9-5-69

file: Granite - Bimetallic Mine
Flint Creek (Philipsburg)
Granite County, Mt.

GRANITE BIMETALLIC SAMPLE TABULATION

Level	No. of Samples	Average Width	Average Assay Au	Ag	Pb	Zn	Cu
1100	23	8.6	0.05	2.18	0.21	0.32	0.09
1200	20	7.7	0.03	4.04	0.13	0.18	0.05
1400	23	8.0	0.03	2.06	0.05	0.27	0.02
1500	42	7.9	0.035	3.06	0.10	0.13	0.01
1600	17	6.6	0.062	0.73	No	0.05	Tr
1700	51	7.2	0.032	3.54	0.09	0.29	0.02
TOTAL	176	7.7	0.037	2.84	0.10	0.22	0.03

By JTL
9-5-69

JTL/hdh

Sampling by Hecla Mining Co.
who dewatered mine in 1969

3/2/66--Handed to D. R. MacLaren by Kenneth Davis of Seattle on this date.

m.l.s.

wash-water. These operations may become so tedious in some cases that much time will be lost, and the number of tanks will have to be increased. In order to obtain clear solutions, it seems to me, the trough system will require as many, if not more, tanks for the silver leaching-plant alone than the ordinary method. Hence, double, or more than double, the number of tanks may be needed, including the base-metal leaching.

6th. Finally, I will point out a disadvantage of a chemical nature. The swift stream of hyposulphite solution in the silver leaching trough causes an additional exposure of surface of the solution to the air, and, in consequence, a more rapid deterioration of the hyposulphite salts. This will be especially the case with calcium hyposulphite solution, to the use of which Mr. Hofmann tenaciously clings. Covering the trough would be of no benefit, since the rapid current causes considerable suction.

If Mr. Hofmann succeeds in explaining these objections away, I shall be the first one to endorse trough-lixiviation, because the principle upon which the rapid solution of the silver chloride is based is a novel and correct one.

C. A. STETEFELDT.

NEW YORK, Dec. 4, 1887.

THE GRANITE MOUNTAIN MINING COMPANY.

We illustrate herewith the map of this magnificent mine, the heaviest dividend-paying mine in America to-day. During the current year to date the company has paid $2,000,000 in dividends, and though only six years old, it has already paid its stockholders $3,600,000. The history of such a mine is well worthy of record, and we give it as follows from official sources:

The property was originally located in the autumn of 1872, but was allowed to lapse from time to time until July 6th, 1875, when the claim known as Granite Mountain lode claim was located by Messrs. James W. Estill, Eli D. Holland, and Josiah M. Merrell, and recorded July 14th, 1875; and the claim known as Granite Mountain Extension lode claim was located November 30th, 1878, by David Simmons, and recorded February 7th, 1879. By deeds dated October 18th, 1880, Charles D. McLure acquired title, and by power of attorney dated November 1st, 1880, he granted to Charles Clark the right to sell all his interest in the property. Until Mr. McLure acquired the title the claims were thought to be "good prospects," but inaccessible, and consequently but very little development-work was done prior to the autumn of 1880. Mr. Clark was able to interest the following gentlemen as the *syndicate* to demonstrate the value of the property, viz.: Charles Clark, Louis Duestrow, Auguste B. Ewing, Oliver B. Filley, Samuel Gaty, Edwin Harrison, Jesse L. January, John R. Lionberger, Lewis M. Rumsey, Moses Rumsey, Augustus F. Shapleigh, and Charles Taussig. These gentlemen completed their organization as a *syndicate* December 24th, 1880, Mr. McLure retaining the largest interest.

To date of the formation of the Granite Mountain Mining Company (September 3d, 1881), the *syndicate* expended $50,000 in the purchase of the property and development work. After the organization of the *company* and until August 4th, 1883, these gentlemen (and a few others who had become interested) advanced money as needed, until over $40,000 more had been expended in development.

This work had passed through a chute of 406 feet of ore, averaging about 50 ounces in silver per ton, and then through 115 feet of barren ground until November, 1882, when the Bonanza Chute was struck in tunnel in No. 2.

At this point it will not be out of place to show how the property has been at all times fully under the control and management of the directory.

Up to May 1st, 1881, there had been expended for development about $7760. On April 24th, 1881, Prof. Joshua E. Clayton visited the property in the employ of the *syndicate* as an expert.

Of date April 27th, 1881, Professor Clayton telegraphed as follows: "Granite Mountain (a) true fissure. Vein four to six feet wide. Course nearly east (and) west. Average sample assays forty-four ounces. (Property) worth $75,000."

Which was followed by his written report.

At that date, No. 1 tunnel had been driven only 186 feet; tunnel No. 2, 443 feet (tapping the ore chute at 300 feet from the mouth), a shaft 114 feet deep connecting Nos. 1 and 2, and a drift 90 feet in length, half-way between the two tunnels. On this telegram (showing $75,000 net *in sight*, for $7700 expended) the *syndicate* made the first payment (of $20,000) on the bond due May 1st, 1881. The quantity and quality of the ore having steadily improved, on August 1st, 1881, the second (and last) payment ($20,000) was made on the bond, and the *syndicate* owned the property and proceeded to organize the company as previously stated. The marvelous tales arising from the story of the telegraphic order to stop work (in November, 1882) being crossed by a message announcing the discovery of the bonanza chute, may be set at rest by the simple statement, that, at no time during the history of the syndicate or company have the management in St. Louis been either discouraged or doubtful.

The order to discontinue driving No. 2 tunnel was because there had been a lack of information at the home office for three weeks previously regarding developments and prospects (the work being in the 115 feet of barren ground, as mentioned above), and the officers wished to be able to give to the gentlemen contributing the development funds some definite information before asking them for more money.

During the summer and autumn of 1883, 1435 tons of ore (from the bonanza chute) were milled in the Algonquin mill, from proceeds of sales of which the treasury received $274,000, as reported in the Annual Report of 1883.

The product of the mine to July 31st, 1886, as sold and credited in bank in St. Louis, is $2,170,000. The tools were first sent to the mine October 8th, 1880, and four years and six months thereafter the company commenced paying dividends, viz., on April 8th, 1885; and to and including December 10th, 1887, paid 36 dividends, aggregating $3,600,000.

The mine is a very remarkable one, the length of the pay chute being enormous and the reserves of ore in sight immense in quantity. No words can give as good an appreciation of this as the map of the underground workings, which we illustrate herewith.

We take from the superintendent's report for the year ending July 31st, 1887, the following particulars concerning the mine work.

Prospecting work done during the year was:

Tunnels, cross-cuts, and drifts	3.801 feet.
Winzes and raises	910 "

In No. 5 tunnel, shown on the map, the length of the main ore-body in first-class ore is no less than 1685 feet, then 510 feet of barren ground, when a new ore-body, consisting of manganese, black quartz and streaks of oxidized ore, the whole varying in width from 1 to 2½ feet, was entered, and has been opened to a length of 161 feet, the face of the drift being still in ore. Some of this ore assays from 10 to 55 ounces.

Tunnel No. 6 has been productive its entire length, 2372 feet. There are chutes of soft oxidized ore, easily extracted and treated. The width of this variety is from 4 to 8 feet. Alternating with these are chutes of ore showing hard compact quartz, arsenical iron, iron pyrites and fahlerz, and mixed with these are seen ruby and native silver. The ordinary width of this variety is from 2 to 5 feet. Occasionally chutes of ore are seen with the two kinds of ore lying side by side.

RUBY SHAFT.—This shaft, which is the principal outlet, has been continued below No. 6, for a distance of 160 feet, making a total depth from the surface of 488 feet.

In the eastern end of the Midland claim and about 50 feet west of the Granite Mountain Ex. claim the "Gore" shaft has been sunk. It is 191 feet deep from surface, and 100 feet below No. 6. In the bottom of the shaft the vein looks very well, being 4 feet wide and assaying from 150 to 175 ounces.

During the year there was erected a large and powerful hoisting plant, fully equipped and capable of developing the mine to a depth of 2500 feet. It consists of a double cylinder, double reel, Corliss engine, 20 × 60, provided with 4 steel tubular boilers 16 × 60. There was also erected one Ingersoll straight line air compressor 24 × 30.

There was also added to the pumping plant a Knowles' improved compound duplex pump, 10×18 inch cylinders.

ORE BREAKING DEPARTMENT.

During the year there were broken and raised to the surface the following amount of ore: extra first class ore shipped to smelters, tons 443·3; first-class ore treated in the mill, 14,901·5; second-class ore stored up, 500, or a total of 15,844·8.

The average costs for mining operations during the past year are higher than they were during 1886, owing chiefly to the fact that the ore this year had to be raised through the shaft, and in 1886 it nearly all went out through the tunnel.

The average cost for breaking ore, sinking winzes, tunneling, etc., including superintendence, labor and supplies of all kinds (and proportions thereof) amount to the following:

For breaking ore at per ton, $6.06; for tunnels and cross-cuts at per linear foot, $12.44; for winzes and raises, at per foot, $17.34.

MILLING DEPARTMENT.

During the past year a forty-stamp mill was erected, of the following dimensions:

Length of crusher room, 42 ft. 10 in.; width of crusher room, 34 ft. 6 in.; length of dryer and roaster rooms, 255 ft. 3 in.; width of dryer and roaster rooms, 37 ft.; length of battery room, 71 ft.; width of battery room, 37 ft.; length of cooling floors, 184 ft.; width of cooling floors, 37 ft.

Length of pan room, 104 ft. 6 in.; width of pan room, 37 ft.; height from pan room floor to crusher floor, 69 ft.; length of engine room, 34 ft.; width of engine room, 20 ft.; length of boiler room, 46 ft.; width of boiler room, 35 ft. 6 in.

The mill throughout is a splendid structure and provided with all the modern improvements, and gives eminent satisfaction.

The following amount of ore was treated for the year: in mill "A," 30 stamps, 7559; in mill "B," 40 stamps, 7342, or a total of 14,901 wet tons, or 14,366 dry tons. Assay of ore mill "A," 172·906 ounces; assay of tailings "A," 10·538 ounces; per cent saved, 94.6 per cent; assay of ore mill "B," 145·778 ounces; assay of tailing "B," 8·607 ounces; per cent saved, 94·847 per cent; number of Doré bars produced, 1627 bars, containing Troy fine ounces, ag., 2,181,921·75 ounces; containing Troy in gold, 1022·9 ounces.; "A" mill in service, 328⅝ days of 24 hours; "B" mill in service, 168¾ days of 24 hours; "A" mill crushed per day, per stamp, 1·23 tons; "B" mill crushed per day, per stamp, 1·117 tons; "A" mill, cost of milling per ton, $14.06; "B" mill, cost of milling per ton, $11.92; average cost both mills combined, $13.

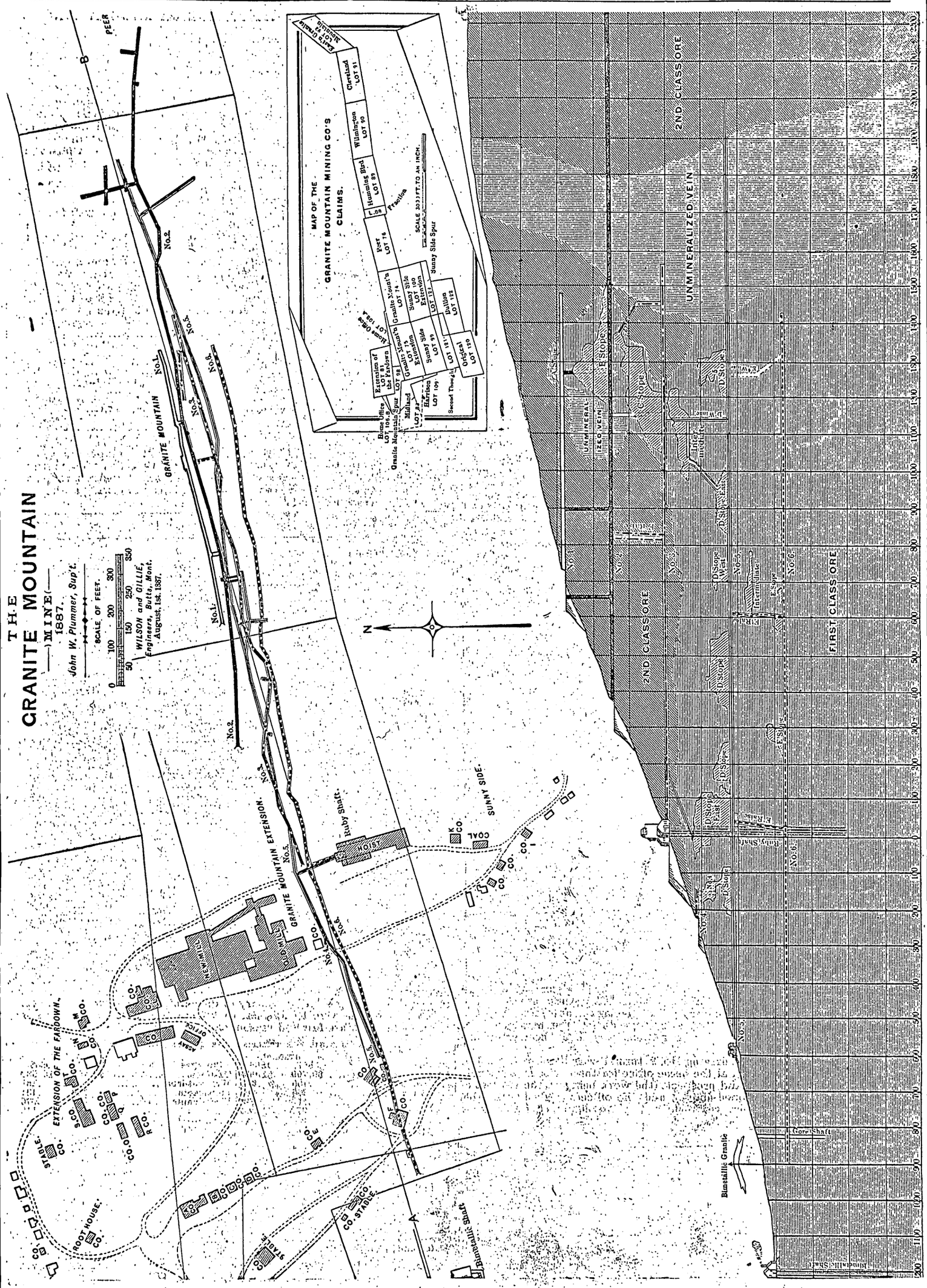
There are cut in the woods and ready to deliver into the yards, 24,067 cords; and in the yards there are 3,891 cords.

Superintendent Plummer says: "In the various statements of costs furnished, some of the items may appear high, yet when it is taken into consideration the high grade of the ore treated, the peculiarities of its composition, and the care necessary in its manipulation from the time it is broken from the vein to its final exit from the mills in the form of tailings, the costs are fair and reasonable."

ANALYSIS OF COSTS FOR TREATING ONE TON OF ORE IN THE MILLS.

Labor.	Amount. 1887.	Amount. 1886.	Supplies.	Amount. 1887.	Amount. 1886.
Superintendence	$0.709	$1.055	Castings	$0.456	$0.530
Millwrights	.155	.276	Wrought-iron	.012	.181
Engineers	.305	.449	Lubricants	.128	.131
Firemen	.146	.132	Illuminants	.053	.076
Crushermen	.258	.263	Charcoal	.040	.115
Dryermen	.258	.294	Quicksilver	.637	.538
Roastermen	.387	.350	Shovels	.010	.060
Salt rolls	.066	.	Belting	.007	.024
Batterymen	.254	.352	Chemicals	.158	.194
Battery helpers	.077	...	Salt	4.122	4.140
Cooling floor	.339	.344	Fuel	2.183	2.090
Panmen	.285	.345	Team account	.203	.023
Pan helpers	.376	.289	Blacksmith account	.302	.390
Dustman	.119	.130	Machine shop account	.005	....
Retortmen	.129	.168	Sundries	.149	.263
Woodman	.084	....			
General labor	.355	.335			
Laboratory assistant	.082	....			
Storekeeper	.094	.069			
Watchman	.057	.115			
Total	$4.535	$4.966	Total	$8.465	$8.754

(Continued on page 432.)


THE
GRANITE MOUNTAIN
MINE
1887.
John W. Plummer, Sup't.
SCALE OF FEET.
WILSON and GILLIE,
Engineers, Butte, Mont.
August, 1st, 1887.
MAP OF THE
GRANITE MOUNTAIN MINING CO'S
CLAIMS.
SCALE 303 FT. TO AN INCH.
GRANITE MOUNTAIN
GRANITE MOUNTAIN EXTENSION.
SUNNY SIDE.
EXTENSION OF THE FARDOWN.
NEW MILL
OLD MILL
OFFICE
STABLE
ROOT HOUSE
Ruby Shaft
Bimetallic Shaft
Bimetallic Granite
UNMINERALIZED VEIN
2ND CLASS ORE
FIRST CLASS ORE
Cor. Shaft

COST OF MINE WORK PER LINEAL FOOT.

	1885.	1886.	1887.
For tunnels, drifts and cross-cuts	$15.30	$11.11	$12.44
For winzes and raises	20.40	14.46	17.34
Breaking and raising ore	4.72	4.72	6.06
Assay value of ore amalgamated, per oz	145.71	176.97	172 80*
Per cent saved	93.42	95.23	94.61*
Mill in service, days	292	339	.....
Ore crushed per stamp per day	1.13	1.04	1.47*
Cost of milling, including supplies	13.32	13.71	13.00
Total ore milled, dry tons	.....	.....	14,366

* Mill A.

REPORT OF TREASURER OF GRANITE MOUNTAIN MINING CO., FOR THE FISCAL YEAR ENDING JULY 31ST, 1887.

Balance cash in St. Louis as reported to annual meeting of stockholders August 18th, 1886, viz:			
At State Savings' Association			$107,319 35
At Boatmen's Saving Bank			20,000.00
			$127,319.35

RECEIPTS.

Proceeds 1568 bars bullion Nos. 1874 to 3441 inclusive. Containing 2,012,909 14-100 ounces pure silver, 716 294-1000 ounces pure gold, per N. Y. assay return, sold for	$1,970,051 91		
Less express charges	$31,563.20		
Less refining charges	26,089.83—	57,653.03—	$1,912,398.88
Proceeds of 385 1515-2000 tons smelting ore			204,816.43
Received on account of smelting ore "en route"			20,000.00
Proceeds of sale of St. Louis city 4 per cent bonds			51,784.11
Freight rebates and discount on mercantile bills			465.27—
			$2,189,464.69
			$2,316,784.04

DISBURSEMENTS.

Montana drafts for pay rolls, supply bills, freight, etc	$616,468.60	
Supply bills (Home Department purchases)	132,875.46	
Insurance	3,877.50	
Attorney's fees	4,775.00	
Home Department—Salaries, rent and expenses	12,414.69	
Dividends paid, Nos. 21 to 31 inclusive	1,400,000.00—	2,170,411.25
Balance cash in St. Louis, July 31st, 1887		$146,372.79

PAUL A. FUSZ, Treasurer.

The Granite Mountain is not only the most profitable mine on the continent, but it is one of the best managed mines in the world. The superintendent, Mr. John W. Plummer, is deservedly esteemed to be one of our best mine managers, and the administration of the stockholders' interests is conducted in a manner that could be imitated with great benefit by our great copper bonanza, the Calumet & Hecla. The stockholders know how their property is managed and what the work costs, and they can have confidence in an administration that is not afraid to state in detail what it is doing.

MODERN AMERICAN METHODS OF COPPER SMELTING.

The *Financial News* of London, England, dated November 24th, in an editorial about Dr. Peters's book says: "Twenty years ago copper was hardly known in the United States, and very few people would have thought of going there for instruction in the art of copper smelting. To-day America has some of the finest copper mines in the world, and its methods of treating copper ore begin to be recognized as both ingenious and economical. The great variety of ore found demands skill and originality on the part of the smelter. The produce of the Montana mines differs as much from that of Lake Superior on the one hand and of Arizona on the other as to be almost a distinct mineral. Each mine has its own peculiar difficulties as regards flux. On the model of a furnace may turn the question whether a particular mine can be made to pay or not. The methods of smelting are as numerous and varied as those of mining. It is in circumstances like these that the inventive genius of America excels. The surmounting of difficulties creates new power, and fresh problems are the life of science. It is not surprising, therefore, that the American copper mines should not only have added largely to the copper production of the world, but should have given birth to a new generation of metallurgists. Among the latter is Mr. E. D. Peters, Jr., late consulting metallurgist of the Calumet & Hecla. He has been connected with some of the most important mining enterprises in the States, and his practical skill being combined with a very fair literary faculty, he is able to share his wide experience with men less privileged. For many years he has been a close observer of all the improvements in American methods of copper smelting, and the fruit of his observations was lately made public in a series of papers communicated to the ENGINEERING AND MINING JOURNAL, of New York. These have now been collected into a well-printed, well-bound octavo volume, issued by the Scientific Publishing Company. English engineers and metallurgists will, we doubt not, be glad to hear that this important work of Mr. Peters can be obtained in a permanent and handy form. Though specially American, it has a great interest for many people in this country, to whom the American copper supply is a matter of vital consequence. Such vague and bewildering ideas prevail among us, not only as to the capabilities of American copper mines, but as to the character of the metal and its applications, that an authoritative exposition like this will be welcome. As a text-book it appears to be as trustworthy as it is exact. Our own mining literature contains nothing exactly parallel with it. Naturally it is much more modern in character than the standard work of Dr. Percy, and, with all deference to his admirers, it is more practical. Mr. Peters is an engineer as well as a smelter, and he describes not only the mere process of smelting but all the secondary operations. He has made, in short, a most interesting and valuable addition to the literature of his profession."

New Use for Electric Lamps.—Experiments with the incandescent electric light at the torpedo station at Newport, R. I., developed a novel use for those lamps. With lamps of about 100 candle-power fastened on the ends of poles submerged in the sea to a depth of 20 feet the water is so illuminated that objects in it can be distinguished within a radius of 150 feet. It is believed that by this means a boat might countermine an enemy's field of submarine mines by cutting their cables or sweeping them to one side.

THE DEVELOPMENT OF THE AMERICAN CHEMICAL INDUSTRY.*

By Dr. Francis Wyatt.

(*Continued from Page* 411.)

MICHIGAN—(SALT).

The chief centers of production in this State are the counties of Saginaw, Bay, Huron, Tasco, Manistee, and Saint Clair, and the first successful boring for salt brine was effected by the East Saginaw Manufacturing Company near the village of East Saginaw, in the Saginaw Valley, about the year 1860. At a depth of 669 feet they obtained a brine which marked 90 degrees of the salinometer, and from that time down to the present the salt production of Michigan has been so steadily increasing that last year it reached the figure of about 500,000 tons.

The first source of salt brine is found in the coal measures, immediately above the white and porous Parma sandstone, which serves it in the capacity of a reservoir. The second source, some 200 feet in thickness, occupies a position between the carboniferous limestones and the "Napoleon" sandstones at the base of the carboniferous system, and is called the "Michigan salt group."

It is estimated to extend over some 17,000 square miles, and is a mass of argillaceous, gypseous, and pyritous shales, with thin streaks of arenaceous and magnesium limestones and large beds of very pure gypsum.

The material most commonly passed through in boring for salts in the Saginaw Valley appears from a careful examination to be as follows:

	Feet.
Alluvial and drift materials	100
"Woodville sandstone," brown and coarse	65
Coal measures, consisting of shales with some sandstones, limestones, and coal	136
"Parma sandstone," white and porous	115
Carboniferous limestone, often highly arenaceous, generally so below	75
"Michigan salt group"	170
"Napoleon sandstone," light buff, rather coarse and porous	110
Total depth	771

The latter is underlaid by red shale.

The third source is the Onondaga or Salina group, found more than 700 feet below the second, and it is this formation that has yielded the rock salt in Manistee and Muskegon counties, on Lake Michigan and at Marine City on the Saint Clair River, as shown in the following table.

TYPES OF MICHIGAN BRINE WELLS AND SALT DEPOSITS.

Name of well.	Material traversed.	Feet.	
Mason well, Muskegon	Surface sand, clay, etc	225	
	Gray limestone and shale	400	
	Blue shale in loose streaks	775	Analysis of brine
	Solid blue shale	150	NaCl.... 12·946
	" red "	150	$CaCl_2$... 7·774
	Lime rock, shale streaks	300	$MgCl_2$... 2·860
	Salt bearing rock, with streaks of sand from 1 to 4 feet thick	50	$CaSo_4$...traces. $MgBr$.... "
	Light color'd lime rock and shale	50	H_2S.... 0·085
	Dark colored lime rock	250	H_2O ... 76·335
	Gypsum and lime	50	
	Lime rock	145	100·000
	Various, ending in loose, porous lime	82	
	Total depth	2,627	
Manistee well	Surface sand, etc	570	
	Lime	45	Analysis of salt from brine.
	Shale and lime	85	
	Shale	105	NaCl.... 92·305
	Black slate	25	$CaCl_2$... ·104
	Yellow marls	15	$MgCl_2$. 1·024
	Black slate	5	$CaSo_4$ .. 3·687
	Lime	5	Insoluble ·292
	Black slate	95	H_2O.... 2·242
	Lime	575	Loss ... ·281
	Brown shale (caves)	100	
	Rock salt	34	100·000
	Total depth	1,964	
Marine City well	Clay	200	Analysis of rock salt as mined.
	Soft rock, with soapstone and shales	540	NaCl . 96·82
	Porous rock, with mineral water and about 5 feet yellow sulphur	40	$CaCl_2$... 0·21
			$MgCl_2$... 0·17
	Hard rock, str aked with soft rock	320	$CaSo_4$ .. 1·34
	Hard lime rock	533	Insoluble 0·84
	Rock salt	115	H_2O.... 0 62
	Total depth	1,748	100·00

The general average composition of the brines and salt produced throughout the State is given on the following page, and it will be observed that those derived from the Parma sandstone and marked + differ materially in their chemical composition from those that come from the "Napoleon" sandstone or "Michigan salt group" especially in that they contain a smaller quantity of the chlorides of calcium and magnesium.

Dispersed over the various counties are no less than 130 manufacturers of salt, operating between them from 100 to 150 steam, and from 250 to 300 "pan" blocks.

There are few solar covers, probably not more than 5000 in the entire State, the local conditions being essentially in favor of artificial evaporation, owing to the vast quantities of cheap fuel supplied in the waste material, sawdust, slabs, etc., from the numerous important saw-mills in the immediate vicinity of the wells.

A specimen "steam block" is a wooden shed 208 feet long, 90 feet wide, 16 feet high at the eaves, and 40 feet high at the ventilators, with a chimney stack rising 10 feet higher.

It contains two settlers, each 140 feet long, 9 feet wide, and 4 feet deep, together with four grainers, each 150 feet long, 10 feet wide, and 18 inches deep.

In the settlers and grainers there are immersed in the brine 3744 feet of 4-inch galvanized iron pipe, the entire length of which is, however, by the numerous connections necessary to make a working relationship among the pump, cisterns, settlers, grainers, and boilers, ultimately

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tute; Carlton W. Nason, of New York, and H. H. Westinghouse, of Pittsburg.

Papers were presented at the morning session as follows: By V. Dwelshauvers-Dery, of Liege, Belgium, honorary member of the Society: "Tables of the Properties of Steam, their Use in Study of Steam Engine Experiments." By Professor H. R. Thurstan: "Philosophy of the Multi-Cylinder Compound Engine, its Theory and its Limitations." By Horace B. Gale: "Theory and Design of Chimneys, with Criticisms on the Common Theory and Experimental Data."

Under the excellent rules of the Society all its papers are printed in advance of the meeting, and sent to those members who have signified their intention of being present, and only five minutes is allowed for the presentation of each paper by abstract. This allows time for the discussion of each paper, and none of the papers have to be passed over as "read by title." The discussion on each of these three papers was quite vigorous, and by no means complimentary. The mechanical engineers are not given to flattery of each other's papers, and if a paper has any weak points they are apt to be severely criticised.

The afternoon session was devoted to reading and discussion of papers, as follows:

By Prof. C. H. Peabody, two papers: "Flow of Steam through Orifices," and "Experimental Study of the Different Types of Calorimeters." By L. S. Randolph: "Cost of Lubricating Car Journals." By E. F. C. Davis: "Steam Pipes for Collieries. By D. K. Nicholson: "Rolling Steel Rails." By C. J. H. Woodbury: "Methods of Reducing the Fire Loss."

These papers proved more acceptable than those of the morning, as they contained new data and were less devoted to theorizing and speculation. The paper of Mr. Woodbury is especially valuable in giving quite a full description of the latest methods of protecting mill buildings against loss by fire, including the most approved methods of "slow burning construction," fire service, watchman's duties. and checks, electric alarms and automatic sprinklers. The paper should be carefully read by every mill owner.

In the evening a subscription dinner was held at Clarke's, in Twenty-third street, and it was voted a great success. The large attendance of ladies was especially noticeable, and the speeches were almost equal to the average of those at a mining engineers' dinner—a high standard of excellence.

Wednesday was devoted to a steamboat excursion to Willetts Point, on Long Island Sound, where an inspection was made of the torpedo station and school of the United States army, under the direction of Lieut.-Col. N. L. King. Lunch was served on the boat, and on the return a visit was made to the Central Forging Works at Whitestone, Long Island. The forging of a heavy shaft under the ten-ton hammer was witnessed. Much interest was taken in a novel method of counterbalancing the weight of heavy compound engine shafts, while being turned in the lathe. The whole weight of the shaft is carried by a carriage with rollers, which is placed under its middle point and supported by a chain which passes overhead over two pulleys to a box outside the building, weighted so as to counterbalance the weight of the shaft and prevent its deflection while being turned.

In the evening a reception was given to the society by the Engineers' Club, at their house, No. 10 West Twenty-ninth street, a good evidence of the cordiality which prevails among the different classes of engineers who constitute the membership of the club. This was largely attended.

Thursday was devoted entirely to the reading and discussion of papers, as follows:

By Fred. W. Parsons. Indicator Rigging for Compound Engines.

By W. H. Bristol. A New Recording Pressure Gauge.

By D. S. Jacobus. General Solution of the Transmission of Force in a Steam Engine.

By S. J. MacFarren. Street Railway Car Gear for Modern Speeds.

Prof. J. Burkitt Webb. Comparisons of Indicators.

By James E. Denton. The Cards from the Pawtucket Pumping Engine With and Without Jacket.

By J. F. Holloway. How to Use Steam Expansively in Direct Acting Pumps.

By C. F. Main. Cost of Steam and Water Power.

By Oberlin Smith. Graphical Analysis of Reciprocating Motions.

The following resolution was passed at Thursday morning's meeting:

WHEREAS, There are now in existence four associations of American engineers, each representing one branch of the profession, and each serving a useful purpose; and

WHEREAS, Many members of the existing societies are desirous that a new organization should be created, which, without superseding or disturbing those already in existence, will be broader and more comprehensive than any of them, and thus more representative and national; and

WHEREAS, It is believed that the result thus outlined may be accomplished without any encroachment on the autonomy of the existing organizations, and without any impairment of their distinctive character; and

WHEREAS, It is especially desirable, in view of the contemplated International Exhibition in 1892, that there should be some organization broadly representative of American engineers, and thus qualified in their behalf, to receive and entertain the foreign engineers who, it is hoped, will then visit the United states; and,

WHEREAS, The desirability and feasibility of closer relations between the members of the existing organizations were demonstrated by the experience of those who took part in the joint excursion of American engineers to Europe in the summer of 1889.

Therefore, be it resolved:

1. That the American Society of Mechanical Engineers views with favor all efforts tending to establish more intimate relations between the existing engineering societies, and to develop a national organization of American engineers.

2. That to promote this object, the council be hereby requested to communicate the substance of these resolutions to the officers of the other engineering societies, and to invite them to unite in a discussion of the subject, and in an endeavor to reduce it to proper form for submission to the consideration of the membership of each society.

3. That to this end the council be further requested to appoint a committee of three members to represent this society in any such conferences, to consider the whole subject herein referred to, and to report the result of their labors to the next meeting of the society.

On Thursday evening there was no regular session, but complimentary tickets for the American Institute Fair had been supplied to members, and many of them paid the fair a visit.

On Friday it had been intended to make a trip on the ferryboat "Bergen," but on account of a slight accident having happened to one of its boilers, this trip had to be given up. Instead of this the steamboat "Laura M. Starin," the same that was used on Wednesday's excursion, was secured, and a trip was made to the works of the Singer Manufacturing Company, at Elizabethport, N. J. Lunch was provided on the boat by the hospitability of President Henry Morton, of the Stevens Institute of Technology. The Singer Manufacturing Company's works are notable as being the largest sewing machine factory in the world, with the exception of the one owned by the same company in Glasgow, Scotland. The Singer Company, both in America and in Scotland, manufacture in addition to sewing machines, the well-known Babcock & Wilcox boiler.

The majority of the members left for their homes on Friday night, but some intended to remain over till Saturday, to visit the steamer "City of Paris," which had been thrown open to inspection.

OFFICIAL REPORTS.

THE GRANITE MOUNTAIN MINING COMPANY.

We accompany the following abstract of the official report of the Granite Mountain Mining Company with a map showing the workings and condition of the mine, which will be of especial interest to our readers, as in 1887 we illustrated it in the same manner.

Mr. L. M. Rumsey, the president, reports:

Since the date of our last annual report, the trustees were fortunate in securing the services of Mr. Thomas Weir to be superintendent of our affairs in Montana. Mr. Weir assumed the duties of his office December 20th, 1888.

His reports and statistical tables herewith attached will be read with great satisfaction, because of their clearness and promise of continued prosperity to our company.

Our fiscal year ends July 31. 1889, and all the maps and reports of the officers are up to that date. I shall consider it my duty to anticipate a portion of the next annual report by informing you of the existing state of affairs in our company to as near the present date as possible.

During the fiscal year ending July 31st, 1889, we have paid out in 12 dividends $1,900,000. This makes an aggregate of $6,700,000 paid out in 55 dividends.

To anticipate a part of the report of the next fiscal year, let me say that on November 9th we shall pay Dividend No. 59, which will make $7,600,000 returned to stockholders since April 8th, 1885, or $19 per share on our capital stock, consisting of 400,000 shares, of the par value of $25.

From October 8th, 1880 (the date Mr. McLure first sent the tools to the mine), to July 31, 1889, the total gross sum of expenditures of every kind by our company has been $4,092,512.29. This includes the purchase of property, erection of buildings and permanent improvements, the amount paid for supplies and labor, expended in litigation, and for express and refining charges on smelting ore and bullion, etc.—in short, as stated above, every expenditure of every nature and kind.

During the same period our mines have produced and sold 10,989,858$\frac{98}{100}$ oz. of pure silver, and 6,521$\frac{569}{1000}$ oz. of pure gold, realizing a gross sum of $10,988,800.24.

The total product of our mines at government standard value ($2.29·29 per fine ounce) has been $14,335,135.38, while our total receipts were, as stated above, $10,988,800.24, showing that the demonetization of silver by our government has cost our company to July 31, 1889, $3,346,335.14, or over 30 per cent. of our gross income.

Since July 31, 1889, Mill B has been increased from 40 to 50 stamps. Mill C was completed in March, 1889, and is a large structure covering 506 × 260 feet. In the three mills we have 170 stamps and 7 roasters. Mill C, at Rumsey, is now connected with the mine at Granite by a wire tramway, 8,650 feet long, having a fall of 1,170 feet, 800 feet of which is almost a vertical drop from the brow of the Fred Burr Cañon. This tramway transports ore and supplies between Rumsey and Granite at a comparatively small cost.

An electric light plant is also in successful operation in the mines, mills and offices at Rumsey and Granite.

We have flumed, through our tailings reservoirs, the water which flows through the Fred Burr Cañon, and are thus able to deliver the water of the creek to the ranches below as pure and uncontaminated as when leaving Fred Burr lake.

We have established at Granite and at Rumsey reading rooms for the employés, in which are kept extensive files of newspapers, magazines and periodicals. These reading rooms are lighted by electricity.

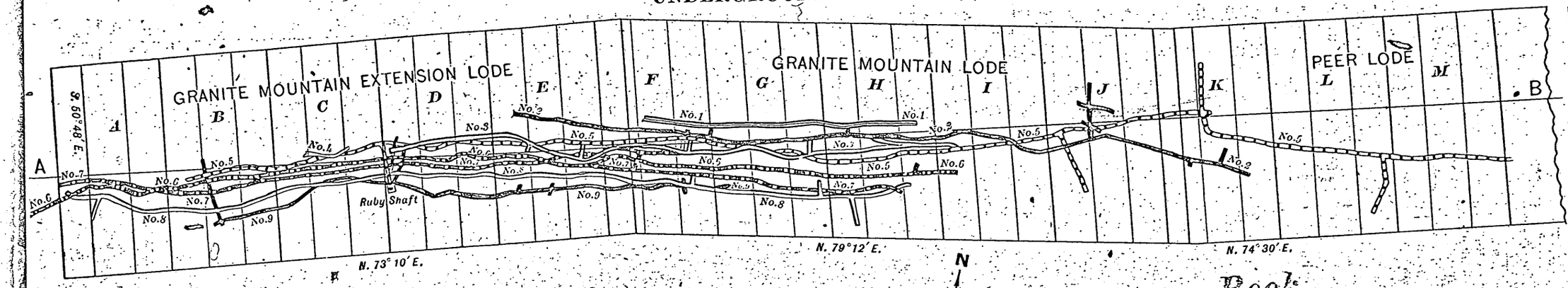
The completion of the Drummond & Philipsburg Railroad to Mill C, at Rumsey, has been of great benefit to our company in every way, and has well repaid the temporary investment of the $100,000 which we advanced them to extend the road from Philipsburg to Rumsey. This "advance", has been returned to us as will be seen by our treasurer's report.

It will be noted that our expenses for the fiscal year ending July 31st, 1889, have largely exceeded those of the previous year. This is largely accounted for by the erection and completion of Mill C and the completion of the tramway. The accompanying inventory will give at a glance these and many other items of what might be termed, perhaps, *unusual* permanent improvements, but their cost, while all charged up to the year 1888–9, will result to the benefit of the stockholders in future years. In all parts of the mine there has been done an immense amount of timbering to secure safety.

Large amounts of "Representation" work, purchase and acquirement of necessary property, together with unusual and expensive litigation, have also greatly helped to cut down dividends. I believe the present year will find us freed from most of these burdens.

From No. 8 and below, the ground has been very much disordered for some distance east and west of the shaft, but the Bonanza ore chute, east of the shaft, continues unbroken through all the levels, No. 9 East having been in good ore for the last 400 feet. We have every reason to

UNDERGROUND WORKS



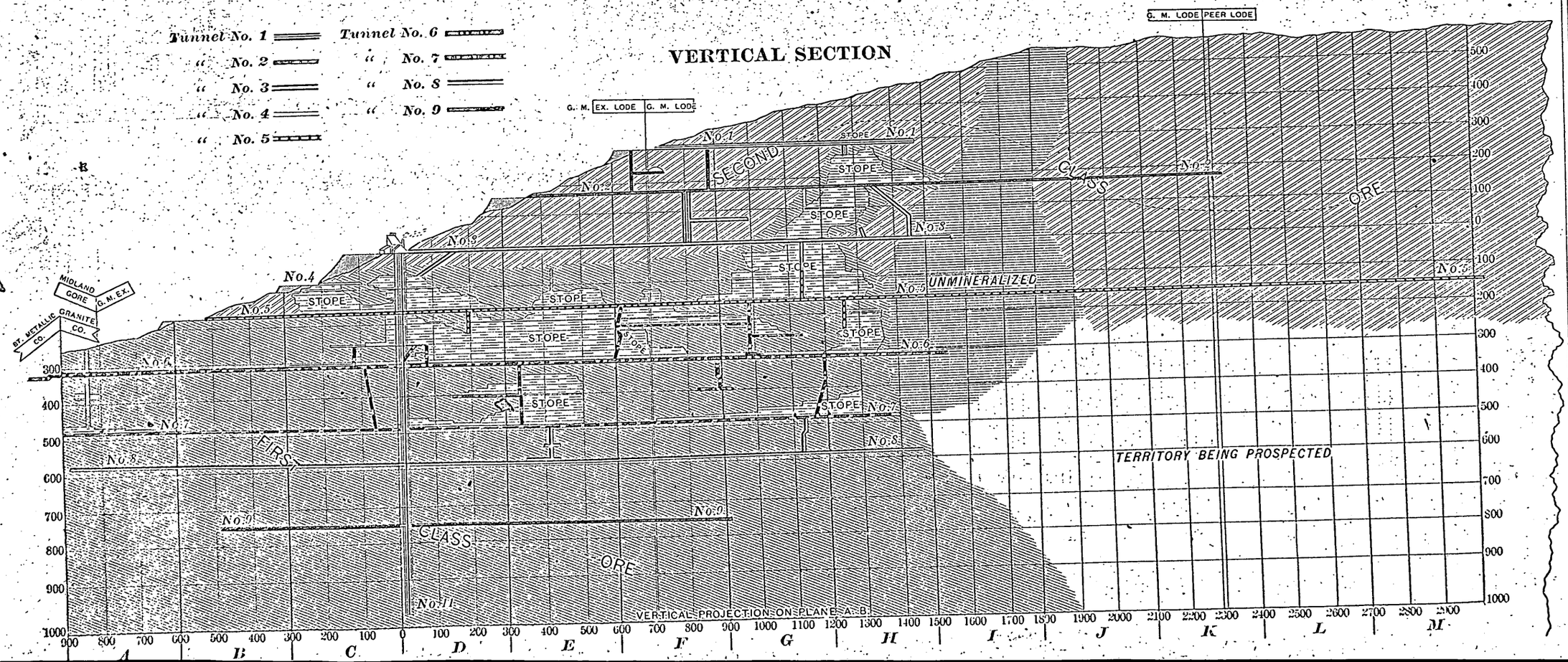
Reference Book
Not to be taken from
SEATTLE PUBLIC LIBRARY
Reference Room.

THE GRANITE MOUNTAIN MINE,

1889.

Tunnel No. 1
" No. 2
" No. 3
" No. 4
" No. 5
Tunnel No. 6
" No. 7
" No. 8
" No. 9

VERTICAL SECTION



believe that our explorations at depth will reward us as munificently as the developments eastwardly promise to do, and as those above have already done, and are yet doing.

REPORT OF TREASURER FOR THE FISCAL YEAR ENDING JULY 31, 1889.

Balance cash on hand, July 31st, 1888, at State Bank of St. Louis			$166,454.61
Receipts.			
Proceeds 2,054 bars bullion, containing 3,311,676.89 ounces pure silver, and 3,332.043 ounces pure gold, per New York assay returns, sold for	$3,149,004.24		
Less express charges	$47,455.27		
Less refining charges	36,041.96		
Less commission	3,330.25		
	86,827.48		
		$3,062,176.76	
Net proceeds 67.695 tons of smelting ore containing 44,490.03 ounces silver and 46.184 ounces gold		88,356.29	
Proceeds of sale of $100,000 of Northern Pacific & Montana Railroad 6 per cent. bonds and interest		101,550.00	
Received sundry rebates and discounts on mercantile bills		1,518.88	
			3,203,601.93
			$3,370,056.54
Disbursements.			
Remitted to Montana Department for pay-rolls, supply bills, freights, etc		$962,974.17	
Supply bills, home department purchases		154,110.75	
Insurance		10,524.10	
Attorney's fees		15,268.40	
Home department, salaries, rent and sundry expenses		17,634.50	
Dividends Nos. 44 to 55, inclusive		1,900,000.00	
Paid Northern Pacific Railroad on account Philipsburg Branch Railroad		57,200.00	
Paid on account of contract for machinery for mill C		108,000.00	
Paid on account tramway construction contract		14,437.70	
			$3,240,149.62
Balance cash at State Bank of St. Louis, July 31, 1889			$129,906.92

THE SUPERINTENDENT'S REPORT MINING DEPARTMENT.

We have mined and hoisted to the surface as follows:

Ore delivered to mill A	9,465·818 tons
Ore delivered to mill B	16,402·009 "
Ore delivered to mill C ore bin	11,243·495 "
High grade ore shipped to smelter	83·104 "
Ore in loading terminal tramway	54·134 "
	37,248·596 "

The various stopes are in good condition, and are producing well.

The average cost of mining operations has increased slightly, owing to increase in depth, amount of water and distance necessary to pump it, increased length of air lines and the fact that all ore and waste have now to be hoisted, while heretofore a good portion come from tunnels.

The following is the average cost for the year, including pro-rata of hoisting plant, blacksmithing, machine shop, superintendent's office, etc.:

Breaking ore, per ton	$6.62·8
For levels, cross-cuts and drifts, per linear foot	11.01·8
For winzes and raises, per linear foot	18.78·9
For sinking Ruby shaft, per linear foot	77.06·4

MILLING DEPARTMENT.

Mills A and B have been kept running during the year. Mill C was completed and started up in March, 1889, and is doing nicely.

Mill A crushed in wet tons		9,465.81·8
Mill B crushed in wet tons		16,402.00·9
Mill C crushed in wet tons		9,813.49·5
Tons of salt used		5,122.91·0
Total tons ore and salt crushed		40,834.23·2
Assay of ore, mill A	162·40	ozs. per ton.
Assay of tailings, mill A	8·57	" "
Per cent. saved, mill A	94·80	" "
Assay of ore, mill B	105·084	ozs. per ton.
Assay of tailings, mill B	7·83	" "
Per cent. saved, mill B	92·85	" "
Assay of ore, mill C	54·05	ozs. per ton.
Assay of tailings, mill C	4·90	" "
Per cent. saved, mill C	90·76	" "
Number of Doré bars produced		2,115·000
Number of ounces pure silver produced		3,396,138·240
Number of ounces pure gold produced		3,607·975
Cost of milling per gross ton in mill A		$11.22
" " " " " " " " B		10.82
" " " " " " " " C		9.61
Cost of milling per gross ton in mills A, B and C (average)		$10.61

The assay of ore was obtained from battery samples. The per cent. saved was obtained from assay of tailings. It is evident the "per cent. saved" (obtained as indicated) is lower than the actual savings.

Until December 15, 1888, salt rolls were used and the salt mixed after the ore had passed the battery. Since that time the ore and salt have been mixed before crushing in mills A and B. Ore to mill C is crushed at Granite, thence it goes over the tramway, and is mixed with salt as it is fed to the dryers at mill C.

The comparatively lower saving in mill C is explained by the fact that the ore was of so much lower grade than that treated in the other mills.

Of the average cost of treating one ton of ore, there is expended for salt $2.73·6; fuel, $1.90·6, and quicksilver, $0.74·1.

Fossil Trees in Scotland.—An interesting discovery has just been made at the Tranent Colliery in the Lothians, Scotland, of a small forest of fossil trees. Single specimens of sigillaria in a fossil state, with all the marks upon them, have frequently been met with by miners, but certainly nothing like that which has been brought to light at Tranent. Several of the trees have been examined, and are found in some instances to be composed of light or dark freestone. In one instance the freestone is found in alternate layers about 15 inches in diameter, approaching to something like 2 feet in height, with strong wide-spreading roots at its base. In some cases there is a height of about 5 feet exposed. There are between 30 and 40 trees opened out at Tranent; and in appearance some of them, as locally described, are said to be not unlike the calamites that have been found in some mines, and which belong to the *Equistacea*, which bear a fruit, and have been well described by Carruthers and others.

IMPRESSIONS AND REMINISCENCES OF THE ENGINEERS' EUROPEAN TRIP.—VII.

By One of Them.

Sewage Disposal Works.—While in London we visited the se age-disposal works at Wimbledon and at Kingston-on-Thames, and Willans Engine Works at Thames-Ditton.

We had an excellent opportunity to inspect the working of two differe systems of sewage disposal. Full accounts of these works have been pu lished in *Engineering* and other English technical papers, but a brief n may here be made of them.

Wimbledon is a suburb of London, with about 25,000 inhabitants. area is 3,220 acres. The total length of sewers and drains exceeds miles. The sewage disposal works comprise the necessary tanks for chemical treatment of the sewage, and 73 acres of land, which are ir gated by the partially purified sewage, though which land it percola and finally escapes into a branch of the Thames in a state of remarka purity.

There are six settling tanks, each 50 by 49 feet, of a depth to cont 6 feet of sewage, or about 90,000 gallons. The chemicals used are li and Spence's "alumino-ferric," or sulphate of alumina, in the proport of 8 grains of the former to 6 grains of the latter per gallon of sewa During hot weather 2 or 3 grains of permanganate of potash is added gallon to the clarified sewage, which removes a slight odor which otherwise perceptible.

The normal flow of sewage is 750,000 gallons per day. The lime us amounts to 7¼ cwt. costing 7s. 6d., the sulphate of alumina to 5¾ cw costing 16s.; wages of man 4s.

The sewage is lifted from the outfall into the tanks by a pair of pum ing engines, the mean lift being 22 feet.

The sludge deposited in the settling tanks is swept from them int reservoir, whence it is forced into filter presses, two of Johnson's and o of Manlove, Alliott & Fryer's make. One of these machines with plates, 36 inches in diameter, suffices for pressing the sludge of sewage 12,000 persons, if worked by day only. Fresh lime is mixed with t sludge before pressing. The resulting sludge cakes, two inches thick, co taining about 54 per cent. of moisture, amount to about 2¾ tons per we per 1,000 persons. Its value as manure is weight for weight slightly excess of stable manure. The working expenses at Wimbledon n amount to 2s. 4d. per ton of cake.

The settled and clarified sewage is taken to the farm of 73 acres, a distributed by surface drains. The crops grown are Italian rye-gra mangolds, osiers and vegetables, the areas devoted to each being 54, 6, and 3 acres respectively. Five to six crops of rye-grass are pr duced yearly, and these are chiefly disposed of in the green state to co keepers of the southwest of the metropolis. The average weight of t grass removed from each acre per annum is about 54 tons. The mango produced exceed 46 tons per acre.

The total receipts for produce for one year were £1,420, or nearly £ per acre, and the working expenses were £910; leaving £510 to assist in payment of interest on the money borrowed for the purchase of land, e The cost of the works and land was £53,439, on which the annual payment is £2,867, pumping and maintenance costs £520 per annum, p cipitation and sludge pressing, £811; making a grand total of £4,200; fro which deduct the profit of the farm, £510; leaving the net annual co £3,690.

This is equal to a tax rate of 6·15d. in the pound on the present r able value, and to 2s. 11d. per head of the population.

The Sewage Works at Kingston-on-Thames.—After having giv ample time for inspection of the Wimbledon sewage works, including t farm, we were taken by the train to Kingston-on-Thames, where found another sewage disposal works of quite a different character. It an entirely new works, built for treatment by precipitation of t sewage from the town of Kingston, containing 33,000 inhabitants, and t neighboring town of Surbiton, with 10,000. The chief point of contra with the Wimbledon works is that the Kingston works dispense with t farm, the treatment being by precipitation with a liquid mixture of cl and charcoal and with a solution of alum, and precipitation in lar tanks. The works were built by the corporation at a cost of £23,000, a they are operated under contract by the Native Guano, or A B C Co pany, the annual payment by the town being equivalent to a "thre penny rate."

The sewage flows from the main sewer of the town into a sump-w 25 feet deep by 14 feet diameter, from which it is pumped to a condu leading to the tanks. At one point in this conduit the mixture of cl and charcoal is injected into it, which acts chemically on the orga matter in the sewage. Further on the alum solution enters the condu from a saw tooth gutter crossing it at right angles. The sewage is th admitted into one or more of the settling tanks, of which there are eigl each being 85 feet long by 45 feet broad. The tanks are deeper at o end than the other, so that the sludge tends to gravitate toward the fro wall. After thorough settling has taken place, the effluent is allowed escape from the tank down nearly to the level of the sludge. The efflue is remarkably clear and free from odor and is said to contain less th 20 per cent. of the total oxidizable organic matter of the sewage. T sludge is then drawn off by pumps into a sludge well, from which it lifted by compressed air to the filter presses, which express the fluid a mold the solid residue into cakes. The expressed water runs back in the sump-well, whence it is taken with the fresh sewage to the settli tanks again. The filter cakes are put into a revolving cylinder, in whi they are thoroughly dried. The vapor or "reek" from this operation forced by a fan into a closed chamber, where it is sprayed and cooled, a finally passes into the external atmosphere through a flue in the boil stack. By this means foul emanations are prevented and the atmosphe in the vicinity of the works appears to be quite pure.

After the cakes are dried they are put into a disintegrator and broke down into a fine earth, which is sold at three pounds per ton to farme and gardeners under the name of "native guano." This guano is said contain 3.8 per cent. of ammonia and 5.0 per cent. of phosphoric aci reckoned as tri-calcic phosphate. Numerous testimonials are shown fro farmers and gardeners as to the value of this manure in actual use.

The Willans Engines at the Kingston Sewage Works.—One of t most novel sights at the sewage disposal works at Kingston-on-Thames

BULLION RECORD BI-METALLIC MINING COMPANY, CLARK, DEER LODGE CO., MONT.

Product of week ending Nov. 30th. Week ending December 7th 1889 No 42.

Date of Melting.	No. of Bar.	Weight of Retort, Avoirdupois. Lbs.	Dec.	Loss in Melting, Avoirdupois. Lbs.	Dec.	Weight of Bar, Avoirdupois. Lbs.	Dec.	Weight of Bar, Troy. Ounces.	Dec.	Fineness of Bar in Thousands. Silver.	Gold.	Pure Silver in Bar, Troy. Ounces.	Dec.	Gold in Bar, Troy. Ounces.	Dec.	Gold in Bar, at $20.67 per Troy Oz. Doll.	Cts.	Remarks.
1889																		
Dec 2	465					14386	2098			627	00024	1315114		8392				25.4% Copy
	6					13577	1980					1241 46		7920				
	7					13646	1990					1247 73		7960				
	8					14475	2111					1323 54		8444				
	9					14489	2113					1324 85		8452				
	470					14448	2107					1321 08		8428				
	1					13659	1992					1248 98		7968				
	2					18984	2032					1274 06		8128				
	3					13776	2009					1259 64		8036				
	4					14311	2087					1308 54		8348				
	5					13947	2034					1275 31		8136				
	6					14146	2063					1293 50		8252				
	7					14160	2065					1294 75		8260				
	8					14345	2092					1311 68		8368				
24 Bars		214399	171			197299	28,773					18040 61		115092		23789		698.43 lbs. Co.
												289969 38		205726				
												308,009 99		217243				

BULLION RECORD BI-METALLIC MINING COMPANY, CLARK, DEER LODGE CO., MONT.

Week ending December 14th 1889 No. 43.

Product of week ending Dec 7th

Date of Melting. 1889	No. of Bar.	Weight of Retort, Avoirdupois. Lbs.	Dec.	Loss in Melting, Avoirdupois. Lbs.	Dec.	Weight of Bar, Avoirdupois. Lbs.	Dec.	Weight of Bar, Troy. Ounces.	Dec.	Fineness of Bar in Thousands. Silver.	Gold.	Pure Silver in Bar, Troy. Ounces.	Dec.	Gold in Bar, Troy. Ounces.	Dec.	Gold in Bar, at $20.67 per Troy Oz. Doll.	Cts.	Remar
Dec 4	479					14174	2017			661	.0004	133323		8673				32%. Co
	480					13879	2051					135571		8819				
	1					14708	2103					139008		9042				
	2					13834	2052					135637		8823				
	3					13652	2006					132596		8625				
	4					13961	1997					132001		8587				
	5					13913	2054					136099		8853				
	6					14242	2017					133323		8673				
	7					13666	2067			631	.0004½	130427		8681				35.5%. Co
	8					13973	2024					127714		8500				
	9					13831	2145					135349		9009				
	490					14064	2016					127209		8467				
	1					14421	1991					125632		8362				
	2					14071	2036					128471		8551				
	3					13755	2029					128029		8521				
	4					13694	2077					131058		8723				
	5					14119	1993					125758		8370				
	6					13831	2038					128597		8559				
18 Bars.		279678	279			251778	36718					2365802		155838		32211		8469
												2085099		247203				
												3316680 1		232826				

BULLION RECORD BI-METALLIC MINING COMPANY, CLARK, DEER LODGE CO., MONT.

Product of bullion ending Dec 14th Week ending Dec 21st 1899 No 41

Date of Melting.	No. of Bar.	Weight of Retort, Avoirdupois. Lbs.	Dec.	Loss in Melting, Avoirdupois. Lbs.	Dec.	Weight of Bar, Avoirdupois. Lbs.	Dec.	Weight of Bar, Troy. Ounces.	Dec.	Fineness of Bar in Thousands. Silver.	Gold.	Pure Silver in Bar, Troy. Ounces.	Dec.	Gold in Bar, Troy. Ounces.	Dec.	Gold in Bar, at $20.67 per Troy Oz. Doll.	Cts.	Remarks.
Dec 16	497					14084	2054			715	0004 8	116861		9859				
	8					13667	1993					142500		9566				
	9					13940	2033					145360		9758				
	500					14029	2046					146289		9821				
	1					14229	2075					148365		9960				
	2					14421	2103					150365		10094				
	3					14379	2097					149936		10066				
	4					14097	2056					147004		9869				27.4% Cop
" 16	5					14036	2047			671	0004 4	137354		9007				
	6					13947	2034					136481		8950				
	7					13728	2002					134334		8809				
	8					14153	2064					138494		9082				
	9					13885	2025					135878		8910				
	510					13879	2024					135810		8906				
	11					13913	2029					136146		8928				
	12					14016	2044					137152		8994				
	13					12466	1818					121988		7999				32% Copper
17 Bars		251869		15000		236869	34544					23903 15		158578		$32777		706.07 lbs Cop
												321668 01		732826				
												355571 16		268683				

MONTANA BUREAU OF MINES AND GEOLOGY

MONTANA SCHOOL OF MINES

BUTTE, MONTANA

October 20, 1964

Office of Mineral Exploration
U. S. Department of the Interior
Region I
South 157 Howard Street
Spokane 4, Washington

Gentlemen:

This letter is concerned with the Granite Mountain minerals exploration loan application.

The geologic probability of making a significant discovery by deep exploration in the Granite-Bimetallic mine is, in my opinion, very good. The Granite-Bimetallic vein is an exceptionally simple, strong, and persistent structure. It has been mined for a horizontal distance of 4,500 feet and a maximum vertical depth of 2,600 feet. In width it ranged from 1 to 20 feet, averaging between 4 and 8 feet. Although the richest ore mined thus far is secondarily enriched, much primary ore has also been mined at a profit. It is to be noted here that the lower levels of the mine were not closed down because of any marked diminution in grade, but because of a break in the market price of silver. The mine was closed and allowed to flood for economic, not geologic, reasons.

Much of the U. S. silver production has come from the epithermal deposits of the southwest, which, in general, are considered less persistent in grade at depth than are the mesothermal deposits of Montana and northern Idaho; and yet these epithermal deposits have yielded commercial silver ore from depth over 3,000 feet. (San Juan region, Colo., Tonopah and Comstock in Nevada) To date the maximum depth reached in the Granite-Bimetallic is 2,600 feet below surface of the Granite Mountain mine.

The Granite-Bimetallic vein is a mesothermal vein, more closely allied to the Silver Belt veins of the Coeur d'Alene district and the Butte district. The three largest silver mines in the United States, the Sunshine,

Galena, and Lucky Friday, are all in the Coeur d'Alene Silver Belt and have reached depths of 4,600; 4,300; and 3,250 feet below surface respectively. All three are now operating on primary ore carrying about 35 ounces of silver per ton. The primary ore of the Granite-Bimetallic is said to carry as much as 30 ounces of silver per ton with by-product gold, copper, lead, and zinc similar to the Coeur d'Alene silver ores. In addition, Granite-Bimetallic ores contain manganese in the form of rhodochrosite whereas the carbonate of the Coeur d'Alene ores is commonly siderite.

At Butte, the silver ores were of less depth than those of the Granite Bimetallic, although one mine carried rhodochrosite-bearing silver ore to a depth of 2,000 feet (Main Range, production over 1,000,000 oz. of silver). However, the copper veins of Butte are silver-bearing to depths of 4,700 feet, and the silver content is sufficient to make Montana one of the principal silver-producing states.

So there is no question but what the silver mineralization of the Granite-Bimetallic vein can be expected to carry to a much greater depth than the modest 1,000 feet below the 1800-foot level of the proposed deep development (2,800 feet below the surface at the Blaine (Bimetallic) shaft and 3,250 feet below surface at the east end of the mine).

Deep development is also proposed in the footwall of the main Granite-Bimetallic vein. Showing at the surface north of the main vein is not particularly encouraging, but the Granite-Bimetallic vein itself was so lean at the surface that the original location was allowed to lapse. Most of the silver veins of the Coeur d' Alene district are poor at the surface--if they reach the surface, but blind veins are present there as well as at Butte; and there is no reason to believe that such blind veins do not exist in the footwall of the Granite-Bimetallic vein. As a matter of fact, the south vein, a branch of the Granite-Bimetallic, cannot be traced above the 700-foot level--yet the south vein has yielded good silver ore. Prospecting the footwall by crosscuts and diamond drill holes makes good sense, and has a reasonable chance of success.

The probable size and grade of the potential deposit cannot, of course, be predicted from present data--this is an exploratory project. If the diamond drilling program indicates the presence of possible commercial ore at depth and/or in the footwall, then a development program must be undertaken to delineate the size and grade of the deposit. However, there is no reason to believe that the next 1,000 feet of depth on the main vein will not yield as much silver as a corresponding volume of unenriched primary

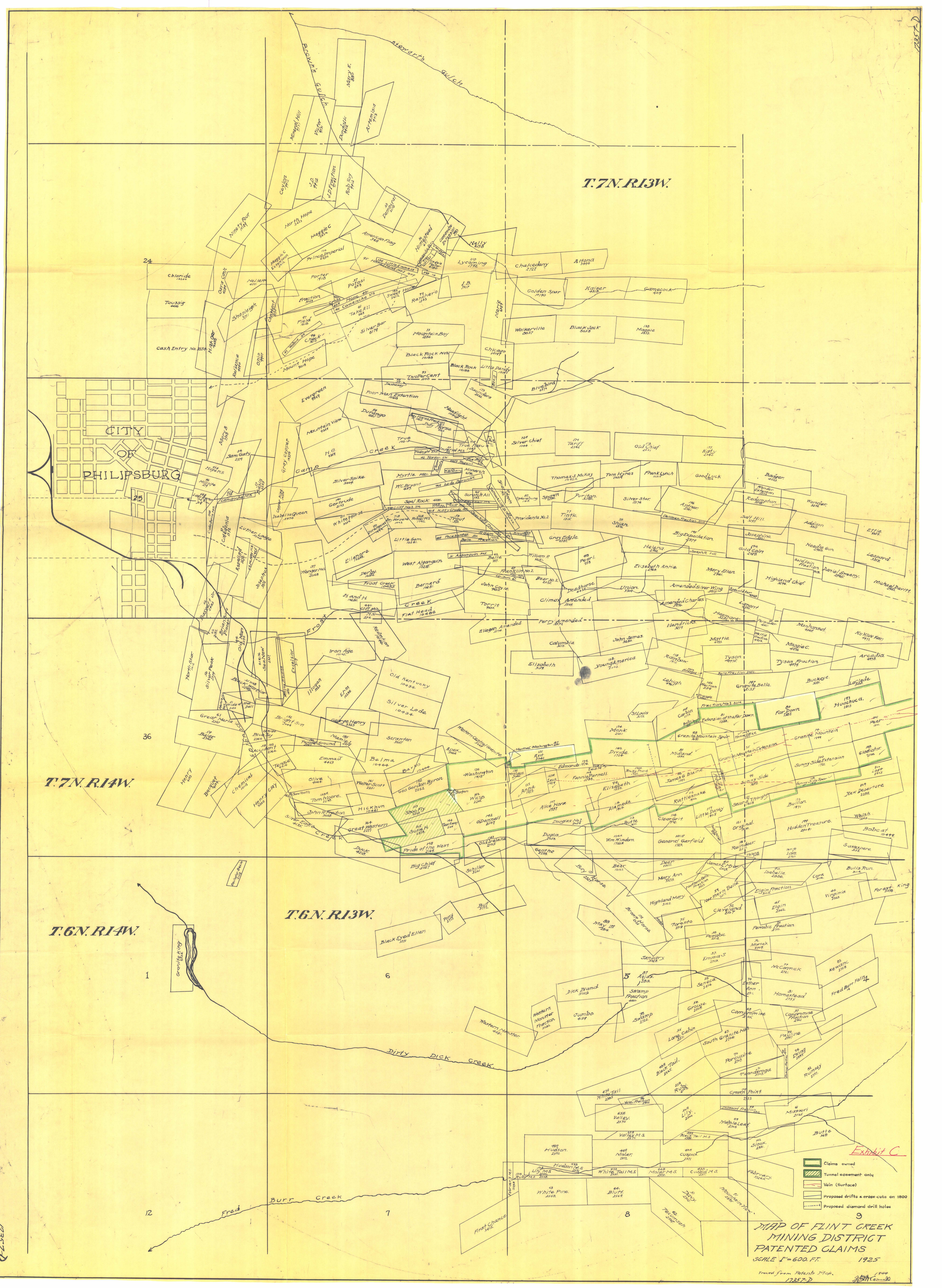
ore above the 1800-foot level within the limits of the mineralized area; in fact, it may actually yield more, because of modern methods of ore treatment. During the time of peak production, the ore from this mine was said to have been "milled." Milled it was, in the sense that it was finely ground, but further treatment was metallurgical--the ground ore was subjected to a chloridizing roast; then, amalgamated to recover silver bullion--instead of concentrate, the normal product of a modern mill. Low-grade ore was not amenable to this proces, but can be readily upgraded by modern concentrating methods, to a saleable product. Thus, much ore that was too low in grade to be "milled" in the old company's metallurgical plant can today be made into a profit-yielding product.

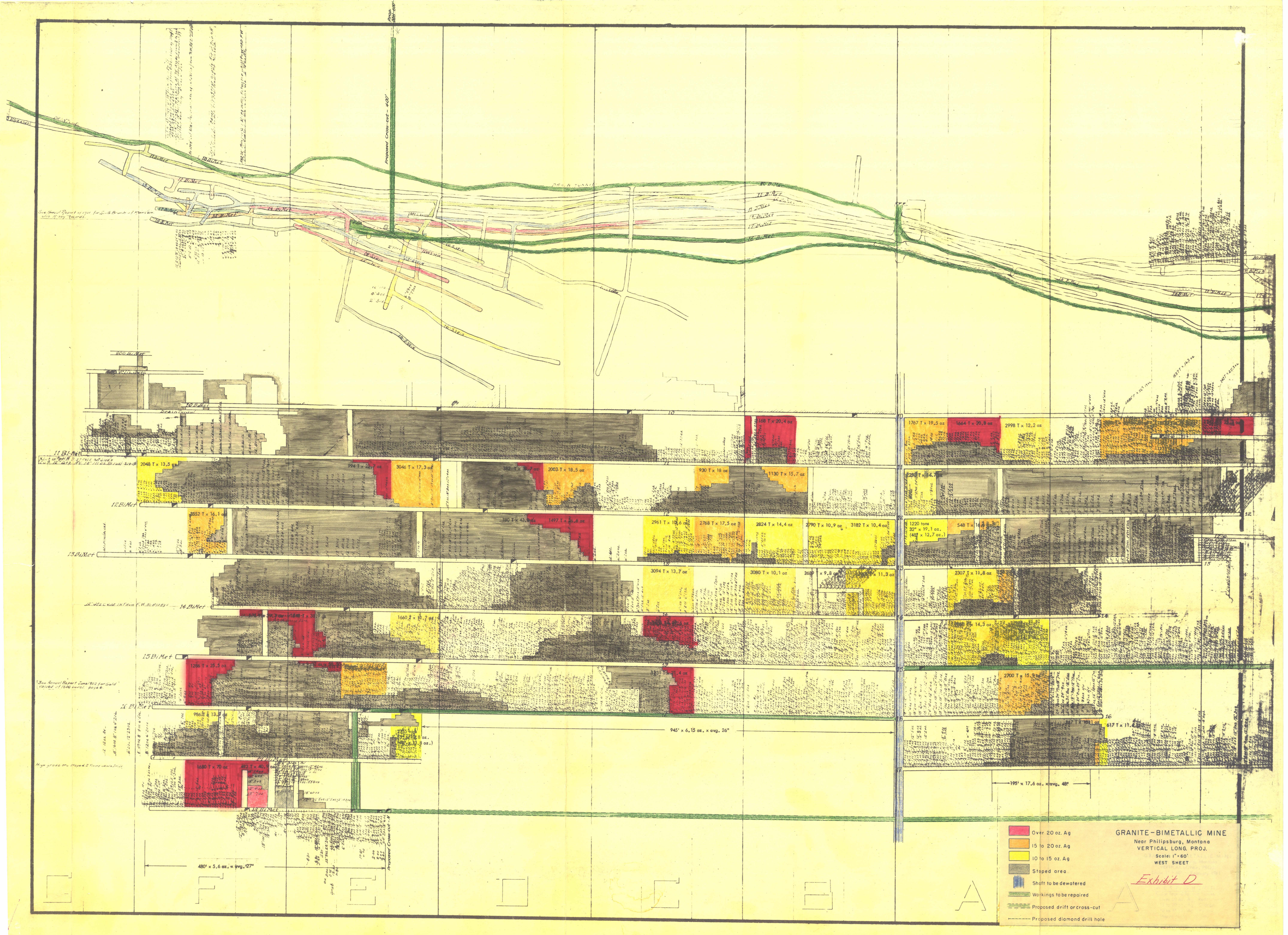
It should be obvious that the above statement is based on a study of the old company's records, as the lower levels of the mine have been inaccessible since 1905.

Sincerely,

Uuno M. Sahinen

Uuno M. Sahinen
Associate Director


T.7N.R13W.
T.7N.R14W.
T.6N.R13W.
T.6N.R14W.
CITY OF PHILIPSBURG
Brown's Gulch
Stewart's Gulch
Camp Creek
Frost Creek
Dirty Dick Creek
Fred Burr Creek
Silver Eagle Creek
Exhibit C
Claims owned
Tunnel easement only
Vein (Surface)
Proposed drifts & cross-cuts on 1800
Proposed diamond drill holes
MAP OF FLINT CREEK MINING DISTRICT PATENTED CLAIMS
SCALE 1" = 600. FT.
1925
Traced from Patents Map.
17357-D


Proposed Cross-cut - 400'
11 Bi-Met
12 Bi-Met
13 Bi-Met
14 Bi-Met
15 Bi-Met
16 Bi-Met
1168 T x 20.4 oz
1767 T x 19.5 oz
1664 T x 20.8 oz
2998 T x 12.2 oz
2048 T x 13.5
3046 T x 17.3 oz
2003 T x 18.5 oz
930 T x 18 oz
1130 T x 15.7 oz
3552 T x 16.1 oz
1497 T x 26.6 oz
2961 T x 10.6 oz
2768 T x 17.5 oz
2824 T x 14.4 oz
2790 T x 10.9 oz
3182 T x 10.4 oz
1220 tons
32" x 19.1 oz.
(48" x 12.7 oz.)
3094 T x 13.7 oz
3080 T x 10.1 oz
2307 T x 11.8 oz
1660 T x 10.7 oz
1266 T x 25.5 oz
2700 T x 15.9 oz
945' x 6.15 oz. x avg. 26"
617 T x 11.4 oz
1680 T x 70 oz
195' x 17.6 oz. x avg. 48"
480' x 5.6 oz. x avg. 127"
Proposed Cross-cut - 11
Over 20 oz. Ag
15 to 20 oz. Ag
10 to 15 oz. Ag
Stoped area
Shaft to be dewatered
Workings to be repaired
Proposed drift or cross-cut
Proposed diamond drill hole
GRANITE-BIMETALLIC MINE
Near Philipsburg, Montana
VERTICAL LONG. PROJ.
Scale: 1" = 60'
WEST SHEET
Exhibit D

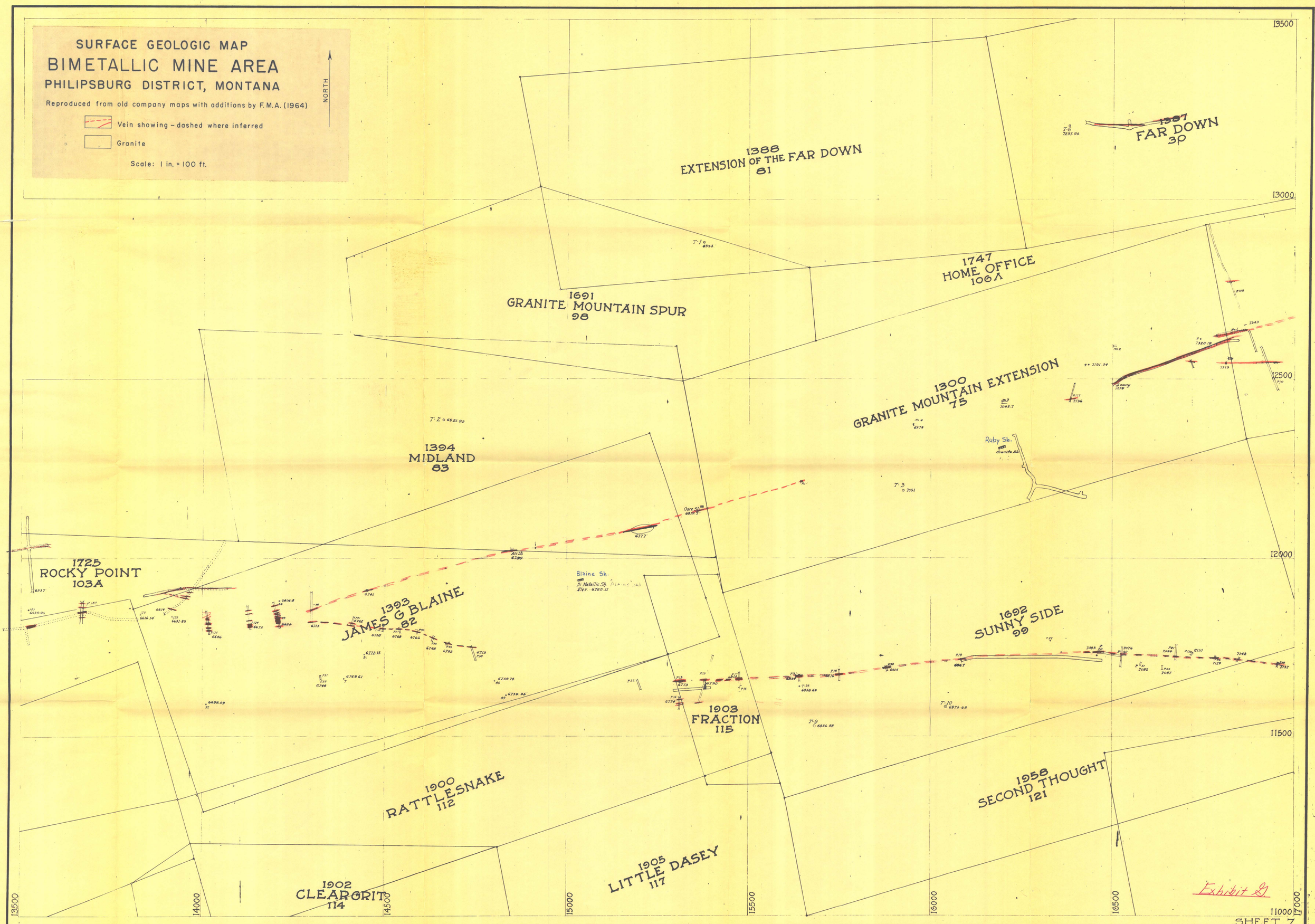

SURFACE GEOLOGIC MAP
BIMETALLIC MINE AREA
PHILIPSBURG DISTRICT, MONTANA
Reproduced from old company maps with additions by F.M.A. (1964)
Vein showing – dashed where inferred
Granite
Scale: 1 in. = 100 ft.
NORTH
1388
EXTENSION OF THE FAR DOWN
81
1387
FAR DOWN
3P
1747
HOME OFFICE
106A
1691
GRANITE MOUNTAIN SPUR
98
1300
GRANITE MOUNTAIN EXTENSION
75
1394
MIDLAND
83
1725
ROCKY POINT
103A
1393
JAMES G BLAINE
82
1692
SUNNY SIDE
99
1903
FRACTION
115
1900
RATTLESNAKE
112
1958
SECOND THOUGHT
121
1902
CLEARGRIT
114
1905
LITTLE DASEY
117
Ruby Sh.
Blaine Sh.
13500
13000
12500
12000
11500
11000
14000
14500
15000
15500
16000
16500
17000
Exhibit G
SHEET 7

Exhibit E
GRANITE-BIMETALLIC MINE
Near Philipsburg, Montana
VERTICAL LONG. PROJ.
Scale: 1" = 60'
EAST SHEET
Over 20 oz. Ag
15 to 20 oz. Ag
10 to 15 oz. Ag
Stoped area
Shaft to be dewatered
Workings to be repaired
Proposed drift or cross-cut
Proposed diamond drill hole
Proposed Cross-cut 400'
Proposed Cross-cut - 400'
Proposed DDH - 600'
Proposed Cross-cut - N
3950 tons
41" x 36 oz
(48" x 30.7 oz)
4709 T x 10.7 oz
2200 tons
31" x 51.6 oz
(48" x 33.3 oz)
1671 tons
34" x 33 oz
(48" x 25.4 oz)
2400 T x 10.7 oz
3090 T x 24.7 oz
1250 T x 34 oz
262 T
42" x 41.7 oz
(48" x 36.5 oz)
6344 T x 10 oz
6328 T x 10 oz
1665 T x 11 oz
4005 T x 11 oz
5650 T x 23.8 oz
7733 T x 15.3 oz
2209 T x 18.8 oz
8690 T x 50"
x 14.3 oz
7004 T x 10.7 oz
8430 T x 51" x 14 oz
13540 T x 78"
x 10.1 oz
8326 T x 10 oz
387 T x 14.9 oz
1628 T x 24.9 oz
1718 T x 30.7 oz
1630 T x 18.9 oz
687 T
30" x 36 oz
(48" x 22.5 oz)
1100 T x 22.9 oz
390 T x 16.4 oz
1781 T x 12.7 oz
990 T x 19.4 oz
669 T x 21.7 oz
3360 T x 11.8 oz
3296 T x 17.8 oz
309 T
38" x 20.7 oz
(48" x 16.4 oz)
1460 T x 12.9 oz
1440 T x 38 oz
644 T
20" x 91.3 oz
(48" x 38 oz)
1215 T x 18.4 oz
3099 T x 13.8 oz
2679 T x 21.8 oz
2769 T x 12 oz
2160 T x 15.5 oz
2000 T
48" x 19.3 oz
WA 112.72