# Mineralogy of the Surf Point and Hunter Veins*

By Harry V. Warren and John M. Cummings

SEVERAL properties situated along the British Columbian Coast contain veins which are closely allied both in their mode of occurrence and in their mineralogy.

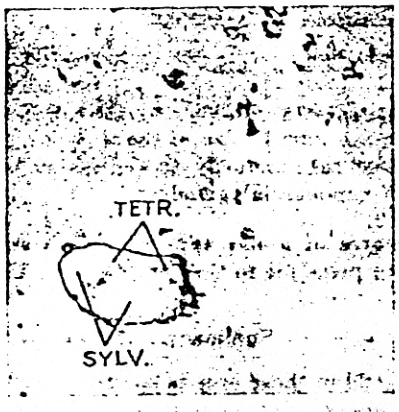
These veins all belong to one geological type, and it is possible in a general way to give definite advice with regard to the treatment of these ores and in future this should obviate the carrying out of many costly mill tests.

Up till the time of writing—May, 1936—no British Columbian deposits of a similar nature have been found away from the vicinity of the coast.

## Location

The Surf Point mine is situated on the westerly slope of Porcher Island, about 25 miles southeast of Prince Rupert.

The Hunter group of claims lies about 8½ miles up the North Fork of the Khutze River, and about 13 miles from seaboard at the head of Khutze Inlet, which is about 100 miles south of Prince Rupert.




Tellurides in pyrite. Bleb is 2 microns in diameter and contains tetradymite, sylvanite and a speck of gold (not discernible in picture). Smaller bleb of sylvanite is 1/3 micron in diameter. Magnification x 3000.

## General Geology

The general geology of the two properties has already been described by Dr. V. Dolmage[1] and by Dr. Joseph T. Mandy,[2] the latter giving both as examples of his "Central Pendant Belt." Dr. Mandy writes of this type as follows: "High-grade auriferous pyrite sometimes with minor quantities of intimately intermixed chalcopyrite, in quartz veins, occupying cooling-contraction fissures and sometimes shear-zones in dioritic rocks of the roof phase of the batholith itself."

The veins are narrow, usually considerably less than two feet in width, and erratic as are the patches of gold-bearing pyrite which occur in them. Some of the veins have been traced along the strike for several hundred feet, but as yet no development work has gone more than 200 feet below the surface.

The country rock consists of differentiated portions of the Coast Range Batholith, which for the most part approaches a quartz diorite in composition. The close proximity of older sedimentaries, which often are present as roof pendants, varying greatly in size and areal extent, support the contention that the dioritic country rock represents a roof phase of the Coast Range Batholith.

R. E. Legg[3] states: "To what depth these veins will persist is not yet known, although geological opinions from various sources are unfavorable to their persistence." In spite of their narrowness there appears to be no conclusive evidence for presuming that these veins will not persist, at least to moderate depths, say from 400 to 800 feet.

Dr. Mandy,[4] writing in Bulletin No. 1, 1932, B. C. Minister of Mines report, describes the occurrence of ore in the Hunter group and in a general way these remarks are applicable to the Surf Point veins. He writes as follows: "Mineralization consists of crystalline gold-bearing pyrite in isolated patches, scattered blebs and streaks and some concentration lenses up to 34 feet in length. Exposed sections of the veins show an estimated pyrite mineralization of from 1 to 5 per cent in patches, blebs, and streaks, and from about 10 to 75 per cent in the concentration lenses or shoots. The sulphide mineralization generally favours a pronounced development of ferro-magnesian minerals, either through differentiation or absorption, of the wall rock."


A bleb of tetradymite, sylvanite and gold in pyrite. This grain is about 2 microns in diameter. Magnification approximately x 2500.

## Mineralogy

The following minerals were identified: pyrite, chalcopyrite, arsenopyrite, pyrrhotite, sphalerite, tetradymite, sylvanite(?), gold, quartz, and chloritic and sericitic material.

Pyrite (FeS2).—Pyrite is the most conspicuous and the most important ore mineral in these veins. It occurs in irregular masses and in disseminated grains; occasionally there occur well developed cubes which in the Hunter veins actually attain three-quarters of an inch in size. In most places, however, the ore is shattered and friable, the pyrite in some cases exhibiting schistose structures.

Chalcopyrite (CuFeS2).—Chalcopyrite, although rare in the Surf Point, is relatively common in the Hunter veins, one table concentrate from the latter actually yielding a chalcopyrite pyrite ratio of one to two. The chalcopyrite occurs in irregular masses and minute veinlets in both pyrite and quartz.

Arsenopyrite (FeAsS).—Arsenopyrite is rare. Under the microscope a few tiny anhedral grains can be seen in pyrite.

Pyrrhotite (Fe x S x + 1).—Pyrrhotite is also rare. Under the microscope a few minute grains can be seen in pyrite from the Hunter veins.

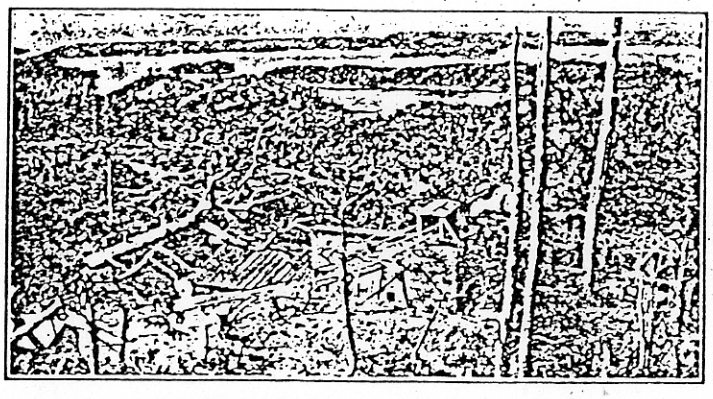
Sphalerite (ZnS).—A few small rounded grains of sphalerite were seen under the microscope. They were associated with chalcopyrite.

Tetradymite (Bi2(TeS)3).—This mineral, which is a bismuth telluride, occurs sporadically as cleavage plates in the Hunter veins. It occasionally attains a size of one quarter of an inch square and one sixteenth of an inch in thickness, but usually is much smaller. Under the microscope, however, there

*This is the sixth of a series of articles on the mineralogy of some of the mines and prospects of British Columbia. For the specimens used in these mineralogical investigations it has been necessary to a large extent to rely on the kindness of the various individuals referred to from time to time. Consequently, although all ordinary precautions have been taken to ensure that the specimens studied are representative of the mines concerned, the authors do not assume any responsibility for the results hereafter discussed. The articles are appearing in haphazard order; the order therefore bears no relation whatsoever to the importance of the property which is being discussed.

can be seen numerous blebs of a soft grey mineral which has been determined as tetradymite by comparison with known sections, by its colour, hardness, anisotropism and reaction to etch tests. The blebs range from 30 microns—three one-hundredths of a millimetre—in their maximum dimension down to the limit of microscopic resolution: obviously conclusive microchemical tests are difficult to obtain.

Sylvanite(?) (Au Ag)Te2.—The determination of this gold silver telluride has not been decisive However, after allowing for native gold and tetradymite seen under the microscope, the gold-silver-tellurium ratio suggests sylvanite The mineral is soft, pale yellow, and its etch reactions suggest sylvanite or calaverite. Furthermore it is undoubtedly the mineral mentioned by Legg[5] as having been independently determined by Graton to be sylvanite "or a very closely related gold-bearing telluride." A suitable selection of filters enables satisfactory photomicrographs to be taken.



20-Ton Flotation Mill at the Surf Point Mine

Neither the tetradymite or sylvanite show any respect for the fractures in or the crystal boundaries of the pyrite through which they are scattered irregularly. This indicates that the tellurides were formed contemporaneously with the pyrite.

Gold (Au).—Several tiny specks of gold were seen as "islands" in the tellurides. The gold is pale in colour and may be assumed to contain considerable silver.

It is interesting to note that no gold was seen in pyrite alone, but only in blebs where sylvanite (?) and tetradymite were intergrown.

Gangue Minerals.—Quartz with minor amounts of sericitic and chloritic material comprise the gangue.

## Paragenesis

Pyrite, arsenopyrite, pyrrhotite, tellurides, and gold were probably deposited more or less contemporaneously and were followed by chalcopyrite and sphalerite which in part overlapped with the earlier set.

## Distribution of Values

In an attempt to discover if any factors controlled the distribution of gold values the following products were selected or hand picked and assayed.

### Hunter

| | | |
|---|---|---|
| (1) High grade table concentrate (—10+20 mesh). Largely pyrite, some chalcopyrite | 12.12 oz. | Au/ton |
| (2) Pyrite 75% and Quartz 25%. Fine disseminated pyrite. | 5.76 | Au/ton |
| (3) Pyrite, massive crystalline, 99 + % pyrite | 9.60 | Au/ton |
| (4) Pyrite 95%, Quartz 5%, fractured | 6.72 | Au/ton |
| (5) Chalcopyrite with a little pyrite | 1.42 | Au/ton |
| (6) Schistose pyrite with a little sericitic material | 12.40 oz./ton | |

### Surf Point

| | | |
|---|---|---|
| (7) Pyrite 75%, Quartz 26%, highly fractured | 9.60 | Au/ton |
| (8) Pyrite, massive crystalline, 99% + pyrite | 8.96 | Au/ton |
| (9) Pyrite 75%, Quartz Chalcopyrite 25% | 10.00 | Au/ton |

These assays together with a mineralographic examination show conclusively that gold values are distributed erratically throughout pyrite. The gold contributed largely by sylvanite(?) and to a minor extent by native gold, both of which are closely associated with tetradymite, all three minerals being scattered in a haphazard fashion through the pyrite.

Some gold may be contributed by chalcopyrite, but the manner of this contribution is unknown as no gold nor tellurides were observed in this mineral.

## Milling Considerations

Whether or not cyanide solutions can dissolve the gold from all gold-bearing tellurides is still unsettled.[6, 7] Nevertheless it is probable that the reason that these ores are not amenable to either amalgamation or cyanidation[8, 9] is because the gold in them is largely present as as a telluride. Fortunately excellent concentration and recovery can be made by flotation and furthermore only relatively coarse grinding is needed for this operation.

Unsatisfactory recovery by cyanidation may also be attributable to the minute size of the telluride particles which cannot be exposed satisfactorily to the action of cyanide within the limits of commercial grinding.

Any ores of a like type should be amenable to treatment similar in principle to that employed at the Surf Point Mines.[10]

## Summary and Conclusions

The gold in these ores is largely contributed by sylvanite(?) —or a closely related telluride—which is invariably associated with the two tellurides.

The ores are not amenable to amalgamation or cyanidation but bulk concentration giving high recoveries can be readily obtained by flotation.


## Acknowledgments

The authors' thanks are due to Professor Turnbull, Professor Gillies, and the late Professor Thomson, for their generous aid and co-operation, and most particularly to Mr. Bishop, who spent many long hours, both directing and assisting in the assaying.

All the laboratory work was carried on in the Ore Dressing, Metallurgical and Geological laboratories of the University of British Columbia.

Furthermore, the work would not have been possible but for the cooperation of Mr. R. E. Legg, Manager of the Surf Point Mine, and Mr. J. M. Meldrum, part owner of the Hunter group of claims. These men not only provided excellent suites of ores, but also gave the University permission to publish the results.



1. Geol. Surv. Can., Summ. Rept. 1922, Part A, p. 27.
2. B. C. Dept. of Mines, Bulletin No. 1, 1932: Lode Gold Deposits of British Columbia, p. 21.
3. B. C. Miner, Feb. 1936, p. 20.
4. Op. cit., p. 35.
5. Op. cit., p. 30.
6. Is the gold in Tellurides soluble in Cyanide. H. E. T. Haultain and W. E. Johnston, Vol. 36, Trans. C.I.M.M., p. 217.
7. Gold Tellurides are Soluble in Cyanide. W. E. Johnston. Vol. 36, Trans. C.I.M.M., p. 224.
8. R. E. Legg, op. cit.
9. G. S. Eldridge, Private Report. Courtesy of J. M. Meldrum.
10. R. E. Legg, op. cit.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# TACOMA SMELTER

AMERICAN SMELTING & REFINING COMPANY

PRELIMINARY SETTLEMENT — January 17th — 4

TACOMA, WASHINGTON. 193

T OF J.M.Meldrum

1241 E. 15th Ave., Vancouver, B.C. MATERIAL Ore

SMELTER LOT 1915 MINE LOT DATE RECEIVED 12-19

S. S. VESSEL Northholm ENTRY NO. 344 DATED 12-21

| GOLD QUOT. | SILVER QUOT. | FOREIGN COPPER QUOT. | |
|---|---|---|---|
| | DATE 12-19 | DATE 12/19 | DATE |
| PER OZ. | 43½ Less 1½ | 8.15 LESS 2 3/4 5.40 | LESS |

| NO. SACKS | WET WEIGHT | H₂O | DRY WEIGHT | ASSAYS AU | AG | CU | Provisional CONTENTS GOLD OZS. | SILVER OZS. | COPPER LBS. |
|---|---|---|---|---|---|---|---|---|---|
| 915 | 6754 | | | | | | | | |
| sacks | 180 | | | | | | | | |
| | 6574 | 1.85 | 6452 | 9.29 | 4.02 | 1.37 | 29.970 | 12.97 | 88 |
| | | | | | | | Less ½ oz.Ag | 1.61 | |
| | | | | | | | " 20 lbs.Cu | | 65 |
| | | | | | | | | 29.970 11.36 | 23 |

Gold 100% to be returned under agreement.

| | | | |
|---|---|---|---|
| Gold advance at $20.00 oz. | | | $ 599.40 |
| Silver at 42¢ | | | 4.77 |
| Copper at 5.40 | | | 1.24 |
| | | | $ 605.41 |
| Base charge | $ 8.50 | $ 27.42 | |
| Material in sacks at 75¢ ton | | 2.53 | |
| Sampling prepaid | | - | |
| Customs | | 2.50 | |
| Freight | | - | 22.45 |
| | | | $ 572.96 |

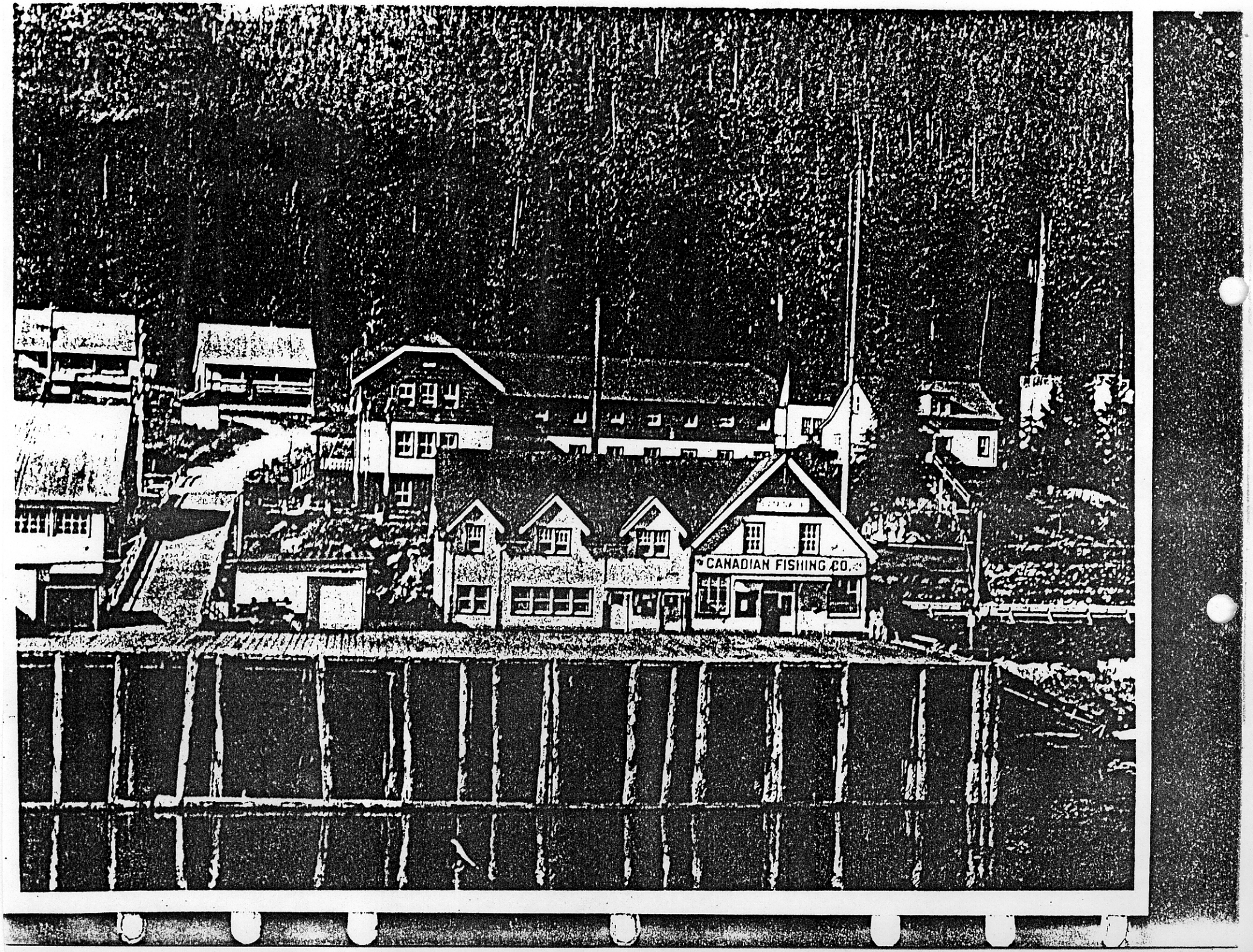
STATE OF WASHINGTON )
; SS
COUNTY OF PIERCE )

WM. MORRISON being first duly sworn, on oath deposes and says: that he is the Superintendent of the Tacoma Smelter of the American Smelting & Refining Company at Tacoma, Pierce County, State of Washington; that the foregoing is a true and correct copy of the settlement made with J. M. Meldrum.

Subscribed and sworn to before me this 17th day of January 1934.

Notary Public for the State of Washington, residing at Tacoma.

NOTICE: All p[illegible] on Ore, not under contract for a specified time, are subject to change without notice.
An additional charge of $10.00 per lot, for sampling and assaying, will be made on lots containing less than five tons.
Duplicate sample of above lot will be held for a period of 30 days.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