night Shift.....	2.50
Wear and tear of mill.....	2.50
Wood, 2 cords at \$1.25 per cord, supplied from the property— (500 acres of excellent wood land).....	2.50

Total \$10.00.

Or one dollar per ton.

Cost of mining..... \$1.00 per ton.

Total cost..... 2.00

Ascertained yield $2\frac{1}{2}$ dwts., not including loss in the tailings.

4. Three small lodes, two of 1 inch, and one of $1\frac{1}{2}$ inch, separated by a thin seam of slate 1 to $\frac{1}{2}$ inch in thickness.
 5. Felspathic sandstone, 11 inches.
 7. Quartz lode, $1\frac{1}{2}$ inches.
- Total 4 feet, of which there is two feet 10 inches crushing material.

The Timmer lode has yielded 8 dwts. to the ton, but this was probably from selected quartz, the slate being rejected. A lode yielding 8 dwts. to the ton, and affording two feet 10 inches crushing mineral, would be very valuable.

The Forest Lode.—This is the lode which has given to the Strawberry Hill property its reputation. The quartz crushed in the mill between February, 1869, and August, 1870, taken almost exclusively from the Forest lode, has amounted to 1,350 tons, yielding 1515 oz., being an average of 1 oz. 2 dwt. 10 gr. per ton. It varies in thickness from 5 inches to $1\frac{1}{2}$ inches. The deepest shaft sunk on this lode is in all 144 feet: being 122 in the rock and 22 feet in the drift. It has been opened to a greater or less extent from one end of the property to the other, by means of 22 shafts.

With it is associated another lode, called the South Forest, and separated from the Forest lode by three feet of felspathic sandstone, locally called whin. The thickness of the South Forest varies from one to three inches, as far as it has been examined.

The foot-wall of the Forest is composed of 8 inches of slate, succeeded by 4 to 6 inches of whin, which is again underlaid by 6 inches of slate. With rare exceptions, the quartz only of the Forest lode has been crushed. The extent to which the quartz of both lodes has been taken out is represented by a horizontal distance of 500 feet, and a depth of 15 feet. So that it may be said that one-sixth portion only of the South Forest has been extracted, compared with the quantity of quartz taken from the North Forest: in other words, five-sixths of the South Forest lode still remains standing in the shafts and stopes.

The relation between the North and South Forest lodes is intimate and peculiar. Numerous small cross lodes (spurs)

starting from the North Forest, penetrate the vein towards the South Forest. It is not known by actual observation whether these connect with the South Forest, but it is very probable that some of them do so. It is further remarked that as the North Forest diminishes with the depth, the small cross lodes increase in number. It is also alleged that the south lode either maintains its thickness or increases with the depth.

This structure is by no means uncommon. In Australia the spurs from lodes are represented to be sometimes very rich in gold, and where they occur in greater numbers than usual the lode is comparatively poor. (See Brough Smyth's description of the Catherine Lode or Reef, p. 323).

It is a matter of the highest importance to this mine that the South Forest and the intervening sandstone with intervening spurs should be thoroughly tested, especially where the North Forest begins to thin out and throw off the spurs. In fact, the extraordinary richness of the North Forest lode has led to the neglect of the South Forest, and to the adoption of a system of mining which almost always proves to be of a very treacherous and unstable character.

The cost of mining this lode has varied from 40 cents to 75 cents *per foot*, enough only of the wall rock being taken out to admit of the works being carried on. The quartz obtained for the crusher has varied from $2\frac{1}{2}$ tons to $1\frac{1}{2}$ tons per hundred square feet. Taking the lowest cost and the largest yield, the cost per ton would be \$16. Taking the highest cost and the smallest yield, the average would be \$50 per ton. The mean of these is \$33 per ton. This mean does not represent the actual mean cost of winning the gold, for the proportions between the quantities raised at the different prices are not given. The items are introduced for the sake of comparisons to be drawn from the results of a different system of mining.

The average breadth of the belt from the South Forest to the band of slate forming the foot wall of the North Forest is four feet six inches. The whole of this should be taken out, conveyed by trollies to the mill and crushed. The cost of mining will not exceed* \$3.50 per ton; cost of crushing, one

* Mr. Forest says he could take the belt out for \$1.50 instead of \$3.50.

dollar a ton. A yield of $4\frac{1}{2}$ dwts. will pay all expenses, and the probability is that the yield will far exceed that estimate. Even if the cost reaches $5\frac{1}{2}$ dwts. per ton, there can be little doubt that the profits under this system will be very considerable. According to experience, it must be inferred that the spurs proceeding from the North Forest towards the South Forest are auriferous, and also that the South Forest itself maintains its original character. It will not be essential to crush the whole of the so-called whin; where the spurs are few, much of the whin may be rejected, but this will depend upon the results of experience.

It will be fair to assume the general composition of the Forest lodes to be as follows:

Quartz, including North and South Forest and		
spurs	6 to 7 in.	
Sandstone	2 ft. 0 in.	
Slate	8 "	
Total crushing material.....	3 "	2 "
Sandstone rejected	1 "	0 "
Total mineral handled.....	4 ft. 2 in.	

The Burlington Mine.—A tunnel on the Burlington property at Tangier affords a good opportunity for examining the structure of the strata and lodes. Owing, however, to the incrustation on the walls of the tunnel between the lodes, the character of the strata could not be well seen. The position of the lodes being known to the foreman the following section was made during an examination of this property in 1870.

SECTION on the Burlington property at right angles to the course of the
Lodes commencing 325 feet N. 74 W. of the Mill.

Name of Lode.	Distance apart.	Thick- ness in inches.	Slate Bands.	REMARKS.
	FEET.			
Tennant	225	6		
Roe	116½	10		
LEARY LODGE ..	31	9	.....	At 60 foot level dip, S. angle, 65; at 99 ft. level, dip S. angle 62. Thick- ness at 99 foot level, 6 inches. A 'Bull Vein' touches the lode in this shaft.
Barker	18			
Bridge	26	9		
To mouth of } tunnel.... }	49			
Lode	6			
	50	.....	Small lodes in slate.	
Air shaft lodes.	17			3 lodes 5 in. of quartz in 15 inches of slate. Dip 65 deg. south
	11½	....	{ 2 ft. 4 in. slate, with 3 small lodes.	
Lode	6	1		In 8 inches of slate.
	21			Two small lodes in 12 inches of slate.
	11	....	{ Slate band 5 ft. 8 in., with 6 small lodes.	
Two lodes....	15	4 & 2		Three feet apart.
Three small } lodes }	11	....	{ Slate and whin. 5 ft. thick,	
	4	....	{ Slate 2 ft. 8 in., with small lodes.	
Lode	15	1½		
	6	.....	Six small lodes.	Fault.
Small lode....	65	.....		Fault.
NIGGER LODGE, end of tunnel.	9	18	.....	Dip S. angle 45 degrees. At west end of stope on this lode, a fault dips E. angle 60. Rolls dip west at an angle of 16 deg. The slate on the hanging wall of the Nigger Lode averages 9 inches, and hold a small gold-bear- ing lode.

INDIAN PATH.

The worked lodes in this district occupy a higher geological horizon than in any other part of the province. They are in the black ferruginous slates which overlie conformably the sand-stone or so called quartzite strata, in which all the other worked lodes in the province are found.

This slate is remarkably ferruginous, and contains a considerable percentage of common iron pyrites, and also in less quantities mispickel. In the vicinity of the Wadlow lode at Indian Path, it is intersected by numerous small quartz veins. The lode itself is massive, being in some places three feet six inches, and contains beside visible gold, cubic pyrites, mispickel, blende and galena. The large amount of sulphurets in the slates suggests the probability of the whole mass near the lode being auriferous, and if cheap crushing could be ensured, it might form an unusually abundant source of low grade ore.

4.—CHARACTER OF QUARTZ LODS IN CALIFORNIA.

An important paper read before the Royal Society by Mr. J. R. Phillips* on the Chemical Geology of the Gold Fields of California, closes with the following summary, which points to the probable origin of certain lodes, belonging chiefly to the class of "true veins."

"The following are some important facts observed on a careful examination of the gold-regions:—

(1.) The quartz veins of California almost uniformly exhibit evidences of having been formed by successive silicious deposits parallel to the walls of the enclosing fissure; and when fragments of exfoliated slaty rock become enclosed, their planes are usually parallel to the quartz in which they are imbedded.

(2.) All remuneratively productive gold veins contain notable quantities of pyrites and other metallic sulphides; and the association of these bodies is so constant and remarkable, that it is probably the result of some chemical action regulating the distribution of the precious metal.

(3.) The auriferous quartz of the pacific gold-fields invariably contains a certain quantity of potash together with a

* Notes on the Chemical Geology of the Gold Fields of California, By J. Arthur Phillips. (The substance of a paper read before the Royal Society, March 12th, 1870.) Phil. Mag., Nov. 1868.

small amount of water which is not eliminated at a temperature of 212° F. Under the microscope it only exhibits well-defined fluid-cavities in specimens that are more than usually chrystalline; and these, even in the same chrystal, when heated, become full at by no means uniform temperatures.

(4.) Mineral veins of evidently very recent date are met with in various localities on the Pacific coast; and some of these contain both gold and silver.

(5.) In addition to the gold found in quartz veins, this metal occurs in certain bands of metamorphosed slates. The outcrop of these, like ordinary veins, are frequently colored red or brown by the decomposition of pyrites.

(6.) The old Tertiary river-beds constituting the deep diggings, and frequently overlaid by a volcanic capping contain large quantities of fossil wood, and are often hardened into a compact conglomerate by a cement consisting either of finely chrystallized iron pyrites or of silica. This iron pyrites encloses gold, which is sometimes water-worn, and at others is in a chrystalline or filiform state, showing that it has not been subject to attrition. In Australia, pyrites replacing the woody constituents of the stems of trees found in similar positions has been shown by various chemists to contain large quantities of the precious metal. The siliceous cement of the ancient river-beds of California has sometimes, but rarely, been deposited in a chrystalline form, and on examination such chrystals have not been found to contain fluid-cavities presenting the usual vacuities.

(7.) Mineral springs are exceedingly numerous, and their waters generally escape from the ground in a state of ebullition. These springs deposit silica, sulphur, iron pyrites, &c., whilst in some instances cinnabar is brought to the surface in large quantities by solfarata action: occasionally the deposited silica takes the form of an ordinary auriferous vein, and gold is stated on good authority to have been found in quartz so produced. At the surface the silica of such deposits contains a larger amount of water than that of the older quartz veins of the country, but appears gradually to lose it, and, although generally amorphous, is sometimes met with in a chrystallized state.

(8.) In the districts abounding in mineral springs are lakes of which the waters are highly alkaline, and which, in addition to carbonates and sulphate of soda, contain large quantities of chloride of sodium. These have no visible outlet, and act as vast evaporating pans, in which the waters of the various streams flowing into them are being concentrated by the action of the sun's rays. The incrustations deposited on the shores of Owen's Lake contain a much larger proportion of

carbonate of soda than the salts obtained by direct evaporation of the lake-waters.

In the present state of our knowledge, the foregoing facts would appear to lead to the following conclusions:—

(a) Quartz veins have been produced by the slow depositions, from aqueous solutions, of silica on the surfaces of the enclosing fissure.*

(b) From the general parallelism with its walls of the planes of any fragments of the enclosing rock which may have become imbedded in a vein, it is to be inferred that they were mechanically removed by the growth of the several layers to which they adhered, and that a subsequent deposition of quartz took place between them and the rock from which they had become detached: in this way were introduced the masses of rock known as "horses."

(c) The formation of quartz veins is often due to hydrothermal agencies operating from below, of which evidences are still to be found in the hot springs and recent metalliferous veins to be met with in various parts of the Pacific coast.

(d) From the presence of gas-cavities and the variable temperatures at which the vacuities in their fluid-cavities become filled, it may be inferred that they are the result of an intermittent action, and that the fissures were sometimes traversed by currents of hot water, whilst at others they gave off aqueous vapour or gaseous exhalations.†

This is precisely what is now taking place at Steamboat Springs, where the formation of a vein is in progress, and from which currents of boiling water are often poured forth, whilst at other times the fissures only give off currents of steam and heated gases.

(e) That gold may be deposited from the same solutions which give rise to the formation of the enclosing quartz, would appear evident from the presence of that metal in pyrites, enclosed in silicious incrustations near Borax Lake, in the semi-opal of the North Star vein, &c., as well as from the fact of gold having been found in the interior of the stems of trees which in deep diggings are often converted into pyrites.

(f) The constant presence of pyrites in auriferous veins, and when so occurring its invariably containing a certain

* By "aqueous solution" it is not intended to convey the idea that silica has been dissolved in pure water, but rather in waters containing various acids, alkalis, salts, &c.

† Sorby, "On the Microscopical Structure of Crystals. || 1. *Crystals formed from solution in water*," Quarterly Journal of the Geological Society, vol. xiv, pp. 453-500.

amount of gold, suggests the probability of this sulphide being in some way necessarily connected with the solvent by which the precious metal was held in solution. Without considerable addition to our present limited knowledge of the subject, it would be impossible to explain the exact process by which the solution of gold was effected. It has, however, been shown by Wurtz* (who has since suggested the probability of ferruginous salts being the means employed by nature for effecting the solution of gold†) that finely divided gold is soluble in the sesquichloride of iron, and more sparingly in the sesquisulphate of that metal. It is also well known that iron pyrites sometimes results from the action of reducing agents on the sulphates of iron.

If, therefore, sulphate of iron, in a solution containing gold, should become transformed by the action of a reducing agent into pyrites, the gold, at the same time being reduced to the metallic state, would probably be found enclosed in the resulting crystals of that mineral. ‡

(g) The silica and other substances forming the cementing material of the ancient auriferous river-beds have probably been slowly deposited from comparatively cold solutions.

(h) The connexion existing between the decomposition of felspar by the agency of boiling springs, the existence of alkaline plains, and the formation of lakes containing various salts of soda and potash, will be at once obvious to the geologist.

V.—AURIFEROUS SLATE IN CALIFORNIA.

Some attention has also been recently directed to bands of auriferous slate found in the copper-bearing band west of the main gold-belt of the State, and in the foot hills of the Sierra. Of the deposits of this description, those near Lincoln, in Placer county, and at Quai Hill, in Calaveras, are the most remarkable.

* American Journal of Science, vol. xxvi. p. 51.

† Memoir read before the American Association for the Advancement of Science, August 1, 1866.

‡ From a somewhat lengthy investigation of the subject, I am induced to believe that gold invariably occurs in pyrites and other sulphides in the metallic form. Tarey matter, like that found in the solfatara at Borax Lake, has occasionally been met with in the quartz veins of California; and although the protosulphate of iron, resulting from the decomposition of the sesquisulphate, would, under certain circumstances, have the effect of precipitating gold from solution, it would probably not do so in the presence of large quantities of the persalts of that metal. A discovery, made by Mr. Daintree, of the fact that a speck of gold lying in a solution of the chloride of that metal, may be increased to several times its original weight by the action of a small piece of cork introduced into the solution, is recorded by Mr. Ulrich. Mr. Wilkinson's experiment further proves that besides gold itself, iron, copper, and arsenical pyrites, galena, blende, &c., likewise form favourable nuclei, which, if immersed in weak solutions of chloride of gold, receive a solid coating of metal by the agency of organic matter such as a chip of wood floating in the solution.—'Notes on the Physical Geography, Geology, and Mineralogy of Victoria' (*ante cit.*), p. 44.

In these localities the gold, instead of being obtained from well-defined veins chiefly composed of ordinary quartz, is enclosed in bands of siliceous slaty rock, extending north-west and south-east, and dipping in conformity with the other strata of the district. At the surface the Lincoln deposit is chiefly distinguished from the other slates of the neighborhood by being, in places, deeply stained by oxide of iron, and forms a low outcrop of about 3000 feet in length and 200 feet in width.

Where this has been cut into, it has been found to consist of alternating bands of clay-slate stained by oxide of iron, and of a friable sandy quartz still retaining distinct evidences of stratification, and which under the microscope presents the appearance of a siliceous skeleton from which the more soluble constituents have been removed by aqueous agencies.

Through these bands, and running parallel with the stratification, dykes of felspathic rock make their appearance, and contain small opaque white crystals too much decomposed to admit of identification. These, like the slate itself, contain gold, but, in the case of the felspathic rock, in very small quantities only. In the slate are also found lenticular masses of blende and iron pyrites, both auriferous, with stains of carbonate of copper. The whole mass of the stratified rock contains a certain amount of "free gold," although the seams vary considerably in their yield, some of them affording mere traces, whilst others assay as much as 3 oz. per ton. The whole of the gold in the portions of the deposits as yet worked is in a "free" state; but it is probable that below the water-level it may be found associated with various sulphides, by the decomposition of which in the upper portions the precious metal has become liberated. The pyrites and blende, in addition to gold, afford by assay a small quantity of silver; and particles both of native silver and native copper may be extracted by washing the decomposed slates.*

5.—GOLD IN GRANITE—SCOTLAND.

In a paper read before the British Association during its last meeting "On the Matrix of Gold in the Scottish Gold Fields," Dr. Bryce, the author, stated that he had found gold in fragments of granite, and tracing it to the native rock, he obtained the crushing of a sufficient portion to prove that it was distinctly, though not remuneratively auriferous.†

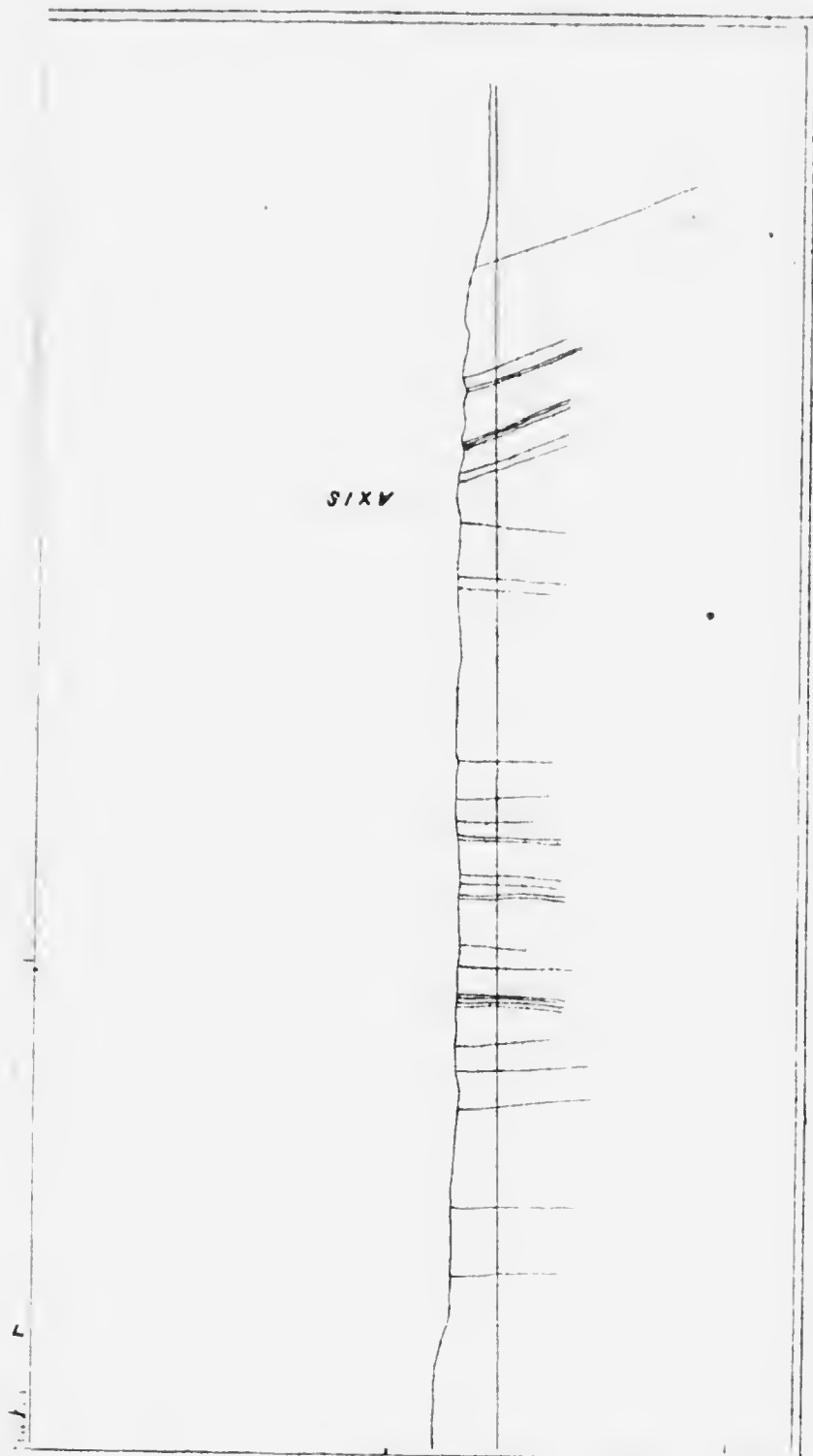
* Notes on the Gold Fields of California,—Phillips.

† Nature, October 20th, 1870.

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CHAPTER V.

MOUNT UNIACKE GOLD DISTRICT.

- 1.—History of the District, abbreviated from the Chief Commissioner's Reports, year 1867 to year 1870.
- 2.—Gold returns of different properties at Mount Uniacke.
- 3.—Description of the District.
- 4.—Structure of the Rocks of the District.
- 5.—Section across the Anticlinal at Mount Uniacke.
- 6.—M. August Michel's description of the Lodes.
- 7.—Section across the West Lake and Hamilton properties.
- 8.—General remarks on the District.

MOUNT UNIACKE GOLD DISTRICT.

- 1.—HISTORY OF THE DISTRICT ABBREVIATED FROM THE CHIEF COMMISSIONER'S REPORT.

YEAR 1867.

“Uniacke is a new district in which some prospecting licenses were taken in 1865. During 1866 some discoveries were made, a small crusher was built about three miles easterly from the Uniacke Station, and a road made from the station to the crusher. During the past summer the old road was repaired, and a new one made running through the district. Owing to the small amount expended on these roads, and the want of good material, they are as yet barely passable; but, being so near a railway station, the want of roads is not so much felt as in some other districts. Two additional crushers have been lately built, and the district has made steady and rapid progress. The ground already applied for and under prospecting license and lease is large, and the surface over which workable leads have been found, equals any district in the Province. The success in prospecting may be accounted for by the small depth of surface soil, a large portion of which is not more than two feet deep. This district only requires capital and skill to make it one of the most productive.



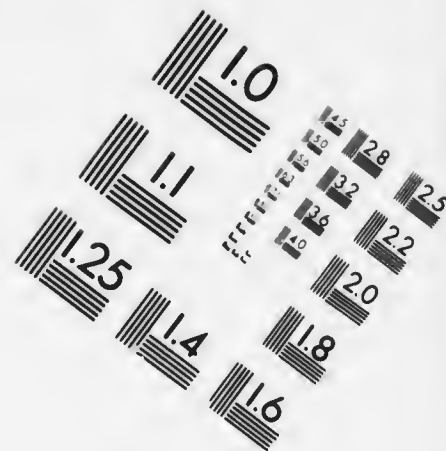
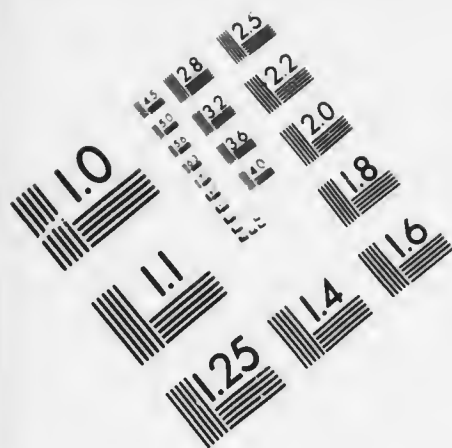
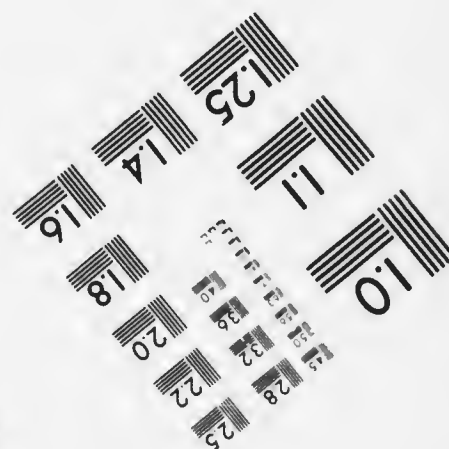
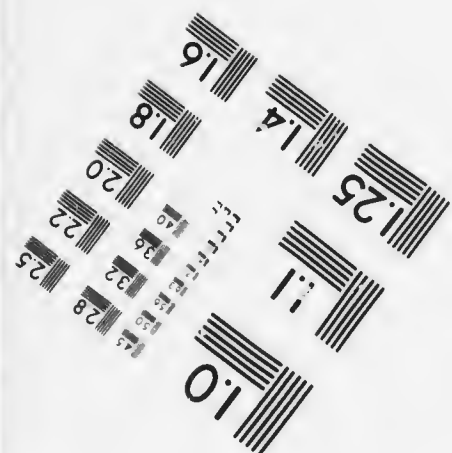
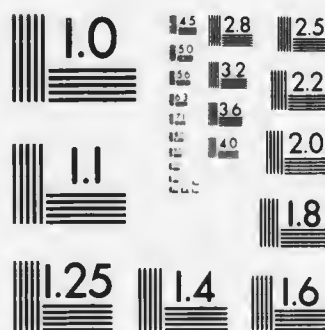


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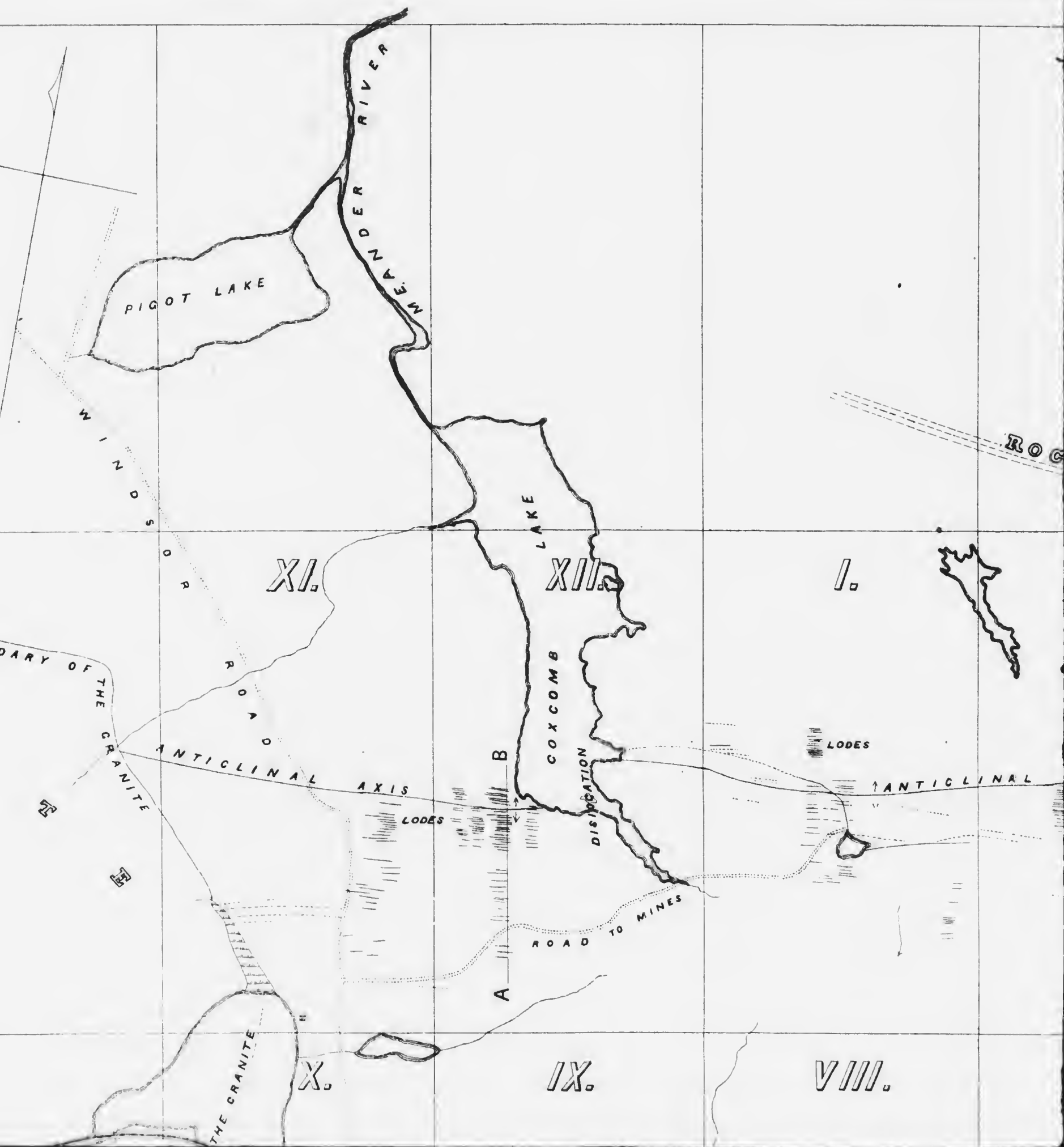
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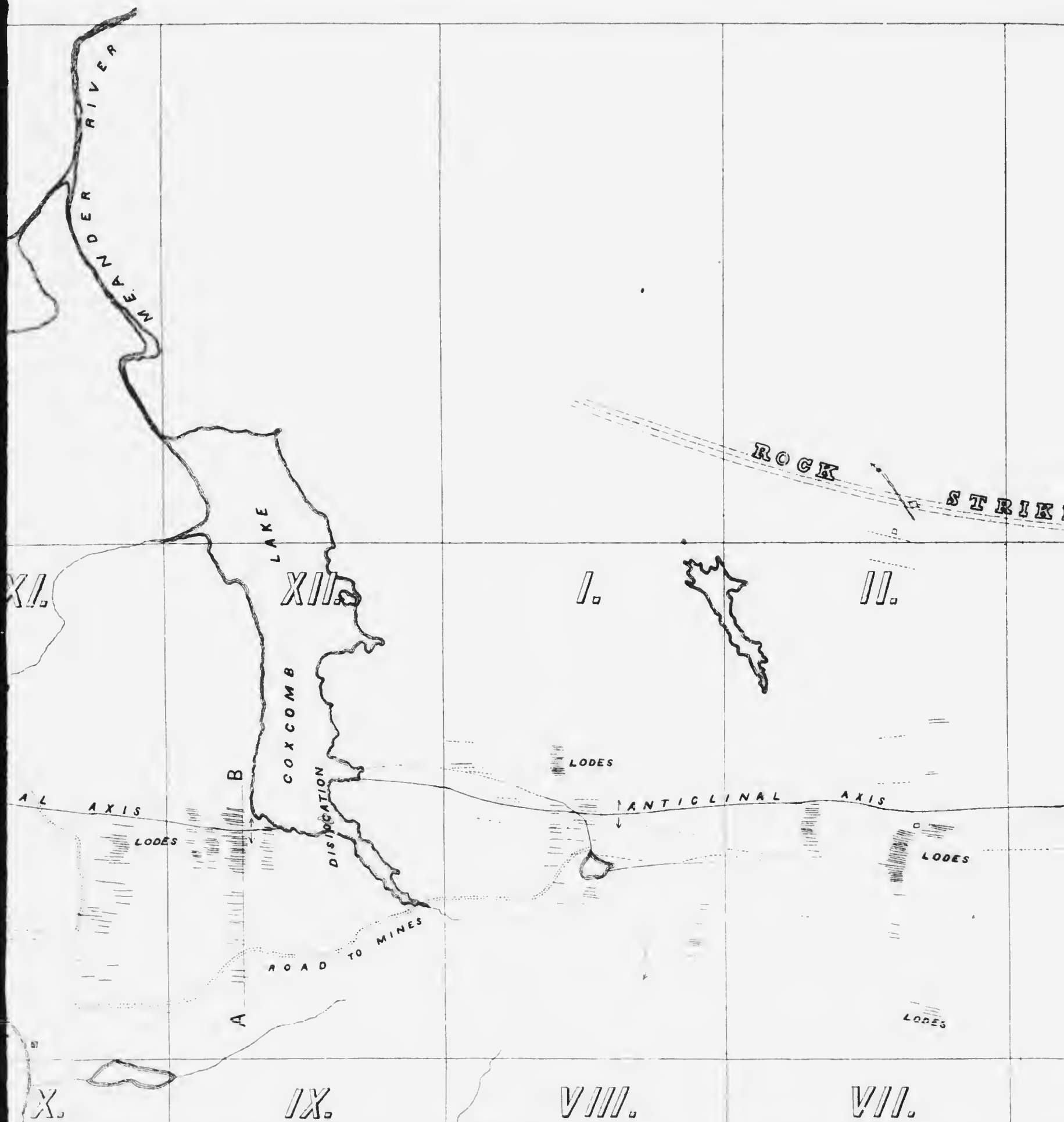
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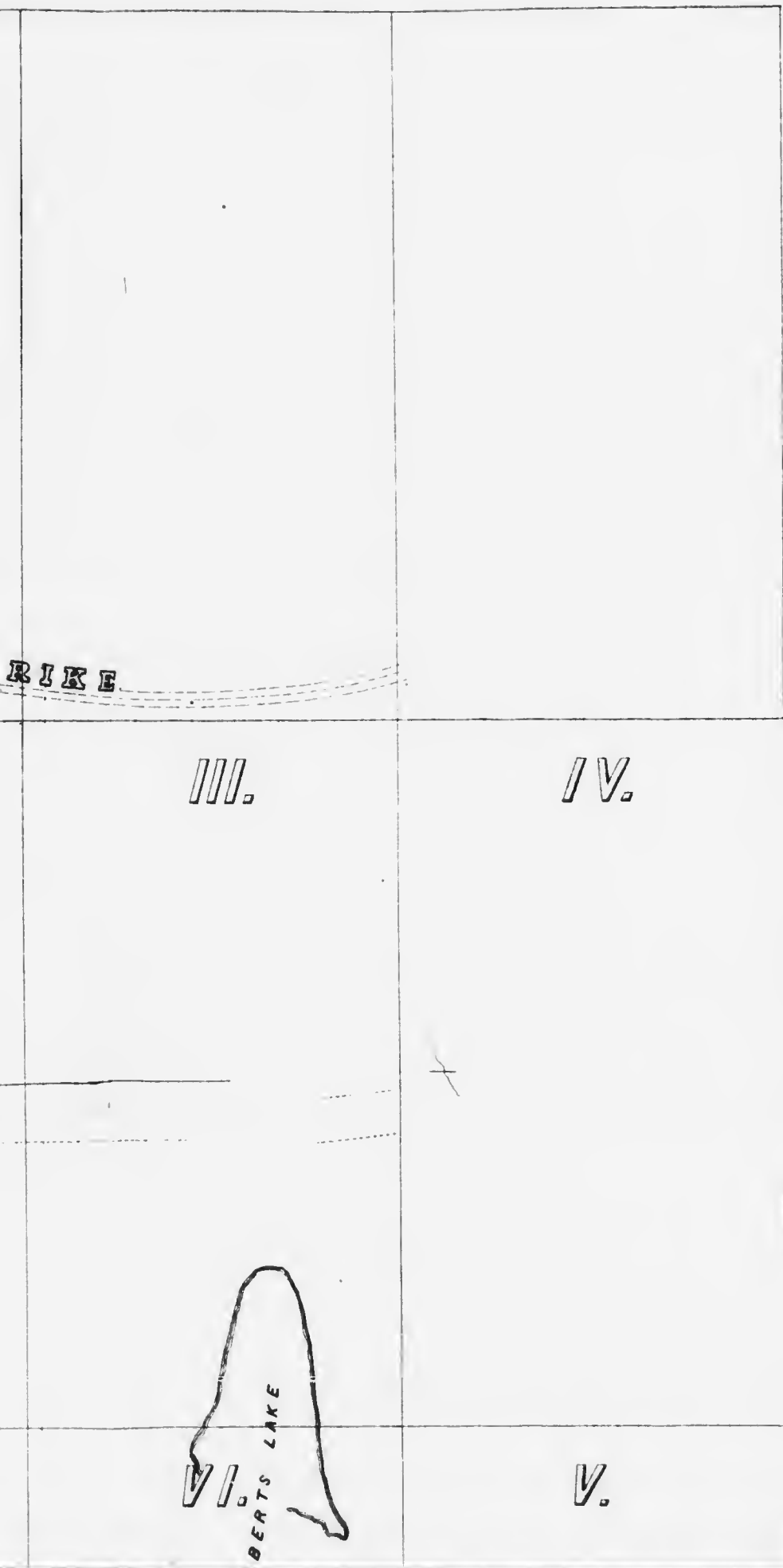
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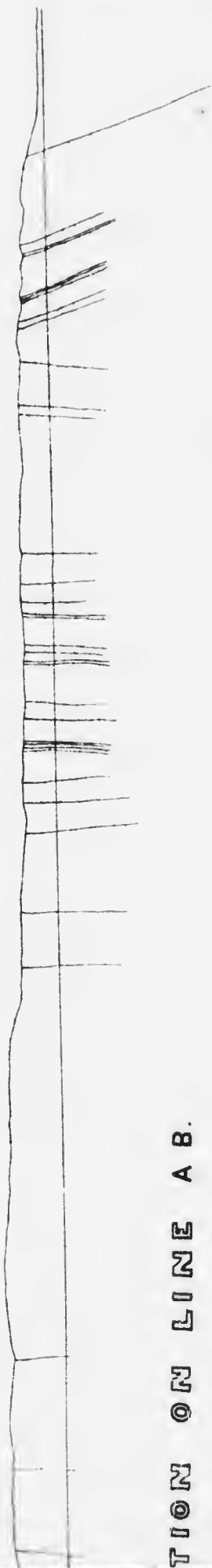


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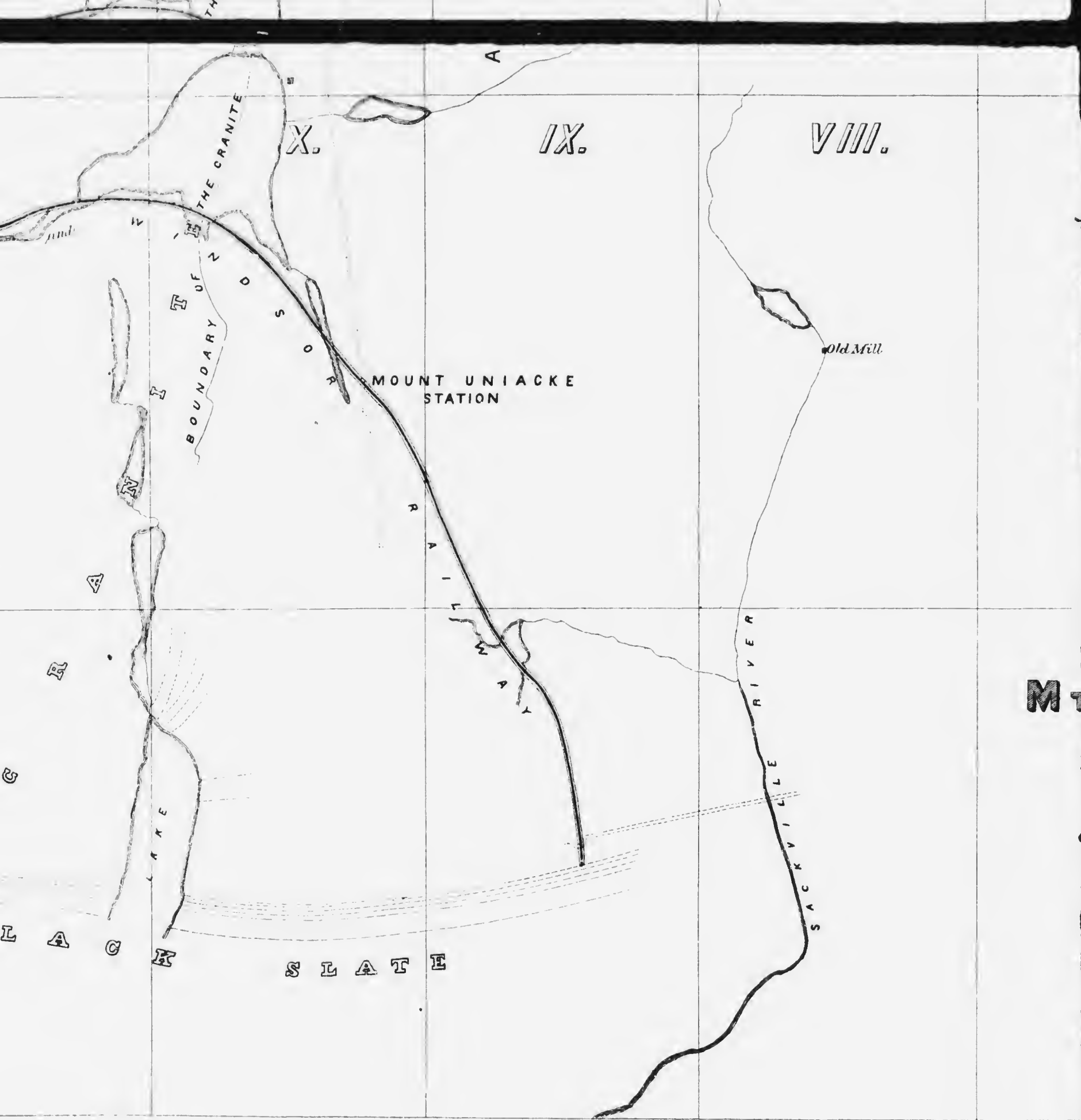


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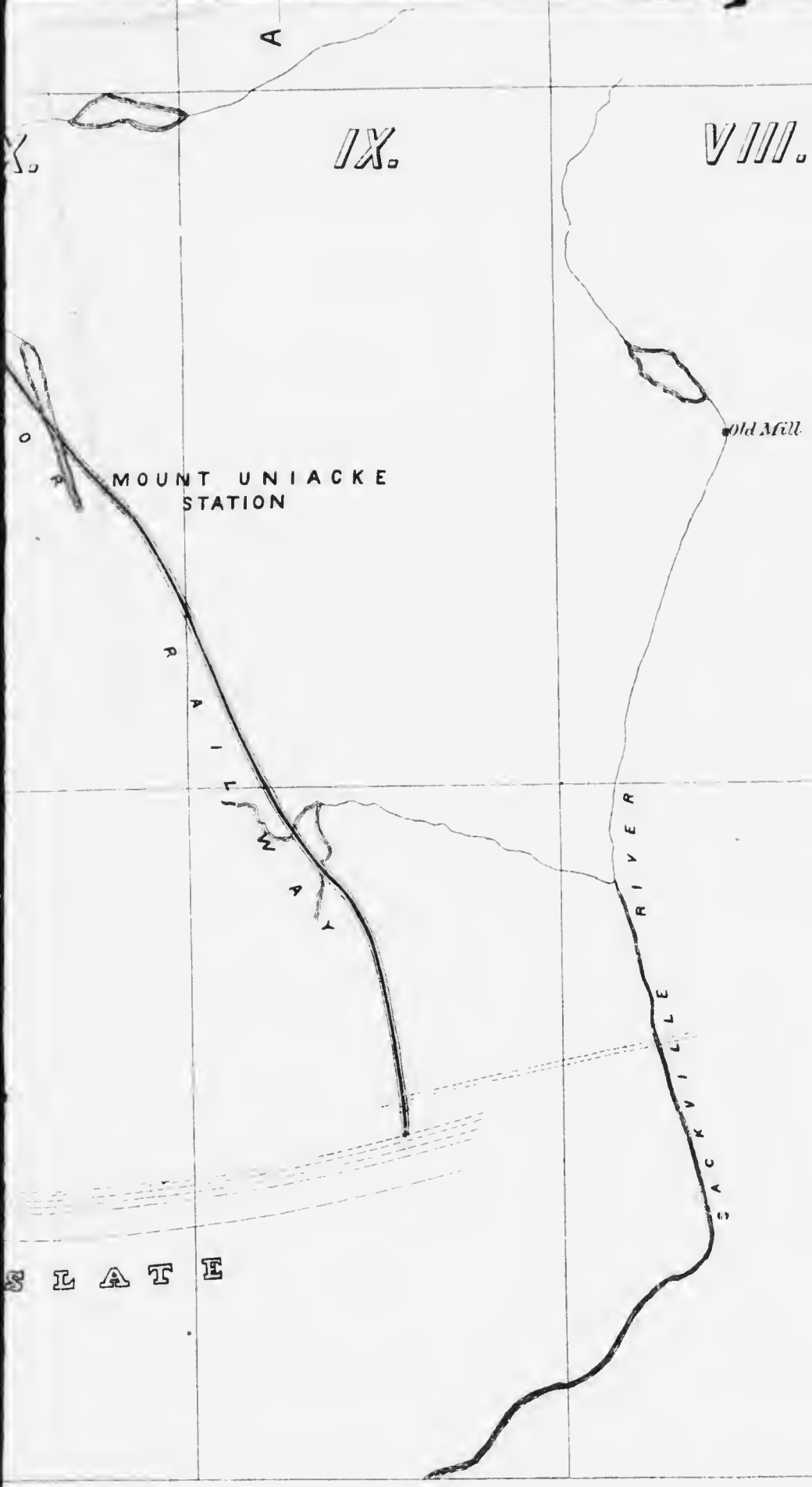
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LODES



IX.

VIII.

VII.

MOUNT UNIACKE
STATION

Old Mill

SACKVILLE
RIVER

SLATE

MT. UNIACK

SCALE

V.

HIBBERTS LAKE

V.

PLAN

ACKE GOLD DISTRICT.

SCALE 2000 FEET ONE INCH

SECTION ON

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INSPECTOR'S REPORT.

"The operations in Mount Uniacke are assuming an important character. Several of the mines were begun towards the end of the past year. Two shafts have been sunk by Mr. Mitchell on a lode the thickness of which is 3 inches, to the depths of 50 feet and 40 feet respectively: the distance apart being 35 feet, and the lode has been stoped between them. On another lode to the west of Mr. Mitchell's mine, Mr. Burkner has sunk two shafts which are now 25 feet deep and stoping has been commenced between them. Adjoining Mr. Burkner on the west, a shaft has been sunk by Mr. Donll on the same lode to a depth of 50 feet, and the lode stoped on each side of it. On the Logan lode, the thickness of which is about 10 inches, the Montreal Company have two shafts, one of which is 55 feet deep, and out of it the lode has been stoped 30 feet to the east and 40 feet to the west, to within 10 feet of the surface. The Mount Uniacke Company have also three shafts on a lode 12 inches thick, to the east of the Logan. The central shaft is now 102 feet deep, the others are 60 feet and 70 feet respectively, and the lode has been stoped from these depths, to the middle shaft, to within 10 feet of the surface. About 80 feet to the south of this lode the same company have sunk a shaft 20 feet on another lode, also 12 inches thick, and have tunnelled a short distance on each side; and further south about 20 feet, they have also a shaft 40 feet deep on a lode from 10 to 12 inches thick. This lode has been worked on each side of the shaft by open trench, to a depth of 30 feet deep on a lode from 10 to 12 inches thick.

Considerably to the west of these operations a lode has been opened by Messrs. Hall and McAllister. This lode is 10 inches thick, and on it are two shafts, one of which is 50 feet deep and the other 35 feet, the distance between being about 50 feet. The lode is being stoped between the shafts, 10 feet being left near the surface, and a tunnel has been driven to the East 16 feet from the east shaft. Further west, the West Lake Company are working a lode or rather an aggregation of lodes, the width being about 9 feet. A shaft has been sunk 26 feet, but at present a portion of the lode is being worked near the surface by a tunnel which is being driven to the East from a depth of 9 feet in the shaft."

YEAR 1868.

"This district has steadily progressed, and the return of gold is larger than that of last year. Two crushers have been built since my last report. The first opened mine—the 'Uniacke Mining Association'—has been largely extended,

and proves highly remunerative. Numbers of others show good returns. Gold-bearing leads have been found over an extensive area. The district, which is a large and important one, bids fair to be one of the best in the Province.

INSPECTOR'S REPORT.

"The operations in this district have been very considerably extended during the year; and present now an interesting instance of the rapidity with which localities apparently barren and valueless, become centres of industry on the discovery of the mineral wealth. Several new companies have begun and carried on mining operations, and though in some cases they are still but little advanced beyond a preparatory state, great progress has been made in developing this important district.

The Mount Uniacke Company have continued to mine the lode opened at the commencement of their operations, the central shaft on which is now 190 feet deep, and the east and west ones each 150 feet. A steam engine with hoisting and pumping gear, has been recently applied at the central shaft. The lode has been stoped between the shafts, and 30 feet to the east of the east shaft to within about 20 feet of the surface. At 110 feet in the middle shaft a cross tunnel has been driven to the south 50 feet into another lode on which a shaft has been sunk to the same depth; this lode has been stoped 50 feet on each side of the shaft from its depth, upwards of 30 feet in height.

The shafts on the south lode have also been sunk further; the west one being 100 feet, the middle 70 feet and the east one 40 feet: from which depths the lode has been stoped to within 15 feet of the surface. On the west side of the west shaft the lode has also been mined by open cutting a depth of 100 feet, a distance of 60 feet. Operations on this lode have however, been recently discontinued, and the mining is now carried on only in the other lodes. The Montreal Company's operations have consisted principally of the opening of a lode to the south of the one worked last year, mining in which was suspended in May last. On this lode, which is distant from the last named 47 feet, and is 10 inches thick, two shafts have been sunk, the depth of the east one being 95 feet, and the west one 34 feet. It has been stoped out of the east shaft 27 feet to the east, and 25 feet to the west shaft, a tunnel has been driven through to the stoping. South of the east shaft, 7 feet, another lode, 18 inches thick, has been sunk on to a depth of 35 feet, and the shaft is being continued.

Adjoining the Montreal on the west, the Uniacke Central Co. have sunk shafts on a lode 6 inches thick, the depths of

the east and middle ones being 35 feet, and that of the west one 25 feet. The lode has been stoped to the surface between these shafts, and also 20 feet to the east one. A shaft has also been sunk 72 feet on a lode a little to the north of the last named, with which it is connected by a cross tunnel from the west shaft.

By the Prince of Wales Co., whose property is next in a westerly direction, a shaft has been sunk 75 feet on a $5\frac{1}{2}$ inch lode, and out of this shaft at a depth of 51 feet, a tunnel has been driven to the west 23 feet. Shafts have also been sunk, from 15 to 20 feet on other lodes, but mining is at present confined to the $5\frac{1}{2}$ inch lode. The Queen Co. have made considerable progress in the developement of their property. Two lodes, one of them being that opened by Messrs. Hall and McAlister have been mined. On each of these, four shafts have been sunk; those on the Hall lode being 65 to 125 feet in depth. Out of the west shaft, and at its depth, 65 feet, tunnels have been driven 17 feet to the west, and 13 feet to the east. The lode has also been stoped, within a few feet of the surface, between the east shafts, and 42 feet to the east thereof. The stoping has also been continued to the eastward of the last shaft 24 feet, from a depth of 30 feet. The other lode mined by the company is situate about 100 feet to the north of the Hall lode; the west shaft in this lode is 30 feet deep, and the other three are 15 feet. Between the two west shafts the lode has been stoped to a depth of 20 feet and the same depth a distance of 30 feet on the east side of the second shaft from the west.

These lodes are very irregular in thickness, and vary from a few inches to 5 feet.

The Westlake Company have three shafts on the lode opened by them, the deepest being upwards of 50 feet; they are connected by a tunnel from which the lode has been stoped to about six feet from the surface. A tunnel has also been driven 20 feet to the west, from the west shaft.

Two shafts have been sunk on a lode by the Imperial Co., the east one of which is 40 feet deep, and the west one 18 feet. From the former tunnels have been driven 50 feet to the west and 25 feet to the east. The lode is nine inches thick.

North of the Queen Co.'s property, the Brunswick Co. and Messrs. McNab & Co. have commenced operations on two lodes. The Brunswick Company have sunk a shaft 47 feet on a lode about 100 feet north of the Queen Co.'s south lode, and tunneled to the west 27 feet. Fifty feet further north they have another shaft, 48 feet deep, from which depth a cross tunnel has been driven to the south into the west tunnel out of the south shaft.

Messrs. McNab & Co. have a shaft on a lode about 200 feet to the north of the Westlake lode, the depth of which is 50 feet; cross tunnels have been driven from a depth in this shaft of 44 feet, 16 feet to the north and 12 feet to the south.

The lode opened by Mr. Donll on the south side of the Central Co.'s. property has been mined by the Union Co., who have continued the shaft to a depth of 70 feet, and stoped to the west 30 feet from the surface; a little stoping has also been done at the bottom of the shaft. At present operations are being carried on on a lode 3 feet to the south, the thickness of which is 2 feet. It is being carried down by open work, and has been mined to a depth of 12 feet.

Mr. Burkner, whose property adjoins on the east, has also sunk his shaft to a depth of 80 feet. At a depth in this shaft of 15 feet a tunnel was driven to the east and the lode stoped to the surface, a distance of thirty feet. Operations have, however, been discontinued.

By the Lawrence Co. a lode has been opened to the north of the Union Co.'s. shaft, and a shaft sunk 40 feet; the lode has been mined by open cutting from the shaft 41 feet to the east.

Explorations have been made by several parties on the areas surrounding the preceding properties, and lodes have been discovered of a more or less promising character. This district is thus being well developed, and extended operations will no doubt ensue."

YEAR 1869.

"The Uniacke gold mining company's works, commenced in 1867, are still carried on with a steady return of profit to the owners. A large amount of permanent work has been performed—a tunnel, cross-cutting the metals, has been driven a distance of 135 feet, exhibiting a number of gold-bearing leads, at a depth of 110 feet from the surface; the quartz mined from the two now worked yielding a handsome profit; with larger crushing power the property would be in a position to profitably employ more men than it has ever been able to do before.

The Montreal gold mining association have been chiefly employed in operations of an exploratory character, by sinking trial shafts on several lodes preparatory to locating permanent works. The results of the explorations, as reported by the manager, Mr. W. M. Robinson, are of a very satisfactory character.

The operations of the Central, Prince of Wales, Brunswick, Queens, West Lake and Toronto Co.'s, during the year, were limited in extent, and chiefly of an exploratory character.

INSPECTOR'S REPORT.

The operations in this largely developed district have not been to that extent which might have been expected from the number of mines and the length of lodes opened. Several of the mines have been worked only a short period during the year, and mining has not yet been resumed in them.

The Mount Uniacke Co.'s operations have been chiefly on the lodes worked last year, the central shaft being now 230 feet deep, and the east one 200 feet. The lode has been stoped to these depths. The lode that was cut by the cross tunnel out of the central shaft has also been mined, the stoping having been extended 20 feet on each side of the shaft sunk on this lode. This shaft is being sunk deeper. The cross tunnel has been driven into the south lode, and a tunnel is in course of driving to the west in that lode.

Several lodes have been opened by the Montreal Co., by shafts varying in depths from 12 to 40 feet, in each of which the lode has been stoped a short distance on each side. These operations have been of a prospecting character, and made for the purpose of developing the property.

The only mining done by the Uniacke Central Co. has been on the north lode, on which a shaft was sunk last year. A tunnel has been driven from this shaft about 100 feet to the west, and another shaft has been sunk on the same lode 20 feet.

The operations of the Prince of Wales Co. have been on the Lumar lode, on which three shafts have been sunk, the east one being 25 feet, the middle 32 feet, and the west one 20 feet. Out of the east shaft a tunnel has been driven to the east 25 feet, and the lode stoped to within 8 feet of the surface. A similar extent of stoping has been done on the west side of the shaft. A tunnel has also been driven to the west from the middle shaft.

The Brunswick Co. have recently begun two shafts on the lode opened last year. On this lode a shaft was sunk 47 feet, and the two in course of sinking are situated to the east of it. No other work has been done during the year.

On the Queen Co.'s property the operations consist of the sinking of the east shafts on the Lumar lode to a depth of 30 feet, the lode being stoped between, and the commencement of other three shafts on the Hall lode. One of these is situated about 150 feet to the east of the last shaft, and is 15 feet deep. The other two are on the west of the west shaft.

The Westlake Co. have sunk their east shaft a few feet deeper, and extended the stoping in connection with it. Shafts have also been begun on other parts of the property. One of these is on a lode 140 feet north of the lode first

opened, and is 20 feet deep. On each side of the shaft an open cutting has been made 15 feet in length and 8 feet deep.

Shafts have also been sunk on this property, formerly held by Mr. Burkner, and now owned by the Toronto Co.; and by Messrs. Bain & Co. on their property. Operations on these are at present, however, suspended."

YEAR 1870.

The Uniacke Union is the only mine that has been kept continuously at work, and has returned 1631 tons crushed, yielding 591 oz. 13 dwts., of gold, the whole returns being 1794 tons crushed, yielding 566 oz. 14 dwts., 5 grs. There has, perhaps, been no district so much injured by the speculating mania of 1867 and 1868 as this one. Properties that were of moderate size were cut up into two or three, and sold to speculators. In some cases crushers were built, not with the expectation of mining, but to sell stock. The result has been litigation, disappointment in making sales, and stoppage of the works, not because the mines would not pay, for on several of them there was sufficient work done to prove them valuable. In fact, it is not considered by those best acquainted with the district, that the Uniacke Union mine is by any means the best. The returns from this district have been—

	Tons.	Oz.	Dwts.	Grs.
1867	1212	947	01	17
3 months 1867	784	748	08	12
1868 ..	3875	3247	03	17
1869	3171	1867	03	12
1870	1794	566	14	05
	10836	7376	11	15

INSPECTOR'S REPORT.

Few of the mines in this district have been worked during the year, the Uniacke Company being almost alone in the regularity of their operations. These have consisted of the usual sinking and stoping on the lodes worked last year. The Queen Company have also taken out a few tons of quartz; and the Westlake Company have recently resumed operations.

GOLD RETURNS of the different properties at Mount Uniacke.

Owners.	Nos. of Areas.	Date of Returns.	Tons.	Cwts.	Ounces.	Dts.	Grains.
UNIACKE G. M. Co.	McClure Property, Leases 3 and 4. 121 areas.	Dec., '66..	20	..	20	..	..
		March, '67..	148	..	123	12	..
		Sept., '67..	271	10	163	4	..
		Dec., '67..	405	..	259	17	12
		March, '68..	290	..	432	..	..
		June, '68..	253	..	398	15	12
		Sept., '68..	490	..	345	6	..
		Dec., '68..	550	..	300	7	6
		March, '69..	424	..	356	15	..
		June, '69..	563	..	357	1	..
		Sept., '69..	569	..	284	5	..
		Dec., '69..	150	..	138	10	..
		March, '70..	321	10	125	13	..
		June, '70..	370	..	105	10	..
		Sept., '70..	545	..	170	5	..
		Dec., '70..	395	..	100	5	..
			5765	00	3385	6	6
WESTLAKE Co.	778 to 782, 811 to 815, 846 to 848, 879 to 881, 912 to 914, 945 to 947, 978 to 980. Block one.	Sept., '67..	19	..	30	9	..
		Dec., '67..	34	..	51	4	20
		March, '68..	243	..	652	10	6
		Sept., '68..	40	..	19	11	..
		Dec., '68..	590	..	116	18	..
			926	..	870	5	2
IMPERIAL Co.	580 to 584, 613 to 617, 646 to 650, 679 to 683, 712 to 716, 745 to 749; Block one.	Dec., '68	50	..	111	..	..
			50	..	111	..	..

GOLD RETURNS, *Mount Uniacke*—Continued.

Owners.	No., of Areas.	Date of Returns.	Tons.	Cwts.	Ounces.	Dwts.	Grains.
BRUNSWICK G. M. Co.	213 to 218, 246 to	Sept., '68..	7	..	1	2	11
	251, 279 to 284,	Dec., '68..	29	15	4	1	9
	312 to 317, 345 to	March, '69..	16	..	..	9	18
	350. Block Two	Dec., '69..	8	..	2	5	10
		March, '70..	3	..	..	15	12
			63	15	8	14	12
UNIACKE UNION G. M. Co.	455, 456, 488, 489,	Sept., '67..	38	10	51	8	5
	521, 522, 554, and	Dec., '67..	175	..	168	11	..
	555. Block two.	Sept., '68..	27	5	29	14	18
			240	15	249	13	23
THE QUEEN G. M. Co.	21, 22, 23, 54, 55,	June, '67..	17	5	21	12	..
	56, 87, 88, 89, 120,	Sept., '67..	50	..	52	1	..
	121, 122, 153, 154,	Dec., '67..	41	..	32	3	10
	155, 186, 187, 188,	March, '68..	11	..	28	11	..
	219, 220, 221.	June, '68..	102	10	168	4	..
	Block two.	Sept., '68..	15	7½	59	9	..
		Dec., '68..	497	10	280	..	10
		March, '69..	237	5	71	1	7
		June, '69..	22	..	17	9	4
		Sept., '69..	55	15	17	12	5
		Dec., '69..	5	..	..	6	12
		March, '70..	6	10	2	13	4
		Sept., '70..	3	..	2	8	6
			1064	2½	572	19	10
CENTRAL G. M. Co.	417, 418, 450, 457,	June, '68..	2	10	2	11	..
	483, 484, 516, 517,	Sept., '68..	23	1	35	3	..
	549, 550, 582, 583.	Dec., '68..	43	18	29	5	23
	Block two.	March, '69..	63	10	58	18	15
		June, '69..	28	13	42	1	..
		Sept., '69..	28	..	34	16	22
			189	12	202	16	12

GOLD RETURNS, *Mount Uniacke*—Continued.

OWNERS.	Nos. of Areas.	Date of Returns.	Tons.	Cwts.	Ounces.	Dwts.	Grains.
MONTREAL M Co.	615 to 617, 648 to	Sept., '67..	135 ..		127	11 ..	
	650, 681 to 683,	Dec., '67..	175 5		188	2 11	
	714 to 716, 747 to	March, '68.	68 16		61	14 ..	
	749, 780 to 782,	June, '68..	99 ..		43	5 ..	
	813 to 815.	Sept., '68..	82 ..		30	5 ..	
	Block two.	Dec., '68..	49 ..		19	...	
		March, '69.	231 ..		93	6 ..	
		June, '69..	391 ..		113	16 20	
		Sept., '69..	209 5		131	6 17	
		Dec., '69..	99 ..		45	18 8	
		March, '70.	75 ..		33	...	
			1590	6	887	5 8	
PRINCE OF WALES M. Co.	252, 253, 285, 286,	Sept., '67..	4 10		1	2 4	
	318, 319, 357, 352,	Dec., '67..	5 ..		13	14	
	385, 386. Block	March, '68.	29 ..		3	28 20	
	two,	Sept., '69..	31 10		11	9 2	
			70	00	16	16 16	
ST. LAWRENCE G. M. Co.	256 to 259, 289 to						
	292, 322 to 325,						
	355 to 358, 388	Sept., '68..	21 5		47	17 5	
	to 391, 419 to	March, '69.	8 10		13	11 10	
	424, 452 to 453,	Sept., '69..	14 10		14	9 ..	
	485, 486, 518,						
	519, 551, 552,		44 5		75	17 15	
	584, 485. Blk 2.]						
ALPHA Co.	68 Areas.	Dec., '66..	8 10		52	16 9	
		March, '67.	2 1		10	18 18	
		June, '67..	18 ..		16	17 13	
		June, '68..	6 9		6	5	
		Sept., '68..	15 5		6	9 18	
			59	5	86	17 9	

GOLD RETURNS, *Mount Uniacke*—Continued.

Owners.	Nos. of Acre.	Date of Returns.	Tons.	Cwts.	Ounces.	Dwt.	Grains.
L. D. Oakes	618, 619, 651, 652, 684, 685. Blk. 2.	Dec., '69..	8 ..		3 5 ..		
		June, '70..	27 ..		11 16 2		
			35 ..		15 1 2		
Jno. Donll, et al.	15 to 20, 48 to 53, 81 to 86, 114 to 119, 147 to 152, 180 to 185, Blk. 2. 840 to 845, 873 to 878, 906 to 911, 939 to 944, 972 to 977. Block 1.	Sept., '68..	4 10 ..		7 4		
		June, '70..	5 ..		11 17 10		
			9 10		2 4 14		
W. H. Mal- ing.	816 to 818, 879 to 881, 912 to 914, 945 to 947, 978 to 980. Block 2. 21 to 23, 54 to 56, 87 to 89. Block three.	March, '67..	4 ..		3 2 10		
		Sept., '67..	40 ..		8 16 ..		
			44 ..		11 18 10		
C. Blois.	181 to 188, 217 to 221, 250 to 254, 283 to 287.	June, '68..	1 10 ..		13 8		
			1 10 ..		13 8		
L. Barkner.	553, 586, 587. Block two.	Dec., '67..	48 ..		5 18 ..		
			48 ..		5 18 ..		
D. Touquoy.	624, 625, 656, 657, 690, 691. Block 2.	Dec., '68..	10 ..		5 2 ..		
		March, '69.	7 10		7 1 18		
			17 10		12 3 18		

3.—DESCRIPTION OF THE DISTRICT.

This district is situated on the dividing ridge which separates the waters flowing into the Atlantic from those which seek the Bay of Fundy. A low and narrow water parting separates Coxcomb Lake, the source of the Meander River, from a swamp whose waters flowing southerly form part of the head waters of the Sackville River, which empty into Bedford Basin. At the head of Coxcomb Lake, a low ridge of sandstone not more than one hundred feet broad, divides the waters which flow into the Meander from those which empty into the Uniake Lakes and reach the Atlantic at Margaret's Bay. Hence, part of the village occupies the summit level between the Atlantic and the Bay of Fundy, and is 480 feet above high tide in Bedford Basin.

The summit plateau is about three miles broad on a north and south course and is diversified with numerous lakes and hills, some of the latter near the Mount Uniake station having an elevation of about 200 feet above the general surface of the country or seven hundred feet above the sea.

A mile and a quarter from the outlet of Coxcomb Lake, which is the main source of the Meander River, the country begins to descend in a very gentle but uniform manner towards the Bay of Fundy, while towards the south the descent of the Sackville River is very gentle and uniform until a second and lower plateau occupied by McCabe, Webber's and other lakes is reached. This plateau is about two miles broad, and is two hundred and forty feet above high tide in Bedford Basin. It is on this easterly extension of the plateau that the Waverley gold district is situated.

The following section, from Windsor to Bedford Basin up the valley of the Meander River and down the valley of the Sackville River, will be of interest for reference.*

* From a survey of a route for the proposed Halifax and Windsor Railroad for the Provincial Government by George Wightman.

VERTICAL SECTION FROM WINDSOR TO BEDFORD, THROUGH MOUNT
UNION & GOLD FIELD.

Name of place.	Distance from Windsor.	Height above High Tide at Bedford Basin.	REMARKS.
	MILES.	FEET.	
Meander River....	6	18	
"	7	27	
"	8	47	
"	9	66	
"	10	86	
"	11	125	
"	12	166	Parker's Mill.
"	13	205	
"	14	260	
"	15	295	
"	16	360	Rawdon road, from Lakelands.
"	17	406	
"	18	435	Dimock's Mill.
"	19	438	
Coxcomb Lake....	20	447	Coxcomb Lake.
	21	447	Coxcomb Lake.
Dividing Ridge....	21½	465	Summit.
Sackville River....	22	440	Sackville River.
"	23	422	Old Mill.
"	24	415	
"	25	406	
"	26	400	
"	27	374	Crossing Windsor Road.
"	27½	374	
"	28	355	Lewis' Mill.
"	29	340	
"	30	276	
"	31	258	McCabe's Lake.
"	32	235	McCabe's Mill.
"	33	235	Above Webber's Mill.
"	34	235	
"	35	135	
"	36	75	
"	37	40	
"	38	14	
"	39	8	
"	40	0	High Tide Bedford Basin.

4.—STRUCTURE OF THE ROCKS OF THE DISTRICT.

Mount Uniacke gold district forms part of the denuded crest of an anticlinal fold. The general dip of the rocks on the south side of the axis is nearly vertical; on the north side it is at an angle of about 65 degrees.

A great dislocation, running north and south through Coxcomb Lake separates the district into two parts. The extent of the movement is not less than eight hundred feet; the axis of the anticlinal west of the head of Coxcomb Lake being 800 feet south of the axis east of the lake. Small faults are here and there to be met with, and local tiltings of the strata, but compared with some other districts in Nova Scotia, Mount Uniacke presents a comparatively uniform structure.

The axis of the anticlinal has a general but slightly undulating course nearly parallel with the area lines (N. 80 E.) on the east side of the great dislocation; on the west side it curves very gradually to the north.

The most distinguishing feature in the district is an immense band of sandstone about 380 feet in thickness, well seen near Coxcomb lake. This broad belt of sandstone is very coarse, almost a grit, and is composed of grains of quartz and sandstone of the size of a mustard seed, and even larger. Among the quartz grains are many of a delicate blue colour and semi-transparent. The coarse beds at the bottom of the mass are succeeded by other beds of similar material, but of finer grain, and these continue increasing in fineness until the summit beds become of a very uniform and fine grained character. The upper beds split easily into rhombic forms, with smooth and level surfaces, of bluish gray colour and weathering white. Above this great band of sandstone there are other very thick beds of the same material, with but few and comparatively insignificant bands of slate. Very little gold has been found above the great band of sandstone, and by far the larger proportion of the mining operations in the district have been carried on in the strata below the thick sandstone belt.

The following section was carefully made across the strata, and from it an idea may be gathered of the enormous thickness of the sandstone (locally called quartzite and whin) in this district.

5. SECTION ACROSS THE ANTICLINAL AT MOUNT UNIACKE.

In this vicinity, and west of Coxcomb Lake, the strata are exposed over wide areas, and where drift or vegetable deposits cover the rocks, their depth is so small that they may be easily removed. An extensive series of explorations was conducted here in 1869 by the late Mr. August Michel, a gentleman who had been for many years engaged in gold mining in South America, and who was subsequently connected with the Geological Survey of Canada under Sir Wm. Logan, F. R. S.

Mr. Michel's explorations in this part of Mount Uniacke district were conducted with the skill, fidelity, and uncompromising truthfulness which all who had the pleasure of that gentleman's acquaintance know to be inseparable from the accomplishment of every work which he undertook.

The trenches which he caused to be excavated to expose the bedding, extended in the aggregate three thousand feet at right angles to the strike of the rocks. There were two sets of main trenches, two thousand one hundred feet apart, one set, the most westerly, being 3000 feet in length, the other set, 2800 feet long. Besides these, there were numerous other trenches excavated on a zone of auriferous rock to be afterwards described: the entire length of the trenches being eleven thousand three hundred feet, involving the removal of 33,900 cubic feet of earth. Rectangular excavations were sunk on the lodes exposed by the trenches to the number of 61, and varying in depth from five to eighteen feet. The total quantity of rock raised from these pits amounted to 12,705 cubic feet.

The following section is exposed by the easterly line of trenches and excavated pits, commencing on the north side of area 282, block 12, and continuing to area 293, block 12, a distance of 3000 feet.

SECTION ACROSS TWO THOUSAND SEVEN HUNDRED FEET OF STRATA
AT MOUNT UNIACKE.

BLOCK XII.		Distance fr in North line of area 249.	No. of Lode.
Felspathic Sandstone, locally called whin.	Feet.		
Dip 47 degrees N.....	42	I.*	
Felspathic sandstone, with bands of mica- ceous slate....	32		
Slate with thin seams of sandstone.....	8		
Felspathic sandstone.....	29		
Slate.....	13		
Sandstone.....	7		
Slate.....	4		
Sandstone.....	15	II.*	
Sandstone with bands of slate.....	15	III.* & IV.	
Sandstone.....	11		
Slate (bluish).....	5		
Slaty sandstone holding a few slate pebbles.	24		
Micaceous slate.....	2 $\frac{1}{2}$		
Slaty sandstone.....	16	V.	
Micaceous slate.....	2 $\frac{1}{2}$	VI.* & VII.	
Slaty sandstone—ripple marked dip 71 deg. North.....	5		
Quartzose slate.....	20	{ VIII., dip 64 N.	
Slate with thin seam of sandstone.....	6		IX.
ANTICLINAL AXIS in band of sandstone—dip N. and S. A thin dark colored seam on each side of the anticlinal.....	31	{ X.,* dip 73 S.	
Quartzose slate with bands of slate.....	42		
Slaty sandstone with bands of slate.....	19	XI.	
Slate.....	1		
Sandstone.....	8 $\frac{1}{2}$		
Slate.....	1 $\frac{1}{4}$	XII.*	
Sandstone.....	2 $\frac{1}{2}$		
Slate.....	13		
Sandstone.....	29		
Slate.....	7		
Sandstone.....	9		
Slate with thin bands of sandstone....	34		
Sandstone.....	31		
Slate ...	38 $\frac{1}{2}$	XIII.*	

NOTE.—The Lodes marked with an asterisk were found to be gold bearing on analysis.

Section, Mount Uniacke—Continued.

BLOCK XII.		Distance from North line of area 249. Feet.	No. of Lode.
Sandstone.....	18	XIV.	
Slate.....	16		
Sandstone.....	4		
Slate with bands of sandstone—dip vertical.	6	XV.	
Sandstone with thin bands of slate.....	13	{ XVI and XVII.	
Sandstone with bands of slate.....	34	XVIII.	
Sandstone with slate band.....	11	XIX.*	
Sandstone with slate band.....	8	XX, XXI.*	
Quartzose slate ...	13		
Sandstone	18		
Quartzose slate	20	XXI,* bis.	
Sandstone with thin seams of slate—dip vertical.....	14	XXII.*	
Sandstone with bands of slate.....	36	{ XXIII,* XXIV., XXV.* and XXVI.*	
Sandstone with bands of slate.....	25		
Arsenical pyrites abundant in lodes from XXI bis to XXVII.	17	XXVII.	
Sandstone with bands of slate	29	XXVIII.	
Disturbed strata—sandstone with bands of slate	32		
Sandstone	12	XXIX.*	
Slate.....	20		
Sandstone with bands of slate.....	28	XXX and	
Sandstone with bands of slate.....	32	XXXI.	
Twisted and contorted slates with bands of carbonate of lime.....	42	XXXII.bis.	
Bands of slate very much twisted.....	23	XXXII.	
Sandstone and band of slate.....	58		
Sandstone with a few bands of slate.....	380		
GREAT BELT OF SANDSTONE.....			

This belt is a grit at the base, then a coarse sandstone, gradually becoming finer on approaching the summit. The upper portion is a very fine sandstone. The entire thickness is three hundred and eighty feet. Its dip appears to be vertical.

Section, Mount Uniacke--Continued.

BLOCK XII.		Distance from North line of area 24.	No. of Leads.
Sandstone, with thin bands of very dark coloured slate.....	20	XXXV and XXXVI.	
Sandstone, with two or three bands of slate 6 inches to one foot.....	100		
Sandstone	33		
Slate.....	1½	XXXVII.	
Sandstone with a few bands of slate 1 foot to 2 feet broad—dip S., angle 86.....	98	XXXVIII.	
Sandstone	23		
Twisted slate..	2		
Sandstone—vertical.....	62	XXXIX.	
Sandstone.....	18		
Sandstone with bands of slate.....	84	XL.	
Sandstone with a thin band of slate.....	37	XLII.	
Sandstone with a thin band of slate.....	33	XLIII.	
Sandstone with a few bands of slate from 6 inches to 1 foot.....	91	XLIV.	
Sandstone with a band of slate.....	21		
Sandstone with two bands of slate.	48		
Slate with a thin band of sandstone.....	18		
Sandstone with one thin band of slate in the middle—dip vertical	103	XLV.	
Slate.....	4		
Sandstone.....	7		
Slate.....	6	XLV. B.	
Slate with a few thin bands of sandstone...	55		
Sandstone with a few bands of slate, 6 ins. to 1 foot in thickness.	251		
Sandstone with a few bands of slate.	141	XLVII.	
Sandstone with a few thin seams of slate...	78	XLVIII. <i>bis</i>	
Sandstone with a few bands of slate—dip N., angle 85 degrees.....	280	XLVIII.	

In examining this section one cannot fail to be struck with the following peculiarities. 1st. The large proportion of slate and consequently of fine sediments in the lower portion of the strata; 2nd. The enormous preponderance of arenaceous materials in the upper portion; 3rd. The practical limitation of the gold to an auriferous zone 730 feet thick.

When tabulated these results appear as follows:—

Total thickness of strata in the section...	2740 feet.
Thickness of lower portion in which slate predominates and where auriferous lodes occur—THE AURIFEROUS ZONE	730 "
Thickness of barren sandstone belt.....	380 "
Thickness of barren zone in which sandstone greatly prevails with a few lodes not found to be auriferous	1630 "

6.--M. AUGUST MICHEL'S DESCRIPTION OF THE LODES.

The following description of the lodes exposed in the trenches opened under the direction of Mr. Michel, is from the pen of that gentleman.

"The number of lodes exposed by the principal trench in block twelve is fifty-three. Several of these lodes have been met with in the other trenches, and particularly in those in block eleven. It is not probable that these lodes, numbered from north to south, constitute the total of those which traverse the areas, for experience proves that all do not crop out from the bed-rock. The general course of all the lodes is east and west. The lodes incline either to the north or the south, or are nearly vertical, according to their relative position to the line of upheaval or anticlinal. Few of those lodes are absolutely encased in quartzite, schist constituting one of the walls of the most part. The width of the lodes met with by trenching, varies from one inch to more than two feet: but, in different parts, there are outcrops of quartz much wider. Some of the lodes, very near to one another, constitute groups or clusters of lodes.

The crys. line quartz, sometimes milky-white, sometimes bluish, the latter being often laminated, fills the greater part of the lodes, and generally the widest: while arsenical iron pyrites, or mispickel, is, at the outcrop, the mineral of the narrower lodes. Certain quartz lodes appear to the sight almost entirely destitute of foreign matter, while others contain metallic sulphides, such as cubical iron-pyrites, often decomposed, mispickel and, sometimes, blende, galena, and copper pyrites. I have observed in the selvages of some lodes, a blackish earthy substance which appeared to me to be the oxyd of manganese.

A great irregularity of formation and of structure characterises generally the lodes in the area under review. One sees lodes hardly impregnated with arsenical iron-pyrites at the outcrop, in narrowing in depth, become converted into veinlets of pure mispickel. Such lodes measuring several inches at their outcrop, are reduced to a mere thread at a few

feet in depth, while others are subject to successive and sudden contractions and swellings. But the most extraordinary case of irregularity, is that of the lodes which assumes curiously twisted shapes by branching sometimes to the north, sometimes to the south. The constancy of formation and structure, that is to say, the regularity of the deposits, has been, so far, the rarest case with the lodes in these areas: but experience has demonstrated in many localities, that the disorders which I have described often disappear at a certain depth.

Visible gold has only been found in one of the lodes, in which were observed some fine grains in several pieces from the outcrop. Mechanical assays, at different times, with about thirty pounds of the same ore, powdered to the fineness obtained in the mills, also produced grains of gold in the residue of the washings.

I have sent to Dr. Dana Hayes, State Assayer, in Boston, in three parcels, sixty-five specimens obtained from as many lodes. Of sixty-five specimens assayed, Dr. Dana Hayes has confirmed the gold tenor of nineteen, ten of which of exploitable value.

In casting one's eye over the plan accompanying this Report, one will see that, according to the results of the assays of Dr. Dana Hayes, all the auriferous lodes are situated north of the band of quartzite of a width of 380 feet, which crosses the areas longitudinally. These lodes are alike situated in the zone of the rich lodes of the district, and are evidently the prolongation of the same."

Description of the Lodes from which a specimen has been submitted to Assay by Dr. Dana Hayes.

By AUGUST MICHEL.

No. of Lode.	Dip.	Thickness at outcrop.	Gold yield per ton, according to Assay of Dr. Dana Hayes.	REMARKS.
BLOCK XII.				
1	EtoW N.	14 ins.	Gold, 19 dwt. 14 gr. = \$20.23.	Irregular lode, branching sometimes to the north, sometimes to the south. Measures 8 inches at the depth of 12 feet, and almost disappears at that of eighteen feet.
1a	"	"	18 Neither gold nor silver.	This lode is a mixture of quartz and slate. After a contraction, it measures the first thickness at the depth of five feet.
2	"	"	2 Gold, 1 oz. 2 dwt. = \$22.73. Traces of silver.	This lode becomes reduced, at a depth of four feet, to a narrow thread.
3	"	"	7 Gold, 10 dwt. 1 gr. = \$10.51.	This lode contracts at the depth of five feet.
4	"	"	2 Neither gold nor silver.	Lode regular, and of uniform thickness.
5	"	"	1 Neither gold nor silver.	These two lodes have been examined from the same pit. They are very irregular in their mode of occurrence, and do not measure more than one or two inches at a depth of fifteen feet.
6	"	"	12 Gold, 1 oz. 4 dwt. 10 gr. = \$25.01. Traces of silver.	
7	"	"	3a1 Neither gold nor silver.	
8	"	"	8 Neither gold nor silver.	Lodes examined from the same pit; abound in mispickel; tolerably regular in their construction.
9	"	"	10 Neither gold nor silver.	
10	"	S.	2 Gold, 12 dwt. 7 gr. = \$12.70.	Of irregular construction, and reduced to half size at a depth of five feet.
11	"	Vert	6 Neither gold nor silver.	Irregular lode, divided in two by slate.
12	"	"	2 Gold, 3 dwt. = \$3.10.	Regular, and of even thickness.

Description of the Lodes—Continued.

No. of Lode.	Course.	Dip.	Thickness at outcrop.	Gold yield per ton, according to Assay of Dr. Dunn Hayes.	REMARKS.
BLOCK XII.					
13	E to W	N. Very slightly.	3	Neither gold nor silver.	Regular, and constant at the depth of five feet.
13a	"	Vert	1a5	Gold, 3 dwt. = \$6.10.	
14	"	S. Very slightly.	3	Neither gold nor silver.	Lode regular, and of even thickness to the depth of five feet.
15	"	"	2	" "	
16	"	Vert	5	" "	This lode widens to 12 inches at a depth of two feet; but at five feet depth it only measures one inch.
17	"	"	5	" "	Very close to No. 16, a single excavation having been dug on the two lodes; the same irregularity of structure as observed in No. 16.
18	"	S.	11	" "	Regular, and of even thickness.
19	"	Vert	7	Neither gold nor silver.	These two lodes, examined from one excavation, are sufficiently regular.
19a	"	"	2	Gold, 8 dwt. 16 gr. = \$8.95.	
20	"	"	1a5	Neither gold nor silver.	Lode regular, and eight inches in width at a depth of five feet.
21	"	"	2	Gold, 1 oz. 2 dwt. 1 gr. = \$22.77.	Very close to No. 20, to which it unites at the bottom of the excavation which served to examine the two lodes.
21a	"	S.	1a5	Gold, 1 oz. 6 dwt. 11 gr. = \$27.53.	This quartz lode is impregnated with arsenical iron pyrites at its outcrop. At the depth of eight feet the quartz disappears, and the lode, which only measures an inch at that depth, consists entirely of mispickel.
22	"	Vert	2	Gold, 17 dwt. 9 gr. = 17.95.	This lode is mostly composed of arsenical iron pyrites, and contracts at a depth of six feet.

Description of the Lodes—Continued.

No. of Lode	Course	Dip	Thickness at outcrop	Gold yield per ton, according to assay of Dr. Dana Hayes	REMARKS.
BLOCK XII.					
23	EtoW	Vert	5	Neither gold nor silver.	These four lodes, very close to each other, have been examined through one excavation of the length of fifteen feet. Their structure is regular, with the exception of No. 24, which disappears at the depth of five feet.
24	"	"	4	" "	
25	"	"	8	Gold, 8 dwt. 3 gr. = \$8.39.	
26	"	"	2	Gold, 7 dwt. 3 gr. = \$7.36.	
27	"	N.	3at1	Neither gold nor silver.	This lode is almost entirely filled at the outcrop with arsenical iron pyrites. At the depth of five feet the lode vanishes to a mere thread.
28	"	Vert	4a5	Gold, 12 dwt. 14 gr. = \$13.00.	The structure of this lode is irregular, at a depth of five feet it is only two inches wide.
29	"	"	2a3	Gold, 5 dwt. 9 gr. = \$5.55.	The structure of this lode is undulatory; it contracts at a depth of six feet and a half.
30	"	"	2a3	Gold, 3 dwt. = 3.10.	Structure irregular.
30a	"	"	2a3	Gold, 4 dwt. 8 gr. = \$4.48.	This lode does not appear on the surface of the bed rock; it was discovered under the quartzite at a depth of a foot and a half.
31	"	Undetectable	2a3	Neither gold nor silver.	Encased between contorted and dislocated rock, and of very irregular structure.
32	"	S.	4	" "	Regular, and of even width.
33	"	Undetectable	2a3	" "	Of irregular structure, and encased between contorted and dislocated rock. It contracts at a depth of six feet.
34	"	"	2a3	" "	Not examined, because it is supposed to be the continuation of No. 33.
35	"	Vert	1a3	" "	Of irregular and undulated structure.
36	"	"	3at4	" "	This lode, very near to the preceding one, was examined from the same excavation; it is quite irregular.

Description of the Lodes—Continued.

No. of Lode.	Course.	Dip.	Thickness at outcrop.	Gold yield per ton, according to assay of Dr. Dana Hayes.		REMARKS.
			Ins.			BLOCK XII.
37	EtoW	S.	1a2	Neither gold nor sil- ver.	Of irregular structure; con- tracts at a depth of five feet.	
38	"	Vert	1a2	"	"	"
39	"	"	3a1	"	"	This lode is regular, but con- tracts in its descent.
40	"	"	2a3	"	"	Tolerably regular; diminishes at the depth of $5\frac{1}{2}$ feet.
41	"	"	2	"	"	Regular in structure, and of even width at the depth of 5 feet.
42	"	"	3a4	"	"	Irregular, with contractions. Examined at the depth of 5 feet. Traces of copper ore.
43	"	"	8	"	"	Regular. Increases to the width of one foot at a depth of five feet. Traces of copper ore.
44	"	"	2a3	"	"	This lode disappears at a depth of three feet.
45	"	N.	2a3	"	"	Very irregular. Measures only 1 inch at the depth of 5 feet.
45a	"	Vert	5a1	"	"	Not very regular. Does not measure more than two or three ins. at a depth of 5 feet.
46	"	"	6a7	"	"	Hardly any trace of this lode at a depth of 5 feet.
47	"	"	2	"	"	Irregular lode, disappearing at the depth of five feet.
48	"	"	1	"	"	Tolerably regular; contracts at a depth of five feet.
A	"	"	1	Gold, 12 dwt. 2 gr. \$12.18.	Irregular lode, subject to swells. It only measures one inch at a depth of fourteen feet.	
B	"	"	8a9	Neither gold nor sil- ver.	Very close to the south of pre- ceding lode; almost disap- pears at a depth of 14 feet.	
C	"	S.	2	"	"	See description of lode No. 40, from which came this specimen.
D	"	Vert	15	"	"	Regular, and appears to pre- serve its width in descent.
E	"	"	17	"	"	Regular, and of even thickness.

Description of the Lodes--Continued.

No. of Lode.	Course.	Dip.	Thickness at outcrop.	Gold yield per ton, according to the assay of Dr. Dana Hayes.	REMARKS.
BLOCK XI.					
1	EtoW	Vertical	Ins.	Neither gold nor silver,	} Regular, and of equal width.
6	"	"	3	"	
7	"	"	6 or 7	"	"
10	"	"	9 or 10	"	"
14	"	"	8 or 9	"	"
25	"	"	8	"	"
26	"	"	30	"	"
28	"	"	8	"	"
29	"	N.	9	"	"

} Regular, and of equal width.

Tolerably regular; contains much mispickel; contracts at a depth of seven feet.

Irregular and contracting in descent; contains mispickel.

Lode irregular, and contracting in depth.

This lode is of singular irregularity, in this sense, that it becomes almost horizontal at a depth of two feet, to disappear in the northern wall.

Very irregular, and almost disappears at the depth of four feet.

Lode regular, and of tolerably even thickness.

Lode irregular, almost disappearing at the depth of four feet.

Very regular in structure, and of even thickness.

7.—SECTION ACROSS THE WEST LAKE AND HAMILTON
PROPERTIES (AREA 775 TO AREA 782 BLOCK I.)

I am indebted to P. S. Hamilton, Esq., for the following information respecting the lodes in this portion of the district, the whole of the shaft at the time of my visits being filled with water.

The Westlake Lode attracted considerable attention in 1868, the returns from 243 tons of quartz, the product of 501 days work, showing a yield of 652 ounces 19 dwts. and 6 grains of gold or very nearly two and three-quarter ounces to the ton. The section described by Mr. Hamilton is 2500 feet in length, and it crosses the anticlinal in the neighborhood of some of the most productive lodes. The Westlake lode is apparently a lenticular shaped sheet of quartz much interseamed with slate. The gold streak appears to be about twenty feet in breadth, and dips easterly at an angle of seven degrees. Mr. Hamilton's suggestion that deeper mining would cut another gold streak, is probable from the well-known fact that the gold streaks or chimneys are generally several in number in any particular lode, and lie roughly parallel to one another.

"On the Westlake property I found, by cross trenching on the surface, nearly, but not quite its whole width, twelve quartz lodes, as nearly as I can remember. There may be others which were not discovered: for the "Westlake" lode, *par excellence*, on which we did most of our mining, although it cropped out at the surface of the ground when we commenced working, was entirely "capped over" by the quartzite on the surface within 200 feet from that first opening. On the adjoining "Imperial" ground I found a number of others distinct and different from those seen on the "Westlake." On the whole cross section represented by these two tracts I found, *on the surface rock*, from 20 to 30 lodes, varying in width when found at from two inches to six feet: but my examinations under ground, both on my own and other mines, lead me to believe that cross cutting at a depth would discover a much larger number of lodes. No trenching was ever done upon the Hamilton tract, but I there found the outcrop of 8 lodes, varying from eight inches to four feet in thickness. Of all these lodes, over the whole section of 2500 feet, there are only seven which have ever had powder put into them, and only one that has been worked to any noteworthy extent. All these seven showed gold at or near the surface, and gave good paying indications.

“Our works, over which I exercised a general supervision as long as they continued, were nearly restricted to the ‘big Westlake lode.’ This lode is seen on the third range of areas from the most southern line of the Westlake tract, and about fifty feet from the northern boundary of that range. This lode dips at a very high angle—about 82 degrees southwards. Another lode, about 150 feet further north, which has been opened to a depth of about fifteen feet only, dips nearly vertical, indicating that it is near the axis of the fold. The ‘big Westlake’ was excavated, and in great part removed for a distance along the lode of from 180 to 200 feet. The gallery thus excavated graduated in depth from about 20 feet at its western termination to about forty feet at the eastern terminus. This gradation indicates, as nearly as I can venture to state it, the direction and dip of the *rich streak*, although gold in some proportion seemed to pervade the whole lode. So far as worked, the rich streak had a vertical thickness of about twenty feet, but of course we know not what sinking to a greater depth would reveal. My theory, founded on experience elsewhere, is, that it would lead to other parallel rich streaks. I may mention that a large proportion of slate is mixed with the quartz in this lode. It carried arsenical pyrites throughout in considerable, although not in large proportion, compared with many other lodes with which I am acquainted.”

CHAPTER VI.

OLDHAM GOLD DISTRICT.

HISTORY OF THE DISTRICT ABREVIATED FROM THE CHIEF COMMISSIONER'S REPORTS.

YEAR 1862.

"In the spring of 1861, when public attention throughout the province was excited by the confirmation of the report of the discovery of gold at Tangier, two men, Edward Horne, of Elmsdale, and Samuel Isner, of Gay's River, who had in their trouting excursions observed a large boulder of white granite in a densely wooded tract, about three miles east from the Truro road, determined to examine it, for the purpose of ascertaining whether it contained gold. Having procured the assistance of some friends, they proceeded to the spot and commenced operations, which resulted in finding some small sights; but as none of the party had ever seen gold in quartz before, they were doubtful as to whether what they saw was in reality the sought-for metal, until some time after, when examined by parties having experience in gold seeking, who pronounced it genuine. The report of the above parties' operations becoming public, several persons commenced prospecting in the neighborhood.

Amos Hough found gold, about the 1st of September, in a brook about a mile and a half south westerly from the first discovery; and at the same time it was found a mile east from Hough's diggings, by Edward McDonald and Donald McKenzie, who brought it to the notice of the government; and, after an investigation, the free claim was awarded to Isner and Horne.

During the winter of 1861-62 mining leases were applied for in the district. Areas were laid off, and on the 25th day of April, 1862, the commissioners gave formal possession to the applicants of the areas applied and paid for.

The auriferous leads of quartz in this district are not known by any distinctive names, but generally by the number of the principal areas through which they run. The leads which have proved to be gold bearing, are thus distinguished in the following table:

OLD DET

VINC THE O

SCALE..... 10000

ENFIELD STATION R. R.
PROV

PLAN OF C

SHOWING

Shubert's River

Hill's Brook

TO ENFIELD STATION
PROV

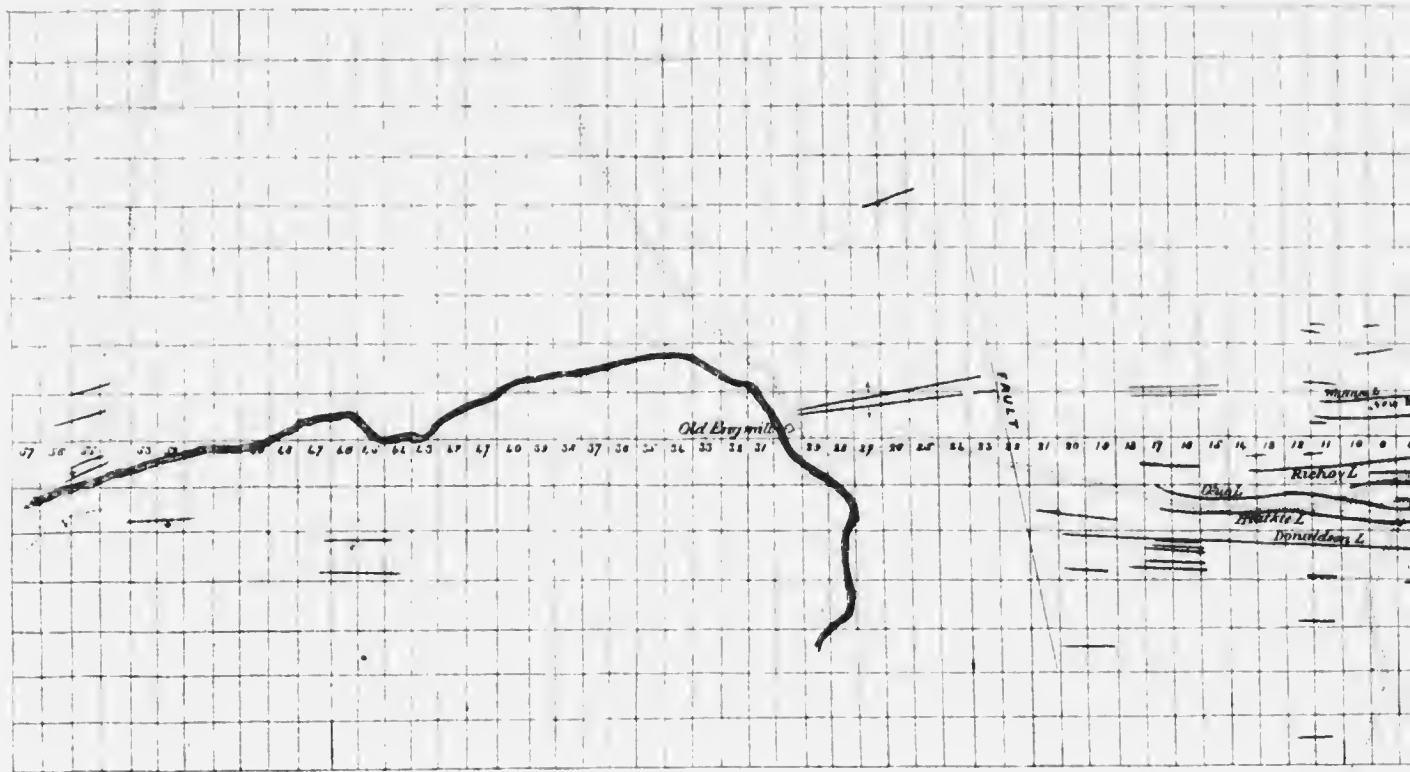


OF OLDHAM GOLD DISTRICT

SHOWING THE OUTCROP OF THE LODES

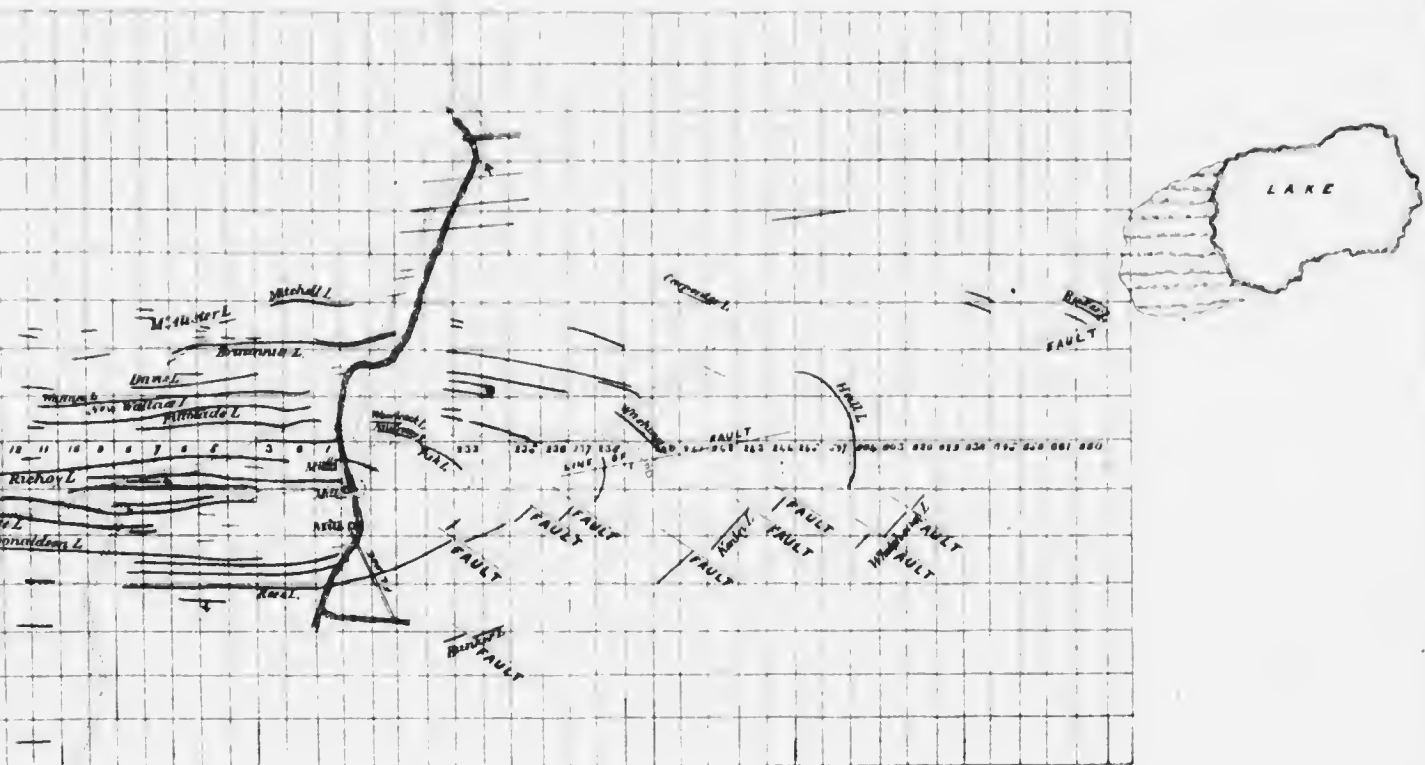
SCALE.... 1000 FEET TO ONE INCH

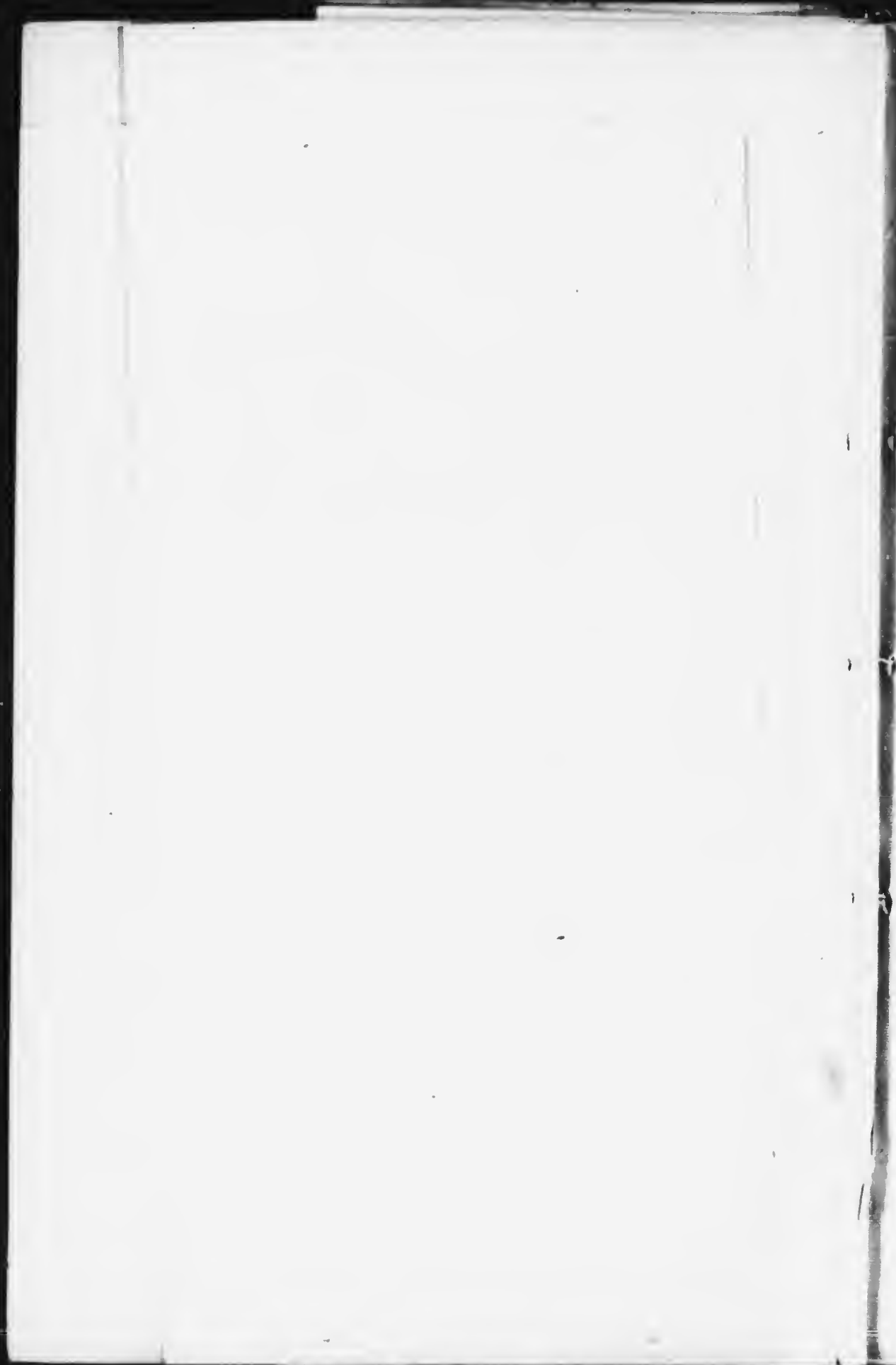
ROAD TO ELMSDALE



FROM GUYSBORO ROAD TO OLONAM

SLATE BELT





No. of Area through which the lead runs.	Thickness of the lead.	Depth of sinking.	Maximum yield per ton.	Average yield per ton.
No. 366	5 to 6 inches.	23 feet	0 oz. 19 dwts	0 oz. 11 dwts
" 1	2 leads ea. 12 in.	12 "	1 5	0 10
" 108	15 inches	6 "	Not known.	
" 113	9 "	11 "	"	
" 106	2 leads ea. 6 in.	8 "	"	
" 105	2 inches	23 "	1 oz. 11 dwts	1 5
" 117	6 to 10 inches	10 "	1 0	1 0
" 314	6 inches	8 "	1 10	1 0

By the foregoing statement it appears that mining in this district has as yet been conducted to a very limited extent, the deepest sinking being only twenty-three feet. The average yield is low; but it should be remarked that the richest quartz has invariably been obtained from the deepest part of the shafts.

The lead which passes through area 108 is perpendicular, and is probably in the vicinity of an anticlinal axis, as the leads lying south of it dip about 80 degrees south, while those north have a northern dip, of about the same angle. The general course of the leads at Oldham is N. 82 degrees E.

The "Barrel Lead," so called, on account of its waved or ribbed shape, and which runs through area 314, has the richest uniform yield, the lowest being 14 dwts, and the highest 1 oz. 10 dwts. to the ton. The deepest sinking on this lead is eighty feet. It varies in its course, and has a dip of 60 degrees N."

YEAR 1863.

"A great increase of activity has been plainly visible in this district since the commencement of the year. This is shown in the number of additional mining areas taken up, the increased amount of labor employed, of quartz mined and crushed, and of gold produced; but more than all by the preparations being made for more enlarged operations during the incoming year. During 1863 five crushing mills were wholly built, or completed, making eight in all now in working order in this district. From the scale of these preparations, and from the promising returns of the quartz lodes opened, it is to be reasonably expected that the current year will show a largely increased and profitable business in gold mining at Oldham."

YEAR 1861.

"Steady and satisfactory progress has also been made in this district, more quartz having been crushed, and more gold produced during the nine months of 1861, than the twelve months of 1863. I must here observe, however, that the long period of excessive drought which prevailed during the past summer and early part of autumn, and which materially retarded the crushing of quartz and the cleaning of gold, in nearly all the districts, most notably affected the operations in Oldham. One small lot of quartz crushed in this district, last spring, gave the largest maximum yield of gold that has yet been attained in Nova Scotia, being at the rate of no less than 103 oz. 11 dwts. per ton of quartz.

"Great improvements have been made during the summer, in the facilities of access to the Oldham mines from Enfield railway station. They amount, in fact, to the making of a new road for nearly the whole distance from Shubenacadie river to the centre of the district. I would strongly recommend the continuation of this road quite across the district to the "New Guysborough Road," so called. I am assured that the distance by a good and nearly level route, does not exceed four miles."

YEAR 1865.

"In Oldham, likewise, as will be seen on reference to the tabular statement in the appendix marked B, there has been an apparent general falling off in mining operations during the year, as compared with those of the last previous year; and this has been owing in a great degree to the cause just mentioned as having materially affected the returns from Renfrew. Yet the prospects of this district continue good, and the results of mining for the past year, as compared with those of 1864, show a large increase in the product of gold per man engaged in mining. A continuation of the Oldham road, across the district to the Guysborough road, so called, has been laid out since the date of my last report, and a part of the construction of the same has been effected, with a view, as I understand, to its early completion. The legislative appropriation for this object cannot fail to promote very materially the development of the unquestionably great mineral resources of the Oldham gold district."

YEAR 1866.

"Oldham is, just now, enduring one of those seasons of depression to which all our gold districts seem to be periodically subject, and which are usually owing to accidental and

temporary causes which it is needless for me in every instance to particularize in this report. The aggregate gold product of this district for 1866 shows a falling off in comparison with that of the preceding year; yet the average yield per ton of quartz and the average yield per man engaged in mining, are greater. These facts show that Oldham is, at all events, capable of sustaining its character as a productive gold field; and such are the mutations of popular feeling in the gold mining world, that it is quite within the bounds of possibility that in another year's time this district may be the most in vogue of any in the province."

INSPECTOR'S REPORT.

"The principal mining in this district is being done by the Boston and Oldham Company, who have sunk four shafts on a lode, the thickness of which is $4\frac{1}{2}$ inches. From their No. 2 shaft, the depth of which is 70 feet, the lode has been stoped to the west within 30 feet of the surface, and on the east side it has also been stoped various heights between the other shafts. At No. 4 shaft, 80 feet deep, it has been stoped to the east about 200 feet, at a depth from the surface of 65 to 70 feet.

The same company are working to the south of this lode, in the barrel-quartz district, so called. The operations are at present entirely superficial, and small in extent.

In the same district the lode is similarly worked in the adjoining claim by Mr. Lockhart; the lode is 5 inches thick."

YEAR 1867.

"Has never done so well as in the past year. The yield of gold was 1359 oz., giving four hundred and eighty-three dollars and eighty-eight cents (\$483 88) for each man per year; whilst in 1861 (the year of its largest yield) there was raised 1362 oz., only giving one hundred and eighty-eight dollars and fourteen cents (\$188 14) per man, and for 1866 the yield was 776 oz., giving three hundred and ninety-nine dollars and sixty-six cents (\$399 66) per man, this being the smallest yield of gold since 1862. From the above statement it may be fairly inferred that the periodical depression to which all are so liable has in this district passed; and I shall be surprised, indeed, if in a short time, Oldham does not take its place as a leading district."

INSPECTOR'S REPORT.

"In the Oldham district the principal mining has been by the Boston and Oldham Company, and Mr. Shaffer. By the

former their shaft has been sunk 57 feet further, and the stoping correspondingly extended. In June last operations were suspended, and have remained so since.

The Britannia lode has been mined to a small extent by Mr. Shaffer, who has also continued to work the barrel-quartz formation."

YEAR 1868.

"Operations are still carried on in this district in a small way, one mine only having been constantly worked for some time past. There has, however, been a new mine opened, which promises to be very profitable, and an increase of ore may be confidently expected from this locality. There is a large field for operations in this gold field, and a geological survey would, in my opinion, be of great benefit; considering the many openings that have been made, the work could be easily done, and with a great degree of accuracy."

INSPECTOR'S REPORT.

"This district has continued in comparative inaction during the greater part of the year, the principal operations having been carried on by Mr. Shaffer, by whom the barrel-quartz has been chiefly mined. Additional openings have been made, at one of which the lode has been mined to a depth of 70 feet from the surface, a length of working been carried down of about 120 feet; at the others it has been stoped to a depth of 40 feet. Openings have also recently been made near these operations by Mr. Burkner, who has begun three shafts. In addition to these, the Ohio lode, on which mining has not been carried on for some time, has within the last few months been re-opened by Messrs. Fraser and McBean, who have begun to work it on one of the old shafts, the depth of which is 50 feet. The same lode is also being sunk upon a little further to the west, by Mr. Donaldson."

YEAR 1869.

"In this district there has been quite an increase of business done by companies and individuals operating on what were abandoned mines. The principal part of the work done, and gold obtained, has been by the Sterling company, who have acquired several small properties formerly partially worked, and besides have recently obtained the 'Frankfort' property. Preparations are being made by the Sterling company to largely extend their works, machinery, &c.

Measures are also in progress to again open the Boston and Oldham mine, by a company recently formed.

The Ritchey and Fraser mine has been again reopened, and is now worked by Capt. Coxetter, by whom some remarkably rich rock has been raised, and the work carried on with vigor and success.

Mining has also been carried on on a small scale by Messrs. Oakes, Pearson, Donaldson, Fraser, Bayne, and Woodruffe. A small crusher, of two batteries, driven by water, has lately been erected, and on the whole the prospects of this district are more encouraging than for some time past."

INSPECTOR'S REPORT.

"The operations in this district have recently been extended by the reopening of some of the mines which have not been worked for some time. During the greater part of the year the principal mining has been carried on by the Sterling company. This company now own the property on which Mr. Shaffer worked the Barrel lode last year, and have continued operations on it. It has been worked by underground stoping to a depth of 230 feet in the main shaft, and about 180 feet in length. On the east side of this shaft the position of the lode is altered by a fault, by which it appears to be thrown to the south. A cross tunnel is in course of driving in this direction, at a depth of 108 feet in the shaft, and 36 feet on the east of it. This tunnel is now 140 feet in length; it has passed through several lodes, which, are, however, irregular in position. A short distance to the north of these operations the company have commenced to work the Frankfort lode, on which nothing has been done for some time. It was formerly mined to a depth of 40 feet, and about 150 feet in length. The shafts have been repaired, and the lode is being stoped along nearly the same distance. A steam engine is about to be erected in a position to allow of its being applied to hoist and pump at both these mines. The same company have also begun to work the Wallace lode, formerly opened on the English company's property. It had been mined to a depth of 70 feet and 150 feet in length, and nearly the same extent of stoping is being carried down. On the Ritchie lode also some mining was done during the year by this company, one of the old shafts on it having been sunk 20 feet further. Operations are, however, at present suspended.

Operations have within the last three months been resumed on the same lode in the adjoining property to the west by Mr. Coxetter, who has thoroughly repaired the shafts formerly sunk on it. The lode had been stoped from the surface to a depth of 75 feet. Since Mr. Coxetter commenced the central shaft has been sunk 75 feet further, and a length of stoping of about 150 feet has been worked.

East of the Sterling Co.'s operations, on the Barrel lode, a similarly formed lode has been mined by Mr. Shaffer, Mr. Macdonald and others. By the former it has been worked to a depth of 30 feet, and about 40 feet in length. On the adjoining area to the south, Mr. Macdonald has worked by underhand stoping from the surface to a depth of 80 feet, and about the same distance in length. Operations on a small scale have also been carried on in a lode of the same character further west.

The lodes on this part of the "diggings" bend round from an easterly to a northerly strike, and are on the south side and east end of an anticlinal, having a resemblance to that at Waverley, which Mr. Burkner's operations have so well developed.

Explorations in various parts of the district have been made by Messrs. Bunker and others, but no regular mining is being carried on. The Messrs. Fraser and McBain continued their operations for a short time on the lode re-opened by them last year; they are now, however, entirely suspended.

Considerably to the west of these last Mr. Donaldson has recently opened a lode on which a shaft has been sunk."

YEAR 1870.

"This district returns more gold in the past year than in any year previous, viz., 2644 tons of quartz crushed, yielding 2052 oz. gold. The mining in this district, with the exception of the Sterling and Oldham and Boston companies, have been by individual efforts, although the most expensive has been during the past year wonderfully successful. The Oldham and Boston have paid fair dividends. The Sterling, although a large sum of money was expended in a crusher, and opening up the works, has not as yet proved a success; this, I judge, was largely due to defect in amalgamating, as from a lode that had returned over an ounce to a ton before, and has returned since $1\frac{1}{2}$ oz. to the ton, 358 tons were crushed that only gave 182 oz. with a loss of 25 lbs. of quicksilver. From the Hall lode, which has been abandoned for some years, from the intervention of a fault, 116 oz. 13 dwts. was obtained from $1\frac{1}{2}$ tons quartz. There is no doubt as to the richness of the Oldham district, but while the appliances put into the hands of amalgamators are such (and they do not know any better than to work with them) as that 25 lbs. of quicksilver can be lost in crushing 358 tons, and that not known until the operation is completed, we must expect failures.

There are three crushers, two driven by water-power, and

owned, one by Mr. Robt. G. Fraser, and the other by the Oldham company; these are principally employed by the different small mines, of which, in this district, there are so many; the third is driven by steam-power, and is owned by the Sterling company.

The returns of gold from the district have been :—

		Tons.	Ozs.	Dwt.	Grs.
	1862.....	84	51	00	00
	1863.....	1025	1223	03	21
9 months	1864.....	1757	1362	15	08
	1865.....	2409	1242	06	21
	1866.....	964	776	12	04
	1867.....	959	1359	12	02
3 months	1867.....	220	192	07	01
	1868.....	1015	719	00	94
	1869.....	1735	1394	16	06
	1870.....	2644	2052	01	03
		12812	10373	14	16

INSPECTOR'S REPORT.

"The principal operations in this district have been those of the Sterling company, who continued for some time to work the lodes mined last year, and have also opened other adjoining them. On the Barrel lode the main shaft has been sunk to a depth of 255 feet, and the lode has been stoped underhand, to nearly the same depth. About 180 feet to the south of this shaft a vertical shaft has been sunk 118 feet, with which the tunnel that was being driven in the course of the fault on the east side of the main shaft has been connected. It is intended to cross-cut from this vertical shaft into the lode, and also to use it for pumping and hoisting, a steam engine and suitable apparatus for these purposes having been erected. Work has, however, been suspended during the last three months. Mining has also been carried on in the Frankfort lode, on which the shafts are 110 feet deep. A length of 400 feet has been worked on this lode by underhand stoping to various depths from the surface. The Blue lode lying north of the above, has also been partially mined.

West of these operations a shaft has been sunk 62 feet, and is intended for a main hoisting-shaft for the different lodes near it. From the bottom of the shaft a cross-cut has been driven south 38 feet, which, at about half the distance, cut the Sutherland lode. In this lode a tunnel has been driven 56 feet to the west of the cross-cut. West of the tunnel, a

shaft has been sunk 77 feet on the lode, and a tunnel driven further west 100 feet. No stoping has been begun, as it is proposed to connect this opening with the main shaft by a tunnel to the east, and to hoist the quartz in that shaft.

A cross-cut has also been driven 80 feet to the north from the bottom of the main shaft to the Harrison lode, the thickness of which varies from 12 to 20 inches. It has been opened by a tunnel from the cross-cut 170 feet in length, and is connected with a shaft 80 feet deep, at that distance, to the west of the cross-cut. Further west, about 200 feet, there is another shaft on this lode 45 feet deep, at which depth tunnels have been driven east and west, but no stoping has been begun. North of these shafts a lode, from 10 to 12 ins. thick, has been opened by a shaft to a depth of 77 feet, and stoped on each side a total distance of 172 feet being carried down. A cross-cut has also been driven from the bottom of the shaft 41 feet to the north, without, however, cutting any lode. Other lodes have been opened on this company's property, on which more or less work has been done. On most of them operations have lately been suspended in consequence of the ill-result of the crushing of a large quantity of quartz, which has been accumulated during the erection of a new crushing-mill, and the hoisting and pumping machinery. This is much to be regretted, as the property of the company is large, and has been extensively developed. There is, however, reason to believe that the deficiency in yield was due less to an actual falling off in that respect than to defective treatment in the mill.

Next in importance to the Sterling company's operations are those of the St. Andrew's company, who, in the early part of the year, re-opened the mine formerly worked by the Boston and Oldham company. The lode worked is known as the Symonds lode, and is about seven inches thick. There are three shafts on the lode. The central, or main shaft, has been sunk by the present company 90 feet, and is now 216 feet deep. The east shaft has been sunk 20 feet, and is now 170 feet, and the west one is about the same depth. The lode has been stoped from these depths to the surface between the shafts; and from a depth of 150 feet in the east and west shafts 40 feet in length has been stoped at the west end, and 30 feet at the east end, a length of underhand stoping being worked of 250 feet. A steam engine is applied to hoist and pump, and the general arrangements appear to be in good form. Other openings on lodes in this locality have been made by Donaldson and others, but the extent of work done is very limited."

OFFICIAL RETURNS of the yield of Gold from the Oldham District

Name of Co.	No. of Lease.	Tons.	Cwts.	Oz.	Dwts.	Grains.	Date.
NAPIER CO.	93	3	..	....	15	...	Dec., '63.
	54	1	...	....	5	14	{ June and Sept., '63.
	63	120	10	45	16	15	{ June and Sept., '63.
	90	39	..	172	10	..	Sept., '63.
	96	15	10	24	4	..	Sept., '63.
	93	3	....	..	10	....	Sept., '63.
	63	9	..	1	9	...	Dec., '63.
	7	7	4	2	9	6	Mar., '64.
	63	13	..	8	15	18	Mar., '64.
	24	100	19	29	18	8	Mar., '64.
	141	4	..	1	1	9	June, '64.
	24	69	16	33	10	...	June, '64.
	7	25	6	15	8	1	Dec., '64.
	24	21	..	4	12	..	Dec., '64.
	141	5	..	1	1	7	Mar., '65.
	176	7	15	1	..	..	Mar., '65.
93, 176 & 177	114	13	18	10	5	..	June, '65.
	24	58	....	11	6	23	June, '65.
	24	103	..	85	14	8	Sept., '65.
24, 141 & 143	125	10	56	15	19	19	Dec., '65.
	150	6	5	3	5	...	Mar., '66.
	204	16	2	3	12	....	June, '66.
	204	56	...	5	3	22	Sept., '66.
	254	146	...	22	16	3	Sept., '68.
	254	130	...	58	19	12	Mar., '69.
	254	170	....	56	15	..	June, '69.
	254	55	....	22	12	....	Sept., '69.
	254	260	...	56	16	7	Dec., '68.
	254	91	10	12	14	18	Mar., '70.
	254	164	3	32	18	12	June, '70.
	254	59	12	13	4	10	Sept., '70.
	254	144	14	20	19	9	Dec., '70.
		1299	6	309	16	21	Total.

GOLD RETURNS, *Oldham District*—Continued.

Name of Company.	No. of Lease.	Tons.	Cwts.	Oz.	Dwts.	Grains.	Date.
STERLING Co. . .	89	11	....	28	7	4	Sept., '63.
	89	20	....	20	15	....	Dec., '63.
	89	8	18	27	15	..	Mar., '64.
	88	14	8	....	7	21	Mar., '64.
	76	2	5	2	1	19	Mar., '64.
	76	3	19	4	1	7	June, '64.
	89	29	19	43	7	5	June, '64.
	29	65	10	30	2	2	June, '64.
	180	3	10	1	4	....	Sept., '64.
	76	5	15	6	5	10	Sept., '64.
	63, 299, 157, etc.	41	6	13	12	10	Sept., '64.
	89	175	....	83	12	....	Sept., '64.
	78, etc.	65	3	46	6	16	Sept., '64.
	89, 142	35	13	16	17	6	Dec., '64.
	76	2	10	2	7	16	Dec., '64.
	Area 101	2	15	1	12	6	Dec., '64.
	165	770	6	116	18	18	Mar., '65.
	165, 130, 102	259	7	30	2	4	June, '65.
	76	5	5	2	17	9	June, '65.
	1	10	17	5	10	8	Sept., '65.
	89, etc.	37	10	11	1	16	June, '66.
Areas 230, 258,	266, 267	6	...	....	13	12	Mar., '67.
" 258, 266, 267,	272 to 275	11	5	3	16	4	June, '67.
" 252, 253, 256,	288 to 291	37	8	24	19	4	Dec., '67.
	274	21	12	12	6	18	Dec., '67.
	274	17	....	23	4	..	Mar., '68.
Part of lease	234	26	1	22	7	12	Mar., '68.
From 40 areas	94	9	90	10	3	Mar., '69.	
	239	5	12	4	....	12	June, '69.
Part of 265	181	12	140	12	17	June, '69.	
234 & part 265,	240, 241	197	15	146	16	1	June, '69.
Leases 234, 239,	242, 265	151	14	159	4	7	Sept., '69.
	272	11	10	30	....	..	Dec., '69.
239, 240,	241, 242	48	9	15	13	4	Dec., '69.
	265	173	4	178	7	....	Dec., '69.
Strig Co's entire	property	173	..	169	19	21	Mar., '70.
	289	10	10	6	6	13	June, '70.
" " entire	property	350	.	178	2	10	Sept., '70.
		3087	8	1747	5	3	Total.

GOLD RETURNS, *Oldham District* — Continued.

Name of Co., or Owners.	No. of Lease.	Tons.	wts.	Oz.	Dwts.	Grains.	Date.
BRITANNIA C... At the time this property was work- ed it was owned by R. J. Fraser, Esq., of Halifax.	131	16	....	15	7	3	June, '63.
	131	23	10	27	14	10	Sept., '63.
	131	.	....	6	....	...	Dec., '63.
	131	2	10	7	3	5	Mar., '64.
	131	15	16	36	3	15	June, '64.
	131	27	....	81	17	4	Sept., '64.
	131	25	3	59	4	14	Dec., '64.
	131	9	1	65	8	....	Mar., '65.
	131 & 173	13	10	5	17	6	Sept., '65.
		132	10	304	15	9	Total.
Bayne & Fraser	90	33	....	134	...	....	Dec., '63.
	90	56	2	147	14	19	Mar., '64.
	90	92	2	171	3	23	Mar., '64.
	153	...	10	....	5	23	June, '64.
	153	.	10	..	5	10	Sept., '64.
	90	5	10	5	16	21	"
	10	1	10	5	....	...	"
	203	...	18	3	12	..	Dec., '66.
		190	2	467	19	...	Total.
	254	130	..	58	19	12	Mar., '69.
Richey & Fraser		130	...	58	19	12	Total.
	6	4	...	2	7	21	Sept., '63.
	6	10	..	5	5	....	Dec., '63.
	6	3	8	1	14	6	Mar., '64.
	6	44	16	48	7	3	June, '64.
	6	23	4½	12	8	22	Sept., '64.
	6	140, etc.	27	10	26	19	Dec., '64.
	Areas 8, 14, } 339, 352, }	355 & 358 {	73	10	123	7	June, '67.
			37	10	61	....	June, '69.
	Area 8	53	...	77	6	12	Sept., '69.
	245	184	...	139	11	...	Dec., '70.
	245	79	10	29	8	15	Mar., '70.
		440	8½	526	5	15	Total.

GOLD RETURNS, *Oldham District.*—Continued.

Name of Owner or Co.	No. of Lease.	Tons.	Cwts.	Oz.	Dwts.	Grains.	Date.
L. E. & W. D. Hall.	20	7	10	4	15	....	June, '63.
	118	2	.	1	8	...	Dec., '63.
	247	..	17	....	3	8	Mar., '64.
	248	5	15	2	3	3	June, '64.
	249	4	18	4	4	12	"
	250	2	15	5	14	14	"
	247	7	..	3	13	....	"
	118	2	10	1	6	18	"
	247	31	...	39	...	3	Sept., '64.
	118	3	10	2	1	15	"
	118, etc.	20	15	19	5	5	Dec., '64.
	246, 247. 248, 249	{ 2	15	1	15	18	Mar., '65.
		{ 4	10	4	....	4	June, '65.
		{ 1	.	.	11	20	Sept., '65.
	296	18	3	17	...	21	June, '69.
		91	3	88	15	8	Total.
McAllister.	103	1	6	...	16	....	Sept., '63.
	102	...	...	91	1	...	"
	102	...	...	33	5	..	Dec., '63.
	102	36	12	38	19	5	June, '64.
	102	20	...	35	12	10	Sept., '64.
	102	46	...	5	12	....	Dec., '64.
	299	2	13	13	14	10	June, '65.
	299	2	14	4	8	...	Sept., '65.
	299	11	16	35	11	....	Dec., '65.
	299	4	..	16	4	....	Mar., '66.
	299	17	.	13	1	....	June, '66.
	299	12	.	12	2	12	Dec., '67.
		154	1	300	6	13	Total.

GOLD RETURNS, *Oldham District*.—Continued.

Name of Owner or Co.	No. of Lease.	Tons.	Cwts.	Oz.	Dwts.	Grains.	Date.
J. B. Morel...	280	22	....	26	9	....	Dec., '63.
	280	6	16	2	7	6	June, '64.
	280	33	7	22	19	10	Sept., '64.
	280	18	....	19	7	4	Dec., '64.
	280	5	15	2	13	14	Mar., '65.
	280	11	5	2	17	5	Sept., '67.
		97	3	76	13	15	Total.
W. G. Pearson, Area	117	31	5	46	14	....	Sept., '63.
	117	10	...	7	5	6	Dec., '63.
	117	20	13	16	13	20	Mar., '64.
	117	23	2	24	10	8	June, '64.
	117	24	10	19	14	1	Sept., '64.
	117	4	16	7	4	7	Dec., '64.
	East side, 117	2	4	6	7	13	"
	East side, 117	2	...	3	7	...	Mar., '65.
	West side, 117	54	8	58	7	3	June, '65.
	East side, 117	35	14	22	17	8	Sept., '65.
	West side, 117	33		21	18	12	"
	117	14	17	4	13	18	Sept., '66.
	West side, 117	4	10	...	...	...	Sept., '67.
	East side, 117	9	10	10	11	12	"
		260	9	250	4	12	Total.
F. B. Donaldson.	278 & 279	1	16	2	18	...	Dec., '69.
	278 & 279	18	9	28	17	12	Mar., '70.
	278 & 279	42	....	54	10	..	Sept., '70.
	278 & 279	83	4	66	9	10	Dec., '70.
		145	9	152	14	22	Total.

GOLD RETURNS, *Oldham District*.—Continued.

Name of Owner or Co.	No. of Lease.	Tons.	Cwts.	Oz.	Dwts.	Grains.	Date.
OLDHAM & BOSTON Co., now St. Andrew's Mining Association.	59	3	10	1	10	12	Dec., '63.
	132	10	3	1	6	13	"
	134	8	6	...	15	13	"
	136	18	7	8	18	15	"
		40	6	12	11	5	Total.
Areas {	15	5	3	3	8	10	Mar., '64.
	27	4	..	2	18	...	"
	136	64	10	18	19	13	"
	273	6	16	..	17	11	"
	299 to 302	15	...	9	4	6	{ June, '64.
	233 to 236	..	..	21	3	22	
	136	24	70	9	4	6	"
	133	10	5	19	1	..	Sept., '64.
	136	1	10	2	16	17	"
	15	3	10	3	6	6	"
	136	16	...	...	18	...	"
		148	4	62	3	13	Total.
	168	48	....	47	7	16	Sept., '66.
	168	253	10	368	15	....	Dec., '66.
		301	10	476	2	16	Total.
	168	141	....	184	1	11	Mar., '67.
	168	168	10	306	16	3	June, '67.
	168	80	10	148	13.	....	Sept., '67.
		390	...	639	10	14	Total.
	168	3	17	..	3	19	June, '69.
	275	34	...	42	3	..	Dec., '69.
		37	17	42	6	19	Total.
Leases {	Area No. 9	17	10	9	18	...	Mar., '70.
	" 301	4	6	2	12	20	"
	273 to 277	92	..	212	17	...	Sept., '70.
		290	16	653	9	21	Dec., '70.
		304	12	875	17	17	Total.

GOLD RETURNS, *Oldham District.*—Continued.

Name of Company.	No. of Lease.	Tons.	lbs.	Oz.	Pwts.	Grains.	Date.
INTERNATIONAL	35	28	10	40	7	...	Sept., '63.
Co.'s property, now owned by W. G. Pearson.	35	37	15	56	7	...	Dec., '63.
	35	5	...	6	8	...	Mar., '64.
	9	...	15	...	10	12	Mar., '64.
	169	4	14	3	4	16	Mar., '64.
	169	7	4	14	10	9	June, '64.
	71	2	...	2	12	7	June, '64.
	35	18	15	18	7	9	June, '64.
	35	50	...	59	7	15	Sept., '64.
Leases—	35, etc.	9	10	8	13	17	Dec., '64.
183, 185, 189,	169, 207	10	...	11	15	...	June, '65.
Areas	553 & 555	18	6	33	3	...	Sept., '65.
Leases 35, 169,	185 & 189	17	...	24	12	...	Sept., '65.
" " "	" " "	4	...	6	10	...	Dec., '65.
Areas	553 & 555	9	13	12	2	...	Dec., '65.
Leases 169, 185 to	189, etc	18	8	18	...	18	Dec., '65.
	233	22	...	24	14	...	Mar., '68.
	233	15	12	15	3	...	June, '68.
	297	6	6	7	4	7	Mar., '70.
		285	8	361	12	14	Total.

DESCRIPTION OF THE DISTRICT.

Oldham Gold District lies near the summit of the watershed which separates the streams flowing into the Atlantic through Porter's Lake from those whose waters reach the Bay of Fundy by the Shubenacadie valley. The continuation of this watershed is the ridge of land which separates the valley of the Musquodoboit from that of the Shubenacadie.

The worked portion of the District is characterized by a valley having a nearly east and west course, through which two small streams flow at right angles across it towards the north. The valley occupies the crown of a very sharp anticlinal fold, the axis of which is nearly parallel to the area

lines and the general outcrop of the lodes, but is broken at intervals by faults, which in this district are both numerous and complex.

The distance of the nearest worked lodes from the Enfield Station on the Halifax and Picton Railway is 14,000 feet, or $2\frac{2}{3}$ miles. The centre of the district near the Sterling Company's mill is 21,000 feet, or very nearly four miles from the same station.

The structure of the rocks is well seen near the Hall lode, 2700 feet from the Sterling Company's mill. The curves described by the edges of the great beds of sandstone separated by thin seams of slate are plainly visible from any of the numerous ridges which form a marked feature in this part of the district, and in which it resembles the western part of Sherbrooke, Renfrew, and Waverley, but with this difference, that while these bold outlines are visible towards the western extremities of the districts last mentioned, at Oldham they are on the eastern side, this extremity of the anticlinal dome being much less compressed at Oldham than the western portion, which is so sharp and well defined that within a space of twenty feet, the strata may be seen to dip north and south of the axis at high but constant angles.

The axis of the anticlinal is by no means regular at Oldham, and its continuity is disturbed by faults, some of which are of considerable magnitude. A fault of this description runs through areas 243, (north west corner), 242, 241, 240, to 236, and perhaps, beyond. Another great fault appears to intersect the axis on or near the range of areas running north and south through area 22, and, perhaps also, through range 19. The apparent effect of these faults has been to move the axis from four to five hundred feet to the north of where it is found on the 7th range. The great fault near the perpendicular shaft on the Sterling Company's property appears to run nearly along the crown of the anticlinal for a distance of several hundred feet; the axis then passes close to the St. Andrew's Company's mill, and pursues a westerly course nearly along the southern boundary of areas 1 to 17, inclusive, sometimes passing into the range south of these. Between areas 17 and 19, a fault or faults occur which throws the axis four or five hundred feet to the north; and its direc-

tion becomes changed by a few degrees, more southerly, so that near the old English mill it lies within a few yards north of the building, whence it continues in a uniform direction for about 3000 feet, and may be found not far from the boundary line between areas 55 and 60 close to the western extremity of the district.

Besides the faults already enumerated there are numerous dislocations on the first and second range of areas lying south of areas 229 to 245 inclusive. These faults have a north west and south east course and are represented on the plan. Many minor dislocations or "jumps" are met with in the lodes, the 'heave' being to the south in proceeding from west to east. These "jumps" are especially noticeable on the Britannia lode.

No Gold mining district in Nova Scotia has been so damaged for mining purposes as Oldham. The open trenches which have been excavated exceed forty three thousand feet in length or upwards of eight miles. Nearly the whole of this work has been done in an area about one mile in length, and half a mile in breadth.

From the close proximity of many of the lodes, these long openings are a great drawback to the prosecution of mining operations on a small scale, and it is only when numerous small contiguous properties are united under one management that mining on a large scale can be carried on with much prospect of remuneration in this district. The expenses incident to drainage have necessarily increased to an extent in some instances, which renders it necessary to suspend operations or to work the mine at a loss. The whole of the surface within the limits described is honeycombed with trenches, shaft and pits, few to a depth exceeding 60 feet; these act as reservoirs for rainwater, which instead of flowing through the watercourses, fills, wholly or in part, the long lines of open ditches forming a large portion of the so called mining operations which have produced so much temporary embarrassment in this valuable district.

THE LODES.

A section from north to south through the St. Andrew's mill, shows the following partially worked lodes. In the

section the relative position is given which the lodes *or their continuation* would assume, supposing that the outcrops had been traced continuously to the line of section. Those which have not yet been traced are given in Italics, those through which the line of section is known to pass are printed in Roman type.

SOUTH SIDE OF ANTICLINAL.

- 1 *Lode,*
- 2 ... *Whitehead Lode,*
- 3 .. *Lode,*
- 4 ... *Hull Lode,*
- 5 *Kenty Lode,*
- 6 *Bunker Lode,*
- 7 *Lode,*
- 8 ... *Keys' Lode,*
- 9 *Republican Lode,*
- 10 Free Claim Lode—dip south angle 65,
- 11 *Lode,*
- 12 ... *Donaldson Lode,*
- 13 *Frazer Mill Lode,*
- 14 ... *Lode,*
- 15 ... *Blaikie Lode,*
- 16 ... *Ohio Lode,*
- 17 .. *Lode.*

AXIS OF ANTICLINAL.

- 18 ... *Morell Lode, dip north,*
- 19 ... *Lode,*
- 20 ... *Sutherland Lode,*
- 21 ... *Lode,*
- 22' .. *Fish Lode,*
- 23 *Andrew's Lode,*
- 24 *Pitblado Lode,*
- 25 ... *Woolcock Lode,*
- 26 *Lode,*
- 27 ... *New Wallace Lode,*
- 28 ... *Old Wallace Lode,*

- 29 ... *Lodes*,
- 30 ... *Davis Lode*,
- 31 ... *Lode*,
- 32 ... *Britannia Lode*, dip North, angle 70.
- 33 ... *Blue Lode*,
- 34 ... *McMaster Lode*, .
- 35 ... *Lode*,
- 36 ... *Mitchell Lode*,
- 37 &c. . Several Lodes not named,
- 38 ... *Carpenter Lode*,
- 39 ... *Baker Lode*,

The former continuity of many of these Lodes in one unbroken sheet, from a south dip to a south-easterly, easterly, north-easterly and north dip may be assumed for all purposes of practical exploration. Partly, in consequence, however, of the disposition of the Lodes here as elsewhere, to vary in their thickness, they have not been so traced, and partly because the occurrence of faults have led to the suspension of operations on very many of the Lodes. An inspection of the plan, will show that the curve round the eastern extremity of the Dome is maintained, although broken by faults, and experience shows that when a lead is thus cut off it may be found again by prospecting to the south of the break, when proceeding from west to east, and that the throw is to the north when proceeding from east to west on the south side of the Anticlinal.

Near the Old English Mill the new rich Lodes largely worked by open trenches during this past summer converge, and it will be interesting to find their continuity unbroken round a sharp fold to the west, and thus establish the view which an inspection of the plan suggests, that the Oldham gold district is a very elongated elliptical Dome, much compressed towards the western extremity.

The so-called Barrel quartz is seen in numerous Lodes near the apex of the curve. The Hall Lode is "Barrelled" in a peculiar manner, and appears to show that the Barrel structure is due to corrugations produced after the deposition of the Lode.

The lines of corrugation, if produced, would converge apparently to a point, and as they present themselves on the

exposed service of the Lode or the rock from which the Lode has been removed, they have a fan-like form. The corrugations are sharp and well defined, plications being visible in some of the larger corrugations. This peculiar form of Lode appears here as in other districts to have been produced under great pressure.

The Lodes at Oldham are generally thin, varying from one inch to twelve in thickness; but the smaller Lodes are not unfrequently rich in gold, hence one reason why the mining operations in this district have been carried on by small proprietors, and a narrow, but rich lead pursued by open trench work as long as it would 'pay' under that system of mining.

In November, of the present year, the new Engine house of the Sterling Company was totally destroyed by fire, and a temporary suspension of the operations rendered necessary. The vertical shaft sunk on their property has reached the depth of 110 feet, unfortunately it is sunk in close proximity to a considerable fault, and the rock through which it passes is much disturbed and the Lodes displaced and fractured. The greatest depth attained on the St. Andrew's property is 280 feet.

THE GOLD STREAK.

1. *The Hall Lode.*—From the information obtained, it appears that the gold "followed the Barrels" on this important Lode. This description is however so loose, that it may be interpreted to mean that the gold was uniformly distributed throughout the quartz excavated, for the whole Lode is 'Barrelled.' It is now a considerable time since this Lode was worked, and it does not appear probable that any special attention was directed to the distribution of the gold. The description may also mean that the gold was chiefly found in certain 'Barrels,' and followed the law which evidently governs the streak in other Lodes in this district, namely, that the dip is to the east at a low angle.

2. *The Old Barrel Lode.*—On this Lode the gold streak dips at a low angle to the east. Its breadth at the surface is stated to have been about 100 feet, growing wider as the depth increased.

3. *The Andrew's Lode.*—This Lode, formerly known as the

Boston and Oldham, has a streak dipping to the east at a low angle, it is also about 100 feet broad at the surface. The dip of the Andrew's Lode is north.

4. *The Wallace Lode*.—Dip of streak to the east, at low angle, until cut off by a fault. Dip of Lode north.

5. *The Britannia Lode*.—The dip of the streak on the load is represented to be to the east at a low angle. Dip of Lode north.

6. *The Frankford Lode*.—Dip of streak east at low angle.

7. On the south side of the Anticline, the dip of the streak is also stated to be to the east at low angles.

Part of the Britannia Lode is now worked by Mr. Shaffer, who has always shown considerable enterprise in this district. The pumping gear of the Britannia Lode is worked by means of Fraser and Baynes water mill, and the connecting rods are about 1040 in length.

Mr. Shaffer, personally superintends the mining operations under his control with business like assiduity and care, giving individual attention to all details, and making himself familiar with the underground operations of each miner. Were this system of personal under-ground supervision more common in our gold districts, instances of failure would be far less frequent. There can be no doubt whatever, that sufficient attention is not given to the distribution of the gold in the lodes, and where it is inclined to be 'pockety' as at Oldham, a careful record of the disposition and character of the gold streak are essential to success.

It is a well-known fact that after a Lode has been abandoned by a Company provided with all the means and appliances for tolerably economical mining; a number of working miners will take the Lode on tribute, put up their horse-gin or bail out the water with a hand windlass, and make the Lode pay well. This arises from the practical knowledge they have acquired of the gold streak. They throw out only such portions of the Lode as experience tells them lie within the limits of the streak; they sink on the streak and do not trouble themselves with the comparatively barren quartz, lying either to the right or to the left. A company with a general manager is too apt to be guided by the object of taking out the Lode irrespective of the gold streak, to keep the mill going. Where the

Lodes are small, it is essential that several should be worked simultaneously, and attention given only to the streak of each Lode. Where the streak is 100 feet broad, this can be done with economy, and the operations may be limited to the streak alone. At Oldham, the cause of the numerous long open trenches is to be attributed to the low angle at which the gold dips to the east. There are no doubt two, if not three, or more gold streaks, and these may be tolerably well defined by recording the position of the barren spots, which intervene between two adjacent streaks in the surface trenches. The importance of this mapping of the streak will be apparent when it is taken into consideration that as soon as the upper streak is worked out on any property, by sinking a depth easily ascertained, the second streak, whose out-crop is to the west will be reached, and if a third streak exist, by sinking still deeper, it will also be cut and may be stoped out, the intervening barren quartz being left untouched. If for instance on any one Lode, say the Richey Lode, the boundary of a streak were found on area 3 dipping east at an angle of 15 degrees, another rich zone or streak on area 5, 250 feet west, another on area 8, another on area 11 and another on 14, the dip being about 15 degrees east, the respective depths at which these streaks would be found on area No. 3, would be approximately 65 feet, 160 feet, 240 feet and 340 feet respectively: the whole of which might be worked simultaneously from one shaft.

A carefully constructed plan of the distribution of the gold in the different Lodes, would be of great value to this district where the dip in the streak is so low; but this is a kind of information which should be recorded at the time and with considerable detail giving the depth at which the Lode yielded the gold stated in the returns; the thickness of the Lode, its inclination and its yield at different points. From these data a sectional plan might be constructed, showing the course of the streak, which could not fail to be of great importance in all districts where the inclination of the streak is low. This subject is referred to at some length in Chap. III.





CHAPTER VII.

RENFREW GOLD DISTRICT.

HISTORY OF THE DISTRICT ABBREVIATED FROM THE CHIEF COMMISSIONER'S REPORTS.

YEAR 1862.

The discovery of Gold at Tangier, Lunenburg and Waverley, induced several of the inhabitants of the Nine Mile River Settlement, to make explorations among the rocky barrens in their neighborhood. Quartz veins were discovered in the summer of 1861, by John McPhee, near William Thompson's mill: but the discoverer, probably from the want of experience, does not appear to have found gold. Towards autumn, Wm. Thompson accidentally found small particles of gold in a piece of loose quartz in the bed of the brook near his mill. This discovery, although made public, attracted very little attention at the time. Towards the end of April, 1862, Andrew Parker, who was attending Thompson's mill, noticed that a small vein of quartz on the bank of the brook contained gold in unusual quantity. The news soon spread through the adjacent settlements and elsewhere, and a few days afterwards a rich lead was found on a brook about a half mile distant from the first discovery. A rush of gold seekers took place, and on the 29th day of April arrangements were made with the proprietors of the land to allow mining areas to be laid off and leased. It was proclaimed a gold district without delay, and Renfrew immediately became the scene of active prospecting and mining operations. In a few months three crushing machines were in the course of construction, and, by the first of November, two were in operation, and a fourth is now being erected.

The auriferous quartz leads in this district may be described as follows:

1st. The "Free Claim Leads" are two in number: their course appear to be nearly east and west, but have only been traced across two areas: one is two inches and the other five inches thick. The quartz of the former is much the richest. A yield of 73 oz. 4 dwt. was obtained from 17 tons, 12 cwt. of quartz taken from these leads. At the depth of 40 feet the larger lead disappeared.

2nd. On the ninth range of areas a lead exists which varies in thickness from 8 inches to a foot. The deepest sinking on it is 9 feet. It dips 75° south: and the maximum yield from it is 4 dwts. per ton.

PLAN OF RENFR

SHOWING OU

SCALE



SECTION ON

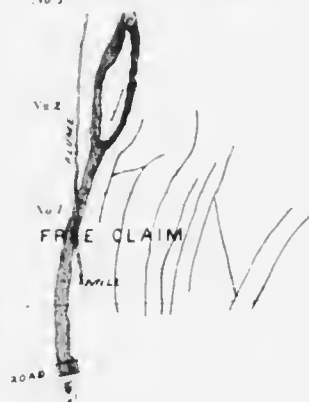
INFREW GOLD DISTRICT

WING OUTCROP OF LODS

1000 FEET TO ONE INCH



DISTURBANCE ON THE
FREE CLAIM



ON ON LINE A P.

ROAD STRIKES

3rd. A lead from 14 to 20 inches thick passes through the tenth range of lots. From a shaft 18 feet in depth on this lead, 22 tons of quartz were taken, which yielded 27 ox. of gold. A ton from another pit yielded 19 dwts.

4th. Another lead, one foot thick, runs through the eleventh range. A small yield was obtained from a ton of quartz taken from a sinking of 20 feet on this lead.

5th. Area No. 343, on the Preeper lead, is one of the richest hitherto worked in the Province. From a trench 80 feet in length, and from 6 to 8 feet deep, 83 tons of quartz were taken, which yielded 180 oz. of gold. It appears to have been disturbed near the Preeper claim, as its course there is about S. 85° E.; while the uniform course of the adjacent leads is about N. 80 E. This lead has not been discovered west of area No. 343; and a lead found to the east in the line of its course is quite different in appearance, and yields but little gold.

6th. The Shubemeadie lead, which varies from 6 to 9 inches in thickness, has produced the best sights and specimens found in the district. Thirteen and a half tons, taken from a shaft ten feet deep on this lead yielded 11 oz., four ounces of which were obtained from specimens when mining.

7th. There are a number of other leads in this district, which have actually proved auriferous, some of which are of such recent discovery that the quartz has not been tested, but which promise to be highly remunerative. Ten tons of quartz, taken from the Hay lead, which is about 6 inches thick, is supposed to have yielded over an ounce per ton.

YEAR 1863.

The fluctuations in the mining business of this district have been very slight throughout the year; and the returns of Gold show a fair remuneration for the men engaged in mining. Still, of the larger extent of ground taken up in mining areas, in this district, during the excitement immediately following the discovery of Gold there, only a small portion has been worked during the year. It has come to my knowledge that operations would have been carried on there upon a much larger scale, by at least one company representing a larger capital, but that, owing to the multitude of lessees having small areas dotted over the district, it was found extremely difficult to secure, in a good locality a sufficiently large mining tract to warrant the outlay required to commence upon such a scale.

So far as I have yet had means of judging, the yield of Renfrew quartz does not exhibit such wide extremes as that of most other districts; whilst the greater part of it yet mined contains a remunerative percentage of gold.

YEAR 1864.

As during 1863, so in 1864, a profitable mining business has been carried on in this district, with no marked fluctuations. That business has, however, steadily increased. Here, as is indeed the case in most of the other gold districts, the total yield of gold for the nine months of 1864 exceeds that for the twelve months of 1863. Renfrew presents a still more remarkable increase this year, in the proportion of gold obtained per man employed, a comparison which affords the surest test of the growing profitableness of its mines. The total yield of gold in that district, during the twelve months of 1863, at \$18.50 per ounce, was equivalent to \$203.90 per man employed. The total product for nine months of 1864, gives \$385 per man, or very considerably more than double the proportion of the previous year.

A road now in course of construction from Enfield railway station to Renfrew, by a nearly straight and almost level route, will, when completed, be a great boon to parties interested in that mining district. The extension of this road into Rawdon, during the incoming year, would still further advance the prosperity of Renfrew, whilst it would be a great accommodation to a large number of people in the adjacent parts of Southern and Central Hants County.

YEAR 1865.

The returns from Renfrew exhibit a slight falling-off in every respect from those of the previous year. Yet, in truth, this is more apparent than real. It happens that the extraordinary and almost unprecedented drought which prevailed in this province during the latter part of summer, very materially affected the product of the Renfrew Mines. During the whole of the three months ending the fiscal year, no quartz was crushed at Renfrew, the mills being unable to work for want of water. Nevertheless, here, as in all other districts, the weather, which was unfavorable for keeping mills in operation, was very favorable for mining. Consequently, the returns of the current quarter will, I have reason to believe, fully account for the falling-off in the yield of the preceding three months. I may here mention, without specially recurring to the fact in the case of every other Gold district to be hereafter mentioned, that this same drought has very materially lessened what, under ordinary circumstances, would have been the product of every one of the Gold districts during the quarter ending September 30th, 1865.

YEAR 1866.

Renfrew has taken a great stride in advance since the date of my last Report. The *Renfrew* quartz has always yielded a fair, paying average of gold; and so far as the bed rock has been exposed, the quartz lodes are numerous. Yet, during the years 1863, '64, and '65, the progress made in mining operations was slight compared with that of most other districts. During the fiscal year just closed, many of the previously leased areas at *Renfrew* fell into new hands; large additional areas were leased; new and larger quartz crushers were erected; and mining was carried on with great vigour, and thus far, with a success which promises to be lasting. As a proof of this I need only point to the fact that, whilst in 1865 the yield of Gold from *Renfrew* was 820 oz. 12dwt. 23gr., in the year just closed it has amounted to 4176oz. 3dwt. 17gr., or more than five times what it was for the preceding year.

I must here observe that the new road from *Enfield* Railway Station to *Renfrew* is in a very bad condition, owing to the bad material of which it was made, all the surface soil in that vicinity seeming to be clayey, and to the extent of the traffic upon it during the past season. As this traffic will unquestionably increase during the incoming year, I fear that the road will soon become quite impassable unless a considerable expenditure is made upon it in repairs as early as possible after the expiration of the coming winter.

INSPECTOR'S REPORT.

In this district the Mines are being vigorously worked by the *Ophir* Company, the *New York and Renfrew*, and Messrs. *Allen & McClure*.

On the lode worked by the *Ophir* Company, known as the No. 1 North lode, four shafts have been sunk, the depths of which are from 80 to 107 feet. In the west shaft the lode has been stoped to within a few feet of the surface, and between the other shafts it is also being stoped at the various depths. The space worked includes three lodes, two one inch and one half an inch thick, separated by slate and quartzite. Four shafts have also been sunk on the No. 2 or South lode, which is about 10 in. thick. These are from 50 to 60 feet deep. At 55 feet in No. 3 shaft a tunnel has been driven between the shafts, and the lode is now being stoped to 17 feet from the surface.

The No. 1 North lode is also worked by the *New York and Renfrew* Company, who have four shafts on it, to the west of those of the *Ophir* Company. Three of these are 100 feet deep, and one, the westernmost, 50 feet. Between Nos. 1 and

3 shafts the lode has been stoped nearly to the surface. From No. 4 a tunnel has been driven through to the adjoining shaft, but stoping has not yet been commenced. The three lodes have run together in this mine, and their aggregate thickness is 10 inches.

On the "free claim" this Company are working seven lodes varying in thickness from 2 in. to 18 in., and running in some cases into each other. On the northernmost of these lodes a shaft has been sunk 80 feet, and the lode stoped to the east about 30 feet in height. On the west side of the shaft little has been done. To the east another shaft has been sunk 60 feet, and the stoping connected with that from the 80 feet shaft. On the east side of the 60 feet shaft the lode has been stoped 30 feet from the surface. South of this lode a shaft has been sunk on another lode 30 feet, and stoping is being done on each side of it, and further south a shaft has been put down to same depth on another lode. Adjoining these on the south two shafts have been sunk 40 feet on the next lode, and a tunnel driven 40 feet to the east, and stoping commenced. Between the shafts the lode is stoped to the surface. Further south of this lode another has been sunk on to the depth of 65 feet, and at 55 feet a tunnel driven on each side 50 feet, and stoping commenced. These lodes, and two others in course of opening, are all within a few feet of each other.

.. The Mines worked by Messrs. Allen & McCure are situated to the north of the No. 1 North lode. There are 4 shafts on the lode, the thickness of which is 10 inches. At the depth of 45 feet in No. 1 shaft the lode is stoped out to the east. "The other shafts are in course of sinking."

YEAR 1867.

"From being third in rank last year, and about fifth in years previous, Renfrew has placed itself first this year, having produced nearly 900 oz. more gold than any other district, and is only second in point of profit to Sherbrooke, each man employed having earned \$895.30 for the year. This result may well inspire the miners in depressed districts with confidence. From being one of the poorest districts, it has in a short time become one of the most productive."

INSPECTOR'S REPORT.

"The operations in this district have been conducted with the same steadiness which has prevailed for some time. On the No. 1 lode, the Ophir Company have sunk all their shafts deeper, the deepest being now 160 feet. With the exception of the easternmost, the depth of which is 45 feet—all these



25

2



shafts have been worked; the stoping from each being regularly carried on. On the No. 5, or deep shaft, a steam engine with hoisting and pumping machinery, has recently been erected. On the No. 2, or South lode, a similar extension has taken place, the shafts being about the same depth as those on No. 1. South of the No. 2 lode, 2 shafts have been sunk by the same company on a lode the thickness of which is five inches; one of these is 95 feet deep, and the other 80 feet. No tunnelling or stoping has yet been begun. The Hartford Company, formerly the New York and Renfrew Company, have also mined the No. 1 lode on the west of the Ophir Company, and their shafts are now 100 to 130 feet deep, and the lode has been stoped between them nearly to the surface. On the Free Claim, the same company have continued to mine the lodes opened last year, the shafts having been sunk deeper on each, and the stoping regularly carried on.

The McLeod lode, lying to the north of No. 1 lode, has been worked by Messrs. Allen and McClure. The former has four shafts on it, the deepest of which is 140 feet; the lode has been stoped between them to the depth of 100 feet in this shaft.

Mr. McClure has two shafts adjoining Mr. Allen on the east, one being 86 feet deep, and the west one 102 feet, and 100 feet apart. The lode has been stoped within 20 feet of the surface between these shafts, and out of the west shaft at a depth of 75 feet, a tunnel has been driven 30 feet to the west. About a quarter of a mile to the south of the lodes worked by the Ophir Company, a lode has been opened by Mr. Andrews, who has sunk a shaft on it, but has not mined to any extent."

YEAR 1868.

Renfrew continues to return a large quantity of gold, but has not reached that of last year; the Ophir and one or two others furnished the greater part of it. It was hoped from the splendid success of the Ophir Company that prospecting would have been carried on with energy; but little has been done outside of the old workings.

INSPECTOR'S REPORT.

The principal mining in this district has been by the Ophir Co., whose operations are carried on with much energy and regularity. On the north lode, the No. 5 shaft, in which are placed the pumps, is now 250 feet in depth; the adjoining shaft on the west is 205 feet, and the others—ranging east from No. 5 to No. 1—are various depths. The lode has been

nelly between Nos. 3 and 5 shafts—a length of working, by underhand stoping, of about 350 feet, including 34 feet on the west side of No. 6 shaft. This extent of opening is being regularly carried down, the No. 5 shaft being kept in advance for the purpose of drainage, and the mine arranged in steps on each side.

On the south lode, in which there are also 6 shafts, a precisely similar system of working is pursued; the No. 5 shaft is now 260 feet deep. About 400 feet of working space, extending from No. 3 shaft to No. 6, the depths of which are 215 and 220 feet respectively, is being mined. At a depth of 100 feet in both the north and the south lodes, and near to No. 4 shaft, a cross-cut has been begun to the north, for the purpose of exploring in that direction. Another lode—the McClure—lying about 80 feet to the south of the south lode, has been opened during the year; four shafts have been sunk on it, the deepest—No. 2—being now upwards of 70 feet. From this depth the lode has been stoped to the surface, 100 feet to the East and 200 to the West. A steam-engine, of the same size as the one on the North lode, has recently been erected, and applied to hoist and pump from the McClure and South lodes. The company have also worked the Brook lode, on which two shafts were sunk last year; these have not been sunk deeper, but between them the lode has been stoped 55 feet in height from the depth of No. 2 shaft, 88 feet; and from the bottom of No. 1, 92 feet, a tunnel has been driven to the West 80 feet.

West of the Ophir Co's shafts, on the North lode, are those of the Hartford Co.; they are three in number, and are each about 150 deep. Mining has not, however, been regularly carried on in them; little having been done prior to September: the stoping now extends between the shafts and 40 feet West of the West shaft, from their depth to the surface.

A shaft has been sunk on the South lode by the Colonial Company—the successors of the Hartford Company—on the property formerly held by the New York and Renfrew Company. This shaft is 66 feet deep, and out of it a tunnel has been driven to the West 80 feet, and to the East 50 feet. In West tunnel, a single height of stoping—6 feet—has been taken down the length of the tunnel; and in the East tunnel, 12 feet in height along its length.

On the McLeod lode, this company have also a shaft, the depth of which is 45 feet; on the West side of the shaft, the lode has been stoped a distance of 40 feet, and to the surface, from a depth of 20 feet.

The operations on the Free claim, by the same company, have not been regular: no mining has been carried on during a portion of the year; a few months ago they were resumed on one of the many lodes that have been opened on that claim.

A shaft, which had reached a depth of 100 feet, is being continued: 20 feet in length on the lode being carried on. The lode has been stoped to the surface from the depth of the shaft, a distance of 80 feet to the East, and the same height, 15 feet to the West.

The company have recently opened another lode—the Philips—lying about 100 feet north of the McLeod lode; it is about 9 inches thick; a shaft has been sunk on it 25 feet.

The only other mine that has been worked in the district is on the lode opened last year by Mr. Andrews, by whom a shaft has been sunk to a depth of 90 feet. At a depth of 75 feet, a tunnel was driven to the East 20 feet, and the lode stoped the additional depth. Operations are at present suspended.

YEAR 1869.

The mining in this district has been principally carried on by the Ophir and Colonial gold mining companies, and by Mr. Charles A. F. Gay.

The works of the Ophir gold mining company are on the North, South, McClure and Brook lodes. A shaft on the North lode is now at a depth of 400 feet. The work on this and the South lode has lately been suspended, but the McClure and Brook lodes are still operated on.

The Colonial company continued to work the North lode until lately, when they also were obliged to cease mining in consequence of there not being provided with sufficient appliances to raise the water, which was largely increased by the suspension of the Ophir. The Colonial have also worked the McLeod lode, and re-opened others that were formerly worked, besides commencing operations on some new ones. The works on the Free Claim have been revived by Mr. Gay."

INSPECTOR'S REPORT.

Mining in this district has not been to the usual extent, the operations, both of the Ophir and Colonial Companies., having been on a somewhat reduced scale. On the North lode the Ophir Company have sunk their No. 5 shaft 130 feet further, but have not continued the stoping beyond the depth at which it stood at the end of last year. The portion of the lode left next the surface has, however, been entirely removed, and operations on this lode are at present totally suspended. The No. 5 shaft on the South lode has also been sunk further; it is now 342 feet deep. On the West side of this shaft the lode has been stoped 145 feet in length, and connected with a shaft on the Colonial Company's property. This shaft the Ophir Company have purchased, and sunk to a depth of 220 feet. On

the McClure lode the No. 2 shaft has been sunk 92 feet further, and the stoping continued in the usual way, 115 feet in length on the East side of the shaft, and 255 feet on the West. Little has been done during the year on the Brook lode, and operations on it have for some time been discontinued.

The Colonial Company continued to mine the North lode until the stopage of the Ophir Companies operations on that lode, when they were obliged, in consequence of the influx of water, to cease working. The shafts have been sunk deeper, No. 1 being now 200 feet, and the lode has been stoped a distance of 100 feet to the West of that shaft.

On the McLeod lode another shaft has been sunk, the depth of which, and of the one begun last year, is 100 feet. At a length of 40 feet tunnels were driven East and West, and the lode stoped to a height of 15 feet; it is now being worked, by underhand stoping, a distance of 100 feet. South of the McLeod lode two shafts have been sunk on a lode, the thickness of which is 8 inches. One of these shafts is 20 feet deep, and the other 50 feet. In the latter the lode has been stoped to the West 60 feet. At a depth of 35 feet a tunnel has been driven to the East 25 feet, and stoping begun.

In the Free claim operations have been carried on by Mr. W. Gay. The lodes have been worked in the usual manner, and with satisfactory results.

YEAR 1870.

The returns from this district, for the past year, are less than for any year since 1865, being 3243 tons crushed, yielding 1171 oz., 18 dwts., 11 grs. There have been no extensive operations attempted. A number of small works are employed, and the old companies are working in a small way.

The amount of gold obtained from this district has been:—

		Tons.	Oz.	Dwts.	Grs.
	1862.....	171	308	00	00
	1863.....	574	785	07	07
9 months	1864.....	850	874	05	06
	1865.....	1114	820	12	23
	1866.....	4181	4176	03	17
	1867.....	7770	9401	02	10
3 months	1867.....	1565	1237	08	10
	1868.....	5994	3373	14	09
	1869.....	7258	3097	15	07
	1870.....	3243	1171	18	11
		32620	25246	07	04

INSPECTOR'S REPORT.

Although the mining operations in this district have not been so extensive as in former years, mining has been carried on with more or less regularity during the year by the Ophir Company, Messrs. Steel, and others.

The Ophir Company's operations have been on the South and Hay lodes. On the former of these the mining has been principally on the top stope, which is being taken out to the surface between the different shafts. On the Hay lode there are two shafts; in the West shaft, the depth of which is 84 feet, the lode is being stoped underhand 27 feet in length on the West side of the shaft, and 25 feet on the East. Nothing is at present being done in the East shaft.

The same lode is being worked by the Renfrew Company, who have two shafts on it; the depth of the East one being 76 feet, and of the West one 70 feet. In this last the lode has been stoped to the surface, 30 feet to the West, and 22 feet to the East; and out of the East shaft the stoping has been carried 55 feet to the West, and 39 feet to the East. In the Free claim the operations have been on the several lodes which have for some time been opened, but principally on the Bayne lode, the shaft on which is now 132 feet deep. Out of this shaft the lode has been stoped 75 feet to the West. No stoping has been done on the East side.

OFFICIAL GOLD RETURNS *from the Renfrew District.*

Name of Owner or Company.	No. lease	Number of Areas.	Tons.	Cwt.	Ounces.	Dwt.	Grains.	Date.
Chas. Sim.		258, 282, 319.....	14	15	12	2	3	Sep. '65.
I. Flemming.	1	283.....	19	20½	5	7	14	"
Chebucto M.A.	11	253, 281.....	6		2	7		Dec. '63
F. S. Andrews.	96	258, 281, 282, 283, 219..	30		15	9	20	June '61.
G. H. Madill.	37	256.....	8	1	1	9		Sep. '61.

New Haven Company's Property.

F. S. Andrews.	148	282, 283, 253, 255, 258,						
Agent New Haven Co.	to 154	279, 281, 282, 283, 319, 372, 373, 411.....	214		82			Mar. '66.
Do.	Do.	Do.	160		47			June '66.
Do.	Do.	Do.	560		152			Sep. '66.
New Haven Co	Do.	253, 255 to 258, 261, 279, 281, 282, 283, 319, 321, 322, 326, 351, 361, 362, 362, 372, 373, 409, 411, 1515, 1551, 369. }	341	14	209	13	11	Dec. '66.
Do.	148 to 154	{ 11 to 30, 31 to 48, 73 to 90, 91 to 102, 142.	135		191	15		Mar. '67.
Do.	156		202	5	207	5		June '67.
Do.	160							
		(to 150, 253, 253, 255, 256, 257, 258, 261, 279, 281, 282, 283, 319, 321, 322, 326, 351, 372, 373, 411, 1515, 1551, 1761, 1762, 1787, 1788, 1797, 1758, 1823, 1824, 1833, 1834, 1859, 1860, 1860, 1869, 1870, 1895, 1896.....	10	6	21	14		Dec. '67.
			4		6			Mar. '68.
Do.	162 } 170 }		25	10	23	7		Dec. '69.
			21	10	10	6	18	Sep. '70.
			37		9	13	5	Dec. '70.
			1789	18½	999	9	23	Total.

GOLD RETURNS, Continued—*Hartford Company's Property.*

Name of owner or Company.	No. of Lease.	Number of Areas.	Tons.	Cwts.	Ounces.	Dwt.	Grains.	Date.
G. H. Madill.	172 and 59	.....	4	5	3	18	15	June '63
Do.	1	.....	50	134	124	2	...	June '63
Do.	1	.....	6	1	7	5	...	Sept. '63
Do.	172 and 59	.....	9	7	41	8	12	Sept. '63
Do.	172 and 59	.....	32	3	103	3	12	Dec. '63
Do.	1	.....	12	...	11	8	...	Mar. '64
Do.	172 and 59	.....	2	17	17	8	...	Mar. '64
Do.	1	.....	24	5	16	10	...	June '64
Do.	172 and 59	.....	1	0	5	6	12	June '64
Do.	7160	.....	6	5	5	4	...	Sept. '64
Do.	2, 4, 59, 1505, 1506, } 1539, 1540, 1541, 1542 }		37	10	102	10	...	Sept. '64
Do.	60 etc. 4, 57, 58, 60	.....	10	00	14	...	...	Dec. '64
Do.	172 and 59	.....	{ 22 25	date	119 4	5 5	}	Dec. '64
John Mahar.	60 & 71	4, 57, 58, and 60	7	...	6	...	...	Mch. '65
J. Muir.	60 & 71	Do.	24	18	32	7	...	June '65
G. H. Madill.	71	1	7	10	13	12	...	June '65
Do.	17	60	30	...	50	14	...	Dec. '65
Do.		2, 59	35	...	83	...	...	Dec. '65
Do.		1	39	...	61	3	...	Dec. '65
Do.		1	50	...	34	10	...	June '66
N. Y. & R. G. Co.		{ 1 to 7, 57 to 60, 218 to 220, 314, 347, 376. 405, 1505, 1506, 1539, 1540, 1541, 1542, 1575, 1576, 1577, 1578, 1611, 1612, 252, 254, 284, 285, to 289, 316, 317, 323, 338, 353 to 355, 366, to 368, 380, 383, 401, to 405, 413, to 415, 436, to 440, 482, 483, 487, 488, 491, 492	13	...	9	4	16	Sept. '66
		1576, 1577, 1578, 1611, 1612, 252, 254, 284, 285, to 289, 316, 317, 323, 338, 353 to 355, 366, to 368, 380, 383, 401, to 405, 413, to 415, 436, to 440, 482, 483, 487, 488, 491, 492	327	...	341	12	...	June '67
Hartford Co.		{ 285, to 289, 316, 317, 323, 338, 353 to 355, 366, to 368, 380, 383, 401, to 405, 413, to 415, 436, to 440, 482, 483, 487, 488, 491, 492	50	...	96	10	...	Sept. '67
		323, 338, 353 to 355, 366, to 368, 380, 383, 401, to 405, 413, to 415, 436, to 440, 482, 483, 487, 488, 491, 492	412	11	272	3	...	Dec. '67
		401, to 405, 413, to 415, 436, to 440, 482, 483, 487, 488, 491, 492	105	...	63	18	20	Mar. '68
		483, 487, 488, 491, 492	58	15	83	5	...	June '68
		{ 1 to 7, 57 to 60, 482, 483, 488, 492, 493, 1505, 1506, 1539 to 1542, 1575 to 1578, 1611, 1612	46	...	49	8	6	Sept. '68
		483, 488, 492, 493, 1505, 1506, 1539 to 1542, 1575 to 1578, 1611, 1612	18	...	17	10	...	Dec. '68
Hartford Co.		{ 1505, 1506, 1539 to 1542, 1575 to 1578, 1611, 1612	50	...	29	17	...	Mar. '69
Do.		1542, 1575 to 1578, 1611, 1612						June '69
Do.		Do.	100	...	33	11	16	
			500	...	214	1	8	Dec. '69
			60	...	49	15	20	Sept. '70
			110	...	96	2	18	Dec. '70
			2287	004	2214	00	11	Total.

GOLD RETURNS, Continued—Colonial Company's Property.

Name of Owner or Company.	No. of Lease.	Number of Areas.	Tons.	Cwt.	Ounces.	Dms.	Grains.	Date.
A. Cox.	30	599, 602, 603 and 614 .	4	10	6	5	..	Decr. '63
G. H. Madill.	6	314 and 317.....	7	7	2	17	..	June '63
Do.	6	Do.	13	10	3	3	12	June '64
Do.	60	376 and 405.....	10	...	2	9	12	Decr. '64
Wright and Smith.	141	192, 193, 228, 229, 200,						
	142	to 203, 221 to 223, 273,						
	143	276, 331 to 335, 386,						
		387, 274, 275.....	41	10	40	...	...	March '66
Brayton Ives.	Do.	Do.	705	...	531	16	7	Sept. '66
New York and R. G. Co.		252, 254, 284 to 289,)						
		316, 317, 323, 338,)						
		353, 355, 366 to 368,)						
		380, 383, 401 to 401 } 12 ...			3	7	22	"
		413, 414, 415, 482,)						
		483, 489, 492, 493,)						
		436, 437 to 440)						
Do.	167	1 to 7, 57 to 60, 192, 193,						
		202 to 205, 218, to 222,						
	168	228, 229, 252, 254, 272	634	...	374	3	22	Decr. '66
		to 275, 281 to 289, 314,						
	169	316, 317, 323, 331 to	282	10	491	9	16	March '67
		335, 338, 347, 353, 354,						
	170	355, 366 to 368, 376,						
		380, 383, 386, 387, 401						
	171	to 405, 413 to 415, 482,						
		483, 488, 492, 493, 1505,						
	172	1506, 1539, to 1512, 1575						
		to 1578, 1611 to 1613,						
		1648, 1649, 436 to 440						
Colonial Co.		151 to 159, 200 to 208,	90	...	17	18	..	Sept. '68
		213 to 223, 192, 193, 228						
		229.....	104	...	30	17	12	Dec. '68
Do.	198	153 to 159, 200 to 208,						
		213 to 223, 262 to 266,						
Do.	199	273 to 276, 327 to 335,	237	...	152	9	9	March '69
		386, 387, (376, 380, 401,						
Do.	200	to 405, 405, 436 to 440,	309	...	219	3	20	June '69
		Blk. 1; 323, 338, 383,						
Do.	201	192, 193, 228, 229, 252,	67	...	46	4	17	Sept. '69
		254, 284 to 289, 314, 316						
Do.	202	317, 317, 303 to 308, 353	167	9	90	19	17	Decr. '69
		354, 355, 357, 359, 363,						
		366, 367, 368, 412 to 418						
		Block 1)*.....	62	...	37	3	13	March '70
			2746	16	2071	9	11	Total.

* Those Areas enclosed in brackets are in Block 1.

GOLD RETURNS, Continued—*Renfrew Mining Co's. Property.*

Name of Owner or Company.	No. of Lease.	Number of Areas.	Tons.	Cwt.	Ounces.	Dwt.	Grains.	Date.
H. B. Prince,	82	.....	10	...	8	6	...	June '64
Do,	117	324, 325, 336, 337, 384, 385, 396 to 399, 442 to 443, 459, 433, 436, 460 to 470, 441.....	273	10	115	16	21	Decr. '64
Renfrew Co.		315, 345, 375, 406 to 408, 309 to 313, 348, 350, 370 & 7, 344....	18	10	15	10	...	Sept. '64
Do.	Do.	Do.	282	10	96	17	...	Sept. '67
Do.	Do.	Do.	162	...	39	10	...	Decr. '67
Do.	Do.	Do.	2	10	2	1	...	June '68
Do.	Do.	Do.	108	4	28	2	2	Mar. '65
Do.	Do.	Do.	25	12	3	12	6	June '65
Do.	Do.	Do.	49	10	9	11	...	Mar. '70
Do.	Do.	Do.	43	...	13	6	...	Sept. '70
Do.	Do.	Do.	295	...	113	9	...	Decr. '70
			1270	6	446	1	5	Total.

The Ophir Company's Property.

Ophir Mfg. Co.	147	162 to 164, 197 to 199.	98	10	245	1	...	Dec. '65
Do.	Do.	Do.	586	...	785	18	...	Mar. '66
Do.	Do.	Do.	616	...	780	18	6	June '66
Do.	Do.	Do.	677	...	1000	10	...	Sept. '66
Do.	173	52, 53, 68, 69, 103 to 106, 134, 135, 136, 162 to 167, 194 to 199, 301, 346, 360.....	1208	5	2142	4	...	Dec. '66
Do.	176	106, 134, 135, 136, 162 to 167, 194 to 199, 301, 346, 360.....	1395	00	1885	15	...	Mar. '67
Do.	Do.	Do.	1503	00	1674	...	...	June '67
Do.	Do.	Do.	1656	...	1587	5	...	Sept. '67
Do.	Do.	Do.	946	15	907	...	...	Dec. '67
Do.	Do.	Do.	704	...	571	10	...	Mar. '68
Do.	Do.	Do.	1317	...	736	3	...	June '68
Do.	Do.	Do.	1385	...	706	15	...	Sept. '68
Do.	Do.	Do.	2029	...	1046	10	...	Dec. '68
Do.	Do.	Do.	1539	...	727	13	...	Mar. '69
Do.	Do.	Do.	1285	...	612	10	...	June '69
Do.	Do.	Do.	850	...	302	...	...	Sept. '69
Do.	Do.	Do.	1920	...	571	10	10	Dec. '69
Do.	Do.	Do.	451	5	141	7	...	Mar. '70
Do.	1180	Do.	304	...	75	2	...	June '70
Do.	Do.	Do.	200	...	105	12	...	Sept. '70
Do.	Do.	Do.	312	...	127	01	5	Dec. '70
			21012	15	17532	13	21	Total.

DESCRIPTION OF THE DISTRICT.

The large deposits of Plaster which rest apparently upon the gold-bearing rocks at Renfrew, within close proximity to some of the worked lodes, impart to the district a feature of peculiar geological interest. Altered sand-stones of probably Cambrian age are overlaid by lower Carboniferous deposits, and on Meadow Brook these rocks of such widely separated geological periods, may be seen in position within one hundred feet of one another. It is by no means certain that the Plaster lies on the surface of the gold-bearing rocks, the line of junction being concealed by drift, and it is not improbable that a dislocation occupies the valley of Meadow Brook, and conceals the lower carboniferous sand-stones and conglomerates which elsewhere are known to underlie the Plaster and rest on the older series.

The valley of Meadow Brook is of great interest from the fact that the wall of Plaster, protected in some measure by a ridge of the older rocks and by massive boulders, must have acted as a check to currents from a northerly to a southerly direction, and along its base it is not improbable that important alluvial deposits of gold will be found. The brooks which flow from the lakes on the west side of the districts, cross numerous lodes and have a considerable fall; where these empty into Meadow Brook alluvial deposit may also be expected. No search appears to have been made for alluvial gold in Meadow Brook, in consequence probably of the difficulties attending drainage.

Renfrew presents some advantages for prosecuting this kind of gold mining which may lead to unexpected results. Experience at Gays River, shows that the conglomerates at the base of the lower carboniferous series are auriferous in certain localities, and that the most valuable portion is at and near the junction of these with the gold-bearing rocks, on the rough surface of which and in the crevices of the slates, alluvial gold is found, which must necessarily be of carboniferous alluvial age.

This district occupies the summit of a low water shed which separates the valley of the Shubenacadie from the Bay of Fundy. It appears to lie on the same great east and west

anticlinal as Mount Uniacke and on the same north and south anticlinal as Oldham. It is a broad and flattened dome, differing in this particular widely from the disposition of the rocks at the last named district. The form of the fold is that of a slight overturn to the south. All the mining operations have been carried on to the south of the axis, the rocks for the most part being covered by drift on the north side except towards the north-western extremity, where the ridges of sand-stone are remarkably well defined. The hard edges of the thick beds of this rock stand out in bold relief for many hundred yards near the lake, which marks the western limit of the district. The same features of well-defined out-crops of the edges of the strata are visible here as at Oldham, and in the sharp valleys between the ridges, numerous rich boulders of auriferous quartz have been recently found, but all search for the lodes from which they originated has hitherto been fruitless.

The broad character of the dome at Renfrew may be inferred from the following table showing approximately the distances of the worked lodes from the axis in the several districts:—

District.	Greatest distance of worked lode from axis of anticlinal.	Least distance of worked lode from axis.
RENFREW.....	8500 Feet.....	1500 Feet.
MOUNT UNIACKE.....	3250 do.....	10 do.
OLDHAM.....	1850 do.....	10 do.

All the lodes hitherto discovered at Renfrew are on the south side of the axis. Rich boulders have been found on the north side, but all search for the lodes from which they originated has proved unsuccessful.

Compared with Oldham, the strata at Renfrew present a comparatively undisturbed attitude round the fold. There are some faults in the south eastern part of the District as shown on the plan, and there is evidence of very considerable disturbance on the line of the axis of the anticlinal. A local crush of considerable interest occurs on the Free claim and on area No. 2—on both of which the lodes have been extensively worked, and the free claim is honeycombed with shafts on separate lodes. Some of the lodes in this claim are mere local sheets of auriferous quartz. They appear to belong to the class of segregated veins occupying fissures which have been produced by local disturbance. It is not yet ascertained

to what extent this disturbance affect the strata below the depth of 175 feet. At this depth the "metals" are thrown to the south about 8 feet, and on the dip the lode assumes its regular course. Some of the small segregated lodes thin out before reaching this depth, being fissure veins of small lateral and vertical extent.

The nest of veins on the Free Claim have proved remarkably rich, and they offer an excellent proof of the transference of gold from the older lodes which are parallel with the stratification, or from the surrounding "metals." Cross veins connect several of these veins as shown on the small plan of the Free Claim.

The deepest shaft at Renfrew is on the well-known Ophir Company's property. It has been sunk a depth of 380 feet. The gold streak on the regular lodes is narrow and dips west at an angle of about forty-five degrees.

The general surface of the country is well suited for mining operations. The slope from the lake at the west end of the district to Meadow Brook at its south-east corner is considerable, and facilities for surface drainage are better than in most districts. The extent of open trenches is not much more than one-third the total length at Oldham, being about 19,000 feet, while the amount of gold produced reached at the close of 1870, 25,246 ounces, against 10,373 ounces from the last named district. The lodes at Renfrew are considerably thicker than at Oldham, and this prevailing feature has led to a better system of mining, although the district is at present in an unusually depressed state, most of the Companies having suspended operations, and the little work that is done outside of the free claim is on the tribute system. Various reasons may be assigned for the present stagnation at Renfrew and other gold-mining districts. A glance at the quarterly returns of the Ophir Company for the last six years shows a very considerable diminution in the yield of gold as the depth increased. The same result has been observed in various other mines in districts far apart, but on the other hand it is one of the results of experience that where a gold streak thins out it is often replaced by another and parallel streak, just as in the thinning out of a bedded lode, it is generally found to be replaced by

another lode, which may or may not be regarded as a continuation, but slightly deviating from the original line of strike.

The following tables show the returns as far as they have been received from Mount Uniacke, Oldham and Renfrew during the present year.

The brief history of the Uniacke Gold Mining Company, (see returns on page 70) compared with the Ophir Company, (page 126) point to a similar diminution of yield as the depth increased, showing that the distribution of the gold in these lodes might lead to steps being taken to search for a parallel streak with favourable results.

YEAR 1871.

GOLD RETURNS from the Renfrew District.

Owners.	Leases.	No. of Acres.	Tons.	Cwt.	Ounces.	Dwt.	Gr.	Date.
Ophir M'g Co.			318	..	260	3	..	Mar. '71.
Do.			516	..	188	12	..	June '71.
Do.			397	..	120	3	..	Sept. '71.
Renfrew Co.			97	..	47	..	..	Mar. '71.
Do.			102	..	33	14	..	June '71.
Do.			52	..	11	15	..	Sept. '71.
Hartford Co.			100	..	109	15	2	Mar. '71.
Do.			153	..	102	13	8	June '71.
Do.			139	..	100	5	..	Sept. '71.
New Haven Co.			68	..	16	14	4	Mar. '71.
Do.			54	..	15	8	6	Sept. '71.

Mount Uniacke District.

West Lake, now owned by Robt Boak	1	..	53	..	8	5	..	March.
Mt. Uniacke Co.	4	..	60	..	21	18	..	"
Do.	1	..	139	..	50	16	..	June.
Central Co.	..	..	13	15	19	10	..	March.
Do.	..	..	19	10	14	4	..	June.
Pr. of Wales Co.	..	..	12	5	13	7	..	March.
Queen Co.	..	..	4	..	19	..	..	"
T. J. Wallace	..	553, 586, 587	83	..	35	..	..	June.

Oldham District.

St. Andrew's Co.	273	All the property as described in previous tables.	110	..	268	15	..	March.
Do.	10		131	15	275	5	11	June
Do.	277		187	6	268	12	15	Sept.
Sterling Co., now owned by B. G. Gray	..	Do.	108	..	160	14	5	March.
	..		131	15	275	5	11	June.
	..		39	..	2	6	..	Sept.
Jos. McAllister.	300	half of 549..	12	6	120	19	..	Dec. '70.
	& 299	338, 340, 551-52	28	5	46	14	20	March '71

It is well worthy of note that the recent returns from Australia point to no such diminution of the yield of gold with the depth. The contrary is indeed found to be the case, and some of the reports from the Bendigo district, Victoria, exhibit extraordinary richness of "reefs" of quartz to which no parallel as far as dimensions and gold producing capacity are concerned have ever been met with in Nova Scotia.*

QUARTERLY REPORTS, VICTORIA.

The Victoria Reef Gold Mines Company, Bendigo, Victoria.—Victoria Reef, from 2026 tons of quartz, got 3362 oz. 18 dwt. 4 gr. of gold. The depth was from 330 to 420 feet, and width of reef from 7 to 14 feet.

Rose of Denmark Company, Johnson's Reef, Bendigo, Victoria, raised 565 tons of quartz from a depth of 360 feet, which yielded 897 oz. 1 dwt. 12 gr. of gold.

Collmann & Tacchi's Company, on Collmann & Wetheroll's Line of Reef, Bendigo, obtained 1175 oz. 11 dwt. 12 gr. of gold from 490 tons of quartz, raised from a depth of from 210 to 720 feet, with a reef 6 feet in width.

The Great Extended Hustler's Reef Gold Mining Company, Bendigo, on the Hustler's Reef, Bendigo.—From 4155 tons of quartz obtained 3050 oz. 12 dwts. of gold. Depth 400 to 500 feet, width of reef (average) 25 feet.

The Argus Company, Argus Line, Bendigo, obtained 326 oz. 19 dwt. from 718 tons of quartz. Depth, 215 to 420 feet: the reef consists of a number of veins—varying from 3 to 13 inches.

The Catherine Reef United Claimholders' Gold Mining Company, Bendigo, won 1047 oz. 9 dwt. from 3636 tons of quartz. Depth from surface, 360 feet, principally small veins."

* Supplement to the London Mining Journal, Dec. 1871.

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