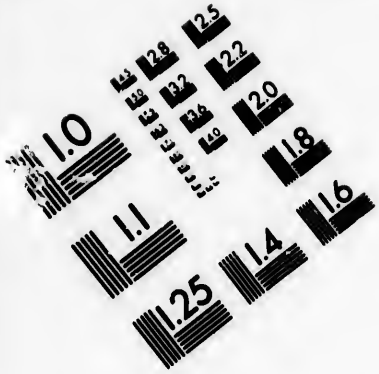

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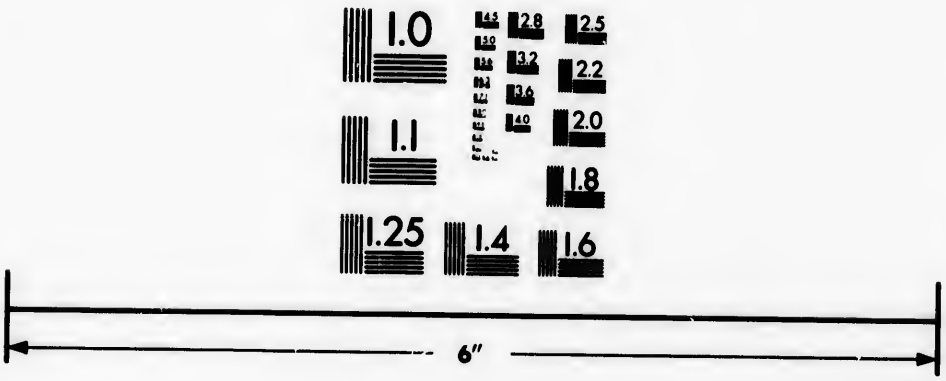

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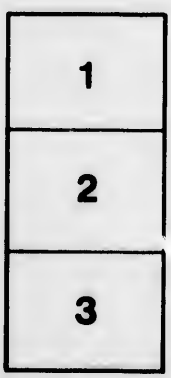

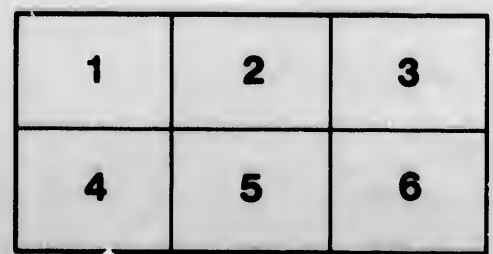

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THE

GOLD-BEARING MISPICKEL VEINS OF MARMORA,

ONTARIO, CANADA.

BY

R. P. ROTHWELL, M.E.,

NEW YORK CITY.

A Paper Read before the American Institute of Mining Engineers, at the Philadelphia Meeting, February, 1881.

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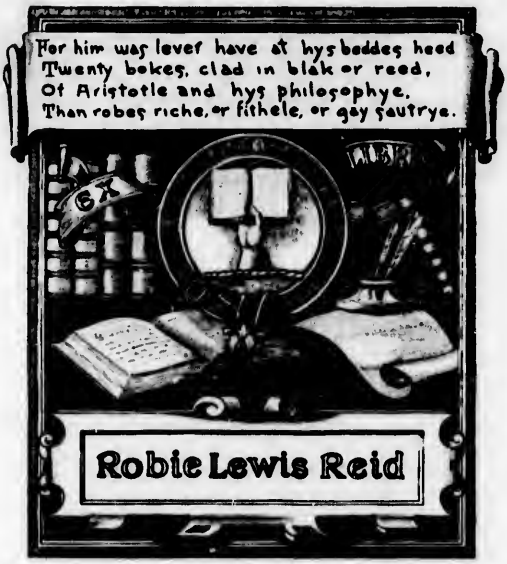
1881.



THE GOLD-BEARING MISPICKEL VEINS OF MARMORA, ONTARIO, CANADA.

BY R. P. ROTHWELL, M.E., NEW YORK CITY.

ABOUT thirty miles north of the city of Belleville (which is situated on a branch of Lake Ontario), and in the township of Marmora, Ontario, there is found a belt of gold-bearing quartz veins which present geological, mineralogical, and economic features of great interest to the profession. The district in which these veins are found is characterized as a rolling country, with low rounded hills of syenitic granite, overlain on the flanks of the hills by Silurian limestones, which lie in nearly horizontal beds, and in some places are so fine in texture as to afford lithographic stone of a fair quality.

The gold-bearing veins run north and south through this belt of syenitic granite, and are quartz-filled true fissures, with micaceous or talcoid slates forming the walls of and horses in the veins. This talcose, slaty rock is evidently the product of the chemical decomposition of the syenite along the fissures, the quartz being segregated from the country rock into the veins, and the hornblende of the syenite furnishing the magnesia of the talcoid slates. The veins, besides quartz, contain also, as gangue, crystallized calc-spar, and occasionally crystallized black mica. The ore scattered through this gangue, in heavy bands in some places and in detached, well-formed crystals at others points, is an arsenical sulphuret of iron (mispickel), having a composition of about 55 per cent. of iron and [illegible] per cent. of arsenic, and perhaps 20 per cent. of sulphur. The mispickel contains the greater part of the gold for which the mines are worked, but free gold is also found scattered through the quartz in small leaves and grains, and it is also found, showing freely at times, in the mispickel itself.

The tests which have been made of these veins and their ores have so thoroughly established the facts of the continuity of the veins, both in length and depth and the economic value of the ores, that

the interest which would naturally be taken in so promising a prospect as this was, even before development, has now deepened into the substantial form of an interest in a great industrial enterprise.

Gold was first discovered in this district in 1865 as free gold in quartz and mispickel, and sporadic attempts have since been made at two or three points to treat the ores, chiefly by raw amalgamation. As might have been anticipated from the nature of the ore, but a very small proportion of the gold was saved in this way, while the expense of treatment in the small and primitive mills adopted was great and the loss of quicksilver heavy. There was neither experience nor technical knowledge available at the time, and no sufficient capital to put up suitable works or to develop the mines; hence they have lain idle all these years without a single serious effort to work them on an economical basis. Nevertheless, many tests of the ores were made, some on quite an extensive scale, in reduction works in the United States and England, and the results were invariably highly satisfactory.

By far the most extensive and the only systematic tests of these veins and their ores have been made upon the properties shown in the accompanying maps, and which form a portion of the properties combined under the ownership of the Canada Consolidated Gold Mining Company.

From these tests some four or five parallel veins have been proven to exist in a belt of 500 or 600 feet in width, running through the property of this company for a length of over three-quarters of a mile, while the main vein has been opened on adjoining properties, making a total proven length of this great fissure of about three miles on the vein, a fact which, next to actual sinking, may be considered the best proof of the continuance in depth of the veins. Three of these veins have been proven on this property by costean pits and shafts sunk at short intervals along their outcrops, to depths varying from 15 to 150 feet. In this manner, the east or main vein has been thoroughly explored over a length of about 800 feet by shafts of from 40 to 150 feet in depth; these have, in every case, been in pay-ore all the way; their lowest points are now in as good ore as has been found on the property; and they have shown this vein to have a thickness exceeding 20 feet in many places, and averaging probably 8 or 10 feet; while the middle and west veins, though smaller, have still apparently a thickness of three feet and upward. As each foot of thickness for a length of 700 feet and a depth of 150 feet will yield about 10,000 tons of ore, the estimates which count as technically in sight,

in this small part of this vein alone, fi m 60,000 to 75,000 tons of ore, must be considered very moderate. These estimates and some much higher have been made by a number of experts of large experience.

Perhaps the question of greatest interest is the average gold contents of the ore; and as this has been determined in a very thorough manner under my own supervision, I shall enter somewhat into the detail of the work, as showing what is considered essential in determining with safety the average value of a gold ore and of a mine.

Some three or four thousand tons of ore have been mined upon this property, and of this about a half has been milled or treated in a variety of ways, and the remainder is now on the dumps. The first tests of these ores were made from samples selected by various experts who have from time to time examined the property. Some of the results were as follows:

Twenty assays, made at the laboratory of the Geological Survey of Canada, of samples from the Marmora mines, gave an average of 1.6367 ounces of gold, equal to $33.81 per ton of 2000 pounds. Twelve of these samples were from the Gatling mines, and gave an average of 1.9107 ounces of gold, or $39.47 per ton.

Professor E. J. Chapman, of the University College, Toronto, says: "I have made assays of its ores from time to time, and I have never failed to obtain from any sample (mispickel), as a minimum value, at least $50 per ton." "The following results were obtained from samples collected very carefully, with a view to obtain the average amount of precious metal held by the undressed ore: No. 1, or East Vein—Gold, $73.50; silver, ¼ ounce. No. 3, or Middle Vein—Gold, $69.86; silver, ¼ ounce. O'Neil Shaft, middle vein—Gold, $60.26; silver, ¼ ounce. On a former occasion, I obtained from a small sample of the Gatling ore $112, and from pure mispickel $156 per ton."

Mr. James Douglas, Jr., Mining Engineer, says: "A sample taken as fairly as possible from the ore-piles on the Gatling Company's property, the five-acre lot and the Hawkeye lot, gives me in gold 1 oz. 5 dwts., value, 25.84 per ton of 2000 pounds."

Professor W. T. Rickard, of London, says: "I took samples from the various shafts and openings on each claim, and ground them together. . . . I picked out a large quantity of pure mispickel, crushed and sampled, and assayed the same. . . . I deducted the estimated amount of quartz, associated with the mispickel, and then

allowed 50 per cent. for depreciation in the quality of the mispickel. The following results were obtained by careful assay:

Hawkeye ore from three shafts, mixed mispickel—Gold, $753.48; silver, $15.71. Total, $769.19.

Gatling five-acre lot.—From one shaft quartz—Gold, $200.93; silver, $3.14. Total, $204.07 per ton.

Gatling Company.—From three shafts, mixed mispickel—Gold, $351.63 ; silver, $21.91. Total, $373.54.

Gatling Company.—O'Neil Shaft, third vein—Gold, $376.64; silver, $7.85. Total, $384.49.

Tuttle Property.—Surface quartz—Gold, $125.48 ; silver, $4.70. Total, $130.18.

Average—First-class quartz and pure mispickel, . .	$372 29
Deduct ⅓ ton for gangue in bulk, leaving . . .	74 46
" ½ ton for inferior mispickel, leaving . .	37 23
" for loss in reduction $7 23, leaving . . .	30 00

Or net yield of ore in treatment $30 per ton.

F. W. Dahne, Esq., who dressed a lot of this ore sent to Swansea, says: "The ore I treated contained, before dressing, 2½ ounces of gold to the ton (2240 pou

Captain Benjamin [illegible]mer, who examined these mines for Messrs. John Taylor & Sons, of London, carefully sampled the ores from the different openings, and had his samples assayed by Professor Chapman, of University College, Toronto, who obtained the following as the average of a number of assays, gold counted at $20.66 per ounce troy:

Sample No. 19, Gold $38.65 per ton of 2000 pounds.
" No. E, " 24.87 " "
" No. F, " 36.60 " "
" No. G, " 24.74 " "
Average, $31.21.

The amount of silver in these samples never exceeded ¼ ounce per ton.

TESTS ON A LARGER SCALE.

Two barrels of average ore treated at Balbach's works, in Newark, N. J., yielded:

From East Vein—Gold, $23.76; silver, $4.07. Total, $27.83 per ton of 2000 pounds.

From O'Neil Shaft.—Gold, $25.62 ; silver, $4.39. Total, $30.01 per ton.

Four barrels of ore sent to Messrs. Richardson & Co., Swansea,

yielded as follows (assays being reduced to dollars per ton of 2000 pounds):

Tuttle Shaft.—Gold, $93; silver, $7 per ton (2000 pounds).

Gatling Company's Deep Shaft.—Gold, $37.21; silver, $20 per ton (2000 pounds).

Gatling Company's A Shaft.—Gold, $23.15; silver, $18 per ton (2000 pounds).

Gatling Company's O'Neil Shaft.—Gold, $23.15; silver, $100 per ton (2000 pounds).

The report for a large lot of ore from the O'Neil shaft, subsequently sent to the same Swansea parties, was as follows:

For 19.8 tons: Gold, $23.15; silver, $0.50 per ton of 2000 pounds.

For 9.9 tons: Gold, $27.90; silver, $0.75 per ton of 2000 pounds.

For 4.4. tons: Gold, $55.81; silver, $0.50 per ton of 2000 pounds.

Analyses of pure mispickel, made by Thomas Thomas and J. Hernaman James, Assayers in Swansea, to Messrs. Richardson & Co., were as follows (the gold being reduced to dollars in a ton of 2000 pounds at $20.67 per ounce):

	SMALL CRYSTALLIZATION.	LARGE CRYSTALLIZATION.
Peroxide of iron	51.00	56.00
Silica	0.51	0.03
Sulphur	19.03	18.13
Arsenic	25.70	23.00
Nickel	trace.	trace.
Silver (per ton of 2000 pounds).	trace.	$6.50
Gold (per ton of 2000 pounds)...	$306.95	2920.67

Mr. E. W. Harmon, in 1876, tested the ores from these properties in the interest of Boston parties, who had a patent process for treating sulphuret ores. The following are the results obtained by Mr. Harmon from average samples selected by himself:

	Per ton of 2000 pounds.
No. 1. East Vein Gatling Company, gold, . . .	$123 84
" 2. " " " . . .	37 84
" 3. " " " . . .	37 84
" 4. " " " . . .	75 68
" 5. Middle Vein " " . . .	48 16
" 6. " " " . . .	116 96
" 7. West Vein " " . . .	41 28
" 8. " " " . . .	120 40
" 9. Sample from all of foregoing, ...	61 92

No. 10.	Gatling South,	41 28
" 11.	" five acres,	550 40
" 12.	" "	595 12
" 13.	" "	37 84
" 14.	Williams mine, tailings,	34 40
" 15	Gatling Company—Shaft, free gold,	440 32
" 16.	Gatling roasted steely ore amalgamated,	48 16
" 17.	Gatling rich pyrites, raw treatment,	1265 92
" 18.	1 pound average material from first test by a stirring (amalgamating) process,	52 46

18.7 tons of ore from the several shafts of the Gatling Company's mines were then treated by the same parties, the process being roasting and amalgamating; the roasting was very imperfect, being effected in a revolving cylinder only 3 feet diameter and 12 feet long, heated from the outside, and with a strong draught of air forced through it by a blower. The consequence was, that the flue-dust contained much gold, and the roasted ore carried 6 per cent. of sulphur.

The following were the assays of lots of from two to three tons each:

	Ore.	Tailings.
No. 1,	$30 90	$30 30
" 2,	41 20	6 67
" 3,	65 23	6 87
" 4,	41 20	6 87
" 5,	51 50	8 58
" 6,	44 71	12 04

Average gold in 18.7 tons was $35.46 per ton, counting gold at $20 per ounce.

Gold actually saved was $25.32 per ton, or 71 per cent. of assay value, while there was still in the bottoms in flue-dust returnable for retreatment, obtainable gold that would have made the yield $27.31 per ton, or 77 per cent.; and the tailings were extremely rich, and could easily have yielded on shaking tables or belts gold enough to have made the actual yield $30 or $31 per ton.

Captain Thomas Couch, Mine Superintendent, in his examination of these mines, in February, 1880, carefully sampled the several mines, taking one and two ton samples of the ore just as it came from each of the shafts and levels, without sorting.

The results were as follows:

	Gold.	Silver.
Tuttle shaft, 2 tons,	$26.46 per ton.	1.28 ounces.
Deep shaft levels, 2 tons,	16.33 "	.79 "
Middle vein, 2 tons,	32.65 "	1.58 "

N. Hawkeye shaft, ...	7.85 per ton.	.38 ounces.
S. Hawkeye shaft	7.44 "	.36 "
Concentrates (Tuttle shaft), . .	137.48 "	6.65 "
" (Levels deep shaft), .	65.00 "	3.14 "
" (Middle vein), . .	107.48 "	5.20 "
"	129.19 "	6.25 "

Assayed by W. E Gifford, 54 Pine Street, New York.

Mr. R. H. Stretch, Mining Engineer, sampled the mines by taking one-ton lots of the ore just as it came from the several shafts and levels, without sorting, and the result of his assays was as follows:

Deep shaft, bottom, ...	$21.50 per ton.
N. level, ...	9.00 "
S. level, ...	7.50 "
A shaft (3 samplings), ...	17.92 "
Tuttle shaft, ...	19.00 "
Average after parting; gold, ...	13.06 "

By far the most exhaustive tests of these ores were made under my own direction. Having secured a working bond upon these properties, I carried on mining and milling operations with a force of eighty or ninety men during nearly four months. During this time, seven shafts were worked upon and attained depths of from forty to one hundred and ten feet; and two levels of forty feet each in length were driven. Three of these shafts, namely, the Tuttle, the A shaft, the deep shaft, and two levels were those upon which the most work was performed, and it is to the ore from these that the following remarks are confined. These openings prove a length along the main vein of about seven hundred feet, as may be seen by reference to the accompanying maps.

The ore extracted, *without any sorting whatever*, was taken to the mill; it was then weighed and crushed for the greater part in five-ton lots, every twentieth shovelful as it came from the Blake crusher being laid aside for a sample. The samples of five-ton lots were crushed fine, quartered down as usual, and assayed; thus, one hundred and eight lots, nearly all representing five tons of ore, were assayed separately, while fifty-one tons from the Tuttle shaft were sampled in the same careful manner in one lot by Mr. Thomas Macfarlane, of the Wyandotte Silver Smelting Company. The assays of these several samples are given in the following table. It will be noted that the richer five-ton lots were obtained by selecting the heavier sulphurets from the remainder of the ore in the ore-house

so as to demonstrate the effect of rough hand-sorting; the low assays were therefore of second-class ore; the whole number of assays gives, however, the average yield of the ore just as it comes from the mine without sorting. The higher assay numbers (last assays made) were, in general, from ore mined nearest the surface, and which accordingly was found at the centre of the dump. Nearly one-half the dump was milled, and the last milled came from the centre of the dump.

NOTE.—The proportions of gold and silver in the assay buttons were obtained by parting 89 buttons in one operation. It was found the average was 68 per cent. gold, 32 silver. The following table gives only the gold, or 68 per cent. of the weight of the button:

Record of Assays of Canada Consolidated Gold Mining Company's Ores, mostly from the Gatling Mine—108 samples, mostly 5 tons each, representing a total of 515 tons of 2000 pounds.

1.....$33 04	29..... $6 33	56..... $9 84	83.....$10 90
2..... 14 06	30..... 8 08	57..... 42 18	84..... 11 07
4..... 9 84	31..... 25 31	58..... 28 12	85 ..... 9 49
5..... 18 98	32..... 7 03	59..... 27 06	86..... 7 38
6..... 43 94	33..... 33 74	60..... 14 76	87..... 4 57
7..... 15 11	34..... 7 38	61..... 39 37	88..... 5 98
8..... 11 60	35..... 7 38	62..... 11 25	89..... 32 34
9..... 10 55	36..... 6 50	63..... 9 84	90..... 7 03
10..... 11 76	37..... 12 65	64..... 23 20	91..... 7 73
11..... 8 44	38..... 16 17	65..... 16 17	92..... 5 62
12..... 11 60	39..... 9 84	66..... 9 49	93..... 33 04
13..... 8 79	40..... 18 28	67..... 8 44	94..... 32 34
14..... 9 84	41..... 21 79	68..... 12 65	95..... 15 47
15..... 9 14	42..... 14 76	69..... 10 72	96..... 6 33
16..... 7 73	43..... 7 03	70..... 10 90	97..... 9 49
17..... 11 25	44..... 10 55	71..... 6 33	98..... 17 58
18..... 16 17	45..... 7 73	72..... 5 27	99..... 17 58
19..... 14 06	46..... 4 92	73..... 8 44	100..... 9 14
20 ..... 7 38	47..... 9 14	74..... 9 84	101..... 5 45
21..... 11 25	48..... 53 43	75..... 5 62	102..... 12 83
22..... 9 49	49..... 5 62	76..... 7 38	103..... 13 36
23..... 7 03	50..... 5 62	77..... 12 48	104..... 4 92
24..... 9 14	51..... 5 62	78..... 11 07	105..... 15 11
25..... 8 79	52..... 17 58	79..... 5 98	106..... 5 62
26..... 11 25	53..... 13 71	80..... 7 03	107..... 28 12
27..... 8 44	54..... 18 98	81..... 10 90	108..... 11 95
28..... 18 28	55..... 8 44	82..... 8 26	109..... 7 03

Average 108 samples, 515 tons Gatling ore, assayed by A. Thies, $13.37 gold per ton.
Check assays, by Prof. Richards, of Boston, and Gifford, of New York, $14.75.
Average value Gatling ore, East vein, $14.06 per ton.
Average samples, aggregating 63 tons Tuttle shaft, East vein, $24.88.
Average samples, aggregating 12 tons, Middle vein, $30.82.

Allowing the proper proportion of ore-reserve to each of these shafts, the average assay value of the ore in reserves I find to be $18.65 in gold per ton.

From these most exhaustive tests, the average gold contents of the ore were determined with great accuracy.

Perhaps the most interesting and certainly one of the most important and valuable facts developed was the very remarkable uniformity of the gold yield of the ore.

In only three instances—even of second-class ore after the richer ore had been roughly picked out—was less than five dollars per ton in gold found, and the highest assay of a five-ton lot was $53.43 per ton. Samples of a few hundred pounds have been found to run as high as $150 per ton, and hand samples very much higher; but these were not considered as safe guides in valuing a mine, and were therefore rejected as exceptional.

THE TREATMENT OF THE GOLD-BEARING MISPICKEL.

When I first commenced testing these mines, about fifteen months ago, I was met by a vast array of *dicta* concerning the difficulties to be encountered in roasting, in amalgamating, or otherwise getting the gold out of arsenical sulphurets of iron. It is fair to add, however, that these difficulties were always reported by *persons who had not themselves worked such ores,* but had "always understood" they existed. No satisfactory record of tests actually made with such ores being on record, so far as I know, I determined to make history myself; and though in some particulars we have still very much to learn, the facts which we did establish may be of use to the profession, and I gladly communicate them.

As there could be no possible question about the facility of concentrating mispickel with a specific gravity of about 6 or 6½ from quartz and calc-spar, with a specific gravity of about 2½, we did not consider it necessary to build concentrating works to test that point; and as there was no concentrator except a centre-discharge buddle taking all the ore as it came from the battery (with forty-mesh screens) without sizing, it was no matter of surprise that at times one-half of the gold was lost in this operation. That, however, was not so much a consideration with us as to determine points upon which knowledge was not obtainable.

The ores were sampled in the manner mentioned above before going through the battery. After concentration, the concentrates from some two or three hundred tons were roasted in a muffle furnace, those from nearly 600 tons in a reverberatory, and those from several hundred tons in a revolving cylinder. The results in all cases showed that these arsenical sulphurets roast with the greatest facility, and in much less time than simple pyrites, owing probably to the fact that the arsenic is volatilized at a much lower heat than the sulphur, and in escaping it leaves the ore in a measure porous, and therefore in suitable condition for oxidizing the sulphur. The consumption of fuel was far greater in the reverberatory and muffle

furnaces than in the revolving cylinder, where indeed one cord a day would roast ten tons of ore.

There was no comparison, either, in the cost of labor in these different systems (in the revolving cylinder it was about 50 cents per ton), and our results give a very decided advantage to the automatic continuous cylinder in the uniformity of the roast. It was found that ore which took one hour and three-quarters to pass through the cylinder was thoroughly roasted, so far, at least, as was necessary for amalgamation.

The chief objection to the cylinder was in the amount of flue-dust made, and that in a somewhat less degree is also the objection to any hand-rabbled furnace. The arsenic fumes are very dense, and when aided by a rapid current of air, they easily carry over dust and gold.

The question is not at all one of roasting the ore, for arsenical sulphurets roast much more easily, more quickly, and sinter less than simple sulphurets; but the important question—the only practical difficulty found in the treatment of these ores—is that of preventing a loss of extremely fine gold, which is mechanically carried over with flue-dust and arsenic fumes. This cause of loss, though it will probably always exist to a greater or less extent, does not appear by any means insuperable; but our tests have thoroughly convinced us that, both on the score of expense and loss in flue-dust, no hand-rabbled furnace is admissible. The automatic continuous revolving furnace, known in the Western States as the White & Howell furnace, and in England as the Oxland, is entirely satisfactory so far as expense is concerned; but without special precautions, it will make too much flue-dust. By taking out most of the shelves, or leaving only sufficient to turn over and not lift the ore (which when hot, runs like quicksand), the greater part of the loss which we encountered would, no doubt, be avoided. There are other modifications in the revolving cylinder which have suggested themselves; but as they have not been tried, they need not be mentioned here.

In Philadelphia, a revolving hearth, with fixed rabbles, and with a preheating furnace forming the flue from the revolving hearth, has worked well, and undoubtedly made less dust than the cylinder.

Of course, some of the gold escaping is recovered by the retreatment of the flue-dust; but there would still be a loss, which should, and in a great measure undoubtedly can, be avoided.

The roasted ore was found to amalgamate with the greatest possible facility, 80 and even 85 per cent. of the gold contained in the

roasted ore being obtained in regular work and with a very slight loss of mercury. There is no flouring of the mercury, and the gold is bright and very readily amalgamated.

Some of the roasted ore was treated by chlorination under pressure (Mears's process), and practically nearly the full fire-assay was obtained. Even including the loss in flue-dust in roasting in the revolving hearth, an ore which assayed less than $14 per ton *yielded, net in the bullion, 91 per cent. of the fire-assay;* so that it is thought that by care in roasting, from 93 to 95 per cent. of the gold in the concentrates can be regularly obtained. That the loss in concentrating will be very small, can be understood when it is considered that the concentration will not be made close. It is proposed to crush the ore in rock-breakers to from $\frac{1}{2}$ to 1 inch size, screen in revolving screens which will size into say $\frac{1}{4}$ to $\frac{1}{2}$ inch and $\frac{1}{2}$ to 1 inch, which would then be jigged, the richer ore going to rolls, and thence directly, to the roasting furnace without concentration, and the poorer going to other rolls, where it is crushed, and then jigged. It is thought that from $\frac{1}{2}$ to $\frac{2}{3}$ of the sulphurets, and consequently of the gold, will be obtained in the coarse jigging, and will suffer no loss in concentration.

The practical working of these ores I hope to give in another paper at some future time, when the works now building shall have given results on a large scale. The works for the Canada Consolidated Gold Mining Company are intended to treat from 100 tons to 125 tons a day.

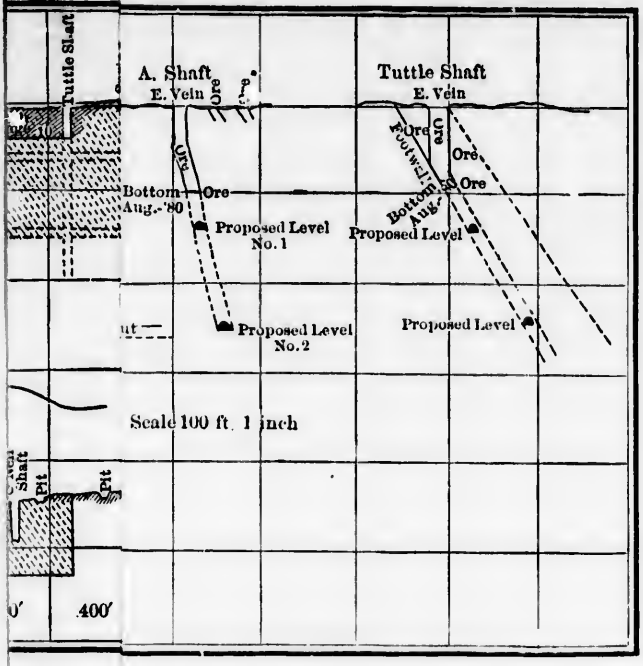
Without going into the cost of mining and milling these ores, a subject which I hope to give, with large practical results, at a later day, I may say that a number of experts, taking from the books the figures of cost of such work as has already been done at the mines, have estimated at from $3 to $3.50 per ton of ore, as it comes from the mines, the entire cost of mining and milling. This cost is made up about as follows:

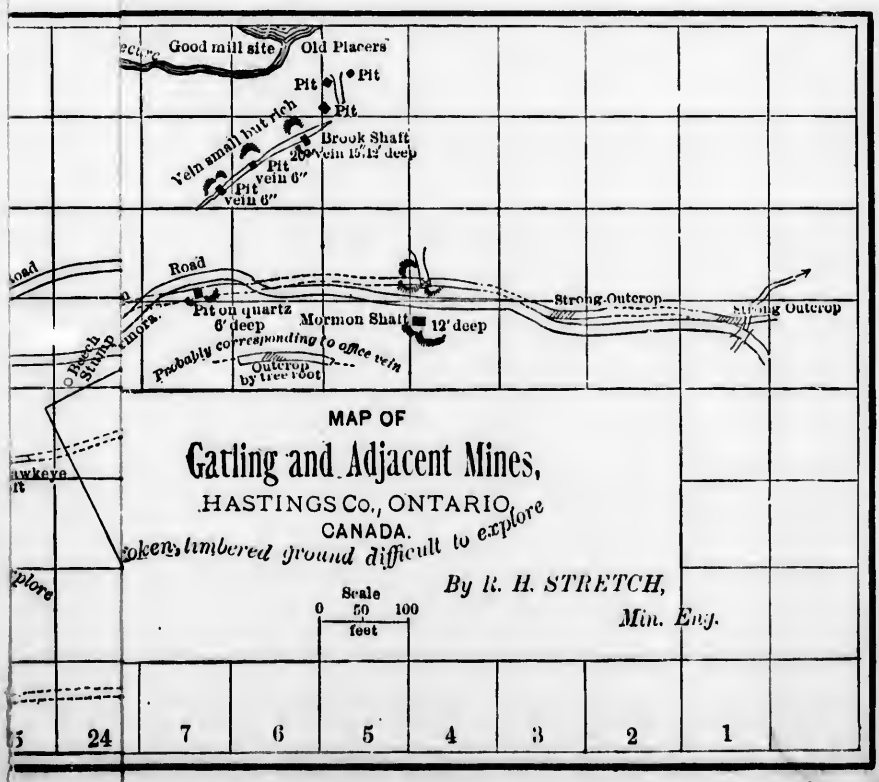
Mining, per ton of ore as mined,	$1 75	
Concentrating, ...	50	
Roasting, ...	20 = 60 cents per ton concentrates.	
Chlorinating, ...	50 = $2 per ton roasted concentrates.	
Contingencies, ...	55	
	$3.50 per ton.	

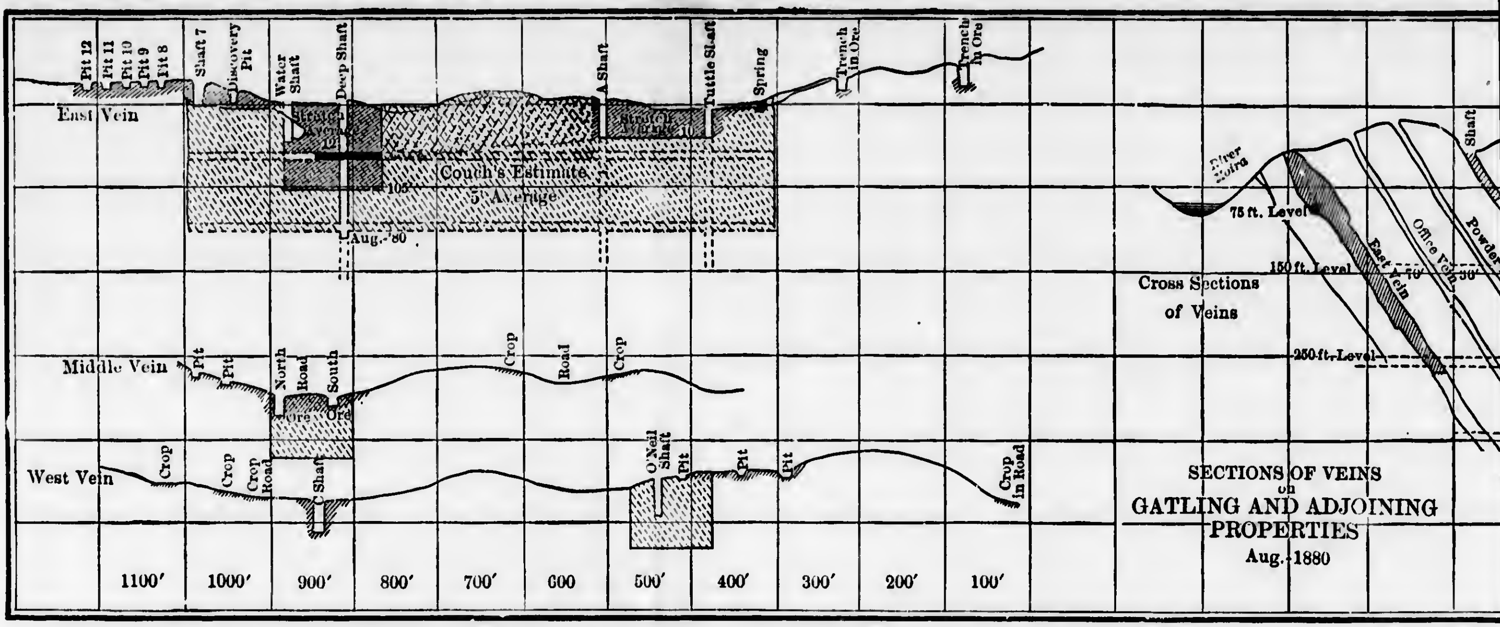
Labor is paid $1 to $1.25 per day; wood, $1.25 per cord;

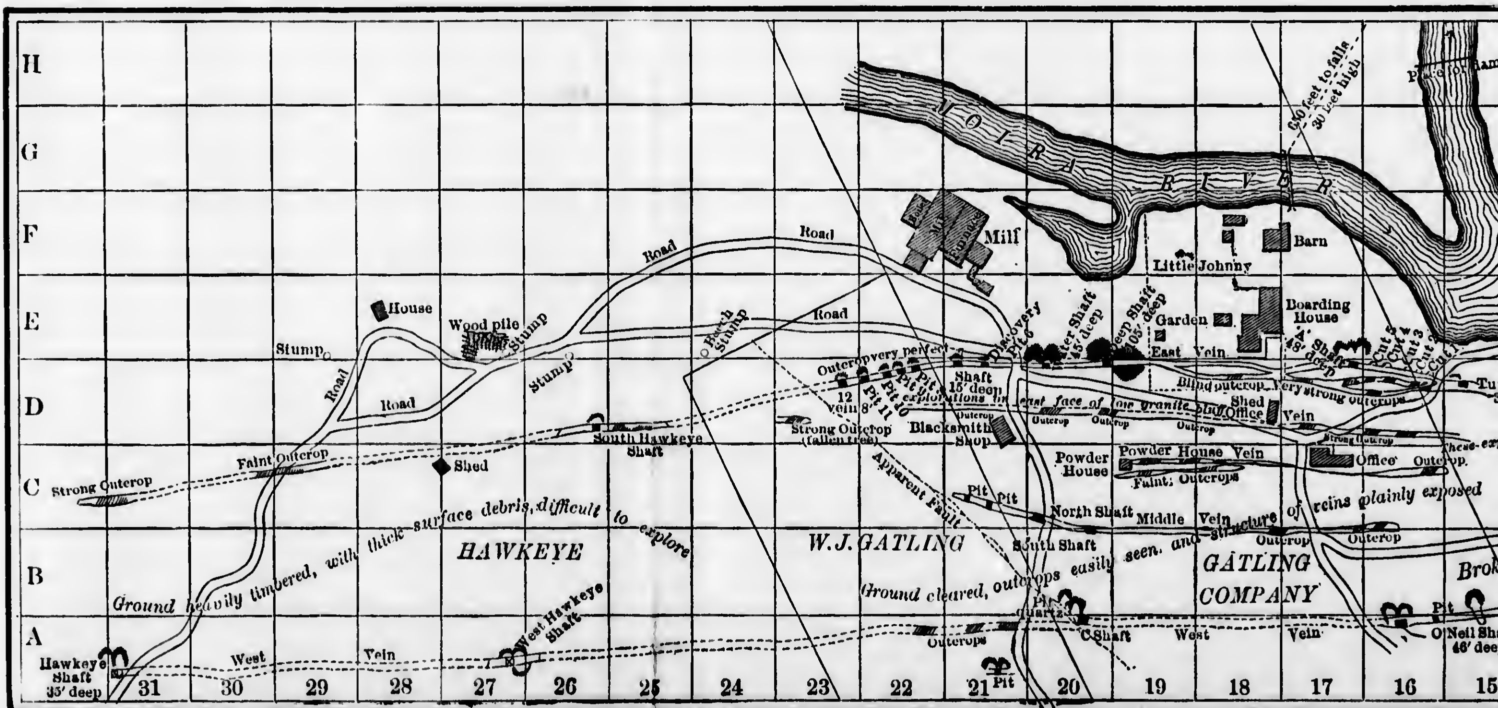
water-power will partly drive machinery. Supplies of all kinds extremely abundant and cheap.

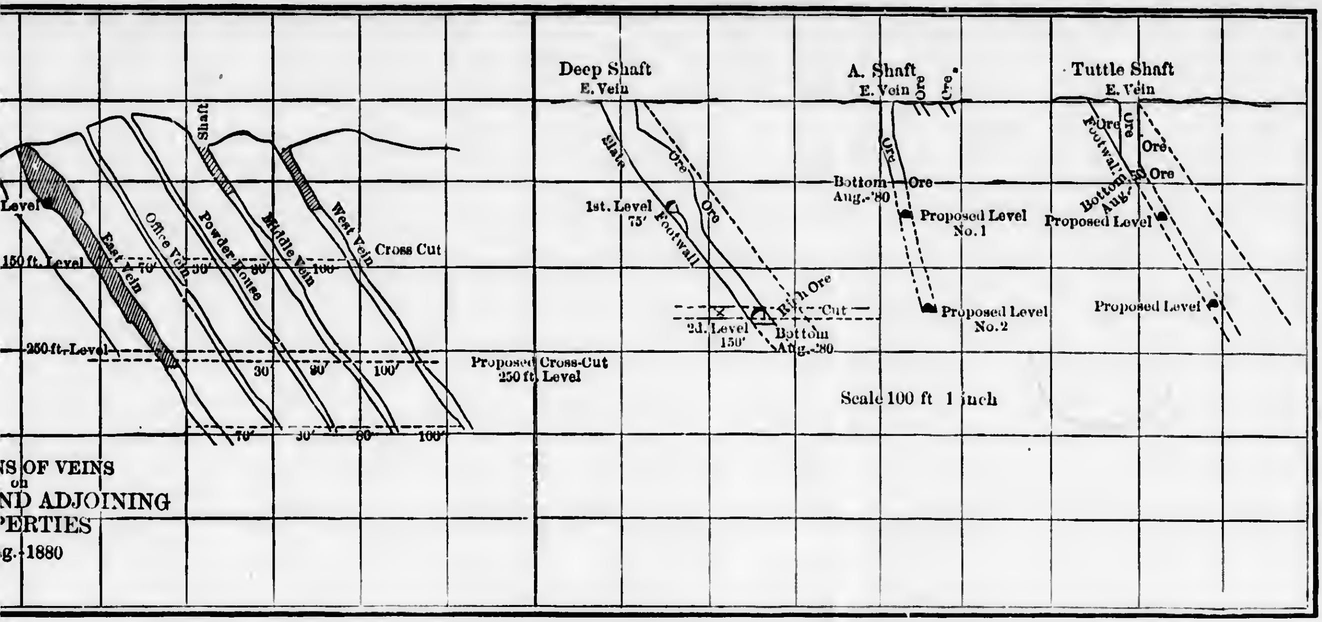
The ore carries as an average between $18 and $19 per ton in gold, and assuming a net yield in bullion of only 80 per cent., the net profit on the treatment of these ores is estimated at from $10 to $12 per ton.


Tuttle Shaft
A. Shaft
E. Vein
Ore
Tuttle Shaft
E. Vein
Ore
Ore
Ore
Ore
Bottom Aug. '80
Proposed Level No. 1
Bottom Aug. '80
Proposed Level
Proposed Level No. 2
Proposed Level
Scale 100 ft. 1 inch
Pit
Pit
400'

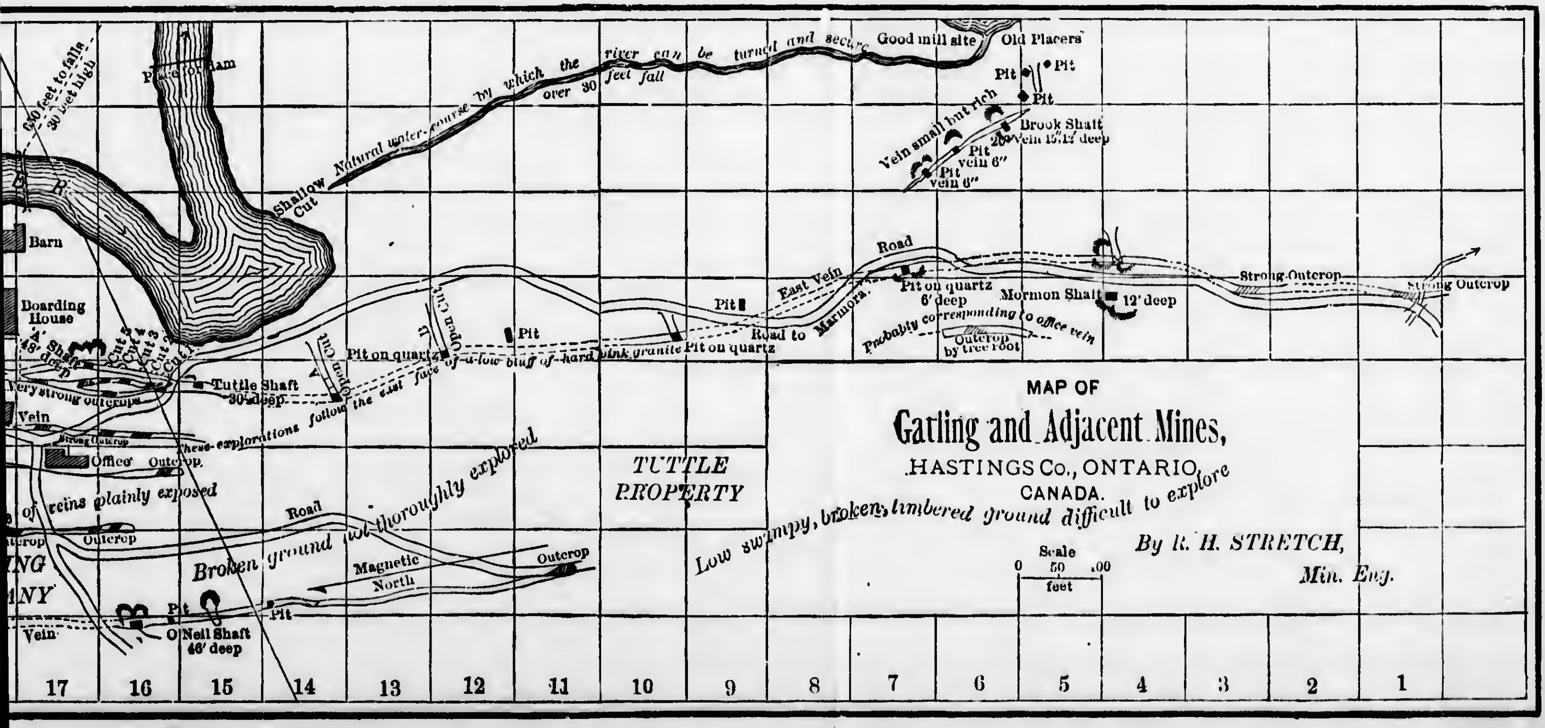

Good mill site
Old Placers
Pit
Pit
Pit
Veln small but rich
Brook Shaft
Vein 15-12' deep
Pit
vein 6"
Pit
vein 6"
Road
Road
Pit on quartz
6' deep
Mormon Shaft
12' deep
Strong Outcrop
Strong Outcrop
Probably corresponding to office vein
Outcrop
by tree root
MAP OF
Gatling and Adjacent Mines,
HASTINGS Co., ONTARIO,
CANADA.
Broken, timbered ground difficult to explore
By R. H. STRETCH,
Min. Eng.
Scale
0 50 100
feet
24
7
6
5
4
3
2
1


Pit 12
Pit 11
Pit 10
Pit 9
Pit 8
Shaft 7
Discovery Pit
Water Shaft
Deep Shaft
A Shaft
Tuttle Shaft
Spring
Trench in Ore
Trench in Ore
East Vein
Couch's Estimate
5' Average
Aug. '80
Middle Vein
Pit
Pit
North
Road
South
Crop
Road
Crop
Ore
Ore
West Vein
Crop
Crop
Crop
Road
Shaft
O'Neil Shaft
Pit
Pit
Pit
Crop in Road
River Moira
75 ft. Level
150 ft. Level
250 ft. Level
East Vein
Office Vein
Powder
Shaft
Cross Sections
of Veins
SECTIONS OF VEINS
on
GATLING AND ADJOINING
PROPERTIES
Aug. 1880
1100′
1000′
900′
800′
700′
600
500′
400′
300′
200′
100′


H
G
F
E
D
C
B
A
MOIRA RIVER
Mill
Barn
Little Johnny
Boarding House
Garden
House
Wood pile
Stump
Stump
Stump
Road
Road
Road
Road
Road
East Vein
Blind outcrop
Very strong outcrops
Shed
Office
Vein
Blacksmith Shop
Strong Outcrop (fallen tree)
South Hawkeye Shaft
Shed
Faint Outcrop
Strong Outcrop
Powder House
Powder House Vein
Faint Outcrops
Office
Outcrop
Apparent Fault
North Shaft
Middle Vein
South Shaft
Pit
Pit
Outcrop
Outcrop
HAWKEYE
W. J. GATLING
GATLING
COMPANY
Ground heavily timbered, with thick surface debris, difficult to explore
Ground cleared, outcrops easily seen, and structure of veins plainly exposed
West Hawkeye Shaft
Hawkeye Shaft
35′ deep
West
Vein
Outcrops
C Shaft
West
Vein
O'Neil Shaft
46′ deep
Pit
Pit
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15



Deep Shaft
E. Vein
A. Shaft
E. Vein
Tuttle Shaft
E. Vein
Level
150 ft. Level
250 ft. Level
East Vein
Office Vein
Powder House
Middle Vein
West Vein
Cross Cut
Proposed Cross-Cut
250 ft. Level
1st. Level
75'
2d. Level
150'
Bottom
Aug.-'80
Rich Ore
Cut
Footwall
Ore
Bottom
Aug.-'80
Proposed Level
No. 1
Proposed Level
No. 2
Proposed Level
Scale 100 ft 1 inch
NS OF VEINS
on
ND ADJOINING
PERTIES
g.-1880



Good mill site
Old Placers
Natural water-course by which the river can be turned and secure over 30 feet fall
Shallow Cut
Place for dam
Vein small but rich
Brook Shaft
Pit
Barn
Boarding House
Tuttle Shaft
30' deep
Very strong outcrop
Road
East Vein
Pit on quartz
6' deep
Mormon Shaft
12' deep
Strong Outcrop
Road to Marmora
Probably corresponding to office vein
Outcrop by tree root
Pit on quartz
Open Cut
These explorations follow the east face of a low bluff of hard pink granite
Office
Outcrop
TUTTLE PROPERTY
veins plainly exposed
Broken ground not thoroughly explored
Low swampy, broken, timbered ground difficult to explore
Magnetic North
Outcrop
O'Neil Shaft
46' deep
Vein
MAP OF
Gatling and Adjacent Mines,
HASTINGS Co., ONTARIO,
CANADA.
Scale
0 50 100
feet
By R. H. STRETCH,
Min. Eng.
17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1