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Geology and Ore Deposits of the Golden Era and Goldfinch Mines, Argenta Mining District, Montana.

Glenn C. Johnston

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GEOLOGY AND ORE DEPOSITS OF THE
GOLDEN ERA AND GOLDFINCH MINES,
ARGENTA MINING DISTRICT, MONTANA.

By
GLENN C. JOHNSTON

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
May 1936

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CONTENTS

	Page
Introduction.	1
Purpose and Scope.	1
Historical Sketch of Argenta Mining District.	1
Acknowledgments	2
Geography	3
Location	3
Accessibility.	4
Climate and Vegetation	4
Physiography	4
Bibliography.	5
General Geology	6
Stratigraphy	6
Pre-Cambrian Strata	6
Paleozoic Strata.	7
Cambrian	7
Devonian	8
Structure.	8
Economical Geology.	9
The Goldfinch Mine	10
Historical Sketch of Mining and Production.	10
Description of Mine.	10
Ore and Ore Zones	11
The Golden Era Mine.	12
Historical Sketch of Mining and Production.	12
Description of Mine	12
Description of the Ore Zones.	13
General Notes on the Property	14
The Mayday Mine.	14
Conclusions	15

ILLUSTRATIONS

	Between Page
Figure 1. Index Map of Southwestern Montana showing Argenta district	3
Plate 1. Areal Map.	3-4
2. Plan of the Golden Era Mine.	11-12
3. Plan and Long. View of Goldfinch Mine.	9-10
4. Vertical Section of Golden Era Mine.	13-14

9/10/36

GEOLOGY AND ORE DEPOSITS OF THE
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ARGENTA MINING DISTRICT, MONTANA

INTRODUCTION

PURPOSE AND SCOPE

This report includes the results of geological investigation of a small area in the northern part of the Argenta mining district. Approximately two square miles were mapped. The underground working of the three mines only were accessible: the Goldfinch, Golden Era, and Mayday mines.

The study of this area was undertaken as a problem in geologic field mapping and the interpretation of the field data with reference to its bearing on the economic geology of the ore deposits.

Due to the limited time at the disposal of the writer the field work accomplished was very inadequate.

Three days were spent in preliminary reconnaissance of areal geology in August, 1935. Later, in the months of September, October, November, and December, five trips were made to this area, each of two days duration. Assisted by fellow students, the writer made two traverse surveys, one of the Golden Era property and adjoining claims, and one of the entire area. (Plates 1 and 2). Plane table and telescopic alidade were used. Underground mapping was done by pacing and the use of a Brunton compass. Specimen samples were taken from all mines, prospects, and outcrops including both vein and country rock.

HISTORICAL SKETCH OF ARGENTA MINING DISTRICT

In 1865 A. M. Esler of Bannack discovered the Legal Tender, first

important mine in the Argenta district. In the same year Mr. Esler built a smelter with a capacity of six tons per day. By 1876 there were six blast and two cupelling furnaces smelting ores of this district. In later years the ores have been shipped to smelters and mills in Montana and Utah.

The mines of Argenta have been worked at intervals. From 1865 to 1880 this district reached its highest production. The next twenty years showed little mining activity. The high price of silver from 1906 to 1909 encouraged mining considerably. Again in 1938 and 1929 considerable ore was shipped from this area. The new price of gold and incidently that of silver has resulted in a boom of this district for the last few years,

Lead and silver are the most important metals produced in this district. Gold production is next in importance and some copper and zinc have been mined.

Practically all the production is from lode mines. Some small placers have been worked but are of no consequence. The total production of the Argenta district is estimated at \$1,500,000.

ACKNOWLEDGMENTS

The author is deeply indebted to, and appreciates the cooperation and help given by the following persons: Mr. J. F. Imbs of St. Louis, Missouri, owner of the Golden Era property; Professor J. U. McEwan of the Montana School of Mines, engineer in charge at the Golden Era property; Mr. Robert Fleming of Argenta, lessee of the Goldfinch property; Mr. Richard Fleming of Argenta, owner of the Mayday mine; Dr. E. S. Perry of Montana School of Mines, head of the Geology Department and under whose guidance this work has been done; Professor P. A. Schafer of Mont-

ana School of Mines; and those students who assisted the writer in the field.

GEOGRAPHY

LOCATION

The Argenta district comprises about twenty square miles. It is five miles northeast of Bannack, and about seventeen miles northwest of Dillon, Montana, and is centrally located in Beaverhead county, T 9 S, Rs. 11 and 12 E.



Fig. 1.--Index map of southwestern Montana showing location of Argenta.

The area considered in this report extends throughout the greater portions of sections 13, R 11 E and 16, R 12 E, the extreme northern margin of the Argenta district. The Goldfinch mine is in the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of section 13; the Golden Era mine is in the NE $\frac{1}{4}$ of the NE $\frac{1}{4}$

AREAL MAP
OF
GOLDEN ERA-GOLDFINCH
DISTRICT
ARGENTA, MONTANA
SCALE: 1"=600'
G. C. JOHNSTON-APR, '36

Sec. 12

Golden Era Mine

Stone Mill
Cabin

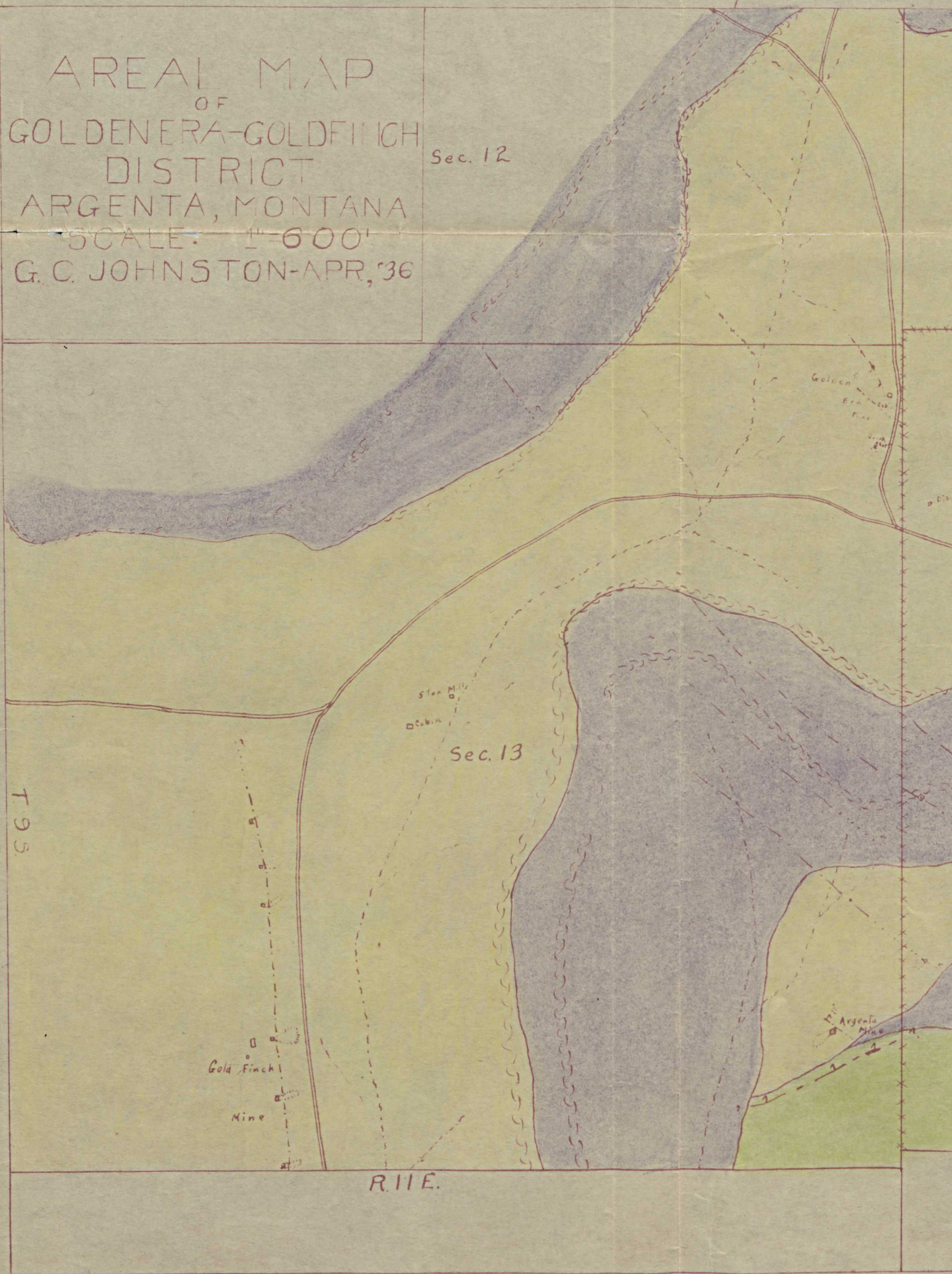
Sec. 13

Gold Finch
Mine

Argenta Mine

R. 11 E.

T 9 S





R. 12 E.

of the NE $\frac{1}{4}$ of section 13; and the Mayday mine is in the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 7, R 12 E. (Plate 1).

ACCESSIBILITY

The nearest town to this area, located on a railroad, is Dillon. Ores may be shipped from this point by rail to Montana or Utah smelters and mills. Transportation by dirt road to Argenta is fair except in December and January. During these months the snow often drifts too deep in the proximity of the mines for automobile transport.

CLIMATE AND VEGETATION

The climate is semi-arid, the annual precipitation ranging from 15 to 20 inches. The summer days are warm and the nights cool. The winters are usually cold. The mean average annual temperature is about 42° F.

Evergreen trees are found on the summits of the ridges, where not depleted by mining and domestic uses. Very little good mine timber is available.

The slopes and valley floors are barren but for scattered bunches of grass and sagebrush.

PHYSIOGRAPHY

The broad features of this area are characterized by north-south trending mountain ranges separated by intermontane troughs. The main mountain masses are well rounded with more or less flat summits. Their slopes are dissected by V-shaped valleys locally widened to U-shape by glaciation.

The maximum relief of the area mapped is about 250 feet. The Goldfinch mine works the lowest point, about 6,000 feet above sea level. The highest point lies about a mile north, marked by a ridge of quartzite.

By using the yellow (shale) and the blue (quartzite) colors of the map on Plate 1 to denote low land and ridges respectively, a general picture of the topography is shown.

There are three prominent ridges of the area (Plate 1): the west ridge, north ridge (a continuation of the former) and the south ridge. A less conspicuous one formed by limestone lies on the east and northeast margin of the area. The ascent from the valley to the north and west ridges begins gently and steadily increases to the base of the conspicuous quartzite bluffs which form cappings. East and northeastward the slope is very gentle and is culminated by a less conspicuous bluff. The north and west slopes of the south ridge are very steep and capped also by quartzite.

Rattlesnake Creek is the only continuous stream of the area. It is about a mile south of its southern boundary and runs in a southeasterly direction, flowing into the Beaverhead River four miles south of Dillon. Small intermittent streams carry the water from spring thaws or heavy rains southward into this creek.

The only source of water within a radius of two miles, other than that from the mines, is a small spring a few hundred feet south of the Mayday mine. This supplies water the year around.

BIBLIOGRAPHY

The northern section of the map on Plate 1 was taken from P. J. Shenon's map of the Argenta district.² The index map of Montana showing location of Argenta was traced from his index map.² The writer used the following reports for references:

1. 1914 Winchell, A. N., Mining Districts of the Dillon Quadrangle, Montana, and adjacent areas: U. S. Geol. Sur. Bull. 574.
2. 1931 Shenon, P. J., Geology and Ore Deposits of Bannack and Argenta, Montana: Mont. Bur. Mines and Geol. Bull. No. 6.

GENERAL GEOLOGY

Sedimentary rocks predominate in the Argenta area. The sediments range from pre-Cambrian (Beltian) to Quadrant (Pennsylvanian). Unconsolidated rocks are represented by glacial moraines and recent stream gravels. The total outcroppings of igneous rocks form a very small area. The intrusives are represented mainly by quartz monzonite and granodiorite, and the extrusives by trachite and rhyolite.

STRATIGRAPHY

The rocks of the area mapped are sediments ranging from pre-Cambrian to and through Devonian,¹ (Plate 1). There are no igneous rocks present.

Pre-Cambrian Strata

The oldest rocks of this region are assigned to the Spokane formation which forms a part of the great thickness of Belt rocks in Montana and neighboring rocky mountain states. They consist of interbedded quartzites, shales, argillites, and one or two arkose horizons. Shales predominate, the quartzites being next in abundance. The argillite occurs in thin horizons interbedded with shales.

The shales are thinly bedded and fissile. The high mica content gives the shale a shiny luster on the parting planes. Its extremely arenaceous character produces a soil when weathered that is very unproductive. The unaltered shales vary in color from reddish-purple to bluish and pale green, the latter of which predominates.

1. The ages of these sediments have been assigned by P. J. Shenon. (1931).

The quartzites are of a dull muddy color and vary in thickness from a few inches to fifteen or twenty feet. In certain horizons occur quartzitic and dense sandstones. In these zones the author has found well preserved ripple marks.

Arkose has not been found in place but observed on old mine dumps. It consists of waterworn pebbles of quartz and feldspar cemented by secondary quartz.

As only the upper part of the Spokane formation outcrops in this area no measurements could be made for thickness. However, Calkins estimates these sediments to be 10,000 feet thick in the vicinity of Philipsburg, Montana.

Paleozoic Strata

Cambrian.--Overlying and apparently conformable to the Spokane formation is the Flathead quartzite of middle Cambrian. The writer was unable to observe the contact at the base of the Flathead because of talus slopes. However, the dip of both formations is the same, an average of three or four degrees to the south, thus indicating no angular unconformity.

The beds of the Flathead formation are largely medium-grained, massive quartzites, the upper ones are greyish white and the lower beds pink to red in color. At the base is an indurated conglomerate consisting of white quartz pebbles in a red matrix of quartzite sand. This characteristic is typical of the base of the Flathead quartzite in southwestern Montana. Float found on talus slopes indicate the presence of thin sandstones and quartzitic sandstones within the formation. The maximum thickness of the Flathead formation in the Argenta district as given by P. J. Shenon is about 500 feet, but the author is inclined to believe

that it is closer to 150 to 200 feet. No section was encountered where accurate measure could be taken.

The Tilden formation lies conformably on the Flathead quartzite. It is composed of a grey sandy limestone, the arenaceous qualities increasing downward to the base. It has been tentatively assigned to the Cambrian period, though no fossils have been found in it. Lithological characteristics and the fact that it conformably overlies Flathead quartzites are the sole reasons for placing it thus. A section measured by Shenon near the Ermont mine gives a thickness of about 400 feet to this formation.

Devonian.--As in the other parts of Montana, the Ordevician and Silurian sediments are not present. Thus disconformable to, but not unconformable to the Tilden formation is the base of the Devonian limestones, known in this locality as the Ermont formation. The members consist of light to blue-grey limestones with shaly beds at several intervals. The base is marked by a black shaly magnesian limestone and the top by a black chert bed considered to be base of the Madison. Devonian fossils have been found between these two horizons. The approximate thickness is about 1,400 feet.

Mississippian and Pennsylvanian beds are the most widely distributed formations of the Argenta district but do not outcrop within the area mapped by the author. There are no bench gravels or glacial moraines present.

STRUCTURE

"The deformation in the Argenta district is merely a local expression of a great system of folding and overthrust faulting which is known

to extend from Canada to Utah."¹ Thrust faults, trending north and south have been made apparent by the cutting out of beds and the shoving of the older beds over much younger ones. A fault shown on Plate 1 has shoved Spokane shales over Flathead quartzite and up against Tilden limestone.

Normal faults, striking north and northwest, and dipping 60 to 70 degrees to the east and northeast, developed later.

The most prominent structural feature is the broad anticlinal fold which strikes about N 25° E. The shales and quartzites shown on the western half of the map (Plate 1) rest on the crest of this anticline.

Past mineral faulting is in evidence but not extensive. Movement along these faults is usually of low magnitude as will be shown in the discussion of the Goldfinch and Golden Era mines.

ECONOMIC GEOLOGY

The mineralized fault fissures in shale have been the source of a considerable part of the gold extracted from mines of the Argenta district, as well as much of the silver and lead.

The veins strike north and northwest, forming a part of the fault system previously mentioned. Due to the soft and easily weathered character of the shale no vein outcrops are found in the Spokane formation. However, it is possible to follow the approximate strike of a vein by the occurrence of float.

Representing this type of deposit are the Goldfinch, Golden Era, and Mayday mines. The first two have produced considerable ore in the past and the Goldfinch and Mayday mines are producing at present. The

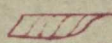
1. P. J. Shenon, See Bibliography page 6.

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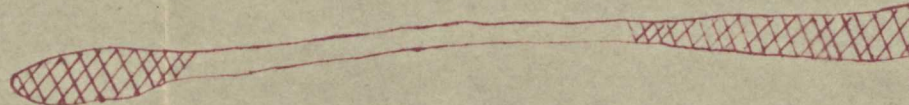
No. 1 Level



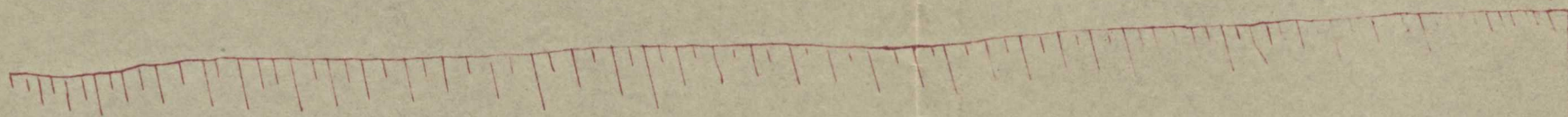
No. 2



Stoped Areas



Plan View of



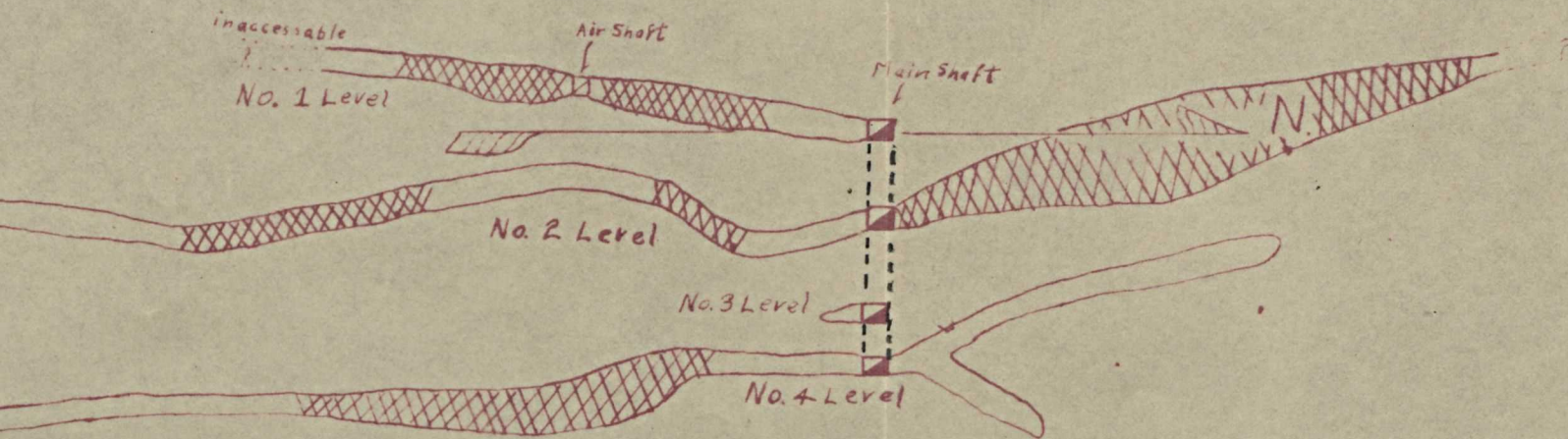
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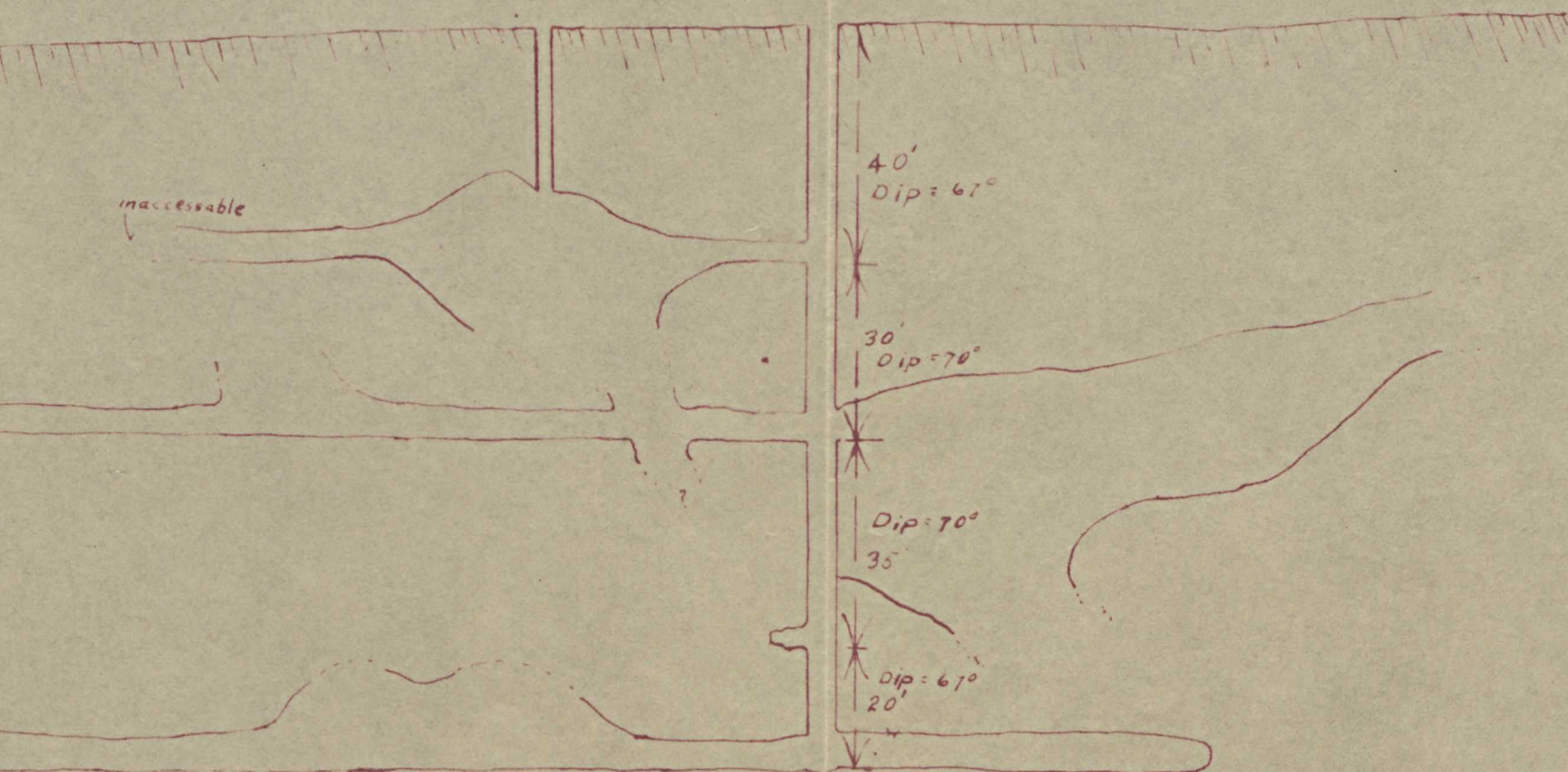
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Long. View of G

Scale:



Plan View of Goldfinch Mine



Long View of Goldfinch Mine

Scale: 1" = 30'

mines and prospects on south ridge have produced only insignificant quantities of ore. The fissures in Flathead quartzite are narrow and productive only in limited brecciated zones too small for commercial development.

THE GOLDFINCH MINE

Historical Sketch of Mining and Production

The Goldfinch property includes five claims. The original location was made in the 1880's by A. V. Clark, who sunk a shaft to a depth of 60 feet and shipped several cars of ore. In 1890 G. W. and A. H. French bought the mine. Since then leasers have worked the mine intermittently. The total production to 1931 was 250 tons of ore. For the last two years Robert Fleming of Argenta has been leasing the Goldfinch and steadily shipping ore.

Description of Mine (Plates 1 & 2)

There are three shafts on the vein at present, of which the north one is the present working shaft. A few hundred feet north are three more shafts on the vein. It is impossible to go underground in either of them.

This vein strikes north and south and dips about 70 degrees to the east. The width of the fissure varies between two and fifteen feet, an average of about four feet. Gouge occurs in irregular lenses on both walls and sometimes the full thickness of the vein. Many slip planes parallel to the strike of the vein are present in the gouge.

The ore shoots are very irregular, forming lenses and pockets. The author mapped the levels of the mine in an attempt to determine a definite system of ore shoots. But as can be seen in Plate 3 the data is too incomplete to show any regularity, if any exists.

The north shaft was sunk in the vein to a depth of 120 feet, top of the water level. On the lower levels is evidence of slight past mineral faulting shown by the fogs in the drift driven on the vein.

The country rock consist of nearly flat-lying Spokane shales. The usual interbedded quartzites are conspicuous by their absence, thus the uniform dipt of the vein.

Ore and Ore Zones

There are three recognized zones in the Goldfinch mine. The leached and practically barren zone extends from the surface down to an average depth of about twenty feet. The contents of the vein in this interval consist of light yellow clay and white quartz. This zone gradually grades into the secondarily enriched oxidized zone which extends in most places to the top of the water table (120' level). The ore minerals here consist almost entirely of dark brown and easily crumbled limonite in a network of quartz, with occasional fragments of partly altered galena and pyrite. The high grade ore shoots are found in this zone.

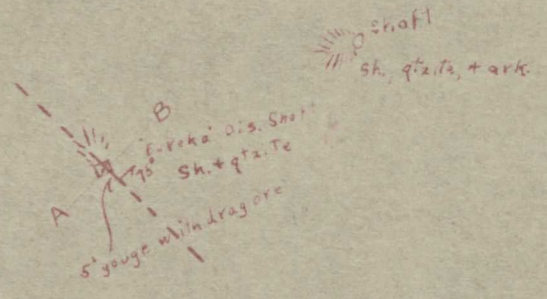
The top of the secondarily enriched sulphide zone extends in some places a few feet above the water table. How much farther below the 120-foot level the primary sulphide zone begins is not known.

The pyrite content in the secondarily enriched sulphides is very high. It is more or less "rotten" and veined extensively by cerussite and limonite. Practically all of the galena is oxidized to cerussite. Small amounts of sphalerite and arsenopyrite are also present.

Samples taken in this zone assay high in lead, several ounces in silver, and very low in gold.*

*Assay values not available.

shaft
sh, quartz + ark.



Fairweather Claim

Red arg. + sh.

Red arg. + sh.

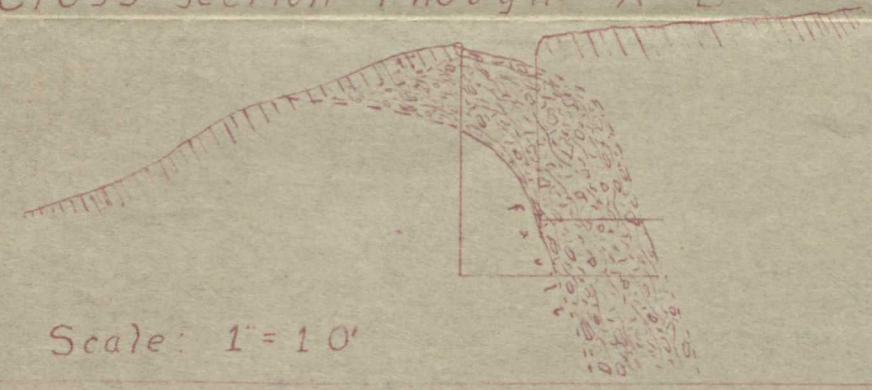
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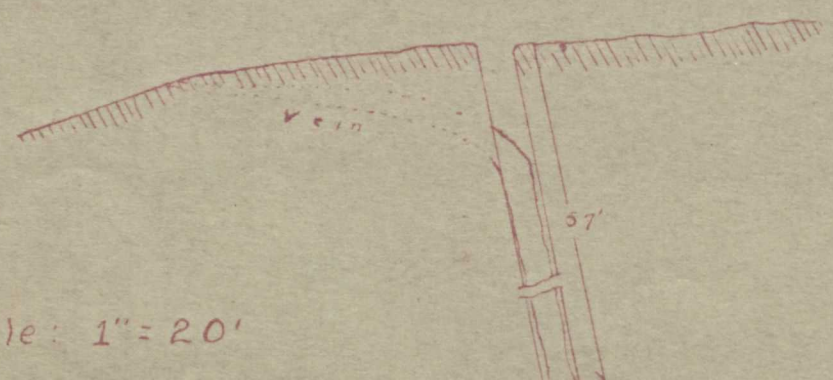
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Cross-section Through A-B



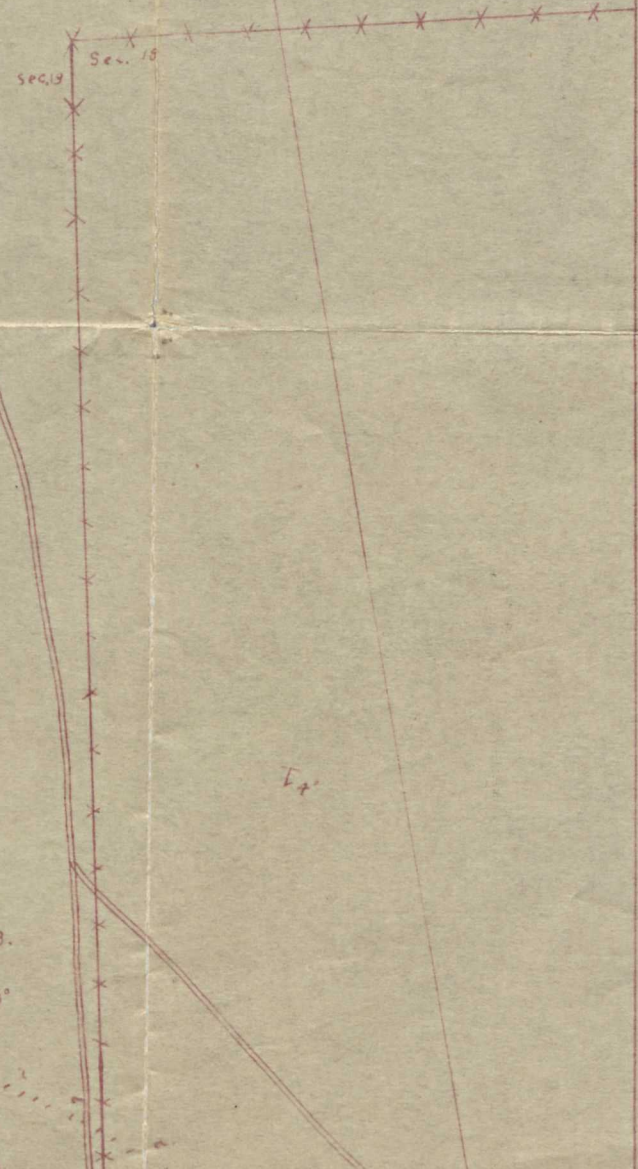
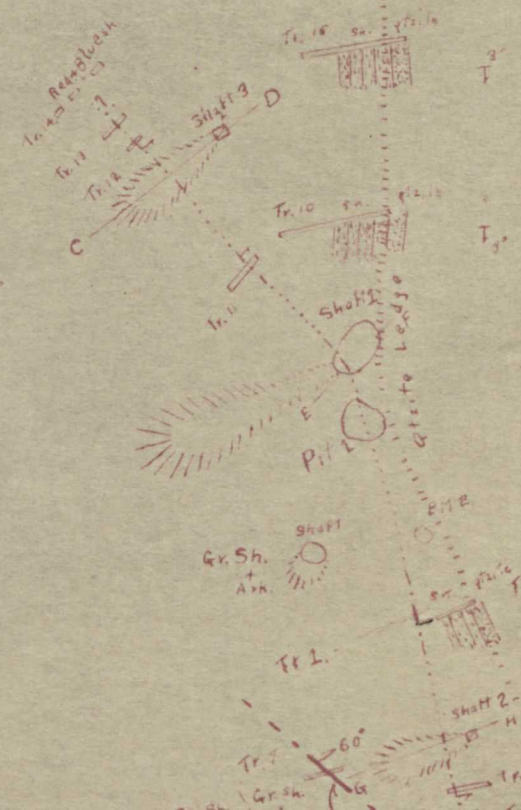
Scale: 1" = 10'

Cross-section Through C-D

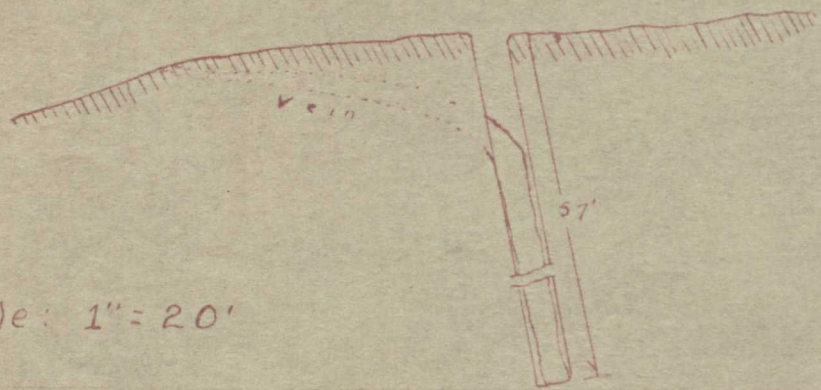


Scale: 1" = 20'

Golden Era Claim
Tom Inib's Claim

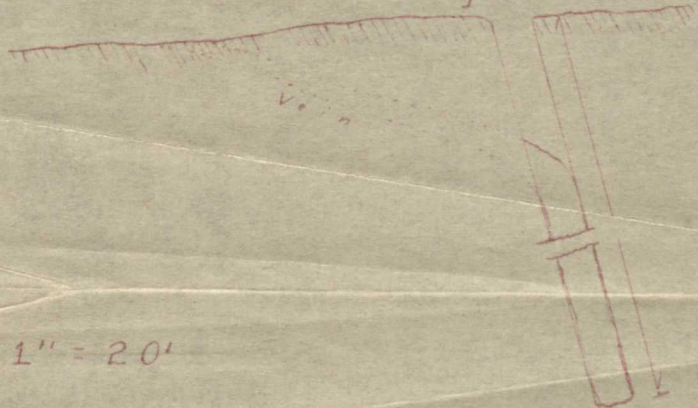


Cross-section Through C-D



Scale: 1" = 20'

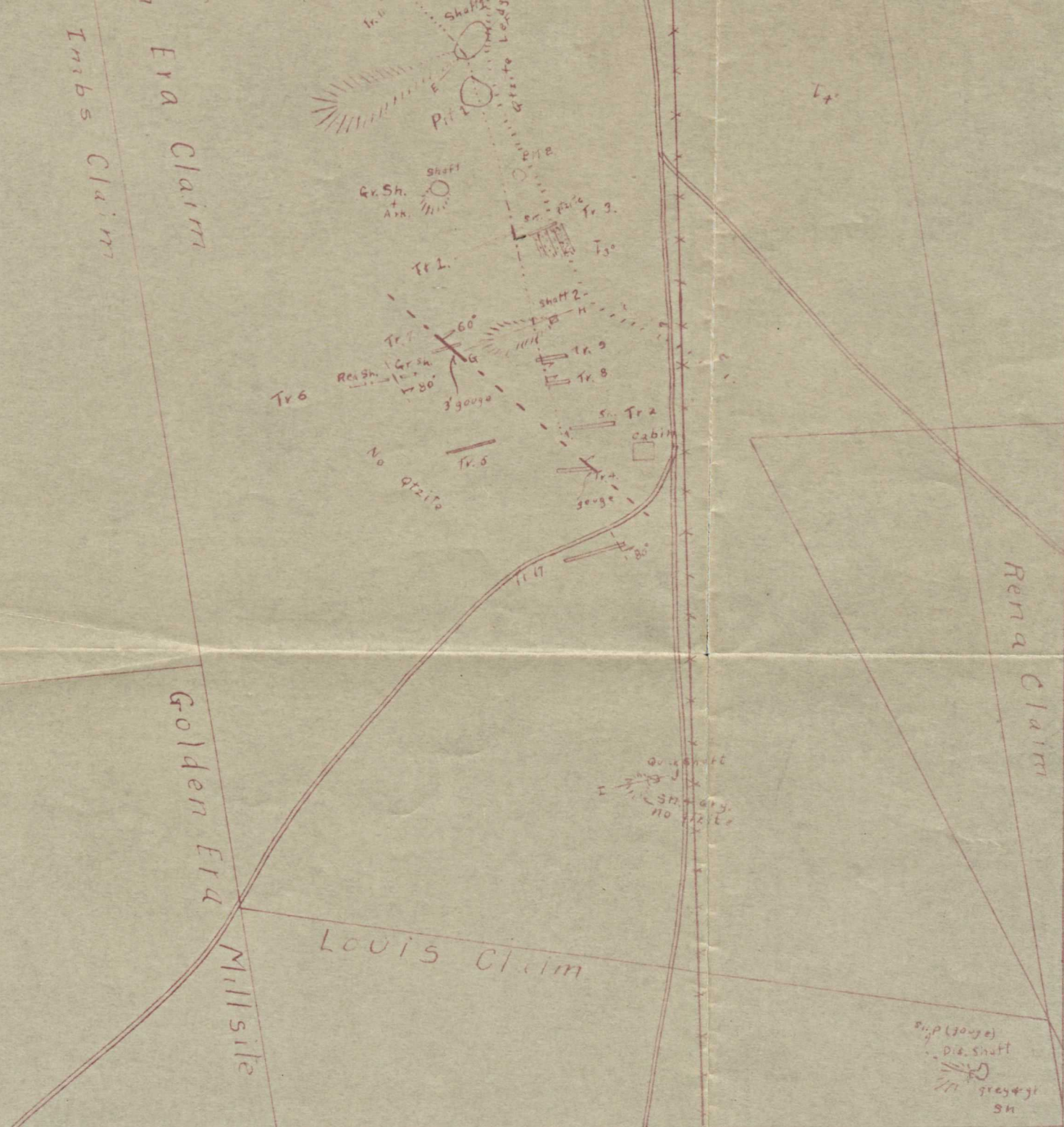
Cross-section Through G-H



Scale: 1" = 20'

Explanation

	Faults Exposed		Trench
	Supposed Fault Extension		Road
	Vein Exposed		Shale
	Vein Unexposed		Quartzite
	Fence		Gouge



PLAN OF THE
 GOLDEN ERA MINE
 ARGENTA DIST., MONTANA
 SCALE: 1" = 100'
 G. C. JOHNSTON APRIL, 1936

GOLDEN ERA MINE

Historical Sketch of Mining and Production

The Golden Era mine was discovered in 1860 by W. D. Booth and later relocated by A. I. Watts. Not until G. W. French and H. Loughlin bought the property in 1884 was there any ore shipped. The St. Louis and Montana Mining Company purchased the mine and shipped 1,000 tons of what was then classed as second grade ore. A few carloads of the high grade streaks assayed 25 percent lead, 21.5 ounces silver, and 4.35 ounces gold per ton. At present the mine is the property of the J. F. Imbs estate.

An inclined shaft was sunk on the vein to a depth of 300 feet, (Plate 1, Shaft No. 1). A map of the old workings was not available, but according to reports, the old timers stoped the high grade shoots from the shaft 275 feet southward where the vein "pinched" out. A drift was driven 80 feet north of the shaft on the vein at the 100-foot level. No stoping was done because of the narrow width of the vein.

At present the old shaft (No. 1) is caved 20 feet from the surface. In the fall and winter of 1935 considerable trenching was done and two shafts were sunk, (Plate), under the supervision of J. U. MacEwan, engineer in charge. No. 2 shaft was sunk on the vein to a depth of 65 feet. No. 3 shaft was sunk in gob to a depth of 118 feet (top of water table). At the 100-foot level a drift was driven north in the gob for a distance of 100 feet.

Description of Mine

The southern portion of the vein strikes north and south. At the old shaft the strike changes slightly to the west. Plate 2 shows the drag of the vein close to the surface, due to the sloughing of the coun-

try westward toward the bottom of the gully. The veins average about $3\frac{1}{2}$ to 4 feet in width and dip eastward 65 to 70 degrees. The dip steepens in the quartzite beds and flattens in the shales.

The clean breaks in the quartzites formed favorable openings for ore deposition. The ore is usually wide and well defined in such places and comparatively free of gouge.

On the other hand, the shattering and crumbling of shale in the fissured zone formed very irregular openings. The vein material consequently is often stringered, ill defined, and accompanied by much gouge.

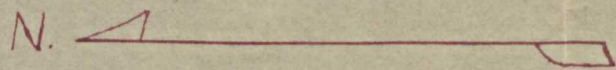
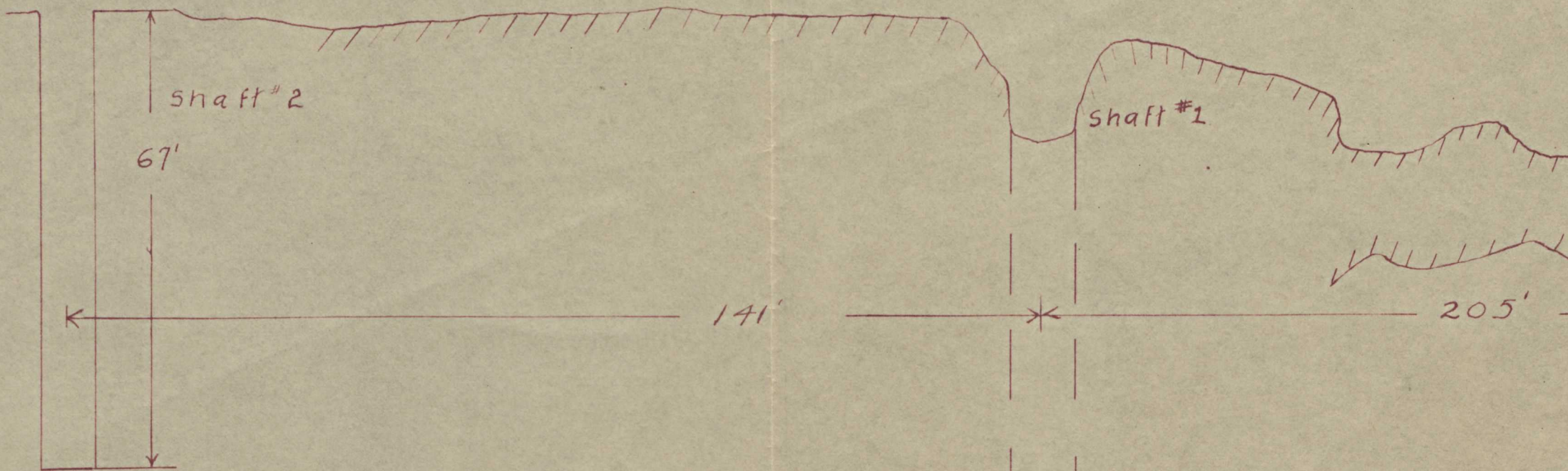
In zones of extraordinary width (8 to 12 feet) many slip planes parallel to the walls are present in the gouge. In these areas the ore is usually found against the foot wall.

The country rock in the proximity of the Golden Era mine is nearly flat lying, dipping slightly to the south.

Description of the Ore Zones

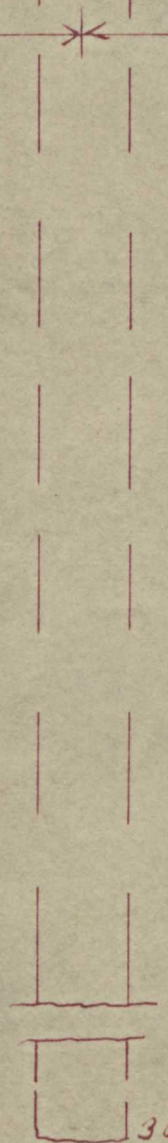
Maps of the old stopes were not available and the stopes themselves were either caved or too dangerous to explore. But from all indications the high grade shoots were larger and more regular than those of the Goldfinch.

The leached zone includes the overlap of the vein and about three feet of the vein in place, grading rather abruptly into the secondarily enriched oxidized zone. The top of the secondarily enriched sulphides occurs at the top of the water table. Miners of the 80's report that the true primary sulphides were not encountered until the 300-foot level was developed.

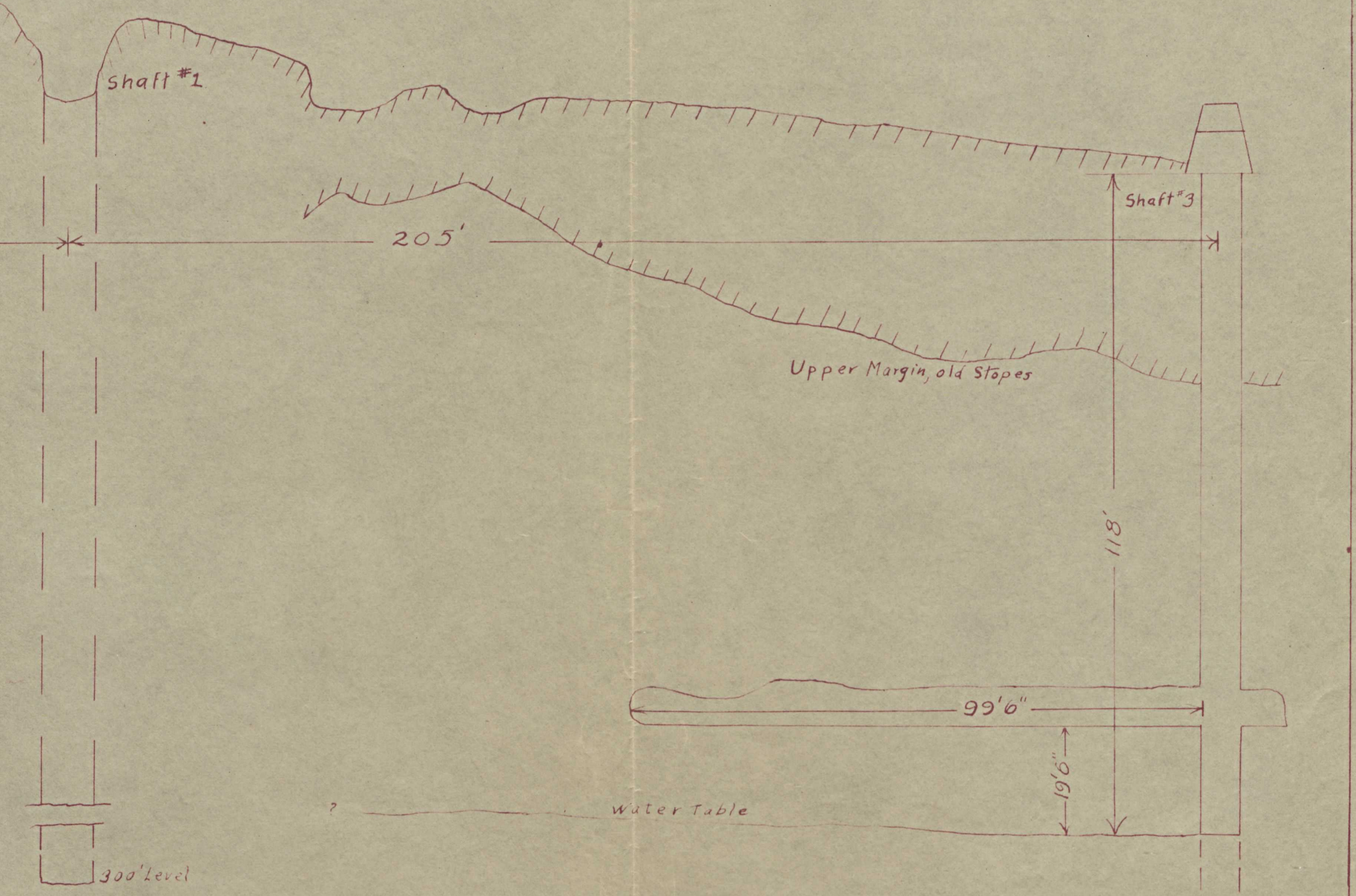


Vertical Section of
Golden Era Mine

Scale: 1" = 20'



300' level



The ore minerals of the Golden Era lode are identical to those of the Goldfinch.

General Notes on the Property

Section A-B (Plate 2) shows a cross-section of a fault exposed by a discovery shaft and small crosscut. The strike taken is probably not accurate as that is the only point where the fault was observed. The fissure zone from wall to wall consists of fine gouge through which a multiple of slip planes parallel to the fault plane passes. Scattered through the gouge are found lumps of leached drag ore.

Trench No. 13 and No. 14, (Plate 2), show an abrupt termination of the northern extension of the vein. It is possible that the fault described in previous paragraphs has displaced the vein.

Trench No. 4 and No. 7 (Plate 2), expose another fault, which when extended cuts the vein approximately at the point where the old timers claimed the vein "pinched" out. No drifts were driven in the gob south of shaft No. 3 to investigate the possibility of the faulting off the vein.

Quick's shaft, at the southern extremity of the property (sunk in the spring of 1935 to a depth of 60 feet) exposes shales and argillites but no quartzite interbedded in the former. This indicates that a fault striking approximately northwest and of considerable vertical movement lies between this shaft and shaft No. 3.

THE MAYDAY MINE

The Mayday mine was discovered in 1934 by Dick Fleming of Argenta. Leasers have sunk three shafts on the vein, each to a depth of about 60 feet. Little stoping has been done. Two or three carloads of ore run-

ning high in lead and silver have been shipped by lessees.

The vein strikes north and south and is nearly vertical. The width of the vein varies from 1 to 2½ feet. The bottom level shows definite signs of widening in the vein.

The ore is similar to that of the mines previously described.

CONCLUSIONS

Mining in the lodes of the Spokane shales of the Argenta district is limited to the oxidized zone and consequently to shallow depths. The scale of production is small at present and will be so in the future.