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GEOL OGY AND O R E 
DEPOSITS OF THE 
CLINTON MINING DISTRICT

by
James F. Piquette

A Thesis
Submitted to the Department of Geology 
in Partial Fulfillment of the 
Requirements for the Degree of 
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INTRODUCTION

This report includes the results of geological investigation of the Clinton Mining District and the Hidden Treasure Mine.

The Clinton Mining District is an unorganized mining district situated in the Garnet Range two and one-half miles north-east of the town of Clinton, Montana, which is on the Northern Pacific Railway and the Chicago, Milwaukee, St. Paul, and Pacific Railroad seventeen miles east of the city of Missoula.

The district is in the same range of mountains as the Garnet Mining District and the drainage from the district covered is to the south into the Hell Gate or Clarks Fork of the Columbia River. The main stream is known as Trail creek, which runs in a southerly direction from the area studied.

Most of the mines in the district are within an area five to six miles long and 2 miles wide beginning two miles east of Clinton and extending in a north-easterly direction across the divide and part way down the Blackfoot River slope on the north.

The Clinton District was discovered in 1879 by Mr. J. D. Richards, Professor House and Mr. Keim, Sr. However, several of the claims have been relocated since the early days of the territory. The district has produced approximately $360,000 mainly in copper and silver ores.
Very little active work was done in the Clinton district prior to 1905. Most of the properties were located before that time but assessment work to comply with Federal law was practically the only development done on the claims.

From 1905 until the present day the Clinton mines have been operated sporadically. In the following pages of this report I have included a history of the development and operations of the individual properties along with the geology and ore deposits of each.

C. L. Hewitt of Helena started the most recent mining and development program in the district. He leased the Hidden Treasure mine January, 1935, from Sid Ward, the present owner. Hewitt took out a sizeable quantity of high grade ore from stopes and drove 450 feet of drift toward the main vein, known as the Cascade vein. The expiration of his lease on January 1, 1936 left 275 feet of drifting to be completed in order to reach the Cascade vein.

In recent months, the present operators started work at the outcrop of the Cascade vein and have shipped ten carloads of ore averaging three per cent copper. Due to weather conditions during the last winter (1939-40), they suspended operations at the outcrop and now are working small ore pockets in the main tunnel.

The writer spent the first six months in 1935 working at the Hidden Treasure mine after helping Mr. Hewitt make his original preliminary survey in 1934. While working there, data and information were gathered. In recent months, eight days were spent at this property and in this district, during which time surveys were made with a Brunton compass, the Hidden Treasure mine sampled
on all levels, and much surface work done on outcrops which were carefully sampled.

The writer is grateful to Sid Ward, owner of the Hidden Treasure mine, for valuable assistance and cooperation during the investigation of the properties. The author is also deeply indebted to, and appreciates the cooperation of, Dr. E. S. Perry, head of the geology department at the Montana School of Mines and under whose guidance this work was done; to Dr. L. L. Sloss of the Montana School of Mines, for assistance in making of photographs of the mineral specimens and the photography of the district; and to Dr. G. F. Seager, of the Montana School of Mines who assisted with country rock identification.

PHYSIOGRAPHY

The surface of the Clinton Mining district is rugged and rough with but a very few level or flat places. Its topography is similar to that of any average area in the Garnet range of mountains. The accompanying contour map gives an indication of the character of the district as does the photograph of the main valley. The average summit height ranges from 6000 feet to 6500 feet above sea level, whereas the elevation of the major valleys is from 3500 to 4000 feet.

The only flat or gently rolling surfaces are to be found along the main watershed and the prominent spurs from it. Deep, narrow valleys and gulches leading to the main drainage channels result in the rest of the area being steep and rugged. These main channels lie 2500 feet or more below the general summit level.

This rugged topography makes possible the mining of ore bodies by adits at various levels and eliminates the necessity of shaft sinking and hoisting.
As previously stated part of the district is drained southward by Trail creek, a tributary of the Hell Gate or Clark's Fork of Columbia River, while the remaining surface is drained by Ashby Creek which flows into the Blackfoot river. The Blackfoot flows into the Hell Gate River at Milltown to form the Missoula river, which is sometimes known as Clark's Fork of Columbia River.

The area is heavily timbered with lodgepole pine and similar varieties of evergreens. Though the snowfall is heavy in the winter, a road into the district can easily be kept open and made satisfactory for ore haulage to the railroads at Clinton.

GENERAL GEOLOGY

A body of granodiorite five miles long and from one-half mile to one mile or more in width occupies most of the mineral-bearing area. It is evident that this intrusive body is only partly uncovered as its outline commonly expands where the body is crossed by ravines and gulches and just as commonly contracts on the intervening spurs.

In character, the granodiorite is light gray in color and is even-grained. It contains feldspar, quartz, hornblende, and mica, and in places near the margin of the mass feldspar phenocrysts occur in a groundmass somewhat darker than usual.

Quartzite, shale, and limestone of the Belt series of Precambrian age surround the granodiorite and have been metamorphosed by it. In general the quartzite shows abundant mica and very fine-grained micas gathered into clusters cause mottled pale-green or brown-colored places in the rock.
Plate I

Fig. A.
General View of the Clinton Area

Fig. B.
Granodiorite
Typical country rock

Fig. C.
Granodiorite
Showing prominence of biotite and hornblende
Metamorphism of the shale has changed some of it to a tough green-banded hornstone, and the limestone is crystalline and resembles a coarse-grained marble. Evidences of metamorphism are very plain as far as 500 feet from the contact, and it may be detected in places as far away as a half-mile, horizontally.

The intrusive is a continuation of the batholith of the Garnet district which is almost entirely granite. This granitic batholith starts a little to the east of Bonner in the Blackfoot river basin and continues north and east beyond Garnet. It finally dips under the older sedimentary sandstones which have been metamorphosed to quartzites. The country rock for the veins in the far northern part of the district is similar to the Butte granite. So close is the similarity that even when closely compared it is very difficult to determine physically one from the other.

STRUCTURAL FEATURES

A large trough or syncline in the sedimentary series is the principal structural feature of the district. This syncline, involving the sedimentary rocks has lowered a mass of limestone across the north-eastern part of the district. The quartzite and shales on either side of the fold are steeply inclined and are also probably deformed by other parallel folds. Not much faulting is evident in the district though it is cut by several porphyry dikes.

Due to the igneous character of rocks and hence absence of fossils, the geologic age of the Clinton Mining district cannot be definitely determined. The sedimentary rocks nearby are of the Belt series as determined by Dr. C. H. Clapp.

The economic possibilities of the district are it is generally believed, very encouraging. However even though true fissures
of low grade are known, in the opinion of the writer it is im-
possible to make any predictions regarding economic importance of
the district until these veins are mined at a considerable depth.

TYPES OF ORE DEPOSITS

For the most part, the veins of the district lie in true
fissures, although there are some contact deposits. A fissure and
fractured zone about a half-mile wide and at least two or three
miles long is mineralized. Several well-defined veins which run
from two feet up to 20 or 25 feet in width may be found in this
zone. These veins dip about 50 to 60 degrees to the west and have
a general strike to the northeast and southwest.

Ascending thermal waters generally are considered responsible
for the veins which filled fissures in granite caused by cooling
and contraction of the intrusion. The waters evidently held in
solution appreciable amounts of copper, iron, and other sulphide-
producing constituents, and probably were brought from a great
depth. During the ascension of these waters, the pressure was
relieved, and the temperature was lowered, and thus each step
the ore minerals and other minerals that had been held in sol-
ution were gradually deposited.

From the author's study of the district, there is little
evidence of disturbance since the veins were formed. As far as
could be determined, the dikes are few, but they do however, cut
the veins. As has been stated before, few faults are to be found
in this district and those found are neither large nor important.
From this evidence, it is reasonable to assume that little distur-
bance occurred since the forming of the veins.
ORE SHOOTS

Regarding the specific character, size, and tenor of the ore shoots in the veins of the Clinton Mining District, definite information is not at hand, although evidence is available that ore shoots do occur. The shoots were found to carry very good values in three or four of the properties that have reached the stage of being styled semideveloped.

The Clinton Mining district is primarily copper producing. Several of the veins opened up in some of the localities were found to carry some amounts of lead and silver, but the great majority of the veins are almost entirely copper-bearing. Malachite, cuprite, and occasionally small amounts of native copper are found in the ores in the oxidized zone. Such masses contain more or less gold and silver.

The zone of secondary ores yields covellite with oxidized minerals and the primary minerals, chalcopyrite and bornite, with the latter two in much smaller quantities. Chalcopyrite is the chief ore mineral and it is supplemented with some bornite and tetrahedrite below the zone of secondary enrichment. Quartz with some iron purite, siderite, and occasionally small amounts of hematite comprise the gangue material.

LODES

Lodes are found throughout the entire granodiorite body and the metamorphic rocks around it in this district. Most of these lodes in the intrusive body carry values chiefly in copper and secondarily in silver and gold while those in the surrounding sedimentary rocks, and particularly in the limestone, contain lead and silver. It also known that considerable amounts of lead may be found in several of the lodes in the granodiorite.
Copper is generally present in the other rocks, especially near the contact.

The most extensively developed lodes are located along Trail Creek and its major tributaries, including Woodville Creek, about two and one-half miles east-northeast of the town of Clinton. In this area, which is less than one square mile in extent, there are at least 50 and probably more mines and prospects. In some of these properties, the workings reach a depth of more than 500 feet below the surface.

Another large group of workings occur in the northeastern part of the mineral-bearing area in the Ashby creek basin. Though the prospects and workings in the remaining area are by no means scarce, very few have been developed to any extent.

In the granodiorite, and probably in places in the other rocks, the lodes are composite veins or shear zones. Each of these is made up of several parallel fractures which together forms a sheared or broken zone ranging from one foot to twenty feet or more in width. The fractures are commonly closely spaced and it was found that the intervening rock is more or less crushed. The lodes dip steeply to the northwest and strike N40°E. Lodes of the Aladdin, Cape Nome, and Cascade cut the Hidden Treasure ore body. Transverse faults cut these and also displace them. Ore seams or veinlets that are generally less than one inch in width but expand locally to a foot or more in width for short distance of a few feet are contained in many of the individual fractures. Those portions of the sheared zones in which the small ore seams are so numerous and close together that the whole mass is rich enough to mine, constitute the most valuable ore bodies.
The dimensions and tenor of these stringer lodes is known in part only. Carload shipments and samples said to represent widths of several feet have contained from 1.5 percent to 6 percent or more of copper and from $2.00 to $10.00 in gold and silver, per ton.

Basing conclusions on the information available, it may be said that ore above a depth of 300 feet is partially (or wholly) enriched, and on the average is twice as rich as ore exposed or mined from greater depth.

MINERALOGY

Chalcopyrite, bornite, specularite, ankerite, calcite, quartz, and possible chalcocite constitute the primary minerals which were introduced from below and which filled the fractures and replaced the wall rock. Barite, strontianite, and a bismuth mineral are reported. The usual copper carbonates and iron oxides were found to occur in the oxidized zone.

DESCRIPTION OF INDIVIDUAL PROPERTIES

CAPE NOME

The Cape Nome mine is located on the east side of Trail Creek and is about three miles east of the town of Clinton in the Clinton Mining District. The mine was extensively developed and worked prior to the year 1912 and ore shipments from the property yielded around 19,000 pounds of copper, 2000 ounces of silver, and $100.00 in gold, according to reports made by the owners. The workings are in the granodiorite body and consist of two adit levels and a 500 foot deep shaft from which several crosscuts and drifts run. The total underground workings aggregate more than 2000 feet.

The Cape Nome shaft was connected by drift with the Alladin property.
Two lodes that strike almost due north and dip about 60° or more to the west have been explored. These were found to have been cut and displaced by vertical northeasterly faults. These lodes have been described as composite veins or shear zones four to ten feet wide. In these lodes have been found lens-like bodies two feet in maximum thickness composed of quartz, barite, chalcopyrite, tetrahedrite, and chalcosite.

In this mine oxidation is partial or complete to depths that range from 100 to 300 feet.

The shipments mentioned above are said to have been composed of mixed sulfide and oxidized ore from different parts of the mine above the 300 foot level. Smelter receipts from these shipments indicate that the copper content ranged from 1.6 per cent to 12.7 per cent, the gold content ranged from a minimum of 0.01 to a maximum of 0.15 per ton, and the silver content ranged from five ounces to 20 ounces. On the average, the ore was found to contain 63 per cent silica and from twelve to fifteen per cent of ferric oxide or its equivalent.

On the 500 foot level, the vein is reported to have a width of several feet and said to average 2.5 per cent copper and six ounces of silver per ton. On this level, the silica content was reported as 55 per cent and the ferric oxide content as 15 per cent.

Sid Ward recently leased this property from a Missoula company and his intentions are to extend the upper tunnel of Hidden Treasure, cut the Cascade vein, go under the Eagle cropping, and drain the Cape Nome shaft. The completion of his plan may prove or disprove the predictions that the area is a second Butte hill.

COPPER BELL

The Copper Bell mine lies west of the Hidden Treasure and South of the Triangle mines. It has been developed by open cuts, shallow shafts and adits. There are nine claims in the Copper Bell group
and from the evidence found, three of the veins are nearly parallel. These veins are in granite, for the most part.

ALADDIN MINE

The group of claims including the Aladdin property lies directly north and east of the Cape Nome mine. Running through this group is the same vein that is found in the Cape Nome property. In the group are the Aladdin claim, the Sovereign claim, and the "A" Extension.

Prior to 1907, this group was sporadically developed and opened by a few prospect holes, adits, and shafts. In 1907, however, the Speculator Mining Company, which formerly operated in Butte, Montana, took a lease and bond on the property and started development work from the 500 foot level of the Cape Nome shaft. In their efforts, the Butte firm drove 1700 to 1800 feet on a vein, cross-cut several feet to the west and then a few feet to the east. However they did not strike the Cape Nome vein proper before that time for taking up the bond expired. A time extension was not granted and therefore the company did not see fit to take over the property. From available reports and evidence, it would seem highly probable that when the lead is found, good ore would be encountered. The surface indications and the indications in the shallow shaft point to a rich ore shoot in the Cape Nome vein; and if this were cut by a crosscut from the Speculator drift, considerable stoping ground would be available.

(11)
THE RAVEN MINE

The Raven property is located directly east and north of the Hidden Treasure mine. In this group are nine claims, namely the Lynn, Home, Gold Gand, Silver Chest, Lakeview, Raven, Wedge No. 2, Wedge No. 3, and Senate. This group occupies the southeast corner of the Clinton Mining District. Running across this property are five nearly parallel veins which have a northeast and southwest strike and dip steeply to the west. The veins average from two and one-half feet to twenty-two feet in width and contain, as do the other veins in the district, copper is the chief metal and carries small amounts of gold and silver values. Fairly good showings of argentiferous galena have been found, however, in one or two of the veins. Part of these veins are contact and some are cut by porphyry dikes. According to reports of the owning company, $12,000 worth of development work was done on the property, principally in adits, pits, and other methods of uncovering paying bodies. Mining by means of adits, the group can be worked to the depth of 700 feet in some instances. The company which did the development work and owns the property is not incorporated and so far as is known has shipped no ore.

TRIANGLE AND GRASS WIDOW MINES

The Triangle and Grass Widow mines are located about two and one-half miles east-northeast of Clinton, on Woodville Creek, a small west branch of Trail Creek, in the Clinton Mining District. During the year 1912, an adit was driven 540 feet on a N. 40° E. course into a steeply rising hill. This piece of development
work was into granodiorite and the working follows a composite vein or zone of parallel fractures that ranges up to ten feet or more in width. This zone dips 75° to the northwest. Some mining was done while development work was in progress and ore shipments are reported to have yielded $3,500. Copper was the most valuable and most prevalent constituent in the shipments.

As stated above, the zone is made up of fractures. Most of the ore seams are less than one inch in width but in places they are very numerous and relatively closely spaced. The granodiorite separating these seams is moderately crushed and has been bleached and sericitized. There is a fairly rich appearing ore body located near the end of the adit which measures 14 inches wide and from forty to fifty feet long. At this point several branch fractures lead off to the north.

The material filling the veins consists in the main of specularite, chalcopyrite, ankerite, calcite, and quartz, all intermingled. Near the collar of the adit, in the section penetrating the oxidized zone, the usual carbonated previously mentioned carry values in copper ranging from 3.5 to 6.75 per cent, values in silver ranging from seven to thirteen ounces, and values in gold 4 to 7 ounces ($150.00 to $250.00) per ton.

The Grass Widoë lode lies parallel to the Triangle mine and is about 600 feet to the northwest. This mine has been explored to a depth of about 500 feet by drifts run from a crosscut from the Triangle adit level. In this mine are two main seams forty feet apart containing ore similar in character and values to that found in the Triangle mine.
The Hidden Treasure Mine in the Clinton Mining District is two miles in a northeasterly direction from the town of Clinton. It is the only mine in that district operating at the present time and is unique in the interesting structural geology features it has. It also presents some interesting features regarding economic geology.

HISTORY

The discovery of the Hidden Treasure mine was made in 1879 by Mr. Keim, Sr., and early exploration work consisted of the driving of an adit into the hillside 135 feet, from which point a winze was sunk 90 feet to a fractured zone and 7 cars of ore averaging 11% copper, 25 oz. of silver and 20 ozs. in gold were shipped in the period from January to May 1889.

After that, the operator moved to the foot of the hill and started another adit in hopes of gaining depth on the ore body to start stoping operations. However, this second adit was driven 1200 feet into the hillside without encountering any shipping ore. However there is a fracture five hundred feet long with a split going off to the last which shows five feet of $8.00 ore that would make good mill rock.

A raise has been driven one hundred and fifty feet at a point along this fracture and again a sizeable body of $9.00 ore was encountered.

Two hundred feet to the north of this raise there is 43 inches of $10.00 assay values. The lower tunnel has four raise locations which start on good milling ore.

It is possible that if sinking were extended to the granite
the ores may be found confined to a narrower zone instead of being shot out through the quartzite.

A series of crosscuts were driven at regular intervals in an effort to locate the above discovered ore body, but they proved futile.

Mr. W. J. Stephens resumed operations and developed the mine to the point where he was offered a large sum of money for his holdings by a Butte company. Mr. Stephens died in 1914. From 1914 to 1924 the mine was not worked, however in 1924 the Missoula mines association made a deal with Mrs. Stephens to buy the property, nine patented claims.

The Missoula Mines association resumed operations in the upper adit and this was extended 25 feet past the collar of the winze, where ore carrying values in apying quantities was found. Further exploration showed that this body carried along for 300 feet and could be stoped to the grass-roots, a distance of about 100 feet.

In 1925 they shipped 1682 tons of ore having a total value of $43,402.

No true vein structures were encountered, the ore body being along faults and fractured zones.

In this body, about $160,000 worth of ore was taken out and the mine closed temporarily due to financial difficulties. The property has been worked sporadically by different operators until January, 1935, when Hewitt took over. Since that time, another $30,000 worth of ore has been mined. The mine is being operated on a small scale at the present time by Sid Ward.

VEINS

The main vein running through the Hidden Treasure group is on a contact and has a maximum width of 150 feet at the outcrop at
the top of the hill. This lode is known as the Cascade vein. Strange as it may seem, during the forty years of mining activity in this mine, none of the operations, with the exception of the present one, have ever succeeded in reaching this main vein or ore body from any other point on the surface or at any depth.

Two adits the No. 1 tunnel 1500 feet long excluding numerous crosscuts at an elevation of 4263 feet, have been driven into the side of the mountain. The one known as the lower tunnel has not been worked in 25 years. The upper tunnel has been worked with a great variety of operations in an endeavor to make the mine a paying property.

**TYPES OF ORE DEPOSITS**

The mineralization encountered in the upper level is contained in quartzite, probably of the Belt series. The ore is found along faults and fractures of the quartzite showing permeations into the fractured zones indicating little replacement into the quartzite. Judging from veinlets found in the granite, it is probable that ore deposition came later than the granite. The ore shoots have a maximum length of 100 feet and have a width of from five to six feet. They are on the hanging wall side. No true veins are indicated, there are no definite boundaries, and the ore has a tendency to concentrate in the quartzite.

Most of the discovered ore was found near the surface, the country rock being granite. The types of rocks found in the Hidden Treasure mine include light quartzite, dark quartzite, shale, and slate.

From the evidence found by the author, the conclusion was reached that the ore found near the surface was the result of a lessening
Fig. A. Metamorphosed sandstone showing alternate bands of ferromagnesium and quartz

Fig. B. Chloritized phyllite

Fig. C. Metamorphosed sandstone

Fig. D. Quartz diorite showing feldspar phenocrysts
of heat in and pressure around the solutions thus causing precipitation towards the upper levels.

No evidence pointing toward secondary enrichment was found.

SEDIMENTARY ROCKS OF THE HIDDEN TREASURE AREA

During the course of exploration and investigation, the author found two common types of sedimentary rocks.

A metamorphosed sandstone showing alternate bands of white quartz and basic ferromagnesium minerals. The photograph of the rock specimen portrays the alternate banding vividly.

A phyllitic rock was studied, which showed considerable recrystallization as evidenced by the formation of micaeous particles. A greenish color suggests that chlorite has been formed. Presumably, this rock is of argillaceous origin.

IGNEOUS ROCKS OF THE HIDDEN TREASURE AREA

Granodiorite is the principal igneous rock and is composed of orthoclase feldspar, quartz, hornblende, and biotite. This rock is rather dark in color and is notable because of the deficiency of quartz. This rock is the only true granite found in the area and is the main mass. There were no light main masses discovered.

Another igneous rock found and studied was a dark diorite showing prominent phenocrysts of feldspar which can be seen in the photographs. The specimens showed no quartz and may be stated at this time that there is a marked deficiency of quartz in the area. It is estimated that in this diorite, the quartz in the area is under ten percent.

Light-colored diorite was also found and studied. Except for color, it had the same characteristics as the dark specimens as may
Fig. A. Shallow seated intrusive showing hornblende

Fig. B. Typical Diorite

Fig. C. Cascade Outcrop

Fig. D. Hidden Treasure Cre Chute

Fig. E. Light-colored dike rock with disseminated pyrite showing last stages of differentiation.
be seen in the photographs.

A fine-grained dike rock containing a little hornblende was found. It was determined to be a shallow intrusive rock. The mass is light gray in color.

Another light-colored dike rock was found. This rock carried disseminated pyrite and was presumably a late differentiation product aplitic in nature.

**PRIMARY MINERALS**

Among the primary minerals, the pyrite was formed first, was followed by chalcopyrite, and zinc or steel, galena. The other possibly being that pyrite was first and was followed by chalcocite, another primary mineral, which replaced it.

Vein matter replaced the fractured quartzite and the veins are disseminations along the fractured zones; true veins are very rare. The gold and the silver evidently came up toward the last and were followed by the sulfides at the very end.

**SECONDARY MINERALS**

Malachite, azurite, and cerrusite are the principal secondary minerals encountered. The secondary oxides include limonite, melanconite, manganite and pyrolusite. Secondary quartz is also found and is believed that it was formed by the percolation of water through the quartzite grains and subsequent deposition. Evidences of alteration due to hydrothermal action. In this latter case, the hornblendes were removed and a small amount of quartz left in the granite, but is is probably due to the decomposition of the feldspars as they are highly altered, though some of the crystals are still to be seen.

**STRUCTURAL FEATURES IN THE HIDDEN TREASURE AREA**

Prominent among the structural features of the Hidden Treasure (19)
Plate IV

Fig. A.
Ore from Hidden Treasure No. 1 tunnel showing prominence of steel galena and chalcopyrite.

Fig. B.
Showing quartz, steel galena, pyrite, azurite, malachite and secondary copper.

Fig. C.
Typical Hidden Treasure ore. Steel galena and chalcopyrite.
area are two directions of faulting indicated in the upper level.

One of these faults runs northeast and southwest and the principal ore body lies along it. The other fault runs across the first one northwest and southeast. This latter type shows slippage along the bedding planes.

Folding due apparently to compressive forces, was evident along the strike faults. The ore bodies are the result of replacement in the fractured zone. There was folding where the alteration occurred, which factor probably caused the existence of ore pockets.

The dip of the strata corresponds to the faulting veins while the pinching of the veins seems to stop at the folding or fractured end.

ECONOMIC GEOLOGY OF THE HIDDEN TREASURE MINE

Most of the high grade ore mined from the Hidden Treasure property has been removed from within 200 feet of the surface. Though some high grade ore was found in the lower limits of the mine, its quantity was far smaller than that found nearer the surface.

Evidence found during investigation indicates a greater degree and extent of fracturing nearer the surface and leads to the theory that a lowering of temperatures resulted in the precipitation of a larger quantity of ore minerals.

Considerable development work done has revealed evidence that there are ore-bearing fissures striking an northeast and southwest direction, while no commercial amounts of ore have been found in the fissures running in the northwest and southeast direction.

The probable reason for the lack of any great quantities of ore in this latter fissure is that this fissure was formed at a later date, than the former.

(19)
The quantity of shipping ore developed or likely to be developed is not sufficient in quantity and is lacking in quality to justify its mining for that purpose. However, there is apparently a great quantity of low grade ore in sight which would, should more development to be done, be suitable for milling. At present time, not enough of this ore has been proven to warrant the construction of a mill and concentrator.

The present operator, Sid Ward, contemplates doing this necessary developing to determine whether or not the extent of the body and the average grade of ore would justify the expense of a treating plant.

CASCADE VEIN

The Cascade vein lies in a granite intrusion into the host rock, which is quartzite of probably Pre-Cambrian age. The mineralization is mainly a disseminated deposit in quartzite and is located in a highly fractured zone.

The principal structural feature associated with the Cascade vein is a fault crossing the intrusive mass, and it may be observed along the road which passes over the exposed edge of this fault.

The leads are running in a general northeast and southwest direction and this observation corresponds to the known fact that the leads in the upper adit of this mine also run in this general direction.

The entire outcrop averages 150 feet in width in a general east-west direction and extends 300 feet from the projected fault in a general north-south direction.

ORE MINERALS OF THE HIDDEN TREASURE OUTCROP

No primary minerals were found in the exploration of this
outcrop but oxidized minerals were found as were the carbonates of copper, azurite and malachite, and tenarite and chrysocolla. The iron oxide found in the outcrop was chiefly limonite.

The most striking feature of this large disseminated body is the scarcity of quartz in the veins.

The outcrop has not been explored more than 15 feet below the surface and the author would recommend further down-ward exploration by means of a shaft sunk near the center of this fractured zone.

No true faulting seems to appear on this outcrop and there is apparently is only fracturing of the quartzite, although there is the one main fault cutting the body which was mentioned previously in this report.

DEVELOPMENT WORK DONE ON THE HIDDEN TREASURE OUTCROP

Three veins in the Hidden Treasure outcrop have been prospected from the surface to a maximum depth of 15 feet and some ore had been mined. Four or five cars of this ore was shipped and smelter receipts show that it averaged $10.00 per ton.

Along the contact of the intrusive outcrop are fingers of granite penetrating the fractured quartzite and running parallel to the bedding planes. There has been no faulting along this contact since the intrusion.

MINING METHODS AT THE HIDDEN TREASURE MINE

Mining development at the Hidden Treasure mine include two adits or tunnel drifts as shown on the maps. What is known as the original discovery is the winze shown which is collared 135 feet in on the upper adit and is 90 feet deep.

Actual mining was done by rill stoping with only occasional timber stubs necessary to hold the back. The ore is blasted down
into chutes for loading into cars in the adit and then is trammed to the surface. Here is dumped into grizzlies and is hand-sorted. Following the sorting, the ore is run down an open transfer chute to bins at the foot of the hill.

The method of roll-stope mining coupled with the steepness of the dip of the veins results in very economical mining. The ore falls directly into the adit chutes without any further handling and the walls are strong enough to eliminate the necessity of expensive timbering. There is sufficient timber on the ground to supply the necessary stulls.

From the bins, ore can be hauled by truck to the railroad siding at Clinton for $0.50 per ton. All shipping to date has been to the Washoe samples of the Anaconda Copper Mining company.

MINE EQUIPMENT AT THE HIDDEN TREASURE MINE

Equipment on the ground at the Hidden Treasure mine includes a complete blacksmith shop and a small compressor plant. There are two old-type hot-head Diesel compressors capable of maintaining a pressure of 120 pounds per square inch on the five drills in operation and a receiving tank of about 150 cubic feet capacity. These plant buildings are located at the upper adit at an elevation of 4263 feet above sea level. There are several old buildings located at 4000 feet above sea level, or the level of the lower adit.

Drilling equipment includes two Ingersoll-Rand Leyner type drifters, one Gardner-Denver stoper, and one Ingersoll-Rand jackhammer.

There are five three-quarter ton mine cars on the property and the mine is well equipped with car-rail and water and air pipes.
A small, single-piston force pump is used to bring water from the lower level to the upper adit level.

Other buildings include a modern house for the manager and his family and a bunk-house for the miners. A powder magazine is located a few hundred feet from the adit and a one and one-half ton truck is used for hauling in supplies and general work.

SUGGESTED DEVELOPMENT OF HIDDEN TREASURE MINE

The author is of the opinion that more exploration work should be done on the property. The Cascade vein should be more thoroughly explored by either sinking directly from the outcrop or indirectly by the completion of 275 feet of proposed drift extension. Diamond drill exploration would be the most adviseable means of proving the Cascade vein.

If the ore body proves to be large enough and rich enough to warrant mining, a concentrating plant should be built of a size commensurate with possible production.

A mill-site situated to enable gravity movement of material has been claimed and an old reservoir would make a very satisfactory tailings pond. Water is abundant.

The condition of the walls and the width of the ore body would govern future choice of mining methods but entry into the body can readily be made by adits which would eliminate costs and costly hoisting.

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CONCLUSIONS AND SUMMARY OF THE GEOLOGY OF THE CLINTON MINING DISTRICT AND THE HIDDEN TREASURE MINE

Geologic conditions of the Clinton Mining District and the conclusions drawn from them are summarized as follows:

1. Few faults are found in the Clinton Mining district and those found are neither large nor important. It is therefore reasonable to assume that little disturbance occurred in the region since the formation of the veins.

2. Ore seams or veinlets are generally less than an inch in width but expand locally to a width of a foot or more for a distance of several feet.

3. Ore is contained in many fractures. Portions of the sheared zones contain small ore seams that are so numerous and so close together that the entire mass is rich enough to mine. These zones constitute the most valuable ore bodies.

4. Ore above a depth of 300 feet is partially or wholly oxidized. On the average, there is twice as much ore exposed and mined on the upper levels as at depth.

Geologic conditions at the Hidden Treasure mine and conclusions drawn from them are summarized as follows:

1. Ore formations are along faults with fracturing the quartzite and permeations into the fractures zone. There was evidently little replacement in the quartzite. No true veins are indicated. There are no definite boundaries and the ore has a tendency to concentrate in the quartzite.

2. Most of the ore discovered was found near the surface. The source rock near the surface was granite and the veins are the
result of lessening of heat and pressure around the solutions thus causing precipitation toward the upper levels.

3. Two directions of faulting are indicated. The northeast-southwest fault containing the principal ore bodies and the northwest-southeast fault crossing it and showing slippage along the bedding planes.

4. The ore bodies are the result of replacement in the fractured zone. The vein folding where the alterations occurred probably caused the formation of ore pockets.

5. For continued life of the Hidden Treasure mine the Cascade vein must be developed or the other ore bodies located.
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Map Showing Underground Workings Clinton Mining Company Clinton, Missoula County, Montana.

Scale 1 in = 100 ft.

Prepared & Traced from Blue Print of Map By Langwell
Traced By J.E. Foxette, Montana School of Mines April 1940
PLAN VIEW HIDDEN TREASURE NO.1 TUNNEL AND CASCADE OUTCROP

SCALE 1 IN = 100'