

WASHINGTON GEOLOGICAL SURVEY

HENRY LANDES, State Geologist

BULLETIN No. 16

Geology and Ore Deposits of the
Covada Mining District

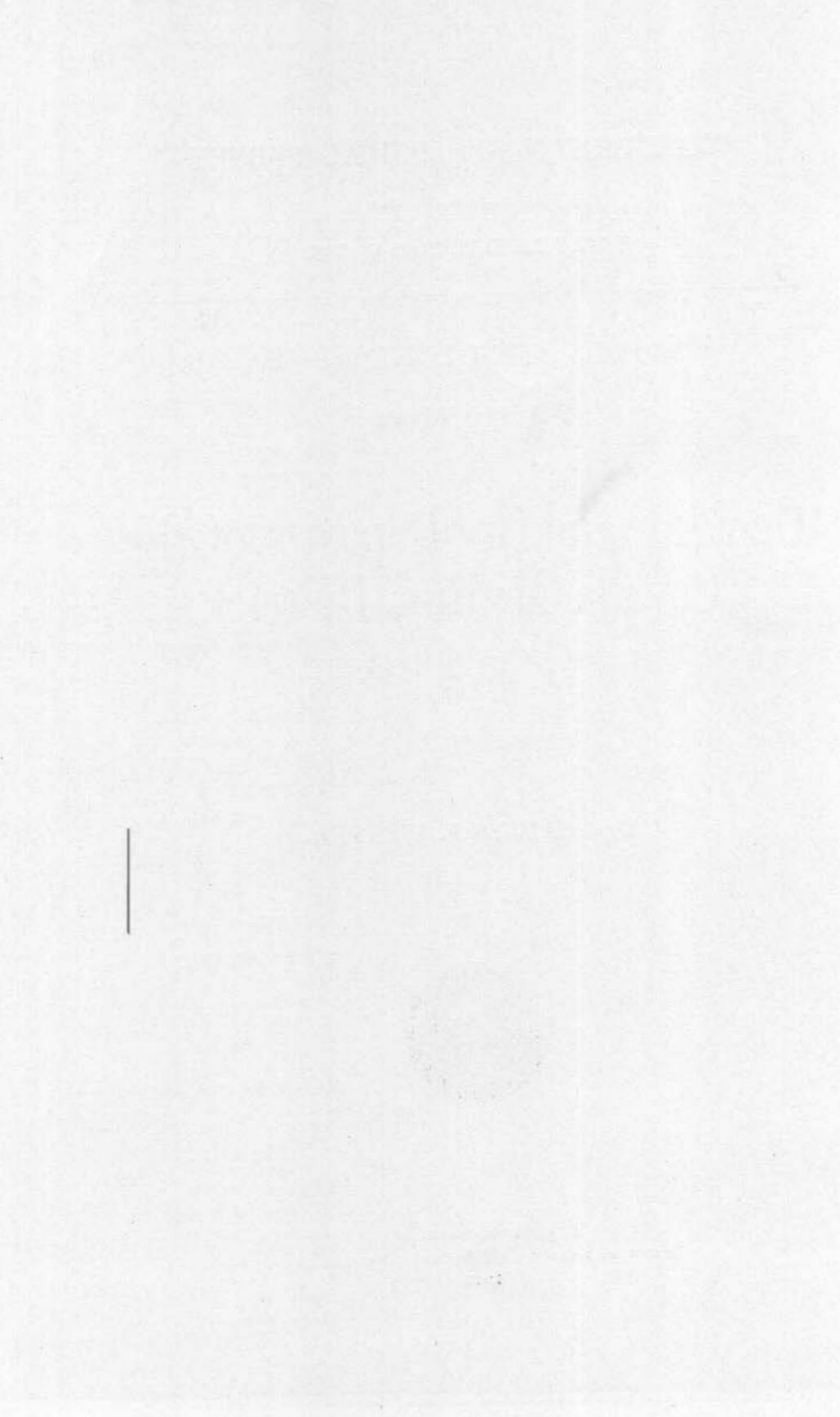
By CHARLES E. WEAVER



OLYMPIA, WASH. :

FRANK M. LAMBOEN,  PUBLIC PRINTER.

1913



BOARD OF GEOLOGICAL SURVEY.

Governor ERNEST LISTER, *Chairman.*

Lieutenant Governor LOUIS F. HART.

State Treasurer EDWARD MEATH, *Secretary.*

President T. F. KANE.

President E. A. BRYAN.

HENRY LANDES, *State Geologist.*

LETTER OF TRANSMITTAL.

*Governor Ernest Lister, Chairman, and Members of the Board
of Geological Survey:*

GENTLEMEN: I have the honor to submit herewith a report entitled "Geology and Ore Deposits of the Covada Mining District," by Charles E. Weaver, with the recommendation that it be printed as Bulletin No. 16 of the Survey Reports.

This report, which involves but little more than a reconnaissance survey, has been prepared at the urgent request of the mining men of the Covada district. For some time there has been a contention between the miners and the Indian claimants in regard to the character of the land in this district—whether or not it contains mineral deposits of probable or assured economic value. In this bulletin Dr. Weaver has set forth the bare facts regarding the general geology of the district, the character of the ore deposits, and a brief description of the individual mining properties. It is regretted that a lack of money has prevented the preparation of a detailed report upon this interesting district, but the hope is expressed that the report as it stands may prove to be of some value to the mining men of Covada and to others who are interested in metal mining in Washington.

Very respectfully,

HENRY LANDES,

State Geologist.

University Station, Seattle, June 2, 1913.

CONTENTS.

	<i>Page</i>
ILLUSTRATIONS	6
INTRODUCTION	7
Field work and acknowledgments.....	7
Location and area of the district.....	9
Literature	10
CHAPTER I. PHYSIOGRAPHY.....	14
Topography	14
General statement	14
Drainage	14
Forms of the surface.....	15
Glaciation	16
Climate	16
Vegetation	17
Relation of the present topography to the general geology.....	18
CHAPTER II. GENERAL GEOLOGY.....	20
Introduction	20
Covada formation	21
Areal distribution	21
General description	22
Meteor granodiorite	23
Areal distribution	23
General description	24
Aplite	26
Granodiorite porphyry	27
Andesite dikes	27
Pyroxenite	28
Quaternary	29
Structure	29
Geological history	30
CHAPTER III. ECONOMIC GEOLOGY.....	33
History of mining.....	33
Treatment and shipment of ores.....	34
Distribution of the ore bodies.....	35
Character of the ore bodies.....	35
Strike and pitch	36
Shape	36
Influences of country rock on the ores.....	37
Mineralogy	38
Genesis of the ores.....	40
Placer deposits	43
CHAPTER IV. DETAILED DESCRIPTION OF THE MINING PROPERTIES.....	44

ILLUSTRATIONS.

<i>Plates</i>	<i>Opposite Page</i>
I. Geologic map of the Covada Mining District.....	16
II. General view of topographic features in the vicinity of the lower tunnel at Advance Mine.....	24
III. General view of mine workings at the Orion Mine.....	32
IV. General view of talus slope, consisting of granodiorite blocks on west side of Stray Dog Canyon; Black Thorn Mine in foreground	40
V. Map of mining claims, Covada Mining District.....	48

<i>Figures</i>	<i>Page</i>
1. General reference map.....	8
2. Map showing mining claims and underground workings of the Advance Mine.....	45
3. Plan of underground workings of the Guin Mine.....	82

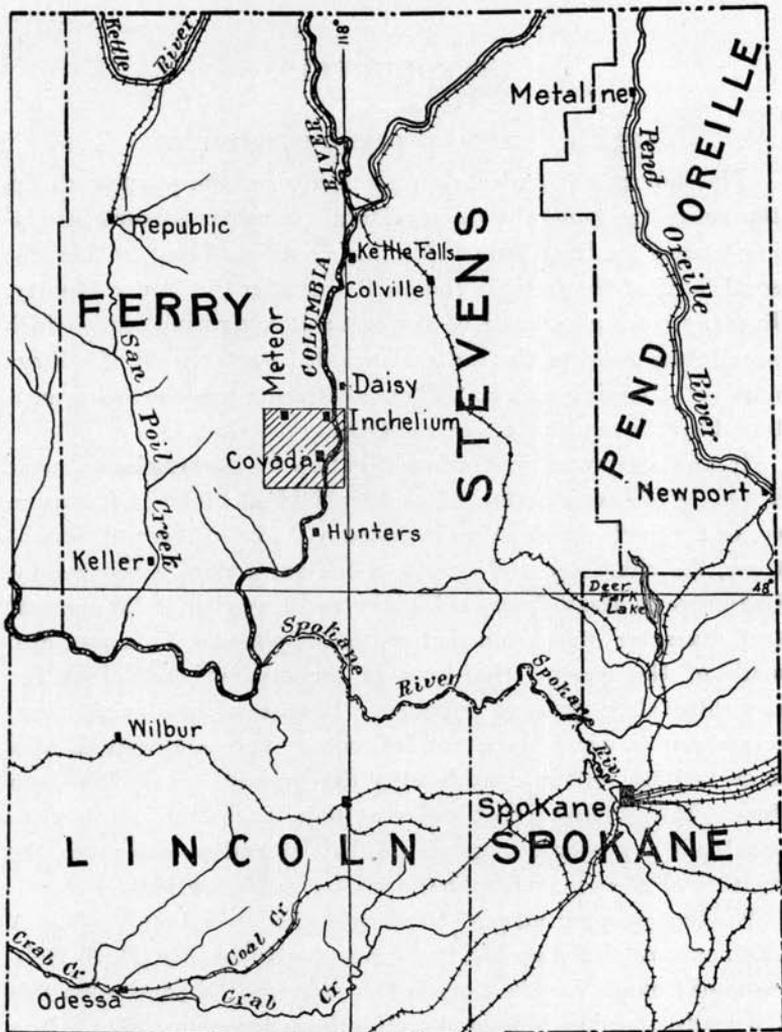
INTRODUCTION.

FIELD WORK AND ACKNOWLEDGMENTS.

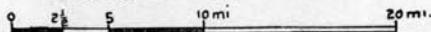
This report was undertaken primarily for the purpose of determining the mineral or non-mineral character of certain mining claims in the Covada Mining District, lying within the south half of the Colville Indian Reservation, in Ferry County. In many cases allotments of agricultural or grazing lands which were being made to the Indians included parts or all of a large number of mining claims. These allotments are now being contested by the mining men of the Covada district.

It was attempted in the investigation of this region to make a geological examination of each individual claim that was in contest. Such examination included a study of the rock formations, the character and extent of the ore bodies, a representative average assay from each claim and a record of the amount and character of development work completed. Note was also made of the general character of the area of each claim for agricultural or grazing purposes. Because of insufficient time, many claims which were not in contest were not visited. On many of the latter considerable development work has been done. It is believed that sufficient data have been obtained to construct a geologic map of the district and to determine the relation of the ore bodies to the geological formations.

No topographic map of this region has ever been made. A small generalized map has been constructed by Mr. Buell Robinson of Covada for the Covada Commercial Club, and upon this the roads, streams, hills, and section lines are represented. In a general way modifications of this have been used as a base map for representing the areal geology in this report. A map showing the position of the various mining claims has been constructed. Their positions can only be regarded as approximate, as detailed surveys have been made in only a very few cases. It is possible that some claims whose names or positions could not be determined have been omitted.



Scale 10 miles = 1 inch



INDEX MAP OF COVADA DISTRICT
WITH REFERENCE TO SURROUNDING COUNTRY

 Area Representing Covada Mining District
Area of Geology Mapped

FIG. 1. General Reference Map.

The geological field work was carried on in the summer of 1912, between July 20th and August 15th. Portions of the succeeding winter months have been devoted to working up the data collected during the summer and in preparing this report. The chemical analyses included within the report were made by Mr. F. M. Ashton of the Department of Chemistry at the University of Washington, and the assays were made by Prof. C. R. Corey of the School of Mines at the State University.

The writer wishes to express his thanks to all who have assisted in this work, and especially to the members of the Commercial Club of Covada. At all times means were provided for transportation to different parts of the district, and persons familiar with the positions of claims and mine workings were detailed to accompany the writer.

LOCATION AND AREA OF THE DISTRICT.

The Covada Mining District is located a little south of the extreme east-central portion of Ferry County, in the north-eastern corner of the State. It is situated adjacent to and just west of the Columbia River and forty-five miles south of the International Boundary, at about latitude $48^{\circ} 15'$ north and longitude 118° west. The district includes those mining claims situated west of Columbia River, south of Steinger Creek and north of Nez Perce Creek. It embraces the lower two-thirds of Township 32 North, Range 36 East, the greater part of the eastern third of Township 32 North, Range 37 East, and the north third of Township 31 North, Range 36 East. The total area involved is approximately forty square miles.

In the northwestern corner of the district, on Steinger Creek, in Section 17, Township 32 North, Range 36 East, is located the old mining town of Meteor. At present it consists of several cabins, only a very few of which are occupied. Covada is situated in the Northeast Quarter of Section 2, Township 31 North, Range 36 East, about one and one-half miles west of Columbia River. It consists of a few houses, a store, and post-office. The majority of the people are scattered about the district. There are no railroads within the district, but the topo-

graphic features are such that most points may be easily reached by wagon road. One wagon road extends southward from Covada to Hunter's Ferry on the Columbia, and thence down the river. The route most usually traveled in reaching Covada is from Spokane northward seventy-three miles on the Great Northern Railway to Addy. From Addy there is a tri-weekly stage connection with Gifford, a small settlement on the east side of the Columbia River, nineteen miles distant. A ferry across the river connects this town with Inchelium, which in turn is connected with Covada by seven miles of wagon road. The trip may be made by rail from Spokane to Meyers Falls, by stage from there to Daisy, by ferry across the river and thence by road to Covada. Meteor may be reached by wagon road either from Gifford or Daisy. In either case the journey may be made in one day. In an air line Covada is thirty-five miles southeast from the Republic Mining District, but there is no direct connection by wagon road. One small steamer plies between the settlements along this section of the Columbia. From Covada there is a bi-weekly mail service by way of Addy, and a long distance telephone connection by way of Davenport.

LITERATURE.

There is practically no literature bearing directly upon the geology of this district and up to the present time no areal geological work has been done. The region is a part of what has been called the Okanogan Highlands, and many of its geological features are very closely related to those in other parts of this province which in places have been studied. Inasmuch as reference will be made to these quite often in this report, a short abstract with occasional quotations will be given of those papers where the geological conditions are most similar to those at Covada.

Hodges, L. K., *Mining in the Pacific Northwest*. PP. 105-116, on the Colville Reservation. Published by the Seattle Post-Intelligencer, Seattle, 1897.

This paper describes in a brief manner the general geography of the Colville Reservation. The north half had been thrown

open to mineral entry in 1896. A short description is given of the several mining properties as they existed in 1897. No reference is made to any mining activity in the Covada region. Those properties existing to the southeast of Covada in Stevens County and those to the northeast in the vicinity of Meyers Falls and Colville are described.

Landes, Henry, Thyng, Wm. S., and Lyon, D. A. Metalliferous Resources of Washington, except Iron; Ferry County, pp. 50-52, Annual Report, Vol. I, Washington State Geological Survey, 1901, Olympia, Washington.

At the time when this report was published very little prospecting had been done in the Covada district. No direct reference is made to the (Covada-Meteor) camp. A few general statements are made concerning the geology and ore deposits of the county as a whole. "As to the geological features of the county, it may be noted in a general way that granite, gneiss, schist, and crystalline limestone are the prevailing formations, with some intrusive and extrusive rocks of a late age. A broad belt of granite, flanked by gneiss, schist and crystalline limestone, lies immediately to the westward of the Columbia and Kettle rivers, and extends from the southern to the northern limits of the county."

Mathews, G. A., Covada Camp. Northwest Mining Journal, Vol. 3, pp. 72-74, No. 5, August, 1909. Seattle, Washington.

The location and area of the camp are defined. The principal rock formations are said to be "granite and diorite, traversed by a series of eruptive dikes. The mineral bearing veins are of the true fissure type, * * *. The dikes are of frequent occurrence, of variable size and character, and are most generally of porphyry. The strike of the leads is * * * northeast and southwest. The dip is 20 to 40 degrees and to the west." The greater part of this article is confined to a description of the various properties in this district.

Staff Correspondence, Operations in the Covada District, Washington. The Mining World, Vol. 33, pp. 367-368, No. 9, August 27, 1910, Chicago, Ill.

This paper, after giving the location of the district, is confined almost entirely to a description of the development of the

different properties and remarks concerning the character of the ores. A small map of the district is inserted. It is a copy from that constructed by Mr. Buell Robinson of Covada.

Bancroft. Howland. Lead and Zinc Deposits in the Metaline Mining District, Northeastern Washington. Bulletin 470, United States Geological Survey, pp. 188-200, 1911, Washington, D. C.

This district is located fifty miles northeast of Covada. Many of the geological features of the two districts are similar. Certain data gathered about Metaline may throw some light on the situation at Covada. The formations consist of "a thick series of more or less dynamo-metamorphosed sedimentary rocks, composed essentially of shale and dolomite." These strata are believed to be of Paleozoic age and several thousand feet in thickness. No igneous rocks were observed. The ores are thought to have been derived from "solutions which may have accompanied the granitic intrusions seen throughout a large part of northeastern Washington, tongues of which probably extend into the Metaline district."

Umpleby, Joseph B. Geology and Ore Deposits of the Republic Mining District. Bulletin No. 1, Washington Geological Survey, pp. 1-65, Olympia, Wash.

The Republic District is roughly thirty-five miles northwest of Covada, but topographically and geologically the two districts are very closely related. In the Republic report a description is given of the topography, physiography, general geology, economic geology and principal mines. "The greater part of the Colville Indian Reservation is regarded as a part of that physiographic unit which is known as the Interior Plateau, and which is bounded on the west by the Coast Range and on the east by the Gold Range and which extends north to the Mackenzie River and, if relations here suggested be correct, it extends south to the Columbia River. South and west of this great unit is an erosion surface recognized as post-Miocene in age." The geologic formations consist of "the metamorphic equivalents of a great series of shales, sandstones, limestones and lava flows, which are of Paleozoic age." These are re-

garded as belonging to Carboniferous time. During the Mesozoic there were granodiorite intrusions. Following these there was "a great period of erosion which may be divided into two parts; a first of base leveling and a second of elevation and erosion. Into these valleys formations of Oligocene age were deposited. They consist of dacite flows, andesite breccias, lake beds, and andesite flows. These are cut by intrusive latite porphyries with which the ore deposits are thought to be genetically related. During the Pleistocene the entire area was glaciated.

CHAPTER I.

PHYSIOGRAPHY.

TOPOGRAPHY.

GENERAL STATEMENT.

The topography of the area involved in the Covada district is characteristic of that of northeastern Washington. It is a part of that physiographic province known as the Okanogan Highlands, which is regarded as the southern extension of the interior plateau of British Columbia. This great plateau is bounded on the west by the Cascade Range of Washington and British Columbia, and on the east by the Gold Range of the Rockies. It is terminated on the south by the Miocene basaltic plateau of eastern Washington. The east-west course of Columbia River in Lincoln County is the dividing line between the two plateaus. The plateau north of the river ranges from one to three thousand feet higher than that to the south and is traversed by several large river valleys extending from north to south, which open out into Columbia River. Columbia River itself, after first crossing the International Boundary, trends south across this plateau to its junction with Spokane River, and then turns west.

The region involved in the Covada district lies a little over half way south from the International Boundary to Spokane River, and within the valley of Columbia River. Columbia River has carved its canyon from the summit of the plateau to the present river level, leaving broad terraces on either side at various elevations.

DRAINAGE.

The entire drainage of the Covada district finds its way directly to Columbia River. There are no large streams traversing it. The northern part of the area is drained by Steinger Creek, which, just north of the area mapped, joins Hall Creek

and within three miles empties into the Columbia. The southwestern portion of the area is drained by Nez Perce Creek, which reaches the Columbia a short distance south of the limits of the map. The central part of the area is traversed by several small creeks which are dry in the summer, but which in winter drain through Covada Creek to the Columbia. A number of little lakes are scattered through the region which receive a small amount of the surface water.

Steinger and Nez Perce creeks are very small but carry some water throughout the entire year. They occupy flat and moderately wide valleys with low grades except near the Columbia, where they descend rapidly. Much of the water apparently seeps below the level of the stream beds. No official records of the volume of water passing through these creeks have been made. Numerous springs occur throughout the district.

FORMS OF THE SURFACE.

The lowest elevations within the district are along Columbia River and range from twelve to thirteen hundred feet above the sea. The entire central portion of the area is a mountain mass trending northwesterly from the Columbia, where it ultimately merges into the main divide between San Poil and Columbia rivers. Within the limits of the area mapped, a mountain spur forms the divide between Steinger and Hall creeks on the north and Nez Perce Creek on the south. This mountainous area is divided by a deep gulch trending northwest and southeast, known as Stray Dog Canyon. The hills to the north and east are comparatively low and rounded; those to the south and west are higher and more rugged. This valley ranges in width from 200 to 600 feet, and near the town of Covada widens out towards the river. The slopes toward Stray Dog Canyon are steep and rugged and in many places precipitous, with talus slopes below. The slopes on the west towards Nez Perce Creek are comparatively gentle and rolling. In Section 30, Township 32 North, Range 37 East, lies Rattlesnake Mountain, a bold, rocky mass with a steep slope to the west and north, but a more gentle one to the south and east.

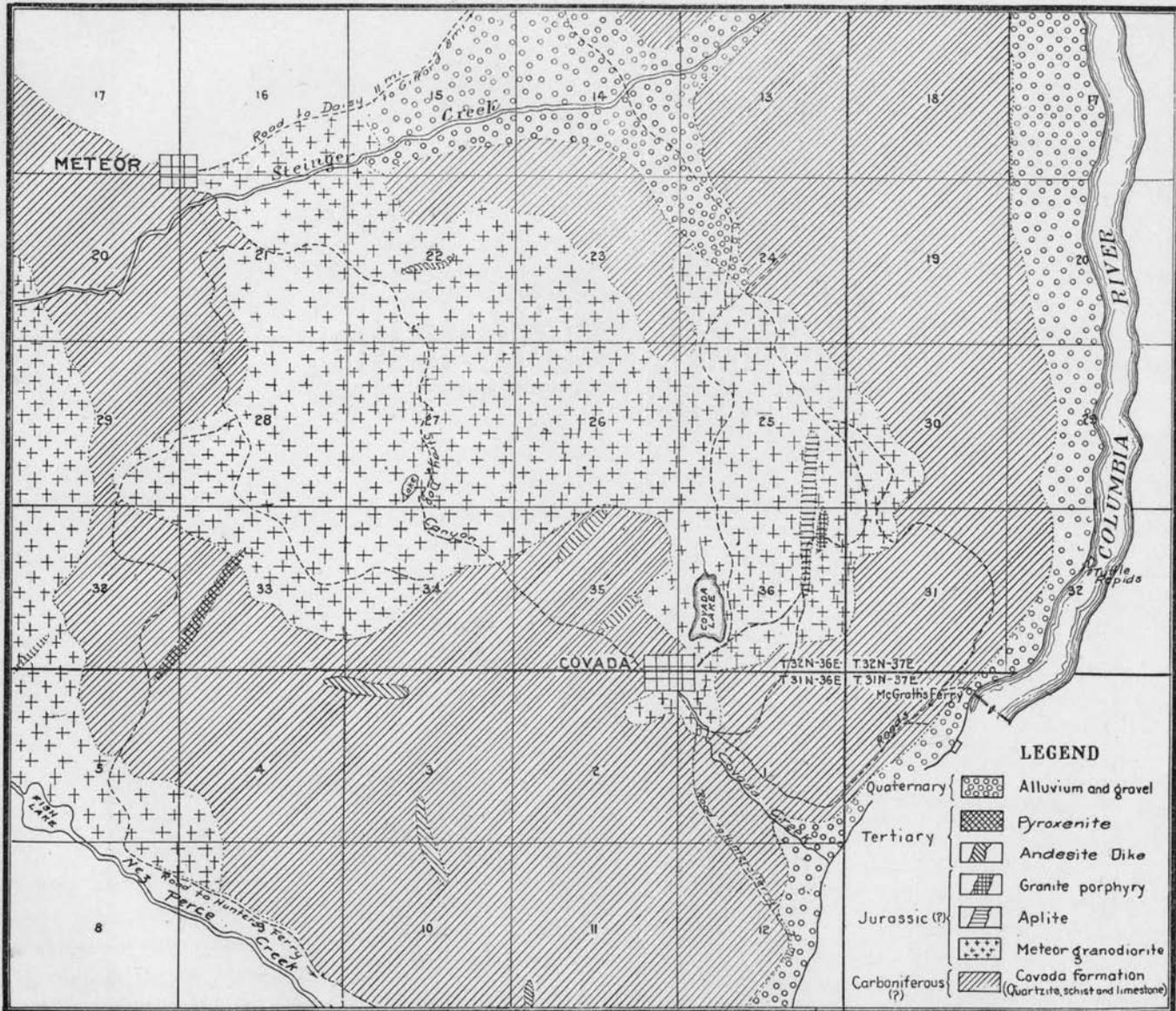
GLACIATION.

There is direct evidence within this district that even the highest knobs on the mountain tops have been glaciated. Glacial grooves and striations in the hard country rock are very well defined. Observations were taken at numerous points and without exception the striations were always trending in the same direction—nearly due north and south. Very little drift is strewn over the surface, but occasional erratics of rock foreign to this district are found. Along the western border of the Columbia, for a distance of nearly a mile back from the river, the bed rock formations are covered with non-consolidated gravels, clays and sands. Occasionally they are partly stratified. They may be in part of glacial origin. Several distinct terraces have been cut into them and these in turn have been dissected by small gullies rapidly descending to the Columbia.

CLIMATE.

The climate at Covada is representative of that in Ferry and Stevens counties. The winter temperatures are somewhat lower than at Spokane and perhaps a little higher than at Republic. The annual rainfall is about the same as at Republic and Spokane. Snow begins falling in November and generally disappears in late April. During the winter Columbia River often freezes over so as to allow teams to cross. No official climatic records have been kept at Covada or Meteor. The nearest points at which such records have been kept are Republic, Spokane, Colville, and Wilbur. The following tables are taken from the United States Weather Bureau records:*

*Summary of the Climatological Data for the United States by Sections; Section 20, Eastern Washington, by Willis L. Moore, U. S. Department of Agriculture, Weather Bureau.



Geologic map of the Covada Mining District.

Location	Elevation Feet	Annual Precipitation	January	February	March	April	May	June	July	August	September	October	November	December
Republic.....	2,628	17.42	1.72	1.33	1.36	1.40	2.20	1.78	1.21	0.59	1.04	1.07	1.93	1.79
Spokane.....	1,943	17.89	2.36	1.89	1.40	1.19	1.51	1.50	0.66	0.54	0.93	1.35	2.17	2.39
Colville.....	1,635	17.66	2.23	1.73	1.36	0.96	1.91	1.51	1.19	0.76	0.79	1.18	2.18	1.86
Wilbur.....	2,203	14.33	1.86	1.64	0.88	0.86	1.50	1.07	0.58	0.50	0.69	1.25	1.76	2.14

FROST DATA.

STATIONS	Length of Record Years.	Average date first killing frost in autumn.	Average date last killing frost in spring.	Earliest date killing frost in autumn.	Latest date killing frost in spring.
Colville.....	9	September 7	June 5	August 21	July 26
Republic.....	8	September 3	June 15	August 26	July 29
Spokane.....	28	October 14	March 26	September 7	June 8
Wilbur.....	9	September 6	June 23	August 17	July 30

The highest temperature ever recorded at Republic was 102°; at Colville, 103°; and at Spokane, 104°. The lowest temperature recorded was at Republic, -32°; at Colville, -29°; and at Spokane, -30°.

Since the elevation of Covada approaches that of Colville, the yearly temperature and rainfall will compare closely with observations at the latter place, the nearest point at which records have been kept.

VEGETATION.

Almost the entire district about Covada is covered with timber consisting chiefly of the following varieties:

- Yellow pine (*Pinus ponderosa*)
- Tamarack (*Larix occidentalis*)
- Red fir (*Pseudotsuga mucronata*)
- Sticky laurel (*Ceanothis velutinus*)
- Huckleberry (*Vaccinium macrophyllum*)
- Thimbleberry (*Rubus parviflorus*)

Along the benches leading down directly to Columbia River the timber is very scattered and in many places absent. Over the greater part of the region, in common with the Okanogan Highlands, the forests are open, with very little underbrush except along the slopes of the canyons. It is possible to drive a team

almost anywhere among the trees. The only timber which has been cut is that used in the construction of local buildings.

RELATION OF THE PRESENT TOPOGRAPHY TO THE
GENERAL GEOLOGY.

The explanation of the present topography of this district must be sought in a study of the geological conditions which occur throughout the Okanogan Highlands and of which the Covada region is a part. Geologic investigations of this broad area have been made, both in British Columbia and Washington, and as a result a fairly definite conception has been formed of the geological processes involved in developing the present topography. The Okanogan Highlands are regarded as a separate physiographic province from either the Cascades or the basaltic plateau of southeastern Washington. Their physiographic history is thought to be entirely separate. Evidence near Republic and in other parts of Okanogan and Ferry counties suggests that the entire area north of Columbia River during Eocene time was reduced to a peneplain. This is thought to have been coincident with a similar peneplanation in the interior plateau of British Columbia.

During the Miocene, elevation of the peneplaned surface seems to have occurred. Accompanying and following this, stream cutting developed broad and deep valleys which acted as basins for the accumulation of vast quantities of later Tertiary lavas, tuffs, stream gravels and lake deposits. Diastrophic movements undoubtedly were taking place during this time of which we have no definite record. During the Pleistocene the entire region seems to have been covered with a part of the Cordilleran glacial ice sheet. After the retreat of the ice, the drainage readjusted itself and the streams continued their downward cutting, ultimately developing the topography as it exists today.

Within the region involved in this report there are practically no data which can throw any light on the early Tertiary physiography. Observations made from some of the higher ridges suggest a uniformity of elevations along the distant mountain

divides. Near the Columbia, on either side, definite terraces may be seen which have been carved from old stream or glacial deposits. There is a suggestion that the difference in elevation on the east and west sides of Stray Dog Canyon is due to an original terrace carved into bed rock. The small valleys and canyons seem to be of comparatively recent development and the result of drainage adjustment as Columbia River was gradually deepening its valley. The characteristic rounding of many of the hill tops and slopes is probably due to the action of the ice sheet.

CHAPTER II.

GENERAL GEOLOGY.

INTRODUCTION.

The general geology of the Covada district has many characteristics in common with those at Republic and Metaline. The interpretation of certain data gathered here must be in part sought for from facts already learned in neighboring regions where studies have been made. Insomuch as no areal geologic mapping has been carried on in the broad intervening areas it is impossible to make exact correlations. Many of the formations well represented at Republic are totally absent at Covada and many best developed at Covada are very poorly represented at Republic. The same holds true for Metaline.

The oldest and most extensively developed formations at Covada are some more or less metamorphosed sediments, consisting of quartzites, schists, slates, and crystalline limestones, with metamorphosed interbedded lavas. No fossiliferous evidence has been obtained to determine their age. Similar rocks have been described at Republic* and Metaline†, and although no fossils were collected they were regarded as probably Carboniferous. The strata at Covada are provisionally assigned to the Carboniferous also. After their deposition they underwent deformation and were invaded by a great batholith of granodiorite which resulted in their metamorphism. Later both the metamorphics and granodiorites were cut by aplite dikes which were probably differentiated products from the granodiorite itself. Both the quartzites and granodiorites are also cut by dikes of andesite and pyroxenite porphyry. There is no evidence as to

*Geology and Ore Deposits of the Republic Mining District, Bulletin No. 1, part I, Washington Geological Survey, 1910, Olympia, Wash.

†Lead and Zinc Deposits in the Metaline District, Northeastern Washington, Bulletin No. 47, p. 192, U. S. Geological Survey, 1911, Washington, D. C.

the exact time of the intrusion of the latter. It is known that surface flows of lava similar in composition occur to the south in the plateau of eastern Washington, as well as to the west and north in the San Poil Valley and at Republic. These are known to be of Miocene age and the basic intrusives at Covada are assigned to that period. Unconsolidated gravels and sands, resting unconformably upon the older rocks, occur along the slopes of Columbia River and glacial erratics are scattered over the mountain tops.

COVADA FORMATION.

AREAL DISTRIBUTION.

Nearly one-half of the areal geology in the Covada district is composed of slates, schists, quartzites, and dolomitic limestones. Throughout the Okanogan Highlands and northward into British Columbia formations of a very similar character are extensively found. No areal mapping has as yet been undertaken in the south half of Ferry County and consequently the exact limits of the Covada formation are unknown. On the eastern side of the Columbia River, along the road to Addy, outcrops of quartzite occur in various places. Although the latter region has not been areally mapped it seems in large part to be composed of metamorphic material. Along both the east and west slopes of the river these old rocks are covered over with Pleistocene gravels and alluvium.

Within the Covada district proper the Covada formation occupies a very prominent place, covering about twenty square miles. It forms one irregular shaped mass, roughly concentric around a central core of Meteor granodiorite. In the north central part of the district some small areas are separated from the main body by Pleistocene alluvium and gravel. The smallest of these lies in the northern part of Sections 13 and 14, Township 32 North, Range 36 East, just north of Steinger Creek. The second area is situated just south of Steinger Creek in Sections 14, 15, 22, 23, in Township 32 North, Range 36 East. The third and largest area enters the northeast corner of the district just west of Columbia River as a belt nearly two

miles wide. In passing southward it narrows to a width of about one mile southeast of Covada postoffice.

South of Covada the formation occupies the entire area between Columbia River and Nez Perce Creek. About three miles west of Covada it turns northward, and in Section 29, Township 32 North, Range 36 East, it narrows down to less than one thousand feet. It widens again, passes northwesterly, crosses Steinger Creek just west of Meteor townsite and passes out through the northwestern corner of the district.

GENERAL DESCRIPTION.

The rocks entering into the Covada formation consist of slaty schists, siliceous slates, quartzites, argillaceous quartzites, and dolomitic limestones. This entire series originally was composed of sandstones, shales, grits, tuffs and limestones which have since been more or less metamorphosed. The quartzites range from very fine to very coarse grain in character. Where they have been most intensely metamorphosed they are hard and dense with a glassy luster. Where metamorphism has been less pronounced the small component grains are found to be angular and very little water-worn. In some places the quartzites are dark gray, in other places a sugary white. Near the contact with the granodiorite batholith the quartzites have been intensely fractured and crushed and the seams have been filled with quartz and very acidic portions of the granodiorite magma. In some places the quartzite is completely filled with a network of small quartz stringers less than one-sixteenth of an inch in thickness. The slates vary considerably in character. In many places they are simply slightly hardened shales, while in other places they pass into sericitic schists. Commonly the slates show that they were originally composed of alternating layers of sandy shale and argillaceous sandstones, often in narrow bands only a fraction of an inch in thickness. This characteristic is well developed on Reister Mountain, south of Covada. In the hills just west of the Columbia River, and especially just north of Rattlesnake Mountain, dolomitic limestones are very

common. They are of a grayish blue color and are interbedded with the quartzites and slates. Near the contact with the intrusive granodiorites they take on a crystalline appearance. The prevailing strike of the strata is due north and south, and the dip nearly vertical. In the vicinity of the granodiorite contact the rocks have been badly displaced and contorted.

No evidence of fossil remains, either plant or animal, have been found. A fossil fish about two feet in length is said to have been collected from the dolomitic limestone near Rattlesnake Mountain, but it was not seen by the writer.

The Covada formation as a whole seems closely related in its general characteristics to that described in the Metaline district, in the Republic district, and with the Cache Creek beds of British Columbia.* It resembles the Peshastin formation of the central Cascades of Washington.† Provisionally its age may best be assigned to the Carboniferous or possibly early Mesozoic.

METEOR GRANODIORITE.

AREAL DISTRIBUTION.

The central portion of the Covada district is areally characterized by a large mass of granodiorite. In addition a narrow belt extends north and south along the western margin of the map, separated from the central mass by a belt of Covada quartzite. Altogether the total area of granodiorite represented upon the map is about eleven square miles. Outside of the Covada district it outcrops extensively, although its exact boundaries have never been mapped. The high hills north of Covada and south of Steinger Creek are composed of this rock and Stray Dog Canyon has been carved in it. Just east of Covada postoffice a small, irregular shaped tongue extends southward to within one mile of Columbia River, where it is overlaid with the older metamorphic rocks. Immediately east of Meteor it extends to Steinger Creek and, although not ex-

*Ann. Rept. Geol. Surv. Canada, New Series, Vol. 7, 1894, pp. 37B-49B.

†Mount Stuart Folio, No. 106, p. 3, 1906. U. S. Geological Survey.

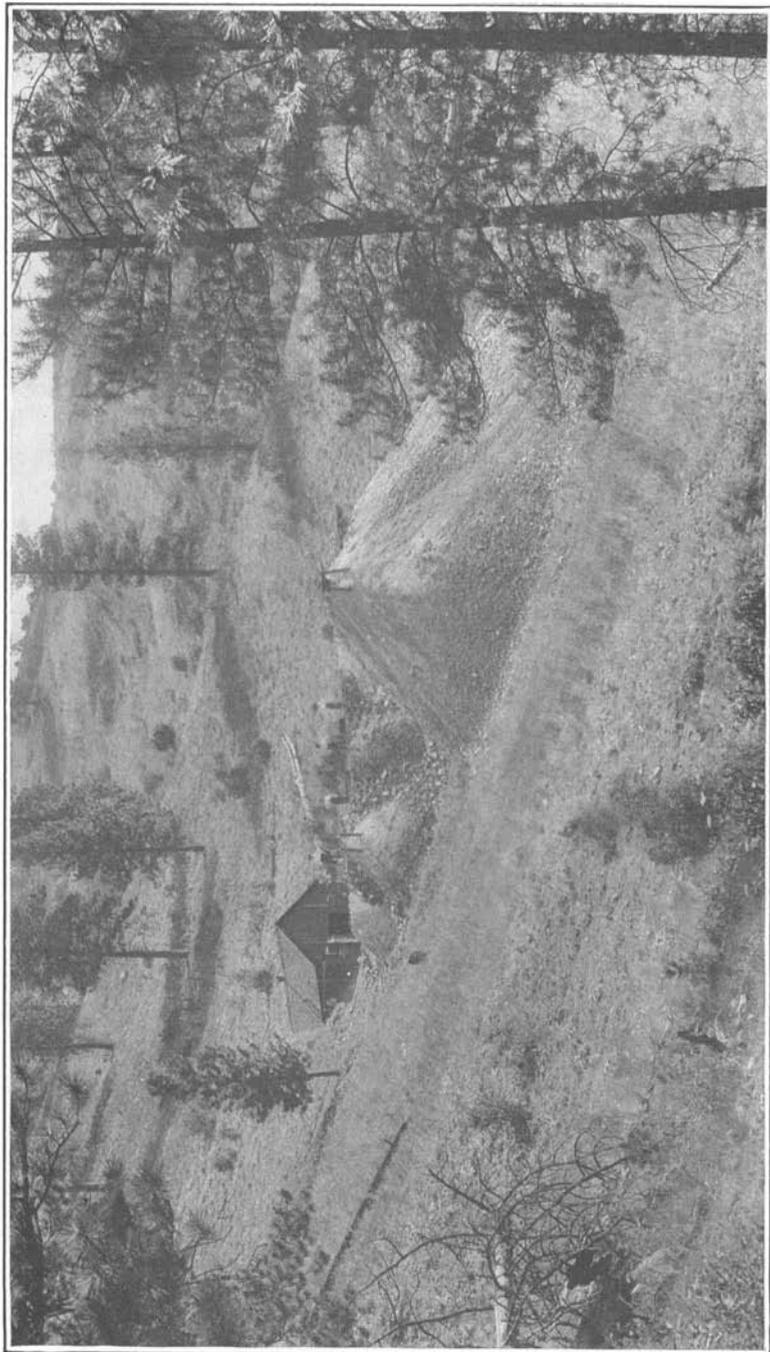
amined by the writer, from there it is said to extend northwesterly far beyond the limits of the map. In several places within the areas studied as the Covada formation, small outcrops of granodiorite may be seen penetrating the quartzite. These are small, with ill-defined boundaries and have not been represented upon the map.

GENERAL DESCRIPTION.

There is much variation in the appearance of the granodiorite in different parts of the district. In many cases the rock is of a distinctly plutonic character and from that passes into a porphyritic condition. The plutonic type prevails. Rather frequently the granodiorite phase passes to the granitic phase. Orthoclase and quartz gradually become more abundant. Biotite predominates as the ferromagnesian constituent in all types, although hornblende is often very abundant. Generally the rock assumes a grayish color, but sometimes possesses a bluish tint. Occasionally it is a pinkish white when it assumes the characteristics of an aplite. Several distinct phases occur in this district and a separate description of each will be given.

Specimen No. 34.

This phase is found in various parts of the granodiorite area, but is best developed in the Syndicate tunnel in Stray Dog Canyon, where this specimen was secured. It is a medium grained rock composed chiefly of plagioclase, biotite, orthoclase, quartz and hornblende. Plagioclase constitutes over sixty per cent of the rock. Much of it has a reddish gray tinge. The biotite occurs in very small flakes evenly scattered through the mass. Under the microscope a few very small accessory crystals of titanite and apatite were observed. Plagioclase occurs in well developed crystals ranging from 0.3 mm. to 0.2 mm. in size. They are nearly all twinned on the albite law, but occasionally in combination with Carlsbad and pericline laws. A few of the crystals show zonary banding, although this is not especially common. Examinations of a large number of crystals show them to have



General view of topographic features in the vicinity of the lower tunnel at Advance Mine.

a composition of Ab. 60 An. 40, which falls in the Andesine class. A few of the crystals are basic oligoclase.

Biotite is abundant and of light brown color, showing intense pleochroism. It occurs in irregular leaves, although sometimes with fairly definite boundaries. Orthoclase is not abundant. It occurs in small crystals generally exhibiting Carlsbad twinning, and often shows rough crystallographic outlines. Quartz constitutes only five or six per cent of the rock. It appears in irregular grains along with the orthoclase, and was one of the last minerals to crystallize. Occasionally a few large crystals may be seen in the hand specimens. The accessory constituents are apatite, titanite and magnetite, which are present only in small amounts.

Specimen No. 33.

This type approaches the granite family more closely. Quartz is abundant and orthoclase occurs in slightly greater amounts than plagioclase. The rock as seen in hand specimens is of a light gray color and of medium grain. Crystals of quartz, orthoclase, plagioclase and biotite may be distinctly seen. This type of rock in the field grades over into that described under Specimen No. 34. Specimen No. 33 was collected from the Black Thorn claim in Stray Dog Canyon. Under the microscope orthoclase is seen to be a very prominent constituent. It occurs in large crystals commonly showing Carlsbad twinning and sometimes perthitic structure. As a rule it is fairly free from alteration, although sometimes fine white micaceous aggregates may be observed along the cleavage lines. The soda lime feldspars occur in subordinate amounts and are very acidic. They fall into the Oligoclase series and have an average composition of Ab. 75 An. 25. They commonly show albite striation and occasionally zonary structure. Decomposition is more pronounced than in the orthoclase, giving rise to mica and chlorite. Quartz is much commoner than in the type represented by Specimen No. 34. It occurs in small irregular grains as well as in large allotriomorphic crystals. It is sometimes full of fluid inclusions, but more often is clear and fresh. In a

few cases it is intergrown with orthoclase. Biotite is the most abundant dark mineral. It has a yellowish to greenish brown color with very strong pleochroism. Many of the crystals are decomposed to green chlorite and brown iron oxide. A very few slender prisms of apatite are seen and occasionally one of zircon. This type grades into the true granodiorite.

APLITE.

In a number of localities dikes of aplite may be seen outcropping on the surface in both the granodiorite and old metamorphic formations. As a rule they are much decomposed and crumble easily. The most prominent exposure occurs southwest of Rattlesnake Mountain, in sections 25 and 36, Township 32 North, Range 36 East. It is nearly one mile in length and trends north and south. The ore deposits on the Longstreet and Fidalgo claims are associated with this dike. Other smaller outcrops occur north of Covada postoffice on the St. Patrick and Royal Ann claims.

Specimen No. 28.

This specimen is representative of aplite within this district. It is a medium to coarse grained rock composed almost exclusively of quartz and orthoclase. The latter is always more or less altered, giving the rock as a whole a yellowish to greenish appearance. Quartz and orthoclase are present in about equal amounts and occur in fairly good sized crystals which are sometimes intergrown. Under the microscope the orthoclase occurs in hypidiomorphic crystals partly intergrown with quartz. Only a few show Carlsbad twinning. Perthitic structure is common. Nearly every crystal of orthoclase is clouded with patches of alteration products consisting chiefly of fine muscovite, some chlorite, and all more or less stained with iron oxide. Because of the decomposed condition they stand in marked contrast to the quartz. The quartz occurs in large irregularly rounded crystals, the largest of which are about one-eighth of an inch in diameter. Nearly all of the crystals are filled with inclusions which are commonly arranged in bands and their exact deter-

mination could not be made. One or two very small primary crystals of muscovite were seen in hand specimens, but they are very uncommon.

GRANODIORITE PORPHYRY.

Small dikes of granodiorite outcrop in the quartzite in several localities. They represent little apophyses of the magma which have extended up into the metamorphic formation. A specimen representative of this dike was collected in the northeast quarter of Section 36, Township 32 North, Range 36 East, on the Rosaria claim. The dike here is about 800 feet long and trends north and south.

Specimen No. 63.

This specimen, which is typical of the entire exposure, is medium grained and composed of plagioclase feldspar, quartz, orthoclase, biotite and augite. With these are imbedded larger crystals of plagioclase. The rock as a whole is badly decomposed. Some specimens have a very close resemblance to a quartzite. The plagioclase is of the andesine variety. It nearly always shows albite striations and in some cases is completely altered to calcite and muscovite. The quartz is present in small amounts in irregular grains and crystals. It is fresh and unaltered but nearly always free of inclusions. Augite is abundant and partly altered to iron oxide. Biotite occurs as a primary mineral composing about three per cent of the rock.

ANDESITE DIKES.

Dikes of igneous rock of andesitic composition occur, cutting through the granodiorite and Covada metamorphic formations in several places in the district. Two small dikes outcrop in Section 35 and in Section 22, Township 32 North, Range 36 East. Others occur in the northwest quarter of sections 3 and 10, Township 31 North, Range 36 East. On the surface the dike rock is much weathered, but it generally stands out prominently from the surrounding rocks. In the workings of the Advance Mine a dike of similar rock has cut the vein and to a certain extent taken its course along the vein. Here it is com-

pletely decomposed. One of the freshest specimens and one most characteristic of this rock was taken from the south end of Reister Mountain, about two miles southwest of Covada postoffice. The dike is about twenty feet wide and strikes north and south. It is here confined within the quartzites and slates of the Covada formation.

Specimen No. 59.

This is a dark gray rock, fine grained, with crystals of hornblende and biotite set in a finer grained groundmass. The feldspars are badly decomposed and iron stained. Under the microscope the rock is found to be composed of hornblende, biotite, plagioclase, augite and very small amounts of orthoclase and hypersthene.

Among the phenocrysts are hornblende, augite and biotite, but no plagioclase crystals. The groundmass is composed of small microlites of plagioclase with a slight tendency to flow arrangement. Scattered among these microlites are small grains of augite. The augite crystals are colorless as a rule. Hornblende occurs in long prisms and exhibits strong pleochroism. Biotite occurs in large ragged flakes with strong absorption. The plagioclase microlites yielded maximum symmetrical extinction angles of 38° , giving it a composition of basic labradorite.

PYROXENITE.

Only one dike of this material occurs within the district. This dike is about 4,000 feet in length and over 100 feet in width and trends roughly N. 40° E. It is situated about three miles west of Covada postoffice in Section 33, Township 32 North, Range 36 East. The rock of this dike is best represented by Specimen No. 38, which is here described.

Specimen No. 38.

This is a hard, dense, dark gray rock composed entirely of pyroxene. On the surface it is much weathered and iron stained. When unweathered and studied under the microscope it is found to be a compact mass of enstatite crystals with a very small

amount of augite. No plagioclase was observed. In some specimens the enstatite is partly altered to serpentine.

QUATERNARY.

The most important geological work accomplished during the Quaternary period consisted of glaciation, stream cutting, and stream deposition. Scattered over the surface of most parts of this district are glacial erratics, more or less rounded and grooved, composed of rocks entirely foreign to this region. Ample evidence is afforded by well defined glacial grooves and striations that the great ice-sheet from the north passed over this portion of Washington. Along the valley of Columbia River are deposits of stratified and non-stratified unconsolidated sediments, partly the work of ice and partly the work of running water. These deposits rest unconformably upon the older Covada formations. Several terraces have been developed and into these later Quaternary gullies and small canyons have been cut. By far the larger part of the original deposits have been removed by erosion so that only remnants now remain clinging to the bed-rock valley slopes.

STRUCTURE.

The more important structural features in this district have been largely determined by the intrusions of granodiorite masses, accompanied by uplifts. The entire region is underlaid with portions of the granodiorite batholith. Around the margins of the district the metamorphic formations rest upon the granodiorite concentrically. The prevailing strike of the metamorphic formation is north and south and not concentric with the central mass of the batholith. The strata appear to have been tilted into a nearly vertical position, and the granodiorite injected parallel to the bedding planes. Very little folding could be observed, although more detailed investigations may show close folding and repetition of the strata. No very extensive faults have as yet been discovered, although minor dislocations are common. In the Meteor mine a fault has dislocated

the vein, but its extent can not as yet be determined. No prevailing direction of faulting has been observed.

GEOLOGICAL HISTORY.

From such evidence as can be obtained from the study of the quartzites, schists, slates and limestones of the Covada formation, this particular region was probably a part of a broad marine basin during late Paleozoic and Mesozoic times. Apparently there were variations from time to time in the depths of water, allowing the coarse grained sandstones and conglomerates to accumulate near shore, and the finer sediments such as shales to form in deeper waters. The limestones give evidence of considerable depth. At intervals during the accumulation of this series, volcanic activity seems to have been more or less prevalent. Thin narrow deposits of metamorphosed volcanic tuffs and lava flows are interbedded with the sediments. The total thickness of this series approximates ten thousand feet as a minimum and is possibly much greater. Whether sedimentation continued throughout the Triassic and Jurassic is at present uncertain because of lack of fossil evidence. At some time, probably near the close of the Jurassic, this entire region was invaded from below by a great mass of plutonic magmas of intermediate chemical composition. These magmas were in the nature of a batholith and in the process of intrusion underwent extensive differentiation, giving rise to all variations, ranging from a granodiorite to a granite. These molten magmas in places seem to have engulfed huge blocks of quartzite from the roof of the batholith. Many apophyses from the magma penetrated up into the Covada formation in the form of dikes. Near the contact the metamorphic rocks are intensely sheared and the small fractures are filled with the more siliceous portions of the granodiorite. In many places the quartzite possesses a chert-like appearance, cut by thousands of small intersecting veinlets of silica and granite. This condition becomes less pronounced at some distance from the contact.

After the upper portion of the batholith had consolidated, extensive fracturing seems to have occurred as a direct result of

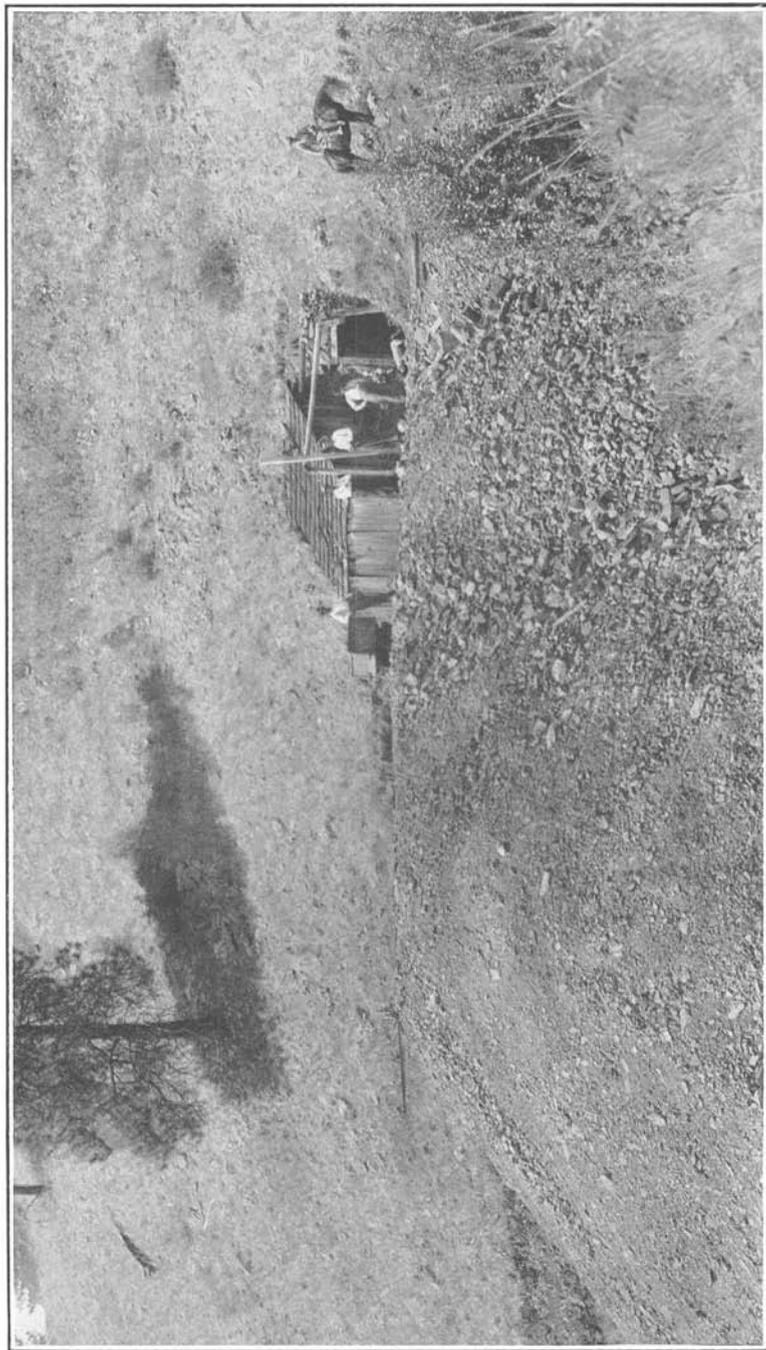
shrinkage from consolidation. The more siliceous portion of the still molten magma along with the salts of the minerals occurring here seems to have been differentiated and drawn off into the fracture zones as magmatic emanations. As these gradually approached the surface they conformed to the physical and chemical laws of solution and upon a decrease of temperature and pressure, formed precipitates. These are now thought to be the veins found outcropping in this district. After intrusive activity had become quiescent the region underwent vigorous erosion. It had probably been uplifted above sea-level into a high mountain mass either just before, contemporaneous with, or soon after the granodiorite intrusion; we have no evidence here to determine the exact date of uplift. Concerning the geologic history during the Cretaceous, Eocene, Miocene and Pliocene periods we have no definite information.

Some distance away to the northwest, at Republic, the three latter periods were characterized by outpourings of volcanic lavas alternating with accumulations of sediments in fresh water lakes. To the south, in the great Columbia plateau, volcanic activity was the dominant feature of the Tertiary. Within the Covada district proper no surface deposits of Tertiary age are present. They may have formerly existed, but if so every vestige of them has been entirely removed by erosion. There are several small narrow dikes of andesite and pyroxenite lavas cutting both the granodiorite and the Covada metamorphic formations. They are probably of Tertiary age and may have been feeders to some pre-existing lava flows which once covered parts of this district.

Evidence obtained from other districts to the north suggest that the Covada region, along with that of the Okanogan Highlands, during the Eocene was reduced to a peneplain and this is considered a part of the great interior Eocene plateau extending northward into British Columbia. After the close of the Pliocene the first definite information which we have of the geological history is largely that of erosion and glacial action. Columbia River has been continuously cutting down its channel

to its present position through this broad peneplained area. The several benches occurring at various elevations above the present bed of the river indicate former positions of the stream.

The entire region about Covada has been glaciated. Glacial deposits may be found along the slopes of the river canyons, and erratics occur even on the tops of the highest mountains. Well defined glacial grooving and scouring are strongly developed in the rock ledges along the mountain slopes. Such marks invariably have a north-south direction, indicating that a portion of the great Cordilleran ice-sheet once moved over and completely covered this district. After the retreat of the ice the drainage lines immediately began to readjust themselves to the changed topography. The present topographic features are the product of these various physiographic developments.



General view of mine workings at the Orton Mine.

CHAPTER III.

ECONOMIC GEOLOGY.

HISTORY OF MINING.

Mining activity within the Covada district is of comparatively recent date. The district is located within the south half of the Colville Indian Reservation, which was thrown open for mineral entry by act of Congress, July 4th, 1898. Ore deposits were known to exist here a number of years before the reservation was opened for mining development. The Indians are reported to have displayed numerous specimens of high grade float for twelve or fifteen years before the opening.

The Covada region was officially included within the Enterprise mining district, situated in the most southeastern section of the Reservation. It is described as follows:*

"Beginning at the mouth of Wilmot Creek, thence up the Columbia River to the north line of the south half of the Colville Reservation; thence following the north line of the said south half, west to the summit of the range or divide between the San Poil and Columbia rivers; thence in a southerly direction to the headwaters of Wilmot Creek; thence following Wilmot Creek to the mouth or place of beginning." The most extensive work has been done in what are commonly called the Covada, Meteor and Columbia camps. The Columbia camp includes most of the properties east of the road from Covada to Gifford.

The first location made in the Covada camp was the Apex group, now known as the Big Chief, by Edgar Balling in 1898. The first location made in the Meteor camp was the Vernie, by H. Garrett and W. A. Pea, in 1899. The Meteor, which is the

*Typewritten document submitted by Mr. H. G. Parmeter of Covada.

best developed property in the Meteor Camp, was located in the same or the following year by Edgar Balling. The claims which now comprise the Meteor townsite and for which patent was issued in 1904 or 1905, were located in 1900 by Archie Wilson. The postoffice at Meteor was established in 1901, and that at Covada on October 10, 1905.

TREATMENT AND SHIPMENT OF ORES.

The greater part of the ores in this district requires metallurgical treatment, and they cannot be considered as free milling. The following data concerning shipments and treatment have been furnished by Mr. H. G. Parmeter of Covada:

In 1902 a car load of ore was shipped from what was then known as the Stray Dog property, now known as the Hercules Group, at a cost of \$24.00 per ton and which gave net returns of \$80.00 per ton. In 1904 five tons were shipped which netted \$80.00 per ton, and in 1907 a car load which returned \$72.00 per ton. In 1907 a mixed car was shipped from the Meteor mine to the Tacoma smelter at a cost of \$24.00 per ton, for freight and treatment. This netted \$96.00 per ton for first class and \$52.00 per ton for second class ore. In 1905 1,935 pounds were shipped from the Silver Crown which gave net returns of \$168.00 for the shipment. From the Silver Leaf 2,800 pounds were shipped to Trail, B. C., at a cost of \$25.00 per ton, which netted \$77.00 per ton to the owners. Two shipments of five tons each in 1912 were sent to the Granby smelter at a cost of \$27.00 per ton and yielded net returns of \$92.00 per ton.

In 1909 thirty-eight sacks of ore were shipped from the Longstreet property to Northport, which netted \$77.00 for the lot. In the same year a car load was also shipped from this property which was very satisfactory, but the exact figures are not obtainable. Numerous other shipments have been made but opportunities for gathering full details regarding them have not been available.

The average cost per ton for freight and treatment is approximately as follows:

Wagon freight to railroad.....	\$10.00 to \$12.00
Railroad freight, about.....	6.00
Treatment	6.00
Total.....	\$24.00

DISTRIBUTION OF THE ORE BODIES.

The larger part of the ore bodies within the Covada district lie in a belt about five miles long from east to west and four miles wide from north to south. This belt begins about one mile west of Columbia River and south of Rattlesnake Mountain, and extends westerly through the south half of Township 32 North, Range 36 East, to the slopes leading down to Nez Perce Valley. It includes Advance Mountain, Meteor Mountain and Rattlesnake Mountain. It is terminated on the north by the valley of Steinger Creek and on the south by the south lines of sections 1, 2, 3, 4 and 5, Township 31 North, Range 36 East. There are ore bodies outside this area, but they are more scattered and less persistent. The vein occurring on the Guin property on the north of Steinger Creek may be regarded as an exception to this general statement.

CHARACTER OF THE ORE BODIES.

The majority of the ore bodies occur in well defined fissure veins, chiefly within the granodiorite mass or in the Covada metamorphic formation not far from the contact. In a number of instances, however, the veins consist of impregnated country rock along zones of fracturing. The vein materials consist of quartz and occasionally calcite, carrying silver and lead with smaller amounts of gold, copper and antimony. The commercial values are chiefly in silver. In the upper or oxidized zone the veins generally consist of rusty, iron-stained, decomposed quartz and altered country rock occasionally containing small grains or crystals of galena. No very deep workings exist, but in those localities where the veins have been opened

some distance below the surface they seem to be more sharply defined. In a number of places small crystals of sylvanite and ruby silver are scattered through the quartz.

STRIKE AND PITCH.

There is no definite regularity to the strike of the veins in this district. Many of them seem to trend nearly north and south, especially in the region just west of Columbia River. On the eastern side of Stray Dog Canyon, in the region commonly referred to as Advance Mountain, many of the veins strike a little north of west, although that direction is not predominant. On the western side of Stray Dog Canyon the general trend seems to be northeast to southwest, but with many variations from this direction.

Nearly all the veins have a dip not very far from the vertical. Flat or slightly inclined veins are very rare. There seems to be no prevailing direction of dip. Examinations made underground often show a reversed pitch to that occurring on the surface. Comparatively little underground working has been done and at the present time it is impossible to formulate any general rule as to the prevailing pitch throughout the mineralized district. In the description of each individual mining property observations taken on strike and dip of the veins will be inserted.

SHAPE.

The veins in this camp are commonly of the fissure type and vary considerably. The shape and size which they have assumed has depended largely upon the original condition of the fractures before mineralization. This has been modified to some extent by alteration and mineralization of the crushed zones adjacent to the plane of fracture. Insufficient development work has been done up to the present time to determine the lateral extent of the veins through the country rock. The entire area of granodiorite as represented upon the map and that part of the Covada metamorphic formation in close proximity to

the contact have been extensively fractured and mineralized, many of the veins intersecting. As a rule the veins are not wide and probably the majority of them are merely a few inches in thickness. There are some veins, however, over three feet in width, but such occurrences are uncommon. When observed along the strike there is found to be much variation in thickness from point to point. When examined from the surface downward into the deepest workings there is also much variation. Insufficient data are at hand to determine whether the majority of the veins widen or thin out in their downward extent. The walls are commonly well defined, although in several cases small, narrow stringers of quartz extend out into both the hanging and foot walls. In several places fairly well defined quartz veins pass into a network of stringers. Most of the ore bodies tend to assume roughly a long drawn out lenticular shape. Many narrow veins outcropping on the surface have pinched out entirely a few feet in depth and may be regarded as small local mineralized fracture zones.

The Covada metamorphic rocks at one time extended over the Meteor granodiorite and the veins now outcropping in the latter at one time undoubtedly extended up into the quartzite. Faulting in places has dislocated the veins, but sufficient underground development work has not yet been undertaken to determine its relative importance. In Stray Dog Canyon calcite constitutes the gangue mineral in one or two properties. It undoubtedly represents a secondary filling in dislocated and fractured zones at some time subsequent to primary mineralization.

INFLUENCES OF COUNTRY ROCK ON THE ORES.

Most of the ore bodies are found in the granodiorite and in the Covada formation not far from the granodiorite contact. In a number of places west of Columbia River and south of Rattlesnake Mountain aplite dikes cut across the Covada formation, and associated with these are mineralized zones. In the quartzites and slates the ore bodies trend nearly parallel to the strike and dip of the formation. In the granodiorite they are more

nearly at right angles to the former, although no definite regularity may be said to exist. In and near the aplite dikes antimony occurs in unusually large amounts, and in places it is impregnated through the aplite, or at least through certain zones within it, as may be seen on the Rosario and Longstreet claims.

MINERALOGY.

The ores in this district are chiefly composed of galena, carrying some silver, together with pyrite, sphalerite, chalcoppyrite and very small amounts of sylvanite and ruby silver. The gangue mineral is nearly always quartz. In the surface outcrops it is commonly much oxidized, giving it a reddish brown, decomposed, honeycombed appearance. In the lower workings of the mines, the quartz is generally fresh and often shows ribbon structure. The ores are generally impregnated through the quartz gangue in the form of small, irregular shaped grains or bunches. In a number of places calcite forms the gangue material, but has been introduced subsequent to the quartz and as a rule does not carry values.

Quartz.

Quartz is the most abundant mineral in the veins of this district and ordinarily occurs in a milky white form with more or less of a banded structure. Grains of galena are abundantly distributed through the quartz. In the oxidized zone near the surface it commonly assumes a rusty, reddish brown color and contains secondary material introduced by infiltration from the surrounding wall rock.

Calcite.

Calcite in places occurs as a gangue mineral, but it is not at all abundant. It is often banded and assumes a yellowish or reddish tinge due to impurities introduced from without. Although no deep development work has been done upon the calcite veins yet they seem to be found chiefly near the surface. This mineral has undoubtedly been introduced at a later time than the silica solutions.

Limonite.

This mineral appears in the oxidized zone of the quartz veins as a reddish-yellow, rusty-colored stain on the quartz or filling small cavities formerly occupied by pyrite. It owes its origin to the alteration of the iron sulphides.

Pyrite.

Pyrite is fairly common in the veins throughout the entire district. It occurs in both crystalline and massive form. Sometimes it is intergrown with the galena and chalcopyrite or sphalerite. It is often somewhat disseminated through the country rock adjacent to the veins. Near the surface it is nearly always more or less oxidized.

Chalcopyrite.

Occasionally small and irregular shaped grains of chalcopyrite are found scattered through the quartz veins. It is not common and as an ore mineral in this district is of no economic importance.

Galena.

Next to quartz, galena is the most abundant mineral in the veins of this district. It is scattered in large or small grains throughout the quartz gangue. It generally occurs in crystalline form or aggregates of crystals. Massive bunches are very often over one foot in diameter. Assays show that it generally carries more or less silver. It is not commonly altered, but in a few places it is found to be coated with oxide or carbonate of lead.

Stibnite.

Next to galena, stibnite is of the most importance among the metallic minerals. Small amounts of it are found associated with nearly all of the veins in the district. In the hills just south and west of Rattlesnake Mountain it is abundantly associated with aplite dikes. The mineralized zones in the aplite range from one to six feet in width. Often these zones are more than half composed of stibnite and bluish quartz.

Sphalerite.

Sphalerite is common, and in a number of places abundant, but not present in sufficient quantities to be of economic importance. It occurs scattered through the quartz gangue in small masses and crystals generally mixed with galena or pyrite.

Molybdenite.

This mineral occasionally is found in those veins outcropping in the granodiorite. It is not at all common and usually appears in very small flakes.

Silver.

Native silver sometimes occurs in wire-like forms, in small cavities in the quartz veins and generally is intimately associated with galena.

Sylvanite.

In a number of places in the Covada camp sylvanite occurs in small flakes about the size of a pin head, scattered through the quartz. It has a silver white color and occasionally appears in crystalline form.

Pyrrargyrite.

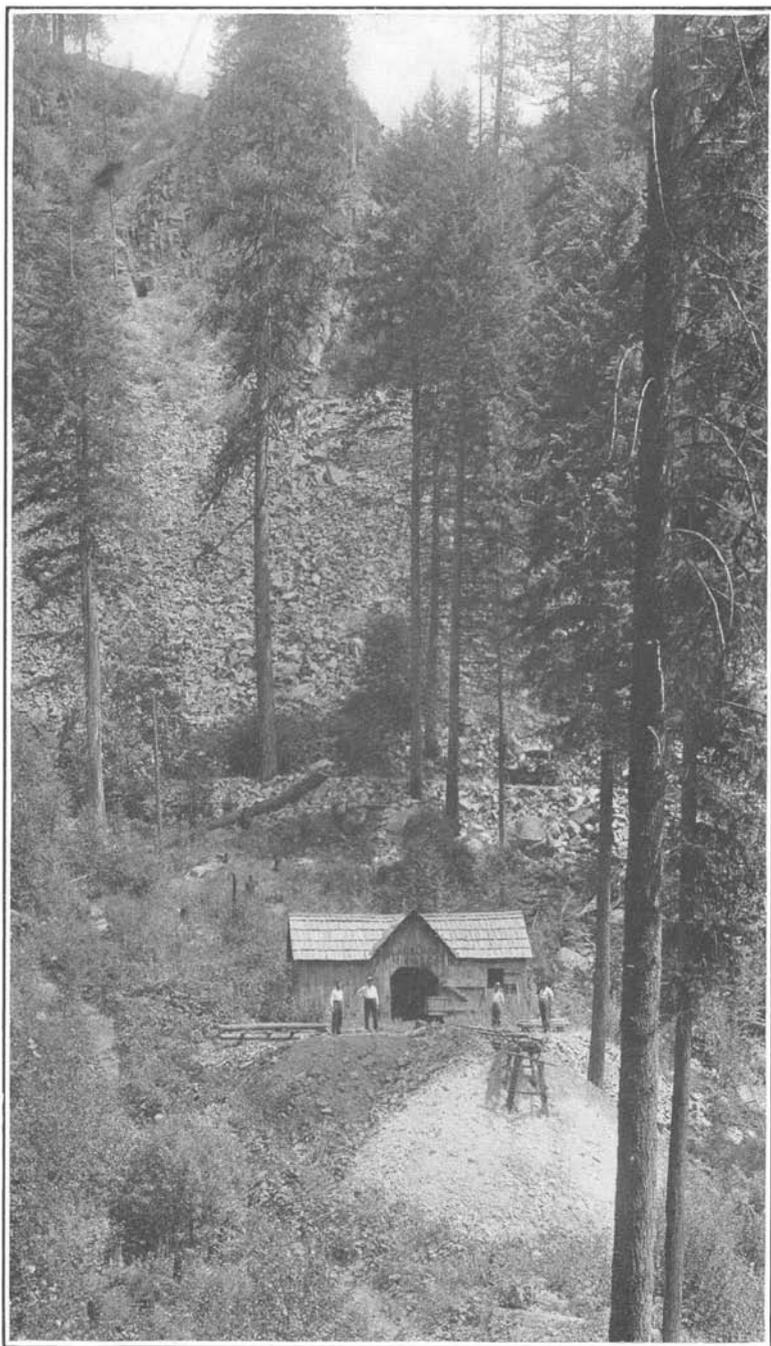
This silver mineral is very similar to sylvanite in its distribution through the quartz veins. The small crystals of it are, however, in many cases much larger than those of sylvanite.

Gold.

Gold is not of prime importance in the Covada district. In a few instances specks of native gold may be seen in the quartz. Average assays taken from the different veins in this district yield varying values in gold. It seems to occur in a finely divided state in some of the quartz veins.

GENESIS OF THE ORES.

The veins of the Covada district are entirely confined to the Meteor granodiorite and the Covada metamorphic formations. Included with the granodiorite are the aplite dikes occurring just west of Columbia River and Rattlesnake Mountain. The more



General view of talus slope, consisting of granodiorite blocks, on west side of Stray Dog Canyon; Black Thorn Mine in foreground.

basic dikes cutting through the granodiorite and metamorphic formations are much later than the mineralization and have no relation whatever to the genesis of the ores. In several places they cut through the quartz veins. The origin of the ores must be sought for in the granodiorite or quartzite. The Covada formation, consisting of quartzites, slates and limestones, is the oldest within this district and was laid down upon the sea-floor probably during the Paleozoic or early Mesozoic time. After the accumulation of these materials the region was elevated perhaps above sea-level, and either accompanying this elevation or at some time subsequent to it there was an invasion from below by portions of a great batholith. The magma within this batholith seems to have ranged from acidic to an intermediate chemical composition. Differentiation of this magma gave rise to subsidiary varieties ranging from the chemical composition of granite to that of the granodiorite. Within this district the latter seems to predominate.

Accompanying the intrusions there is thought to have been a fracturing of the rocks forming the roof of the magma. Later, upon the consolidation of the upper portion of the granodiorite batholith, there must have been attendant changes in volume. Such changes in volume would produce shrinkage not only in the upper portion of the consolidated magma itself, but also in the overlying capping of metamorphic rocks. This shrinkage would be accompanied by fracturing and fissuring. It is believed that the fracture zones, extending well down into the upper portion of the already consolidated magma, were the avenues through which magmatic waters found their way from the underlying batholith towards the surface. It is supposed that by the process of magmatic differentiation the more siliceous portions of the magma were drawn toward the surface into the fracture zones and that accompanying them were salts of gold, silver, lead, zinc, iron and antimony. The solutions containing these salts are assumed to have penetrated far up into the fracture zones and into the minor side fractures, and under reduced temperatures the mineral content to have been precipitated. In some cases

they seem to have acted upon the wall rocks and to have altered them to a certain extent, resulting in partial replacement and mineralization some little distance away from the true veins.

Dikes of aplite are found cutting the granodiorite and quartzite not far from the main contact. They appear to have been intruded at the time of, or just after, the principal invasion of the batholith. They are mineralized and it is believed that the metallic minerals associated with them have been differentiated from the granodiorite magma along with the differentiation of the aplite solutions.

The exact period of mineralization can not be definitely determined. It occurred later than the origin of the Covada metamorphic formation and either contemporaneous with or subsequent to the intrusion of the granodiorite batholith. It occurred prior to the intrusion of the andesitic dikes. Intrusions of granodiorite are known to have occurred extensively through the Cascades of Oregon and Washington, in California and British Columbia, at or near the close of the Jurassic period. It is quite possible that the intrusions in the Covada district were contemporaneous with those in the Cascades. If so, fissuring and mineralization occurred in the Jurassic. The andesite dikes which cut both the granodiorite and the Covada formation are probably of Eocene or Miocene age. Lavas very similar in character are extensively developed to the north and south of here, at Republic and on the basaltic plateau south of Columbia River. These are definitely known to belong to the Eocene and Miocene periods.

After the veins had been formed, this district in common with other parts of the Okanogan Highlands underwent extensive erosion, and in places the covering of quartzites and slates has been entirely removed, exposing the consolidated granodiorite itself as well as the mineralized fracture zones.

At Republic the ore bodies are thought to have been derived from solutions emanating from latite porphyries of Miocene age. In the Metaline district the ores are thought to have been derived from the granodiorite magmas, although they are not

exposed at the surface. The basic intrusions of Tertiary age in the Covada district can not possibly have been responsible for the introduction of the ore-bearing solutions and from such evidences as we now have the granodiorites are regarded as their source.

PLACER DEPOSITS.

Placer deposits in the Covada district are not of much importance. They are confined chiefly to the horizontally bedded sands and gravels along the slopes leading down to the Columbia River. These gravels and sands are found along the upper benches of the river as well as along the present flood plain. No very extensive development has ever been undertaken, but a number of claims have been located in sections 29 and 32, Township 32 North, Range 37 East. Water for sluicing has been obtained in small amounts from springs issuing from the eastern slopes of the hills, and then carried by flumes to the placer diggings. No data are available as to the values per cubic yard. The deposits are composed of materials ranging from the size of a pea to three or four feet in diameter. Interbedded with the gravels are sands and clays. They may be in part of glacial origin, but are largely derived by the work of streams.

CHAPTER IV.

DETAILED DESCRIPTION OF THE MINING PROPERTIES.

INTRODUCTION.

In the examination of the mining properties in this district, particular attention was given to those claims which were in conflict with Indian allotments. Several which were not in contest were visited and studied, but because of insufficient time some important claims were not seen. A careful examination of each claim in contest was made, and all discovery shafts, pits and open cuts noted. Samples were taken from each ore body in such a way as to represent an average for the entire vein. On some of the properties considerable development work has been done, while on others nothing has been accomplished beyond the yearly assessment work. Some of the claims have been abandoned and then relocated. At the present time there are approximately two hundred claims in the district; sixteen of these are patented. In describing each of these claims the more salient features will be presented, as follows: The geographical location; history of development; the underground workings and production; and the economic geology. The latter will include a description of the country rock, the form, distribution and character of the ledges, and their relation to the country rock.

THE ADVANCE MINING COMPANY.

The property of this company consists of nine claims located a little over one-half mile northwest of Covada postoffice, in Section 35, Township 32 North, Range 36 East. These claims are the Rising Sun, Cora, Nellie, White Quartz, Saturday, Cabin, Tamarack, Sunbeam, and Silver Spray. The larger part of the development work on this group has been done on the Cora and Nellie claims, which lie on what is locally known as Advance

Mountain. The outcroppings of the vein are fairly numerous and openings have been made upon it at many places. This vein varies in width from three to six feet and trends North 75° West, dipping into the hill at an angle of 70° to the north-east. It is reached in depth by two crosscut tunnels, one hun-

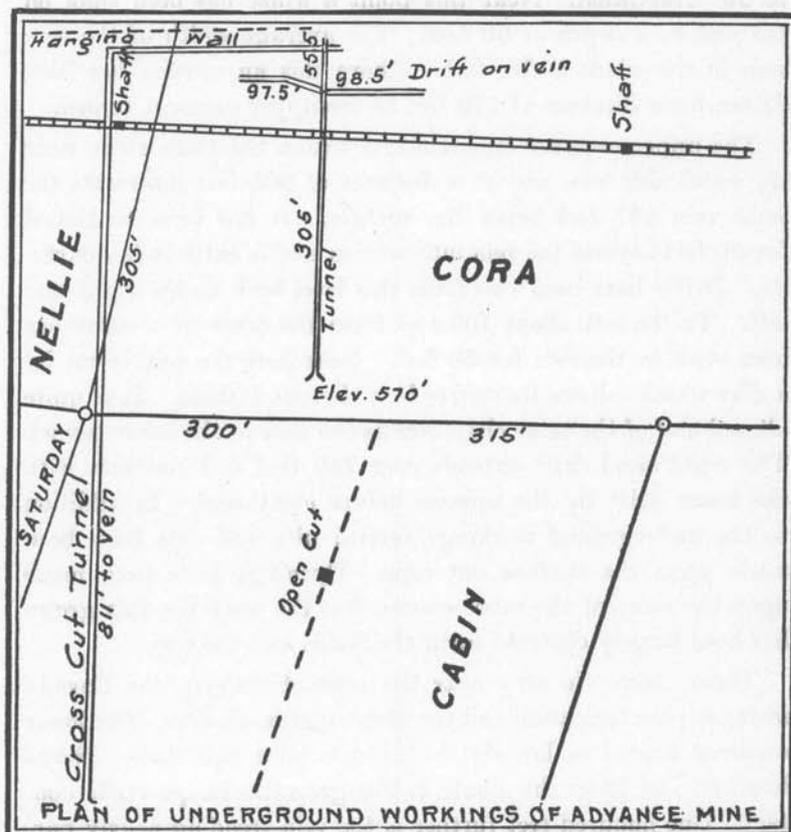


FIG. 2. Map showing mining claims and underground workings of the Advance Mine.

dred and seventy feet apart in elevation and connected by an upraise. The lower crosscut tunnel starts on the Cabin claim and has been driven in the direction North 15° East for a distance of 811 feet, where it intersects the vein at a depth of 307 feet. From this point a drift extends to the right upon the

vein. The vein is here trending North 75° West and dipping 55° to the Northeast. The country rock is granodiorite. About 75 feet from the west end of the drift the vein is locally deformed by an intersecting dike, and displaced by a slight fault. At this point the strike changes to North 55° West and the dip to 50° Northeast. Near this point a winze has been sunk on the vein to a depth of 60 feet. The average width of the vein seen in the winze is five feet. Above this an upraise has been driven for a distance of 170 feet to the upper crosscut tunnel.

The upper crosscut tunnel starts within the Cora claim near the south side line, and at a distance of 305 feet intersects the same vein 137 feet below the surface. It has been continued for 50 feet beyond the vein intersection and is entirely in quartzite. Drifts have been run from this level both to the right and left. To the left about 100 feet from the crosscut a winze has been sunk on the vein for 30 feet. Near here the vein is cut by a dike which follows its course in a sinuous fashion. It is quite altered and of the same character as the dike in the lower tunnel. The right-hand drift extends over 150 feet and connects with the lower drift by the upraise before mentioned. In addition to the underground workings several pits and cuts have been made upon the surface outcrops. Openings have been made upon the veins of the other claims, but the work for this group has been largely centered upon the Nellie and the Cora.

These claims lie very near the contact between the Covada metamorphic formation and the Meteor granodiorite. The lower crosscut tunnel is largely in the quartzite and slate. Seven hundred feet from the mouth is the granodiorite-quartzite contact. One hundred feet further is the vein trending nearly parallel to the contact and occurring in the granodiorite. In the upper tunnel the vein is entirely in the quartzite. The vein is of the fissure type and varies in width from six inches to six feet. Over a considerable distance it maintains the latter width. The gangue is quartz containing silver, gold, lead and zinc. A general assay of samples taken from the upper tunnel in the right-

hand drift gave the following returns: Gold, 0.04 oz. per ton; silver, 1.00 oz. per ton.

MAYFLOWER.

This claim is located in the northwest corner of Section 1, Township 31 North, Range 36 East. The northwest end extends into Section 36, Township 32 North, Range 36 East. It is situated only a few hundred feet southwest of Covada post-office and lies partly in the valley and partly on the hill slope. It is now owned by C. C. Rohlf of Covada. The country rock is granodiorite, but the quartzite contact is close to the south-east end line. The development work on this claim is confined to assessment work. Outcropping in a few places is a vein of quartz which trends North 35° West and dips 45° Northeast. Several openings have been made upon this vein. At the foot of the hill just south of the store, a shaft has been sunk to a depth of 20 feet on the vein, which is here 18 inches wide. Further up the hill a second opening has been made on the same vein in granodiorite. Still further up the hill are two others, 20 feet apart and about six feet deep. The vein here is 18 inches in width and contains some galena. An assay of an average sample from this vein showed a trace of gold and 1.60 oz. silver to the ton.

LAKEVIEW FRACTION.

This claim is triangular in shape and lies immediately to the northeast of the Mayflower. It was located in 1904 and is now owned by C. C. Rohlf of Covada. It lies in the granodiorite area, on a vein of quartz which trends North 40° West and dips 55° Northeast. The discovery shaft lies 600 feet from the north end line and is an open cut about eight feet deep. The vein is 12 inches in width with eight inches of granodiorite in its center. Several other smaller openings have been made upon the vein. The surface of the claim is rough and rocky. An average sample from this claim gave a trace of gold and 0.60 oz. of silver per ton.

PLYMOUTH ROCK.

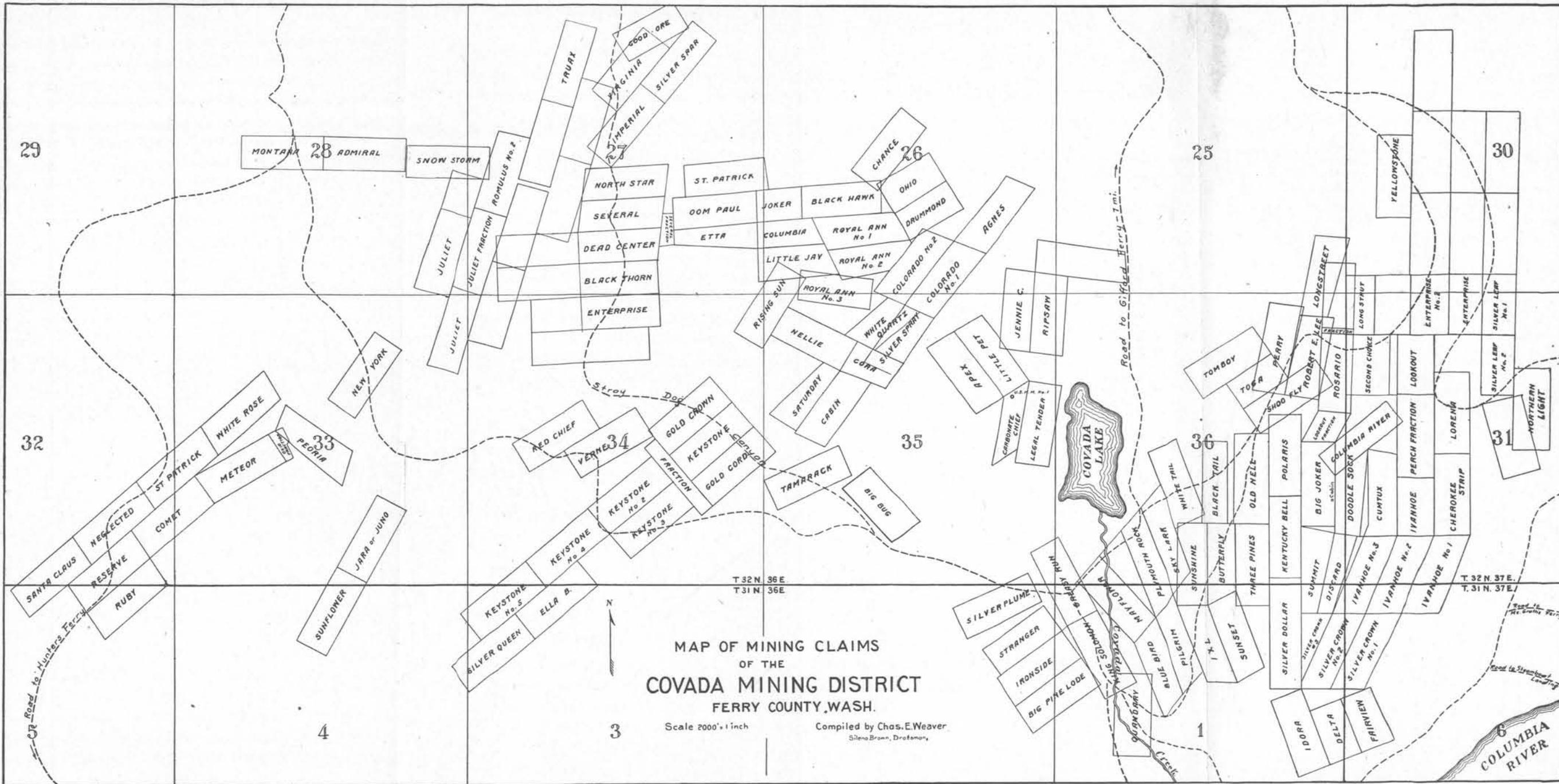
This claim lies directly east of the Lakeview Fraction, and about 1,500 feet east of Covada postoffice. The country rock in the northern part of the claim is granodiorite and in the southern part quartzite. The discovery hole is 900 feet south of the north center end-line. The quartz ledge at this point is 34 inches wide and is well defined. It is composed of iron-stained, honeycombed quartz. The discovery tunnel, which is near the discovery hole, is 30 feet in length and has been driven in South 65° East as a crosscut to the vein. Within it the vein is well defined and trends North 50° West and dips 25° to the Northeast. About 12 feet east from discovery hole there is a shaft 32 feet deep. The vein here is well defined and is said to assay high in silver. One hundred and twenty-five feet from the center end-line there is an outcrop of rusty honeycombed quartz in a little pit. A sample from this claim assayed as follows: Lead, 6% ; silver, 15 oz. per ton ; gold, 0.01 oz. per ton.

PILGRIM.

This claim is the southeastern extension of the Plymouth Rock and joins it on its north end-line. It was located in September, 1904. The eastern and southern part of the claim lies in the quartzite and the western in granodiorite. The vein is an extension of the Plymouth Rock. It has about the same strike and dip, *i. e.*, 50° to the northeast. It lies very close to the contact of the granodiorite and quartzite. The development consists of the discovery pit and several small open cuts. An average sample from the claim gave the following returns in the assay: Gold, trace; silver, 0.60 oz. per ton.

BLUE BIRD.

This claim, located June 1, 1909, lies parallel to and west of the Pilgrim. On the north it joins the Mayflower. The country rock is granodiorite in the north part of the claim and quartzite in the southern part. The discovery hole is located 100 feet south of the north end-line. Another shaft 12 feet deep is situated a little further down the hill. It shows the slaty quartzite



MAP OF MINING CLAIMS
OF THE
COVADA MINING DISTRICT
FERRY COUNTY, WASH.

Scale 2000' = 1" inch
Compiled by Chas. E. Weaver
Sileno Brown, Draftsman

Map of mining claims. Covada Mining District.

country rock, and the vein of greatly decomposed reddish quartz occurring in small stringers. Fifty feet east of this shaft there is a small tunnel running into the hill South 70° East. The vein material seems to be only silicified country rock which is largely quartzite and impure limestone. The formation strikes North 70° East and dips 25° Southeast. The assay of a sample from the discovery hole gives a trace of gold and 1.00 oz. of silver per ton.

QUANDARY.

This claim lies about 1,500 feet southeast of Covada post-office. The discovery tunnel is an open cut 20 feet long, eight feet deep and three feet wide. The country rock is hard, banded quartzite. The tunnel runs due north and contains a thin layer of quartz.

KING SOLOMON.

The King Solomon claim is situated in the northwest quarter of Section 1, Township 32 North, Range 36 East, and about 1,000 feet south of Covada postoffice. The development work consists of several shafts, tunnels and open cuts. The discovery tunnel is situated at the north center end of the claim. The country rock there is granodiorite. There is a vein in it composed of quartz, with slight impregnations of galena. It has a strike of North 10° West and a dip of 30° Northeast. Very close to the discovery tunnel there is a shaft which was sunk to cut the discovery vein. It passes through granodiorite to a depth of 27 feet. About 100 feet from the side-line and 75 feet from the end-line a tunnel has been run in on a side vein for a distance of 25 feet in a direction North 70° East. By the side of this a shaft has been sunk on the vein to a depth of 15 feet. This is near the contact between the granodiorite and quartzite. At a point 150 feet from the end-line and 50 feet from the side-line a shaft has been sunk to a depth of 10 feet in quartzite. A small vein of quartz about four inches wide outcrops and strikes North 35° West, dipping 70° Northeast, but it is not the discovery vein. The granodiorite contact lies 10 feet to the east. Twenty feet to the north a small cut has been made on the same vein. Thirty feet farther north the same vein is at the contact.

Here a shaft has been sunk 10 feet deep. The vein is four inches wide with a strike of North 20° West and a dip of 70° to the Northeast. Near the center of the claim a crosscut has been run into the hill in a direction North 70° East for 50 feet to tap the vein. Another vein of very much decomposed, honey-combed, rusty colored quartz outcrops 500 feet from the north end-line and 60 feet from the east side-line. It is about one foot in width, strikes North 10° West and dips 70° Northeast. A small opening has been made upon it. The country rock here is quartzite. The assay of an average sample from the discovery vein shows a trace of gold and 7.80 oz. silver to the ton.

GREASY RUN.

This claim was located in 1907 and is now owned by A. B. Nickens of Covada. It is situated at Covada postoffice. The country rock is granodiorite overlain with alluvium in places. The extreme north end of the claim extends into the area of metamorphic rocks. The discovery, located 30 feet from the south center end, is a shaft sunk on the vein to a depth of 30 feet. This is a quartz vein containing galena and is about one foot wide, striking North 20° West, dipping 70° to the Northeast. About 15 feet west of the shaft there is an open cut about 15 feet long and 10 feet high which is extended as a crosscut to tap the vein in the shaft. On the south end-line, 50 feet from the east side-line, another shaft has been sunk in the granite to a depth of 30 feet. There is a small vein of quartz about four inches wide which is probably the same as before mentioned on the King Solomon. Near it there is a small outcrop of the same vein eight inches wide containing galena and pyrite. A sample from this claim gave the following assay: Gold, trace; silver, 2.20 oz. per ton.

SILVER PLUME.

This claim is situated in the northeast corner of Section 2, Township 31 North, Range 36 East, a few hundred feet west of Covada postoffice. It was located in 1907 and is now owned by G. W. Sizemore of Covada. At the discovery there is a two-foot quartz ledge striking North 65° East. The quartz is iron

stained and honeycombed, with crystals and small masses of galena scattered through it. Near it a crosscut tunnel has been driven due south for a distance of 165 feet to the intersection of the vein. At this point the vein strikes North 65° East and dips 55° Northwest. The vein varies considerably from the average width of two feet. The country rock is quartzite. The mouth of the tunnel is situated 200 feet north of the discovery shaft. At a point 500 feet northeast of the southwest end-line is a tunnel extending into the granite in a direction South 55° West for a distance of 60 feet on a vein of quartz about one foot or more in width. It is dipping 55° to the southeast. The vein material consists of white quartz more or less honeycombed and iron-stained, containing a considerable amount of galena.

WHITE TAIL.

This claim, located in April, 1911, is in the southwest quarter of Section 36, Township 32 North, Range 36 East, about one-half mile northeast of Covada postoffice. The discovery is located 100 feet north of the south end-line. A shaft has been sunk to a depth of 10 feet on the vein, which is about 14 inches wide and consists of iron-stained quartz with some galena. The country rock here is granodiorite. The vein strikes North 30° West and dips 70° Northeast. A small side-vein lies a little to the east of this. A shaft about eight feet deep has been sunk upon it in granite. This vein seems to trend about North 80° East. Seventy-five feet west there is another opening upon the side-vein. The White Tail vein outcrops again at the north center end-line as a vein composed of quartz disseminated in a belt of granodiorite about 15 feet in width. Open trenches have been cut across it and show considerable galena impregnated through the mass. The country rock is entirely granodiorite. An assay of a sample taken from the shaft 150 feet west of the discovery shaft gives 0.01 oz. of gold, and 1.20 oz. of silver to the ton.

BLACK TAIL.

The Black Tail claim lies in the south central part of Section 36, Township 32 North, Range 36 East, a little over one-half

mile northeast of Covada postoffice. It was located in April, 1911. The country rock is entirely granodiorite. The discovery is situated 50 feet from the south center end-line. A shaft has been sunk on the vein to a depth of 12 feet. The vein is about four feet thick in places, but here and there seems to be only a silicified zone in the granodiorite. It strikes North 30° West and dips 70° Northeast. Several small cuts and pits have been made along the vein in the near vicinity. About 300 feet from the end-line and near the west side-line there is a narrow stringer of quartz about four inches wide containing some galena. An average sample from the discovery shaft on this claim yields through the assay a trace of gold and 0.20 oz. of silver to the ton.

BUTTERFLY.

The Butterfly claim is situated about one-half mile east of Covada postoffice and joins the Black Tail on the north. The discovery shaft of this claim is located about 200 feet north of the south end-line. The shaft is 13 feet deep and in granite. The vein, consisting of iron-stained quartz, varies in width from four inches to one foot and is nearly vertical. About 100 feet east of the discovery shaft a tunnel is being driven as a crosscut to the vein. At present it extends 200 feet and is entirely in quartzite. One hundred and twenty feet from the mouth a small, narrow vein of quartz was encountered. The main discovery vein has not yet been reached. About 25 feet southeast from the discovery shaft an open cut 12 feet long and six feet deep has been made in granodiorite, but no quartz vein was seen. The main contact between the granodiorite and quartzite is near the discovery shaft. Fifty feet south of the discovery an open cut 25 feet long and four feet deep has been made, exposing the main vein. The assay of an average sample from the discovery vein shows 0.01 oz. of gold and 0.30 oz. of silver per ton.

SUNSHINE.

This claim lies just east of and parallel to the Butterfly and a little less than one-half mile east of Covada postoffice. It was located in April, 1912. The discovery shaft lies 250 feet north

of the south center end-line and two shafts about 10 feet apart have been sunk in granodiorite to a depth of 10 feet each. The vein is quartz, about four feet wide, having a strike of North 15° East and a dip of 70° to the East. In places it seems to be merely a zone of silicified granodiorite. An open cut 10 feet long, four feet wide and six feet deep has been made 50 feet north from the south center end of the claim, exposing vein matter about two feet wide. The country rock is entirely granodiorite. The assay of an average sample from the discovery shows no gold and only a trace of silver.

I. X. L.

This claim lies in Section 1, Township 31 North, Range 36 East, about one-half mile southeast of Covada postoffice. It is now owned by James Hartwell of Covada. The discovery shaft on this claim is 100 feet south of the north center end-line. The country rock is quartzite. The vein consists of quartz and at this point is three feet wide, striking North 20° West with a nearly vertical dip. Seven hundred and fifty feet from the discovery shaft and 150 feet from the west side-line a crosscut tunnel has been driven 63 feet in a direction North 80° West to tap the vein. The assay from an average sample from the discovery shows 0.36 oz. of gold and 0.24 oz. of silver per ton.

SUNSET.

The Sunset claim was located in March, 1912, by T. B. Miller. It lies parallel to and on the east side of the I. X. L., a little over one-half mile east of Covada. The discovery shaft is situated 25 feet from the north center end-line and has been sunk to a depth of 14 feet in quartzite. The vein consists of small stringers of quartz. Small apophyses of granodiorite extend up into the quartzite near the contact, which is not far from the discovery shaft. This is the only development work upon the claim. The assay for an average sample from the discovery of this claim showed a trace of gold and 0.30 oz. of silver per ton.

OLD NELL.

This claim is situated in the northwest quarter of the south-east quarter of Section 36, Township 32 North, Range 36 East, about three-fourths of a mile northeast of Covada postoffice. The discovery lies 350 feet from the south central end-line. A shaft has been sunk seven feet in granodiorite exposing a vein of quartz. About 800 feet from the north end-line on the main vein a second open cut has been made about eight feet long and four feet deep. Stringers of quartz were encountered in quartzite. When this cut was first made it is said to have carried much native antimony. A tunnel has been started at a point 150 feet east of the center and 350 feet from the north center end running into the hill South 65° East for a distance of 25 feet. The country rock is silicified quartzite. This lies near the granodiorite contact and is referred to by the miners as a porphyry dike. A sample taken from the open cut in the center of the claim yielded, upon assaying, trace of gold and 0.20 oz. of silver per ton.

POLARIS.

This claim was located in July, 1903, by Henry Garrett and H. P. Stevenson. It is situated in the east central part of Section 36, Township 32 North, Range 37 East, about three-quarters of a mile east of Covada postoffice. The discovery shaft is located 584 feet south of the north end-line and has been sunk to a depth of 20 feet. A tunnel has been driven north and south towards the shaft. A large amount of trenching has been done just north of the shaft. About 75 feet west of the discovery is a shaft seven feet deep, sunk on a quartz vein eight inches in width, trending east and west and dipping vertically. The country rock is granodiorite. At a point North 20° East from the shaft a tunnel starts into the hill North 85° East and continues for 100 feet as a crosscut through granodiorite to tap the vein. Several other openings have been made on the vein by open cuts and pits. An average sample from this claim upon assaying showed a trace of gold and 0.20 oz. of silver to the ton.

BIG JOKER.

The Big Joker lies parallel to and just east of the Polaris, near the east line of Section 36, Township 32 North, Range 36 East. It was located in 1909 and is now owned by Mr. Messenger of Covada. The discovery is located 300 feet north of the south end-line in quartzite. A shaft has been sunk to a depth of 12 feet, showing a vein of iron-stained quartz about two feet wide, striking North 10° East and dipping 50° to the Southeast. Eighty feet in a direction South 40° East from the discovery there is a shaft eight feet deep, ten feet long and five feet wide in quartzite. The vein, which is a side lead, is three feet wide, trends North 80° West and dips 70° Southwest. There are 12 inches of good quartz containing galena and pyrite. The country rock is much silicified nearby, probably due to the proximity of the quartzite granodiorite contact. On the west side of the claim several pits have been sunk on a quartz vein with vertical dip. It averages 26 inches in width. Several shallow shafts have been sunk on a small, narrow vein in quartzite 300 feet from the south end-line. An open cut 25 feet long and 10 feet deep has been made in the granodiorite 300 feet from the north end-line in the west side. It cuts a pyrite-bearing quartz vein dipping 20° west. Forty feet east a shaft 10 feet long and four feet wide has been sunk to a depth of 10 feet in quartzite on a vein similar to the one just mentioned. This lies on the contact between the granodiorite and quartzite. Several openings have been made upon this contact vein.

KENTUCKY BELL.

The Kentucky Bell is now owned by J. C. Seaman of Covada. It is situated in the southeast quarter of Section 36, Township 32 North, nearly one mile east of Covada postoffice. The discovery lies 150 feet north of the south center end-line and is now caved in. Three hundred feet from the end-line is a 30-foot shaft sunk as a slope 70° East on the discovery vein, which is 18 inches wide and consists of iron-stained quartz. The country rock is quartzite. At the bottom of the shaft there is a short crosscut to the east. About 50 feet north of the slope on

the same vein there is an open cut showing the vein to have a width of 18 inches. The granite-quartzite contact lies a little to the west of the discovery. On the west side-line of the claim, 600 feet south of the northwest corner-stake, a crosscut tunnel starts into the hill North 80° East in quartzite. The granodiorite contact lies just west of the mouth. This tunnel intersects the vein at 400 feet and is extended 93 feet farther. The vein where tapped is six feet wide, consisting of quartz and gouge material. Drifts to the right and left extend about 25 feet in the direction North 20° East. Three hundred and twenty-five feet from the mouth a vein was encountered. On it a drift to the left runs North 18° West for 25 feet and to the right due south 15 feet. Several pits have been sunk on the vein at the surface.

THREE PINES.

This claim lies immediately south of the Old Nell. It is situated about three-quarters of a mile east of Covada postoffice in the southeast quarter of Section 36, Township 32 North, Range 36 East. The discovery shaft is 10 feet deep and sunk in granodiorite. The vein is composed of quartz with galena. It has a thickness of 16 inches, strikes north and south and dips 45° west. This shaft is located 100 feet south of the north center end-line. The assessment work for this claim has been done on the Kentucky Bell.

SILVER DOLLAR.

The Silver Dollar lies immediately south of the Kentucky Bell. It is situated in the northeast quarter of Section 1, Township 32 North, Range 36 East. The discovery shaft is 108 feet south of the north center end and has been sunk eight feet in granodiorite, showing a quartz vein trending north and south. The assessment work for this claim has been done on the Kentucky Bell.

SUMMIT.

The Summit claim lies in the southeast quarter of Section 36, Township 32 North, Range 36 East, east of and parallel to the Silver Dollar and Kentucky Bell. The discovery shaft is situated 270 feet north of the south center end-line. It is now caved in,

but shows a ledge of white quartz, iron-stained in places. Seventy-five feet north of the discovery is a shaft 15 feet deep in quartzite showing a vein of quartz carrying pyrite, antimony and galena. The bedding of the quartzite here is North 40° West with a vertical dip. On the east side-line 400 feet south of the northeast corner is a shaft 25 feet deep. The vein is six inches wide, strikes North 85° East and dips 70° Northwest. On the side-line 200 feet north from the southwest corner is a shaft 20 feet deep in quartzite. The Summit claim is 300 feet wide at the south end and 600 feet at the north.

SILVER CROWN NO. 3.

The Silver Crown No. 3 is a small triangular shaped claim lying in the northeast quarter of Section 1, Township 36 North, Range 36 East, nearly one mile east of Covada postoffice. It lies just east of and parallel to the Silver Dollar. It was located in 1909 and is now owned by Mr. Howe of Covada. The discovery shaft is situated 175 feet south of the north end-line and has been sunk to a depth of 12 feet in quartzite. The vein has an average width of six inches, strikes North 10° West and dips 70° Northeast. The gangue is quartz showing considerable galena. A sample from the discovery shaft shows upon assaying 0.02 oz. of gold and 0.60 oz. of silver to the ton.

SILVER CROWN NO. 2.

This claim lies just east of and parallel to Silver Crown No. 3, about one mile east of Covada postoffice. It was located in 1909 and is now owned by Mr. Howe of Covada. Considerable development work has been done. The discovery shaft is located 575 feet from the north center-line and has been sunk to a depth of 10 feet. Forty-five feet in the direction South 75° East from the shaft is the mouth of a tunnel which extends into the hill 85 feet in a direction North 75° West. Thirty feet from the shaft in a direction North 80° West is the surface opening of an upraise from the fifty-foot level. A short distance from the discovery shaft is the entrance to the main shaft reaching the 50-foot level. At the intersection of shaft and vein on the

50-foot level a drift extends to the left for 40 feet in the direction South 70° West. Here the vein dips 60° Northwest. At the face of the drift a vein four feet wide, trending North 15° West and dipping 45° Northeast was encountered. A drift has been run on this to the south for 10 feet and to the north for 20 feet and a raise has been made from it to the surface. A sample taken here assayed 0.04 oz. of gold and 16.10 oz. silver per ton. From the shaft on the 50-foot level a drift has been run to the right along the vein for 25 feet. The country rock is quartzite with a strike of North 15° West and a dip of 60° Northeast. The shaft extends 50 feet farther and at the 100-foot level some drifting has been done. At a point 150 feet from the north end-line of the claim and 100 feet east of the center-line an open cut 10 feet long by seven deep and four wide has been made in the quartzite.

SILVER CROWN NO. 1.

This claim lies just east of Silver Crown No. 2 on the steep slope leading down to the Columbia River in the northwest quarter of Section 6, Township 31 North, Range 37 East. It was located in 1909 and is now owned by Mr. Howe of Covada. The discovery shaft is situated 50 feet from the south end-line. It is 12 feet deep and has been sunk on a three-foot seam of quartz and gouge material. On the hillside 150 feet from the northeast corner and 50 feet from the side-line a tunnel has been run North 55° West for 125 feet as a crosscut through quartzite and limestone. A short distance from the mouth is a vein of quartz 12 inches wide. At the face a vein was encountered about 14 inches wide with a strike of North 15° West and a dip of 75° Southwest. Seventy-five feet south of the tunnel two open cuts have been made in the quartzite and limestone. About half way between the end lines and 100 feet from the east side-line a cut 15 feet long, ten feet deep and four feet wide has been made. The rock is quartzite with seams of quartz about four inches wide. Two similar cuts occur about 100 feet to the southeast. Here the vein strikes North 43° West, with

nearly vertical dip. It consists of 16 inches of solid quartz with some pyrite and antimony.

IDORA.

The Idora lies in the east central part of Section 1, Township 32 North, Range 36 East, and south of the Silver Dollar. It is now owned by James Hartwell. The discovery shaft, 300 feet from the south center end-line, has been sunk to a depth of nine feet in quartzite. The quartz vein is about four inches thick, strikes North 30° West and dips 45° Northeast. Scattered through it are grains of galena. It outcrops at intervals upon the surface. Two hundred feet from the west side-line and 300 feet from the north end-line a crosscut has been driven into the hill 60 feet in the direction North 80° East. At the face is a zone of silicified quartzite with stringers of quartz containing galena. The main vein has probably not been reached.

OHIO.

The Ohio claim lies just south of the center of Section 26, Township 32 North, Range 36 East, about one and one-half miles northwest of Covada postoffice. It is now owned by Mr. M. H. O'Connel of Covada. The discovery shaft is 200 feet from the southwest end-line and is in granodiorite, which is the country rock throughout the entire claim. A tunnel has been run for a distance of 150 feet in a direction South 70° West along a vein four inches wide and composed of solid quartz with pyrite and a little galena. This is said to be a side vein parallel to the main one of the claim.

DRUMMOND.

The Drummond lies parallel to and just south of the Ohio, a little less than one and one-half miles north of Covada postoffice. It is at present owned by Mr. M. H. O'Connel of Covada. The discovery shaft, 750 feet from the north end-line, has been sunk 10 feet and a vein of white quartz two feet wide is exposed, showing pyrite, galena and sphalerite. The country rock is granodiorite. About 50 feet south a tunnel has been run into

the mountain 95 feet as a crosscut in the direction North 30° West. At the face a drift runs 30 feet to the east and 11 feet to the west on a vein of crushed quartz. Pyrite and galena are quite abundantly scattered through the quartz. Several open cuts have been made at various places on the claim. A sample taken from the face of the drift in the tunnel yielded upon assaying 0.02 oz. of gold and 1.20 oz. of silver to the ton.

CHANCE.

This claim lies on the hillside just west of Covada Lake. The discovery shaft, situated 250 feet from the northeast end-line, has been sunk to a depth of 22 feet in granodiorite. The vein, composed of quartz, is eight inches thick, strikes North 40° East and dips 70° Southeast. This is the only opening on the claim except a small shaft eight feet deep, 100 feet to the southwest. An average sample from the discovery shaft showed upon assaying 0.02 oz. of gold and 1.60 oz. of silver to the ton.

ROYAL ANN NO. 1.

This claim is located in the southwest quarter of Section 26, Township 32 North, Range 36 East, a little over a mile northwest of Covada postoffice. It was located in 1904 and is now owned by C. C. Rohlfs of Covada. At a point 800 feet from the east end-line a crosscut tunnel extends southward 75 feet into the hill toward the vein. The country rock is granodiorite. At the face of the crosscut there are two parallel veins running approximately in an east-west direction and consisting of quartz rich in galena and pyrite. The veins together average about one foot in thickness, with a dip to the south and southwest. An assay of an average sample taken here showed 0.04 oz. of gold and 12.50 oz. of silver to the ton. Another tunnel, extending South 40° West, has been driven 110 feet. Fifty feet from the mouth a drift has been run along a vein to the left. To the right another extends 72 feet in the direction South 85° West. At the face of the crosscut a drift extends to the right and left for 25 feet in the direction South 40° East. The discovery shaft is on open cut 25 feet long, 15 feet deep and four feet wide.

The vein is eight inches wide with small stringers along the side. The gangue is quartz containing considerable amounts of galena, sphalerite, cerusite and pyrite. About 40 feet east of the discovery there is an open trench 30 feet long and six feet deep. The country rock is entirely granodiorite.

ROYAL ANN NO. 2.

This claim lies just south of Royal Ann No. 1. It was located in 1904 and is now owned by C. C. Rohlfs of Covada. The discovery shaft, located 50 feet from the east end-line, has been sunk 12 feet in granodiorite with gneissoid structure. The assessment work for this claim has been done on the Royal Ann No. 1.

ROYAL ANN NO. 3.

This claim lies about one mile to the northwest of Covada postoffice and a little to the southwest of Royal Ann No. 2. It also is owned by C. C. Rohlfs of Covada. The discovery shaft, 735 feet east from the west end-line, has been sunk 10 feet in granodiorite. The vein, which is six inches wide, consists of well mineralized quartz. An average sample from here yields upon assaying 0.02 oz. of gold and 3.20 oz. of silver to the ton. One hundred and fifty feet east of the discovery a shaft has been sunk on the vein to a depth of 40 feet. The country rock is granodiorite. The vein ranges from 10 to 16 inches in width, strikes North 70° East and dips 75° Northwest. A cabin is built over this shaft. One hundred and fifty feet from the west end-line and 150 feet from the south side-line there is a shaft 30 feet deep in granodiorite. The quartz vein is of the same character as before and contains considerable galena.

RELIANCE.

This claim lies just north of the Greasy Run, about 1,000 feet north of Covada. The 10-foot discovery shaft is situated 300 feet from the north end-line. The country rock is schistose quartzite near the granodiorite contact. The vein consists of quartz eight inches wide with a strike of North 80° West and a vertical dip. An average sample from the discovery shaft yields upon assaying a trace of gold and 0.20 oz. of silver to the ton.

SILVER PLUME.

This claim lies just west of the Greasy Run and about 1,000 feet northwest of Covada postoffice. It is now owned by Mr. J. M. Anderson of Covada. The discovery shaft is located 100 feet north of the south end-line. The country rock is schistose quartzite. The vein strikes north and south and dips 50° to the west.

SILVER SPAR.

This claim joins the south end of the Legal Tender claim of the Big Chief Group, and is about 1,500 feet north of Covada postoffice. It was located in 1907 and is now owned by Mr. A. M. Anderson of Covada. The discovery shaft, located 350 feet from the south end-line, has been sunk 12 feet in quartzite. The vein of quartz is 12 inches wide, strikes north and south, and has a vertical dip.

LEGAL TENDER.

This claim lies just west of Covada Lake on the slope of the ridge and about one-half mile north of Covada postoffice. It was located in March, 1910, and is now owned by A. M. Anderson of Covada. The discovery shaft is 250 feet from the north end-line and is eight feet deep. The vein consists of a mixture of quartz and mineralized country rock, about three feet wide and containing galena, pyrite and sphalerite. The vein strikes North 20° East and dips 60° Northwest. This claim lies against the east side-line of the Carbonate Chief claim, one of the Big Chief Group, which is patented.

LONE PINE.

This claim lies about one-half mile northwest of Covada postoffice. It was located in July, 1912, and is owned by Mr. Edward Sizemore of Covada. The discovery is 600 feet from the north center end-line. It is an open cut 10 feet long and eight feet deep, in quartzite. Outcrops of quartz show upon the surface.

BIG BUG

The Big Bug claim lies about one-half mile west of Covada in Section 35, Township 32 North, Range 36 East. It was located in 1907 and is now owned by Mr. H. G. Parmeter of Covada.

The discovery shaft is 400 feet northwest from the southeast end-line and is 20 feet deep in quartzite. The vein in the bottom of the shaft is six inches wide, strikes North 65° East and dips 45° Southeast. At a point 1,100 feet from the south center end-line a crosscut tunnel extends into the hill North 60° West, a distance of 50 feet. At the face a four-inch vein of pure quartz trending North 70° East and dipping vertically was encountered. An assay of an average sample taken showed a trace of gold and 0.40 oz. of silver per ton. Nearby there is an open cut 10 feet long and six feet deep. The country rock is quartzite and the vein, which is six inches wide, is the same as in the tunnel. Fifty feet from the discovery shaft in a North 60° West line there is a cut eight feet long and six feet deep showing the quartz vein to be eight inches wide.

COLORADO NO. 1.

This claim is about one mile north of Covada postoffice and joins the north end of the Silver Spray claim of the Advance Group. It was located in 1905 and is owned by Mr. M. H. McConnel of Covada. The discovery shaft is situated 300 feet north of the south center end-line on a steep hillside. The assessment work for this claim has been done on the Colorado No. 2.

COLORADO NO. 2.

The Colorado No. 2 lies parallel to and northwest of the Colorado No. 1. It is owned by Mr. M. H. McConnel of Covada. The discovery is an open cut 12 feet long and eight feet deep and located 100 feet from the south center end. Twenty-five feet to the northeast there is a slope eight feet deep on the vein, which is four feet wide with two feet of ore. Antimony and galena are common. Twenty-five feet farther is another shaft 12 feet deep on the same vein. The country rock here is quartzite. Several open cuts have been made on the vein for the entire length of the claim. At a point 25 feet from the west side-line and 100 feet from the southwest corner a tunnel has been driven South 55° East into the hill as a crosscut to tap the discovery vein. Two hundred and five feet from the mouth a small vein

two feet thick was encountered, which has been drifted upon for 50 feet. The discovery vein has not as yet been reached. The contact between the granodiorite and quartzite occurs here. An average sample taken from the tunnel 25 feet south of the discovery tunnel yields in the assay a trace of gold and 0.60 oz. of silver per ton.

BLACK HAWK.

This claim lies parallel to and on the north side of the Royal Ann No. 1, about one and one-quarter miles north of Covada postoffice. It was located in April, 1905, and is now owned by Mr. Kelley of Covada. At a point near the north side-line, 600 feet from the southeast corner of the claim, a tunnel has been driven South 35° West into the hill a distance of 60 feet on a vein of quartz eight inches wide with a vertical dip. The country rock is granite. On the southwest corner of the claim is an open cut 12 feet deep and 25 feet long. The vein exposed in it is a side lead about one foot wide and carrying a considerable amount of galena and antimony. Two hundred feet from the southwest end-line a tunnel has been driven on the discovery vein North 70° West, a distance of 80 feet. The vein is one foot wide and consists of white massive quartz containing galena, pyrite and sphalerite. An average sample from this vein assayed 0.03 oz. of gold and 3.30 oz. of silver per ton. A parallel tunnel 70 feet in length lies about 10 feet away.

JOKER.

This short claim, located in 1909, joins the west end of the Black Hawk. The discovery shaft is situated about 170 feet from the southwest end-line and has been sunk 10 feet in granodiorite on a quartz vein eight inches wide. The vein strikes North 70° West and has a vertical dip. An average sample from this vein yielded in the assay neither gold nor silver. At the east center end-line of the claim a cut 30 feet long has been made in the granodiorite, exposing the discovery vein one foot thick with a strike of North 70° West and a vertical dip.

DISCOVERY.

This claim is situated near the Black Hawk, about one and one-quarter miles northwest of Covada postoffice. The discovery is an open cut in granodiorite on a quartz vein which may be a continuation of the side vein of the Black Hawk. The cut is 10 feet deep and 15 feet long. The vein is about seven inches wide, strikes North 80° West and dips 70° Northwest. It is situated 200 feet from the southwest end-line.

LITTLE JAY.

This claim is situated in the southwest quarter of Section 26, Township 32 North, Range 36 East, about one mile northwest of Covada postoffice. The discovery shaft is in granodiorite 10 feet deep on a vein striking North 83° West and dipping vertically. The vein is eight inches wide. Two hundred feet from the west end-line is an open cut 10 feet long and eight feet deep in granodiorite exposing a quartz vein eight inches wide with a vertical dip and striking North 80° East. An average sample taken from the discovery shaft yielded in the assay a trace of gold and 0.20 oz. of silver to the ton.

CHEROKEE STRIP.

This claim is situated in the southwest quarter of Section 31, Township 32 North, Range 37 East, about one and one-half miles east of Covada. It was located in 1906 and is owned by Mr. L. G. Curry of Covada. The discovery shaft is located 150 feet from the north center end-line and is 12 feet deep. The vein strikes north and south and dips 80° to the east. The formation here consists of banded quartzite. The assay of an average sample taken here shows a trace of gold and 0.20 oz. of silver per ton. This claim is not in contest and no further examination was made on it.

NORTHERN LIGHT.

The Northern Light is situated in the northeast quarter of Section 31, Township 32 North, Range 37 East, one and three-fourths miles east from Covada. The discovery shaft, 10 feet

long and eight feet deep, is 500 feet from the south end-line, in a greatly crushed and sheared slate. The vein material is brown weathered quartz and clay gouge. Just under the discovery shaft is a tunnel driven into the hill North 45° West for 38 feet. Near the mouth the tunnel goes through gravel and sand horizontally bedded and of fluvial or glacial origin. It is probably a remnant of an old river bench. Slate is encountered 15 feet in from the mouth of the tunnel. The vein is greatly crushed and is in part crushed country rock. An average sample taken here showed in the assay a trace of gold and 0.20 oz. of silver to the ton.

SHOO FLY.

The Shoo Fly is situated in the northeast quarter of Section 36, Township 32 North, Range 36 East, about one mile northeast of Covada postoffice, and is now owned by G. W. Sizemore of Covada. The six-foot discovery shaft is in the center of the claim, in granodiorite. The vein extends North 40° East, dips 45° Northwest, and is 18 inches thick. Galena is fairly abundant. The contact between the granodiorite and quartzite is close by. 700 feet from the south end there is an open cut 25 feet long and 10 feet deep in quartzite, but near the granodiorite contact. A crosscut starting on the Polaris claim extends 165 feet into the Shoo Fly. Three hundred and fifty feet from the northeast corner of the claim and 70 feet from the sideline an open cut 30 feet long and four feet deep exposes a quartz vein trending North 40° East. Another tunnel starts on the Rosario and extends North 70° West 300 feet across the Robert E. Lee into the Shoo Fly. It cuts through 80 feet of granodiorite aplite, which is considerably mineralized. This claim is not in contest.

ROBERT E. LEE.

This claim lies in the northeast quarter of Section 36, Township 32 North, Range 36 East, about one mile northeast of Covada. The claim is owned by G. W. Sizemore of Covada. The ores in this claim are in a dike of granodiorite aplite. A tunnel runs into the hill North 80° East, a distance of 76 feet

through the aplite, in which are scattered irregular bunches and grains of stibnite. The assay of one sample taken here showed a trace of gold, 0.02 oz. of silver per ton and 57.35 per cent antimony. Another sample showed no gold, a trace of silver and no sulphides. A winze has been sunk in the tunnel and a vein eight feet wide was cut. In this there is eight inches of pure stibnite. The mouth of this tunnel is on the west side-line of the Robert E. Lee. The claim is not in contest.

LONGSTREET.

The Longstreet lies just north of the Robert E. Lee in the southeast quarter of Section 25, Township 32 North, Range 36 East. It was located in 1903 and is owned by the Longstreet Mining and Milling Company. This claim is not in contest and only a part of the workings were visited. Several buildings, including an assay shop, have been erected. Extending the length of this claim is a dike of aplite containing considerable amounts of stibnite scattered through it. A large number of tunnels and open cuts have been made to expose it.

KING FRACTION.

The claim joins the Oom Paul and Etta, and the Keystone Fraction. It was located in 1907 and now belongs to the Syndicate Group. The 30-foot discovery shaft is in granodiorite. The vein is one foot thick and probably a continuation of the Etta. It is quartz, runs east and west, and contains small grains of galena and pyrite. Several open cuts have been made elsewhere on the claim.

OOM PAUL.

The Oom Paul is situated in the southeast quarter of Section 27, Township 32 North, Range 36 East, about one and one-half miles northwest of Covada postoffice. It was located in 1900 and is owned by S. L. Magee of Spokane. Three hundred feet from the east end-line of the claim there is a dike of andesite trending nearly east and west. Near the east end-line there is a vein of quartz about four inches wide which is probably a continuation of the Black Hawk. Three hundred feet from the west end-line and on the center line a tunnel has been

run eastward 60 feet, cutting a vein which strikes North 80° East and dips 80° West. The vein is about six inches wide in a much decomposed granodiorite. Considerable galena is present with some pyrite. An open cut nearby, 15 feet long and eight feet deep, exposes the vein striking North 80° West and dipping 80° Northeast, and having a width of eight inches. Some galena is present. The discovery shaft is 50 feet deep and has been sunk on the vein.

ST. PATRICK.

The claim is parallel to and on the north side of the Oom Paul, one and one-half miles northwest of Covada postoffice. It was located in 1907 and is now owned by Mr. Kelly of Covada. The discovery shaft, which is 16 feet deep, is situated on the hillside above the mouth of the tunnel and 150 feet from the side-line. The vein is a mixture of quartz and talc three feet thick. The tunnel just referred to starts near the south side-line and 400 feet from the west line as a crosscut and extends into the hill North 55° West, a distance of 70 feet, but the vein in the discovery shaft has not been reached. One hundred and fifty feet west of the discovery, a shaft has been sunk on the vein in quartzite. The vein here is four inches wide, strikes North 80° East and dips vertically. It consists of quartz with galena and pyrite. An average sample, upon assaying, showed 0.03 oz. of gold and 2.00 oz. of silver per ton.

ETTA.

The Etta is a triangular shaped claim lying parallel to and just south of the Oom Paul, about one and one-quarter miles north of Covada postoffice. The discovery shaft is 60 feet deep. Thirty-five feet down a drift has been driven due west 15 feet on a vein trending east and west and dipping 70° north. On the 60-foot level at the bottom of the shaft another drift has been driven due north 20 feet along a vein. The country rock is granodiorite. About 50 feet west of the discovery shaft another shaft has been sunk six feet on a vein 14 inches wide containing galena and pyrite. An assay of an average sample taken here showed a trace of gold and 0.30 oz. of silver to the ton.

Near the west end and south of the claim a crosscut tunnel has been driven to tap the discovery vein. It extends into the hill North 40° West a distance of 35 feet in granodiorite and cuts a small side vein of quartz containing galena.

SEVERAL FRACTION.

The claim lies in the southeast quarter of Section 27, Township 32 North, Range 36 East, about one and one-quarter miles northwest of Covada postoffice. It is owned by G. A. Mathews of Covada. The discovery shaft is 20 feet deep and in granodiorite. The vein is four inches wide, strikes North 80° East and dips nearly vertically. The vein is quartz carrying galena and pyrite. Fifty feet away there are two shallow shafts, each six feet deep. Several open cuts have been made.

SILVER SPAR.

This claim is situated in the northeast corner of Section 27, Township 32 North, Range 36 East, nearly two miles northwest of Covada postoffice. It was located in January, 1907, and is a part of the Imperial Group. It is owned by G. E. Terpening of Covada. The discovery lies 400 feet north from the south end-line and is in granodiorite. Two hundred feet in the direction South 25° West from the discovery is a shaft 20 feet deep on a ledge in granodiorite. There are several open cuts in addition. The vein, about 18 inches wide, consists of calcite with some quartz.

GOOD ORE.

The claim lies in the southeast quarter of Section 22, Township 32 North, Range 36 East, about two and one-half miles northwest of Covada postoffice. It is now owned by G. E. Terpening of Covada. The discovery shaft is 10 feet deep in granodiorite. The vein strikes South 60° West, dips 60° Southeast and comprises a zone two feet wide of crushed and much altered quartz and country rock. A crosscut tunnel has been driven 140 feet toward the vein in the direction South 55° East. One hundred feet from the mouth a vein of quartz six inches wide was encountered. Several open cuts and short

tunnels have been made, and wherever the vein was cut the same strike, North 60° East, prevailed.

SEVERAL.

This claim lies due west of the Oom Paul in the south central part of Section 27, Township 32 North, Range 36 East. It is owned by G. E. Terpening of Covada. The discovery shaft, which is 12 feet deep, and in granodiorite, shows a vein one foot wide with well defined walls striking North 55° East and dipping 60° Southwest. A sample taken here yielded in the assay a trace of gold and 1.00 oz. of silver per ton. A tunnel has been driven as a drift on what is supposed to be the discovery vein a distance of over 360 feet. The country rock is entirely granodiorite.

BLACK THORN.

The claim is situated about one and one-half miles northwest of Covada postoffice in the southern part of Section 27, Township 32 North, Range 36 East, in Stray Dog Canyon. It is owned by the Black Thorn Mining Company. The discovery opening is a 15-foot tunnel running due north into the side of the canyon. The vein is six inches wide and dips 75° East. The assay of a sample taken here showed 0.04 oz. of gold and 1.40 oz. of silver to the ton. A tunnel has also been driven into the side of the hill toward the vein a distance of 285 feet. The first 200 feet passed through loose boulders of the talus slope. At the face, the vein is eight inches wide. The country rock is entirely granodiorite.

KEYSTONE.

This is one of the Keystone Group consisting of eight claims. It lies in the eastern part of Section 34 about one mile northwest from Covada postoffice, in Stray Dog Canyon. It is owned by G. A. Mathews of Covada. A tunnel has been driven as a drift on the Keystone claim 600 feet in the direction South 45° West. The country rock is quartzite. The vein is well defined, pitches 45° to the Northwest and varies in width from six inches to two feet. The vein is much crushed and contains galena, sphalerite, pyrite and chalcopyrite.

SYNDICATE.

This claim lies in the northeast quarter of Section 34, Township 32 North, Range 36 East, about one and one-third miles northwest of Covada postoffice. It is owned by J. W. Bartlett of Covada. The country rock is granodiorite. A tunnel has been driven, as a crosscut, 850 feet into the hill in the direction North 58° East. Six hundred feet from the mouth a small vein of very little importance was encountered.

DAN PATCH.

This claim is situated in the southwestern quarter of Section 13, Township 32 North, Range 36 East, about three and one-half miles north of Covada postoffice. It was located in May, 1910, and is now owned by L. G. Curry of Covada. The country rock is entirely quartzite and slate. Near the west end a tunnel has been driven into the hill North 25° East a distance of 54 feet along the vein. The vein pitches 30° to 45° to the northwest and has a total width of three feet, 16 inches of which is quartz. A sample taken from the face of this tunnel showed upon assaying 0.04 oz. of gold and 10.15 oz. of silver per ton. A sample taken from the gray talc here showed a trace of gold and 0.40 oz. of silver per ton. One hundred feet up the hill from the discovery tunnel there are several open cuts exposing a vein trending North 65° East and containing galena and sphalerite. A shaft has been sunk to a depth of 30 feet on a vein trending North 10° West and dipping 70° to the Southwest. It ranges from two to eight inches in thickness and is composed of quartz with some pyrite.

REN RICE.

This claim joins the east end-line of the Dan Patch and is about three and one-half miles north of Covada postoffice. It was located in 1910 and is owned by Mr. L. G. Curry of Covada. The 12-foot discovery shaft is in quartzite and shows a six-inch quartz vein somewhat crushed trending North 68° East. The assay of a sample taken here yielded a trace of gold and 0.30 oz. of silver per ton.

GREAT SCOTT.

The Great Scott lies just south of the Dan Patch, about three and one-half miles north of Covada postoffice. It was located in December, 1911, and is now owned by Mr. Messenger of Covada. The discovery shaft is eight feet deep. Nearby is another shaft nine feet deep with a quartz vein striking North 15° East and dipping 75° to the southeast. Several open cuts have been made. The country rock is entirely composed of quartzite and slate. A sample taken at the discovery shaft showed in the assay a trace of gold and 0.20 oz. silver per ton.

VICTOR.

This claim lies east of the Ren Rice, about four miles northeast of Covada postoffice. It was located in February, 1912. There is one shaft 40 feet deep and timbered. The vein at this point, consisting of yellowish stained quartz, strikes North 15° West and dips 70° to the Southwest. Nearby are several open cuts. The discovery shaft, situated 100 feet from the north end of the claim, is 8 feet deep and shows a vein striking North 15° West and dipping 75° Southwest. The country rock is quartzite. A short distance away is a tunnel 10 feet long. An average sample taken here showed upon assaying 0.01 oz. of gold and 0.50 oz. of silver per ton.

SAINT PAUL.

The Saint Paul joins the Victor and lies about four miles northeast of Covada postoffice. It was located in 1912. The 10-foot discovery shaft is situated 300 feet from the south end of the claim. Twenty feet away an open cut has been made. The country rock is quartzite. The vein, which is the same as that on the Victor claim, strikes North 20° West and dips 75° Southwest. It consists of one foot of solid quartz and four inches of crushed wall rock. An average sample taken here showed in the assay a trace of gold and 0.20 oz. of silver per ton.

JAY BIRD.

This claim lies on the north side of Rattlesnake Mountain, three miles from Covada postoffice. It was located in August,

1904, and is owned by Ira B. Gifford of Inchelium. It joins the Rattlesnake claim on the north end in Section 25. A tunnel has been driven along the vein South 36° East, a distance of 20 feet. The vein, composed of quartz, is four inches thick, strikes north and south, and dips 70° West. This claim is one of a group and the assessment work has been largely done on another claim.

SAINT PAUL.

Saint Paul claim lies on the north side of Rattlesnake Mountain, about two miles northeast of Covada postoffice, on Theodore Berjue's farm. It was located in May, 1911. The discovery shaft is 100 feet south from the north end-line. It has been sunk 10 feet in quartzite on a well-defined eight-inch quartz vein, which strikes North 55° East and dips 75° Southeast. Galena and pyrite are scattered through it. About one foot of the wall rock is well mineralized.

LAUREL.

The Laurel is situated on the north side of Rattlesnake Mountain. The discovery is a small open cut in limestone and quartzite. No very well defined vein was seen, although an irregular seam of quartz extends in various directions through it. The formation strikes North 10° West and dips 60° Northeast.

RATTLER.

This claim is situated on the north side of Rattlesnake Mountain. The discovery tunnel starts 200 feet from the north center end-line and extends South 25° West for 95 feet. At the face there is a vein of much crushed quartz, almost three feet wide. The country rock is quartzite. The assay of an average sample taken here shows a trace of gold and 0.20 oz. of silver per ton. The south end of the claim extends up the mountain side.

ALGONKIAN.

This claim lies on a flat, well-timbered area, one-half mile northwest of Rattlesnake Mountain and about two and one-half miles northeast of Covada postoffice. It was located in 1911 and is now owned by Mr. A. M. Anderson of Covada. The

discovery shaft lies 100 feet west of the east end-line. It is eight feet deep and nearby is an open cut or trench. The country rock is quartzite. The vein, which is about six inches thick, strikes east and west and dips vertically. The assay of an average sample taken from the discovery claim shows 0.06 oz. of gold and 8.20 oz. of silver per ton.

STRAY DOG MINE.

This group of five claims lies in the west half of Section 27, Township 32 North, Range 36 East, two miles northwest of Covada postoffice. It is owned by the Stray Dog Mining Company. A long crosscut has been driven into the hill on the west side of Stray Dog Canyon. Some distance in from the mouth a vein of quartz was encountered and a drift was made upon it. This vein strikes North 20° East, dips 75° Northwest, has a width of six inches, and contains a considerable amount of galena and pyrite. A few hundred feet farther in another vein was encountered and a drift made along it. The vein varies from two to five feet in width and contains galena, pyrite, sphalerite and a little sylvanite. The vein strikes North 30° East and dips 80° to the Northwest. An upper crosscut tunnel has been driven and the two are connected by an upraise. The country rock is granodiorite. This group is not in contest and the investigation was only superficial.

IMPERIAL.

This claim was located in 1903 and is owned by Messrs. Messenger and Terpening of Covada. It lies a little over two miles northwest of Covada postoffice. A tunnel has been opened west of the west end-line and extends South 75° East as a crosscut for 204 feet. Forty feet from the face there is a vein three inches wide, trending north and south and dipping vertically. The vein towards which the tunnel is being run is estimated to be 30 feet from the face. The rock is granodiorite. This claim is not in contest.

CAPTAIN.

The Captain claim was formerly known as the Gold Cup. It lies just west of Stray Dog Canyon in the northwest quarter

of Section 27, Township 32 North, Range 36 East. It was located as the Captain in January, 1912. A tunnel has been driven as a crosscut North 45° West a distance of 40 feet through granodiorite. At the face a vein of calcite occurs, much twisted and broken. Twenty feet above a slope has been sunk on a vein striking east and west and dipping 45° to the South. It is six feet wide and a jumbled mass of calcite and country rock. This claim is not in contest.

WHITE ROSE.

This claim is situated in the northeast quarter of Section 3, Township 32 North, Range 36 East, nearly three miles northwest of Covada. The discovery shaft is near the center of the claim, in quartzite, but close to the contact with the granodiorite. Eight feet away from the discovery there is a shaft 60 feet deep and a 20-foot drift extends east from it. The vein strikes North 20° East and dips vertically.

DIXIE QUEEN.

This claim lies just southwest of the New York claim, in Section 33, Township 32 North, Range 36 East. The discovery shaft is located 700 feet from the north end in quartzite. It exposes a quartz vein two feet wide, striking North 20° East and dipping nearly vertically. A short distance west is another small shaft 10 feet deep.

RESERVE.

This claim is situated in the southeast quarter of Section 32, Township 32 North, Range 36 East, about three miles due west of Covada postoffice. It was located in March, 1905, and is now owned by Mr. L. G. Curry of Covada. The discovery shaft, which is 100 feet from the north end, is 48 feet deep and at the bottom a drift has been run a distance of 75 feet. The country rock is quartzite. The vein consists of seven feet of crushed country rock and three feet of white quartz, containing galena and pyrite. It strikes North 45° East and dips to the northwest. About half way between the end lines on the west side is a ledge of solid white quartz dipping 45° West. An average

sample from the discovery shaft shows, in the assay, 0.04 oz. of gold and 7.80 oz. of silver to the ton.

RUBY.

This claim lies just east of the Reserve and is a part of this group. It is owned by Mr. L. G. Curry of Covada. The 12-foot discovery shaft is in slaty quartzite. The assessment work for the claim has been done on the Reserve claim.

SANTA CLAUS.

The Santa Claus claim lies just west of the Reserve and is a part of the same group. The discovery shaft is a slope 40 feet in length and sunk on a quartz vein striking North 20° East and dipping 50° to the Northwest. The vein is about three feet thick.

NEGLECTED.

The Neglected claim is a part of the Reserve Group and joins the northeast end-line of the Santa Claus. The discovery shaft is 20 feet deep and is in quartzite. The vein strikes North 20° East with a vertical dip. It is about eight inches wide and contains some pyrite and galena. The assay of an average sample taken here shows no gold and only a trace of silver.

MONTANA.

This claim lies in the central part of Section 28, Township 32 North, Range 36 East. It is now owned by Messrs. Fish and Pea. The country rock is granodiorite. A shaft has been sunk to a depth of 90 feet and from the foot a drift has been run to the east. Twenty-five feet farther east a second shaft has been sunk to a depth of 20 feet.

ADMIRAL.

The Admiral claim is situated in the northeast quarter of Section 28, Township 32 North, Range 36 East. It is owned by Mr. Joseph Hartwell of Covada. At the discovery a slope has been sunk 30 feet on a vein eight inches thick. Another shaft some distance to the east is 20 feet deep. The country rock is granodiorite.

SNOWSTORM.

This claim was formerly known as the White Swan. It is situated in the east central part of Section 28, Township 32 North, Range 36 East, about two and one-half miles northwest of Covada postoffice. It was located in April, 1912, and is now owned by Messrs. Sizemore and Mathews of Covada. The discovery shaft is 500 feet from the east center end and has been sunk 10 feet in the granodiorite. The vein is very narrow, strikes North 80° East and dips 65° to the Southeast. Fifty feet west of the discovery is a shaft 15 feet deep. Here the vein strikes North 80° East and dips 45° Southeast. The assay of a sample taken here shows a trace of gold and 0.30 oz. of silver to the ton. Some distance from here a crosscut tunnel has been driven 600 feet to the vein and a drift of 100 feet made along the vein. From here both a winze and upraise have been made, the latter to the surface. The vein strikes North 30° East, and dips 70° to the Northwest. The country rock is granodiorite.

TRUAX.

The Truax claim lies in the southwest quarter of Section 22, Township 32 North, Range 36 East, about two and one-half miles from Covada postoffice. It is owned by Mr. M. H. O'Connell of Covada. The discovery shaft lies in the center of the claim. There are two veins here lying close together which have been exposed in a series of open cuts. The country rock is granodiorite, into which a crosscut tunnel has been driven South 25° East a distance of 143 feet to tap the vein.

DEAD SHOT.

This claim belongs to the Golden Treasure Company and is situated about two miles northwest of Covada. There are two veins on the claim. On one of these a tunnel has been driven a distance of 20 feet along what is supposed to be an extension of the Black Thorn vein. The other vein trends North 15° East through the granodiorite and has a width of one foot.

JULIET.

This claim was formerly known as the Little Tom, but was relocated by George Eves as the Juliet. It lies about two miles northwest of Covada postoffice. The discovery shaft is about eight feet deep and exposes two intersecting veins of quartz carrying considerable antimony. The assay of a sample taken here shows 0.02 oz. of gold and 3.40 oz. of silver to the ton. Four other openings have been made.

NEW YORK.

The claim lies in the north central part of Section 23, Township 32 North, Range 36 East, about two and one-half miles northwest of Covada postoffice. The country rock is granodiorite. One shaft has been sunk to a depth of 40 feet on a vein of quartz one foot wide and carrying galena, pyrite and a few specks of ruby silver. A building has been erected over the mouth of the shaft, and an engine for hoisting installed. Five hundred feet away a second shaft has been sunk, but is now filled with water. It is said to be 60 feet deep. The claim is not in contest.

RED CHIEF.

This claim is situated in the west central portion of Section 34, Township 32 North, Range 36 East, about two miles northwest of Covada postoffice. The discovery shaft, which lies in the middle of the claim, has been sunk on the vein to a depth of 25 feet. The vein strikes North 50° East, dips 60° Southeast and is four feet wide; 16 inches of this is solid white quartz and the remainder crushed wall rock mineralized with pyrite and galena. The country rock is granodiorite, although the quartzite contact is not far away. There are two smaller shafts on the claim and one tunnel which has been driven as a crosscut South 50° West, a distance of 25 feet.

VERNIE.

The Vernie claim lies in the center of Section 34, Township 32 North, Range 36 East. It was located in 1899 by H. Garrett and W. A. Pea. The country rock is quartzite, but it lies near the granodiorite contact. One tunnel has been driven

South 65° West a distance of 50 feet on a vein dipping 60° Southeast, and having a width of four feet. In places the quartz is impregnated with pyrite, galena and sphalerite. Seventy-five feet west of the tunnel is located the discovery shaft, 10 feet deep. Three hundred feet from the tunnel is another shaft about 40 feet deep.

GRAND VIEW.

This claim lies in Section 3, Township 31 North, Range 36 East, about two miles due west of Covada postoffice. It belongs to the Silver Queen Group, and is owned by Mr. J. C. Seaman of Covada. The country rock is quartzite and slate. A shaft has been sunk to a depth of 80 feet and at the 30-foot level a drift has been driven south 10 feet. The vein strikes North 40° East, dips 70° Southeast and has a width of about four feet. The gangue is quartz with some galena and a little sylvanite. The claim is not in contest.

LAURA S.

This claim was located March 1, 1913, and is now owned by Mr. H. A. Pea and E. J. Sparling. It lies about two miles west of Covada postoffice. The claim was formerly known as the Ada. The discovery shaft is 800 feet from the east end-line and has been sunk to a depth of 40 feet in quartzite. It was filled with water at the time of examination, but the ore lying on the dump at the mouth of the shaft was quartz containing galena, pyrite and many small particles of sylvanite.

DEWEY.

This claim was located in January, 1911, and is owned by Mr. J. Seaman of Covada. It is situated about one and one-half miles southwest of Covada postoffice. The country rock is quartzite and slate cut in places by a dike of andesite. The discovery tunnel is 800 feet from the north end-line of the claim and extends into the hill South 60° West a distance of 25 feet. The vein is about eight inches wide and lies nearly flat, but is probably not in place. A tunnel just above Mr. Seaman's house in the same draw extends into the hill North

60° West a distance of 100 feet, but is in gravel and sand the entire distance. An average sample from the discovery tunnel upon assaying shows no gold and a trace of silver per ton.

SYRACUSE.

The Syracuse claim lies on Reister Mountain about two miles southwest of Covada postoffice. The country rock is quartzite and slate. A 30-foot discovery shaft has been sunk on the vein, which is six feet wide and consists of crushed country rock containing quartz. It strikes North 30° East and dips 60° Northeast. The assay of an average sample taken here shows a trace of gold and 0.20 oz. of silver to the ton. Near the end of Reister Mountain a dike of andesite outcrops, striking north and south and having a width of 20 feet.

PERRY.

The Perry claim is situated about one mile northeast of Covada postoffice in the northeast quarter of Section 36, Township 32 North, Range 36 East. It is now owned by Mr. Joseph Hartwell of Covada. The claim extends north and south. A slope has been sunk to a depth of 42 feet on an east-west vein, supposed to be a continuation of the Toga. It extends down to the north at an angle of 45°. The vein is four feet wide and consists of white quartz, well mineralized. The assay of an average sample taken here shows neither gold nor silver. Twenty-five feet to the north is an open cut on the north-south vein upon which the claim is located. It is rich in antimony and resembles that on the Longstreet vein. The quartzite contact lies nearby. One hundred feet north there is a 10-foot tunnel. Three hundred feet farther north on the hill slope is another open cut in quartzite. It seems to be a zone of mineralized country rock adjacent to the contact. Twenty-five feet north of this cut is a 10-foot tunnel run as a crosscut to this mineralized zone. Several other open cuts have been made at intervals.

SILVER LEAF.

There are several claims in this group. They are not in contest and only a hasty examination was made. The Silver

Leaf lies on the south side of Rattlesnake Mountain in Section 30, Township 32 North, Range 37 East, about two miles northeast of Covada. It is owned by the Silver Leaf Mining Company of Covada. A tunnel has been driven in a distance of 242 feet through quartzite to the face. Some distance to the west a large opening has been made in the side of the mountain. The country rock is quartzite and highly silicified. One zone is mineralized with quartz, galena and sphalerite. It is said to assay high in silver. The vein as well as formation strikes north and south with vertical dip. At the bottom of the glory hole a shaft has been sunk 30 feet on the vein. Near the base of the shaft the vein is locally cut by a fault. Sphalerite is abundant. The tunnel on this claim is 350 feet north of the south center end-line.

BUFFALO.

The Buffalo claim lies on the slope of Columbia River east of the Ivanhoe Group. It is owned by Mr. Thompson of Covada. Two ledges are found in the slaty schist and calcareous quartzite of the claim. The discovery is close to the river on a vein striking North 80° West and dipping 45° to the Northeast, and having a width of two feet. The assay of an average sample taken here shows a trace of gold and 0.20 oz. of silver to the ton.

ROSARIO.

The Rosario lies in the northwest corner of Section 31, Township 32 North, Range 37 East, a little over one mile northeast of Covada postoffice. It is owned by Mr. George Terpening of Covada. At the discovery a crosscut tunnel has been driven North 70° West a distance of 320 feet. Farther north on the claim another tunnel has been driven in North 60° West a distance of 50 feet on a zone of crushed and mineralized country rock.

GUIN MINE.

This property consists of ten claims located in Section 11, Township 32 North, Range 36 East. They are the Guin, Sunnyside, Homestead, Wizard, Big Pet, Missing Link, Hall

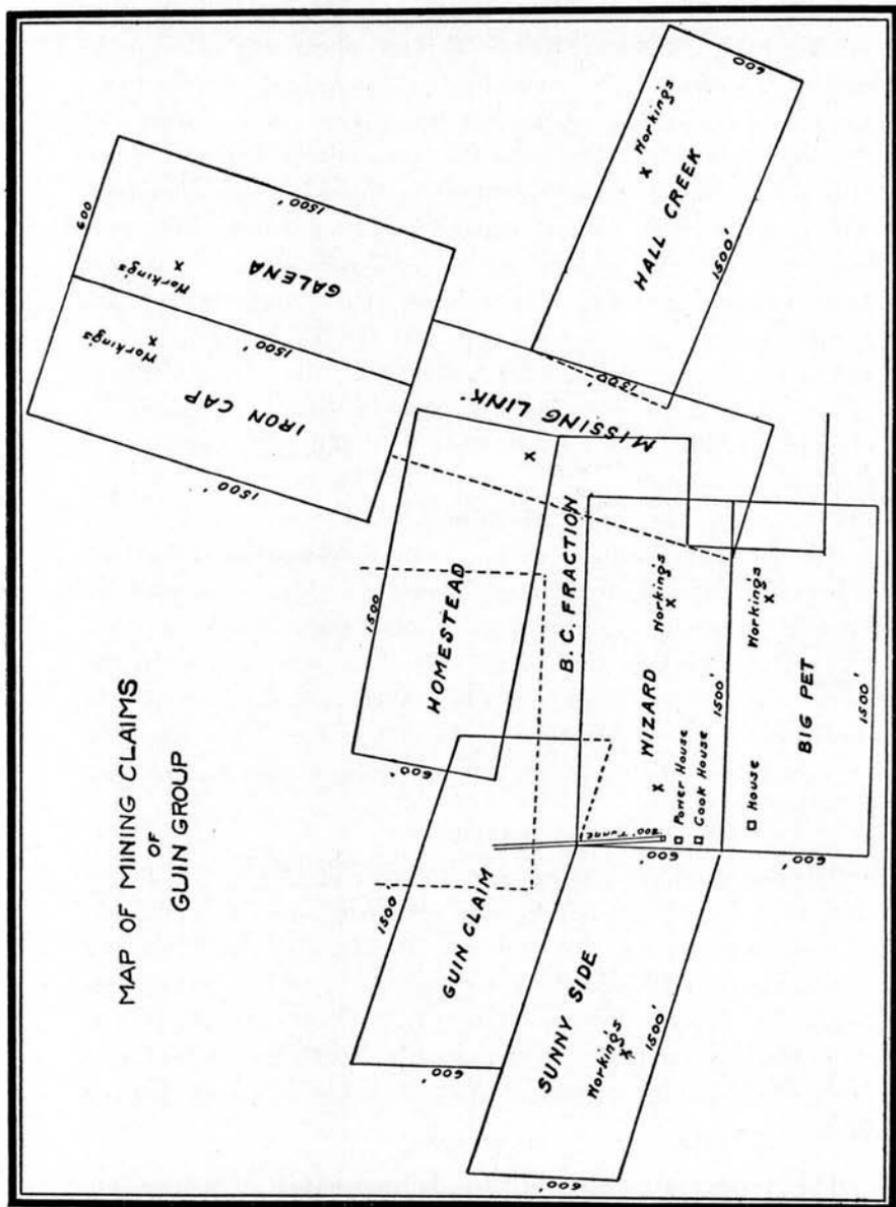


FIG. 3. Map showing mining claims and underground workings of the Guin Mine.

Creek, Galena, Iron Cap and B. C. Fraction. Considerable development work has been done on this property and chiefly on the Wizard and Guin claims. A crosscut tunnel starts near the west center end-line of the Wizard claim and extends a distance of 800 feet into the Guin claim. Four hundred feet from the mouth a vein was encountered striking North 10° East and dipping 20° to the Southeast. Drifts have been made to the left and right. On the right-hand drift a slope has been sunk on the vein a distance of 180 feet on a 45° slope. The vein in the bottom is about 10 feet wide and consists of white quartz. The country rock is quartzite. Assays of two average samples taken here showed in one case 0.08 oz. of gold and 34.50 oz. of silver; and in the other 0.07 oz. of gold and 25.50 oz. of silver to the ton.

On the Guin claim a shaft has been sunk on the vein to a depth of 150 feet. There are 250 feet of workings on the 130-foot level, 250 feet on the 150-foot level and 100 feet on the 100-foot level. The vein is six feet wide on the 100-foot level.

On the Missing Link a quartz vein outcrops in quartzite and upon it a 10-foot shaft has been sunk. On the Galena claim a shaft has been sunk to a depth of 17 feet on a quartz vein three feet wide. It is well mineralized with galena and pyrite. There are also two tunnels 100 and 150 feet in length driven as crosscuts to the vein. Open cuts and short tunnels have been opened on the other claims, but the greater part of the assessment work for the group has been performed on the Wizard and Guin claims. At the time of the examination two shifts of men were working on the vein in the slope.

BIG CHIEF GROUP.

The Big Chief Group consists of six claims situated west and northwest of Covada Lake in Section 35, Township 32 North, Range 36 East. They are the Ripsaw, Jennie C., Little Pet, Apex, Carbonate Chief and Legal Tender. The group was formerly known as the Apex. It was located in 1898 by Edgar Balling and is now owned by the Big Chief Mining Company, of which J. C. Harclerod of Spokane is president. This group

is not in contest and because of insufficient time no extensive investigation of the properties was undertaken. Several long crosscut tunnels have been driven in the quartzite to the vein. In addition, shafts have been sunk from which at different levels drifts have been driven on the veins. A considerable amount of development work has since been done on this property.

METEOR GROUP.

The Meteor Group of claims are situated about three miles due west of Covada postoffice in Section 33, Township 32 North, Range 36 East. There are four claims altogether, viz., the Peoria, Ohio Fraction, Meteor and Comet. These were located in 1900 by Edgar Balling and are now owned by the Meteor Mining Company, of which W. A. Halteman of Spokane is manager. A large amount of development work has been done but as the group is not in contest no extensive examination was made. One long tunnel has been driven on the Meteor claim on a quartz vein over three feet wide. This has been drifted upon and stoping has been carried upwards for some distance toward the surface. The country rock is quartzite. On the surface several openings have been made and a deep shaft sunk with considerable drifting at different levels.

Other properties in this district upon which a considerable amount of work has been done, but which were not visited, are the Cold Springs Group, the Orion Group, the Southern Cross and the Steinger Groups. None of these are in contest and two of them are patented.

INDEX.

	<i>Page</i>
Acknowledgments	7
Admiral Mine	76
Advance Mining Co.....	44
Algonkian Mine	73
Andesite dikes	27
Aplite	26
Baneroft, Howland, Report by.....	12
Big Bug Mine.....	62
Big Chief Group.....	83
Big Joker Mine.....	55
Black Hawk Mine.....	64
Black Tail Mine.....	51
Black Thorn Mine.....	70
Blue Bird Mine.....	48
Buffalo Mine	81
Butterfly Mine	52
Calcite	38
Captain Mine	74
Chalcopyrite	39
Chance Mine	60
Character of the ore bodies.....	35
Cherokee Strip Mine.....	65
Climate	16
Colorado No. 1 Mine.....	63
Colorado No. 2 Mine.....	63
Covada formation	21
Dan Patch Mine.....	71
Dead Shot Mine.....	77
Dewey Mine	79
Distribution of the ore bodies.....	35
Dixie Queen Mine.....	75
Drainage	14
Drummond Mine	59
Economic geology	33
Etta Mine	68
Galena	39
Genesis of the ores.....	40
Geological History	30
Glaciation	16
Gold	40
Good Ore Mine.....	69
Grand View Mine.....	79
Granodiorite porphyry	27
Greasy Run Mine.....	50
Great Scott Mine.....	72
Guin Mine	81
History of mining.....	33
Hodges, L. K., Report by.....	10
Idora Mine	59
Imperial Mine	74
I. X. L. Mine.....	53
Jay Bird Mine.....	72

	<i>Page</i>
Joker Mine	64
Juliet Mine	78
Kentucky Bell Mine.....	55
Keystone Mine	70
King Fraction Mine.....	67
King Solomon Mine.....	49
Lakeview Fraction Mine.....	47
Landes, Henry, Report by.....	11
Laura S. Mine.....	79
Laurel Mine	73
Legal Tender Mine.....	62
Limonite	39
Literature	10
Little Jay Mine.....	65
Lone Pine Mine.....	62
Longstreet Mine	67
Lyon, D. A., Report by.....	11
Mathews, G. A., Report by.....	11
Mayflower Mine	47
Metaline District	12
Meteor granodiorite	23
Meteor Group	84
Mineralogy	38
Mining World, Report in.....	11
Molybdenite	40
Montana Mine	76
Neglected Mine	76
New York Mine.....	78
Northern Light Mine.....	65
Ohio Mine	59
Okanogan Highlands	14
Old Nell Mine.....	54
Oom Paul Mine.....	67
Perry Mine	80
Physiography	14
Pilgrim Mine	48
Plymouth Rock Mine.....	48
Polaris Mine	54
Pyrargyrite	40
Pyrite	39
Pyroxenite	28
Quandary Mine	49
Quartz	38
Quaternary	29
Rattler Mine	73
Red Chief Mine.....	78
Reliance Mine	61
Ren Rice Mine.....	71
Republic District	12
Reserve Mine	75
Robert E. Lee Mine.....	66
Rosario Mine	81
Royal Ann No. 1 Mine.....	60
Royal Ann No. 2 Mine.....	61
Royal Ann No. 3 Mine.....	61
Ruby Mine	76
Saint Patrick Mine.....	68
Saint Paul Mine.....	72

	<i>Page</i>
Saint Paul Mine.....	73
Several Mine	70
Several Fraction Mine.....	69
Shape of veins.....	36
Shipment of the ores.....	34
Shoo Fly Mine.....	66
Silver Crown No. 1 Mine.....	57
Silver Crown No. 2 Mine.....	57
Silver Crown No. 3 Mine.....	57
Silver Dollar Mine.....	56
Silver Leaf Mine.....	80
Silver Plume Mine.....	50
Silver Plume Mine.....	62
Silver Spar Mine.....	62
Silver Spar Mine.....	69
Snowstorm Mine	77
Silver	40
Sphalerite	40
Stibnite	39
Stray Dog Mine.....	74
Strike and pitch of veins.....	36
Structure	29
Summit Mine	56
Sunset Mine	53
Sunshine Mine	52
Sylvanite	40
Syndicate Mine	71
Syracuse Mine	80
Three Pines Mine.....	56
Thyng, Wm. S., Report by.....	11
Truax Mine	77
Topography	14
Treatment of the ores.....	34
Umpleby, J. B., Report by.....	12
Vegetation	17
Vernie Mine	78
Victor Mine	72
White Rose Mine.....	75
White Tail Mine.....	51

PUBLICATIONS

OF THE

WASHINGTON GEOLOGICAL SURVEY.

Volume 1.—Annual Report for 1901. Part 1, Creation of the State Geological Survey, and An Outline of the Geology of Washington, by Henry Landes; part 2, The Metalliferous Resources of Washington, Except Iron, by Henry Landes, William S. Thyng, D. A. Lyon and Milnor Roberts; part 3, The Non-Metalliferous Resources of Washington, Except Coal, by Henry Landes; part 4, The Iron Ores of Washington, by S. Shedd, and the Coal Deposits of Washington, by Henry Landes; part 5, The Water Resources of Washington, by H. G. Byers, C. A. Ruddy and R. E. Heine; part 6, Bibliography of the Literature Referring to the Geology of Washington, by Ralph Arnold. Out of print.

Volume 2.—Annual Report for 1902. Part 1, The Building and Ornamental Stones of Washington, by S. Shedd; part 2, The Coal Deposits of Washington, by Henry Landes and C. A. Ruddy. Postage 20 cents. Address, State Librarian, Olympia, Washington.

Bulletin 1.—Geology and Ore Deposits of Republic Mining District, by Joseph B. Umpleby. Bound in cloth; price, 35 cents. Address, State Librarian, Olympia, Washington.

Bulletin 2.—The Road Materials of Washington, by Henry Landes. Bound in cloth; price, 60 cents. Address, State Librarian, Olympia, Washington.

Bulletin 3.—The Coal Fields of King County, by Geo. W. Evans. Bound in cloth; price, 75 cents. Address State Librarian, Olympia, Washington.

Bulletin 4.—The Cement Materials of Washington, by S. Shedd and A. A. Hammer. In preparation.

Bulletin 5.—Geology and Ore Deposits of the Myers Creek and Oroville-Nighthawk Districts, by Joseph B. Umpleby. Bound in cloth; price, 50 cents. Address, State Librarian, Olympia, Washington.

Bulletin 6.—Geology and Ore Deposits of the Blewett Mining District, by Charles E. Weaver. Bound in cloth; price, 50 cents. Address, State Librarian, Olympia, Washington.

Bulletin 7.—Geology and Ore Deposits of the Index Mining District, by Charles E. Weaver. Bound in cloth; price, 50 cents. Address, State Librarian, Olympia, Washington.

Bulletin 8.—Glaciation of the Puget Sound Region, by J. Harlen Bretz. Bound in cloth; price, 60 cents. Paper cover; price, 35 cents. Address, State Librarian, Olympia, Washington.

Bulletin 9.—The Coal Fields of Kittitas County, by E. J. Saunders. In preparation.

Bulletin 10.—The Coal Fields of Pierce County, by Joseph Daniels. In preparation.

Bulletin 11.—The Mineral Resources of Washington, with statistics for 1912, by Henry Landes. In preparation.

Bulletin 12.—Bibliography of Washington Geology and Geography, by Gretchen O'Donnell. Paper cover; price, 25 cents. Address, State Librarian, Olympia, Washington.

Bulletin 13.—A Preliminary Report on the Tertiary Formation of Western Washington, by Charles E. Weaver. In preparation.

Bulletin 14.—The Quincy Valley Irrigation Project, by Henry Landes, A. W. Mangum, H. K. Benson, E. J. Saunders, and Joseph Jacobs. Paper cover; price, 20 cents. Address, State Librarian, Olympia, Washington.

Bulletin 15.—A Preliminary Report on the Tertiary Paleontology of Western Washington, by Chas. E. Weaver. Paper cover; price, 20 cents. Address, State Librarian, Olympia, Washington.

Bulletin 16.—Geology and Ore Deposits of the Covada Mining District, by Charles E. Weaver. Paper cover; price, 25 cents. Address, State Librarian, Olympia Washington.

PUBLICATIONS OF THE U. S. GEOLOGICAL SURVEY, IN CO-OPERATION WITH THE WASHINGTON GEOLOGICAL SURVEY.

(For copies of these publications address the Director, U. S. Geological Survey, Washington, D. C.)

Topographic Maps of the Following Quadrangles: Mount Vernon, Quincy, Winchester, Moses Lake, Beverly, Red Rock and Cedar Lake. Price, 10 cents each.

Water Supply Paper No. 253: Water Powers of the Cascade Range, Part I, Southern Washington.

Water Supply Paper No. 313: Water Powers of the Cascade Range, Part II. Cowlitz, Nisqually, Puyallup, White, Green, and Cedar Drainage Basins.

Water Supply Paper No. . . . : Water Powers of the Cascade Range, Part III. In preparation.

Water Supply Paper No. 272: Surface Water Supply of the United States, 1909. Part XII, North Pacific Coast.

Water Supply Paper No. 292: Surface Water Supply of the United States, 1910, Part XII, North Pacific Coast.

Water Supply Paper No. 312, 1911. In preparation.

Water Supply Paper No. 332, 1912. In preparation.

PUBLICATIONS OF THE U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF SOILS, IN CO-OPERATION WITH THE WASHINGTON GEOLOGICAL SURVEY.

(For copies of these publications address one of the members of congress from Washington.)

Reconnaissance Soil Survey of the Eastern Part of the Puget Sound Basin.

Reconnaissance Soil Survey of the Western and Southern Parts of the Puget Sound Basin.

Reconnaissance Soil Survey of Southwestern Washington.

Reconnaissance Soil Survey of the Quincy Area.