


6-1-1934

# Geology and Ore Deposits of the Butte-Highland Gold Mine.

Stockton Veazey Jr.

Follow this and additional works at: [http://digitalcommons.mtech.edu/bach\\_theses](http://digitalcommons.mtech.edu/bach_theses)

 Part of the [Ceramic Materials Commons](#), [Environmental Engineering Commons](#), [Geology Commons](#), [Geophysics and Seismology Commons](#), [Metallurgy Commons](#), [Other Engineering Commons](#), and the [Other Materials Science and Engineering Commons](#)

---

## Recommended Citation

Veazey, Stockton Jr., "Geology and Ore Deposits of the Butte-Highland Gold Mine." (1934). *Bachelors Theses and Reports, 1928 - 1970*. Paper 43.

This Bachelors Thesis is brought to you for free and open access by the Student Scholarship at Digital Commons @ Montana Tech. It has been accepted for inclusion in Bachelors Theses and Reports, 1928 - 1970 by an authorized administrator of Digital Commons @ Montana Tech. For more information, please contact [astclair@mtech.edu](mailto:astclair@mtech.edu).

GEOLOGY AND ORE DEPOSITS  
OF THE BUTTE-HIGHLAND GOLD MINE

by

STOCKTON VEAZEY JR.

56609

A Thesis  
Submitted to the Department of Geology  
in Partial Fulfillment of the  
Requirements for the Degree of  
Bachelor of Science in Geological Engineering

MONTANA SCHOOL OF MINES  
BUTTE, MONTANA  
June, 1934

W/496-146807

C O N T E N T S

|  | Page |
|--|------|
| Introduction . . . . .   | 1    |
| Location. . . . .  | 1    |
| History of mining development . . . . .  | 2    |
| Field work and acknowledgments. . . . .  | 2    |
| Previous work . . . . .  | 3    |
| General remarks . . . . .  | 3    |
| General geologic features of the district and its<br>relation to the surrounding region. . . . . | 3    |
| Description of rock formations . . . . .   | 4    |
| Sedimentaries . . . . .  | 4    |
| Belt series. . . . .   | 4    |
| Flathead quartzite . . . . .   | 5    |
| Paleozoic limestones . . . . .   | 5    |
| Igneous rocks . . . . .  | 8    |
| Quartz monzonite . . . . .   | 8    |
| Diorite. . . . .   | 8    |
| Gabbro . . . . .   | 9    |
| Pegmatite. . . . .   | 10   |
| Structure. . . . .   | 10   |
| Geologic history . . . . .   | 12   |
| Ore deposits . . . . .   | 13   |
| General characteristics . . . . .  | 13   |
| Breccia and bedding-plane replacements. . . . .  | 14   |
| Chimneys and pipes. . . . .  | 15   |
| Quartz veins. . . . .  | 16   |
| Conclusions. . . . .   | 16   |
| Bibliography . . . . .   | 17   |

I L L U S T R A T I O N S

|   | Page      |
|---|-----------|
| Plate I. Geologic map of area surrounding Highland<br>Mountains . . . . . | 5         |
| II. Plan of main orebody - 600 level. . . . .                             | 15        |
| III. Geologic map of Nevin's Hill area . . . . .                          | In pocket |
| IV.   "   "   " tunnel level. . . . .                                     | "   "     |
| Figure 1. Index map . . . . .   | 1         |
| 2. Microphotographs of cordierite schist . . . . .                        | 7         |
| 3. Microphotographs of pegmatite . . . . .                                | 10        |

G E O L O G Y   A N D   O R E   D E P O S I T S  
O F   T H E   B U T T E - H I G H L A N D   G O L D   M I N E

By

Stockton Veazey Jr.

INTRODUCTION

Location

The Butte-Highland mine is situated at the head of Basin Creek, in the Highland mining district, Silver Bow County, about 14 miles south of Butte. The tunnel portal and present surface plant are at an elevation of about 7350 feet above sea level, facing westward across the head of Basin Creek valley. The "ghost" mining town of Highland lies a mile to the east, near the forks of Fish Creek. Access to the mine is obtained at present from Beaudine's siding, 12 miles west. The property may also be reached, with difficulty, over poor roads from Limekiln hill, or from Moose Creek.

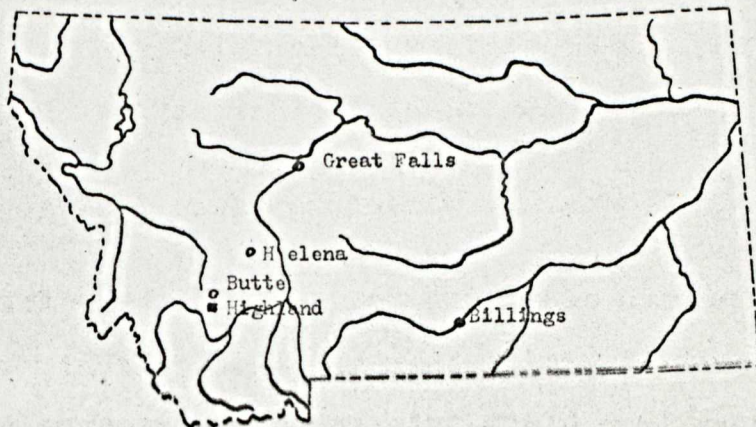


Fig. 1. Index map showing location of area studied

Placer diggings were discovered along the upper course of Fish Creek in 1866. The town of Highland City was established during the gold rush, and during 1869 and 1870 had a larger population than Butte.

The lode mines of the Highland district were among the first exploited in the state. As early as 1868 shafts were sunk to a depth of about 50 feet on the Nevin's and Only Chance claims. In 1872 two arrastras were being run on the Nevin's property and three on the Only Chance, treating ore which was reported to be "paying well."

The United States Treasury report on production of precious metals for 1883 gives the following information: "The Only Chance Mining Company of New York have a Huntington mill, a steam-hoist, and such appliances as were considered requisite for the treatment of the ores of their Only Chance mine, of Red Mountain, but the results have not been as good as were expected. The Nevin's mine has been worked on a lease, with about the usual results."

Since that time operation of the properties has been intermittent. No further information appears in the government reports, and no data are available concerning production.

#### Field-work and acknowledgments

Field work was carried on at intervals during July and August, 1933. Another trip was made to the district in October. Many valuable suggestions concerning field work were received from Mr. Paul Billingsley. For assistance by Mr. George Powe in part of the mapping, and for supervision by the Department of Geology of the Montana School of Mines the writer wishes to

express his appreciation. The Butte-Highland Mining Company offered every encouragement to the work, and <sup>for</sup> accommodations and for the use of maps the writer is especially indebted.

#### Previous work

A brief description of the Highland and Moose Creek mining districts by A. N. Winchell appears in U. S. Geological Survey Bulletin 574, "Mining Districts of the Dillon Quadrangle, Montana, and Adjacent Areas." No other literature on the geology of the area has been published.

#### General remarks

A large part of the Highland area is timbered. The winter snowfall maintains the streams throughout the year, and a supply of water is available for mining and other purposes.

Talus, vegetation, and thick coverings of residual alluvium offer serious difficulties to geologic studies. The frequent concealment of contacts and the metamorphosed condition of the rocks make accurate deductions from detailed studies possible over a very restricted area.

#### GENERAL GEOLOGIC FEATURES OF THE DISTRICT AND ITS RELATION TO THE SURROUNDING REGION.

The Highland mining district, consisting of the drainage area tributary to Fish Creek, covers the area immediately north of Red Mountain. The district lies on the southern border of the Boulder batholith granite area, and includes a part of that area and also the northern border of an area of folded, faulted,

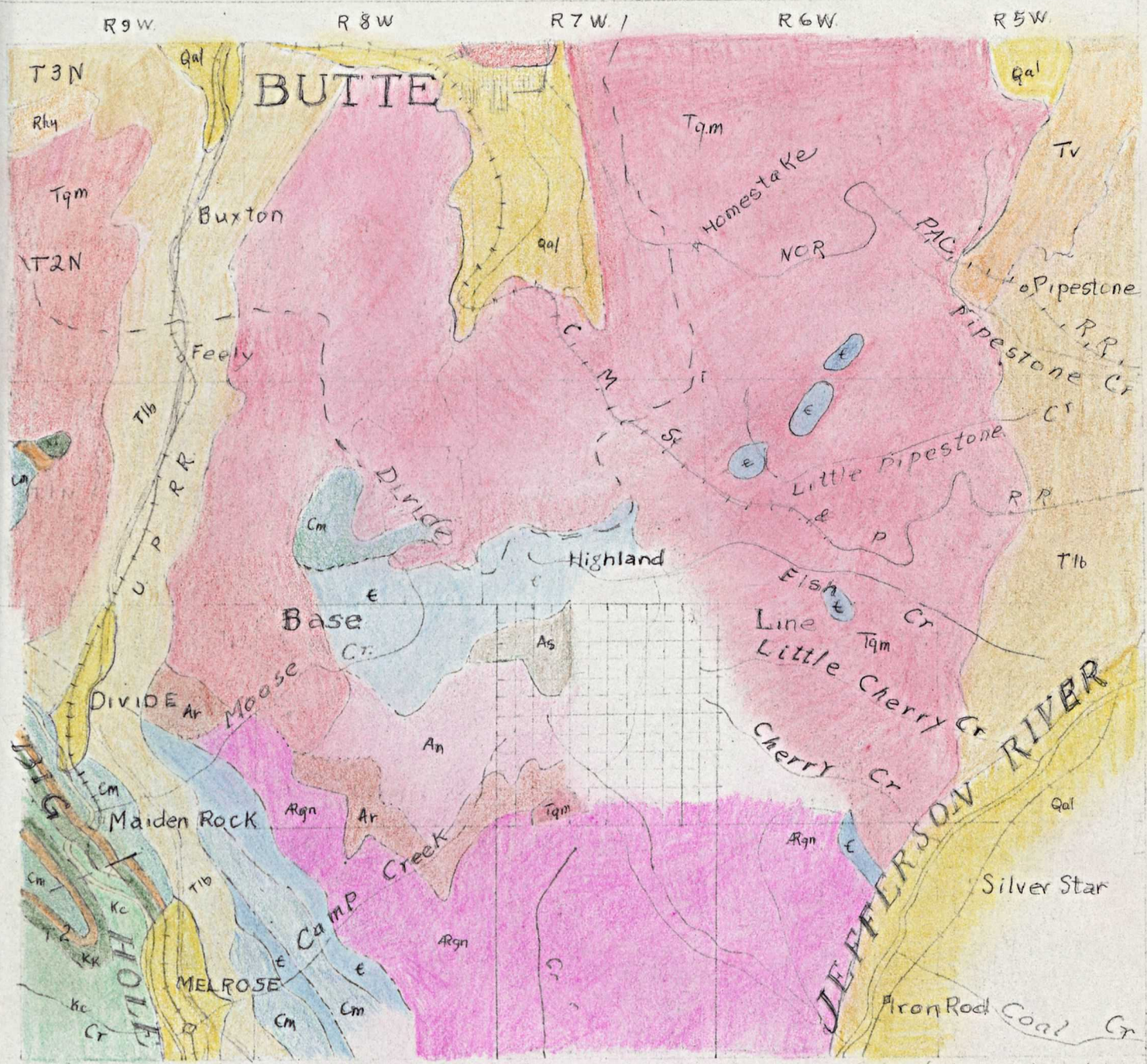
and metamorphosed sedimentary rocks. These rocks include quartzites, shales, and limestones, of Belt and Paleozoic ages, and of varied lithologic character. So far as observed, the Paleozoic series nowhere overlies the slates and quartzites of the Belt series, but seems to have been faulted into a position beside them.

The entire series of sedimentary rocks is cut by intrusions of quartz monzonite, diorite, pegmatites, and aplite, and is cut off entirely by the quartz monzonite of the batholith on the northern border of the area. The quartz monzonite probably extends beneath the sediments for some distance to the south. Outliers of the batholith appear on Red and Table Mountains, and on Camp Creek, still farther from the main mass. The Highland district may be considered a remnant of the original roof of the batholith.

## DESCRIPTION OF ROCK FORMATIONS

### Sedimentary rocks

The sedimentary rocks of the Highland district, as previously mentioned, consist of formations of pre-Cambrian and of Paleozoic age. The pre-Cambrian Belt series is represented by a thick series of slates, argillites, and quartzites, tentatively correlated with the Spokane formation. (See Plate I, from Mont. Bur. Mines & Geol. maps.) The main mass of the Highland mountains is made up of these rocks; they are well exposed on the high ridges of Red Mountain, and to the southeast, on Table Mountain. The formation is largely an argillitic



Use map from 1" quadrangle sheets  
Montana Bar Mines & Geology

Geology from manuscript sheets  
Montana Bar Mines & Geology

### GEOLOGIC MAP of AREA SURROUNDING HIGHLAND MOUNTAINS

#### Legend

|                                  |   |   |
|----------------------------------|---|---|
| <b>Qal</b> Alluvium - Quaternary | <b>Kc</b> Colorado formation } Cretaceous   | <b>E</b> Lms. and qst. - Cambrian       |
| <b>Tib</b> Lake bed              | <b>Kk</b> Kootenai formation } Cretaceous   | <b>As</b> Spokane series } Algonkian    |
| <b>Tv</b> Volcanics              | <b>Je</b> Ellis formation - Jurassic        | <b>An</b> Newland limestone } Algonkian |
| <b>Tqm</b> Quartz monzonite      | <b>Cm</b> Madison limestone - Carboniferous | <b>Rgn</b> Gneiss & schist - Archean    |



quartzite, massive in places, but generally thin-bedded, and occasionally quite fissile. The dominant rusty-red color of these rocks is responsible for the name of Red Mountain.

✓ A small exposure of Flathead quartzite forms a talus slope on a hillside 2000 feet south of the Highland mine. The formation at that place is apparently part of a fault block, and is highly brecciated and silicified along its southern and eastern boundaries. At the talus slope, however, little or no alteration is evident; the rock shows the characteristic pink, banded appearance typical of the Flathead. Other outcrops of quartzite, usually capping ridges, occur in the country to the west, and are probably to be correlated with the same formation. These occurrences are close to the batholith or its outliers; however, the rock is altered and silicified to such an extent that positive correlation would require considerable detailed investigation.

The later Paleozoic limestones, in which the ore deposits of Nevin's Hill occur, occupy a folded belt extending eastward down the valley of Fish Creek. There are two distinct members of this limestone series, separated by a band of shales and dark magnesian limestone about 180 feet thick. Due to the general recrystallization of the formations and destruction of such fossils as may have been present, stratigraphic correlations with neighboring districts cannot be made without further investigation. Winchell suggests that these limestones may be part of the Gallatin formation.

The massive limestone members are very white and crystalline, with the exception of one mottled blue-gray bed at the Only Chance shaft. Near the contact with the batholith the rock is frequently reddish-colored; considerable iron has been introduced along cleavage planes and crystal boundaries, and the reddish color of the oxide is there predominant in the rocks. This effect, and the completeness of recrystallization, are the only special contact phenomena near the granite in this immediate locality.

The band of shales and magnesian limestone occupies a central position in the area mapped. Where exposed in the main tunnel at the Butte-Highland mine, the rocks do not show the same degree of metamorphism as do the outcrops. In the tunnel they appear as banded magnesian limestones, extremely dark, ranging from crystalline to schistose and micaceous. In this section the dominant minerals are seen to be calcite and biotite, with a subordinate amount of epidote. Pyrite and a very small amount of gold were introduced during hydrothermal alteration. A 200-foot assay of this band exposed in the tunnel showed \$1.50 in gold (at \$20.67 per ounce).

The outcrop of this member shows considerable dynamic metamorphism. Where least altered the beds at surface are of a gray-green to purplish color, with narrow, light gray banding. More generally the rock is of a greenish-black color, micaceous and often schistose. Its most distinctive feature is that it is spotted with numerous cordierite<sup>1</sup> metacrysts of varying size

---

<sup>1</sup>Cordierite - a complex silicate of magnesium, ferrous iron, and aluminum.

which are conspicuous on weathered surfaces, standing out as small, rounded, gray nodules. It is a rock of marked individuality and is easily distinguished from any of the other rocks of the district. It is most abundant on Nevin's Hill, where all gradations may be seen from this to the banded argillitic material described above.

Under the microscope the groundmass is seen to consist largely of biotite and plagioclase feldspars. The cordierite metacrysts are generally elliptical in shape, and contain numerous inclusions of apatite or zircon. The metacrysts often transgress the structure of the groundmass; however, the biotite frequently shows flow structure, bending around the cordierite metacrysts. The combined criteria of field evidence, mineral composition, texture, and structure, point to dynamic metamorphism of this series at considerable depth, with recrystallization and rock flowage taking place.

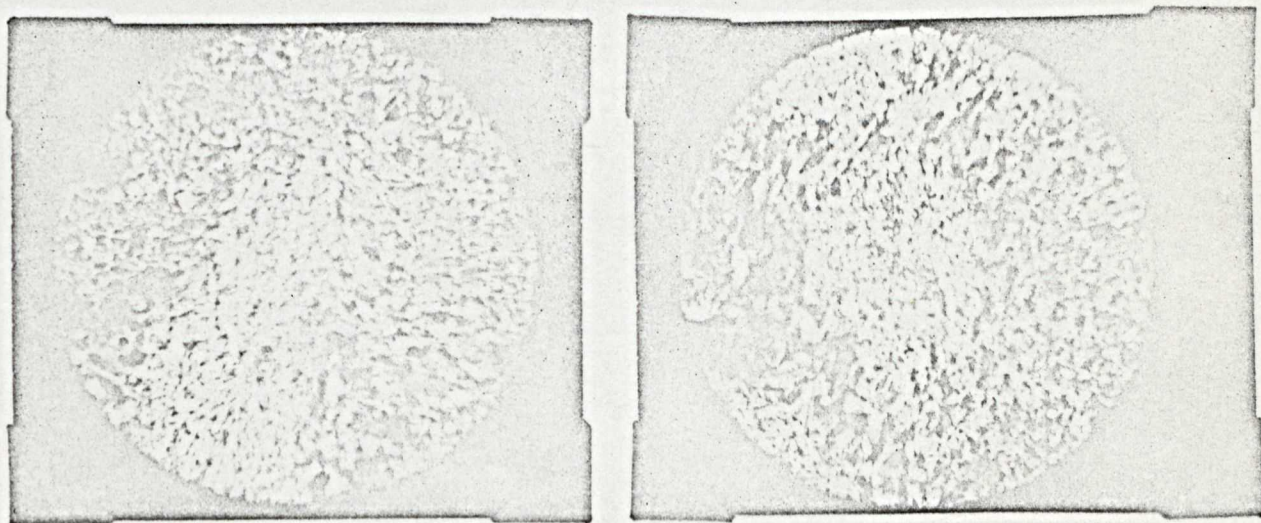


Fig. 2. Microphotographs  
Thin sections - Cordierite schist

## IGNEOUS ROCKS

### Quartz monzonite

The main mass of the batholith in the northern part of the Highland district is the typical quartz monzonite commonly called Butte granite. The average of analyses<sup>1</sup> of this rock over the Boulder batholith is as follows: 24% quartz, 28% orthoclase (sodic), 32% andesine, 9% biotite, and minor amounts of hornblende, magnetite, titanite, and apatite, stated in order of importance. No analyses were made of the rock in the area studied, as no change in the general character is apparent.

Along the south side of Kelly gulch, which follows the granite-limestone contact, a few lenticular outcrops of coarsely crystalline granitic schist appear within the limestone. The direction and dip of schistosity accord with the attitude of the sediments; the granite here forced its way up the bedding planes of the limestone, the schistosity probably developing during flowage.

An intrusion of fine-grained, light-colored granite is exposed for 100 feet in the Butte-Highland tunnel. No outcrop is evident, but the intrusion is undoubtedly derived from the main batholith, the finer texture being due to more rapid cooling of this outlying mass.

### Diorite

An area of diorite occurs to the south of the Only Chance mine, on the Moose Creek divide. The rock is extremely dark, greenish, and finer-grained than the quartz monzonite of the 1 Winchell, A. N., U.S.G.S. Bull. 574, 1914.

batholith. In hand specimen it appears to consist almost entirely of hornblende, but microscopic examination shows the presence of acid feldspar, biotite, and some quartz. The occurrence of this rock was noted by Weed<sup>1</sup> and by Winchell<sup>2</sup>, who remarked that it "grades insensibly but rather rapidly into the ordinary quartz monzonite of the batholith"; this observation was confirmed by the writer. Another occurrence of dioritic rock, coarser in texture, is visible in the first 120 feet of the Butte-Highland tunnel. The rock is extremely soft and weathered; the outcrop is now entirely destroyed and covered by soil and vegetation.

These diorite segregations represent the primary basic border of the batholith, of which only portions now remain. Further intrusion in other places pushed the more acidic residual magma through and beyond this border, breaking up and including the diorite in the main mass. <sup>No</sup>

#### Gabbro

At 1400 feet inside the main tunnel of the Butte-Highland mine a 3-foot sill of extremely fine-grained, black gabbro intrudes the massive white limestone 5 feet past the shale beds. The rock consists of pyroxene, labradorite, and biotite, with minor amounts of quartz, chlorite, and pyrite indicating hydrothermal alteration, as in the nearby shale and limestone band. This dike was not observed at the surface.

---

<sup>1</sup> Weed, W. H., Jour. Geol. vol. 7, p. 737, 1899

<sup>2</sup> Winchell, A. N., U.S.G.S. Bull. 574, p. 37, 1914

## Pegmatite

On the hillside above the Highland mine two outcrops of pegmatite appear. They contain coarsely crystalline feldspar and quartz, with some tourmaline and mica.

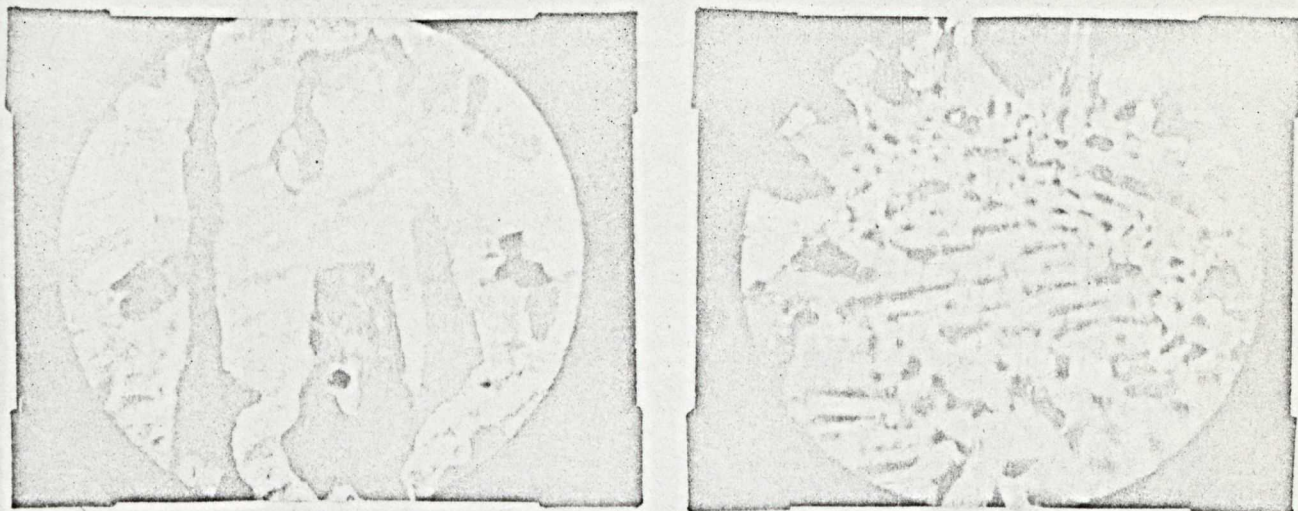


Fig. 3. Microphotographs  
Thin sections - Pegmatite.

It is interesting to note that although a 100-foot intrusion of fine-grained granite is exposed in the Butte-Highland tunnel, none of this rock may be found on the surface; also that a small outcrop of pegmatite appears at surface near the place where the granite would be expected. Whether the granite intrusion, narrowing upward, grades into the exposed pegmatite, or whether the pegmatite represents an entirely separate intrusion during the last stages of magmatic differentiation and cooling, remains undetermined.

## STRUCTURE

The sediments of the Highland district generally dip at rather steep angles into the batholith. The region was involved in the period of Rocky Mountain folding preceding the intrusion

of the Boulder batholith, and probably also in the thrust faulting. Most of the major structures antedate the granite intrusion, and appear not to have been influenced by it.

The sediments of the Nevin's Hill area are closely folded into steeply pitching, twisted folds. The altered magnesian limestone beds, used as a key horizon in mapping, generally dip steeply northward, but the series is twisted to a steep southward dip not far east of the Only Chance shaft. The massive white limestones near the batholith, north of the Highland mine, show a dip to the southward, and the same beds in Kelly gulch dip north. Either folding or faulting may be responsible for this change of dip.

The Flathead quartzite occupies a small area in the southern part of the area mapped. The beds are brecciated and silicified on the borders. To the west of the "Mother Lode" shaft in the main saddle, these sediments are thrown into contact with the limestones by a fault which follows the course of the gulch to the west. That this fault is a regional feature, and extends eastward down Fish Creek is suggested by the topographic alignment of Fish Creek, by the presence of the low saddle below Nevin's Hill, and by the heavy fault zone intersected in the southernmost workings on the tunnel level of the Butte-Highland mine. However, further structural mapping would be required to definitely prove the continuity and position of this fault.

Another strong fault zone is intersected by the main tunnel 150 feet southeast of the portal. It is quite probable that this fault was produced during a period of north-south normal faulting

in Cligocene time. Its position corresponds with the abrupt change in topography on the west side of Nevin's Hill, where a steep slope rises abruptly from the rolling, mature topography on the west. The limited underground development and the scarcity of exposures along this line do not permit definite conclusions as to the movement of this fault.

The main fissure system cut by the Butte-Highland tunnel has a general north-south trend, corresponding to those found at and near the surface in old workings. These joints at times contain gouge and show evidence of faulting; others have served as channels for mineralizing solutions.

#### GEOLOGIC HISTORY

The geologic history in other mining districts of the Boulder batholith has been worked out by means of Cretaceous sediments and later volcanic flows which are not present in the Highland district. The general history has been shown to be the same throughout the batholith, however, by Billingsley, Stone, and others. The structures and igneous intrusions of the Highland district, correlated with similar features in other districts in the region, were developed during the following sequence of events:

1. Middle Cretaceous - Main Rocky Mountain folding, and formation of large earth folds.
2. Upper Cretaceous(?) - Thrust faulting along northwest lines, and local intensification of folding. The strong fault which extends westward from Fish Creek across the saddle below the Only Chance mine, bringing the brecciated Flathead quartzites into contact with the limestones north of the gulch, is probably



of this age. The close folding of the limestones at Nevin's Hill probably took place during this activity.

3. Eocene(?) - Intrusion of the batholith and formation of the ore deposits; extensive erosion and peneplanation.

4. Oligocene - Normal north-south faulting; continued erosion.

Differentiation of the batholith appears to have taken place as follows: (1) diorite and gabbro segregations, dike and sill intrusions; (2) cooling and solidification of the main magma; (3) pegmatite intrusions and ore deposition.

#### ORE DEPOSITS

Ore in the Nevin's Hill area occurs as one of three main types - (1) replacement along bedding planes in the limestone and in zones of brecciation, (2) chimneys and pipes, (3) quartz veins in the limestone.

#### General Characteristics

Replacement orebodies in the limestone of types (1) and (2) as seen at present consist usually of irregular bodies of soft gold-bearing iron oxides. The common minerals are calcite, limonite, hematite, sericite, and chlorite, with lesser amounts of quartz. The first three minerals mentioned, in altered earthy or brecciated limestone, form the greater portion of the ore. Carbonates of copper are occasionally found in porous portions of the limonite. It seems reasonable to suppose that the ore was originally deposited as sulphide and that the present occurrence of the oxides is due to the action of surface waters.

In the main orebody of the present Butte-Highland workings much of the ore is a highly colored, rubbly, silicified breccia.

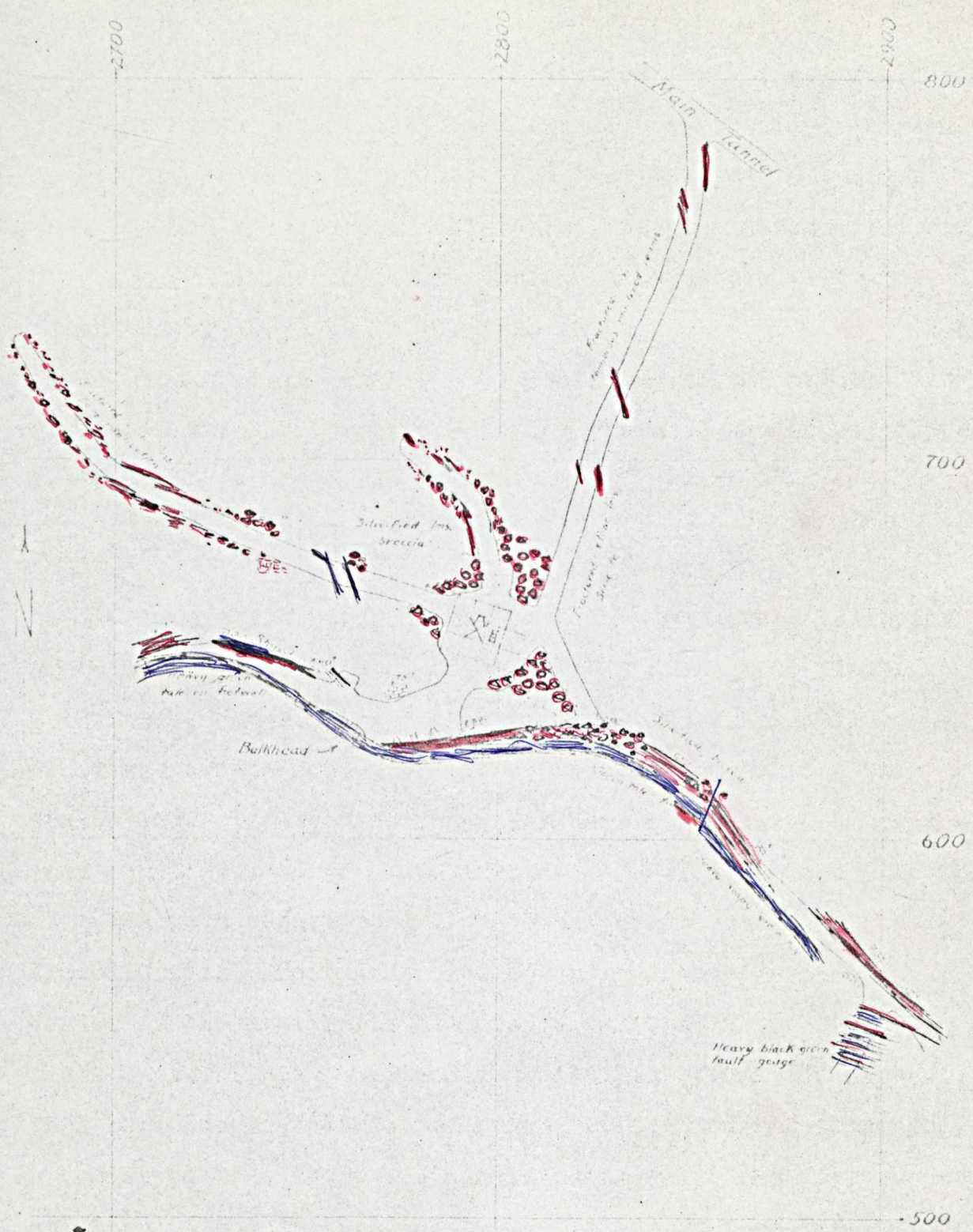
Other portions of the ore, deposited by bedding replacement, consist of banded, soft, clay-like material. It is a characteristic of the deposit that the gold is extremely erratic in its occurrence - the grade of ore may vary widely in a short distance with no change whatsoever in the appearance. The gold occurs as free particles, very finely disseminated. It is scarcely ever visible in hand specimens of the ore, but may be concentrated by panning.

#### Breccia and bedding-plane replacements

The main orebody of the present Butte-Highland mine occurs along the limbs and nose of a steeply pitching fold, directly below the abandoned workings of the Only Chance mine. The limestone along the nose of this fold, and for a short distance along the limbs, was fractured and brecciated, forming an especially favorable channel for ore deposition. Along the limbs of the fold, away from the brecciated zone, ore was deposited by bedding replacement, and some rather high grade ore has been secured from this clay-like material.

On the 500-foot level of the Only Chance mine, stoping was carried on northwest of the shaft along a fissure or other ore structure which either has not been discovered or is not productive on the main tunnel level.

The footwall of the entire orebody on the main tunnel level consists of a heavy, soapy, green talc, apparently containing considerable chlorite. The material has been subjected to heavy squeezing and contains innumerable slickensides, making it dangerous and difficult ground in which to drive a mine opening.



600 LEVEL - BUTTE-HIGHLAND MINE  
 PLAN OF MAIN OREBODY

SCALE 1 IN - 40 FT.

S. Veazey 10/23

This material may have been derived from hydrothermal alteration of the original footwall rock, may be simply a fault gouge, or, as is probably the case, may be a product of both faulting and hydrothermal alteration. The gradation from fractured, crystalline limestone through banded, clay-like ore, into the heavy green gouge suggests that this may represent a major fault zone through which the mineralizing solutions obtained access to the limestone, depositing the ores and thoroughly altering the gouge material.

### Chimneys and Pipes

Chimneys and pipes of ore in limestone have furnished a great part of the gold mined on Nevin's Hill. The Diamond T, Gold Excel, and Heinman's shafts were all sunk in chimneys of ore which cropped out at surface; the workings of the Only Chance and Butte-Highland companies have encountered other irregular chimneys of ore not exposed at surface. Generally these chimneys have been formed along small north-south fissures. The Gold Excel, Heinman's, and Nevin's ore-shoots occur at the border of the argillitic limestones, at the intersection of small fissures with the massive white limestone. It appears that here the argillitic sediments, silicified and fractured, have served to conduct the mineralizing solutions from the source at depth; the massive limestones adjacent were replaced along favorable horizons where intersected by fissures, forming the "pipes" or chimneys.

Other favorable horizons in the massive white limestone contain similar chimneys of ore. The two Diamond T shafts were sunk on shoots a short distance apart in the same limestone

horizon. The chimney of high-grade ore exposed in the Butte-Highland tunnel 1400 feet from the portal extended upward more than 100 feet, but it could not be determined how much farther up the shoot extended, as the old workings are now caved.

#### Quartz veins

The only quartz vein of consequence on Nevin's Hill is that on the J. B. Thompson claim. This vein, replacing the limestone along a favorable channel of deposition, contained much high-grade silver ore, in the form of sulphides. The vein has been stoped to surface, and any workings below the adit level are not accessible; consequently detailed study of this orebody was impossible.

A strong quartz vein appears near the nose of a fold east of the Only Chance shaft. However, it appears to be barren of mineralization.

#### CONCLUSIONS

Geological conditions are favorable for future development in the Nevin's Hill area. Prospecting would be advisable along the borders of the altered magnesian limestones, especially where these beds have been closely folded. It is probable that more ore will be found along the main east-west fault zone.

## B I B L I O G R A P H Y

Billingsley, Paul, and Grimes, J. A., Ore deposits of the Boulder batholith of Montana: Am. Inst. Min. Eng. Trans. vol. 58, pp. 284-368, 1917

Weed, W. H.: Jour. Geol. vol. 7, p. 737, 1899

Winchell, A. N., Mining Districts of the Dillon Quadrangle, Montana, and Adjacent Areas: U. S. Geological Survey Bull. 574, 1914

U. S. Treasury Report on Production of Precious Metals for 1883

Sec 32  
T 1 N R 7 W

LEGEND

- Quartz Monzonite
- Pegmatite
- Diorite
- Massive white limestones
- Metamorphosed argillite & limestone
- Drift & alluvium
- Quartzite



GEOLOGIC MAP  
of  
NEVIN'S HILL AREA  
HIGHLAND DISTRICT, MONTANA  
S. VEAZEY, 1933  
SCALE 1 IN. = 250 FT

Sec 32  
T 1 N R 7 W

PARK  
2882

HYBLAND  
9882

N Fk. Fish Cr.

ORO  
9882

ONLY CHANCE

Old Mill

400 Tilton Camp

Fish Creek





Quartzite  
fractured & unaltered

Diorite porphyry  
altered, micaceous  
extremely soft

Fault zone - 27'  
dark clay gouge

Blue crystalline lms.  
Black shaly lms.

White, micaceous  
recrystallized limestones  
bedding obscure

2' bedded zone  
part silicified lms.

Fine grained granite

Sharp contact with granite  
Shows faulting along strike

3' zone lms., unaltered lms.

Chimney of soapy white lms.  
(No values)

Low of contact black, altered

Shattered zone

Numerous fault slips  
wide bands of int.

Crystalline white lms.

shattered and  
then pp to a sh  
in small

Dark magnesian ls.  
Metamorphosed, fractured,  
veined.

White, crystalline ls.  
Gabbro dike

Chimney of high grade  
oxidized ore ls.

SUR NO. 4025  
MURPHY LODE

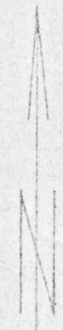
Heinman's shaft  
Gold Excel shaft

Banded zone altered ls.  
some Fe<sub>2</sub>O<sub>3</sub>

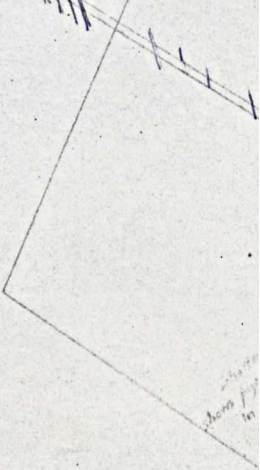
10' banded zone  
stringers of Fe<sub>2</sub>O<sub>3</sub>

DIAMOND T SHAFT

ONLY SUR NO. 11  
CHANCE LODE



Crystalline white



GEOLOGIC MAP  
of  
TUNNEL LEVEL  
BUTTE - HIGHLAND MINE

SCALE 1 in. = 100 FT.

S. Veazey

Oct. 1933



SUR NO. 4025  
MURPHY LODE

ONLY SUR NO. 11  
CHANCE LODE

Heinman's shaft  
Gold Excel shaft

DIAMOND T SHAFT

1/4 Sec. 32 - Elev. 8026'

ONLY CHANCE SHAFT  
Elev. Collar 7974'

Dark micaceous lms.  
Dark gray crystalline lms.  
Dark magnesian lms.  
Metamorphosed, fractured,  
veined.  
White, crystalline lms.  
Gabbers dike  
Cherty of high grade  
sized ore lms.

Banded zone altered lms.  
some Fe<sub>2</sub>O<sub>3</sub>

10' banded zone  
strings of Fe<sub>2</sub>O<sub>3</sub>

Elev. Sill  
7513'

Schistified lms. breccia

Zone of  
dark brown