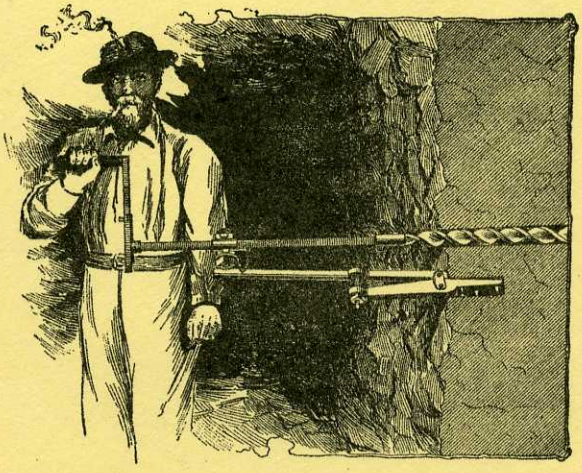
Mining in Eastern & Central Washington



Ed. by L.K. Hodges

1897

Mining in Eastern & Central Washington

A HISTORY OF THE EARLIEST MINING CLAIMS IN THE FOLLOWING AREAS: The Cascade -- Slate Creek -- Thunder Creek -- Ruth Creek -- Chico Tin Mines -- Gold Creek -- Cle-Elum -- The Icicle -- The Swauk -- Wenatchee -- Peshastin & Negro Creeks -- Levenworth -- Lake Chelan -- Stehekin District -- Methow -- Twisp -- Salmon River -- Okanogan Lake -- Palmer Mountain -- The Colville Reservation -- Northport -- Colville -- Cedar Canyon -- Mineral Creek.

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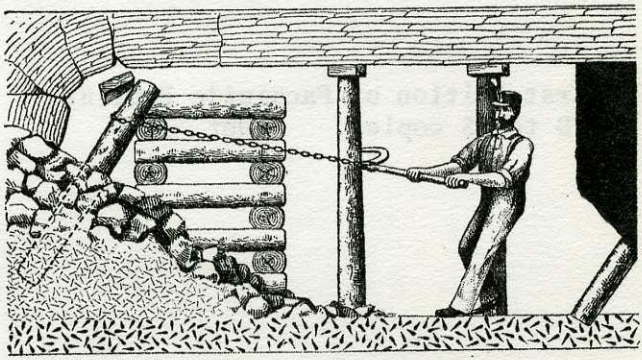

Extract from the larger work "MINING IN THE PACIFIC NORTHWEST" By L. K. Hodges, Publ. Seattle, WA, 1897. Post-Intelligencer. Later Reprinted by THE SHOREY BOOK STORE. January, 1967.

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Publisher's note and acknowledgment

For many years Hodges' MINING IN THE PACIFIC NORTHWEST has been one of the rarest books published on this area in modern times. Copies have been practically unobtainable at any price. In the past 32 years we have handled only two copies of the original edition.

As it was originally printed on highly perishable newsprint, what few copies come down to us are usually in tatters or with parts missing. Public institutions fortunate enough to possess copies have had to guard them zealously to keep parts and maps from disappearing or deteriorating into scrap paper.

The task involved in reprinting this book has been colossal. Printed in small type both as to text and maps, this book would be a challenge to any printer, however skilled he might be. The different pages and maps vary in clarity and it has taxed our abilities and equipment to the limit to produce a work acceptable to both researchers and historians as well as active geologists, prospectors and mining men in search of the rare information included in these vital pages, covering mining activities going back to the very beginning of mining in British Columbia and Washington Territory. We have done our very best to produce a work that would please the public and believe we have done a good job.

Many people and institutions have urged us to reprint this work. The Washington State Department of Conservation and Development was first in supporting our efforts. The Seattle Public Library

and its valuable staff have added their support and advice to this project and loaned us their rare original copy for reproduction purposes. Mr. Nard Jones of the Seattle Post-Intelligencer which published the work in 1895, gave us his unqualified support and the permission of the firm to reprint it. Dozens of individual customers interested in mining activity gave us their advance orders, thus enabling us to go ahead on this expensive undertaking which is our largest publishing venture to date.

Not everyone interested is willing to pay the sum of $30.00 which this book sells for. Many are interested in only certain areas. Accordingly we have also made available the book in parts as follows:

#134 A.	MINING IN WESTERN WASHINGTON.	$10.00
#134 B.	MINING IN CENTRAL AND EASTERN WASHINGTON.	$10.00
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We hope this facsimile of one of our scarcest Northwest books will please you.

Sincerely,

J.W. Todd, Jr.,
Manager

MINING

IN THE

PACIFIC NORTHWEST

A COMPLETE REVIEW OF THE MINERAL RESOURCES OF WASHINGTON AND BRITISH COLUMBIA

WITH MAPS

EDITED BY L. K. HODGES

THE POST-INTELLIGENCER
SEATTLE, WASHINGTON
1897

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The Shorey Book Store
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PREFACE.

The enterprise of the Seattle Post-Intelligencer in sending the writer on a tour of the mining districts of the Pacific Northwest called forth such general commendation and the articles published in the course of that tour aroused such wide interest as to suggest the advisability of republishing them in book form. Such a publication was recommended by many readers of the Post-Intelligencer, who desired to have them in convenient form for reference. The canvass for subscriptions abundantly proved that a demand for such a work existed and the present volume is the result.

The purpose has been to give in a succinct form and with moderation of statement a description of each mining district in Washington and in Southern British Columbia, following a general description of each district with a description of each mine and the more important prospects in that district. The original plan was to revise the articles and add to them articles on the more important districts which were not on the writer's itinerary, with a map to illustrate each district. It has been found necessary to enlarge the scope of the work to such an extent that the original matter has been almost entirely rewritten and much more has been added than was at first contemplated. This has required a much longer time than was estimated, but the public would rather endure such delay than be presented with a hastily prepared and glaringly incomplete work. Even now it has been found impossible to do full justice to some districts, without further unduly delaying publication.

It can safely be said that this is the first attempt to describe with any approach to thoroughness the mineral resources of this section and to tell what has been done to develop them. The aim has been to collate information on the subject from the most reliable sources available and to mass the material facts without any exaggeration or verbal flourishes, leaving them generally to tell their own story. How far this aim has been attained, it is for the reader to judge. The articles on the Trail Creek, Slocan, Nelson and Ainsworth Districts are mainly condensed from the recent reports of W. A. Carlyle, Provincial Mineralogist of British Columbia.

An important feature of the work is the maps. By studying the large map in connection with the small district maps, it will be possible to ascertain the route into any district and the location of a mining property in that district. The maps do not profess to show all the claims or to be free from inaccuracies. It would have been impossible to make them so without a survey and a larger expenditure than was warranted. But it can be said without fear of contradiction that this volume contains a more complete set of detailed maps than has yet been published and that the large map contains a mass of valuable information which has never yet reached the public.

Some desire has been expressed that this volume should include the descriptions of the country traversed by the writer in the course of his tour, which formed a part of the articles in the Post-Intelligencer. This was considered beyond the scope of a work designed to deal with mining exclusively and would have unduly increased the bulk of the book. All such matter has therefore been omitted and these pages have been devoted only to the purpose indicated by the title.

For valuable aid in preparing both the reading matter and the maps, the publishers are indebted to the officers of the state of Washington and the Province of British Columbia, to the United States Surveyor General, and to many private individuals. These latter are so numerous and have all taken so deep an interest in the undertaking that it would be impracticable to name

them all and to single out a few would be invidious. The publishers therefore take this means of thanking them, one and all.

We believe that this work will be instrumental in giving the people of the Pacific Northwest a fuller knowledge of the mineral wealth with which nature has blessed them; and will spread such knowledge far and wide. We hope that it will also aid in some degree in promoting the development of that wealth.

THE EDITOR.

JAMES D. HOGE, JR.,
L. K. HODGES,
Publishers and Proprietors.

INTRODUCTORY.

A map of the western portion of the United States, designed to show the mineral belt, would twenty years ago have shown Washington and the adjoining section of British Columbia as a blank. There might have been a few spots, such as the Swauk, Ruby and Sultan placers and the Peshastin mines in Washington, the Cariboo, Rock Creek and Wild Horse placers in British Columbia, but otherwise this whole broad stretch of country would have been regarded as barren, so far as mineral was concerned. During those twenty years the people of the Pacific Northwest have been occupied in filling in that blank. They have not worked continuously, for many circumstances have until late years diverted their attention, but for eight years past they have gradually centered their energies more and more on mining, until now it is their one absorbing interest, to which every other takes a subordinate place. They have proved what has been repeatedly denied, that the mineral belt extends through the whole breadth of Washington and British Columbia, and discovery has been continually pushed northward through Alaska to the confines of the frozen ocean. It is now an established fact, which the most pessimistic skeptic cannot gainsay, that the backbone of the American continent, from the Arctic Ocean to Tierra del Fuego, with all its ribs and spurs, has mineral for its marrow. This mineral is of every kind, precious and base, and in every combination, and it only awaits the application of man's genius and industry to be turned to his uses.

A geological survey of this region as a whole has never been made, at least so far as Washington is concerned, British Columbia being far in advance in this particular. Thus, what is known on the subject in Washington has been learned by a number of individuals, each of whom has studied a particular section as opportunity offered. These sources of information have established that the Cascade Range is mainly built of granite, syenite, diorite and kindred rocks. Among them occur broad belts of gneiss, schist, slate, shale and sandstone and dikes of porphyry and limestone. The same formation extends eastward through the Gold Range and to the western foothills of the Rocky Mountains in the eastern part of Washington and the Selkirk Range in the Kootenai District of British Columbia. The mineral ledges occur, in most instances, in fissures in the granite, syenite, diorite and slate, often cutting through several of these rocks, but are also in contact between two of them, or between one of the granitic rocks and a dike of porphyry or limestone. Towards the east, in the Gold Range, there are numerous areas in which the eruptive rocks have burst through the older formation and in the latter have caused fissures, which have either been filled in with mineral-bearing rock or have been impregnated with mineral along the walls of the cavities thus created. The presence of one of these ledges is generally indicated by a heavy capping of oxidized iron, or magnetic iron, often of great width and thickness.

The ores of this section are almost universally base and of low grade. The exceptions are the silver-lead belt extending from the Slocan District through a strip of Washington east of the Columbia River as far south as the Spokane River, known as the Colville and Cedar Canyon Districts; some ledges on Palmer Mountain which carry high-grade silver ore; the Slate Creek District, where high-grade free milling gold ore has been followed to some depth. Recent development, however, has shown high-grade silver ores in the Silverton, Sultan, Troublesome, Miller River and Gold Creek Districts, the values here being in ruby silver, high grade gray copper and brittle silver, and the Cascades promise yet to give birth to several high-grade camps. There are other isolated instances where the ores are rich enough to be

classed as high-grade, and the cutting of ore chutes at depth in some cases has been followed by such satisfactory increase in value as to justify the hope that, as development proceeds deeper, higher grade ores will be found.

The minerals are in every combination, the most common being iron and copper pyrites, arseno-pyrite, chalcopyrite, pyrrhotite, galena, tetrahedrite or gray copper, zinc blende. The pyritic ores carry gold in some proportion almost invariably, with a few ounces of silver, and often carry so much copper as to make that metal the principal element of value. The galena is usually rich in silver where the ledges are small, the silver value decreasing in inverse ratio to the increased size of the ledge, and the lead value ranges as high as 75 per cent., while such ore also carries a few dollars per ton in gold. Gray copper is a high-grade silver ore, and when associated with iron carries a good gold value, and shows pockets of ruby silver and brittle silver of high value. Silver also occurs in association with copper in some districts, notably about Nelson, British Columbia, and in the form of chlorides, bromides and carbonates. It is also found in equal value with gold in dry ores, southward from the Slocan galena belt. Free gold is often found on the surface, where the ore has been subject to the decomposing influence of the air, and continues in decreasing ratio as the ore bodies are followed down, but with increasing depth the gold is found more and more in iron and copper sulphides. The minerals named are found in every possible combination, sometimes one, at other times another predominating.

It is probable, however, that the developments of the next few years will give copper as high a place among the mineral productions of Washington and British Columbia as it occupies in Montana and Michigan. A study of the large map, in connection with the chapters on the several districts, will show the reader that a great belt of gold-bearing copper ores has been traced from a point on the coast 200 miles northwest of Vancouver, British Columbia, across the Skagit Valley between Hamilton and Marble Mount, across the Stillaguamish east and west of Silverton, through the Sultan Basin and Silver Creek, through the Index Range of mountains, through the Miller River and Money Creek Districts, across the Snoqualmie and Cedar River watersheds. Ores of like nature have also been found further south, along the western slope, as far as the St. Helens District. On the eastern slope like bodies of gold-bearing copper ore have been found in Palmer Mountain, the Methow, Chelan and Cle-Elum Districts. Further east, in the Gold Range, they occur of immense size in the Boundary and Trail Creek Districts of British Columbia and in the Colville Reservation, particularly along the Kettle River and its tributaries. The ores of this belt are copper sulphides in various forms, in which the copper contents rarely fall below 5 per cent. and are commonly over 20 per cent., frequently rising beyond 30 per cent. Bornite is often found in bunches, carrying 40 and 50 per cent. copper, and masses of native copper weighing as much as 1,000 pounds have at times been encountered. These copper ores invariably carry a good gold value and often a few ounces of silver.

The ledges in this region have a gangue of quartz, porphyry, porphyritic quartz, hornblende or modifications of these several rocks, and in the Cascade Mountains are exposed to such a width has to excite even the most phlegmatic miners to wonder. Here the exposures occur along steep mountain-sides, which have been plowed down by the glaciers, or along gulches, of which the beds are the ledges and the walls are the walls of those ledges. Nature has done the surface prospecting in these cases. Further east, in the foothills and in the Gold Range, where the formation is covered with wash, the exposures are not as continuous but are often extremely large, and development has been rewarded by the opening of some ore bodies so large as to tax the credulity of one most willing to believe.

Mining in Washington dates back to the returning tide of miners from the Cariboo District of British Columbia in the early 60's. They worked placers on Rock Creek, north of the boundary, and, traveling southward,

washed gold from the gravel bars of the Peshastin and Swauk Creeks in Eastern Washington, Ruby Creek and the Sultan River west of the Cascades. The first quartz ledge to be discovered, so far as records go, was the Culver, on the Peshastin, where the town of Blewett now stands. This mine, after many vicissitudes, is still being worked and its product is reduced at a twenty-stamp mill. Then mining languished until the early 80's, when the first discoveries of silver ore were made in the Colville district and a few prospectors strayed up the Cle-Elum. The only notable discoveries in the interim were near the sources of the Snoqualmie, where immense croppings of iron ore became known as the Denny and Guye iron mines. The Denny mines have already proved to be copper, and development may yet have the same result on the Guye mines.

It was not until the opening of Chief Moses' Reservation in 1887 that the mining business fairly began in Washington, and in the same year the first discoveries were made in the Boundary and Trail Creek Districts of British Columbia. Development began on the low-grade silver ores of Salmon River and on the gold and silver ores of Palmer Mountain. About the same time prospectors invaded the Cascade Range on all sides and during several succeeding years discoveries were made on the Cascade, Methow, at Monte Cristo, on Silver Creek, Miller River, Money Creek, the Snoqualmie, Summit and other districts. A decided interest in mining had been awakened and it appeared as though the industry had already come to stay.

But the first flock of investors was doomed to failure, mainly through their own fault. They were without experience in mining, for Washington had been mainly populated by farmers, merchants, manufacturers and professional men from the Eastern and Middle Western States, while British Columbia had absorbed a similar population from the British Isles and Eastern Canada. The working people were generally drawn from the same sources. This was not a mining population, for it knew nothing of mining, having always turned its mind into other channels. There was a sprinkling of old miners and prospectors from California, Colorado and other mining states, but the formation was new to them. A few of them flung aside precedent and boldly proclaimed the mineral wealth of the state and the adjoining British territory. But the experts, with their heads filled with California and Colorado precedents, scoffed at them, saying that the ore was too base and low grade to pay for treatment and that the formation was so broken that it would be impossible to follow any ore body from the croppings to any considerable depth. The moneyed men in the cities were absorbed in real estate speculation and readily voiced the unfavorable opinions of the experts, being anxious that outside investments should go into their own schemes and not be diverted into any alluring mining ventures.

Thus the first men to make known the mineral wealth of the Pacific Northwest "caught on" in only a limited degree. They induced some investments among men of means and caused quite a flurry in the Salmon River, Palmer Mountain, Cascade and Silver Creek Districts. But a combination of circumstances forbade success at that time. The surface free gold in the ledges on Palmer Mountain led to the belief that free gold would continue indefinitely, and stamp mills were built without concentrators and managed by unskilled millmen. Wild speculation was practiced in some instances and there were not lacking evidences of fraud in others. The result was failure. As ore changed from free milling to base, a larger percentage of the value was lost in the tailings. Victims of fraud loudly denounced the mines as worthless and others took up the cry and repeated it far and wide. The fall in the price of silver caused a suspension of work in the low-grade silver mines of Salmon River, which had already suffered in the eyes of investors from two abortive attempts at reduction of the ore. Only a few persons held their faith in the Pacific Northwest as a mining region and most of them were bankrupted by the panic or the collapse of their mining ventures. Only in a few places was development continued, notably among which is Monte Cristo. For a few years mining languished with every other industry.

Three districts were notable exceptions. One of these was Slocan, in British Columbia, where the ores, although almost purely silver-lead, were so high in grade that they could be profitably mined under the most adverse condition of the metal market. Another was Monte Cristo, whither the railroad was completed in 1893, the year of the panic, and where development was prosecuted and machinery installed at great expense as though there had been no panic. The third was Trail Creek, where the famous Le Roi and War Eagle mines became regular shippers in 1895 and declared their first dividend in that year.

The revival of mining was due mainly to the favorable results attained in Slocan and Trail Creek, which drew attention to a new field of employment for industry and capital. Another cause which contributed largely to this revival was the general stagnation in other lines of business, which had driven thousands out of business or employment and left them stranded in the cities. By a common impulse many of them took to the mountains and became prospectors. They returned to their former homes with good reports of what they had found and obtained means to continue work. Thus a movement was started which caused the renewed operation of properties long neglected, the development of new ones and the extension of discoveries. The opening of dividend-paying mines in the Trail Creek and Slocan Districts and the continued improvement shown by development at Monte Cristo drew the attention of the investing public in this direction. Large investments were made in British Columbia by capitalists from England and Eastern Canada and the stream of investment is now turning to Washington.

The Pacific Northwest can offer what mining investors are particularly seeking at present—immense bodies of low-grade ore. Forty or fifty feet is an ordinary width for one of these ledges and some of them are as wide as 200 feet. In the Cascade Range the advantage is offered of ledges exposed so clearly on the sides of steep and lofty mountains that they can be opened at great depth by tunnels running into the mountain-side. This not only saves the additional cost of sinking, but of hoisting machinery and pumps, for it affords natural drainage. Throughout the whole mineral belt in question, not only in the Cascades, but in the Gold Range, innumerable rapid streams furnish abundant cheap power to operate mining machinery and reduction plants. The presence of such water-power could have been mentioned truthfully as regards nearly every mining property described in this volume, but it would have been a wearisome repetition. This general statement suffices to cover the whole field, and some conception can be formed of the greatness of the advantage by comparison with the low-grade districts of West Australia and South Africa, where no water-power exists.

So also as regards timber. The valleys and foothills west of the Cascade summit are abundantly clothed with fir, cedar, spruce and hemlock. In higher altitudes, where mines are often opened, there is a smaller growth of larch and Alaska cedar, too small for merchantable timber, but large enough for mine timbers and buildings. On the eastern slope the same kinds of timber, of great size, are to be found for some distance from the summit. When the eastern foothills are reached the high ridges and plateaus and the upper benches are densely clothed with pine timber, often of good size. The same conditions extend through the Gold Range in both Washington and British Columbia, except that in many of the valleys and canyons there occurs a large growth of cedar, hemlock and other timber, together with the pine. The mining claim is a rare exception where timber for all purposes cannot be found upon its surface or immediately adjacent.

The climate of the Pacific Northwest is peculiarly agreeable for travel and outdoor work in summer. West of the Cascade summit spring sets in early in middle of June. The summer in that section is not extremely hot and the nights are always cool. No rain falls from June until late in September and the equinoctial storms of that period are usually followed by several weeks of clear, warm, autumn weather. In the mountains little snow falls until

April, rainstorms grow less frequent until they cease altogether about the December, but from that time forward the snowfall is heavy. The snow has usually disappeared from the mountains by the middle of May, except at great altitudes and in deep gulches where it has piled up in slides. East of the Cascades the air is dry and exhilarating the year around and, though the heat is sometimes intense in summer, it does not produce that feeling of chronic lassitude experienced in the moist atmosphere of the Eastern States. The nights, too, are always cool, permitting of sound sleep, which prepares one to endure severe exertion in extreme heat. Spring sets in during April, the bunchgrass springs up as fast as the snow goes, and this rich food for horses, everywhere found in the open country, makes it a prospector's paradise. There are no thunderstorms or tornadoes west of the Rocky Mountains, so that a man need burrow into the ground only in search of wealth. There are no venomous snakes west of the Cascades, but rattlesnakes abound in some places east of that range. On the other hand, small game and fish can be found almost anywhere and large game is to be had for the hunting.

While many districts are remote from railroads, preparations are on foot for extensions which will largely remedy this defect. The Columbia and Okanogan Valleys form a natural route for the Great Northern to tap the whole of Okanogan County with a branch from Wenatchee, unless the Central Washington should first occupy the field with an extension from Coulee City by way of Waterville and Orondo, as it now contemplates. The Seattle & International is well situated to occupy the Snoqualmie and Cedar River Districts with branches whenever developments hold out prospect of remunerative traffic, and it can also tap the White Horse District by a branch along the north fork of the Stillaguamish. The Seattle & Northern already has the traffic of the Skagit copper belt secured and can be extended up the Skagit and Cascade Rivers at moderate cost. The Great Northern can draw the traffic of the Silver Creek and Index Districts by building a branch up the Skykomish north fork. The fast developing wealth of the Colville Reservation has already induced the Spokane Falls & Northern to survey a line up the Kettle River, which may be partly in United States and partly in British territory. The advantage of having its main line run through the heart of the rich Kootenai District, added to the manifold advantages of having a more direct southern route through the Rocky Mountains and of developing the rich coal fields on that route, has induced the Canadian Pacific to prepare for the construction of a line through the Crow's Nest Pass this season. A line is now under construction from Slocan City, at the foot of Slocan Lake, to Slocan Crossing on the Kootenai River, where it will connect with the Columbia & Kootenai branch of the Canadian Pacific. This will form a link in the connection between the old and new main line. F. August Heinze is now extending the Columbia & Western up the Columbia River from Trail to Robson and has raised funds for a further extension through the Boundary Creek District to Penticton, connecting with the Canadian Pacific steamer on Okanogan Lake.

The first requisite for the development of a mining district is a wagon road. The first prospectors blaze a trail and the next flight of newcomers aids them to cut it out and make it plain and passable. This is as much as they should be expected to do at their own expense. The county should follow up their work by cutting a good horse trail into any new district which gives promise of development, and when that development has assumed important dimensions and holds forth an early prospect of regular production the trail should be transformed into a wagon road. In this manner lines of travel and transportation would be continually improved to keep pace with the progress of development.

The Province of British Columbia has set a good example in this respect, which Washington is only now beginning to imitate. It has built a main trunk road from Penticton through Camp McKinney, Midway, Greenwood, Anaconda and Carson to Grand Forks, a distance of 110 miles, connecting at the latter point with the Kettle River roads to Marcus and Bossburg, on the Spokane Falls & Northern Railroad. It has also built roads in the Kootenai country wherever they would reach a large enough group of claims to warrant the expense. Shorter roads in Boundary Creek have been built in several directions at the private expense of Robert Wood, owner of the town of Greenwood. The State of Washington has made a beginning in this direction by constructing a horse trail from the mouth of the Twisp, over the Twisp and

Cascade Passes to the mouth of the Cascade River, thus connecting the county road systems of Eastern and Western Washington. It has also constructed a road across the Colville Reservation, except for a short gap, which will be closed by an appropriation made at the last session. Appropriations have also been made for a road from Wenatchee up the Columbia River to Ives and for the widening of the trail to a wagon road between the mouth of the Twisp and North Creek, and between Marble Mount and Gilbert's Camp, near the head of the Cascade River, leaving the remainder of the trail to be widened later.

Unlike their earlier, less careful and therefore less successful predecessors, the present investors in mines in the Pacific Northwest are fully alive to the necessity of modern economical processes of reduction, carefully and skillfully managed, for the extraction of the value from the ores. Stamp mills are now seconded by concentrators and slime tables. The employment of a skilled millman is admitted to be one of the conditions of success. The cyanide process has been applied with a large degree of success at one mine and a plant erected last season at another, will be put in operation this year. Experiments are continually made with new processes of reduction, from among which, it is hoped, one will be evolved capable of cheap application on the mine ground. Meanwhile the bulk of the ore produced goes to the smelters at Everett and Tacoma, Wash.; Trail, Nelson and Pilot Bay, B. C. Coke for flux is produced at the Fairhaven and Wilkeson mines, Washington, and at Nanaimo, B. C. Coal in large quantities is produced at Newcastle, Franklin, Black Diamond, Gilman, Renton and Danville, in King county; Wilkeson, Carbonado, Pittsburg, in Pierce county; Roslyn and Cle-Elum, in Kittitas county; Blue Canyon, in Whatcom county; and Fairhaven mine, in Skagit county, Washington; at Nanaimo, Wellington and Comox, B. C. New discoveries have been made on Day Creek, Skagit county; the Skykomish River, King county; Camas Prairie, Kittitas county; on Chumstick Creek, Okanogan county; also on Rock Creek, British Columbia.

It is a trite, but by no means true, saying that mining is a gamble. It is only a gamble when a man unfamiliar with the business buys property he has never seen or of which he does not know the value. It is not a gamble if entered upon on business principles, with a full knowledge of what is being bought, obtained either by personal inspection or through the report of a reliable mining engineer. There is no more reason why a man should buy "a pig in a poke" in the mining business than in any other business. If he does so and finds that he has not bought a pig but some other animal, he must not blame the mining business, but his own unbusinesslike manner of engaging in it.

One result of the great size of the ore bodies in this section of the country has been the necessity of large amounts of capital to carry on the preliminary work of prospecting and make such a showing of mineral as will put the claims in a salable condition. The locators of claims rarely having the necessary capital, this work has been undertaken by development companies, organized for the purpose of thoroughly prospecting claims in exchange for an interest and of then selling them to others, who will further develop them into mines. Such companies have filled a decided gap in the mining community and are operating with marked success in many districts.

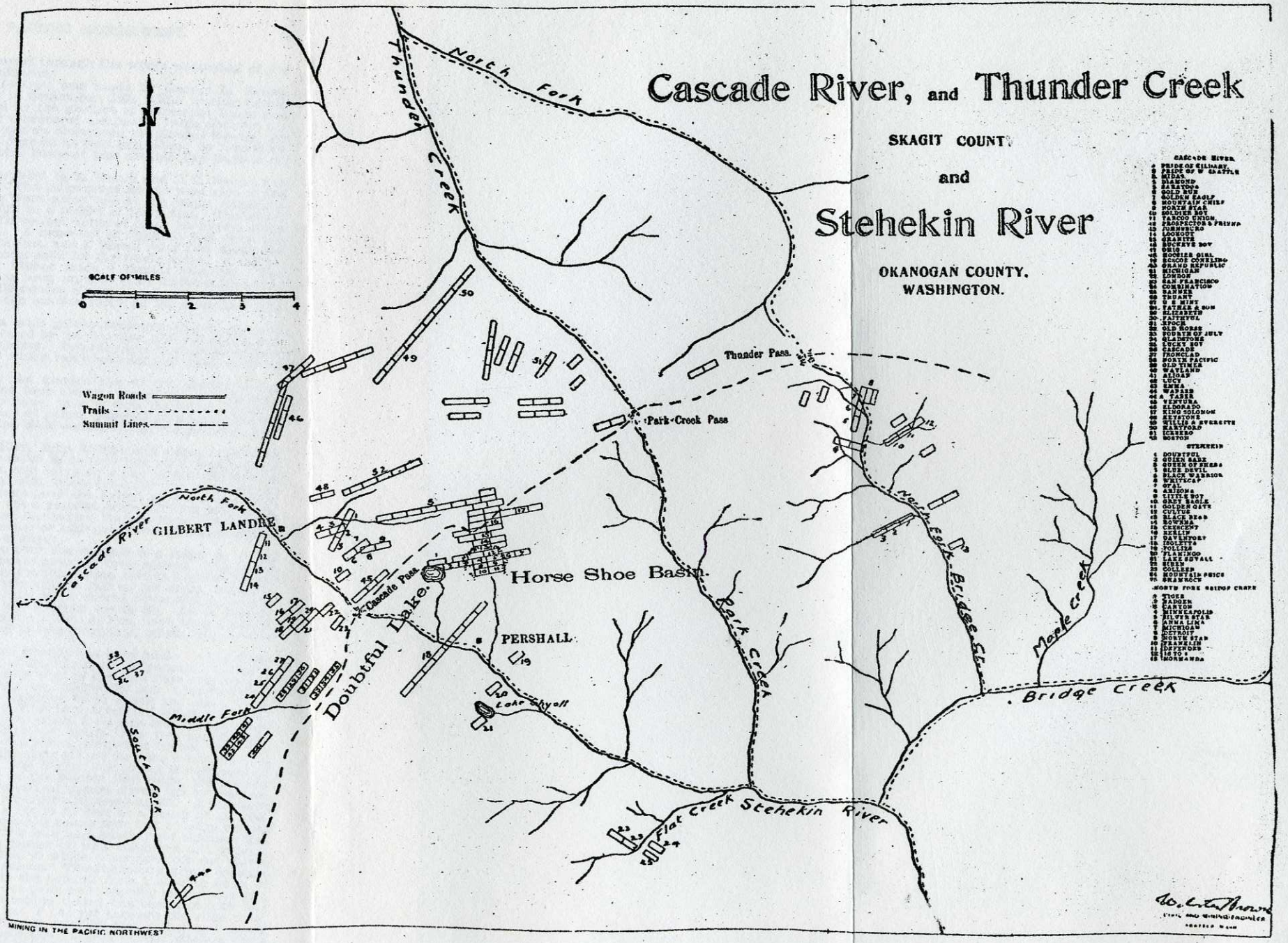
That mining is destined to fill a leading place among the industries of Washington and British Columbia must be evident to every observing mind. It has already taken first rank in British Columbia and is fast stepping into that rank in Washington. It must have a decidedly beneficial effect on the general prosperity of both province and state, for it brings with it a number of kindred industries and furnishes a ready cash market for the products of the farmer, stock-raiser and manufacturer of various wares. It tends to diversify industry and thus to prevent undue reliance of a whole community on any single means of support. It requires a healthy, active, open-air life and makes a sturdy, independent, self-reliant race of men and women.

THE CASCADE.

Among the earliest mineral discoveries in the Cascade Range was the galena district at the head of the Cascade River, one of the headwaters of the Skagit. Tradition dates it back to one of a party of soldiers, who were coming across the summit from Fort Colville to Fort Vancouver, about twenty years ago. This man found a piece of rich float and afterwards returned and located the Soldier Boy claim. But it was not till many years later that the discoveries occurred which led to the inrush of prospectors, for the district was then almost inaccessible, and only in the early 90's were trails made from the east and west to open it to packhorses.

There are two routes into the district. One is by the Seattle & International Railroad to Woolley, eighty miles, thence by the Seattle & Northern Railroad to Hamilton, fourteen miles; thence by wagon road to Marble Mount, thirty-four miles; thence by road six miles, and by trail twenty-four miles, to the Cascade Pass. From the east the district may be reached from Wenatchee, on the Great Northern Railroad, by the steamer City of Ellensburg to La Chapelle Landing, forty miles, and stage to Chelan, two and one-half miles, or the steamer to Chelan Falls, thirty-nine miles, and stage to Chelan, three and one-half miles. Thence the steamer Stehekin takes one up Lake Chelan, sixty-eight miles, and a horse will complete the trip over the trail to the mouth of Bridge Creek and over the state trail to the Cascade Pass, a total distance of thirty miles.

The mountains in this district are formed of granite, of which the direction is northeast and southwest, and are cut in the same course by true fissure ledges of quartz carrying galena, iron and copper sulphides and some gray copper. As in other districts, the croppings occur in the rocky beds and walls of the gulches and on the cliffs above timber line, so that they are traceable with small difficulty, though at times covered by soil or rockslides. Feeders run into the main ledges from all directions, the principal ones running north and south. The granite formation carrying this galena belt has been traced northeast across Doubtful and Horseshoe Basins, east of the main divide, to the divide between the north forks of Thunder and Bridge Creeks, eight


Cascade River, and Thunder Creek
SKAGIT COUNTY
and
Stehekin River
OKANOGAN COUNTY,
WASHINGTON.
N
SCALE OF MILES
0 1 2 3 4
Wagon Roads
Trails
Summit Lines
Thunder Creek
North Fork
Thunder Pass.
Park Creek Pass
Cascade River
North Fork
GILBERT LANDING
Cascade Pass
Horse Shoe Basin
Doubtful Lake
PERSHALL
Lake Ethel
Middle Fork
South Fork
Park Creek
North Fork Bridge Ck.
Maple Creek
Bridge Creek
Flat Creek
Stehekin River
CASCADE RIVER
STEHEKIN
NORTH FORK BRIDGE CREEK

miles from Cascade Pass and southwest through the whole watershed of the Cascade's several forks to their confluence.

The discovery of the Cascade District was made by George L. Rouse, John C. Rouse and Gilbert Landre in September, 1889, while tracing across the summit the great ledges exposed by the glaciers of Horseshoe Basin and on the rim of Doubtful Basin. They discovered the Boston ledge cleaving the summit and cropping far down the eastern slope, and the Rouses located the Boston claim and Mr. Landre the Chicago on its west extension. In November of that year Gilbert Landre and John Russner also located the Buffalo on that ledge.

The Boston, owned by George Sheckler, G. L. Rouse and J. C. Rouse, has the greatest showing in the district. The ledge crops on the west side of the Boston Glacier, which in places has worn away one of the walls, leaving a great body of galena exposed in a cliff to a height of forty feet. The ledge, which is divided in the middle by a three-foot horse of black porphyry, crops at this point to a width of fifty feet. A cross-cut of eighteen feet from the side of the glacier showed ore for ten feet, and a tunnel sixty feet along the wall showed galena and sulphides almost solid for the whole width. A thirty-five foot tunnel at a point 150 feet higher made a similar showing. The thickness of the ore body where it has been exposed some distance higher is four feet. Assays run as high as 110 ounces silver, 60 per cent. lead and a little gold, and two tons shipped to the smelter returned $92 silver and lead per ton.

Below the Boston the ledge forks, with galena predominating in one and sulphides in the other fork, and is covered by the Chicago group of six claims, held by Gilbert Landre and C. H. Landers. Several short tunnels have been run to strike the ore bodies in ledges which run about six feet wide, showing streaks of galena and sulphides.

Southeast of the Boston and on the eastern rim of the glacier is the Ventura, or San Francisco, group of four claims, owned by the Cascade Consolidated Mining Company. They have, parallel with the Boston, a well-defined three-foot ledge with six inches of galena showing in a small tunnel, samples from which assayed as high as 104.26 ounces silver, 40.1 per cent. lead and $4.40 gold.

West of the Boston William McKay, John Millett and others have the Eldorado group of five claims on a parallel ledge four feet wide, well defined for some distance down the mountain, and carrying a pay streak which runs well in gold. An eighty-foot cross-cut will, when extended, tap the ledge at great depth, and a forty-foot drift shows good ore bodies, of which the main one assays $70 gold, silver and lead. On a parallel ledge William Mertaugh, Charles Simpson, George W. Boles and Alexander Munroe have the Bunker Hill and Sullivan, with three or four inches of high-grade ore, of which assays have run into the hundreds of ounces of silver.

South of the Boston and traceable over the summit is a ledge on which Gilbert Landre and others have the Denver group of three claims. The ledge, which is nine feet wide and is broken by granite horses, carries eighteen inches of ore on one wall and two inches of mineralized talc on the other, shown in a twenty-foot tunnel. Assays run as high as 140 ounces silver and a trace of gold, and it is claimed that the ledge will average nearly $50. All of Messrs. Landre and Landers' interests, comprising fifteen claims, have been acquired by the London and Galena Mining and Milling Company, which will develop them.

The largest single investment in this district has been made by the Silver Queen Mining and Smelting Company, which has fourteen patented claims in several groups. The Midas group is a mile west of Cascade Pass and has two claims on a ledge opened by tunnels fifty and fifty-eight feet, with twelve to sixteen inches of ore on the footwall assaying $47 in silver and lead, and a two-inch streak which carried $604 silver, $12.50 lead, a total of $616.50. A cross-ledge is covered by three claims, on one of which a twenty-foot tunnel shows one to four inches of ore assaying $98.90 and $101.80 from two samples; on another there are a twenty-foot cross-cut and a thirty-foot tunnel, with two to ten inches of fair ore showing on the floor all the way in, while the face of the drift is in ore of lower grade. The Soldier Boy group is composed of five claims near the pass. Three are on the Soldier Boy ledge, the pioneer location of the district, in which a twelve-foot tunnel shows ten to fourteen inches of good ore carrying some native copper and assaying $21. A cross-cut has been run seventy feet to tap this ledge in 250 feet at a depth of 400 feet. A ten-foot cut nine feet wide on another claim shows four feet of ledge matter with a two-inch pay streak on the hanging wall, and another cut eighteen feet long and twelve feet deep shows five inches of iron sulphides and galena. The other claims are on a parallel ledge, in which a sixteen-foot cut shows four inches of iron pyrites and a little galena. The Johnsburg group consists of four claims on a ledge running up to the summit from the south bank of the Cascade River, three miles west of the pass, and cropping on the side of a gulch. A tunnel intended for a main working tunnel has been run fifty feet at a point 1,500 feet above the valley, but is not yet through the slide rock. Another tunnel has been driven 200 feet at a point 500 feet higher and shows a good strong ledge four feet wide, with eight inches of ore, while a third tunnel is in fifty feet at a point 800 feet higher and shows three feet of solid

galena. Samples taken for the full width between the walls in each of these tunnels, and ground together, gave an assay of $51.75 for all values.

A number of ledges parallel with the Soldier Boy cut the curve of the basin, but have had little work done on them. On one of these R. A. Osterly and others have the Grand Republic group of three claims, on which tunnels twenty-five and fifteen feet and a twenty-five-foot open cut show a nine-inch pay streak carrying about $40 for all values. On other ledges with about as much pay ore are the St. Patrick and Nip and Tuck.

The same mineral formation extends across to the middle and south forks of the Cascade, where the granite is cut by dikes of quartzite, gneiss and schist. The largest group, consisting of six claims, is the Fourth of July, owned by Joseph Rigby, of Omaha. One ledge shows twenty-four inches of ore in a fourteen-foot shaft and fifteen-foot open cut, carrying galena, carbonates and sulphurets to the value of $50 and upwards in gold and silver. Another ledge showing twelve inches of $80 ore in the croppings will be tapped by a cross-cut, now in forty feet. Another ledge shows sixteen inches of pay ore in a thirty-five foot cross-cut, assays showing 13 per cent. copper, besides good gold and silver values. Below this, on the Granite, Thomas Barrett, of Woolley, has shown up sixteen inches of pay ore in a four-foot ledge by means of a ten-foot shaft, and on the Jumbo he has ten inches of pay ore, though a forty-foot tunnel on the ledge has not penetrated to the ore chute showing in the croppings. Half a mile below this he has the Homestake on a five-foot ledge, in which several small streaks aggregating sixteen to eighteen inches assay from $40 upwards.

Charles L. Pollard has the Michigan group of five claims on two parallel ledges which have been traced for 1,500 feet. One of these is five feet wide, with a sixteen-inch pay streak showing on th wall of a tunnel run sixty-five feet along the ledge. Two assays show 192 ounces silver, 60 per cent. lead and $3 gold; 204 ounces silver, 40 per cent. lead, $3 gold. Southwest of this group Thomas Barrett has the Black Canyon on a four and one-half foot ledge, in which an open cut twelve feet long shows twelve inches of good galena ore.

A great blow-out of oxidized iron which has been traced 4,000 feet up the mountain from the south fork is covered by Richard Joy and Joseph Peraud with the Cascade group of three claims. A sixty-five foot tunnel shows a ten-inch streak of black sulphurets and iron pyrites carrying gold and silver.

SLATE CREEK.

By Douglass Allmond, of Anacortes.

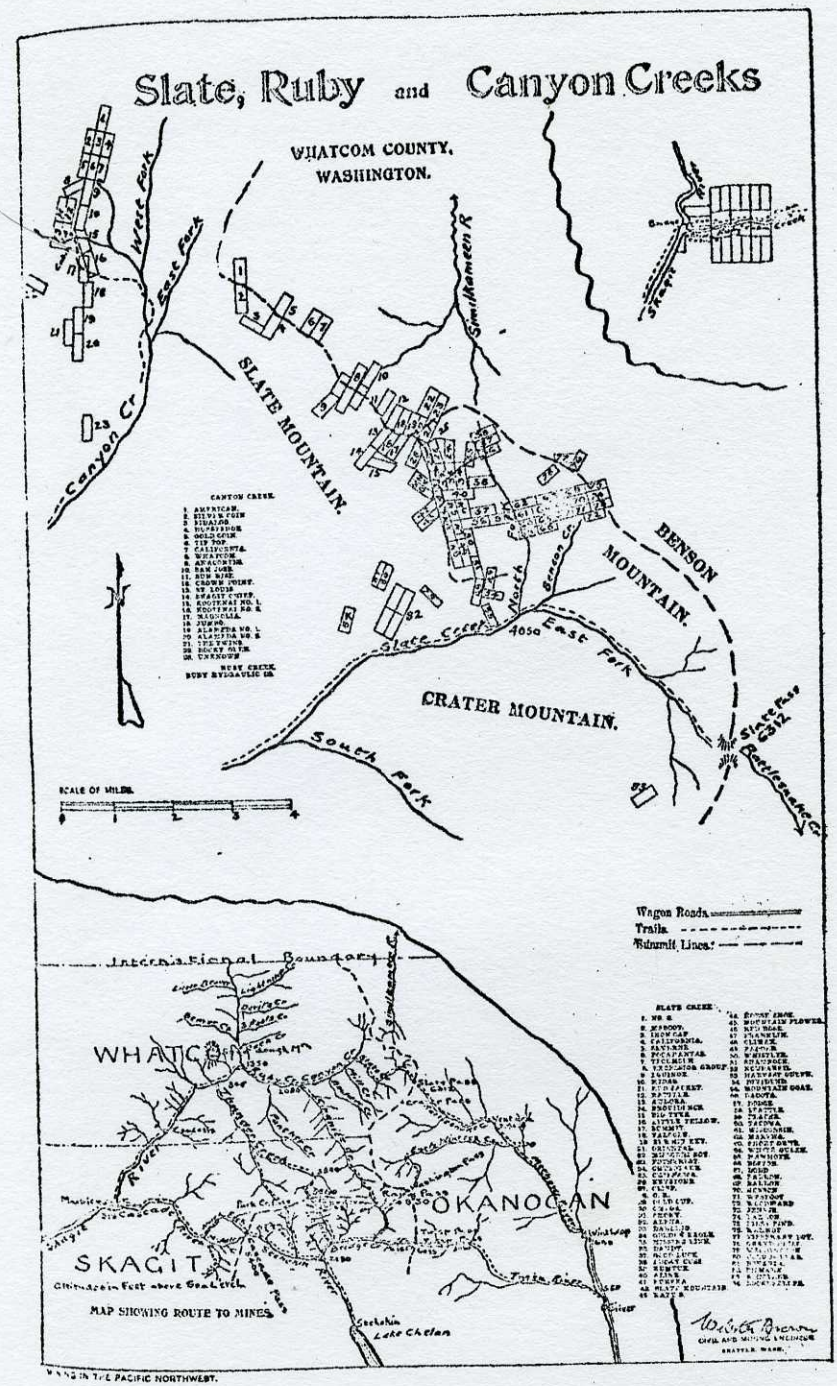
The mining regions of the Skagit Valley, for the sake of convenience, may be divided into five distinct districts, as follows: Slate Creek District, embracing the country between the Slate Creek summit and the mouth of Ruby Creek; Thunder Creek District, including all that section drained by Thunder Creek; Cascade District, the country about Cascade River; Monte Cristo District, at the headwaters of the Sauk, and Hamilton District, including all that section of the valley from Marble Mount to tide water.

The route to the Slate Creek District from Seattle is by the Seattle & International Railroad to Woolley, eighty miles, and thence by the Seattle & Northern to Hamilton, fourteen miles. From Hamilton a good road can be followed up the Skagit Valley to Marble Mount, thirty-four miles, and from that point a pony trail leads to the mouth of Ruby Creek, the western boundary of the district, twenty-nine miles, and to the headwaters of Slate Creek, twenty-five miles further, with branch trails to the various sections of the district. From the head of Slate Creek a trail leads down the Methow River for fifteen miles and a wagon road thence to Ives Landing, seventy-five miles.

The Slate Creek District includes Ruby, Canyon, Granite, Mill and a number of lesser streams and the country north toward the international boundary line. The principal mines, however, are near the headwaters of Slate Creek, hence its name. The first discoveries in this country were made nearly twenty years ago by a man named Rowley. Then prospectors looked for placers only, but as the placer ground was limited, the creeks were difficult to handle, the cost of getting to the camp was enormous, and the trip extremely hazardous, the camp was short lived, although upwards of 2,500 men went in the first season and fully $100,000 worth of dust was taken out. In those days the only route to the diggings was through British Columbia.

After abandoning the district for twelve or thirteen years, prospectors again went in, and not succeeding very well in getting at the placer gold, turned their attention to prospecting for ledges. On and on they pressed, until, on nearing the source of Slate Creek, they found that some of the gold in the creek carried particles of quartz. But at first the ledges could not be found, so it was determined to dig for them. The result was that a number of blind leads were located, some of them proving very rich.

One of the first and also one of the most valuable finds was the Eureka


Slate, Ruby and Canyon Creeks
WHATCOM COUNTY, WASHINGTON.
SLATE MOUNTAIN.
BENSON MOUNTAIN.
CRATER MOUNTAIN.
Canyon Cr.
West Fork
East Fork
Similkameen R.
Slate Creek
North Fork
South Fork
Bonanza Creek
Slate Peak 6512
Rattlesnake Cr.
SCALE OF MILES.
Wagon Roads
Trails
Sawmill Lines
International Boundary
WHATCOM
OKANOGAN
SKAGIT
MAP SHOWING ROUTE TO MINES.
Lake Chelan
Twisp River
Methow River
Skagit River

group, which was located in 1893, its owners incorporating under the name of the Eureka Mining Company of Anacortes in 1895. In this group are six quartz and two placer claims. These are all situated on the eastern slope of Slate Hill, and, except the Lowman, are extensions on the Eureka lode. Slate Hill is a part of a spur of the main Cascade Range, and with Benson Mountain forms the divide between Slate Creek, the waters of which find their way into the Skagit, and the headwaters of the Similkameen River. After running westerly about three miles this spur turns to the south and forms the divide between Slate Creek and Canyon Creek. The spur is composed mainly of slate, with poryhyry overlying or capping the summit in places. The Eureka lode, the only one on Slate Hill on which any systematic mining has been done, is probably the principal lode of the hill. Nowhere does it show any outcropping, being covered with from four to eight feet of earth, the top two feet being soft earth and the rest a hard cement compounded of clay with oxide of iron. At the Eureka this surface dirt was stripped off for about forty feet in length and thirty feet in width, exposing the ledge. In this process of stripping the cement was washed through a primitive cradle and yielded good wages. The ledge thus exposed is thirty feet between walls. The quartz, which extends from wall to wall with very little slate intermixed, is much decomposed and mixed with oxide of iron. The entire ledge assays high in free milling gold. Seemingly there is little difference in value of any part of it. Pieces picked up at random, being broken, usually show free gold. The ledge runs nearly north and south, parallel with Slate Hill, dipping to the east about 70 degrees, the walls, so far as exposed, being well defined. A shaft 5x9 feet, starting on the east side or hanging wall, was sunk in 1895 to a depth of fifty-four feet. At this depth a cross-cut was run six feet to the footwall, and was then run in the opposite direction twenty-four feet without reaching the hanging wall, making thirty feet of solid quartz, all well mineralized and assaying well in gold. The ledge shows in the shaft to a depth of twenty-five feet the same brown iron oxidized ore as on the surface. At this depth it changes to a hard white quartz, impregnated with fine iron pyrites, carrying gold apparently in a free state, as several tests show it will amalgamate to 80 per cent. of the assay value. Work in this shaft was abandoned late in the fall of 1895, owing to the difficulty of hoisting the ore by hand. A tunnel was then started further to the east and below the shaft. Work was continued in 1896 and the tunnel is now in 270 feet. This will cut the ledge at a depth of 124 feet perpendicular below the shaft. The mine can be easily worked by comparatively short tunnels to a depth of 1,400 feet, this being the level of the creek. The ore carries $30 in gold, apparently free milling even when in sulphurets.

The Beck group of five claims is situated on the western slope of Benson Mountain, a part of the same spur as Slate Hill, and is distant from the Eureka group about three miles. There are two parallel ledges, about 400 feet apart, with three claims on one and two on the other. These claims are owned by Melville Curtis, A. M. Barron and H. H. Soule, all of Anacortes. The veins run northeasterly and southwesterly, with a dip of 80 degrees northwesterly. The outcrop is well defined and is traceable through all the claims. The quartz shows from three to six feet in width, with a slate footwall, and porphyry in places on the hanging wall. The quartz is generally white, carrying very little oxide of iron. It carries gold, silver and a small quantity of copper, an average of four assays giving 2¾ ounces gold and 51 ounces silver. Tunnels have been started on three claims and are in from twenty to fifty feet. Situated on the sidehill, all these claims can be worked from one main tunnel to a depth of 1,200 feet.

The Mammoth, also on Benson Mountain, and near the Beck group, is owned by Messrs. Risley and Woodin. It is a four-foot ledge, from which some very rich ore has been taken. Very little development work has been done, however, although the surface showing would seem to warrant it.

Northerly from the Eureka group and on the Canyon Creek slope of Slate Range, is the Excelsior, owned by Messrs. Benson and Templar. This is a six-foot lead, well defined, but of comparatively low grade, shown by an open cut and short tunnel.

Four miles northwesterly from the Eureka is what is known as the Anacortes group, near the headwaters of Cascade branch of Canyon Creek. Probably thirty claims have been here located, and without doubt some of the richest ore ever taken from any mining camp came from some of the ledges of this locality. The first location was made in 1894. In 1895 ten pounds of ore from the Anacortes claim yielded $76.40 in gold. The ledge from which this rich rock was taken runs through four claims of the Anacortes group, which, with four others, are owned by J. H. Young, T. B. Childs, P. E. Nelson, D. M. Woodbury, M. S. Smith, John Russner and Douglass Allmond. The ledge is small, not showing over twenty inches in any place. Eleven hundred feet up the hill from where the rich rock of 1895 was taken the ledge was again uncovered and very rich rock struck. Surface work only has been done on this property.

The Crown Point, alongside the Anacortes, has a ledge four feet between walls, the gangue being quartz mixed with black slate, and carrying gold and a little silver. The owners, R. C. Sylvester, C. I. Carpenter, W. J. Farrell and

C. Ashley, have carried on development work systematically from the beginning, and have a sixty-foot tunnel.

Other promising claims of this group are the Gold Coin, Kootneai, Whatcom and Gold Coin.

The Alameda group is southerly of and across Cascade branch from the Anacortes group. Unlike most of the other mines of the Slate Creek country, which are blind leads, the Alamedas show on the surface a three-foot ledge of white quartz. The Alamedas are owned by P. E. Nelson, J. C. Phelps, G. B. Smith, of Anacortes, and others. From the assays it would seem that the ore runs from $28 to $35 per ton in gold, and that it is free milling. The find is a late one and very little work has been done.

The Whistler is on Crater Mountain, five miles southeast of the Eureka, and is owned by J. W. Romaine, R. A. Maxwell and John Leedy, of Whatcom. The ledge is about twenty feet in width, with a fifteen-inch streak of rich ore, carrying gold in a free state and also in black sulphurets. Shipments of ore have been made, yielding, it is said, $200 in gold per ton.

The Rockefeller, owned by John McCullough and James Bedell, is on Slate Hill. A ton shipment of ore yielded good results. The Bismarck group of four claims on Slate Mountain is owned by C. F. Megquier, H. Havekost and P. W. Law. A fifty-foot tunnel has been run on a four-foot ledge. The ore carries gold and a small quantity of silver and copper.

While placer mining on a small scale will not, in all probability, ever be a success on Ruby or Canyon or their tributaries, there is every reason to hope that with proper appliances, hydraulicking will prove remunerative. Gold can be panned from almost any of the benches along the creeks, and nuggets weighing as high as $20 have been found. During the past season F. J. Scougale worked a group of fourteen claims near the mouth of Ruby Creek with a small hydraulic plant and in six weeks took out $950 in nuggets ranging from 10 cents upwards. Frank Ledger and others built a flume a mile long and worked the Old Discovery claims near the mouth of Canyon Creek for about a month, employing seventeen men.

But the placer ground can only be worked thoroughly on a large scale, and this will be done during the coming summer by the Ruby Hydraulic Gold Mining Company. This company has bought the Scougale claims, extending a mile up Ruby Creek from its mouth and covering an area of 420 acres. It has a depth of auriferous gravel ranging from thirty-five to 200 feet, estimated to contain from 15,000,000 to 20,000,000 cubic yards, carrying from 25 cents to $1 in gold per cubic yard. There are several prospect holes on the property, one of them being eighty feet deep. At the bottom the gravel runs about 80 cents to the yard in coarse gold and the gold grows finer as the surface is approached, but it shows good colors all the way down. On the north side of the creek the ground is broken in places by rock, the gold is coarser and bedrock is frequently exposed.

The company proposes to equip this property with a complete hydraulic plant. It will make about three miles of ditch and flume, with a capacity of 2,000 miner's inches, giving a pressure of 300 feet, lay 1,000 feet of twenty-four inch steel pipe, with giants, install a dynamo for electric lighting, in order that work may continue night and day, and build a sawmill to cut the necessary lumber. A five-foot tailing flume will carry the debris into the Skagit Canyon, where the river is swift enough to carry off the largest boulders. Estimates of the cost of this plant and of the necessary buildings range from $16,000 to $30,000, and it is estimated that it could move from 4,000 to 6,000 cubic yards of gravel every twenty-four hours.

There is a prospect that a similar plant will be erected on Canyon, near Boulder Creek.

THUNDER CREEK.

By Douglass Allmond, of Anacortes.

Not until late in the fall of 1891 did the prospector penetrate to the headwaters of Thunder Creek. This stream has its source at the backbone of the main Cascade Range, a little north of east of Marble Mount, in Skagit County, and, flowing northwesterly for twenty miles, empties into the Skagit River about four miles south of the mouth of Ruby Creek. The headwaters of Thunder Creek and Cascade River (the next large stream to the south) are not more than four miles apart, but the divide is rugged in the extreme, well deserving the name of Sawtooth Range.

In 1891 John Russner and two other prospectors crossed the Boston Glacier, at the head of the Cascade, climbed the Sawtooths, and descending the northerly slope crossed another glacier that really forms the head of Thunder Creek. The trip was a dangerous one, but the men were rewarded by finding a "good prospect," although they did not then have any conception of the richness or extent of their find. Cascade District prospectors had found only galena ores, and this was what Russner and his companions were looking for;

so when they located a ledge of green ore, not having any of the attractiveness of bright galena, they put in their stakes simply because the lode was well defined, and carried away samples, having only a faint hope that these might show some value, although there did not seem to be anything to cause enthusiasm. The locations were called Willis and Everett. To the surprise of all, however, this greenish ore proved to be very rich in silver, some assays running as high as 3,400 ounces.

In 1892 there was quite a rush to the new camp, and many more good finds were made, although galena ores predominated. Six more claims were located on the Willis and Everett lead and covered the entire distance from these two claims, which were at an altitude of about 7,500 feet, down to Thunder Creek. The works at the lower claim are near the creek, and at an altitude of perhaps 2,500 feet above sea level. At this point the ledge carries galena.

Perhaps several dozen claims in all have been located in the Thunder Creek country, but the amount of development work done is very limited. In the fall of 1892 the Skagit Mining and Milling Company was formed and obtained control of the Willis and Everett claims. This company shipped several tons to the smelter, the returns being 190 ounces in silver. But notwithstanding the richness of this ore, it was found unprofitable to ship, because of the heavy charges for packing, etc., and mining was not again resumed. This was the only ore ever shipped out of the district, owners of claims contenting themselves, on account of the low price of silver, with merely doing assessment work.

A. E. Hartay and others own two good claims at the head of Thunder Creek Basin. They are northerly of the Boston, in Cascade District, and it is believed that the Boston lead cuts through the Sawtooth Range, again cropping on the Thunder Creek side, where Hartay made his locations. Assays show about $140 for all values.

Among other promising locations in the district may be mentioned the Hartford and extensions, on the Willis and Everett lead; the Ice Gate group, a high-grade galena; the Major, Silver Queen, Jasper, St. Louis and Puget Sound.

The Thunder Creek country may well be said to be a camp of great promise, although difficult of access, only awaiting the quickening touch of capital and energy. It can be reached by two routes. One of them is by trail up the Skagit; the other via Lake Chelan. From Marble Mount to the mouth of Thunder Creek is about twenty-five miles, and from the mouth to the headwaters is about twenty miles. It is about forty miles from Lake Chelan to the headwaters of Thunder Creek. This latter route is up the Stehekin to Park Creek, thence up the latter stream and across the main Cascades via the Park Creek summit.

RUTH CREEK.

Prospecting in this district only dates back to the close of the summer of 1894, but the few discoveries so far made are an earnest of what remains to reward more general and thorough work and an evidence that the mineral found further north and south in the Cascade Range extends through the whole width of Whatcom County. The district lies between the main range of the Cascades and the loftier parallel range on the west, of which Mounts Baker and Shuksan are the principal peaks, and is drained by the Nooksack River and its tributaries. Most of the ledges so far discovered crop in the south slope of the ridge closing in the Ruth Creek Valley on the north, and in and about Hannegan Pass, which crosses the divide between the headwaters of the Nooksack and Chilliwack Rivers.

The exploration of this region began in 1894 with the partial construction of the state trail up Glacier Creek, due north of Mount Baker, for twenty miles eastward, with the intention of crossing the Baker Range north of Mount Shuksan, thence down Beaver Creek to the Skagit, across the main range and down the Methow. This route was abandoned in favor of the one by way of the Cascade and Twisp Passes, over which the trail was last year constructed, but its partial construction by the Hannegan Pass route opened the way to prospectors. Whatcom County has followed up this work by building bridges across the north fork of the Nooksack and converting the trail into a wagon road, thus making it possible to haul supplies within fourteen miles of the camp. The route from Seattle is by the Seattle & International Railroad to Deming Station, 112 miles, thence by wagon road twenty-six miles and by trail fourteen miles.

Late in the summer of 1894 E. H. Thomas, of Blaine, and J. W. Hulett made the first discovery, on which they located the Hulett. This was a ledge of great width, heavily capped with iron at frequent intervals, which crops high on Burnt Mountain, north of the nineteenth mile post. The walls are granite and hornblende and the ledge is easily traced for several miles over the mountains. The ore carries iron and copper pyrites and arsenical iron, and assays from surface specimens range from a trace to $23 gold, with traces of

silver and a small percentage of copper. This was the first of five parallel ledges, all heavily capped, running through Ruth and Granite Mountains. The country rock is granite, in which large masses of hornblende occur, but at the base of Ruth Mountain is a trap overflow. On one of the parallel ledges, with a large heavy capping, are the Granite and Edith, which have been little prospected. On another, near Hannegan Pass, Messrs. Galloway and Shoemaker, of Lynden, have several claims from which good gold assays have been obtained. A good prospect was found in the Marine, located in September, 1895, by J. W. Barber and others on Burnt Mountain, half a mile east of the Hulett. In the cropping was twenty inches of honey-combed guartz carrying pyrites and arsenical iron, of which three assays of surface samples ran $5.60 gold, $24.58 silver and lead, 6 per cent. copper; $23.20 gold; $19 gold, respectively. In an eighteen-foot shaft the ledge widened to five feet and carries five inches of solid mineral.

Last season George Longdon and others discovered near the head of Beaver Creek a small lake formed by a dike of granite against a mass of quartz 300 feet wide. This quartz constitutes the bed of the lake and is plainly visible through the clear water, evidently carrying mineral.

THE CHICO TIN MINES.

A great deposit of tin ore cropping near Wildcat Lake, four miles from Chico in Kitsap county, has for some time been the subject of much speculation and its value has been attested by such authority among mining engineers as to warrant the organization of the Cook Kitchen Mining Company to develop it. The deposit is held under twenty-six mining claims, covering 462 acres of land, with a water right on Wildcat Lake, a sheet of water covering 160 to 200 acres.

The deposit consists of a great body of killas carrying cassiterite, or pyrites of tin, native oxide of tin, with considerable wolframite, tourmalin, arsenious iron and mica. It is over 400 feet wide and of much greater length, running six degrees north of west and south of east, the contact south about one mile being gray sandstone, and north a hard calcine dolomitic rock. Four shafts are down for depths ranging from twenty-five to eighty-five feet, the deepest being at the footwall with an extension now in progress fifty feet deeper. One of these shafts shows solid tin ore on all four sides, increasing in value as it goes down, while a small cut near the footwall shows rock richly impregnated with arsenious iron, sulphate of iron, cassiterite or tinstone and brittle argentum, the cassiterite crystals being in plain sight. Another cut shows more malachite copper than the first mentioned. A number of assays have been made, showing the percentage of tin in the ore taken from the deepest shaft to range from three to five and one-half, while samples from one of the cuts carried traces of tin, iron and copper, and from another cut ten ounces silver and 4 per cent. tin. An assay from a depth of twenty-five feet in the shaft ran: Silver, 39¾ ounces; tin, 4¾ per cent; copper sulphides, 5¼ per cent., and another assay for gold and silver alone showed $3.72 gold, $2.32 silver.

This deposit is peculiarly accessible, being only four miles distant by road from Chico, on Port Washington, a branch of Puget Sound. With deep water navigation thence to any railroad the cost of transportation will be at the minimum.

In order to reduce the ore, it is proposed to crush it and wash out the lighter waste, then roast the concentrates remaining in order to get rid of the arsenic and sulphur and oxidize the iron pyrites, which is removed by a second washing. Oxide of copper will be extracted with diluted sulphuric acid and the copper in the solution then precipitated with iron. The purified ore, known as black tin, will then be shipped to the smelter.

GOLD CREEK.

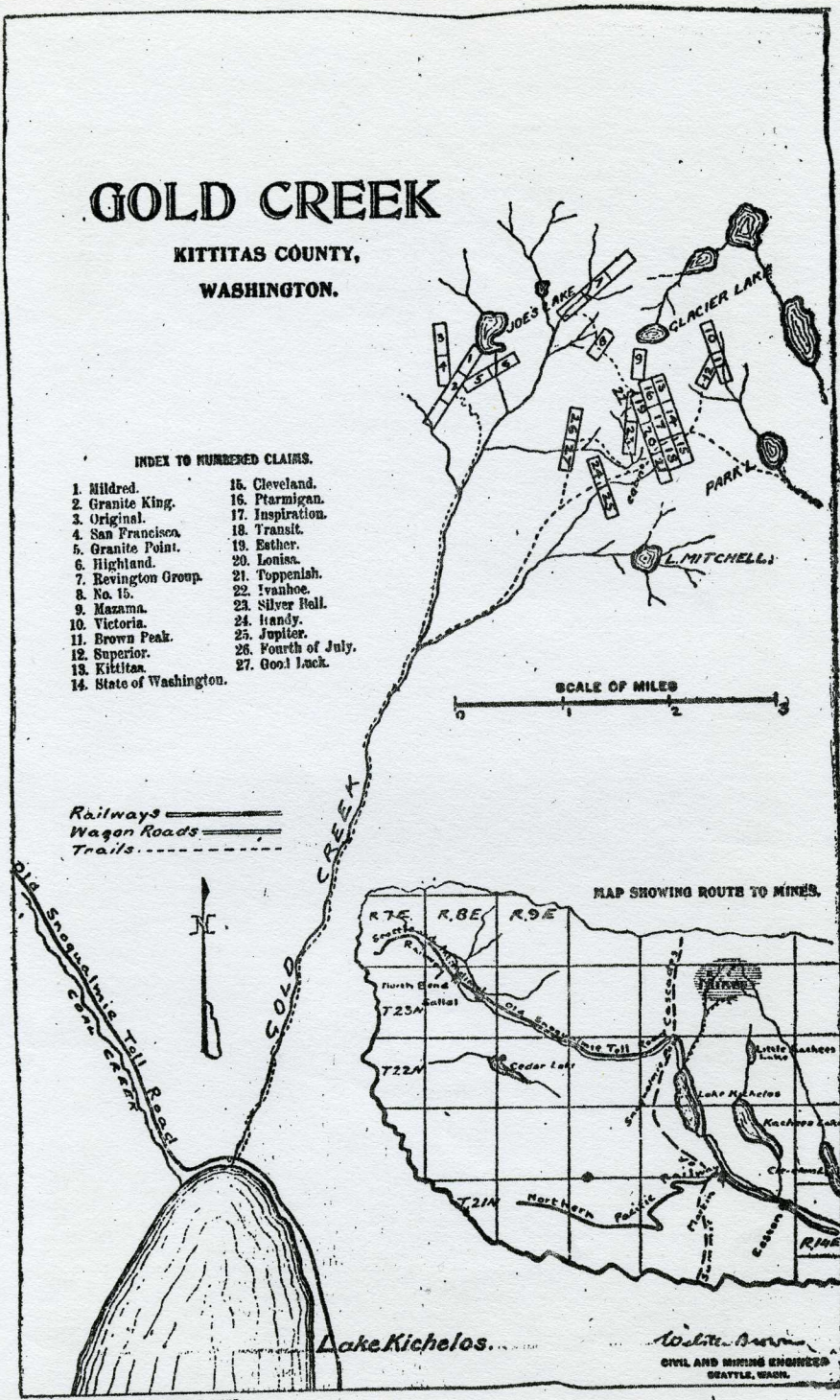
A short distance east of the summit of the Snoqualmie Pass is a mining district, of which little has been heard but where much has been done with satisfactory results. At the head of Gold Creek, which flows into Lake Kitchelos, the source of the Yakima River, the granite and syenite country rock is cut by true fissure ledges, running almost north and south, with the line of the divide, and sometimes cutting both granite and syenite in their course. The surface ledge matter is porphyry, but as one goes down in it, it changes to quartz. The mineral carries gold and silver in the form of sulphides, bromides of silver, ruby silver, steel galena and carbonates of lead.

The nearest route by rail from Seattle is by the Northern Pacific to Martin Station, 101 miles, thence northward on the Snoqualmie wagon road along the east bank of Lake Kitchelos, ten miles, and by trail up Gold Creek,

GOLD CREEK

KITTITAS COUNTY,

WASHINGTON.



eight miles. The district can also be reached by the Seattle & International Railroad to Sallal Prairie, sixty-three miles, and the Snoqualmie Pass road, thirty-four miles. Prospecting began in the year 1890 and has been followed up by a large amount of development.

The principal property is the Esther and Louisa group of twelve claims, owned by the Gold Creek Mining Company of Seattle. One of the main ledges running through two claims has widened from thirty-six to forty inches in the face of a thirty-foot tunnel and carries concentrating ore ranging in value from $10 to $40, according to various assays. Two lower levels have been run seventy feet each on this ledge and two feeders have been opened. Several shipments of sorted ore aggregating about ten tons were made to the Tacoma smelter in 1896 and the returns showed an average gross value of about $100 a ton. A parallel ledge has been opened, varying in width from two to three feet, with a pay streak of eight to twenty-two inches. On another ledge extending through two claims a twenty-foot tunnel has shown a pay streak of six to eight inches and a 100-foot tunnel on another ledge has shown six to twelve inches of ore assaying from $20 to $100. This company has two power drills, operated by steam, and an ore breaker. It will this season erect a concentrator and put in a water power plant to run all the machinery.

On the right bank of the Creek is the Granite King group of six claims, owned by the Granite King Gold Mining Company, two claims being on each of three ledges. One of these has three tunnels, the upper 180 feet, the second seventy feet long 150 feet lower down the mountain and the third thirty feet, showing it to be about four feet, mineralized for the full width between strong walls and carrying twelve to twenty inches of highly mineralized rock. A second ledge runs into this one from the right and has twelve inches of pay ore carrying gold and copper. The third shows galena and copper sulphides in a twenty-foot tunnel. Assays from these several ledges have never gone below $26 and have run as high as $180. Work was continued far into the winter, until the cabin was carried away by a snowslide and the occupants had a narrow escape with their lives.

On the Good Luck, Lon Jose and Mrs. Revington have run a cross-cut 100 feet to tap a good ledge, cutting a number of stringers ranging from six to twelve inches and carrying rich galena ore, on one of which they have run a drift. The same parties have run a tunnel thirty feet on the Fourth of July ledge, showing a good pay streak.

CLE-ELUM.

The great belt of copper and gold ledges which runs through the backbone of the Cascade range crops with great strength on the mountains drained by the Cle-elum River and extends northeastward across the Teanaway to the base of Mount Stuart and west to Lake Kahchees. In the same belt are many ledges of quartz carrying free gold and sulphurets, with galena in its various forms. Further southeast, down the course of the river, is a belt of pyrites ledges capped with magnetic and hematite iron, which have caused them for years to be miscalled the Cle-elum iron mines. The district has been legally organized and extends from the headwaters of the river to Cle-elum Lake and from Kahchees Lake on the west to the Teanaway divide on the east. Recent discoveries have, however, extended beyond the latter line to a connection with the Negro Creek unorganized district among the foothills of Mount Stuart.

The district is easily reached from Seattle or Spokane. From the former city one takes the Northern Pacific train to Cle-elum, 122 miles, and the branch line to Roslyn, four miles distant. A wagon road leads thence to Cle-elum Lake and up the Cle-elum River to I-i-ass Lake, near its source, thirty miles away. Trails branch off from the road up all the principal creeks and traverse the district to the summits on the right and left.

The country rock of the district is granite, syenite, porphyry and slate, with dikes of serpentine and the mineral ledges cut in a generally northwest and southeast direction, with some cross ledges running east and west. Discoveries in this district began about 1881, when A. P. Boyls, the present venerable but vigorous mining recorder, in company with S. S. Hawkins and Moses Splawn, traveled up Camp Creek and on Hawkins Mountain traced three parallel ledges carrying iron sulphurets. From that time forward prospecting traced the belt twenty miles down the Cle-elum from its head and east and west for fifteen miles as already outlined.

The best developed property is the Aurora group of five claims on Mammoth Mountain, owned by John and Timothy Lynch, which carry high-grade gold and silver ore. The mountain is composed mainly of metamorphic rock, cut diagonally by dikes of granite in which are fissure ledges of quartz running east and west. One ledge has been traced five feet wide over 2,000 feet and carries free gold and sulphurets, being heavily oxidized to a depth of fifty feet. A shaft fifty feet deep on the hanging wall cut a twelve-inch stringer at thirty-five feet and showed ore averaging $40 gold. A six-inch

feeder widened to eighteen inches in a sixty-foot tunnel, from which a winze is being sunk. A twenty-foot dike of porphyry crops out very distinctly on the west and carries decomposed red oxide of copper and iron, with two feet of red ochre on the hanging wall carrying $114 gold, 8 ounces silver. On a parallel five-foot ledge, enclosed in a porphyry dike, a tunnel is in twenty feet, showing free gold and sulphurets. Another ledge four feet wide runs parallel and will be tapped by a tunnel now in seventy feet. An average of the croppings shipped to San Francisco returned $126 gold, $1.09 silver and assays have shown $200, $269, $229 gold, with a trace to $1 silver. On another parallel ledge three feet wide and traced for 1,000 feet, a tunnel has penetrated sixty feet showing ore the full width, after cutting a slate horse carrying pyrites, and another tunnel is in 115 feet at a point 100 feet deeper, while a third tunnel is in twenty feet and shows good mineral. A shipment of twenty tons from the two last-named ledges returned $56 gold and a trace of silver. A mill of four 320-pound stamps and one four-foot concentrator was erected in 1896 on a millsite at the foot of the mountain and made a successful run, exact results of which were not obtainable. The running of a 2,000-foot cross-cut to tap al lthese ledges at depth is contemplated for this season.

West of this group E. P. Gassman has the American Eagle group of four claims on a parallel four-foot ledge with two feeders, and a shaft is down ten feet on it showing ore which assayed from $27 to $125 gold. A cross-cut has been run sixty feet to tap the main ledge, which would also be struck by the proposed cross-cut on the Aurora group. On a twenty-four inch ledge on the Vidette, A. P. Boyls is sinking a shaft showing similar ore.

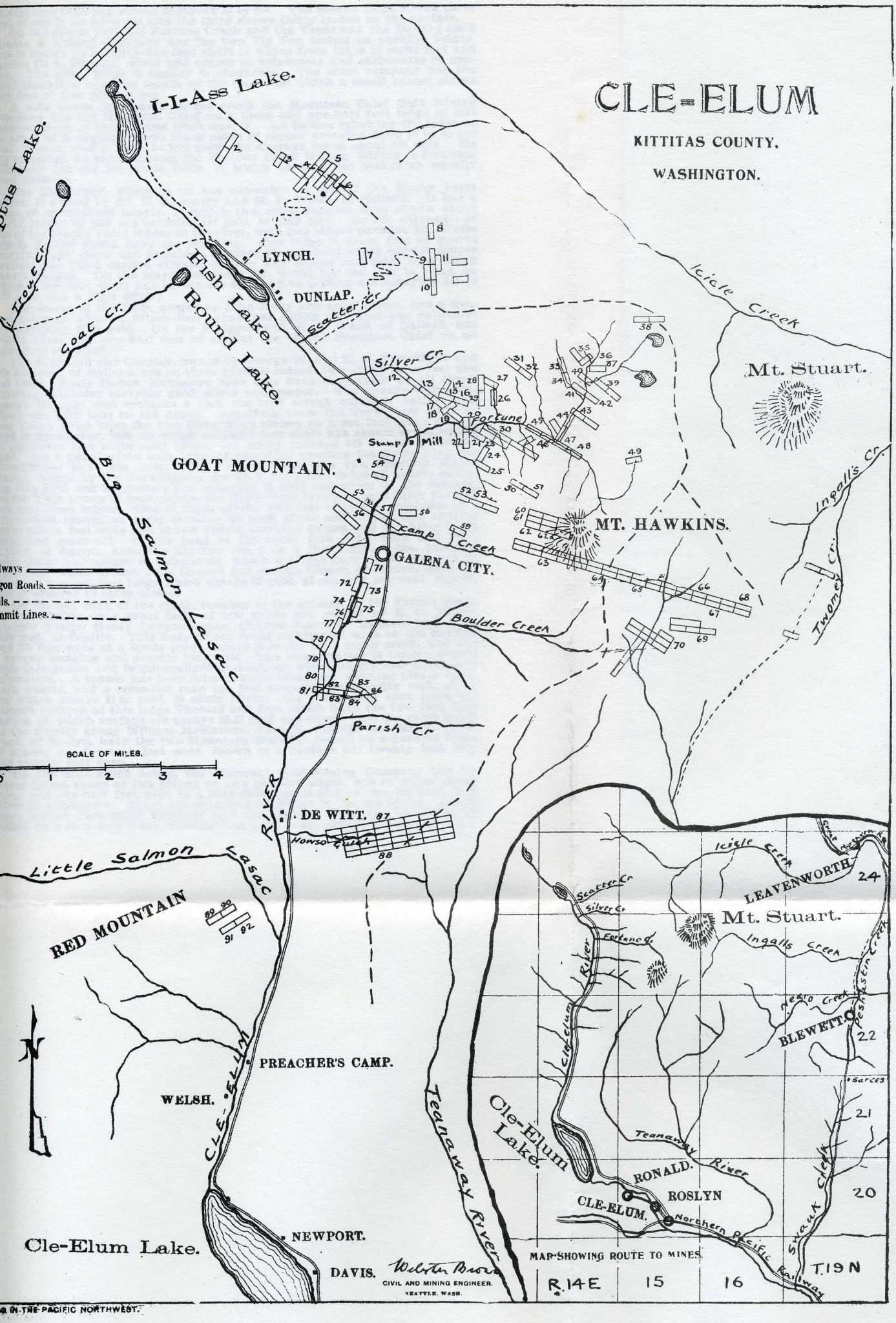
On another parallel ledge to the southwest P. A. Stanton and James Grieve have the two Bronco claims. A thirty-foot tunnel has been driven on a four-foot ledge of sulphurets and arsenical iron, and 100 feet below another tunnel is in 110 feet, striking a 26-inch feeder. A sackful of ore shipped to the Tacoma smelter returned $138 and assays have run $140 to $180.

Also on Mammoth Mountain, J. H. Topping, of Seattle, has the Topping on a six-foot ledge of free milling and concentrating ore, on which an inclined shaft is down thirty-three feet, and a cross-cut has been started. Two assays ran $60 and $37 gold, $23 and $3 silver. The Prince group, owned by Mr. Topping, J. A. Johnson and Mrs. J. F. Cummings, of Seattle, comprises five claims on a ledge of sulphuret ore traced through the whole string across the head of the river, with one claim on the Topping ledge. A tunnel has been run a short distance.

On the south side of Mammoth Mountain is the Fish Eagle, owned by James Grieve and K. W. Dunlap, on a great outcrop of copper ore stained red with oxidized iron, blue with bromide of copper and black with oxide of copper, at least forty feet wide. A cross-cut tunnel has been driven 262 feet to tap the ledge at a depth of 190 feet and is expected to strike it in twenty-five or thirty feet more.

On a sharp granite peak at the head of one of the forks of the Icicle, but reached by a trail branching off for three miles from the Cle-elum road, is the King Solomon Mine, owned by James Grieve, K. W. Dunlap and August Sasse, where development has been prosecuted with fifteen to twenty men. The ledge cuts through this peak in a north and south course and is of white quartz, fully eight feet wide. It carries galena, antimonial silver and gold with a trace of copper, and will average $133, mostly in gold. Assays of the rich streaks give $180 gold, 60 ounces silver, 22 per cent. lead. A tunnel was first driven 300 feet from the summit and is now in 130 feet on the ledge and an upraise has been made for twenty-two feet, from which the ore is being stoped out for smelting. The same ledge has been traced 1,200 feet over the summit of the peak and down a gulch on the north side, in which it crops eight feet wide between granite walls 100 feet high. A tunnel has been driven fifteen feet at this point, where Mr. Grieve has the Silver Fiend, and a cross-cut will be driven 200 feet to tap the ledge near the King Solomon line. On an eight-foot ledge parallel with the Silver Fiend, and carrying similar ore, Messrs. Grieve, Gassman and Dunlap have the Humbug, on which they are tunneling. On the next gulch east of the Silver Fiend Messrs. Grieve and Sasse and Mrs. Churchill have the Last Chance on a six-foot ledge, carrying gold, lead and plumbago, assays giving $4.30 in gold. A cross-cut has been run thirty feet and a shaft sunk twenty-five feet. On another six-foot ledge parallel with the Silver Fiend John Stewart has driven a tunnel twenty feet on the White Star, showing similar ore to the Silver Fiend with several feeders. A water jacket smelter will be erected this summer to reduce the large quantity of high grade ore on the King Solomon dump.

On the mountains on each side of Fortune Creek, flowing westward from Mount Hawkins, is a belt of ledges some of which carry free gold and sulphurets, while others carry iron and copper sulphides. On Huckleberry Mountain, south of the creek, Robert Montague, O. R. Johnson, Andrew Jackson and Simon Justhand have the Huckleberry group of three claims on a ledge of sulphuret ore three to four feet wide, opened by tunnels forty and twenty feet long, which assays about $35 in gold, silver and copper. On the same mountain the Rocky Point Mining Company has the two Rocky Point claims on three strong fissure veins of pyritic ore running up and down the mountain. On one of these a fifty-foot tunnel shows ore the full width with



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an eighteen-inch pay streak assaying $8 to $50. The second ledge shows three feet of ore in an open cut and the third shows thirty inches on the surface.

On the divide between Fortune Creek and the Teanaway the Ballard Gold Mining & Milling Company has the two Tip Top claims on parallel ledges. One is shown by a thirty-five foot shaft to widen from three to eight feet and carries $14 to $20 gold, silver and copper in sulphurets and carbonates of copper. The other ledge is similar in character. The same company has the Gold Mountain near the mouth of the creek, on which a small tunnel shows two feet of free milling ore.

A mile above the mouth of the creek the Mountain Chief Gold Mining Company has the Mountain Chief on a three and one-half foot ledge of talc between walls of granite and black quartz. An incline following the ledge at an angle of 45 degrees shows black oxide of copper assaying from 10 to 40 per cent. copper, and a trace to $104 gold, the average being about $30 gold. On the extension up the mountain the Fortune Creek Mining, Milling & Smelting Company has the Mountain Belle, in which an open cut makes an equally good showing.

The Mayflower, which is on the extension of one of the Rocky Point ledges, is owned by Dr. C. S. Emery and H. F. Weise, of Ballard. It has a ledge of crystallized quartz, in which two small tunnels have shown about thirty inches of pay ore carrying $14 gold, largely free. On the extension of one of the Rocky Point ledges to the river, with two others parallel, Mr. Weise and S. Kedzie Smith have the Big Bug. One ledge is seven feet of quartz carrying ruby silver and bromides, another of undefined width carries copper pyrites; the third carries streaks of iron and copper sulphides in a black quartz gangue. On the Mayflower ledge Mr. Weise has the Just in Time, on which a ten-foot shaft has shown six feet of free milling ore assaying $45 to $178 gold and a little silver.

The Queen of the Hills, owned by John Kelly and John Bailey, has a five-foot ledge on which a fifteen-foot tunnel has shown free gold and sulphuret ore, assaying $9.45 gold. On the Whippoorwill, R. S. Ward, of Ballard, has shown three and one-half feet of similar ore to the Mountain Chief on an eight-foot open cut.

The Standard and Ohamer, owned by George W. and E. H. Terwilliger and Ole Ohamer, of Ballard, are on three parallel ledges, two about three feet and the third twenty inches. Extensive open cuts have been made on all three, showing sulphides carrying gold, silver and copper. The twenty-inch ledge assays $13 gold and contains a rich one-inch streak carrying native lead. There are fifty tons on the dump. Adjoining these the Terwilliger brothers and Ralph Miles have the two Ruby King claims on a six-foot ledge discovered in September, 1896, on which an eight-foot shaft has shown seven inches of sulphides and antimonial silver, one assay running 643 ounces silver, $18 gold. On a twenty-four inch ledge of sulphides crossing the Ruby King the Terwilligers have the Lake City. Above these the two Rushing Water claims, owned by the Terwilligers, are on a forty-foot ledge of quartz carrying free gold and sulphurets and assaying $5 gold and silver on the surface. On the Twin group of four claims, the Terwilliger brothers have three parallel and two cross ledges. One of these carries two feet of copper sulphides in a fifteen-foot tunnel, an assay showing $23 gold, silver and copper, and another crops thirty feet wide and shows quartz carrying galena and sulphides in an eight-foot cross-cut. At the head of the north fork John Berg and John Kelley, of Roslyn, have the Tip-Top No. 1 on a thirty-inch ledge, carrying gold, silver and copper in sulphurets, which a fifteen-foot shaft shows to be widening. John Grosso, John Somers and Adolph Elsner, of Roslyn, have the Mary on a seven-foot ledge which assays $9 gold, $6 silver, 1 per cent. copper, and is believed to carry nickel.

On the left bank of the creek, running to the summit, is the Family group of four claims on a great body of low grade ore, owned by E. O. Marsh, Andrew Teuke, Henry Langenbacher, Charles Sears, of Ballard, and A. C. Bowman, of Seattle. This body of ore crops eighty feet wide on the summit and 225 feet wide at a lower point, where it is cut by a small creek, and has a syenite hanging and granite foot wall. The ledge matter is talcose quartz with talc gouge and is mineralized throughout with fine-grained white iron sulphurets. A tunnel has been driven thirty-three feet, running into a hard, dark quartz, and a cross-cut runs ten feet towards the hanging wall, all in ore which assays $1.80 gold, 20 cents silver. On a supposed spur from the summit outcrop of this ledge Thomas and Don Smith have the two Don Tom claims, on which surface ore assays $2.27 gold and silver. On the same gulch as the Family group William McKasson, John H. Corbins and Mayor H. P. Fogh, of Roslyn, have the two Mountain Whistler claims on a parallel ledge of similar ore fourteen feet wide, shown in a surface cut twenty feet long and twenty feet deep.

On the next gulch below, the Clermont Gold Mining Company has the Silver Queen group of two claims on two parallel ledges, one of which shows three and one-half feet wide in a fifty-foot tunnel and carries $16 gold, $2.30 silver in sulphurets. There are seventy tons of ore in the ore house. Above these claims Terwilliger brothers and Ole Ohamer have the two Goldbug claims on a four-foot ledge showing free gold in an eighteen-foot open cut.

L. F. McConihe, of Roslyn, and W. E. Head, of Seattle, have a four-foot ledge of sulphuret ore assaying $18 gold on the Gambler's Dream.

At the mouth of Fortune Creek the Fortune Creek Mining, Milling and Smelting Company has erected a mill with two 600-pound stamps, of which the weight and number of drops will be increased by coil springs forcing them down. The river has been dammed to produce fall enough to run a water wheel, which was ready to turn last summer, but was carried out by the fall floods. The company has also shipped in a pyritic water-jacket smelter of twenty tons daily capacity, which will be erected in the spring.

The great copper belt extends for seven miles northwest and southeast from the base of Mount Hawkins through the Teanaway watershed to the source of Ingalls Creek at the base of Mount Stuart, and is covered with locations for the whole distance. There are two main ledges, which have been traced on the surface at intervals, one being fifteen to twenty feet and the other five feet and upwards, with walls of granite and porphyry on one side and granite and serpentine on the other. Both carry red and black oxide of copper and masses of native copper weighing 400 pounds and upwards, the ore always having a considerable gold value as well.

The most easterly group is the Grandview of three claims, owned by Paul Gaston, J. T. Hamilton and Dr. R. C. Corey, on which one ledge crops ten to twelve feet wide. In a tunnel sixty feet long at a depth of eighty feet is a pay streak eighteen to forty-eight inches wide, in which bodies of native copper frequently occur, surrounded by black oxide. The lowest assays have shown 10 per cent. copper and $6 gold, and the value has run as high as 60 per cent. copper and $15 gold. A cross-cut has been started to tap this ledge at a depth of 140 to 150 feet. Then come the Butte group of three claims, owned by the Anaconda of Washington Copper & Gold Mining Company, on which two open cuts have defined the smaller ledge to be three to fourteen feet wide, and the Crown Point group of five, owned by Messrs Gaston, Corey and Hamilton, where the ledge is shown up by an open cut and has been stripped. The Swayne and Haight group of seven claims, bonded to D. N. Baxter, adjoins on the west, having a 120-foot tunnel showing good ore in one ledg e. The Johnson group of eight claims, owned by Messrs, Gaston, Corey and Hamilton, has a fifteen-foot shaft and several open cuts showing a streak of native copper two to twelve inches wide for the whole length. The Boyls group of eight claims on both ledges, owned by A. P. Boyls is bonded to Messrs. Corey and Hamilton. The wider ledge has been opened by tunnels forty, seventy, ninety and 200 feet, giving a depth of 300 feet and blocking out 1,000 tons of ore similar to that in the Grandview and assaying 10 to 48 per cent. copper. On the smaller ledge are tunnels thirty and 100 feet, ore from which carried 48 per cent. copper and about $10 gold and silver. A ledge of free milling ore eighteen to thirty-six inches wide and assaying from $75 to $175 gold on the surface crosses these two at right angles.

The first discovery on Mount Hawkins was three parallel ledges carrying iron sulphurets, on each of which two claims have been taken. In the Cle-Elum and Hawk group A. P. Boyls and W. B. Kelly have four claims, two on each of the lower two ledges. One shows two to five feet wide in a fifty-foot inclined shaft, from which assays averaged about $50, though a sample across the bottom is said to have shown $455 gold. A 120-foot cross-cut will tap this shaft in thirty feet more. On the other ledge an incline of thirty feet shows it to be eight to ten feet wide, carrying $25 gold and a little silver. The I-i-ass, owned by P. J, Flint, is on the third ledge, which is defined as forty feet wide by a cross-cut, and has a pay streak in the croppings four or five feet wide, assaying $25 gold and upwards, with a little silver. On the extension Moses Emerson and John O'Neil have the Epha and an extension showing four to six feet of quartz carrying $7.20 gold and an ounce of silver on the surface.

On the west spur of Mount Hawkins is the Ida Elmore, owned by Messrs. Hawkins, Grieve and Dunlap, on which a tunnel thirty-six feet shows a ledge eighteen to thirty-six inches, assaying $45 free gold and $82 gold in sulphurets. A cross-cut has been run 236 feet to tap it. On a parallel ledge is the Maud O., owned by A. D. Olmstead, C. O. Swayne and A. W. Haight, of Roslyn, E. W. Wilson and C. W. Sill, of Seattle. A tunnel and incline have been run 147 feet on the ledge, showing eighteen inches of solid free milling ore, of which an average assay gave $74 gold and $1 silver. A small stamp mill has been bought for this property and will be erected when the snow goes off. Near the mouth of Camp Creek J. C. Jackson and Charles Eaton have the Beaver on a four-foot ledge between granite walls, on which a tunnel is in thirty-five feet. The ore assays $18 gold, silver and copper in sulphurets.

The Ruby group of two claims has five closely parallel ledges, which have been traced across the river to Goat Mountain, and is owned by H. F. Weise and S. Kedzie Smith. One ledge of great size has a fifty-foot tunnel along the hanging wall, which shows iron sulphides on the wall and fine-grained arsenical iron in a number of streaks, assaying $7.35 to $28 gold and silver. Another ledge is six or seven feet between walls and shows eleven similar seams of arsenical iron and sulphides in a small tunnel. A third ledge is similar in size and character and the two appear to be running together. Another is sixteen feet wide, similar in all respects, and the remaining two,

thirty inches and five feet wide, are also like them, except that they carry more copper, assays running $13 to $20 silver, $4 to $5 gold and 10 per cent. copper.

Three of these ledges show very prominently on the extension up Goat Mountain, on which Messrs. Weise and Smith have the Brown Bear group of three parallel claims. The widest is sixty feet, cropping in a gully where a waterfall pours over a cliff of ore twenty-five feet high. A ten-foot tunnel shows galena and sulphides assaying $48.85 gold and silver and 5 per cent. lead, and sixteen feet of ore shows in the croppings and assays $63.40 gold and silver. The two parallel ledges are thirty and forty feet wide, and carry more galena, being similar in other respects to the first. On the extension of the same series down the mountain to the river the Jackson brothers located the Cascade in the fall of 1896 and by their first shot took out $65 ore carrying more galena than on the other claims.

On Goat Mountain a good showing of galena ore has been made by Curtis Homer, of Roslyn, and Michael McHugh, of Buckley, on the Silver Dump, nearly opposite the mouth of Camp Creek. A tunnel has been driven forty feet on the river bank, and shows an eighteen-inch pay streak of solid galena, assaying $63 silver and some gold. Near this claim David Payne, Robert Babcock and Charles Roberts, of Roslyn, have a ledge of great width, which assays $35 gold, $6 silver and 3 per cent. copper. On the southeast end of Goat Mountain William McKasson has the Hardscrabble on a six-foot ledge carrying iron pyrites and capped with iron-stained porphyry. On a ten-foot cross ledge of similar ore John H. Corbins has the Mattie.

A great belt of ledges runs across Howson Gulch and up the mountain on the left bank opposite Red Mountain, in a northeast and southwest course, cutting the granite, while a number of cross ledges run almost at right angles. The most active work is being carried on by the Morning Star Mining Company, which has seven claims on three ledges. One of these measures sixteen feet and a 100-foot tunnel shows the ledge matter mineralized the full width. An assay a few feet from the mouth showed $9.60 gold, besides copper and silver. Another ledge crops eight feet wide and shows white iron sulphides carrying $5.70 gold in a fifteen-foot tunnel, which is being driven 100 feet. Another ledge eight to ten feet wide is being opened by a tunnel, ore from which assays $7 gold and silver.

On the same belt John McDonald, of Seattle, and William Campbell, of Port Blakeley, have the War Eagle group of twenty-eight claims, which they are developing. On the War Eagle ledge, six feet wide, are four claims, and a sixty-foot tunnel shows iron sulphides the full width, assays running about $40 gold and silver, mostly the former. Another seven-foot ledge runs through four claims and a thirty-foot tunnel shows sulphurets and molybdenite. Another claim is on a twenty-six foot ledge, on which a fifteen-foot tunnel shows galena and sulphurets its whole width, assaying $8 to $10 gold and silver. An eight-foot ledge running through two claims is opened by a ten-foot tunnel, now being extended, and has been stripped, the surface ore carrying $5 free gold. A forty-foot tunnel shows galena ore carrying $8 or $9 gold and silver in a six-foot ledge and a tunnel of the same length shows sulphide ore in a four-foot ledge.

At the head of Boulder Creek, on the summit of the ridge between the Teanaway and the Cle-Elum, is a great porphyry dike running southeast and northwest, which is fully 100 feet wide and spreads at one point to a greater width. It is veined with quartz ledges four to twenty feet wide, carrying gold, silver and nickel. On the Keystone group of ten claims, owned by Adolph Elsner, John Grosso and John Somers, of Roslyn, is a ledge twenty feet wide, in which a twenty-foot shaft shows a twenty-four inch pay streak assaying 8 to 18 per cent. quicksilver, $2.40 to $15 gold. On an eight-foot ledge a twenty-eight foot tunnel shows six inches of talc on each wall, which assays 2½ to 8 per cent. quicksilver, $5 to $24 gold, besides nickel. A cross-cut has been driven thirty-two feet. The Chesapeake group of five claims was located in 1896 on the northeast end of the dike by John Mulligan and others. The surface ore assayed $13 gold.

One of the famous claims of this district is that located by the late Elvin Thorp ten years ago on Red Mountain and now owned by Edward Pruyn and J. B. Davidson, of Ellensburg. The ledge is iron pyrites twelve feet wide under a red iron cap, and assays have ranged from $18 to $165 in gold, silver and copper. A tunnel was run 240 feet on the ledge by the original owners. On the northeast extension J. S. McConihe and Jacob Welsh have the John C., and on one of the peaks William McKasson and John H. Corbins have the St. John and St. Luke on a ledge eighteen feet wide.

The famous Cle-Elum Iron Mines, which may yet turn out to be gold and copper mines, are on a seven-foot ledge showing red hematite and magnetite in the croppings, which assays 56 per cent. metallic iron. It has been traced two miles down the river and bears eastward across the Teanaway to the headwaters of the Peshastin. On this ledge the Pacific Investment Company has twelve patented claims, on which it ran a number of tunnels and surface cuts.

Placer gold is found throughout the bars of the Cle-elum River and has been mined spasmodically for many years, but the gold is mostly fine and the best pay would probably be found on the bedrock of the old channel. Several

parties are working to reach bedrock, among them Messrs. Hicks and Jones near the mouth of Fortune Creek, L. F. McConihe on the Princeton bar, John H. Corbins and William McKasson at the Battle Ax camp. The high bars on the sidehills are evidently old river wash and skill and persistence, backed by money, might show good pay on bedrock, but it is probable that only hydraulicking on a large scale would be profitable. Until the last year work was confined to the low bars, from which Theodore Cooper, James Wright and John Lind took $400 in 1895 in coarse gold with some pieces of platinum at the China camp. R. De Witt and William Taylor have wing-dammed the channel at Big Salmon le Sac and taken light gold from bedrock.

THE ICICLE.

The mountain walls between which this stream flows from the snows of Mount Stuart into the Wenatchee offer an inviting field to the prospector, in which he has barely begun to uncover the mineral. If the discoveries already made may be taken as an earnest of what remains to be found, this is as rich a part of the Cascade mineral belt as many already described. It lies in a direct line with districts which make good showings, on the north, south and west, being divided by a single mountain ridge from the headwaters of the Cle-elum.

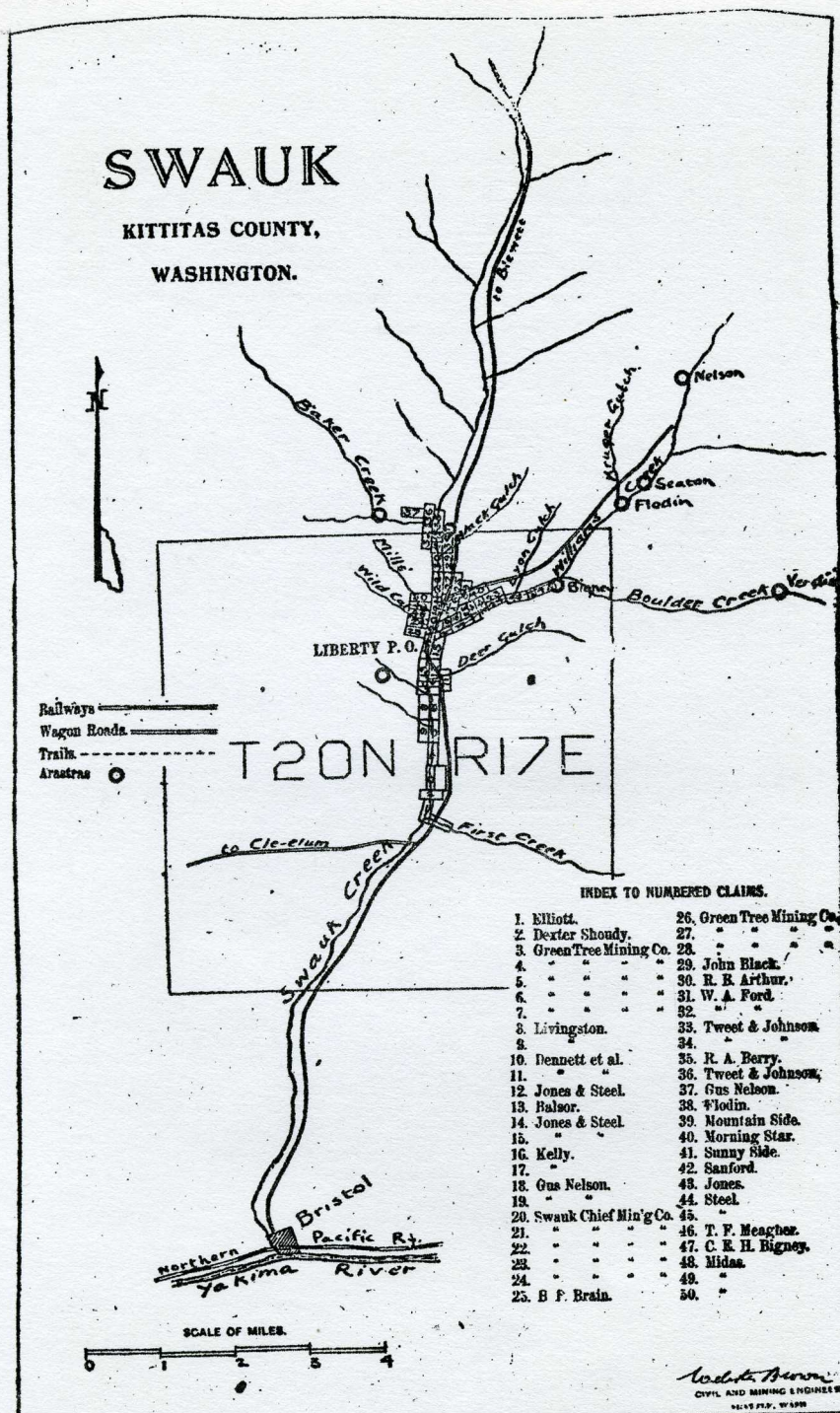
The district is reached from either the Northern Pacific or the Great Northern Railroad. The former is left at Cle-elum, 122 miles from Seattle, a branch line followed to Roslyn, four miles, and the wagon road followed up the Cle-elum Valley, twenty-five miles, to the mouth of Scatter Creek. Thence a horse trail leads three miles over the divide to the headwaters of the Icicle. The Great Northern Railroad may be taken to Leavenworth, 151 miles from Seattle, and thence a trail leads up the Icicle thirty miles to its head.

The greatest discovery, and the one having most development, is on the Pickwick group of thirteen claims, from which the Pickwick Mining and Development Company expects to ship ore this season. This is a great deposit of decomposed quartz, carrying copper carbonates, sulphides and bornite, which covers a great but undefined area in the basin at the head of Phantom Creek, an affluent of the Icicle near its source. It has been traced over a space 6,000 by 145 feet and its boundaries were not found. From an open cut thirty feet long a shaft was sunk forty feet and cross-cuts made from the bottom seventy-five feet one way and forty-five feet the other, and all the rock cut through had the minerals already mentioned disseminated through it. A mill test of this rock showed it to carry 15 per cent. copper, $14 gold, $5.40 silver, a total of $34.40. At another point a tunnel was driven 100 feet and a cross-cut forty-five feet each way, and all this work was in ore carrying a smaller percentage of copper but more gold than that taken from the shaft. The company has recently bought two adjoining claims and will make a road to connect with the Cle-elum Valley road, with a view to shipping ore this season.

A number of locations—probably fifty—have been made during the past year on the two forks of Jack's Creek, which enters the Icicle about twenty miles from its mouth, and on some of them work was continued until snow fell last winter. On one of these A. F. and F. D. Estes ran a thirty-foot tunnel on a twelve-foot ledge assaying $28 gold and copper. L. A. Parker and H. C. Castlebury have shown gray copper in a sixteen-foot cross-cut on a ten-foot ledge, where they have the Bald Eagle and Gray Eagle. A five-foot ledge carrying arsenical iron, on the mountain overlooking the left fork of Jack's Creek, gave a surface assay of $13.80 gold, and extends through the Blind Lead group of three claims held by John Bjork, A. Van Epps, H. L. Farley and Camille Massey, and four extensions held by Ed Gonsur, with Messrs. Massey and Farley. On the left bank of the right fork of Jack's Creek a dike of dolomite and quartz is slightly mineralized throughout with white iron and sulphurets, carrying gold, silver and nickel, and is opened by a twenty-six foot tunnel. On this ledge are the Nevada and Excelsior, held by Messrs. Bjork and Van Epps.

THE SWAUK.

In other sections of Washington placer mining has quickly become dwarfed in importance by quartz mining, but on the Swauk and its tributaries the former system still holds pre-eminence. It is only during late years that discoveries of mineral-bearing rock have distracted attention from the auriferous gravel which has yielded nuggets large enough to become the talk of the state. The district is easily accessible, considering its distance from a railroad. From Seattle the route is by the Northern Pacific Railroad


SWAUK
KITTITAS COUNTY,
WASHINGTON.
N
to Blewett
Baker Creek
Nelson
Kruger Gulch
Seaton
Flodin
Miller Gulch
Lyon Gulch
Williams
Wild Cr.
Bigney
Boulder Creek
Vertic
LIBERTY P. O.
Deer Gulch
Railways
Wagon Roads
Trails
Arastras
T20N R17E
to Cle-elum
First Creek
Swauk Creek
Bristol
Pacific R.y.
Northern
Yakima River
SCALE OF MILES.
0 1 2 3 4
INDEX TO NUMBERED CLAIMS.
1. Elliott.
2. Dexter Shoudy.
3. Green Tree Mining Co.
4. " " " "
5. " " " "
6. " " " "
7. " " " "
8. Livingston.
9. "
10. Dennett et al.
11. " "
12. Jones & Steel.
13. Balsor.
14. Jones & Steel.
15. " "
16. Kelly.
17. "
18. Gus Nelson.
19. " "
20. Swauk Chief Min'g Co.
21. " " " "
22. " " " "
23. " " " "
24. " " " "
25. B F. Brain.
26. Green Tree Mining Co.
27. " " " "
28. " " " "
29. John Black.
30. R. B. Arthur.
31. W. A. Ford.
32. " "
33. Tweet & Johnson.
34. " "
35. R. A. Berry.
36. Tweet & Johnson.
37. Gus Nelson.
38. Flodin.
39. Mountain Side.
40. Morning Star.
41. Sunny Side.
42. Sanford.
43. Jones.
44. Steel.
45. "
46. T. F. Meagher.
47. C. E. H. Bigney.
48. Midas.
49. "
50. "
CIVIL AND MINING ENGINEER.

to Cle-elum, 126 miles, and thence by a good wagon road sixteen miles to Liberty, the center of the district; or by the same railroad to Ellensburg, 151 miles, and thence by an equally good road to Liberty, thirty-six miles. From Liberty roads branch out up the several creeks and buggies can be driven through the open, grassy pine woods in many places where no road has been made.

The gold of the Swauk's placers is believed to have come from Table Mountain on the east and the Teanaway Range on the west, and is found in the bars which cover old creek channels along the banks of Williams, Boulder and Baker Creeks, and of Swauk Creek between Baker and First Creeks, a distance of three miles north and south and about the same east and west. The country rock is sandstone and slate, with dikes of basalt and porphyry, the bedrock of the old channels being slate, with occasional dikes of sandstone and basalt, carrying 2 to 3 per cent. of iron, which is locally known as iron rock. One theory is that the gold in Williams Creek, and in the Swauk below that creek, came from the summit of Table Mountain, for on this level plateau there is said to be good pay dirt, and all its drainage runs into the Swauk, and all the valleys and gulches carry more or less placer gold. However, the fact that little gold has been found in the Swauk above Baker Creek, and that all the coarse gold is found on the bedrock of old channels between this stream and First Creek, leads to the conclusion that the gold deposits in the Swauk itself were not washed down by that stream, but by its tributaries, Baker, Williams and Boulder Creeks. The upper dirt carries only fine gold in most instances, and the miners do not take the trouble to attempt to save it, but in the old channel big nuggets are found. The character of the ground above Baker Creek is also different, for it is all hill wash, while below that stream it is evidently channel wash, with boulders of a different character. The nuggets range in size from a pinhead up, the larger ones being generally rough, flat pieces about three-quarters of an inch thick, or in the shape of a network of wires, mashed together by the action of the water. They are found in the three or four feet of dirt next to the bedrock. The product of Williams Creek is worth $1.50 to $2 an ounce more than that of Swauk and Baker Creeks, as the latter carries considerable silver. The Swauk gold is worth $13.50 an ounce, and that of Williams Creek $14.50 to $15.

The good pay in coarse gold has led the miners to despise fine gold as not worth the trouble of saving, yet it has been proved by panning the dumps that they will pay well for working over, and that more careful and systematic work would bring good results. Experience has shown that the gold is finer towards the mouth of a stream and thus it is that the nugget hunters have only worked the bars for two miles below Liberty. That there is good pay in the gravel beyond that point is proved by the fact that Chinamen who worked there many years ago earned $2 or $3 a day to the man, and that shafts sunk deeper than their workings showed dirt carrying twenty colors to the pan.

The Fraser River miners passed through this district on their return southward without discovering its wealth. Bent Goodwin, a deaf-mute, made the discovery by accident in 1868, while hunting. Going to the creek for a drink at a point a little below John Black's present mine, he fished up a piece of gold worth $10 or $12, which he found lying on the bedrock. He and his companions went to work and their success soon caused a rush of miners, who located the flats all along the creek. Among them were M. Cooper, Frank Gibbs and John A. Shoudy. The oldest pioneer now working is John Black, who came about twenty years ago and finally went to work on the high bars, half a mile above Liberty. In 1893 he replaced his primitive outfit with a hydraulic plant and has since worked on a large scale on a bar twenty-five feet high. He uses six Hungarian riffles in thirty feet of sluice box, with no quicksilver, and saves nearly all the gold in the first two riffles, making no effort to catch the fine gold. His biggest nugget was worth $565, while others have weighed 23 and 20 ounces respectively.

The placer claim furthest up the valley now being worked is on the high bar north of the mouth of Baker Creek, which has the honor of having produced the champion nugget, weighing $1,004. This claim is now owned by Gus Nilson, who has been drifting on bedrock. On the other side of Baker Creek is a range of six 200-foot claims, from which the late J. C. Pike took out a $745 nugget. These claims, which aggregate thirty-seven acres, all high bar, with ten to eighteen feet of dirt above bedrock, are now owned by W. A. Ford. A tunnel has been run 196 feet due west from the rim of bedrock until it reached a point where it dropped off nine feet at an angle of 45 degrees and the water drove the miners out. This is supposed to be the old channel, from which the gold has been washed up to the high rim. Mr. Ford is using a hydraulic and has found nuggets of $5 up to $300 on bedrock. He found spots of blue gravel which seemed to run back under the mountain to the west, and this fact, together with the discovery in the tunnel, leads to the belief that the old channel ran from northwest to southeast, obliquely across the present one. This theory will explain the failure to find pay dirt on the Swauk above Baker Creek, although the prospecting in that part of the valley has not been thorough.

The next four claims on the east below Black's are owned by the Green Tree Mining Company, of Tacoma which has at times leased them on shares,

but is now tunneling on bedrock. At the forks of Swauk and Williams Creeks Gus Nilson has tunneled 600 feet on bedrock and drifted 900 feet, taking out about $50,000. L. H. Jansen, of Tacoma, is drifting on bedrock on the two next claims. H. C. Jones and H. C. Dennett, on the two next adjoining claims, are drifting on bedrock under a bar seventy feet high and find the pay dirt closer to bedrock as they go down stream. Beyond them, David, Thomas and George Livingstone have run a tunnel 170 feet to bedrock on three claims and have started another, taking out nuggets as large as 11 ounces and averaging about 50 cents. From one of their claims three nuggets were taken ten years ago, the largest of which weighed $400 and the smallest $200. Next below them John Mayer has sunk twenty feet to bedrock, which is here below the present channel, has erected a pump and raises dirt by a whim from three tunnels, one of which is 300 feet long. On the two next claims Dexter Shoudy has a tunnel 400 feet, and the furthest work down the creek is being done by two gangs of Chinamen, who strip off the surface dirt and wheel the pay dirt to sluice boxes.

The placer mines of the Swauk were extended up Williams creek in 1868 by H. M. Cooper, who found gold about a mile above the mouth of the creek, on ground now included in Thomas F. Meagher's claim, and the workings now extend two miles above the mouth. The first prospecting was done in the creek bottom, but this was found to give poor pay, and not until the bedrock of the old channel was struck were good results obtained. It runs a little south of west and north of east and is cut diagonally by the present channel about a mile from the mouth. The gold is all coarse, in pieces from 10 cents to 17½ ounces, and is in flat, smooth nuggets. It is nearly all found in the six or eight inches of dirt next to bedrock, and the miners rarely work the upper dirt.

The first claim above the mouth is owned by Andrew Flodin, who has run about 400 feet of tunnel on bedrock. Thaddeus Neubaur is drifting on bedrock. H. C. Jones' claim, next above, is being worked on shares by John Doyle, each taking half. He has run a drain race 484 feet across the bedrock and struck the pay streak, on which he has since been tunneling. He finds that the bar pays only on bedrock, but thinks it would pay all the way through if worked in conjunction with the claims below. It now pays $3 a day to the man after deducting the owner's half, the nuggets weighing $23 and less. Thomas F. Meagher has three claims next above, at the mouth of Lyons' Gulch, taking in all the old channel, from which he took out over $15,000 in 1895 with a hydraulic. He has about 3,000 feet of tunnel, and is now drifting on bedrock from an open drain. His gold is generally coarse, his largest nugget being $222, but there is fine gold all through the bar.

C. E. H. Bigney has some extensive workings on the eighteen acres next above Mr. Meagher's on the high bars on the left bank. He has sunk an inclined shaft to bedrock 116 feet on the upper edge of the claim, and put down an air shaft ninety-three feet. He has done 2,805 feet of tunneling on bedrock, and struck the old channel 160 feet from the face of the bar, at a depth of twelve feet below the present channel, so that he has to pump to keep clear of water. The dirt is raised by a water-power hoist from the incline and by a whim from the other shaft. He got the mine in shape to produce in 1892, and in 1895 took out about $16,000. William H. Elliott, on the next claim, has drifted 500 feet on bedrock from one side of the creek to the other, but has not yet reached the old channel, and, although he has struck some gold, he does not expect pay dirt till he does so. Nis Jensen, whose claims adjoins Mr. Elliott's, has driven a tunnel on bedrock 250 feet from the old channel and another 107 feet, which proved to be twenty feet above bedrock, but has not yet reached the pay streak. He finds that the whole bar carries gold, as large as pinheads near the surface, and in nuggets running up to $7.25 near bedrock. Louis Quietsch, next above Mr. Jensen, has run a tunnel 125 feet and drifted either way on bedrock, but, while he found fine gold, there was not enough to pay, and he has lately turned his attention to quartz mining. George D. Verdin, who owns the last placer claim up Williams Creek, has driven a bedrock tunnel and sunk two shafts, but has transferred his energies to quartz claims.

Placer gold was first struck on Boulder Creek by W. R. Hart in 1891. A shaft was sunk to bedrock and struck the rim, from which a cross-cut was started, but water forced a stoppage of work. The gold was in small nuggets, the largest weighing one-half pennyweight. The Livingstones prospected these claims eight years ago and found moderately coarse gold, from two feet below the surface downward. This claim, with another adjoining and two on a gulch leading down to them from the right bank, is now owned by Thomas F. Meagher, C. C. Whitaker and A. F. York. During two months' hydraulicking on the gulch claims they took out nearly $2,000, the dirt carrying gold from the grass roots down. It is in the form of both smooth nuggets and wire gold, and ranges down to flour gold. The largest piece was worth $160; others weighed $98, $95 and $45, and there was quite a number of $25 nuggets. The product brings about $15 an ounce at the mint, 1 per cent. silver bringing down the value. Adjoining the Boulder Creek claims of this firm Mr. Hart has two others, one on which he has three men employed in sinking a shaft to bedrock, while on the other two men are running a bedrock drain. On the claims next below the gulch James Sutherland and August

Ziegel have sunk a shaft sixty feet to bedrock and are tunneling from it. They found one nugget of $24 and got $10 or $12 in the bottom of the shaft, but have not so far found enough to pay. Their work is hampered by water, as bedrock is sixty feet below the level of the present creek, which the old channel seems to parallel. Prospecting is also going on above Mr. Hart's claim and in the adjoining gulches, but nowhere has the old channel been reached or pay dirt been struck.

The miners of the Swauk have hitherto shown a decided repugnance to the invasion of outside capital, which would work the placers on a large scale by modern methods and therefore more economically, but efforts are being made in this direction. Although hundreds of thousands of dollars have been taken out, the ground has only been worked enough to prove its value, only about one-tenth of the gravel having been worked. In fact, it may fairly be said that the work so far done is practically equivalent only to thorough prospecting. The consolidation of the placers and their operation as a whole, with proper water pressure, would make good paying property of all the placer ground, while now the cost of handling the dirt is so high in many places that it only pays ordinary wages.

Discoveries of free milling quartz, which is now diverting attention from the placers, date back to 1887, when Thomas Tweed and William Johnson found a pocket on the east bank of Swauk Creek, opposite the mouth of Baker Creek, which carries wire gold in nuggets ranging as high as $6, and was apparently a broken quartz ledge. A sixty-foot tunnel showed a number of stringers running into one, but no main ledge in place. They built an arrastre and ground between $10,000 and $11,000 worth of rock in it, twelve tons yielding $2,200.

Later discoveries show the quartz ledges to extend from some distance up Baker Creek across the Swauk and through the hills cut by Williams and Boulder Creeks and Kruger Gulch. The general course of the ledges is northwest and southeast, the walls being slate and the ledge matter blue and bird's-eye quartz. The ore carries enough free gold to make it pay well, and the miners grind it in arrastres, being content to let the sulphurets escape in the tailings, but as the ore grows baser at depth this crude process will have to be abandoned.

George Hampton located the first claim, the Red, on the hill between Kruger and Lyons Gulches in 1889. It is a three-foot ledge carrying about $16 gold, mostly in sulphurets. He sank shafts seventy-five and fifty feet and cross-cut 200 feet, taking out about fifty tons of ore.

Two years later Andrew Flodin located the First of August on a four-foot ledge of bird's-eye quartz between solid slate walls. He has sunk a shaft ninety-six feet, showing a pay streak twelve or thirteen inches wide, with well-defined walls. He has also run a cross-cut 170 feet, which will strike the ledge at a depth of 140 feet in seventy feet more. In 1894 he built a water-power arrastre on Williams Creek, with a capacity of 3,200 pounds a day, and averaged $21.23 a ton in a year's run. On the southwest extension of this ledge he has run three cross-cuts, of which the longest struck the ledge in eighty-five feet. He is sinking a shaft on another ledge on the same claim, of which he has not defined the width, the ore being black slate veined with quartz.

The Brown Bear group of two claims at the head of Kruger Gulch, owned by Keith W. Dunlap, Mrs. M. A. Chapman, Whitson & Parker, Vestal Snyder and Matt Eartholet, all of North Yakima, has a ledge about three feet wide which has assayed from $100 to $140. A shaft is down forty-five feet and will be extended before drifting begins. Below the Flodin claims on Kruger Gulch William Queitsch has the Dandy on a six-foot ledge and has run a tunnel twenty-five feet on a stringer, which returned from $20 to $25 at his arrastre.

On the Morning Dr. O. M. Graves has two ledges of bird's-eye quartz, one sixteen to twenty-four inches and the other three to four feet, the smaller one assaying $12.50 free gold. A tunnel has been driven fifty-five feet toward the face of the ledge and will strike it in fifty feet more, having cut two small feeders already. Dr. Graves has put in a steam stamp mill, with one 750-pound stamp for prospecting purposes.

On the extension of the Morning ledge Louis Queitsch has the Bunker Hill on which he has five veins ranging from seven feet down. A thirty-foot tunnel on the widest shows good free milling ore.

The ledges have been traced over the hills on both sides of Kruger Gulch and development is proceeding there also. A. B. Morrison and Daniel Morrison have started a tunnel on the Livingstone ledge adjoining the First of August on the northeast. On the south side of Williams Creek they have sunk a shaft seventy-five feet on a four-foot ledge on the Bullion, run a cross-cut tunnel over 100 feet and another sixty feet at a point fifty feet further down, yielding $8 a ton. Gus Nilson and H. C. Condon, of Yakima, have two feet of ore on the Great Wonder. A shaft is down twenty feet on the ledge and a forty-foot tunnel has cross-cut it. A few tons milled gave $35 a ton and they have built a one-ton arrastre. On another claim an eighteen-inch cross ledge of $32 ore, on which a shaft is down eighteen feet, with a tunnel twenty-three feet.

The Great Western group of two claims, owned by Gus Nilson, Evan Strander and Charles Kineth, has a fourteen-foot ledge, from which the

four feet next the footwall carries $6 free gold and a higher value in sulphurets, which they have tapped with a fifty-foot cross-cut. Another ledge four feet wide has a twelve-inch pay streak carrying $18 free gold, shown in a sixteen-foot shaft.

On the mountain south of the south fork John H. Price has the Wall Street group of six claims on a series of parallel ledges, two of which are cut by the creek. One of these shows up seven feet wide in a forty-foot shaft and sixty-foot drift and carries $8 free gold, besides sulphurets. Another is thirty inches wide in an eighteen-foot shaft and carries $4 to $5 free gold. Another, five feet wide, is cross-cut by a 145-foot tunnel, which also cut a series of stringers two to twenty-four inches wide, the main ledge assaying $4 free gold and the smallest stringer $10.

George W. Verdin has taken some of the richest ore in the camp from the two forks of the widest ledge of the Wall Street series, on which he has the Gold Vein and Badger. One of these shows a foot of ore in tunnels eighty and 100 feet and a small shaft, the average value being $30, though pockets have run as high as $1 a pound and several thousand dollars were cleaned up from one run of an arrastre.

A little to the left of the forks of Williams Creek G. W. Seaton has the two Gold Leaf claims on a ledge of free milling ore. A shaft is down sixty feet and is intersected by a tunnel of the same length. Another tunnel forty feet long taps the ledge at a depth of fifty feet and a third tunnel has been run 100 feet on the ledge. This work shows it to widen to three or four feet and fifty tons milled in a one-ton arrastre averaged over $30.

On the gulch running into Boulder Creek, from which they made their rich strike of placer gold, Messrs. Whitaker, Meagher and York have the two Bertha claims on a ledge of porphyritic quartz, similar to the rock found in the placers and carrying free gold of the same character. It crops out five to six feet wide, between walls of basalt and iron rock. They have stripped a stringer from four to eight inches wide running into the ledge, which is richly studded with small nuggets. They also have the North Star on a three-foot ledge across the gulch.

In the next gulch above the Bertha, Albert Tallicut has the Josie on two small seams of ore which he is milling in an arrastre, one pocket containing 25-cent nuggets. South of Boulder Creek Mr. York has the Uncle Sam on a three-foot ledge, carrying $8 free gold.

Free milling ore was discovered in the spring of 1896 a mile above the mouth of Baker Creek by George F. N. Watson. He has the Green horn on a three-foot ledge between walls of porphyry and iron rock, which gives 1,000 colors to the pan in fine round shot gold. The Bobtail, on the north extension, owned by Irvine Liggett, Isaac Zeran and Dr. H. B. Runnels, shows twenty inches of similar ore in a twenty-foot shaft. The Mary Ellen, owned by the same parties, is on a parallel ledge fourteen to twenty-four inches, showing well in a twenty-eight foot shaft. The Big Bear and Little Bear, on a four-foot ledge traced for 3,000 feet, are owned by F. D. Wilson and E. J. Young, and show ore rich in coarse and flake gold.

E. J. Gaffney and F. W. Clayton in 1896 discovered a ledge four to sixteen inches wide on the west bank of the Swauk below Liberty, assays from which range from $26 upward.

Some of the more progressive miners in the Swauk district are already preparing to erect stamp mills and concentrators and another year is likely to see quite an increase in production following upon such improvement in methods.

WENATCHEE.

This city is known chiefly as the outfitting point for the districts in Okanogan county north of it, being the connecting point of the Great Northern Railroad and the Columbia River steamer line, but it also has the making of a mining camp at its back door, within three miles of it by wagon road. The ore is low grade, bearing gold and a small proportion of silver, but is in such large deposits that, if worked on a considerable scale with modern methods and skillful management, it would pay handsome dividends. The deposit is a great dike of porphyry in which are numerous veins of quartz, and extends over three miles in an almost due north and south course from Squilchuck Creek to Canyon No. 2, directly back of the town, among the foothills. Another parallel dike of almost equal size has been located for a distance of five miles. The principal work in this district has been done on the Golden King group of three claims, located by M. J. Carkeek, of Seattle, and owned by the Golden King Mining Company, of Seattle.

The dike is a veritable landmark in the Squilchuck Canyon, standing out on the north side, one mile from the Columbia, from 100 to 150 feet wide between walls of bastard granite rising in a great cluster of pinnacles and spires of bright red, yellow and brown to a height of 150 feet above the road and growing taller toward the crest of the hill until it reaches an elevation of 500

feet. The whole dike is more or less mineralized, the porphyry carrying about $2 gold besides silver, but the best value is in the quartz stringers, which range in width from six inches to seven feet, and have given assays ranging from $4 to $16. The dike is so thoroughly mineralized from the very surface that it could be mined very cheaply, in fact it could be quarried out, and with a large stamp mill could be reduced profitably.

The Golden King Mining Company has a mill with five 500-pound stamps, operated by steam power, and in 1894 began to mill the surface ore, which was quarried. The intention was to mill only the quartz, but it was not carefully sorted, so that a large proportion of the less valuable porphyry went through the battery and the milling at times was not over-skillful. During a sixty days' run of four tons every twenty-four hours $1,600 in bullion was taken out. The mill was then shut down in October, 1894, and a tunnel was started at the foot of the hill on the roadside to develop the deposit at depth. It runs for the first 100 feet through surface wash and slide rock, which requires heavy timbering to prevent caves, and then runs for eighty-six feet through the dike at an acute angle, cutting thirty feet across at right angles to the course of the deposit. In this eighty-six feet about forty seams of quartz from six to thirty inches wide were cut, their width on the surface running as high as seven feet. This quartz is the pay ore and there is plenty of it to keep a mill busy without the lower grade porphyry. Since the mill shut down only assessment work has been done on the tunnel and several offers to lease the property have been declined.

Adjoining the Golden King on the south is the Charlotte, owned by D. P. Bigelow, of Seattle; Thomas Groves and F. M. Scheble, of Wenatchee, on which prospecting shows seventeen feet of porphyry veined with quartz, assaying $6 to $8 gold and silver on the surface. Parallel with the Golden King on the west is the Last Chance, owned by J. M. Rae, on which a tunnel has been run a short distance. On the main dike, extending northward, are the Gilman, owned by D. H. Gilman, of Seattle; the Eureka, running down to Dry Gulch, owned by Angus Mackintosh; the Sunrise, on the opposite side of Dry Gulch, owned by M. J. Carkeek; the Tibbie, owned by P. P. Shelby; the Bagley, owned by C. P. Converse, of Seattle. The only work worth mentioning on these claims is a surface cut forty feet across the dike on the Tibbie. On a parallel dike of the same character and carrying ore of the same value, 200 feet in width, extending from Squilchuck Creek, across Dry Gulch and Canyon No. 2 to the Wenatchee River, a distance of five miles, claims have been located by William Parry, D. A. Curry, W. B. Reddy, —— Lunn, W. H. Merriam, Arthur Gunn, George Evans and E. Ross, but the only work has been done by Mr. Lunn, who holds two claims and has sunk a shaft forty to forty-five feet from the highest outcrop.

PESHASTIN AND NEGRO CREEKS.

Almost midway between the two transcontinental railroads which traverse the state from east to west lies the district where the first stamp mill in Washington was erected. Taking the Northern Pacific train from Seattle to Cle-elum, 122 miles, one can ride or drive to Blewett, the center of the district, a distance of thirty-two miles over a good road; or taking the Great Northern train to Leavenworth, 150 miles, one can go over a good road fourteen miles to the mouth of Ingalls Creek and thence by trail five miles to the camp furthest up Negro Creek or four miles to Blewett. A road four miles long would close the only gap in the road between the two railroads.

The mineral belt through which Peshastin Creek flows northward into the Wenatchee River, receiving Ingalls and Negro Creeks as tributaries from the west and Ruby Creek from the east, has a totally different geological formation from the country north and south of it. To the north, from a line cutting across the Chiwah River some distance above its mouth, is a sandstone formation which terminates on the northwest about the mouth of Icicle Creek, a granite formation lying north of it up the Chiwah River to Red Hill. About seven miles up the Peshastin this sandstone gives way to a series of strata of metamorphic rocks, including serpentine, syenite, diorite, magnesian limestone, talc, porphyry, porphyritic quartzite and granite. In the dikes of porphyritic quartzite occur ledges of nickel, silver and copper ore and some gold with gouges of talc, the dikes having a general trend from northwest to southeast, but bending generally more to an east and west line. On the one side this belt terminates two miles southeast of Blewett and to the west it gradually widens toward the base of Mount Stuart, which peak it includes. It extends into the Swauk district, where it forms a basin and swings to the northwest.

Mineral was first discovered in this district about 1860 by a party of miners returning from Fraser River, but they only worked the placers and gradually drifted away, one of them, a negro, who took out $1,100 in a season from the bars at the mouth of Negro Creek, giving that stream its name. It was not till 1874 that the first quartz ledge was discovered. In that year John Shafer

located the Culver on a ledge of free milling ore near the summit of the mountain dividing the Negro Creek canyon on one side from the Culver draw on the other, but was a short time behind Samuel Culver, who located the Polepick on a parallel ledge. Culver then took the Humming Bird on another ledge. James Lockwood staked out the Bobtail adjoining it, and John Olden and Peter Wider took the Fraction; John Olden and Samuel Culver the Little Culver. All these claims, except the Polepick and Little Culver, were shortly afterward bought by James Lockwood and his son, E. W. Lockwood, and H. M. Cooper, who erected a six-stamp mill with one Frue vanner, which they operated by water power. The mill reduced eight tons of ore in twenty-four hours and the clean-up from the first nine days' run was $2,100. The company also had an arrastre with a capacity of 1,000 pounds a day, of which the product averaged $70 a day. After running the mine and mill for eight years this company sold it to Thomas Johnson, who shut down after a short run. Then arose the dispute as to the ownership of the property, which culminated in the killing of William Donahue by Thomas Johnson in 1896, but this did not prevent the sale in 1891 to the Culver Gold Mining Company. This company erected a ten-stamp mill with four Woodbury concentrators and stretched a bucket cable tramway from the mill to the Culver mine, one-fifth mile. Some ore was shipped before the completion of the mill, one lot returning $800 a ton.

In 1892 the Culver Company sold out to the Blewett Gold Mining Company, composed of Seattle capitalists, and this company set to work to thoroughly develop the mine and mill its ores.

On the Culver group are three parallel ledges between walls of serpentine and porphyry, that of the Culver itself being from two to ten feet wide, with occasional bunches of ore sixteen feet wide. The body of the ore is a reddish gray quartz and there occasionally occurs on the walls a transparent green talc with white crystals, through which, as in a magnifying glass, the flakes of free gold can be plainly seen. The Humming Bird and Bobtail ledge is two to four feet wide, and contains a blue quartz carrying a larger percentage of sulphurets than the Culver. The Fraction ledge is of about the same size and character and runs higher in iron sulphurets. As depth is attained the free gold runs out and the ore becomes base. The value runs all the way from $8 to $20 in free gold with occasional pockets as high as $700, and it carries a trace of silver. The group has been developed by a number of tunnels aggregating several thousand feet, the longest of which is 600 feet, attaining a depth of 350 feet on the Humming Bird.

The company has erected a twenty-stamp mill at the mouth of the Culver draw, near the old Lockwood mill, allowing space for twenty more stamps, and has four Woodbury concentrators, the whole plant having boiler capacity for forty stamps. The bucket tramway was moved to the new site and the mill equipped with every labor-saving appliance, such as self-feeders to the stamps. A steam sawmill was erected three miles up the creek with a capacity of 10,000 feet a day and sawed lumber for the mill buildings, the mine and repairs to the road and bridges over which the machinery was hauled from Cle-elum. The development of the mine and operation of the mill were continued together by the company until 1894, when the system of leasing sections of the mines to small associations of miners was inaugurated, and has been continued with good results ever since, it being found that when miners have a direct interest in the product they sort the ore more carefully than when working for wages. The company still runs the mill and charges a royalty on the product and a milling charge, graduated up to a certain value. Above that figure the company and the lessees simply share the product on a graduated scale, the company's share increasing the higher the value of the ore. Under this system about sixty men are employed in mine and mill when both are in full operation. During the year 1896 the mill reduced 2,469 tons of Culver ore, from which the extraction averaged $12.62 a ton, and 473 tons of customs ore, from which returns are not obtainable. The product of the Blewett Company in bullion was about $60,000 for the year 1896.

It having been found that with the most careful milling the arsenic in the ore floured the quicksilver on the plates and thus prevented it from catching the gold; also that much of the fine copper sulphides escaped in the slime in the shape of foam, the tailings have been reserved in dams, with a view to further treatment by some improved process. This was established in the summer of 1896 and is a small cyanide plant erected under the direction of A. J. Morse for Rosenberg & Co., one of the parties of lessees. It has a capacity of ten tons a day and throughout the winter has been treating the tailings, of which 600 tons, containing from $3 to $30 a ton in gold had accumulated, and has extracted from 70 to 75 per cent. of the value. This plant has demonstrated the presence in the ores of substances which prevent close saving of their values and some modern process such as the cyanide will be finally adopted by the Blewett company.

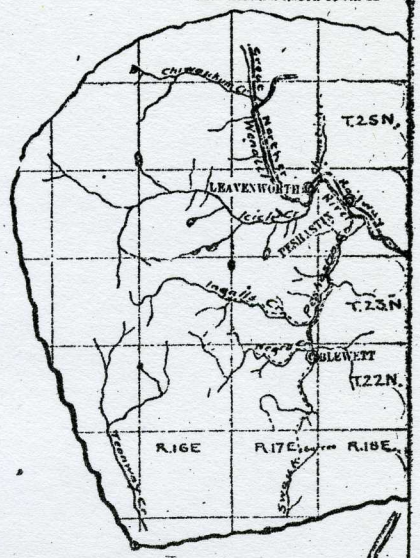
In 1878 the Culver ledge was traced over the ridge to Negro Creek and the Olympia group of five claims was located on it, its width averaging about four feet. These claims were sold to the Cascade Mining Company, which ran a tunnel southward on a stringer to the right of the ledge on one claim and struck two bodies of ore, of which it followed the wall. On another claim it

Negro Creek
AND
Peshastin

KITTITAS COUNTY,

WASHINGTON.

MAP SHOWING ROUTE TO MINES



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4. Paymaster.
5. Bay and Bay.
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Railways.
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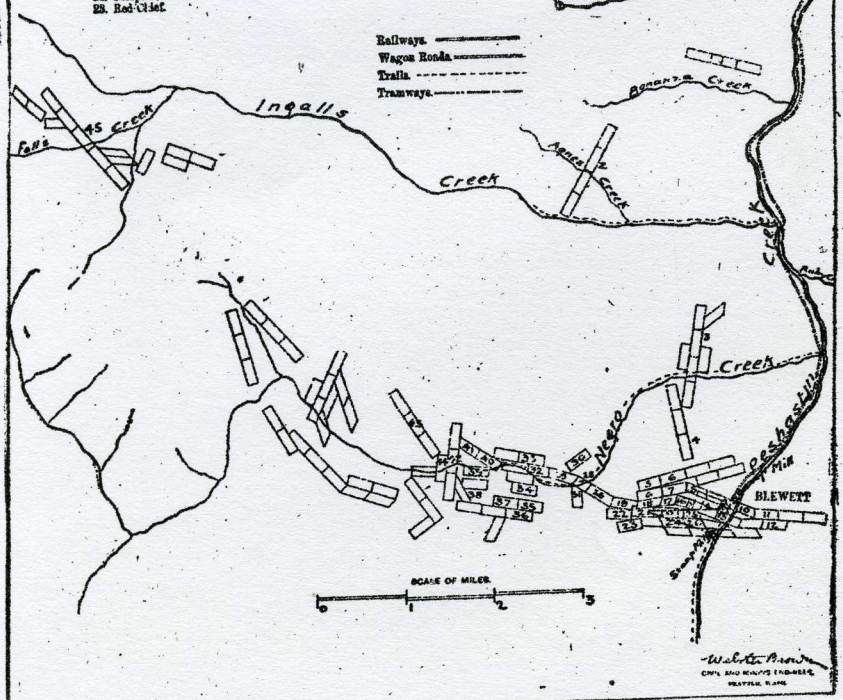


Walter Brown
CIVIL AND MINING ENGINEER
SEATTLE, WASH.

ran a sixty-foot cross-cut tunnel in the direction of the ledge, but did not tap it, and ran a tunnel about fifty feet on the ledge near the summit, but it has since caved in. A two-stamp Huntington mill was hauled from The Dalles on the Columbia by team and over the mountain by block and tackle. It was erected without concentrators and was run by water power in the expectation of saving the free gold. It was run for a couple of months in 1880 and reduced about fifty tons of ore, but the assay value of $10 to $70 a ton was chiefly in sulphides and very fine gold, so that only about $4.50 a ton was saved and the small percentage of copper was also lost. A year or two later, owing to the death of Marshall Blinn, the organizer of the company, the mill stopped and has never resumed. For a time the property was under bond to Edward Blewett, who ran a tunnel 200 feet in an endeavor to trace the ledge into the Culver, of which it has the characteristics and the same value in free gold, and several open cuts have been made, showing ore in a number of places. The Culver ledge spreads out towards the summit, and is divided by horses of syenite, which rock forms the hanging wall, and then disappears.

Much of the gold in early days was lost by the milling of ore in arrastres, three of which were built and one is now in operation at intervals. When it is remembered that the fine copper sulphides which go off in foam cannot be saved even by cyanide and that only pan amalgamation is effective with them, one can imagine how much value is lost by such a rude mill as an arrastre.

In the spring of 1896 the Blewett Company sold the ten-stamp mill to Thomas Johnson, who has been milling the Polepick ore in it, with the addition of canvas tables. This mine has a quartz ledge varying from eighteen to thirty-six inches, and occasionally widening to five feet. Assays range from $10 to $132 in free gold, and average about $27. Development began with a cross-cut tunnel 237 feet, from which an upraise was made 147 feet, in ore all the way. A drift has been run 100 feet west from the upraise at the 100-foot level, on which stoping is being done, and another upraise has been started.

Adjoining this claim on another ledge three feet wide is Polepick No. 2, owned by Dexter Shoudy & Co., on which a tunnel has been run eighty feet, showing ore which assays $28.

On the Culver draw is the Phoenix, on which D. T. Cross and John F. Dore, of Seattle, and the late William Donahue tapped a five-foot ledge of brown quartz at a depth of 100 feet by cross-cutting 125 feet. They have run three levels 100 feet long at intervals of twenty feet and have stoped the ore from the highest level to the surface, having taken out in all 1,000 tons, which was milled at the Blewett mill and returned about $20 gold on the average. Some of this ore was reduced in 1895 in a small mill with four 250-pound stamps and a side-jigger concentrator, which was erected by the California Milling and Mining Company, but the cost of operation was out of proportion to the possible product and it has been shut down for nearly two years.

The Peshastin is on a three-foot ledge, also on the Culver draw, on which William Donahue, Dore and Cross ran a tunnel and stoped some ore some years ago. In 1894 they bonded the claim to George W. Martin, of Minneapolis, who also leased the Blewett mill and built a chute down the hill to it. He ran through about 100 tons, but it was so poorly sorted that it did not pay for milling and the company canceled the lease. He then gave up, and Dexter Shoudy & Co. bought the mine. They ran a tunnel through the Fraction tunnel into the west end of the claim and took out about eighty tons of ore, which yielded about $21 a ton in free gold and eight tons of concentrates worth $100 a ton.

On what is supposed to be the Culver ledge J. L. Warner and his associates have the Lightning, with the White Elephant and Pine Tree on parallel ledges. They have simply kept up assessment work, driving a thirty-foot tunnel on the Pine Tree.

A short distance above the Culver draw, on the west side of the canyon, Dexter Shoudy & Co. are working the Black Jack on a ledge of blue quartz two to five feet wide. They have run a tunnel over 200 feet on the ledge, from which they have done some stoping, and are now cross-cutting toward a red porphyry dike which shows on the surface. They have found some cinnabar, yielding native quicksilver. About 260 tons of ore was milled last spring, and though not well sorted, yielded $8 a ton. The same parties own the Eureka, on the other side of the canyon, on a three-foot ledge which assays $16.64 gold and on which a tunnel has been driven forty feet. The owners bought the arrastre built by John Shafer sixteen years ago, and are milling the ore in it.

The Polepick, Peshastin, Black Jack and the Johnson mill have recently been bonded to parties in the East, who contemplate working them together.

On the Marion Charles Donahue has three veins, one of which is eight feet wide and carries $6 free milling and $9 concentrating ore. He has run a drift 150 feet on a small stringer and has cross-cut eighty feet to the ledge. One of the other ledges he has identified as the extension of the Polepick, and on this he has drifted sixty-five feet and cross-cut eighty feet. On the Gem is a five-foot ledge of concentrating ore which assays $8 to $16 gold and 75 cents to 54 ounces of silver. A cross-cut has been run sixty feet, but has not yet tapped the ledge, and a tunnel is in twenty feet on ore.

Between the Peshastin and the Gem is the Manistee, owned by William Donahue's heirs, Dore and Cross. A tunnel has been driven 140 feet on a

broken horse on the surface and the ledge has not been found in place. About eighty tons was milled in an arrastre in 1890 and paid $16 a ton.

On the east side of the creek John Bomaster has the I. X. L., on which he has run a tunnel forty feet on a blanket ledge six or seven inches wide and assaying about $20 a ton.

On the west side of the creek E. E. Keyes, of Menominee, Mich., has the Caledonia group of four claims on three parallel ledges. One of these has ledge matter on the surface, on which a tunnel driven twenty feet has not yet struck ore. On another, twelve feet wide, a shaft has been sunk thirty feet, in which iron pyrites is coming in. On the third there is a two-foot cropping of gray copper tapped by a cross-cut tunnel of about 120 feet. On the Goat there is a two-foot ledge of white quartz carrying free gold, from which some assays ran over $100. A shaft fifteen feet deep shows the free gold to continue.

Near the Tip Top, at the head of the basin and crossing the divide to Ruby Creek, Oliver Cloud and John Gilmore have the Sunset, on which is a six-foot ledge carrying gold and copper, and in two tunnels sixty feet and thirty feet on the ledge there is a showing of sulphurets on the face.

On the east side of the canyon is the Tip Top, which has had a varied career. It was first worked by the Tip Top Mining Company, which sank a shaft seventy-five feet and drove a cross-cut tunnel 380 feet quartering with the ledge and another 400 feet a short distance below. The ore was stoped out from the first two levels and run through the arrastre, its value averaging $40, while some ran up to $90. The company abandoned the claim in 1888, and in the following year T. J. Vinton relocated it, and held it until 1895. He then leased it to James Kirk, who took out considerable ore, from which the extraction at the Blewett mill averaged $22. It is now leased to George W. Porter, who realized $10 a ton out of sixty tons milled.

Just below the new mill, Peter Anderson and Thaddeus Neubaur have a vein of clear white talc ore, in which the free gold is plainly visible, similar to that of the Culver ledge. They have driven two tunnels, aggregating 400 feet, showing up the ledge well to a width varying from six inches to three feet.

Within the last few years John Kendle has been prospecting in the camp by means of an instrument which, he claims, betrays the proximity of an auriferous ledge by electric attraction and which has gained credit with some prospectors. His instrument is supposed to discover gold, silver and copper and to indicate within certain limits how deep it is beneath the surface. It is a brass or silver cup containing a secret composition of acids, from which a tube of the same material extends an inch or more and then turns at right angles. Into it is cemented a copper wire eight inches long, which ends in a flat circular brass elbow. From this another copper wire extends six inches at right angles, so that it is parallel with the cup, and by this last wire the prospector holds the instrument as he walks slowly over the ground, pressing his finger ends firmly against the wire.

Mr. Kendle claims to have located over twenty ledges by means of this instrument and to have proved its accuracy by showing ore on development, seven of them being on his own claims. One of these claims is the Snowflake, located under eight feet of snow, where other men had in vain run crosscuts thirty, forty and sixty feet to strike the ledge. He ran a tunnel on it for twenty feet and found six feet of quartz between walls of quartzite and porphyry, which he says carries $7 gold and some copper. He and Henry Weinmann, his partner, have a Dodge mill with a capacity of twenty tons in twenty-four hours which they propose to set up at the mine and run by water power to crush the ore, treating the pulp with cyanide. Another ledge located by this means and covered by two claims, is the Sunset, fifteen feet wide and carrying $10 to $15 gold. This is owned by Messrs. Kendle and Weinmann, who also have, in partnership with Paul Fein, three claims on the Yankee Doodle ledge, to strike which Mr. Weinmann had previously run cross-cuts 150, 125 and 100 feet. They have run a tunnel 140 feet on it, showing nine feet of talc and three of white quartz carrying $4 free gold. Mr. Kendle claims to have also located by means of his instrument a four and one-half foot ledge for James Smith, who struck it with a forty-foot cross-cut; a five-foot ledge for James Gilmore, who struck it in a tunnel driven to its face; and a third for McDonald & Perry, who struck it two to three and one-half feet wide, carrying ore worth $19 to $22, by driving twenty feet.

The mineral belt cut and exposed by the deep canyon of Negro Creek differs in many respects from that on Peshastin Creek, although only a high ridge divides the streams. Interest in this district languished after the suspension of work at the Cascade Mining Company's mill and did not revive until the great red buttes which stand out from the canyon walls of Negro, Ingalls and Peshastin Creeks attracted attention in 1892. Prospectors soon found that the dikes of which these buttes were the highest points contained chutes of porphyritic quartzite, between walls of lime and porphyry, the chutes ranging in width from three to thirty feet, and several occurring across the width of the wider dikes. The qnartzite carries not only gold and some silver, but nickel to an average of 2½ per cent. It also carries cobalt, and the walls carry traces of nickel. Some of the ledges furthest up the creek are distinctly copper ore, carrying 25 to 30 per cent. of that mineral, and one ledge carries cinnabar in which there is native quicksilver. Prospecting has gone on

steadily and has extended the belt across the divide at the head of Negro Creek to Falls Creek, across the north wall of the canyon to and across Ingalls Creek, down the Peshastin a mile below the latter stream and across Ruby Creek, an eastern tributary of the Peshastin. A large amount of development has been done on many of the claims, but lack of capital and the need of a wagon road has prevented the district from becoming a producer.

About a mile up Negro Creek, which cuts it in two, is a ledge of porphyry forty feet wide, on which is the War Eagle group of four claims, bonded by J. F. Buttles, George Hood and James Grant to the Co-operative Mining Syndicate, of Seattle. It cuts through the granite, slate and serpentine country rock in a course slightly east of north and west of south, from the summit overlooking the Culver draw, on one side of Negro Creek, to that overlooking Ingalls Creek on the other. It is veined with quartz and carries value throughout its width, gold predominating where it cuts the granite. An average assay from a shaft twenty-five feet deep on the Ingalls Creek divide shows $4.60 gold and numerous assays have run from $20 to $60 gold, some of the ore also carrying nickel. A tunnel has been run twenty feet from Negro Creek on the ledge and is being continued through well-mineralized rock.

On the divide between Ingalls and Negro Creeks, opposite the Cascade Mining Company's property, W. S. Newland and Henry Brenard have the New York group of thirteen claims, forming a square on which is a mass of quartzite carrying gold, silver and copper. Only assessment work has been done in the shape of a shaft or tunnel ten to fifteen feet deep on each claim, and none of these have defined any ledges. Specimens taken at random from the surface of one claim assayed $4.60 gold, 3½ per cent. copper and a trace of silver, and the Nellie assays $4 gold, $30 silver, besides nickel. The group could be worked from a tunnel on each side of the mountain, and a tramway half a mile long would take the product to Ingalls Creek.

Across the creek from the Cascade Mining Company's group are the Eagle and Iowa, owned by Henry Blinn, of Leavenworth. They have a ledge three and one-half feet wide of quartz carrying iron and copper pyrites, which assays $7 gold. A shaft is being sunk, and shows improvement in the ledge.

Next up the creek comes the Daisy Dean, owned by the Donahue estate and F. H. Osgood, on a twin ledge between walls of serpentine and diorite. One ledge three to four feet wide assays $32.30 gold, the other, three and one-half feet wide, carries $8 silver and 60 per cent. lead. Two tunnels have been run about twenty feet each at different levels.

Going up on the creek, there next comes the Rainier group of thirteen claims, with two millsites, owned by the Negro Creek Nickel and Copper Mining Company. The Rainier ledge is covered by four claims and is a dike running northwest and southeast across Negro Creek, three and one-half miles above its mouth. A cross-cut 170 feet on this dike struck a series of five nickel-bearing ledges from ten to thirty feet wide. The ore in the tunnel assays 2½ to 3½ per cent. nickel and $5.20 gold. The Tacoma has a quartz ledge four and one-half feet wide running into the Rainier series, and carrying copper and iron pyrites, with $8.20 gold and a few ounces of silver. Red Butte No. 1 and No. 2 are on a deposit of white talc thirty feet wide, carrying about $5 gold, of which a red butte forms one side, and a ninety-foot tunnel has shown up a large chute of nickel ore. The Montana is on a spur southwest of the Gordon ledge, carrying nickel, free gold and silver, twelve feet wide. Fractions A and B are extensions of spurs of the Ontario and Meridian. The South Ontario and two others cover a large dike of low-grade nickel ore about thirty feet wide. This company constructed an extension of the wagon road up the Peshastin from the mouth of Ingalls Creek two years ago, and partly constructed it to the Rainier group. It also surveyed a line for an electric road up the Peshastin and Negro Creek, thirteen miles, to the Rainier group, and three miles further, to the park on which the Persinger group abuts.

Adjoining Red Butte No. 1 and No. 2 are the Union and Dominion, which are three-quarters of a mile up Bear Creek, on the north of Negro Creek. They have been bonded by W. T. Rarey, G. S. Merriam, George Beam, James Fullweiler, C. Striker and H. Souder, to George E. Ward, of Seattle, who is to erect a plant and begin development by April 1, 1897. They have a ledge of free milling and concentrating ore east and west, cut by Bear Creek. Twelve samples were taken of different grades of ore across the ledge and the assays ranged from $107.49 gold and $1.10 silver up to $875.53 gold and $6.50 silver. Eight tons shipped to the Tacoma smelter only returned $11.30 a ton, because they were not sorted and were taken from a point beyond the ore chute. A tunnel has been run 100 feet on the ledge, showing it to range from eighteen inches to four feet, with good ore all through. Across Bear Creek from these claims is the Amigo, owned by Gus Guoin, S. W. Elliott and Charles Harvey, on a five-foot ledge of copper sulphurets running northeast and southwest, which assays on the surface $2.75 to $5.40 gold and silver.

Adjoining the Union and Dominion on Bear Creek are the Gordon and an extension, owned by Supreme Judge Gordon, W. I. Agnew and G. E.

Filley, all of Olympia. It has a ledge forty feet wide, running north and south and assaying 40 per cent. nickel, with free gold and silver. A tunnel fifty-five feet long has cross-cut the ledge, defining its width.

Following up Negro Creek comes the P. P. Nickel, owned by Tony Preston, of Leavenworth. A shaft is being sunk on the hanging wall, where is three or four feet of quartz, carrying $4.50 gold and a good percentage of nickel.

A little further up, on the north side, is the Ontario, owned by Martin Lewis and Mr. Morrell, who have a ledge forty feet wide, between walls of serpentine. The ore carries $7 to $8 gold, 3 per cent. nickel and 3½ per cent. copper in sulphides. A shaft is down about twelve feet on the hanging wall, a tunnel has been run ninety feet on the stringer, cutting towards the main ledge, and a tunnel is in seventy feet to cross-cut the main ledge, which it is expected to strike in another hundred feet.

On the south side of the creek, next above the Ontario, comes the Meridian, owned by George Persinger, of Leavenworth, and John Lindsay, of St. Louis. It has a ledge of dark blue quartz, forty feet wide, between serpentine walls, the ore carrying gold, silver, copper, sulphides and nickel. The outcrop is in iron-stained red and blue cliffs on the wall of the canyon. A tunnel has been run sixty feet on the ledge and a mill test of the ore, made in St. Louis, gave $10.50 gold, $5 silver, $2.50 copper and 2 per cent. native nickel, besides nickel sulphides.

The North Pole group of ten claims is next in order, and is owned by George Persinger, Michael Callaghan, John McKenzie, Andrew Stoughton and William Lee, of Leavenworth; George Kline of Wenatchee, and John S. Jurey, of Seattle.

North Pole No. 1 and two other claims are all on one ledge ninety-one feet wide running due north and south, which crops out in big red buttes on the Cinnabar King claim. The ore is red and blue quartz between walls of serpentine, and carries, gold nickel and quicksilver. A tunnel has been run ninety feet on the hanging wall on this ledge, and there was 200 tons of ore on the dump on the creek bank, when a flood swept half of it away in the spring of 1895. There is now, however, 150 to 200 tons on the dump. The Champion and Idaho are on another ledge four and one-half feet wide, which runs east and west, and joins the North Pole ledge at an angle on the east. It assays $12 gold and 10½ per cent. copper. A tunnel run forty feet to cross-cut the ledge has not yet tapped it. The Persinger Copper Lode and Gray Eagle are on a ledge running northwest and southeast, which outcrops three feet wide on the summit and contains copper sulphide ore carrying gold and silver. Assays range from 22 to 32 per cent. copper, $5 to $16 gold and 3 to 5 ounces silver. A tunnel twenty-five feet on the main ledge on the top of the hill shows good ore all through, and a cross-cut is being run 100 feet below, which is in fifteen feet and will tap the ledge in about twenty feet more. The Ivanhoe No. 5 is west of the Rainier group on the north side of the creek, and has a five-foot ledge of copper sulphide ore assaying about 20 per cent. copper with a little gold and silver. A cross-cut taps the ore in forty feet. About 200 feet of new tunnels has been completed on this group in the last year, and has shown up extensive bodies of copper pyrites.

On the Ivanhoe ledge John and William Lynch have the Leo, with four feet of ore assaying 25 per cent. copper, with some gold and silver. They ran a cross-cut tunnel sixty feet, following a two-foot stringer into the main ledge.

At the north end of the Everett are the Cinnabar King, owned by George Persinger, Harvey Souder and Charles Striker, on a dike 200 feet wide, which crops out in a line of jagged red cliffs on the north wall of the canyon. A surface cut across the dike shows it to be all mineralized red and blue quartz, with serpentine walls. An assay shows it to carry $3.50 gold, besides nickel and cinnabar.

On the first dike which cuts across the Peshastin canyon on the north is another string of claims. On the right bank are the Monarch No. 1 and No. 2, owned by Ralph White, of Rossland, Tim O'Leary, the contractor, and Mr. Walker. The dike is porphyritic quartzite seventy-five feet wide, running slightly north of east and south of west. A mill test of a ton taken from a ninety-foot tunnel gave $90 returns in nickel, cobalt and gold, and assays range from $4 to $5 gold, 2½ per cent. and upwards in nickel, 1½ to 2½ per cent. cobalt. On the opposite hill and on the same ledge, George Persinger, Tony Preston and Michael Callaghan have the Red Butte group of three claims, extending along the outcrop to the summit, with a fourth on a parallel ledge on the southwest. A tunnel has been run into the ledge at the base of the hill, ore from which assayed as high as 12½ per cent. nickel, 2½ per cent. cobalt and $12 gold. In the valley between the Monarch and Red Butte groups is the Rattlesnake, half of which is held by the owners of each group.

This dike has been traced across the mountains and one and one-half miles eastward to Ruby Creek, where it crops out on part of a group of thirteen claims held by Charles Harvey, S. W. Elliott and H. C. Castlebury. On this group are four parallel ledges from twenty to sixty feet wide between walls of serpentine and conglomerate, marked by red buttes like those on the rest of the belt. Assays average 8 per cent. nickel, gold and silver not being shown.

At the north end of this group are the Red Cloud and Tralee, owned by W. Kelly, of Spokane; C. King, of Kalispell; Charles Harvey and Charles Moriarity, of Leavenworth, on a sixteen-foot ledge assaying $25 copper, $6 gold, as well as nickel and cobalt. Further up Peshastin Creek, below the mouth of Negro Creek, F. D. Estes and John W. Miller, of Leavenworth, have two claims on a seven-foot ledge of sulphide ore carrying $6 and $8 gold on the surface, besides copper.

Five miles above the mouth of Ingalls Creek is the State group of six claims, owned by John and William Lynch. They are on two parallel dikes sixty feet wide, which are cut by the creek.

The nickel-bearing formation has been traced across the Negro Creek divide to Falls Creek, a tributary of Ingalls Creek from the south. W. F. Patterson and Charles Newberry, of Blewett, have located the Bonanza and Deadwood, near the head of the creek, on the largest dike so far discovered in the district. The creek runs between the two locations, and the dike rises almost perpendicularly from it. The owners are cutting across the face of these cliffs to expose green ore. The surface ore assays about 5 per cent. nickel, $3.50 gold and a trace of copper. Adjoining this group and running to the forks of the creek, also extending westward to Cascade Creek, is the Nickel Plate group of twelve claims, owned by John and William Lynch. The main ledge is sixty feet wide and is covered by five claims, on which prospect holes have been sunk, while the other claims are on spurs from this and the Bonanza and Deadwood ledges, ranging in width from ten to thirty feet. The ore is of the same character and value as the Bonanza and Deadwood.

The placer ground from the mouth of Peshastin Creek far up towards its head is still being worked with a fair measure of success. The deposits of gold-bearing material are gravel hills built up in the course of ages on old river channels, running sometimes parallel, at others across the present channel of Peshastin Creek. In the old channels the gold is mostly coarse, and therefore easily saved, but where the present streams have acted on it it is fine and requires more care and skill. One of the largest enterprises of this kind is being carried on by W. M. Keene and O. A. Benjamin, of Seattle, on the flats beside the Wenatchee on its right bank, one and one-half miles below Peshastin. Mr. Keene began by sluicing back from the river bank, taking water from a point half a mile up that creek. He found that the old channel bedrock sloped back from the present river channel, and thus his ground was flooded. Being joined by Mr. Benjamin, he put in a hydraulic and a pump to raise the dirt from beneath the water on the old channel. The dirt pays well, even for manual work, good streaks running as high as $1 a yard. At the mouth of Ingalls Creek Mr. Hensel, a farmer, is working several claims with good results in fine gold. On the right bank of the Peshastin, at the mouth of Ruby Creek, James and Thomas Lynch, Riley Eisenhour and Thomas Medhurst have worked six claims with a big hydraulic giant at high water and ground sluiced at low water.

Where the canyon narrows below Negro Creek the late J. H. Crawford, W. H. Wilcox and Frank B. Holley had four claims on the left bank, to which they built 2,000 feet of ditch and flume from Negro Creek, with 150 feet of fall, and hydraulicked down to the old channel bedrock, which is thirty feet above the present channel. The gold is coarse, in nuggets as large as $6.75, and they are working with only wood riffles and no plates or quicksilver, not attempting to save the fine gold.

A mile above Negro Creek George W. and J. M. Bloom, two brothers, and John Snyder are working three good claims which take in all the bar ground on both sides of the creek, on the old channel. The Bloom brothers started in 1893 by sluicing out the dirt on the right bank of the creek and took $70 from a space fifteen feet square. In 1895 they took $20 from the space next below, ten feet square and at the most eighteen inches deep, and were last year joined by Mr. Snyder. They cut a ditch for a bedrock drain, but failed to reach bedrock, and then started a tunnel to cut across from rim to rim of the old channel, which is in twenty-eight feet, keeping the water down with a bucket wheel. From the first eight feet of this tunnel they took $4.20, and they have a be.. of gravel twenty feet deep, which they say carries 25 cents a yard from rim to rim and surface to bedrock. The gold is nearly all coarse, but they save the fine gold by means of pole riffles placed lengthwise of the sluice box, with cleats underneath which raise them an inch above the bottom. This arrangement causes a continual boil in the water, which thus sucks the gold under the cross-pieces. On the lowest claim they are driving a tunnel back to the old channel, of which they have not yet found the bedrock, the dirt running as well as on the upper claims. They propose to dig a ditch one and one-fifth miles along the creek, with a capacity of 1,000 inches, and will put in a six-inch pipe and hydraulic.

LEAVENWORTH.

The last five years have proved the presence of a great mineral zone in the mountains on each side of the Chiwah Canyon, as in other parts of the Cascade Range, and development is proceeding with such vigor that a year or two more should suffice to make the district a regular producer.

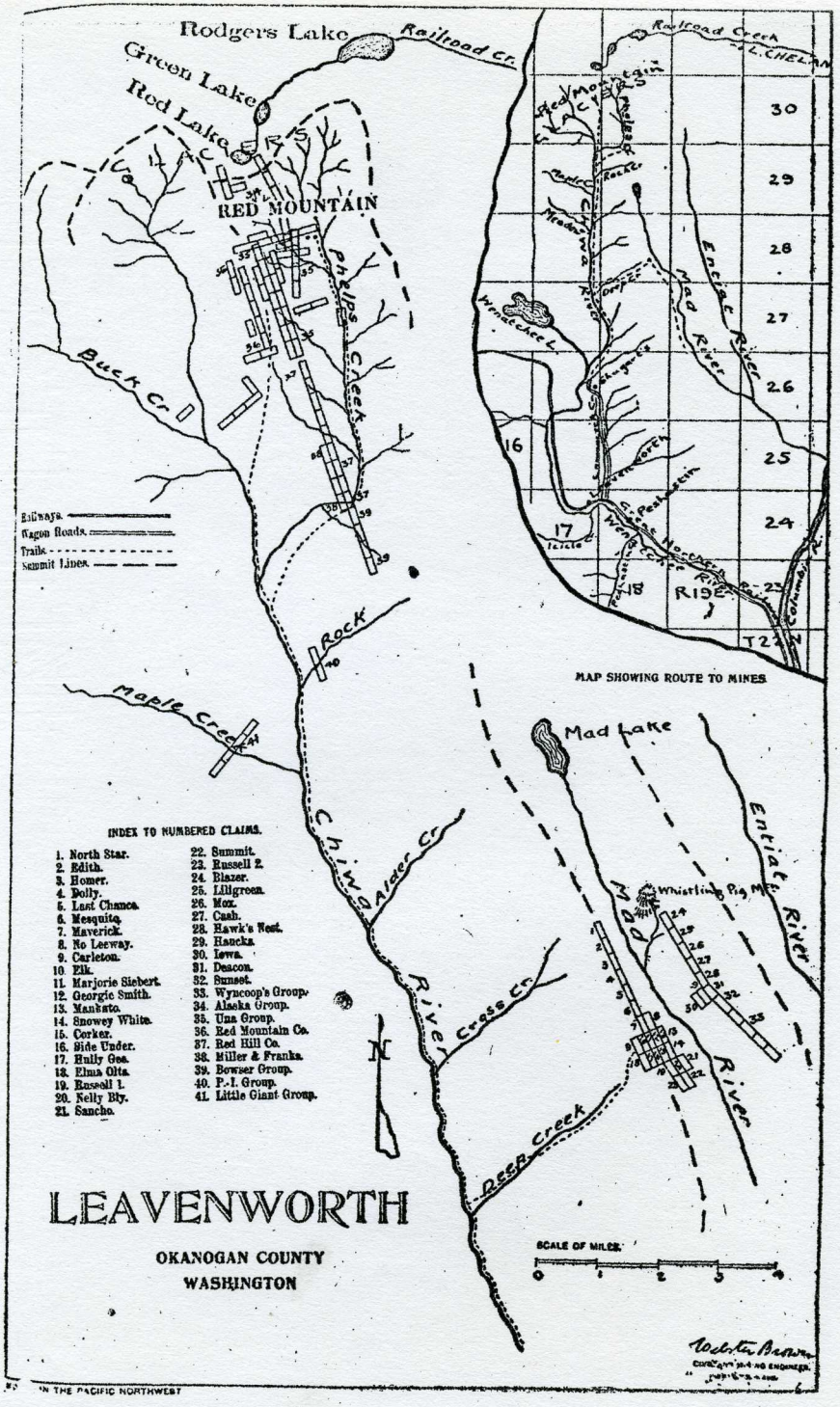
The Leavenworth District is easily accessible from Seattle. Leaving that city on the Great Northern train, one goes to Leavenworth, 151 miles, and then goes northward by a good road to Shugart's ranch, fourteen miles, and by trail to either the Phelps Basin or the Chiwah Basin, thirty-eight miles in each case. These basins are one at each side of a high ridge ten miles long, known as Red Hill, the Chiwah flowing down one side and Phelps Creek down the other, to unite at the tail of the hill. On this mountain, called Red Hill to distinguish it from Red Mountain in the Trail Creek District, is the greatest mineral zone with the most active work.

The first discovery of mineral on this mountain was made in 1893 by George N. Watson, who found in a low saddle on the summit, between porphyry and granite walls, a ledge of iron pyrites four feet wide, running a little east of south and west of north, with a slight eastward dip. He located the Emerald, and this ledge has since been traced on the surface through a string of claims for about five miles. On a parallel ledge he and Dr. L. L. Porter, of Roslyn, have the Esmeralda, which a shaft forty-two feet deep and drifts twenty-six and twelve feet have shown to widen from eighteen inches on the surface to five feet. The ore is arsenical iron and copper sulphides and assays $14 gold, 33 per cent. copper and a small amount of silver.

The thorough prospecting which followed on Mr. Watson's discovery and examinations by mining engineers have shown the mountain to be formed of granitic rocks, with cliffs of gneiss on the side of the Phelps Creek Basin, and to be a great mineral zone, in which the ledges, carrying chalcopyrite and pyrites, have been traced by croppings of ore and by locations for five miles across country. The ledges are true fissures of great size and strength, but have not yet been defined by development.

The largest property on the mountain is the Red Cap and Bryan groups of twenty claims, owned by the Una Mining and Milling Company, of Seattle, covering over 500 acres from the Phelps Basin southward and from the summit down to Phelps Creek, with a tunnel site on the Chiwah side, two of the claims being placers in the flat at the confluence of the Chiwah and Phelps Creek. The majority of the claims are on the main ledge or system of ledges, while five run continuously for 7,500 feet along the main cross ledge, which has a course south of west and north of east, breaking through granite, gneiss and syenite and dipping slightly to the northwest into the mountain. It shows well mineralized chutes of ore on the surface, carrying chalcopyrite, pyrites of iron and copper and some manganese. The lowest assay from the surface was $3.73 gold and the highest $72 gold, but copper will also form a large part of the value. The main ledge has ore bodies showing in numerous places, heavily charged with arsenical and sulphide ores, assaying from $3 to $180 gold. The average value of the ore through the mountain is $50 gold and silver, on the basis of a number of assays. A tunnel is in fifty-two feet to cut the broad main mineral zone at a maximum depth of 1,500 feet and is being continued with a double shift of miners. At 112 feet it will cut the first ledge, which shows three and one-half feet wide on the surface, carrying sulphides and black sulphurets and assaying $45 gold, silver and lead, and a little further will strike the second, which is seven and one-half feet wide and well mineralized on the surface with copper sulphurets, copper oxides and bunches of native copper, assaying $48.60 for all values. The Bryan group lies on the south edge of the company's holdings and has a ledge showing three and one-half feet of solid ore, heavily charged with copper sulphurets and native copper in bunches. Another ledge further up the mountain shows twenty-five feet of talc carrying sulphides, and will be tapped at great depth by the cross-cut tunnel, and yet another, which cuts the red cliffs forming the rim of the basin, has been defined to a width of seven feet, with only the hanging wall found. A tunnel has been started on this group also and will be pushed this season, when a tunnel will also be driven from the Chiwah side of the mountain. This company has already expended over $3,000 on development.

The company which had been most active in development until the advent of the Una was the Red Hill Mining Company, which owns ten claims on the two main ledges running across Phelps Creek south of the Una property. On the Black Bear a tunnel has been run sixteen feet, showing a twelve-foot ledge carrying copper and iron sulphides, which assayed $2.50 to $29 gold and silver; on the White Swan ledge, traced for some distance to a width of eight feet, a forty-foot tunnel showed arsenical iron assaying $12 to $18 gold, silver and copper.


Rodgers Lake
Railroad Cr.
Green Lake
Red Lake
RED MOUNTAIN
Railroad Creek
L. CHELAN
Red Mountain
Phelps Creek
Buck Cr.
Railways
Wagon Roads
Trails
Summit Lines
Entiat River
Mad River
Rock
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Chiwaukum Cr.
Mad Lake
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Entiat River
Mad River
Cross Cr.
Deer Creek
MAP SHOWING ROUTE TO MINES
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12. Georgie Smith.
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14. Snowey White.
15. Corker.
16. Ride Under.
17. Bully Goe.
18. Elma Olta.
19. Russell 1.
20. Nelly Bly.
21. Sancho.
22. Summit.
23. Russell 2.
24. Blazer.
25. Lilligreen.
26. Mox.
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28. Hawk's Nest.
29. Hancka.
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33. Wyncoop's Group.
34. Alaska Group.
35. Una Group.
36. Red Mountain Co.
37. Red Hill Co.
38. Miller & Franks.
39. Bowser Group.
40. P.-I. Group.
41. Little Giant Group.
LEAVENWORTH
OKANOGAN COUNTY
WASHINGTON
SCALE OF MILES
0 1 2 3 4
Walter Brown
CONSULTING MINING ENGINEER
SEATTLE, WASH.
IN THE PACIFIC NORTHWEST

The Red Mountain Mining Company also owns ten claims on the two main ledges, but has not as yet done any development.

Among the other extensions on the Emerald ledge are the Spokane, by J. D. Wynkoop, Capt. Benton and Henry Carpenter, of Yakima; the Emerald No. 2, by H. D. Watson and Tony Preston; the Standard, by G. N. Watson and Albert Medhurst; the Great Eastern, by D. H. Watson; the Eveleen and Ohio, by H. Blinn. On the Esmeralda ledge D. H. Watson has the Esmeralda No. 2 and on a cross ledge the Northern Light. On the latter an open cross-cut extending twenty feet from the footwall has not struck the hanging wall, and shows iron sulphides assaying $8 gold. Turner & Co., of Spokane, have the Fourth of July group of six claims on three parallel ledges. Running over the summit from the head of Phelps Basin to Red Lake, Frank Reeves and others have the two Alaska claims on a twenty-five foot ledge showing sulphides clear across the croppings. The Smuggler ledge has been traced up the hill and on it Carl Christianson has located the Standard, John M. Miller, William Nack and Carl Christiansen have the Morning, Custer, Liverpool and Cariboo. On another ledge Tony Preston and John W. Miller have the Queen Victoria group of three claims, and Turner & Co. have the two Great Northerns. On the Chiwah side of the hill, below the Emerald ledge, are the Mountain Goat and its extension by Frank A. Losekamp & Co., the Sacred Faith and its extension; the Portland and its extension, by Emil Frank & Co.; the German, by Sig. Frudenstein; the Black Diamond group of four claims, by Losekamp & Co.; the Black Man, by John W. Miller; the Black Crystal, by —— Karbs, of Spokane, and the Eagle, by William Nack and Carl Christiansen.

Until the last year but little development had been done on Red Hill, but the movement which has begun may be expected to spur owners on to show what there is beneath the surface.

Near the mouth of Maple Creek Charles Allen has the Champion group of five claims, where there were evidences of the presence of white men as early as the year 1866. One ledge cropped eight to ten feet wide, showing sulphurets, and former owners had run a cross-cut 310 feet to tap it and then abandoned it for lack of funds. The other ledge shows pyritic ore and is well defined to a width of fifteen to twenty feet between walls of syenite and porphyry running southeast and northwest, assaying $4 to $7 gold on the surface, and has an east and west spur on the summit. A cross-cut has been run about 300 feet to tap it at a depth of 250 feet. Further up the mountain Philip Hatch and others have the two Drummer Boy claims on a ledge showing four feet wide in an open cut, where the ore assays $5.68 gold and silver.

On the Rock Creek Canyon, half a mile from the Chiwah, is the P.-I. group of two claims, owned by Frank Schuenemann, of Pasco. The surface showing is a gneiss blow-out of oxidized iron, carrying gold and silver, and one streak of ore assayed 444 ounces silver. A cross-cut tunnel is in sixty-seven feet.

On Fall Creek, still further down the Chiwah, A. W. Purdy has the Big Elephant group of six claims on a large ledge of hematite ore, defined by a twelve-foot open cut, carrying gold, silver and copper, which assays on the surface $3 to $9 gold and $3.75 silver.

On the summit of the range between Mad River and the Chiwah is another section of the same district, of granite and shale formation, which is reached from Leavenworth by fourteen miles of road and three miles of trail. On this range are two great parallel ledges of light green schistose talc between granite walls, carrying free gold. The Monterey Gold Mining and Milling Company has nine claims, comprising the Georgie Smith group. Eight claims are on a ledge of light green talcose quariz sixty feet wide, with no defined pay streaks, which was tapped in thirty-five feet by a cross-cut last summer. The gold is said to be all free and assays of surface specimens have run $3.25, $125, $350 and $3,128 gold. The other claim is on a seven-foot cross ledge. The company is about to erect a ten-stamp mill and will begin milling ore this spring.

On the extension of the Georgie Smith ledge the Cable Mining Company, of Seattle, has five claims, which with two on a second ledge on the east bank of Mad River, are known as the Palmer group. The main ledge on this group is thirty-five feet wide and shows a pay streak of twenty-four inches at a depth of eleven feet in an open cut, ore from which assayed $186 gold. A cross-cut tapped the main ledge in forty feet, but has not cut through it. This ledge crops so strongly that it can be readily traced for 15,000 feet. The second ledge is also a true fissure in granite.

J. C. Parsons and Bickford & Son have the two Hawk's Nest claims on the Georgie Smith ledge. On a twenty-foot ledge of free milling ore Louis Houch, Charles Blazier, Charles Lilygren and Max Spromberg have the Mother Lode group of four claims, on which they have run a sixteen-foot tunnel.

At the mouth of Deep Creek the Deep Creek Mining Company has a group of thirteen placer claims, on which four men were employed last summer with a hydraulic giant. The dirt carried about 26 cents a yard and about 90 per cent of the value is saved in the sluice boxes with silver plates, though the gold in the Chiwah River bars is generally so fine that it can only be saved by great care and skill.

The extension of the wagon road from Shugart's ranch to the head of the Chiwah River or Phelps Creek would not be attended with any great difficulty and would do much to facilitate work. It is understood that the people of Leavenworth contemplate making this improvement, as it would redound greatly to their benefit.

LAKE CHELAN.

Development is fast proving that the precipitous mountains which shut in this beautiful body of water on each side are full of mineral equal in abundance and value to the mineral belt which is cut by the Columbia River and extends east and west along the boundary line for an indefinite distance. The principal ore bodies opened so far carry gold-bearing iron and copper pyrites, but there are also in close proximity rich narrow ledges of silver-bearing ores.

The district, while not tapped by any railroad, is easily accessible. From Seattle one goes by the Great Northern Railroad to Wenatchee, 174 miles; by the steamer City of Ellensburg to Chelan Falls, thirty-nine miles; by stage to Chelan, three and one-half miles, or to Lakeside, five miles; or steamer City of Ellensburg to La Chapelle, forty miles, and stage to Chelan two and one-half miles; by steamer Stehekin to Meadow Creek, fifty-two miles, or Railroad Creek, the same distance, these two streams emptying into the lake almost opposite one another. If one wishes to make a more extended trip to adjoining mining districts, the Seattle & International train can be taken from Seattle to Woolley, eighty miles; the Seattle & Northern train thence to Hamilton, fourteen miles; stage thence to Marble Mount, thirty-four miles; then go on horseback over the state trail, which runs up the Cascade River, over the Cascade Pass and down the Stehekin River to the mouth of Bridge Creek, forty-one miles. Leaving the state trail here, one would go sixteen miles over another trail to Stehekin, at the head of Lake Chelan, where the steamer Stehekin would be taken and one would go in the reverse direction over the route first described. Taking this route, the traveler would make a circuit of 471 miles and would pass through the Skagit copper belt, the Cascade and Stehekin silver belt, the Lake Chelan gold, copper and silver district, and the Wenatchee low grade gold district. This trip would at the same time give an opportunity to see the Switzerland of America and enjoy unrivaled hunting and fishing.

The country rock of this region is granite, amid which lie great dikes of porphyry, and the ledges are usually in the contact between these two rocks in the Meadow Creek District, their course being slightly south of west and north of east. The first prospecting was done in 1891 from rowboats on the lake, whence the croppings of mineral could be descried on the mountains on each side, but in the following year the heights were scaled and explored in a more thorough search.

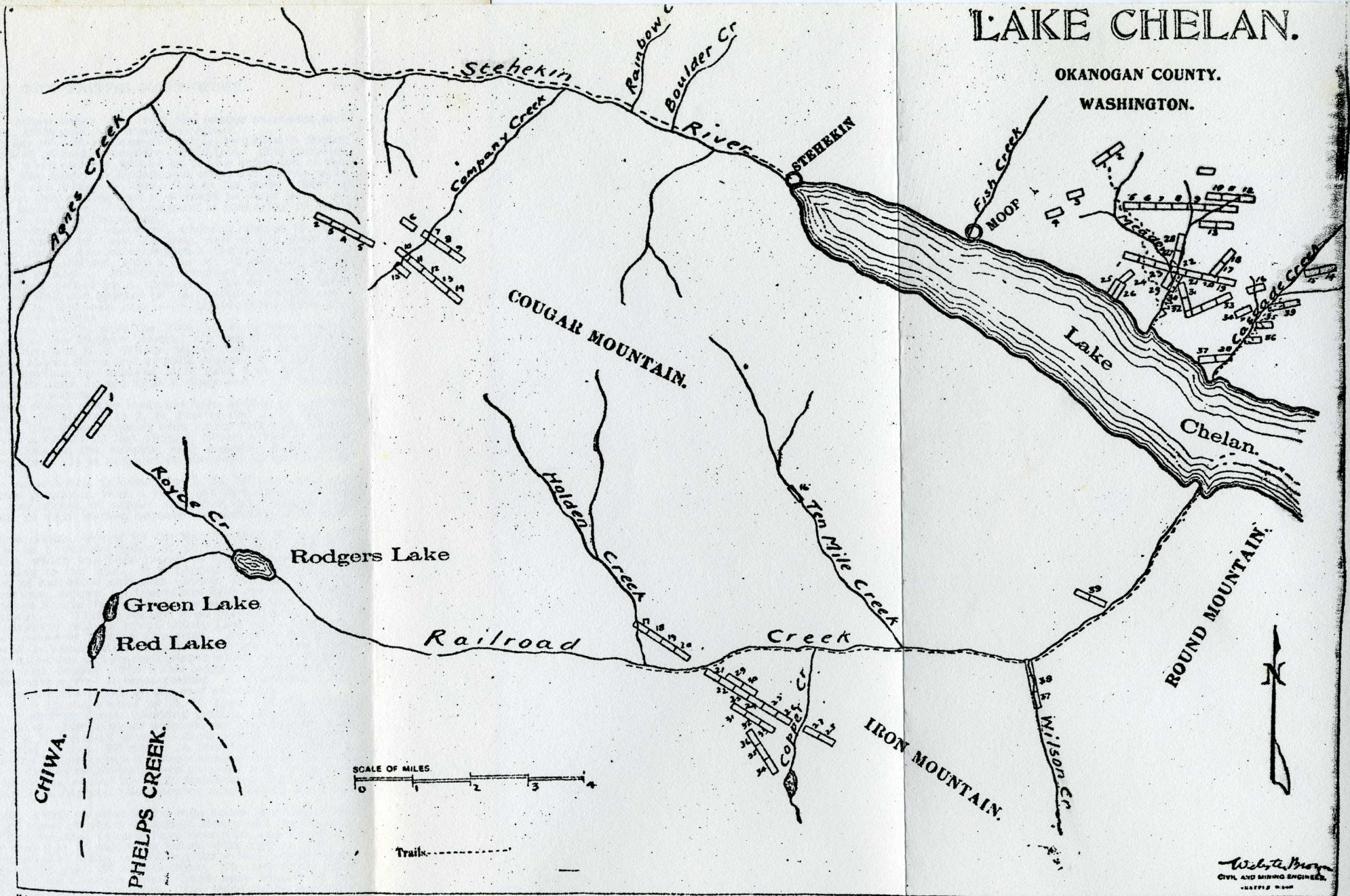
The first discovery has so far proved t he greatest, thanks to the energetic development of the last year, though others may yet rival it. This is the Blue Jay, on the east bank of Meadow Creek, 1,000 feet above the east bank of the lake, discovered by Capt. Charles Johnson, of Lakeside. It is now being developed to a depth of 150 feet by the Chelan Gold Mining Company, which has bought it. The red iron capping of the ledge rises in a series of big swells on both sides of and above a slide in which the crumbled, iron-stained rock slopes for 200 feet down to the next bench. It is a clearly defined ledge of iron and copper pyrites from thirty to forty-five feet wide between walls of granite and porphyry, the line of cleavage being marked by seams of quartz. Of the ledge eight feet is white quartz and ten feet is diorite exactly like that of other sulphide districts. An assay of the surface ore showed it to carry $8 gold, 12 per cent. copper and a little silver.

An open cross-cut and tunnel were run on the ledge for seventy-two feet, giving a depth of fifty feet, and cross-cuts were then run twenty-six feet to the hanging wall and fifteen feet to the footwall, defining the width of the ledge as forty-six feet. A winze was sunk on the hanging wall for nine feet to ascertain whether the ore chute widened. It proved that the chute widened from eighteen inches of broken ore at the roof of the tunnel to twenty-eight inches of solid ore at the floor of the winze, with a total width of seven feet. This improvement occurred in a depth of fifteen feet between the roof of the tunnel and the floor of the winze. There were also in the width of the ledge four other streaks of solid ore, one three feet wide composed mostly of oxide of copper, with decomposed quartz and iron pyrites; the three others, twenty, six and four inches wide respectively, of solid iron and copper sulphides, the last being against the footwall. The ledge is also mineralized throughout, and through it run various streaks of soft iron and copper sulphides, having a greater dip than the wider pay streaks and all tending towards the footwall —an indication that at depth they will come together. Assays from the average of the pay streaks in the winze range from $18 to $37 for all values,

LAKE CHELAN.

OKANOGAN COUNTY.

WASHINGTON.



MINING IN THE PACIFIC NORTHWEST

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1. North Star Group.
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3. Monarch.
4. Mystery.
5. Mystic.
6. Deer Park.
7. W. T.
8. Sunrise.
9. Sunset.
10. Stockholm.
11. Gold Bug.
12. Horton
13. Goericke.
14. MonteRosa.
15. Dawn.
16. Mary G.
17. Black Cap.
18. White Cap.
19. Blue Cap.
20. Red Cap.
21. Tenderfoot.
22. Emma.
23. Minnie.
24. A. M. H.
25. Irene.
26. Gold Bug.
27. Buckskin.
28. Chelan.
29. Copper Mtn No. 1.
30. Copper Mtn No. 2.
31. Lulu H.
32. Lottie.
33. Sky Rocket.
34. MaryGreen.
35. Iron Dyke.
36. Last Chance.
37. Raymond.
38. Marcus Stein Group.
39. D.T.Denny Group.

North of Lake.

1. Moscow.
2. Silver Bell.
3. Buster.
4. Nebraska.
5. Clayton.
6. Phyllis.
7. Crumrine.
8. Emma Lee.
9. MattieJane.
10. Wolverine.
11. Idaho.
12. Canada.
13. Devonshire.
14. Mastodon.
15. Elephant.
16. Hard-scrabble.
17. Lake View.
18. Emma.
19. Diamond J.
20. Gem.
21. Blue Jay.
22. Blue Jay Ext.
23. Willie Gibson.
24. Little Jap.
25. Sunday Morning.
26. Happy Thought.
27. Chub.
28. Unique.
29. Black Bear.
30. New York.
31. Confidence.
32. Seattle.
33. Bismarck.
34. Johnson.
35. Iowa.
36. Carrie A.
37. Orphan Boy.
38. Hunter.
39. Silver King.

gold predominating. The highest assay was from the copper sulphides and showed 16½ per cent. copper, $16.80 gold, the remainder silver.

A contract has been let for 100 feet of cross-cut tunnel to follow a feeder and tap the ledge at a depth of 220 feet, after running 200 feet. This contract will be completed by May 1, when another will be let for an extension of the cross-cut to tap the ledge. The feeder to be followed crops two inches wide where the cross-cut enters it and widens to three feet at the point where it enters the ledge. In the first thirty-three feet it widened to eight inches of ore superior to that in the main ledge. The company is preparing to erect a compressor plant and power drills in the spring.

The Blue Jay ledge has been traced eastward, where it widens to sixty feet on the two Gem claims, owned by Capt. Johnson, and on the Blue Jay extension, owned by O. Graham, of Anacortes, where a thirty-foot open cut and tunnel show it to be well mineralized, with a pay streak carrying $10 to $19 gold and half that value in silver. Further extensions eastward trace the ledge through the Winnipeg, owned by A. Crumrine, the two Iron Cross claims of Messrs. Turner and Bull and onward to the summit. On the west extension E. F. Christy, A. H. Murdoch and —— Buckingham have the Gibson and Frank Lightner the Granite.

At least five distinct ledges parallel with the Blue Jay have been traced, some of them to the summit of the Methow Range. On one of these is the Emma Lee, owned by S. J. Gray and E. J. Wilder, where it crops fifteen feet wide in a porphyry dike and shows three feet of solid mineral in a fifty-foot open cut and tunnel. The surface ore assayed $14.35 gold, 6 ounces silver, 15 per cent. copper. The Mattie Jane, owned by S. J. Gray and "Bill" Rasnic, and the Iron Cap, by S. J. Gray, adjoin.

The Phyllis group of three claims on this ledge has been bonded by Andrew Crumrine, S. J. Gray and L. H. Millard to J. B. Powles and J. G. Cotton, of Seattle, for development. The ledge crops at least thirty feet wide, showing several pay streaks, and a tunnel 112 feet along it shows a two to seven inch streak of copper sulphides on the hanging wall assaying 21 per cent. copper, $6.50 gold, 6 ounces silver. It is intended to cross-cut at 100 feet and open up the other pay streaks.

The Nebraska, on the same ledge, is owned by L. H. Millard, and has eighteen feet of mineralized porphyry, with a thirty-six foot tunnel on the hanging wall showing a pay streak of copper sulphides, gray copper and galena to widen from four to eight inches, surface ore assaying $1.25 gold, 21 ounces silver.

The Idaho group of two claims, owned by the Seattle Gold Mining and Development Company, is on a parallel ledge of porphyry over fifty feet wide between granite walls, which has been traced to the Sawtooth Range and crops in a gulch running to the lake. It is capped with iron and the croppings show three feet of sulphides and gray copper, assaying $8 to $16 gold, 16 ounces silver, 16 per cent. copper. A tunnel has been run seventy feet in the hanging wall, and when it is in 100 feet the ledge will be cross-cut, with 200 feet of depth. The Canada, by William Bigger, is on the extension.

Another mineralized porphyry dike of great width, 1,000 feet northwest, runs through the Moscow, owned by Andrew Crumrine. An open cut thirty feet along the hanging wall is being extended in a tunnel and shows three feet of ore carrying copper sulphides and peacock copper which assays $8 gold, 11 ounces silver, 7 to 11 per cent. copper. The whole ledge is mineralized and the tunnel is being extended with a view to cross-cutting. A. Crumrine, J. W. Nicol and N. B. Church have the Silver Bell on the east extension.

The Buster group of three claims, owned by H. H. Hunt and Ole Olsen, is on a ledge near the head of Fish Creek, carrying pyrites, associated with native silver. On a parallel six-foot ledge of sulphide ore crossing Meadow Creek M. M. Kingman and R. N. Pershall have the Chub, and in a thirty-foot shaft have shown ore assaying $14 gold, $18 silver. A four-foot ledge crossing the Blue Jay is covered by the Emma group of three claims, owned by Spencer Boyd, who has shown three feet of sulphides in two cuts, ten and twenty feet long. The three Bismarck claims, owned by W. P. Robinson and A. H. Murdoch, are parallel with the Blue Jay and show copper sulphides in the croppings.

Crossing Cascade Creek, which empties half a mile below Meadow Creek, are four parallel ledges, on three of which J. Robert Moore has the Cascade group of three claims. Two ten-foot tunnels have been run, one showing a four-foot ledge carrying two feet of sulphides mixed with galena. W. H. Phelps has the Iowa on a parallel ledge, in which a forty-foot tunnel shows twelve inches of ore assaying $60 gold, 200 ounces silver. The two Silver King claims, on another ledge cut by Cascade Creek, have been bonded by the Seattle Gold Mining and Development Company. The ledge is ten feet wide and on one side shows iron and copper sulphides and on the other a twenty-four inch chute of galena ore, carrying a little copper. A tunnel is in thirty-five feet on this ore chute and when extended to 200 feet will give a depth of 500 feet. The Elephant and another claim, owned by J. M. Scheuyeaulie, are on a great body of ore 50 to 100 feet wide carrying silver, assays having run as high as 50 ounces.

The first ore shipped from Lake Chelan had silver for its principal value, and thus drew attention from the great ledges of pyrites on the heights. The

Sunday Morning, owned by J. Robert Moore, is on a twelve-inch ledge of quartz cropping on the water's edge at the foot of a granite cliff, and a seventy-foot tunnel showed it to widen to five feet, with a pay streak carrying galena and ruby silver two to four inches wide. A shipment of 4,600 pounds to the Omaha smelter returned $250 a ton gross. The floor of the tunnel is now being lowered three and one-half feet and the ore taken out in doing so is sacked for shipment, the latest assay being 2,005 ounces silver and $74 gold. When this work is completed the tunnel will be extended. Mr. Moore is also driving a tunnel on the Happy Thought, adjoining.

The Little Jap group of four claims is on a ledge of porphyry four feet wide and carrying two inches of high-grade ruby silver ore, cropping 250 feet above the lake, with a cross ledge of the same width carrying iron and copper sulphides. A tunnel thirty-five feet showed the pay streak to widen to four inches, with iron sulphides of smal value throughout the ledge matter. A cross-cut has been run fifty-five feet to tap both ledges at depth.

On the Hunter group of two claims D. H. Lord and A. W. La Chapelle have a four-foot ledge with a four-inch streak of gray copper and ruby silver cropping near the mouth of Cascade Creek. A fifteen-foot tunnel has shown ore assaying 140 ounces silver. $16 gold.

The Railroad Creek discoveries show ledges of galena on the summit of the Entiat Range, where this district adjoins Red Hill in the Leavenworth District, the Chiwah and Phelps Creek flowing south from one side and Railroad Creek flowing east from the other. The latter stream has its source in Red, or Nellie, Lake, and Green, or Jackson, Lake, and makes a leap of 1,350 feet at Beecher Falls into Rodgers Lake, two miles further east. On the summit, near the two former lakes, eighteen miles from Lake Chelan, the Cascade Range Mining Company has the North Star group of eight claims, six on one ledge and two on another, the formation being granite and the course southwest and northeast. The main ledge has a pay streak of fifteen to twenty inches, assaying 100 to 140 ounces silver and 33 1-3 per cent. lead, shown in tunnels twenty-five and thirty-three feet long.

A great deposit of gold-bearing copper ore was discovered in July, 1896, by J. H. Holden, of Seattle. The ledge is at least seventy-five feet wide between diorite walls and runs northwest and southeast from the base of Cougar Mountain across Railroad Creek and through Copper and Irene Mountains. The ore body is from thirty to fifty feet wide, containing five distinct streaks of copper and iron sulphides close together, carrying $4 to $10.20 gold and 2½ to 18 per cent. copper. There are intervening streaks of copper carbonates carrying 19 per cent. copper and $9.50 gold. On this ledge Mr. Holden has the Irene group of three claims, on which he has recently resumed work.

Ten miles from the mouth of the creek a ledge has been exposed by a slide in the bed of Wilson Creek between granite walls and shows in the croppings four feet of quartz carrying antimonial silver and fine-grained pyrites. The Seattle Gold Mining and Development Company has the Raymond, and Marcus Stein has two claims named after himself, from the surface of which he took ore assaying high in gold and silver, but he has done no development.

STEHEKIN DISTRICT.

With a story of a lost mine dating back to 1880, this district has a mining history beginning in the year 1885. It extends along the summit of the range northward from Cascade Pass and includes the whole watershed of the Stehekin River. Discoveries began on Doubtful Lake, north of the pass, then extended to Horseshoe Basin, then along each side of the Stehekin Canyon, next up Park and Bridge Creeks, flowing from the right, and then up Agnes and Company Creeks on the left. Development has proceeded far enough to prove the presence of small ledges of rich ore and large ledges of low-grade ore in close proximity, but hitherto the many handicaps which beset the progress of a mining camp have prevented any mine from becoming a producer. Yet the high-grade ore would pay a handsome profit on shipment to the smelter. The ore is of two kinds—one carrying galena, gray copper and sulphides in which silver is the principal value, though there is a large admixture of gold; the other carrying iron and copper sulphides under the familiar iron cap, which has been found a sure sign of a mineral deposit throughout the Cascades, as in the Gold Range. The sulphides are always of low grade, at least on the surface, their value being divided among gold, copper and silver, usually in the order named. While the sulphide ledges are of great size, those carrying mainly silver-lead ores are of no mean proportions, often spreading to a width of ninety feet on the surface. The ledges near the headwaters of the Stehekin generally run from east to west and cleave the granite country rock so strongly that they can be traced with the eye by the break in the line of the latter on the jagged summits for miles.

The most convenient route to this district at present is the most circuitous. Going by the Great Northern train to Wenatchee, 174 miles, one

takes the steamer City of Ellensburg up the Columbia to Chelan Falls, forty miles, goes by stage to Chelan or Lakeside, four or five miles respectively, and then by the steamer Stehekin to the postoffice of Stehekin at the head of Lake Chelan, sixty-eight miles. There horses can be procured to ride thirty miles over the trail to Horseshoe Basin, or the same distance to Doubtful Lake, in each case up the Stehekin River. Trails also branch off to Company and Agnes Creeks on the left and up Bridge and Park Creeks on the right. A shorter route with a longer horseback ride is by the Seattle & International Railroad to Woolley, eighty miles, and by the Seattle & Northern to Hamilton, fourteen miles, over a good wagon road up the Skagit Valley and six miles beyond Marble Mount, a distance of forty miles, then over the state trail twenty-five miles to the Cascade Pass. In the one case the distance is 317 miles, in the other 169 miles.

On the basin surrounding Doubtful Lake George L. Rouse and John C. Rouse in September, 1885, located the Quien Sabe on a ledge carrying galena, black sulphurets and copper sulphides, its unbroken width being twenty-five feet, while it spreads to 150 feet where broken by granite horses. It can be traced by the red iron stain eastward through the sawteeth to Horseshoe Basin and runs westward through the summit into the Cascade District, where it crops on the Boston, at the side of the Boston Glacier. Two claims are on the extensions. On a parallel ledge twenty feet wide and quite as clearly traceable east and west they took the Doubtful, and the Lake and Flora on smaller ledges parallel with it. The two Quien Sabe claims are now owned jointly by the Rouses, C. C. May, of Davenport, Adolph Behrens, of Seattle, and Harry Frank. They have run a tunnel 120 feet on the ledge, showing two feet of ore, with the remaining gangue more or less mineralized, but have not cross-cut to find other pay streaks. On the Doubtful tunnels have been run 110 and 30 feet, showing eighteen inches of ore which averages $15.70 gold, 37.80 ounces silver and 44 per cent. lead, while the rest of the ledge would pay to concentrate. The Flora has a six-foot ledge assaying $28 gold and 40 ounces silver on the surface. On extensions or parallel ledges Britanus Stennis has the Sunnyside and Genne and George Taylor the Gertie.

In 1889 and succeeding years the Doubtful Lake series of ledges was traced through to Horseshoe Basin by M. M. Kingman and Albert Pershall, who found the Quien Sabe ledge cropping in the lower basin, and by Lloyd Pershall, Ed Pershall and Ed Christy. In the end a series of thirteen ledges was located, cutting across the upper and lower basin and ranging in width from twelve to thirty feet. The Davenport and two other claims on the same ledge are still owned by Messrs. Kingman and Pershall, who have run a tunnel fifty feet, showing ore which assays 60 to 90 ounces silver, $2 to $5 gold and 40 per cent. lead. The other twelve ledges on Horseshoe Basin, with two claims on each, are known as the Blue Devil and Black Warrior group and are owned by Henry Rustin, of Hazelton, Pa. A cross-cut tunnel is in 125 feet to cross-cut all twelve ledges, and will strike the first 675 feet further at a depth of 440 feet. Open cuts have shown this ledge to be at least twenty-five feet wide and assays show $4.50 to $7.50 gold, 60 ounces silver and 14 to 17 per cent. copper.

Below the confluence of Horseshoe Creek with the Stehekin, a ledge crops twelve feet wide in a gulch on one wall of the canyon and has been located across the river and up the opposite mountain. The Isoletta group is on this ledge and is being developed by J. D. and R. N. Pershall, C. C. May and Mrs. Hess, of Walla Walla. A tunnel has been driven 215 feet on the ledge, showing four and one-half feet of pay ore, which assays 300 to 700 ounces silver and $3 to $7 gold. A shipment of 2,200 pounds from the dump, where it had been exposed to the action of air and water for two years, returned $60 a ton.

On the same ledge, across the canyon, R. N. Pershall, M. M. Kingman and Charles Johnson have the Homestake and Star, on which it crops thirty to fifty feet wide, with a body of ore four feet wide shown by a thirty-foot open cut. This ore carries chloride and bromide of silver and gray copper, and assays 112 to 400 ounces silver and $15 gold. The Twin Falls, under the falls of Horseshoe Creek, is owned in common with the Isoletta group, and has shown up three feet of gray copper ore. On extensions Albert Pershall and M. M. Kingman have the Christy, and F. F. Keller the Viola. The same ledge crops ten to twenty feet wide on the Flamingo, owned by J. M. Scheuyeaulle and others, where assays have run up to $3 gold, 20 ounces silver, 8 per cent. copper. Adjoining this the same owners have the Lottie S. on an eight-foot ledge assaying 9 per cent. copper, 2 ounces silver, and on Shyall Lake Mr. Scheuyeaulle has the Lake Shyall on a ledge 50 to 100 feet wide, on which assays have run $2 gold, 10 ounces silver and as high as 75 per cent. copper. On a ledge varying from eight to fifty feet wide, which crosses Flat Creek, Mr. Scheuyeaulle and his associates have the Sunset group of three claims, giving assays as high as $60 gold. The Mountain Sheik and another claim are on a parallel ledge about twenty feet wide, assaying 15 ounces silver, 10 per cent. copper, and are owned by the same parties.

The Crown Prince and Free Coinage, owned by Cook & Clarke and others, of Spokane, are on a ledge running into a steep cliff, and they will cross-cut it by tunneling on a stringer, which has already widened from

nine to twenty-three inches in a cut of only twenty-eight inches. The ore is copper sulphides carrying 31 per cent. copper, $4.85 gold and 3 ounces silver.

The galena ledges plowed down by the glaciers of Horseshoe Basin have been traced twelve miles eastward to the head of Bridge Creek, twenty-three and one-half miles by trail from Stehekin, but there they are found parallel or associated with ledges of pyritic ore in a formation of granite and porphyry. Of the Tiger group of seven claims, owned by E. S. Ingraham, H. O. Hollenbeck, Van Smith, Professor Piper, George Young, H. Willis Carr and others, three claims are on a ledge fully fifty feet wide, running northeast and southwest near the head of the north fork. The croppings show three pay streaks, twenty-four, eighteen and six inches wide, two of them carrying galena, steel galena, gray copper and sulphurets, as shown in a twenty-foot open cut, while a twelve-foot shaft shows the third to change from large galena crystals to sulphides. Assays range from 103 to 176 ounces silver and uniformly show about $24 gold. Three other claims are on a parallel ledge five feet wide, in which a twenty-foot tunnel shows a fourteen-inch streak of white iron assaying $6 gold, $8 silver, besides copper. On two of the claims cuts have been made preparatory to tunneling and have shown a quartz gangue, but in the other the gangue is porphyry carrying six inches of cube galena on one wall and a streak of iron sulphides on the other. The remaining claim is on a parallel ledge of hard crystallized quartz about ten feet wide, carrying sulphides, which assay $5 gold and silver on the surface.

The Minneapolis is held by William Keho and Joseph Lathrop on a ledge of iron and copper pyrites cropping fifty feet between walls and carrying mineral the full width to a value of $18 gold, silver and copper. A cross-cut has been driven forty feet and will tap the ledge in another sixty feet.

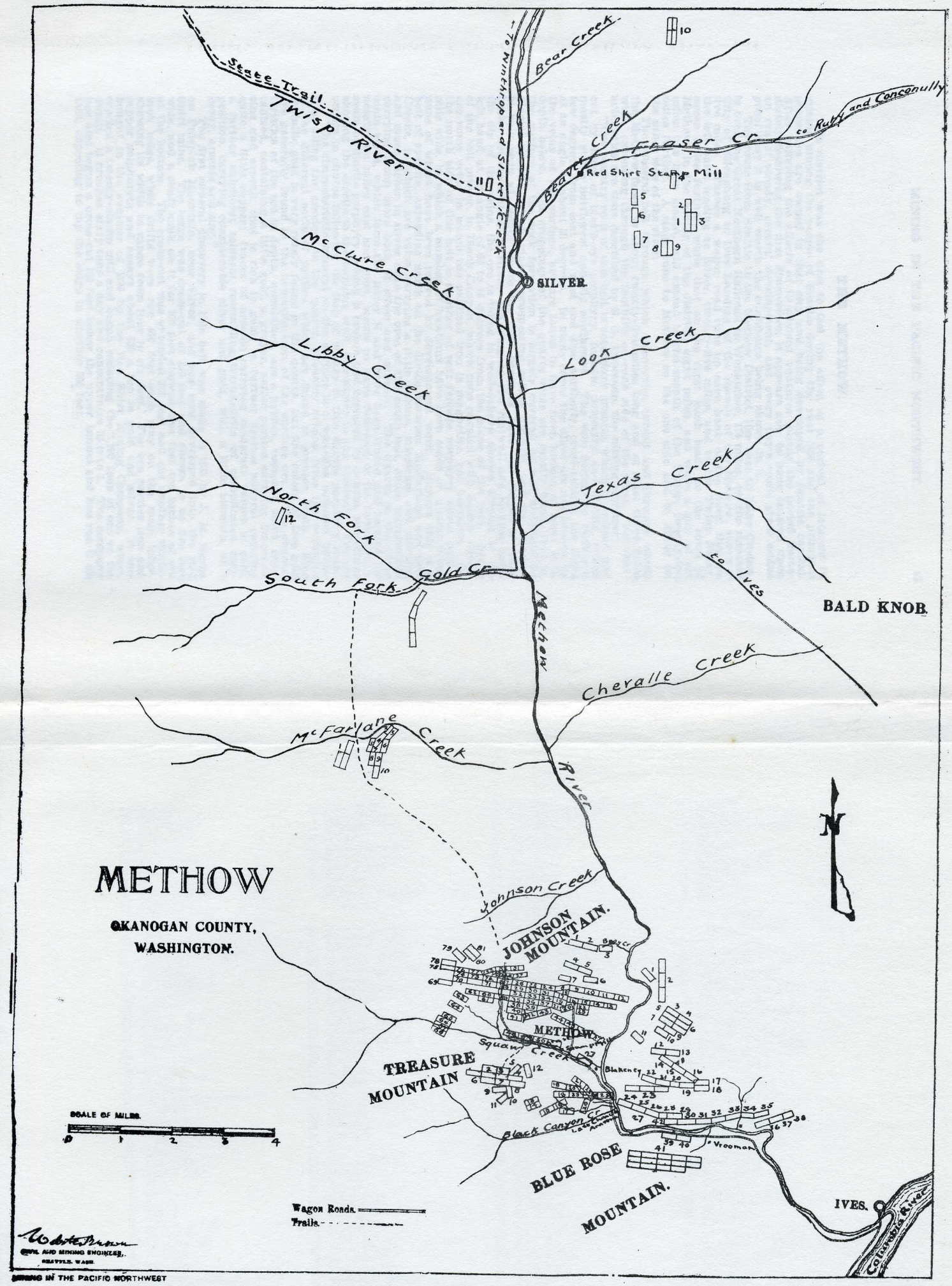
The Defender group of three claims is held by M. A. Allmandinger, Daniel Devore and others on three small ledges, each about two feet wide. The main ledge was supposed to carry ruby silver, but a cut to be continued by a tunnel showed a two-inch streak carrying gray copper and sulphides, which assayed 100 ounces silver. Another ledge showed four inches of galena in a twenty-foot open cut.

Among the other leading claims on Bridge Creek are the Mayflower on a thirty-foot ledge and the East Side on one five feet wide, both owned by William Keho and Henry Quinn. M. Bushman and W. I. Lyle have the Jefferson and Tennessee on parallel ledges about eight feet wide, carrying galena. In the Maple Creek Basin John Ferguson has the Prince of Wales on a four-foot ledge carrying eighteen inches of antimonial and ruby silver, Gilkey & Co., of Edison, having the Lulu on the extension, an assay from which ran $180 gold and silver, while ten other claims trace it across the mountain to Bridge Creek. Gilkey & Co. also have two claims on a four-foot ledge with eighteen inches of ore which averaged several hundred ounces in silver, and have the Sailor Boy on one thirty inches wide carrying $25 gold, 18 ounces silver. At the head of Bridge Creek is the Gray Eagle on a four-foot ledge assaying 140 ounces silver and $4 gold, the owners being Rogers & Howe, of Waterville, Oscar Johnson and Peter Dalberg.

The great deposits of sulphide ore extending across Company and Agnes Creeks near their sources and through the intervening ridge were first discovered eight years ago by Peter Goericke, of Conconully, but he strove in vain to find them again on a second trip and nearly lost his life in the attempt. Dennis McDonald and William Stillwell continued the search and in 1894 discovered a ledge of iron pyrites sixty feet wide, cut by Company Creek. They located the Well-known group of claims on this and parallel ledges.

Seven of these claims on one ledge comprise a group which has been acquired by the Stehekin Mining Company. The ledge is over 100 feet wide in walls of blue porphyry and the center claim is on both sides of the deep canyon of Company Creek, with perpendicular porphyry walls for over 600 feet, in which a 500-foot tunnel would give 2,500 feet of depth. The ledge is clearly traceable on both these walls and the quartz and schist gangue is impregnated throughout with iron and copper pyrites, assaying $2 to $7 gold and 2 to 15 per cent. copper.

The belt was then traced through the mountains from the head of Railroad Creek across Company Creek to the head of Agnes Creek. On another ledge, nowhere less than 100 and often 300 feet wide, and on spurs and lesser parallel ledges, J. M. Scheuyeaulle, J. W. Horton, Gus Anderson and J. E. Merritt have the Goericke group of ten claims, while on a parallel ledge from eight to fifty feet wide they have three claims. Surface ore on the wider ledge has assayed as high as $45 and on the smaller one as high as $60 gold, but the assays from these bodies of sulphide ore have generally averaged about $7 gold. As little work has been done, these assays are all of surface ore, and the precedents of other similar districts where depth has been gained warrant the belief that higher values will be obtained when work has been carried on some distance below the surface.


State Trail
Twisp River
To Winthrop and State Creek
Bear Creek
Beaver Creek
Fraser Cr.
Co. Ruby and Conconully
Red Shirt Stamp Mill
McClure Creek
SILVER
Libby Creek
Look Creek
Texas Creek
North Fork
South Fork
Gold Cr.
Co. Ives
BALD KNOB
Methow
Cheralle Creek
McFarlane Creek
River
N
METHOW
OKANOGAN COUNTY,
WASHINGTON.
Johnson Creek
JOHNSON MOUNTAIN.
METHOW
Squaw Creek
TREASURE MOUNTAIN
Blakeney
Black Canyon
Co. Vrooman
BLUE ROSE MOUNTAIN.
IVES.
Columbia River
SCALE OF MILES.
0 1 2 3 4
Wagon Roads
Trails
Webster Brown
CIVIL AND MINING ENGINEER,
SEATTLE, WASH.
MINING IN THE PACIFIC NORTHWEST

North of Squaw Creek.

1. Liverpool.
2. London
3. Greengage.
4. Black Boy.
5. Storm King.
6. Big 4.
7. Crystal.
8. California.
9. Milly.
10. Seven Up.
11. Twilight.
12. Badger.
13. Louise.
14. Standard.
15. Columbia.
16. Yakima.
17. Hidden Treasure.
18. Sunrise.
19. Grey Billy.
20. Seattle.
21. Austinburg.
22. Balance.
23. Dead Shot.
24. Lookout.
25. Sailor Boy.
26. Hunter.
27. Jefferson.
28. Washington.
29. Virginius.
30. Buckhorn.
31. Highland Light.
32. Cora.
33. Irene.
34. Chicago.
35. Just-in-time.
36. Henrietta.
37. Philadelphia.
38. Gold Dollar.
39. Mary Ann.
40. Dry Gulch.
41. Central.
42. Podunk.
43. Old Rye.
44. Snow Ball.
45. Aurora.
46. Trilby.
47. Methow Queen.
48. Paymaster.
49. St. George.
50. St. Patrick.
51. Full Moon.
52. Snowflake.
53. Lincoln.
54. Voltaire.
55. Okanogan.
56. Ophir.
57. Spring.
58. Grubstake.
59. Yes I Know.
60. Jeff Davis.
61. Eureka.
62. Spike Team.
63. Clifton.
64. Small Change.
65. Drumlummon.
66. Derby.
67. Elkhorn.
68. Sicily.
69. Ransomet.
70. Golden Eagle.
71. Homestake.
72. Golden Chariot.
73. Tiger.
74. Doubtful.
75. Little Fellow.
76. Seattle.
77. Second Thought.
78. Copper King.
79. Missing Link.
80. Inland Light.
81. Grand View.

South of Squaw Creek.

1. Tiptop.
2. Excelsior.
3. Nip and Tuck.
4. Mountaineer.
5. O. K.
6. 'Alf an' 'alf.
7. Moonshine.
8. Ben Hur.
9. Lily.
10. Elephant.
11. Crichton.
12. Mammoth.
13. Old Man.
14. Old Woman.
15. Black Canyon.
16. Blue and Grey.
17. Portland.
18. Selkirk.
19. Original.
20. 96.
21. Old Crow.
22. Bones.
23. Meadow Lark.
24. Grey Eagle.
25. Helensburg.
26. Last Chance.
27. Smuggler.

East of Methow River.

1. Bluebell.
2. Emerald.
3. Methow Chief.
4. Yellow Duke.
5. Josephine.
6. Last Chance.
7. Charleston.
8. Reno.
9. Albert Lea.
10. Sunny South.
11. Monte Cristo.
12. Boston.
13. Thompson.
14. Seven Eagles.
15. Wednesday.
16. Thursday.
17. Sunday.
18. Tuesday.
19. Monday.
20. Reno.
21. Parallel 1.
22. Parallel 2.
23. Navarre.
24. Savage Queen.
25. Diamond Flush.
26. Monitor.
27. Carnival.
28. Bismarck.
29. Blue Grouse.
30. Friday.
31. California Boy.
32. Decoration.
33. Humboldt.
34. Ida May.
35. Cripple Creek.
36. Dryville.
37. Riverside.
38. East End.
39. Blue Rose.
40. Twins.
41. Schultz-Chesney.
42. Saturday.

Northern Section.

1. Red Shirt.
2. Brooklyn 1.
3. Pride of the Hills.
4. Black Warrior.
5. Crockett.
6. Mike Maloney.
7. Silver Bow.
8. Brother Jack.
9. Panic.
10. Safe Deposit.
11. Spokane.
12. North Star.

McFarlane Creek.

1. Guy.
2. Bryan.
3. Damfino.
4. Black Jack.
5. Lucky Boy.
6. Jumbo.
7. Yesler.
8. Western Pride.
9. Northern Light.
10. Albion.

THE METHOW.

This district was the first to feel the effect of a revival of interest in mining among the people of Seattle during the year 1896 and the principal properties are owned in that city and being developed by Seattle capital. After suffering the effects of ill-advised ventures during the period immediately following the first discoveries, it appears now to have entered upon an era of steady, careful development, and every day's work gives added proof that it is well worth the confidence being shown in it.

The route from Seattle to the Methow District, like that to Lake Chelan, is over the Great Northern Railroad to Wenatchee, 174 miles, by the steamer City of Ellensburg to Ives Landing at the mouth of the Methow, seventy-five miles. Thence a wagon road runs up each bank of the river, that on the left bank leading to Silver, twenty-five miles, and to the Twisp Ferry, seven miles further, while that on the right bank leads to the town of Methow, in the center of the district, eight miles, and when a gap of six miles has been closed, will extend to the mouth of the Twisp, twenty-five miles further. A stage runs to Methow on the one side and to Silver on the other side of the river.

The mineral belt through which discoveries extend and through which the Methow flows, is about twenty-five miles long and at least three miles wide, extending through the foothills on each side of the river. Its characteristics are thus described by S. G. Dewsnap, the mining engineer:

"The country rock of this belt is secondary granite, which is crossed and cut by dikes of bird's-eye porphyry, feldsite porphyry and diorite, which mostly strike northwest and dip southwest. The vein formation strikes a few degrees from east and west and dips northerly, cross-cutting the dikes at an angle of about 30 degrees. In many cases the dikes are not broken by the veins at the surface, but are found to have been broken at some little depth below. The croppings of the quartz veins are mostly blind, that is, the surface of the rock formation is largely covered by soil underlaid by glacial cement, which makes prospecting rather difficult, and the bedrock is only seen at points where the dike contacts have left ridges or hogsbacks not covered by detritus. Standing on the footwall and looking down the dip of the veins, the ore is found in well-defined chutes dipping to the left hand at an angle of 60 to 66 degrees from the plane of the vein. South of the belt proper, in Black Canyon, which runs parallel with Squaw Creek, are some veins in which the oxidized iron is magnetite, not hematite. On the north side of this belt is another of soft feldsite porphyry about half a mile wide, in which a number of locations have been made on quartz veins, none of which have been proved by development work. Beyond this is a belt of syenite, extending north on the divide between McFarlane and Gold Creeks, in which are veins carrying a little galena, mispickel and stibnite, and much richer in silver than the ores of the south belt, some tetrahedrite carrying much more both of silver and arsenic. The quartz in the three main veins, which form the letter N and have been traced and located for nearly six miles east and west, seems to have followed in its formation a seam of diorite porphyry, which is broken and replaced by quartz, sometimes shoving the diorite to the hanging wall, sometimes to the footwall. The ore occurs in chutes following the line of breaks in this diorite porphyry seam.

"The characteristic mineral on the surface is a wax-like compact hematite, filling the crevices in the quartz, probably arising from the oxidation of the different sorts of pyrites which are found at greater depth. Free metallic gold is very rarely found in the quartz, but fine colors of free gold are generally found in the hematite iron of the surface ore. The characteristics of the ore in depth, unoxidized, are a pyrites, compact, hard, crystallized, containing a little gold, a grayer, softer pyrites carrying traces of zinc and arsenic that is rich in gold; a further pyrites mineral carrying quite a little copper; traces of arsenic carrying moderate values in gold; a further sulphuret mineral resembling tetrahedrite of complicated composition, carrying considerable silver and gold, with a little bismuth, antimony, arsenic and zinc."

The first mineral discovery in this belt was made in 1887 by J. M. Burns on Polepick Mountain, near Silver, and has now developed into the Red Shirt mine. The ledge was cross-cut at 240 feet and shown to be five feet wide, and a shaft sunk on it for 150 feet showed five feet ten inches of ore at the bottom. The cross-cut was extended 210 feet and cut another thirty-inch ledge, while drifts were run 400 feet each way on the main ledge, showing its width to range from four to six feet. The ore carries iron and copper sulphurets and assays about $20 a ton in gold and silver. It was bought in the summer of 1896 by the Red Shirt Mining Company, which erected a twenty-stamp mill and began reducing the 1,700 tons of ore on the dump. It crushes sixty tons a day and concentrates 33 into 1. The company has also begun a cross-cut 160 feet below the upper tunnel and has run it 400 feet, expecting to tap the ledge in another 200 feet.

There are several promising prospects on the same and parallel ledges. On the Brooklyn, the extension of the Red Shirt, Mr. Burns has sunk a small shaft on the ledge. Frank Benson has sunk fifty feet on the two Pride of the Hill claims, on a parallel ledge, showing four feet of quartz assaying $30 gold. On the Capital, Love Hedge has sunk twenty feet, showing a five-foot ledge.

The next discovery near the Red Shirt was made in 1890 by Mrs. M. Leiser and is now owned by J. S. Crockett, who has extended the forty-foot tunnel run by the former owners and shown up a ledge of quartz and crystallized lime carrying a good value in gold and silver. Then followed the discovery of the Black Warrior, also owned by Mr. Crockett, where a small shaft shows eight feet of pyritic ore between walls of diorite. Several adjoining claims have good surface showings, but the extent and value of the ledges is not apparent for lack of development. Among these are the Mike Maloney, by W. H. Lilley and O. S. Booth; the Silver Bow, by James McCann and Sims Connelly; the Brother Jack, on an iron cap assaying $20 gold on the surface, and the Panic on a parallel ledge, both owned by Charles Klemme and J. J. Snyder.

Five miles northwest of the Red Shirt, at the head of Bear Creek and Pipestone Canyon, near Winthrop, is the Safe Deposit group of four claims, owned by the Safe Deposit Mining and Milling Company. The ledge runs north and south and, as the property is due north of the Red Shirt, is believed to be an extension of that ledge. The gangue is quartz and the mineral is copper pyrites carrying gold and silver, between walls of porphyry and granite. Assays range from $7 to $14 and the ore will concentrate 30 into 1. A twenty-foot shaft is down on one claim and on another is one of sixty feet, which is being continued with a double shift, each showing the ledge to range from three to thirteen feet and the ore to increase in value with depth. When the course and pitch has been defined, a cross-cut will be run 200 feet to tap the ledge at a depth of 240 feet. The company is negotiating with the Red Shirt Company to concentrate fifty tons of ore a day at its mill, a wagon road within half a mile of the property making transportation easy.

It was not till 1892 that discoveries extended southeastward to Squaw Creek, where J. W. Draa and Nels Johnson made the first discoveries, but so broad a belt of mineral was soon revealed in that vicinity that it became the center of interest and has since remained so, except for a lull during the year 1895. The principal ledges were first found cropping on Johnson Mountain, on the left bank of Squaw Creek, but they have now been traced across the Methow almost to its mouth and over the mountains to Gold and McFarlane Creeks in one direction and to Black Canyon in the other. The three main ledges are those already described as forming the letter N, but they are paralleled by a number of others and intersected by several cross ledges, showing the whole country to be veined with mineral-bearing rock.

The greatest depth so far attained in this part of the district is on the Highland Light, owned by the Highland Light Gold Mining Company. This is on one of the main ledges cropping near the summit of Johnson Mountain and has been developed by a shaft 140 feet deep, which cuts through an ore chute dipping towards it from the west and remained in it for the first fifty feet. A drift was run twenty feet at the twenty-five foot level and the ore above stoped out. Another drift was run forty-five feet at the fifty-foot level and from it some stoping has been done on an ore chute cropping east of the shaft, which ran $92 for all values. A drift was run fifteen feet to the east at the 100-foot level, showing thirty inches of similar ore. At the bottom of the shaft drifts were run sixty feet to the west and forty feet to the east. The west drift cut the ore chute through which the shaft was sunk and defined it as three feet wide and carrying ore worth about $45. There are 400 tons of ore of all grades on the dump, which is being reserved for local treatment, either in the existing five-stamp mill on Squaw Creek or by some other approved process. While much of the ore is rich enough to pay for shipment to the smelter, it is essentially concentrating ore and can be more economically reduced on the ground.

The property showing the next largest amount of development, although work has been suspended during the winter, is the Friday group of five claims, on the left bank of the Methow, owned by the Friday Gold Mining Company. At a point on the mountain side 225 feet above the river a tunnel 110 feet long taps the ledge, with drifts sixty-five feet to the east and forty-three feet to the west, the former showing the width to be ten feet, the latter twenty-two feet between walls. The ore is better where the ledge is narrower. The main station is at the inner end of the tunnel and from it a double compartment shaft has been sunk eighty-four feet. The ledge has been cross-cut at the bottom of this shaft and is twelve feet wide, and drifts extend fifty-eight feet to the east, forty-three feet to the west, the west drift showing fourteen feet of well-mineralized quartz, with lenses of high-grade sulphuret ore. Ten tons of this ore shipped to the Everett smelter recently yielded $70 a ton. Above the main station are two stopes, each 34x18 feet, exposing ten feet of solid ore of varying quality, a shaft extending from them to the open air. The ore is mainly iron pyrites, chalcopyrite and mispickel, with rare bits of zinc blende. In all, sixty-two and one-half

tons of ore have been shipped, returning an average of about $80, and assays of $97 have been obtained frequently, $140 repeatedly and $406 occasionally. The ore is essentially a gold ore, carrying from a trace to six ounces of silver and as high as 2 per cent. copper. There is a large quantity of ore on the dump, which is to be reduced by a stamp mill and concentrator to be erected this season. The ledge is tapped by a seventy-five foot tunnel on another claim and a drift has been run thirty feet to the west, showing good ore. On a third claim a ninety-foot shaft shows good prospects.

On the Friday ledge on the west is the Diamond Queen group of two claims on a bluff overlooking the river, owned by the Diamond Queen Gold Mining Company. Two tunnels have been driven on the ledge, one sixty feet showing it six feet wide and the other fifty feet at a point 300 feet lower, which will in twenty-five feet more cut an ore chute cropping on the surface. The ledge is well defined for 1,400 feet on the surface. An assay from croppings of the ore chute returned gold $10.80, silver 61 cents, and assays from the upper tunnel ran $3.65 to $32.70 gold.

Beyond this group and on the same side of the river is the Emerald group of three claims, owned by the Emerald Mining and Milling Company. The ledge crops five and one-half feet wide between granite walls and has been traced for 3,000 feet. A sixty-foot tunnel, attaining a depth of sixty feet, shows it to widen to nine and one-half feet, with a thirty-inch pay streak. The surface ore assayed $25 gold, silver and copper, while samples taken from the face of the tunnel at fifty-three feet assayed $122 and $157, the ledge matter outside of the pay streak being mineralized to the value of about $10. A contract has been let for a 200-foot tunnel, 300 feet below the upper tunnel, to be used as a working tunnel, and is being continued day and night.

Another property which has shown up well for a large amount of development is the Hidden Treasure, adjoining the Highland Light, owned by the Hidden Treasure Gold Mining Company. An upper tunnel has been run 200 feet, gaining 120 feet in depth, and has cut ore chutes sixty-five, thirty-five and twenty-five feet long respectively, being now in the fourth, which shows thirteen inches of ore. A second tunnel fifty feet below has been driven 115 feet through good concentrating ore and is now in the main ore chute, carrying twenty-six inches of high-grade ore. One shipment of seven tons of $70 ore was made last season and there are 100 tons of $30 ore on the dump. The company has built a wooden tramway down the mountain from the mine to the road, down which ore will be transported by gravity.

Another well-developed property is the Okanogan, one of the pioneer locations on Johnson Mountain, owned by the Okanogan Mining Company. A prospecting tunnel was first driven fifty feet on the ledge and a new tunnel was then started forty feet below. This is now in 165 feet, showing six feet nine inches between the walls, with twenty-six inches of copper sulphides at the 114-foot mark. A winze is being sunk from the face of this tunnel and is now down fifty feet, giving 130 feet of depth below the surface. The winze is now running through an ore chute three feet wide, assays of which run from $20 to $28 gold, and assays generally have ranged from $10 to $97.

The Hunter, the first location on Johnson Mountain, has also shown well under development, and has been bonded with two other claims for $10,000 to F. S. Mack, of New York. A tunnel has been run 200 feet on the ledge, gaining a depth of sixty feet and showing nine feet four inches of quartz carrying copper sulphides between perfect walls. The value averages from $16 to $20 gold and 8 to 12 per cent. copper.

The Methow Mining Company has the Washington group of seven claims, all but one of which are adjoining. Three of these are on the Hunter ledge, which is shown to be six to six and one-half feet wide in an open cut fifteen feet long and ten feet deep on one claim; four and one-half feet wide in a twelve-foot shaft on another, showing oxidized and decomposed quartz, and from four to four and one-half feet in the third, where it is well mineralized with copper sulphides on the surface and where two stringers run into it. Another claim is on a stringer three to eighteen inches wide, carrying high-grade ore with free gold often showing, and yet another has a ledge seven to ten feet wide cropping the entire length, though quite undeveloped. The last claim of the group is the Bill Nye, and, although three miles west of the others, is probably on an extension of one of the main ledges, showing five feet of similar quartz, partially decomposed, in a fifteen-foot shaft.

The Gray Eagle group of three claims, owned by Fischer Brothers, of Seattle, has made a good showing, being on the Friday ledge. A shaft has been sunk 140 feet, with a drift at the fifty-foot level driven 100 feet west and ten feet east, with a stope twenty-seven feet high on the west drift. At the 100-foot level there is a drift seventy-three feet to the west with an upraise of eighty-nine feet. All this work shows a vein from four to eight feet, with a diorite dike shoving it first to one wall, then to the other. Several car-load shipments of high-grade ore have been made and about 200 tons are on the dump.

Adjoining the Gray Eagle group is the Last Chance, owned by J. R. Esmond and Edward L. Ensel, on a well-defined ledge three and one-half feet wide with talc gouge on the walls, which are diorite and bird's-eye porphyry. A tunnel was run forty-five feet on the ledge by the former

owners, who stoped out the ore above and shipped three car loads to the Everett smelter, netting $39 gold and a little silver. A shaft was sunk fifteen feet from the tunnel, showing sixteen inches of ore all the way, which assayed $31 gold and a little silver.

The Hunter ledge also shows up well on the Sailor Boy, on which Nels Johnson and Alexander McKinnon have sunk sixteen and twenty-foot shafts along the footwall, showing four feet of good oxidized ore; on the Lookout, where John Summers and Thomas McLaughlin have sunk sixty feet; the California, where Andrew O'Malley, Richard Malone and William O'Neil have run a twenty-foot cross-cut; the Mills, where A. L. Johnson, S. P. Richardson and William Goggins sank inclines fifty feet and eighteen feet, showing the ledge to be at least six feet wide, and making a shipment, which returned $37; on the Crown Point, owned by A. McKinnon; on the Badger and its extension, where Lloyd Pershall and others have run a fifty-foot tunnel and sunk twenty feet. The ledge was then traced across the river and Messrs. Johnson and Draa located the Josephine group of three claims in that direction..

The Standard and an extension, both on the Highland Light ledge, owned by the Standard Gold Mining and Milling Company, have the ledge shown four to four and one-half feet wide where it has been stripped for twenty to thirty feet. There is ten to fourteen inches of ore, average samples of which assayed $38.60 gold and a little silver. Judging from adjoining properties, there is probably 5 per cent. copper. The company will tunnel on the ledge and by driving for 1,000 feet will gain 700 feet in depth.

Among the other properties on the Highland Light ledge, which forms the cross stroke of the letter N described by the three main ledges of Johnson Mountain, are the Columbia, owned by the Cable Mining Company, where it crops fourteen feet wide and carries some free gold on the surface; the Big Fraction, owned by John and Frank Welsh and others. The Gray Eagle ledge is the southern parallel stroke of the N and has been traced onward across the river through the Diamond Queen and Friday groups.

On extensions are the California Boy and Decoration, by C. L. Martin; the Humboldt, by Daniel Murray; the Ida May, by Daniel Murray and Harry Hayward, and the Cripple Creek. To the west the same ledge was extended by the location of the Mountain Lily group of five claims, owned by T. W. Robinson and J. R. Esmond. On this group a shaft is down ninety-five feet, with a fourteen-foot drift at the bottom, cross-cuts have been run fifty and thirty feet, defining the ledge to be four feet ten inches to seven feet wide, and an eighteen-foot shaft has been sunk.

On a parallel ledge to the north are the Parallel group of two claims, owned by C. R. Martin, Thomas Warren and A. F. Burleigh; the Reno fraction, by C. R. Martin; the Monday, by Charles Durr and Chris Stilrecht, and the Tuesday group of three claims, owned by the Tuesday Gold Mining Company. This ledge has so far been merely prospected, the most work being on the Tuesday group, and has been defined to a width ranging from two to seven feet. The Tuesday Company has sunk sixteen feet on the footwall, with ore the full width and no hanging wall in sight, and has defined the ledge by a ten-foot shaft in another place. Assays range from $58 gold upwards. Beyond these is the Riverside group of three claims, near the wagon road, owned by the Riverside Gold Mining Company, where the ledge shows four feet wide in a fourteen-foot shaft, with sixteen inches of pay ore, while the whole ledge assays $13 gold and silver.

Parallel with the Friday ledge the Ben Lummon Gold Mining and Milling Company has a claim on a four-foot ledge, and on the opposite side of the river, below the Gray Eagle, has two other claims on twin ledges, each six feet wide, with five and one-half feet of black slate between them and with porphyry walls. The ore is similar to the Gray Eagle and assays $15 to $18 gold on the surface. These three compose the Ben Lummon group.

Among other properties on parallel ledges showing well on development is the Ocean Wave, owned by Jacob Durr's heirs, L. W. Barton and Lee Bowen, where a seventy-foot shaft shows a six-foot ledge, on which another shaft is down twenty feet and several open cuts have been made. On the Chicago Andrew O'Malley and William O'Neil have stripped an eighteen-inch ledge for 300 feet and sunk eighteen feet, showing ore which averages about $100, three tons having returned $57.49 over freight and treatment. One of the famous pioneer claims is the Paymaster, adjoining Methow town, on which Claude and Burrell Johnson ran tunnels 235 and 65 feet and sank a shaft 105 feet, showing forty inches of ore which assayed $23 to $60. On this ledge J. M. Scheuyeaulle has the St. Patrick, in which thirty feet of work has shown three feet of ore assaying as high as $187 gold. On the Yes or No Melton Woods and P. H. Farley have shown three feet of ore in a fifteen-foot shaft. On the north side of Johnson Mountain Nels Johnson has sunk a ninety-foot shaft on the London, showing a ten-foot ledge, and J. R. Esmond has sunk a shaft on a parallel ledge six feet wide running high in copper sulphides.

The Just in Time group of two claims on Johnson Mountain is owned by the Just Gold Mining Company and has a tunnel 108 feet, showing up the ledge from five to six feet without the footwall, the ore assaying $24.40 gold. Another tunnel fifty feet higher taps a parallel ledge three to four feet.

The company is drifting west on the lower tunnel to locate an ore chute which appears to be about forty feet west, then will tunnel further down the mountain and cut the ore chutes to a depth of 400 feet.

On Elue Rose Mountain, directly across the river from the Friday, the Squaw Creek Mining Company has eight claims, commonly called the Schulz and Chesney group, after their locators. They are on a series of parallel ledges ranging from four to six feet wide, shown in a number of small shafts and open cuts, and carrying pay streaks of galena, gray copper and azurite, assaying 40 ounces and upwards in silver. A forty-foot tunnel has shown up ore carrying $60 to $70 gold, and development is now in progress on a ledge which has widened to twenty feet and carries lenticular bodies and pockets of copper pyrites and gray copper, often of high grade, besides large bodies of concentrating ore.

On the same series of ledges A. J. Dexter has the Blue Rose; R. S. Ells the Montana; William Noble and J. M. Sparkman the Overlook; Fred Simmons and George Gates the Idaho; E. A. Sartor the Lizzie; Fred Simmons and R. S. Ells the Ninety-five; Fred Simmons the Lone Star; Fred Simmons and Michael Long the Major and Summit; Rev. Mr. Thomas the Annie.

On Treasure Mountain is the Nip and Tuck group of four claims, owned by the Treasure Mountain Mining Company, of Seattle. A tunnel forty feet and another eighty-five feet at a point fifty-five feet below are on the middle one of three veins into which the ledge has split, and showed from three to twenty-five inches of ore, thirty tons of which reduced at the Squaw Creek mill was worth $16 gold. It is intended to cross-cut for the other two veins into which the ledge has split. Lee Ives and others have the Excelsior on the same ledge and have sunk twelve feet, showing it to be twelve feet between walls, with a number of stringers, the pay ore assaying $23.50 gold, $6 silver.

On Gold Point Hill, two miles west of Methow, Alexander McNeil and M. M. Kingman have the Larsen group of four claims on two ledges. One of these shows forty inches wide in a double compartment shaft forty-five feet deep, ore from which assayed $22 to $78. On the other ledge a fifteen-foot shaft shows sixteen to twenty-four inches of ore assaying $25 to $60. On the two White Elephant claims M. M. Kingman and R. N. Pershall have run a 100-foot tunnel on a five-foot ledge. Mr. McNeil has also the Chippewa group of three claims, two on a four-foot ledge on which he has sunk ten feet and the third on one five feet wide, shown by a similar shaft. The two Sacramento claims of C. J. Ogden and W. A. Bollinger are on a three and one-half foot ledge, showing in a twenty-foot shaft.

The most recent developments are on McFarlane and Gold Creeks, to the west of Squaw Creek, and good ore bodies are being shown up. On the Black Jack S. G. Dewsnap has run a tunnel 150 feet and has cross-cut from footwall to hanging wall, showing four feet of quartz well mineralized with gold, silver and copper for its whole width. The Damfino has a sixty-foot tunnel showing fort yinches of similar ore. On the Parallel a forty-foot tunnel showing forty inches of similar ore. The Catherine, on McFarlane Creek, makes a good showing on an eight-foot ledge. The Osiola, on the Gold Creek Divide, shows up six feet of copper and gold ore. On the Oregon group, on the south fork of Gold Creek, an incline shaft is down fifty feet, showing five feet of arsenical iron ore, which carries $10 to $40 gold. On the north fork of Gold Creek a number of discoveries have been made and development is being carried on with very encouraging results. On the North Star a ninety-foot shaft shows the pay streak to widen from two inches to four feet, surface ore assaying $20 gold, 234 ounces silver.

That the same mineral belt extends through the Methow foothills far up the river is shown by the discoveries in the Spokane mine at the mouth of the Twisp, owned by Morgan, Nichols & Co., of Minneapolis, who are actively developing it. The ledge is between four and five feet, between walls of porphyry, and runs northwest and southeast nearly perpendicular, with a slight pitch to the west. Prospecting was begun with a shaft sunk forty feet, showing ore all the way and a widening ledge. A tunnel was then run above the top of the shaft, which was covered up, and is now in eighty feet. A drift is being run 108 feet lower and will be used as a working tunnel, from which an upraise will be made for a shaft. The work so far has shown twenty-four to thirty inches of solid mineral on the footwall, sometimes crossing to the hanging wall. The pay streak carries about $50 gold and silver and the whole ledge carries good value. It is proposed to erect a matting plant on the ground this season.

Development in the Methow District would probably have proceeded much faster but for the ill-effects of some early experiments in the treatment of the ore. Some slight showings of free gold on the surface led the prospectors to the erroneous conclusion that it was a free gold belt and they proceeded on that assumption. A five-stamp mill with one concentrator was erected on Squaw Creek and two arrastres were built. Twelve tons of Paymaster ore run through the stamp mill barely paid expenses, and forty-five tons milled at Charles Austinburg's arrastre sent down tailings which assayed $45, assays of the ore having ranged from $23 to $60. The arrastres are now abandoned and the stamp mill has been bought by J. A. James, of Seattle, who contemplates some improvements with a view to doing a customs business. Experiments are, however, being made with

a view to the adoption of the cyanide or some other leeching process, and some such method will be adopted where the percentage of copper does not run too high. The country rock of the district is ordinarily so hard that tunneling costs $10 to $12 per foot and shafting by contract costs $16 per foot down to the 150-foot level. While the ore is rich enough to pay a good profit over cost of mining, freight and treatment, much better results can be obtained by the erection of a reduction plant on the ground, and the question as to the best process now occupies the minds of mining men. The small proportion of free gold is in extremely minute particles, rendering amalgamation not worth while, except in connection with concentrators, and the values are mainly in sulphurets. The percentage of copper ranges from 2 to 13 per cent., and where it does not exceed the former figure and the action of the solution is not hampered by other ingredients, the cyanide process may be successful. However, experiment will settle this question, and, now that the mining men have become aroused to the fact that the problem is not to find the gold-bearing rock, but to extract the gold after they have found it, ultimate success is assured.

THE TWISP.

While the first mineral discoveries on the headwaters of the Twisp River were made as long ago as 1884, general prospecting has only set in within the last two years, and the last flock of prospectors has defined the character of the country's mineral. Development began in earnest last year and will be continued with vigor during the coming summer, a large number of Spokane citizens having taken interests there.

The country formation is granite, as in other sections of the Cascades, and is broken by numerous dikes of porphyry. The ledges have assumed a reddish hue from oxidation, which makes them easily traceable, and carry free gold on the surface in most instances, though the change to sulphurets is already becoming apparent in the limited amount of development so far done. Towards the headwaters of the Twisp and on the Twisp Pass the ore is sulphide, rich in copper, and having the same characteristics as the older and more developed sulphide ore belts.

There are two routes to this district from Seattle. One is by the Great Northern Railroad to Wenatchee, 174 miles; by the steamer City of Ellensburg on the Columbia River to Ives, seventy-five miles; on horseback over a wagon road up the left bank of the Methow to Twisp, thirty-three miles; on horseback over the state trail to Gilbert's Camp on North Creek, twenty-four miles, and onward to the Twisp Pass, six miles further. The legislature has appropriated funds for the widening of the trail up the Twisp into a wagon road this season, a change which will greatly aid development.

The first discoveries were made in 1884 by E. W. Lockwood, of Wenatchee, Ed Shackleford and H. M. Cooper, who located what is now the Washington, but despairing of success on account of the remoteness of the district, abandoned it. They then went to the lake forming the source of North Creek and made a discovery there, but made no location.

John Gillihan was the next prospector to penetrate the district and in 1892 he located the Oregonian group of eight claims, in company with F. S. Sanford and James Gaston. This group is at the head of North Creek, near the glaciers which feed that stream, the walls being usually of porphyry. One ledge crops two to four feet wide for 800 feet. A twenty-foot shaft shows another four feet wide, traceable for 1,500 feet and carrying ore which assays $60 to $600 gold. Another has been traced for the same distance to a width of twelve feet and in an eighteen-foot tunnel shows ore assaying $11 to $114 gold. On another, which is held under two claims, a shaft twenty-five feet deep has shown three feet of ore carrying $15 gold. Another has been traced the whole length of two claims and is six feet wide, a ten-foot shaft and twenty-foot tunnel showing ore which assays $16 to $43. An assay from an average sample of the whole group showed $27.50 gold.

The next location was the Derby, by P. B. Shonafelt and R. P. Dolsen, who have bonded it for $10,000 to Frank Rosenhaupt, of Spokane. The ledge crops near the Oregonian twelve feet wide and in a sixty-foot shaft and forty-foot tunnel shows quartz carrying $8 to $10 gold throughout, with a pay streak of eight to twenty-two inches on the hanging wall carrying $100 gold and upwards.

In the summer of 1895 discoveries extended from North and South Creeks up the Twisp to the summit of the pass, and in 1896 development was inaugurated. On Gilbert Mountain were found eight parallel ledges, on which about thirty locations have been made, while the same belt has been traced across North Creek to Clark's Mountain. On Goat Park Mountain are two great main ledges with many cross ledges.

On Gilbert Mountain the pioneer claim is the Mountain Goat, owned by P. Gilbert, A. Raub, Nelson Clark, Henry Plummer, George Witte and Frank Thompson. It has two ledges five and three and one-half feet wide,

one of them with a cropping so strong that it was visible a mile distant, standing twelve feet high in a perpendicular cliff, and a fifteen-foot tunnel has shown three feet of free milling ore similar to that of the Derby. Four surface assays showed from $95 to $387 gold.

On the same belt is the Big Eight group, owned by the Big Eight Mining and Milling Company, on which the two main Mountain Goat ledges run through three claims from base to summit of the mountain and eight parallel ledges run through the whole group. A fifty-foot tunnel on one of the Mountain Goat ledges shows it well mineralized throughout, with surface ore assaying from $27 to $280. The surface ore shows free gold, but the sulphurets increase with depth. A contract will be let this spring for an extension of the tunnel.

On this belt the Washington, owned by Nelson Clark and R. J. Danson, has a five-foot ledge, which a twenty-foot tunnel shows to be fairly well mineralized. The Portland group of seven claims, owned by the Consolidated Twisp Mining and Milling Company, has three claims on a six-foot ledge shown by a fifty-foot tunnel, and two on cross ledges. The ore carries $13 free gold throughout, though two assays made of the drillings from the tunnel ran $1,500 and $1,900. On another ledge a ten-foot tunnel shows six feet of well-mineralized quartz. The Mobile, on the Mountain Goat ledge, is held by P. B. Shonafelt and R. P. Dolsen and has a twenty-foot cut showing a good pay streak.

The three great ledges on Goat Park Mountain crop out between walls of granite and gneiss on the side of a deep gulch on the north slope, and have been traced down the face of the mountain and up over its summit for a total distance of 12,000 feet. On the surface they show red oxidized quartz carrying free gold, but at two to ten feet below the surface the ore runs into copper and iron sulphides. Surface ore assays from $5 to $88 gold, besides good copper values.

The Orient Gold Mining and Milling Company has the Orient group of four claims on two of these ledges, which crop 250 feet apart, one thirty-three and the other twenty feet wide. A surface cross-cut twenty feet long showed ten feet of ore in one of these, carrying free gold and sulphides, a mill test giving $15 gold. A cross ledge seven feet wide, carrying copper sulphides, has been shown by a fifteen-foot cut, and a cut on the other ledge defines its width as twenty feet.

On the same series of ledges the Ben Lummon Gold Mining and Milling Company has six claims, on which it will begin development this spring. One claim has three ledges six to twelve feet wide of gold and copper; two others are on a ledge carrying gold and silver, and thoroughly mineralized, which an open cross-cut defines to a width of seven feet; the fourth is on a nine-foot ledge of similar ore; a fifth as a sixteen-foot ledge carrying gold, silver and copper, which on an adjoining claim carries ore assaying high in gold and silver; the sixth claim is on a seven-foot ledge carrying from $4.50 to $37 gold and a small percentage of copper.

On Bear Creek, at the foot of this mountain, E. W. Lockwood, O. D. Johnson and F. M. Scheble have the Cumberland on a sixteen-foot ledge of copper sulphide ore. J. H. Shepard has the Crown Prince group of four claims on a four-foot ledge, and George and Edward Witte, Henry Ramm and C. F. Wilke have the Marshal Ney on a four-foot ledge showing free gold with black sulphurets and iron and copper sulphides.

On the Lone Star and Cathedral, on Clark's Mountain, J. H. Shepard and R. A. Lee have a ledge four to six feet wide, and on the Chamber of Commerce and Jennie Lee they have one of about the same size, while in the Daisy they have a good showing of gray copper. On the White Bear F. P. Young, Bert Young and W. C. Campbell have a two-foot ledge of brown and white quartz showing sulphides, with a two-inch streak of what appears to be crystallized lead. On the Chamber of Commerce ledge Elmer Abernethy has located the Broadway, while Nelson Clark and B. R. Stafford have a ledge six to eight feet on the Latah, and Mr. Clark and his son Frank have the Everett on a small lead which shows good mineral. Elmer Abernethy has the Lulu on a four and one-half foot ledge carrying a foot of solid ore, which can be traced several hundred feet; has the Green Eye with two ledges, one of which is the same as the Lulu, and the Flossie, with a three-foot ledge. He and D. M. Henderson have the Summit and Princess on an iron cap of great width covering three and one-half feet of pyritic ore. On the west end of the mountain the Yellow Jacket is owned by John and Samuel Dimick, E. L. Tozier, A. L. Tozier and E. R. Gilbert.

On the summit of the Twisp Pass the Three Links Gold Mining Company has three claims on a twenty-foot ledge cropping for 3,000 feet between walls of porphyry and granite. It shows sulphide ore for its whole width, assaying on the surface $4 to $12 gold, 2½ ounces silver, 4 per cent. copper.

Adjoining this group is the Gold Bar group of five and one-half claims, owned by the Gold Bar Mining Company, on several ledges of sulphide ore cropping about twenty feet wide down the mountain side. A sixty-foot tunnel on the hanging wall of one ledge is in ore the whole length, and an eight-foot cross-cut did not strike the footwall. Assays run all the way from a trace to $600 gold, with some copper, the average value being about

$40. A fifty-foot shaft on another ledge shows four feet of similar ore, carrying from $40 to $60 gold.

On the same series of ledges the Golden Triangle Mining Company has nine claims, which it will develop this season. The ledges are of great size and carry fine-grained white iron sulphides, showing free gold on the surface.

The Twisp River Mining and Milling Company has the Hattie group of three claims on Elmer Mountain near the Derby, on three ledges of free milling ore carrying gold and a little silver, which were discovered late in 1896. One ledge crops twelve feet wide and has been traced across the mountain, while the others are of less width. Several assays have ranged close to $100.

SALMON RIVER.

This district was once the center of mining excitement in Washington and is likely to be so again, for the presence of large mineral deposits has been so conclusively proved that its eclipse can be but temporary. Its chief drawback is its remoteness from means of steam transportation, but the development of other districts to the north, south and west is likely to bring this ever nearer.

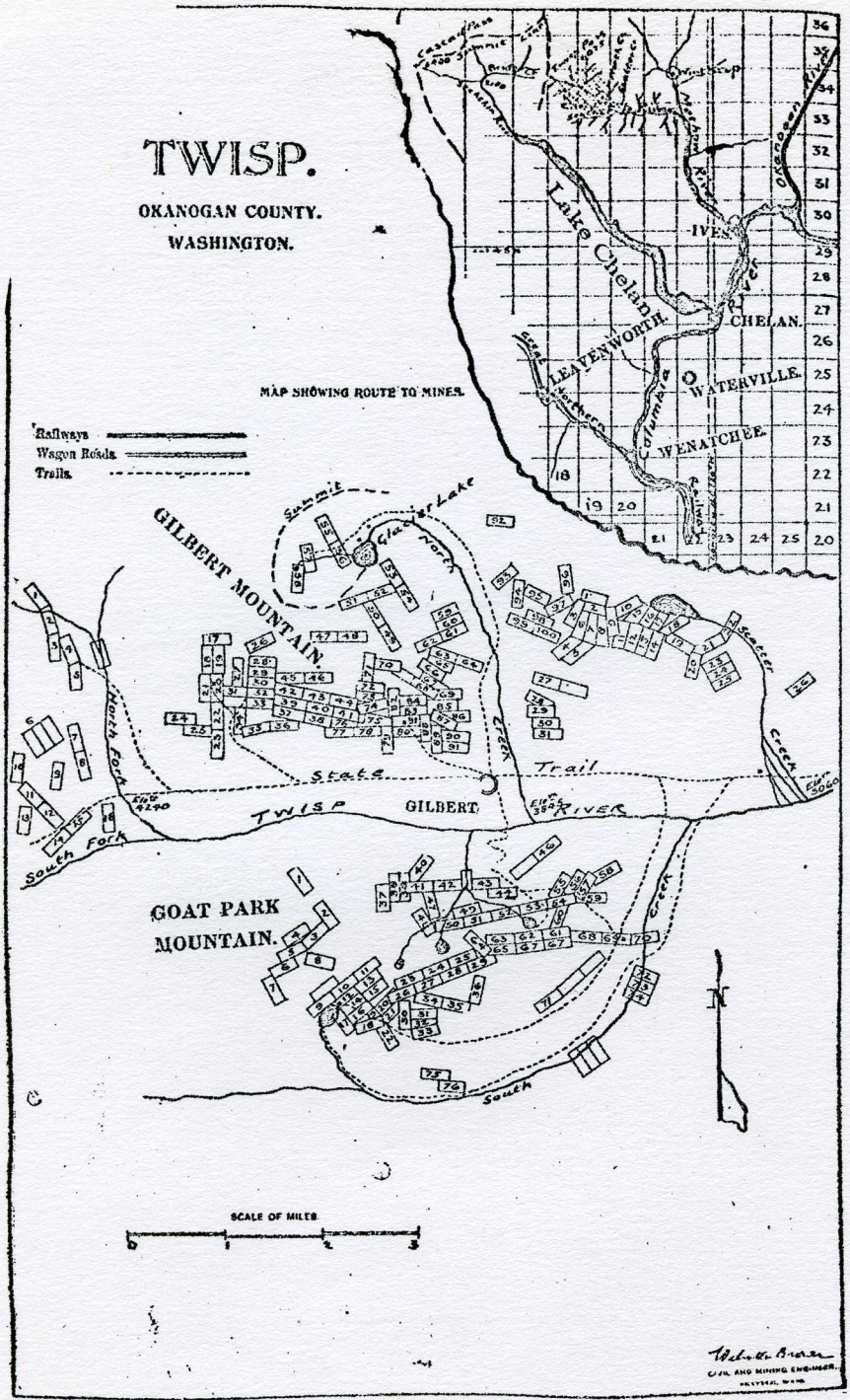
The route from Seattle is by the Great Northern Railroad to Wenatchee, 174 miles; thence by steamer City of Ellensburg up the Columbia and Okanogan Rivers to Brewster, eighty-five miles, and stage to Ruby, forty miles, Conconully, forty-six miles; at high water, steamers to Johnson's Landing, 130 miles; thence by stage to Ruby, sixteen miles, and to Conconully, six miles further.

The first mineral discoveries of this district were made after the opening of the Moses Reservation, in the fall of 1886, in Ruby Hill, a steep mountain rising to a height of 3,800 feet above the town. In a country rock of granite and gneiss were found ledges of quartz, carrying silver in almost all its forms, with a small quantity of gold, the croppings being stained with iron and copper. The ledges run a little west of north and east of south, and pitch about 22½ degrees east, and are on the summit of the hill, ranging in width from six feet upward. The ore is principally sulphurets, carrying from 10 to 100 ounces of silver, with rich pockets of native, wire and ruby silver running much higher, and an average of about $3 gold. The first discovery was made by Jack Clonan, Billy Milligan, Tom Donan and Thomas Fuller, who struck a ledge about eighteen feet wide, which ran uniformly from wall to wall about $14 gold and silver. They located the Ruby on it, and this proved to be the lowest grade mine on the hill, for Dick Bilderback and his father, Pat McGreel and Will Chilson, located the First Thought on a parallel ledge further east, which was thirty to forty feet wide on the surface and which ran about $28 gold and silver for its whole width. The discovery of the Fourth of July, showing the richest ledge on the hill, and the Arlington, both by the same party, came next. The discovery of the Peacock by John Pecar and the Lenora by James Robinson and James Gilmore, on Peacock Hill, to the northeast of Ruby Hill, then diverted attention.

About the same time the mineral belt was found to extend northward beyond Conconully to Mineral Hill, which is an extension of the same ridge, shutting in the Salmon River Canyon on the west, and is about two miles northwest of Conconully Equally valuable discoveries were made on the opposite side of the canyon and through the lime belt, which runs north of Johnson Creek and east of Toat's Coulee up to Wagon Road Coulee, east of Loomiston. The ore in the lime belt is all high grade, carrying black sulphurets of silver and showing copper stains.

After sinking a fifty-foot shaft and running a 100-foot tunnel, both on the ledge, and discovering a small stringer running into the main ledge, with a rich pocket at the junction, from which $1,000 was taken, the discoverers of the Ruby sold it to Jonathan Bourne, Jr., of Portland. This was the beginning of a heavy investment by a large company of Portland people, headed by Mr. Bourne and by others who followed his lead. The First Thought showed $28 ore in an eighty-foot shaft, and was sold to Mr. Bourne and his associates for $40,000 cash. On the Arlington the locators sank a forty-foot shaft, showing a six-foot vein, which ran about $40 gold and silver, and in 1888 sold for $45,000 cash to the Arlington Mining Company, of which Mr. Bourne was president. Mr. Bourne incorporated the Ruby and First Thought, each separately, organized the Washington Reduction Company to put in a concentrating plant to treat the ores, and acquired other claims, so that he and the corporations which he controls now own twenty-seven contiguous claims on Ruby hill.

The Arlington Mining Company did about 800 feet of development in the shape of shafts, drifts and tunnels, reaching a depth of 225 feet, at which the ledge was the same in size and character as on the surface. The company then started the erection of a leeching plant, but, after expending about $130,000 on this and other work, discovered that no water could be



MINING IN THE PACIFIC NORTHWEST

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5. Chief Moses.
6. Three Links.
7. I. X. L.
8. Anita May.
9. Surprise.
11. Anaconda.
12. Sarah.
13. Lucky Jack.
14. Chelan.
15. Copper King.
16. Gold Bug.
17. Tiptop.
18. Granite No. 2.
19. Chief.
20. Iron Horse.
21. Granite No. 1.
22. Accident.
23. Vincent.
24. Black Bull.
25. Last Chance.
26. Snowflake.
27. Climber.
28. Daisy.
29. Ivy.
30. Theresa.
31. Iron Goat.
32. Mountain Goat.
33. War Eagle.
34. Thursday.
35. Washington.
36. Franklin.
37. Quartette.
38. Rockford.
39. Mobile.
40. Pioneer.
41. Copper King.
42. Alabama Coon.
43. Royal Ann.
44. First Glance
45. Walter B.
46. James Earl.
47. Oregonian.
48. Fay D.
49. E. X. L.
50. Derby.
51. E. X. L.
52. Alpine.
53. Equinox.
54. Snowstorm.
55. E. X.
56. Lady of the L.
57. Spokane.
58. St. Laurence.
59. Roller Mill.
60. C. & C.
61. Bertha.
62. 4th July.
63. McKinley.
64. Yellow Rose.
65. Bryan.
66. Snow Slide.
68. Cap. Joe.
69. Sitting Bull.
70. St. Anthony.
71. Ben. B.
72. White Lily.
73. Admiral.
74. J. B.
75. M. J.
76. Hoosier.
77. St. Paul.
78. Minneapolis.
79. Franklin.
80. Dick.
81. Portland.
82. Trilby.
83. Norfolk.
84. Highland Chief.
85. Beatrice.
86. Allen J.
87. Bloomer.
88. Jack B.
89. Twisp Chief.
90. Oro.
91. M. & M.

East of North Creek.

92. Liza.
93. Josephine.
94. The Fountain.
95. Flossie.
96. Elmer.
97. Green Eye.
98. City of Salem.
99. Yellow Hornet.
100. Yellow Jack.
101. Robert.
102. Little Fellow.
103. Lulu.
104. Golden Gate.
106. Buckeye.
107. Gilbert.
108. McCord.
109. Summit.
110. Prince.
111. Mary.
112. Hattie.
113. Greenhorn.
114. Falcon.
115. Bryan.
116. Bright Eye.
117. Tenderfoot.
118. Vulcan.
119. Constitution.
120. Continental.
121. Constitution.
122. Ethel.
124. Dan Logan.
125. E. D. Baker.
126. Shamrock.
127. Myrtle.
128. Granite.
129. Delane.
130. Referendum.

South of Twist River.

1. Ben. Franklin.
2. Ivanhoe.
3. Mayflower.
4. Q. D. Q.
5. Jennie.
6. Porcupine.
7. Cultus Jim.
8. Bandana.
9. Big Boy.
10. Mountain Lily.
11. Greenhorn.
12. Gold Bar.
13. No. 6.
14. Gold Brick.
15. Jessie.
16. Eva.
17. June.
18. Gladstone.
19. Golden Triangle.
20. Highland Scot.
21. Skylark.
22. Uncle Sam.
23. Kangaroo.
24. Union.
25. Nellie.
26. Cumtux.
27. Crown Prince.
28. Crown King.
29. Cornucopia.
30. Ella.
31. O. K.
32. St. Paul No. 2.
33. St. Paul Globe.
34. Burlington.
35. Waverly.
36. Bonanza.
37. Dewdrop.
38. Helena.
39. Irene.
40. Boston.
41. Good Enough.
42. Lucky Boy.
43. Daisy.
44. Bluebill.
46. Lost Boy.
47. Estella.
48. Bluebird.
49. Bull's Eye.
50. Cascade.
51. White Rose.
52. Columbia.
53. Bula.
54. Garfield.
55. Mingo Chief.
56. Peachblow.
57. Exchange.
58. Michigan.
59. Alpine.
60. F. & B.
61. Orient.
62. Little Giant.
63. M. & G.
64. Ben Harrison.
65. Florence Grace.
66. North Star.
67. Windsor.
68. Comstock.
69. Ben Lummon.
70. Wicks.
72. Bridge.
75. Garnett.
76. Fink Boy.

obtained on the site selected, although there was abundance in the creek 250 feet below. Work on the plant was suspended, mining stopped and, of the several hundred tons of ore which had accumulated, the best was concentrated at the Washington Reduction Company's mill.

On the First Thought Mr. Bourne went vigorously to work. He first ran tunnel No. 3 900 feet, tapping the ledge at a depth of 400 feet, and then upraised a shaft to the surface, 234 feet. He ran another tunnel about 1,000 feet on the footwall, and made a cross-cut 112½ feet, all through ore. Another tunnel was run 800 feet on the hanging wall, which gave a depth of 200 feet. A number of drifts from the tunnel on the footwall to that on the hanging wall showed the ledge to be from thirty to sixty feet wide. It averaged from six to ten ounces silver and $3 gold, though there were rich streaks and pockets, showing native and ruby silver, which ran up to 1,000 ounces.

Meanwhile the Washington Reduction Company erected a concentrator at Ruby and built a cable bucket tramway a mile long, from the First Thought mine. It has two rock crushers, two Dodge pulverizers with screens, eight Frue vanners, canvas strakes, and an electric dynamo run by water power, the whole costing about $70,000. It ran for about three months in 1892, and, after a suspension during the winter, started again in the spring of 1893 and ran until July. As silver then fell below 70 cents, the mill was stopped after producing about $40,000 in concentrates, clear of freight and treatment charges, and has not since turned a wheel.

The Fourth of July was bought by a syndicate which incorporated, leaving out Mr. Bourne's one-eighth, as he refused to sell. The company sank about 780 feet, ran drifts for some 500 feet and stoped about 800 tons of ore. This was the richest ledge on the hill, being fifteen feet wide, with a pay streak four feet wide, from which one shipment of twenty tons paid $480 a ton gold and silver, while specimens of ore carrying native and wire silver were carried away, which would aggregate thousands of dollars in value. About 200 tons of ore were shipped and 300 tons were treated at the Ruby concentrator.

Among the first locations on Ruby Hill was the Wooloo Mooloo, by Hugh McCool and others, who found a ledge eight feet wide, carrying black sulphurets, the first two assays from which ran 3,000 and 5,000 ounces silver. They sank a shaft 160 feet on the ledge and then lost it. The War Eagle, owned by a number of St. Paul men, has an eight-foot ledge of low-grade ore on which a shaft has been sunk 150 feet. On the Idaho, George Turner, W. N. Drumheller and William Pfunder have a shaft about 150 feet deep on the same ledge.

The discovery claim on Anaconda Hill was the Anaconda, located by Thomas Higstrun, on a twenty-foot ledge of chloride ore, showing well on the surface and assaying 200 to 300 ounces. Higstrun sold it for $10,000 to John Rudberg, who resold to Hale & Smith, Xenophon Steeves and J. C. Moreland, of Portland, for $15,500, he retaining a one-eighth interest. The new owners sank a shaft thirty-five or forty feet and then lost the ledge. They ran a tunnel lower down the mountain to tap it in about 400 feet, at a point below the shaft, but did not strike it there. They have been continuing assessment work and have run on the ledge again, showing up good black sulphurets.

About the same time that the first discoveries were made on Ruby Hill a similar body of ore was found near the foot of Conconully Lake by "Texas" George Runnels and J. C. Boone, who located the Lady of the Lake on it the day the Moses reservation was opened. They bonded it to O. B. Peck for $40,000, and he made about 100 feet of drifts and cross-cuts, but forfeited the bond.

The Lone Star, on the west side of Salmon River, about a mile above Conconully, was located by Henry C. Lawrence, who interested Allen C. Mason, of Tacoma. There is a ledge of galena ore about twelve feet wide which assays about 100 ounces of silver, on which a shaft has been sunk 350 feet, and drifts have been run each way on the ledge at every 100 feet, aggregating 1,000 feet, about $40,000 being spent and a considerable quantity of ore taken out.

Directly across the river from the Lone Star is the Tough Nut, owned by H. C. Thompson, Milo Kelly and others. The ledge is about six feet wide, showing black sulphurets and galena like the Lone Star ore, and the work on it consists of a 100-foot shaft and a tunnel 150 feet, both on the ledge.

The Homestake, adjoining the Tough Nut on the south, is owned by Ben Everett, Charles Ulmann and Otis Sprague, of Tacoma. They ran a tunnel 150 feet through a twenty-foot ledge, well mineralized with silver-lead ore, and have 200 tons of ore in the bins.

Adjoining the Lone Star on the north is the John Arthur, owned by James Robinson, of Ellensburg, and Deputy Collector of Customs J. T. McDonald, of Oro. A shaft is down 125 feet on the same ledge as the Lone Star, showing the same kind of ore. The north extension on the same ledge is the St. Clair, located by Thomas Hanway and —— Dudley, who sank a 100-foot shaft near that of the John Arthur and on the same ore chute.

The greatest development in this section of the district, however, was on Mineral Hill, where the Bridgeport Milling & Mining Company bought five

claims. Double compartment shafts were sunk 125 feet on one claim and 130 feet on another, and a tunnel was run 160 feet on the hill above the latter. Shafts were also sunk on the other three. A pair of hoisting engines, boilers, air compressor, two machine drills and a sawmill were erected, the whole property representing an expenditure of $30,000 on mines and machinery. All the claims have ledges three to six feet wide of high grade silver-lead ore, of which a ten-ton shipment ran $300, $20 of this being gold and the balance silver.

The Buckhorn, adjoining this group on the west, is owned three-quarters by the Bridgeport company and one-quarter by A. C. Cowherd, and has a ledge forty to fifty feet wide on the surface.

Among the noted rich claims on Mineral Hill is the La Euna, for which T. L. Nixon, of Tacoma, paid $10,000. It has a small ledge of very rich ore, of which a five-ton shipment from a forty-foot shaft gave returns of 398 ounces per ton.

Mineral Hill also boasts of the Mohawk, for which H. C. Lawrence refused an offer of $30,000 and on which a tunnel 200 feet has shown a three-foot ledge of high grade ore, running over 300 ounces silver. On the Independence, John Stech, of Seattle, who paid $4,000 for it, has a 100-foot shaft on a four-foot ledge of similar ore to that in the Bridgeport group, and is keeping up his assessment work. In the Pointer, adjoining the Tough Nut on the south, Messrs. Hargrove and Stokesberry have a five-foot ledge, running 130 to 150 ounces silver, on which they have a 150-foot tunnel.

It was about the time that the first discoveries were made on Salmon River that the late ex-lieutenant governor, Charles E. Laughton, organized a company to build a concentrator to treat their ores on the customs plan. He erected a building in the canyon between the Tough Nut and Lone Star mines and put up a plant consisting of a rock crusher, a set of rollers to pulverize the rock, drum screens to size the material, wooden jigs and wooden bumper-vanners. But much of the mineral escaped with the tailings, so that the latter were richer than the concentrates, less than half the value being saved. About fifty tons from the Tough Nut and a little from the Homestake were concentrated, and then, as the assay value failed to show up, the mine owners refused to furnish more ore, and after a two weeks' run in 1889 the machinery stopped, never to run again. Some time later the machinery men foreclosed their mortgage and Allen C. Mason bought the mill, but has never run it. He has sold some of the shafting and parts of the machinery.

In the lime belt the principal group is the Silver Bluff of ten claims, owned by the Silver Bluff Mining and Milling Company. On the surface the ore in this group runs in great bunches of high value, and a large amount of prospecting has been done in the endeavor to find where it lies in the country rock below. Work was going on last summer, and one car load was shipped which netted over $100. The Belcher is another claim on the lime belt, owned by the Belcher Mining Company, about one and one-half miles from the Silver Bluff. A shaft has been sunk 275 feet and drifts run at the 100-foot level and at the bottom.

That Salmon River cuts some free gold ledges is evidenced by the discovery of gold in the sand at several points on its course. Charles H. Ballard and J. R. Wallace found gold in the sand of a bench about a mile square one mile below Conconully and took out $20 in prospecting it. The ground carries from one-tenth of a cent to 10 cents to the pan, and would make good hydraulic ground. Eight miles above town, at a place called the Meadows, on the north fork of Salmon River, Layton S. Baldwin, L. Irwin Baldwin, H. A. Wilder, John Armstrong, of Conconully, and J. P. Gleason, of Seattle, located claims on a bar which appears to be an old river bed and where the dirt carries shot gold to the amount of 10 to 15 cents a cubic yard.

OKANOGAN LAKE.

With a railroad penetrating its center and a steamer connecting with it on the lake, this district has every cause to look for rapid development. The Canadian Pacific Railroad runs from Vancouver to Sicamous, 335 miles, and thence a branch runs to Vernon, forty-seven miles, and to Okanogan Landing, fifty-one miles. Vernon is in a rich valley with good roads branching from it, and the construction of others to new camps will be inexpensive.

The mineral belt of this district runs through the hills which shut in the Okanogan valley on the east and west. The country formation consists of belts of diorite, granite and quartzite, cut by dikes of lime and porphyry. Running through this in a generally east and west direction are iron-capped ledges carrying gold, galena, iron and copper sulphurets and ranging in width from two to fifty feet. There are also large bodies of low grade free-milling quartz which carries gold, with little or no silver.

The pioneer mine of this district is the Monoshee, on the north side of Monoshee Mountain, about fifty miles southeast of this town and over-

looking Cherry Creek, in which placers have been worked for about thirty years. It was discovered about ten years ago by Donald McIntyre, and has a ledge of free milling gold quartz about three and one-half feet wide. Mr. McIntyre, with F. G. Vernon and a Mr. Riskie, drove five tunnels on the ledge to a length of fifty to 200 feet, and stoped out the ore thus opened. They erected a mill of an old style and ran about 200 tons of ore through it, and, finding it did not save the value, stopped operation and have never resumed.

The next important discovery was not made till 1891, and has the prospect of being developed on a large scale through the investment of a large amount of English capital. This is the Swan Lake group of six claims, discovered by the late Capt. F. D. Shorts and W. J. Armstrong, of Vernon. These claims are on a great deposit of free-milling quartz which crops out in steep buttes and bluffs through the hills sloping down from the east of Swan Lake, four miles north of Vernon. One of these outcrops has been opened in a point of rock on the roadside, and the ledge can be traced far up the hill. It appears to be an almost flat deposit, and has been traced on the surface over a square mile of ground. A shaft has been sunk fifty feet at a point 600 feet below the highest outcrop, with a twenty-foot drift from the bottom. All this work is in ore, which has given assays ranging from $3.25 to $13 in free gold, with a trace of silver. The deposit is pronounced to be similar in extent and character to the great Treadwell mine in Alaska, and with the Canadian Pacific railroad running along the lake shore only a few hundred yards distant, has every facility for cheap development and operation. The group is now owned by the Swan Lake Mining and Development Company, which has bonded it to Arthur H. Craven, the representative of London capitalists, for $120,000, and he has examined the property and tested the ore with a view to deciding the course to be taken with it. If the ore will average $4 a ton in gold he proposes to erect a fifty-stamp mill and chlorination works and reduce the ore by the method in use at Treadwell.

In the fall of 1895 the BX group of seven claims, adjoining the Swan Lake group, was located by Leo Simmons, E. C. Simmons, Charles Casterton and E. C. Thompson, all of Vernon. The greatest showing is where BX Creek had cut through the ledge down to the granite footwall and where, by stripping, it was exposed for a width of sixty feet. Assays from this place gave $6 to $8 gold and a little silver, wihch is a fair example of the whole group. The country rock, which is chlorite, is itself mineralized, having given an assay of $6.50 gold. A twenty-five-foot shaft sunk on a four-foot ledge showed plumbago mixed with the broken surface rock.

A little later, in December, 1895, James McClellan found a ledge of free-milling ore similar to that at Swan Lake on his ranch about eight miles north of town, and with Alex McArthur, J. Brown and Tom Clinton located the Larkin group of three claims. On an eight-foot ledge a hole has been sunk fifteen feet, assays of $1 to $8 being obtained from surface rock, while a parallel ledge is ten feet wide. A short distance further north, near Lumby, large bodies of free-milling ore were discovered by A. J. McMullen and Samuel McIlvanie in April, 1896.

Explorations had meanwhile turned southward along Okanogan Lake, and one result is the creation of Camp Hewitt, on a mountain 1,500 feet high, overlooking the lake from the west and sixty miles south of Okanogan Landing. Here, in June, 1895, Gus Hewitt and Alexis C. Broth found a cropping of free-milling quartz three or four feet wide in a porphyry dike in a granite formation, in which free gold was plainly visible, and located the Dandy and King Solomon on parallel ledges about four feet apart. The surface rock was much decomposed, and Messrs. Hewitt and Broth spent much of the summer in panning gold out of it and got good returns. In the winter of 1895 they ran a cross-cut tunnel 115 feet on the Dandy, but have so far been unable to locate the ledge, and will now drift from the tunnel for it. On the King Solomon the surface rock is in a slide, but the ledge in place has been traced for 6,000 feet through four claims and a cross-cut tunnel is being run. The Winifred, a supposed extension of the Dandy, located by C. Booth and R. B. Venner, has a shaft twenty feet deep on a ledge three feet wide. On a parallel ledge is the North Star, owned by George Bell and Donald McIntyre. There was a cropping three and one-half feet wide carrying free gold, but a ten-foot shaft has shown galena carrying about $20 gold, and also copper. With the Stag, an extension of the North Star, Henry Hardy and C. E. Casterton have had a similar experience, for, while they had a three-foot cropping of free-milling ore between granite walls, they ran into galena carrying gold and silver with copper and iron sulphurets, from which they got assays of $14 to $20 gold. The Mountain View, two miles nearer the lake, discovered by Messrs. Hewitt and Broth in April, 1896, has a ledge of galena ore five or six feet wide in a lime formation, running east and west with a dip to the south. An incline shaft has been sunk thirty feet.

Another place where the old placer workings have led to discoveries of quartz ledges is the ridge between Siwash and Six-Mile creeks, on the west side of Okanogan Lake, for the bars of Siwash Creek have been worked for over twenty years. Joseph Hitchier located the Jumbo and William Clark the E. S. on a ledge of iron and copper pyrites in a lime formation, running

almost due north and south. From the decomposed quartz at the outcrop, and from the fact that a cross-cut tunnel on the E. S. has been run thirty feet without finding the walls, it is believed that the ledge is at least thirty feet wide.

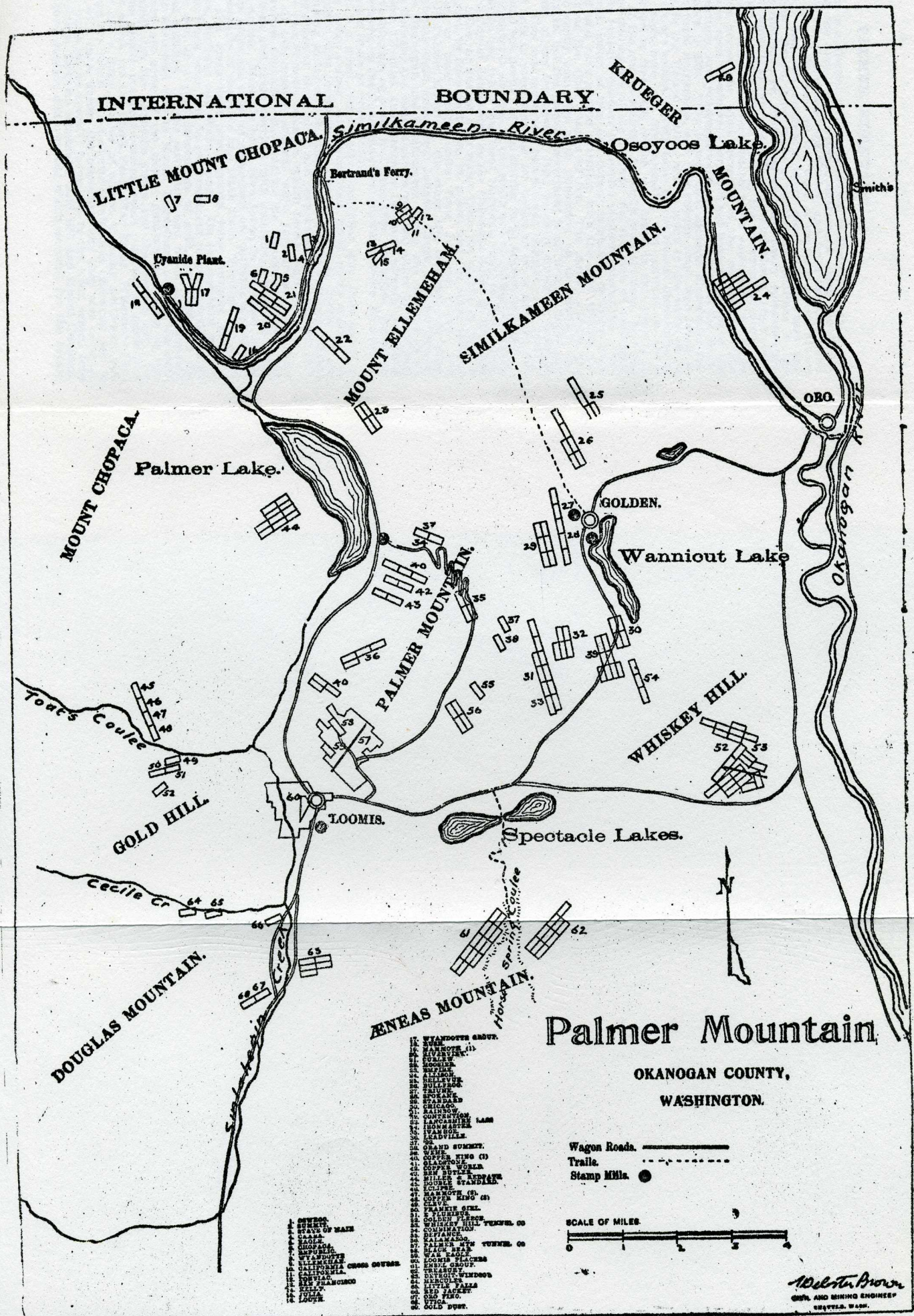
Still nearer the town, on the point which divides the east arm from the main body of Okanogan Lake, a cropping of galena ore was found last spring by J. N. Norden and his two sons, which was six feet wide on the surface and was traced for 100 feet. It runs a little west of a north and south line in a badly shaken formation resembling syenite. The first shot showed up ore, which assayed $10.80 gold, $54 silver and a little copper. The Mordens' located the Morning Glory with the Jumbo on the north, and adjoining the Jumbo E. Harris located the Hardup. The south extensions, following the ledge to the water's edge, are the Morning Star by the Mordens and the Chieftain by F. H. Latimer. On another ledge, which runs at right angles to the Morning Glory, are the Close Call and Old Iron, owned by A. N. Pelly. This ledge is nine feet wide on the surface and ten feet on the face of the cliff overlooking the lake, and has assayed $3 to $17 silver, a good percentage of copper and a trace of gold. Mr. Pelly is driving a tunnel on the ledge in the face of the cliff and will sink a shaft from the bench above.

Prospecting then came closer to the town, and in December Camp Lefroy was established on the hills to the northwest, with locations reaching within one mile of Vernon. The mineral is in a belt of four parallel ledges three-quarters of a mile in width and well defined for a distance of three miles. The ore is quartz, carrying gold, copper and magnetic iron, with a little galena, and is between well-defined walls of slate and schist. The first location was the Mabel May, by Richard Shook and G. Milligan, who found rich float showing free gold, but have not yet found the ledge, though they have made a surface cut and are running a cross-cut tunnel. On the extension and on a parallel ledge further up the hill is the Babel group of four claims, owned by F. H. Latimer, F. M. Kirby, James Martin and G. A. Henderson. On another parallel ledge are the Warrior and Maverick, owned by H. F. Parke, F. H. Latimer and F. M. Kirby, and the Big D, by J. G. Webster and H. F. Dennison. Further west is the Little One, by Messrs. Kirby and Latimer, on a four-foot ledge, the Chariot, by Mr. Dennison, being an extension on it, while on the southeast is the Blue Jay, owned by Messrs. Kirby and Latimer, with an eighteen-inch ledge. All these ledges are from one to five feet wide and carry iron pyrites and gold, with a little arsenical iron, while the Falcon also shows galena and copper. Surface ore has assayed as high as $10 in gold.

On the hills between Okanogan Lake and Long Lake on the east, a number of locations have been made on ledges of iron and copper pyrites carrying gold. Among these are the Silver Queen and Barney Barnato, by Simon E. Ord; the Aberdeen and Countess, by John Howard and William Appleton; the Alexander, by George H. Meakins; the Sunset, by — Colbee and J. O. Williams; the Gold King, by J. K. Johnson; the War Horse, by F. H. Barnes and William Haupt; the IXL, by J. K. Johnson, and the Lark, by William Johnson.

Along both banks of Deep Creek, four miles west of Okanogan Lake and two and one-half miles southwest of Hewitt's Camp, a number of parallel ledges of iron and copper pyrites and galena carrying gold, between well-defined walls, have since been the scene of much work. On the north side of the creek is the Panorama, owned by J. L. Webster, showing a little free gold. Next on the west is the Little Duncan, owned by Mr. Webster and J. Walker, in which an open cut five feet deep showed ore assaying 101 ounces silver. On going fifty feet lower and starting an incline, ore was obtained which assayed $6.40 gold and $11.90 silver. On the same ledge is the Major, owned by J. L. Webster and James Martin. On the south side of the creek is a succession of ledges on which have been located the Stella, by G. A. Hankey and others; the Iron Mask, by Mr. Webster; the Farmer, by Messrs. Dennison and Latimer, on which a small shaft shows galena and copper pyrites widening from eighteen to thirty-six inches, and the Blind Man, by Messrs. Webster and Walker, which stands on the side of the gulch.

Further south and within twelve miles of Penticton, on the west shore of Okanogan Lake, Alexander Thompson in May, 1896, located the Aberdeen on a ledge of pyrites fifteen feet wide, which has been bonded by W. T. Thompson. Extensions on this ledge are the Rambler, by Joseph Thurber, and the Scrambler, by H. E. Walker.



IN THE PACIFIC NORTHWEST.

PALMER MOUNTAIN.

This name is given to a district of Okanogan county directly south of the boundary, comprising the area which extends southward along the Sinlahekin River to the mouth of Horse Spring Coulee, and from the Okanogan river on the east to Mount Chapaca on the west, a territory about fifteen miles square. Mineral was first discovered there nearly thirty years ago by the late "Okanogan" Smith, who made a number of locations in the mountains along the Similkameen River and claimed heavy compensation from the government when they were included in Chief Moses' reservation in 1880. As he refused the sum offered, $250,000, the government drew the lines so as to exclude a strip extending fifteen miles southward from the boundary and running across the whole breadth of the reservation. The fact that this strip was open to mineral entry did not become known in the then thinly settled territory, and prospectors did not enter it until the reservation was thrown open in 1886. Then it was that mineral discoveries followed one another in rapid succession, and this remote tract was found to be among the richest in the United States, not so much in the value of its ore as in the size of its ore bodies, though some of the richest discoveries in the state have been made here. At first attention was centered on silver ores, then it was turned to free gold, which was found in rich pockets in the oxidized surface of the quartz ledges. As depth was obtained, base ore soon replaced the free-milling ore of the surface, and the lack of equipment to save the sulphurets brought disaster to several pioneer enterprises. During the last year great bodies of iron and copper sulphides, carrying gold, have been discovered and have shared attention with the good results following deeper mining on the other classes of ore. The earlier miners and prospectors were too easily contented with gophering on the surface and working out rich pockets, but the present movement is all to gain depth and block out large bodies of ore for mining, then to erect carefully designed plants for reduction. This new movement has already brought such gratifying results that it is safe to pronounce the ore bodies to be of assured permanence and value, and the destiny of the district to be beyond question.

The center of the district is Loomis, at the south end of Palmer Mountain. To reach it from Seattle, one takes the Great Northern train to Wenatchee, 174 miles; the steamer City of Ellensburg up the Columbia River to Brewster Landing, eighty-five miles, or during high water from the middle of May to the beginning of August, to Johnson Creek, 130 miles; and the stage seventy miles from Brewster, or twenty-eight miles from Johnson Creek. For Golden, on the east of Palmer Mountain, the stage trip is eighty-two miles from Brewster and twenty-eight miles from Johnson Creek, and for Oro, at the confluence of the Okanogan and Similkameen rivers, the distance is six miles further. From Spokane the district can be reached either by the Great Northern to Wenatchee, 174 miles, and thence by the route already described, or by the Central Washington railroad to Coulee City, 125 miles, thence by stage fifty miles to Orondo, on the Columbia river, six miles above Wenatchee, and thence by the same route as from Seattle.

Palmer Mountain is a great, broad ridge, ten miles long from north to south and about six miles across, with numerous small peaks marked by cliffs of white dolomite. The formation of the mountain is diorite on the southern slope, extending as far as the summit, and on the northern portion this is intersected by dikes of black slate and serpentine. The eastern portion consists of slate capped with dolomite, which forms high white noticeable through all the country around, while further east are large dikes of wildly contorted dolomite extending to the Okanogan River. The black slate is only here and there overlaid with dolomite, where the latter has resisted glacial action. Minerals have been found in all these formations. On the eastern slope are veins of silver-lead ore carrying a good percentage of gold in contacts of dolomite and black slate. Through the black slate run on north and south lines great quartz veins carrying gold, on which are the Triune, Spokane and Wehe groups. On the northern part of the mountain, in the black slate, are large, prominent ledges carrying high grade silver ore, as well as a good percentage of gold, on which are the Ivanhoe, Empire and Bullfrog. In the serpentine and black slate contacts which extend on the northwest side to Mount Ellemeham and on the west overlook Palmer Lake are some of the richest gold-bearing veins on the mountain, among which are the Leadville group and the Bunker Hill. On the south end in the diorite are gold-bearing veins carrying a small percentage of silver, on which are the Black Bear, War Eagle, Wisconsin Central, Grand Summit and a large number of others, coursing northwest and southeast. Iron caps are found in the diorite identical in character and in identical formation with those across the boundary, and they also occur of large size in diorite walls in the syenitic formation to the west, which runs through Aeneas Mountain, Douglas Mountain, Gold Hill and Mount Chapaca. Palmer Mountain shows surface disturbances which account for the break-

ing over of some of the ledges, for as depth is attained it is found that they are permanent and that the break-over is merely a surface disturbance. This is proven in the Black Bear, where the greatest depth has been reached, and agrees with the experience at the Cariboo mine at Camp McKinney, B. C., which is on the same geological formation and shows the same surface displacement. These disturbances caused many prospectors to think their ledges near the surface had given out, and scared away some timid investors who were inexperienced in mining.

When it was thrown open to entry, iron caps were found all over the Okanogan country, but the great wealth of mineral which they conceal had not then been made known, and as the surface ore gave such low values that it would not pay to ship in a country where long wagon hauls shut out all but the highest grade ores, they were passed over or abandoned after a little work had been done. The prospectors turned their attention to the free-milling quartz and high grade silver, and soon found enough to occupy them.

The first strike which attracted notice was the Jessie, on the east side of the ridge, near the summit, by C. H. Schepstur, William H. Townsend and Charles Cole, and now owned by Mr. Townsend and Adelbert Hart. Here they found a four-foot ledge of high grade ore, having on the surface a great quantity of decomposed quartz carrying free gold. The owners pounded up some of this rock in a hand mortar, panned out the sand and melted down quite an amount of bullion. They ran a fifty-foot tunnel on high grade ore all the way. A number of similar discoveries followed, and then came the great silver-bearing ledge of the Ivanhoe group. It is only within the last year that the ledges of sulphide ore capped with iron have received the attention which development has proved they well merit.

The first property to attract general attention was the Black Bear and War Eagle group of five claims on the south end of Palmer Mountain, now owned by E. J. N. Hale and others, of Spokane. They have several parallel ledges, oxidized on the surface so as to free the gold, but growing base at depth. A shaft was sunk 190 feet on one ledge and cross-cuts were run at the 100-foot level to two other ledges, all being two to four feet wide and assaying $28 gold and upwards. Drifts were run each way on each ledge on this level and also on the 150-foot level, showing pay ore of increasing size and value. On another ledge a shaft is down 100 feet and a tunnel in 150 feet, showing twenty-four inches of good ore between strong walls. A five-stamp mill was erected at Loomiston, and in five months' run in 1892 produced $113,000 in gold, but it was badly managed, and, having no concentrators, sent all the sulphurets away in the tailings, from which one assayer says he has taken an assay of $43.50 gold and another $12.04 gold and thirty-six ounces silver. In 1895 O. S. Stocker and others did the assessment work in return for what ore they could take out in doing so and mill. After repairing the dilapidated plant, they milled forty-five tons and cleared a nice profit.

The depth attained on this group so far proved the permanence and value of the ore bodies as to encourage an enterprise which will in a year or two prove these facts beyond dispute. This is the great main cross-cut tunnel which is being driven into the bowels of the mountain from its south end by the Palmer Mountain Gold Mining & Tunnel Company. The company has acquired twenty-seven claims in a solid block, on which are sixteen known true fissure ledges, parallel or nearly so, and carrying gold, both free and in sulphurets of iron and copper. The company is driving a tunnel seven feet high and eight feet wide, with double tracks and steel cars, from a point one mile from Loomis and 120 feet above that town, with the intention of cutting all these ledges at a continually increasing depth until the furthest is tapped at a depth of 1,200 feet at a distance of 3,600 feet from the portal. It is also expected that many blind ledges will be cut, as geologists estimate that only a small proportion of mineral ledges crop on the surface. This expectation was confirmed by the tapping of two such ledges of fine-looking ore in the first 150 feet of work. The tunnel has at this writing penetrated 250 feet and its face is a mass of pyritic ore, carrying veins of white quartz running with the tunnel, an indication of the proximity of a rich gold-bearing ledge.

Mining is at present being prosecuted with hand drills, but the company will, when weather permits, construct a flume from Toats Coulee Creek, one mile west of the portal, and thereby conduct water from that stream which will develop 1,100 horse-power. This will suffice to generate electric power for a compressed air drill plant, tramways and reduction plants, as well as to other adjoining mining properties.

The ledges in this group contain free gold, auriferous sulphides, usually pyrite, small quantities of galena and silver. It is proposed to erect a plant at the mine for the reduction of these ores by modern methods and thus dispense with the necessity of shipping anything but bullion.

A kindred enterprise of almost equal magnitude has been undertaken by the Whiskey Hill Tunnel and Mining Company on the east slope of Whiskey Hill, a continuation of Palmer Mountain, about eight miles to the northeast of Loomis and one mile west of the Okanogan River. This company owns twenty-one claims on which are nine well-defined ledges running nearly parallel in a generally northeast and southwest course. It will run a cross-

cut tunnel, eight feet wide and seven feet high, 3,200 feet into the mountain, tapping the group at a maximum depth of 900 feet. Considerable prospecting work has been done on the different ledges. On one a shaft is down eighty feet and a sixteen-foot cross-cut at the bottom has not found either wall. The ledge matter is white quartzite, heavily impregnated with iron and lime, and in places carrying some galena, and the ore assays $37 gold and $7.20 silver. The company expects to strike many blind ledges, and from the fact that quartz encountered in facing up the tunnel site assayed $12.75 gold, it is believed that Whiskey Hill contains great masses of rock which will pay to mill. A gravity tramway one mile long will convey ore or concentrates to the Okanogan River, where it can be transported by boat four months in the year and, whenever the government removes the obstructions from this river, it can be navigated all the year round except during midwinter. The preliminary work is now in progress and the driving of the tunnel will begin very shortly.

The greatest depth so far attained is on the Ivanhoe group of four claims by the Ivanhoe Company, and the work done has been amply repaid by results. Where discovered, the ledge was almost flat on the summit of Palmer Mountain and the surface soil was stripped off it with a plow and scraper by A. C. Cowherd, the original owner. This exposed in an area of 175x50 feet a ledge twenty inches to four feet thick, carrying brittle, ruby, malleable and native silver and considerable free gold. From this cut about 1,000 tons of ore was taken and shipments of sorted ore were made with the following results per ton: 6,899 pounds, 1.62 ounces gold, 572 ounces silver; 15 521 pounds, 1 ounce gold, 278 ounces silver; 25,500 pounds, 1 ounce gold, 326 ounces silver. Several thousand tons of low-grade ore remaining, a ten-ton mill with Dodge pulverizer, amalgamating plates, concentrator and slime tables was erected at the foot of the mountain and considerable ore was reduced. But the plant was not adapted to the ore, which needed more skilful treatment, and is to be replaced by a more modern mill this season. During the last year the incline shaft, already started, has been sunk to a depth of 500 feet, showing the ledge seven feet wide and very strong, with three and one-half feet of pay ore, which in places is phenomenally rich, one assay running over 9,000 ounces silver and 3 ounces gold, and the pay ore generally running from 500 to 1,000 ounces silver. A drift had already been run seventy feet at the 120-foot level, showing the ledge six and one-half feet wide, and others have been run forty-five feet each way, all in ore and showing an increased width. Much of this ore was so rich in native silver that it was sacked in the mine. There are over 2,000 tons of shipping ore on the dump, besides a large quantity in sacks, awaiting the opening of navigation for transportation to the smelter.

The only regular producer of bullion in the district at present is the Triune mine, which is equipped with a ten-stamp mill and four Frue vanners operated by steam. This ledge has also broken over to the west and at this point carries much free gold, though sulphides are also mingled with it. Shafts were first sunk thirty-six and nineteen feet, the first showing no walls and the second not cutting the ledge. A tunnel was then run 125 feet on the blanket, only ten to twenty feet below the surface, and the ore above was stoped out and milled. The mill then, however, had no concentrators, and more than half the value, being in sulphurets, was lost in the tailings. It was in 1895 that the mine was properly equipped and the mill put under skilled management by the Triune Gold Mining Company, which then acquired the property. It has since run a cross-cut 165 feet, which cuts the ledge at an acute angle and taps the thirty-six foot shaft and has cut a feeder three feet wide. Drifts have been run on the main ledge, above which the ore was stoped. An open cut has also been made on the blanket, from which forty-four tons of ore were milled, yielding $450 free gold, besides concentrates. A tunnel has been run 225 feet, tapping the ledge at a depth of eight feet, higher up the mountain, following the blanket in that direction. In order to trace the solid formation down into the mountain below the break-over, a shaft has been sunk 150 feet, which showed it to straighten up, and followed down a number of stringers carrying $68 gold, 12 ounces silver, until they united in six feet of solid ore. To the south of the mill is a cropping of rose quartz twenty feet high and thirty feet wide, averaging $9 gold, according to a mill run. The mill in 1896 produced about $40,000 in bullion and after a suspension in November, enforced by frost, was started on February 1 and is now making a large monthly product of bullion.

Adjoining the Triune on the south is the Spokane group of three claims, owned by J. Barnett McLaren, of Vancouver, B. C., who has a ten-stamp mill on the shore of Wannicut Lake, a mile distant from the mine. A tunnel has been run ninety feet on a three-foot ledge, with a drift sixty feet south, a third sixty feet from the first, and a fourth connecting the first and third. A thirty-four foot winze has been sunk at the face of the ninety-foot drift and from it some of the richest ore in the mine has been taken. A forty-foot tunnel has been run on a twelve-inch stringer 500 feet further south and a twenty-foot shaft is down on a four-foot ledge carrying galena which assays 20 ounces silver, $5 gold. The mill was run for six months in 1893 on ore often carrying $100 gold, but much of the value was in sulphurets, to save

which concentrators were needed, and financial troubles followed during which work has been suspended.

Adjoining the Spokane is the Standard group of six claims, also owned by Mr. McLaren, on three parallel ledges. One of these is tapped by a 130-foot cross-cut and averages four feet wide, carrying about $4 gold. On another a forty-foot shaft shows eight inches of $6 ore, and the third makes a similar showing in a thirty-foot tunnel.

Among the well-developed properties is the Leadville group of four claims and two fractions on a series of parallel ledges, owned by John Judge. On one of these, five to six feet wide, an eighty-five foot shaft showed a twenty-four inch pay streak to often widen to six feet. A tunnel has been run 333 feet at a point 155 feet below and has been connected with the shaft by an upraise. This gives a large body of ore in sight, which averages $20 gold, though pockets of free gold have run as high as $5,000. Another ledge is shown to be ten feet wide by an open cut and has a pay streak assaying $20 gold, on which a shaft is being sunk. The third ledge, five feet wide, is shown up by a forty-foot shaft and has a pay streak from the croppings of which free gold can be taken and which assays $100.

One of the richest discoveries on Palmer Mountain was the Grand Summit, which was located directly on the summit by John Enright and William Towne. The ledge is two to three feet wide and had a rich pocket near the surface which assayed $39,000 a ton gold. A tunnel is in fifty feet on the ledge and a shaft is down forty feet, showing good average ore, of which fifty tons milled at the Ivanhoe and Black Bear mills averaged $20 gold.

Another fine showing has been made by John Mainwaring and Stephen Naggy on the Gladstone group of three claims, through which run four parallel ledges, eighteen, fourteen, twelve and thirteen feet wide, between walls of diorite and porphyry. About 500 feet of tunnel and drifting has been done, one tunnel running 300 feet on one ledge, which could be tapped at great depth from the base of the mountain.

On the summit of the mountain east of the Triune is the Bullfrog group of eight claims, bonded by Mrs. Adelbert Hart and Mr. J. Deuel to Mr. Stevens, of La Grande, Or. Through them a seven-foot ledge has been traced 3,000 feet along the apex of the mountain and a tunnel has been run 160 feet to cut the lead, and is now in ore, while two shafts forty and thirty-six feet have been sunk on the lead. A shipment of 4,600 pounds returned about $150 a ton in gold and silver, and twenty assays averaged $160 gold and silver. Work is being pushed on the tunnel and shipment continues.

To the east of the Bullfrog is the Bellevue group of four claims, on which Reilly Brothers, of Pittsburg, have done over 250 feet of development work, showing a high grade of gold and silver sulphuret ore and considerable telluride. Several tons shipped to the smelter have netted over $100 per ton, while some of the ore bodies have assayed $400 to $500 per ton.

On the Ninety-two, between the Ivanhoe and Grand Summit, William Deuel and William James have driven a tunnel 160 feet, showing three feet of free milling ore which assays $12 to $15 gold.

One of the noted properties is the Rainbow group of ten claims, which after many changes has come into the possession of the Anglo-American Gold Mining and Milling Company. It was bonded in 1892 by H. A. Noble and others, of Seattle, who erected a ten-stamp mill without concentrators, but through lack of skilled management failed to extract the value from the ore and abandoned the property, selling the mill. The main ledge is shown four feet wide in a tunnel 150 feet long, from which a winze was sunk sixty-five feet and a cross-cut has been run 312 feet, tapping the ledge 128 feet below the surface. From these workings there are from 400 to 500 tons of ore on the dump, and assays range from $5.61 to $323.94. On another claim a 316-foot cross-cut taps the ledge at a depth of 110 feet, showing it two to four feet wide, and a sixty-foot tunnel above is all in ore. Shafts eighty and ten feet deep and a thirty-foot open cut are said to define an ore chute 180 feet long. Assays from this ledge ran in gold, $4.72, $295.84, $270.21. On a third ledge shafts are down thirty and thirty-five feet, showing two to three feet wide of ore carrying $25 in free gold and sulphurets. The six remaining claims are undeveloped. The company proposes to erect a ten-stamp mill this summer and, if concentrators are added and skilled men are employed, may be expected to make it profitable.

Adjoining the Rainbow S. J. Sincock has the Lancashire Lass group of four claims, on extensions of two of those on the Rainbow and on a cross ledge, running east and west. On the latter a forty-two foot shaft shows three feet of ore assaying $25 gold. An eighteen-foot shaft shows a number of streaks of ore running into another ledge. Another ledge has a body of iron pyrites exposed by an open cut thirty feet long and six feet wide, with no walls in sight.

Up the mountain from this group is the Contention group of five claims, owned by Mosher & McDonald, of Seattle, on two ledges crossing one another. A ninety-five foot shaft shows three feet of free milling ore, on which a drift has been run at the fifty-foot level, another drift at the bottom being headed for the junction of the two ledges.

A mile north is the Chicago group of four claims, which J. F. Jordan is developing. A sixty-foot cross-cut has tapped a body of sulphide ore carry-

ing gold and silver, the croppings of which have been traced for half a mile. A thirteen-foot shaft on this ledge shows ore assaying $16.40 silver, $3.60 lead, $64 gold. A tunnel shows another deposit of sulphide ore and a twenty-foot shaft shows a twenty-four inch stringer, and another three-foot ledge is opened by a twenty-foot shaft and several open cuts. Further south on the mountain Mr. Jordan has the Oro Fino, on which a thirty-five foot inclined shaft shows a five-foot ledge carrying gold, silver and platinum to the value of $22.75.

The Wehe brothers have a group of fourteen claims on the east slope of the mountain, some of which carry rich ore. A shaft forty-five feet deep shows one ledge four feet wide with two feet of steel galena ore assaying 50 to 200 ounces silver and 1 to 2 ounces gold. A twenty-foot tunnel has shown six to eight inches of galena in another ledge. Shafts twenty-five and twenty feet deep show another ledge of three to four feet carrying galena, with free gold on the surface, assays running $6, $37 and $120 gold and silver, while bunches of telluride ore of course run much higher. Another ledge forty feet wide, with three to four feet of pay ore, is shown up by a forty-foot cut and a tunnel of the same length. A forty-five foot shaft shows six feet of ledge matter on another claim, with only one wall found. A twenty-foot shaft shows another ledge carrying galena five feet wide, and a fifteen-foot cut shows another eight feet wide, of which the pay streak carries $30 gold. On the Uncle Sam, a little to the south, Andrew O'Malley has run a cross-cut eighty feet to tap a small ledge carrying galena, in which a twenty-five foot shaft has shown ore assaying $4 gold, $41 silver and 15 per cent. lead.

On the north end of the mountain, half a mile east of Palmer Lake, is the Empire group of four claims, owned by the Empire Mining Company. A shaft eighty feet shows a ledge three feet and a tunnel sixty-eight feet shows it six feet wide. The ore carries iron and copper pyrites and galena and is free milling and concentrating, averaging $22 gold. A smaller vein runs $160 gold and 300 ounces silver and shows native silver and free gold on the croppings.

Attention has recently been fastened on the deposits of sulphide ore, which the earlier prospectors passed over as worthless, on account of their low surface values. The first rediscovery of this kind was on the Copper World group of four claims on the summit, south of the Ivanhoe, which John Wentworth and William Riley are now developing. The main ledge has been traced for over a mile and is shown to be at least twenty-five feet wide by a surface cross-cut, the surface ore assaying $5 gold, $2.50 silver, 35 per cent. copper. A shaft has been sunk fifty feet on the hanging wall and drifting has so far not reached the footwall, this work all showing chalcopyrite and iron pyrites. On the extension of this ledge John Wentworth and E. W. Pember have the Copper King, showing eight to ten feet of ore, which would be cut by an extension of the great tunnel.

Adjoining the Copper World Thomas Brown and William Riley have the Ben Butler group of three claims on a ledge which is widening from fifteen inches in a twenty-foot shaft and carries gold and copper, a surface assay showing $7.80 gold.

Another great showing of sluphide ore has been made on the Kalamazoo group, at the base of the mountain, two miles from Loomis, by Messrs. Harris and Boyd. After running an open cut thirty feet through cement gravel, they cut two feet of white quartz, heavily charged with iron and copper sulphides and native copper. They then sank on it and defined it to be at least fifty feet wide, of increasing value.

Another discovery of the same nature was made last October, one mile north of the Ivanhoe, by George King and P. H. Pinkston, who have taken the Ironmaster and an extension. The ledge has an iron capping from 20 to 250 feet wide at various points and the croppings show iron sulphides and a little copper, assaying $6.19 and $4.19 gold and silver from two samples.

On the Defiance, on the south slope, the Everett Mining Company has sunk 112 feet on a three-foot ledge of free milling ore, and at the ninety-seven foot level has drifted forty feet south and forty-two feet north. Near this J. M. Sparkman, Lotka & Allen and J. H. Sexton have tunneled eighty-three feet on a twelve-inch vein carrying $10 gold and some copper in pyrites, on which they have the Baltimore group of three claims. In the same vicinity George Paskel and the estate of John M. Hoe have the Combination on a sixteen-foot ledge of sulphide ore carrying $12 gold and 5 ounces silver, which will be cross-cut at a depth of 175 feet by a tunnel now in 200 feet. A twenty-inch stringer has already been cut by the tunnel.

Since the death of Okanogan Smith, all his claims along the Similkameen have come into new hands. On the San Francisco group of three Frank Grogan has run a tunnel sixty feet on a six-foot ledge of galena carrying a little gold. On another ledge of galena eight or nine feet wide John McDonald has tunneled 100 feet and sunk ninety feet. Two miles below this is the Cabba, another of the Smith claims, on a twelve-foot ledge well mineralized with galena, on which a shaft is down 100 feet. On the Julia, on the north slope of Mount Ellemeham, Allan Reiste and Guy Fruit have sunk eighty feet on a six-foot ledge of sulphide ore with a little galena, four feet of which carries $60 gold, 112 ounces silver.

The most work on the Similkameen has been done by the Wyandotte Mining, Milling and Smelting Company on the Wyandotte group of six claims and two millsites, running up the mountain from the left bank of the river, three miles south of the boundary. Near the summit of the mountain is a blanket ledge of free milling ore carrying $20 gold and $10 silver, twenty-five to thirty inches wide, between granite walls. An inclined tunnel was first run on the ledge and a few tons of the ore crushed in an arrastre. From a shipment of one ton was realized $50 above freight and treatment charges. Most of the work was done further down the mountain. The first ledge struck was iron pyrites between walls of porphyry and crystallized slate, running 40 degrees east of north and west of south, almost straight up and down the mountain. At the surface it is six feet wide, but in an inclined tunnel it widened to fifteen feet in 150 feet. At this point a stope was made to get the tunnel level, and then it was turned westward to develop the ledge. Near the surface this tunnel cut a blanket ledge of white quartz two feet thick carrying free gold, which cut across the pyrites ledge, and eighty feet higher up the mountain is another blanket ledge dipping 45 degrees to the east, on which a tunnel has been run 400 feet. The pyrites ledge is colored black with graphite and carries $8 gold, but no silver, while the lower blanket ledge runs $15 to $20 gold in the discovery shaft, changed to 80 ounces silver in the course of the tunnel and afterward back to the original gold value. On a parallel ledge of about the same size and character is a tunnel twenty-five feet. Another parallel ledge between granite walls widened in a fifteen-foot inclined shaft from ten inches to two feet, and increased in value from 30 ounces silver and no gold on the surface to 1 ounce gold and a trace of silver in the first five feet, the gold value continuing to increase with depth.

The company last summer erected a cyanide plant of 100 tons' daily capacity, under the direction of Dr. Paul Langhammer. It is operated by a sixty-horsepower engine and has an electric plant to furnish 200 lights. The ore will be brought to the crushers by a 400-foot cable tramway, and a cable ferry transports supplies across the river, thus shortening the distance to Loomis to ten miles. The plant will be put in operation this spring and meanwhile development is being pushed to prepare large bodies of ore for treatment.

The Wyandotte group is adjoined on the south by the Mammoth group of three claims, on which the Mammoth Mining Company has sunk thirty feet, showing an eight-foot ledge carrying pyrites which assays $16 to $18 gold. On the Pennsylvania J. E. Longacre, W. E. Meek and J. A. Meek have a blanket ledge twenty-eight inches wide, carrying $42 silver and a trace of gold, a twenty-five foot tunnel showing it to turn into the mountain. On the summit of the mountain they also have the Juanita on eighteen inches of ore assaying $32 gold, $2 silver.

Following down the left bank of the Similkameen, one comes next to the Curlew group of five claims, which Otto Hausing, Theodore Wilken and Joseph Linton have taken on three parallel ledges of gold-bearing quartz, each two to three feet wide on the surface between granite walls. Assays from the surface give $10 to $80 gold and a little silver, but one ledge carries galena and another a streak of high-grade brittle silver. Next below these are the three Riverview claims, on which Mosher & McDonald, of Seattle, have sunk 100 feet on a four-foot ledge of low-grade ore.

Across the river, on Mount Ellemeham, Stephen Cloud, William Bouchard, C. J. Sadenwater and others, of Michigan City, Indiana, have the Hoosier group of three claims on a ledge forty-seven feet wide, which they have traced from base to summit of the mountain.

On Kruger Mountain, which overlooks Oro from the north and is crossed by the boundary, are ten or twelve parallel ledges running east and west, carrying iron and copper sulphides, the country rock being hornblendic diorite with dikes of schist and granite. The first locations were the Allison group of five claims, now owned by Dr. Langhammer, who is developing them and has secured the power of Similkameen Falls to operate an electric plant, which he proposes to install, both to run a 100-ton cyanide plant and to light the town of Oro. A good body of gold-bearing sulphide ore has been shown up in a sixty-foot shaft, the average value being $45 in gold with no silver. There are four veins, two five feet and two four feet wide, which are being opened by a 200-foot tunnel 192 feet below the surface.

The Mammoth Mining Company has the Black Warrior on this mountain on two parallel ledges, each five and one-half feet wide, one carrying iron and copper pyrites, the other carrying galena. One ledge is almost flat and the hanging wall appears to have been carried away by glaciers, three shafts having been sunk on it. The galena ledge assays $60 gold and silver and 20 per cent. lead, the pyrites ledge $53 gold, 220 ounces silver.

Joseph Bertrand has, on the Warsaw, a six-foot ledge of free milling ore, carrying $18 gold, 20 ounces silver, on which he has sunk an inclined shaft sixty-five feet and which he has traced 600 feet.

On the British side of the mountain the first discovery was the Gold Dust, by George A. Engel and W. F. Keller, who have two claims on four parallel ledges and one cross ledge, one of which they have cross-cut for eighteen feet without striking the footwall. The ore assays from $4 gold, 6 per cent.

copper and 2 ounces silver up to $20 gold, 18 per cent. copper and 5 ounces silver. The Dividend is on the extension of these ledges and George Bauerman and Benjamin Anderson have stripped the northerly one to a width of sixteen feet and the southerly to a width of twenty feet, the ore assaying $12. The same parties have the Lakeview, on which a twenty-foot tunnel shows four feet of ore and a cross-cut defines the ledge as eight feet wide, assays running $14 gold, 4 per cent. copper. On the Lakeview extension W. T. Thompson has four ledges, a cross-cut showing one to be ten feet wide. Another Lakeview, on the American side of the line, is owned by E. J. Goddard and B. O. F. Farrar and has a ledge three feet wide on the surface, showing a good deal of free gold, which has been traced for 300 feet, but a shaft which is now sixty-five feet deep shows it to have split into two two-foot ledges. They are believed to come together again deeper. Assays average $12 gold, 12 per cent. copper, 4 ounces silver, though some specimens have run much higher. On the Calumet James Anderson and E. D. Boeing have a ledge twenty to thirty feet wide containing rich streaks of two to three feet carrying petzite. This mineral is 23 per cent. gold, 43 per cent. silver, 34 per cent. tellurium, and picked pieces of ore assay as high as $15,000, the average, however, being about $40. The ledge has been cross-cut. On the Gold Hill, bonded to Capt. Hall, of Rossland, for $8,800, a twenty-five foot shaft showed six feet of quartz, with only one wall in sight. On the International, bonded to George Canfield, of Oakesdale, and G. H. Norton, of Kettle Falls, a twenty-five foot shaft shows a four-foot ledge assaying 27 per cent. copper, $4 gold. The Satellite, bonded to Capt. Hall for $3,000, has a drift on the ledge about fifty feet and several open cuts, showing four feet of ore which averages $10 gold. The Copper King, also under bond to Capt. Hall, has a cross-cut four or five feet long, showing eighteen to twenty inches of copper sulphides, which assay $12 gold and 6 per cent. copper. The Copper Queen, which is believed to be on the Copper King lead, has a three-foot ledge of quartz, carrying copper sulphides, but no work has been done and no assays have been made. The New York, which is bonded to Mr. Canfield, has a shaft twelve feet deep and a cross-cut on a five-foot ledge, which shows well in gold and copper, though no assays have been taken. The Frosty, which is on the American side adjoining the New York, has a shaft ten feet deep on two and one-half feet of ore similar to the Gold Dust, which assays $9 gold and 15 per cent. copper.

On the steep face of Mount Chapaca, directly opposite the Wyandotte and 1,500 feet above the river, is the Rush group of three claims, located on a true fissure vein running almost north and south, and owned by the Chapaca Mining Company. A shaft was sunk on the ledge and a drift run 200 feet northward further down the mountain, where there is a ledge four to six feet, which assays from 20 to 200 ounces of silver and sometimes as high as $20 gold. An inclined shaft was sunk 175 feet and drifts were run both ways at the 100 and 175 foot levels, showing the ledge from five to eight feet. The company then started a tunnel to strike the ledge at a depth of 400 feet and cut three ledges with it, one of which did not show on the surface. At the point where it was struck, the main ledge was quite small, but drifting north and south showed it to widen to fifteen feet, averaging 200 ounces. The other two ledges were twenty-two inches, running $22 gold, and three feet, running $8 gold. A shaft was then sunk 175 feet from the upper drift for the purpose of connecting the two drifts, and in places it showed ore fifteen feet wide. Altogether, about 1,600 feet of development work has been done.

The next largest showing on Mount Chapaca has been made by J. W. Miller and George Redpath, of Seattle, on the Grandview group of eight claims, with two millsites. They have one great ledge of free milling quartz nineteen and one-half to twenty-two feet wide, running diagonally across four claims, on which they have run an open cross-cut and tunnel, showing two to fifteen inches of decomposed quartz on the hanging wall, which assays $115 to $484 gold, and five to six feet in the center assaying $6 to $58 gold. A thirty-three foot shaft also shows up this ledge. A parallel ledge is shown fourteen feet wide by an open cut and tunnel of 110 feet and carries ore in the center of five or six feet, from which gold can be panned. A three-foot cross ledge has four to eighteen inches of ore in a thirteen-foot shaft, assaying $33 to $270 gold. Three small parallel seams of similar character have merely been prospected. Another similar ledge is shown from six inches to five feet wide by open cuts twenty-eight, twenty-nine and thirty-six feet long, and assays from $37 to $280 gold. Two parallel ledges, eight and thirteen feet wide, on the same two claims, have not been developed. In the fall of 1896 one of the locations was made on a large iron capping, of which the surface ore assayed $2 to $6 gold and 5 to 29 per cent. copper, being typical copper sulphides. Another ledge is two and one-half feet wide and a twenty-nine foot open cut and tunnel shows twelve to fourteen inches of smelting ore carrying about $50 gold and silver, besides quite a per centage of copper.

Half a mile south of the boundary, on Mount Chapaca, Allan and George Reiste have the Golden Zone and an extension on a ledge which a 150-foot tunnel shows to be widening, with a continuous chute of ore carrying free gold and sulphurets. One ton of ore from the croppings milled $22 on the plates and assays average $40. On the Summit J. D. Lindburg and Clay

Taylor have a 140-foot tunnel on a six-foot ledge assaying $22 free gold. On the south end of Mount Chapaca is an iron cap fifty to seventy feet wide, which has been traced through four claims—the Copper King, by George Millberg; the Mammoth, by W. A. Berry; the Eclipse, by Peter Berg, and the Double Standard, by W. F. Kurtz. On the Double Standard, which was only discovered last spring, a shaft is down ten feet on copper and iron pyrites and is being continued. Surface assays on the Eclipse show $11 gold, and the oxidized croppings on the Copper King show $12 and $16 gold, with traces of copper and silver.

Separated from Mount Chapaca by Toats Coulee on the north is Gold Hill, on which free gold was discovered in 1892. The ledges are at an elevation of 4 000 feet above the sea and 2,000 feet below the summit, and range from four to eight feet wide in a red porphyry dike, cutting the formation. They run northeast and southwest and are almost perpendicular, with a slight dip to the northwest. The quartz carries free gold, but most of the gold value is contained in hematite of iron, there being but little silver. Assays average $10 gold, though specimens have run as high as $2,000. The pioneer location was the E Pluribus, by D. G. Chilson, of Loomis, and the Moody brothers, of Spokane, who have sunk shafts ten to twenty-six feet on the ledge, showing it to be four to ten feet wide. At the bottom of the deepest shaft the ledge is seven and one-half feet and averages $10 in gold. The northeast extension of the E Pluribus is the Frankie Girl, owned by Benjamin Hall and Daniel Mulcahy, of Loomis, and W. E. Hensley, of San Francisco. They have sunk several shafts ten to eighty-five feet, in the deepest of which the vein varies from four to seven feet, of the same grade as the E Pluribus, though some assays run very high. A narrower parallel vein runs through these two claims and is equally rich. On a parallel ledge northeast of the E Pluribus Henry Wellington and L. D. Burton have the Cleve and have made a twenty-foot open cut and started to extend it with a tunnel, showing about fifteen feet of low-grade ore. On another parallel vein Lester Sly, William Robinson and W. E. Hensley have the Golden Fleece, on which they have sunk shafts fifty-five feet on the hanging wall showing two and one-half feet of ore, and thirty-five feet on the footwall, showing three feet of the same grade as the E Pluribus.

Fifteen miles west of Loomis, at the head of Toats Coulee, D. G. Chilson has the Oceanic and Majestic on a six-foot ledge between granite walls, which has been traced 3,000 feet. A shaft twenty feet and openings along the ledge are said to show ore the full width, twenty assays of which range from $10 to $90 gold and silver. Of this value 65 per cent is free gold and the remainder in sulphurets.

West of Gold Hill is the El Dorado group of three claims, owned by Lee Brothers & Barney, through all of which a ledge at least ten feet wide can be traced. A shaft is down fifteen or twenty feet on each claim and openings along the ledge show free gold on the surface, assays ranging from $10 to $35, mostly in gold. The same owners have the Sunnyside a mile further west, on a ten-foot ledge of free milling ore, which assays $15 to $20 gold and silver from a twenty-five foot shaft.

Flowing into the Sinlehekin from the south side of Gold Hill is Cecile Creek, which has on its banks some rich ledges of iron and copper pyrites. On the Little Falls H. M. Redmond has a two-foot vein of quartz exposed throughout the depth of a fifty-foot shaft, and assaying from $20 to $350 gold. The Hercules, owned by the Hercules Mining Company, of Pittsburg, has an iron cap eighty feet wide between walls of diorite, running east and west and pitching north about 45 degrees. Several cross-cuts on the cropping have traced the cap rock for over a mile, for which distance it has been located. Surface assays give $2 gold, 5 to 9 ounces of silver and traces of copper, and development, which is now being prosecuted, shows high-grade gold-copper ore.

On Douglas Mountain, south of Cecile Creek, are a series of ledges of quartz running high in gold. The country formation is granite, like that of Gold Hill, and the ledges are in a porphyry dike running northeast and southwest, carrying more copper than those of Gold Hill. The first location was the Utica, by D. G. Chilson, John Boyd, Daniel Mulcahy and H. M. Perdue, who have a shaft fifty-eight feet on the hanging wall, showing ore the full width of five feet. An open cut from the footwall seventy-five feet from the shaft runs thirty feet toward the latter and is all in vein matter heavily impregnated with hematite. Assays average $12 to $15 in gold, silver and copper. On the Oro Fino, the northeast extension of the Utica, D. G. Chilson and John Woodruff have a cross-cut twenty feet and a shaft fifteen feet, showing a vein four feet wide, which assays as high as $60 gold. On the Red Jacket, a mile north of the Utica, R. H. Redmond has a shaft forty feet on a three-foot vein of fine ore, from which he sorted and shipped two tons of the highest grade and obtained returns of $80.

Across the Sinlehekin from Mount Douglas and Gold Hill is Aeneas Mountain, a ridge extending many miles south of Loomis and rising to a height of 2,800 feet above the town, on which are a series of parallel ledges of iron and copper pyrites, carrying gold and wearing red iron caps. The ledges run northeast and southwest across the granite and diorite formation. Seattle men are most active on this mountain, having joined with Loomis

citizens to form the Detroit-Windsor Mill and Mining Company and develop the Detroit-Windsor group of five claims, seven miles south of Loomis. Three claims are on a ledge capped with iron for a width of fourteen feet, with granite and diorite for the hanging wall and granitic porphyry for the footwall, the ledge cutting the formation up the mountain and being traced through the three claims. A shaft is down 100 feet, showing iron and copper pyrites, and a cross-cut at the ninety-foot level shows it to have widened to eighteen feet. Assays have ranged from $10 gold and 2 per cent. copper to $35 for both values, the copper ranging from 2 to 5 per cent. and the average value being $15 to $20 for the whole width of the ledge. The two other claims are on a parallel ledge lower down the mountain. The work so far done has demonstrated the permanence and value of the ledge. The shaft will now be continued to a depth of 120 or 130 feet and then a cross-cut will be run to tap the ledge at a depth of 400 feet. The nature of the ground makes it possible to attain a depth of 1,000 feet with a 1,500-foot cross-cut.

The two ridges of Aeneas Mountain which shut in Horse Spring Coulee have become the scene of mineral locations for a distance of six miles. The principal group here is the Treasury, of six claims, on which M. F. McConkey has been working for five years and in which he lately interested a Seattle company. Four claims are on a twenty-four foot ledge of rose quartz, on which a shaft is down eighty feet in ore assaying about $80 gold, and a number of open cuts have been made. A cross-cut has been run 200 feet and has cut a parallel ledge, the expectation being that in 800 feet more it will cut the main ledge at a depth of 500 feet. Assays run from $8 gold upwards and some of it has been milled in an arrastre.

Further to the east, on the same ridge, Ed Manuel and a number of others have located a string of claims on a belt of iron-capped ledges of sulphide ore, which has been traced for three miles north and south and for a width of two miles east and west. The ledges are twenty to thirty feet wide between diorite walls, and surface assays show $2 to $4 gold and 8 per cent. copper, while some have run as high as $70.

THE COLVILLE RESERVATION.

This broad stretch of country, comprising the central part of the northern half of Washington, had long been a forbidden land to the ubiquitous prospector, when, on February 20, 1896, the northern half of it was thrown open to mineral entry. It is usual to exaggerate the unknown, and the great mineral discoveries made on the north, east and west had given good ground for the general belief that this land, given over to the Indian farmers and hunters, abounded in mineral deposits of great wealth. Actual observation has confirmed this belief, and development on quite a number of claims during the past year has proved the previously accepted theory that the area of eruptive rock veined with sulphide ore, which has made Trail Creek famous, is only one of a series of such areas extending throughout the country to the south and west. Many of the ledges of sulphide ore have proved to be equally rich in gold with the average of those in Trail Creek, and some far richer in copper than the best in that district, nor do they yield anything in the size of the ore bodies. On the eastern border of the reservation is a belt of galena ledges, and over to the northwest, on Myers Creek and its tributaries, and on the head waters of Eureka Creek, is a belt of free-miling ore bodies of immense size. The sulphide ore belt seems to cover the greater part of the country opened, for it has been traced through the whole strip extending from the boundary south to Kettle Falls, between the Columbia and Kettle Rivers; also along the watershed of Kettle River, where it flows meandering from west to east.

The reservation is fast being made accessible from all directions by means of roads, although no railroad as yet enters its confines. From the west the Great Northern Railroad will take you 174 miles to Wenatchee, and the Columbia River steamer City of Ellensburg will carry you on to Johnson Creek, 130 miles, during the period of high water, which is from May 1 to August 1. Thence the journey must be made on horseback, ten miles up the Okanogan River road to Tenasket schoolhouse, thirty-three and one-half miles by the state road to Curlew Lake and thirty miles down Curlew Creek to Kettle River. From the east the starting point is Spokane, whence the Spokane Falls & Northern Railroad will take you 102 miles to Marcus, 110 miles to Bossburg or 130 miles to Northport. The state road runs from Marcus up Kettle River and across country to Curlew Lake, which is the center of the northern half of the reservation, to which all roads lead. Roads also cut across country from Bossburg and Northport to Empire Camp, Pierre Lake and other mining centers which have sprung up within a year, ferries crossing the Columbia at all these towns. The route from the south is by the Central Washington Railroad from Spokane to Wilbur, ninety-one miles, and thence by road across the Big Bend and up the Sans Poel River to Eureka Camp, sixty-two miles, this road connecting with that leading down

Curlew Creek. The Sans Poel & Columbia River Ferry & Transportation Company has established a free ferry on the Columbia at the mouth of the Sans Poel, and will complete the forty-eight miles of road to Eureka Camp by the end of April. This will materially reduce the distance by the present Sans Poel trail.

Reliable information as to the geology of this great area is scanty, and is only obtainable in scraps as to restricted tracts of country which have come under the personal observation of some individual. The simile applied to the Trail Creek country by Mr. Woodhouse, quoted in another chapter, would seemingly apply here also. As water pours through a hole broken in ice, so the eruptive rocks have burst through the older formation in patches and are generally veined with sulphide ore ledges, the richest of which are found along the edges of the area of eruption. The country rock is generally diorite, as in Trail, and the ledges have the same characteristics in the sulphide ore belt. This description applies to the eastern and northeastern part of the reservation. In the northwest different characteristics prevail, which will be described later in this chapter.

Within a few miles of the boundary, on the mountains through which Sheep Creek flows from Red Mountain into the Columbia River, there is an extension southward of the Trail Creek formation, in which much development work is being done. On a series of five iron-capped ledges, ten to fifty feet wide, running northwest and southeast between walls of syenite and diorite, is the Birton group of twelve claims, owned by the Birton Gold Mining & Milling Company. A shaft is down thirty-five feet on one ledge, showing the gold value to increase from $3 on the surface to $10, in iron and copper pyrites, and a contract has been let for 100 feet more on this shaft. The property is only one and one-half miles from the Red Mountain Railroad and six miles from Northport, where the erection of a smelter is under contemplation, and in that case freight and treatment would cost only $7.

Adjoining the Birton, the Fidelity Gold & Copper Company has the Fidelity group of six claims on an eight-foot ledge. A seventy-six-foot shaft shows thirty inches of pyritic ore, assaying $12.80 gold, 4 per cent. copper, and two smaller shafts and a thirty-foot tunnel show low grade ore throughout.

On a mountain rising from Sheep Creek, three miles by wagon road from the Red Mountain Railroad and twelve miles from Northport, is the Rich Four group of four claims, which the Rich Four Mining & Milling Company is developing. Three claims are on an iron-capped ledge cropping forty to 100 feet wide through their whole length in a ravine with perpendicular walls fifty to 150 feet high. The ledge is slate mixed with white quartz, all more or less mineralized with gold, one streak of quartz showing near the hanging wall. The other claim is on a similar ledge sixty feet wide, across the summit of the mountain.

The greatest showing so far on this part of the reservation is on the Big Iron, one and one-half miles from the boundary, five miles from the Red Mountain Railroad and eight miles north of Pierre Lake, which the Big Iron Mining Company is opening. Some conception of the extent of the surface showing can be formed from the fact that the location was made by a man so ignorant of the mining laws that he only covered the actual area of the outcrop, and yet this is a tract 450x250 feet. This is a huge blowout of blue iron, in some places twenty to thirty feet thick, covering a body of gold-copper ore, of which diligent development has failed to define the extent. A shaft is down seventy-five feet, all in mineral, and a cross-cut 110 feet is also all in mineral and has not struck either wall, passing through two good pay streaks seven and two feet wide. The pay ore is iron and copper pyrites, assaying ½ to 1½ ounces gold, 2 to 5 ounces silver and 3½ to 5 per cent. copper, while the ledge matter is very silicious, with the mineral apparently free, carrying $1 to $10 gold and very little copper.

Adjoining this property, on the same and parallel ledges, is the Little Iron group, owned by L. D. W Shelton, W. C. Morris and Edward Maloney.

Ore of the same character as at Trail Creek, but often running higher in copper, is being taken out of a number of properties around Pierre Lake, which is about midway between the Columbia and Kettle Rivers, some miles south of the boundary and sixteen miles from Bossburg. The ledges in this district are enclosed in porphyry dikes filling true fissures in diorite and syenite, striking northeast by southwest.

The Little Giant Mining Company has sunk 100 feet on the Little Giant, following three feet of copper pyrites, which assays over $100 gold and copper. At forty feet the shaft broke through the supposed hanging wall into more ore of the same grade. A drift is being run from the shaft and 100 sacks of ore have been shipped, being hauled over a road built by the company.

The Bald Eagle Gold Mining Company is developing the Bald Eagle group of five claims in the same district. Three claims are on a ledge which has been traced through them and through ten adjoining claims. It crops ten feet wide and shows somewhat greater width in a thirty-five-foot shaft. Another claim is on a parallel and the fifth on a cross ledge, which have been clearly traced by croppings. Work on the shaft was stopped by water and ore gas—the latter a favorable indication—but will be resumed when a

pump and fan have been erected. The surface ore assayed $7 gold and 4.14 per cent. copper.

The Syndicate group of five claims, owned by the Syndicate Gold Mining Company—an allied corporation to the Bald Eagle—has two claims on parallel ledges cropping three to six feet wide and running through into a third claim, which is located crosswise. A cross-cut, which is in twenty-five feet, will tap one ledge in fifteen feet more, when drifts will be run both ways. Another claim in the group has an iron capping four or five feet wide, thoroughly mineralized, and a fifth has four feet of ore in a fifteen-foot shaft, assaying $13 gold, $2.17 silver and 19 per cent. copper.

The Little Gem group of four claims, three miles northwest of Pierre Lake, owned by the Lincoln Mining & Development Company, has a quartz ledge cropping two and one-half inches wide and increasing to nine inches in a seventy-five-foot shaft. Assays have run 34 ounces silver, $3.60 gold and 5 per cent. copper.

Two miles east of Pierre Lake the Colville Gold Mining Company has the Mackinaw group of four claims. Three of these are on an iron-capped ledge thirty feet wide, traced for 2,000 feet, which a short inclined shaft shows to be heavily charged with chalcopyrite, increasing every foot. Another claim is on a parallel ledge of the same character, on which a shaft is being sunk. The same company has the Fidalgo on a twenty-five-foot ledge at the foot of Jumbo Mountain, one mile south. Near the head of Pierre Creek this company has the Eldorado group of four claims on three ledges which have been traced for over a mile, and it also has two claims in the Curlew Camp and three in the Eureka Camp. The company proposes to sink a shaft on the Mackinaw group.

Near the head of Pierre Creek and eight miles from the Spokane Falls & Northern Railroad, the Churchill Mining & Milling Company has the Churchill group of four claims on three ledges of sulphide ore of great width. A shaft is down thirty feet on one of these, in a good body of ore, carrying gold, with gray copper and chalcopyrite coming in. Assays at five feet were $6.40 and at thirty feet $18.60 in all values.

Five miles southeast of Pierre Lake and ten miles northwest of Bossburg, the Centennial Mining & Smelting Company is sinking on the Centennial group of ten claims, which has an iron cap over six feet deep. A sixty-foot shaft cut three streaks of arsenical iron ore, assaying $8 to $18 gold and copper. The shaft will be sunk forty feet more and then a drift will be run on the dip of the ledge, which is expected to show the streaks all running together.

Near the sources of Flat Creek, ten miles west of Northport, the Quadra Mining Company will this spring begin development of the Quadra group of four claims. The cropping is an iron cap twenty-five feet wide and a twenty-eight-foot cross-cut has pierced the footwall and run three feet on mineralized ledge matter, assaying $4 gold, $1.17 silver, besides copper.

West of this group the Searchlight Gold Mining Company has the Searchlight group of four claims on two ledges, which crop about forty feet wide.

On the north fork of Fifteen-Mile Creek the Alert Gold Mining Company has five claims on as many different ledges, ranging from ten feet upwards. A forty-eight-foot cross-cut has shown four feet of ore in one of them, carrying $6 gold, besides silver and copper.

On Iron Mountain, at the head of Flat Creek, R. B. Lane and Ledgerwood Bros. have the Lafayette group of four c laims on an iron capping 100 feet wide, and on the divide between Flat and Pierre Creeks they have the X-Ray group of eight, on which an iron cap forty-four feet wide has been traced 2,000 feet.

The Seattle Gold & Copper Mining & Milling Company will this season develop the Lucky Dog group of seven claims on several ledges between Pierre Lake and Saratoga Mountain, with a placer claim on Kettle River. Two claims are on a ledge near Pierre Lake cropping four feet, on which a fifteen-foot cross-cut shows streaks of sulphide ore aggregating eighteen inches. This cross-cut is being continued to strike the ledge in sixty feet, when drifts will be run. Four more are on two similar ledges two and one-half miles from Bossburg, and another is on Toulou Mountain, west of the Kettle River wagon road, which shows pyrites in the croppings, but has not yet been defined.

The Kettle River Mining & Milling Company has the Saratoga group of six claims on the ridge between Kettle and Columbia Rivers, from two to five miles up the road from Marcus. The Saratoga is on a mountain of the same name, on which there is an iron cap 200 feet wide. A sixty-foot cross-cut shows the whole ledge to be mineralized with copper and iron sulphides, and has cut three streaks of solid ore, each about six inches wide, assaying $47.80 in gold, silver, copper and lead. The five other claims are all on one large iron-capped ledge two and one-half miles further south, in which an open cut 200 feet long and ten feet wide showed ore assaying $4.95 gold, and a trace of silver, besides copper.

The Sunnyside Group Mining Company has great ore bodies on its seven claims, immediately south of the last-named group. There are two parallel ledges, with four claims on one and three on the other. A cross-cut, after running fifteen feet through diorite, has passed for forty-eight feet through

ledge matter carrying streaks of sulphide ore, and has not struck the hanging wall. A shaft is down twenty feet in ore, four assays of which ran from $21 to $48 in gold, silver and copper, including 14 per cent. copper. The company is installing a steam drill and hoist.

On the Nest Egg, at the rock cut in the stage road fifteen miles from Bossburg, T. S. Burgoyne, Hon. W. C. Jones, Dr. Edward Pittwood and W. W. Stearns have an iron-capped ledge in which a 100-foot tunnel shows good ore, carrying gold, silver and copper.

On the Scotia, on Toulou Mountain, a 200-foot cross-cut has tapped an eighteen-foot ledge of sulphide ore.

Adjoining the Sunnyside is the Empire group of four claims on a ledge of sulphide ore cropping thirty to eighty feet wide, the iron capping of which carries from $4 to $7 gold. The Empire Mining Company is now beginning development.

On the mountain fronting Northport from the east bank of the Columbia River, and within one and one-half miles by wagon road from the Red Mountain Railroad, is a series of ledges of galena and sulphide ore, of great size, which were the prize of a hot race between prospectors on the night of the opening of the reservation. They crop very clearly for over a mile parallel with a broad silicate dike, which is plainly visible from the opposite bank of the river, and runs northeast by southwest. The first location was the Mountain View or Contention, which is the subject of a contest among rival claimants. It shows eight inches of galena in the croppings, and in a forty-seven-foot shaft on the side of the mountain shows a good body of galena and sulphides.

On the extension of this ledge and on parallel ledges, the Colville Reservation Mining Company has the Mountain View Extension group of four claims. The Mountain View ledge has been tapped by a seventy-five-foot cross-cut, which shows four feet of ore carrying galena and sulphides and assaying $11 to $64 in gold and silver, but has not yet reached the further wall. A winze will now be sunk from the face of the cross-cut.

The Coyote group of three claims, which has been bonded for development by William Adams and others of Northport to John Leary, George Kinnear and A. H. Manning, of Seattle, has a cropping at least fifteen feet wide and in a fifty-foot shaft shows ten to thirty-six inches of ore, carrying $30 gold and silver. This shaft will be sunk to the 200-foot level this summer, and a test shipment of twenty tons will be made when spring opens.

The White Horse, owned by A. W. Ryan, is on the Mountain View extension, and the Bald Eagle, by Messrs. Harris, McFadden and others, is on the supposed extension.

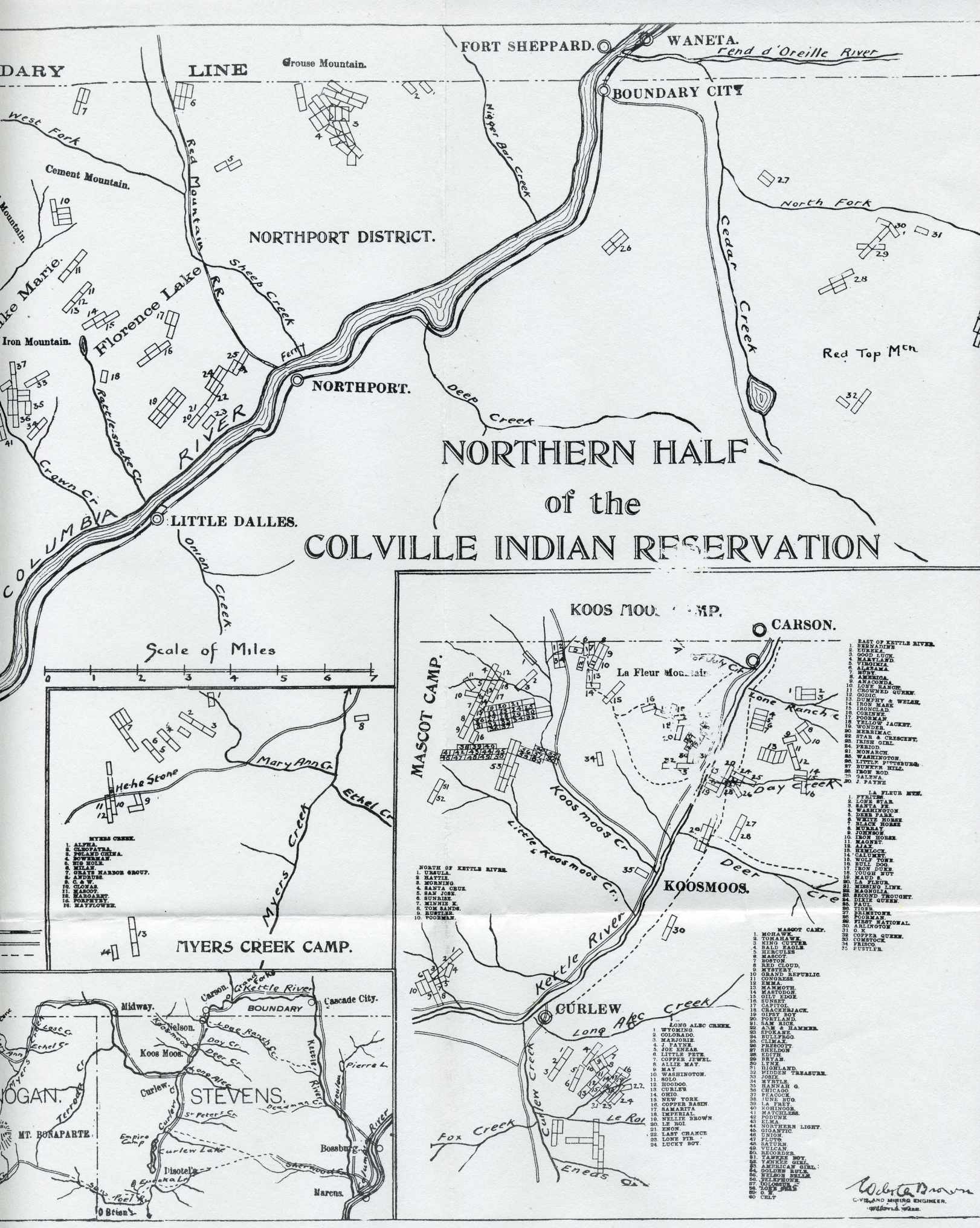
On one of these ledges, ten to twenty feet wide, between walls of slate and diorite, the White Otter Gold & Silver Mining Company has the White Otter, which will be developed this year. The ledge matter is lime quartz, with streaks of porphyritic quartz, and one ore chute of gold-bearing galena is exposed in the croppings. It cuts an abrupt hill at right angles, so that, by tunneling, great depth can be attained at short distance.

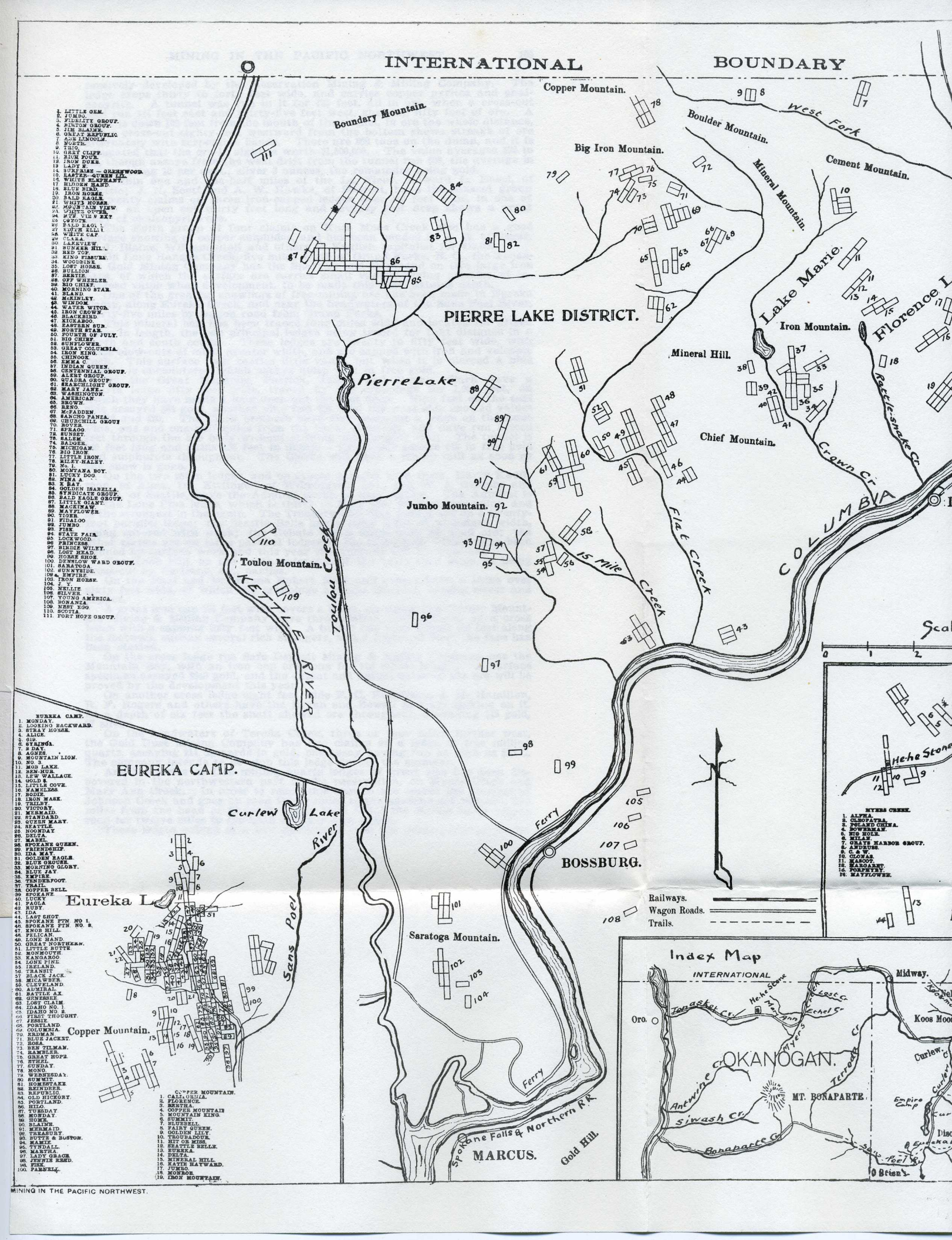
On three of these ledges the Northport Development Company has the Iron Horse group of nine claims, through which the quartz has been traced. On the Mountain View ledge a cross-cut of forty feet is all in mineralized quartz, with eight feet of ore, and a shaft is down forty-five feet. Another ledge has an iron cap thirty to forty feet wide and the third is three or four feet, showing galena. Surface ore assayed $14 to $25 gold, silver and copper. The company will run a 400-foot cross-cut, tapping two ledges at a depth of 350 feet.

The most famous series of mineral croppings on the reservation is on La Fleur Mountain, at the head of Koos Moos Creek, directly south of the boundary, being an extension of Smith's Camp in the Boundary Creek district. The La Fleur was discovered years ago, and numbers of men have since been carrying specimens of peacock copper from it as evidence of the mineral wealth that awaited development in this closed country. The result was the systematic movement in the winter of 1895-6 for the opening of the northern half of the reservation to mineral entry, which was crowned with success on February 20, 1896. A race for the La Fleur from Marcus followed between several rival claimants, and contesting locations were made. The ground of one claim was that congress had opened the reservation by an act passed in 1892, and that the president's proclamation was unnecessary, all locations made in the interval being valid. This claim was sustained by the United States courts, and the contest has recently been compromised between the Comstock and La Fleur companies, the La Fleur being now held as the Butte, together with its extension, the Comstock, by the Comstock Mining & Milling Company.

The croppings of this ledge were great masses of peacock copper or bornite forty to fifty feet wide. A shaft fifty feet deep shows the ledge five feet between walls, with two and one-half feet of solid ore averaging $75 a ton, viz., 30 to 45 per cent. copper and the remainder in silver. On the Comstock a shaft has been sunk making a similar showing.

The Lone Star and Washington group of eight claims is on the extension of the La Fleur ledge to within 154 feet of the boundary, and is being ex-


DARY LINE
Grouse Mountain.
FORT SHEPPARD.
WANETA.
Pend d'Oreille River
BOUNDARY CITY
West Fork
Cement Mountain.
Red Mountain
Nigger Bar Creek
NORTHPORT DISTRICT.
Cedar Creek
North Fork
Florence Lake R.R.
Sheep Creek
Iron Mountain.
Red Top Mtn
Rattle-snake Cr.
NORTHPORT.
Deep Creek
RIVER
Crown Cr.
COLUMBIA
LITTLE DALLES.
Onion Creek
NORTHERN HALF
of the
COLVILLE INDIAN RESERVATION
Scale of Miles
0 1 2 3 4 5 6 7
Mary Ann Cr.
Hehe Stone
Ethel Cr.
Myers Creek
MYERS CREEK CAMP.
MYERS CREEK.
1. ALPHA.
2. CLEOPATRA.
3. POLAND CHINA.
4. BOWERMAN.
5. BIG HOLE.
6. MILAN.
7. GRAYS HARBOR GROUP.
8. ANDRUS.
9. C. & W.
10. CLOVAR.
11. MASCOT.
12. MARGARET.
13. PORPETRY.
14. MAYFLOWER.
KOOS MOOS CAMP.
CARSON.
MASCOT CAMP.
La Fleur Mountain
Lone Ranch Cr.
Day Creek
Koos moos Cr.
Little Koosmoos Cr.
KOOSMOOS.
Deer Cr.
Kettle River
CURLEW
Long Alec Creek
Curlew Creek
Fox Creek
Le Roi
Eneas Cr.
EAST OF KETTLE RIVER.
1. BERNADINE
2. EUREKA.
3. GOOD LUCK.
4. MARYLAND.
5. VIRGINIA.
6. ALABAMA.
7. BURT.
8. AMERICA.
9. ANACONDA.
10. LONE RANGER.
11. CROWNED QUEEN.
12. GODIC.
13. DUMPHY & WELSH.
14. IRON MASK
15. IRONCLAD.
16. CORINNE.
17. POORMAN.
18. YELLOW JACKET.
19. WONDER.
20. MERRIMAC.
22. STAR & CRESCENT.
23. IRISH GIRL.
24. PERIOD.
25. MONARCH.
26. WASHINGTON.
27. LITTLE PITTSBURG.
28. BUNKER HILL.
29. IRON HOD.
30. SALENA.
J. PAYNE
LA FLEUR MTN.
1. FYRITES.
2. LONE STAR.
3. SANTA FE.
4. WASHINGTON.
5. DEER PARK.
6. WHITE HORSE.
7. BLACK HORSE
8. MURRAY.
9. JOHNSON.
10. IRON HORSE.
11. MAGNET.
12. ATLAS.
13. HEMLOCK.
14. CALUMET.
15. WOLF TONE.
16. BULL DOG.
17. IRON DUKE.
18. TOUGH NUT
19. MAUD S.
20. LA FLEUR.
21. MISSING LINK.
22. MAGNOLIA.
23. SECOND THOUGHT.
24. DIXIE QUEEN.
25. PAUL.
26. TIGER.
27. BELMONT.
28. POORMAN.
29. FIRST NATIONAL.
30. ARLINGTON.
31. O. K.
32. COPPER QUEEN.
33. COMSTOCK.
34. FRISCO.
35. FUSTIFER.
NORTH OF KETTLE RIVER.
1. URSULA.
2. HATTIE.
3. MORNING.
4. SANTA CRUZ.
5. SAN JOSE.
6. SUNRISE.
7. MINNIE K.
8. TOM SANDS.
9. RUSTLER.
10. POORMAN.
MASCOT CAMP.
1. MOHAWK.
2. TOMAHAWK.
3. KING CUTTER.
4. BALD EAGLE.
5. HERCULES.
6. MASCOT.
7. BOSTON.
8. RED CLOUD.
9. MYSTERY.
10. GRAND REPUBLIC.
11. CONGRESS.
12. EMMA.
13. MAMMOTH.
14. MASTODON.
15. GILT EDGE.
16. SUNSET.
17. CAPITOL.
18. CRACKERJACK.
19. GIPSY BOY.
20. PORTLAND.
21. SAM RICE.
22. A.M. & HAMMER.
23. ENGLAND.
24. BULLFROG.
25. CLIMAX.
26. PRESCOTT.
27. SHELDON
28. EDITH.
29. BRYAN.
30. LYNX.
31. HIGHLAND.
32. HIDDEN TREASURE.
33. JORIE.
34. MYRTLE.
35. HANNAH G.
36. CHICAGO.
37. PEACOCK.
38. JUNE BUG.
39. LA FREY.
40. KOOTENOSE.
41. MATCHLESS.
42. PODUNK.
43. ELNA.
44. NORTHERN LIGHT.
45. GIGANTIC.
46. UNION.
47. PLUTO.
48. SATURN.
49. VULCAN.
50. RECORDER.
51. YANKEE BOY.
52. YANKEE GIRL.
53. AMERICAN GIRL.
54. GOLDEN RULE.
55. NELSON BELLE.
56. TELEPHONE.
57. COLOGNE.
58. LONE STAR.
59. D. B.
60. CELT
LONG ALEC CREEK.
1. WYOMING
2. COLORADO.
3. MARJORIE.
4. J. PAYNE.
5. JOE ENEAR.
6. LITTLE PETE.
7. COPPER JEWEL.
8. ALLIE MAY.
9. MAY
10. WASHINGTON.
11. SOLO.
12. HOODOO.
13. CURLEW
14. OHIO
15. NEW YORK.
16. COPPER BASIN.
17. SAMARITA
18. IMPERIAL.
19. NELLIE BROWN.
20. LE ROI.
21. ENON.
22. LAST CHANCE
23. LONE PIR.
24. LUCKY BOY.
Webster Brown
CIVIL AND MINING ENGINEER.
SPOKANE, WASH.
Midway.
Carson.
Kettle River
Cascade City.
BOUNDARY
Nelson.
Koos Moos.
Long Ranch Cr.
Day Cr.
Deer Cr.
Lone Alec
Curlew Cr.
Curlew
Kettle River
Pierre L.
Curlew L.
STEVENS.
St. Peter's Cr.
Deschamps Cr.
Empire Camp
Curlew Lake
Bossburg.
Dimotel's
Eureka Lake
Sherwood Cr.
Marcus.
O'Brien's
Last Cr.
Ethel St.
Mary's Cr.
Terrace Cr.
OGAN.
MT. BONAPARTE.



1. LITTLE GEM.
2. JUMBO.
3. FIDELITY GROUP.
4. BINTON GROUP.
5. JIM BLAINE.
6. GREAT REPUBLIC.
7. ABE LINCOLN.
8. NORTH.
9. TRIO.
10. GRAY CLIFF.
11. IRON FOUR.
12. IRON DUKE.
13. LADY M.
14. SUNBEAM — GREENWOOD.
15. EASTER QUEEN LD.
16. WHITE ELEPHANT.
17. HIDDEN HAND.
18. BLUE HEAD.
19. IRON HORSE.
20. BALD EAGLE.
21. WHITE HORSE.
22. MOUNTAIN VIEW
23. WHITE QUEEN.
24. PIN VIEW EXT
25. COYOTE.
26. BALD EAGLE.
27. SUPER ELD.
28. WHITE CAP.
29. CLARA.
30. LAKEVIEW.
31. BUNKER HILL.
32. RED TOP.
33. KING SISBURN.
34. WOODBINE.
35. LOST HORSE.
36. BULLION
37. BENTIE.
38. OFF WHEELER.
39. BIG CHIEF.
40. MORNING STAR.
41. BLAND.
42. McKINLEY.
43. WINDOM.
44. WATER WITCH.
45. IRON CROWN.
46. BLACKBIRD.
47. KICKAROO.
48. EASTERN SUN.
49. NORTH STAR.
50. FOURTH OF JULY.
51. BIG CHIEF.
52. SUNFLOWER.
53. GREAT COLUMBIA.
54. IRON KING.
55. CHINOOK
56. EMMA C
57. INDIAN QUEEN.
58. CENTENNIAL GROUP.
59. ALERT GROUP.
60. QUADRA GROUP.
61. SEARCHLIGHT GROUP.
62. MARY JANE.
63. WASHINGTON.
64. AMERICAN
65. BROWN.
66. RENO.
67. McFADDEN
68. RANCHO PANZA.
69. CHURCHILL GROUP
70. ROVER.
71. SPRAGG.
72. SUNSET.
73. SALEM.
74. BADGER.
75. MICHIGAN.
76. BIG IRON.
77. LITTLE IRON.
78. MILEY-HALEY.
79. No. 1.
80. MONTANA BOY.
81. LUCKY DOG.
82. NINA A
83. X RAY.
84. GOLDEN ISABELLA.
85. SYNDICATE GROUP.
86. BALD EAGLE GROUP.
87. LITTLE GIANT.
88. MACKINAW.
89. MAYFLOWER.
90. TIGER.
91. FIDALGO
92. JUMBO
93. FISK.
94. STATE FAIR.
95. LOCKWOOD.
96. PRINCESS.
97. BIRDIE WILEY.
98. LOST HEAD.
99. HORSE SHOE.
100. DENSLOW WARD GROUP.
101. SARATOGA
102. SUNNYSIDE.
103. ENFIRE.
104. IRON HORSE.
105. NELLIE
106. SILVER.
107. YOUNG AMERICA.
108. BONANZA.
109. NEST EGG.
110. SCOTIA.
111. FORT HOPE GROUP.

EUREKA CAMP.
1. MONDAY.
2. LOOKING BACKWARD.
3. STRAY HORSE.
4. ALICE.
5. GUS.
6. STRING.
7. 2 DAY.
8. AGNES.
9. MOUNTAIN LION.
10. NO. 3.
11. MOB LAKE.
12. DEN-HUB.
13. LEW WALLACE.
14. GOLD S.
15. LITTLE COVE.
16. NAMELESS.
17. BOONE.
18. IRON MASK.
19. TRILBY.
20. VICTORY.
21. MERMAID.
22. STANDARD.
23. QUEEN MARY.
24. SEATTLE.
25. NOONDAY
26. DELTA.
27. MABEL.
28. SPOKANE QUEEN.
29. FRIENDSHIP.
30. IDA MAY.
31. GOLDEN EAGLE.
32. BLUE GROUSE.
33. MORNING GLORY.
34. BLUE JAY.
35. EMPIRE.
36. TENDERFOOT.
37. TRAIL.
38. COPPER BELL.
39. SPOKANE.
40. LUCKY
41. PAOLA
42. RUBY.
43. IDA
44. LAST SHOT.
45. SPOKANE FTN NO 1.
46. SPOKANE FTN NO. 2.
47. KNOB HILL.
48. PELICAN.
49. LONE HAND.
50. GREAT NORTHERN.
51. LITTLE BUTTE.
52. MONMOUTH.
53. KANGAROO
54. LONE PINE.
55. IRELAND.
56. TRANSIT
57. BLACK JACK.
58. MICAWBER.
59. CLEVELAND
60. ADMIRAL.
61. BATTLE AX.
62. GUNNESEE.
63. LOST CLAIM.
64. IDAHO NO. 1
65. IDAHO NO. 2
66. FIRST THOUGHT.
67. JESSIE.
68. PORTLAND.
69. COLUMBIA.
70. ERDMAN.
71. BLUE JACKET.
72. ROSA.
73. BEN TILMAN.
74. RAMBLER.
75. GREAT HOPE.
76. ETHEL.
77. SUNDAY.
78. MONO.
79. WEDNESDAY.
80. SUMMIT.
81. HOMESTAKE.
82. REINDEER.
83. REPUBLIC.
84. OLD HICKORY.
85. PORTLAND.
86. HILO.
87. TUESDAY.
88. MONDAY.
89. HOME.
90. BLAINE.
91. MERMAID.
92. TREASURY.
93. BUTTE & BOSTON.
94. MAMIE.
95. TYNDALL.
96. MARTHA
97. LADY GRACE.
98. JENNIE REED.
99. FINK.
100. PARNELL.

COPPER MOUNTAIN.
1. CALIFORNIA.
2. FLORENCE.
3. BERTHA.
4. COPPER MOUNTAIN
5. MOUNTAIN KING.
6. SUMMIT.
7. BLUEBELL.
8. FAIRY QUEEN.
9. GOLDEN LILY.
10. TROUBADOUR.
11. HIT OR MISS.
12. SEATTLE BELLE.
13. EUREKA.
14. DELTA.
15. MINERAL HILL.
16. KATIE HAYWARD.
17. JUMBO.
18. MONROE.
19. IRON MOUNTAIN.

MYERS CREEK.
1. ALPHA.
2. CLEOPATRA.
3. POLAND CHINA.
4. BOWERMAN.
5. BIG HOLE.
6. MILAN
7. GRAYS HARBOR GROUP.
8. AMBUSH.
9. C. & W.
10. CLONAS.
11. MARCOT.
12. MARGARET.
13. FORESTRY.
14. MAYFLOWER.

tensively developed by the Reservation Mining & Milling Company. The ledge crops thirty to forty feet wide, and carries copper pyrites and chalcopyrite. A tunnel was run in it for 125 feet, all in ore, when a cross-cut was run 144 feet east and thirty-five feet west, showing fifty feet of ore. A shaft is down 100 feet from the mouth of the tunnel, in ore the whole distance, and a cross-cut eighty feet westward from the bottom shows streaks of ore alternately with serpentine bands. There are 800 tons on the dump, and it is estimated that the ore in sight is worth $1,500,000. The value averages $30 to $40, though assays from the west drift from the tunnel ran $96, the average in copper being 10 per cent., silver 3 ounces, the remainder being gold.

Within one and one-half miles of the La Fleur, Edward L. Ensel, of Seattle; J. N. Scott and A. W. Hawks, of Everett, have the Mascot group of twenty claims on three iron-capped ledges over 100 feet wide, in one of which an open cut thirty feet long and seventy feet deep shows a great body of chalcopyrite ore.

The Edith group of four claims on Koos Moos Creek also has a good surface showing of copper sulphides, and has been bonded by A. E. aGlleger, H. J. Blaine, William Stoll and others to English capitalist for $10,000.

On Lone Ranche Creek, five miles south of Grand Forks, B. C., the Tenasket Gold Mining Company has the Sparling and Raymond on two large iron caps, of which the surface ore carries small values, giving promise of increased value when development, to be made this year, attains depth.

One of the greatest showings of free-milling ore has been made in Eureka Camp, along Eureka Creek, and near the headwaters of the Sans Poel River, thirty-five miles by wagon road from Grand Forks.

This mineral belt has been traced four miles wide and located for fifteen miles in length, the two principal ledges being traced for that distance in a north and south course. These ledges are twenty to fifty feet wide, with some blow-outs of much greater width, and are capped with iron and volcanic rock. This surface rock carries little value, but when it is pierced a blue quartz is encountered which assays quite well in free gold.

On the Great Republic, Patrick, James and Dennis Clark have a quartz ledge fifty feet wide, traced by the croppings for 1,000 feet, on which they have made a long open cut ten feet deep. Nine feet on the east side assayed $64 gold, another nine feet $24, and the west side showed values of $16 and $20. The Clark brothers have also cross-cut a ledge on the Lone Pine, one and one-half miles from the Great Republic, and have run fifteen feet through the ore body without striking the hanging wall The tunnel is 140 feet long and gains 100 feet in depth. This ledge assays $10 in free gold and sulphurets throughout. The Clarks will erect a stamp mill as soon as the snow is gone.

On the two main ledges, and on others parallel with them, Harry Kauffman, of Alma, Dr. Kittinger, of Wilmington, Del., and W. J. Grambs and others, of Seattle, have the Admiral group of nine claims. The Admiral is on the Lone Pine ledge, which is thirty to forty feet wide at this point, and is the strongest in the camp. The Treasury and Blue Jacket are on a twenty-foot parallel ledge; the Seattle Belle has a large ledge of undefined width, being covered with wash; the Rebate has a large body of good ore; the other claims are on large parallel ledges in the same belt. They have been defined by surface work and this year the Admiral will be cross-cut.

The Knob Hill, on the north extension of the Lone Pine ledge, is being cross-cut by Portland, Or., parties.

On the Paul and Brimstone Robert Neill and others have a ledge over sixty feet wide, of which the croppings average $15 gold, besides silver and copper.

A great iron cap 150 feet wide covers a ledge, on which the Copper Mountain Mining & Milling Company have three claims, with another on a cross ledge with a capping fifty feet wide. A tunnel has been driven 133 feet along the footwall, cutting several rich stringers, and a cross-cut from the face has been started.

On the cross ledge the Safe Deposit Mining & Milling Company has the Mountain Boy, with an iron cap cropipng for its whole length. A surface specimen assayed $340 gold, and the extent and actual value of the ore will be proved by the development this year.

On another cross ledge eight feet wide F. C. Robertson, J. M. Hamilton, R. F. Rogers and others have the Bryan and Sewall and are sinking on it. At a depth of six feet the shaft showed ore throughout, averaging $45 gold, $7 silver.

On the headwaters of Teroda Creek, three or four miles further west, the Gold Dust Mining Company has two claims on a ledge of free milling quartz, assaying $14 upwards in gold, one assay having run as high as $2,675. The company intends to develop this ledge during the summer.

Another series of free milling quartz ledges of great size has been discovered in the northwestern part of the reservation, on Myers Creek and Mary Ann Creek. In order to reach this section one leaves the steamer at Johnson Creek and goes by road thirty miles to the government sawmill, five miles from the head of Sawmill Creek, then takes the Kettle River wagon road for twelve miles to the head of Mary Ann Creek.

These ledges extend in a belt northward from the three-cornered divide,

from which Mary Ann Creek flows east to Myers Creek, Rock Creek flows east to Kettle River and Sawmill Creek flows southwest to the Okanogan River. It cuts through a series of four great, bald buttes extending northward, in diminishing size, from Mount Bonaparte to the boundary, and formed of quartzite. The country rock is metamorphic slate, cut by dikes of porphyry.

The Hehe group, five miles southwest of the Hehe stone, is owned by A. E. Anrud and J. H. Calvert, and covers five parallel ledges of free-milling quartz. One ledge is fourteen feet wide, and in a ten-foot shaft shows ore carrying $30.80 gold and silver, only a small part of the value being silver. Another ledge twenty feet wide runs up the mountain from Hehe Stone, and assays $6 to $8 free gold on the surface, while a third shows several seams of quartz carrying $4 to $8 gold on the surface.

Five miles southwest of this group and due north of Mount Bonaparte, Messrs. Calvert and Anrud have the Porphyry group of five claims on a porphyry dike eighty feet wide and parallel with it. In this dike a sixteen-foot ledge of quartz crops on three claims, as defined by an open cross-cut, and shows colors in panning, while an assay ran about $12 gold.

The greatest and richest showing in this vicinity is on the Big Hole, at the forks of Mary Ann Creek, eight miles south of Camp McKinney, owned by George King, Charles Armstrong, C. P. Devine and Neal Undem, of Seattle, who have resumed work. The ledge is thirty to forty feet wide, of honeycombed quartz, and carries from a trace to $18 free gold, with two feet of pay ore, the lowest assay of which was $108.50 gold and the highest $600 gold, 218 ounces silver. The indications are that at depth the ore will change to galena. The same parties have the Cleopatra, on which an open cut shows eleven feet of ore with only one wall in sight. A number of small streaks of ore run through, assaying $18 to $20 gold and 8 to 18 ounces silver, and small particles of galena carrying gold and silver are discovered all through the ledge matter. It is intended to sink fifty feet on each ledge and then cross-cut to define the width.

On the extension of the Cleopatra, A. Walker has the Wenatchee, on which the ledge crops twelve feet wide between slate walls, and carries free gold and a little sulphurets in a slate and quartz gangue. A small shaft showed ore assaying $12 to $28.

The Columbia, on the boundary, has another great body of quartz 250 feet wide, an average sample of which showed $10 free gold.

On the Poland China, Neal Undem and Jerome Haskins have stripped the ledge for 100 feet in width and have not found either wall. The quartz carries free gold throughout, assaying all the way from $2.50 to $600.

Eight miles up Myers Creek from Kettle River and one and one-half miles from the boundary, P. H. Pingston has the Pingston claim on a blow-out of arsenical iron 50x100 feet, of which the decomposed surface rock assays $4 to $16 gold.

The Chicago and New York are on a ledge of sulphide ore, carrying $4 to $12 gold and copper in a quartz gangue, which a ten-foot open cross-cut shows to be nine feet wide.

Near the source of Myers Creek, Senator Turner, Congressman Jones, United States Attorney Brinker and Deputy Marshal Vinson have the Bimetallic on a seven-foot ledge of sulphide ore, assaying 12 per cent. copper, 6½ ounces silver and $2 to $3 gold.

Another great body of white and grey honeycombed quartz crops 200 feet wide on the Andruss, one and one-half miles south of the boundary and fifteen miles northeast of Oro, the owner being the Tenasket Gold Mining Company. Surface prospect holes have shown free-milling ore assaying $2.62 to $74.80 gold.

Placers are extensively worked during the summer on Myers, Fourth of July and Deadman Creeks, and in some instances have paid good wages, even for work with pan and rocker. Deadman Creek is located for eight or nine miles, the dirt panning as much as 40 cents a yard, not only in the creek-bed but in the high bars, rising 250 feet above it, and hydraulic mining ought to be profitable here.

NORTHPORT.

This town is not only the junction of the several branches of the Spokane Falls & Northern Railroad leading to Trail Creek and Nelson, but is the center of an organized mining district extending from the Kettle River eastward to the Metaline District and from the boundary southward to Bossburg. The part ofthis district between the Columbia and Kettle Rivers is described in the chapter on the Colville Reservation. The section east of the Columbia comprises part of the belt of silver-bearing country, of which the Slocan, Ainsworth and Nelson Districts on the north and the Colville and Cedar Canyon Districts on the south have experienced most development. The principal work now in progress is on Red Top Mountain,

east of Northport between the forks of Cedar Creek, and on the headwaters of that stream and on Deep Creek. At the head of Deep Creek the ore is principally galena and carbonates, with some azurite of copper, red oxide of copper and gray copper. At the head of Cedar Creek the ores are all silver-lead and carbonates, while directly east and south of Northport the ores are lead and gray copper, and at Little Dalles are of the same character. The district has the advantage of wagon roads to Northport, making transportation to the railroad cheap and easy, and the contemplated erection of a smelter at that town by the Union Smelting and Refining Company, composed of strong capitalists, holds out the prospect of reduction almost on the ground.

On Red Top Mountain, three miles in a direct line and five miles by wagon road from Boundary Station on the Spokane Falls & Northern Railroad, is the Clara group of four claims, owned by the Trail Creek Midland Mining Company, which is actively developing. Of the two ledges, one is in the contact between porphyry and slate and the other between granite and slate, the gangue being quartz carrying gold, silver and copper. A tunnel is in over 125 feet on one ledge and will be continued to 200 feet, when an upraise will be made of 150 feet and stoping will begin. A cross-cut will also be driven for 150 feet to tap the parallel ledge, when both will be worked from this tunnel. This work has shown nowhere less than six inches of good silver sulphide ore, the width frequently increasing to six feet and averaging between eighteen and twenty-four inches. A thirty-five foot winze from the tunnel at the 100-foot line shows improved value. A shipment of fifteen tons to the Tacoma smelter in October, 1896, returned $63.70 in gold, silver and copper. Ore of less value than $30 is held in the dump awaiting the erection of the smelter at Northport, ten miles distant by rail, and meanwhile the company is investigating a newly invented smelter with a view to erecting one, if a test should prove successful. The property can be developed entirely by tunneling and therefore at slight cost.

The Lakeview group, owned by the Lakeview Mining Company, consists of two claims on the same ledge and one on a cross ledge. The main ledge has been stripped for 150 feet, showing twelve to twenty inches of ore, while a 180-foot tunnel, an eighty-foot incline and a fifty-foot incline show twenty to forty inches of ore, three shafts six to ten feet deep making a similar showing. The ore carries chlorides, sulphides and bromides of silver and some native silver, and a number of assays, not only of the solid ore but of the ledge matter intervening between pay streaks, range from $8 silver and 80 cents gold in the slate gangue to $336.40 silver and $15 gold in the chlorides and bromides. One car load of this ore is said to have netted $1,100.

The Red Top Mountain Mining Company has two claims on the same mountain, on which a shaft is down 125 feet, showing the ledge to widen from seven to eight and one-half feet, with eighteen inches of galena assaying $78 in silver and lead, with a little gold, the remainder of the ledge being good concentrating ore.

On Deep Creek George Foster has a claim named after himself, on a ledge cropping twenty feet wide, on which he has worked intermittently for eight years. A number of open cuts, a tunnel of about forty feet and a shaft of about fifty feet have shown a good body of ore carrying about 40 ounces silver.

On the Iron Horse, also on Deep Creek, W. C. Taylor has a good ledge of iron and copper sulphides, on which he has sunk a small shaft, showing ore assaying $2 gold and 2 to 4 ounces silver.

On Onion Creek, which flows into the Columbia from the east seven miles below Northport, is a belt of gold-bearing sulphide ore in a quartz gangue, cut by the creek from a point two miles above its mouth. On the Alice May Messrs. Hansen, Paulson, Sherman and Roseberry have a ledge cropping twenty feet wide, in which a seventeen-foot shaft shows five feet of sulphide. The Lisburn Gold Mining Company has sunk twelve feet on the Lisburn, showing the same width of ore, and good results have been obtained on the Etna, Occidental, Wall Street and several other claims.

COLVILLE.

This district has reached a more advanced stage of development and produced more ore than any other silver district in Washington. It forms the southern half of a belt extending about ten miles east from the Columbia River across the Colville, and from the headwaters of Cedar and Deep Creeks, which empty into the Pend d'Oreille River near the boundary, southward for seventy-five miles, terminating in that direction in the Cedar Canyon District, which is described in another chapter. Like all other pioneer discoveries, it has had its alternate periods of activity and torpor, and now appears to have become the scene of renewed develop-

ment, in sympathy with the movement generally prevalent throughout the Pacific Northwest.

The formation of this belt of country is granite, lime, slate and quartzite, and is veined with a belt of bodies of silver-lead ores, running sometimes north and south and others east and west. These occur either in contacts between granite and lime, slate and lime, or slate and quartzite, or in fissures in the slate or lime. Where they occur in the lime formation the ledges show a good deal of surface disturbance, but at depth settle into permanent bodies of ore, either in chutes or veins. In the slate formation the ledges are almost invariably in place.

The first discovery was made in 1883 at the Embry camp, two miles east of Chewelah, by a party of prospectors sent out by John N. Squire, of Spokane. The ore in that section carries galena, sulphide of silver, some carbonate of lead and chloride of silver, mixed with iron and copper pyrites. A rush of prospectors followed within two years and explorations extended northward. Thus followed the discovery of the Old Dominion, seven miles from Colville, where the ledge is in a contact between granite and lime, the ore carrying bromide, chloride and sulphide of silver, with occasional bunches of galena. Then followed the discoveries at the head of Deep Creek and Cedar Creek and along the range east of the Columbia to Little Dalles, this territory being included in the Northport District. Fifteen miles further south, in the Young America at Bossburg, the ore is lead and silver entirely. Five miles further southeast, in the Big Bonanza, we find a heavy mixture of galena and iron pyrites, carrying about 40 per cent. lead and 10 ounces silver. Still traveling southward, we come to Gold Hill, two miles east of Marcus, where the ore is copper pyrites carrying gold. On Rickey Mountain, five miles more to the south, there is a great quantity of gray copper ore, but it is very much broken and no solid bodies have yet been found. Going fifteen miles onward to the south, we come to the Summit camp, where the ore carries galena and lead carbonates, and five miles to the southwest of this camp is the Wellington, with the same class of ore. Five miles south of this is the Cleveland mine, where the ore is galena carrying about 40 ounces silver. This mine is treated of in the chapter on Cedar Canyon, of which it is the pioneer. All the ores of this belt are high grade, except those of Deep Creek, where thy carry from 25 to 40 ounces silver and 40 per cent. lead.

The best developed and most productive mine in this belt is the Old Dominion, which embraces a group of claims covering the whole mountain and which is owned by the Old Dominion Mining and Concentrating Company. It is reached from Spokane by the Spokane Falls & Northern Railroad to Colville, eighty-eight miles, whence a wagon road leads to the mine, seven miles distant. The ore chute crops on the surface to a length of 400 feet in the contact between lime and granite, and in chambers forty to fifty feet wide. The mine was first developed near the surface by a series of tunnels aggregating 3,000 feet in length, attaining a depth of 250 feet. A tunnel was then driven 3,000 feet on the contact at a further depth of 400 feet and at the end of that distance struck a chamber of ore, which is now being developed. A cross-cut has also been started and has opened other small veins, ranging from six inches to twelve feet. The ore carries bromide, chloride and sulphide of silver, with some native silver, and its contents range from 25 to 125 ounces silver, with 30 per cent. lead and $3 gold. There is on the ground a concentrator with a capacity of seventy tons a day to treat the low-grade ore. The smelter returns show that about $2,000,000 has been taken out of the mine and, when shipping regularly, it produces about $16,000 a month gross, or $12,000 net, employing seventy-five men.

The Young America group of four claims is a quarter of a mile northeast of Bossburg, on the Spokane Falls & Northern Railroad, 110 miles from Spokane, and is owned by the Young America and Cliff Consolidated Mining Company. The whole property is covered with float and a ledge cropping twelve to twenty feet wide runs across all four claims. A tunnel was run 120 feet soon after discovery, at a depth of only thirty feet, and ore stoped to the grass roots. From this stope ore netting $40,000 at the smelter was taken, at a time when freight and treatment cost $30 a ton. After a long suspension, the mine was worked by lessees, who operated in the wasteful manner to be expected under that system when not properly controlled, and shipped ore aggregating $25,000 in value. The old tunnel exposes a chute fifty feet long and five feet wide of high-grade silver-lead ore carrying 90 ounces silver, 50 per cent. lead, and the entire face of the tunnel is in solid shipping ore. A cross-cut is being run to tap the ledge at a further depth of seventy-five feet. The croppings of a parallel ledge have been discovered, showing six feet of carbonates and two and one-half feet of galena.

The Bonanza, which is also reached from Spokane by the Spokane Falls & Northern Railroad to Bossburg and by wagon road five miles in a southeasterly direction from that town, recently fell into the hands of a number of miners who held liens and who have leased and bonded it for two years to John Hanley. The croppings show a true fissure ledge of low-grade ore from ten to forty feet wide between walls of slate, with an ore chute 200 to 300 feet long. A shaft is down eighty feet and an incline 150 feet, the latter

on a continuous body of ore, and a 100-foot drift connects the two. Several thousand tons of ore have been shipped, its character making it desirable for fluxing, and three or four car loads will be shipped before the coming May.

Traveling on southward, we come next to the Summit group of five claims, owned by the Summit Mining Company, ten miles by wagon road from Addy Station, which is seventy-four miles by the Spokane Falls & Northern Railroad from Spokane. This group is on a series of five parallel ledges of sulphide and galena ore, one of which is in the contact between slate and diorite, while the others are in fissures in the slate. All are dipping into the mountain at such angles as to encourage the belief that they will unite in a great contact vein at a depth of 600 feet or less. In a 130-foot shaft one ledge widened from thirty inches to five feet, maintaining the latter width for the last sixty feet, and five drifts on it are each thirty feet long, all in ore. An average sample of hand-sorted ore assayed 50 ounces silver, 53.2 per cent. lead, and the whole ledge will concentrate. On a four and one-half foot ledge, 120 feet to the west, a shaft is down 110 feet, showing quartz mineralized throughout with galena and carrying occasional bunches of that mineral, with perfect walls. A fifty-foot shaft on the same ledge 125 feet further north also shows it equally strong and well defined, containing ore of which the concentrates will carry 1½ ounces silver to the unit of lead. Another vein eight inches wide is shown by a 125-foot shaft to be solid ore carrying gray copper, silver and gold, and assaying $90 to $1,000, one shipment having returned $155.15 gross, or $136.15 net. About 160 feet of drifts have been run from this shaft and a cross-cut is in forty feet to tap the ore chute shown in the croppings. A thirty-foot shaft on another ledge shows three feet of quartz carrying gold and silver. The company is continuing development, shipping the high-grade ore and reserving the second-grade, of which there is over 1,000 tons on the dump, for concentration by a plant to be erected in the fall. This ore will go 6 into 1 and make concentrates worth about $70 a ton.

Three and one-half miles by road northeast of Chewelah, in the Colville Valley, which is sixty-five miles by the Spokane Falls & Northern Railroad from Spokane, is the Eagle group of six claims, owned by I. S. Kaufman, C. D. Ide and C. W. Ide. The croppings show large deposits of galena and sulphides of silver in a limestone formation. Two shafts 200 and 115 feet deep respectively have been connected by a series of drifts on the ledge, making an aggregate of 2,500 feet of development. This work shows ore chutes ranging from eighteen inches to eight feet in thickness, connected by stringers, and about $20,000 worth of ore has been taken out, ranging in value from 25 to 100 ounces silver, 40 to 70 per cent. lead.

The Buck Mountain group of eight claims, owned by the Buck Mountain Mining Company, is four miles north of Cedar Canyon and twelve miles by road from Springdale, which is forty-seven and one-half miles from Spokane, on the Spokane Falls & Northern Railroad. One ledge is six feet wide in a twenty-two foot shaft and in tunnels sixty and forty-five feet, which show eight inches of solid galena and bunches of that mineral throughout the ledge, growing more solid with depth. One car load returned 61 ounces silver, 77½ per cent. lead, and assays have averaged about that figure. Another ledge is seven and one-half feet between lime and granite walls and in a thirty-foot shaft shows chloride and gray copper ore throughout, assaying 64 ounces silver, $3 gold, 8 per cent. copper. Another ledge crops ten feet wide and carries chlorides, which assay 36 ounces silver, 12 per cent. copper, $5.20 gold. Three claims are along another ledge between slate walls, which a forty-foot shaft shows to widen from three and one-half to seven feet. Three assays from samples taken at increasing depths showed 40, 52 and 64 ounces silver respectively.

Two miles southeast of Springdale by road is the Honest Johns group of three claims, owned by the Honest Johns Mining Company. The croppings show a sixty-foot ledge containing lead carbonates. A cross-cut has been driven 280 feet to tap the ledge 175 feet below the surface and will do so in about 100 feet more. It has cut a thirty-inch stringer carrying 41 ounces silver, 31 per cent. lead and $2.20 gold, besides 20 per cent. iron, which makes it a good fluxing ore.

CEDAR CANYON.

About most of the mining districts of the Pacific Northwest there is little of the romantic to make their names live in history, but Cedar Canyon is an exception. The greatest discovery there was made accidentally by a bankrupt farmer who knew nothing of mineral, and in the face of ridicule he persisted in shipping some apparently worthless sand to the smelter. When it netted him good returns, other bankrupts like himself went into the district, and most of them are now comfortably off, and regard the

foreclosing of mortgages on their farms as the beginning of their good fortune.

For Cedar Canyon the starting point is Spokane. The Central Washington train may be taken for Davenport, fifty miles west. Then a horse or buggy will take one over a good road for thirty-five miles to the head of the canyon, which is in the Huckleberry Mountains north of the Spokane River. Over this road the ore is hauled to Davenport in half a day, it having been greatly improved and shortened in the last year. An alternative route is by the Spokane Falls & Northern Railroad to Springdale and thence by a wagon road twenty-two miles, which will be shortened and improved this season.

A precursor of the discoveries on Cedar Canyon proper is the Cleveland, which was found in June, 1894, by Messrs. France, Finsley and Lingenfelter, who have bonded it to Messrs. Monahan, King and McAulay. The ledge is eight feet wide, carrying galena, with antimonial silver on the surface, and was tapped by a 200-foot cross-cut. From this a drift was run 150 feet, a winze sunk sixty feet and an upraise made for twenty feet, the ore being then stoped out. The ledge occasionally pinches to two feet, but has produced about 1,500 tons of ore, of which 800 tons shipped to the smelter assayed $22 to $80 a ton in silver and lead. The main ledge has been struck forty feet higher up the mountain and carries 25 ounces silver and 59 per cent. lead. This mine is now operated under lease from the owners.

On what is probably the extension of the Cleveland ledge Dr. J. P. Turney, A. W. Turner, C. G. Snyder, H. H. McMillan and C. E. Richard, of Davenport, have the Bland. It is six to eight feet between lime walls, as shown by a cross-cut, and carries antimonial silver, carbonates of copper and azurite, assaying 52 ounces silver, 5 per cent. lead and a trace of gold.

These locations were the forerunners of the most valuable discoveries on Cedar Canyon, in the course of which the extent and character of this mineral belt has been pretty clearly defined. The country rock is augite syenite overlaid with quartzite 100 feet thick. The ledges associate closely with phosphate lime, which varies in thickness from 4 to 100 feet. The ore is in quartz and includes sulphurets, which assay 500 to 2,500 ounces of silver, galena carrying 20 ounces of silver to each unit of lead. The lead carries considerable copper, which decomposes and colors the quartz with carbonates of copper and lead, azurite, malachite and yellow carbonates of lead. In some ledges there also occur silicate of copper and sulphide of silver in streaks, as well as a little zinc and brittle silver.

The discovery of the Cleveland stirred up interest in Davenport, and George Gibson, B. O. Gibson, Charles Golden and W. O. Vanhorn went prospecting in Cedar Canyon in August, 1894, and Golden located the Deer Trail and Royal. One day, while pursuing two deer, Vanhorn stumbled over a big quartz boulder carrying galena, and immediately went prospecting down the mountain, where he and his brother, Isaac L. Vanhorn, located the Deer Trail No. 2. They had pieces of the boulder assayed and found it carried between 70 and 80 ounces silver to the ton. A tunnel was then run for 100 feet from the croppings, partly through a solid formation and partly through red sand and gravel, but showed no regular ledge and therefore was stopped. W. O. Vanhorn panned down some of the red sand for gold, but found strings and flakes of native silver. He then sacked two and one-half tons and hauled it to Davenport. After enduring much ridicule and with great difficulty he raised enough money to pay the freight, and received in payment about $150 a ton. He then shipped nine tons more, which brought him $1,360.

The Deer Trail No. 2 is now the principal one of twelve adjoining claims, all owned by the Deer Trail No. 2 Mining Company, and has developed into one of the best paying mines in Washington. It has been shown with tolerable certainty that the red sand, gravel and boulders into which the tunnel ran is part of a true fissure ledge which has either broken off and settled with the settling of the mountain, or has been heated and decomposed by the slaking of the lime walls. The break-over pitches into the mountain at an angle of only 15 degrees, so that the face of a 200-foot tunnel is only seventy-five feet beneath the surface. The red sand is simply rich mineralized quartz, decomposed and acted on by fire due to the slaking of the lime. The croppings carried 28 ounces in the form of black sulphurets and galena. A tunnel run 180 feet into the mountain from this point showed the ore in a vein one to six feet thick, cutting through lime and quartzite and pitching east about 15 degrees, while the country formation ran almost perpendicularly into the hill. As the tunnel ran in the ore grew richer and began to show green carbonates of copper, azurite, malachite, oxycarbonate of lead, native silver in strings and flakes, and steel galena. The flakes of native silver are sometimes as large as a silver dollar and thin as tin foil. The first car load from near the mouth of this tunnel netted $237 at the smelter, the second over $600, the third $1,000, and they increased in value until one car load netted over $2,900. A quarter of a car load shipped later carried 5,600 ounces to the ton. As the tunnel advanced up the hill on the pitch of the vein, the latter grew thinner, until at last it ran out altogether.

CEDAR CANYON

STEVENS COUNTY.

WASHINGTON.

INDEX TO NUMBERED CLAIMS.

1. Sister Hilbert.
2. Nancy Hanks.
3. Horse Stake.
4. Fairview.
5. Blue Grouse Ext 2
6. Bore Silver.
7. Nata Fina.
8. Nata Rica.
9. Sunday Morning.
10. Saturday Night.
11. Chester.
12. Silver Basin.
13. Rattle Silver.
14. Shasta.
15. Lone Star.
16. Underfoot.
17. Silver Queen.
18. Brooks.
19. Dixie Queen.
20. Moonshine.
21. Elephant.
22. Legal Tender.
23. Victoria.
24. Providence.
25. Runyon.
26. Deer Trail No. 2.
27. Royal
28. Deer Trail No. 1.
29. Hoodoo No. 2.
30. Hoodoo No. 1.
31. Hoodoo Ext.
32. Josephine
33. Idaho.
34. Cleveland.

Hunter Creek

SCALE OF MILES

0 1 2 3

Columbia River

to Hunter Creek

FRUITLAND.

to Davenport

Cedar Canyon

to Spokane

CEDARVILLE.

Railways

Wagon Roads

MAP SHOWING ROUTE TO MINES.

Columbia River

HUNTER CREEK.

Hunter Cr.

FRUITLAND.

Cedar

CEDARVILLE.

Spokane Falls and Northern R.R.

SPRINGDALE.

SPOKANE INDIAN RESERVATION.

Spokane River.

DAVENPORT.

Central Washington

30 29 28 27 26 25

36 37 38 39 40 41

Roberts Bros.
CIVIL AND MINING ENGINEERS.
SEATTLE, WASH.

...IN THE PACIFIC NORTHWEST.

The theory as to there being a ledge in place was confirmed when No. 2 tunnel was started further south, for it was found close to the mouth, running down almost perpendicularly with the country formation between walls of lime phosphate and syenite. Several tunnels have been run into the ledge 100 feet below the highest workings, where it is still three to five feet wide and is straightening up, dipping at an angle of 40 degrees. From one of these tunnels a drift has been run 100 feet one way and fifty feet the other, showing up more solid ore, carrying sulphides and galena, of about the same value as that above. This proves the permanence of the ledge, which evidently changes its pitch according to the disturbance which has occurred in the mountain.

When development began on a large scale tunnels were run at five different places, showing up the ledge for about 600 feet in length. There is now an extensive system of tunnels and drifts aggregating about 2,000 feet. As the ledge is almost level, the ore was stoped out from the side of the tunnels and the old workings were filled up with the waste material. As work progressed, it showed the ore varying in thickness from one to six feet. It is richest at the thinnest points, the red sand carrying most value and being either distributed through or lying on top of the other mineral. The ore is so soft that it can be mined with pick and shovel and often crumbles in the fingers, but the increased cost of timbering and sorting offsets the saving in powder. Smelter returns have averaged about $150 a ton and have ranged from 150 to 500 ounces of silver, from $2 to $20 gold and 7 per cent. lead, but some assays have run as high as 3,000 and as low as 10 ounces. Only ore running over 80 ounces in silver has been shipped and there is now a quantity of this low-grade ore on the dump estimated to contain 500,000 ounces. In addition there is a vein of sand in the mine fourteen inches wide above and below the main ore body which contains about 20 ounces silver per ton and which has not yet been disturbed. Negotiations are in progress for the erection of a concentrator in the district to do a customs business and treat this large accumulation of ore.

Dividends have been paid aggregating over $40,000, in addition to the amounts divided among the owners before the property passed into the hands of the corporation.

The Deer Trail ledge has been traced to the south through the Jolly Boy, owned by W. A. Crawford, J. A. Cameron and Seth T. Emerson, and the Elephant and Moonshine, and to the north through the Royal.

The discovery of another ledge on the other side of the canyon followed that of the Deer Trail and this has been traced through a string of claims for 16,500 feet. It was found by C. W. Burdsal and C. T. Porter, who located the Saturday Night, Sunday Morning and Plata Rica. On the Saturday Night a 100-foot shaft and thirty-five foot drift showed two to five feet of ore, two tons of which, shipped from the fifty-foot level, returned 71 ounces silver at the smelter. In the second fifty feet the shaft ran through ore carrying 150 to 200 ounces, on which a drift is being run at the 100-foot level. A ledge eighteen inches wide is shown up in a cross-cut and a fifteen-foot shaft on the Sunday Morning, with streaks one to three inches wide carrying sulphurets running into it. A shaft is down on the Plata Rica ledge six feet wide, carrying streaks of ore two to twelve inches wide, and a cross-cut taps the ledge below in about 330 feet, one shipment giving good returns.

A good property on the same ledge is the Plata Fina, owned by Messrs. Burdsal, Porter and T. G. Small. An eighty-foot shaft shows three feet of ore, on which considerable drifting has been done and the first shipment gave good returns. On the Delaware Harvey Jones has tunneled about 100 feet on a four-foot ledge. The Vanhorn brothers have sunk eighty-five feet on the Silver Queen, showing four feet of good ore; Mr. Keeler has tunneled on the Pride of the Valley with good results: and the ledge has been cross-cut on the Oro Fino by J. F. Conkling. The Esther Hilbert group of seven claims, owned by Len Coombs, Fred Lauer, H. Allen, I. Breslauer and Charles Young, has a shaft down fifteen feet on a thin streak of ore carrying 40 to 200 ounces silver, and the ledge has been cross-cut 100 feet deeper by a 160-foot tunnel, from which a drift has been run 100 feet on the ledge.

Discoveries were extended last year in all directions from Cedar Canyon. At the head of Oropathan Creek Alfred Hughes and John O' Leary have the Highland Chief on a four and one-half foot ledge between walls of granite and lime, the ore carrying carbonates of copper and sulphurets of silver, and assaying 120 ounces silver. On the Rattler group of two claims, seven miles west of Cedar Canyon, Dr. J. P. Turney and others have a large broken ledge of decomposed quartz carrying 12 to 300 ounces silver. A shaft is down sixty feet on the broken ledge and another thirty-eight feet on the solid ledge matter.

This district has the distinction of having been developed almost entirely by the original prospectors with the money they took out of the ground, the sole exception being the Deer Trail No. 2, which is paying good dividends.

Another section tributary to Davenport is the Egypt District, near the confluence of the Spokane and Columbia Rivers, where great ledges of quartzite jut out in the canyon walls. At the foot of Pitney Butte is the

Egypt, owned by Charles Grutt and sons, of Davenport, on which a four-foot ledge of galena is tapped by a 120-foot cross-cut and is opened by a tunnel. On the Silver Queen, Greenville Blake has shown eighteen inches of galena ore, assaying 60 to 130 ounces silver, besides copper and lead, by sinking a forty-eight foot shaft, from which he has drifted sixty-five feet. On Mill Canyon, ten miles from Davenport, C. G. Snyder, H. A. P. Myers, Dr. J. P. Turney, H. H. McMillan and Charles L. Young, all of Davenport, have the Iron Crown group of five claims on four parallel ledges, assaying from $33 upward in gold. One ledge is shown thirty feet wide by a thirty-foot shaft and thirty-foot cross-cut at the bottom. A cross-cut 100 feet below has tapped the second ledge, sixteen feet wide, assaying 7 per cent. copper, and is being extended to the first ledge. A mile south of this group C. L. Young, W. K. Snyder, C. G. Snyder, G. E. Brown and J. T. Young have the Elkhorn, on which a forty-foot cross-cut has tapped eighteen inches of galena ore. On the United Workman group of two claims Dr. Turney and C. L. Young have sunk a shaft twenty-six feet on a six and one-half foot ledge carrying gold and silver, while a tunnel showed ore in ten feet, assaying 12 ounces silver, $3 gold. The John L., near Fort Spokane, owned by Col. William Ridpath, has a 125-foot shaft on a ledge carrying galena, a sample shipment of which netted $135. A tunnel is being run on the ledge.

MINERAL CREEK.

In a broad belt of limestone cut by Mineral Creek and on a spur from Mount Rainier,, between Green River and the Summit district, is a series of mineral ledges carrying gold, silver and copper in various forms, principally galena, on which citizens of Tacoma, Centralia and Chehalis have done a large amount of development. The first discovery was made in July, 1891, by John T. Davis and James A. Evans and prospecting has traced the belt across to Washington and Bear Creeks. The country rock is dolomite and the ledges are in fissures in slate, running northeast and southwest, the gangue being calcite and talc.

The district is tributary to Tacoma, being fifty-four miles southeast of that city. The route is by the county road from Tacoma to Elbe, on the Nisqually river, the Lewis county road thence to the mouth of Mineral Creek and a trail for seven miles to the head of the creek.

The first discovery was the Waterfall, by Messrs. Davis and Evans, on the middle ledge of five which are cut by Mineral Creek and are almost parallel. On these the Davis & Evans Mining Company has fourteen claims, which it is developing. Nearest the mouth of the creek is the Iron Mine, which shows brown hematite, carrying gold and silver in the croppings, and is said to have sixteen feet of solid ore carrying $15 to $18 gold and silver. A thirty-foot shaft is down on the ore body. The Contact has a twenty-foot ledge with several streaks of galena aggregating four feet and assaying about $40 gold and silver. Tunnels have been driven 140 and 100 feet and connected by a winze and a shaft is down seventy feet, with several cross-cuts and drifts from it. From these workings a large quantity of ore has been taken and is ready to ship. On the Waterfall a thirty-foot shaft and tunnels twenty and forty feet have shown four feet of ore of the same grade as the Contact.

On the south fork of Mineral Creek this company has the Tacoma on a body of ore seventy feet wide, which a surface cross-cut shows to have sulphides of manganese disseminated throughout the ledge matter, while assays show it to carry $4 and more in gold.

On the Eliza, the Mineral Creek Mining Company has a twenty-foot ledge, on which a tunnel over 100 feet long shows three to four feet of galena ore. The same company has driven a tunnel forty feet on the Goldie, showing a still larger body of ore.

On the Mary Ann, Dr. C. B. Martin has three ledges, eighteen inches to four feet wide, showing good pay streaks in tunnels fifteen, twenty-five and forty feet long.

On the Mashell river, within three miles of the wagon road, the Co-operative Mining Syndicate of Seattle is developing the Jessie Harper group of nine claims. These are on a ledge of free milling quartz, which has been uncovered at several points, and is thus shown to be continuous for over 500 feet, while a twenty-foot shaft and several surface cross-cuts show eight feet of gold-bearing quartz. The surface ore averages $3 to $5 gold and assays have run as high as $52. A cross-cut, now in 165 feet, will tap the ledge thirty-five feet further at a point below the shaft. Gold has been panned out of the creek below this property and is presumed to have been washed out of the ledge.

The wagon road could be extended to the Jessie Harper and up Mineral Creek at moderate expense.

DIGEST OF THE MINING LAWS OF THE UNITED STATES, WASHINGTON AND BRITISH COLUMBIA.

By Melvin G. Winstock, Attorney, Seattle, Wash.

Whenever a doubt arises concerning any questions relative to an interest consult a responsible attorney. If his advice is worth having, he will charge you a fee, but in the end this will prove an economy. Don't attempt to draw your own legal contracts. Many a fortune has been lost in the attempt of the mining man to be his own lawyer.

Definitions.

Ore.—Certain minerals in their natural condition.

Mineral.—That which is secured from a mine, from working in the ground, and legally it includes salt, coal and similar substances.

Lode or Vein.—A flattened mass of metallic or earthy matter, a fissure in the earth's crust filled with mineral matter.

A Mine.—A way or passage under ground.

Vein or Tunnel.—The first working vein found in the tunnel.

Location.—The act of appropriating a parcel of land according to certain established rules. A mining claim may contain one or more locations.

LAWS OF THE UNITED STATES.

Who May Locate.

Mineral lands are open to exploration and purchase by all citizens of the United States without regard to sex and those who have declared their intention to embrace citizenship. All persons born or naturalized in the United States and subject to the jurisdiction thereof, and none others, are citizens.

What Lands May Be Located.

The right to mine can be given only in public lands, and said lands must contain valuable mineral deposits.

Extent of Ground Open to Location.

No claim located shall exceed 1,500 feet along the vein nor shall it exceed 300 feet on each side of the middle of the vein at the surface.

It is not necessary that the locator should be present on the ground. One may locate as agent for another.

Description.

The location must be along the vein or lode, it must be distinctly marked on the ground so that its boundaries can be correctly traced, that the record contain reference to some natural object or permanent monument to identify the claim and that all the lines shall be parallel. Remaining details are governed by rules and regulations established by the miners of each district not inconsistent with national or state laws.

Extent of Work Necessary.

One hundred dollars' worth of labor shall be performed on improvements made each year. Where there are several owners and one or more fails to do his share, he must be served with a personal notice or by publication in a newspaper published nearest the claim, once a week for ninety days. If at the expiration of such time said delinquent shall fail to do or perform his share, then his interest becomes the property of such of his co-owners as have performed the amount of work required by law.

How to Obtain a Patent.

Applicant must file in the proper Land Office an application for a patent under oath, showing a compliance with the law. He must file also a plat and field notes of the claim or claims in common, made by or under the direction of the Surveyor General, showing accurately the boundaries, which shall be distinctly marked by monuments on the ground, and shall post a copy of such plat, together with a notice of such application for a patent, in a conspicuous place on the land or claim in question. This posting must be done prior to the filing of the application for a patent. He must also file, when he applies for his patent, the affidavit of at least two persons that such notice has been duly posted together with an exact copy of such notice.

The Register of the Land Office then causes to be published in a news-

paper, by him designated as the nearest to the claim, for sixty days, a notice that such application for a patent has been made. He must for the same period also post such notice in his office.

At the time of filing his application, or within sixty days, claimant must file with the register a certificate of the surveyor general that $500 worth of labor has been expended on improvements made upon the claim by himself or grantors; that the plat is correct and shall give such other description as is necessary for identification, to be incorporated in the patent. At the end of sixty days claimant must file his affidavit showing that plat and notice have been posted in a conspicuous place on claim during the period of publication. If no adverse claim is filed within said sixty days, the law assumes the applicant to be entitled to his patent upon payment to the proper officer of $5 per acre, for the land embraced within the claim.

How to Make an Adverse Claim.

When an adverse claim is made during the sixty days period of publication, it must be under oath of the person or persons making the same and shall show the nature, boundaries and extent of such adverse claim and all proceedings, except publication of notice and filing affidavits thereof, are stayed until the controversy is settled by a court of competent jurisdiction or the adverse claim is waived. Within thirty days after filing adverse claim, contesting party shall begin proceedings to determine the question of right of possession and shall prosecute the same with reasonable diligence to final judgment. Failure so to do operates as a waiver. After such judgment, the party entitled to possession may file with the register a certified copy of the judgment roll, together with a certificate from the surveyor general that the requisite amount of labor has been done on the claim and the description required in other cases, shall pay to the register $5 per acre of such claim, whereupon the whole proceedings and judgment roll shall be certified by the register to the general land commissioner and the patent issues.

Before Whom Oaths May Be Taken.

All affidavits required under the mining laws of the United States may be made before any officer authorized to administer oaths within the land district where the claim may be situated, and all proofs may be taken before any such officer.

Miscellaneous.

The owner of a quartz mill or reduction works not owning a mine in connection therewith may also receive a patent for his mill site, at $5 per acre.

No one individual can enter or locate upon more than 160 acres nor can an association enter upon more than 320 acres.

The government before patent issues requires payment for mining land at the rate of $10 per acre where claim is situated more than fifteen miles from a railroad, and $20 per acre where such claim is located less than fifteen miles from such railroad.

WASHINGTON MINING LAWS.

In the State of Washington there is a mining board consisting of the governor, lieutenant governor and the state treasurer, the object of which is to collect information concerning the production of all precious and useful minerals of the state, and to perform such other duties as will advance the mineral interests.

Mining Claim Governed by Law in Force at Time of Location.

All mining claims upon veins or lodes of quartz or other rock in place, bearing gold, silver or other valuable mineral deposits heretofore located, shall be governed as to length along the vein or lode by the customs, regulations and laws in force at the date of such location.

Form and Extent of Mining Claim Limited.

A mining claim located upon any vein or lode of quartz or other rock in place, bearing gold, silver or other valuable mineral deposits, after the approval of this act by the governor, whether located by one or more persons, may equal, but shall not exceed, 1,500 feet in length along the vein or lode; but no location of a mining claim shall be made until the discovery of the vein or lode within the limits of the claims located. No claim shall extend more than 300 feet on each side of the middle of the vein at the surface, nor shall any claim be limited by any mining regulation to less than fifty feet of surface on each side of the middle of such vein or lode, at the surface, excepting where adverse rights, existing at the date of the approval of this act, shall make such limitation necessary. The end lines of such claim shall be parallel to each other.

Right of Possession of Mining Claims.

The locators of all mining locations heretofore made, or hereafter made under the provisions of this chapter, on any mineral vein, lode, or ledge on the public domain, and their heirs and assigns, so long as they comply with the laws of the United States and the state and local laws relating thereto, shall have the exclusive right to the possession and enjoyment of all surface included within the lines of their location, and of all veins, lodes and ledges throughout their entire depth and the top or apex of which lies within the surface lines of such location, extending downward vertically, although such veins, lodes or ledges may so far depart from the perpendicular in their course downward as to extend outside of the vertical side line of said surface location.

Work Required on Mining Claims—Local Regulations.

The miners of each mining district may make any rules and regulations governing this (the) location and amount of work necessary to hold possession of a mining claim, not in conflict with the laws of the United States or of this state; but on each claim it shall be necessary to do at least $100 worth of work each year and the first year shall date from the date of location of such claim. A failure to comply with this requirement shall work a forfeiture of the claimant's right to such claim, and the same shall become subject to relocation.

Recorder of Mining Districts—Records of.

The miners of each mining district may elect a recorder of the said district. When so elected, such recorder shall provide books of record, in which it shall be his duty to record all notices of locations or transfers, bonds, conveyances or assignments of mining claims within his district when the same shall be presented to him for record. Such records are public records, open to inspection, and shall have the same force and effect, so far as notice is concerned, as the record of deeds and mortgages.

Election, Powers and Duties of Recorder.

When a recorder shall be elected, he shall hold his office for a term of one year from the date of his election, and until his successor is elected and qualified. He shall, immediately after his election, file with the county auditor of the county in which his district is situated, an oath to the effect that he will faithfully discharge the duties of his office. He shall be a certifying officer, and certified copies of his records shall have the same force and effect as similar papers certified by other officers of this state. His fees shall be the same as those of the county auditor for similar work, and should the office of recorder of any mining district at any time become vacant, it shall be the duty of the person last holding said office, and of any person into whose possession the same may come, to forthwith transmit all records, papers and files of said office to the auditor of the county in which said district is located, and such auditor shall thereafter keep the same as part of the records and files of his office.

Location Notices, Etc., to Be Recorded by County Auditor.

All location notices, bonds, assignments and transfers of mining claims shall be recorded in the office of the county auditor of the county where the same is situated, within thirty days after the execution thereof; provided, that all records of mining claims and of assignments, deeds, bonds and transfers heretofore made (that is prior to 1888) by any recorder of any mining district, or by any county auditor, are valid.

Aliens.

Aliens are not prohibited from acquiring mineral lands.

Water for Mining.

The use of the waters of this state for irrigation, mining, and manufacturing purposes is deemed a public use.

Boring for Salt, [illegible]l, Coal.

Boring for salt, oil and coal may be done by the county commissioners by special tax levy, on presentment of proper petition and after election in favor of the same.

Taxation of Mines and Mining Property.

Quarries and fossils in and under the same, are subject to taxation.

Improvements on land the fee of which is in the state or in the United States are subject to taxation.

Mineral lands are included in the tax list.

Mining ground, quarries, etc., and the improvements thereon shall be assessed at the price at which the same would sell at a fair voluntary sale for cash.

Miner's Lien.

All persons doing work upon or furnishing materials for mines or mining claims have a lien upon the same for the work done or materials furnished.

Contractors and builders are deemed agents of owners.

The claim of lien must be filed with the county auditor within ninety days from the time of last work done or last materials furnished.

A lien binds property for eight months unless proceedings be commenced or time be extended.

Evidence.

Certified copies of recorded instruments are received in evidence the same as the originals.

Mining recorders and county auditors may certify copies of instruments of record concerning mines and the same may be used in evidence.

Crimes.

The fraudulent sale of mines, or salting or misrepresenting to accomplish the sale, is a felony.

Fraudulently changing samples or assays with intent to defraud, is felony.

Making or giving a false assay or sample with intent to defraud is felony.

Robbing a vein, sluice-box, quartz-mill, etc., or trespassing upon a mining claim with intent to commit a felony, is felony.

Deed of Mining Claim, United States.

THIS INDENTURE, Made the..... day of.....
in the year of our Lord one thousand eight hundred and ninety.....
BETWEEN .....
.....
.....the part.... of the first part, and
.....
.....
the part..... of the second part, WITNESSETH: That the said part.... of the first part, for and in consideration of the sum of .....
..... DOLLARS, ... of the United States of America, to ..... in hand paid by the said part..... of the second part, the receipt whereof is hereby acknowledged, ha..... granted, bargained, sold, remised, released and forever quit claimed, and by these presents do.... grant, bargain, sell, remise, release and forever quit-claim unto the said part..... of the second part, and ..... heirs and assigns,
.....
.....
.....
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.....

TOGETHER with all the dips, spurs and angles, and also all the metals, ores, gold and silver-bearing quartz, rock and earth therein; and all the rights, privileges and franchises thereto incident, appendant and appurtenant, or therewith usually had and enjoyed; and, also, all and singular the tenements, hereditaments and appurtenances thereunto belonging or in anywise appertaining, and the rents, issues and profits thereof; and, also, all the estate, right, title, interest, property, possession, claim and demand whatsoever, as well in law as in equity, of the said part..... of the first part, of, in or to the said premises, and every part and parcel thereof, with the appurtenances.
.....
.....
.....
.....

TO HAVE AND TO HOLD, all and singular, the said premises, together with the appurtenances and privileges thereunto incident, unto the said part..... of the second part, ... heirs and assigns forever.

IN WITNESS WHEREOF, the said part..... of the first part ha....
.....
hereunto set ..... hand .... and seal.... the day and year first above written.

Signed, Sealed and Delivered in the Presence of
.....
.....

.....(Seal.)
.....(Seal.)
.....(Seal.)
.....(Seal.)
.....(Seal.)

Location Certificate—Lode Claim.

Know all men by these presents, that I, ..., of the county of ....., State of ....., claim by right of discovery and location ..... feet, linear and horizontal measurement, on the ..... lode, along the vein thereof, with all its dips, variations and angles; together with ..... feet in width on each side of the middle of said vein at the surface, and all veins, lodes, ledges, deposits and surface ground within the lines of said claim; ..... feet on said lode running ..... from the center of the discovery shaft, and ..... feet running ..... from said center of discovery shaft.

Said claim is situated in the ..... of ....., in ..... mining district, county of ....., State of ....., and is bounded and described as follows: .....

Date of discovery, ..., 189.. Staked and located, ..., 189.. Date of certificate, ..., 189..

Attest: ....

As a part of this form, and in addition to the data therein given, the claimant is required to state the names of adjoining claims, and if none adjoin, the relative positions of those nearest, or show by affidavit or otherwise why this is not done. This is an essential requirement.

This notice must be recorded in the office of the mining recorder and in the office of the auditor of the county in which claim is situate.

Location Certificate—Placer Claim.

Know all men by these presents, that I, ..., the undersigned citizen of the United States, resident of the county of ....., and State of ....., having complied with the provisions of chapter 6, title 32 of the Revised Statutes of the United States, and with local customs, laws and regulations, claim by right of discovery and location, as a placer claim, the following premises situate, lying and being in ..... mining district (or county), county of ....., and State of ....., to wit: (Description.)

To be known as : (Name.)

Located ....., 189... Date of Certificate, ..., 189...

Contract to Sell and to Buy.

I, ..., vendor, hereby agree to sell to ...., and I, ..., purchaser, agree to buy of the said ....., the ..... lode mining claim, situate, etc., ...

The agreed consideration of said sale is $..... cash in hand paid, the receipt whereof is hereby acknowledged; $..... to be paid within ..... days from the date hereof, and $..... within ..... days from such date, making a total consideration of $.....

Said vendor, within ..... days from date, will deliver to purchaser or his attorney an abstract of title duly certified by the clerk and recorder of said county, or by some reputable abstract office together with all the original title papers which are in his possession or within his power to produce.

And within said time will place in escrow in ..... a good and sufficient warranty deed conveying to said ....., or such person as he shall nominate, the said premises, clear of encumbrances, to be by such ..... held in escrow until final payment be made under this contract, or default is made under the same. Deposit with said ..... to the credit of vendor shall be equivalent to payment of any said installment.

Time is the essence of this contract as to each and every installment, and if any installment or installments be not paid within the time or times hereby limited therefor, all previous installments shall be and remain the property of said vendor, the deed in escrow shall be returned to him for cancellation, and the property shall remain his own, unaffected and unencumbered by this contract. But if he fail to deliver abstract within said period, or to deposit said deed in escrow, or if his title prove encumbered or otherwise not marketable, vendee may recover any and all installments paid, or may sue for specific performance and for a perfect title, or for damages, or otherwise as he may be advised.

Witness the hands and seals of said parties this ..... day of .....,

A. D. .....

.....(Seal.)

.....(Seal.)

Bond and Agreement for Sale.

This agreement made and entered into this ..... day of ....., 189.., by and between ...., of the county of ....., State of ....., part.... of the first part, and ...., of the county of ....., State of ....., part.... of the second part:

Witnesseth, that the said part.... of the first part hereby agree.. that if the said part.... of the second part shall, on or before the expiration of ..... from the date hereof, pay or cause to be paid to the said part.... of the first part the sum of ..... ($....) dollars in gold coin, he will, upon such payment being made, make, execute and deliver to said part.... of the

second part the title to all of th.. certain lot, piece or parcel of land situate, lying and being in the county of ....., State of ....., bounded and particularly described as follows, to wit: .....

The said part.. of the first part further agree.. that the said part.... of the second part, ... agents, employes or assigns may at any time during said period of ..... enter upon said premises and work, mine and prospect the same in such manner as ..... may deem best, and mill any ore that may be taken therefrom (provided all work done thereon shall be done in a good, workmanlike manner), and may place thereon (and remove at ..... pleasure) such machinery and fixtures as may be necessary for the convenient working thereof.

The said part.... of the second part hereby agree.. that in the working, mining or prospecting of said premises ..... will not suffer or permit any lien to attach thereto for or in consequence of any indebtedness ..... may incur for labor, materials or improvements ..... may employ, purchase or place upon said premises during the said period of .....; and that in case ..... they shall fail to pay or cause to be paid to said part.... of the first part the said sum of $..... within said period of ....., ... will, at the expiration of said period of time, quit and surrender to said part ..... of the first part the said premises, and will within ..... days thereafter remove any machinery and fixtures that ..... may have placed thereon.

It is mutually understood and agreed that the stipulations and agreements herein contained shall apply to and bind the heirs, executors, administrators and assigns of the respective parties hereto.

In witness whereof, the said parties have hereunto set their hands and seals the day and year first above written.

.....(Seal.)
.....(Seal.)
.....(Seal.)

How to Incorporate a Company.

Under the laws of the State of Washington any two or more persons may make and subscribe written articles of incorporation in triplicate, and acknowledge the same before any officer authorized to take acknowledgement of deeds. One copy must be filed in the office of the secretary of state, one in the office of the auditor of the county in which the principal place of business of the corporation is to be located, the other remaining in the possession of the corporation. Said articles shall state the corporate name of the company, the object for which the same shall be formed, the amount of its capital stock, the time of its existence, not to exceed fifty years, the number of shares of which the capital stock shall consist, the number of trustees and their names, who shall manage the concerns of the company for such length of time (not less than two nor more than six months) as may be designated in such certificate, and the name of the city, town or locality and county in which the principal place of business of the company is to be located. No corporation shall commence business or institute proceedings to condemn land for corporate purposes until the whole amount of its capital stock shall have been subscribed for. Stock of corporations is deemed personal property.

BRITISH COLUMBIA.

The greatest particularity is required under the mining laws of British Columbia. The act concerning mines at present in force through British Columbia was passed April 17, 1896.

Interpretation of Terms.

The following is the interpretation of terms used in the construction of the mineral act:

"Mine" shall mean any land in which any vein or lode, or rock in place, shall be mined for gold or other minerals, precious or base, except coal.

"Mineral" shall mean all valuable deposits of gold, silver, platinum, iridium, or any of the platinum group of metals, mercury, lead, copper, iron, tin, zinc, nickel, aluminum, antimony, arsenic, barium, bismuth, boron, bromine, cadmium, chromium, cobalt, iodine, magnesum, manganese, molybdenum, phosphorus, plumbago, potassium, sodium, strontrium, sulphur or any combination of the aforementioned elements with themselves or with any other elements, asbestos, emery, mica and mineral pigments.

"Limestone, marble, clay or any building stone, when mined for building purposes," shall not be considered as mineral within the meaning of the act.

"Rock in place" shall mean all rock in place bearing valuable deposits of mineral within the meaning of the act.

"Vein" or "lode"—Whenever either of these terms is used in the act, "rock in place" shall be deemed to be included.

"Mineral claim" shall mean the personal right of property or interest in any mine.

"Mining property" shall include every mineral claim, ditch, mill-site or water right used for mining purposes, and all other things belonging to a mine or used in the working thereof.

"Legal post" shall mean a stake standing not less than four feet above the ground, and square or faced on four sides for at least one foot from the top, and each side so squared or faced shall measure at least four inches on its face so far as squared or faced, and any stump or tree cut off and squared or faced to the above height and size.

"Mill site" shall mean a plat of ground located as defined by the act for the purpose of erecting thereon any machinery or other works for transporting, crushing, reducing or sampling ores, or for the transmission of power for working mines.

"Streams" shall include all natural water courses, whether usually containing water or not, and all rivers, creeks and gulches.

"Ditch" shall include a flume, pipe or race, or other artificial means for conducting water by its own weight, to be used for mining purposes.

"Ditch-head" shall mean the point in a natural water course, or lake or other source, where water is first taken into a ditch.

"Free miner" shall mean a person, or joint stock company, or foreign company named in, and lawfully possessed of, a valid existing free miner's certificate, and no other.

"Record," register" and "registration" shall have the same meaning, and shall mean an entry in some official book kept for that purpose.

"Full interest" shall mean any mineral claim of the full size, or one of several shares into which a mineral claim shall be equally divided.

"Cause" shall include any suit or action.

"Judgment" shall include "order" or "decree."

"Real estate" shall mean any mineral land in fee simple under any act relating to gold mines or to minerals other than coal.

"Joint stock company" shall mean any company duly incorporated for mining purposes under the "Companies Act," "Companies Act, 1890," and any company duly incorporated in British Columbia for mining purposes under the "Companies Act, 1862," (Imperial), and shall include all companies, whether foreign or local, registered or incorporated under the "Companies Act," 1894, C. 32, S. 2.

Free Miners and Their Privileges.

Every person over 18 years of age and every joint stock company may become a free miner by taking out a miner's certificate, the cost of which is $5 per annum.

Minors who take the benefit of this act are regarded as of full age in all mining transactions.

Miner's certificate to a joint stock company must be issued in its corporate name. Such a certificate may be issued for one or more years and cannot be transferred.

A fine of $25 is provided as a penalty for such as work at mining without first obtaining the necessary certificate.

Every owner of a mine or contractor for the performance of work upon a mine must take out a license certificate for each and every employee or upon conviction pay a penalty of one hundred dollars, in addition to the unpaid license fees.

A free miner may kill game for his own use.

A free miner may obtain a new certificate for one lost on paying $1.

Should co-owner fail to pay for his free miner's certificate, his interest goes to his co-owners pro rata according to their former interests.

A shareholder in a joint stock company need not be a free holder.

A free miner may claim 1,500 by 1,500 feet. But all angles must be right angles and all measurements must be horizontally.

A free miner may cut timber on Crown lands.

A free miner may obtain a five-acre mill-site upon Crown lands in the form of a square.

A claim may be held from year to y r by work being done to the value of one hundred dollars.

Two claims in each mining division, not on the same vein or lode, may be held, and more than one on the same vein, if held by a purchaser.

A claim must be marked by two legal posts, each four inches square and not less than four feet above the ground. They must be numbered 1 and 2.

A legal post marked "Discovery Post" must also be placed on the lode where it was discovered.

On No. 1 post must be written: (1) Initial Post. (2) The name of the claim. (3) The name of the locator. (4) The date of location. (5) Approximate bearing of No. 2 post. (6) Length and breadth of the claim. (7) The number of feet to the right and the number of feet to the left of the location line.

On No. 2 post must be written: (1) The name of the claim. (2) The name of the locator. (3) The date of location.

The line from No. 1 to No. 2 must be distinctly marked by blazing trees or planting posts.

Locations made on Sunday or public holidays are not for that reason invalid.

Lodes discovered in tunnel may be held if recorded in fifteen days.

A free miner may, on the payment of $500 in lieu of expenditure on claim, obtain a Crown grant.

Any miner may, at the discretion of the gold commissioner, obtain a water right for a term of twenty years.

No transfer of any mineral claim or interest shall be enforcable unless in writing, signed and recorded.

No miner shall suffer from any act of omission or commission, or delays on the part of government officials.

No claim shall be open to location during the last illness of the holder, nor within twelve months after his death, unless by permission of the gold commissioner.

A mineral claim must be recorded within fifteen days after location, if within ten miles of office of the mining recorder. One additional day is allowed for every additional ten miles or fraction thereof.

Partnerships, unless otherwise specified, will be deemed to be annual. The business shall pertain to mining and to mining only. Partnerships can locate and record one claim for each partner.

If any partner should fail to keep up his free miner's certificate, his property in the partnership shall revert to his partners pro rata according to their former interests. A partner owning any part of a share is entitled to a vote, but the result of the vote shall be determined by the full interests voted upon. A majority can make assessments. Assessments must be paid within thirty days. Any partner failing to pay assessment will be permanently liable to the partnership and his interest may be sold to satisfy the assessment. But a partner may, by proper notice to the foreman or manager, abandon his interest, after which he will not be liable for assessments.

Limited partnerships may be entered into; but "Limited" must become a part of the partnership name.

Necessary Labor to Be Done.

Work on each mining claim to the value of one hundred dollars must be done every year from the date of record of the mineral claim. An affidavit made by the holder, or his agent, setting out a detailed statement of the work done must be filed with the gold commissioner or mining recorder, and a certificate of the work obtained and recorded before the expiration of each year from the date of record of said claim. A free miner holding adjoining claims may, subject to filing notice of his intention with the gold commissioner or mining recorder, perform on any one or more of such claims, all the work required to entitle him to a certificate of work for each claim. The same provision applies to two or more free miners holding adjoining claims in partnership. In lieu of the above work the miner must pay one hundred dollars and get a receipt and record the same.

Law Concerning Placer Mines.

Placer claims shall be divided into creek diggings, bar diggings, dry diggings, bench diggings and hill diggings.

Every free miner shall be entitled to locate and record a placer claim on each separate creek, ravine or hill, but not more than two claims in the same locality, only one of which shall be a creek claim. He shall be allowed to hold any number of placer claims by purchase.

A "creek claim" shall be 100 feet long, measuring the direction of the general course of the stream, and shall extend in width from base to base of the hill or bench on each side, but when the hills or benches are less than 100 feet apart the claim shall be 100 feet square.

In "bar diggings" a claim shall be a strip of land 100 feet long at high water mark, and in width extending from high water mark in the river to its lowest water level. Dry diggings, 100 feet square.

In "bench diggings" a claim shall be 100 feet square; provided, that the gold commissioner has authority, where a bench is narrow, to extend the limits of a claim beyond the limits of the bench, but not to exceed 100 feet square.

In "hill diggings" a claim shall have a base line or frontage of 100 feet, drawn parallel to the main direction of the stream or ravine on which it fronts. Parallel lines drawn from each end to the line at right angles thereto, and running to the summit of the hill, shall constitute the side lines thereof. Legal posts shall be placed 100 feet apart on both the base line and the side lines, and no claim shall extend beyond the posts so placed.

If any free miner, or party of free miners, discover a new mine, placer claims of the following sizes, in dry, bar, bench, creek or hill diggings shall be allowed, viz: to one discoverer, one claim 200 feet in length; to a party of two discoverers, two claims, amounting together to 600 feet in length; to a party of three discoverers, three claims, amounting to 800 feet in length; to a party of four discoverers, four claims, amounting together to 1,000 feet in length; and to each member of a party beyond four in number, a claim of the ordinary size only. A creek discovery claim shall extend on each side of the

center of the creek as far as the summit of the hill, but not exceeding 1,000 feet.

A new stratum of auriferous earth, gravel, or cement, situated in a locality where all placer claims are abandoned, shall be deemed a new mine.

In defining the size of placer claims, they shall be measured horizontally, irrespective of inequalities on the surface of the ground.

Any location made on Sunday or any public holiday shall not for that reason be invalid, any law or statute to the contrary notwithstanding.

How to Locate Placer Claims.

A placer claim must be as nearly as possible rectangular, and marked by four legal posts at the corners. The posts must be at least four inches square. One post must be marked "Initial Post," and on that post a written notice must be placed stating: The name of the claim, the length of the claim in feet, its general direction; the date of notice and name of locator. If any side line extends 100 feet in length, legal posts must be placed on such line not exceeding 100 feet apart.

What Must Be Recorded.

Placer claims must be recorded within three days after location, if within ten miles of the mining recorder's office, and one additional day is allowed for each additional ten miles or fraction thereof.

Placer claims may be recorded for one or more years on payment of fees —$2.50 for each year.

Transfers must be in writing signed by the transferer and recorded in the mining recorder's office, and within the time required for recording placer claims.

The holder of a placer claim has no right to any vein or lode within its limits, except by location and record under the mining act.

Taxes on Mines.

An annual tax of 25 cents for every acre and fractional part of an acre of land conveyed by the crown must be paid on the 30th day of June and said tax becomes a charge upon the claim and in default of payment said claim may be sold. Such taxes are remitted if the owner proves to have done $200 worth of work on the claim for the year during which said taxes are assessed.

Legal Forms.

Under the law of British Columbia the government has prescribed certain forms and these must be followed absolutely: Such as Location Notice, Record of Mineral Claim, Record of Partnership Mineral Claim, Application for Certificate of Work, Certificate of Work, Certificate of Improvements, Application for Certificate of Improvements, Certificate of Improvements, Mining Recorder's Certificate, Mill Site (notice), Mill Site (affidavit of applicant prior to lease), Lease of Mill Site, Mill Site (affidavit of applicant prior to Crown grant), Mill Site (certificate of improvements), Tunnel or Drain License, Mill Site (application for Crown Grant), Water Notice, Water (grant of water right), For a Full Claim, For a Fractional Claim. These may be found in the act relating to gold and other minerals excepting coal. Passed April 17, 1896.

Scale of Fees to Be Charged.

For every free miners' certificate (for each year)..... $5.00
Every substituted certificate 1.00
Recording any claim 2.50
Recording every certificate of work 2.50
Recording any "lay over" or every other record required to be made in the "Record Book" 2.50
Recording every abandonment, including the memorandum to be written on the record 2.50
For any other record made in the "Record of Abandonments"..... 2.50
For recording every affidavit, where the same does not exceed three folios of 100 words 2.50
For every folio over three, per folio..... .20
The above rate shall be charged for all records made in the "Record of Affidavits."
For all records made in the "Record of Conveyances," where the same do not exceed three folios..... 2.50
For every folio, over three, a further charge of 30 cents per folio.
For all copies or extracts from any record in any of the above-named books, where such a copy or extract shall not exceed three folios, per copy 2.50
Where such copies or extracts exceed three folios, 30 cents per folio for every folio over three.
For filing any document ..... .25
For a Crown grant 5.00

MINERAL OFFICERS OF BRITISH COLUMBIA.

Minister of Mines—Hon. Col. James Baker.
Provincial Mineralogist—W. A. Carlyle.
Public Assayer—H. Carmichael.

Mining Recorders.

Nanaimo—M. Bray, Nanaimo.
New Westminster—D. Robson, New Westminster.
East Kootenay—J. Stirret, Donald; F. C. Lang, Golden; G. Goldie, Windermere; C. M. Edwards, Fort Steele; M. Phillips, Tobacco Plains.
West Kootenay—J. H. Graham, Revelstoke; Corry Minhennick, Lardeau; A. Sproat, New Denver; John Keen, Kaslo; W. J. Goepel, Nelson; J. Kirkup, Rossland; J. C. Rykert, Rykert's; T. Taylor, Trout Lake; R. J. Scott, Illecillewaet.
Cariboo—W. Stephenson, Quesnelle Forks; J. Bowren, Barkerville.
Yale—W. Dodd, Yale; L. Norris, Vernon; C. A. R. Lambly, Osoyoos; W. McMynn, Midway; H. Hunter, Granite Creek; G. C. Tunstall, Kamloops.
Lillooet—C. A. Phair, Lillooet; F. Soues, Clinton.
Cassiar—Ezra Evans, Manson Creek Omineca; Jas. Porter, Laketon.
Alberni—Thos. Fletcher, Alberni.
Victoria—W. S. Gore, Victoria.

Gold Commissioners.

For the Province—W. S. Gore.
Alberni—Thos. Fletcher, Alberni.
Cariboo—John Bowren, Richfield.
Cassiar District—James Porter, Laketon, Cassiar.
Lillooet District—Frederick Soues, Clinton.
East Kootenay District—J. F. Armstrong, Donald.
West Kootenay District—N. Fitzstubbs, Nelson; J. D. Graham, Revelstoke.
Yale District—Charles Lambly, Osoyoos; G. C. Tunstall, Kamloops.

Assayers.

Public Assayer, H. Carmichael, Victoria; W. Pellew Harvey, Vancouver; J. A. MacFarlane, Vancouver; Robbins & Long, Rossland.

THE REDUCTION OF ORES.

By C. E. Bogardus, of Seattle.

In treating this subject, it is undertaken with some misgivings, as the scope is broad to place in a short article; to give a clear idea of the proper items. No doubt some readers will miss what to them are important points, but when we stop to consider the vastness of the field and that large volumes are written upon one single process the indulgent reader is asked to overlook the lacking features.

The use of the metals by man dates into ancient history, and necessarily the separation from the ores has, since their first use, always been a problem. At first it was how to get the metal, now it is how to cheapen the process; either by modification of the present systems or by entering new paths of research.

In the commercial world the metals are divided into precious and base. There are only three of the precious metals, gold, silver and platinum, while the list of base metals includes the balance, lead, iron, copper, zinc, antimony, etc.

Space will permit only a synopsis as to how gold and silver are separated from the ores. In connection with them lead and copper are of necessity joined. With the copper also come nickel and cobalt.

Gold and silver occur in nature free and combined. The free metal or native is when it is in the form as used in commerce, the metallic state, as placer gold or as pieces of "the real stuff" in quartz. In combination, they are united chemically with some other element and must undergo a treatment. Gold and silver ores are in general treated alike, as they occur in the same ore and consequently both must be extracted together, although there are some gold ores and some silver ores each having special processes to obtain the value.

Platinum is so extremely rare in ores, the most being obtained from placers and then usually in connection with gold, that its metallurgy will not be dealt with here.

Silver occurs to a limited degree native, but usually in chemical combination, the most common being chloride, bromide, sulphide, telluride, antimonial sulphide (ruby silver and brittle silver), argentiferous galenas and argentiferous gray coppers, all of which must be separated by one of the many processes.

Gold is found as native and in chemical combination with tellurium, called tellurides, which are extremely rich. It is also associated with sulphurets, known as iron pyrite, pyrites, sulphurets and iron sulphurets, being a chemical combination of iron and sulphur. The gold in this case is not chemically combined but mechanically held.

Free gold or free silver ores are treated by a variety of mills, each working with the same end in view, to separate the gold or silver from the rock by amalgamating them with mercury. There is a long list of them, but I shall put them into two divisions. First, stamp mills, which work by a large weight, 500 to 1,000 pounds, called the stamp, dropping rapidly into an inclosed mortar. The pulp, when about the size to pass through a forty-mesh screen, splashes through the screen onto a copper plate, the plate having first been coated with mercury. The gold and silver are held by the mercury, while the balance of the material washes on off the plates. There are gravity stamps, spring stamps and steam stamps. The second division of mills includes all the balance, Huntington, Crawford, Merrill, etc., each differing from the other in the manner of pulverizing the ore, some accomplishing it by large wheels, some by centrifugal revolving weights, others by revolving balls, each having its merits and being adapted for special ores, while the gravity stamps are the most successful with general ores and are usually preferred. The mercury on the plates, when it contains considerable gold, is scraped off and placed in a chamois or buckskin sack and squeezed dry, the excess of mercury passing through the chamois. The residue, dry amalgam, consisting of the gold and some mercury, is put in an iron retort, from which the mercury can all be distilled at a low red heat, caught in water and used again, while the retort contains the gold. This is melted in a black lead or clay crucible, run into bricks, and is ready for market.

At this point it might be added that there is quite a mistaken idea of what a mill test is. A mill test is a test made on a sample of ore to see how much free gold it contains and the percentage that can be saved by amalgamating with mercury. A large sample, 100 to 1,000 pounds, is often shipped to a smelter for a mill test. No smelter will smelt a single shipment by itself. The ore is sampled and an assay made, all shipments being treated alike in that respect. The smelters do not test for free gold nor make mill tests, excepting the same as any competent assayer can do in his laboratory.

Few ores occur in which the total value is free gold; part is as a rule associated with the sulphurets. This gold is not caught by the mercury, but is

carried off of the plates. In a free gold ore the sulphurets are usually a small percentage of the ore, running from 2 to 30 per cent. When less than 2 per cent., it does not as a rule pay to save them unless quite rich. When above 30 per cent. the sulphurets interfere with the amalgamation and there is too great a chance of loss in concentration besides.

To save this value the pulp is carried over concentrators, which are machines arranged for separating, by gravity, the use of water and a shaking motion, the heavy mineral from the light gangue, which is worthless, the quartz, porphyry, etc. In handling an ore carrying about 10 per cent. sulphurets, for every ten tons of ore crushed and run over the concentrators, there will be one ton of concentrates carrying the value. There is always some loss, varying with the nature of the ore; in future treatment there is the cost of working only one ton in place of ten. The concentrates from a gold ore will yield their value by the following methods, pan amalgamation, cyanide, chlorination, bromination, smelting or some of the new processes, the means used to be determined by two points, cost of treatment and percentage of value saved. Some ores take one, others another.

For pan amalgamation the concentrates are thoroughly roasted, then placed in large pans with mercury, stirred and ground until the gold is amalgamated; steam heat is often used, while occasionally salt and bluestone are added, especially when silver is present. The pulp is washed away and the mercury handled the same as when taken from the plates of the stamp mill.

I would state here that no one process, except smelting, will treat all ores and any process needs some modification for each ore treated. They often treat one ore to perfection and are worthless for another. Ores are individual in character, no two alike.

Chlorination depends upon the fact that gold is soluble in chlorine gas, forming a chloride of gold, acting when the ore is roasted perfectly, but inert on the raw pyrites; roasting is burning off the sulphur, changing the iron from a bisulphide to a sesquioxide, whereby the gold is freed. The roasted pulp is placed in a perfectly airtight chlorination barrel or false bottom vat, moistened and a current of chlorine, generated by using salt, sulphuric acid and dioxide of manganese, passed through it. When the action is complete, the gold chloride, being soluble in water, is leached out of the pulp, and precipitated with ferrous sulphate. After being allowed to settle, the liquor is drawn off, the gold collected, usually by the filter press, melted and cast into bars.

Bromination is on the same principle, forming bromide of gold instead of the chloride. It is used by a few companies, the claim being that it is cheaper and simpler than chlorination.

Smelting will be taken up in connection with general ores.

Cyanide process, by which concentrates are often treated, is given in full in another chapter in this book.

When an ore carries no free metal, the ore as a whole is considered and the best means will depend upon its nature.

The gold and silver in Washington are usually associated together, and the ore must be treated to save both metals. When there is no silver of value, the ore is handled the same as the concentrates from the stamp mill. It is concentrated when it will permit. In such cases the ore is pulverized by the stamps or Cornish rolls; rolls seem to be preferred as the product is in a more even and better condition for concentration.

We now come to the treatment of the general ores carrying gold and silver mixed with iron sulphurets, copper sulphurets or galena.

Smelting or matting will handle all ores. But by this means the object in view is only half accomplished; the precious metals do not come out of the furnace pure and ready for use, but are associated with some base metal as carrier, from which they must be separated. The aim in smelting is to make the gangue melt and be thin enough for the valuable metals to collect and settle to the bottom. The ore will not melt by itself without such extreme heat as to endanger loss of value by volatilization, so the proper ingredients are added to obtain a fusion at a moderate temperature; this is called fluxing, the materials added being called fluxes.

Smelting is classified according to the carrier used to collect the gold and silver, being lead smelting, copper matting and iron matting or pyritic. Lead and copper smelting methods merge into each other, for now at many places they are both accomplished in the same furnace at the same time, while on the other hand copper and pyritic smelting pass imperceptibly from one into the other.

Lead smelting or the use of lead as a carrier is the old reliable and today is in most general use. It is the one place where all ores are taken excepting possibly some high grade copper oxide or carbonates, and they can be handled by other means, although they can be used in small quantities at a time at the lead smelter. It was not many years ago when the lead furnace superintendent would refuse a great many so-called base ores. This term has a different meaning when used in the various branches of mining. A free gold man, in speaking of a base ore, means one from which he cannot extract the gold by mercury. To the smelter foreman it is the ore containing metals which interfere with his saving value. Zinc and antimony are base

ores for the lead furnace. Ores which were refused a few years ago are today readily taken. Before long the term base ores will not be in use. There is now a company in the field claiming that by the use of their furnace zinc is an aid instead of a detriment.

We will now start with an ore at the mine and carry it through the lead smelter.

At the mine the owner has three grades of ore, shipping, concentrating and refuse. His shipping ore is either the pay streak, which breaks down clean without any poor material being mixed with it, or is separated by sorting, which is selecting the high grade for shipping, using the hammer for breaking when necessary, placing the balance with the second grade or throwing it over the dump down the ravine as refuse.

This seemingly simple point is in fact one of the important ones about a mine. A well-trained man is necessary for the position. He must have a quick perception and be one who studies his ores. Every variety of ore should be tested for him. He should not only know that a certain appearing piece carries value, but how that value is there, whether as ruby silver, in the gray copper, with the lead, carried with one of the sulphurets or some of the dozen more combinations possible. Many a mine has had thousands of dollars thrown down the ravine from careless sorting by men who "knew ore."

While at the mine, the second grade had better be treated, if low grade, but with a small percentage of mineral, it can be concentrated the same as the sulphurets of a gold ore as mentioned. In concentrating, the ore must be thoroughly understood as to where the value lies to know what to save and how to crush. Some minerals of high value are brittle, pulverizing easily and if not correctly handled the value will be lost. An ore high in sulphurets but of low value can only be treated by some of the cheap processes of the future; it cannot be concentrated by mechanical means. Ore that cannot be put three or more into one is not worth doing anything with, as the loss and cost equal the gain. Galena, iron and copper sulphurets handle nicely.

The concentrates are sacked and shipped with the regular ore to the smelter. Upon arrival, it is weighed and the ore shoveled into an ore breaker. Coming from this, it is shoveled into cars or conveyors, every tenth shovelful being thrown aside as a sample. If the concentrates are a large shipment, every tenth sack is set aside as a sample. The ore sample is crushed again and taken to a sampling floor, thoroughly mixed and cut into quarters, the two diagonal quarters taken, the other two thrown away. The part saved is remixed and quartered again and this process is continued until there is about 100 pounds, when it is quartered and the two halves sacked. One half is labeled and put away for future reference in case of a dispute. The balance is taken to the sampling room, crushed finer and quartered down to between one and two pounds, when it is dried, pulverized to pass an eighty-mesh screen and sent on to the assay room, where, after thorough mixing, it is divided into three samples, one for the smelter, one for the seller and the third to be sent to a reliable assayer as umpire in case of a disagreement. The assays usually check (agree) but sometimes a shipment will have to be resampled and it occasionally takes a year to settle satisfactorily to both parties.

All samples are tested by the smelter for gold, silver, lead, copper, iron, lime, zinc, silica and antimony when present. The ore is not put in the furnace and the seller paid for the ounces of gold and silver extracted, but he is paid entirely upon the assay of sample taken. Part of a shipment may not be smelted for two or three months after receipt and then never smelted in the furnace alone. As stated, each ore must be fluxed. In lead smelting this is the proper combination of silica, iron and lime. To the superintendent the ore has four parts, precious metals, valuable base metals, worthless base metals and the gangue. Saving the highest percentage of value at the least cost is his aim. Ores are bought which can be mixed and the proper combination of silica, iron and lime obtained if possible, for by so doing so much ore is being melted instead of the same amount of dead flux, which must be added in case of a deficiency; iron ore for the lack of iron, limestone for the lime, and quartz for silica. In most cases there is an excess of silica, which necessitates the purchase of iron and lime. The smelting charges are made accordingly. A fixed rate is made on a neutral basis; when the silica equals the iron and lime. When the silica is in excess a charge of 15 cents per each unit in excess is made, but 15 cents is paid for each unit the iron and lime are in excess of the silica. In regard to the detrimental metals, zinc and antimony, a limit is established, in the amount allowed in an ore (at present in Washington this limit is 10 per cent.). Below this limit the ore is treated without extra cost, but above that an additional charge of 50 cents for each per cent. in excess—a 12 per cent. zinc ore would cost $1 extra.

In making up his mix, the metallurgist adds a certain per cent. of galena for a carrier to save the gold and silver. About 12 per cent. is used now.

Most of the iron occurs in the ores as sulphurets. The sulphur in a lead smelter is out of place and must be eliminated by roasting. In roasting, what it takes nature years to do man accomplishes in a few hours. When she finishes, there is left the red streak of iron stain on the mountain side, by which the prospector spots his ledge.

All parts of the charge, ore, flux and fuel, which is usually coke, are weighed and fed in regularly at the top of the furnace, a force draft being used to keep up the combustion. The process is continuous, the slag being drawn off from one point at regular intervals, while the lead is taken out at a lower point when necessary. From January to January, it stops not except for an accident, which, if it stops the furnace, is quite expensive. The lead bullion is now ready for the refinery, where the gold, silver and lead are separated.

When there is copper in an ore that goes to a lead smelter, sufficient sulphur is left in the charge to form a copper sulphide or matte and the copper saved in the same form as in copper smelting. As all lead smelters buy ores carrying more or less copper, they save it in this way, putting them in with the regular ores, but ores without copper are preferred. This matte is drawn out with the slag, from which it separates on standing, for, being heavier, it settles to the bottom, and when cold it is broken off and saved.

In smelting there is a small loss, in the slag, from volatilization and in the dust. The last is mostly regained when good dust chambers are used, but the first and second, especially the first, it is the object of the superintendent to make as low as possible. They vary with the fluxing and the manipulation of the furnace.

One method of refining the lead bullion will be given. The bullion is melted in a large iron kettle with a certain percentage of zinc, the zinc having a greater affinity for the gold and silver than the lead. They liquate on cooling. The zinc with the gold and silver is taken off, and the lead again treated. When the lead has given up all the precious metal, it will contain some zinc, from which it is freed in a cupel furnace, and is then ready for market. The zinc is separated from the gold and silver in the cupel furnace by distillation and oxidation. The precious metals are placed in a sulphuric acid bath and heated, the silver passes into solution as silver sulphate, while the gold remains undissolved.

The silver solution is decanted, the gold washed, dried, melted and cast into bars. Pure copper sheets are suspended in the silver sulphate and by metathesis we obtain metallic silver and copper sulphate. When all of the silver is deposited it is washed, dried and melted and run into bars. The sulphate of copper solution is evaporated and crystallized. This is a large source of the blue vitriol of commerce.

The other forms of smelting are copper smelting and pyritic, alike in their products, both being mattes, a sulphide product having the precious metals dissolved in them. In consequence they need more of a subsequent treatment to yield a finished product. They verge into each other, varying from a matte high in copper with but little iron, to one mostly iron and a small amount of copper. A strictly iron matte can be made and is made at Deadwood, North Dakota, but as a rule a small amount of copper is desirable.

Pyritic smelting is designed to concentrate the value of pyritic or sulphide ores, by heat, using the sulphur as a part, if not all, of the fuel, fluxing away the gangue and the metals of no value. Part of the iron forms a sulphide, making with the copper sulphide the matte carrying the gold and silver with them. The process is in successful operation at a number of places, but it is not an easy plant to conduct. In fluxing, the range is greater than in lead smelting and theoretically it is quite simple, but practically it takes an experienced man to obtain good results. No preliminary roasting is needed, as the sulphur is used for the fuel.

The matte product will yield its value by three different treatments. A straight iron matte can be roasted and pan amalgamated the same as gold sulphurets are often treated. When there is sufficient copper to pay to save it is shipped to a lead smelter, roasted and treated the same as a sulphuret ore, the iron acting as a flux. The copper forms a copper matte, while the gold and silver are taken up by the lead. The arsenic and antimony are made use of in pyritic smelting, whereas in lead and copper furnaces they are obnoxious. They pass into the iron matte, forming arsenides, antimonides, sulpharsenides and sulphantimonides with the iron taking place of so much sulphur which may be used for fuel.

As the copper increases, we pass into copper smelting, which, though it in turn verges into lead smelting, the iron on one side and the lead on the other, still has its own necessities and is distinct.

Copper smelting is used to treat all copper ores and is simply one step in the concentration process which is taken, step by step, until metallic copper is obtained.

Copper occurs as native in a few places. This ore is treated quite simply, being crushed, concentrated, melted and cast into ingots. This copper ranked higher than that from other ores until electricity was introduced for refining.

Copper smelting, or matting, as it is usually called, because the product in most cases is a matte, has within the last few years made a great advance, the Americans being far in the lead.

The sulphuret ore must be roasted, as the extra sulphur is not used as fuel, but a small amount is necessary to unite with the copper and iron to make the matte. Roasting is conducted in a variety of ways, from the

cheap crude method of heap roast, known from antiquity, to the modern automatic reverberatory furnace.

The heap roast is made by properly piling the ore in heaps 24x46x6 upon a bed of fuel with correctly arranged draft holes and chimneys. Only sufficient fuel is used to get it under way, when the burning sulphur keeps it going. From sixty to seventy-five days are needed to burn a heap of this size. The product is an oxide of iron, oxide of copper, some copper sulphate with a small amount of unroasted material. When cool enough to handle, the mixture goes direct to the furnace. In the reverberatory furnace of today, the ore is pulverized and fed at one end, where a flame plays over it. The sulphur immediately begins to burn, and the material is now slowly moved along the furnace, getting hotter and hotter as it approaches the fire. Unless the melting is done in this furnace, it is withdrawn in the form of a powder, the sulphur all gone and the metals in the form of oxides. The most improved furnaces now have automatic stirrers and automatic dischargers.

In copper smelting it is not the object to get as high grade matte as possible, for two reasons--subsequent treatment can be conducted better and the precious metal saved closer. About a 40 per cent. matte is the first product. The fluxing is different from lead smelting in having a wider range as to slag, not being bound down to a fixed limit. The aim is to have a slag fluid enough for the matte to settle through and not too thin, or the matting will not be perfect.

The furnaces used are water jacket shells of copper, cast or wrought iron. Some brick ones are in use, but they are losing ground. The charge is fed continuously at the top and like the lead smelter there is not a stop except for accidents. During fusion the copper unites with the sulphur, making copper sulphide, the balance of the sulphur combines with iron and the two sulphides form the matte. The percentage of iron sulphide determines the grade of the matte and that is fixed by the amount of sulphur. When an excess of sulphur is allowed, it takes too much iron into the matte and robs the slag of necessary iron; if sulphur is deficient, the grade of the matte is too high and the slag gets the iron, making it too thin.

In the old style furnace the matte was allowed to settle to the bottom and was drawn off at intervals, as was also the slag, the matte being then refined by roasting and resmelting, slowly raising the grade by eliminating the sulphur and the iron until pig copper was obtained.

Today at the most advanced works the separating of the slag and matte is done in another furnace, a reverberatory hearth, where they are allowed to run in a molten state and kept so. The slag is tapped off and the matte maintained in a fluid state. As needed, it is conveyed to the large Bessemer converters, where the purification into metallic copper is accomplished in one operation, by burning out the impurities, the iron being carried into the slag. The copper is cast into large plates ready for electrolytic treatment for separating the gold, silver and the small traces of other metals. These large plates are suspended in a sulphuric acid bath as the anode, and a thin sheet of pure copper is the cathode. As the current is turned on the impure anode dissolves and perfectly pure copper deposits at the cathode. The gold, silver and impurities drop to the bottom of the tank.

In treating oxide and carbonate ores the product is black copper instead of matte. At times the raw sulphuret ores are smelted without roasting owing to certain conditions, but roasting is the rule. Nickel and cobalt, when in an ore, are saved in the copper matte.

Coming back to silver, there are two processes for treating exclusively silver ores which deserve mention. One, known as the Russell process, is used when the silver is as a chloride or bromide, soluble in a hypotyposulphite of soda solution. The silver is precipitated as a sulphide, which is washed, dried, melted and run into bricks. Some of the ores, such as sulphides, etc., can be converted into a chloride by roasting with salt or salt and copper sulphate. Then there is the old Mexican or Patio method of amalgamation, for the ores that are chlorides or can be converted into chlorides by roasting, as in the Russell process. The ground pulp in the form of a mud is placed in a Patio with mercury. In America a large amalgamating pan or barrel is used. The mixture is stirred and ground until the amalgamation is complete. The silver chloride is changed to metallic silver, which amalgamates. This silver amalgam is treated the same as gold amalgam. As worked in Mexico the process is crude, but it is used with great success there.

As to the new methods, it might be added, they are becoming as numerous as patent car couplers. Hundreds of mining and smelter men, electricians and inventors are working to solve the problem of a cheap means of extraction of the value from ores. Some are branching onto new lines, others trying to improve the old, bringing to their aid electricity, chlorine, bromine, cyanide and other chemical solvents together with new ideas in furnaces and heat producers, combining different methods with various results. The goal is a means by which a small plant can be placed, on the property, in the mountains, treat the ore there and treat it cheap. This would solve the problem for camps which today are at a standstill--ore, where lack of transportation facilities prohibits development; another having the railroad, but where the freight rate takes all the profit on the low grade ores. It would do away with trying to concentrate low grade material, where value is lost.

Only a very small amount of microcosmic salt is needed, not more than

and also treat ores of low value, but too high in sulphurets to be concentrated.

There are now in the West, to my knowledge, about a dozen of the revolutionizing processes, most of them claiming to extract the value for $1.50 a ton at the mine. Many of the same pass into history each year. Some one will solve the problem and for the man who does it there is an unlimited fortune awaiting him locked up in a stronger vault than any bank. Who will find the magic key?

At this writing no one has proven that he has such a process. Before this is with the reader, some one may achieve this end. If so, it will be a boon to the mining man of small means. It means wonders for Washington.

CYANIDE TREATMENT OF ORES.

By S. G. Dewsnap, Methow, Wash.

In the onward march of science and art, there is no branch which has made greater advancement within the past quarter of a century than the reduction of ores. This advance has been made in the improvement of old processes and the finding and adoption of new ones.

In the old processes the advance has been in machinery which rendered the processes more efficient in extracting a greater percentage of the value and in reducing the cost of treatment.

Among the new processes the treatment of ore by cyanide has made most rapid progress.

The cyanide process is based on the fact that gold and silver are soluble in a solution of cyanide of potassium or sodium in water.

"The discovery of this fact has been attributed to Hagen in 1806. Dr. Wright, of Birmingham, England, used cyanide of gold solution for electroplating in 1840."—Dr. Scheidel.

Since that time numerous experiments have been carried on with the idea of extracting gold and silver from ores by the use of cyanides, with other chemicals, electricity, etc., but it remained for John S. McArthur and Robert W. Forest to complete the process and adapt it to successful metallurgical operation. For this they received patents in the United States in 1889 and about the same time patents were taken out in nearly all other countries.

The scope of the process is a broad one, but by no means universal. Its application is limited to ores (by ores is meant native rock, bearing precious metals, whether in their natural state or as concentrates or tailings from other processes) which either have no decomposing action on the cyanide solution or can by a preliminary treatment be rendered inactive to the cyanide solution. Gold and silver exist in ores in many different forms and combinations. From some of these combinations cyanide solution will dissolve the gold and silver and from others it will not. There are in some cases mechanical difficulties in the way of treatment of an ore by this process, as a tendency to slime, rendering it almost impossible to pass the liquid solution through the ore mass. This renders the operation so slow as to require the plant to be of such large proportions that it would become unprofitable, even when a very high percentage of the value is extractable by the solutions.

However, ores that are adapted to the process can be treated by it at a much less cost than by any other known process. Ores in which gold exists as metalics, but in such a state of division that it is impossible to amalgamate it, yield excellent results from cyanide treatment. Many sulphide and arsenide ores give up their gold and silver to cyanide solution without changing the sulphides in any way.

The principal chemical reaction upon which the process rests is the formation of double cyanides of gold or silver and the alkaline metal. These double salts are soluble in water and when formed can be washed out of the ore. The following formulae represent the reactions in their simplest forms:

2 Au Gold	+	4 K C N Potassium cyanide	+	O Oxygen	+	H_2O Water	=	2 Au K $(C N)_2$ Cyanide of gold and potassium	+	2 K O H Caustic Potash
2 Ag Silver	+	4 K C N Potassium cyanide	+	O Oxygen	+	H_2O Water	=	2 Ag K $(C N)_2$ Cyanide of silver and potassium	+	2 K O H Caustic Potash

While these reactions are taking place, there are many more reactions going on with the other metals and minerals of the ore, which complicate the result. According to this equation, 15.12 parts of gold should be dissolved for each ten parts of cyanide decomposed, while in the best works by actual test from forty to forty-five parts of cyanide are decomposed for one part of gold extracted. This difference is to be accounted for by many reactions which take place between the cyanide solution and the ingredients of the ore, the water and the air. Some salts of iron, alumina, manganese, magnesium and

copper, which are found in all precious metal ores to a greater or less extent, have some decomposing action on the cyanide solution.

The solution of cyanide in passing from a very dilute to a strong solution passes a point at which it has its maximum power to dissolve gold. This is probably due to the fact that a strong solution has no power to dissolve oxygen gas from the air, which is essential to the reaction between the cyanide and the gold. The strength found most efficient differs with different ores from one-tenth to six-tenths of 1 per cent., i. e., from one pound to six pounds of cyanide of potassium to 1,000 pounds of water. When the value of the ore is in silver, the solution has to be stronger than when the ore value is in gold.

The solutions are separated from the ore by percolation or filtration, and the precious metals recovered from the solutions by precipitation by metallic zinc or alumina. The following formula will illustrate the chemical reaction:

$2\,Au\,K\,(C\,N)_2$	+	Zu	=	$Zn\,K_2\,(C\,N)_4$	+	2 Au
Cyanide of gold and potassium		Zinc		Cyanide of zinc and potassium		Gold

According to this formula, one ounce of zinc should precipitate about six ounces of gold, but in practice it requires six to twelve ounces of zinc to precipitate one ounce of gold. This solution of zinc is due to the caustic potash generated in the solution, as indicated by previous reaction, and also by other reaction due to other ore ingredients. The gold precipitated is never pure, but contains impurities carried into the solution by the cyanide and by the caustic potash and which are precipitated along with the gold and silver. When zinc is used as a precipitant, some of this always remains with the gold, as well as some slimes which are mechanically carried along with current of solution. The precipitated gold is treated with acid to remove zinc or other soluble impurities; is dried, roasted and smelted with the proper fluxes, and cast into bars.

As no two ores are treated in exactly the same way to yield best results, so the methods of procedure differ at different works. In general, the ore must be in a sufficient state of division for the solution to come in contact with the gold. The coarser the ore can be ground and attain this end the better, because the easier it can be percolated. Ores differ greatly in the grinding necessary; the proper fineness can only be determined by careful laboratory experiment.

The ground ore is treated either by agitation or by percolation.

In the agitation process, the ore is placed with the necessary solution, either in a vat with a power stirring apparatus, or in a revolving cylinder or movable box, and kept in motion for some hours until the cyanide solution has dissolved all the precious metal that the ore will yield to it. The charge is then transferred to a filter and filtered and washed, first with a weaker solution of cyanide and lastly with water. The filtrate and first washings are passed through the zinc boxes for the precipitation of the gold and silver they contain, and then passed to the storage tanks to be renewed by adding enough fresh cyanide to bring them to the proper strength. The quantities of ore operated on are small and the time required much shorter than with the percolation process. Agitation is adapted to the treatment of high grade concentrates and rich slimes.

In the percolation process the pulverized ore or tailings is charged into vats with filtering bottoms, care being taken to distribute the ore as uniformly as possible. The cyanide solution is run on in sufficient quantity to cover the ore and it slowly filters through the charge and passes to the precipitation boxes and the storage tank to be renewed and again passed through the charge. It is usual to use comparatively strong solution for the first percolation and to follow by weaker solutions until they are finally washed once or twice with water to remove any of the solutions remaining in the ore. Much time is needed for the slow passage of these solutions, so that economy requires that the vats be large. The rapidity with which a solution will penetrate depends entirely on the character and condition of the ore. If the ore be coarse ground and free from slimes, thirty to fifty hours will suffice to work off a vat of ore, but ordinarily the time required will be from three days to two weeks. The size of the vats depends on the amount of ore to be treated and the time required for the treatment of any given ore. In many instances the ore has to undergo a previous treatment to remove substances which have a decomposing influence on cyanide. Ordinarily tailings which have been exposed to the weather are acid, due to the action of the oxygen of the air on the sulphur of the ore. This is removed by a washing with water or treatment with lime or soda. An excess of alkali added invariably causes a loss of zinc in the precipitation boxes.

The size of vats used in different parts of the world varies from 30 to 600 tons capacity and they are constructed of wood, brick, stone and cement or concrete. They are charged with ore from the top, ordinarily from cars dumping from overhead tracks. The vats are emptied either from a side or bottom opening, the tailings being shoveled into cars on a track below or where water is available, the tailings are sluiced or hydraulicked out. At the larger plants at the Rand (Witwatersrand) in South Africa, the tailings are handled by steam shovels or machine cranes and loaded into railway cars to

be discharged some distance from the mills. In this district over forty cyanide plants are at work on the tailings from the stamp mills, from which, during the first six months of 1894 317,950 ounces of gold, worth $4,769,250, was realized. Further, only about 60 per cent. of the tailings are treated by the cyanide process; the balance is slimes, which, owing to the difficulty of percolation, are allowed to run to waste.

The number of plants for the treatment of ore by this process is increasing in the United States and will increase more rapidly as more is known of the process. Many different devices have been tried for the recovery of the gold from the solution, but the greater part of it is now recovered by the use of zinc. The metallic zinc is shaved into very thin, loose shavings and these are placed on a perforated iron plate, two or three inches from the bottom of a box, which is twelve or fourteen inches square and about the same depth, and a series of twenty or more of these boxes are so arranged that the solution flows upward through each of them, i. e., the solution passes from the top of one box to the bottom of the next. The zinc is renewed as fast as dissolved by passing forward and putting new zinc in the last box. The precious metal comes down as a brown or black slimy precipitate. This precipitate is removed from time to time by changing the flow of the solution to another set of boxes, while the one set is cleaned up, and the precipitated bullion washed, dried, refined and melted into bars. These boxes are usually made of wood, but sometimes of iron.

The refining is done by placing the dried precipitate on the smooth hearth of a small reverberatory furnace and giving it a thorough roasting. It is then charged with a mixture of borax, soda and nitre into black lead crucibles, where it melts down and the base metals are oxidized and removed by the slag. By proper treatment bullion from 850 to 950 fine is obtained. Ordinarily the bullion is about 780 fine.

The causes of loss of gold in treatment by this process are many and too careful management of the plant cannot be had. These losses occur by leakage of solution, by imperfect washing of the tailings, loss of cyanide by decomposing action of the ore or the water, loss of zinc by alkaline solutions, loss of fine particles of the precipitated gold by being carried away by air currents during the process of drying, refining and smelting.

The cost of the process is variable within certain limits. For ore in which the value is principally gold, treated at American works, it ranges from $1 to $5 per ton. The average of twenty-three lots of ore handled by different works gives the cost as $2.30½ per ton.

The cost of a plant is given by Dr. A. Scheidel, in Bulletin No. 5, published by the California State Mining Bureau, as: "For a plant of fifty tons per day capacity, $25,000; a 100-ton plant, about $40,000. At Johannesburg, South Africa, at $6.25 for each ton of ore it is intended to treat per month."

"The general arrangement of the plant may be of different kinds. The most convenient method is to have solution vats, leaching vats, extractors, and dumps in four tiers, so that each series may be completely drained into that next below it. By this means sufficient solution can be stored in the solution vats, and sufficient room left in the dumps to enable work to proceed for from twelve to twenty-four hours without pumping. Many plants, however, have the solution vats and dumps on the same level as the leaching vats. In this case the solution issuing from the leaching vats is passed through the precipitation boxes into a small tank and is continually pumped back as required." See "Notes on Gold Extraction by Means of Cyanide of Potassium, as Carried Out on the Witwatersrand Gold Fields," by W. R. Feldmann.

Laboratory Work.—The most important part, viz., the determination of the fitness of an ore for cyanide treatment, is left till last, while in actual practice it is the beginning. The reasons why some ores will give up their precious metals to cyanide solutions while others will not have never been satisfactorily learned. The fact remains that under favorable circumstances some ores will give up all their gold and silver to the cyanide solution, others a part and others again none at all. The only way to determine whether they will yield their metal or not is to make careful laboratory tests on well selected samples. The writer first makes a preliminary test to determine if the ore is acted on by cyanide solution; if no solution of precious metal takes place, it is useless to go farther. If such solution takes place, then a number of experiments are made to determine if there are substances in the ore which decompose the cyanide solution, and, if so, the cheapest method of getting rid of them—washing them out or neutralizing them. Then follows the determination of the proper strength of solution to give most economic results as related to time required and to the fineness of crushing necessary.

The treatment of cyanide is a chemical process and to undertake the process without chemical knowledge of it is sure of failure. In the operation of a cyanide plant there is constant employment for a good chemist. Careful analysis should be constantly made to insure uniform good results. There is no other process in which so great an advancement is likely to result from patient investigation.

That a very considerable number of the ores of Washington can be treated by this process to advantage the near future will demonstrate. Many ores which cannot now be treated by this process will yield their metal when the conditions which operate in the treatment and the reactions which take place are better understood.

BLOWPIPE ANALYSIS.

By Charles H. Bebb, of Seattle.

The ever-increasing development of the mineral resources of the state of Washington and adjacent territory has naturally attracted a number of men who are daily exploring unknown ground in search of the precious metals. Many of them are old prospectors, but many more are enterprising adventurers to whom the prizes to be won in the gold fields are always an attraction.

It is for the latter class that this article is primarily intended, and its scope does not pretend to be more than enough to enable a man of average intelligence, with the fewest and simplest of appliances, to determine the presence or absence in a sample of ore under examination of gold, silver, copper or lead. He should also be able to determine, by comparing the result of his assays with the whole amount tested, the comparative richness of the ore. He should remember, however, that for anything like exact quantitative work with the blow-pipe months of study and laboratory work are necessary.

The common blowpipe is a curved conical tube of metal, usually brass, terminating in an orifice as large as a fine needle; simple as it is, if well made, it will be found to answer fairly well, as far as the purposes of this article are concerned.

The ordinary form of blowpipe is shown in figure 1, although the danger of moisture collecting in the tube and being thence blown into the flame is materially lessened by cutting the pipe in two at the point marked (a), fitting a perforated cork over the small end and inserting it firmly in the wider as shown in (b) figure 1.

The chemical blowpipe is similar to the common blowpipe in principle, except that it has a chamber near the end which collects the condensed moisture. This chamber is shown at A in figure 2. It also has movable jets, shown in figure B, that fit on the arm at C, which can readily be taken off and cleaned.

Where possible, one should have the chemical blowpipe, but where it cannot be obtained, or becomes injured in any manner, a contrivance similar to that shown in figure 1 affords a fair substitute.

After obtaining a blowpipe, the beginner must spend a few hours in learning the proper method of blowing. His object will be to maintain a steady or uninterrupted stream of air from the jet for several minutes at a time. This is not so difficult as would appear at first. Distend the cheeks and breathe slowly through the nose for some time, keeping the cheeks inflated and the mouth shut. When one can accomplish this readily, the mouth piece may be applied to the lips, and the operation repeated, without attempting to blow, or do more than keep the mouth full of air. As the air flows out through the blowpipe, the cheeks fall together and must be again distended without interrupting the flow of air through the tube. To accomplish this, shut the communication between the mouth and lungs by the palate and inhale through the nose. No energy should be wasted in hard blowing, for the beginner will soon see that the stream of air may be maintained with scarcely more force than is supplied by the natural tendency of the inflated cheeks to collapse.

Where obtainable, gas is the most convenient combustible for the blowpipe flame, but rape seed oil in a lamp (figure 3) is the best for general use, as it can be packed in small compass and weighs but little. Candles may also be used when no better material is at hand, and of these high grade stearine are the best, for paraffine candles, although giving a higher heat, are apt to soften in warm weather. In some instances even tallow candles will answer, but they require constant snuffing.

In an ordinary flame, as from a lamp or candle, the combustion only takes place on the outer rim of the flame. When a stream of air is blown into it from a blowpipe, however, the combustion takes place in the interior, is more complete, and an intense heat is produced. When the beginner can maintain a steady stream of air for several minutes he should seat himself at a table with his arm resting on the edge, and the lamp lighted and trimmed, so as to produce a full, steady, but not a smoky, flame, slightly to the left of his face. He should then hold the blowpipe lightly between the thumb and first and second fingers of his right hand, and direct the jet or small end to the edge of the flame just above the wick. By regulating the blowing a steady flame should be produced which will be regular and conical if the jet be well shaped.

When the lamp burns, the oil is sucked up by the wick and vaporized. These vapors unite with the oxygen in the air and burn on the outer edge of the flame, forming a hot coat—a, b, c in figure 4.

As the oxygen does not penetrate inside this coat, the vapors within are highly heated out of contact with the air, and any metallic oxide placed

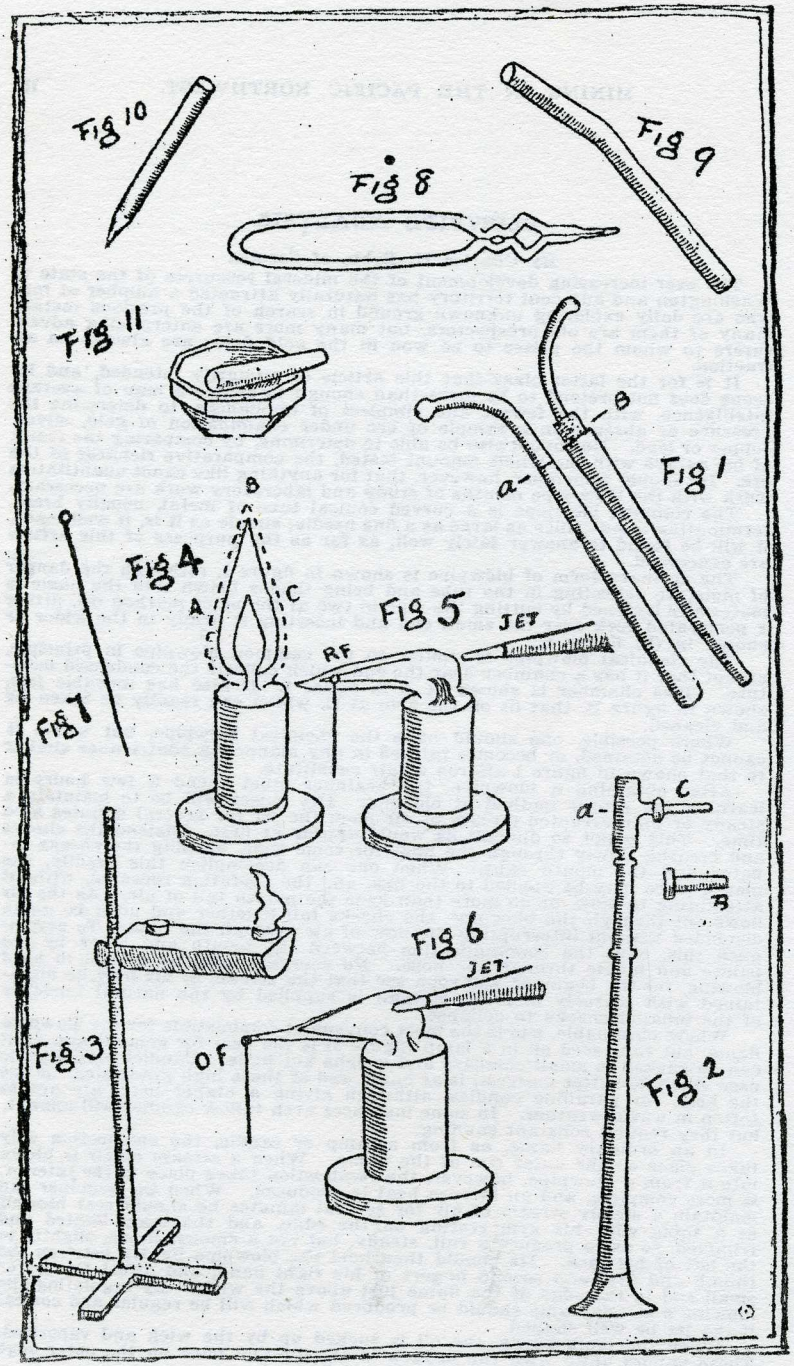
Fig 10
Fig 9
Fig 8
Fig 11
B
a-
Fig 1
B
Fig 4
A
C
Fig 5
JET
RF
Fig 7
C
a-
B
Fig 6
JET
OF
Fig 3
Fig 2

within it will, when hot, tend to part with its oxygen to the carbon and hydrocarbons of the flame. This flame is known in blowpipe analysis as the "reducing flame," abbreviated to "R. F." Figure 5 shows how it is produced with the blowpipe, the whole flame being deflected by a gentle blast so regulated that it maintains its yellow color and is luminous. As shown in figure 5, the jet is outside of the flame. No soot should be deposited on the assay and only the extremity of the luminous part should envelop it.

The other flame used in blowpipe analysis is known as the oxidizing flame abbreviated to "O. F.," and the manner of producing it with the blowpipe is shown in figure 6. As is there shown, the jet is thrust somewhat into the flame, the blast made a little stronger, and the carbon more completely consumed. The inner blue cone of the flame is sharply defined and is surrounded by a nearly colorless envelope, corresponding to the coating a, b, c, in figure 4, at the extremity of which metals may be intensely heated in contact with the air, and rapidly oxidized. No luminous streaks should be allowed to appear in the flame, and assay should be kept as far from the blue point of the flame as is consistent with a temperature high enough for rapid oxidation.

Before passing from the subject of the flame, it must be remembered that the heat is most intense at the tip of the blue cone just referred to and this is used to test the fusibility of substances without regard to chemical action.

For the purposes of this article but five methods of supporting the assay, or "supports," as they are technically termed, may be considered—charcoal, platinum, wire and forceps and open and closed glass tubes. Charcoal should be made from basswood, pine or willow and should be of even texture and cut into rectangular blocks from one to three inches in width, the same in thickness and not to exceed six inches in length. The assay should be placed either on a flat surface, or in a cavity prepared for it at right angles to the rings of growth.

When an excavation is made for the reception of the assay, it should be cup-shaped, shallow, smooth and regular. This may be effected by picking a hole in the charcoal with a knife, and revolving in it the rounded end of the agate pestle.

Platinum wire is used for supporting beads made from fluxes. The size known as No. 27 Jewellers' hole 12½ is best. It should be cut in pieces three inches long and a loop made in one end similar to that shown in figure 7. Care should be taken that the loop is no larger than the actual size shown in the figure when an oil lamp is used, although it should be not more than half the size when a candle is employed. After using, the looped ends should be thrust in a bottle of sulphuric acid, and before use they should be rinsed with water and thoroughly cleansed.

Platinum forceps of a shape shown in figure 8 can be readily made by any jeweller from elastic brass wire, the tips being made of platinum wire hammered, or soldered, or riveted on for holding splinters of substances in the flame to ascertain their fusibility and the color imparted to the flame.

Open Tubes.—A piece of straight glass tubing not exceeding one-quarter of an inch in diameter and slightly bent as shown in figure 9, about one inch from the end. This slight angle helps to prevent the assay from falling out.

Closed Tubes.—A closed tube may be readily made by heating an open tube (six inches long) in the middle and drawing it out. Thus two closed tubes three inches in length are formed. The ordinary shape is shown in figure 13.

In addition to the above-named articles a certain amount of accessory apparatus is necessary, including:

An agate pestle and mortar, to be used for reducing ores to a fine powder, but it should be used for grinding only, never for pounding hard bodies. Its shape is given in figure 11.

A four-ounce hammer.

A small retangular block of hardened steel to be used as an anvil. On this, after first wrapping them in stout paper, the harder ores may be pounded into pieces of suitable size for grinding in the agate mortar.

A dozen test tubes of hard glass of standard size.

Substances used to produce chemical changes in bodies by which they are recognized are known as blowpipe re-agents or fluxes. But small quantities are needed and it is best to purchase them from responsible druggists so as to be sure of their purity. Those most commonly employed and the only ones necessary to be mentioned in this article are sodium carbonate, hereafter spoken of as soda, biborate of soda, or borax and phosphate of soda, and ammonia or microcosmic salt.

Two ounces of soda will be ample to have on hand at a time and it should be kept in a glass-stoppered bottle, so as not to absorb moisture from the air.

The same quantity of ordinary commercial borax is sufficient and is ordinarily pure enough, but it is always best to heat a loop of platinum wire, dip it in the borax and fuse it to a bead in R. F. and then heat it in O. F., examine the bead when hot and when cold, after heating in each flame, and if the bead remains perfectly colorless and transparent, the borax is pure.

half an ounce, and it, like soda and borax, should be kept in a tightly stoppered bottle and labelled.

Pure or "test lead" must also be purchased. Eight ounces will be sufficient.

Finely pulverized bone ash for making cupels, as will be hereafter explained, must be bought; eight ounces will be sufficient.

The beginner's list of apparatus may be concluded with a two-ounce glass stoppered bottle of fuming hydrochloric acid, one of concentrated sulphuric acid and one of pure nitric acid.

Let us suppose that the beginner has procured the articles already enumerated, and has obtained a measure of proficiency in the use of the blowpipe. He has found, or there has been given him, a piece of rock which by its weight or by the appearance of minerals with metallic lustre contained in it, he suspects to be rich in valuable metals. How shall he proceed to determine whether it contains gold, silver, copper or lead, or all, or none of these elements? Also which ones, if any, are present in sufficient quantities to constitute rich ore. Where possible, a sample of ore weighing at least two pounds should be taken and cracked into fragments the size of a hickory nut. Three of these should be taken at random, and further crushed into particles the size of an apple seed. Half of this should be taken, wrapped in clean paper, labelled and laid aside. The remaining half should be wrapped in stout paper and further crushed on the steel anvil, after which it should be finely pulverized in the agate mortar, and also wrapped, labelled, and laid aside.

Suppose, for example, that it is desired to test the fragment under examination for gold and silver. A piece of charcoal is slightly bored, as described before, and a small portion of the pulverized mineral is placed in the bottom of the cavity. The lamp and stand are placed in front of the operator slightly to the left. The lamp is inclined downward to the left so that the O. F. envelopes the assay, which is held below and to the left of the lamp.

The assay, after roasting, as described hereafter, should be kept in the O. F. for several minutes, when if none but volatile metals are associated with the gold, the former will be driven off, and on examination with a magnifying glass a minute malleable gold colored globule will be found at the bottom of the cavity. While being heated, the gold assumes a peculiar greenish hue resembling melted copper. It is a good plan to add a small portion of borax and continue the flame for a few minutes to remove traces of oxidizing metals and brighten the globule. A little soda may also be added, as it hastens the elimination of sulphur and arsenic, if present in small quantities.

When gold is present, but associated with reducible metals, such as silver or copper, the gold must be reduced by a process known as cupellation.

Prepare a piece of charcoal as before described, except that the cavity should be slightly deeper. Place a small portion of the assay in the bottom of the cavity together with six or seven parts of test lead, and one to two parts of powdered borax glass (in proportion to the amount of the assay). Raise the wick of the lamp so that the flame smokes slightly, and turn upon the assay a moderate R. F. As soon as the globules of lead begin to run together, the whole assay should be covered with a hot R. F. The object of the operation is to collect the gold and silver, if any be present, together with all the reducible metals, into one globule with the lead, and volatilize or slag off any others. It is readily seen that the top of the assay may be easily heated, but in order to properly heat the bottom the assay must be turned over. This cannot be done if any lead is oxidized and dissolved in the melted body, for the latter will then stick to the charcoal. It is thus apparent that great care must be exercised, particularly in the beginning of the process, to keep the assay always under R. F. After about two minutes in the reducing flame, the gold and reducible metals are collected into a "button" with the lead, and the flame is then changed to a pointed O. F. and directed upon the button. The latter bubbles and boils actively under the flame for another two minutes, during which time all sulphur, antimony or arsenic present in the original ore is removed. The lead button is then poured out on the anvil, freed from slag, if any adheres, and is ready for cupellation.

For cupelling, a smooth cavity is bored in the charcoal a quarter of an inch in depth and five-eighths of an inch in diameter at the top, gradually decreasing towards the bottom so as to render it cup-shaped. A small amount of bone ash is then mixed into a paste with water and pressed into the cavity with the broad end of the agate pestle, so as to leave the bone-ash surface slightly concave and nearly even with the coal. The bone ash is then heated slowly to redness in the O. F. to remove any trace of moisture, and the lead button is placed in the cupel so formed, the O. F. directed upon it. When the lead button has become fused, the coal cavity is brought nearly vertical, and the O. F. is directed on the bone ash, just in front of the button, rather than on the button itself, so that the ash may be hot enough to absorb the fused litharge, none of which must remain on the surface of the cupel. By a proper direction of the flame and turning of the charcoal, the button is slowly driven about until a considerable amount of silver is shown by a play of colors

due to the film of litharge. In the course of the next few seconds the lead button, previously red hot but not very lustrous, becomes bright and fixed in the cupel. This fixing should occur on a portion of the cupel on which the button has not previously rested, and the brightening is more effectual if at the last moment the button is almost touched with the tip of the R. F. to remove any trace of litharge. After it becomes bright, the button is slowly removed from the flame and examined with the magnifying glass to detect any film of litharge which would give the silver-white lustrous button a yellowish tinge. Gold, if present in sufficient quantity, would give a yellowish hue to the button. This should not be confounded, however, with the yellow due to the film of oxide of lead, which latter is at once removed by treating the assay for a few seconds in the R. F. If on the contrary the color is due to gold, it will remain unchanged in the R. F. A large button should not be cooled rapidly, as it is apt to "sprout" or throw out branch-like projections, thus losing silver. If heated too strongly after brightening, the button loses silver by a combination with lead oxide, forming a rose-colored coating on the cupel. This latter, however, must not be mistaken for the bright orange red coating frequently formed by the litharge alone near the rim of the cupel. Should the button have a pure deep gold color it may, for the purposes of this article, be considered pure gold, as 2 per cent. of silver will give gold a brass yellow color, and a comparatively white globule may contain as large a percentage of gold, as 40 per cent. It is therefore necessary to separate the silver from the gold.

When gold is present in an amount not to exceed the proportion of one part of gold to two and one-half parts of silver, it is separated by a process known as "parting." The globule is heated with moderately strong nitric acid, and all the silver is dissolved, leaving the gold a dark residue. Even if the button, after fixing and brightening, is silver-white and lustrous, it may still contain 4 per cent. of gold, and therefore all globules obtained from cupel action should be parted, and in order to be on the safe side an amount of pure silver should be added and fused with borax glass on charcoal along with the globule, varying from two and one-half times the weight of the button in cases of a brass-yellow globule to half the weight in that of a silver-white globule. In this fusion a moderate R. F. should be used and directed upon the glass until the metals are well fused and thoroughly mixed.

The resulting globule should be gently heated in a test tube with diluted (three-quarter strength) nitric acid and the silver dissolved out, leaving the gold in a dark brown or black spongy mass or in separate particles.

The cessation of bubbles indicates that the silver has been dissolved and the acid should then be boiled a short time, the solution poured off and the proportion of gold present estimated from the amount left in the test tube in comparison with the whole amount tested.

After a portion of the ore under examination has been tested as described in the preceding sections for gold and silver, take in the platinum forceps a small part of the rock that has been put aside and labeled, moisten it with hydrochloric acid, and heat it in the flame. The latter should be colored a beautiful blue if copper be present.

If this reaction is not obtained, a small amount of the powder should be used to saturate a bead of microcosmic salt on platinum wire and adding chloride of sodium (salt), when the blue flame should result if copper be present in appreciable quantities.

When the presence of copper is ascertained, a small portion of the fine powder is mixed with three times its volume of soda and a little water into a stiff paste. A moderately deep cavity is then made in a piece of charcoal and the bottom covered with this paste. After two or three minutes treatment with a strong R. F., if the substance is not readily fused the assay may be cooled and powdered and a little more soda added. On a second treatment one or more metallic buttons should have been collected, which can be separated by a knife-blade from any slag or fused soda that has not sunk into the coal.

The metallic globules so reduced are either pure copper or an alloy with other reducible metals.

Where the globule is pure copper, the surface is often darkened, but may be brightened and a copper color obtained. If rubbing fails to show the true color of copper or one of its alloys, the globule should be heated for a minute or two in the inner edge of the O. F. and, when cooled, hammered out and rubbed.

If then the true color is not obtained, but the globule is still dark, add a small portion of borax and treat it again in the O. F. to brighten and remove traces of sulphur. Too short a treatment of soda in the beginning is often a cause of failure to beginners in this test.

Although copper and most of its compounds are easily reducible by the above process, if the presence of copper is ascertained by coloration of the flame in the platinum forceps, or with microcosmic salt, but cannot be reduced to a metallic globule, the ore is probably a sulphide, arsenide, or selenide of copper and should be first roasted. To roast the powder, make a wide, shallow cavity in a piece of charcoal and spread over it a layer of the powdered substance, pressing it down gently with the end of the agate pestle.

Heat gently at first with the O. F. to avoid fusing and then bring it to a low red heat until the garlic fumes of arsenic or sulphur fumes are no longer perceptible. Then treat alternately in the O. F. and R. F. until no fumes escape. The powder will then usually form a crust, which should be carefully turned with a knife-blade and the bottom treated in the same manner.

After portions of the ore under examination have been tested for silver, gold and copper, as before described, a small portion of the powder is placed in a shallow cavity on charcoal and the lamp turned downward, so that the flame can be directed downward upon it. In the O. F. lead is volatile and in the R. F. is is also volatile and colors the flame an azure blue.

Near the assay a dark yellow lemon coat is left on the charcoal, while at a distance the coating is sulphur yellow. Lead fuses easily, and when sulphide or chloride are heated before the blowpipe on charcoal, they fuse and deposit a white coating outside of the yellow coat above described. The white coat is volatile in R. F. and tinges it blue.

Lead in metallic globules may be readily obtained from its oxides and most of its salts by the reduction tests before described. The globule is a light bluish gray in color, malleable and soft. The characteristic reactions are the coatings it gives the coal and the azure blue tinge it imparts to the R. F. Lead is easily volatilized and very fusible, yielding a metallic globule very readily, so that care must be taken to continue the heating no longer than necessary to obtain the metal. When lead is reduced on charcoal, it may safely be said that the first globule to appear is lead, and the assay may be cooled and the globule or globules may be detached from the slag and unfused portions with the knife blade. Their weight compared to that of the assay will determine the proportion of lead in the ore.

LIST OF APPARATUS.

1 common blowpipe (brass).
1 blowpipe lamp and stand.
1 pint rape seed oil.
½ dozen wicks to fit lamp.
1 mortar and pestle.
1 dozen standard size blowpipe charcoal.
3 pieces platinum wire 3 inches long, jewelers' No. 12½ hole.
1 pair brass wire forceps, platinum tips.
1 4 ounce hammer.
1 piece 1½x½x3-inch hardened steel.
1 dozen ¼ test tubes, 6 inches long, of hardened glass.
1 magnifying glass, double lens.
1 roll stout wrapping paper (5 yds).

CHEMICALS.

2 ounces biborate soda.
2 ounces bicarbonate soda.
1 ounce microsmic salts.
2 ounces concentrated sulphuric acid.
2 ounces concentrated nitric acid.
2 ounces concentrated hydrochloric acid.
(All in glass-stoppered bottles.)
8 ounces pure test lead.
2 ounces pure silver.
8 ounces finely powdered bone ash.

[THE END.]

INDEX TO MINING CLAIMS.

Abbreviations: gr., group; cr., creek; r., river; mt., mount; mtn., mountain; l., lake; C., camp; pl., placer; ext., extension.

PLEASE NOTE: This Index is the Index for the whole book "Mining in the Pacific Northwest" from which this book is extracted. Certain portions of this are applicable to this book. Others are not. If your interest in Northwest mining is extensive you should have the complete book. Price $30.00.

J.W. Todd, Jr.,
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