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REPORT ON

BRISTOL SILVER MINES

by

G. W. CRANE

April 12, 1924

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Item 21

GEOLOGICAL REPORT

on

THE PROPERTY

of the

BRISTOL SILVER MINES CO.

LINCOLN CO., NEVADA

Prepared for

CHARLES E. SCHWARZ

MINING AND METALLURGICAL ENGINEER

MIAMI, OKLA.

by

G. W. CRANE

Salt Lake City, Utah

April 12, 1924

C O N T E N T S

C O N T E N T S - Cont'd

April 12, 1924

Mr. Chas. E. Schwarz
Miami, Oklahoma

Dear Sir:-

I have examined the property of the Bristol Silver Mines Co. and in response to your request, submit the following report.

Scope of the Report.- Understanding that you have obtained personally, and through other sources, much first hand information as regards the economics of the operation, I have confined my discussion primarily to the geological features as revealed by a study of the surface and the underground workings of the property with a view to the interpretation of the manner of occurrence of the known ore bodies, the general geological conditions in the district and an appraisal of the latent possibilities for additional discoveries. In order to limit the text to a generalized summary and correlation of the facts, an attempt has been made to present the facts of the geology by map and tables in as much detail as the time allowed made possible. All data on production and ore assays were furnished by the Company's Salt Lake office.

Maps.- The maps accompanying this report are as follows:

1. A claim map of the Bristol and Jack Rabbit Mining Districts showing the mineral rights of the Black Metals and Bristol Silver Mines Companies, the location of the principal mine workings, also roads, topography and some geology on a scale of 400 feet to the inch.

2. A map showing in both north-south and east-west section the ore bodies and mine workings of the Bristol mine, also the geology and the distribution of the several classes of ore.

3. A set of 14 mine level maps of the Bristol mine showing the ore bodies and the fissure systems, also a composite map of all the levels on a scale of 50 feet to the inch.

4. A map showing the workings of the Bristol group of mines

and the locus of the proposed Black Metals-Bristol tunnel in plan and in section on a scale of 200 feet to the inch.

GENERAL FEATURES.

Location.- The Bristol Silver Mines property is located in the Bristol Mining District, Lincoln County, Nevada. It is situated near the north end of the Bristol Mountain Range at elevations ranging from 6500 to 8200 feet, A.T. The annual rain fall is about 11 inches, the climate is desert, frequently windy, but mining operations are seldom interrupted by weather conditions.

Transportation.- The mines are connected by a 9000-foot aerial tramway with the Jack Rabbit terminal of the Pioche Pacific Railroad, a narrow gauge which connects with a branch line of the Union Pacific Railroad at Pioche, 15 miles to the southeast.

Mining Rights.- The company owns in full the mining and surface rights on 24 patented and 13 unpatented lode claims on the Bristol side of the range, together with 55% of the capital stock of the Black Metals Mines, Inc. which owns 4 patented and 8 unpatented lode claims and holds a lease on six adjacent patented claims at Jack Rabbit. The whole constitutes an area of about 825 acres which covers the hitherto most productive part of the Bristol and Jack Rabbit districts.

Mineralized Areas.- The producing mines of the district are found grouped in certain mineralized areas at intervals of a mile or more apart. At Jack Rabbit are the old Day and Onondago mines now in the Black Metals group. At Bristol, the Hillside, Tempest, Inman, Vesuvius, National, May Day and Gypsy mines form the Bristol Mines group. The Iron and Detroit mines about one-half mile northwest of the Bristol camp and the Home Run mine about as far south are in mineralized areas more or less to themselves. All the mines named above have production records and are owned or controlled by the Bristol Silver Mines Co. A description of each of the mines will be found in this report and their distribution with respect to the property is shown on the accompanying district map.

Production.- The Bristol District is reported to have been

organized in 1871 and in the late seventies production warranted the erection of a smelter at Bristol Springs, four miles northwest of the mines, and later a 5-stamp mill at the same place. Prior to 1904, no records of production are available but the district is estimated to have produced $3,000,000 in gross values. Between 1904 and January 1, 1919, railroad records show that there were shipped from the district 33,475 tons of ore which brought a net smelter return of $375,902.82. Between January 1, 1919 and December 1, 1923, the mines under operation by the Bristol Silver Mines Co. produced 38,330 tons of ore of a gross value of $752,205.86. According to all records then, the district has produced ore having a gross value of from four and one-half to five million dollars.

GEOLOGY.

Geologic History of the District.- Preparatory to a discussion of the nature and occurrence of the ore deposits, it will be well to review briefly the larger geologic events which lead to ore deposition and to its subsequent erosion, faulting and alteration.

Except in detail, the geologic history of the Bristol Mining District does not differ materially from that of other sections of the great intermountain country. It may be divided into two periods of marked contrast. The first was one of sedimentation, deformation and erosion. The second was one of vulcanism, faulting and fissuring, mineralization and more erosion.

During the first period which was much the longer, all of the sediments represented in the district were laid down, deposition continuing almost without interruption from Lower Cambrian well into Pennsylvania time. This was followed by a period of folding and faulting of varying severity throughout the intermountain region, resulting in the tilting and general elevation of large sections of the country and in much thrust and block faulting. The period of deformation was accompanied and followed by a long period of erosion which in the course of time completely removed great thicknesses of strata

and exposed to view in places the once most deeply burried beds. This brought to a close the first great period of events and as yet no ore bodies of the Bristol type had been deposited.

The second chapter in the history began with a period of volcanic activity which affected the whole of the western part of the American hemisphere. There was a great uplift throughout the intermountain country accompanied by first flows of andesite, followed by flows of rhyolite, which in turn were succeeded by monzonite and rhyolite intrusions. In some parts of the country, the flow rocks were very thick covering even the highest of the limestone mountains. In Bristol, they may have been less extensive for no flow rocks remain today except in the mountain ranges to the north.

The volcanic activity was accompanied by additional faulting and fissuring and this in turn by the appearance of ore depositing solutions arising from depth along the newly formed fissures from sources common to those emitting the intrusive rocks themselves. The period of ore deposition was probably relatively short, but after the ore deposits were formed, additional fissuring seems to have faulted them some though not extensively. During the period of vulcanism and of ore deposition and down to the present day, erosion went on without interruption. The flow rocks were completely removed. New mountain peaks and canyons were formed and the broad intermountain valleys were partly filled with alluvial material. Through erosion, the ore deposits nearest the surface were exposed to view while those at greater depth experienced secondary concentration by the oxidation of their primary minerals, a process still going on wherever the ore bodies are within reach of the surface waters.

Surface Formations.- As the district stands today, the surface rocks consist almost entirely of Paleozoic limestones with some Cambrian shale and quartzite. Igneous rocks are restricted to a single rhyolite dike reported as outcropping in the northern end of the camp. Mining

operations to date are entirely within the limestone formations, which are nowhere strongly folded. The normal strike of the bedding is east and west with a dip of 10 to 20 degrees to the north, but locally, due to faulting, the dips are steeper and in other directions.

The Quartzite.- The oldest formation in the district is the Lower Cambrian quartzite, which is basal to all the later rocks and correlates in age with the Pioche and the Tintic quartzites. At Bristol, we have no direct check upon its thickness but the same formation in the Patterson Mountains to the north is reported to be 10,000 feet thick.

None of the Bristol workings have reached the quartzite, but the formation outcrops at the western base of the range about 2000 feet directly west of the Gypsy mine and again near the Home Run mine further south. Its appearance here is due to post mineral faulting and subsequent erosion. The rock is typically grayish-white to pale pink in color, of fine, even grain and almost pure quartz. It is thoroughly broken and recemented with no evidence of bedding, indicating that the upper well bedded portions of the formation have been eroded.

While not susceptible to mineralization by replacement, the quartzite has some economic importance in that at Pioche the most productive fissures were those found within it. Fissures in the quartzite are usually strong and persistent both latterly and to depth, features of promise when within range of known mineralizing solutions.

The Shales.- Overlying the quartzite is the Middle Cambrian shale, which correlates in age with the Louise and Gladstone shales at Pioche and the Ophir shale at Ophir and Tintic.

The shale outcrops just to the west of the Home Run mine and from there north along the line of quartzite knobs that mark the west boundary of the district. Perhaps the best exposure is that at the Lindsay tunnel where, due to faulting, only a portion of the shale formation outcrops. The beds exposed consist of about 200 feet of

grayish green fissil shale interspaced with thin beds of impure quartzite and shaly limestone which probably represent only the lower portion of the formations.

The thicker limestone members which at Pioche carry the Prince and Louise iron ore beds and the Combined Metals silver-lead-zinc beds do not appear to be exposed and I saw no evidence of their occurrence. The deepest workings in the Bristol district have not entered this formation.

The Limestones.- Overlying the shale are about 3000 feet of limestone which present a continuous exposure from the Home Run mine at the west base of the range to the Hillside mine at its crest. These limestones, which are in part Middle and Upper Cambrian and in part Ordivician in age, contain the ore bodies developed to date. They consist, for the most part, of massive, blue, sub-crystalline, dolomitic limestone with interbeddings of thinly bedded light gray to white laminated limestone. The massive blue beds are commonly mottled or have a bold, irregular banding and numerous small, white worm-like inclusions known as vermicular markings. The light colored beds have a dull, fine grain and are often somewhat shaly. A descriptive section of the limestones cut by the Snyder shaft (see page 8) is representative of the lower portion of the section and is fairly typical of those higher in the series.

Other Sedimentary Formations.- Near the north end of the Bristol Range, impure limestones and pink quartzites of probable Silurian age overlie the Cambrian and Ordovician limestones and still farther north, limestones of Devonian and Carboniferous age are reported. These formations, however, do not come within the range of operations at Bristol.

The Igneous Rocks.- No igneous rocks were observed outcropping on the Bristol Silver Mines property and none have been encountered at depth in any of the mine workings. A light colored rhyolite dike about 40 feet in width is reported to outcrop on the Copper Lizzard

claim about one mile north of the Gypsy shaft.

In connection with the genesis of the ore deposits, it is interesting to note that just to the west of Stampede Gap, a distance of five or six miles south of Bristol, there is outcropping a large intrusive mass of granite, an off shoot of which has been traced to Pioche, ten miles to the east. This may be the parent stock to the 40-foot dike outcropping on the Copper Lizzard claim and it is not unlikely that deeper work on the Bristol property will ultimately encounter similar dikes. Presumably, it is to some unexposed intrusive stock of this type that the Bristol ore bodies owe their source.

General Structural Features.- Structurally the Bristol Range north of Stampede Gap is a monoclinal fold pitching gently to the north. Except locally, where influenced by faulting, the bedding strikes nearly east and west and dips 10 to 20 degrees to the north. Faulting and fissuring are common and very important and are in part pre-mineral and in part post-mineral in age. Descriptions of the mineralized fissures will be found under the discussion on the geology of the Bristol mines. Chief among the post-mineral fissures is a strong N. 5° E. fault which is marked by a succession of pink quartzite ledges and outcrops of shale along the western base of the range. It crosses the Bristol property near the shaft on the Contact claim and again farther south near the southwest corner of the Blue Bird No. 4 Mineral claim. No mineral deposits other than iron have been found on this fissure and it may represent the Basin Range type of post-mineral faulting. The throw is down on the east and may be as much as 500 to 1000 feet.

Other post-mineral faults were observed in the May Day and Bristol mines and are described in that connection.

THE BRISTOL MINE.

Developments.- The Bristol mine proper includes the old May Day and Gypsy mines and considerable late work at lower levels on the downward extension of the same ore shoots. The Snyder shaft, which was sunk to a depth of 1021.5 feet on an incline of 70° with working levels at approximately 100-foot intervals below the Gypsy 600 level, now serves as an outlet to all the workings while the old May Day and Gypsy shafts though still open have fallen into disuse. The extent and nature of the underground developments contiguous to the three shafts are shown in plan and section and by levels in the set of 50-foot scale maps accompanying this report.

Geology.- All rocks exposed in the workings of the Bristol mine are limestones of the series next overlying the shales. They are characterized by two main types, the massive, sub-crystalline, blue and dark gray dolomite variety and the thin bedded, fine grained, light gray variety which are true limestones, generally impure and weather white on exposure. A descriptive section of the succession as exposed in the Snyder shaft beginning at the collar is as follows:

Snyder Shaft Section

Depth in Ft. From - To	Horizon Thickness	Description
0 - 12	12 Feet	Thin bedded, fine grained, light gray limestone, dips 12° N.
12 - 45.5	33.5 "	Heavy bedded, blue banded limestone.
45.5- 48.5	3 "	Thin bedded, fine grained, light gray, banded limestone.
48.5- 58.0	9 "	Massive, fine grained, blue banded limestone.
58 - 62	4 "	Three beds of light gray, banded, fine grained limestone.
62 - 74	12 "	Fine grained, banded, blue limestone.
74 - 79.5	5.5 "	Thin bedded, light gray limestone with clay parting top and bottom.
79.5- 86.5	7 "	Thin bedded, light gray limestone, beds dip 11° N.
86.5- 92	5.5 "	Thick beds of dark blue, fine grained limestone.

Depth in Ft. From - To	Horizon Thickness	Description
92 - 93	1 Ft.	Single bed light gray, banded limestone.
93 - 100.5	7.5 "	Massive, fine grained, gray limestone.
100.5- 105	4.5 "	Massive, fine grained, light gray limestone.
105 - 108	3 "	Single bed, dark blue, fine grained limestone.
108 - 112	4 "	Two beds dark gray, fine grained limestone.
112 - 113	1 "	Light gray limestone, strongly mineralized with silver and lead.
113 - 121	8 "	Fine grained, gray limestone, much fractured and recemented with calcite and spots of lead carbonate.
121 - 124	3 "	Fine grained, gray limestone, not brecciated.
124 - 131	7 "	Massive, fine grained, gray limestone with 6" bed with clay partings at the base.
131 - 136	5 "	Fine grained, light gray limestone.
136 - 143	7 "	Fine grained, gray limestone.
143 - 144	1 "	Very shaly, light gray limestone. Distinctive horizon.
144 - 159	15 "	Massive, gray mottled limestone.
159 - 175	16 "	Massive, dark gray, banded limestone.
175 - 183	8 "	Thin bedded, light gray limestone, quite shaly at bottom.
183 - 205	22 "	Fine grained, gray, mottled limestone. Partly brecciated and recemented with calcite. Beds dip 10° N.
205 - 216	11 "	Fine grained, gray limestone with shaly bed at bottom.
216 - 259	43 "	Massive, fine grained, gray limestone. Stope on fissure in these beds.
259 - 304	45 "	Massive, gray limestone. Stoping in these beds.
At 304		Floor of Gypsy 200 level station.
304 - 341	37 "	Massive, fine grained, dark gray limestone.
341 - 356	15 "	Massive, fine grained, light gray limestone.
356 - 363	7 "	Massive, fine grained, dark gray limestone.
363 - 380	17 "	Massive, fine grained, light gray limestone.
380 - 396	16 "	Massive, fine grained, dark gray limestone.
396 - 417	21 "	Massive, fine grained dark blue limestone, base strongly marked bedding.

Depth in Ft. From - To	Horizon Thickness	Description
417 - 445	28 Ft.	Massive, fine grained dark blue limestone.
445 - 492	47 "	Massive, sub-crystalline, dark blue limestone.
492 - 511	19 "	Thin bedded, dark blue, banded limestone, dip 10½° N.
511 - 515	4 "	Thin bedded, light gray limestone (Lower 1' copper stained.)
515 - 542	27 "	Massive, dark blue limestone on foot wall May Day fault.
At 542		Floor of Gypsy 600 level station and May Day fault.
542 - 628	86 "	Massive, dark blue, mottled limestone.
628 - 668	40 "	Massive, fine grained, gray and light gray limestone.
668 - 678	10 "	Light gray, banded limestone. Beds dip 8° N. 20° E.
At 678		Floor of the 700 level station.
678 - 690	12 "	Light gray, banded limestone with iron seams on bedding.
690 - 774	84 "	Light gray, banded limestone resembling Dagmar of Tintic. Dips 22° NE.
At 774		Floor of the 800 level.
774 - 798.5	24.5 "	Thin beds of light gray, banded limestone (Dagmar type.)
At 798.5		The Tempest fault crosses the shaft N.65°E. and dips 55° SE. Hanging wall beds dip 30° NE.
798.5- 810	11.5 "	Thin beds, fine grained, gray limestone. Beds dip 8° S.
810 - 835	25 "	Thick beds, blue vermicular limestone.
At 835		Floor of the 900 level.
835 - 869	34 "	Massive, fine grained, gray limestone, no banding dips 12° S. 70° E.
At 869		Fault N. 60° W. dips 44° SW. At 50' beds strike N. 20° E. and dips 15° SE.
869 - 896	27 "	Massive, bluish gray limestone. Some red mottling and 2" clay seam at bottom.
At 896		Fault strikes N. 50° E. and dips 45° SE.
896 - 912	16	Massive, gray limestone. At 75 ft. tight slip N. 75° E., dips 60° SE.
912 - 931.5	19.5 "	Massive, gray and light gray limestone.
At 931.5		Floor of the 1000 level station.

Depth in Ft. From - To	Horizon Thickness	Description
931.5- 981.5	50 Ft.	Massive, dull gray limestone, wavy banding.
981.5-1009.5	28 "	Massive, dull gray limestone, No banding.
At 1009.5		Floor of 1100 level station.
1009.5-1021.5	12 "	Massive, dull gray limestone, lighter in color than that above the 1100 level.
At 1021.5		Present bottom of the shaft. No water.

Formations at Depth.- The 130.5 feet of thin bedded, light gray, banded limestone encountered in the shaft between a point 10 feet above the 700 level station and a point on the Tempest fault at 24.5 feet below the 800 level station is a characteristic horizon, that in Tintic is known as the Dagmar limestone. Now the Dagmar is separated from the highest of the shale members by about 550 feet of dark gray and blue limestones known as the Teutonic formation. The 223 feet of massive, fine grained, gray and blue limestone below the 798.5-foot level in the Snyder shaft is apparently only the upper part of the Teutonic horizon and assuming that this formation at Bristol has a thickness equal to that at Tintic,or 550 feet, there would still remain about 327 feet of limestone between the bottom of the shaft and the top of the underlying Ophir shale. Without further study of the exposures in the direction of Stampede Cap, this is the nearest we can approximate the fact.

Occurrence of the Ore Deposits.- The ore is of the fissure-lode type and was formed by the replacement of the limestone wall rocks of the fissure through the action of ascending magmatic mineral-bearing solutions. The larger ore shoots occur along the major fissure intersections and along the fissures to considerable distance latterally and upward from the intersections, but rarely downward or into the foot wall of the main solution channel. Sheeting in conjunction with

the main fissures was especially favorable to the formation of large columnar ore shoots.

Occasionally ore is found making off from the main fissures following certain limestone beddings, but this is not a common occurrence. Evidence of the mineral depositing solutions having shown a preference for limestones of a certain character is not pronounced. On the other hand, a glance at the longitudinal section of the Bristol mine will disclose that practically every bed of limestone cut by the Snyder shaft has at some point on the fissures been replaced by ore. This argues that the degree of fracturing and fissuring, or the physical state of the wall rocks rather than their chemical character, has been the prime local factor controlling the course or direction of ore deposition.

THE FISSURE SYSTEMS.

Developments upon the Bristol Silver Mines property have demonstrated the existence of at least four sets of mineralized fissures and a number of post-mineral faults. The mineralized fissures are known locally as the May Day, the Tempest, the Gypsy-National and the lead-zinc series. The post-mineral faults are barren of mineral and in some places fault the ore bodies.

The May Day Fissure.- In its relation to the ore deposits, the most important structure in the Bristol district is the May Day fault, or fissure, on which occur the Hillside, the May Day and much of the lower workings of the Bristol mine. The fault in most places is a well defined wall which has a normal strike of N. 65° E. and dips 45° SE. Not uncommonly, there are two walls 4 to 6 feet apart, but in some places these split up forming a fault zone 10 to 15 feet in width. The fault is of the thrust type and was formed during the earliest period of deformation. The throw is to the east on the north, several hundred to a thousand feet, offsetting the relatively flat bedding at least 200 feet where it cuts the Snyder shaft.

In the Bristol mine, ore has been stoped on this fissure from

the collar of the May Day shaft to the 700 level of the Snyder shaft below which the fault becomes much steeper in dip or passes into the hanging wall of the ore shoot. At the Hillside mine, ore has been stoped from the May Day fissure to a depth of about 500 feet and on the surface its croppings can be traced for 2000 feet or more over much of which it is wholly unexplored.

The Tempest Fissures.- In the hanging wall of the May Day fault is a set of N. 70° E. fissures which dip about 60° SE. and are known as the Tempest series. There are three or more fissures in this series, the best known of which carries the ore in the Tempest mine. Others in the series are seen in the May Day and Gypsy mines where they intersect the May Day fault. In some places, they appear to be contemporaneous or sympathetic featherings of the May Day, but as a rule the May Day is faulted. In all cases the faulting is normal with the down throw on the south and as much as 20 feet.

Intersections of the May Day and Tempest fissures are the common carriers of ore shoots in the Bristol mine. Examples of these are the 300 May Day Bonanza stope, the 500 Gypsy Cave stope and the 800 level Shrinkage stope. Below the 900 level, a Tempest fissure forms the foot wall of the old stopes and of the still unmined ore bodies developed there.

The Gypsy-National Fissures.- In the hanging wall of the May Day fault and intersecting both the May Day and the Tempest fissures is a series of N. 7° to N. 15° E. fissures which dip about 65 to 80 degrees to the east and are known as the Gypsy-National series. These fissures are nearly at right angles to the planes of the May Day and Tempest fissures and in places have faulted the latter 5 to 15 feet. The Gypsy fissure carried the ore in the Dave Fox, the Bingham Canyon and the Perry stopes of the old Gypsy mine. The National fissure, which lies about 400 feet east of the Gypsy, carried the ore in the National mine and at no place has it been worked to depth.

The Lead-Zinc Fissures.- There was observed in the Gypsy mine and on the lower levels of the Snyder shaft still another set of

fissures which strike from due north to N. 20° W. and dip from 70 to 80 degrees west. These, because of their usual association with lead-zinc ores, are known as the Lead-Zinc series. They seldom appear singly but usually in sets of half a dozen or more, forming what is more particularly a sheeted zone and frequently give rise to ore shoots of considerable size. Fissures of this type are very prominent in the backs of the Dave Fox and the Perry stopes and are especially well developed in the big Shrinkage and the 803 stopes on the 800 level of the Snyder shaft. They appear to have served more as relief rather than as main channels or carriers of the ore depositing solutions.

The Post-Mineral Faults.- There is at least one set of post-mineral faults which strike nearly north and south and dip from 90 to 70 degrees to the west. These are well exposed on several of the north-south drifts connecting the May Day workings with the Gypsy shaft and again on the west side of the 750 stope where the fault wall is plainly defined striking north and south and dipping 70° west. Here the stope makes right up to the fault where the ore is cut off by a slickensided wall and, although no crosscuts have been run to demonstrate the fact, the ore has every appearance of having been faulted.

A post-mineral fault dipping to the west on the Gypsy 300 level intercepts and faults the Gypsy fissure and, in a number of places, the two are so closely associated as to be easily confused. Mr. Anderson so confused them, I think, for in his paper on the geology of the Pioche and Bristol districts he speaks of the post-mineral faults in the Bristol mine as being in part ore-bearing and puts the Gypsy fissure in this class. On the trail below the mouth of the May Day tunnel is a west dipping N. 15° E. fault, which is probably post-mineral.

Sequence of Fissuring.- The oldest fissure observed on the Bristol property is the N. 70° E. May Day which of all the fissures exhibits the most faulting, the throw being largely latteral or of

the thrust type. It was formed during the earliest period of folding which took place long before the period of ore deposition.

The May Day fissure is faulted by the Tempest as much as twenty feet in places and the Tempest is faulted by the Gypsy. The Tempest and the Gypsy fissures are probably very much younger than the May Day as both may have been formed during the period of vulcanism or immediately prior to their mineralization. The relation of the National fissure to the Tempest and May Day is not disclosed by any developments, but since the National is parallel to the Gypsy in both strike and dip, the two are assumed to be of the same age. The N. 20° W. fissures were pre-mineral and probably resulted from the same stresses that produced the National and Gypsy fissures. But since their mineralization, the former have been reopened and partly filled with barren calcite.

Solution Channels.- In connection with the mineralization of the four sets of intersecting fissures, it is not only interesting but important from the point of view of future developments to determine if possible which of them has been the main feeding channel for the mineral depositing solutions. Our line of evidence includes -- degree of mineralization, character and sequence of mineral deposition, and the field relations of the several sets of mineralized fissures. In both degree and character of mineralization, the May Day fissure easily has first claim, for more ore has been mined to date from the May Day fissure than from all the others put together and the May Day ore, intrinsicly high in iron and copper with often no lead and very little zinc, is more characteristic of the initial stages in the sequence of ore deposition than are the lead and zinc ores of the adjacent and intersecting fissures.

The argument from field relations also indicates that the May Day was the solution channel, for in addition to being the strongest fissure in the field and, therefore, probably the deepest in range, it is also the underlying or foot wall structure through which ascending solutions would necessarily pass to reach those in its hanging

wall. In view of these facts, I think we are forced to conclude that the May Day fissure has been the feeder to the several sets of hanging-wall fissures within the environs of the Hillside, the May Day and the Gypsy mines, not to except the Tempest, the Inman, the Vesuvius and the National mines. Deposits in the May Day foot wall, such as those at the Detroit and Iron mines on the Iron fissure, have been mineralized from another source, probably the Iron fissure itself, and this fact lends emphasis to the possibilities of finding ore shoots in the large undeveloped May Day foot wall area. All this is assuming that there has been but one period of primary mineralization of which I saw no evidence to the contrary.

THE ORE DEPOSITS.

Character of the Ore.- All the ore mined in the Bristol district has been thoroughly oxidized excepting an occasional nodule of galena incased in lead carbonate. No other sulphides were seen. The ore minerals include gold, silver, lead, copper, zinc and occasionally some bismuth. The gangue minerals are largely iron and calcite with a little manganese oxide and occasionally some quartz. Silver occurs as the chloride, lead chiefly as the carbonate, with some sulphate and oxide and a little unaltered galena. Copper occurs mainly as the carbonate and oxide, with secondary concentrations of the silicate and black oxides. Zinc occurs as the carbonate, the oxide and the sulphate, iron as limonite, manganese as sooty pyrolusite.

Classes of Ore.- The ore produced at the Bristol Silver mines is of two classes--a copper flux and a lead ore. The copper flux ore is relatively high in iron and copper and contains about 10 oz. of silver per ton and 2% or less of either lead or zinc. The lead ore, on the other hand, is relatively low in iron and copper and carries about 21 oz. of silver per ton, 11% lead and about 6% zinc. Average assays of the two classes of ore are as follows:

Class	Oz.Au.	Oz.Ag.	%Pb.	%Cu.	%Zn.	%Fe.	%CaO	%Insol.
Copper Flux	.014	10.19	1.72	6.04	2.48	23.6	9.55	7.0
Lead Ore	.02	21.0	11.0	3.0	6.25	9.82	11.75	8.0

Some ore relatively high in zinc which was mined from the intersection of the Gypsy and the N. 20° W. fissures was sufficiently characteristic to be put into a class by itself, but due to limitations in its treatment has, as a rule, been classed as lead ore.

Distribution of the Several Classes of Ore.- The copper flux ore is obtained chiefly from the stopes on the May Day and the Tempest east and west fissures. The lead ore occurs mainly on the Gypsy and National north-south fissures in the hanging wall of the May Day fissure and at the intersection of the north-south fissures with the east-west fissures. The highest lead values were obtained from the stopes at these intersections. Most of the lead-zinc ore was mined from the backs of the Dave Fox, the Perry and the Shrinkage stopes where considerable N. 20° W. sheeting is in evidence. The ore mined at the Detroit and Iron mines on the Iron fissure is of the lead ore class but contains considerable zinc. Ores containing bismuth in quantities up to 20% and in shipment lots averaging 2% bismuth and 70 oz. of silver per ton were obtained from the Tempest mine. Here also was mined the highest grade gold ore in the camp.

The distribution of the several classes of ore as stoped from the Bristol mine is shown in color on the north-south and east-west sectional maps accompanying this report. There it will be noted the lead stopes are confined largely to the fissures in the hanging wall of the May Day iron-copper shoot and that the lead-zinc ores are found still farther in that direction, showing a sequence of mineral deposition.

The transition from a lead ore to a copper flux ore in going from the 800 Shrinkage stope to the 900 Iron stope was gradual, but to the east of the Iron stope and down to the 950 level, the ore mined showed higher lead values. This would indicate that developments have so far been confined to the foot wall of the lode and that stoping to the south will lead to ores more generally of the lead class.

Size and Shape of the Deposits.- The deposits vary greatly in size, ranging from mere stringers to irregular pod-like shoots 50 to 100 feet in diameter and 200 feet in length. The larger shoots are characteristic of the ore bodies on the fissure intersections. Those conforming to the plane of the fissures are roughly tabular in form. Stopes in the sheeted zone are usually columnar in shape following the fissure intersections. Where the limestone bedding has been followed, the stopes are usually thin, nearly flat and relatively small compared to the stopes on the fissures. This applies more particularly to the Bristol mine, for the "A" bed stope at the Black Metals mine is a bedded deposit of large scale.

Contiguity of the Deposits.- In the May Day and Gypsy mines, stoping has been practically continuous from the collar of the May Day shaft to the 1000 level of the Snyder shaft. At a number of points, the ore pinched to relatively narrow dimension due probably to tightening of the fissure or to the appearance of limestone beds less favorable to ore deposition. This is particularly true of the May Day copper flux ores. The Gypsy lead ore stopes are also largely contiguous, except in the region of the Gypsy 200 level. Here the relation of the Bingham Canyon stope to the Perry stope is such as to strongly indicate their probable connection on ore at points both north and south of the Gypsy shaft. All the ore bodies below the Perry stope show definite connections on ore. In fact, a study of the maps and sections of this mine disclose a contiguity of ore bodies so pronounced as to suggest that once the ore was located, the miner had simply to follow it to depth as well as latterly.

Factors Controlling Ore Deposition.- Apparently the fissure systems and the degree of fracturing of the adjacent rocks due to intercepting fissures and zones of sheeting have had more to do with the localization of the ore bodies than any other single element. The ore bodies almost without exception are either directly on or immediately adjacent to a fissure and the influence of the limestone formation is often more apparent than real. Limestone selection in connection with

ore deposits of magmatic origin is more characteristic of solutions heavily charged with silica and, therefore, of ore deposits having a highly silicious gangue. For instance, such is the case in Tintic where the ore bodies are very largely confined to certain limestone horizons most susceptible to replacement. The ore deposits of Bristol, on the other hand, are characteristically low in silica and high in iron and calcium. So also must have been the solutions from which they were deposited and it may be that this fact explains the relatively small amount of selective replacement at Bristol.

Secondary Concentration.- As previously stated in this report, though originally deposited as sulphides, the ore deposits at Bristol are now almost completely oxidized. Through this process, there has been considerable transportation of the copper and its redeposition as secondary silicate, carbonate and oxides. Zinc, too, under similar conditions usually undergoes considerable secondary seggregation. At Bristol, I saw but one deposit distinctly of this type. This occurred near station 1005 on the 1000 level of the Snyder shaft, where in the foot wall of a large iron-copper stope, zinc ore was mined averaging 33% zinc, about 4% copper and less than 2 oz. of silver per ton.

During the process of oxidation, silver also is subject to considerable transportation and redeposition, sometimes to the wall rocks and adjacent fissures but more particularly to lower positions on the lode and below ground water level where it usually occurs as the chloride in association with the primary ores, which at Bristol we may expect to be mainly sulphides.

At Bristol no secondary concentrations of silver were identified in the present workings and not until mining operations have reached the water level will we know what depth holds in store in the way of enriched silver ores.

Ground Water Level.- The deepest mine workings in the district are those on the 1800 level of the Black Metals shaft which did not reach ground water and this at a depth of about 300 feet below the bottom of the Snyder shaft. The highest living water in

the district is that at Bristol Well at an elevation of 5451 feet, A.T. and located on the flat about four miles northwest of the Bristol mines. The difference between the level of the water in this well and the bottom of the Snyder shaft is about 830 feet, which may represent the minimum additional depth to ground water level.

Dry Lake Valley, 8 miles southwest of Bristol Camp, drains the surrounding country to elevations as low as 4800 feet, A.T. This is a depth of about 1480 feet below the bottom of the Snyder shaft, but the intervening distance is so great that a rise of several hundred feet in the water table contour would be probable. Taking 830 feet as a minimum and 1480 feet as a maximum, it is safe to say that the water level will probably be found at about 1100 feet below the present bottom of the Snyder shaft, for at best we are guessing, considering the various unseen factors that may enter to upset our calculations.

In the Tintic district, the normal water table stands at 4800 feet, A.T. and it may be as low at Bristol.

OTHER MINES OF THE GROUP.

Black Metals Mine.- The Black Metals mine, formerly known as the Day mine, is located at Jack Rabbit on the north side of the Bristol range and at the terminal of the Pioche Pacific railroad. The mine was opened up in the early seventies and furnished iron-manganese-lime flux ore for the early day smelters; also some high grade silver ore. Developments consist of the Day shaft which is 1000 feet in depth and nearly vertical with levels at about 75-foot intervals down to the 1200 level. At the 300 level, the shaft makes connection with a surface tunnel and at the 900 level with a drift from the bottom of the Jack Rabbit incline shaft. Stoping has extended from the surface to the 900 level following the intersection of a prominent north-south fissure and one of the N. 70° E., or Tempest type. The ore occurs replacing the limestone wall of the fissure.

Production records are not definite but were probably in excess of 200,000 tons. Several thousand tons of ore mined from the fissure intersection above the 300 level are reported to have assayed 30 to 50 ozs. of silver to the ton with copper values ranging from 1 to 2%. The ore taken from below the 300 level was more of the fluxing type with silver as low as 10 oz. to the ton. Average shipments of this class of ore assayed as follows:

.01	oz. Au.	3.0%	Fe.
10.00	oz. Ag.	10.0%	Mn.
.8	% Pb.	40.0%	CaO
.2	% Cu.	1.2%	Insol.

In recent years, the Black Metals Mining Co. shipped approximately 25,000 tons of low grade fluxing ore, most of which was taken from what is known as the "A" bed stope between the 200 and 400 levels. This stope follows a certain limestone bedding for 600 feet on the dip replacing the bed over an irregular area of 50 feet or more in width. This is a clear case of formation selection in the deposition of the ore and resembles in some particulars the bedded deposits in the Prince and Louise mines at Fiocho.

Shipments from the "A" bed assayed as follows:

Tons	Oz.Au.	Oz.Ag.	% Pb.	% Insol.	% Fe.	% Mn.	% CaO	Net Smelter Returns
135.43	.01	10.35	.45	1.1	3.7	4.25	43.3	$617.33
126.36	.01	13.95	---	1.0	3.2	6.72	42.1	1018.23
Lot #90	.017	9.30	.25	1.2	3.5	7.86	42.0	---

A small stope a short distance north of the main intersection on the 325-foot level produced 54 tons of ore assaying as follows:

.01	oz. Au.	36.0%	Pb.
329.00	oz. Ag.	6.5%	Cu.
2.1	% Bi.		

This carload of ore brought the company $17,500.00 of which $10.00 per ton was for the bismuth contained.

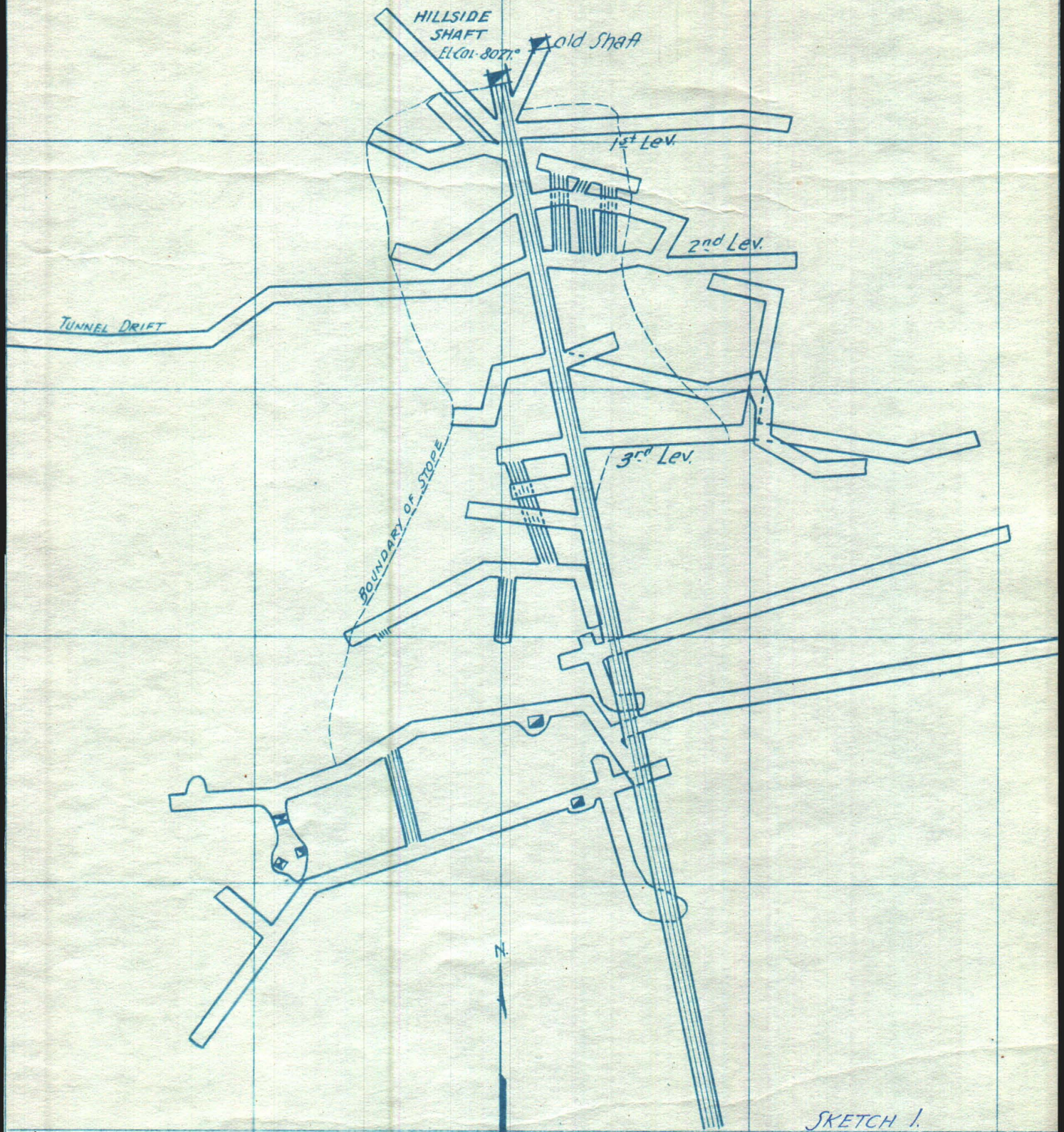
A small amount of exploration below the 900 level failed to find the ore going down, but considering the developments on the upper levels, this part of the property deserves much more thorough prospecting.

In connection with the Black Metals mine are some old workings on the Onandago claim which produced in the early days a few thousand tons of good lead-silver ore. Since the present owners have had the property, leasers have shipped approximately 500 tons of ore, which was similar to the good lead ore at Bristol. This ore came from near the bottom of the Jack Rabbit incline, four shipments assaying as follows:

Tons	Oz.Au.	Oz.Ag.	% Cu.	% Pb.	% Ins.	% Fe.	% CaO.	% Mn.
Control	.03	63.0	.25	20.5	7.8	2.7	27.8	1.44
31.644	.0225	22.3		19.3	7.75	1.6	23.6	1.4
55.645	.03	22.2		24.5	3.35	10.85	18.85	1.5
28.089	.02	31.75		22.3	8.9	2.7	28.65	1.9

These assays are interesting in that they show the strength and type of mineralization to be equal to the best of the Bristol ores.

Hillside Mine.- The Hillside mine on the Hillside claim is the highest in the group, the collar of the shaft having an elevation of 8027 feet which is 705 feet above the collar of the Gypsy shaft. The mine workings consist of a 46° incline shaft sunk on the May Day fissure to a depth of approximately 500 feet on the incline with strike drifts at about 75-foot intervals and a large amount of stoping on the fissure. The shaft follows the fissure to about the fifth level, below which it is in the hanging wall of the vein. (For plan and sections see Fig. 1 .) The ore occurs replacing the limestone at the intersection of the May Day with north-south fissures and at the intersection of at least one steeper pitching but parallel fissure of the Tempest set. The latter occurs 35 feet in the foot wall of the May Day fissure on the 200 level and intercepts the May Day at the surface. Both carried ore from the surface to the 200 level. Apparently the shaft was sunk near the center of the main ore shoot which in places was about 125 feet in length. Between the 200 and the 500 levels, the ore is said to have averaged about 16 feet in thickness and at the 700 level the average thickness is about 14 feet. The ore is of the same general character as that mined from the



SKETCH 1.

PLAN MAP
HILLSIDE WORKINGS

Scale: 1in. = 50ft.

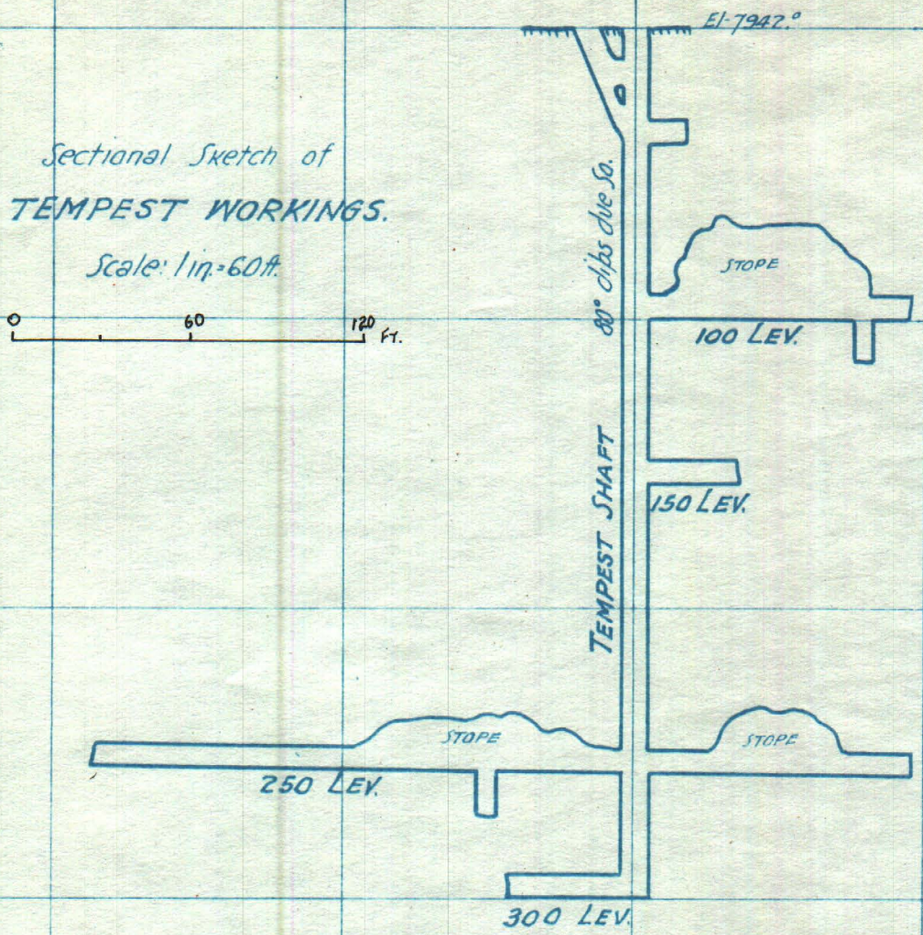
Traced from Map by F. Walker
Accompanying Report by G. W. CRANE

Sectional Sketch of

TEMPEST WORKINGS.

Scale: 1 in. = 60 ft.

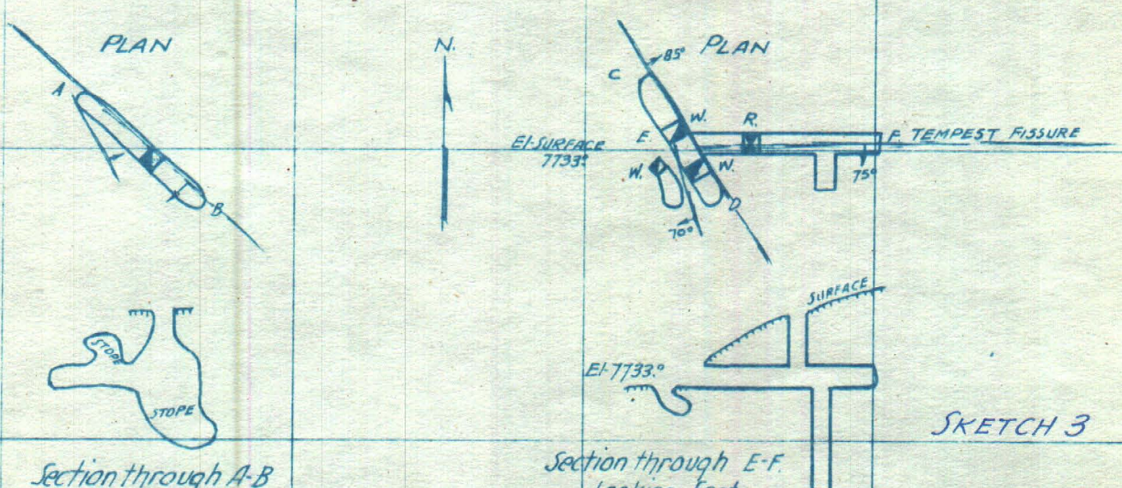
0 60 120 FT.



SKETCH 2.

Sketch of INMAN WORKINGS

Scale: 1 in. = 60 ft.



Section through A-B
Looking Northeast.

Section through E-F
Looking East

SKETCH 3

Section through C-D
Looking Northeast

Accompanying Report by G.W. CRANE

upper levels of the May Day property and both copper and lead ores have been mined.

Shipments during 1914 averaged as follows:

Ore	Shipment (Tons)	Oz.Au.	Oz.Ag.	% Pb.	% Cu.	% Zn.	% Fe.	% Mn	%CaO	%Insol.
Copper	406	.0136	4.20	None	7.88		15.07	1.96	16.94	6.86
Lead	366	.0208	11.9	3.06	6.19	4.7	22.16	1.93	11.73	6.42

Production figures prior to 1911 are not available, but recorded shipments since that time total 1143 tons. Estimates place the gross production during the early period as $2,000,000 gross.

O. S. L. Mine.- The O. S. L. mine on the Red Cloud claim is situated in the head of a gulch about 300 feet S. 65° W. from the Hillside shaft and at an elevation of about 100 feet below its collar. The mine workings consist of a 150-foot incline shaft and latteral stoping from it. All the work is on the May Day fissure near its intersection with a strong north-south fissure. The ore is like that mined from the May Day mine, high in iron, good silver and copper and only 2 to 3 percent lead. Several thousand tons of ore are reported to have been shipped from the O. S. L. mine. No records of shipments are available.

Tempest Mine.- The Tempest mine on the Tempest claim is near the crest of the south slope of the tramway hill and at an elevation of about 620 feet above the collar of the Gypsy shaft. Due to bad ladder ways, the mine is inaccessible at present, but an old sketch of the workings (Figure 2) is reported to be practically up to date. The shaft and the several level drifts are on the Tempest fissure which here strikes N. 80° E. and dips 70° south. The ore bodies occur at the intersection of the Tempest with several small north-south faults or fissures which dip 80° east. The stopes are mainly on the Tempest vein but in part on the north-south fissures near their intersection with the Tempest fissure.

Much the greater part of the ore was of the copper flux class, but some lead ore was mined at the intersection of the Tempest

and the north-south fissures and to some distance on the latter away from the intersection. The gold values are considerably higher than is usual for the Bristol ores, averaging about .045 oz. per ton. So also are the silver values high, in both the copper and the lead ores. To quote from Mr. E. H. Snyder,

> "Some of the ore along the Tempest fissure contained high percentages of bismuth, one small bunch assaying as high as 22% Bi. The average material in this shoot assayed from 1 to 2 percent Bi. and from 30 to 90 ozs. of silver. A shipment made by Mr. Bowling, who was operating under lease at the Tempest while this property was owned by the Day Bristol Co., assayed .10 oz. Au., 70.0 oz. Ag., 2% Bi., 1% Cu., and 42% Fe."

Lot shipments of copper ore as shown by the records are as follows:

Date	Shipment (Tons)	Oz. Au.	Oz. Ag.	% Pb.	% Cu.	% Zn.	% Fe.	% Mn	% CaO	% Insol
1914	772	.0179	7.49	None	10.81	None	21.04	2.25	10.40	15.50
1917) 1918)	582	.045	18.13	--	1.95	0.64	27.85	--	19.4	6.16

Inman Mine.- The Inman mine on the Inman claim is situated on the south slope of the tramway hill in a position about midway between the Vesuvius and the Tempest mines and at an elevation of about 400 feet above the collar of the Typsy shaft. The mine workings consist of several small shafts with stopes from these as illustrated by the sketch map. (See Sketch 3)

The ore occurs between walls of thin bedded, gray, laminated limestone on the Tempest fissure where intersected by a later N.10° W. fissure which faults the Tempest about 2 feet. There is also a N. 30° W. and a N. 50° W. fissure in conjunction with the ore. The Tempest fissure strikes N. 85° E. and dips 75° south. The limestone beds strike N. 80° E. and dip 15° north.

No bedded deposits were observed and not much replacement of the limestone along the fissure, the ore occurring mainly between the walls.

The ore consists of limonite, containing carbonates of copper, lead and zinc. Some of the copper occurs as secondary chrysocolla

and red and black oxides.

The mine is reported to have produced several hundred tons of direct smelting ore which was high in copper and iron with about 10 oz. of silver per ton. A recent shipment by a leaser ran 15% copper and 11 oz. silver per ton.

Vesuvius Mine.- The Vesuvius ore bodies on the Vesuvius claim lies on the south slope of the tramway hill and in a position about midway between the Gypsy and the Inman shafts. The mine workings consist of a 200-foot tunnel, a 50-foot vertical winze with about 75 feet of drifting at its bottom and a large inclined stope on and above the tunnel level. The ore occurs replacing massive, blue, vermicular limestone on the intersection of an east-west fissure and several N.25° E. fissures along which the tunnel was driven. Crossing the stope is a strong vertical N. 5° W. fissure on which the winze was sunk. The limestone beds strike N. 80° E. and dip 9° north.

*James M. Hill, who examined the property in 1913, describes two bedded deposits about 50 feet apart exposed in the workings:

> "The lower consists of lead and zinc carbonate that clearly replaces dark limestone. The ore body was apparently 2 to 3 feet thick, had a fairly regular floor but an irregular roof and lateral limits and was about 50 by 100 feet in largest horizontal dimensions. The upper bed, 18 to 24 inches thick, carries much more copper carbonate than the lower bed but contains both lead and zinc carbonate. It makes above the south of the fissure that trends N. 60° E. and west of the vertical north-south break. Both ore bodies occur in nearly pure limestone above beds of very dense siliceous shaly limestone."

Records of production prior to 1906 are not available, but it is reported that before that time the mine produced several thousand tons of smelting ore. Records for 1914 show a production of 248.2 tons of lead ore and 210 tons of copper ore which assayed as follows:

Ore	Oz.Au.	Oz.Ag.	% Pb.	% Cu.	% Zn.	% Fe.	% Mn.	%Ins.	%CaO
Lead	.0203	10.74	3.47	6.42	11.06	7.39	0.88	9.93	19.04
Copper	.0166	7.88		7.02	4.23	4.52	0.87	10.26	20.82

All the ore came from above the tunnel level. Where outcropping

* U.S.G.S. Bulletin No. 648, "Notes on Some Mining Districts in Eastern Nevada." Page 132.

at the mouth of the tunnel, the ore replaces a bed of blue vermicular limestone for a few feet on its dip. The National fissure was not observed here. The property was not worked by the present owners.

National Mine.- The National Mine on the National claim lies on a north sloping hillside about 450 feet east of the Gypsy shaft. The workings consist of a 100-foot tunnel and a 65-foot incline winze with considerable stoping from the winze and on the tunnel level. The ore occurs replacing limestone on the National fissure, which here strikes N. 7° E. and dips 70° east, and in conjunction with several N. 20° W. fissures. It contained considerable copper which occurred as malachite and chrysocolla with some red and black oxides.

The mine is reported to have produced about 5000 tons prior to 1906. Since that time records show that one shipment of 39 tons was made in November 1914 which assayed as follows: .025 oz. Au., 15.94 oz. Ag., 6.5% Pb., 9.89% Cu., 7.3% Zn., 9.5% Fe., 9.8% Insol., and 16.4% CaO.

Home Run Mine.- The Home Run mine is located on the Home Run group of claims and lies about 3000 feet S. 20° W. and 620 feet below the collar of the Gypsy shaft. The property was opened about the year 1911.

Developments consist of a 225-foot incline shaft and 200 to 300 feet of drifting in connection with some stoping. The shaft inclines N. 10° E., 190 feet on a 50° pitch, thence N. 5° E., 35 feet on a 70° pitch to the bottom. The shaft and most of the underground work is on a N. 15° E. fissure which dips 65° west. At the 60-foot level a drift follows the fissure to the south about 75 feet to a connection with an old shaft now filled. Along this drift the fissure carries small seams of iron and copper which to judge from the stoping widened in places to two or more feet. Ore has also been mined from a brecciated zone in the foot wall of the inclined shaft, openings in which are still shot with veinlets of iron and secondary copper.

No pay streaks were noted in any of the open places. The formation here is a massive, gray, mottled, dolomitic limestone interbedded with thin beds of light gray limestone, the whole dipping about 20° to the northeast. No igneous rocks are present. The horizon is probably very close to the underlying shale which outcrops on a low ridge about 300 feet to the west , but no shale was seen in the mine workings.

The ore occurs mainly as secondary concentrations of copper filling the fissure and the brecciated limestone formations. Old reports mention several caves as having been filled with ore. The ore is chiefly copper with good silver and some lead. The copper occurs largely as chrysocolla and malachite with possibly some oxides. Calcite is the principal gangue mineral with some quartz.

Twenty tons of ore mined in 1911 were reported to average 25.4% copper and 28.6 oz. silver per ton. Later 697 tons of ore were shipped, which brought a net smelter return of $6,976.46.

Iron Mine.- The Iron Mine is located on the Iron claim near the northwestern limits of the Bristol property and about 2700 feet northwest of the Gypsy shaft. Hill, who visited this property in 1913, describes the workings and ore as follows:

> "The fissure is opened by three shafts, the southernmost of which was being worked in October, 1913. This shaft was 380 feet deep, with four levels about 90 feet apart. The longest drifts on the 200-foot level total 165 feet, mostly south of the shaft. Above this level the ore has been stoped to the surface. The ores make in irregular lenses 6 feet in maximum width in either the foot or hanging wall of the fissure, which strikes N. 12°-15° E. and dips 48° E. The ore is soft iron-stained lead carbonate, and the lower-grade ore contains much unreplaced limestone. A considerable quantity of high-grade sorted ore seen on the dump is hard massive cerusite. In this class of ore rounded residual kernels of galena are surrounded by layers of anglesite and cerusite. A very minor amount of copper carbonate is present in some ore, and thin films of silica have been deposited in openings and crevices in the ore."

The Iron mine is on what is known as the Iron fissure, which on its surface outcrop varies from 2 to 8 feet in width.

The ore consists of silver, lead and copper, the last five shipments averaging 12.0 oz. Ag., 26.8% Pb. and 1.2% Cu. Shipments of 212 tons during 1914 assayed as follows:

.0114 oz. Au.	1.62% Cu.	.42% Mn.
10.44 oz. Ag.	10.88% Zn.	14.0 % Insol.
27.34 % Pb.	14.56% Fe.	2.41% CaO.

This ore had a net smelter value of $2,887.25.

About 200 yards south of the Iron shaft and on the same vein are two shallow cuts from which considerable lead-silver-copper ore has been mined. The cuts are 15 and 25 feet in length with small stopes at one end, the deepest not over 15 feet below the surface. One shipment from the two pits is reported to have assayed 14 oz. Ag., 33% lead and 1.2% copper. The Iron mine workings are at present under lease and shipments are made about once a month.

Detroit Mine.- The Detroit mine is located about 450 feet north of the Iron mine and near the center of the Detroit claim. The workings consist of an inclined shaft, reported to be 450 feet in depth, and a few shallow surface cuts about 50 feet south of the shaft. All the work is on the Iron fissure and in all essentials the mine and its ore are identical to the developments at the Iron mine except that shipments show a little more zinc. The vein is equally strong. The Detroit Mine is being worked under the Iron mine lease.

GENERAL CONSIDERATIONS

The Ore.- The ores of the Bristol district are fair to low grade as a class, but being thoroughly oxidized and containing an excess of iron, manganese and lime over insoluble content, they have a low reduction charge and have always been in demand at the Salt Lake lead smelters. While some of the ore is high grade, it is as a rule fairly uniform in character and but little is too poor to mine. Under quantity production, practically no selective mining would be required. But with the present limited equipment, production is so restricted that to make a profit selective mining is necessary, which in turn tends to limit the production.

During its recent operations, the Bristol Silver Mines Co.

produced copper flux and lead ores which assayed as follows:

Class	Oz.Au.	Oz.Ag.	% Pb.	% Cu.	% Fe.	% Mn.	%CaO.	%Insol.
Copper Flux	.025	17.0	1.0	2.5	28.0	2.0	8.0	7.0
Lead Ore	.015	12.5	8.6	1.85	8.5	2.0	22.0	8.0

With silver at 60 cents per ounce, lead at 8.5 cents per pound and copper at 13.0 cents per pound, the smelting value of the copper flux is $16.36 per ton and that of the lead ore $20.31 per ton.

Stage of Developments.- One of the most striking features of the mine plats is the relatively small amount of development work in connection with the large amount of stoping, but this is characteristic of the days when mining operations consisted almost entirely in following the ore and that usually from the outcrop. Practically every mine in the district, with the possible exception of the Gypsy, started on ore and developments today have gone but little beyond the outcrop stage. When the present operators obtained control of the May Day-Gypsy mine, developments had stopped at a tight place in the lode on the Gypsy 600 level. Since that time the Snyder shaft has been sunk to the 1100 level and the ore shoot mined to an additional 500 feet on the dip with ore still in the bottom. This is indicative of the possibilities at depth at the Hillside mine in particular and at the several shallow developments on the May Day, Tempest, National and Iron fissures.

Prospects at Depth.- The ore was deposited from ascending hot solutions in a formation which at the time of ore deposition was probably burried beneath a great thickness of volcanic flow rocks. Thus, it is likely that ore deposition was not influenced to any great degree by surface conditions, but was more particularly controlled by conditions at depth, including structures, formation characteristics and point of source. Erosion alone is responsible for the discovery of most of the deposits and this explains to some degree the wide range in their elevations and, at the same time, warrants the

supposition that ore deposition has gone on to much greater depth than has been demonstrated. So far, no decided change in the formation or in the ore has occurred with depth to indicate that the latter does not go down. The partial change from a lead-silver to a copper flux ore below the 900 level of the Snyder shaft is probably local only for the same conditions were found on the 500 level of the May Day shaft, below which the Perry, the Lloyd, the Johnson and the Shrinkage lead stopes were subsequently developed.

At a depth of approximately 330 feet below the bottom of the Snyder shaft, it is likely that the shale formation will be encountered and with it new conditions of deposition, the probable effect of which will be to lessen chances for ore deposits. But this is the shale formation in which the Combined Metals and Prince and Louise bedded deposits at Pioche were found and it is entirely possible that similar deposits may occur replacing the limestone beds in the shale horizon at Bristol. Those nearest the problem are quite hopeful of this.

When the quartzite is reached some 400 or 500 feet below the top of the shale, no further replacement deposits may be expected, but here again we may look for fissure vein deposits like those of the Raymond Ely at Pioche. The May Day fault is a fissure of the first magnitude and almost certainly extends to depths well into the quartzite horizon. Acting as the main channel for ascending mineral-bearing solutions, it may well be mineralized at depth. Not until the quartzite is penetrated 300 to 400 feet may ground water be expected.

Conditions as described above are those expected in the foot wall of the May Day fault. Formation changes in the hanging wall of the fault may be expected in each case at additional depth of about 200 feet.

On reaching ground water level, enriched silver ores will most likely be found. Secondary concentration of the silver is very pronounced in the deeper mines of the Tintic district where, except for

a more silicious gangue, the ore is of the Bristol type. In the Chief mine, operations have followed enriched silver ores for over 400 feet below ground water level with no signs of decreasing values. In contemplating the possibilities of enrichment at depth at Bristol, it is reasonable to suppose that oxidation results established in the one camp would obtain in the other where conditions as to climate and mineral composition of the primary ores are so nearly parallel.

General Prospect.- Between the workings of the Hillside mine and the Snyder shaft and in the hanging wall of the May Day fissure is an area over 2000 feet in length east and west in which a half dozen shallow mines have been developed on ore outcrops. In each case, the mineralization is at the intersection of a north-south and east-west fissures which, with but one exception, are the same fissures carrying the ore in the Bristol mine.

A 200-foot scale map accompanying this report shows in plan and section the fissure systems within the area described. Here is a block of ground in which further developments promise to locate new ore bodies. The partly developed ore shoots already found were deposited from solutions ascending on the fissures and almost certainly go to depth. It is not improbable that conditions not unlike those which obtained on the May Day 200 level and again on the Gypsy 600 level, causing the ore shoots to pinch almost to extinction in a way common to this type of deposit, may have discouraged mining operations in most of these workings and that on further sinking, as in the May Day, the ore shoots will again open up.

Considerations such as these lead me to believe that the prospects to the east of the Snyder shaft deserve thorough development. This should be done by some close range work such as by drifting to the east on the May Day fissure from the lower levels of the Shyder shaft. In this way, the intersections of the several north-south fissures withthe May Day can be reached at elevations to which known ore bodies have already been traced. And, of course, there should

be deeper work in the Snyder shaft. Once the ore has been proven to extend to depth below the Hillside and Tempest shafts, a tunnel from the Jack Rabbit end of the district would be warranted.

Another ore-bearing area deserving attention is that along the Iron fissure on which are located the Detroit and Iron mines. The Iron fissure is strongly mineralized and well defined on the surface for more than a claim's length and has been mined to depths of about 400 feet. The ore bodies, while not large, are of better grade than the average Bristol ore and should they be found to enlarge at depth, they would rival the best in the district. The Iron fissure is in the foot wall of the May Day fissure and projected south on its course intersects the latter a short distance north of Bristol camp. No work has been done to locate or prospect the intersection of these fissures, but since in conjunction with other fissures both have made commercial ore bodies, it would seem that their intersection should do likewise.

Conditions at the Black Metals end of the camp are apparently good, but until the mine can be studied in detail and the occurrence of the ore determined, I would not venture an opinion as to its value as a prospect or a scheme for its development. Considering the size of the stopes and the character of the ore developed above the 900 level, prospecting at depth on parallel structures would certainly seem warranted. Due to its northerly dip, the limestone formation is about 3000 feet thick at Jack Rabbit and probably extends to depths considerably below ground water level. This, it seems to me, is a good feature in that it allows for greater range for the known type of ore deposit than we have at Bristol.

Conditions at the south end of the camp as shown by developments at the Home Run mine do not promise any close range prospects. The Home Run shaft is sunk in limestone, but its low position on the range and close proximity to the shale outcrops on the west would indicate that the shale is probably not much over 200 feet below its collar. However, the workings exhibit considerable mineralization and fissuring of the Bristol type which would indicate that they lie

within the main mineralized zone.

While geological conditions at the Home Run end of the camp are not so promising as those at Bristol, yet they show mineral possibilities that give the property considerable potential value in view of the ore developments that seem bound to follow the exploitation of the Bristol area.

Respectfully submitted,

Salt Lake City, Utah
April 12, 1924

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